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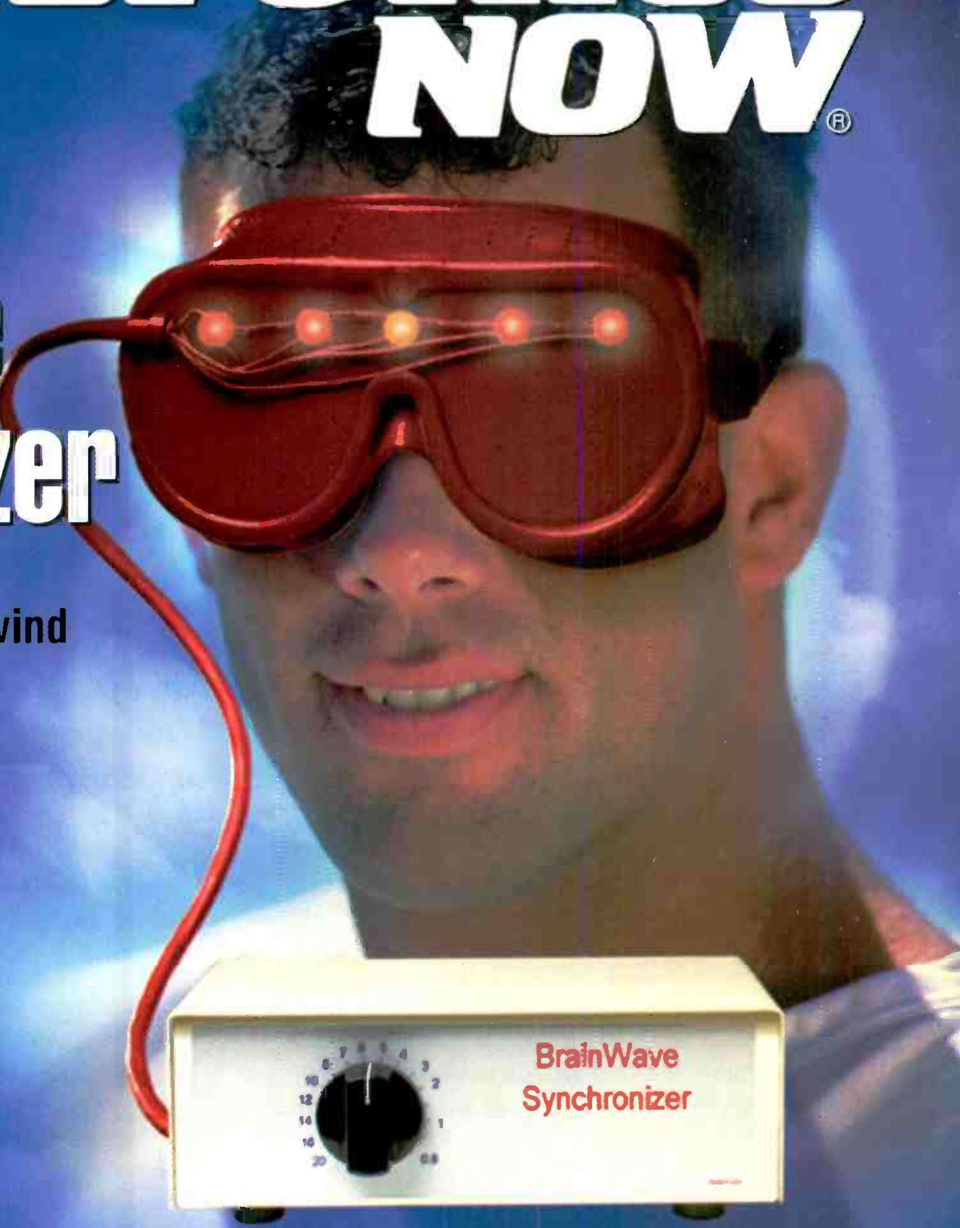

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EDITORIAL

Buyer Beware

Just over a year ago (March 1998), my Editorial addressed the confusion surrounding the scheduled move from analog to digital TV. Well a year has passed and a lot of that confusion is still with us. What's worse, there's now yet another uncertainty that might make you think twice about running out and buying one of those so-called HDTV-ready sets.

Here's the rub: To view digital HDTV signals on an HDTV-ready set you need a set-top HDTV converter box. You also need a way to get the signals from the box to the set. You could, of course, just run an RGB, S-video, or composite video cable between the two devices. Unfortunately, since those are all analog formats, the signal quality would not be as high as with a purely digital link.

So why not just use a direct digital link? Well, you can't; your new $10,000+ HDTV-ready set does not have one. That's because that part of the DTV specification is still in flux.

You see, while there is a technical specification based on the IEEE 1394 interface, negotiations are still "on-going" regarding the copy protection part of the standard. Hollywood, it seems, is worried that without a copy-protection scheme in place on an HDTV digital interface, it would be possible for someone to use the digital connection to pirate high-quality copies of HD transmissions. Without getting assurance that their rights are being adequately protected, Hollywood is unlikely to release anything of value to HDTV broadcasters if sets with digital interfaces are on the market.

Everyone expects this to be eventually resolved, and industry sources say that HDTV-ready sets and set-top boxes with copy-protected digital interfaces should be on the market in late 1999 or early 2000. Of course, if you just bought an HDTV-ready set, that does not do you a whole lot of good.

Carl Laron

Carl Laron
Editor

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Q & A

READERS' QUESTIONS, EDITORS' ANSWERS
CONDUCTED BY MICHAEL A. COVINGTON, N4TM1

Cable Simulator

Q *I am a technician for a telecommunications repair facility, and my test bench is in need of two cable simulators. These units simulate from 1000 to 30,000 feet of cable. Lack of availability or prohibitive price has kept my employer from purchasing this test equipment. In desperation, I'm considering building it. I understand there is more to this than simply line resistance, and any information you can share is greatly appreciated. — R. M., via e-mail*

A We can offer an educated guess, but no specific plans. Basically, the electrical equivalent of a long cable is the circuit shown in Fig. 1, where R, C, and L depend on the kind of cable you're simulating. For example, standard RG-6 cable has a capacitance of 18.6 pF per foot and a characteristic impedance of 75 ohms. From the capacitance and impedance we can calculate the inductance per foot, using the formula

$$L = Z^2C$$

which gives about 0.1-microhenry-per-foot. Accordingly, a simulator for a 1000-foot section will have a 100-microhenry inductor (here shown split into two 50-microhenry coils), an 0.02-microfarad capacitor (0.0186 if you can find it), and a resistance that you can determine by experimenting with a real cable (the resistance of the inductor may be enough). Multiply those values by 30 to simulate a 30,000-foot section.

That's just the beginning. At VHF frequencies a real cable will have frequency-dependent dielectric losses that are tricky to model. Not only that, but your inductors and capacitors will succumb to high-frequency effects; the capacitor has some inductance and the inductor has some capacitance. You may need to break up your model into units considerably smaller than the equivalent of 1000 feet. In short, quite a bit of experimentation is going to be required, which is probably why this equipment is so expensive in the first place. If you're successful at building a useful instrument, do let us know.

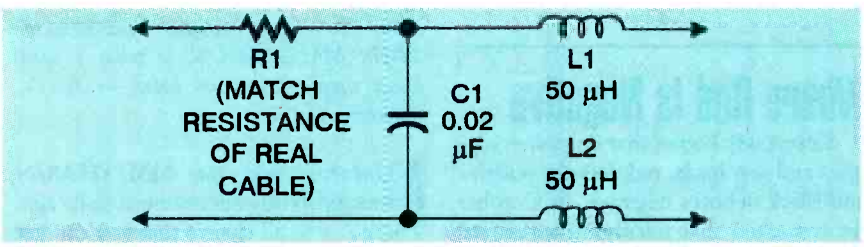

FIG. 1—THIS SCHEMATIC IS A ROUGH electrical equivalent of 1000 feet of RG-6 cable. Note that this model is not accurate at higher frequencies.

Decoding Caller ID

Q *Does Caller ID use the same protocol all over the United States? What are the baud rate, number of bits, and so forth? Where can I get some technical information on Caller ID? — J. D. V., Pelotas, Brazil*

A The protocol is indeed the same nationwide and is described in some detail in **Popular Electronics**, August 1996, pp. 45-49 and 76; you can order a copy from our Reprint Bookstore. That article includes plans for a Caller-ID decoder that interfaces to a PC.

The baud rate is 1200, the modulation standard is Bell 202, and each message includes a length marker and a checksum. Special modem chips such as the Motorola MC145447 and MC14LC5447 are used to collect the data, which is sent on the phone line between rings. In fact, a good way to learn more about Caller ID is to read the data sheet for the MC14LC5447, available on request from Motorola Literature Distribution, P.O. Box 20912, Phoenix, AZ 85036. You can download the data sheet from www.questlink.com (do a part number search for MC14LC5447). Motorola also makes an evaluation kit, the MC145460EVK, for experimenting with Caller ID decoding.

Telescope-Drive Parts Wanted

Q *I have an electronic telescope-drive corrector that I damaged by applying 30 volts instead of 9 volts and frying all the semiconductors. I hope you can help me identify the parts I need. They are TTD62103P (unidentified semiconductor), PMM8713 (Sanyo IC), TC40103BP (Toshiba IC), MC14060B (Motorola IC), C1815-Y5F (transistor), and 3.15434 MHz (crystal). — T. Q., Bronx, NY*

A Amateur astronomers (including this author) use telescope mounts with drive motors to track the stars as the earth rotates. During long-exposure photographs, it is necessary to make some manual corrections for three reasons: the motor's gears are not perfectly smooth, the earth's rotation period relative to the stars is not exactly 24 hours (which is what you get with readily available motors running at their rated speed), and the positions of celestial objects are shifted slightly as light is refracted by the earth's atmosphere. A drive corrector lets you run a 60-Hz motor on a frequency of your own choosing, close to 60 Hz, which you can vary moment by moment. Plans for one are in the book *Astrophotography for the Amateur*, by (who else?) Michael A. Covington (Cambridge University Press) More information on the book, including

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where it can be purchased can be found on my Web site (www.mindspring.com/~covington/astro). Note that some newer drives use stepper motors and a completely different corrector circuit.

Your very first step should be to contact the manufacturer of the drive corrector, since some of the specialized ICs are going to be very hard to get anywhere else. Gone are the days where a few hundred semiconductors could replace everything you'd ever encounter; custom and semicustom ICs have become so common that electronic equipment is often almost unrepairable without the manufacturer's assistance. Many ICs are made only in small quantities and never make it to ordinary parts dealers.

Also, consider the possibility that not all the semiconductors are burned out. How does power enter the drive corrector? Does it go through a fuse or diode? If so, see if that is the only thing that's burned out.

One bit of good news is that the 3.15434-MHz crystal is almost certainly undamaged; if you need a new one, you can get one custom-made by International Crystal Mfg. Co., 10 N. Lee Ave., Oklahoma City, OK 73102. In the meantime, to see if a new crystal would make the circuit work, substitute a 3.58-MHz crystal available at RadioShack; the oscillator will run too fast, but it will run.

The TC40103BP and MC14060B are common CMOS logic ICs more familiarly known as 40103 and 4060 respectively. Suitable replacements include CD40103B, HCF40103B, and HCC40103B and ECG4060B, NTE4060B, and CD4060B respectively. Be sure to specify whether the chips are in ordinary DIP packages or surface-mount packages. Unfortunately, the 40103 is rather hard to find; try a major distributor. We found them at Newark Electronics (75 Orville Drive, Bohemia, NY 11716-2580; Tel: 800-463-9275; Web: www.newark.com), which also has most of the other parts you need. The 74HCT40103 is *not* a substitute unless your circuit happens to be powered from 5 volts, and since you didn't mention a 5-volt regulator chip, that does not seem to be the case.

The C1815-Y5F is almost certainly a Japanese 2SC1815 transistor (they leave out the "2S"). Suitable substitutes include ECG85 and NTE85, as well as many other NPN switching transistors.

The Sanyo PMM8713 eluded us. After much searching we found Sanyo's data sheet collection at www.semic.sanyo.co.jp/english/index-e.html, but even then we couldn't identify it. You may be able to track one down through Sanyo's distributor in Norwood, New Jersey (Tel: 201-784-0303).

The TTD62103P has us stumped, even after trying many online search engines. Can you figure out what it is from its position in the circuit? Or can a reader identify it?

Where Red Is Negative

Everybody knows that on power supplies and test leads, red denotes positive and black denotes negative. In October we remarked that telephone wires (red and green) are "the only place in all of electronics where red denotes negative."

Stan Strom and one or two other readers contacted us to point out that red also marks the negative terminal of a thermocouple—some thermocouples, at least. So there are at least two contexts in which red denotes negative. Are there others?

Listening To Your Heart

Q *There is a growing population of senior citizens like myself who would like to listen to our heartbeats. My friend was told by his doctor that he was experiencing heart fibrillation. How did the doctor know this? Because he heard a rumble in the background.*

If you could identify the parts for such a system, it would be greatly appreciated by many senior citizens who should not have to wait until there is a crisis before seeing a doctor. — K. R. W., Sun City Center, FL

A Electronically speaking, this is a simple project—just hook up a suitable microphone element to a microphone-level amplifier such as RadioShack's 277-1008. You might try removing a microphone from its plastic case and placing the element directly on your chest or attaching a miniature earphone to the tubing of a stethoscope and using it as a microphone.

The hard part is interpreting what you hear. Remember that your doctor hears dozens of heartbeats every day, almost all of them normal, and is intimately familiar with the tone quality of his stethoscope (they make them in different lengths with different resonant frequencies). No matter what equipment you build, you won't have the doctor's trained ear. If you're worried about your health, frequent medical checkups are probably a wiser investment than instrumentation.

LED Clock Chip

Q *A portion of my ham shack has passed away. This is a 6-digit LED 24-hour clock. The chip, a National Semiconductor 24-pin MM5375AA/N, is what I need. Local suppliers are no help. — E. D., Placentia, CA*

A Unfortunately, the MM5375AA/N was apparently discontinued years ago. There is a small chance that you can get one from Rochester Electronics, Inc., 10 Malcolm Hoyt Drive, Newburyport, MA 01950; Tel: 978-462-9332; Web: www.

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Many electronic component manufacturers have Web pages; see the directory at http://www.hitex.com/chipdir/, or try addresses such as http://www.ti.com and http://www. motorola.com (substituting any company's name or abbreviation as appropriate). Many IC data sheets can be viewed online. www.questlink.com features IC data sheets and gives you the ability to buy many of the ICs in small quantities using a credit card. You can also get detailed IC information from www.icmaster.com, which is now free of charge although it formerly required a subscription.Extensive information about how to repair consumer electronic devices and computers can be found at www.repairfaq.org

Books: Several good introductory electronics books are available at RadioShack, including one on building power supplies.

An excellent general electronics textbook is *The Art of Electronics*, by Paul Horowitz and Winfield Hill, available from the publisher (Cambridge University Press, 1-800-872-7423) or on special order through any bookstore. Its 1125 pages are full of information on how to build working circuits, with a minimum of mathematics.

Also indispensable is *The ARRL Handbook for Radio Amateurs*, comprising 1000 pages of theory, radio circuits, and ready-to-build projects, available from the American Radio Relay League, Newington, CT 06111, and from ham-radio equipment dealers.

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Manuals for older test equipment and ham radio gear are available from Hi Manuals, PO Box 802, Council Bluffs, IA 51502, and Manuals Plus, PO Box 549, Tooele, UT 84074.

Replacement semiconductors: Replacement transistors, ICs, and other semiconductors, marketed by Philips ECG, NTE, and Thomson (SK), are available through most parts dealers (including RadioShack on special order). The ECG, NTE, and SK lines contain a few hundred parts that substitute for many thousands of others; a directory (supplied as a large book and on diskette) tells you which one to use. NTE numbers usually match ECG; SK numbers are different.

Remember that the "2S" in a Japanese type number is usually omitted; a transistor marked D945 is actually a 2SD945.

Hamfests (swap meets) and local organizations: These can be located by writing to the American Radio Relay League, Newington, CT 06111; (http://www.arrl.org). A hamfest is an excellent place to pick up used test equipment, older parts, and other items at bargain prices, as well as to meet your fellow electronics enthusiasts—both amateur and professional.

rocelec.com; they sell discontinued National Semiconductor products. If you're really fond of the clock, another alternative is to program a microcontroller to perform the same function as the discontinued chip.

Fuel Cells

Q *I read the item about the methanol-powered fuel cell in the Prototype section in the October 1998 issue of* **Electronics Now**. *It was intended to operate a cell phone. How many of those fuel cells would it take to power a car or motorcycle? — J. P., Rapid City, SD*

A A fuel cell is a battery to which you keep adding chemicals (fuel); it converts chemical energy to electricity. Methanol, or wood alcohol, is easily made in a number of ways. It's also quite poisonous.

We suspect it would be a lot more efficient to burn the methanol in some kind of internal- or external-combustion engine, thereby converting chemical energy into heat and motion (expansion), rather than converting it to electricity and then converting the electricity to motion.

Long-Range Cordless Phone Found

Periodically, readers ask for a way to amplify the transmitter in a cordless phone so it will work several miles from the base unit. In general, this isn't practical (or legal), because it would interfere with other cordless phones on the same frequency; if a signal reliably travels 1 mile, it will sometimes have some effect 10 or even 50 miles away. At the very least, your calls would be overheard by others.

Panasonic, however, has solved the problem. Their new "GigaRange" cordless phones operate on 2.4 GHz, where there is plenty of bandwidth, and they use spread-spectrum technology to prevent interference and protect privacy.

Roughly, spread-spectrum means that the frequency changes every few milliseconds in a predetermined pattern. This has two benefits: privacy, because if you don't know the pattern you can't follow it, and prevention of interference, because if the transmitter lands on the same frequency as something else, it won't stay there long enough to do any harm.

The claimed range is "about a country mile; city mileage may vary." More information is available on the Web at www.panasonic.com/gigarange.

Writing to Q&A

As always, we welcome your questions. The most interesting ones are answered in print. Please be sure to include plenty of background information (we'll shorten your letter for publication) and give your full name and address (we'll only print your initials). *If you are asking about a circuit, please include a complete diagram.* Due to the volume of mail, we regret that we cannot give personal replies. Please send to Q&A, **Electronics Now** Magazine, 500 Bi-County Blvd., Farmingdale, NY 11735. Questions can also be e-mailed to *covington@mindspring.com* but please do not expect an immediate reply (being a monthly magazine, we have to maintain a backlog) and please don't send graphics files larger than 100K. EN

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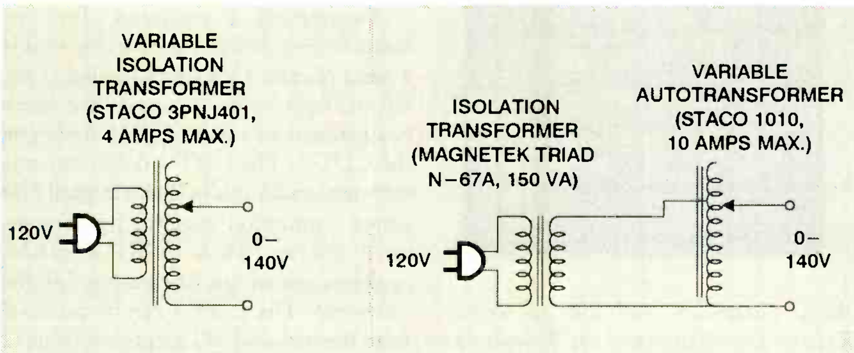

FIG. 1

McTube Clarified

I'd like to clarify a point of possible confusion concerning the schematic diagram for the "The Real McTube" (**Electronics Now**, February 1999). Although the contacts are not labeled, RY1 is drawn in the normally-closed position. Readers should note that when RY1 is off, J1 and J2 should be connected together. That condition exists when the unit is either powered off or with a footswitch plugged into J3. As long as RY1 is not grounded—activating it—the audio signal should bypass the amplifier circuit.
FRED NACHBAUER

Airport Buddy Authorship

I was surprised to see that the article "Airport Buddy" (**Electronics Now**, January 1999) used the exact circuit that I published in *Electronic Design News* (*EDN*) magazine in September 1997. I don't mind cross-pollination of ideas. We all stand taller, because we stand on the shoulders of others, but I, personally, do my darndest to give credit where credit is due.

I would appreciate a correction in your magazine identifying me as the originator of the circuit and acknowledging that *EDN* actually published it previously.
STEVE HAGEMAN
Windsor, CA

High Pressure

I suspect that you will receive quite a few calls and letters pointing out that the atmospheric pressure is typically around 29 inches of mercury, not 39 as I typoed in "Tech Musings" (**Electronics Now**, February 1999).

It was a very clear and calm day. I was on a different planet at the time.
DON LANCASTER

Half the Picture

It has come to our attention that one of the illustrations in the February 1999 installment of "Q&A" appeared incorrectly. In particular, half of Fig. 4 was inadvertently left out during the preparation of the magazine. The complete illustration appears here as Fig. 1. We are sorry for any inconvenience or confusion that might have been caused.—*Editor*

EN

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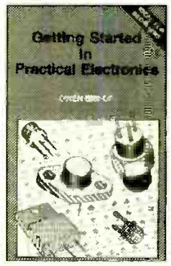

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EQUIPMENT REPORT

SOUNDSMITH CORP. CDT-4 AUTOMATED CD-PLAYER TESTER

This careful listener can help you test and repair CD players and CD-ROM drives.

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Not too long ago, one was literally surrounded by cassette-tape players. Every home stereo was equipped with one, most cars had cassette decks, pocket-size players were everywhere, and no boom box was without one. Today, however, cassette decks are disappearing.

In there place we have cheap pocket-size CD players. Single-play CD decks and even multi-disc changers are available in many new cars, every stereo system has a disc player, and no boom box is without one. Computers, both desktop and notebook, all come standard with CD-ROM drives, which are almost identical in operation to their audio-only counterparts.

But, as with anything mechanical and/or electronic, every one of those CD players will end up needing repair at some point. Granted that a lot of cheaper units are considered to be essentially throw-away items, higher-end audio players and CD-ROM drives often wind up in repair shops, factory service centers, and PC repair and salvage depots. In those types of operations, anything that can help pinpoint problems can save time, and thus lead to greater profits. That's especially true if the device can detect intermittent problems that usually take hours to track down, which destroys productivity and profits.

Soundsmith CDT-4

The Soundsmith CDT-4 is an automatic test system for all types of disc drives. It non-invasively tests CD players, DVD, laserdisc players, CD-ROM, and DVD-ROM drives. The CDT-4 tests drives for changes in signal level, skips, distortion, and loss of signal. Errors are displayed on 7-segment LEDs and logged in non-volatile memory for up to 5 days. The information can also be fed to a computer or printer through an RS232 port. The device costs $749.95.

The CDT-4 is a test instrument the size of a small shoe box. It comes with a special audio CD that not only tests the integrity of the player's analog signal path, but also contains tracks that the CDT-4 tester can "listen" to and then keep track of where and when any errors occurred and what types of errors they were. Such clues can help pinpoint malfunctions.

Failures have many possible causes, including manufacturing defects, temperature extremes, component wear, and so on. Intermittent problems are hardest to deal with, because usually the only way to solve such problems is by having a technician patiently listen for problems to occur. Small repair shops can ill afford to spend hours listening for errors to reveal themselves, so there's got to be a more efficient way to test. The CDT-4 is the answer: it listens for CD-player errors for you, without taking a salary.

It is important to note, however, that the device will not turn someone completely unfamiliar with troubleshooting and repairing CD players into an expert technician overnight. That still takes years of experience. The CDT-4 is simply a tool that can help screen out defective drives and provide clues as to what might be causing various problems. But if, for example, a CD player or other unit simply won't power up, the CDT-4 would be of no assistance.

Hooking It Up

Connecting a computer drive or home entertainment player to the unit is a piece of cake. One simply connects the left and right stereo outputs on the device being tested to a pair of RCA inputs on the CDT-4. The CDT-4 does not come with any audio cables, but a typical CD player connection requires just a common stereo RCA-to-RCA cable. Speakers should not be connected to the test setup. The CDT-4 can be powered from the included AC adapter or from 12 volts DC for automotive testing.

With both the CDT-4 and the device being tested turned on and with the test CD loaded, a simple calibration procedure is performed first. That involves playing the CD, pressing a calibrate button on the CDT-4, and adjusting a dial to illuminate LED indicators in a certain pattern—sort of like a level meter. Next, one stops the disc, presses a test button on the CDT-4, and then plays the disc through to the end—it takes just over an hour to play the 32 two-minute tracks.

As the disc plays, any errors detected are logged by the CDT-4, and an alarm will sound when the first error is detected. The alarm can be turned off if desired. Once the disc is finished playing, the error log can be scrolled through. Unfortunately, instead of providing numeric error codes, various patterns on the seven-segment displays must be deciphered using a key printed in the CD jewel box and in the instruction manual. Each error code generates a pattern on the display that indicates the channel (left or right), type of error, and which track and where in the track the error occurred. Error information can also be output through a serial port on the CDT-4 to a computer or printer.

The CDT-4's instruction manual explains what the error codes mean and also provides some tips as to what certain problems might indicate. For example, a drive that experiences problems before it's fully warmed up might have thermal defects. Or if errors occur toward the end of the disc, that could

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mean that tolerances are off and the drive can't track a disc properly at the outer edge. The type of error that occurs can also give clues as to what's wrong. But again, a technician must then confirm the problem, repair it, and then retest before the job is done. The CDT-4 is quite useful in verifying that a repair is successful, as the device can be made to work in conjunction with a player's repeat mode and test it for hours on end.

The instruction manual even gives some advice on troubleshooting certain drive parts by nudging them here or there, applying a drop of oil, and so on. But, as mentioned before, the CDT-4 will not fix problems for you. That's still up to you, but if your work involves screening out defective drives or listening for trouble, the CDT-4 could be your best friend. It'll work long hours and never complain.

For more information on the CDT-4 contact the manufacturer directly (The Soundsmith Corporation, 8 John Walsh Boulevard, Suite 417, Peekskill, NY 10566; Tel: 800-942-8009; Web: www.sound-smith.com), or circle 15 on the Free Information Card. EN

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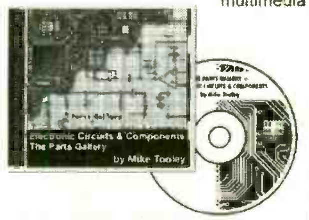
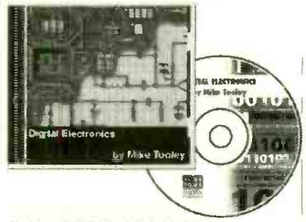


The Parts Gallery has been designed to overcome the problem of component and symbol recognition. The CD ROM will help students recognize common electronic components and their corresponding symbols in circuit diagrams. Quizzes are included. The Parts Gallery is free with Electronic Circuits and Components.

Digital Electronics details the principles and practice of digital electronics, including logic gates, combinational and sequential logic circuits, clocks, counters, shift registers, and displays. The CD ROM also provides an introduction to microprocessor-based systems. Includes circuits and assignments for Electronics Workbench.



Analog Electronics is a complete learning resource for this most difficult subject. The CD ROM includes the usual wealth of virtual laboratories as well as an electronic circuit simulator with over 50 pre-designed analog circuits, which gives you the ultimate learning tool. The CD ROM provides comprehensive coverage of analog fundamentals, transistor circuit design, op-amps, filters, oscillators, and other analog systems.

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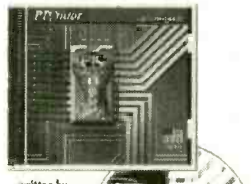
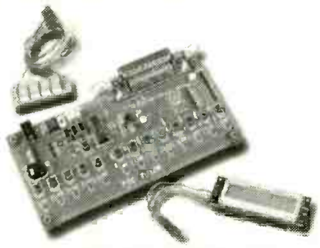


written by John Becker

The complementary development kit includes a reprogrammable PIC16C84, which you can program via your printer port. The institution version (designed for use in schools, colleges and industry) includes a quad 7-segment LED display and alphanumeric LCD display. The development kit provides an excellent platform for both learning PIC programming and for further project/development work. Assembler and send (via printer port) software is included on the CD ROM.



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BY SAM GOLDWASSER
SERVICE EDITOR

Troubleshooting HOT Problems

THIS MONTH WE WILL CONTINUE OUR DISCUSSION OF THE HORIZONTAL-DEFLECTION SYSTEM. AS BEFORE, OUR EMPHASIS IS ON COMPUTER-MONITOR TROUBLESHOOTING AND REPAIR, BUT MOST OF THE INFORMATION ALSO APPLIES TO TV sets and other CRT-based raster-scan systems.

Before we go on, I'd like to give special thanks to a few Philips engineers (actually one and several fractions!) for much of the information in this (as well as last month's) article. More details can be found at my Web site (www.repairfaq.com).

And finally, a warning: Make sure you understand the safety issues involved in working inside a monitor or TV, especially with respect to line voltage, high-voltage hazards, and charged capacitors (even when unplugged). Always confirm that power-supply capacitors are discharged before touching anything, even after the plug is pulled, and use an isolation transformer when probing signals in a powered monitor. See the safety information provided in previous articles in this series and/or the "Safety Guidelines for High Voltage and/or Line Powered Equipment" at my Web site.

When troubleshooting deflection system problems—especially those that tend to blow expensive parts—the use of the series light-bulb trick described a few months ago may be worth while unless you own stock in the appropriate semiconductor manufacturer!

Deflection System Signals

Due to the particular nature of the signals on the deflection yoke, special techniques must be used to safely view them on a scope. You cannot put a ground clip on either terminal of the horizontal yoke because one side carries the flyback pulses, which are approximately 1000 V p-p, and the other side carries the S-correction voltage, which may be 100 V average with a 50 V p-p vertical rate parabola. Both signals are at the horizontal frequency (15.75 kHz and up). You need a 100:1 oscilloscope probe for the 1000 V p-p signal! The vertical coil carries lower voltages (on the order of 50 V p-p max) and at the vertical frequency (50 to 120 Hz), so this is less of a problem.

Usually you connect the scope ground to a large heat sink, unless the heat sink carries a warning label that it is not grounded But even if it does not, don't assume!. Always check first to identify a proper ground and use an isolation transformer for safety since the chassis and power-line grounds might not be the same.

When diagnosing TV and monitor deflection problems, a current probe may be desirable to view the current waveforms in the yoke and flyback. If you have a current probe for your scope, it can be used to monitor the various current waveforms. I have used a Tektronix current probe I picked up for 10 cents at a garage sale to view the yoke current on TVs. The rendition of the horizontal deflection current waveform is quite good. However, the vertical suf-

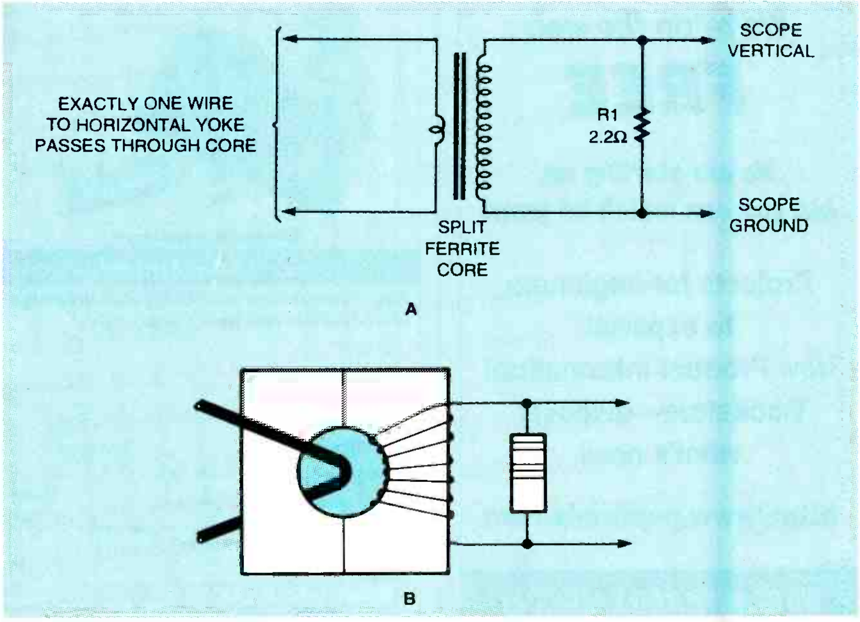

FIG. 1—WHILE NOT STATE-OF-THE-ART, this current probe is easy to build and works well for this application. The schematic is shown in A, while the layout is shown in B.

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fers from severe distortion due to the low frequency cutoff of my probe.

Building a Current Probe

If you don't have a current probe for your scope, here's how to build your own "Not So Fantastic Current Probe." As the name implies, it is not exactly state of the art, but it will do for this application and will work with almost any type of scope.

On the plus side, this current probe should cost you next to nothing and, despite its name, seems to be actually quite usable for viewing the horizontal deflection waveforms. It is made from a split ferrite core (preferably one that snaps together) of the type used on keyboard and monitor cables for RFI suppression.

The schematic is shown in Fig. 1A; a sketch of the physical layout is shown in Fig. 1B. To build yours, wrap seven turns of insulated wire around one half of the core. Next, solder a 2.2-ohm resistor across the two leads to act as a load. Finally, connect the leads to the vertical input of your scope via a coaxial cable or probe. Note that these instructions are just guidelines; you can experiment with the number of turns and load resistor value for best results.

To use your probe, place one—and only one—of the current-carrying wires to the horizontal yoke inside the ferrite core and clamp the two halves together (use a rubber band, adhesive tape, or whatever else works if it doesn't have built-in clips to hold it together).

For a typical horizontal deflection yoke, the probe will yield a signal with a few tenths of a volt p-p amplitude. The shape is similar to that from my fancy and (originally) expensive Tektronix current probe—a slightly squashed sawtooth for a monitor that is functioning properly (you do recall from our earlier discussions why it isn't a perfect sawtooth, right?). Enjoy the show! Like the Tektronix probe, this one will also not work well for low-frequency (i.e., vertical yoke) signals.

HOT Specs and Substitutions

Now it is time to continue with some discussions of issues related to Horizontal Output Transistors (HOTs). These are at the heart of every deflection system and are one of the most common parts to fail in a TV or monitor. Hopefully, based on our discussion last time, you will be able to appreciate that the HOT must be treated with more respect than just a fast switch.

Every deflection transistor has its own requirements for:

- Amount of base drive current, especially the I_B at end-of-scan.
- Waveform of base drive current (rising, steady, falling).
- Speed of reduction base drive current at switch-off.

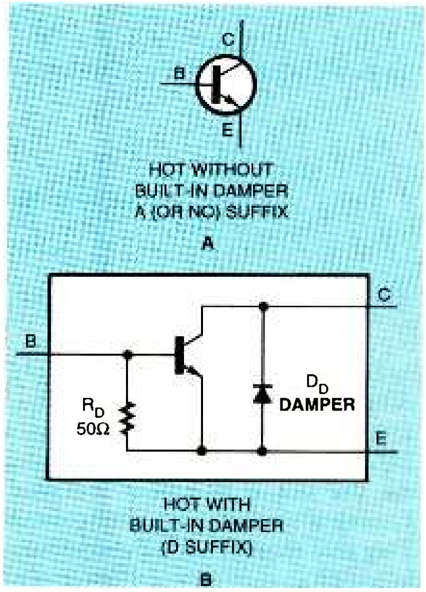

FIG. 2—WHILE THE PIN-OUT for a HOT without a damper (A) looks like a standard bipolar transistor, adding a built-in damper diode (B) complicates things.

The most effort goes into the optimization of the magnitude of the base drive current. The problem is: gain spread. In the ideal world, all transistors would come from the factory with exactly the same gain. In the real world, this isn't the case—it isn't even close. You have to find one optimum drive so that neither the high-gain nor the low-gain type will dissipate too much power, taking into consideration the variations in other circuit components as well. There used to be other spread factors influencing the dynamic transistor parameters, but fortunately, those have been mostly eliminated by better process control.

If the drive current is not exactly right, two conditions could occur: overdriving and underdriving. Overdriving causes a slow switch-off behavior; some collector current keeps flowing during the beginning of the flyback and will cause dissipation. Underdriving causes bad saturation; the collector voltage will start to rise before the flyback should start. This too causes dissipation. Either condition is easily observed with an oscilloscope, a current probe, and a 1:100 voltage probe (be sure to calibrate it for high-frequency response!).

The dissipation as a function of the base drive current is a more-or-less parabolic function with a global minimum. The minimum will be different for high-gain and low-gain types. By measuring the curves for both extreme types and combining them, an optimum drive for the random type will be found, with a figure for the worst-case dissipation.

All this will only be true if you insert a device that is a member of the population spread for which you optimized the base drive. If you just insert a random other device (different type, same type but different brand, same type and brand but much older/newer batch), then all bets are off. Dissipation may be way too high, with early failure as a result (and possibly a distorted picture geometry due to excess damping of the waveform).

Note that with horizontal output transistors, bigger is **not** better. If you substitute a higher-rated transistor (more amps, more volts, more watts, faster switching, whatever) for a lower one, then there is a very big chance that it will fail earlier, not later. The reason is that the drive conditions will now be wrong (most likely underdrive) and the transistor will overheat from too high conduction losses. So do yourself a favor and get a correct replacement type.

If cost weren't an issue, transistors and other parts could be hand selected (and some are in any case). But, you wouldn't be able to buy a monitor for $200 if that were required!

As noted above, component spread requires that base drive must be optimized for the whole range of gain within a type. That range can be so large that at the limits of the spread the dissipation can still be too large. The reason is that the device with the largest gain will be overdriven, causing a tail in the current at switch-off, whereas the device with the smallest gain will be underdriven, causing it not to saturate enough. Each condition can be easily viewed on the scope. By varying the base drive you can minimize dissipation.

Normally one base drive is set for the entire population, accepting the variation in dissipation and its upper limit. Sometimes the variation is so large that this will not be acceptable. But this is unlikely for a BU508 in a 16-kHz appli-

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cation. Substituting it with a similar type from a different brand with different parameter spread may indeed cause it to dissipate too much and thus fail early. This has nothing to do with price or quality, just with a different optimum base drive.

Table 1 is a list of HOTs used in smaller monitors—and not a complete one at that. In nearly all cases, the devices will be plug-in substitutes for each other within a category. Note that transistors with built-in damper diodes (see Fig. 2) also are likely to have a base to emitter resistor of about 50 ohms; keep that in mind when testing a HOT with a multimeter because a 50-ohm resistor will look like a shorted junction on the diode-test scale.

For designs with larger screen sizes (and higher frequencies) the device selection is not so straightforward, as some designs split the horizontal deflection and high voltage generation circuitry.

Continuous dissipation is hardly ever the cause of failure. Failure is usually due to some infrequent transient condition. For multi-frequency monitor designs 1991-1994 mode-change was/is a big killer. When repairs are made, it is wise to cycle through a mode-change sequence. Delays of about 1 minute between changes should be used; shorter delays can cook the device.

As a rule, once an engineer has a bad experience with mode change he takes greater care in the small-signal circuitry of his next design. This has led to mode change, in general, becoming more benign in the last couple of years. However, in Taiwan and Korea there is a high turn around of engineering staff and some, shall we say, less than perfect designs do still reach production.

Note that "cooking" a device by mode changing would take at least 30 minutes of continuous changing, with a delay of about 20 seconds between each change. If a device fails during such a sequence, the old spit test is good indicator of why that happened. That is, a drop of spit on the HOT immediately after failure can tell us a lot: if it sizzles, then the device has probably cooked, if it doesn't then the device failed instantly after one stressful cycle. Frontiers of technology it is isn't, but it is a useful technique. If you do get failures that haven't been caused by the HOT "cooking" I have no easy solution, sorry! (But see below).

By the way, a MOSFET would have to be mighty large to replace a bipolar deflection transistor. For example, a 1500V MOSFET that behaved as a BU2508 would have to be nearly twice the size and at least twice the price. Getting 10V on all the gate cells of such a big chip requires a lot of charge to be injected (i.e., current) and then removed (reverse current); much like a bipolar drive.

Table 1—Some Typical HOTs Used in Monitors

14 inches, SVGA (38 kHz)	A-types:	BU2508AF, 2SC4830, 2SC5148.
	D-types:	BU2508DF, 2SC4762, 2SC4916, 2SC5149, 2SC4291, 2SC5250.
15 inches, XVGA (64 kHz)	A-types:	BU2520AF BU2522AF, 2SC3885A, 2SC3886A, 2SC4757, 2SC4758, 2SC5129, 2SC4438, 2SC4770, 2SC4743, 2SC5067, 2SC5207, 2SC5251, 2SC5002.
	D-types:	BU2520DF, 2SC3892A, 2SC3893A, 2SC4531, 2SC4763, 2SC4124, 2SC4769, 2SC5296, 2SC4742, 2SC4744, 2SC4927, 2SC5003.

(A=no damper, D=built in damper diode).

Typical HOT Dissipation

Just measuring the actual power dissipation in a HOT is not trivial due to the nasty shapes of the voltage and current waveforms. The information in Table 2 is for TVs, but similar numbers apply to monitors, and extrapolation to higher scan rates is easy since, as noted, dissipation is roughly proportional to the horizontal scan rate. As you very likely might guess, a monitor running at a 100-kHz horizontal scan rate will likely be dissipating quite a bit of power in the HOT!

HOT-Related Failures

The remainder of this month's installment deals with problems resulting in blown HOTs. Those are among the most common types of monitor failures and can be both the easiest and toughest to repair. Sometimes, HOT failure is an isolated event with no real cause. In that case, replace the HOT and you are done. However, very often there is a cause for the failure, and you may go through a few expensive replacement HOTs before identifying it. And the ones none of us want to deal with at all are the random failures separated by a few days or months.

HOTs Keep Blowing

Unfortunately, what causes a HOT to continually blow or run hot is often difficult to definitively diagnose and repair and will often involve expensive component swapping.

It might be logical to assume that a new flyback transformer is needed (if for no other reason than that it is an expensive part!). But that is not necessarily the case.

In fact, if it were the flyback failing under load or when it warms up, there should be some warning such as the picture shrinking for a few seconds before the "poof." If, on the other hand, the monitor performed normally until it died, there are other possible causes. Those are summarized below and in Fig. 3.

Causes for HOT Failure

- Improper drive to HOT. That includes a too weak drive (or a HOT with a too low H_{FE}), causing $V_{CE}(sat)$ to be too large, giving conduction losses. It also includes a too strong drive (or a HOT with a too high H_{FE}), causing it to switch off too slowly, giving switching losses.

Base drive should be optimized to balance between those 2 losses. Check driver and HOT base circuit components. Dried-up capacitors, open resistors or chokes, bad connections, or a driver transformer with shorted windings can all affect drive waveforms.

- Excessive (B+) voltage on HOT

Table 2—Typical HOT Dissipations

14-21 inches, 16 kHz: About 1 W	(some have the HOT running in free-air)
21-36 inches, 16 kHz: Less than 2 W	(some new large CRTs only need 9 A p-p)
25-36 inches, 32 kHz: Less than 4 W	(dissipation really is proportional to frequency)

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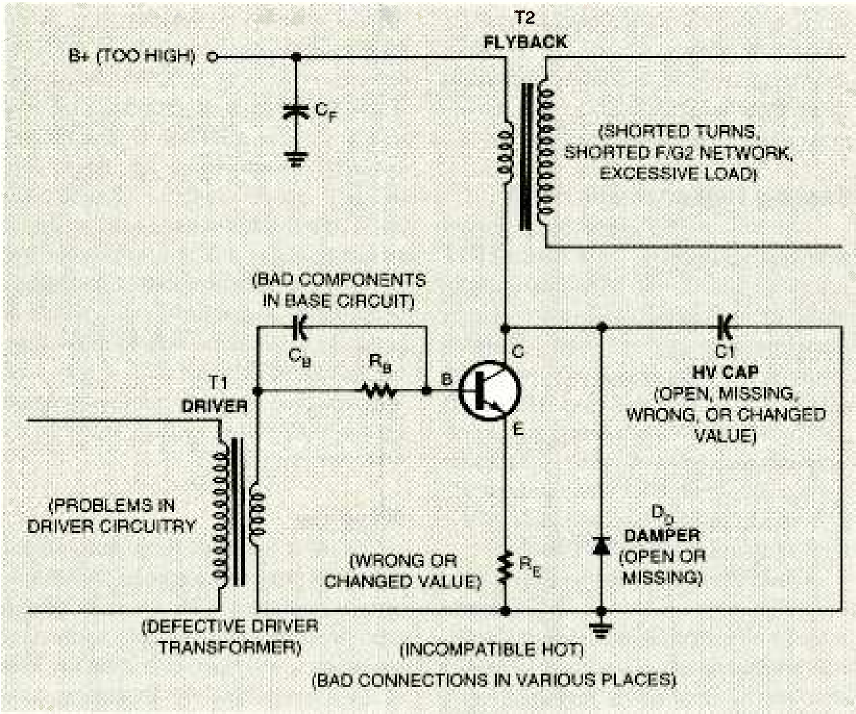

FIG. 3—AS YOU CAN SEE HERE, there are a lot of different problems that can lead to HOT failure.

collector. Check the low-voltage regulator (and line voltage if this is a field repair), if any.

- Defective safety/flyback capacitors or damper diode around HOT (though that usually results in instant destruction with little heating).
- New transistor not mounted properly to heat sink—probably needs mica washer and heat-sink compound.
- Replacement transistor not correct or inferior cross-reference. Sometimes, the horizontal deflection is designed based on the quirks of a particular transistor. Substitutes may not work reliably. In such cases, you can always *try* to optimize the base drive by changing the value of the power resistor that feeds the drive circuit at the primary of the drive transformer. But you're on your own here! Clearly label what you have done or else your name will be mud if the unit ever needs to be repaired by someone else in the future.
- And, of course, bad connections in the drive or output circuitry can be the cause of almost any sort of failure!

The HOT in a properly designed monitor or TV should not run excessively hot if properly mounted to the heat sink (using heat sink compound). It should not be too hot to touch (**CAREFUL**: don't touch with power on—it has those nasty thousand-volt spikes and may be line connected; unplug the unit first, then discharge the power-supply filter caps before touching). If it is scorching hot after a few minutes, then you need to check the other problems.

However, it is possible that the deflection circuit is just poorly designed in the first place and it has always run hot (though it is unlikely to have always been scorching hot). There is no way to know for sure without a complete analysis of the circuit—not something that is a realistic possibility. In this case, the addition of a small fan may make a big difference in HOT survival.

It is also possible that a defective flyback—perhaps one shorted turn—would not cause an immediate failure and only affect the picture slightly if at all. That would be unusual, however. We will deal with the details of flyback testing in a future Service Clinic article.

Note that running the monitor with a series light bulb may allow the HOT to survive long enough for you to gather some of the information needed to identify the bad component.

HOTs Blowing at Random Intervals

In such cases, the HOT may last a few months or years but then blow again. As you might expect, these are among the hardest problems to locate. It could even be some peculiar combination of user cockpit error—customer abuse—that you will never identify. Yes, this should not happen with a properly designed monitor. However, a combination of mode switching, loss of sync during bootup, running on the edge of acceptable scan rates, and frequent power cycles, could test the monitor in ways never dreamed of by the designers. It may take only one scan line that is too long to blow the HOT.

On the other hand, the cause might be one of the ones listed in the preceding section, just not as obvious—blowing in a few days or weeks instead of a few seconds. Even so, in such cases the HOT will likely be running very hot even after only a few minutes.

Another possible cause for random failures of the HOT are bad solder connections in the vicinity of the flyback and HOT (very common due to the large number of hot-running, high-power components) as well as the horizontal driver and even possibly the sync and horizontal oscillator circuits, power supply, or elsewhere.

Preventing Random HOT Failures

As noted above, a bigger HOT is not necessarily the answer. A selection of the same HOT for 1700-V breakdown voltage may help, but is not an option outside the design lab.

A separate HV supply (only in the most expensive monitors) would also help to save the deflection transistor, but might kill its HV twin. Of course, this is not an option in the field (unless you are REALLY into rework!).

Soft-start circuits make a big difference, but are an inherent part of the design, not an afterthought.

The chance of failure may also be a function of unspecified transistor parameters, so sometimes the mere swapping of a HOT might solve it permanently.

And, in the unlikely event it is an EMI problem (like a cellular phone lying on top of the set), then obviously the cause must be eliminated. A layout change is a better remedy but out of reach of a repair shop.

Testing for HOT Failure

This topic was covered in detail a couple of months ago, but just to refresh your memory:

For a monitor or TV with no blown fuses that will not start, here are some quick checks to see if the HOT is good and has power and drive:

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• HOT tests—check across each pair of pins for shorts (preferably removed from the circuit board). No junction should measure much less than 50 ohms or so. Lower readings almost certainly indicate a bad HOT. If in-circuit, however, the reading between base and emitter will be near zero due to the secondary of the driver transformer.

• Power—with the HOT removed, measure across the collector to emitter with a multimeter (if there is no deflection, this is safe with the HOT in place). There should be solid B+, typically about 100 to 160 V (for 115 VAC TV sets—possibly higher for 220 VAC sets), 60 to 170 V or higher for auto-scan monitors. If this is missing, either there is a problem with the power supply or the emitter fusible resistor has blown (probably in addition to the HOT) and there is no return for your voltmeter. If it is pulsing, the power supply may be cycling on overvoltage—the HOT may be good in this case but there is no base drive.

• Drive—put an oscilloscope on the base—there should be pulses around .7 V for most of the scan and probably going negative a couple volts at least for retrace. If drive is weak or missing, determine how base drive is derived as there may be a problem in the startup power supply or deflection IC.

Testing Replacement HOTs

The following is useful both to confirm that a substitute replacement HOT is suitable and that no other circuit problems are still present. However, single scan-line anomalies (when changing channels or where reception is poor with a TV, or when switching scan rates and/or when no or incorrect sync is present with a monitor) resulting in excessive voltage across the HOT and instant failure are still possible and will not result in a HOT running excessively hot.

• Function—confirm that the monitor or TV behaves EXACTLY as you expect it to. Look for any sign of changes in picture width and other aspects of geometry that might indicate a less-than-happy horizontal-deflection system.

• Temperature—after letting the unit run for a while, unplug the unit and confirm that the voltage on the HOT collector is near zero (discharge the power supply filter capacitors if it is not) and see how hot the HOT is. Note: Unplugging without switching off may result in the capacitors discharging faster if the unit has a soft (logic-controlled) on/off switch. Careful, the HOT may be really hot—start at the far end of the heat sink and work your way towards the transistor case. Obviously, a temperature probe (insulated!) would be better as it would be able to make measurements while the HOT is powered. You can also use a cheap thermometer for this purpose—attach its sensor to the heat sink near the HOT.

Wrap Up

That's it for now. Next time we will continue our discussion of deflection-system operation with a variety of specific problems and possible causes and solutions. Until then, check out my Web site, www.repairfaq.org. I welcome comments (via e-mail only please at sam@stdavids.picker.com) of all types and will reply promptly to requests for information. See you next time! EN

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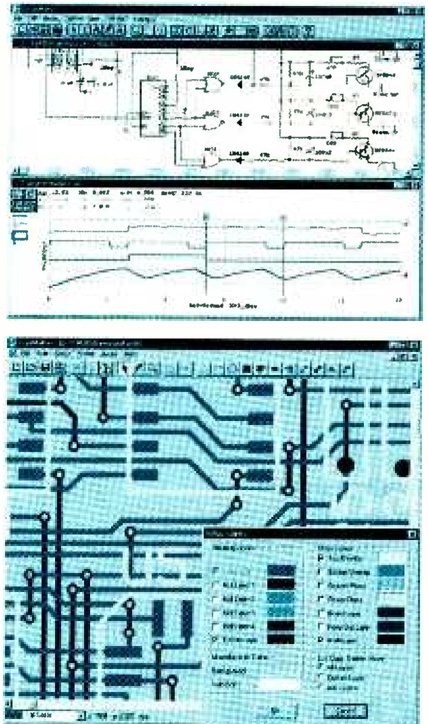

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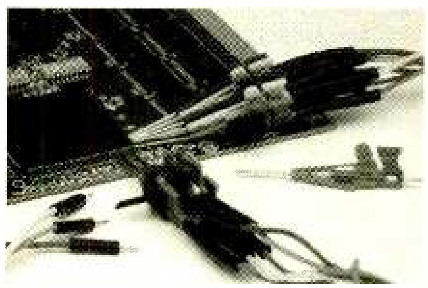

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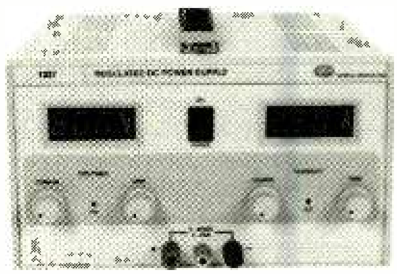
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(continued on page 56)

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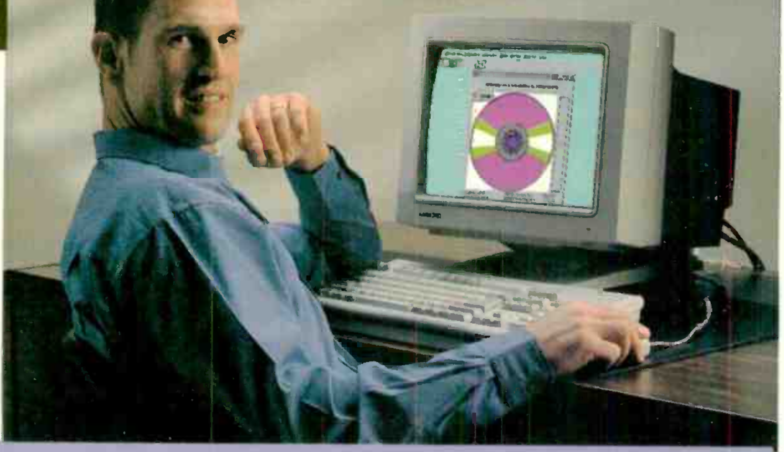

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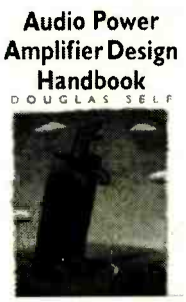

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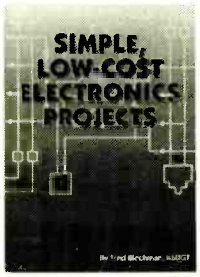

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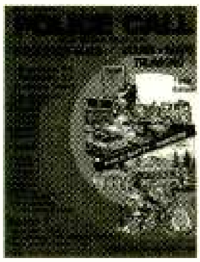

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Tel: 800-233-2766 or 508-339-3000
Fax: 508-339-6356
Web: www.datel.com.
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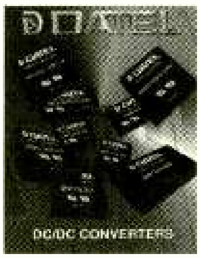

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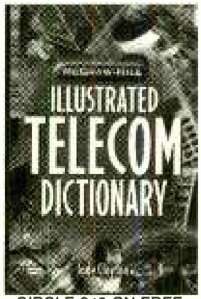
The new 224-page, full-color, guide contains detailed data sheets and applications information for the high-quality, moderate-power (3–75 watts), modular DC/DC converters. Covering 41 different product families and more than 250 products, it is hierarchically organized by product configuration (single, dual, or triple output), output voltages, rated output current, and specified input voltage range.

Included among the catalog's new DC/DC converters are ten 50/60W devices in the standard "half-brick" format, six families of 25–40W devices, a dozen new 15W devices, and many isolated and non-isolated, low-voltage units. There is an expanded section on safety approvals, explaining the requirements of IEC950, UL1950, and Europe's EN60950, as well as an explanation of the CE mark. In addition, there is a 50-page tutorial on these converters.

Mc-Graw Hill Illustrated Telecom Dictionary

by Jade Clayton
McGraw-Hill
1221 Avenue of the Americas
New York, NY 10020
Tel: 800-2MCGRAW
Web: www.ee.mcgraw-hill.com
$29.95



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A convenient reference/review for everyone from public telephone company professionals to instructors and students in the areas of computer science, information systems, telecommunications, and electronics, this dictionary provides over 2000 convenient and easy-to-understand definitions of telecommunications-industry terminology and technology.

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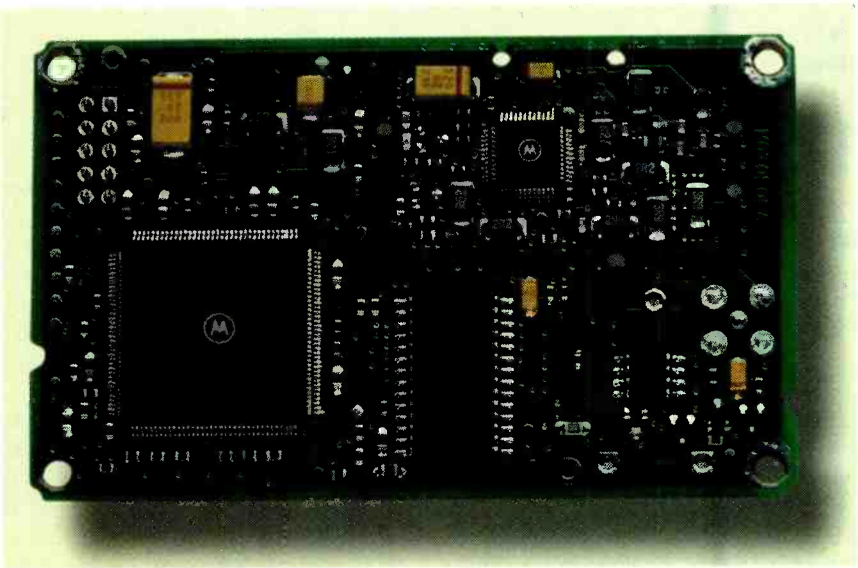
Prototype

Urban GPS

Global Positioning System equipment works great for motorists on an open interstate highway, hunters in the field, or boaters on open water. However, the canyons created by tall buildings in urban areas often mask the signals from the GPS satellites—signals that are needed for accurate navigation. Dense foilage, bridges, underpasses and other obstacles also interrupt reception to degrade the performance of GPS-based equipment such as navigation and automatic vehicle-locating systems. That often limits the ability of some key users who must work in an urban environment to obtain maximum benefit from GPS. That includes law enforcement, EMS (emergency medical service) providers, taxi operators, delivery services, and ordinary motorists with on-board navigation systems.

To combat that, Motorola is now offering its *Oncore* series of GPS receivers, which are designed to eliminate these problems. Available in Oncore and GT Plus Oncore versions, both feature an eight-channel GPS receiver that can track the eight best-available satellite signals. (Eight is the maximum number of GPS satellites that can typically be viewed and tracked simultaneously.) Software in the new receivers needs less than a second to re-acquire a lost signal and has the ability to memorize height so it can determine a position using only two signals.

The new receivers are capable of performing a "hot start" in less than 15 seconds and a "cold start" in less than 90 seconds. If the GPS signal is interrupted, for example, when the vehicle passes under a bridge or travels along an underpass, position data is re-acquired in less than a second. That is especially important when GPS is used with a digital map, for dead reckoning, or during an emergency response. The receivers also come with Motorola's *Urban Canyon and Foliage* software, enabling the Oncore receiver to operate in locations that previously had poor GPS reception—such as in the center of a city. The GT Plus Oncore is set up to handle Differential GPS.



THE MOTOROLA GT PLUS Oncore GPS receiver is set up to handle differential GPS.

FOR MORE INFORMATION

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Positioning and Navigation Systems Business
4000 Commercial Avenue
Northbrook, IL 60062-1840
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Fax: 847-714-7324
Web: www.oncore.motorola.com

Mobile Data Solutions Inc.
Bar Hill Business Park
Saxon Way, Bar Hill
Cambridge CB3 8SL, England
Tel: +44 1935 826451
Fax: +44 1935 826551
e-mail:
100307.2360@compuserve.com

Hey, Taxi!

One example of the use of the new Oncore receivers is in the *Mobistar* mobile radio-data communications system developed by Mobile Data Solutions Inc. located in Cambridge, England. Those systems are now in routine taxi service in London and Singapore. London's largest taxi operator, Computer-Cab, whose routes cover all of greater London, has installed these GPS-based system in some 2700 of those world-famous black cabs and plans to have them installed in 4000 cabs by the year 2000. On the other side of the world in Singapore, Citycab, one of the world's largest taxi operators, is well on its way to equipping its 3500 vehicle fleet with GPS capability. Naturally, both applications were made possible because of Oncore's ability to perform well in a dense urban environment.

Positioning information is transmitted to a central dispatching center, where it is viewed on a map display by

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LONDON'S FAMOUS TAXIS are now fitted with the GPS-based Mobistar System.

dispatchers. Using this position data and the location of the customer, the dispatcher can send the detailed pickup information to the closest taxi to make the pickup, rather than to the cab at the top of list, which might be miles further away. The information is displayed on the screen of a compact mobile data terminal mounted on the taxi's dashboard. If the first driver declines the job, the information is automatically transmitted to the next closest available taxi. No longer are customers left waiting if the taxi is stranded in traffic in another part of London or Singapore. Taxi cab drivers are far less often greeted by "Finally, I have been waiting for a half-hour." In London, the average wait time has been reduced by 30%. Since empty cabs no longer travel across town to pick up fares, operating costs are also reduced by about 30%. In Singapore, it is estimated that 20% less time is spent communicating with cabs to simply find out where cabs are currently located.

The system can do more than just get to customers faster. Security is enhanced since the cab's location is always known should there be a robbery or an unruly passenger. The dispatcher knows exactly where to send the police if there is a problem. The system is even equipped with a "panic" button to summon help. Mobistar can also be used to the track the location of a stolen taxi. Taxi operators in other cities like Hamburg, Paris, Toulouse, and Stockholm are working on similar systems.—**by Bill Siuru** PT

Recycling Batteries

The U.S. Environmental Protection Agency (EPA) recently certified a label proposed by the Rechargeable Battery Recycling Corporation (RBRC) for NiCd rechargeable batteries and product packaging. This is EPA's first certification of a label other than the label language required by the 1996 "Mercury-Containing and Rechargeable Battery Management Act." That Act established uniform national standards to encourage recycling certain used batteries, but it also allows EPA to approve different labels if they accomplish the same goals.

RBRC, a not-for-profit public service organization, introduced the alternative label to alleviate consumer confusion about recycling NiCd batteries. The current labels present disposal as an acceptable alternative, RBRC contends. The new label features a battery surrounded by three chasing arrows and states simply "RECYCLE." The EPA and RBRC agreed that the label must include information on where and how to recycle their used batteries. RBRC's toll-free consumer helpline, 1-800-822-8837 (1-800-8-BATTERY), is featured on the label for that reason.

THE NEW NiCd RECYCLING LABEL features a battery surrounded by three chasing arrows and "RECYCLE," along with RBRC's toll-free consumer helpline, 1-800-822-8837.

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"These batteries contain cadmium, a heavy metal that can be harmful to public health and the environment if not disposed of properly," said Carol Browner, U.S. EPA administrator. "I congratulate the retail chains participating in this new recycling program and hope others will follow their example."

RBRC's program, called Charge Up to Recycle, has enlisted 20,000 retail stores and community locations nationally to serve as collection sites for used NiCd batteries. Consumers can find the locations by using the 800 number or checking the RBRC Web site: www.rbrc.com. Participating retail stores include ACE Hardware, Circuit City, RadioShack, Target, and Wal-Mart.

The organization has shown that the recycling program is financially viable, that it offers readily available battery collection points, and that the collection, transportation, and recycling of the batteries is environmentally sound. Their program is funded by more that 250 manufacturers and marketers of portable rechargeable batteries and products. All participants ship their collected batteries to INMETCO (International Metals Reclamation Company), whose recycling process is recognized by the EPA as being the "best demonstrated available technology" to recycle NiCD batteries. PT

Combined Developments Yield Secure Data Model

Fermenti Labs, together with Fred Kruggerand Associates (FKA), has announced a new security model for sensitive data based on the merging of their two technologies.

In 1984, Fermenti, of Skokie, IL, won a research-and-development contract from the Defense Advanced Research Projects Administration (DARPA) to develop a new type of memory chip for the US Government. That chip, called a Write-Only Memory (WOM for short) was heralded as the ultimate in data security. In several tests, it was found to be impossible for even the most dedicated computer "hacker" or government spy to extract the data securely held in the WOM chip.

However, further tests revealed a shortcoming with the new system: indexing of new data as it was added to the chip was, to quote one of the research scientists assigned to the project, "somewhat less than reliable." Unless that hurdle was overcome, the WOM chip seemed destined to end up on the scrap heap of technologies whose time had not quite yet come.

Enter FKA. According to spokesperson Janet Dammut, an article detailing the state of Fermenti's research in an issue of the Defense Department's (DoD) industry publication *Secret Government Contracts Quarterly* had caught the eye and imagination of the Valley Mountain, CA company's engineer, Franklin Furter. In a sudden flash of insight, Dr. Furter had a vision that proved to be solution to the WOM problem.

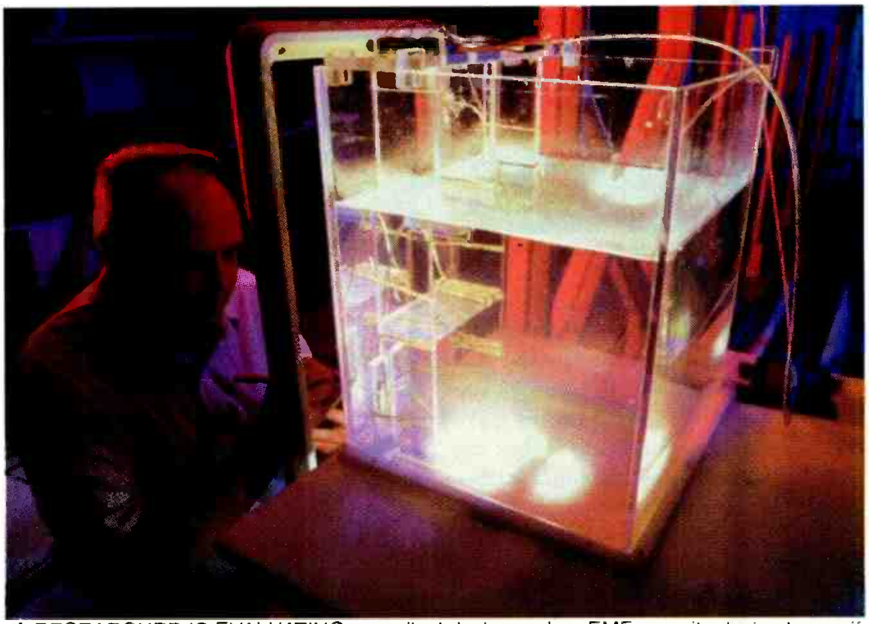
Said Dammut, "The basic solution involves the implementation of an index generator as an integral part of the WOM's data-input lines. With the ability to update and sort the data index on a real-time basis, Fermenti's groundbreaking research is no longer a laboratory curiosity. The combination of our Write-Index Generator (WIG) and Fermenti's Write-Only Memory is the marriage of two technologies that can proudly take their place in the real world."

Engineering samples of the WIG-WOM will be available from both companies as soon as all Year 2000 compliance tests have been completed, which is estimated to be around April 1. PT

The Beat Goes On

As electronics components become smaller and smarter, they allow development of increasingly sophisticated pacemakers, implantable defibrillators, and other medical devices that improve the quality of life for many patients. At the same time, growing concern about theft from retail stores has lead to widespread use of electronic article surveillance systems that generate fields of electromagnetic energy while in use. Those electromagnetic fields can potentially interfere with these sensitive medical devices, causing concern for retail customers.

To help manufacturers of both types of equipment understand—and help prevent—these potentially harmful interactions, researchers at Georgia Tech have established the EAS/Medical Device E3 Team Center. At the center, both types of devices can be tested together. For more information, visit their Web site: www.gtri.gatech.edu/resnews/E3TEST.html. PT



A RESEARCHER IS EVALUATING a medical device and an EMF security device to see if there is a dangerous interaction

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Drilling For Tomorrow

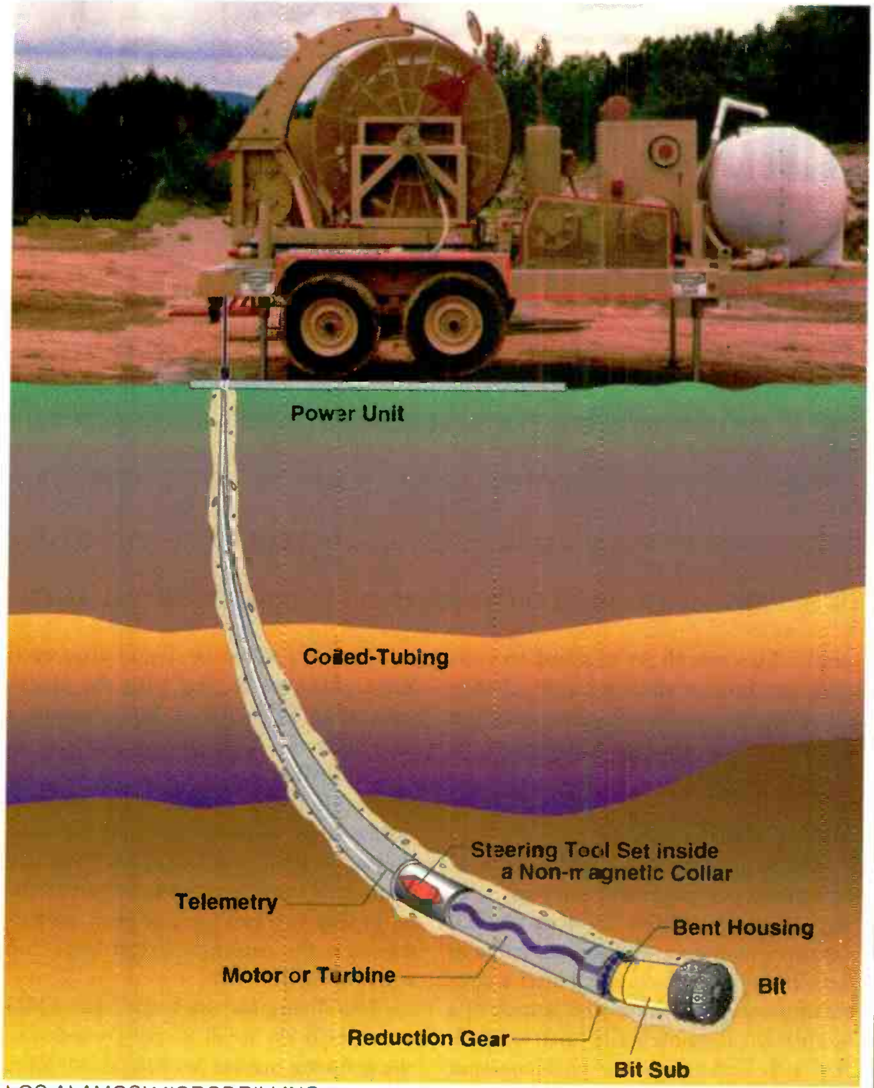
Researchers at the DOE's Los Alamos National Laboratory are currently testing new microdrilling technology that may revolutionize the way underground resource exploration is carried out in the 21^{st} century. The technology may one day be used on space missions for boring "microholes" in planetary bodies.

The technology consists of a standard mining drill bit and oil field drillout turbine attached to a one-inch steel coil. (Today's production well drills can be anywhere from six inches to more than a foot in diameter.) The steel coil is wrapped around a tubing reel that can hold thousands of feet of coil. It is part of a drilling system that ultimately will occupy a space roughly $1/20^{th}$ that of a typical rig, said Jim Albright, leader for Los Alamos' Geoengineering Group. Placed through an injector wellhead, the coil then begins drilling holes less than two inches in diameter. The steel coil is flexible enough to drill holes at various angles. He added the new rig costs about 90% less than a conventional rig. Albright also said microdrilling saves even more because it requires only about a barrel of fluid per 1000 feet of drilling instead of 40 barrels of fluid per 1000 feet.

As a complementary part of this project, the researchers, in collaboration with U.S. industry, also are developing miniature seismic instrumentation packages that can be placed inside the microholes for data gathering. As electronic circuitry continues to shrink, according to Albright, microdrilling may become the preferred tool for placing other sensors deep underground to perform an array of data-gathering activities, including monitoring soil contamination and underground nuclear testing.

This technology is undergoing testing, boring through volcanic rock or tuff, on Fenton Hill, a site near Los Alamos. Several major oil companies are contributing financial or technical support. The DOE is also contributing money toward the development of a microhole drilling infrastructure.

"We need to make sure that the technology can be used across different types of sedimentary rock and that the drilled holes remain stable and don't cave in. After all, the holes being drilled are less than two inches wide," Albright stated. Researchers hope to drill down to a target depth of 6000 feet within the next three to five years. PT



LOS ALAMOS' MICRODRILLING system drills holes that are less than two inches in diameter and can drill at various angles.

DVD Rewinder

U.S. Less, a Singapore developer, manufacturer, and distributor of accessories for home electronics, announced the availability of the DVR, a stand-alone rewinder for DVD discs. According to the company's press release, "Using the DVR to rewind your movie after watching it will reduce the amount of stress placed on the DVD drive's mechanical components. Those components, including the motors, gears, and belts, will prevent the expensive unit from suffering premature breakdown due to excessive use."

The DVR joins U.S. Less's similar rewinders for video discs and audio CDs. No suggested retail price was available at press time. First units are expected to reach the market by April 1. PT

"It plays like that whenever the cat is away."

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BY KONSTANTINOS KARAGIANNIS
COMPUTER EDITOR

AMD and Cyrix Challenge A Giant

LAST MONTH WE TOOK A LOOK AT INTEL'S PLANS FOR THE COMING YEAR, REVEALING SOME OF THAT CORPORATION'S PROCESSOR ROAD MAP. WE ALSO INTRODUCED THE BASICS OF SUPERSCALAR ARCHITECTURE AND 3-D PROCESSOR ENHANCEments. This month we're going to continue our look at the constantly changing processor market by examining the offerings of two of Intel's biggest competitors: AMD and Cyrix.

AMD'S BEST YEAR?

Thanks to its K6-2 with 3DNow! advertising campaign and discount pricing, Advanced Micro Devices (AMD) has become quite a well-known name in the CPU marketplace. Even after a couple of missteps, including its launch of a Mobile K6 for notebooks that was riddled with heat and power problems (not to mention the fact that AMD couldn't make enough to satisfy its two licensed laptop vendors at the time), AMD has managed to keep on releasing chips.

It's safe to say that AMD is a company with two main goals: Provide high-performance CPUs and provide them at a cheaper price than Intel. To determine if it's been successful you have to consider what it is AMD is providing for the consumer dollar.

In terms of raw computing horsepower, AMD CPUs always fall behind those of Intel in benchmark testing. At the time of this writing, the K6-2 is the most advanced AMD chip. However, whenever we've benchmarked a K6-2 side-by-side with an identical clock-speed Pentium II, the latter always outperforms the AMD chip (even with the K6-2's 64K of L1—Level 1—cache, which is twice the L1 memory of PII).

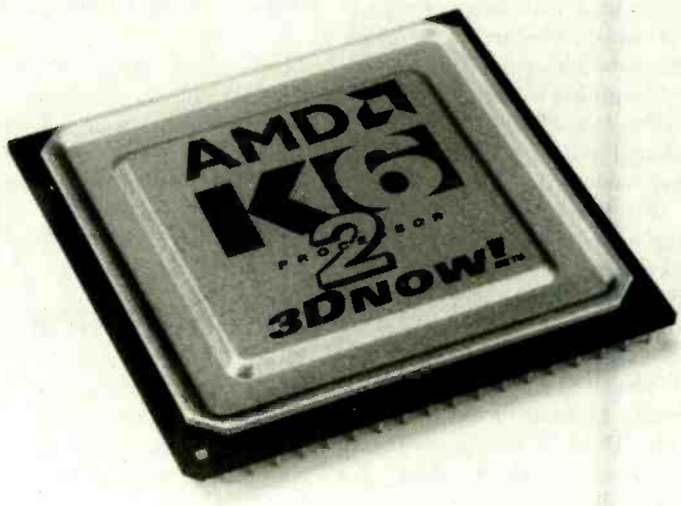
On average, we've found that each K6-2 performs on par with the clock-generation PII below it. For example, a 333-MHz K6-2 performs about as well as a 300-MHz PII. On the plus side, the price difference between the chips is rather large. That means that for your dollar you tend to get more performance from AMD products—you're just limited in that you can't get as great performance as the currently fastest Intel chip with any AMD CPU.

This "bang for the buck" that AMD provides is no small nicety considering the growing market for sub-$1000 PCs. But are you really getting a product that's just as good as an Intel offering?

Currently, there are still *very few* companies planning on supporting the 3DNow! technology found in K6-2 processors. As we mentioned last month, Intel's Katmai instruction set has a tremendous amount of support from software manufacturers. For those who want to be able to run just about any program that will be hitting stores this spring and summer, a new Intel machine is a sound, though more costly, investment.

While AMD seems to be a "full length" behind Intel in the processor race, being number one in its market should be the focus of every company's plan, and AMD is no exception. It believes that this year will be a crucial one in achieving that goal.

Most notably, the company's working on a project called Sharptooth, which is expected to be released soon (possibly by



THE AMD K6-2 RAISED THE BAR for Intel competitors, getting closer to PII performance than any other CPU. AMD hopes to close the speed gap even more with its coming K6-3 and K7 chips.

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the time you read these words) as the K6-3. This is basically a K6-2 processor with 3DNow! technology, but with an "extra-large" L2 (Level-2) cache as well. The reason we used quotes just there is the company has devised an unusual cache scheme. While the chip will have an internal L2 cache, the CPU could be plugged into a motherboard with another L2 cache. This external L2 will become an L3 (Level-3) memory. It's an interesting idea, and one that should bring at least 1MB of "secondary" cache to the average desktop. The new K6-3 is expected to launch with a maximum speed of 450 MHz.

Also this year, AMD plans to release a totally new chip—the K7. Raising the ante a bit, the chip is scheduled to come out in a 500-MHz version by the end of the summer. It's not clear what its L2 cache design will be, as AMD's details are still a bit sketchy.

For those who weren't with us last month, we introduced the concept of the trace-size manufacturing process. The concept here is simple: the tinier the internal chip traces, the faster and more efficient the processor. The current industry standard is a 0.25-micron process, and the first version of the K7 will stick to it. During the second half of 1999, though, AMD plans on releasing a 0.18-micron version.

With the K7 chip, AMD will have to shift its marketing strategy slightly. The new chip will not be much cheaper than those from Intel when you take into consideration the supporting motherboard cost increase. This is because K7 has to move to a slightly pricier bus platform (the one used in Alpha machines). This Slot A design is expected to be able to accommodate up to 200-MHz bus speeds; not bad considering Intel's fastest bus speed by the summertime should be about 133 MHz. It hasn't been determined yet if K7 machines really will launch at the 200-MHz bus speed, though.

All K7 chips will contain the vendor's 3DNow! technology, which will make the chip perform very well when running applications designed to take advantage of the instruction set. However, as we mentioned earlier, considering the number of vendors that plan on first supporting Intel's Katmai set and maybe adapting to fit 3DNow!, we're just not certain how useful 3DNow! will be to high-end users.

Intel has more than 80 percent of the CPU market share right now, making it difficult and expensive for "little" software developers to work on code that can only be used by a small percentage of computers for sale. This coming year, AMD hopes to make the market more of a 70-to-30 battleground, which could convince more programmers to write 3DNow! code.

As a final push to compete head-to-head with Intel, which is working on a new chip code-named Coppermine, AMD engineers are working on the use of copper-interconnect technology in their 0.18-micron designs. That new method of chip manufacturing could provide a significant speed boost (it could make a 500-MHz chip act like a 550-MHz one, for example) while keeping costs down. Copper might not hit AMD chips until next year, though. By then, the company might be using copper-interconnect technology to help their CPUs reach a gigahertz.

CYRIX'S MII IS A SUPERSCALAR PROCESSOR that's becoming a popular choice for sub-$1000 and even sub-$800 PCs. Just watch for the number on the chip—it refers to a performance rating and not an actual clock speed in MHz.

CYRIX TRYING TO KEEP AFLOAT

They're trying. Their chips are appearing in plenty of sub-$1000 and even sub-$800 PCs. But can Cyrix compete?

Readers of this magazine may be familiar with Cyrix because it is a National Semiconductor company (*i.e.*, Cyrix was acquired by National). But as diverse and impressive as National is, Cyrix is not exactly a top-notch branch: The CPU manufacturer's forte has been the production of low-price, low-performance CPUs.

The newest chip available from Cyrix is the MII. Like the K6-2, the MII has a 64K L1 cache, two pipelines for multiple transactions (making it superscalar like Pentium II), and the MMX instruction set. Like the Pentium II, it can handle multi-branch predictions of which commands the CPU will need, and it can even handle out-of-order completion of those commands.

Unfortunately, even though the MII has a large L1 cache and PII-like architecture, it doesn't come even close to performing as well as a PII. In fact, it benchmarks slower than even a similar-clock speed Celeron (which is a PII with only 128K of L2 cache, compared to PII's 512K).

Part of the reason for that performance hit is the lack of an integrated L2 cache in the MII. The other reason is that Cyrix does not label its chips with a real clock speed. They use a *PR* number, which stands for "performance rating." That number represents what clock speed Cyrix *thinks* the chip performs like.

To illustrate, let's look at the fastest MII, the 400PR chip, which should be in stores by the time you read this (at press time, Cyrix had a late February release in mind). The 400PR could actually be a 333- or 366-MHz chip.

What we don't particularly like about the PR rating is that the processor market is getting muddy, and Cyrix does not even specify which type of 400-MHz processor is being compared to its newest chip. Considering that our benchmark tests showed that a 300PR MII doesn't perform as well as even a 300-MHz K6 (K6-2's much slower predecessor), we're not sure the company's strategy is a sound one.

(continued on page 56)

VENDOR INFORMATION

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Tel: 800-848-2979
Web: www.cyrix.com

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Johnson City, NY 13790

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Tanner Electronics
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LEARN TO RELAX WITH A BRAINWAVE SYNCHRONIZER

JAMES MELTON

Put yourself into an "altered state" of restful calm with this simple device. Whats more, you can save your favorite sessions and share them with others.

Have you ever been mesmerized by a candle or a fireplace flame? Perhaps you've been traveling down a highway with the sunshine and the trees aligned so that you experience a rapid "picket-fence" effect from the alternating bright and dark areas. Maybe you've felt either somewhat nauseous or very distracted by flashing lights.

Those effects come from the tendency of your brain to "synchronize" with the input presented to it. From the earliest days of brainwave study, researchers have known that your brain responds measurably to external stimuli. As with any waveform, brainwaves have a frequency. Further, specific ranges of frequencies correspond to certain states of consciousness. See Fig. 1.

For example, brainwave activ ty at 12 Hz and above is called the "beta" state. That state is generally recognized as the "awake" state; it is probably (hopefully!) the range that your brain is operating in right now as you read this article. Activity from 7 to 13 Hz is called the "alpha" state. In that state, you are usually relaxed. Sometimes you are in a trance-like state or just beginning to fall asleep, or perhaps you are still alert.

The 4- to 8-Hz range is the "theta" range that is associated with deep meditation, creativity, and dreaming. Below 4 Hz, you are in a deep, dreamless sleep or other profound state. In all of the available literature, the above frequencies represent the areas that have been studied. Obviously, each individual has specific frequencies or ranges of frequencies that correspond to their own brain functions.

Learning more about brain functions, and more specifically about how your brain functions, is suprisingly easy. For example, you can perform several interesting experiments with equipment that you can build yourself. One such piece of equipment is the Visual Brainwave Synchronizer that is presented here. It will let you experiment with various combinations of frequencies, which are recorded on a cassette tape. When the tape is played back, light-emitting diodes in a set of light-proof goggles are flashed in front of your eyes. That stimulates your brain into the frequency at which the LEDs are flashing. You can modify the "program" to suit your needs. Since the program is stored on a tape, you can save a successful session and make copies for others.

Theory Of Operation. The Visual Brainwave Synchronizer is a two-chip circuit that includes a tone-burst generator and a decoder. The basic signal produced is a 50% duty-cycle burst of a 1000-Hz tone that is switched on and off at a frequency of 2–20 Hz. Those bursts of tone are recorded on a cassette. A simple control varies the low-frequency part of the signal; the user sets the signal frequencies to synchronize with the desired brainwave frequency.

After recording a "program" on the cassette tape, the tape is played back into the Visual Brainwave Synchronizer. The incoming pulses are converted back to electrical pulses that flash a set of LEDs that are installed in a set of goggles. Since the pulses are at the

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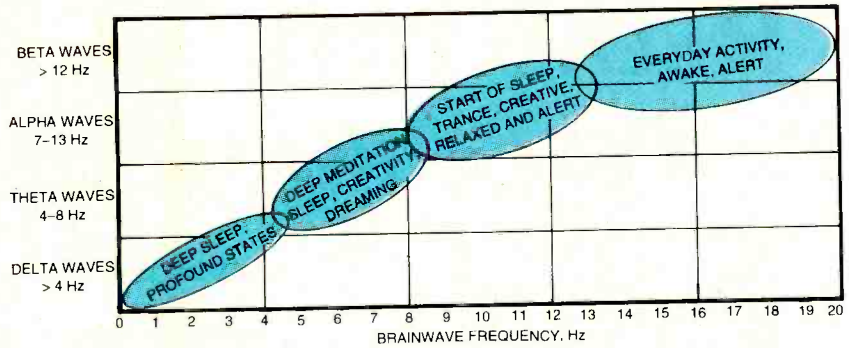

Fig. 1. The human brain generates frequencies of electrical activity. Those frequencies are a direct indication of our mental state.

same frequency as the recording, the user simply puts on the goggles, sits in a comfortable chair, and lets the pulses of light enter his or her eyes—which can be either open or closed. The stimulation of the optic nerves induces the brain to synchronize to the LED frequency. The light in the goggles is kept at a reasonable level, and the output is modulated (reduced) during the incoming pulses.

If you are working with a partner, it is possible to connect the output of the tone-burst generator directly to the input of the decoder. That will let you control the frequency of the flashing LEDs directly from the control box. There are two drawbacks to that mode of operation if you are experimenting on yourself. First, it becomes very distracting to have to pay attention to the control knob while you are trying to relax. Second, it is possible that you might relax so far that you would actually fall asleep while the stimulator was at a very low setting. You would then become stranded in that state until you were "rescued." Having a cassette tape of your session not only ends the session when the tape runs out, it also lets you repeat a "good" session or make copies for other people to use.

Circuit Description. The schematic diagram of the Visual Brainwave Synchronizer is shown in Fig. 2. The tone generator portion of the circuit is made up of two separate oscillators from IC1, a quad NAND gate. Two of the gates, IC1-a and IC1-b, form an oscillator that operates in the 2- to 20-Hz range. The frequency of the oscillator is set by R12. Note that R2 is in series with R12, so that there is always some resistance in the feedback path of the oscillator. The other two sections form a similar oscillator that runs at 1000 Hz. The output of the low-frequency oscillator is fed to pin 8 of IC1-c on the high-frequency oscillator; that arrangement turns the 1000-Hz oscillator on and off.

The output of the 1000-Hz oscillator is fed through current limiter R5 and voltage limiter D1 and D2. The conditioned signal is fed through J2 to the microphone input of the cassette recorder. That output is set to be at about 0 dB into a line-level input.

The tone-decoder portion of the circuit is fed from the speaker output of the cassette recorder into J1. The input signal is coupled into an 8-ohm to 25,000-ohm audio transformer. The output of the transformer is grounded on one side and fed directly into the base of Q1. That transistor serves a dual function of rectifying the incoming signal and grounding R11; the result is a 1000-Hz signal with a 50% duty cycle. That signal is fed into IC2-a.

The output of IC2-a is a buffer that feeds the rest of the inverters. Each remaining inverter drives the LEDs with current-limiting resistors.

Construction. The circuit for the Visual Brainwave Synchronizer can be built on a perfboard using standard construction techniques or on a single-sided PC board. If you want to use a PC board, a foil pattern has been included here. As an alternative, an etched and drilled board is available from the source given in the Parts List.

If you've purchased a PC board or etched one from the foil pattern, the parts-placement diagram in Fig.

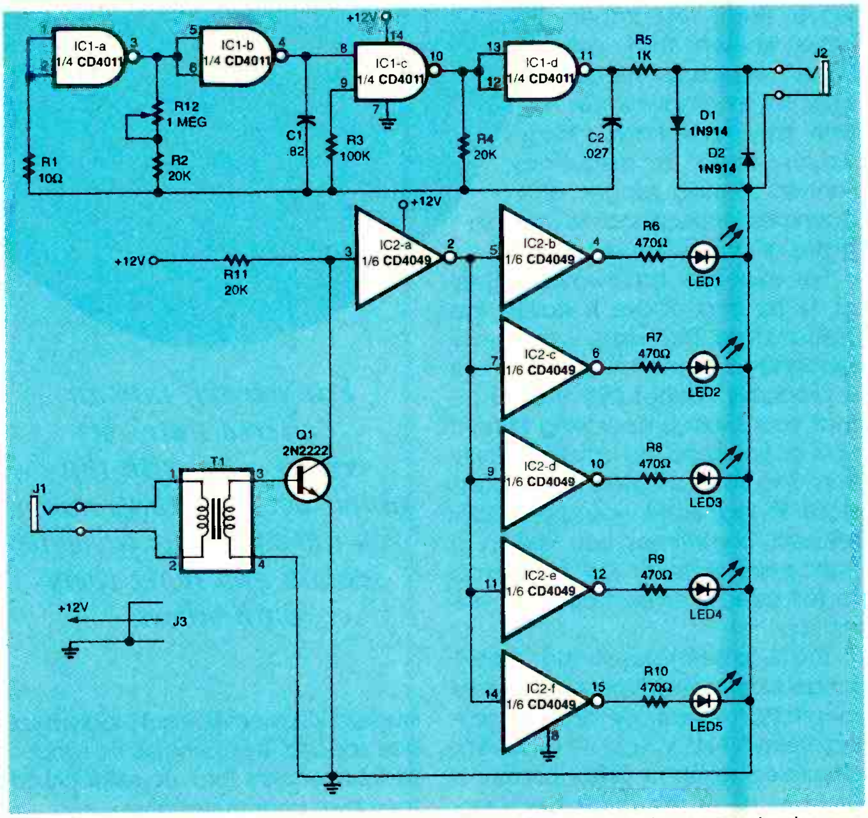

Fig. 2. The Visual Brainwave Synchronizer is actually two separate circuits: an encoder that generates low-frequency bursts of 1000-Hz pulses and a decoder that takes an input and flashes a set of LEDs.

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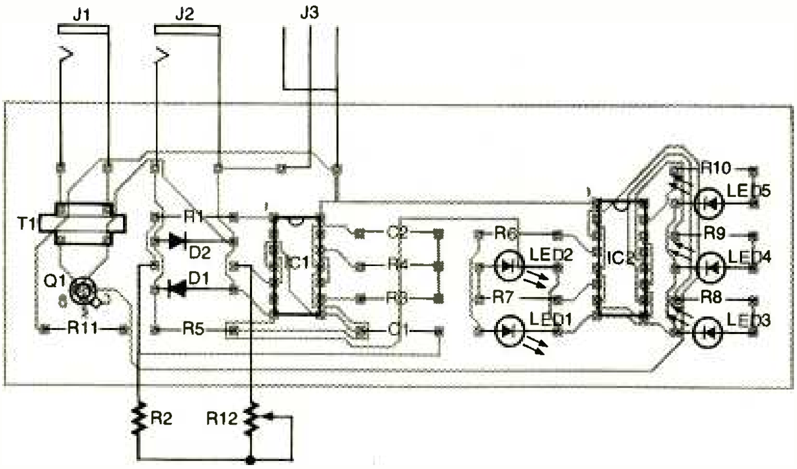


Fig. 3. The layout of the Visual Brainwave Synchronizer's PC board is clean and neat. The LEDs are mounted on a set of goggles and are connected to the board with a cable.

3 can be followed when building the board.

Transistor Q1 can be either a metal can or plastic. The pinouts for the two types of packages are not the same, so be aware of that; make sure that you get the leads in the correct holes.

The LEDs are not attached to the PC board; they will be mounted to a set of goggles. You can use any type of goggles. The author's prototype used eye protectors that can be found in most hardware stores. Drill appropriate holes for the LEDs. Two of them should be centered close to the location of your eyeballs on each side, one goes in the middle of the goggles, and the last two are placed on each side near the outside of the goggles; the construction details can be seen in Fig. 4. Use Duco cement to glue them in place. Red LEDs work well; that color will penetrate your eyelids even when your eyes are closed. Although the prototype used a yellow LED in the middle position, it does not seem to affect operation.

After you make the goggles, spray paint them on the outside with some dark color paint; blue, black, or brown work well. The idea is to make sure that you cannot see any outside light. One method that did not work very well is the use of a black permanent-marker pen; it did not produce a good coverage. One thing to beware of when painting the goggles is that a thick coat of paint could dissolve the goggles. Several light coats are always better than one thick one.

The goggles are wired to the PC board with a six-conductor cable. Since all of the LEDs share a common ground, one wire can be used for the ground. Use a cable tie through a pair of holes in the goggles to hold the end of the cable securely in place.

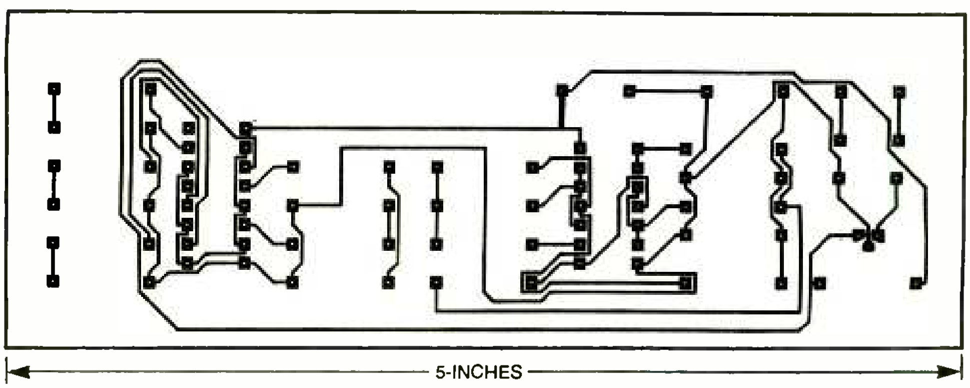
As an alternative to J1–J3, the cables that are connected between those jacks, the cassette recorder, and the power supply can be permanently wired in. For example, a 12-volt DC transformer can be wired directly to the PC board in place of J3. Similarly, audio cables that end in suitable plugs for the cassette recorder's microphone and output jacks can be wired in place of J1 and J2.

If a mono cassette recorder is used, the signals do not have to be split or combined between stereo channels. If you are going to use a stereo recorder, link both channels together for J1 and J2. For J1, be sure that you are wiring the ground for both channels together; if you cross the output wires, the signals will cancel each other out.

Figure 5 shows the completed Visual Brainwave Synchronizer control box. Any appropriate case can be used; the author's prototype used a computer "A-B" port selector enclosure. That type of case is already drilled in its front panel with a suitable hole for mounting R12.

Calibration. After you build the Visual Brainwave Synchronizer, you will have to calibrate the device. This calibration procedure is the hardest part of the operation, since the oscillator circuit does not behave in a linear fashion. The audio-taper potentiometer specified for R12 helps make the oscillator a little more linear, but in general, you will have to calibrate using either a frequency counter or by actually counting the pulses. The general rule of thumb is that for a potentiometer with a 270° rotation, the markers should be spaced about 18 degrees apart. The general arrangement for the potentiometer marks is shown in Fig. 5. As you will be experimenting and testing the unit against your specific results, absolute accuracy is not needed as long as your results are repeatable.

If you have a frequency



Here's the foil pattern for the Visual Brainwave Synchronizer. The circuit fits easily onto a single-sided PC board.

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Fig. 4. The goggles have the LEDs mounted to them in a straight line. The goggles are painted a dark color to block out all light.

PARTS LIST FOR THE VISUAL BRAINWAVE SYNCHRONIZER

SEMICONDUCTORS

IC1—CD4011 quad NAND gate, integrated circuit
IC2—CD4049 Hex inverter, integrated circuit
Q1—2N2222 NPN transistor
D1, D2—1N914 silicon diode
LED1–LED5—Light-emitting diodes, red

RESISTORS

(All resistors are ¼-watt, 5% units, unless otherwise noted.)
R1—10-ohm
R2, R4, R11—20,000-ohm
R3—100,000-ohm
R5—1000-ohm
R6–R10—470-ohm
R12—1-megohm potentiometer, audio taper

CAPACITORS

C1—0.82-µF, Mylar
C2—0.027-µF, Mylar

ADDITIONAL PARTS AND MATERIALS

J1, J2—⅛-inch subminiature audio jack
J3—Coaxial power jack
T1—600-ohm/25,000-ohm miniature audio transformer (Mouser 42TM017 or similar)
Case, 12-volt DC power supply, wire, hardware, etc.

Note: The following is available from: James Melton, 2747 Wentworth Drive, Grand Prairie, TX 75052: A complete kit of all electronics parts and PC board, $79.95 plus $3.00 for shipping and handling. Texas residents must add appropriate sales tax.

counter, the cleanest signal is on pin 8 of IC1. That signal is a 12-volt squarewave; it should be the easiest for a frequency counter to read. If you do not have a frequency counter, you will need to count the pulses by eye. The following procedure describes how to do that:

- Connect the output of J2 to the input of J1. That will make the goggles flash in time to the frequency.
- Set R12 to its lowest setting.
- Count the number of pulses you see in a 10-second time period.
- Divide that number by 10.
- Mark that number on the dial at R12's position.
- Move R12 to speed up the oscillations a little, and repeat the process.

If you move the dial in regular increments, you will be able to count the pulses until it gets to about 12 Hz. At that point, the human eye begins to see the pulses as a continuous light. Since the main frequencies that you are interested in are lower than that frequency, calibration to that frequency should not present a problem in using the unit; the higher frequencies can be simply marked as shown in Fig. 5.

Making a Tape. Connect the power supply to a 120-volt AC power source and J2 to the microphone input of a cassette recorder. Set R12 to about 15 Hz. Begin recording the pulses.

Change the frequency according to your wishes. A suggestion is to make a tape that starts at 15 Hz, slowly drops to 2 Hz, and then goes back to 15 Hz. When that tape is played back, you can make notes concerning what frequencies are best for you. It takes two people to do that—one to experience the effect and another to make note of the time and the feeling of the person under test.

The tape obviously can be any length, but 30 minutes seems to be a reasonable length of time for a session.

Playing the Tape. Connect the output of the cassette recorder to J1 and begin playback. You will have to adjust the output of the recorder until you see the LEDs flashing in the goggles; that is all that is needed. Note that the LEDs can be either completely on and off or always on

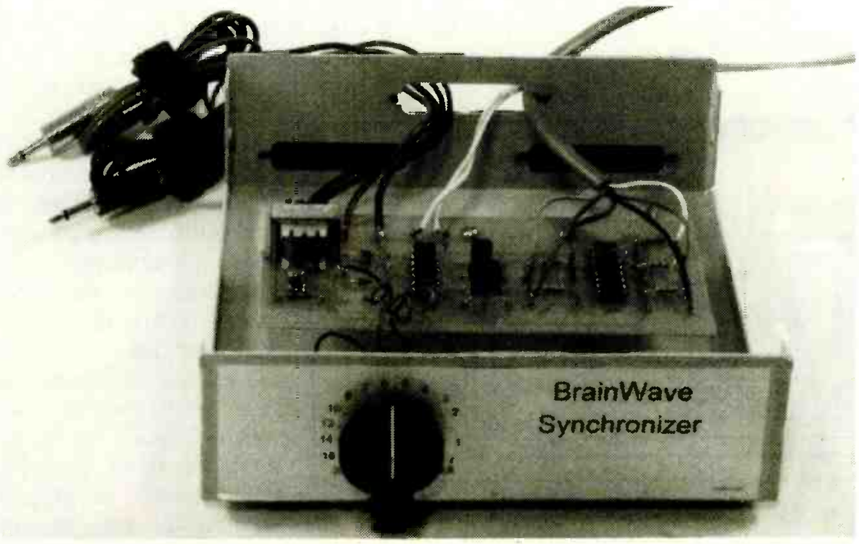

Fig. 5. The completed Visual Brainwave Synchronizer fits nicely into a computer port switchbox. The switchbox's knob can be recycled for turning R12.

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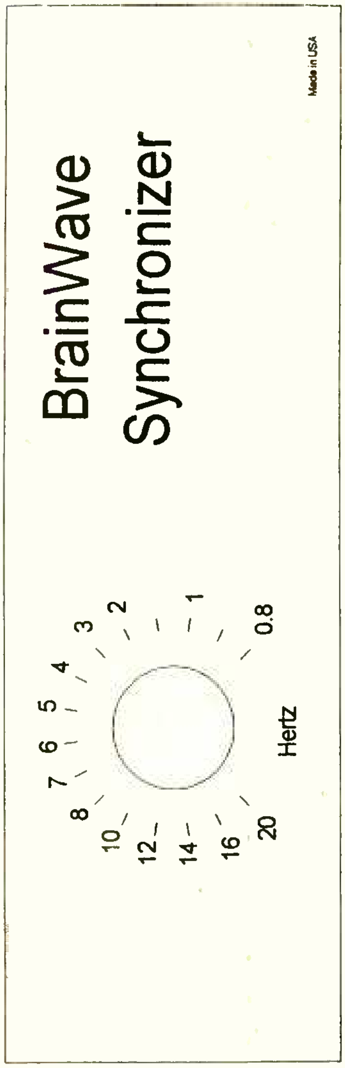

Fig. 6. Here is a front-panel layout for the Visual Brainwave Synchronizer. The actual calibration marks might be in slightly different positions on your unit due to manufacturing tolerances in R12, but in general they will be very close to these positions.

and modulated slightly; that depends on the recorder's playback-noise level and power-supply noise. In either case, the effect will be the same.

Many contributions to the advancement of science start out as an idea that seems either very simple, very farfetched, or a combination of the two. There are numerous accounts of important discoveries that have been made in the homes or garages of experimenters. It is possible that the Visual Brainwave Synchronizer will help you understand more about yourself and how your brain works. Good luck with your experiments.Ω

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Many electronics enthusiasts discovered that the bridge from classroom theory books to hands-on project building is difficult to span at times without a handy pocket guide. Even the equipment manual to operate a gadget often makes things murkier rather than clearer. A compact text authored by a seasoned expert with hands-on knowledge and a knack of writing in an easy-to-understand style is many times more valuable than the price of ponderous theory and equipment manuals or the parts for a project that could be damaged. Here's a sampler of some titles you may want to own!

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BUILD A STEP ATTENUATOR

Increase the accuracy of RF measurements with this useful workbench accessory.

JOHN PIVNICHNY

As any radio engineer, technician, or hobbyist will tell you, the heart of any radio-frequency (RF) circuit is some form of tuned circuit. Examples of that include antennas and filters. Unless those tuned circuits are adjusted correctly, any radio or RF device becomes about as useful as a winter coat on a warm summer day.

You might have just built an RF circuit, repaired a radio, or maybe you've tried to troubleshoot a non-working receiver. Are those IF (intermediate-frequency) transformers set properly to give the right bandpass? Will that filter provide enough rejection to eliminate unwanted signals?

If you need to be able to take readings of tuned circuits, filters, antennas, and other radio-frequency equipment, then the step attenuator presented here is the perfect addition for your workbench. With the ability to set precise 1-dB steps of attenuation, the unit is an easy way to answer all of your questions.

Step Attenuators in Use. Let's take a look at a bandpass filter that might be used in a shortwave radio. A typical circuit might be designed like the schematic diagram shown in Fig. 1. With the values shown, that circuit should be able to pass any signal between 5.95 MHz and 6.6 MHz in the 49-meter band; any signals outside those limits should be rejected and not pass through. If everything is aligned properly, the response of the circuit should be similar to the graph shown in Fig. 2. Notice that the filter has two end sections that are tuned to the center of the passband and two rejection circuits in the center. Rejection circuit L1/C2 is tuned below the passband while L2/C3 is tuned above. Those rejection circuits produce the deep notches in the passband.

If you are building or aligning that circuit, one approach would be to first isolate the end sections by disconnecting L1/C2 and L2/C3. Each end section would then be tuned to the center frequency of 6.267 MHz; a dip meter could be used for that task. The rejection circuits would also be set to their frequencies above and below the passband at 7.456 MHz and 5.267 MHz respectively.

Connect it back together and what do you have? Theoretically, you should have an aligned and properly working bandpass filter. However, if anything was disturbed or reconnected incorrectly, all of your work was for nothing. To be sure, let's check it and find out.

You will need an RF-signal generator with a 50-ohm output that covers the frequency range of the filter (at least 6.6 MHz in this case), a step attenuator, and an RF meter with a 50-ohm input. The RF meter does not have to be calibrated; it will be used to compare the level of two signals. Various commercial RF meters are available, but they tend to be too expensive for the home workshop. Alternatives are to borrow one, purchase a used unit, or build one yourself. In the event that you want to try building your own, plans have been published in various magazines over the years; a suitable unit is the author's "dBm Meter" that was published in the November, 1995 issue of **Electronics Now**.

The equipment is set up as shown in Fig. 3. Set the signal generator for a continuous signal with no modulation to the center of the passband. Set the step attenuator for 0 dB and note the reading on the RF meter. Now switch in 3 dB of attenuation on the step attenuator and note the reading on the RF meter. Switch out the 3-dB attenuation and then tune the signal generator lower in frequency until the RF meter has the same reading as it did when 3 dB of attenuation was

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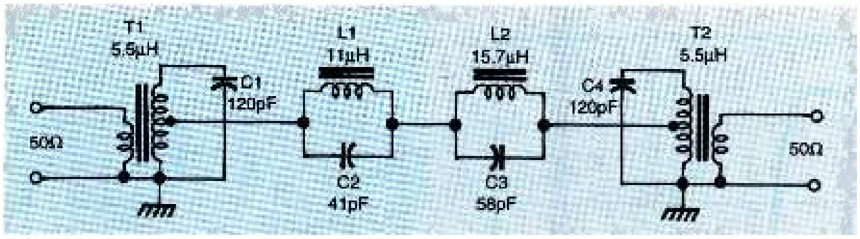

Fig. 1. This schematic diagram is a typical bandpass filter for a receiver in the 49-meter band. If you'd like to build this circuit, wind all of the inductors on T50-6 toroidal cores. Transformers T1 and T2 have a six-turn winding and a 36-turn winding with a center tap; L1 has 52 turns and L2 has 62 turns.

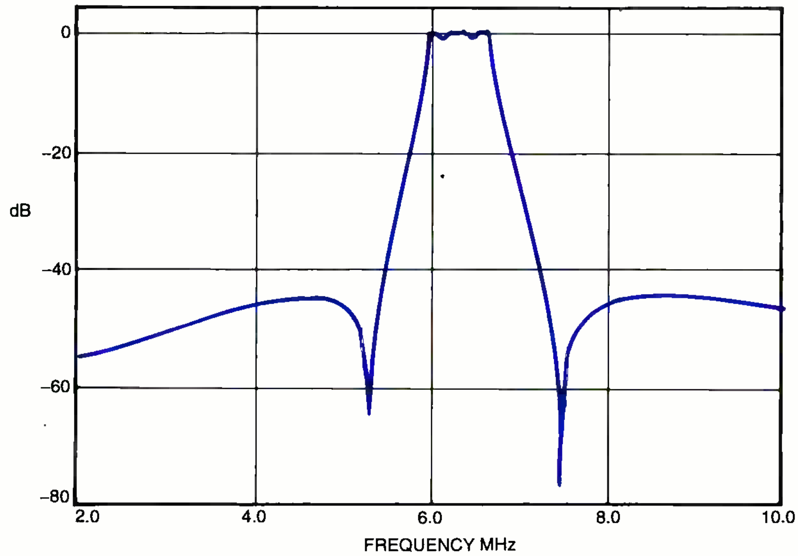

Fig. 2. The frequency response of the filter circuit in Fig. 1 has a passband between 5.95 MHz and 6.6 MHz.

switched in. That frequency will be the 3-dB down point on the lower edge of the passband. Read the frequency. A frequency counter may be helpful here, but it is not absolutely necessary if the signal generator is reasonably accurate.

Tune the signal generator up above the center frequency until the RF meter again registers the same attenuation level to get the 3-dB down point for the upper edge of the passband. Then record the frequency.

Repeat the entire procedure with 6 dB of attenuation switched in. Record the upper and lower frequencies at 6 dB down. Continue to do that with increasing steps of attenuation, such as 10 dB, 15 dB, 20 dB, 25dB, and so on down to around 40 dB or so. From the recorded frequencies, you should be able to mark measured points on a graph similar to Fig. 2. Note that once you get past around 45 dB down on the example filter of Fig. 1, you can get both sides of the rejection notches.

The results of the author's test on the filter circuit in Fig. 1 is shown in Fig. 4. Each dot represents one measured point. Comparing the plots in Figs. 2 and 4 show some differences. The differences between theory and reality is due to how accurately the inductances of the coils are set by squeezing or spreading the turns on the coils and due to stray coupling between the filter elements. Thanks to the step attenuator, those differences are not due to the measuring instruments.

With that example, you can see that the step attenuator is very useful for finding accurate relative-dB levels. Of course, that is only one example of the use of a step attenuator. Since step attenuators can be expensive to purchase, it is worth the effort for the home experimenter to build one. Let's take a look at how step attenuators are designed.

A Step Attenuator Circuit. The circuit for the step attenuator is shown in Fig. 5. A series of double-pole, double-throw switches, S1–S8, are wired to pass a signal directly through from J1 to J2 when they are switched in one position. In the other position, three resistors dissipate or attenuate some of the signal. The resistor values in ohms are selected to provide a specified amount of attenuation and also provide a 50-ohm match to both the input and output terminals.

Because the attenuator circuit maintains a 50-ohm match in either switch position, the circuit is designed to let several circuits with different attenuation be connected together in series. The various combinations of circuits set a particular value of attenuation. For example, attenuations of 1, 2, 3, 5, 10, and 20 dB can be combined for any value from 0 to 41 dB. Although six attenuators with the binary values of 1, 2, 4, 8, 16, and 32 dB could be used to set any value from 0 to 63 dB, it is easier to use the decimal values and just add two additional 20-dB circuits. Besides being easier to add the individual values together in one's head, all values from 0 to 81 dB in 1 dB steps can be

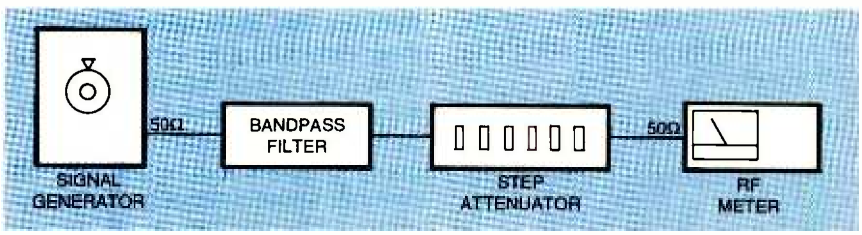

Fig. 3. To use a step attenuator to test a bandpass filter, a signal generator is connected to the circuit under test. An RF meter is connected through the step attenuator to the output of the circuit. Noting the drop in the RF meter with the step attenuator switched in gives you a power level to find the frequency that will attenuate the signal with the attenuator switched out.

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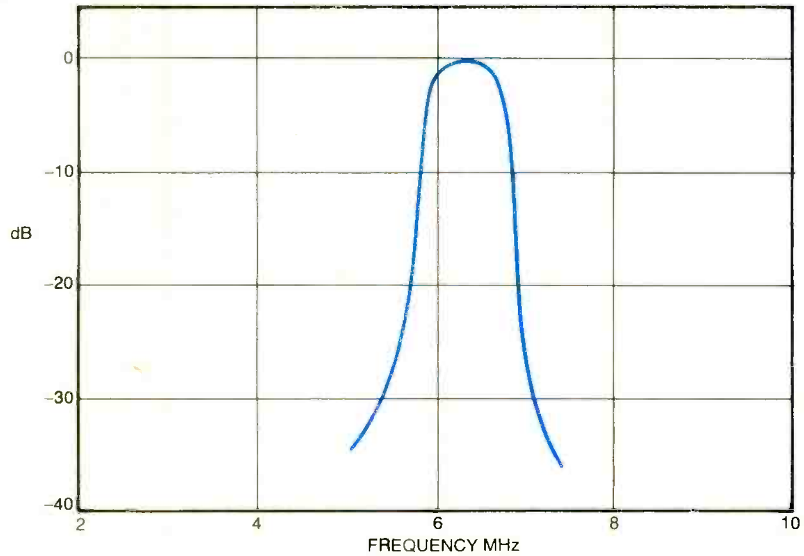

Fig. 4. Here is the plot of the circuit in Fig. 1 as built by the author. Variations between this plot and the one shown in Fig. 2 reflect variations in the circuit and what it is theoretically capable of.

set—a very useful range.

You might be wondering why we're using multiple 20-dB circuits instead of a single 40-dB circuit. If you try to attenuate too much in one circuit, you will soon find out that at radio frequencies, the switch itself will provide some coupling from input to output, even with no resistors connected. That coupling is due to stray capacitances and inductances within the switch. The switches used in the author's prototype measured a 35-40-dB attenuation at 20 MHz before any resistors were added. Because of that limitation, 20 dB is about the largest attenuation value that should be used on any one circuit. Note that commercial step attenuators costing hundreds of dollars also have 20 dB as their largest single step.

Note that the resistor values used in the step attenuator are not the usual 5% values. Although selecting the nearest 5% value will give acceptable results, better accuracy is achieved with the 1% values shown. If you're going to make the effort of building your own unit, it makes sense to build the best instrument that you can.

PARTS LIST FOR THE STEP ATTENUATOR

RESISTORS

(All resistors are ¼-watt, 1% units.)
R1, R3—866-ohm
R2—5.75-ohm (see text)
R4, R6—432-ohm
R5—11.5-ohm
R7, R9—294-ohm
R8—17.4-ohm
R10, R12—178-ohm
R11—30.1-ohm
R13, R15—95.3-ohm
R14—71.5-ohm
R16, R18, R19, R21, R22, R24—61.9-ohm
R17, R20, R23—249-ohm

ADDITIONAL PARTS AND MATERIALS

J1, J2— BNC chassis-mount connectors
S1–S8—Double-pole, double-throw slide switches
Case, wire, ground lugs, hardware, etc.

Note: The following item is available from: Unicorn Electronics, Valley Plaza Drive, Johnson City NY 13790; Tel: 607-798-0260; Web: www.unicornelex.com: A complete kit of all parts including a drilled box, $23.95 plus $3.50 for shipping and handling. NY residents must add appropriate sales tax.

Building the Step Attenuator. The step attenuator is very simple to build. The photograph in Fig. 6 shows how the layout of the components follows the schematic diagram. In general, slide switches will provide better isolation than toggle switches for the higher dB stages; slide switches are good choices if you cannot measure the isolation of any other type of switch first. A small metal box should be used to

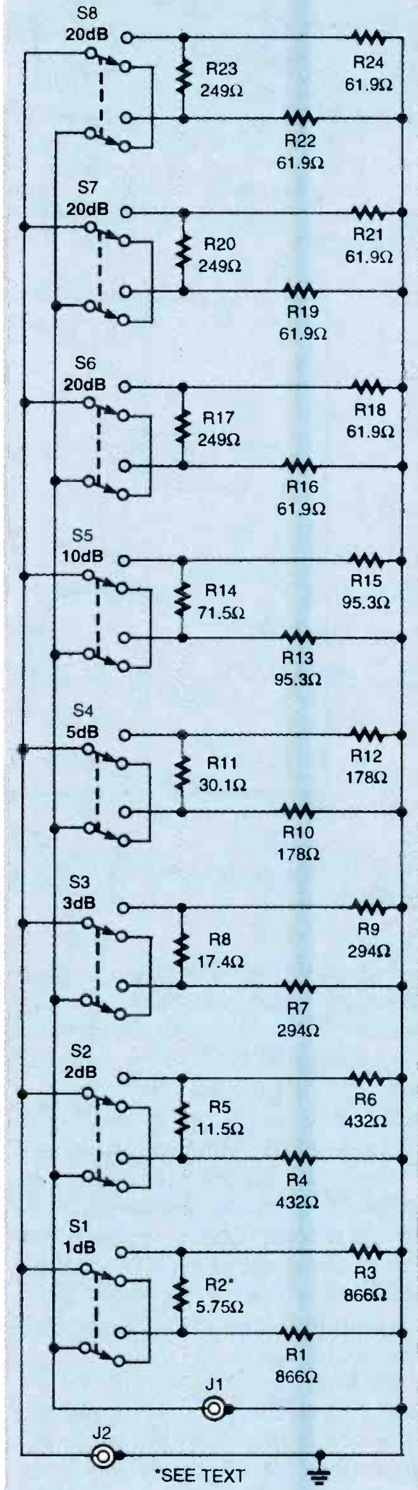

Fig. 5. The step attenuator is simply a series of resistors that are designed to add a certain amount of attenuation between J1 and J2. The resistors can be switched in and out at will to add different amounts of attenuation in 1-dB increments. Since the value of R2 is not commercially available, use two 11.5-ohm units in parallel.

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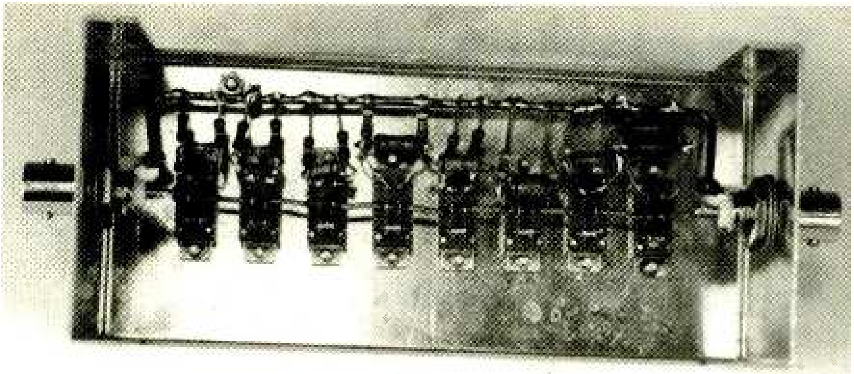

Fig. 6. The step attenuator is a simple layout that is very similar to its schematic diagram. Since good grounding is very important to the circuit, a heavy bus bar is used for connecting together the grounded resistors.

provide an electrically shielded container; any signals will be kept from radiating outside the box. The author's prototype measures about 2 inches by 2 inches by 4½ inches.

Rectangular openings for the slide switches are cut by first drilling two $^3/_{16}$-inch diameter holes; file out the remainder of the opening with a tiny square file. A drilled and filed box is available as part of a complete kit from the source given in the Parts List. Two BNC connectors for J1 and J2 should be mounted in the ends of the case.

One set of contacts on each switch needs to be connected together with a short length of bus wire. An additional pair of bus wires is used to connect J1 to one common terminal on the switches; the other common terminals are connected to J2.

A good grounding bus will be needed to connect all of the parallel resistors together. A 14-gauge or larger bare copper wire is connected between the ground lugs of J1 and J2. Add at least two more ground lugs equally spaced along the length of the wire, and fasten them down with small screws directly to the front of the box.

Connect the resistors directly to the switch terminals and the ground bus using the shortest lead lengths possible. The path from the end of a resistor to the bus wire should not be more than ¾-inch. If necessary, add another ground lug to shorten the distance. Once the grounded resistors are installed, add the final resistors between the switch terminals, keeping the leads as short as possible.

A final note on the subject of resistors is the value of R2. Since that value is not a standard value, two 11.5-ohm resistors are wired in parallel; as you know, the resulting resistance of two resistors in parallel with the same value is half of the value of one of the resistors.

Once dry-transfer labels are applied to the front panel and the case is closed up, you have an accurate step attenuator. Not only can a step attenuator be used for checking the passband of IF transformers and crystal filters, it can be teamed up with a sensitive RF voltmeter to measure and compare signal levels passing through any receiver circuit including amplifiers, mixers, and tuned circuits. In short, if you work with RF, you're sure to find that a step attenuator is a useful addition to your workshop. Ω

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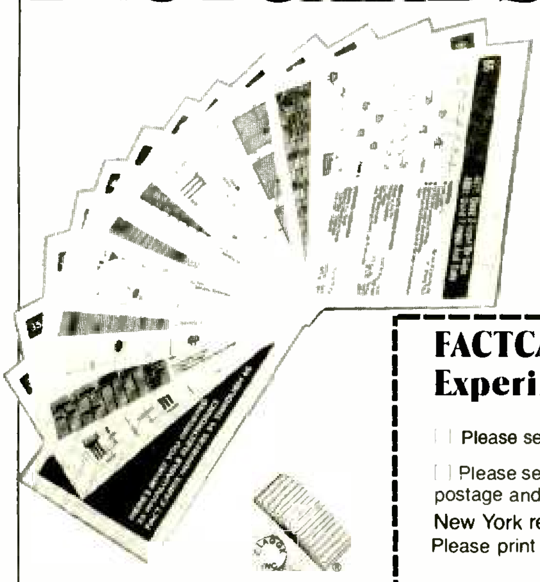

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Sifting Signals from Noise

Getting usable signals from low-powered space satellites is not a simple task. Here's how it is done.

TOM NAPIER

Under ideal conditions, a one is a one in a digital signal, and a zero is a zero. However, we don't live in an ideal world, and there are many circumstances where things are not quite so clear cut. One of those circumstances is when dealing with spacecraft telemetry.

Before we go further, it is important to make a distinction between the communications satellites that you are most certainly aware of and scientific, military, and other types of satellites and probes. Unlike communications satellites, which are equipped with high-power transmitters, power is a scarce resource on a scientific, military, or other satellite. You don't use any more than you must to drive the transmitter. It is often easier to add more antenna area or receiver sensitivity on the ground than to increase transmitter power in the satellite. In fact, it might be impossible to add transmitter power. For example, you could be dealing with a deep-space probe that was launched 25 years ago. You might even be listening in to some other country's satellite to spy on their military communications.

These days, every measurement made on a spacecraft, be it a battery voltage or a picture of a distant planet, is changed into a pattern of bits. Those bits are lumped together into frames. The frames are transmitted as a serial string of bits by changing the phase of the high-frequency carrier. By sending signals digitally one can apply clever encoding schemes that allow robust error correction so that the integrity of the data that is recieved is ensured.

The Noise Problem. Because no more transmitter power is used than is absolutely necessary; or because, like Voyager II, a probe is sending signals from much further away than it was designed to; or because you are listening to a faint sidelobe from a satellite whose antenna is pointed towards its owner's receiver, the signal being received is almost certainly being swamped by noise. The noise may come from natural background radiation, from the antenna, or from the amplifier at the front end of the receiver.

However it arises, by the time the signal has been down-converted and demodulated to a base-band binary signal, you could be hard pressed to see any ones and zeros in it. To the eye it is just fuzz.

Noise is a problem because if you represent a one and a zero as two different voltages, say plus and minus 1 V, then the voltage received for, say, a "one" bit could be anywhere in a range of voltages around +1 V. Although +1 V is still the most likely value, measurement of a "one" bit might result in +0.5 V or +1.5 V.

When the noise is high enough, a "one" bit with noise can result in a negative output. This is interpreted to mean that a "zero" bit was sent and thus a bit error is generated. The same thing can happen to "zero" bits. A -1 V signal plus noise can result in a positive output and thus a "one" bit is read rather than a "zero."

The noise tends to be Gaussian, that is, at any particular moment the probability of its voltage deviating from zero looks like the familiar Gaussian bell-shaped curve. To take the levels used above, a "one" bit looks like a Gaussian curve centered on +1 V and a "zero" bit looks like a Gaussian curve centered on -1 V. The result can be seen in Fig. 1. The probability of a bit error is the area of each curve that spreads beyond the zero volt line.

Making The Best Of Things. Assuming Gaussian noise, one can calculate the expected number of bit errors in terms of the input signal-to-noise ratio (SNR) and then plot that as a curve. That curve represents the best error rate that can be achieved for any given noise level. Figure 2 shows the expected bit error rate for different signal-to-noise ratios. This curve refers to the raw data; if the data bits have been encoded at the transmitter it may be possible, once the bits have been converted to binary form, to greatly reduce the error rate by computer processing the recovered bits.

It is the design engineer's task to

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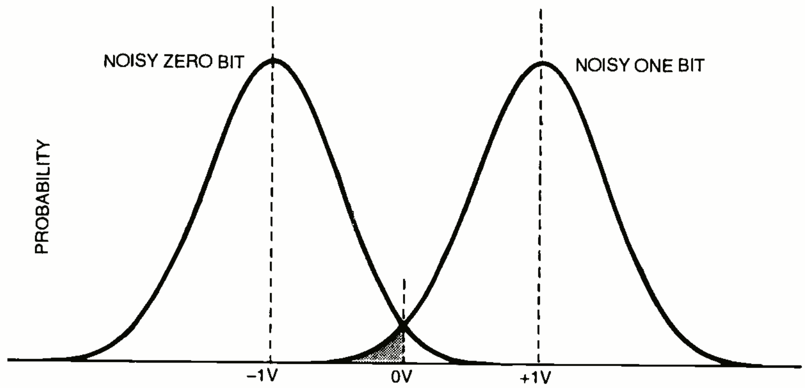

Fig. 1. Noisy binary data can be represented as two overlapping Gaussian distributions. The shaded area shows the fraction of "one" bits that will be read as "zero" bits.

build a piece of equipment, called a "bit synchronizer," which performs as near to this curve as is practical. If you plotted the performance of a fairly good bit synchronizer on the same graph, its error rate curve might be the same shape as the theoretical curve but about 1 dB to the right of it.

A block diagram of a bit synchronizer (1975 vintage) is shown in Fig. 3. Bit recovery is done in stages. If it hasn't already been done in the IF amplifier, the signal amplitude is adjusted to some standard level. Then the signal is filtered to remove any noise having a higher frequency than the data. A phase detector, which looks for the transitions between bits, adjusts the frequency and phase of the output clock to match the input data. The data bits are integrated and then sampled in sync with the clock. The clock signal tells the following equipment where the bits start and stop.

If the data has been encoded in some way, the encoding is then removed. Finally, the cleaned-up data and clock are passed on to the next device, usually a "frame synchronizer" whose job is to look for the framing information in the data and to divide up the serial data into the parallel words that were generated in the satellite.

There is a bit synchronizer in every data receiver, though in simple systems it might be only a chip or two and it is not called by that name. If the noise level is low, the signal amplitude is fixed by an AGC circuit, and the data rate is known in advance and never changes, then a voltage-controlled crystal oscillator can be used as the output clock. The data filtering can be primitive and the simplest of phase-locked loops (PLLs) can lock the crystal to the data. However, bit synchronization becomes quite complex when the data rate is not known exactly, is varying, or when the noise level is high.

Traditionally, a bit synchronizer is a rack-mounted box. It can be tuned to work at many different data rates, and it does not require that the input signal be any particular amplitude. If you wanted to buy one, it would cost you from $10,000 to $250,000 depending on how fast your data is and how badly you want the best possible error rate. A NASA engineer once said that an improvement of 1 dB in performance was worth about a million dollars since it lowered the cost of the antenna system by that much.

What Does A Bit Synchronizer Do? A typical bit synchronizer can cope with data rates from 10 bits per second (bps) to 10 million bits per second (Mbps). It doesn't care whether the input signal is 100 mV high or 10 V high. There are at least a dozen ways the data bits might be encoded. It can handle them all correctly.

The simplest code is Non-Return-to-Zero (NRZ) in which a one bit is high for the complete bit period and a zero bit is low for an entire bit period. However, there are many other ways of coding data. One important way is the bi-phase code in which each bit consists of either a 01 pattern or a 10 pattern. That requires twice the bandwidth to transmit, but it has no DC component. By contrast, NRZ can contain long strings of one bits or zero bits. That makes it difficult to keep in sync with the transitions—since there are none—and it creates havoc if any of the equipment is AC coupled since the DC level drifts.

Recovering The Bits. After the input signal has been amplified or attenuated to some convenient level, it is filtered. Often the demod-

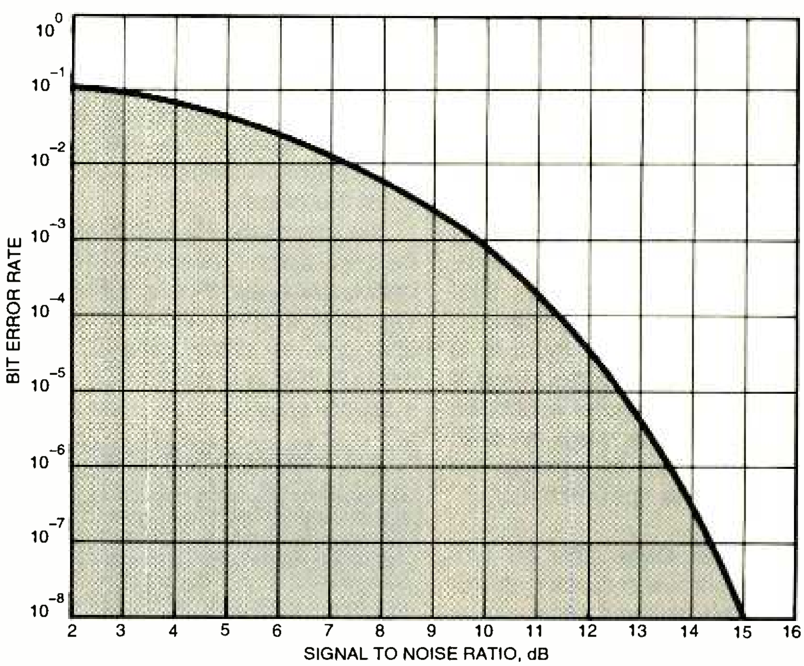

Fig. 2. This curve shows the best achievable bit-error rate for any given signal-to-noise ratio. The error rate achieved by a practical bit synchronizer would be about 1 dB to the right of this curve.

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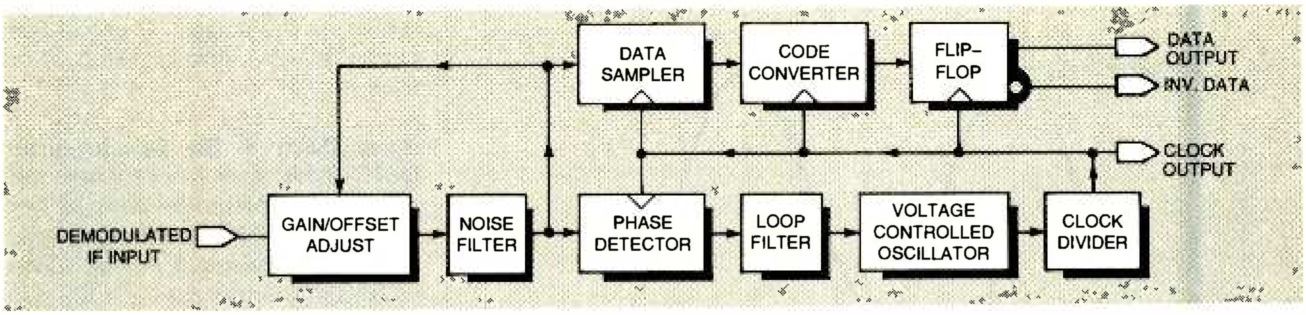

Fig. 3. The block diagram of a typical bit synchronizer. In 1975 most of these blocks required one or two printed circuit cards.

ulated signal contains noise frequencies at many times the bandwidth of the data. It also usually contains traces of the carrier or IF frequency. Those can be filtered out without changing the underlying data at all.

There are two common methods of proceeding from this point. The first is to assume that one knows where the data bits begin and end; that is, that the phase-locked loop driving the clock has already done its job. In that situation, each bit is integrated for exactly one bit period. Since the data bits are at the same level for the entire bit, integrate continuously in the same direction. The noise, on the other hand, is varying up and down so that it tends not to accumulate in the integrator. That maximizes the ratio between the data and the noise. At the end of the bit, the integrator output is sampled and the integrator is reset. If the sample is positive we say we received a "one" bit, if negative, a "zero." For the best results the integrate, sample, and reset processes must be exactly aligned with the incoming bits.

Another approach is to combine the filtering and integrating functions in a single "matched filter." This is a low-pass filter that behaves like a finite-time integrator. Its response to a step input is a ramp that is one bit-period long. It automatically integrates each bit as it arrives and maximizes the SNR. It is still necessary to sample the output at just the right moment.

Clocking The Data. The bit synchronizer contains a clock generator whose phase and frequency is locked to the input data. In the long term, the clock has to follow slow changes in the data rate. The commonest source of those is the motion of the satellite itself. As it approaches the receiving antenna ,its carrier frequency and data rate rise as a result of the Doppler effect. After it has passed its closest point, the data rate falls. The clock has to track those changes.

However, the input data may also have jitter—each bit may not be exactly the same length. The clock should ignore that effect.

The clock is controlled by a PLL. That circuit has a phase detector that looks at the difference between the timing of the input bits and the timing of the clock edges. A conventional phase detector expects two input transitions from each cycle of the input signal. In a bit synchronizer, the data transitions are irregular, and there are, on average, only half as many transitions as bits. The normal PLL equations no longer apply and neither do 95% of the books and articles on PLLs.

The output of the phase detector drives a loop filter; basically just an integrating capacitor and a damping resistor. The voltage on the capacitor controls the frequency of the clock.

The complete PLL behaves like a second-order low-pass filter for phase changes; that is, it filters out the jitter but it allows the slow changes in data rate to pass through. The bandwidth of the filter is usually adjustable. A wide bandwidth makes it easier to acquire lock on a new signal. It also allows the clock to track larger changes in the data rate. A narrow bandwidth generates the most accurately timed clock output. In practice the loop bandwidth is often set wide at first to capture a signal and then made narrower to get the cleanest output.

Acknowledgements

These advances in bit synchronizer technology would not have been possible without the help of my former colleague Jay Layer. Having been in the bit synchronizer business from day one, he warned me about many design snags before I tripped over them myself.

All photos that accompany this article are courtesy of Aydin Telemetry, Newtown, PA

The Technical Problems. A full-range bit synchronizer needs a data filter that can be tuned over six decades. When modern bit synchronizers were being developed in the 1970s, it was not possible to make a filter that could tune over many decades. Bit synchronizers had several plug-in cards, each filtering one particular range of bit rates. For example, for low rates they had active filters that used capacitance multiplier circuits or Sallen and Key filters with photoresistors to tune them. Those didn't work too well above about 100 kHz, so for higher frequencies designers used LC filters with Varactor tuning diodes. Relays switched the signal to the correct boards as the data rate was switched.

The phase locked loop that controls the clock oscillator also has to be tuned to suit the bit rate and the loop bandwidth. That function was also spread over several circuit boards.

The integrated data reaches a peak and must be sampled there to achieve the best performance. Since the propagation delay in the components between the clock and the integrator is not exactly known, the integrator output may contain part of one bit and some of another. That reduces the peak signal-to-noise ratio and degrades the quality of the data.

That wasn't a major problem at

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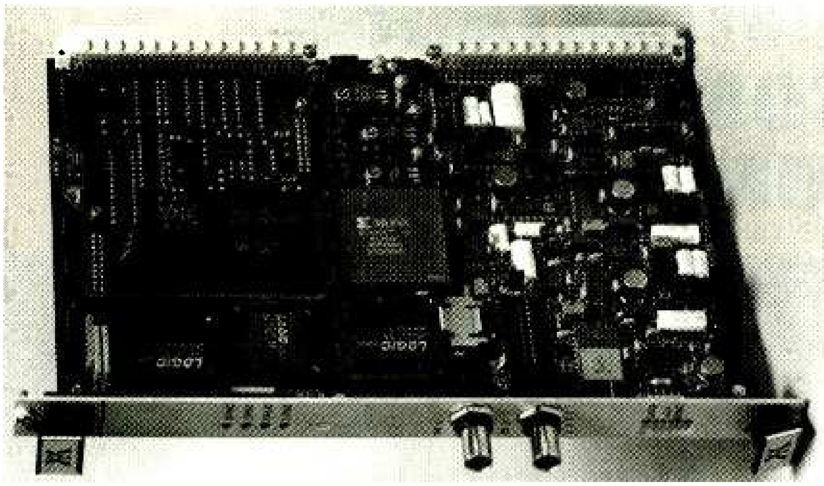

Fig. 4. This bit synchronizer on a VME board was introduced in 1993. It had the same performance as the rack-mounted box but was a fraction of the size. It was computer controlled.

low data rates, but at 10 Mbps, one bit is 100 ns long. Conventional TTL logic was beginning to run out of steam, and ECL was being used instead. All of this added greatly to the size and cost of the bit synchronizer. The tunable bit synchronizer shown in the lead photo (it is a 1975 vintage unit) contained about fourteen 4- by 8-inch boards in a rack-width box that was 5¼ inches high.

Of course, it was always possible to build a much simpler device to suit a special purpose, but many customers wanted to be able to use their equipment with a range of different satellites. Some government customers wanted tunable equipment just so they wouldn't have to tell anyone what bit rates they were using. That information might have revealed whose satellites they were listening to!

New Developments. The author's first direct involvement with bit synchronizers was when he joined the team designing one that was to advance the maximum bit rate from 10 Mbps to 40 Mbps. The project took four engineers about two years to complete. The technology was the same as before, but it used faster logic. The end result worked but it took a lot of tweaking to get it to run above 32 Mbps. The old ways had reached their limit.

Despite that, our company bid for the design of a 100 Mbps tunable bit synchronizer. Fortunately, a method was found that measured the bit amplitude and the bit phase with the same device: a flash analog-to-digital converter. That eliminated the propagation time effects in the logic chips. If the phase was correct, then the sampling time was forced to be perfect too. Although the early designs were somewhat less than optimal, we made a product that worked well from 1 Mbps to 100 Mbps—a world record at the time.

Later, a simpler way of doing the same job was found. The result was a box that processed data at 210 Mbps. However, there was nothing in this idea that stopped it from being applied at much lower data rates. In studying how to apply the newer technology to the older 10 Mbps rack-mounted box, it was found that analog filtering had to remain at the front end but that the frequency-control loop could be handled numerically. It is much easier to set up different bit rates and loop bandwidths by changing a few numerical parameters than it is to switch many different capacitors and resistors.

Another recent innovation is the development of electrically tunable filters that would use the same amplifier and multiplier chips over the entire six-decade bit rate range. That system is based on the ability to switch in one of six different capacitors in four places.

The AGC function was implemented by a new chip that had a logarithmically-controlled gain. Since the signal amplitude was being sampled by an analog-to-digital converter, it was relatively simple to make a digital control loop. That loop ensured that the signal amplitude would always be correct and that its offset would always be zero. In fact, the schematic for that part of the circuit was converted into a Xilinx chip. It was even possible to pack the code conversion algorithms into the same chip.

All this, combined with digital processing, made it possible to shrink the standard bit-synchronizer line. Units that were once a rack-mounted box are now a single VME card without any degradation in performance. The result is shown in Fig. 4. Naturally the cost of manufacture also dropped by a large factor.

You can still buy the old box with all the knobs on the front panel. If you open it up you will find a lot of empty space, a small computer card to read the front panel controls, and a VME bit-synchronizer board. Ω

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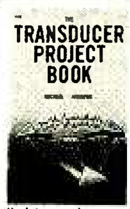

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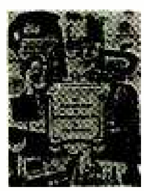

#166—By Hugo Gernsback. Here is a collection of 21 April Fools Articles, reprinted from the pages of the magazines they appeared in, as a 74-page, 8½ × 11-inch book. The stories were written between 1933 and 1964. Some of the devices actually exist today. Others are just around the corner. All are fun and almost possible. Stories include the Cordless Radio Iron, The Visi-Talkie, Electronic Razor, 30-Day LP Record, Teleyeglasses and even Electronic Brain Servicing. Get your copy today. Ask for book **#166** and include **$9.99 (includes shipping and handling)** in the US (First Class), Canada and Overseas (surface mail), and order from **CLAGGK Inc., P.O. Box 4099, Farmingdale, NY 11735-0793.** Payment in US funds by US bank check or International Money Order. Allow 6-8 weeks for delivery. MA05

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"QUANTRISTADOR" CONQUERS QUANTUM COMPUTING

A new transistor that operates 10 times faster than anything currently available could someday mean faster computers, and much more.

DOUGLAS PAGE

Quantum mechanic Researcher Jerry Simmons inspects the end of a cryogenic sample holder for performing electrical measurements on the DELTT quantum mechanical transistor. Once loaded with DELTTs (from circular cases in foreground), the holder is lowered into a cryostat, allowing transistor performance to be tested at different temperatures.

Computer speeds have taken a quantum leap. The reason is that scientists at Sandia National Laboratory have developed a radically different type of transistor—a quantum mechanical "tunneling" transistor (colloquially called the Quantristador)—that operates at a trillion operations a second, 10 times faster than the speed of the fastest transistors currently in use.

The researchers say Quantristador works like turning on a light without closing a switch. Electrons "tunnel" from path to path through a barrier that, according to classical physics, is impenetrable. The process takes place almost instantaneously.

Physicists use the term "tunneling" to describe the phenomenon of particles appearing in places where they should not be able to go—the same way cars use a tunnel to appear on the other side of a mountain without having to scale the summit. Only quantum mechanics can explain such behavior.

While quantum mechanics is largely theory, the Sandia device is quite real. "We have demonstrated real circuits that work and are easily fabricated," says Jerry Simmons, leader of the Sandia development team. "It is not ready to be marketed yet, but it is a significant advance."

Speed Demon. The device, called DELTT (Double Electron Layer Tunneling Transistor), promises to drastically improve sensor accuracy and computer speed. DELTT potentially will perform in the teraflop range—one trillion floating point operations per second, which is roughly ten times faster than the fastest transistor circuits currently in use. The researchers actually aren't sure how fast it will operate because its actual speed has yet to be measured, says Simmons, because it's "not easy to measure such high speeds, which are near

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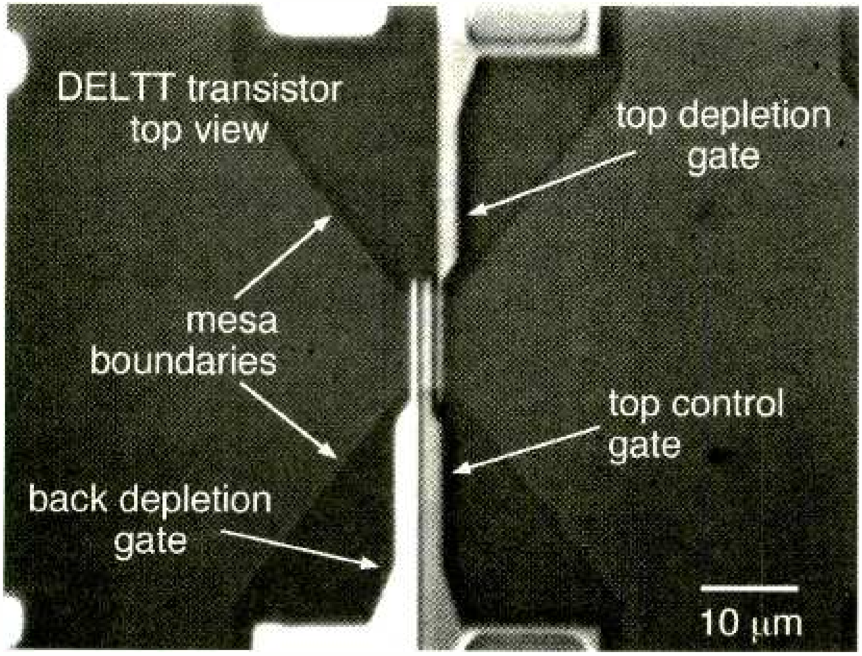
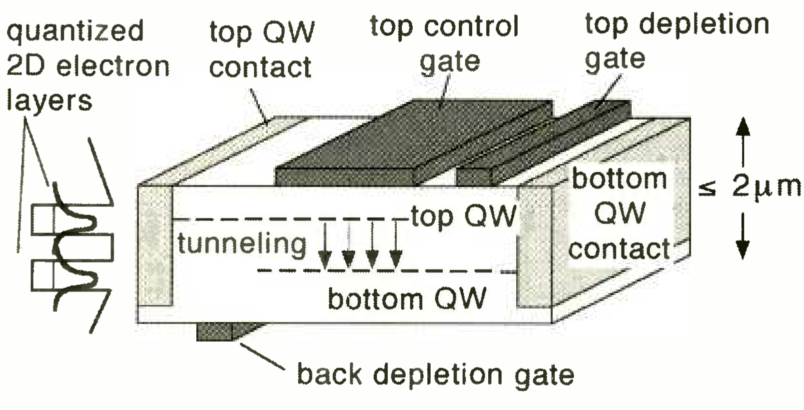


Photograph of the DELTT transistor, seen from above: The top and back depletion gates allow independent contact to the two electron layers, while the top control gate turns the transistor on and off.

the limits of what can be measured with conventional equipment."

"Quantristador" also runs on extremely low power—tens of millivolts and microamps, compared with the several volts and milliamps required by conventional transistors. The researchers say electrons travel so fast in the DELTT gallium arsenide transistor that the normal electrical processes that slow down transmission of information—like scattering of electrons by crystal imperfections that behave much like speed bumps in the electrons' pathway—can be minimized.

Weak "Fences." "Quantristador" works by relying on the dual wave-particle nature of matter. In the device, two gallium arsenide layers, each only 150 angstroms thick (one angstrom equals 10^{-10} meters), are separated by a 125-angstrom aluminum-gallium-arsenide barrier, similar to a fence separating two yards. Ordinarily, gallium-arsenide electrons in one yard do not have the energy to climb the fence to reach the other yard. But the tiny thickness of the barrier causes the electron to behave like a wave, which can poke into the barrier.



Schematic of the structure of the DELTT transistor: Tunneling between the top and bottom quantum wells (QW) occurs only when electrons in both wells have identical momentum and energy, which can be controlled by the top control gate. The total thickness of the semiconductor layers is kept less than 2 microns, allowing the back depletion gate to be brought close to the quantum wells and the entire device to be made small. At the left is the energy-band diagram of the structure, containing the two quantum wells separated by a thin tunnel barrier.

When an electron is adjusted to have the same energy and momentum states in both regions—which can be controlled by applying a voltage to these regions—the electron can pass from one yard to the other without any scattering, as occurs in normal electron motion due to crystal imperfections. In effect, the electrons tunnel under the barrier fence.

Previous efforts to build tunneling transistors have been made by researchers who created layers side by side on a surface. That, however, proved too difficult a task for current technology to manufacture accurately at even 1000 angstroms. Simmons and his Sandia team used a unique design change which allowed them to stack all DELTT layers vertically, using molecular beam epoxy (MBE) or chemical vapor deposition (CVD), which enabled single-atom layers to be grown. The readily-available technologies of MBE and CVD are the same processes used to make semiconductor lasers for compact disk players.

Obstacles. Actual use of the new transistor by industry may be several years in the future because of engineering obstacles still to be solved, including questions of temperature. The device now works only at or below 77 degrees Kelvin (-321 F). Simmons says they are making rapid improvements in this area and should have the device operating at room temperature by some time this year.

Another issue involves designing millions of such circuits on a chip, as is currently done with ordinary transistors. Because of "Quantristador's" multifunctionality—it has three positions (off-on-off) instead of the conventional two position on-off gate—the same amount of work can be performed with significantly fewer transistors, and chips would have to be completely redesigned.

Applications. "Quantristador" is likely to appear in military equipment first. Simmons' research is funded by Sandia's Laboratory-Directed Research and Development office, which funds speculative, defense-

(continued on page 50)

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The EC909-12 Analog Microprocessor

Thanks to this amazing breakthrough, the days of the digital microprocessor could be numbered.

KEN KEMSKI

In the days before digital processors, calculations were oftentimes carried out using purely analog computers. Operations like addition, subtraction, and multiplication were performed using the appropriate circuits to act on DC voltage levels. After passing through the apparatus, the value of this output voltage could then be directly read as the answer. As an example, assume we wish to solve the equation x=log(y+z) where y=7 and z=2. In an analog computer, y and z would be adjusted to 2 and 7 volts respectively, added to produce 9 volts in a simple voltage-summing circuit, and then passed through a DC amplifier with a log transfer function. The output could then be read with a voltmeter as 0.954 volts, the same answer you would get with your digital calculator!

With the advent of digital computers, analog computers were effectively retired. Today's microprocessor is versatile, relatively inexpensive, and fairly fast, allowing us to have tremendous computing power in a small desktop or notebook package. There is, however, a company with a new product challenging current digital technology. The price and performance benefits of their new devices may possibly dethrone the digital microprocessor forever. All of this, while speeding up our desktop computers by over 3 orders of magnitude.

The company is Ecraf Technology Corp. (ETC). Based in Sarasota, FL and with offices world-wide, Ecraf (pronounced "EK-raff") has introduced a line of unbelievably fast analog processor chips that mirror the architecture of an Intel Pentium II MMX in the same "Slot 1" configuration. These are designated as the 909-xx series of devices. When I first heard about their new products I called Ecraf on the phone and (to my astonishment) was connected directly to Dr. Wilhelm Ecraf, senior vice president and director of research and engineering (He is the youngest brother of Dr. Dieter Ecraf, founder and CEO of Ecraf Technology). By the end of our conversation he had sold me on their design philosophies, while I had convinced him to send me tons of their technical literature including most of the 127 patent submissions they have filed in the last 2 years. He also supplied me with a couple of the EC909-12 microprocessors for evaluation. I have since visited him in Sarasota and got to witness some of their research activities in person. I will try to summarize the key advantages of the 909-xx family below, and then give a personal test report.

The Barrier Reflex Diode. The key behind the EC-909 family of analog microprocessors is a new electronic device called the "Barrier Reflex diode" (or BRD; most design engineers call them "birds"). The BRD works exactly the opposite of a conventional semiconductor diode and opens up a world of new applications. As you know, a conventional diode does not conduct in the forward direction until the "knee" or barrier voltage is reached, at which time it will conduct and maintain a generally fixed voltage drop. A Barrier Reflex diode, on the other hand, conducts perfectly, essentially like a superconductor but at ordinary room temperatures, until the knee voltage of 1.21576 volts is reached; It then becomes a near perfect insulator and ceases all forward conduction until the applied voltage falls below the barrier reflex voltage. The fortuitous knee voltage and the immeasurably small operating currents permit extended operation from tiny batteries.

Among the advantages of the device is that it performs like a perfect switch. The switching speed is

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measured in fractions of a femtosecond (<1 × 10^{-15} sec). When on, it is a perfect conductor (forward drop=0.00 V). When off, it is a near perfect insulator (current=0.00 μA). The temperature coefficient of barrier reflex voltage is presently unmeasurable. It is simple and cheap to build. It integrates into monolithic circuits with ease. Its only disadvantage is that it produces large quantities of intense white light when operating.

Being a two terminal device, it is easy to design applications around it. A basic test setup is shown in Fig. 1. A simple lattice of 64 BRDs constitutes an ultra-high-performance bidirectional 64-bit A/D-D/A converter with less than 1 fs settling time and perfect accuracy. Twelve such arrays are integrated in Ecraf Technology's analog microprocessor designs as primary I/O.

Editor's Note: Designers should note that a serious applications problem still exists, in that BRD produces a prodigious amount of pure white light when it is in the conducting state. While packaged individually in its familiar hermetically sealed ceramic pellet (1BRD34), enough light still penetrates the "purportedly opaque" ceramic casing to "fill a room as if bathed in sunlight." Dr. Ecraf's brother Helmutt was reported to have been blinded in earlier experiments in 1995 with a BRD, before the housing was changed from clear glass to "opaque" ceramic. It has been calculated that the light produced from a simple 64-BRD lattice (0.01 square inches) conducting immeasurably small currents would be sufficient to light a small city! Until an opaque material is found that can contain this light, the BRD will probably find limited use, reserved for specialized applications such as the EC909 series of analog microprocessors.

Not that we know a little more about the Barrier Reflex diode, let's look at the EC-909 microprocessor in more depth.

General. The 909-xx family of analog microprocessors have the same pin assignments as an Intel Pentium II, but there the similarity ends. The data and address pins connect

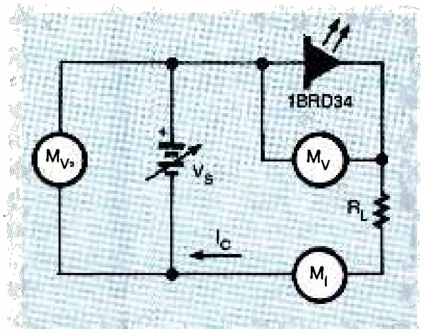

Fig. 1. Here's the basic setup for testing the 1BRD34 Barrier Reflex diode. Note, experimenters should wear appropriate eye protection when working with this device.

directly to ultra high-speed bidirectional 64-bit D/A converters, changing the digital words into analog voltages, using Barrier Reflex diodes, essentially at the speed of light. Those voltages are processed by a proprietary monolithic analog computer with a die size of only approximately 0.1-inch square. As the "voltage words" appear at the output, equally fast A/D converters feed them back to the motherboard where they can be handled conventionally. It is the monolithic analog computer that is the heart of the new technology, as it is the fastest processor ever produced by man. It leapfrogs current technology by at least a thousand-fold and will allow for the development of products never even dreamed of until now. "What's the big deal with analog?" you might ask. Read on.

Speed. A digital processor works from a "clock," or timing signal. With a clock of say, 300MHz, the time between clock cycles is just over 3 nanoseconds (3.33 × 10^{-9} sec). That is, the microprocessor "does something" every clock cycle, or every 3+ nanoseconds. Most operations (such as adding 2 memory locations together and placing the result in a third location) consume several clock cycles. If the operation requires 8 clock cycles for example, it would take over 24 ns for that single operation to occur! Modern processors use parallel pipelines, split-phase clocks, and the like to try to do as much as possible in those time intervals, but the basic limitation remains. In Ecraf's analog processors, the voltages traverse the small die essentially at the speed of light, providing fantastic virtual clock frequencies. Since the chip is about 0.1-inch square, and the speed of light is approximately 186,000 miles/sec., it takes only 4 *picoseconds* for the analog signal to ripple through and complete a command! This is about 3000-times faster than a 300-MHz digital processor, corresponding to a clock speed of over 900,000 MHz! Getting interested?

Accuracy. People think of digital computers as "accurate." In fact, accuracy is directly related to word length. Each numerical operation in a digital computer is rounded to the nearest least-significant bit, and thus serves as only an approximation of the right answer. In Ecraf's analog computer design, the operations are linear, and provide essentially infinite accuracy internally (the equivalent accuracy of a 4096-bit word, limited only by the noise floor). In fact, the only real accuracy limitation occurs when the analog answer is necessarily converted back to a 64-bit digital word. That is done only for compatibility with the rest of the computer external to the processor.

Cost. The modern digital CPU consists of millions of transistors on a fairly large die, and is necessarily expensive to design and manufacture. The Ecraf EC909-12 on the other hand has only about 400,000 elements, many of them simple-to-fabricate Barrier Reflex diodes, and is, overall, very easily manufactured. This is exemplified in its S.R.P. (Suggested Retail Price) of only $12 US, and that will buy you the deluxe EC909-12 P9 (Virtual 900-GHz version). Their yield from fabrication wafers to packaged die is over 98% for these analog wonders!

Memory. Here is an unexpected bonus: We all know that among the various memory types (EDO, Fast Page Mode, SDRAM, etc.) the cheapest memory is analog RAM, or aRAM. We also know that at .004-ns (4-picosecond) latency, it is several thousands of times faster than the SDRAM we presently use in our purely digital computers. The problem

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has been that modern CPUs do not (indeed cannot) utilize aRAM. Guess what? aRAM is a perfect match for the 909-xx series of CPUs! Not only is it as fast as the new generation of analog CPUs, but the cost per megabyte is less than one one-hundredth of major brand EDO or SDRAM memory modules (on a cost-per-megabyte basis). The EC909-xx series accepts up to 1024 gigabytes of installed aRAM, although that is more than many of our applications now require.

Video. A side benefit of purely analog processing is that the CPU can off-load the video processor to speed up video performance. VGA is an analog system, replacing the earlier EGA and TTL video modes that were digitally based. The industry went to analog video interfaces so the number of colors and corresponding perceived resolution would not be compromised and so that the speed could be increased as video technology advanced (Sound familiar?). By routing the video tasks through the EC909-12 via a simple driver patch, the video processing speed can be increased by several thousand-fold as well. This makes 300 frames/sec for 1600 × 1200 × 16.7 M game presentations a snap, something the AGP video bus can't even dream of.

Mass Storage. The magnetic storage we use in present hard-disk technology is also an essentially linear process. A "bit" recorded on the hard drive can assume virtually any value of magnetism, much like the musical waveforms we store on cassette tapes. A modern hard disk stores and retrieves the data digitally, as strictly 1s and 0s, saying in effect "if it's magnetized it's a 1, if not it's a 0." The EC909 series of analog processors improves on that technology markedly. It stores any of 4096 levels of magnetism in each bit location of the hard drive's platter, effectively multiplying its capacity by over 4000 times. A 4-gigabyte off-the-shelf drive becomes a 16,000 gigabyte drive with enhanced reliability in an analog computer system.

Reliability. A tremendous enhancement in operational reliability is made available from new gate designs possible with pure analog computing. Instead of simply "OR" or "AND" or similar types of gates, analog logic has been synthesized as "MAY BE" and "SHOULD BE" gates. For example, your word processor is loading from the hard drive, and a bad byte comes along. Ordinarily, it will crash the program, yielding the dreaded message, "This Application Has Performed An Illegal Operation. . ." Since a computer is smart, it should say "This byte is obviously wrong and will crash the program. I SHOULD modify just one bit in this byte, and the program will load normally." The smooth nature of the waveforms of analog gates will do just that, discarding the obvious error, and permitting the system to continue loading the program. Another example is when you are keying in a password to a program. You type those letters, numbers, and punctuation only to make one small mistake. The analog logic says "MAY BE he meant to type his password correctly" and then supplies the proper keystrokes to the program. This is a savings in time and money, a computing improvement long overdue in this author's opinion.

Bibliography

"Analog Microcomputers" Dr. Wilhelm Ecraf, 1994

"A Close Look at the Light Emanating From Barrier Reflex Diodes " Dr. Helmutt Ecraf, 1995

"Dynamic Range No Longer A Problem in Analog Computing " Dr. Dieter Ecraf, 1998

Energy Efficiency. The current consumption of the EC909-12 is 800 μA at 1.5V. It will run for hundreds of hours from a single AA cell. We know that aRAM has always been a power miser, consuming only 1 μA/megabyte active, 0.01 μA/megabyte standby. This will allow notebook computers to be constructed to run for weeks continuously on a single AA alkaline cell. The Active Matrix LCD screen is still an obstacle when it comes to power, but it is, after all, digital. Dr. Ecraf has filed 12 new patent submissions detailing an analog LCD screen, but is rather close-lipped about that secret project. When I queried him as to the excessive power required for both back-lighting and powering the active devices, he only said "Do you remember how you winced at the bright light emanating from a heavily shielded, forward-conducting Barrier Reflex diode?"

Well, there is more, but the aforementioned should give you some idea as to what promise this new technology holds. I have been using an EC909-12 P9 Analog Microprocessor for about a month now, and I will proceed to describe my experiences with it.

Test Report. My existing computer was built around an Asus P2B-LS motherboard powered by an Intel P2-400 processor with 256M of SDRAM. I removed the P2-400 and SDRAM, and replaced it with the EC909-12 P9 and 4 gigabytes of aRAM that I obtained from Diamondback Electronics Co. The BIOS did not identify the processor correctly, so I manually set it up as a Pentium II with a processor speed of 900,000 MHz. Booting the computer took only a second or two. Wow! Was it fast! I tried to run various benchmarks on it, but they all reported "Overflow" errors. Typically, I'd double click on the program, and instantly a dialog box informing me of register or stack overflow would be reported. I called the publishers of "Super PC Speed Check" (on which my P2-400 measured 892), and they informed me "Our software is limited to calculating and displaying benchmarks up to 4,194,304," and "Who was I kidding, claiming that I overflowed that range? That would be over 4000 times faster than a P2-400!" I thanked them and went about further testing.

All of my software (with the exception of the benchmarks) ran flawlessly. Games were breathtaking, and the Ecraf video patch worked like a dream. Because of the analog processing, pixellization was eliminated, and the screens looked just like the photographs on the software packages. I did some checks on arithmetic computations performed with the original digital processor and then the EC909. The EC909 matched the first 24,000+ digits of

(continued on page 50)

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See the world, one block or building at a time, through the eyes of a Russian spy satellite.

Now that the cold war is over, there's no need to let all of the technology and resources that it spawned go to waste. For example, for decades, the U.S. and the former Soviet Union used satellite photography to spy on each other as well as the rest of the world. Now, SOVINFORMSPUTNIK, founded by the Russian Space Agency, is marketing much of that photography commercially. And if you have Internet access, you can view the available imagery at www.terraserver.com. Then you can download the photos or purchase hard copy prints. There is a nominal fee for most downloads, but many others are free.

The images on the TerraServer Web site come from two sources—the United States Geological Survey's (USGS) huge database of aerial imagery of many parts of the U.S. and SPIN-2. SPIN-2, a trademark name for Space Information 2-meter imagery, is owned jointly by SOVINFORMSPUTNIK; Aerial Images, Inc.; and Central Trading Systems, Inc. The Web site itself is a joint project of Microsoft; Aerial Images, Inc., Digital Equipment Co., SOVINFORMSPUTNIK; and Kodak. Aerial Images, Inc. is an American company that has teamed up with the Russians to market declassified satellite photographs from Russian mapping satellites.

Finding Your Image. You can access images of the locations you want in a couple of ways. First, you can use the map of the world on the Web site. Shown in green are the parts of the world for which images are currently available. With a few mouse clicks, you can zoom in on the precise location you are interested in viewing in detail. Alternatively, you can use the *Encarta Virtual Globe Gazetteer* if you know the place name. The Gazetteer contains the names and locations of 1.1 million places in the

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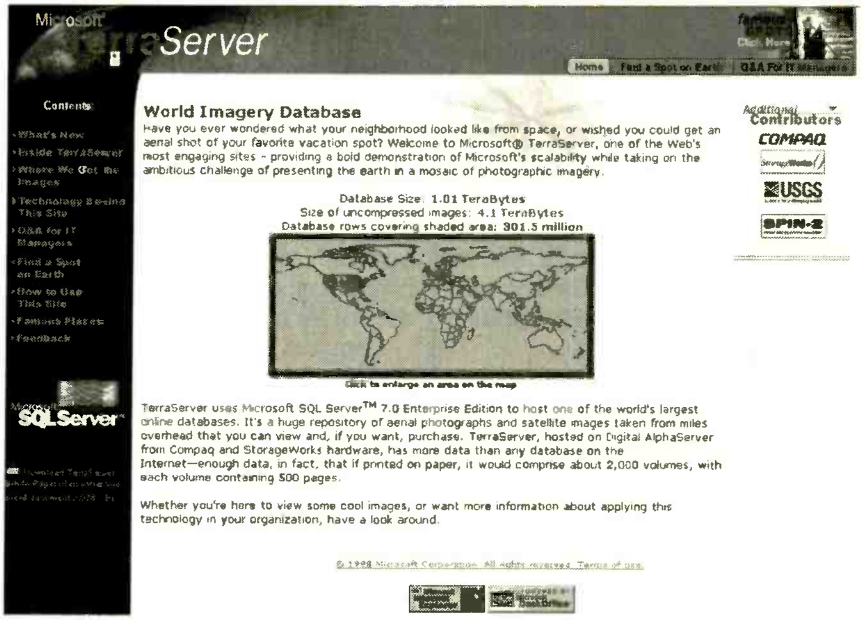
Russian launched photographic satellites will be "mapping" the US as well as many parts of the world to update images already available on the www.terraserver.com Web site.

world. If you know the location's latitude and longitudinal coordinates, you can enter them as well.

Once you find the spot you are looking for, you can view nearby places by pushing navigation buttons to pan and zoom. For instance, you could follow the trail you plan to take on your next hiking trip. However, the images are not "real time." Indeed, some images are a decade or more old, but work is underway to acquire and add up-to-date imagery.

The agreement between Aerial Images and SOVINFORMSPUTNIK includes the launching of Russian Soyus rockets carrying photographic satellites. One satellite was launched from the Baikonur Cosmodrome in February 1998 for a 45-day mission on which the satellite took photos of the southeastern United States and major cities around the world. Aerial Images and SOVINFORMSPUTNIK have planned two additional satellite missions during each of the next two years to complete the imaging of the U.S. and major population centers around the globe.



The Microsoft TerraServer Web page. From here you can find images for most of the U.S. and much of the world.

Getting Your Image. Once you have found the image you want, you can download it. If it is a USGC image there is no charge, but you will need Netscape 4.0 or Internet Explorer 4.0 to do the download. To download Spin-2 images from the Soviet satellites costs $7.95 to $24.95 (depending on the size of the area covered) with payment by credit card. You can also order high-quality prints from Kodak Earth Imaging that will be delivered to your doorstep. Prices for prints range from $12.95 to $39.95 for a 20 × 26 poster size. Browsing and viewing is free. Even the Kodak prints are much less expensive than typical aerial photography.

And how good are the images that are taken by cameras aboard a satellite orbiting at an altitude of 220 km (136 miles) above the earth? With Spin-2's two-meter resolution you can distinguish objects as small as two meters across, which is about six feet. You can def-

In this aerial photo of the Bronx, NY, you can see the "House that Ruth Built," along with the rest of the homes and roads in the area.

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initely pick out individual buildings, including houses. Also distinguishable are trees, changes in terrain, roads, and so forth. While you can tell the difference between a car or a truck, you will not be able to determine the make nor model, nor will you be able to see people. The images are stored in small tiles so that a user with a 28.8K modem can view the images with about a 10-second response time.

One Big Database. Microsoft's TerraServer is the world's largest WindowsNT database on the Web. Indeed, Microsoft choose this application to showcase the capabilities of the TerraServer. TerraServer is bigger than all the HTML pages combined already on the Internet. If printed in a paper atlas with 500 pages per volume, it would require 2000 volumes. And with new information continually coming online from USGS and SPIN-2, the Microsoft TerraServer is expected to double in size over the next year.

Applications. There are lots of applications for these images besides providing just another interesting site for surfing. Foremost, they represent a very low-cost alternative to high-cost aerial photography used by real-estate developers, zoning and urban planning, environmental and national-resource planners, timber and forestry managers, transportation system designers, construction and civil engineers, etc. They can also be used in public-safety activities such as in preparing Enhanced 911 maps. Children can use the images to accompany school reports. With time there will be multiple images of the same spot taken at different times. Then, for example, you will be able to see how your neighborhood has changed over the years.

Like many other emerging technologies, more applications are still to come as users learn about new capabilities and find yet different ways to use the images. Log onto www.terraserver.com and you might find a few uses for these overhead images yourself. If not, it's still fun to find your house or your favorite fishing hole. Ω

QUANTUM COMPUTING

(continued from page 43)

related projects. Sandia sees this device as someday being used in satellites and smart missiles to process information faster, with less payload and much lower power consumption than is possible using current technology.

Because the device is tunable, it can also act like an energy spectrometer on a chip, allowing sensitive detection of chemical and biological species such as nerve gas and anthrax. This capability will help defend the public against chemical and biologic terrorism by providing customs and airport security officials with rapid and reliable detection of extremely minute amounts of toxic materials. Ω

ANALOG MICROPROCESSOR

(continued from page 46)

the value of pi (as obtained from the "Handbook of Standard Mathematics"), while the original processor fumbled after only 207 digits. This was some processor!

With so much new hard disk space, I copied all of my CDs (over 4000 programs) directly to the hard drive. That speeded operations up immensely, although my desktop is a bit cluttered now. Perhaps the nicest result is that I have not had a single fatal error reported since the CPU swap. Thank you Dr. Ecraf for the "SHOULD BE" gate! Actually, the only complaint about the EC909-12 that I have is in regards to the intense light that emanates from the CPU module seams, I need to keep the case cover always closed as the light is annoying, especially when trying to play games in subdued light. If you opt for this microprocessor upgrade, be sure to look away from the module the first time it is turned on in case the ceramic cover on your CPU leaks light as mine did.

In any event, the EC909-12 Analog Microprocessor should be available to the general public by the time you read this. The scheduled release date is April 1. Ω

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BY DON LANCASTER

Underwater Arc Absurdities, Character Generators for Video, and More

TWO PERSISTENT PSEUDOSCIENCE WEB MYTHS INVOLVE PULSING OR SPARKING OF WATER. IN ONE CASE, AN EXCEPTIONAL HYDROGEN ELECTROLYSIS SUPER-EFFICIENCY IS CLAIMED. IN THE SECOND, A STRONGLY "OVERUNITY" ENERGY IS attributed to "underwater arcs".

The only minor problem with these pulse sparking claims is that there are now many thousands of water pulse-sparking machines in daily use. The devices have long been stocked in depth in every large city. These are known as EDM (Electro Discharge Machining) machines.

As far as I know, no machine shop using those devices has ever reported them vaporizing from excess energy generation. Nor have there been any reports of their exploding from the utterly trivial amounts of hydrogen they usually produce.

When you generate hydrogen, an efficient electrolysis will take place when you apply a DC voltage near 1.3 volts. At that continuous voltage, as much as one sixth of the required energy can come from ambient heat rather than the electricity, but only at uselessly low production rates. At a DC thermoneutral voltage of around 1.5 volts, all of your needed conversion energy has to come from your input electricity. Above 1.5 volts DC, excess heat is generated and wasted.

It seems to me that pulsing would move you away from those optimum values. Further, the cell capacitance is probably quite high, so your pulse charging and discharging can easily reduce overall efficiency. That's because the charge-discharge cycles produce additional waste heat.

There is an arcane field here called EIS, for electrochemical impedance spectroscopy. Searching the Web gets you useful (but costly) resources.

Two things about arcs and sparks: Any time you see them in a motor or generator, you're guaranteed to have inherent inefficiency. Any time that sparks are present, the measurements involving them will almost certainly be dead wrong because of off-scale rms crest factors.

There is also a ridiculous claim that a "pulsed DC" somehow does not involve alternating current, or vice versa. Sorry, but any "pulsed DC" can easily be shown to consist of a direct current level along with groups of AC sinewave harmonics. At least that's what this Fourier dude seems to have claimed a while back—and he sure has me convinced. Observations that increased pulse frequencies might generate "more" hydrogen can usually be explained by an increasing duty cycle that simply ups the average DC value.

One misguided Web site promotes gathering of gases above underwater electric arcs for potential use as fuel substitutes. I don't see how that can be anything but thermodynamically ludicrous. I'd predict absurdly low true efficiencies, especially when all costs are fully amortized.

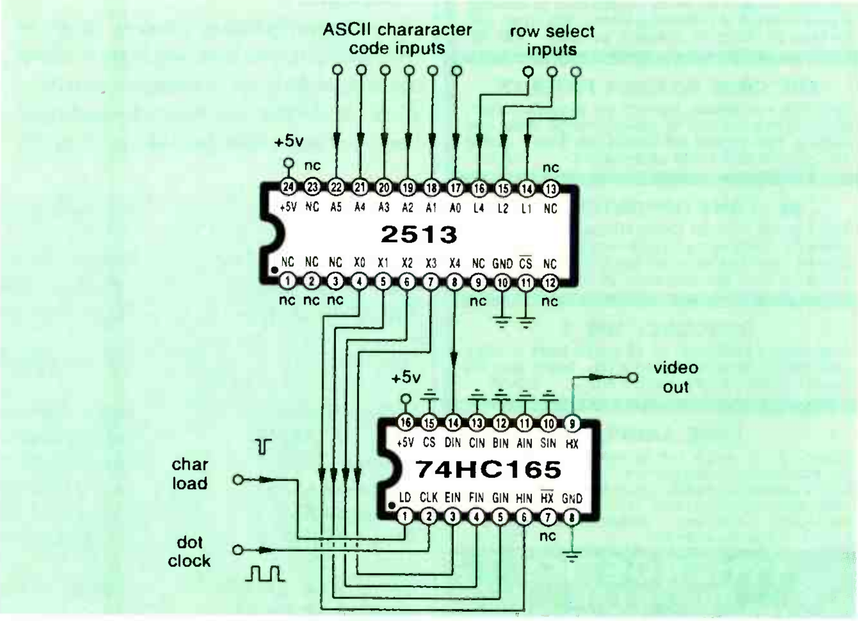

FIG. 1—A CLASSIC CHARACTER GENERATOR circuit. Inputs to a special EPROM pick character and row. Output becomes serial dot video.

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For more details, see www.tinaja.com/amlink01.htmlamlink01

If you feel otherwise about any of these schemes, please show me some reproducible experiment along with a credible and published theory.

Key points: A fuel is a substance that can deliver new BTUs of energy to the on-the-books economy. Energy carriers (such as hydrogen) are most emphatically NOT fuels! In fact, any energy carrier always wastes fuel in exchange for convenience, shipability, or safety, and sometimes in stupidity. A current Chicago hydrogen demo project now seems to be trucking the hydrogen in from Pennsylvania.

It's a gas.

A thermodynamic process must be reversible if it is to have any hope of being efficient, kicking off minimum waste heat. Thus, a decent electricity-to-hydrogen converter must also be able to decently convert hydrogen to electricity. The best thermodynamic processes usually have to end up as either isothermal (taking place at a constant temperature) or adiabatic (adding or removing zero heat).

A great book on this is Sandfort's *Heat Engines*. A copy can be found through www.tinaja.com/amlink01.html

More on EDM can be found in HACK60.PDF and HACK63.PDF on my www.tinaja.com Web site, and in *EDM Today* magazine. More on Fourier analysis can be found in MUSE90.PDF, on crest factors in MUSE125.PDF, and on thermodynamics in HACK64.PDF. And lots of "real science" links to electrolysis information sites can be found at my www.tinaja.com/h2gas01.html

A Cheap Video Review

There seems to be a lot of renewed

ITT Semi PIP2250	Picture-in-picture processor
Motorola MC141540	Monitor on-screen display
Motorola MC141541	Enhanced on-screen display
Motorola MC141543	Advanced on-screen display
NEC 42271	Color border PIP generator
Philips PCA8510	Stand-alone on-screen display
Philips PCA8515	Serial I/O on-screen display
Philips PCB8517	Stand alone OSD for monitor
Philips SAA5252	Line 21 Decoder
Philips SAA5355	Single chip color CRT controller
Philips TDA8315	NTSC decoder and sync processor
Seimens MEGATEXT	High performance Teletext chip
Seimens SDA5273	Teletext processing system
SGS-Thomson STV5730A	Multistandard on-screen display

FIG. 2—HERE IS A SELECTION of some on-screen display (OSD) circuits.

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interest in lower-cost video displays, especially PIC-based video message overlays. For those old enough to remember, we first looked at these as my classic TV Typewriter back in the September 1973 issue of this magazine's predecessor, **Radio Electronics**. Details also were available in my *TV Typewriter*, *Cheap Video*, and in my *Son of Cheap Video Cookbooks*.

Back in those days, a character-generator approach was used. ASCII characters were typically generated as a 5 × 7 or a 6 × 9 mono dot matrix.

A specially organized ROM was used. Some of these even had a then-stunning 2240 bits of internal data storage. You inputted a character that you wanted (often only 6-bit uppercase ASCII) along with a vertical scan-line selector. A row of dots then was output that matched the desired character and position.

A PISO (parallel-in, serial-out) shift register or a similar circuit then changed the parallel dot patterns into a serial string of dots. Those dots either create your actual video or else are superimposed over existing video.

As we've seen a number of times before, superimposing video can get tricky. You cannot directly add two video signals together. The timing of both video sources must get exactly locked together. This can be done by genlocking, use of frame grabbers, or by a common station sync. More on this can be found in HACK60.PDF.

Personal computer technology quickly moved beyond this character-generator scheme. Instead, bitmapped graphics screens are used, removing all the limits of single-font text only. With bitmapping, any combination of dots in any color or brightness can be used, mixing text and graphics.

But the character generator method has made a big comeback, mostly for VCR messages and TV receiver status displays. It is also being used for PIC data displays and for other lower cost apps where you simply want to put some limited information on screen or on top of another incoming video source.

The basic character-generator concept from way back when is shown in Fig. 1. That circuit puts a five-dot wide by seven-dot high character into a six-by eight-pixel display space. A monitor or TV set rapidly scans from its right to left, but only slowly moves from its top to bottom. The top row of all character dots is put down on the first scan line, followed by the appropriate dot patterns on the lines that follow.

This particular character generator was upper case only, so it accepts six bits of ASCII code to generate letters and numbers. It also has three row-timing inputs that pick the dot row needed. The 2513 is basically a read only memory. In exchange for ASCII and row inputs, a parallel five-dot pattern is output. That dot pattern is converted to serial video by a shift register locked to the video timing. The shift register also acts as a latch so the character dot information is always available.

These days, single chip solutions can be used to generate all of the dot patterns and all the timing for much fancier color characters. A listing of some of the available devices is shown in Fig. 2. Those devices are typically microprocessor programmable. In one mode, commands are stashed in the internal memory locations to set the display format, color, position, and all other options. In a second mode, ASCII characters are routed into sequential on-screen slots. Program and command set examples are shown in MUSE115.PDF on my Web site.

One representative circuit is shown in Fig. 3. The SGS-Thomson STV5730 chip works in either NTSC or PAL formats, and offers a number of options. It can generate a stand-alone display or lock to incoming video. Up to 11 rows of 28 characters each can be generated. A transparency option is available. Be sure to study the data sheet (available on line from www.queslink.com) because there are lots of possibilities.

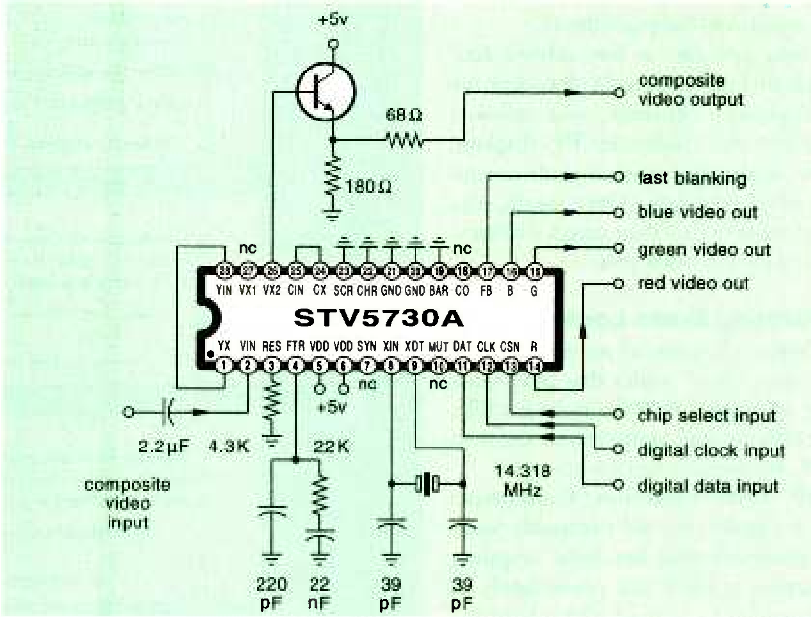

FIG. 3—SIMPLIFIED CIRCUIT EXAMPLE of a single-chip OSD.

Can a PIC be used to generate its own dot rate video? The surprising answer is that it can, but only with some really intense design.

Tim Jenison's Calibar pattern generator from NewTek is one example. Tricks possible with that unit include continuously running the high addresses of a 4× color clock-pattern generator EPROM from a 4-bit binary counter, and then letting the PIC control all of the needed low addressing. Even then, a sneaky trick had to be done to provide for the alternate-line color-phase inversion: patterns for pairs of horizontal lines are used. Similarly, a full two-field frame was used that read different EPROM sync patterns on each field. More on the Calibar can be found in MUSE120.PDF.

A good source for PIC compatible character-generator displays is Decade Engineering. Details on their BOB-5L are available in MUSE115.PDF. That

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unit used the earlier Rohm BU5963AS character-generator chip, which is no longer sold. Later models use newer chips. Decade may be easily reached through the banner link on my Web site.

Another route to low-priced video displays is to use an older computer. Ideal candidates are the Apple IIe or even a Commodore 64. I've got great heaping piles of Apple IIe's available at www.tinaja.com/bargca01.html

There are also a few related new devices including Line-21 decoders for the hearing impaired and teletext processors for European TV displays. These sometimes also include useful stand-alone displays. Once again, the easiest place to find data sheets and samples is www.questlink.com

Re-raveling Some Loose Ends

There's all sorts of unrelated short annoyance "fixit" topics that have been piling up around here for quite a while. I've collected and summarized them in Fig. 4. So, without further ado:

HP 3300 Function Generator: This is a really nice old sweepable function generator that has been cropping up surplus at fairly low prices lately. It was intended to be used with a hard-to-find sweeper or other exotic plug-in. The only "little" problem is that the instrument won't work at all without some sort of a plug-in.

Figure 4A shows a connector that lets you run the 3300 as a stand-alone function generator. The connector used is an Amphenol 57-30500. You can also use this jumpering as the start of your own custom plug-in. More details are available at www.tinaja.com/bargte01.html

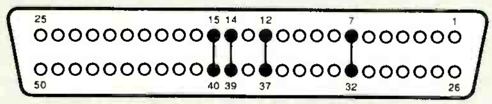
Packard Bell Woes: Seems I've got this older Packard Bell computer that has a nasty habit of randomly turning off all its CD-ROM and LS120 drives. What usually happens is that a NoIDE flag in the registry mysteriously gets set to its "01" value.

I suspect this is a generic problem. Your fix is to carefully go down into the registry and reset this value.

Figure 4B shows you one possible path. On Win 98, you run REGEDIT, then drop down through these folders in order: HDKEY_LOCAL_MACHINE; System; CurrentControlSet; Services; VxD; and finally IOS. Then change the NoIDE flag back to 00.

Note that an improper registry modification can trash your machine and a careful backup is a very good idea here.

Amplenol 57-30500 connector



(a) Running an HP 3300 function generator without a plugin.

1. Run REGEDIT.
2. Select the following folder:

HDKEY_LOCAL_MACHINE/System/CurrentControlSet/Services/VxD/IOS

3. Verify or change NoIDE flag to its 00 value.

(b) Repairing the Packard Bell "lost drives" syndrome.

1. Open Program Files, then Netscape, then Users.
2. In each user file, find the lprefs.js file.
3. Add or modify in its suitable position:

user_pref("mailnews.start_page_enabled";false);

(c) Fire bombing the "Netcenter" infuriation.

1. Right click on the AOL messenger icon.
2. Select Preferences then select Misc.
3. Unclick the following box:

Start Netscape AIM when Windows Starts

(d) Shooting the AOL Messenger.

1. Discuss the redirection problem with your ISP.
2. Verify that a server side solution is workable.
3. Modify and add to the ISP's server config file:

Redirect permanent /oldurl/newurl/

(e) An alternative to the "redirect" command in HTML.

FIG. 4—SOME "ODDS & ENDS" SOLUTIONS to annoying problems.

Also note that this repair only works if the NoIDE flag has in fact gotten trashed to an "01" value.

"NetCenter" Infuriations: The latest versions of NetScape Navigator seem to stupidly try and force you to go to "NetCenter" rather than the place you really want to go to get your mail. A cure is to go into the Program Files and drop on down first into NetScape and then to Users. Inside of each user folder should be a prefs.js file. Then, by using an editor or word processor, very carefully enter

user_pref("mailnews.start_page_enabl ed", false);

at its alphabetical location. Then, you resave your prefs.js file. Should this preference already be present, just change it from "true" to "false" as per Fig. 4C.

Shooting the AOL Messenger: Just as infuriating is the AOL messenger in NetScape that inexcusably and uselessly clutters up your browser task bar. This one is easier to cure. Right click on Messenger, then on Preferences, then on Misc. You'll then unclick the Start NetScape AIM when Windows Starts box option. Again, this procedure is summarized in Fig. 4D.

A Redirect Alternative: Later versions of HTML have a redirect command in them. Redirect is useful to move you from an old page to a new one. This is also one method to track responses to banner ads. But any redirect takes time, and gives your viewer an unneeded page to view. Old redirects have a nasty habit of disappearing. Worse, if your redirect delay time is set too short, the browser back arrow no longer works. For any clicking on back

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immediately is forwarded.

At any rate, there's a subtle, little known, and older alternate that even works with Apache servers. As shown in Fig. 4E, just have your ISP put the following command in their Apache server configuration file folder:

Redirect permanent /oldurl/newurl/

This obviously needs close co-operation with your ISP, and I am not sure how a permanent redirect can be used to tally click-through counts, but this is otherwise both cute and useful. Many thanks to Kragen Sitaker for this tip. More on redirects can be found on my web-mastering library pages, along with lots of other goodies.

Some SETI Books

A thought-provoking paper, "How Rare are Extraterrestrial Civilizations?" by Mario Livio, recently appeared in the February 1999 *Astrophysical Journal*. In it, Mario makes a strong case for dramatically raising the odds on currently present extraterrestrial civilizations. His argument is that other civilizations should show up not much sooner nor later than halfway through the parent star's life cycle, which means they should be emerging "right about now."

There's a lot of reasonable books on SETI topics. I have summarized a few of these in the resource sidebar. More title details can be found at http://www.tinaja.com/amlink01.html or on this online column version at http://www.tinaja.com/muse01.html

The recently revised classic text in this area remains Frank Drake's *Is Anyone Out There?* Some earlier thoughts on SETI can be found in HACK65.PDF, or search the web under "Drake equation". More SETI topics also appear in the online Space Telescope Science Institute library at stlibrary.stsci.edu

New Tech Lit

From Analog Devices comes their latest Winter 1999 Short Form Designer's Guide. Through AKM Semiconductor you can get details on their AK410 24-bit digital audio interface receivers. And from National, information is available on their LM3812 series of "battery gauge" current sensors.

An astounding collection of aerial and satellite photographs appears at the Terra Server site, which is newly up at www.terraserver.microsoft.com The coverage in the four terabyte(!) database has both aerial and satellite photography with resolutions down to one meter per pixel.

Metalloradicals latest album has gone platinum! Actually, these are the key compounds to understanding photosynthesis and creating possible organic batteries and energy carriers. The key paper in this area was first detailed by Hoganson and Babcock in *Science* for September 26, 1997. The more recent pair of biological-hydrogen update papers appears in *Science* for Dec 4, 1998; see pages 1842 and 1853. Also, check out "A New Type of Hydrogen Bond" in the December 11, 1998 issue. More links and information on hydrogen and related topics is found in www.tinaja.com/h2gas01.html.

One source for the WWII military tech manuals is Surplus Al. Check his new www.qsl.net/w3ugd Web site. More on test equipment manuals and buying military surplus is found at www.tinaja.com/resbn01.html

Free Tygon tubing samples can be obtained from Norton. A new catalog of

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technical plastics and polymer books is available from the Hanser Gardner folks.

From JKL Components comes data sheets on small narrow-spectrum ultraviolet lamps. JKL is a good source for mini fluorescent lamps of all types. From 1-800-Batteries comes their latest catalog on batteries for camcorders, cell phones, and similar gear.

Featured insider trade journals for this month include *Digital Graphics* about poster- and billboard-sized color printers; *Scientific Computing & Automation* on industrial and lab PC apps; and *Card Technology* on smart cards, PCMCIA, and such.

The latest books from Newnes are *CE Marketing Handbook* on safety regulations, the *Power Electronics Design Handbook*, and *VCR Troubleshooting and Repair*.

The latest Lindsay Publications title is a *1913 Harper's Aircraft Book* by A. H. Verrill. It includes detailed modeling instructions for many classic early planes. More information on all sorts of other book titles at www.tinaja.com/amlink01.html

For the insider secret fundamentals of active filters, check out my *Active Filter Cookbook*, either by itself or as part of the Lancaster Classics Library. You can visit www.tinaja.com/synli b01.html or see my Synergetics ad for that.

The Synergetics Consultant's Net has also been recently improved; see www.tinaja.com/consul01.html For instant resource solutions, check out www.tinaja.com/info01.html

The very latest additions to my www.tinaja.com/barg01.html surplus site include radiosondes, frequency synthesizers, Tektronix plugins, and centrifuges. Plus superb "project starters" that include some mondo switches. The latter are heavy duty twelve pole, twenty position plus off, non-shorting. They are even prewired. Let me know what new uses you can come up with for these.

As usual, most of the mentioned resources appear in our Names & Numbers or SETI Resources sidebar. Always check there before calling our US technical help line shown in the nearby box. Let's hear from you. EN

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COMPUTER CONNECTIONS

continued from page 27

However, the good news, as we mentioned earlier, is that the chip is *cheap*. There are plenty of consumers who need a decent PC, but can't take a second mortgage to buy it. For these users, or for students, an MII is a good choice.

This low-end trend might be changing soon, though. Cyrix has announced plans to release a high-speed chip later this year, maybe around November or December. Code-named Jalapeno, the chip will likely be coming out with a 600 number on its surface. It will also feature a licensed version of 3DNow! technology. Hopefully when this "600" chip is released it will have a "MHz" next to it and not a "PR."

That's about all for this month. If you'd like to drop me a line, feel free to send e-mail to connections@gernsback.com, or send a snail-mail to *Computer Connections*, **Electronics Now**, 500 Bi-County Blvd., Farmingdale, NY 11735. EN

NEW PRODUCTS

continued from page 16

Separate front-panel meters monitor output voltage and load current. These settings can be varied manually using the front-panel coarse and fine controls. Outputs are floating—neither the output nor the negative terminal (nor any point within the regulator circuitry) is connected to ground. The supply is designed to operate in an ambient temperature of 40° C. The Model 1337 DC Power supply has a list price of $375.

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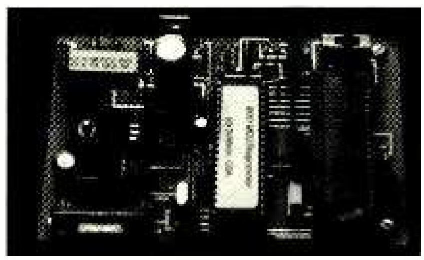

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The programmer software is a menu-driven system, containing a submenu for each device to handle different programming algorithms and voltages. It can blank check, write, read, and verify the device to be programmed. It can also erase flash MCUs. The programmer accepts both Intel hex and binary format files. The 9600-bps version retails for $75 ($65 for kit only) and the 57,600-bps version costs $85. The AT89C2051/1051 Adapter costs $30.

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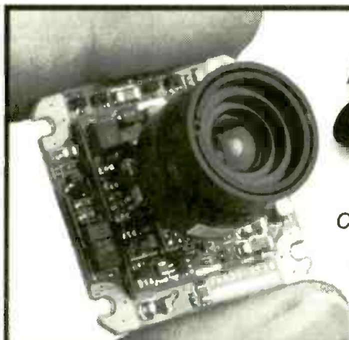

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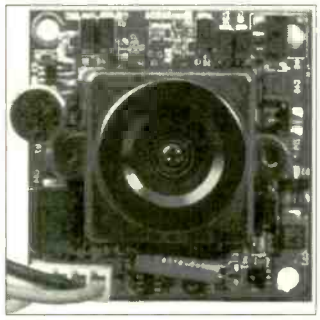

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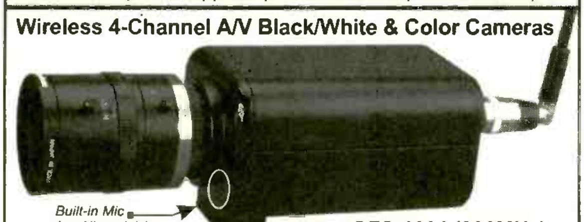

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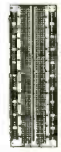

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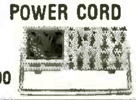

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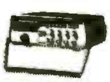

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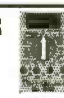

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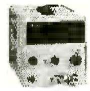

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INTERNET SECURITY
The latest tricks and methods hackers use on the Net to pirate software (warez), and hack websites. Includes examples, countermeasures, password defeats, Packet-Switched Networks, UNIX, Sprintnet, X.25, anonymous FTP, brute force techs, lots of tips. More! $29. wrds=29.4K

INTERNET TRACKING & TRACING: Scammers, spammers, stalkers, infectors, and others hide behind the Internet's anonymity to commit serious offenses. Learn from master hackers best methods to track, trace IDs and origins, and to protect your own privacy. More! $29. wrds=17.0K

INTERNET FRAUDS DATABOOK: Internet cons, scams and related frauds now rake in $2+Billion annually! Most are done anonymously with impunity. Details how they're done, how to ID them, how to protect yourself. More! $25. wrds=19.1K

THE COOKIE TERMINATOR: Many websites track your every move! Browser cookie, history and cache files contain personal data readily accessible to Internet predators, scammers, spammers and snoops. Your financial, medical, political, habits, lifestyle, future plans data is exposed to the world! Step-by-step how to remove and stop cookies from destroying your privacy. $25. wrds=8.4K

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PBX SECURITY
PBXs hacking losses of $5-$10 Billion/yr! Detailed vulnerabilities (especially for out-dial), countermeasures. Exclusive author interview in Forbes! $24. wrds=17.4K

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100+ ATM crimes, abuses, vulnerabilities, defeats exposed - TEMPEST, mag stripes, false fronts, supercool, More! Case histories, labeled internal photos, figures. $39. wrds=41.0K

CELLPHONE/CORDLESS GUIDE
How cellphones operate; mods. Vulnerabilities to hack attack; countermeasures. Cloning details for NAMs, ESNs, SIDHs, Op Sys, PROMs, forcing ACK, test mode and resets, cable diagrams, scanning, tracking, scanner restorations, freq allocations, roaming, step-by-step to keypad-reprogram 100+ popular cellphones. One FREE database search. Plus much on Cordless phones. More! $49. wrds=80.0K

PAGER (BEEPER) MANUAL: How Pagers work, different types and uses, freqs, advantages over and uses with cellphones, and tips and tricks. How phreaks hack Pagers; countermeasures. Plus plans for a Personal Pocket Paging System (xmitter and receiver). More! $29. wrds=11.7K

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How they work and the many vulnerabilities of Caller ID, ANI, *69, *57, Call Blocking, *67, et al. Describes ESS, SS7, CN/A, CAMA, DNR, Diverters, Centrex! $25. wrds=15.2K

FAX MACHINE SECURITY
All known methods used to hack Faxes and countermeasures. Includes computer fax modems, crimes, interceptions, fax servers, fax-on-demand, protocols, parameters, compression, encryption, and fax surveillance-type mods. More! $29. wrds=28.0K

VOICE MAIL SECURITY
VMSs are hacked to penetrate PBXs to make outgoing calls, get free VMB usage, secretly read/change/delete messages, control or damage the VMS (or its PBX) itself. Details how hackers do it, countermeasures. A must for users, sysops, security personnel! $29. wrds=14.2K

STOPPING POWER METERS
As reported on "60 MINUTES"! 6th Edition! Details devices that can slow down (even stop) power meters while loads draw full power - great science projects! Devices plug into one outlet and normal loads into other outlets. Describes meter creep, overload droop, pole meters, etc. $29. wrds=10.4K

SPM THE VIDEO: Now its easier to learn about KW-HR Power Meters than ever before! This educational video shows you how they work and their anatomy. Demonstrates SPMEM device and external magnetic methods used to slow and stop meters! Hosted by a top expert in the field. From the novice to the pro, an excellent source of info on these exciting devices! Great in combo with our SPM-related manuals! $29. (20 min)

THE I.G. MANUAL: Details external magnetic ways (applied to meters) outlaws use to slow down and stop power meters while drawing full loads. $25. wrds=4.9K

KW-HR METERS: How watt-hour energy meters work, calibration, error modes (many), ANSI Standards, etc. Demand and Polyphase Meters. Experimental results to slow, stop power meters by others. $25. wrds=24.2K

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COMPUTER SECURITY
Describes in detail how computers penetrate each other, and how VIRUSES, TROJAN HORSES, WORMS are implemented. Dozens of computer crime and abuse methods and countermeasures. Includes disk filled with hacker text files and utilities, and the legendary FLUSHOT+ protection system. Internet advice, password defeats, glossary - much more! Manual + PC Disk! $39. wrds=49.5K

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BEYOND VAN ECK TEMPEST
Remote eavesdropping plans of TV video "noise" signals. Range up to 1 KM. Describes how van Eck systems work, and are also used in surveillance of computer systems. Plus TVRO vs phone privacy detailed! $29. wrds =14.9K. Van Eck Demo Tape is $29. (15 min). Both for only $49!

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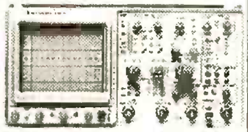

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GM412, less lens..$119, GM410, less lens..$169

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TYPE B: $15ea. or 2 for $27

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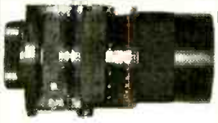

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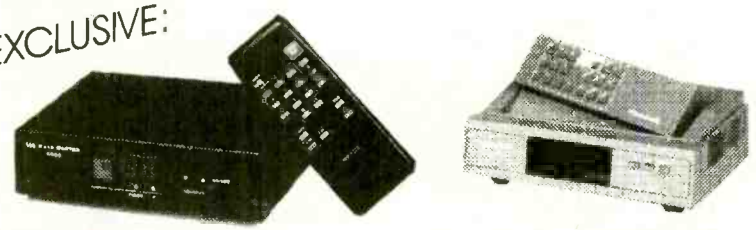

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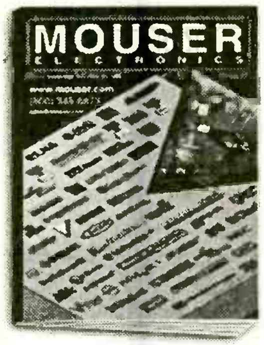

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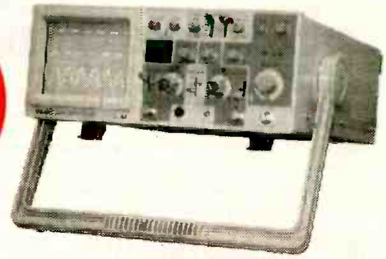

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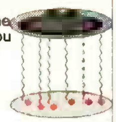

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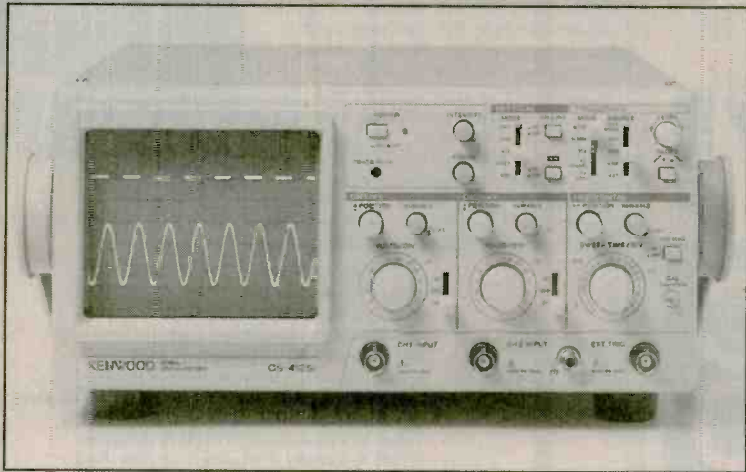

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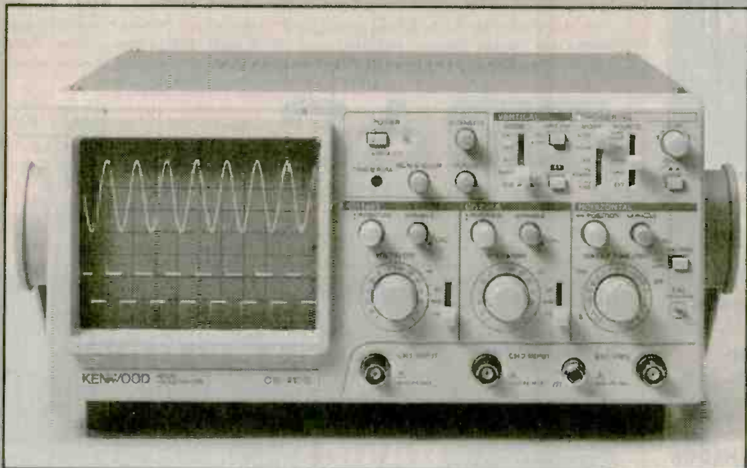

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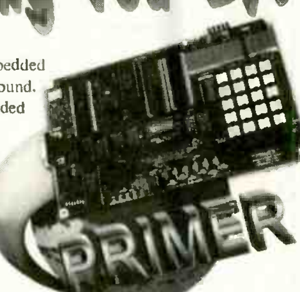

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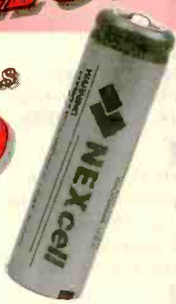

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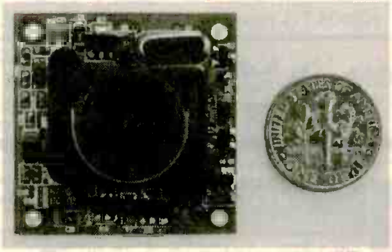

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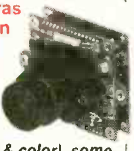

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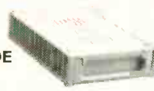

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- •CMOS/TTL data input
- •7 x 11 x 4mm !

AM-TX1-xxx $12.60

AM Receiver

- •Compact Hybrid Module
- •Very stable
- •CMOS/TTL output
- •Patented Laser Trimmed
- •5Vdc, 0.8mA (HRR6)
- •2kHz data rate
- •Sensitivity -105dBm
- •38 x 12 x 2 mm

AM-HRR6-xxx... $16.33

FM Transceiver

- •Only 23 x 33 x 11mm
- •Up to 40,000bps data rate
- •Up to 450ft. range.
- •5V operation
- •418MHz or 433MHz FM
- •5V CMOS logic interface
- •Fast 1mS enable
- •Power saving feature
- •Carrier Detect output

BiM-xxx-F $87.36

RS232 Transceiver

- •3wire RS232 interface
- •19.2Kbps half duplex
- •418MHz or 433MHz FM
- •7.5-15Vdc, 20mA
- •TX/RX Status LED's
- •Up to 400ft. range
- •1/4 wave ant. on board
- •User data packetizing
- •58 x 40 x 15mm

CYPHERNET $139.30

AM Transmitter

- •Range up to 250ft.
- •SAW controlled stability
- •Wide supply range 2-14V
- •CMOS/TTL input
- •Low current. 4mA typ.
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- •Small: 17 x 11mm

AM-RT5-xxx $12.10

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3½ Digital LED Panel Meter #TY-43

It is a precision A/D converter integrated circuit. The display is a 6" LED for high visibility. It is easy to assemble and use the meter as a voltmeter, ammeter, ohmmeter, thermometer, frequency counter or capacitance meter. DC±199.9mV full scale input 5-6VDC.
Kit:$ ~~28.00~~ 15.00

20 Color LED Audio Level Meter #TY-13

Use this dual LED display indicating meter with your stereo power amplifier to indicate instantaneous speaker power. Operating range is -30dB to +5dB & can be calibrated to operate with 1-200W amplifiers. Not consume any amplifier power. A peak LED illuminates on overload!
Kit:$ ~~23.50~~ 9.99

Fluorescent Light Driver #TY-2

This unit drives 6-40 watts fluorescent light for portable & emergency use. Works from a 7.2-16 VDC battery. Includes a "Hi-Efficiency Switching Mode IC Driving Circuit" suitable for use with different lights.
Kit:$ ~~18.75~~ 9.99

40W Mini Stereo Multi-Input Amp #TA-83

Operated from AC source as well as 12V DC car battery. Used as a microphone PA amplifier while simultaneously mixing with an auxillary input souce such as CD & MD player.
Kit:$ ~~30.50~~ 24.40

300W MOSFET Power Mono Amp #AF-3

300W RMS into 4 ohms, 200W RMS into 8 ohms. Frequency response: 10Hz-20KHz. THD < 0.03%. S/N 91 dB. Input Sensitivity & Load impedance at 1KHz, 1V 47K & 4-16 ohm. Power Requirement: ±55V - ±65V DC at 8A(each channel). A speaker protection circuit which provides time delayed speaker turn on.
Kit$ ~~165.00~~ 132.00

120W + 120W Pre & Main Stereo Amp

It has provision for input program source switching, a phono pre-amp stage with RIAA equalization, 3-band tone controls, built-in power supply rectifier & filter & a speaker protection circuit. It only needs to be installed in a suitable housing & the addition of a power transformer in order to make it operational ***#TA-800MK2***
Kit:$ ~~67.92~~ 57.73
Asmb.:$ 86.95

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#TA-120	36W Class A Power Mono Amp	$ 32.50
#TA-388	FET Class A Stereo Pre-Amp	64.00
#TY-25	Stereo Loudspeaker Protector	16.75
#KA-905	75-in-one Lab Kit	24.99

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LG-1273	3x12x6¾"	$ 26.50
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LG-1983	2½x19x8"	35.25
LG-1923	3x19x11½"	36.50
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LG- Black anodized rack cabinet

LL-1923B	2¾x19x12"	$ 69.50
LL-1925A	5x19x12"	79.50

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**LL-Gold plated cap screw for front panel*

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Toroidal Transformers

#001	28/30Vx2	6A	$ 30.00
#002	36Vx2	3A	25.00
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#005	26Vx2	3A	19.00
#006	18Vx2	5A	19.00
#007	53Vx2	8A	47.00
#008*	28/30Vx2	6A	40.00
#009*	48/53Vx2	8A	66.00
#010	30/36Vx2	400mA	8.50
#011*	9Vx2	22A	62.00
#012*	33/42Vx2	6A	48.00

Transformer

**Toroidal Transformer*

150 Mhz 8 Digit Frequency Counter
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It is used for adjustment, test & repair of any kind of high frequency circuit products. It can give up to 8 digit of resoulution for a wide frequency range 10Hz -150 MHz. The last input frequency can HOLD on the display for future reference & comparison. The circuit structure is compact & reliable for the most updated A/D LSI circuitry. The input impedance is 1M ohm.
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Asmb $ 99.00

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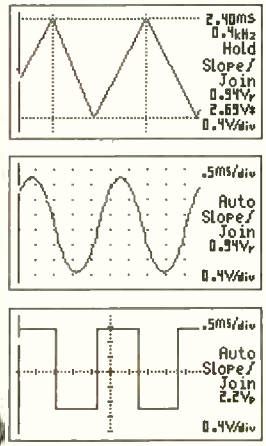

Simulated screenshots

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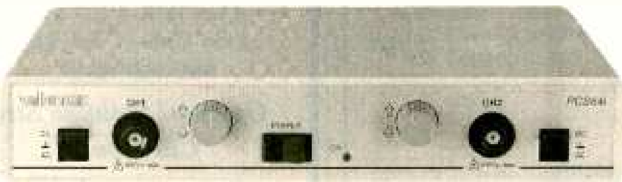
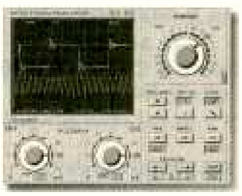
PCS64i DIGITAL OSCILLOSCOPE FOR PC

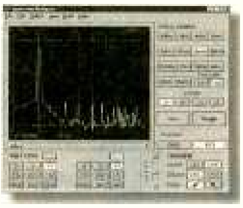


OPTICALLY ISOLATED FROM COMPUTER

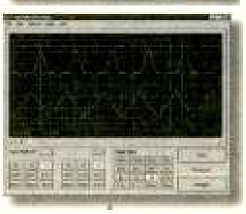
- Uses an IBM compatible computer and its monitor to display waveforms
- All standard oscilloscope functions are available in the DOS or Windows program supplied.
- Operation is just like a normal oscilloscope
- Markers for indicating voltage and frequency provide considerable ease of use.
- Can also be used as a spectrum analyser up to 16 MHz, and as a transient signal recorder, for recording voltage variations or for comparing two voltages over a longer period (up to more than 1 year!).
- Connection is through the computer's parallel port.
- The oscilloscope and transient recorder have two completely separated channels with a sampling frequency up to 32 MHz in real time, oversampling of 64MHz is possible in the Windows software.
- Any waveform displayed on the screen can be stored for later use.



OSCILLOSCOPE [DOS-screen]
- timebase : 100ns to 100ms per division
- input sensitivity : 10mV to 5V/division
- pre-trigger function (not in 64MHz mode)
- true RMS readout (only AC component)



SPECTRUM ANALYSER [Windows-screen]
- frequency range : 0 .. 800Hz to 16MHz
- linear or logarithmic timescale
- operating principle : FFT (Fast Fourier Transform)



TRANSIENT RECORDER [Windows-screen]
- timescale : 20ms/Div to 2000s/Div
- max record time : 9.4hour/screen
- automatic storage of data
- automatic recording for more than 1 year
- record and display of screens
- data format : ASCII

SYSTEM REQUIREMENTS:
- IBM compatible PC
- Windows 95 or 3.11 or MS-DOS
- VGA display card (min. 800x600 for Windows) and mouse
- 480Kb free conventional memory (Dos software)

OPTIONAL ACCESSORIES
- NiCd battery pack : BP9 for battery operation
- oscilloscope probes (2x) : PROBE60S (isolated)
- carry case : BAG21X19

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Modern computing and standard surge suppressors...a recipe for disaster.

Almost all surge protection devices use MOV's (metal oxide varistors) as their active element. MOV's are sacrificial/wear/ limited life components. Surge suppressors based on this technology are doomed to failure. These surge "suppressors" also don't suppress a thing. They divert powerline surges equally to the ground and neutral wire. When you put current on the common ground wire of interconnected equipment some of that current will flow (through the inherent ground loops) to the data lines. This is a major cause of lock-ups and misoperations that plague today's computer environments. Another fact; all modern computers use switch mode power supplies. During surges the power supply capacitors must charge to the clamping level of the MOV before the MOV turns on. A recent study has shown that it takes a 3000A surge 15 microseconds (15,000 nanoseconds) to charge the typical capacitors of these power supplies to that level. The surge is virtually over before the MOV reacts. ***(See five things you probably don't know about your surge suppressor at www.fivethings.com.)***

THE POINT: Standard surge suppressors allow too much current to hit the computer. Standard surge suppressors divert surge current to the ground wire and disrupt data transfer. Standard surge suppressors eventually fail without warning. Modern computers have logic voltage levels (the signals that transmit the data) and power supply voltages that are dramatically lower than that of their recent predecessors. Modern computers use integrated circuits with transistors of ever decreasing physical geometries. Modern computers are virtually always interconnected to other computers or peripheral equipment. The bottom line; ***modern computers are much more sensitive and susceptible to powerline anomalies.***

INTRODUCING BRICK WALL SURGE FILTERS. . .

The World's Best Surge Suppressor

Initially engineered for critical, non-fail industrial applications, this patented device protects indefinitely and sets a new standard for every measure of surge suppressor and powerline filtering performance.

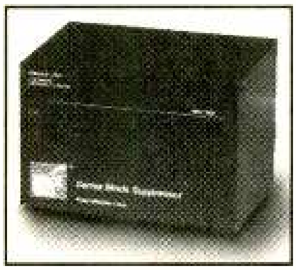
A Brick Wall 1) Utilizes <u>NO MOV'S</u> or Any Other Sacrificial Components (a two pound inductor and nine capacitors are the heart of the unit) 2) Has No Joule Rating or Surge Current Limitations *3) HAS BEEN TESTED AND CERTIFIED BY UL TO THE MOST DEMANDING CLASSIFICATION OF A NEW GOVERNMENT SPECIFICATION; CLASS I, GRADE A. Which Means: UL PUT ONE THOUSAND 3OOOA, 6000V SURGES (this is the largest surge an interior environment can experience) THROUGH A UNIT (at 60 second intervals) AND DOCUMENTED NO FAILURE OR PERFORMANCE DEGRADATION OF ANY KIND WHATSOEVER..*

i.e.: A Brick Wall Will Not Fail.

We know of no cord connected, MOV based surge protection device that has, or can pass this test.

A Brick Wall possesses UL's lowest Suppressed Voltage Rating (let-through voltage) of 330V. This is the lowest rating they will grant. In that test of one thousand 6000V, 3000A surges, *UL NEVER SAW THE LET-THROUGH VOLTAGE EXCEED 290V. YOU CANNOT DO BETTER THAN THIS FOR A POINT-OF-USE SURGE PROTECTION DEVICE.* Once again, we know of no other surge protection device that could come close to this performance level.

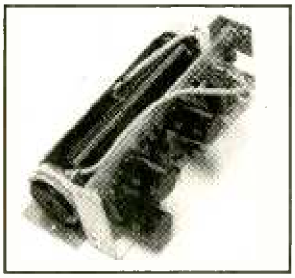
A Brick Wall is a current activated *Series Mode* device. *Since it is not wired in parallel, nor voltage activated, it does not have to wait for the capacitors of the power supply to charge before it becomes effective. YOUR EQUIPMENT IS PROTECTED INSTANTANEOUSLY (and indefinitely).*



These devices were engineered utilizing a current limiting/surge filtering technology. *THEY DO NOT DIVERT ANY SURGE CURRENT TO THE GROUND WIRE. They <u>Will Not</u> Cause Your Computer System To LOCK-UP, CRASH OR MISOPERATE as a consequence of surge diversion. Your current surge "suppressor" will.*

Powerline Filtering

In addition to all this, Brick Wall Surge ***<u>FILTERS</u>*** *are the best AC powerline filters you can buy (that we have been able to find anyway). Industrial machinery, copiers, coffee makers, laser printers, fluorescent lights, refrigerators, etc., all cause powerline noise that can cause your computer to misoperate. A Brick Wall Surge Filter will make powerline noise related problems disappear.*



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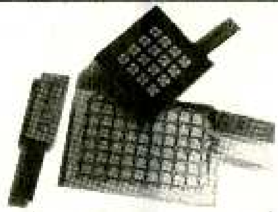

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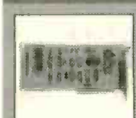

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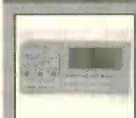

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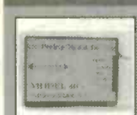

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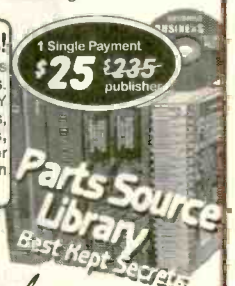

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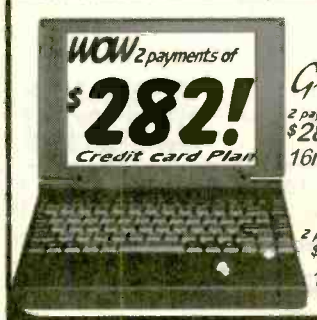

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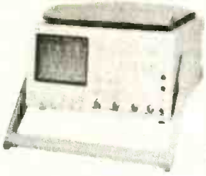

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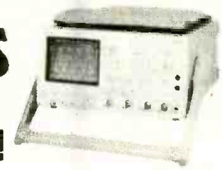

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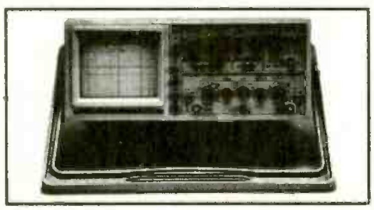

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6-1/2" Two Way System

This is our most popular in-wall. You won't believe how good these really sound. Big enough to produce great home theatre sound and still fit everyone's budget. Put a pair in every room of your house. Great for front or rear speakers in your surround system. The 6-1/2" polypropylene woofer and 1" textile dome tweeter were specially designed with home theatre in mind. The crossover network utilizes a mylar capacitor for crisp clean highs. 3 piece design make installation in new or existing walls a snap. **Specifications:** ◆6-1/2" polypropylene cone woofer with poly foam surround ◆1" textile dome tweeter/ midrange ◆8 ohm impedance ◆3 component L/C crossover network ◆Frequency response: 50-20,000 Hz ◆Power handling capability: 60 watts RMS/85 watts max ◆Sensitivity: 89 dB 1W/1m ◆Overall dimensions: 8-1/2" W x 12" L x 3-1/2" D ◆Hole size: 7-1/4" x 10-3/4" ◆Fits into standard 2" x 4" wall ◆Net weight: 12 lbs. per pair.

#300-036 .... **$89.90** (1-3 PRS) **$79.50** (4 PRS-UP)

Satellite Speaker Stands

These quality speaker stands are perfect for mini or rear surround speakers. The heavy die cast base provides stability. Textured black satin finish blends in well with any decor. The height is adjustable from 26-1/2" to 47-1/2" and the speaker wire can be run inside the pole for a better appearance. The top base is adjustable from 4-1/8" to 7-1/2" to accommodate most mini speakers. Includes foam pads to prevent marring of speaker cabinet. Sold in pairs. Net weight: 12 lbs.

#240-762 .... **$39.80** (1-3 PRS) **$35.50** (4 PRS-UP)

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◆Operates five devices (TV, VCR, Cable, Satellite, A/V Receiver) ◆Lighted component keys which indicate what device is currently being used ◆Preprogrammed, 621 codes that work over 6,400 models ◆New ergonomic design features a contoured case, index finger grooves, and keys grouped in clusters for easy operation ◆Satellite cursor control is tailored for use with a Home Theatre system, keypad design allows movement through menus with ease ◆Retains codes when replacing batteries ◆New flat back design for easy operation ◆Money back guarantee ensures customer satisfaction ◆Toll free customer service number provides the customer with friendly, knowledgeable assistance ◆Requires 2 AAA batteries (#140-150 not included)

#180-806 .... **$29.95** (1-3) **$26.95** (4-UP)

3M 3/4" Temflex™ 1700 Vinyl Electrical Tape

General purpose 7 mil electrical tape. UL listed and CSA approved. 3/4" x 60' rolls.

#350-052 .... **75¢** (1-9) **59¢** (10-UP)

Gold Plated A/V Cables

A super quality, "siamesed" type cable. Two RCA cables for stereo (audio) signal from VCR to receiver/stereo TV and one low noise coaxial type cable for video.

Part #	Length	Price (1-9)	Price (10-UP)
180-120	3 ft.	$4.25	$3.95
180-118	6 ft.	4.90	4.50
180-121	12 ft.	8.95	7.95
180-124	20 ft.	12.75	11.50

6-1/2" Round Coaxial System

Dayton Loudspeaker Co.

Designed for the home and office, these 6-1/2" round in-walls are ideal for ceiling installations, or for use as rear channel surround speakers. Adding music to the kitchen, den, bath, or patio has never been easier! System features a weather resistant 6-1/2" treated paper cone with poly foam surround, coaxially mounted 1/2" polymer dome tweeter, and built-in crossover with a mylar capacitor in the tweeter feed. Retrofit design allows installation in both new and existing construction in just minutes. System includes removable steel mesh grills, built-in mounting bracket, hardware, and installation instructions. **Specifications:** ◆Impedance: 8 ohms ◆Frequency response: 60-20,000 Hz ◆Power handling capability: 30 watts RMS/45 watts max. ◆Sensitivity: 89 dB 1W/1m ◆Dimensions: 9" round x 2-7/8" deep. ◆Net weight: 5 lbs. per pair.

#300-408 .... **$69.95** (1-3 PRS) **$62.75** (4PRS-UP)

3 Amp Power Supply

ZURICH

This fully regulated power supply is perfect for powering CBs, car radios, and other 12 VDC devices that draw up to 3 amps. Heavy duty steel housing with front mounted switch and binding posts. Short circuit and overload protection! **Specifications:** ◆Output Voltage: 13.8 VDC (fixed) ◆Output Current: 3A (cont), 5 amps (surge) ◆Ripple Voltage: Less than 3mV at rated output ◆Input Voltage: 120 VAC, 60Hz ◆Dimensions: 5-1/2" x 3-1/2" x 6-1/2" ◆Weight: 5 lbs.

#120-530 .... **$19.95** (1-3) **$18.50** (4-UP)

DMM and LCR Meter

In addition to functions found in regular DMM's, this meter can also measure inductance in 5 ranges (4mH, 40mH, 400mH, 4H, 40H), capacitance in 5 ranges (4nF, 40nF, 400nF, 4uF, 400uF), frequency in 4 ranges (4KHz, 40KHz, 400KHz, 4MHz), TTL logic test, diode test and transistor hFE test. 5 AC/DC ranges up to 1000V (AC750V), 3 AC/DC current ranges up to 20A and 7 resistance ranges up to 4000 M ohms. Includes test leads, battery, spare fuse, and manual. Net weight: 1 lb.

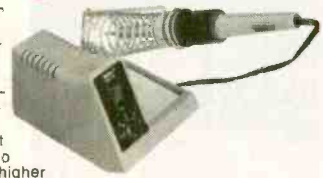
#390-513 .... **$85.90** EACH

2.5W Mini Audio Amplifier

This amp contains both pre-amplifier and power amplifier on a super small board measuring only 1-5/8"x1-1/4". Maximum output power is 2.5W into 4 ohms with 12VDC input power. No adjustments required. Short circuit protected.

#320-215 .... **$9.95** EACH

Weller WLC100 Soldering Station



The Weller WLC100 solder station is ideal for the professional, serious hobbyist, or kit builder who demands higher performance than usual of a standard iron, but without the high cost of an industrial unit. Power is adjustable from 5 to 40 watts. Includes 40 watt pencil iron. UL approved. Net weight: 1-3/4 lbs. Replacement sponge #372-119.

#372-120 .... **$39.95** EACH

KESTER "44" Solder

Kester "44" rosin core solder is designed for electronic and electrical work. It uses a fast acting, instant wetting, non-corrosive, and non-conductive flux for faster soldering and a strong, long lasting bond.

Part #	Alloy Lead/Tin	Spool	Dia.	Price (1-3)	Price (4-UP)
370-080	60/40	1 lb.	.031"	$8.50	$7.95
370-090	60/40	1 lb.	.050"	8.50	7.95
370-098	60/40	4 lb.	.031"	33.90	31.80
370-088	60/40	1/2 lb.	.020"	6.95	5.75
370-072	63/37	1 lb.	.020"	14.90	13.50
370-086	63/37	1/2 lb.	.031"	9.95	8.50
370-074	63/37	1 lb.	.031"	12.50	11.50
370-087	36/37	1/2 lb.	.031"	7.95	6.75

TECH SPRAY Pro Wick

Pro Wick's advanced fine braid design provides wicking action that is second to none.

Part #	TS #	Size	Length	Price (1-9)	Price (10-UP)
341-415	1802-5	.06"	5'	$1.40	$1.25
341-416	1803-5	.08"	5'	1.45	1.30
341-417	1804-5	.10"	5'	1.60	1.45
341-424	1802-10	.06"	10'	2.75	2.50
341-425	1803-10	.08"	10'	2.80	2.55
341-426	1804-10	.10"	10'	2.95	2.70
341-440	1802-25F	.06"	25'	6.80	6.30
341-441	1803-25F	.08"	25'	6.85	6.35
341-442	1804-25F	.10"	25'	7.60	7.00
341-418	1802-100	.06"	100'	21.90	20.50
341-419	1803-100	.08"	100'	21.90	20.50
341-423	1804-100	.10"	100'	23.90	22.50

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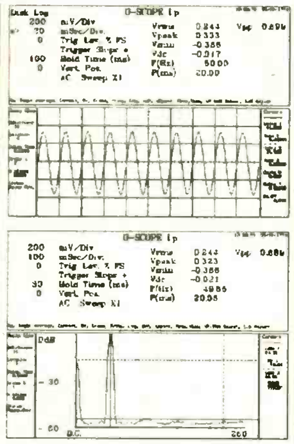

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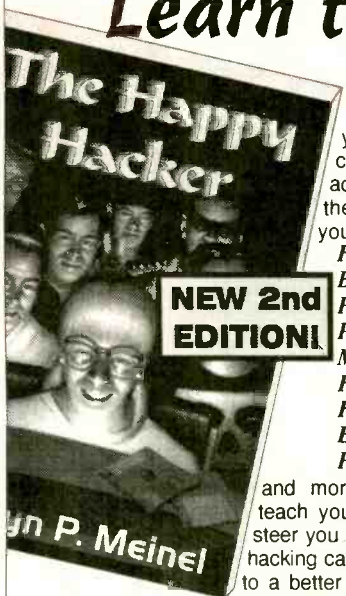

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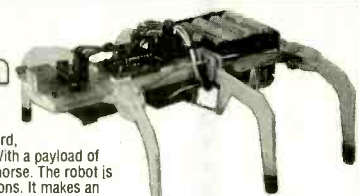

You can build this Hexapod Robot

This easy to build robot really walks using an alternating tripod gait. It can walk forward, reverse, and turn on a dime, left or right. With a payload of more than 12 oz., this robot is a real workhorse. The robot is programmed using simple BASIC instructions. It makes an excellent foundation for many simple and advanced robot experiments. The kit includes all the hardware, structural components, Hitec servos, First Step Micro kit, software, and an illustrated assembly manual. The Lynxmotion Hexapod Walker is a lot of fun to build and even more fun to operate.

Shown with the IRPD, no contact obstacle detector.

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Transmits color or B&W with fantastic quality - almost like a direct wired connection to any TV tuned to cable channel 59. Crystal controlled for no frequency drift with performance that equals law enforcement models that cost hundreds more! Basic 20 mW model transmits up to 300' while the high power 100 mW unit goes up to 1/4 mile. Audio units include sound using a sensitive built-in mike that will hear a whisper 15 feet away! Units run on 9 volts and hook-up to most any CCD camera. Any of our cameras have been tested to mate perfectly with our Cubes and work great. Fully assembled - just hook-up power and you're on the air!

C-2000, Basic Video Transmitter Cube....$89.95
C-3000, Basic Video and Audio Transmitter Cube....$149.95
C-2001, High Power Video Transmitter Cube....$179.95
C-3001, High Power Video and Audio Transmitter Cube....$229.95

Super Pro FM Stereo Radio Transmitter

A truly professional frequency synthesized FM Stereo transmitter station in one easy to use, handsome cabinet. Most radio stations require a whole equipment rack to hold all the features we've packed into the FM-100. Set frequency easily with the Up/Down freq buttons and the big LED digital display. Plus there's input low pass filtering that gives great sound no matter what the source (no more squeals or swishing sounds from cheap CD player inputs!) Peak limiters for maximum 'punch' in your audio - without over modulation, LED bargraph meters for easy setting of audio levels and a built-in mixer with mike and line level inputs. Churches, drive-ins, schools and colleges find the FM-100 to be the answer to their transmitting needs, you will too. No one offers all these features at this price! Kit includes cabinet, whip antenna and 120 VAC supply.

We also offer a high power export version of the FM-100 that's fully assembled with one watt of RF power, for miles of program coverage. The export version can only be shipped outside the USA, or within the US if accompanied by a signed statement that the unit will be exported.

FM-100, Professional FM Stereo Transmitter Kit....$299.95
FM-100WT, Fully Wired High Power FM Transmitter....$429.95

AM Band Radio Transmitter

Ramsey AM radio transmitters operate in the standard AM broadcast band and are easily set to any clear channel in your area. Our AM-25, 'pro' version, fully synthesized transmitter features easy frequency setting DIP switches for stable, no-drift frequency control, while being jumper setable for higher power output where regulations allow. The entry-level AM-1 uses a tunable transmit oscillator and runs the maximum 100 milliwatts of power. No FCC license is required, expected range is up to 1/4 mile depending upon antenna and conditions. Transmitters accept standard line-level inputs from tape decks, CD players or mike mixers, and run on 12 volts DC. The Pro AM-25 comes complete with AC power adapter, matching case set and bottom loaded wire antenna. Our entry-level AM-1 has an available matching case and knob set for a finished, professional look.

AM-25, Professional AM Transmitter Kit....$129.95
AM-1, Entry level AM Radio Transmitter Kit....$29.95
CAM, Matching Case Set for AM-1....$14.95

CCD Video Cameras


B&W Camera


Color Camera

If you're looking for a good quality CCD board camera, stop right here! Our cameras use top quality Japanese Class 'A' CCD arrays with over 440 line line resolution, not the off-spec arrays that are found on many other cameras. You see, the Japanese suppliers grade the CCDs at manufacture and some manufacturers end up with the off-grade chips due to either cost constraints or lack of buying 'clout'. Also, a new strain of CMOS single chip cameras are entering the market, those units have about 1/2 the resolution and draw over twice the current that these cameras do - don't be fooled! Our cameras have nice clean fields and excellent light sensitivity, you'll really see the difference, and if you want to see in the dark, the black & white models are super IR (Infra-Red) sensitive. Our IR-1 Illuminator kit is invisible to the human eye, but lights the scene like a flashlight at night! Color camera has Auto White Balance, Auto Gain, Back Light Compensation and DSP! Available with Wide-angle (80°) or super slim Pin-hole style lens. They run on 9 VDC and produce standard 1 volt p-p video. Add one of our transmitter units for wireless transmission to any TV set, or add our IB-1 Interface board for audio sound pick-up and super easy direct wire hook-up connection to any Video monitor, VCR or TV with video/audio input jacks. Cameras fully assembled, including pre-wired connector.

CCDWA-2, B&W CCD Camera, wide-angle lens....$99.95
CCDPH-2, B&W CCD Camera, slim fit pin-hole len....$99.95
CCDPH-2, Color CCD Camera, wide-angle lens....$149.95
IR-1, IR Illuminator Kit for B&W cameras....$24.95
IB-1, Interface Board Kit....$24.95

FM Stereo Radio Transmitters

Microprocessor controlled for easy frequency programming using DIP switches, no drift, your signal is rock solid all the time - just like the commercial stations. Audio quality is excellent, connect to the line output of any CD player, tape deck or mike mixer and you're on-the-air. Foreign buyers will appreciate the high power output capability of the FM-25; many Caribbean folks use a single FM-25 to cover the whole island! New, improved, clean and hum-free runs on either 12 VDC or 120 VAC. Kit comes complete with case set, whip antenna, 120 VAC power adapter - easy one evening assembly.

FM-25, Synthesized FM Stereo Transmitter Kit....$129.95

A lower cost alternative to our high performance transmitters. Offers great value, tunable over the 88-108 MHz FM broadcast band, plenty of power and our manual goes into great detail outlining aspects of antennas, transmitting range and the FCC rules and regulations. Connects to any cassette deck, CD player or mixer and you're on-the-air, you'll be amazed at the exceptional audio quality! Runs on internal 9V battery or external power from 5 to 15 VDC. Add our matching case and whip antenna set for a nice finished look.

FM-10A, Tunable FM Stereo Transmitter Kit....$34.95
CFM, Matching Case and Antenna Set....$14.95
AC12-5, 12 Volt DC Wall Plug Adapter....$9.95

RF Power Booster

Add some serious muscle to your signal, boost power up to 1 watt over a frequency range of 100 KHz to over 1000 MHz! Use as a lab amp for signal generators, plus many foreign users employ the LPA-1 to boost the power of their FM Stereo transmitters, providing radio service through an entire town. Runs on 12 VDC. For a neat, professionally finished look, add the optional matching case set.

LPA-1, Power Booster Amplifier Kit....$39.95
CLPA, Matching Case Set for LPA-1 Kit....$14.95
LPA-1WT, Fully Wired LPA-1 with Case....$99.95

Treasure Finder Kit

Search for buried treasure at the beach, backyard or park. This professional quality kit can detect metal at a depth of up to 6 inches. Easy to use, just listen for the change in tone as you 'sweep' the unit across the surface - the larger the tone change - the larger the object. Has built-in speaker or earphone connection, runs on standard 9 volt battery. Complete kit includes handsome case, rugged PVC handle assembly that 'breaks down' for easy transportation and shielded Faraday search coil. Easy one evening assembly. This nifty kit will literally pay for itself! That guy in the picture looks like he found something - what do you think it is - gold, silver, Rogaine, Viagra? You'll have fun with this kit.

TF-1, Treasure Finder Kit....$39.95

Binocular Special

We came across these nice binoculars in an importers close-out deal. Not some cheap in-line lens jobs, these beauties have roof prisms, a super nice rubber armored housing over light weight aluminum. 10 x 25 power with fully coated optics. Includes lens cleaner cloth, neck lanyard and nice carry case. For extra demanding use in bright sun, choose the EX module with ruby coated Objective lens. First quality at a close-out price! We've seen the exact same units with the 'Bushnell' name on them being sold for $30 more!

BNO-1, Binoculars and case....$24.95
BNO-1EX, Ruby Coated Lens Binoculars and case....$29.95

Speech Descrambler

Decode all that gibberish! This is the popular descrambler / scrambler that you've read about in all the Scanner and Electronic magazines. Speech inversion technology is used, which is compatible with most cordless phones and many police department systems, hook it up to your scanner speaker terminals and you're in business. Easily configured for any use: mike, line level and speaker output/inputs are provided. Also communicate in total privacy over telephone or radio, full duplex operation - scramble and unscramble at the same time. Easy to build, all complex circuitry contained in new custom ASIC chip for clear, clean audio. Runs on 9 to 15VDC. Our matching case set adds a professional look to your kit.

SS-70A, Speech Descrambler/Scrambler Kit....$39.95
CSS, Custom Matching Case and Knob Set....$14.95
SS-70AWT, Fully Wired SS-70A with Case....$79.95
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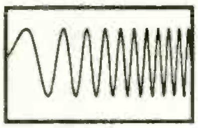
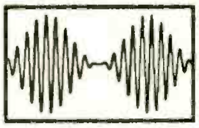
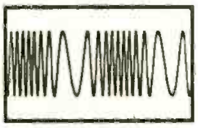
  Ramps, Triangles, Exponentials & more to 2 MHz!
- **Pulse Generator**
  Digital waveforms with adjustable duty cycle



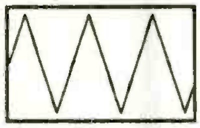
DC to 21.5 MHz linear and log sweeps



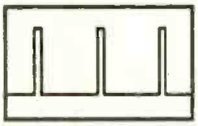
Int/Ext AM, SSB, Dualtone Gen.



Int/Ext FM, PM, BPSK, Burst

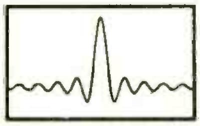


Ramps, Triangles, Exponentials

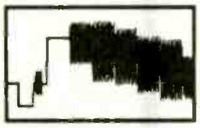


Pulse Generator

Noise



Arbitrary Waveforms



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Digital Power Meter

Measures Watts & Watt-hours (kW-hr)

Simple to use. **Plug the Power Meter into any AC outlet, and plug the appliance to be measured into the Power Meter. That's it!**

Model 4-1850:
- Measure REAL ("true") power 1 to 1850 Watts
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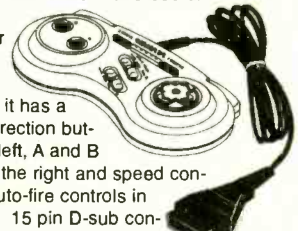

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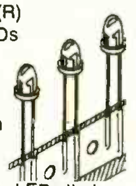

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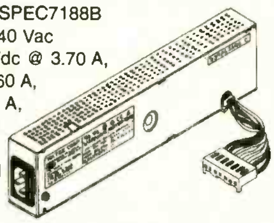

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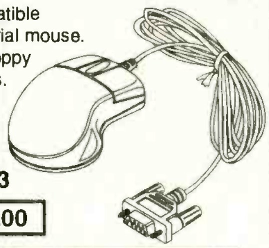

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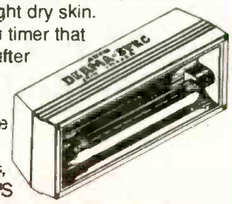

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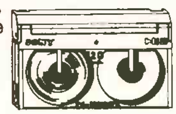

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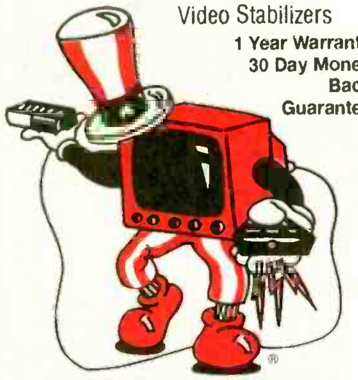

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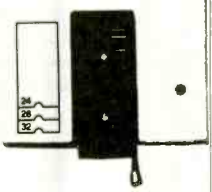

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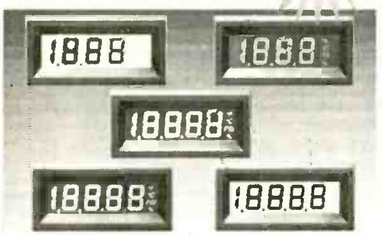

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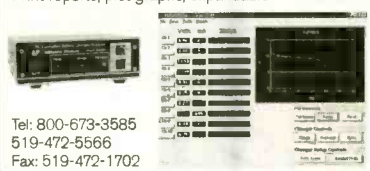

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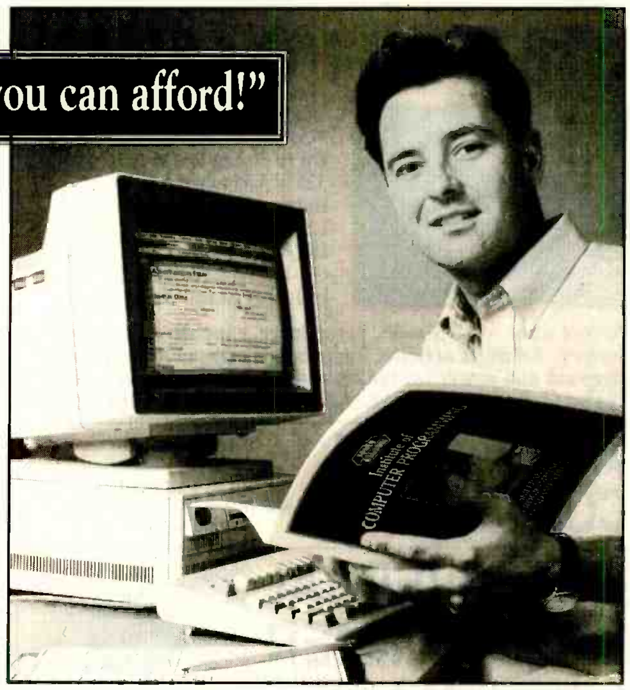

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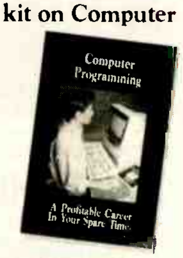

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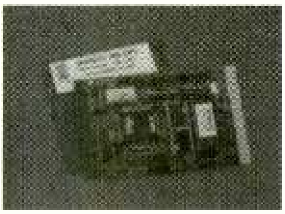

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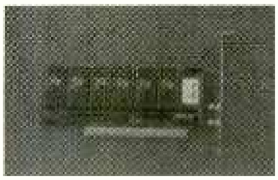

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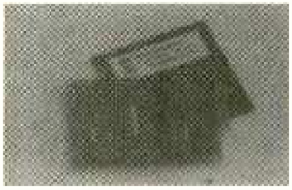

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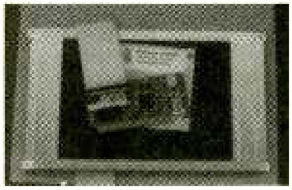

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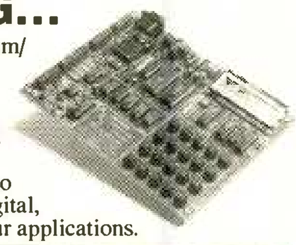

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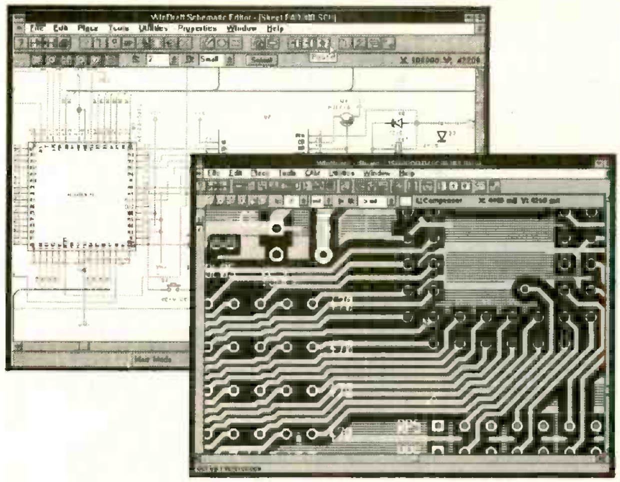

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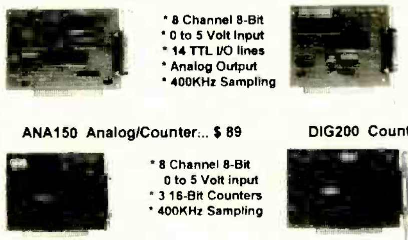

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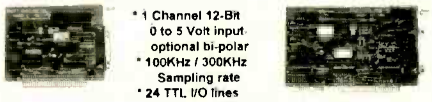

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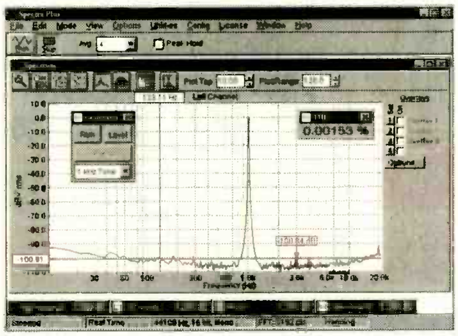

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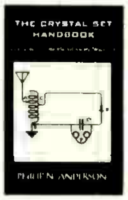

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We cannot bill for classified ads. **PAYMENT IN FULL MUST ACCOMPANY YOUR ORDER.** We do permit repeat ads or multiple ads in the same issue, but in all cases, full payment must accompany your order.

WHAT WE DO

The first word and company name of each ad are set in bold caps at no extra charge. No special positioning, centering, dots, extra space, etc. can be accommodated.

RATES

Our classified ad rate is $2.50 per word. Minimum charge is $37.50 per ad per insertion (15 words). Any words that you want set in bold are each .40 extra. Indicate bold words by underlining. Words normally written in all caps and accepted abbreviations are not charged anything additional. State abbreviations must be post office 2-letter abbreviations. A phone number is one word.

If you use a Box number you must include your permanent address and phone number for our files. ADS SUBMITTED WITHOUT THIS INFORMATION WILL NOT BE ACCEPTED.

For firms or individuals offering Commercial products or Services. **Minimum 15 Words.** 5% discount for same ad in 6 issues within one year; 10% discount for same ad in 12 issues.**Boldface (not available as all caps)**, add .40 per word additional. **Entire ad in boldface,** add 20%. **Tint screen behind entire ad,** add 25%. **Tint screen plus all boldface ad,** add 45%. **Expanded type ad,** add $4.00 per word.

General Information: A copy of your ad must be in our hands by the 13th of the fourth month preceding the date of issue (i.e. Sept issue copy must be received by May 13th). When normal closing date falls on Saturday, Sunday or Holiday, issue closes on preceding work day. Send for the classified brochure.

DEADLINES

Ads not received by our closing date will run in the next issue. For example, ads received by November 13 will appear in the March issue that is on sale January 17. ELECTRONICS NOW is published monthly. No cancellations permitted after the closing date. No copy changes can be made after we have typeset your ad. NO REFUNDS, advertising credit only. No phone orders.

CONTENT

All classified advertising in ELECTRONICS NOW is limited to electronics items only. All ads are subject to the publishers' approval. WE RESERVE THE RIGHT TO REJECT OR EDIT ALL ADS.

AD RATES: $2.50 per word, Minimum $37.50

Send you ad payments to:
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100 -- Antique Electronics	270 -- Computer Equipment Wanted	450 -- Ham Gear Wanted	630 -- Repairs-Services
130 -- Audio-Video Lasers	300 -- Computer Hardware	480 -- Miscellaneous Electronics For Sale	660 -- Satellite Equipment
160 -- Business Opportunities	330 -- Computer Software	510 -- Miscellaneous Electronics Wanted	690 -- Security
190 -- Cable TV	360 -- Education	540 -- Music & Accessories	710 -- Telephone
210 -- CB-Scanners	390 -- FAX	570 -- Plans-Kits-Schematics	720 -- Test Equipment
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9 - $37.50	10 - $37.50	11 - $37.50	12 - $37.50	37 - $92.50	38 - $95.00	39 - $97.50	40 - $100.00
13 - $37.50	14 - $37.50	15 - $37.50	16 - $40.00				
17 - $42.50	18 - $45.00	19 - $47.50	20 - $50.00				
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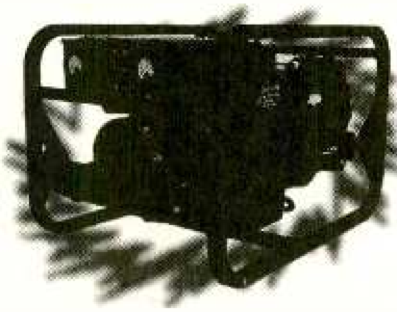

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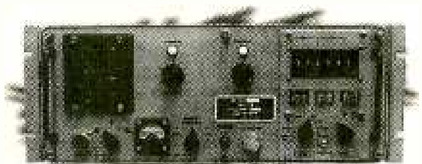

HARRIS RF 131-122
TWO CHANNEL EXCITER

This exciter is compatable with the RF 110 power amplifier. It features digital synthesized tuning with remote control capability in the 2-30MHz range at 100Hz increments. Modes of operation are U/LSB, compatable AM, CW, and ISB. These units are in good physical condition and appear to have no apparent faults. So far any units we have shipped to other customers have worked very nicely, you will be pleasantly surprised!!!
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Pick of the litter $950.00ea

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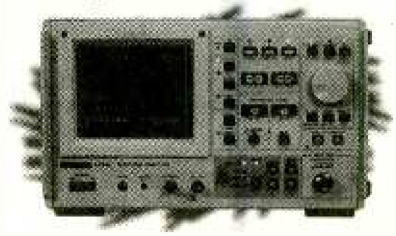

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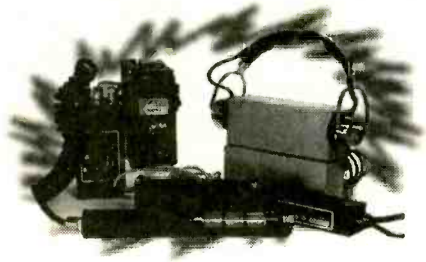

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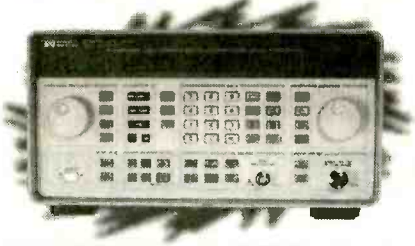

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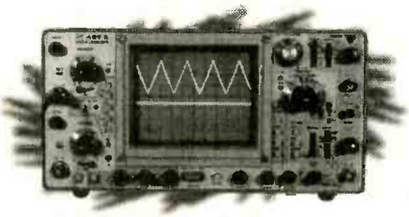

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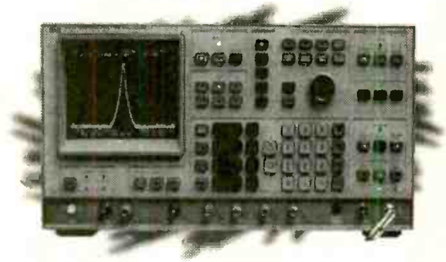

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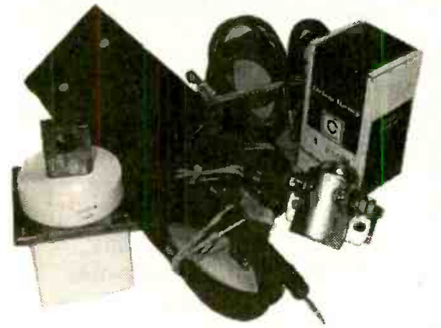

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Goodie box

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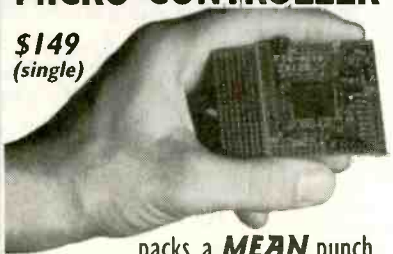

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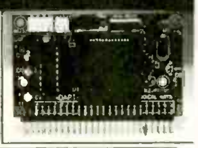

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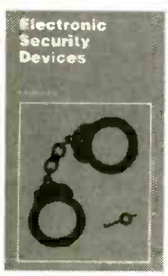

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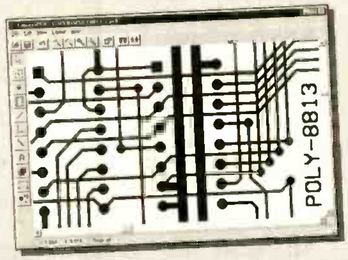

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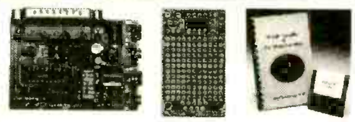

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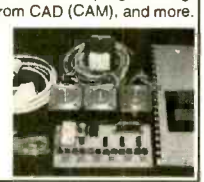

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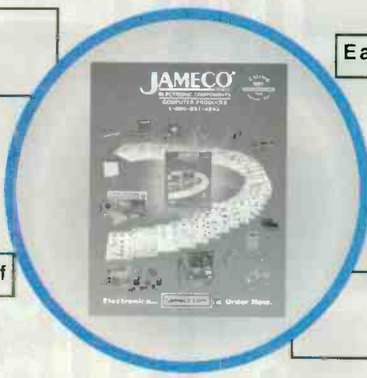

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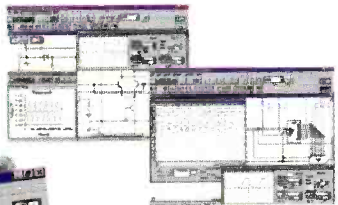

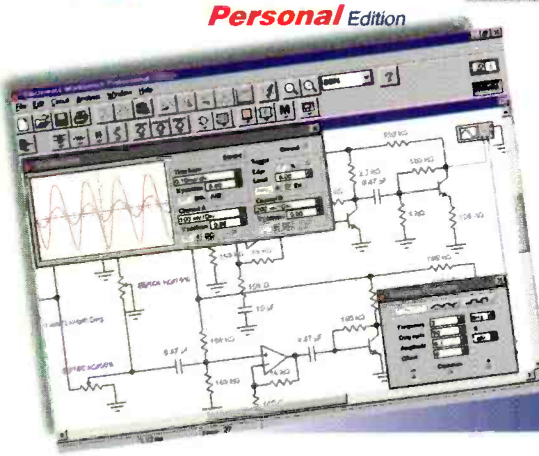

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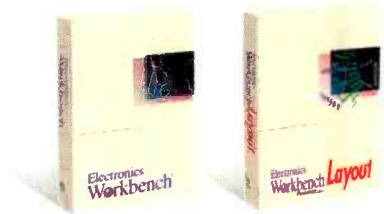

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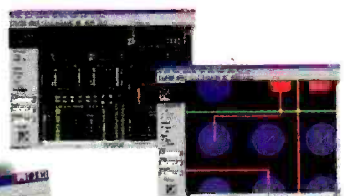

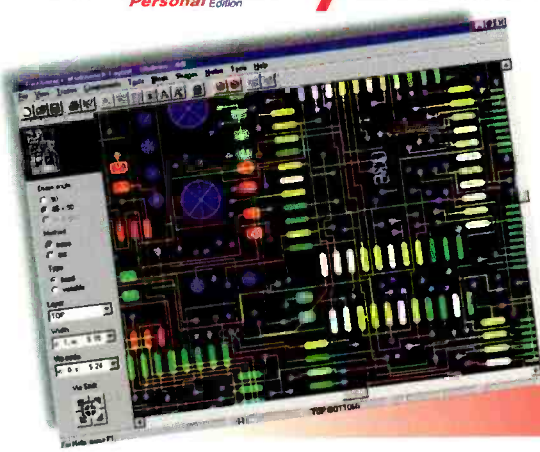

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