

DMX512 theater controls  
 Hydrogen energy journal  
 Some stage lighting books  
 Overunity energy fantasies  
 Asynchronous RS422 comm

**F**inding a source of "unlimited free energy" would be one of the most heinous possible crimes against humanity. The unavoidable consequences of turning the planet into a cinder would make Hitler look like Mother Teresa.

Great heaping piles of free energy enthusiasts can be located on such fantasy forums as Bill Beaty's odd [www.eskimo.com/~bilb/freenrgl/fnrg](http://www.eskimo.com/~bilb/freenrgl/fnrg) or else Jerry Decker's [www.escribe.com/science/keely](http://www.escribe.com/science/keely) Fortunately, almost all of free energy pseudoscience boils down to labwork so mesmerizingly awful that it is *not even wrong*. To me, it sure is challenging fun to find out exactly where and precisely how they have screwed up.

The outcome is *never* in doubt.

Because accurately measuring real nonlinear power or doing small  $\Delta T$  calorimetry can both be exceptionally difficult tasks. Worse, they'll almost always output deceptively *high* when carelessly done. *Everybody* always fouls these up. At least on their first few hundred tries.

I've recently posted some essential tools that might let you intelligently evaluate pseudoscience on your own. Find these at [www.tinaja.com/glib/b/ashpseu.pdf](http://www.tinaja.com/glib/b/ashpseu.pdf) These key tools include finding out what is really happening, doing an objective meta study, using a binary consequence tree, slicing up with Ockham's razor, applying my highly devastating "looks like a duck, quacks like a duck" filters, avoiding negatives, and tracking the cash flow. These tools separate useful adjuncts for porcine whole body cleanliness from the total hogwash.

### Free Energy Ludicrosities

Here is my take on all the ongoing pseudoscience *scam de jours*...

**The Adams Motor**— To me, this one looks and acts exactly like a plain old switched reluctance motor. Except for having woefully inefficient flux paths. this is simply one continuously driven variant of the stepper motor. Independent tests give efficiencies in

the ten to thirty percent range. That extreme difficulty of measuring rms power of pulse waveforms appears to be the basis for the overunity claims.

**But**— New "real" switched reluctance motors are poised to revolutionize air conditioning and electric autos.

**Brown's Gas**— A stoichiometric mix of two parts of hydrogen and one part of oxygen by volume provides many highly unexpected properties. *None* of which include proponent's claims of overunity, long term monatomics, or radioactive neutralization. To date, zero believable differences between Brown's Gas and plain old stoke gas have *ever* been convincingly shown.

**But**— Rather exciting "real" hydrogen stuff is coming down over nanotube storage and metalloradicals.

**The Neuman Motor**—After a careful and long term review, I do not see much here. Clear cut and unarguable results seem conspicuously lacking. Recent web measurements on these large high voltage dc machines show efficiencies of *twenty* percent. Even these are suspiciously *high*, owing to

a questionable power measurement. Uh, if a motor sparks, it *is* inefficient.

**But**— exotic pulse energy recycling *may* improve battery life.

**The Water Powered Car**—These seem to reside somewhere between wishful thinking and outright criminal fraud. "Molecular resonance" of water takes place at frequencies far higher than claimed and provides zero overunity options. Ask any radio astronomer. There's very strong evidence that *any* strange waveforms or high voltages during electrolysis can only *reduce* your conversion efficiency. Another name for a system where a car engine drives some alternator that generates hydrogen which runs the engine is a *dynamic brake*. Switching it in would cause the auto to stop in *much less* than its usual coasting distance.

**But**— A modest hydrogen injection might improve the performance stats of an otherwise stock gasoline engine.

**The Magic Lamp**—Take a 32 volt light bulb and a 110 volt bulb. Connect them to dimmers and adjust for equal high brightness. Use a cheap enough

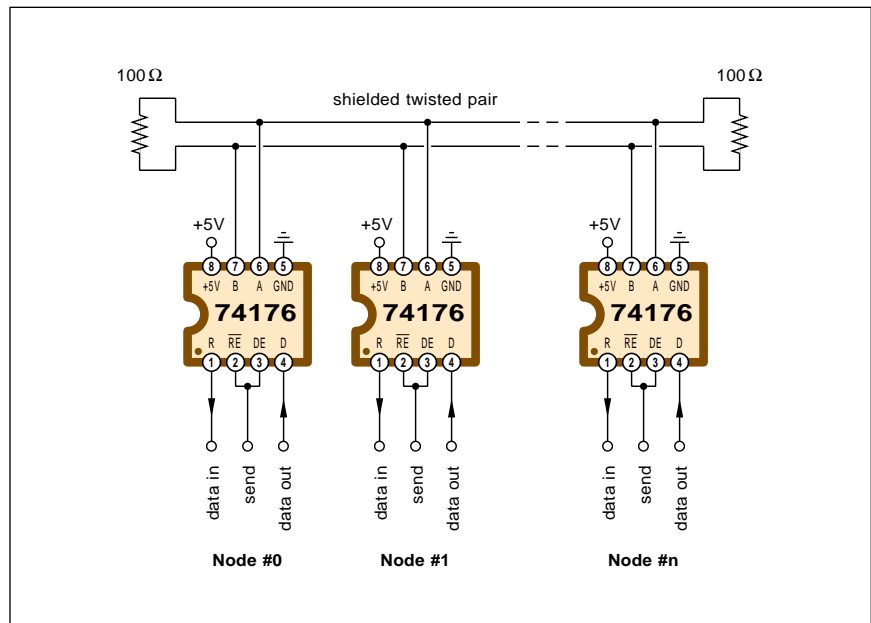


Fig. 1 – THE RS485 SERIAL COMM STANDARD is widely used for computer networking. The older RS422 differs in that the left driver is permanently enabled, while all other nodes must act as receivers.

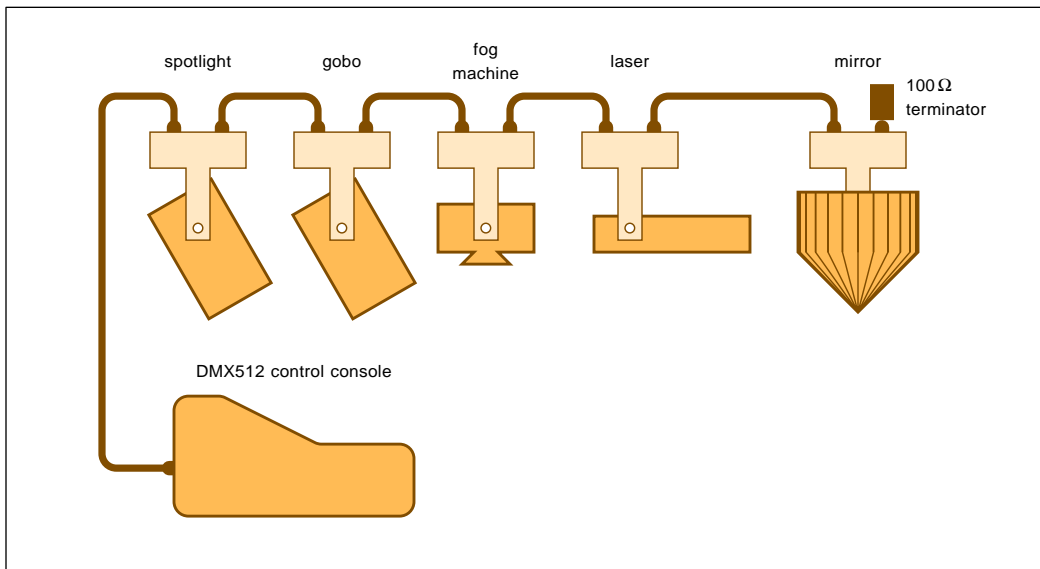


Fig. 2 – THE DMX512 LIGHTING CONTROL STANDARD lets a single console and a daisy-chained wire pair control spotlights, fog machines, lasers, mirrors, or animation.

meter, and you'll measure one third the current and one third the voltage on the 32 volt bulb. Then jump to the wildly wrong conclusion that the 32 volt bulb is more efficient and uses less power. No matter that it is no cooler than the other bulb. Careful analysis quickly leads to classic E.E. student lab blunder #01-A, that of confusing average and rms on low duty cycle waveforms. **But**– A lot of high efficiency lamps are now under study, based on studiously *avoiding* any incandescence at all.

**The Hydrosonic Pump**–A blocked cavitating pump applied to generate heat. (Just what they warned me to

*avoid at all costs* in fire school.) A high-wear pump with one-sixth the efficiency of a heat pump and six times the costs of a resistor. While rerunning that classic "mechanical equivalent of heat" experiment. And ignoring the fact that all mechanical energy is much "more valuable" than heat energy. This one comes out of the woodwork each decade. **But**– A sonoluminescence is now associated with cavitation that leads to several really exciting new wonderments.

**The Tesla Turbine**– Bladeless discs which control shear forces in viscous liquids to convert moving fluid into rotary motion. Viscous liquids are

inherently lossy and thus *demand* a thermodynamic inefficiency. Your conversion clearly is a non-adiabatic process. One that always throws off unwanted heat. Thus, a Tesla turbine simply *has* to be inefficient to work at all. **But**– When used backwards, Tesla turbines are quite useful for such essential tasks as pumping live fish or transporting frozen chickens.

**The Switch Flippers**– There's folks out there who claim that no current flows if you connect an open circuit wire to a battery. Instead, mysterious "superluminal" communications and an "etheretic energy transfer" takes place if you flip switches fast enough

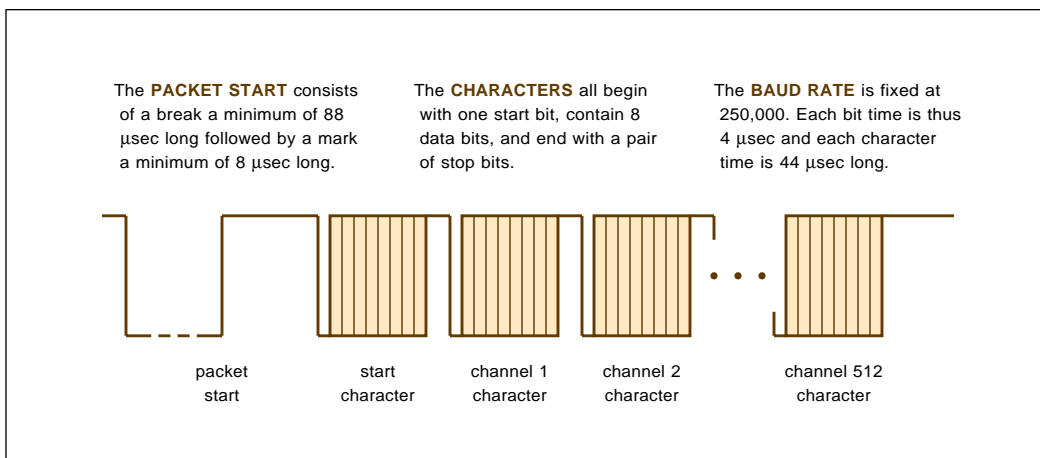


Fig. 3 – DMX512 COMM WAVEFORMS Up to 512 8-bit channel commands can be sent to various devices along a chain up to 4000 feet long. Each device responds to its own channels in a selected proportional or on-off manner.

on long enough wires. Sorry, but a *transient* current *always* results the instant you connect *any* wire to any battery, open circuited or otherwise. The *Maxwell* field equations and the characteristic impedance of the line sets the initial current. The ultimate current gets determined only after slower-than-light reflections from the load take place. This flipping concept is flat out wrong, for too much of electronics simply would not work were it true. **But**— There's all sorts of astounding real electronics uses for fast switch flips.

**Homopolar Machines**—The homopolar generator is the only known machine that can generate true dc. Because of special relativity, it turns out that it does not matter in the least whether the magnets move or not. There is no way to decide if a *uniform* magnetic field is rotating or stationary. Your homopolar output depends only on your relative stator and rotor speeds and the magnetic field strength. What the magnets are up to simply does not matter. Which can lead to severe misinterpretations and subtleties over what's really happening. Especially in the way of counter EMF's and the reaction torques. **But**— Homopolar machines are one possible solution to electric autos, as well as other "Uh— compared to what?" needs.

**Zero Point Energy**— If something is sitting still and you know where it is, you have got more information than when something is sitting still and you do not know where it is. Which is what zero point energy is all about. Simply a way to get all the special relativity statistical math to balance out. Here's the kicker: If *all* of the *gross* zero point energy in a volume the size of the earth were somehow 100 percent recovered, it would equal the chemical energy in *one* gallon of gasoline. **But**— An exciting new field of *Bose-Einstein Condensates* is now opening up, revealing a previously unknown state of matter.

You'll find plenty of ongoing and lively web discussions on all these topics. Start with [www.dejanews.com](http://www.dejanews.com) to pick up as much detail as you can stand. Both pro and con. On second thought, let's capitalize that *Con*.

A wondrously bizarre assortment

- Concert Lighting: Techniques, Art & Business**, James Moody, *Focal Press*, 1997.  
**Concert Sound and Lighting Systems**, John Vasey, *Butterworth-Heinemann*, 1994.  
**Control Systems for Live Entertainment**, John Huntington, *Butterworth-Heinemann*, 1994.  
**Discovering Stage Lighting**, Francis Reid, *Focal Press*, 1993.  
**Effects for the Theatre**, Graham Walne, *Drama Publishers*, 1995.  
**Handbook of Scenery, Properties and Lighting**, Harvey Sweet, *Allyn & Bacon*, 1995.  
**Light on the Subject: Stage Lighting for Directors**, David Hays, *Limelight Editions*, 1989.  
**Lighting and Sound (Phaidon Theater Manual)**, Neil Fraser, *Phaidon Press*, 1995.  
**Lighting and the Design Idea**, Linda Essig, *Hbj College & School Div*, 1996.  
**Lighting the Stage: A Designer's Experiences**, Francis Reid *Focal Press*, July 1995.  
**Painting with Light**, John Alton, *University of California Press*, April 1995.  
**Projection for Performing Arts**, Graham Walne, *Focal Press*, 1995.  
**Recommended Practice for DMX512**, Adam Benette, *USITT*, 1993.  
**Scene Design and Stage Lighting**, Oren Parker, *Holt, Reinhart & Winston*, 1996.  
**Stage Lighting Design: The Art, Craft, & Life**, Richard Pilbrow, *Drama Publishers*, 1997.  
**Stage Lighting Handbook**, Francis Reid, *A & C Black*, 1996.  
**Stage Lighting in the Boondocks**, James Miller, *Meriwether Publishing*, 1987.  
**Stage Lighting Revealed: Design & Execution**, G. Cunningham, *Betterway Pubs*, 1993.  
**Stage Lighting Step by Step**, Graham Walters, *Betterway Publications*, 1997.  
**Theater Backstage from A to Z**, Warren Lounsbury, *University of Washington Press*, 1989.  
**Theater Lighting from A to Z**, Norman Boulanger, *University of Washington Press*, 1992.  
**Theater Technology**, George Izenour, *Yale University Press*, 1997.

Fig. 4 – SELECTED THEATER AND CONCERT LIGHTING BOOKS. More details on many of these titles are found at [www.tinaja.com/amlink01.html](http://www.tinaja.com/amlink01.html)

of pseudoscience files shows up at [www.keelynet.com](http://www.keelynet.com) Links to others at [www.tinaja.com/scweb01.html](http://www.tinaja.com/scweb01.html) More objective "real engineering" analysis at [www.tinaja.com/pseudo01.html](http://www.tinaja.com/pseudo01.html)

### Stage and Concert Lighting

Have you ever wondered how the dozens of lights and related effects are controlled at a theater, a club, or a rock concert? Obviously running a separately controlled power line to each and every lamp is ridiculously expensive and fraught with peril.

It turns out there is a rather little known but widely applied lighting standard called DMX512. This allows up to 512 lights (or combinations of lights and special effects commands) to be controlled by one cable.

Before we can look into DMX512, though, we'll first have to find out a little about...

### EIA RS 422

This older *serial* (bits go one at a time) *asynchronous* (random spacing between words) *data* (digital ones

and zeros) communication standard is shown in figure one. RS422 has largely been replaced by the RS485 which we will describe here.

Your key element is a twisted pair *transmission line*. A digital logic *one* consists of your "B" line of the pair being made positive from 2.5 to 5 volts while bringing the "A" line of the pair near ground. A digital logic *zero* consists of the "B" line of the pair going near ground and the "A" line of the pair being made positive from 2.5 to 5 volts.

A *driver* circuit converts an input one or zero into the differential pair. Your *receiver* circuit can sense this differential voltage and convert it on back to a local output one or zero. A *transceiver* is simply a chip which holds one or more receivers and one or more drivers. There can be dozens and sometimes hundreds of drivers and receivers in any combination, but *only one driver can be active at one time*. This can be handled by having a *master driver* which is in control of your system, or else by using some

A DMX512 LIGHTING RESOURCE SAMPLER

<b>AMX</b> 11995 Forestgate Dr Dallas TX 75243 (800) 222-0193	<b>Electronic Theater Cntrls</b> 630 9th Ave Ste 1001 New York NY 10036 (212) 397-8080	<b>Intl Laser Display Assn</b> 4301 32nd St W, Ste B-23 Bradenton FL 34205 (941) 758-6881	<b>Production Arts Lighting</b> 636 Eleventh Ave New York NY 10036 (212) 489-0312
<b>Angstrom</b> 837 N Cahuenga Blvd Hollywood CA 90038 (800) 422-5744	<b>ESTA</b> 875 Sixty Ave Ste 2302 New York NY 10001 (212) 244-1505	<b>Mole-Richardson</b> 937 N Sycamore Ave Hollywood CA 90038 (323) 851-0111	<b>Pyrotechnics Guild Intl</b> Bill Sprague 93 Poquanticut Ave N Easton, MA 02356
<b>Artistic License</b> Livingstone Ct, Peel Rd Harrow, Middlesex HA37QT ENGLAND	<b>Doug Fleenor Design</b> 396 Corbett Canyon Rd Arroyo Grande CA 93420 (805) 481-9599	<b>PLASA</b> 38 Leonards, Eastbourne E Sussex BN21 3UH UK 01323 410335	<b>USITT</b> 6443 Ridings Rd Syracuse NY 13206 (800) 93USITT

sort of *collision detection*.

Because of those balanced signals and the *differential* receivers, noise immunity can be quite good. All but incredibly bad *common mode* signals are ignored. Lines can sometimes be nearly a mile long.

Note that there must be one and only one terminating resistor at the "start" of the transmission line and one and only one terminating resistor at the "end" of the line. The line *must* go from device to device in the *daisy chain* manner shown. Use of stubs or multiple paths is a no-no. Only one message can route over the RS422 or RS485 line pair at a time.

RS485 is used for many computer networking systems. When you use classic RS422 comm, only a single and a permanently enabled driver is used. This driver chip *must* go at one end of the comm line, replacing the termination. A single RS422 line pair thus will be unidirectional only. It may have one transmitter driving any reasonable number of receivers.

Additional details are in the EIA standards themselves or in the great tutorial found at [bb-elec.com/bb-elec/literature/485appnote.pdf](http://bb-elec.com/bb-elec/literature/485appnote.pdf)

Your latest replacement for either standard is RS644 and is called *low voltage differential signalling*. New chips here are the 65LVDS31 driver and a 65LVDS32 receiver from all the folks at *Texas Instruments*.

### DMX512

Figure two shows you the DMX512 standard. This uses a RS422 or newer standard twisted pair to get from a *control console* up to whatever lights and devices need controlled.

The serial code is shown in figure three. Its *packet* consists of a header and up to 512 data blocks. Each data block is called a *channel* and holds an eight bit word. These words might be sensed as eight individual on-off controls, or might set a brightness to one of 256 levels. Or to a linearized but lesser number of levels. Channels may get paired for 16-bit resolution. Several channels might get used for one device. Perhaps one to set your level, one to set the color, and two to set the position. Non-lighting effects such as smoke generators, spinning mirrors, animation, and certain laser effects can also be controlled.

Your baud rate is 250,000 bits per second. When the full 512 words are used, updates take place at a max rate around 44 per second.

Each channel byte uses one start bit, eight data bits, and two stop bits similar to classic UART serial comm. Those 11 bits make each channel byte 44 microseconds long.

The packet starts with a logic zero that is at least 88 microseconds long. This is followed by a MAB, or *make after break* that is 8 microseconds or

longer. A *start character* follows that forms an optional enable.

Up to 512 bytes of channel data follow. Each of which can represent any 8-bit value from 0 to 255. The use of these values depends on the device being addressed.

Each device is set to respond *only* to its intended channels.

The suitable shielded twisted pair cables include *Belden* 9841 and 9842 and *Alpha* 5274. Normal terminating resistance is 110 ohms. A connector known as a 5 pin XLR gets used, with male on the cables or terminators and female on the devices.

The pinouts are...

- pin 1 - shield and common
- pin 2 - dimmer complement
- pin 3 - dimmer true
- pin 4 - optional complement
- pin 5 - optional true

Do observe that there is zero error correction here. And that the optional return channel has nonstandard uses. Thus, DMX512 should definitely *not* get used for pyro or anywhere public safety is a concern.

Although a variety of commercial controllers are readily available, you can easily build your own DMX512 controller as a mid-range PIC project. Additional PIC support appears at my [www.tinaja.com/picup01.html](http://www.tinaja.com/picup01.html)

### Some Resources

I've gathered a few of the DMX512 standards, suppliers, and info sources together in the resource sidebar. A useful site is [www.dmx512.com](http://www.dmx512.com) An amazing number of nice international lighting links appear at [www.ozemai.com.au/~bhill/links.html](http://www.ozemai.com.au/~bhill/links.html)

### 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)



**NAMES AND NUMBERS**

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

**Bumpon/3M**  
3M Center, Bldg 220-7W-03  
St Paul MN 55144  
(800) 362-3550

**Dallas Semiconductor**  
4401 Beltwood Pkwy S  
Dallas TX 75244  
(972) 371-4000

**Electronic Expeditors**  
14828 Calvert St  
Van Nuys CA 91411  
(818) 781-1910

**Intl Jnl Hydrogen Energy**  
PO Box 248266  
Coral Gables FL 33124  
(305) 284-4666

**Linear Technology**  
1630 McCarthy Blvd  
Milpitas CA 95035  
(408) 432-1900

**Loctite**  
1001 Trout Brook Cross  
Rocky Hill CT 06067  
(860) 571-5100

**Micrel Semiconductor**  
1849 Fortune Drive  
San Jose CA 95131  
(408) 944-0800

**Pacific NW Natl Lab**  
Box 999  
Richland WA 99352  
(509) 372-4270

**Recharger**  
4218 W Charleston Blvd  
Las Vegas NV 89102  
(702) 438-5557

**Static Control Comps**  
3010 Lee Ave  
Sanford NC 27331  
(800) 488-2426

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

**Texas Instruments**  
PO Box 809066  
Dallas TX 75380  
(800) 336-5236

**Peter Zelchenko**  
1757 W Augusta Blvd #3  
Chicago IL 60622  
(312) 733-2473

Apparently the "must have" book is Adam Bennette's *Recommended Practice for DMX512*. This plus the standard itself can be gotten from *USITT*, short for the *US Institute of Theater Technology*.

Useful newsgroups include...

- [alt.stagecraft](mailto:alt.stagecraft)
- [comp.arch.embedded](mailto:comp.arch.embedded)
- [net.theatre.stagecraft](mailto:net.theatre.stagecraft)
- [rec.arts.theater.stagecraft](mailto:rec.arts.theater.stagecraft)
- [sci.engr.lighting](mailto:sci.engr.lighting)

Figure four shows you my choice of popular and more general books on concert and theater lighting. More details on many of these titles are at [www.tinaja.com/amlink01.html](http://www.tinaja.com/amlink01.html)

**New Tech Lit**

From *Apex*, their new data book on power integrated circuits. And from *Micrel*, a data booklet on their new *QwikRadio* single chip UHF modem data receivers. Only *three* external parts are needed here!

A new free data book and CD ROM from *Dallas Semiconductor*. Dallas seems to be the first one to tame the

data monster by providing only the *first page* of each data sheet in the printed catalog. You go to the CD or their site at [www.dalsemi.com](http://www.dalsemi.com) when you need more detail.

A free *Filter Design Software for Windows* CD is now being promoted by *Linear Technology*.

*Electronic Expeditors* has some 33 million integrated circuits and semis in stock. Check [www.expeditors.com](http://www.expeditors.com) But a much better source for instant ordering of single quantity samples is [www.questlink.com](http://www.questlink.com)

*Serial Port Complete* is a new Jan Axelson book on RS232 and RS484 links and networks. The PC's, Basic Stamps, and other popular micros are well covered. A companion software disk is included. Jan also wrote his great *Parallel Port Complete* text. Publisher is *Lakeview Research* More at [www.tinaja.com/amlink01.html](http://www.tinaja.com/amlink01.html)

*Volume One: The Instant Book* is a bound tutorial by Peter Zelchenko on *Book-on-demand* publishing. Contact him at [www.volumeone.net](http://www.volumeone.net) For more on BOD, other service bureaus, and related topics, do check the details at

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- PostScript Beginner Stuff . . . . . \$29.50
- PostScript Show and Tell . . . . . \$29.50
- PostScript Video & secrets . . . . . \$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
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## Tech Musings

[www.tinaja.com/bod01.html](http://www.tinaja.com/bod01.html)

The latest release of the *Inventor Assistance Source Directory* is newly available from the fed's *Inventions & Innovation* program. The publisher is *Pacific Northwest National Lab*. But calling yourself an "inventor" is often monumentally stupid. Find out why at [www.tinaja.com/patnt01.html](http://www.tinaja.com/patnt01.html)

The superb *International Journal of Hydrogen Energy* is one definitive but extremely expensive (\$1476) pub. Chances are you could access copies through a larger library. Additional magazines on hydrogen, books, links, and resources are found through my [www.tinaja.com/h2gas01.html](http://www.tinaja.com/h2gas01.html)

Free samples of new light curing adhesives through *Loctite*. They also publish a new *product selector guide*. Free samples of *Bumpon* stick-on feet are available from *3M*.

*Moldmaking with Materials from Dow Corning* is a nice free video.

For those fundamentals of active filter design, check my *Active Filter Cookbook*. Available by itself or in my *Lancaster Classics Library*. See my nearby *Synergetics* ad or visit my [www.tinaja.com/synlib01](http://www.tinaja.com/synlib01)

I've finally managed to provide a powerful online site search for my [www.tinaja.com](http://www.tinaja.com) website. Yeah, this now includes *full text searching for*

*all the tutorial Acrobat PDF files*. As well as the usual HTML and text. A bunch of earlier columns have newly gotten uploaded.

Instant answers and cost effective technical solutions can be found at [www.tinaja.com/info01.html](http://www.tinaja.com/info01.html), while lots of great test equipment bargains (especially superb Tek 2213 scopes and fantastic buys on premium logic data analyzers) are found by clicking [www.tinaja.com/barg01.html](http://www.tinaja.com/barg01.html)

As usual, most of the mentioned items are in our *Names & Numbers* or *DMX Resources* sidebars. Always look here first before calling our free US technical helpline. ♦

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