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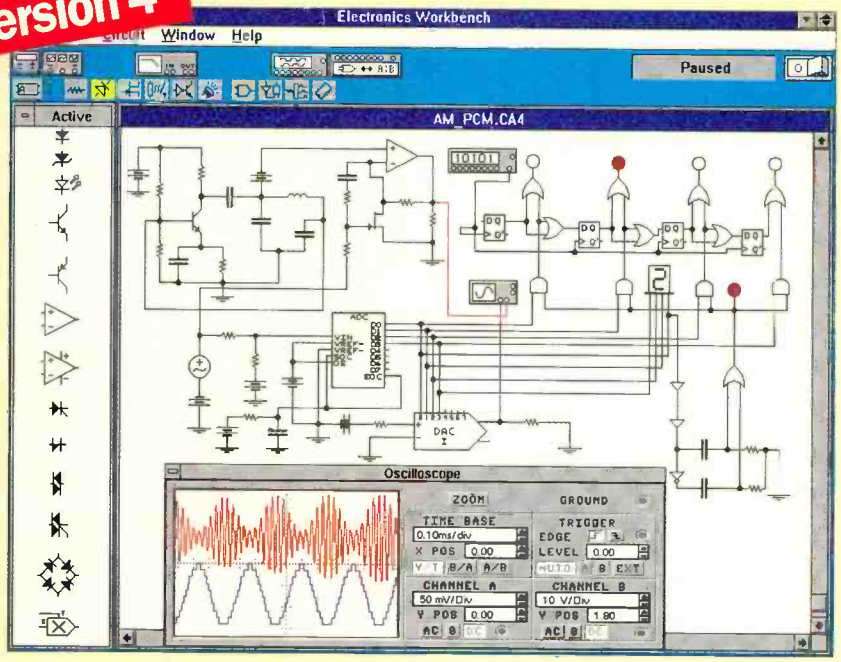

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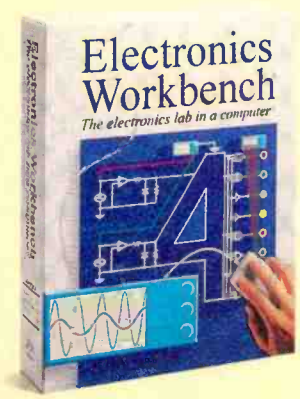

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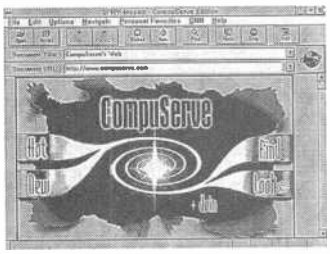

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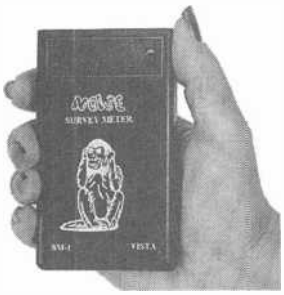

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EDITORIAL

WATCHING THE NET

A few months back, I promised that **Popular Electronics** would soon be providing Internet coverage that would be of special interest to electronics hobbyists. Well, this month we keep that promise in a couple of ways.

First of all, there's our article *Exploring the Internet*, which helps you untangle some of the mystique surrounding the Net, sorts out the hype from the reality, and shows you how the Net can benefit you both personally and professionally. That article will be of special interest to "newbies" (those who are new to the Internet), as it explains some of the Net's history and covers topics such as "Netiquette," finding an Internet provider, and more. The story begins on page 46.

This month also marks the debut of *Net Watch*, our monthly guide to what's happening on the Internet, with a special emphasis on resources for the electronics hobbyist. Each month, that column will present timely tips on making the most of your time online. It will provide pointers to manufacturers and other electronics-related home pages, tell you what's going on in the electronics-related Usenet discussion groups, and offer a wide variety of other news and information that electronics hobbyists will find useful.

Of course, we have not forgotten that the Internet is fun, too. That's why every month you will also find news and information about the Net in general, as well as pointers to all sorts of interesting and fun sites and discussion groups. The premier installment of *Net Watch* begins on page 28.

And no, we have not gone completely Internet crazy. There is a full complement of all of the columns and features you've come to always expect in every issue of **Popular Electronics**, including an add-on for scanners that restores the missing frequencies in the 800- to 950-MHz range. That story begins on page 39.

Carl Laron
Editor

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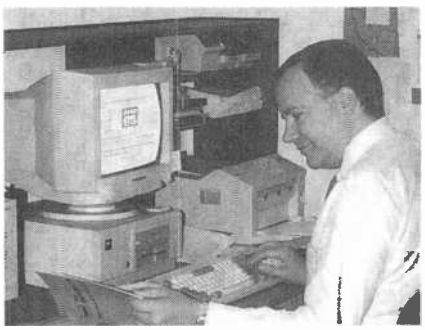

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LETTERS

Our Readers Write

SHORTWAVE CONVERTER SOURCE

It has come to my attention that readers have been unable to contact the kit supplier mentioned in my article "Build a Shortwave Converter for your Car" (**Popular Electronics**, September 1995). Fortunately, there are alternate sources for all of the parts for that project.

All parts except the PC board, enclosure, air-variable capacitor (C21), the ferrite bead, and the toroid cores for L2–L4 are available from Circuit Specialists (P. O. Box 3047, Scottsdale, AZ 85271-3047; Tel. 800-528-1417). The toroid cores and the ferrite bead are available from Amidon Associates (3122 Alpine Ave., Santa Clara, CA 92704; Tel. 714-850-4660). The air-variable capacitor, C21, is available from Ocean State Electronics (P. O. Box 1458, 6 Industrial Drive, Westerly, RI 02891); order part APC 50B, which costs $11.00. That's a 50-pF-unit, so add a 75-pF silver mica capacitor in series to attain the desired 30-pF value. PC boards are available from Far Circuits (18N640 Field Court, Dundee, IL 60118; Tel. 708-836-9148) at a cost of $7.50 each, plus $1.50 shipping and handling for 1–4 boards. Illinois residents must also add appropriate sales tax. The enclosure is available from Radio Shack, as detailed in the article.

I hope that helps anyone interested in building the project, and I am sorry for any confusion or inconvenience that this might have caused. If you have problems with those sources, you can e-mail me at lrwilliams@nopc.org.—Lyle Russell Williams

MESSAGE-STOPPER PARTS

For those readers having difficulty obtaining the Teltone M-949-01 Telephone Line-Sense Relay and the CM8870 DTMF Receiver IC used in the article "Answering Machine Message Stopper" (**Popular Electronics**, September 1995), a partial kit consisting of one M-949-01 and one CM8870 is currently available as item AMMS-PK for $15 postpaid from Pliler Electronics, (Dept. AMMS, R# 2, Box# 482, Baxter Springs, KS 66173).
—Brian Pliler

IN SEARCH OF TRUE RANDOMNESS

Concerning the "random number generator" shown in *Circuit Circuits* in the September 1995 issue of **Popular Electronics**, I think you might mention to your readers that no mathematician or physicist has ever discovered what true "randomness" is. Now, with investigations of chaos theory and other complex systems, it is becoming clear that true randomness might not exist at all.

I first discovered that as a young man when a job required me to generate random numbers. You might suppose that we could have just guessed a number off the top of our heads to do the job, because everyone would necessarily not mention the number they guessed to anyone else. Well, it was soon discovered that different people would guess the same numbers. Real random number generation with computers would fail as well.

In fact, if you have a "fair" coin (no one can define perfect fairness, either) with two sides, you'd expect it to land on its head 50% of the time. Yet classical probability shows that a fair coin can come down on heads all the time, forever in fact, and then maybe offer up one tails, and then go on throughout infinite time being heads again. Gamblers don't often come upon this result, but it happened enough long ago for individuals to break the bank at casinos.

So I was told that because 6666666666666, then 6666666666, then 666666666, then 666666, could occur, and did occur, when computers generated random numbers, those non-random results had to be weeded out. Of course, what rule do you use to make a truly random number more random by interfering with their randomness? And who would write them? And what would their interpretation be? For theoreticians?

Even static space, and star distribution, and other natural phenomena really obey complex rules, equatable in equations, and aren't truly random—assuming we could define randomness in the first place.

It's very likely that randomness is really a large and complex pattern, not non-patterned noise. So the little repeating sequence device shown in *Circuit Circus* is a form of true randomness, even though it repeats eventually, a subset of randomness. However, computers use another, more complex pattern that also is not random in the ordinary sense of the term. It, too, repeats, only in far, far more complex patterns. But even the largest computer in the world cannot totally avoid sequences in generating random numbers.
W.A.K.
Clearwater, FL

HAVES & NEEDS

I recently bought a used Tektronix model 465 oscilloscope with a unit labeled DM 44 on top of the cabinet. The 465's channel one doesn't work, and I don't know what the DM 44 is.

Does anyone have a service manual and operator's manual for the scope? I've found sources for this scope, but the prices were outrageous. Can anyone help?

Thanks.
CHUCK HALL
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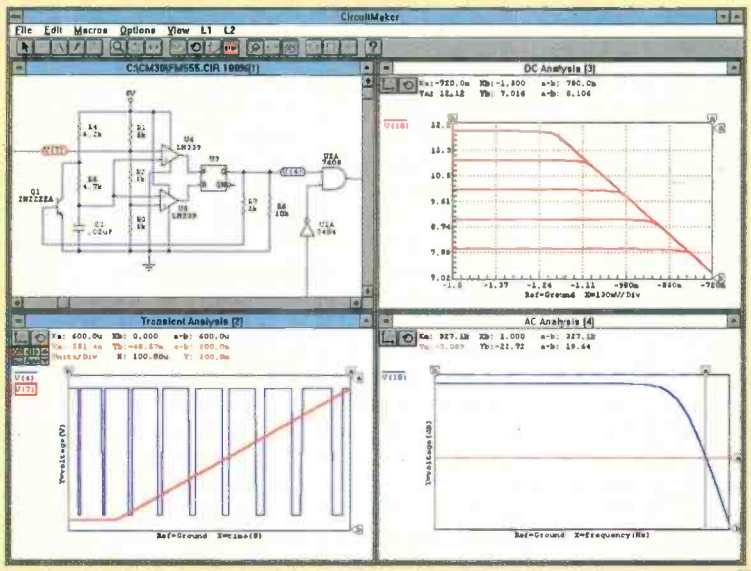

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This easy to use layout tool is unmatched. It includes many advanced schematic editing features not found in similar programs. These powerful features minimize the time and task associated with drawing a schematic and insure a professional looking final product. Printout and export options are numerous and results are of the highest quality. But that's what people have come to expect from CircuitMaker.

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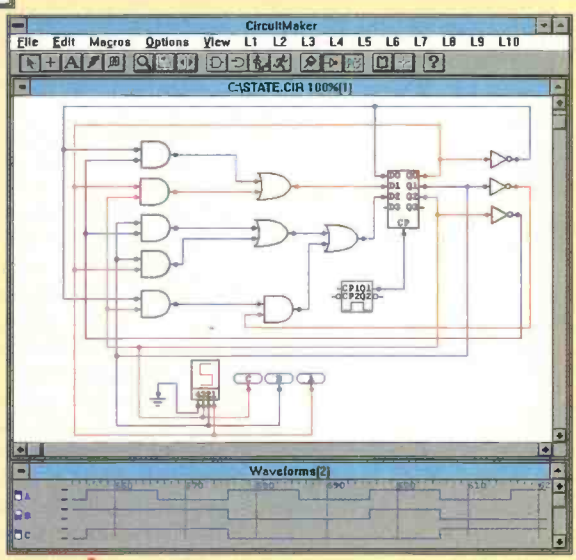

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A demo version is available on major on-line services or for $10 direct. Competitive upgrades are available for $149. Call for details. CircuitMaker is a registered trademark of MicroCode

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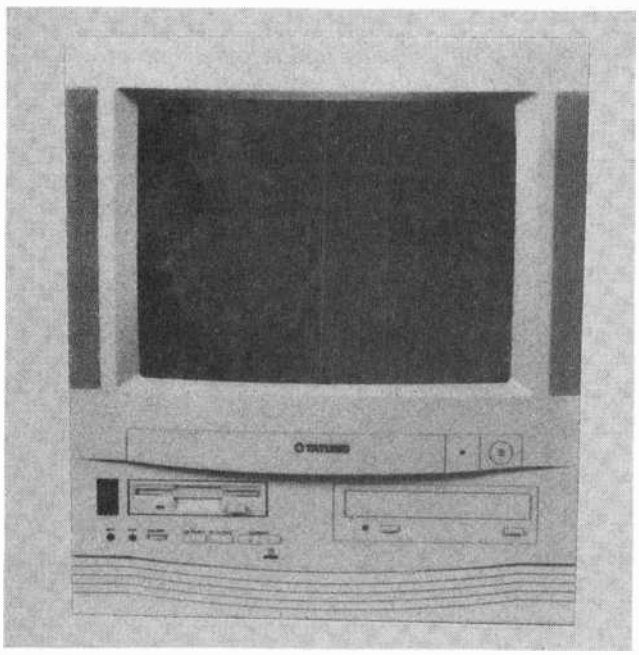
NEW PRODUCTS

All-in-One Multimedia PCs

Tatung Company's TMP9000 line of 486 and Pentium IBM-compatible "All-in-One" PCs are based on an innovative design in which the monitor and CPU of the system are in a single case. Aimed at the home user, the PCs offer a simple setup that exceeds "plug-and-play" expectations and a robust set of multimedia functions including built-in TV.



With the monitor pre-connected to the system within the same case, users don't have to configure the monitor. Five-watt integrated amplified stereo speakers are built into the bezel at the side of the display, directing sound at the user and eliminating another connection. A sound chip built onto the Riser card saves an expansion slot and provides true stereo playback compatible with Sound Blaster Pro, Ad Lib, and Microsoft Windows Sound Systems. The TMP9000 can serve as a television, fax machine, CD-player, or radio.

The PCs come with built-in dual- or quad-speed CD-ROM drives and TV cards, both of which can be used without entering DOS or Windows. A remote control provides easy access to TV and CD functions, and a PC/TV button (duplicated on the computer's front panel) makes it easy to switch between TV and PC operations. With Windows drivers, the TMP9000 also supports other television video functions, including capture, pause, scalable Windows sizing, full-screen viewing, and channel scan. It can be upgraded to an MPEG compatible system by inserting an MPEG module card to play video CD programs.

The 486 model comes with a built-in 14-inch color monitor, and the Pentium model has a 15-inch color monitor. Both are high-resolution, anti-glare, Super-VGA monitors. In compliance with energy-saving standards, the monitors power down when not in use for an extended period of time.

The TMP9000, with 8 MB of RAM (updgradable to a maximum of 64 MB) and 540 MB of hard-disk space, is available in five different configurations: 486DX2, 486DX4, Pentium 75 MHz, Pentium 90 MHz, and Pentium 100 MHz. List prices start at $1800. For more information, contact Tatung Company of America, Inc., 2850 El Presidio Street, Long Beach, CA 90810; Tel. 415-703-0400; Fax: 415-703-0469; e-mail: tsai@pri.com.

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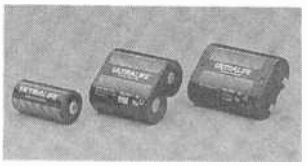
LITHIUM CAMERA/ COMPUTER BATTERIES

Three high-energy lithium batteries from *Ultralife* are targeted at the consumer photographic and computer markets. *Models UB123A, UB223A*, and *UB2CR5* fit most automatic cameras and flash units, and are also used for memory back-up power in a large number of personal computers.

The lithium batteries are said to deliver exceptionally high energy and maintain stable voltage over a wide range of temperatures. They are well



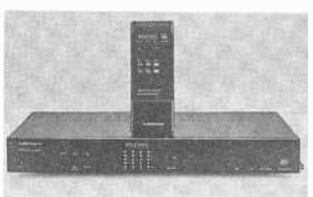
suited to provide power for equipment used outdoors. The batteries have a shelf life of up to 10 years. They are environmentally friendly, containing no toxic compounds or heavy metals.

The lithium photo/computer batteries are available in 3-volt and 6-volt models and have suggested retail prices of $9.95 and $14.95, respectively. For further information, contact Ultralife Batteries, Inc., 1350 Route 88 South, Newark, NY 14513; Tel. 315-332-7100; Fax: 315-331-7800.

CIRCLE 102 ON FREE INFORMATION CARD

DOLBY PRO LOGIC PROCESSOR

By adding *AudioSource's SS-Five* Dolby Pro Logic surround-sound processor, you can turn your existing TV, VCR, and stereo setup into an exciting home theater. Easy to install and easy to use, the SS-Five features "set-it and forget-it operation" and a special "instant on" function that automatically turns the system on and off with your TV and VCR. Built-in amplifiers supply your center and rear



surround speakers with enough power to capture all the action of any surround-encoded program or movie. A sophisticated 18-bit Pro Logic chip provides increased dynamic range (to 105 dB), heightened channel separation (better than 55 dB), significantly lower noise, and proper placement of every sound. All functions can be set and adjusted using the inte-

(Continued on page 87)

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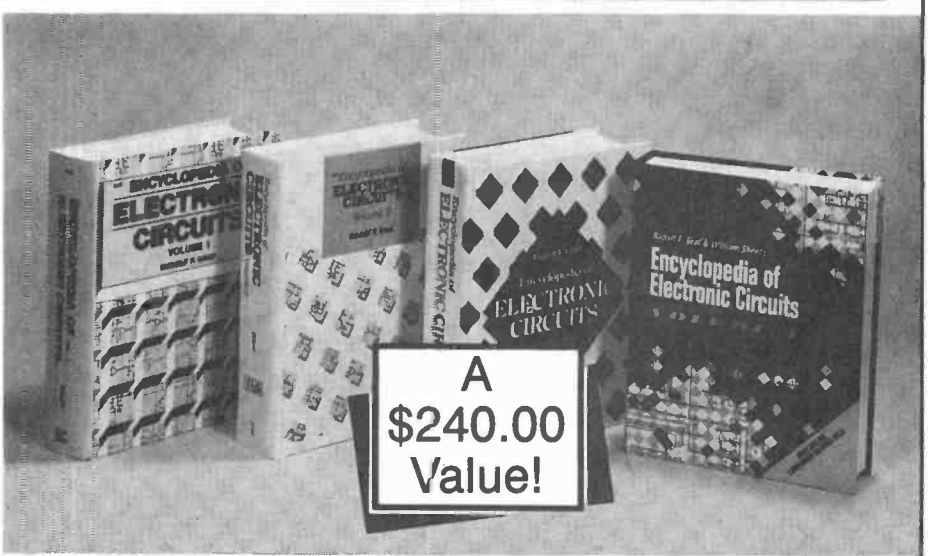

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GIZMO®

A Star is Born

STARSIGHT INTERACTIVE ON-SCREEN PROGRAM GUIDE. From StarSight Telecast Inc., 39650 Liberty Street, Third Floor, Fremont, CA 94538; Tel. 800-643-STAR. Price: $15 activation fee; $25.99 for 6 months service; $46.99/12 months; $84.99/24 months.

If you doubt for a minute that men and women approach life differently, just look at the way a "typical" married couple watches television.

The woman tends to scan through the TV listings in a newspaper or magazine to find the shows she'd like to watch. She'll use the remote control to turn on the TV, tune the channel, adjust the volume, and then, perhaps, to hit the mute button during commercials—only changing the channel when the show is over.

It's a whole different ball game when her husband gets his hands on the remote. Forget the *TV Guide*—he'll find something good to watch by flipping through the channels. (Somehow, he can tell if it's good in the split second he allots to each channel.) Occasionally, he'll settle on one program and watch the whole thing. More often, he'll watch it until the first commercial break arrives, and then start flipping again.

In a bestselling self-help book, it is postulated that such gender-related viewing differences stem from our ancestral pasts as hunters and gatherers. Men still relish the thrill of the hunt, chasing down elusive programming as they would stalk herds of migrating beasts. Women prefer to know exactly where and when they can find the shows they want, just as they would memorize the location of a stand of blackberry bushes or chestnut trees so that they could gather the fruit or nuts there every year.

We think that theory is more than a bit silly—but, hey, the book sold millions of copies. And, for whatever the reason, our experience verifies that those viewing differences are real, and so are the arguments they generate.

Both the "hunting" and the "gathering" methods of watching TV leave much to be desired. If you depend on printed TV listings, it's easy to miss out on something. Last-minute schedule changes won't be reflected, particularly in weekly guides. And space constraints limit the type and amount of descriptive information provided. Flipping through the channels is also iffy. How do you know what program is on if there's a commercial showing as you reach that channel? And how long are you willing to linger on each channel to determine if the program is actually worth watching? The only other option—the scrolling on-screen guide offered by many cable companies—is generally despised by both types of viewers for being excruciatingly slow and too limited.

The situation just keeps getting worse as the world of television becomes ever more complex and still more programming choices are offered. It becomes increasingly tedious to wade through printed TV listings, and flipping through all the available channels can take up a whole evening's viewing time.

Now there's a better way. StarSight is an on-screen, interactive program guide with something to appeal to both types of viewers. Arranged like a printed television schedule, it provides complete, continually updated program information for the next seven days. It also provides one-touch VCR recording of any program appearing on the grid. (That's a major bonus for all of those folks who are so busy hunting and gathering that they've never learned the valuable art of storing programs for future consumption!)

StarSight lets you plan in advance your viewing and recording for the upcoming week. Or you can use your remote control to scan through the on-screen guide at each viewing session. If you still insist on flipping through the channels, you can take advantage of StarSight's on-screen program descriptions to learn what's on each channel, even when a commercial is airing. And you can "flip" without completely interrupting the show your spouse is watching—with the TV remaining on one channel, it's possible to flip through the program descriptions of what's on all

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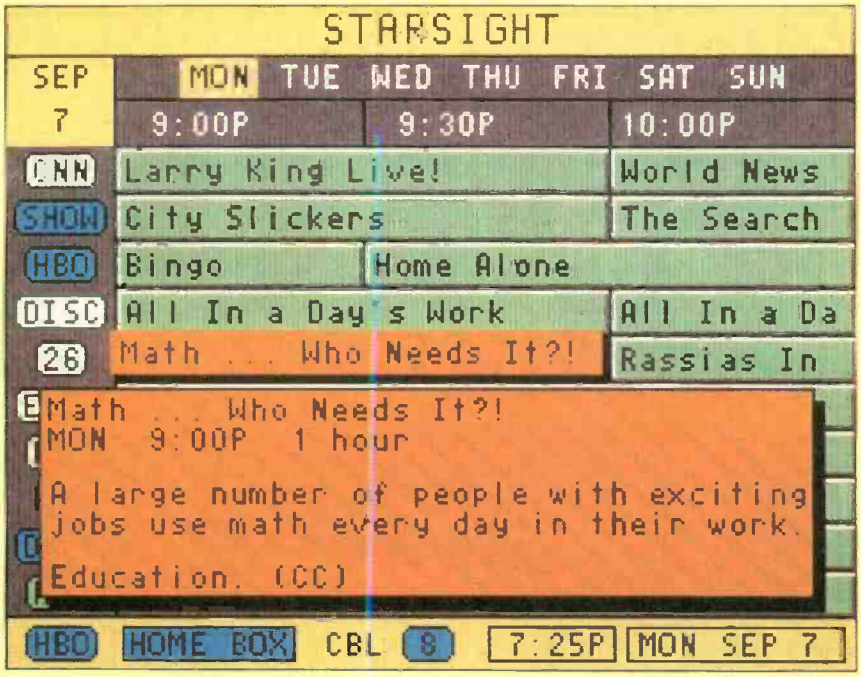

The StarSight program grid gives viewers the ability to see up to seven days of up-to-date television schedule information.

the other channels. If there are some channels that no one in the house ever watches, you can eliminate them from the lineup completely, reducing the time spent hunting for that perfect program. The remaining channels can even be rearranged on the grid, prioritized to match your viewing preferences.

Fifty-seven channels and nothing on? Who cares! You can simply spend the whole evening flipping through StarSight, and never have to watch anything at all!

RECEIVING STARSIGHT

To receive the StarSight on-screen program guide, you must buy StarSight-capable hardware and must subscribe to the service. The requisite hardware is available in a stand-alone unit, and is being built into some TVs, VCRs, cable boxes, and satellite receivers. So far, Daewoo, Goldstar, Matsushita, Mitsubishi, Philips, Samsung, Sharp, Sony, Toshiba, and Zenith—whose combined products comprise almost 75% of the TVs and VCRs sold in the U.S.—have announced plans to incorporate StarSight circuitry into some models of televisions and VCRs. (Later in this issue, we'll be reviewing the first StarSight-equipped VCR and a stand-alone unit.) The programming data is available on a subscription basis either directly from StarSight Telecast Inc. or, in some areas, through the local cable-television provider. It costs between $3.50 and $4.50 a month.

At the heart of StarSight's circuitry is a receiver that picks up a variety of data transmitted in the vertical blanking interval (VBI) of the local PBS station's TV signal. Along with the program schedule information, that data includes authorization messages, region commands, category information, additional program information, and special services such as closed captioning.

The circuitry also includes an on-screen

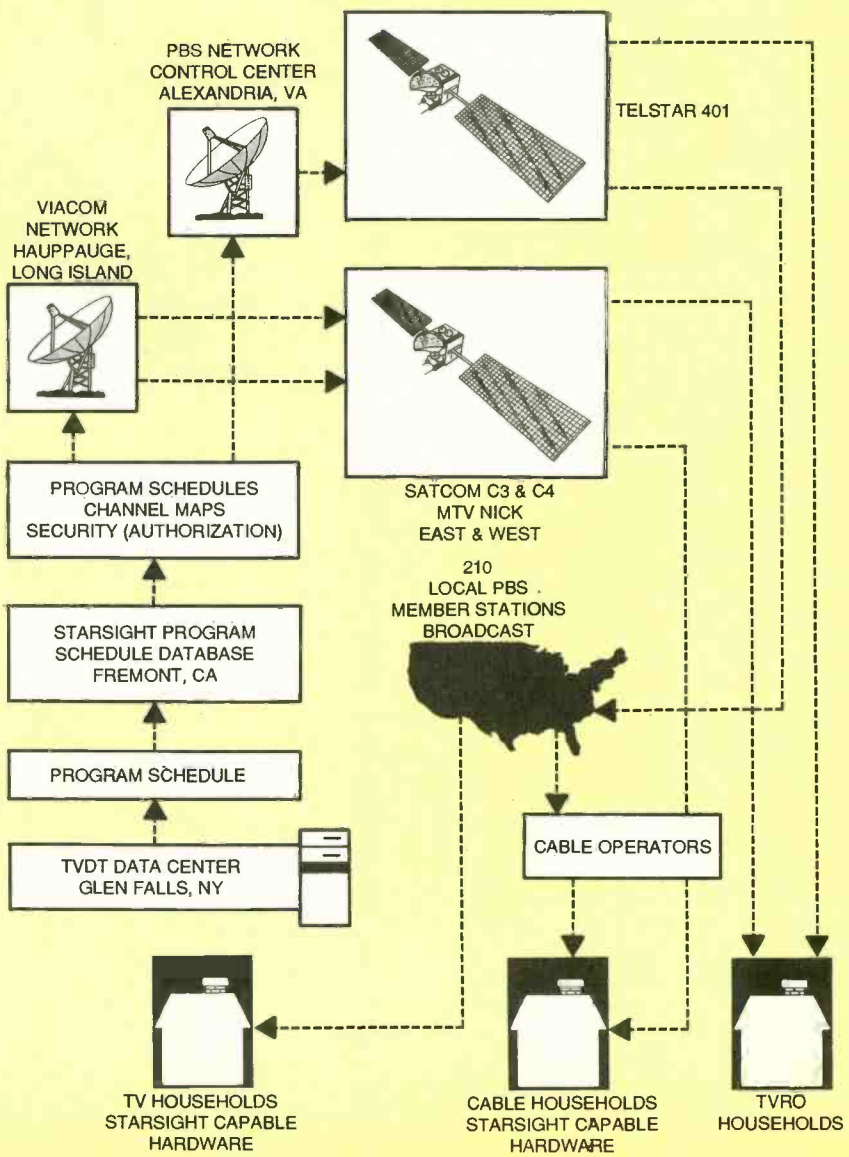

FIG. 1 StarSight's Transmission Network. Program schedules, along with StarSight format data, security codes, and channel maps, are sent via satellites to local PBS stations and cable operators across the country. The StarSight signal is being delivered to 98% of U.S. TV-owning households via the Public Broadcasting Systems vertical blanking interval (VBI).

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display, 256K to 512K of RAM, a ROM chip that contains StarSight firmware, a security chip, and a specialized universal infrared code transmitter. The length of the schedule and the amount of program information provided depends upon the amount of RAM; a 512K system provides seven days of schedules with full descriptions on 70 channels.

Program data is provided by TV Data Technology (TVDT), based in Glen Falls, New York. TVDT, which is one of the major providers of program schedule information to the print media in the U.S., arranges the data according to StarSight specifications, adding the data needed to allow viewers to access the information the way they want to see it.

Continuously updated program schedules are forwarded at a rate of 56 kilobits per second over a dedicated data line to Fremont, California. There, the schedules are formatted and security algorithms added. The completed schedules are then sent to the Public Broadcasting Network Control Center in Alexandria, Virginia, where StarSight's uplink VBI data inserter network node is located, and to Viacom's uplink facilities in Long Island, New York.

From Virginia, the data is inserted into the outgoing PBS VBI, uplinked via the Telstar 401 satellite at a rate of 17 kilobits per second, and then sent back down to approximately 200 PBS member stations across the country. Viacom inserts the data on the VBIs of Nickelodeon and MTV and uplinks it to the SATCOM C3 and SATCOM C4 satellites, which downlink it directly to cable operators and TVRO households.

Each local PBS affiliate or cable operator is equipped with the StarSight hardware needed to filter out all schedule information that does not apply to the immediate broadcast area. The extracted data is then converted to a data rate of 960 bits per second and rebroadcast to the StarSight subscriber units in the area. To prevent the signal from being pirated, StarSight can activate or deactivate the receiving circuitry by matching the component's unique serial number with a code that is transmitted in the data stream.

The StarSight signal is available to virtually all American households. Of course, not every home receives the same television programming. To customize the program guide, the data downloaded to each subscriber includes a "channel map" that StarSight uses to determine which channels should be displayed in the grid. The correct channel map depends on where the subscriber lives and whether he or she receives a television signal via cable, satellite, or broadcast. A StarSight operator asks those questions during the initial setup, and then downloads the proper channel map to the viewer's StarSight-equipped TV, VCR, cable box, satellite decoder, or stand-alone receiver.

SETUP AND OPERATION

The installation and subscription processes vary slightly depending upon which type of StarSight-equipped device you purchase. For instance, if you're using a StarSight-equipped VCR, there's no need for the StarSight operator to ask if you're using a TV and a VCR; if it's a cable box, you won't be asked if you receive cable TV. There are also some minor differences in the layout and labeling of the remote-control buttons.

For simplicity's sake, we'll describe how to install, subscribe to, and operate StarSight using the stand-alone receiver. In the subsequent review of Samsung's VCR, we'll point out some of the differences that arise when the circuitry is included in a VCR. ■

Stand-Alone StarSight

STARSIGHT MODEL CB1500 RECEIVER. From StarSight Telecast, Inc., 39650 Liberty Street, 3rd Floor, Fremont, CA 94538; Tel. 800-643-STAR; Price: $149.99.

CIRCLE 51 ON FREE INFORMATION CARD

If you're happy with the video gear you already own, but want to add StarSight, your best bet is the *Model CB1500* stand-alone receiver from *Starsight Telecast Inc.* It won't break the bank, and it won't take up too much space in your already crowded entertainment center.

The CB1500, manufactured by Magnavox, is a slim unit (14 × 11 × 1.5 inches) that can perch atop your VCR. The front panel sports only the infrared receiver and the StarSight logo; all functions are accessed via the remote control and all connections are made via rear-panel jacks.

The receiver comes with a StarSight power transformer, two remote infrared emitters, and one RF cable, and that's all you'll need for hook-up if your setup includes only a TV. You'll need to buy extra RF cables for the more common setups: TV, VCR, and cable box (Fig. 2), TV and VCR, and TV and cable box. Of course, if your setup doesn't include a VCR, you can't take advantage of StarSight's one-touch recording feature. The remote emitters, which relay remote commands from the StarSight receiver, are placed so that they sit one inch in front of the VCR and/or cable box.

GETTING STARTED

Once you've hooked up your StarSight-equipped component, you're ready to subscribe to the service. By selecting "StarSight setup" from the main menu, you are presented with step-by-step on-screen instructions, in which you are asked a series of questions about your TV source, your PBS station (if you're not sure what channel your local PBS broadcasts are on, you can check the state-by-state listings included in the owner's manual), and your particular video setup (Do you have cable TV? With or without a cable box? TV only or TV and VCR?).

Armed with that information, the CB1500 searches for schedule information on your PBS station. When it is found, you are issued a Star# and an ID#, and are instructed to call StarSight's toll-free number. An operator asks for those numbers, your address and phone number, and some additional information about the equipment you'll be using with StarSight.

Part of the setup procedure involves programming the StarSight universal remote

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The rear panel of the CB1500.

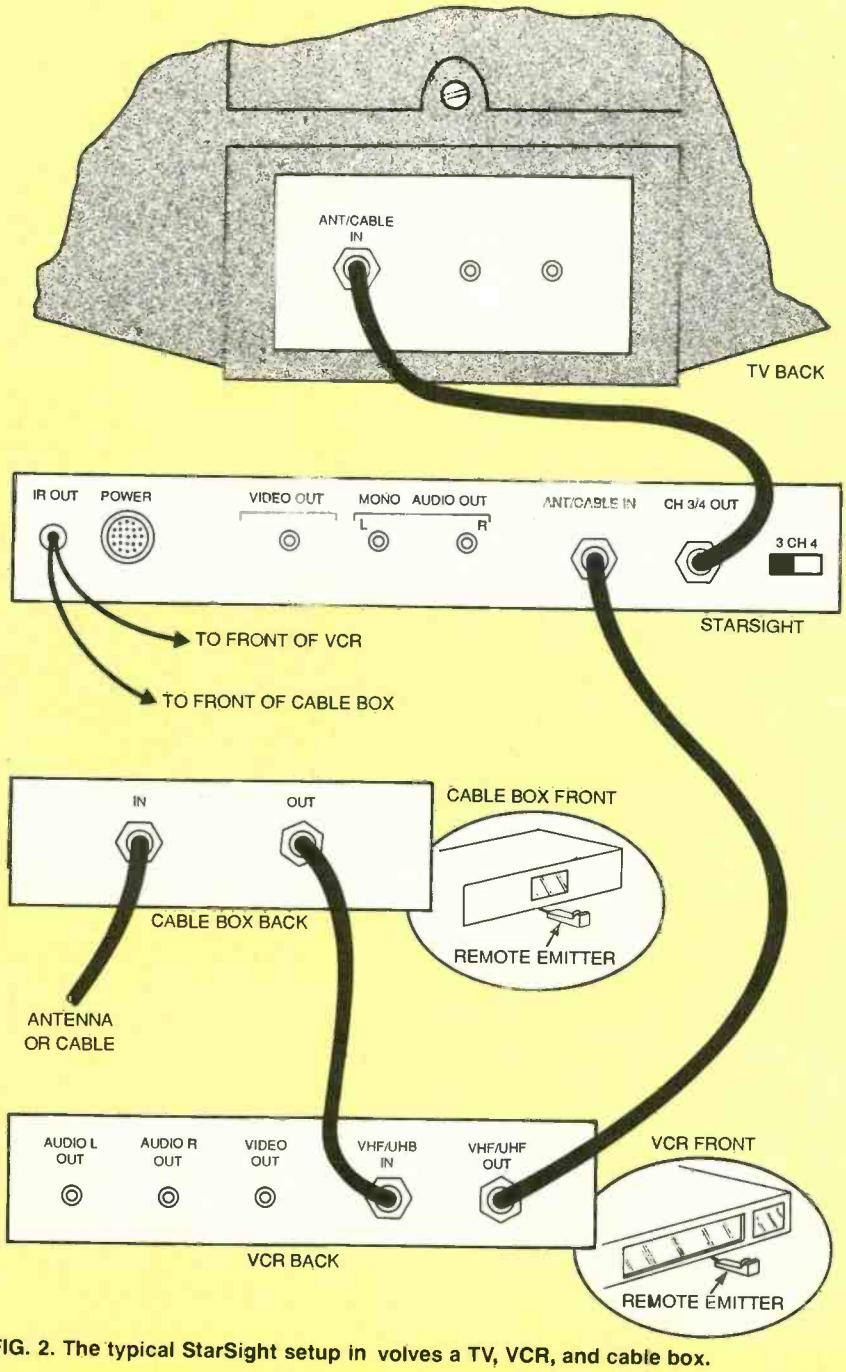

FIG. 2. The typical StarSight setup involves a TV, VCR, and cable box.

to operate all your video gear works. The manual includes codes for each major manufacturer and brand, and on-screen directions guide you through the process of inputting those codes and testing to see that each component responds properly.

When everything is working as it should, you'll receive on-screen congratulations for becoming an authorized subscriber. Actually, you're not quite set yet. It takes between 4 and 12 hours for all the program data to be collected, and you must either turn off your TV and VCR, or leave them tuned to PBS, during that time. The downloading time is factory preset for between 2 AM and 8 AM, but you can use an on-screen menu to select the time frame most convenient to you. (That same time period will be used each time StarSight needs to update program information. If you are watching TV at the time, an on-screen prompt advises you to press the EXIT button if you do not want to be interrupted at that time.)

SURFING WITH STARSIGHT

Now the fun begins—and fun is the best way to describe using StarSight. It requires very little effort on the part of the user, and makes viewing more enjoyable. And virtually all primary TV, VCR, and cable-box functions are accessed through the StarSight remote, eliminating some of the clutter that plagues media rooms.

The remote control is somewhat longer than most, with well-defined, protruding buttons. The buttons at the top of the remote labeled TV, VCR and CABLE serve as power switches for those devices. Just below them are the buttons used to control the TV, VCR, and cable—channel and volume up and down, MUTE, PLAY, FF, REW, PAUSE, STOP, and REC. Toward the bottom of the remote is a numeric keypad.

The buttons used to operate StarSight are centrally located. A round button emblazoned with a star is surrounded by up, down, left, and right arrow keys. Arranged in an arc above those are four buttons labeled TUNE, THEME, GUIDE, and EXIT. Below the STAR button are DAY and PAGE up and down toggle switches, and a row of buttons labeled TO DO, CANCEL, and LAST CH.

When you turn on the TV, a press of the STAR button lets you know what you're watching. A pale yellow bar that pops up at the bottom of the screen contains the channel number and call letters, network affiliation, time, and date. A brighter yellow box just above the bar contains the program title and time remaining. The pop-ups remain on screen for five seconds.

We learned that our set was still tuned to the local PBS station, Channel 13, WNET, and that there was one hour and 28 minutes left to the current program "Congressional Hearings on Whitewater." A second press

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Wireless pet-containment breakthrough!

Computerized collar creates world's first sonic-controlled dog?

Small U.S. company develops technology that uses sonic waves and a microprocessor on your dog's collar to replace expensive fencing, cruel chains and leashes...keeping your dog safe and free!

by Charles Anton

One of the hottest ideas in recent years has been electronic pet containment. Unfortunately, these systems require wires *that have to be buried in your yard* to create a boundary and communicate with the dog's collar. Although effective for some, they can cause an installation nightmare!

Elexis Corporation, one of the major players in the industry, asked its team of engineers, "How can we eliminate the wires?"

A smart collar. This simple question led to the development of a "smart collar." The computerized collar actually senses your dog nearing the sonic boundary by monitoring the strength and modulation of an ultrasonic signal emitted by the Sonic Fence emitters. Many months and thousands of dollars later, *the world's first totally wireless pet containment system was born!*

Unlimited range. Sonic Fence is the latest in pet containment technology—a true breakthrough for pet owners. Sonic Fence creates a barrier that gives your dog freedom to roam within your yard and keeps him safe at the same time.

Wireless pet containment system breakthroughs...

- **Affordable.** Costs much less than installing an unsightly chain-link fence.
- **Easy installation.** No more digging up your yard to bury wires. Just place the emitters six inches into the ground.
- **Totally portable.** Take it with you! It's perfect for picnic areas or campsites.
- **Security.** Sonic Fence keeps your dog within your yard...safe and out of trouble.
- **Hidden barrier.** Without fences or wires, Sonic Fence creates a hidden ultrasonic boundary that only your dog knows is there.

The system is simple: it consists of a computerized collar and sonic emitters. A sonic emitter sends a signal of up to 75 feet. The containment area is expandable to an unlimited range. The computerized collar interacts with the sonic signal of the emitter, sensing when your dog nears the boundary. The strength of the signal is evaluated as your dog nears the perimeter that you have defined. He will first receive an audible beep. If he continues, a mild correction will be administered.

The humane solution. Sonic Fence will work with virtually any size or breed of dog. The correction is similar to a static electricity charge, and it won't harm your pet in any way.

Patented design. The Sonic Fence system operates with a computerized collar and sonic emitters, so you get the advantages of pet containment without digging up your yard to bury wires. Installation is complete within minutes by simply defining the boundaries with the sonic emitters. Sonic Fence creates a boundary 20 feet thick and 10 feet high to create the only safe zone in your yard for your pet.

The humane alternative to fencing.

Sonic Fence is totally portable—no more leaving your dog at home while you're on vacation or chaining him up at a campsite. Now he can freely interact with your family within the temporary barrier you establish.

Easy training. By spending as little as 15 minutes a day working with your dog, your pet could be fully trained in about three weeks. Plus, you can train as many dogs as you like on the same system—as long as they're each wearing a computerized collar.

Risk-free. Sonic Fence is made in the USA and is backed by our exclusive risk-free home trial. Try it, and if you're not satisfied, return it within 90 days for a full "No Questions Asked" refund. It's also backed by a one-year manufacturer's warranty. Most orders are processed within 72 hours and shipped UPS.

Not available in stores! *For a limited time, Sonic Fence is available at the factory-direct price of just $199! The system includes: one sonic emitter, one computerized collar, 24 training flags, batteries for the emitter and collar, an installation planning diagram and an instructional video.*

Free emitter! To help you create your perfect customized yard, we will give you a free emitter for every two emitters you purchase!

Sonic Fence	$199	$16 S&H
Extra computerized collar	$119	$9 S&H
Extra emitter* (and training flags)	$89	$8 S&H

* Buy two additional emitters, get a third emitter free!

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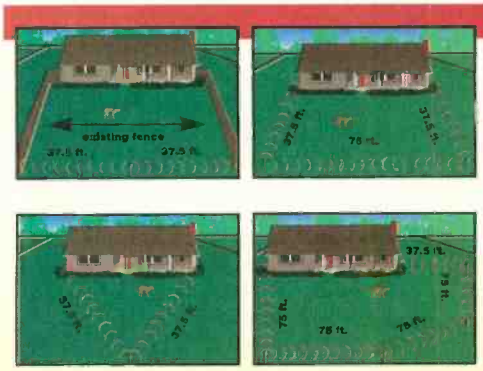

Design the perfect layout for your yard and your pet with Sonic Fence. The four-post layouts are perfect for typical back yards. And the two-post and one-post layouts are ideal for city lots or lots with partial fencing. Each emitter protects 75 feet of perimeter. Add as many emitters as you like for unlimited coverage! Each **X** *represents one emitter.*

Each Sonic Fence emitter broadcasts an ultrasonic signal. The Sonic Fence computerized collar constantly checks for the perimeter signal acting like a security system to keep your pet within the protected area.

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The CB1500's remote control allows the user to navigate through interactive on-screen television listings, activate one-touch recording, and control a TV, VCR, and cable box.

of the STAR button called up a brief program description— "Coverage of hearings conducted by the committee investigating Whitewater"—and the theme—Public Affairs/Government. The more detailed pop-up information stays on screen for 30 seconds, or until you press STAR again to remove it.

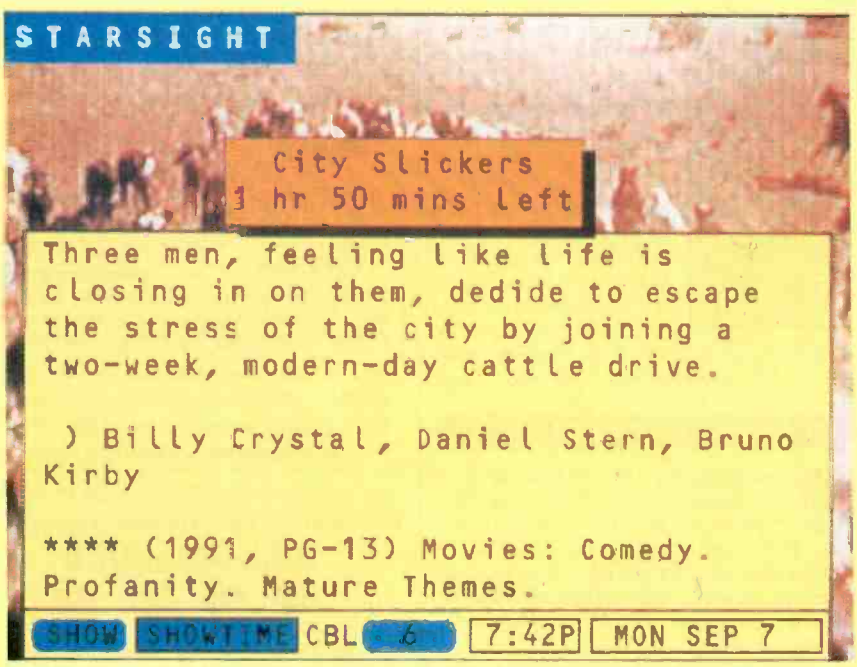
When you flip through the channels using the channel up and down toggle switch, the first pop-up screen appears briefly with each new channel. If the more detailed pop-up was on screen when you began flipping, you'd get the full program descriptions for each channel. StarSight refers to that as "grazing."

You can also do what StarSight calls "browsing" to learn what's on other channels while staying tuned to one. The up and down arrow keys found above and below the STAR button are used to browse. The program you're watching remains on screen; only the pop-ups change as you scroll through the channels. To get full program information on one of the pop-ups, you press the STAR button. To tune to the program being described, press the TUNE button.

For the most extensive programming information, a press of the GUIDE button will call up the StarSight program grid. Arranged like the grids found in many printed schedule guides, programs are arranged vertically by channel and horizontally by time. The four arrow keys are used to scroll up and down, moving the highlight bar through the channels and across through half-hour time segments. To expedite matters, the DAY and PAGE keys move the grid directly to the next screen in each direction.

Pressing the STAR button reveals more information about the highlighted show. Should you decide to watch that show, pressing the TUNE button switches to the correct channel. If you have a favorite channel, you can position the highlight bar on that channel and press GUIDE to see what's playing on that channel for an entire week.

From anywhere within the StarSight program guides—the grid, the theme list, or the favorite channel guide—you can go directly to a current show that interests you by simply pressing the TUNE button.



StarSight's instant information pop-up lets the viewer know at a glance the channel, time, date, title, and time remaining, and provides information about the show's content, theme, actors, etc.

CUSTOMIZING THE GRID

You might find yourself spending an awful lot of time navigating through the guide, especially if you receive a lot of cable channels. StarSight offers a few ways to help you find the programs you like, quickly and easily.

First, you can select programs by category, using StarSight's theme guide. Pressing THEME brings up an on-screen list of 11 themes: movies, specials/mini-series, sports, children's programming, health/science/education, news/talk/magazine, entertainment/variety, comedy, action/mystery/horror, drama/romance, and miscellaneous. Each of those themes is further divided into categories that can be viewed by pressing the STAR button. Movie categories, for instance, include action/adventure, comedy, drama, western, horror, fantasy/science fiction, musical/dance, historical/biographical, and miscellaneous. By highlighting any of those categories and pressing STAR, you can view a list of one specific type of movie.

By the way, within every theme there is a closed caption category. StarSight allows hearing-impaired viewers to easily locate all the programming within a category that provides captioning.

The second way to make program selection easier is to customize the StarSight grid guide to reflect your viewing tastes. Most of us have certain channels that we watch most often and others that we rarely, if ever, tune in. Choosing "select guide channels" from the StarSight Setup Menu displays your complete channel lineup. You can "deselect" channels by scrolling through the list and using the STAR button to highlight those that you never watch. The next time you call up your grid guide, those channels no longer appear. Nor will they appear when you flip through the channels.

Even if it doesn't bother you to see all those superfluous channels on your grid or while flipping, it's a good idea to remove them from the lineup. StarSight has a finite amount of memory. By removing those channels from the lineup, you increase the amount of information that will be shown for the remaining channels.

Finally, you can further customize the StarSight grid by changing the channel order to reflect your viewing preferences. That is done using the "change channel order" option on the StarSight Setup menu. The STAR and arrow buttons are used to "click and drag" the channels shown on screen to a new location in the lineup, placing the most frequently watched channels at the top.

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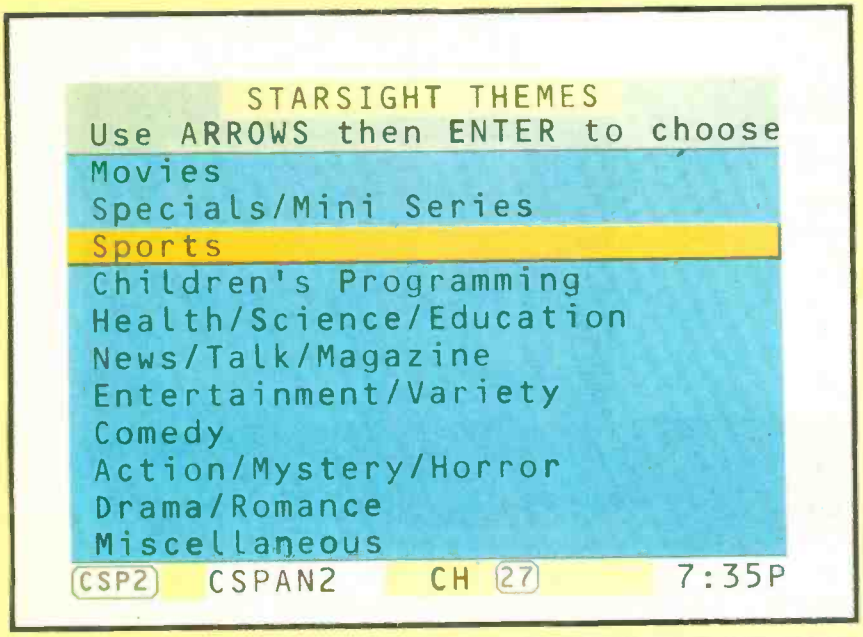
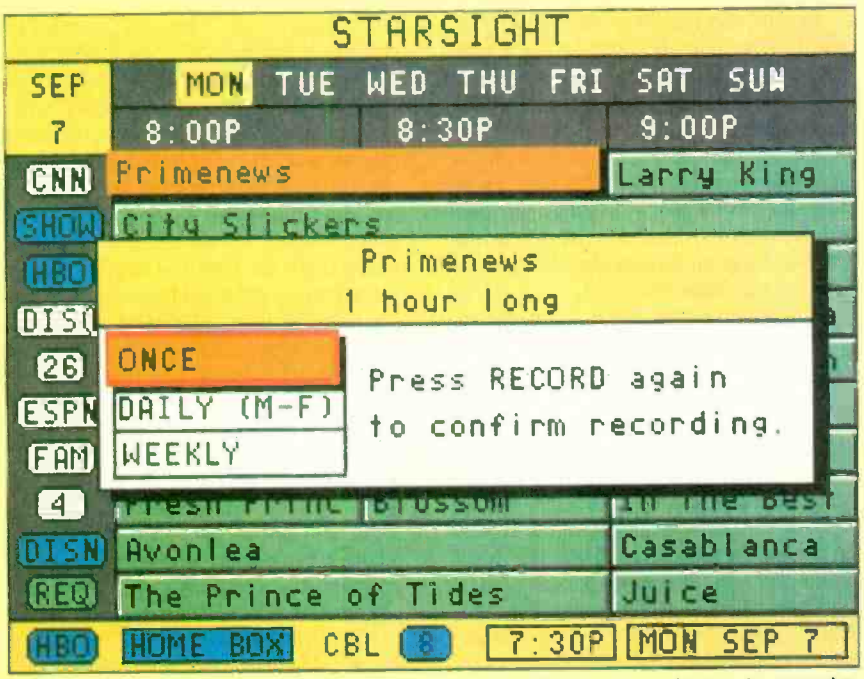


The viewer can select a show by theme, using the StarSight Theme Selection Menu.



With the touch of a button on the remote control, StarSight allows viewers to record a current or future television program or a daily or weekly series by simply selecting the program title to be recorded.

ONE-TOUCH RECORDING

StarSight has a lot to offer even if you don't have a VCR in your video setup. One-touch recording is the icing on the cake.

When you are scrolling through the grid guide, a theme guide, or a favorite-channel guide, you can record any program by highlighting it and pressing the REC button. A recording prompt pops up, asking you to select once, daily (M–F), or weekly, and to confirm recording by pressing REC again.

There's no need to enter start or end times, channel, or date—everything is done by program title alone. The only things you need to remember are to keep your VCR turned off (StarSight turns it on when it's time to begin recording) and to insert a tape.

If you want to record the program that you're currently watching, a press of the REC button calls up the same on-screen prompt, and a second press confirms and starts the recording. The manual recommends that if the show you watch is likely to run over its allotted time slot (a baseball game that goes into extra innings, for instance), you go to the grid to highlight and also record the show scheduled to immediately follow the game.

If you want to watch one channel while recording another, you must dig out your VCR remote control (or get off the sofa to use its front-panel controls) and use the TV/VCR to select "TV." If your setup includes a cable box, however, you will not be able to watch one channel while recording another (that's not StarSight's fault—blame the cable company for that one).

With recording made so simple, you might find yourself using StarSight to record everything in sight. If so, you'll need some way to keep track of all those shows you plan to tape.

StarSight provides two on-screen lists, one for one-time recordings, the other for series recordings. Both are accessed by pressing the TO DO button. The individual recordings lists keeps track of 25 scheduled recordings, including the four most recently completed ones, which appear shaded in gray. The series list keeps track of five daily or weekly series recordings. You can cancel a recording in either list by highlighting the show to be recorded, pressing CANCEL, and then pressing STAR.

PUTTING IT TO THE TEST

We are one of the few cable-free homes in our area, depending instead upon a satellite dish for our programming. Unfortunately, the CB1500 is not intended to handle satellite programming—neither traditional TVRO nor the two small-dish DBS systems, Primestar and DSS. Uniden manufactures a StarSight-equipped IRD, which we'll be reviewing in our January issue. Satellite, with its hundreds of program choices, is the ideal video environment for StarSight.

Before we began using the CB1500, we were afraid we wouldn't be able to fairly review the StarSight service. After all, who needs a fancy program guide to get through the eight stations we receive clearly on channels 2 through 21? But we were pleasantly surprised at the difference StarSight made in our viewing experience, even with such a limited program selection.

Before we "deselected" any channels, our grid consisted of 17 stations, half of which were too weak for us to tune in clearly. One of the first things we did after hooking up the CB1500 was to remove those channels from our lineup. Then we rearranged the remaining channels so that the ones we watched most frequently appeared at the top of the grid.

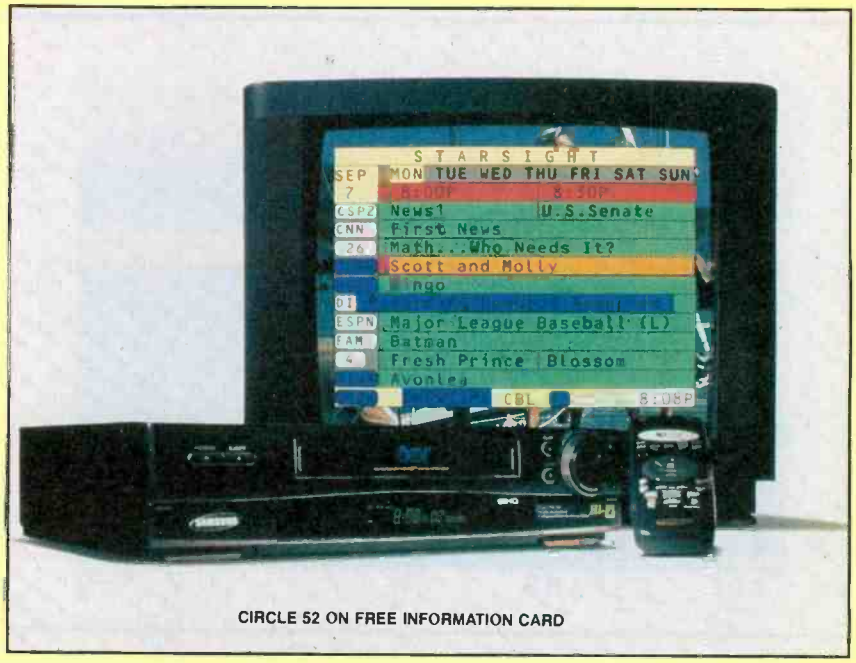
The streamlined, personalized grid was incredibly easy to use—a hundred percent easier than wading through all the channels we don't receive (or just don't watch) listed in the daily newspaper's TV sched-

(Continued on page 18)

AmericanRadioHistory.Com

StarSight-Equipped VCR

VR8905 4-HEAD HI-FI VCR WITH STARSIGHT CAPABILITY. From Samsung Electronics America, Inc., 105 Challenger Road, Ridgefield Park, NJ 07660-0511; Tel. 201-229-4000; Price: $549.



CIRCLE 52 ON FREE INFORMATION CARD

The first StarSight-equipped VCR to hit the market is *Samsung's VR8905*. The 4-head, hi-fi VCR has all the functions and convenience features you'd expect from a top-of-the-line model, including the "Diamond Head" video head system, said to reduce wear and significantly increase head life; narrow-width video head (26-micron head gap) for improved playback in SPL mode; a closed-caption decoder; and a dubbing mode for optimum quality tape-to-tape editing. All that, and StarSight, too.

Let's take a look at its StarSight capabilities, all accessed via the remote control, first. You wouldn't suspect that the remote control was StarSight compatible if not for its prominently displayed StarSight logo. The StarSight controls blend in with all the others—and there are quite a few buttons on this remote control, even without opening the door to its hidden compartment. Several buttons perform double duty, having a StarSight function as well as a standard VCR function.

Although the buttons are labeled and arranged differently on the VR8905 remote than on the stand-alone receiver's remote, for the most part they function exactly the same way on both StarSight units. A small INFO button is used to call up the pop-up screens, and a button labeled GUIDE calls up the StarSight program grid. When you change channels using the channel up and down keys, the pop-up information message appears automatically for each channel. To browse through the pop-up messages without changing the channel being watched, use the up and down arrows on the large jog/shuttle dial. Those are also used, along with the left and right arrows on the dial, to move around the grid guide. Below the dial are the page up and down and day up and down keys, used to move more quickly through the grid. The EXIT, PROG LIST, CENTER, and THEME buttons are all located within the remote control's compartment.

We would have preferred to see a distinct set of StarSight controls on the Samsung remote. Both the CB1500 and the VR8905 are easy to use, but the stand-alone unit is more intuitive. We occasionally found ourselves searching for the right button when using the VCR remote, something that never happened with the CB1500.

Besides the remote control layout, the main differences between using a StarSight-equipped VCR and a stand-alone unit are in the initial hookup and in recording programs. Instead of the double infrared remote emitter supplied with the stand-alone unit, the VR8905 comes with a "cable box mouse"—a fancy name for a mouse-shaped infrared remote emitter used to transmit remote signals from the VCR to the cable box.

When doing one-touch StarSight recording using the VR8905, you are offered a couple of extra options. You can extend or reduce the length of a recording by using arrow keys to change the end time; there's no need to record the following show to catch those extra innings. The on-screen prompt that appears when you hit the REC button also offers you the chance to change the tape speed (using the SP/SLP button) before confirming the recording.

When recording a program using StarSight, you can still watch a show on another channel by pressing the TV/VCR button (but not if you have a cable box—unless you add an A/B switch and want to watch an unscrambled channel.) Either way, you will not receive the StarSight data on the channel you are now watching.

You don't have to subscribe to StarSight to be able to record programs on the VR8905. You can still record the old-fashioned way, although if a schedule conflict appears, the StarSight programming will take precedence. A nice feature of the VCR's timer programming screen is its calendar display. The four arrow keys are used to highlight the right date (and you're much less likely to input the wrong date when you're actually looking at a calendar). The arrow keys are also used to highlight the day of the week for one-time recordings, or the "Mon–Fri" icon for recording at the same time each week day.

Even though many of the features offered by the VCR are not needed when StarSight is activated, it's nice to know they are available. For instance, on-screen programming makes it easy to set the time and date manually, although you won't have to do so if you subscribe to StarSight, which keeps the time and date current automatically, even taking into account Daylight Savings. (Actually, you won't have to manually set the time and date even if you don't subscribe to StarSight, because the VCR has its own auto-set clock feature.) Similarly, the VR8905 provides its own timer recording list—a nice feature that you're not likely to use if you do all your timer recording via StarSight. The VCR also allows you to use on-screen menus to select antenna or cable input; program it to control your cable decoder box; and add or delete channels.

It is a pleasure to use the VR8905 to watch video tapes. Playback quality is excellent, and the picture is smooth and clear. Even in still/pause mode, the picture remains steady and undistorted, with any blurring or jitters easily corrected using the manual tracking buttons.

The VR8905 also offers a host of convenient search and playback options. The FF and REW buttons can be used in either the stop or the play mode. If you hold them down while in stop mode, you can see the high-speed picture search on screen. If you hold them down while in play mode, the VCR goes into "jet search," in which the searching speed is increased nine times for tapes recorded at SP speed and 27 times for tapes recorded at SLP speed.

The jog dial/shuttle ring on the VCR's front panel and the pseudo-jog/shuttle (it's

AmericanRadioHistory.Com

World's quietest and most effective air purification system finally available to the public!

Breakthrough air purification system uses negative ions to actively remove contaminants better than any other filter and operate in total silence.

by Vicky S. Hindelang

Do you have a problem with the air in your home? Is it musty and stale? Do you sneeze the second you walk in the door? Are you bothered by tobacco smoke, dust, dander or odors? Trust me...you are not alone.

But, because you don't want a bulky, noisy air filter, you just live with the problem. A remarkable new product is now available that ends this compromise: Clearveil 250's compact design rids your home of airborne contaminants *and* operates in total silence.

Proven technology. Clearveil 250, a fanless electronic air purifier, uses patented microprocessor-controlled ionization and collection technology for contaminate removal. This method has been proven superior to other air filters, including High Efficiency Particulate Arresting (HEPA) filters. Clearveil is Japan's market leader in air purification devices, selling over 350,000 units since 1988.

The best method. In the past, the HEPA filter was considered to be the most effective air purification method. But the technology behind Clearveil is significantly more advanced. Scientific studies have shown Clearveil to be more effective in capturing a higher percentage of even the smallest contaminants.

HEPA filters have a certain level of permeability because they must allow air to pass through them. This means that small dust particles including bacteria, viruses, smog and tobacco smoke are also free to pass. But Clearveil's non-permeable sheet doesn't allow those particles to escape. This makes a big difference to anyone concerned with pure, pollutant-free air.

Energy efficient. Because Clearveil is so unobtrusive you will want to run it all day long. And since it only uses about four watts of electricity, you can! One Clearveil unit, running 24 hours a day, will only cost about $4 a year! Just one Clearveil unit will purify a 250-square-foot area. Additional units can be purchased to purify the air in larger homes or office buildings.

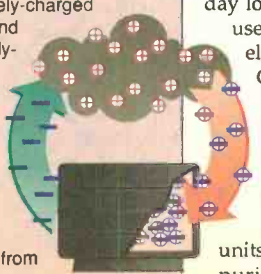
THE CLEARVEIL ADVANTAGE

After 168 hours of use, the Clearveil filter (A) has collected much more dust than the HEPA filter (B).

- **No noise.** Because it doesn't rely on a fan, Clearveil operates in perfect silence, 24 hours a day.
- **No misses.** Because it doesn't draw air through a filter, Clearveil catches minute particles of dust that even HEPA filters miss.
- **No mess.** Clearveil uses a positively-charged collection sheet to draw the negative ions back into the unit once they have collected dust.

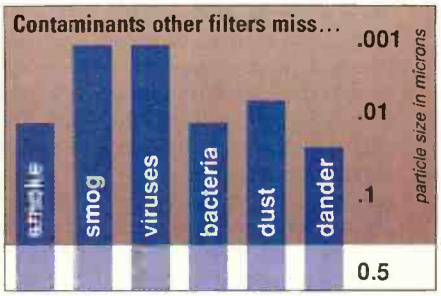
How it works

1. Clearveil releases negative ions.
2. The negative ions combine with positively-charged dust particles and form a negatively-charged unit.
3. Then a collection plate with a positive charge attracts those negatively-charged units, removing them from your air and home.



"The success of Clearveil...is directly attributed to the design of a sleek, silent unit that removes smoke, microbacteria, dust and viruses while replenishing negative ions to levels found in clean, mountain air."

–Gary Jones, Marketing Director, Clearveil Corp.



You'll feel healthier. Negative ions do more than just remove the harmful contaminants from the air that you breathe. They can actually improve your environment, making it healthier and more envigorating. Studies have shown these ions can help increase alertness and ease tension.

HEPA filters are rated to remove contaminants as small as .3 micron. But many contaminants, including dander, smoke and viruses, consist of smaller particles. Clearveil's superior collection system will remove particles as small as .001 micron.

Try it risk-free. Clearveil is backed by Comtrad's exclusive risk-free home trial. Try it, and if you're not totally satisfied, return it within 30 days for a full refund, "No Questions Asked." It also comes with a one-year manufacturer's limited warranty. Most orders are processed within 72 hours and shipped UPS.

Guaranteed performance. We're so sure you'll love what Clearveil does for your environment that for a limited time we're offering it at the special introductory price of $199. We guarantee that you'll notice a difference in the air you breathe. We also guarantee that Clearveil will operate in total silence. If you don't agree, return it for a full refund, "No Questions Asked."

Clearveil is so compact you can put it just about anywhere!

Clearveil 250 ..... $199 $16 S&H
Replacement sheets (12) ..... $20 $2 S&H
For optimum results, replace the sheet once a month.

Please mention promotional code **891-PL-6636.**

For fastest service call toll-free 24 hours a day

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Midlothian, Virginia 23113

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actually a four-way toggle) on the remote both allow one-touch playback at speeds ranging from still picture to plus or minus nine times normal play speed. Turning the front-panel jog dial clockwise (to advance the tape) or counterclockwise (to reverse) while in pause mode creates frame-by-frame, slow-motion, or normal playback effects, depending upon how far the dial is moved. The front-panel shuttle ring is used during playback to change the speed. The right and left arrows on the remote-control shuttle also change the playback speed, and can be used for slow-motion viewing. The remote's up and down arrows duplicate the front-panel jog-dial's functions when in pause/still mode.

In playback mode, the up arrow doubles as a SKIP button, fast-forwarding through 30 seconds of recorded material per press (six presses fast forwards through three minutes) to skip past commercials—a valuable playback feature. The down arrow, when pressed during playback, either repeats the last five seconds of the tape (which comes in handy if you've overshot your mark with the skip button) or returns the tape to the 00:00:00 position and restarts playback from there. You can select either option using the VCR Function Menu.

The VR8905 offers the VHS Index Search System (VISS), which automatically inserts a mark on the videotape at the beginning of each recording session. Index marks can be located directly by pressing the INDEX button and inputting the number of the mark. If you don't know the number, the index scan and play function lets you fast forward or reverse the tape, searching out all the index marks. Each time a mark is found, the VCR goes into play mode for a few seconds. The index search is continued until the PLAY button is pressed.

If you tape a block of programming, you must record each show as a separate entity if you want an index mark inserted at its start. (That's not a problem, of course, if you use StarSight instead of traditional recording methods.) But even without the index marks, it's easy to locate a specific show within the recorded block using the VR8905's on-screen display.

Intended to help you monitor recordings, the display appears as a bar across the bottom of the screen. In it is found a counter showing time elapsed; the tape speed; and the "tape histogram," a graphical representation of the current position of the tape. A second press of the DISP button changes the display to show the time remaining.

Say you've recorded NBC's entire Thursday night lineup—beginning at 8 PM with "Mad About You" and ending at 11 PM, when "ER" is over—to watch without interruption over the weekend. When you start to watch, you realize the first two shows are repeats. You can fast forward directly to "Seinfeld" by watching the counter to see when an hour has elapsed—no hit-or-miss blind searching. (The elapsed time also appears on the front-panel display, but that's hard to see from across the room.)

Several features facilitate editing and dubbing. The VR8905 offers front-panel jacks for connecting a camcorder or another VCR. And selecting the tape-dubbing mode from the VCR Function menu makes copying a tape from another VCR a one-step procedure: You simply press PLAY on the playback VCR and REC on the VR8905 at the same time. In dubbing mode, you can press the VR8905's P/STILL button to edit out unwanted material. The excellent picture quality in pause/still mode, and frame-by-frame capabilities of the jog/shuttle controls make it easy to do precise edits.

The VR8905 is an excellent recording, playback, and editing machine in its own right. With the addition of StarSight circuitry, it would make a welcome addition in any home video setup.

STARSIGHT WRAP-UP

StarSight is an idea whose time has clearly come. And StarSight Telecast has managed to bring that idea to fruition in a timely, attractive, intelligent manner.

The statistics speak for themselves: More than 59.3 million U.S. households subscribe to a cable system offering at least 30 channels and 7000 program choices each week. The numbers of channels and program choices just keep expanding. And while more than 75% of households own at least one VCR, more than 70% of all consumers still use their VCRs just to play back rented movies—they haven't learned to program their VCRs to record.

StarSight promised an interactive product that would make television viewing and recording easier, and they delivered precisely as promised. It simplifies viewing choices, and makes recording a breeze. It requires virtually no effort on the part of the user, who never has to leave the couch once the unit is connected. And it is reasonably priced.

From a business standpoint, StarSight Telecast made some smart moves—beginning with patenting almost every aspect of the system, including one-touch recording, tuning to a show by title, pop-up menus, and pop-up show synopses. (In fact, DirecTv had to license some StarSight technologies for use in the DSS on-screen program guide and recording feature.) The fledgling company also managed to garner support—and financing—from many of the biggest names in the consumer-electronics, cable, and broadcasting industries.

It has been projected that by 1998, thanks to licensing arrangements with consumer-electronics giants and major cable operators, StarSight will be actively reaching almost a quarter of all television-owning households in the U.S. After using StarSight, we think that estimate might be too conservative. ■

STAND-ALONE STARSIGHT

(Continued from page 15)

ule grid. And we're sure that the benefits of using StarSight multiplies in direct proportion to the number of channels received.

Interacting with the StarSight guides required very little effort on our part. The controls are largely intuitive, intelligently arranged and labeled, and backed up by on-screen prompts. We never found ourselves wondering which button to push to accomplish a certain task.

The StarSight CB1500 reduced some of the arguing between the "hunters" and the "gatherers" in our household. The hunters could flip through the channels more quickly and efficiently, the gatherers could continue watching their program as the hunters "browsed" through pop-up descriptions of the other channels' offerings, and both factions enjoyed scanning through the grid and theme guides.

More important, StarSight gave us a sense of total control over our video environment. Control is sorely lacking in most American households, where up to 70% of viewers use their VCRs solely to watch rented movies, never having mastered the art of time-shifted recording. Although we don't have that problem, we must admit that, with StarSight, we never experienced that twinge of worry (Did I set it to start at 8:00 or 9:00?) that sometimes accompanies standard recording techniques. We also had the feeling, for the first time, that we knew exactly what our viewing choices were, and could make an informed decision about the best show to watch at any given time. ■

"Wow! That train is coming right at me!"

AmericanRadioHistory.Com

This Is Radio PC Calling

RADIO ROCK-IT RDS. From ADS (Advanced Digital Systems) 13909 Bettencourt Street, Cerritos, CA 90703. Tel. 310-926-1928. Price: about $199.

So you think you have a multimedia computer just because you have a CD-ROM drive and sound card? Well, think again. With *Radio Rock-It* installed, our multimedia PC is now equipped with yet another medium—a smart radio.

Like many workers these days, we spend a lot of time in front of our computers. Not only at the 9-to-5 day job, but in our home offices as well. To keep from going absolutely crazy, we normally have some music playing in the background whenever we're at our PC. Sometimes, it's a CD playing in our CD-ROM drive—that is, if we're not running any CD-ROM-based application. Usually, however, it's the radio. Now, it's Radio Rock-It, a new plug-in "smart radio" card from *Advanced Digital Systems* or *ADS*.

CIRCLE 53 ON FREE INFORMATION CARD

RBDS TECHNOLOGY

Just what is a smart radio? It's one that has support built in for the Radio Broadcast Data System (RBDS) standard. Although you might not have ever heard of RBDS, it is not really new. In Europe, a similar system called RDS has been used since the mid 1980s to provide such services as alerting car radios to broadcast traffic reports, or to assist in seeking stations by program format.

In the U.S., the RBDS standard was announced in January 1993 at the Consumer Electronics Show, sponsored by the Electronic Industries Association's Consumer Electronics Group (EIA/CEG). The standard was developed by the National Radio Systems Committee (NRSC), which includes representatives from the EIA and the National Association of Broadcasters (NAB). The service is broadcast on the 57-kHz subcarrier of an FM station's signal.

RBDS is seen as a benefit for broadcasters, manufacturers, retailers, and consumers. RBDS benefits broadcasters by allowing them to better identify themselves to listeners by displaying their call letters and logos on RBDS-equipped radios. For manufacturers and retailers, the new features should translate to improved sales as consumers upgrade their equipment. For consumers, RBDS means improved convenience—you never have to stop at a country station again as you search for top-40 hits when you're traveling out of town.

Up until now, RBDS has not become a common, well-known, or sought-after feature on new receivers. Home RBDS receivers are available from Denon and Onkyo, and mobile receivers are available from about a dozen manufacturers, though mostly only in European models or those at the high end of the product line. Radio Rock-It is the first such receiver available for the PC.

The number of stations broadcasting the RBDS information has grown steadily, and now numbers about 250 stations and translators across the country. (See the accompanying table for a list as provided to us by the EIA.)

Unfortunately, as became evident during our tests of Radio Rock-It, 250 stations is only a drop in the bucket. Although we live in a major metropolitan area, we were in the reception range of only five potential RBDS stations. That's somewhat surprising, considering that a station can acquire RBDS capability for as low as about $2500.

However, the number of RBDS stations will at least triple under a program underway by the EIA, which is planning to jumpstart the industry by spending up to $1 million to equip 500 FM radio stations in the 25 largest metropolitan areas with RBDS capability. About 85 percent of the population will then be able to receive at least one RBDS station. Delco, Denon, and Pioneer are working with the EIA to fund the project, and other companies are expected to join the effort. Radio stations that receive the equipment will provide air time that will be used to run advertisements and educational messages to inform listeners about RBDS.

RBDS allows a variety of information to be sent to compatible receivers. For example, a station's call letters and logo or nickname could be sent, along with the program type or format. For network programming, the receivers could receive information to re-tune to stations broadcasting the same programming with better reception. Right now in the U.S., we would find the feature most valuable for listening to National Public Radio's "All Things Considered" daily news broadcast because many of NPR's affiliates are low-powered educational stations, and it is easy to drive out of range of a broadcast. RBDS-equipped receivers would potentially be able to re-tune to a stronger station, or a station's translator, as you drove into its range. As more stations create regional and even national networks, travelers will be able to appreciate the re-tuning feature even more.

Another powerful feature of RBDS is that radios could be commanded to automatically tune to emergency broadcasts or even traffic reports. In-car CD and cassette players could be automatically muted so that traffic or emergency alerts could be heard. In addition, RBDS might be incorporated into the Emergency Broadcast System, which the FCC is currently in the process of updating. One of the potential benefits is that RBDS could allow an emergency broadcast to actually turn a radio on in the middle of the night to sound an alert about, for example, an approaching tornado.

Users could easily scan for programs by format type. The system supports 20 program types: Top 40, Jazz, Religious Talk, Soft Rock, Classical, News, R&B, Soft R&B, Nostalgia, Classic Rock, Oldies, Rock, Sports, Adult Hits, Country, Religious Music, Soft, Talk, Information, and Any Type. Broadcasters could send

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information not only about their format, but about recording artists, song titles, or album titles.

Broadcasters could also potentially send clock-synchronization signals, paging information, or other data, or even advertisements to make RBDS more than pay for itself.

ID LOGIC

When RBDS was originally proposed, it had a couple of potential drawbacks. First, of course, is that an RBDS receiver would be useful only when a great majority of stations—if not all—encoded their signals with RBDS data. Second is the problem of AM broadcasters—RBDS, being an FM subcarrier, is not compatible with AM.

A solution to both problems, called ID Logic RDS, was developed by PRS Corporation. It was adopted as part of the RBDS standard in the U.S. ID Logic is basically a database of the more than 13,000 radio stations, both AM and FM in the U.S. and Canada. The database contains the call sign, frequency, format, and location of each.

In every market, radio stations change format, call signs, and sometimes even frequencies rather often. To combat that problem, ID Logic contains the ability to update its database. One station in each market must be available to supply that update information.

For ID Logic to work, you must have a way of telling the receiver where it is. The ID Logic database ROM contains a description of almost 7000 cities, so it should be easy to find one near you. In addition, it contains descriptions based on latitude and longitude. The updatable database RAM uses such information to supersede the data in its ROM.

The RBDS standard allows five updating modes that manufacturers of RBDS receivers can incorporate in their products. One potential mode would be to automatically update the receiver when it is turned off, but before going to sleep. It would then tune to the local station providing updates, and load the relevant data. The same procedure could be done at power up instead, or at a predetermined schedule time, or when a receiver entered a new territory. Manufacturers could also provide a manual update key. Of course, the data can update the AM band as well as the FM band. In operation, a user would not necessarily be aware of whether the information was originating from the tuned station or from the radio's database.

RADIO ROCK-IT

Radio Rock-It is the first RBDS receiver for the PC. Although it provided a glimpse of the power of RBDS, it also proved to be extremely frustrating because of a plethora of software bugs that plagued the first release. During our review, the software was being revised. We tested a couple of updates. Unfortunately, while they fixed some problems, they created others. Worse yet, the program consistently chewed up system resources for no apparent reason, leaving us with insufficient memory to complete basic tasks—seemingly regardless of how much memory we had installed in a machine, and regardless of whether we ran it on a 90-MHz Pentium or a 40-MHz 386. Normally, we would choose not to review an item that presented as many problems as Radio Rock-It did. However, we are covering it here because of the importance of RBDS technology, and because Radio Rock-It has tremendous potential—once ADS works out some of the bugs in its software.

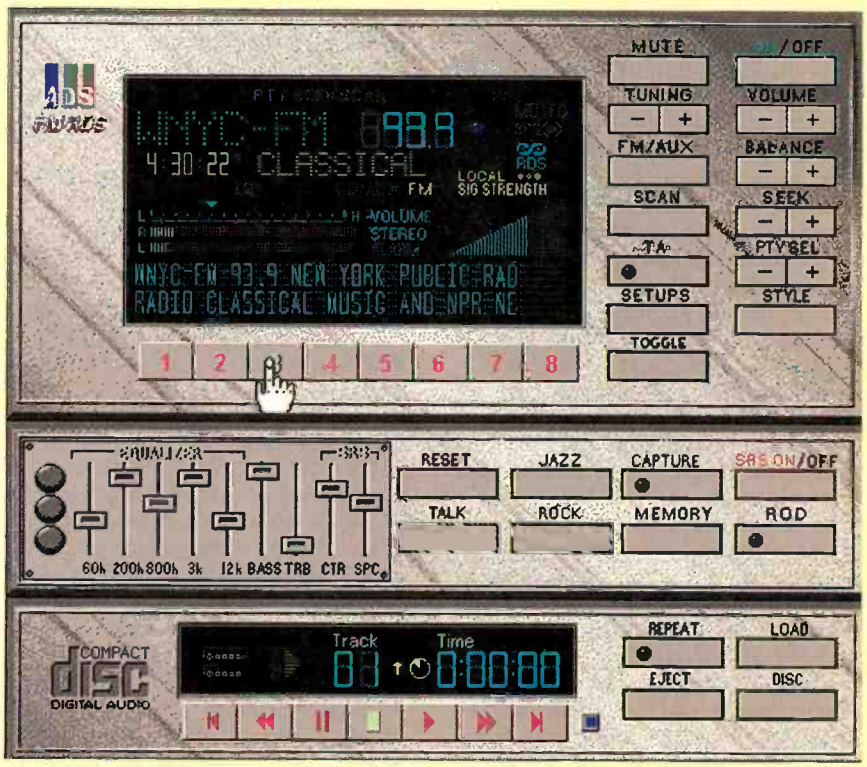
The Radio Rock-It card is rather easy to install. The half-length card plugs into any slot in your PC. There is only one jumper on the board, which is used to select a range of port addresses. No interrupts or DMA settings are required. The jumper has only two possible settings; the installation software configures everything else.

The rear panel of the card has five input and output jacks: A mini phone jack is provided for antenna input. Stereo mini phone jacks are provided for processed stereo out, unprocessed line audio out, and line audio in jacks. A stereo mini phone jack is also provided for RS232 data out.

A standard FM dipole "T" antenna, terminated in a mini phone jack, is provided with the card. For the most part, that antenna was useless. Because, by default, it had to be positioned only a few feet from the computer, it was easily swamped by spurious signals radiated from the PC, especially on the lower end of the FM band. (We tested the card in three mainstream computers. Although each emitted different levels of interference, the dipole antenna was unacceptable with each.)

An outdoor, roof-mounted antenna performed better, although we still have some complaints. First, we had to supply an F-to-mini phone jack adapter. One should have been included with the board. Second, using an outdoor antenna didn't completely eliminate interference. Some showed up during disk writes and some screen re-writes. It was audible on all but the strongest stations. On some frequencies, the interference was silent, but completely swamped the receiver. Of course, the inside of a computer case is an extremely hostile environment for a radio receiver. However, our experience leads us to believe that ADS could have done a better job of shielding the tuner.

The stereo-out jack feeds processed audio to your speakers. If you desire, the output of your sound card can be fed through the Radio Rock-It to take advan-



The main Radio Rock-It display–when it works—shows an abundance of information including the call sign, frequency, format, signal strength, and volume level. The station can also choose to send a 64-character message. Many receivers will show such messages as scrolling displays. As you can see here, the ADS attempt to break the message into two lines creates awkward word wraps, and the loss of characters.

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U.S. RBDS RADIO STATIONS

ALABAMA

WZYP-FM	104.3	Athens
WRJM-FM	93.7	Geneva

ARIZONA

KKFR-FM	92.3	Phoenix
KSLX-FM	100.7	Scottsdale

CALIFORNIA

KSIQ-FM	96.1	Brawley
KLON-FM	88.1	Long Beach
KKGO	105.1	Los Angeles
KPCC-FM	89.3	Los Angeles
KTWV-FM	94.7	Los Angeles
KCRW-FM	89.9	Los Angeles
KATM-FM	103.3	Modesto
KHOP-FM	104.1	Modesto
KNPR-FM*	88.1	Ridgecrest
KSFM-FM	102.5	Sacramento
KPBS-FM	89.5	San Diego
KPLM-FM	106.1	Palm Springs
KYXY-FM	96.5	San Diego
KKHI-FM	95.7	San Francisco
KDFC-FM	102.1	San Francisco
KEAR-FM	106.9	San Francisco
KECG-FM	88.1	San Francisco
KALW-FM	91.7	San Francisco
KKSF-FM	103.7	San Francisco
KCBX-FM	90.1	San Luis Obispo

COLORADO

KMUI-FM	100.3	Denver
KCFR-FM	90.1	Denver

CONNECTICUT

WSHU-FM	91.1	Fairfield
WPKT-FM	90.5	Hartford
WHCN-FM	105.9	Hartford

DISTRICT OF COLUMBIA

WAMU-FM	88.5	Washington
WETA-FM	90.9	Washington
WDCU-FM	90.1	Washington
WGAY-FM	99.5	Washington

FLORIDA

WAPN-FM	91.5	Daytona Beach
WSFP-FM	90.1	Ft. Myers
WAOA-FM	107.1	Melbourne
WLRN-FM	90.3	Miami
WTMI-FM	93.1	Miami
WMFE-FM	90.7	Orlando
WOCL-FM	105.9	Orlando
WUFT-FM	89.1	Gainesville
WOWW-FM	107.3	Pensacola
WFLZ-FM	93.3	Tampa

GEORGIA

WDMG-FM	99.5	Douglas
WSTR-FM	94.1	Smyrna
WABE-FM	90.1	Atlanta
WCLK-FM	91.9	Atlanta
WKLS-FM	96.1	Atlanta

ILLINOIS

WCIL-FM	101.5	Carbondale
WLRW-FM	94.5	Champaign
WBEZ-FM	91.5	Chicago
WKKD-FM	Oldies 96	Chicago
WXRT-FM	93.1	Chicago
WLS-FM	94.7	Chicago
WNUA-FM	95.5	Chicago
WNU-FM	90.5	DeKalb
WLLR-FM	101.3	East Moines
WAAG-FM	94.9	Galesburg
WSWT-FM	106.9	Peoria
WDBR-FM	103.7	Springfield
WGFA-FM	94.1	Watseka
WPGU-FM	107.1	Urbana

*Translator
Source: EIA

INDIANA

WSHW-FM	99.7	Frankfort
WENS-FM	97.1	Indianapolis
WZPL-FM	99.5	Indianapolis
WITZ-FM	104.7	Jasper
WZWZ-FM	92.7	Kokomo
WWKI-FM	100.5	Kokomo
WMRI-FM	106.9	Marion
WLEZ-FM	102.7	Terre Haute
WXKE-FM	103.9	Ft. Wayne

IOWA

KRVR-FM	106.5	Davenport
KMFG-FM	103.3	Des Moines
WMT-FM	96.5	Cedar Rapids
KOEL-FM	92.3	Oelwein
KUOO-FM	103.9	Spirit Lake
KAYL-FM	101.5	Storm Lake

LOUISIANA

WGGZ-FM	98.1	Baton Rouge
KFXY-FM	96.7	Morgan City
WLMG-FM	101.9	New Orleans
WMYZ-FM	95.7	New Orleans
KCIL-FM	107.5	Houma
KMJJ-FM	100.1	Shreveport

MASSACHUSETTS

WAAF-FM	107.3	Boston
WBUR-FM	90.9	Boston
WGBH-FM	89.7	Boston
WBCN-FM	104.1	Boston
WMUX-FM	106.7	Boston
WBOQ-FM	104.9	Gloucester
WBCS-FM	96.9	Newton

MARYLAND

WHFS-FM	99.1	Annapolis
WEAA-FM	88.9	Baltimore
WIYY-FM	97.9	Baltimore
WXYV-FM	102.7	Baltimore
WETH-FM*	89.1	Hagerstown

MICHIGAN

WIOG-FM	102.5	Bay City
WLLZ-FM	98.7	Detroit
WKQI-FM	95.5	Detroit
WJLB-FM	97.9	Detroit
WQRS-FM	105.1	Detroit
WDBM-FM	88.9	East Lansing
WKAR-FM	90.5	East Lansing
WLAV-FM	96.9	Grand Rapids
WKLQ-FM	94.5	Holland
WRKR-FM	107.7	Portage

MINNESOTA

KBEM-FM	88.5	Minneapolis
KNOW-FM	91.1	St. Paul
KSJN-FM	99.5	St. Paul
KSTP-FM	94.5	Minneapolis
KTIS-FM	98.5	Minneapolis

MISSOURI

KYYS-FM	102.1	Kansas City

NEBRASKA

KESY-FM	104.5	Omaha

NEVADA

KKLZ-FM	96.3	Las Vegas
KNPR-FM	89.5	Las Vegas
KNPR-FM*	88.7	Boulder City
KNPR-FM*	91.7	Beatty
KOMP-FM	99.3	Henderson
KNPR-FM*	88.7	Indian Springs
KNPR-FM*	89.5	Laughlin
KNPR-FM*	88.7	Moapa Valley
KNPR-FM*	88.7	Pahrump
KBUL-FM	98.1	Reno
KNEV-FM	95.5	Reno
KNPR-FM*	88.1	Scotty's Junction
KNPR-FM*	105.1	Searchlight
KLUC-FM*	98.5	Las Vegas
KFMS-FM	101.9	Las Vegas
KWNR-FM	95.5	Las Vegas
KEYV-FM	93.1	Las Vegas
KRRI-FM	105.5	Las Vegas
KOMP-FM	92.3	Las Vegas
KEDG-FM	103.5	Las Vegas
KFBI-FM	107.5	Las Vegas
KYRK-FM	97.1	Las Vegas
KLNR-FM*	91.7	Panaca
KTPH-FM*	91.7	Tonopah
KEYV-FM*	103.5	Laughlin

NEW JERSEY

WFPG-FM	96.9	Atlantic City
WKDN-FM	106.9	Camden
WBGO-FM	88.3	Newark
WFME-FM	94.7	Newark
WNNJ-FM	103.7	Newton
WPAT-FM	93.1	Patterson
WADB-FM	95.9	Point Pleasant
WCHR-FM	94.5	Trenton
WBSS-FM	97.3	Millville

NEW MEXICO

KKOB-FM	93.3	Albuquerque
KKSS-FM	97.3	Santa Fe

NEW YORK

WAMC-FM	90.3	Albany
WGY-FM	99.5	Albany
WZRQ-FM	102.3	Albany
WSKG-FM	89.3	Elmira
WHTZ-FM	100.1	New York
WNEW-FM	102.7	New York
WNYC-FM	93.9	New York
WBEE-FM	92.5	Rochester

NORTH CAROLINA

WUNC-FM	91.5	Chapel Hill
WCXL-FM	104.1	Kill Devil Hills

NORTH DAKOTA

KSSS-FM	101.5	Bismark
KDVL-FM	102.5	Devil's Lake
KFNW-FM	97.9	Fargo
KNOX-FM	94.7	Grand Forks

OHIO

WOUB-FM	91.3	Athens
WGUC-FM	90.9	Cincinnati
WVXU-FM	91.7	Cincinnati
WWNK-FM	94.1	Cincinnati
WCLV-FM	95.5	Cleveland
WCPN-FM	90.3	Cleveland
WGAR-FM	99.5	Cleveland
WENZ-FM	107.9	Cleveland
WKSU-FM	89.7	Cleveland
WLTF-FM	106.5	Cleveland
WLVQ-FM	96.3	Columbus
WDFM-FM	98.1	Defiance
WKRJ-FM*	91.5	New Philadelphia
WGLE-FM	90.7	Toledo
WKKO-FM	99.9	Toledo
WGTE-FM	91.3	Toledo
WKRW-FM*	89.3	Wooster
WHIZ-FM	102.5	Zanesville
WOUZ-FM	90.1	Zanesville
WGLE-FM	90.7	Lima

OKLAHOMA

KSYE-FM	91.5	Frederick
KIRQ-FM	98.1	Lawton

OREGON

KYTE-FM	102.7	Newport
KOPB-FM	91.5	Portland
KKRZ-FM	100.3	Portland
KMCQ-FM	104.5	The Dalles

PENNSYLVANIA

WRTI-FM*	97.1	Allentown/ Bethlehem
WITF-FM	89.5	Harrisburg
WRVV-FM	97.3	Harrisburg
WROZ-FM	101.3	Lancaster
WDAS-FM	105.3	Philadelphia
WFLN-FM	95.7	Philadelphia
WHYY-FM	90.9	Philadelphia
WIOQ-FM	102.1	Philadelphia
WMGK-FM	102.9	Philadelphia
WMMR-FM	93.3	Philadelphia
WPLY-FM	100.3	Philadelphia
WRTI-FM	90.1	Philadelphia
WUSL-FM	98.9	Philadelphia
WWDB-FM	96.5	Philadelphia
WXPN-FM	88.5	Philadelphia
WXTU-FM	92.5	Philadelphia
WDUQ-FM	90.5	Pittsburgh
WRTI-FM*	97.7	Reading

RHODE ISLAND

WWBB-FM	101.5	Providence
WHJY-FM	94.1	Providence

TENNESSEE

WYPL-FM	89.3	Memphis

TEXAS

KEAN-FM	105.1	Abilene
KNLE-FM	88.1	Austin
KTTX-FM	106.1	Brenhane
KTEX-FM	100.3	Brownsville
KKYS-FM	104.7	Bryan
KORA-FM	98.3	Bryan
KTEX-FM	106.9	Bryan
KAYD-FM	97.5	Beaumont
KQXY-FM	94.1	Beaumont
KYKR-FM	95.1	Beaumont
KCBI-FM	90.9	Dallas
KERA-FM	90.1	Dallas
KBNA-FM	97.5	El Paso
KILT-FM	100.3	Houston
KUHF-FM	88.7	Houston
KJMZ-FM	100.3	Irving
KOOI-FM	106.5	Jacksonville
KYKX-FM	104.5	Orange
KCRN-FM	93.9	San Angelo
KXTN-FM	107.5	San Antonio
WACO-FM	99.9	Waco

UTAH

KSOS-FM	106.9	Ogden
KSOS-FM*	92.1	Salt Lake City
KSOS-FM*	96.7	Salt Lake City
KISN-FM	97.1	Salt Lake City
KSOS-FM*	98.3	Utah County

VIRGINIA

WLTY-FM*	95.7	Norfolk
WNVZ-FM	104.5	Norfolk
WESR-FM	103.3	Onley
WKOC-FM	93.7	Virginia Beach
WCDX-FM	92.7	Richmond

WASHINGTON

KFAE-FM	89.1	Richland
KISW-FM	99.9	Seattle
KUOW-FM	94.9	Seattle
KMPS-FM	94.1	Seattle
KVTI-FM	90.9	Seattle-Tacoma
KDRK-FM	93.7	Spokane
KEZE-FM	105.7	Spokane
KRPM-FM	106.1	Tacoma

WISCONSIN

WIZM-FM	93.3	LaCrosse
WERN-FM	88.7	Madison
WUWM-FM	89.7	Milwaukee
WMYX-FM	99.1	Milwaukee
WMSE-FM	91.7	Milwaukee

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tage of its five-band graphic equalizer and its built-in SRS (Sound Retrieval System) processing. If all sound is routed through the receiver, only one set of speakers is required.

The audio-out jacks send unprocessed stereo audio out to either your sound card or to another device such as a cassette deck for recording, while the line-in jack accepts input from a sound card or other external audio source for processing.

The RS-232 jack is provided for commercial uses of the card. It allows data to be sent to an external device such as a printer, or an electronic sign. The feature is not available without special software. However, ADS plans to enhance the software to provide such features as the control of multiple-disc CD players.

The software is installed in the traditional Windows style. The resulting program group contains three applications: Radio Rock-It, SoundStation, and ID Radio. The Radio Rock-It application provides a user interface to the tuner board that includes a radio control panel, an equalizer/enhancement module, and a CD-player controller. Each can be "turned off" so that it is not displayed. Optionally, a small "remote control" lets you control the system.

The main radio display looks like a sophisticated receiver. It has such buttons as MUTE, TUNING, SCAN, SEEK, BALANCE VOLUME, and a set of eight memory-preset buttons that can be used to store 16 stations in memory. They operate just as you would expect them to on a standard receiver. There are also a couple of buttons that you might not be familiar with.

First is PTY SEL, which selects the program type that you want to search for. Second is TA, which lets you search for traffic announcements, and, if you want, automatically record them to your hard disk.

Searching for program type is convenient. If you want, for example, to bypass all stations except for those that normally play classic rock, you can simply set the program type to CLAS ROCK. Press one of the SEEK keys, and the radio will stop at the next station up or down the dial that plays classic rock. Unfortunately, there is a room for error here—when an RBDS station doesn't send the right program type data, for example. For most of the stations in our area, that wasn't much of a problem. WNEW-FM rarely plays anything other than what fits into the ROCK program type. However, WNYC, another RBDS station, broadcasts a variety of programming. During the day, it's programming schedule is largely classical music, which is what showed up in our display. However, CLASSICAL also showed up during "Fresh Air," a show of interviews, or during the NPR newscasts.

Along with format, call sign, and logo, stations are free to transmit up to 32 characters. WNYC, for example, sends: WNYC-FM NEW YORK PUBLIC RADIO CLASSICAL MUSIC AND NPR NEWS. At least that's what we assume that the station was sending. The software didn't quite get it right, and an awkward line break repeated some letters, and dropped others.

The SoundStation application is designed to control the mixing levels of the sound devices in your PC, and also to control the CD player. Although some users will undoubtedly find it useful, others who have become familiar with their existing audio mixer will probably want to simply ignore SoundStation.

The third application, ID Radio, not only controls the ADS tuner module, but also demonstrates the power of the ID Logic portion of the RBDS standard. In fact, the software contains a complete database of all AM and FM stations in the U.S. and Canada. As mentioned earlier, ID Logic works for both AM and FM stations. However, when ID Radio is switched to the AM simulation mode, the tuner board is silenced.

The first task is to set your home location by choosing your state or province, and the closest city. (That is similar to what should be done with the Radio Rock-It software, except that in this application, it works.)

In the FM mode, the software works to control the Radio Rock-It board completely. You can tune a frequency directly from a normally hidden keyboard (something that the Radio Rock-It software doesn't allow), tune up and down one step at a time or scan through the band. You can scan by format, and even search for a station by call sign. Once you find that location, you can instantly "skip" there to find other stations in that location.

Okay, most people probably don't have any use for that. But readers of **Popular Electronics** probably do. Every summer, when the door to FM skip opens up, it is possible to receive stations from hundreds of miles away. From our location on Long Island, NY, we've received stations from as far away as Virginia and Florida. Because those "doorways" normally open up to a particular area at any given time, we could use the travel feature of the ID Logic receiver to scan through the band and log other stations that might be receivable here.

The ID Logic receiver also lets you probe some of the technical areas of the ID Logic technology. For example, by clicking on the dot of the "i" in the ID Logic logo, you can get information about the grid in which your city is located. For geographical reference, the continent is divided into a matrix of rectangles of ½ degree latitude by ½ degree longitude. That grid location tailors the database to determine which stations will be displayed at any given location.

Here is where we found ID Logic to be something less than perfect. From our Long Island location, we could tune into a station and be presented with the wrong call letters. By setting the "tuning sensitivity" to DX or DX², we could be presented with a variety of choices, of which we could select one. For example, we often listen to WKCR, 89.9 MHz, which originates from Columbia University and offers an eclectic programming lineup (called "variety" by ID Logic) that includes perhaps the nation's finest jazz programming.

Based on our location, the station that ID Logic thought we should receive was WWEB, from Wallingford, Connecticut—a station we've never received. Only in the DX² setting did we get other choices: WQTQ in Hartford, WRLI in South Hampton, Long Island, WSUF in Noyack, Long Island, and, finally, WKCR in New York. From our real-world experience, Grid 5052 needs a little fine tuning to correspond to actual reception conditions.

If the previous example was an isolated case, we wouldn't mention it. But once we moved outside the power-house stations, identification became a little too much of a hit-or-miss situation for our tastes. Of course, as more stations incorporate RBDS subcarriers to their signals, the potential for errors will decrease, and ID Logic will do what it was intended to excel at: filling in the gaps.

On the other hand, we were impressed by the great database of station data made available by ID logic. Readers with Internet access who have an interest in such data might want to browse the home page of PRS Corporation, the company responsible for ID Logic. The URL is:
http://www.hk.net/prs

The one big drawback of the ID Logic receiver is that the data is static—unless you manually edit it. The Radio Rock-It software is supposed to combine the benefits of ID Logic with the automatic updating made possible by RBDS. Perhaps by the time you read this, ADS will have worked out the problems with the software supplied with the tuner. We hope so.

We were impressed enough with the ADS Radio Rock-It package to consider it worthy of coverage despite its numerous bugs. Although the package was apparently rushed to market without adequate testing, we know that the company is hard at work trying to get things patched up. However, if we bought the unit (an evaluation sample was provided to us) we would definitely have sent it back for a refund. If you buy Radio Rock-It, make sure that you have that option. ■

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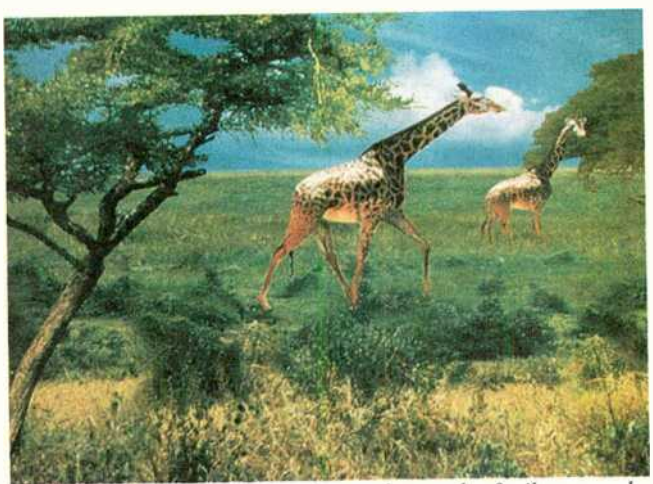
MULTIMEDIA WATCH

By Marc Spiwak

A Game With A Mission

One of the nice things about multimedia is that it can take you away from your office, away from your PC, and off to distant places. It does that through realistic animation, sound effects, and more. It's true that video games in general have always tried to simulate different experiences. For example, flight simulators have allowed game players to "take flight" for years. And driving games have turned plenty of kids into skilled race-car drivers well before they could ever drive a real car. Outer space isn't even off limits to PC users.



ECO East Africa transports players thousands of miles around the world to preserve wildlife on the brink of destruction.

Shoot-em-up games have been around since the advent of arcades. Those games let someone handle a "weapon" without putting themselves or anyone else in danger. Also, if you should end up getting "killed" instead of the creature you were shooting at, it's not such a big deal and you get to try again.

Shooting games have come a long way from the old hit-the-clown-in-the-face-with-water setups. Today games such as Doom and other similar titles put the player in the center of the action with excellent (or, depending on your point of view, disgusting!) graphics and realistic killing noises. Those games simply could not be without the power of today's PCs; you need a fairly powerful CPU to run the games at optimum speed.

Games don't have to be high-tech to be fun. The old Pong game certainly was entertaining for its time, even though there were no fancy graphics. And action games hold their own as long as they deliver fast action. You don't need ultra-realistic graphics in a fast-moving game because the action distracts the player's attention from the screen details. Driving games can be fun as long as there's a fast-moving black line to follow and some screeching noises here and there.

ANOTHER LAND

While action games can be fun without fancy graphics, a game that purports to take one to another land had better do a good job of simulating that land, especially if fast-moving screen action is not a priority. What's interesting is that a game intended to immerse a player in real-time video or animation requires a lot more computing horsepower than does a game with high-speed action and low-resolution graphics.

Take, for example, *ECO East Africa* from IVI Publishing. That game transports players thousands of miles around the world to East Africa, where the mission is to preserve wildlife on the brink of destruction. While the game does not require what would today be considered a state-of-the-art machine, it does require a minimum of a 486/25 or better, 4 megabytes of RAM, and 256-color VGA graphics.

ECO East Africa is an environmental-simulation CD-ROM that produces realistic images of East Africa. Players experience how beautiful and fragile life can be in a wildlife preserve. The game starts with the player arriving in a fictional game park called Ethemba, which is modeled after the Serengetti in East Africa.

Players can choose the tourist mode where they can simply view Ethemba's beautiful grasslands, mountain ranges, animals, and more, and see how changing seasons and food supplies affect the wildlife. Someone who wants to do more for the wildlife can choose to play in the game-warden mode, where they must actively manage the park.

The game warden has important decisions to make, and his own back to watch as well. One imme-

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diately learns that the previous warden was killed by poachers who have also dangerously depleted the animal population. With limited financial resources, the warden must hire park personnel; make improvements; and purchase food, weapons, and other necessities. Changing seasons bring poachers, government interference, and unpredictable weather. Those factors make it difficult to balance Ethemba's delicate ecosystem.

The warden is given an 8-page journal, in which travel, budget, staff, supplies, park improvements, and population must be documented. A running count of animals and tourists is also kept in the journal. The warden makes decisions based on information from newspapers, radio transmissions, letters, and the previous warden's diary.

The game combines elements of photography and hand-drawn animation to create 12 species of animals and their habitats. Also seen are lightning storms, sunsets, star-filled nights, and sunrises. Authentic African music featuring the Nigerian Talking Drum Ensemble completes the picture of East Africa.

The more money the warden can raise by increasing global awareness of Ethemba, the easier it is to contain poachers, build improvements, and keep everyone happy. But funds can dry up quickly. The warden is doing a good job when animals start to appear in the park. Even if animals do return, however, poachers can come in and ruin your day and the park. The warden's job is not an easy one.

ECO East Africa has a street price of about $45. That's a lot less than what a real safari trip through Africa costs. If you'd like to see East Africa, and maybe even try your hand at saving the wildlife there, then I urge you to visit ECO East Africa today.

Enjoy a game of golf almost anywhere in the world with one of Access Software's ultra-realistic, computer golf-simulation games.

LET'S PLAY GOLF

Speaking of travel, let's go off somewhere and play golf. The question is, where would you like to play? Access Software is big into golf-simulation games with its *Links 386 CD* game in particular. Links does an excellent job of simulating the golfing experience by letting players play on two different courses: Harbour Town Golf Links on Hilton Head Island, South Carolina, and Banff Springs Resort Course in Alberta, Canada. It's almost as though you were watching golf on television, except that you're the guy swinging the club.

Links 386 CD features a digital sound track that includes music and commentary. The talents of comedian Bobcat Goldthwait are heard as your personal golf caddie; there are two soundtracks to choose from depending on how much ridicule you can stand—or deserve.

The best thing about the CD-ROM version of the game, though, is the simulated aerial fly-by's of each course. The fly-by's are each over 200 megabytes in size, so they only fit on the CD. Fly-by's are at an altitude of about 50 feet and give "helicopter views" of the courses. All for only $49.95.

Another nice thing about the Links line of computer golf games is that you can buy new courses to play on when you get tired of Harbour Town Golf Links and Banff Springs Resort Course or just want to try some fresh ground. The add-on courses are being released on CD-ROM now, and each CD includes a fly-by of the course. *Devil's Island Fantasy Course* rises from crystal blue waters in the middle of the Bermuda Triangle. It's a tough course but the scenery makes it all worthwhile. *Prairie Dunes Country Club* duplicates the actual course in Hutchinson, Kansas, which is ranked among the top 20 golf courses in America. The add-on courses are $29.95 each.

NEW STUFF

Let's continue on our topic of sports as we check out this month's line-up of the new and interesting. Baseball fans will want to check out Stormfront Studios' *Tony La Russa Baseball 3* on CD-ROM. The disc integrates high-resolution graphics, 3D models, photographs, digitized speech, music, video, and, of course, baseball. The game features TV-style graphics and accurate representations of all 28 major-league stadiums, which have been rendered from 3D models. With digitized play-by-play commentary, this is very close to real baseball, and you'll never get rained out. Tony La Russa Baseball 3 is priced at $59.95.

Geared toward children

(Continued on page 90)

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Access Sof-ware
4910 W. Amelia Earhart Drive
Salt Lake City, UT 84116
CIRCLE 60 ON FREE INFORMATION CARD

Edmark Corporation
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PO Box 3218
Redmond, WA 98073
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IVI Publishing
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Minneapolis, MN 55344
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Microsoft Corporation
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CIRCLE 64 ON FREE INFORMATION CARD

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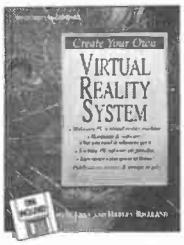

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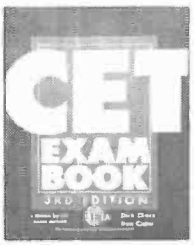

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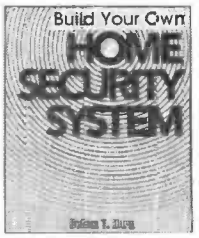

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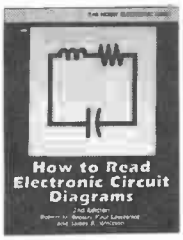

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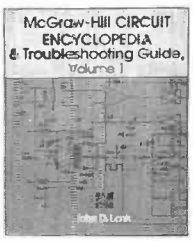

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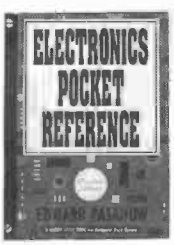

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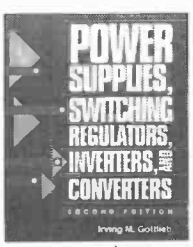

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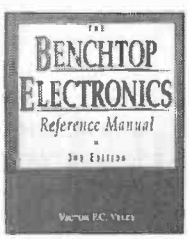

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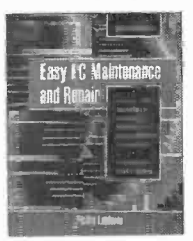

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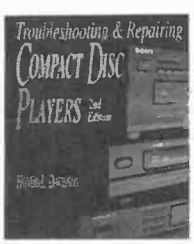

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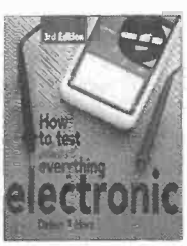

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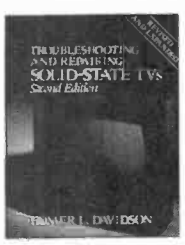

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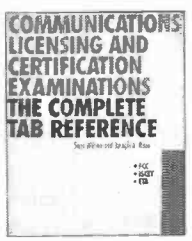

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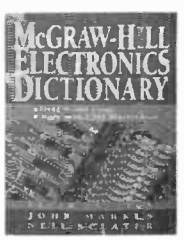

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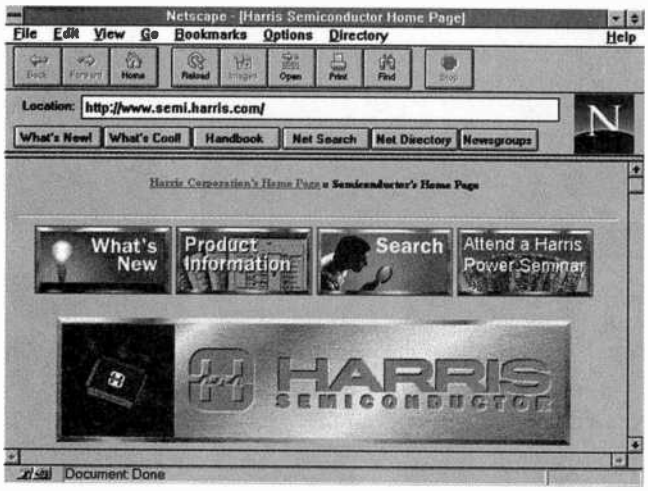
NET WATCH

By Dan Karagiannis

A World of Information

Welcome to a new monthly column! From this issue on, **Popular Electronics** will be bringing you information on some of the hottest sites (both electronics-related and general-interest) on the Internet, and what the best ways to get to them are. If you're connected to the "Net" and have access to the World-Wide Web, get ready for some fun. If you're not online yet, what are you waiting for? (Check out the "Investigating the Internet" article, found elsewhere in this issue, if you need some tips on getting onto the Net.)



The Search feature of the Harris Semiconductor home page lets you find data sheets for that elusive part you've been looking for.

But what is the Internet? We've all been hearing more and more about it lately. Within the past year, a (literally) virtual revolution has swept the globe. Each day, more and more computer users are entering the world of cyberspace to find and exchange information on a variety of topics ranging from astrology to zoology. The Net is the medium for that transfer.

Now, what few people know is that even though the Net has been hyped in the press only recently, it actually has been around for quite a while. It all started in the late 1960s as a government networking experiment to link together military and university computers. The tiny network that resulted in 1972 was called ARPAnet, and consisted of approximately 50 computers when it was functional. (For a closer look at the history of the Internet, see the "Investigating the Internet" article.)

Several developmental steps later, the Internet has become a network of networks, connecting millions of computers/servers, with about 30-million users logging in around the world through providers. But what are all those machines and their users accomplishing when connected to the Internet?

Perhaps a better question would be "what *aren't* they accomplishing?" The Internet grows in leaps and bounds each day, and more and more types of transactions are being performed there. People shop, do research, play games, and even meet each other on the Net.

So, as you might imagine, as a result of the world being brought together online, there's bound to be something of interest for everyone on the Net, including hobbyists. Let's get to some of those goodies.

ELECTRONICS SITES

One of the greatest things about the Internet is all the free stuff you can download. This month, we'll take a look at a couple of places on the Web where electronics enthusiasts can find both useful software and data.

Note: Those who wish to visit the Web sites described in this column each month can look at the "Hot Links" box for URL (Uniform Resource Locator) addresses. Just enter the URL of a site you'd like to visit in the URL command line in your Web browser and you're on your way.

First up is Ivex Design International's Web site; Ivex is the company that manufactures the popular WinBoard PCB Layout and WinDraft Schematic Capture software. The Ivex site was created to give its customers a way to access information about new products and software revisions (including bug fixes), but best of all, it also provides an FTP (File Transfer Protocol) link for downloading shareware versions of the programs just mentioned. Those are fully functional versions with a 100 pin/pad limitation. (Unlimited versions of the software are available for a registration fee; more information on registration is available at the site as well.)

What I also liked about the Ivex site was the fact that they provide links to some of their competitor's Web sites. Even though there were only a couple of other links at the time of this writing, Ivex claims that they will add any that they are made aware of. That way, cybernauts can see what electronics-design software

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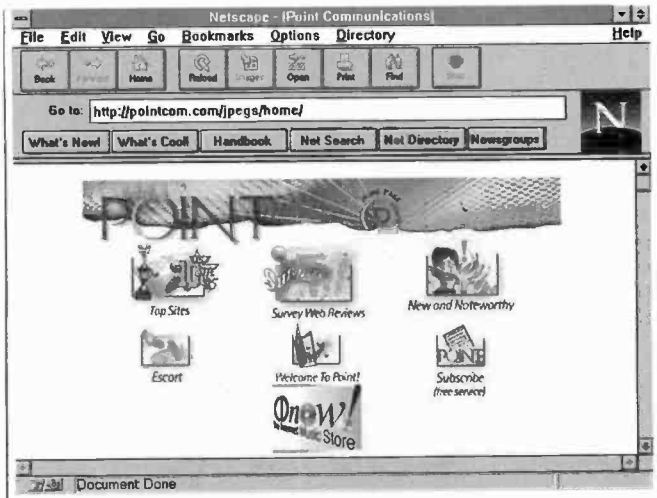


Point Communications has found a way to make surfing the Net easy for the beginner. Read some reviews of sites or let them take you by the hand on a tour of the Web.

they like for themselves, without having to spend time searching for other vendors.

If you want another place to go for software links, try the Electronic Design Software page. You can download such programs as PADS Logic and PADS PCB, as well as link to other sites for math software. Let's face it, no hobbyist likes doing electronics math!

So, let's say you want to use the software just mentioned to design a project. In keeping with the spirit of electronic design, flipping through piles of paper data books to find information on a particular semiconductor is simply not acceptable. Wouldn't it be much easier to be able to enter a part number and get a manufacturer's data sheet on your computer's screen?

Now you can, without using expensive CD-ROMs that must be updated (for even more money) at least once a year. Just visit the Harris Semiconductor site on the Web. It has the best search engine that I've found so far for ICs and other semiconductors.

The Harris Semiconductor Search feature works like this: Just enter a part number, like "4093," and you'll be presented with information on which Harris part matches up. You'll also be presented with a link to a downloadable Adobe Acrobat file of the actual data sheets from the Harris book containing the part. Information on all parts might not be available, but you should be able to solve most design problems with the information you find here.

Speaking of problems, if you don't have Acrobat you obviously can't view the data sheets. Well, no need to worry, you can download a shareware version using a link at that site as well.

Once you have selected a part according to its description on your computer screen, you'll most likely want to buy the actual unit itself. The Harris page makes that easy, too. Just click on the Contact Us button on the screen and you'll be presented with a few options for getting in touch with the company (including, of course, e-mail).

Just be warned, you might find yourself spending some time at that site. There really is a lot of useful information there to aid in electronic design, including a Design Support link that lets you access application notes, tech briefs, design software, and even a lexicon or compendium of electronics-related terms and their definitions.

HOT SITES

First up in our coverage of non-electronics oriented sites is the Point Communications page. Actually, it's a site that helps you find other sites. By logging on, you can see what the most popular Web pages are, read reviews of them, and even read what their Point Survey ratings are on a scale of 0 to 50 (those ratings are compiled from surveys that you can participate in).

According to Point Communications, "a score of 50 would indicate perfection, but it's really only a theoretical score; we don't expect anyone to score 50 unless God Himself starts up a Web site. And He's probably having trouble getting phone lines installed."

The 0 to 50 scale applies to three areas: The first is Content—"just how broad, deep, and thorough is the information?" Does it have good links and clips? Is the information accurate and complete?

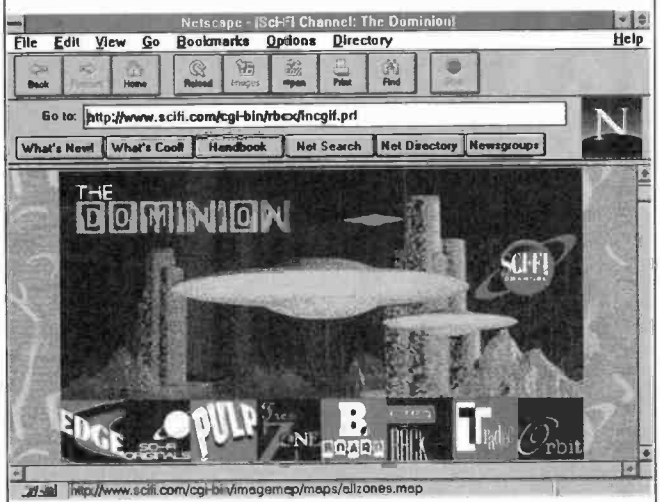
The second factor is Presentation. Is the page attractive, colorful, and easy to use? "Does it lead visitors through the information nicely? Does it use multiple media? Is it unique?"

Finally, pages are rated on Experience. In fact, this is what Point considers to be its key rating. Is the page fun? Is it worth the time spent on line? "All things considered, does the site deliver the goods?"

Also, if you enter the Point Escort home area, you can take a guided tour of the Web, from one great site to another. And if you stray too far away, there is a "safety line" that will allow you to quickly get back to Point's home page. "Newbies," or those new to the Internet, should definitely visit this site to get a feel for Web surfing. There's also information and downloadable software that can help you develop your own Web page.

Now, let's look at something a bit different. For fans of science fiction, fantasy, and horror, the Dominion,

(Continued on page 89)



The Sci-Fi Channel's Dominion site will link you to a world of information dealing with almost every techie's favorite type of fiction.

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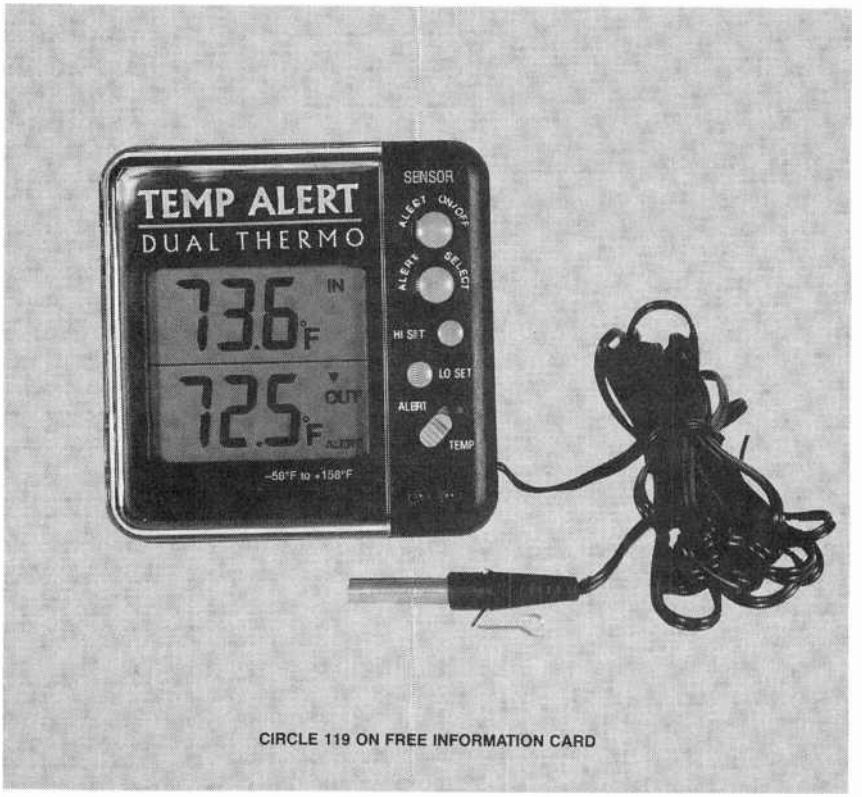
A Hands-on Electronics® REPORT

Extech Indoor/ Outdoor Temperature Alarm



CIRCLE 119 ON FREE INFORMATION CARD

It warns you when the temperature is not just right.

After the time and date, the one thing everyone always wants to know is the temperature. But taking temperature readings one step further, wouldn't it be great if an alarm could sound when the temperature is not exactly where you would like it to be?

That's exactly what Extech's *Model 401012* indoor/outdoor temperature alarm does. It's a solid-state, dual-display thermometer with a programmable alarm that can work in four modes. The device costs only $19.

The unit has a built-in indoor temperature sensor, and another sensor on a 10-foot cable that can be placed outdoors or wherever else you need to know the temperature. A large 1.5-inch LCD normally displays the two temperatures, which can range from −58 to +158 degrees Fahrenheit (Extech also offers a unit that displays temperature in degrees Celsius). The unit is powered from a single "AAA" battery, supplied, that can last up to two years depending on how often the alarm is used. The correct temperature is factory calibrated.

The indoor/outdoor thermometer measures only about 3 by 3 inches, and is only slightly thicker than the "AAA" battery that powers it. A snap-down stand on the back of the unit allows it to rest at a comfortable viewing angle on any flat surface. Also included is a mounting plate that has double-sided tape already attached to it and holes for two screws. The plate can be mounted permanently on any vertical surface with the tape or screws. You can then either hang the thermometer on the plate or take it with you wherever you go.

Temperature Alert. Four buttons and one switch located out on the right side of the unit are used to set the temperature alarm. The alarm works for the outdoor sensor only. That probe's 10-foot cable should be long enough for most applications, but readers of this magazine should have no trouble lengthening the two-conductor cable, if necessary (just make sure the splice is made waterproof).

The switch sets the unit into the program mode. An ALERT SELECT pushbutton scrolls through four alarm modes. Any alarm point can be set anywhere within the thermometer's full range (−58 to +158 degrees F). Two of the alarm modes have one-point settings. The "High-Temp Alert" mode sounds an alarm and flashes two LEDs for five seconds every minute if the temperature of the outdoor probe rises above a preset temperature. The "Low-Temp Alert" mode sounds the alarm when the temperature falls below a user-set point.

The other two alarm modes have two-point settings. The "Inside-Temp Alert" mode sounds the alarm when the temperature falls within any two temperature points set by the user. The "Outside-Temp Alert" mode sounds the alarm when the temperature falls outside a two-point range. The unit retains the most recently entered settings whenever it is turned off.

Good For A Project. Readers often call and write asking us how to turn some device on and off according to temperature. The indoor/outdoor temperature alarm is a good starting point for those projects. And at a price of only $19, you won't be afraid to

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experiment with it or worry about voiding its warranty.

Although the unit does not have any kind of output jack to control external devices, it does open up quite easily by removing only four screws. Inside, a piezoelectric disc buzzer is connected to a small PC board with wire leads. The transistors that drive the transducer are also easily accessible. It would be very easy to connect another circuit to the alarm output.

It would be up to the builder to devise a circuit that could convert the 5-second series of pulses that drive the thermometer's buzzer into a signal that could activate a relay or solid-state driver. The relay could power some other device, the most logical being heating, cooling, or ventilation equipment. In effect, the thermometer could be used as a thermostat. We know that this is easy work for a lot of our readers. Those kinds of applications came to mind when we learned of this device.

Those applications aside, the inexpensive digital thermometer is a neat gadget to have on hand. The outdoor-probe lead is thin enough to allow a window to close over it for a quick and permanent enough installation. However it is a good idea to protect the probe lead with some kind of sleeving or tape if that's how it will be installed.

The thermometer's most basic use will be to satisfy general curiosity about temperature and weather conditions. But other concerns might be in a baby's room, where you would certainly want to know when the temperature is not between, say, 65 and 75 degrees. Or perhaps you're concerned about the temperature in your attic, where you would like to turn an exhaust fan on when the temperature exceeds 120 degrees.

In a crawl space one might be concerned about pipes freezing. Many people have to heat crawl spaces to prevent that. The heat is a small price to pay to not have to deal with frozen pipes, but why heat the pipes unless it's necessary. The temperature alarm can indicate when it's time to turn on the heat.

A greenhouse is another place where temperature is critical. If you have an outdoor greenhouse, the unit provides an easy way to monitor its temperature. You don't even have to monitor it when you can be warned that the temperature is not right.

Perhaps there's a classic car in your garage that you don't want to expose to temperatures below 50 degrees. On camping trips you might want to be warned when the temperature in the tent falls below 30 degrees. As you can see, possible applications for the device are almost limitless.

We're sure that a lot of people will find the indoor/outdoor temperature alarm to be useful. And at a price of only $19, it's a good thing to buy now and keep around for when you really need it. It also might make a great starting point for that next big project.

For more information on the Extech Model 401012 indoor/outdoor temperature alarm, contact the manufacturer directly at the address given in the box below, or circle no. 119 on the Free Information Card. ■

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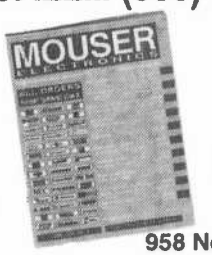

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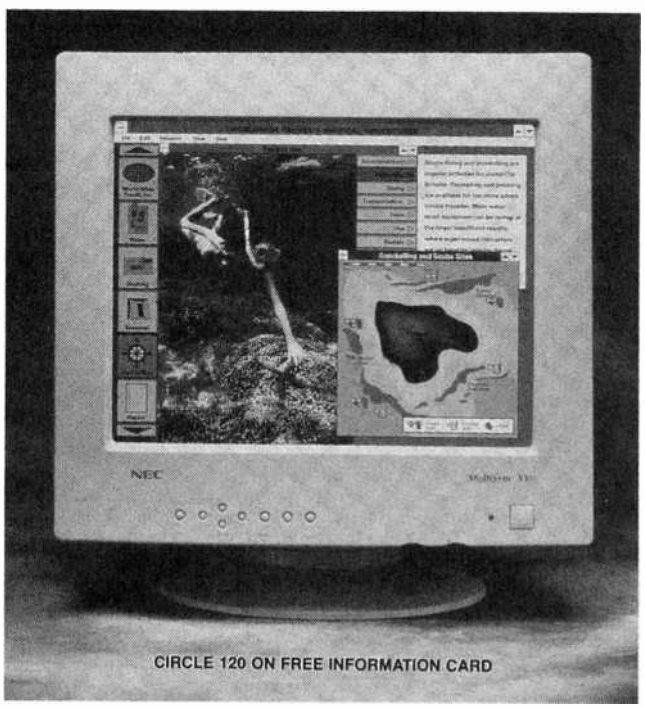
PRODUCT TEST REPORTS

By Stephen A. Booth

NEC MultiSync XV17 Computer Monitor

Though it is well-known for its desktop and portable computers, *NEC Technologies* doesn't nearly have the brand-recognition of Panasonic, Sony, Thomson, Zenith, or other names in the video-display business. That's despite the fact that NEC has been building broadcast and data-grade monitors for quite a long time. The company tried to parlay that expertise to gain entry into the U.S. consumer market a decade ago, and briefly marketed high-end video gear here before limiting its offerings to PC monitors. Judging by the *MultiSync XV17*, it's a shame NEC doesn't sell TVs in the U.S. anymore.



NEC Technologies' MultiSync XV17 17-inch computer monitor.

You might get caught up in the specmanship and jargon of multimedia computers, but no matter what's under the hood, the component you'll confront day in and day out is the display monitor. A high-quality display won't necessarily increase your satisfaction with the PC—at least not consciously. But a poor monitor will surely detract from the experience, even if subconsciously.

Many computers come with a monitor of the same brand, usually a 14- or 15-inch model, but you almost always have the option to buy a monitor of your choosing. One popular option is to step up to a larger unit.

One impetus in the move to larger displays is the sophisticated imagery of multimedia software, for reference works or blast-em-up games. Other inducements include the availability of full-motion video via MPEG cards and CDs, tuner-boards for broadcast and cable TV, and desktop video applications. Desktop is a key word here: a 17-inch monitor still fits manageably, and its display area isn't overwhelming at arms' length from the keyboard, mouse, or game controller.

If you're thinking of upgrading your PC's current display, or if you're shopping for a whole new setup, you ought to take more than a peek at the 17-inch MultiSync XV17. It'll work with PC-compatibles or Apple Macintosh computers. Setup and operation's easy, thanks to some very thoughtful features including on-screen menus (you can put away the owner's manual). Performance-wise, the MultiSync XV17 was on the money in APEL's bench tests (more on that in a moment). While at $799 it is far from inexpensive, it's in the ballpark with 17-inchers from other brands.

On that note, we strongly recommend you spend an extra $49 on the optional MultiSync Monitor Lens. That snap-in screen enhances contrast while further reducing reflected glare—an important consideration if you'll spend long hours at the PC.

The accessory lens also makes the MultiSync XV17 compliant with Sweden's strict TCO '92 guidelines for magnetic field, alternating electric-field, and electrostatic emissions. Out of the box, the monitor already conforms to Sweden's tough SWEDAC specs (formerly called MPR II). Speaking of specs, it meets U.S. Environmental Protection Agency "Energy Star" requirements by consuming fewer than 30 watts in its power-down mode. That is automatic when connected to an Energy Star-compliant PC (or a video card) that incorporates the Display Power Management System approved by the Video Electronics Standard Association (VESA).

FEATURES

Probably the first thing

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you'll notice about the MultiSync XV17 is the virtual flatness of its CRT. What little curvature there is to the glass is mostly in the vertical plane, from top to bottom.

That pays off in the excellent test-measurements for geometric distortion—and it's what you pay for in a computer monitor. (You could spend as much on a 27-inch or larger TV, but you'd accept the fishbowl curvature in a TV display). Behind the scenes there's an Invar shadow mask, and the dot-pitch (or spacing) of the phosphors is just 0.28mm. The Invar alloy keeps heat-induced warpage to a minimum when the mask's bombarded by the electron guns. That, in turn, keeps colors true, especially at the corners of the display. You'd expect tight 0.28mm dot-pitch in a good 14- or 15-inch monitor (0.39mm in a cheaper unit), but it's exceptional in a larger CRT (0.31mm would have been good).

Once you turn on the power, color is the next thing you'll notice about the MultiSync XV17—or, more accurately, colors. The monitor offers five settings for color temperature. Those are preset at the factory but could be customized and stored in memory with NEC's AccuColor controls, available through the On Screen Manager (OSM) menu. The factory settings can be restored at any time.

As opposed to brightness and contrast (there are separate, recessed knobs for those) color temperature has to do with tint, or hue. In a camcorder, it would be called White Balance. It's measured in degrees Kelvin, and the MultiSync's presets range from 3900 through 9300 degrees.

Incidentally, contrary to what you might expect, the lower the temperature the "warmer" the image—that is, the more it tends to the red scale of the spectrum. Higher readings induce a cooler look, with more blue in the mix. In color video displays, the most neutral setting (yielding ideally-pure white) occurs at 6500 Kelvin. That is the NTSC standard for color TVs (5400 Kelvin for black-and-white), though it's seldom encountered right out of the box in home TVs. To compete on brightly lit showroom floors (and because few consumers view TV in cinema-like darkness) manufacturers pump up the color temperature.

With the MultiSync, at least, you'll have a choice. The third factory preset (6500 Kelvin) is almost perfect NTSC color, so you might want to retain it if you'll watch TV or video on the monitor. As with the other presets it was determined by consumer focus-groups, but the presets are all yours to change.

You might be wondering why you would want to bother? Well, for one thing, you might want to vary color balances according to software, ambient lighting, or even the time of day. More important, perhaps, would be to match on-screen color to the capabilities of a color printer—either your own, or that of a printing service you might use. To that end, NEC offers the Colorific software package ($49) for critical calibration between the monitor and specific printers.

Adjustments are made through the monitor's AccuColor Controls, accessed from the OSM. That on-screen window has cursor-controlled color bars to let you manipulate red, green, and blue separately. As you do so, you'll see the change in color balance in the background. You can't enter a new temperature numerically, nor will the OSM tell you the temperature of your revised color-balance in degrees. In place of the Preset temperature, it simply reads "Custom."

Besides color, the MultiSync's OSM lets you control virtually every aspect of the display's operation, including position, size, geometry, resolution, the location of the OSM (it's centered in the factory default), and the language it speaks (the menu is in English from the factory, but French, German, Italian, Spanish, and Swedish are selectable).

Finally, although APEL found set-up easy, the monitor supports the Plug and Play protocols of Microsoft's new Windows '95 operating system for automatic configuration.

TEST RESULTS

The MultiSync XV17 underwent electrical testing and visual exams at the Advanced Product Evaluation Laboratory (APEL), an independent testing facility located in Bethel, Connecticut. The electrical measurements for geometric distortion and color appear in the accompanying chart, and indicate that the monitor is as good as they come. After viewing computer-generated images and patterns, three different pairs of eyes agree. But all concur that unless you intend to use the monitor when shaving, the optional lens-screen is a must to reduce reflections and glare. For the record,

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the test results published here were derived at the 1024 × 768 resolution mode—but performance was similar at the 640 × 480 and 800 × 600 modes.

Regarding color temperature, the stated values of NEC's factory presets are almost exact. At 6635-degrees Kelvin, Preset 3 is so close to the NTSC color TV standard (6500-degrees Kelvin) that you ought to use it for any video applications—it's the closest most people will ever get to seeing TV like it is intended.

Among the screen-distortion measurements, it's worth noting that APEL measured the visible display image at 15.2 inches, diagonally. The total diagonal of the glass picture-tube is 17 inches—and that is the measurement that NEC and all other brands use in advertising (for example, so-called 14-inch monitors typically deliver an image that's just under 13 inches). There's legislation afoot to force monitor makers to state the actual image size of their CRTs—just as TV marketers must do. For the record, product literature for the MultiSync XV17 does cite the visible display as 15.2 inches.

Aspect ratio is another bit of TV jargon, referring to the width-to-height ratio of the display area. It's commonly expressed as 4:3 (1.33:1). The factory-preset 1.34-to-1 here is close enough, and can be adjusted through the OSM menu.

"Have you seen the Wok?"

Like any of the other screen-distortion measurements, the squareness error is negligible. That represents deviations from perfection—in this case, perfect 90-degree angles at each corner of the display.

Keystone, pincushion, and barrel distortion would look just like the objects they describe. Keystone distortion creates a parallelogram, wider either at the top or the base. Pincushioning gives the display the appearance of being pinched inward from the sides, while Barrel distortion makes the borders appear to bellow outwards.

With bow distortion, think of archery. Opposite borders of the display—top and bottom, or left and right sides—might appear concave and convex. Another way to look at it: One side seems pincushioned, its opposite barreled, but the remaining opposite sides are parallel.

Linearity error looks for any variation from straight lines on any side of a square—waviness, for example. It's a pretty exacting exam that puts a variety of square patterns across the screen, from large to minute, and looks for non-linearities in any size and at any point on the display.

TABLE 1—TEST RESULTS

Color Temperature Measurements	
Factory Presets	APEL Tests
9300 degrees Kelvin	9260 degrees Kelvin
7500 degrees Kelvin	7704 degrees Kelvin
6500 degrees Kelvin	6635 degrees Kelvin
5000 degrees Kelvin	5104 degrees Kelvin
3900 degrees Kelvin	3972 degrees Kelvin
Screen Distortion Measurements	
Display Image Height:	9.04 in.
Display Image Width:	12.10 in.
Display Image Diagonal:	15.20 in.
Aspect Ratio:	1.34
Aspect Ratio Error:	0.4%
Squareness Error:	0.5%
Horizontal Keystone Error:	–0.2%
Vertical Keystone Error:	–0.4%
Horizontal Pincushion Error:	0.4%
Vertical Barrel Error:	0.2%
Horizontal Bow Error:	0.7%
Vertical Bow Error:	–0.8%
Horizontal Linearity Error:	0.5%
Vertical Linearity Error:	0.9%
Screen Distortion Index:	0.5%

TABLE 2—FEATURES

Dot Pitch:	0.28mm
Scanning:	Non-interlaced
Refresh Rate:	Up to 100 Hz, depending on video card scanning frequency.
Resolutions Supported:	
VESA	640 x 480
VESA	800 x 600
VESA	1024 x 768
VESA	1280 x 1084
Mac	640 x 480
Mac	832 x 624
Mac	1024 x 768

- Color-temperature presets (5), user adjustable
- On-Screen Manager display- and color controls
- User-selectable language menus (6)
- Front, bezel-mounted controls
- Degauss button
- Tilt/Swivel base
- EPA Energy Star, Swedac (MPR II) compliant
- Microsoft Windows '95 Plug and Play Compatible

CONCLUSION

So, what's the result of all of those exacting tests? Simply put, the MultiSync XV17 was an outstanding performer. For example, its overall screen distortion index of just 0.5 percent is more like a high-fidelity audio spec than most video ratings.

As for the 24 visual, or subjective, exams performed on the MultiSync XV17, those are "pass/fail" tests—you either see a problem or you don't. The only truly objectionable artifacts we saw were ourselves, reflected in the monitor's faceplate under just about any ambient lighting condition. White or light-colored shirts, as one would typically wear in an office, also showed up far too well.

When you pay $800 or so for a monitor, you shouldn't get wash-out on your screen. We think NEC ought to throw in the optional glare-screen, but then that would simply be a big improvement over near-perfection!

For more information on the NEC MultiSync XV17 monitor, circle no. 120 on the Free Information Box, or contact the manufacturer directly at the address given in the "For More Information" box below. ■

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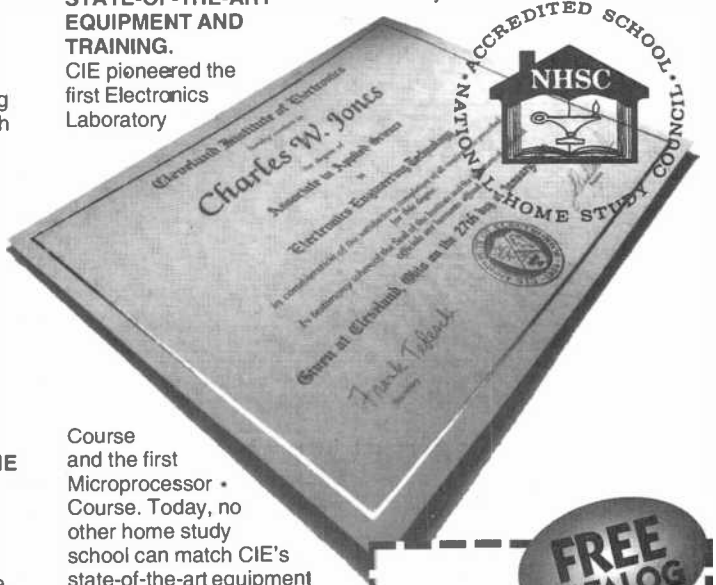

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This simple device down-converts signals in the 800- to 950-MHz band so that an ordinary scanner can "hear" them.

Build the Scanner Converter

BY MARC SPIWAK

Every day we are bombarded with communications signals on numerous different frequencies. And many people take advantage of those signals—some people use them to communicate with others, while other people simply listen to the signals as a form of entertainment.

The common scanner can receive many different frequencies, but some frequencies, specifically from 800 to 950 MHz, are out-of-reach for most scanners. Police, fire, and other services communicate within that band. Sometimes certain signals are out of a scanner's reach because of physical limitations of the electronics, and other times the signals are deliberately "blocked," or the scanner is programmed *not* to receive them. One reason for that could be that certain signals are not supposed to be accessible. For example, it is illegal to tap into cellular telephone transmissions which also happen to exist between 800 and 950 MHz.

The Scanner Converter presented in this article down-converts signals between 800 and 950 MHz by 400 MHz, so that ordinary scanners can receive them between 400 and 550 MHz. You can get all the parts needed to build the Converter as a kit (see the Parts List for supplier information), or you can build the circuit from scratch. We don't recommend the latter, however, and we'll say more about why later.

But no matter where you get the parts to build the circuit, the best thing about the Converter is that there are no calibration or alignment procedures whatsoever. Power it up and it should work.

Basic Theory. When signals approach 1 GHz (gigahertz, or one-billion hertz), special considerations must be taken into account in the design and construction of a circuit that will receive them. Fortunately for us, the most critical part of the Converter circuit is the PC board itself, and if the right parts are soldered onto it, it should then work properly right off the bat.

As shown in Fig. 1, the basic theory behind the Scanner Converter circuit is to mix input signals (A) with a 400-MHz local-oscillator frequency (B). The output of the mixer is then the sum (A + B) and difference (A – B) frequencies. With a 400-MHz local oscillator, the difference frequencies of signals between 800 and 950 MHz end up being between 400 and 550 MHz. That allows the frequencies to be received with just an ordinary scanner.

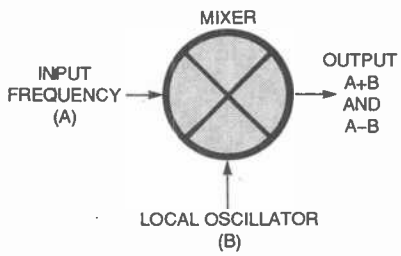

Fig. 1. The basic theory behind the Scanner Converter circuit is to mix incoming signals (A) with a 400-MHz local-oscillator frequency (B). The output is the sum (A + B) and difference (A – B) frequencies.

WARNING!

Please note that unauthorized wire and electronic communications interception and interception of oral communications is illegal under Federal and State Law. In addition Federal law renders illegal the intentional manufacturing, assembling, possessing or selling any electronic, mechanical or other device, knowing or having reason to know that the design of such device renders it primarily useful for the purpose of surreptitious interception of wire, oral or electronic communications. Federal law imposes both civil and criminal penalties for violations of the applicable statutes. Thus, the use of the Scanner Converter described in this article is intended for and should be restricted to educational, scientific and/or informational purposes. This is not intended to constitute legal advice and readers are advised to obtain independent advice as to the propriety of their use thereof based upon their individual circumstances and jurisdictions.

Circuit Description. Figure 2 is the schematic of the Converter. The circuit can be powered from any 9- to 12-volt DC source, including a good alkaline 9-volt battery. Switch S1 either puts the unit into its bypass mode, where a scanner connected to J3 will receive its normal signals, or it applies power to the circuit and down-converts all 800- to 950-MHz signals as follows:

At the heart of the circuit is OSC1, a 40-MHz oscillator module. Transistor Q1 amplifies the oscillator's output, which is then bandpass filtered four times so that only the tenth harmonic at 400 MHz is presented to the input of U1, a Mini Circuits MAR1 wideband UHF/VHF amplifier.

Signals from an antenna connected to J2 are high-pass filtered by capacitors C4–C7 in conjunction with inductors L2–L4. Those inductors are etched into the tracings on the PC board, making the exact PC board

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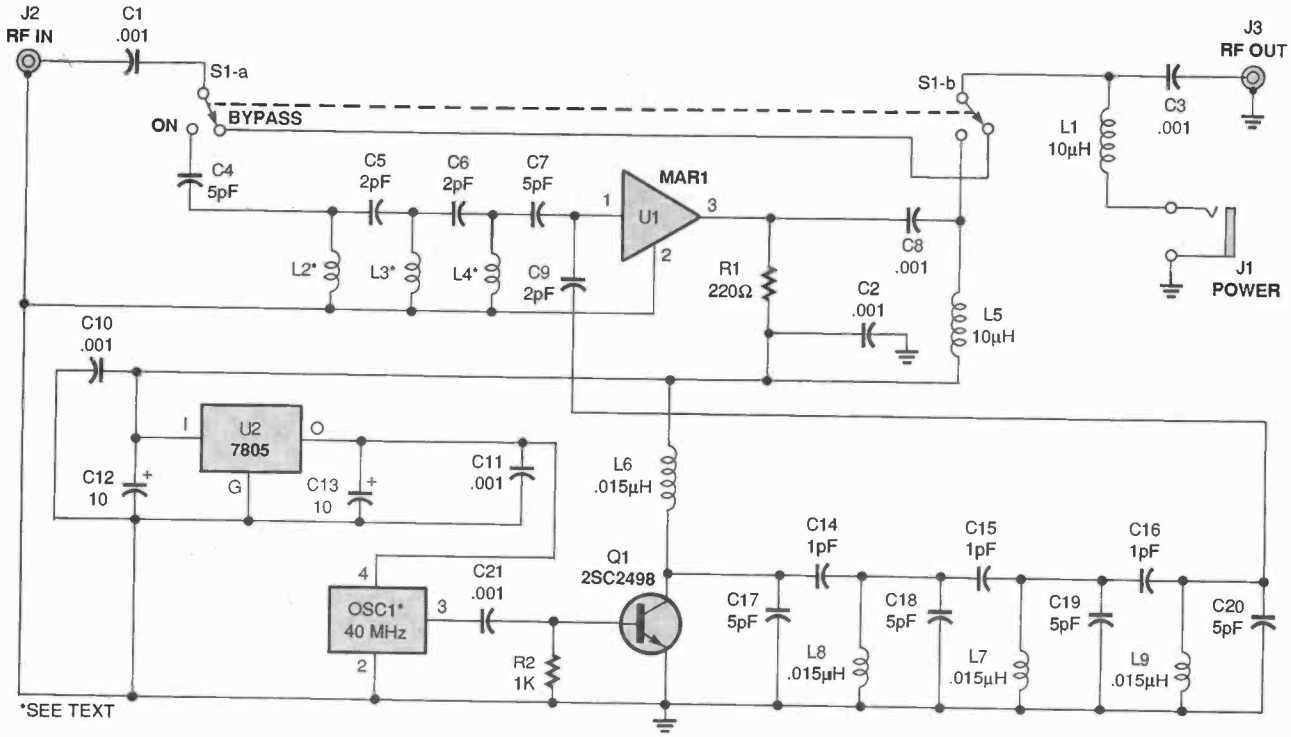

Fig. 2. At the heart of the Converter circuit is OSC1, a 40-MHz oscillator module. Only the 10th harmonic at 400 MHz is presented to the input of U1.

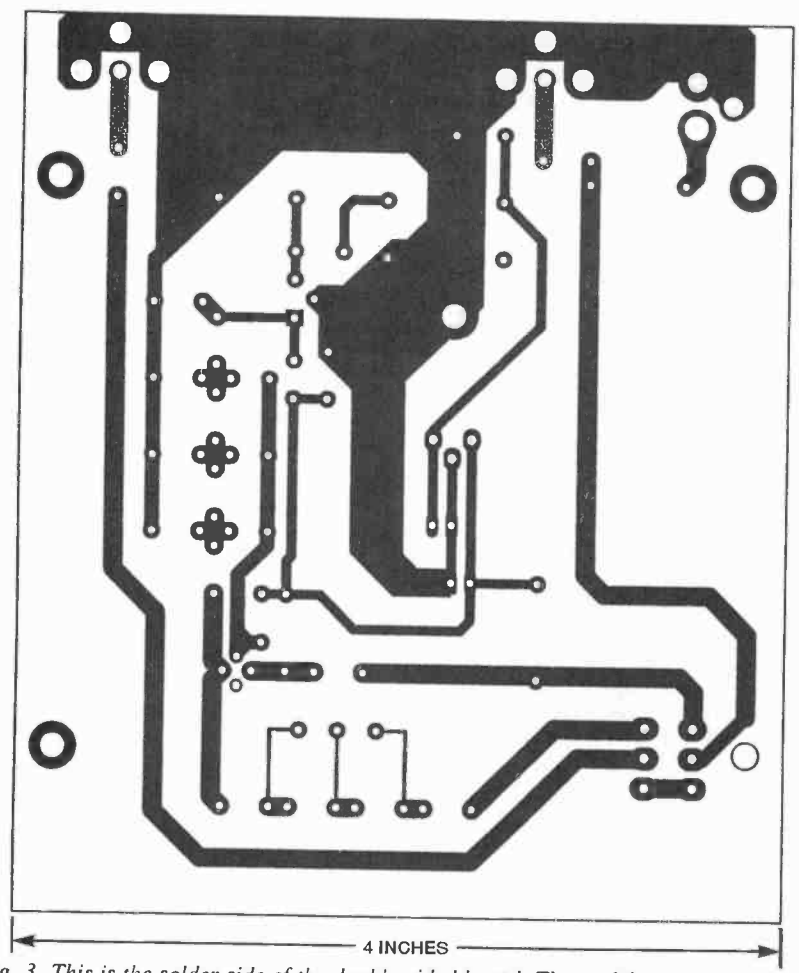

Fig. 3. This is the solder side of the double-sided board. Three of the components, L2–L4, are stripline parts that are etched into the board.

layout a necessary part in order for the circuit to function (in other words, as we will deal with later, the circuit cannot be wire wrapped). Mixer U1 amplifies and mixes the two inputs—signals between 800 and 950 MHz and the 400-MHz local oscillator—and passes the 400- to 550-MHz output to J3.

Construction. The main thing to consider when building this project is the PC board. In order to design a circuit to operate at such high frequencies, and require nothing in the way of alignment, certain components, namely inductors etched onto the PC board itself, must be of exact values. That is known as stripline construction, and it is the only suitable method for building this project. For that reason, the circuit cannot be made using point-to-point wiring or wire-wrapping.

If you are skilled at making your own PC boards, then you can probably make the double-sided one for this project as we have provided the foil pattern for the solder side of the board in Fig. 3 and the one for the component side in Fig. 4. The component side is plated and acts as a ground plane.

Note the size of the circular white areas in the Fig. 4 pattern. While some

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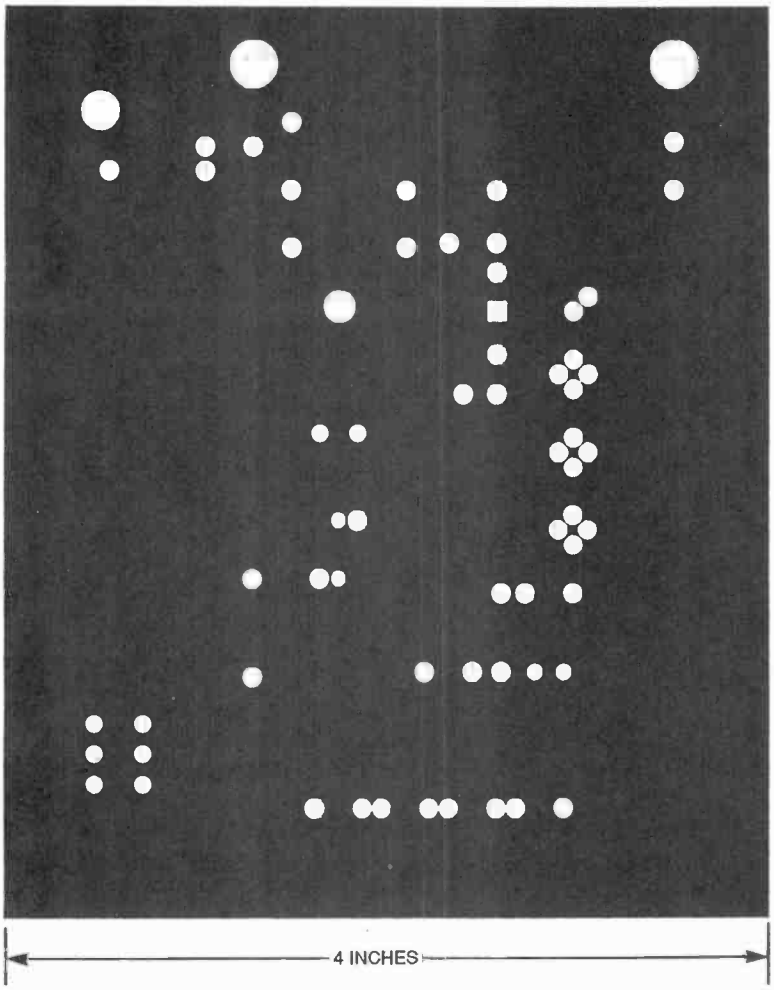
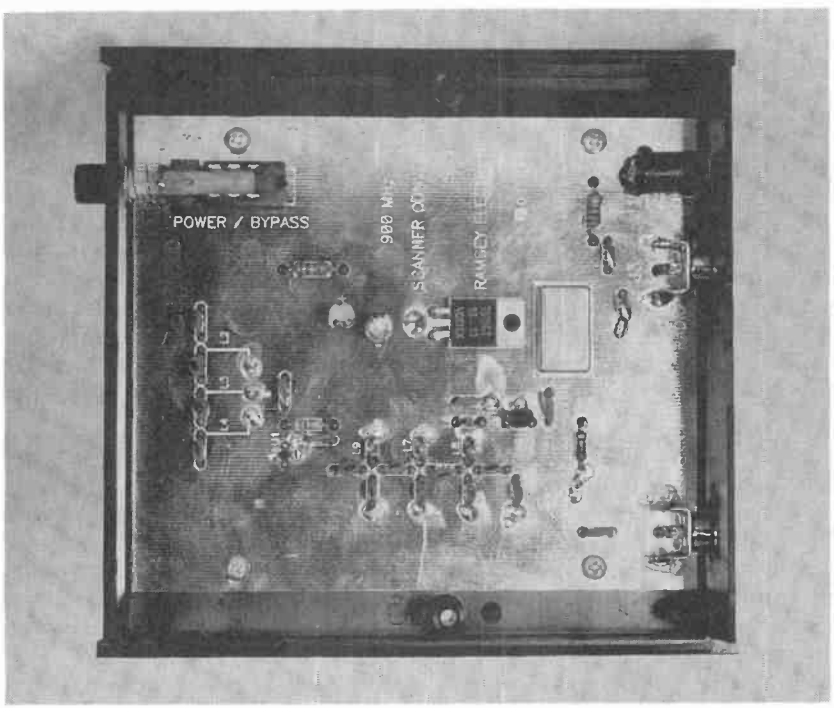


Fig. 4. Here's the component side of the board; it's really just a ground plane with circular etched areas.



Here's a view of the board showing that the entire top surface is a ground plane. The board also contains, on its other side, three stripline inductors, which makes the use of a PC board for this project mandatory.

PARTS LIST FOR THE SCANNER CONVERTER

SEMICONDUCTORS

U1—MAR1 wideband MMIC amplifier (Mini Circuits, see text)
U2—7805 5-volt regulator
Q1—2SC2498 NPN transistor

CAPACITORS

C1–C3, C8, C10, C11, C21—0.001-μF, ceramic-disc
C4, C7, C17–C20—5-pF, ceramic-disc
C5, C6, C9—2-pF, ceramic-disc
C12, C13—10-μF, 25-WVDC, electrolytic
C14–C16—1-pF, ceramic-disc

ADDITIONAL PARTS AND MATERIALS

R1—220-ohm, ¼-watt, 5% resistor
R2—1000-ohm, ¼-watt, 5% resistor
L1, L5—10-μH axial inductor
L2–L4—Stripline inductor, see text
L6–L9—0.015-μH (see text)
OSC1—40-MHz oscillator module (Digi-Key part number CTX-120-ND or equivalent)
J1—2.5-mm power jack
J2, J3—PC-mount RCA jack
S1—DPDT pushbutton switch
Printed-circuit materials, project enclosure, 9- to 12-volt DC supply, wire, solder, hardware, etc.

Note: The following items are available from Ramsey Electronics, Inc. (793 Canning Parkway, Victor, NY 14564, Tel. 716-924-4560): SCN-1 Scanner Converter kit—$49.95; matching case set—$14.95; assembled and tested SCN-1 with matching case—$89.95. Shipping and handling is $4.95. New York residents please add appropriate sales tax.

of the component leads must be soldered on both sides of the board, any lead that does not get soldered to both sides must not make contact with the top ground plane; the large white areas are what make that possible. Therefore, if you are making your own board, you will have to make sure that the holes you drill through the solder side fall into the center of the circular etched areas on the component side.

Leads that must be soldered on both sides of the board are indicated by an "X" in the parts-placement diagram shown in Fig. 5. Any leads not marked with an "X" in Fig. 5 must to be kept from touching the ground plane as just described. If making sure that

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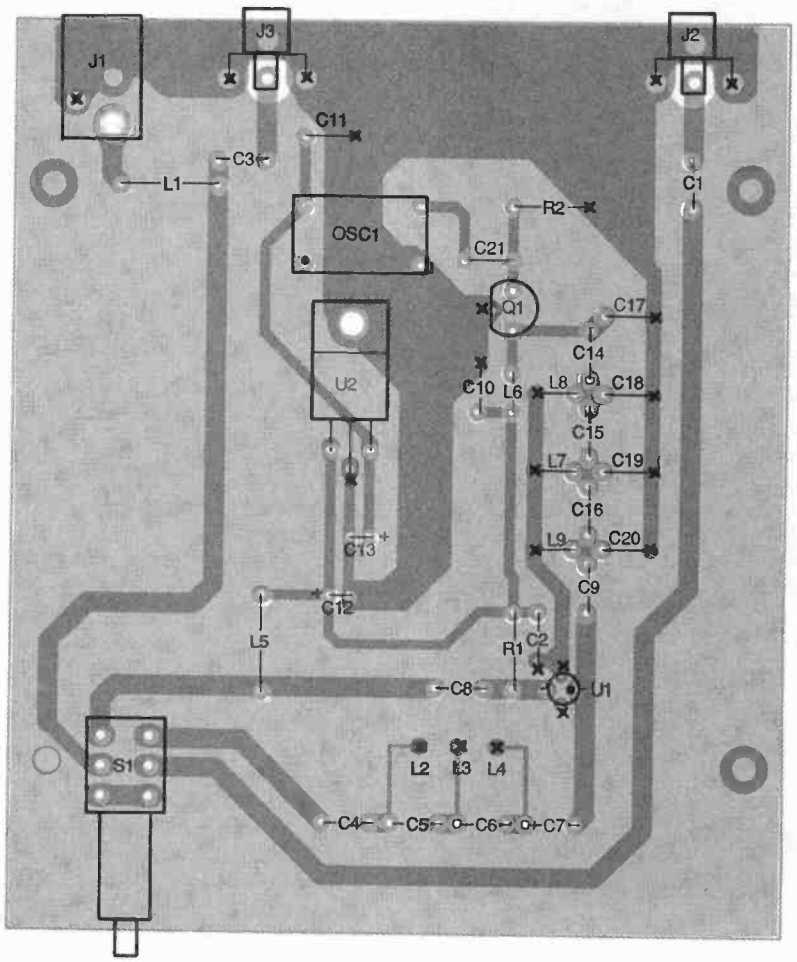

✖ = SOLDER ON BOTH SIDES, SEE TEXT

Fig. 5. Use this parts-placement diagram to make assembling the unit much easier. Leads that must be soldered on both sides of the board are marked with an "X." Note the three feedthroughs that go through the board at L2, L3, and L4; those are made from scrap component leads and are soldered on both sides of the board.

the holes are drilled that way sounds like more trouble than it's worth, and it might just be, then you might want to consider buying the kit described in the Parts List. It will definitely save you a lot of trouble and you are assured of having a good printed-circuit board to work with.

Once you have a board, begin by installing the capacitors and resistors. Be sure to double-check the orientation of all the polarized capacitors. Then install transistor Q1, making sure that component is oriented properly as well.

Oscillator OSC1 will have a dot on one corner, or a notch, or one corner that's more pointed (less rounded) than the other three, to indicate pin 1. Be sure to match that with the orientation in the parts-placement diagram. The 7805 voltage regulator, U2, must be mounted flat on the board as shown; bend its leads to fit the board before soldering.

You will have to install three feedthroughs at the ends of stripline inductors L2, L3, and L4, and solder them on both sides. Those feedthroughs connect the stripline inductors to the ground plane on the top side. You can use trimmed resistor leads to make your own feedthroughs.

The MAR1 amplifier, available from its manufacturer, Mini Circuits (P.O. Box 350166, Brooklyn, NY 11235-0003; Tel. 718-934-4500); other distributors; and as part of the kit described in the Parts List, is a tiny part with four leads. An even tinier dot indicates pin one; if you can't see the dot, use a magnifying glass—it's that small. Mount the part with pin 1 oriented as shown in Fig. 5 and with the dot visible on the top side and solder all four leads.

If you don't buy the kit, you will have to wind your own inductors for L6–L9. They are each made of 2 turns of 26-gauge enameled wire and should have a diameter of ⅛-inch each. Mount those and the other inductors on the board.

When all parts are installed, inspect the board for proper soldering, and also double-check that any leads that should be soldered on both sides of the board actually are. If you purchased the matching case for the Scanner Converter from the Supplier, or are using a similar enclosure, now is a good time to install the board in it. That will prevent the bottom traces from shorting against anything. Otherwise take precautions to prevent shorts during testing (*i.e.* don't let the board rest on a surface that is conductive).

Testing and Use. To test the board, make sure S1 is in the bypass position, and apply a 9- to 12-volt regulated DC supply to power jack J1 (the center pin of J1 is positive). Locate or make a shielded cable with an RCA plug on one end and a connector on the other end that matches the antenna input on your scanner. Connect the RCA end of that cable to J3 on the Converter, and the other end to the scanner's antenna input. Also connect an antenna to J2 on the Converter. If you don't have a suitable antenna, see the article elsewhere in this issue that shows you how to make one.

Turn on the Converter by pressing S1 and tune your scanner to receive any multiple of 40 MHz—40, 80, 120, etc. Background noise on the scanner should cease at those frequencies and the signal-strength meter on the scanner should show an increase. That is due to the scanner receiving the output of the Converter's oscillator or its harmonics.

Now tune your scanner to receive a signal between 400 and 550 MHz. As a result, you will actually tune in signals that are 400 MHz higher. For example, want to hear 800 MHz? Just tune in 400 MHz. Pressing S1 on the Converter should return the scanner to normal operation.

With your scanner converter complete, you are now ready to experience hours of listening pleasure. Enjoy your added reception! ■

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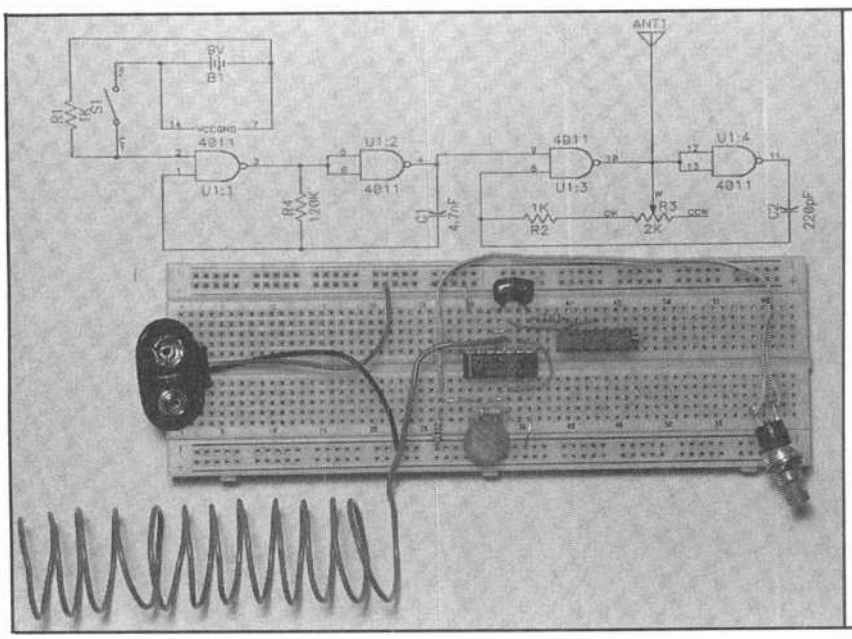

Build the Poor-Man's Transmitter

It's a simple, inexpensive transmitter that demonstrates the basic principles of amplitude modulation.

BY JAMES CICON

You are shipwrecked on a deserted tropical island. All you have are oranges (there are lots of them on a tropical island), and your Nintendo *Gameboy*. At first you think your situation is heaven, but then the batteries go dead in the Gameboy, and you start thinking that if you only had a phone, maybe you could get some pizza delivered. What to do?

Well, they didn't call you "kid McGyver" for nothing in high school, so you take out half a dozen oranges and make a battery. You then rip open your Gameboy and use the guts to make an emergency radio beacon. In no time at all, you are back at home telling every one about wrestling great-white sharks and battling with marauding cannibals.

Now, this article isn't going to tell you how to make batteries out of oranges (if you are *really* interested, see the article "Experiments in Galvanism" in the November 1991 issue of **Popular Electronics** for information on how to do that). Nor will it recommend that you take your Gameboy apart. But it is going to show you how to build a *Poor-Man's Transmitter* that makes for a great little radio beacon. Best of all, it can be built for just a few dollars.

The project is a simple AM transmitter that you can use to transmit tones into your AM or FM Radio, TV set, CB radio, police scanner, ham radio, or anything else that you happen to have lying around that picks up radio waves (later in the article, we'll get to why the AM transmissions can be picked up by so many different types of devices). To avoid annoying your neighbors, the range on the Transmitter as shown is just about enough to reach across an average-size room, provided no one is standing in the way.

AM-Transmitter Basics. The Poor-Man's Transmitter is basically a simple amplitude-modulated (AM) radio transmitter. The dictionary defines modulation as "an inflection of the tone or pitch of the voice" (to convey meaning). It also defines modulate: "to vary the amplitude, frequency, or phase of a carrier wave for the transmission of intelligence."

Amplitude modulation, as the name implies, changes the loudness or amplitude of a carrier to transmit intelligence. In order to build an AM transmitter, three things are needed: a carrier wave, another wave to modulate it, and some way of transferring an intelligent message into the system. The Poor-Man's Transmitter works by supplying all three of those.

Circuit Description. The schematic diagram for the Transmitter is shown in Fig. 1. Power for the circuit is supplied by B1, a 9-volt battery.

Two sections of a 4011 NAND gate, U1-c and U1-d, are used as part of a radio-frequency (RF) oscillator (carrier). The other two sections, U1-a and U1-b, are used in an audio frequency (AF) oscillator (modulator). Switch S1 enables and disables the modulation to allow the transfer of an intelligent message with the Transmitter.

When you press S1, the AF oscillator composed of U1-a, U1-b, R4, and C1 starts generating an audio signal (see Fig. 2). That signal gates the RF os-

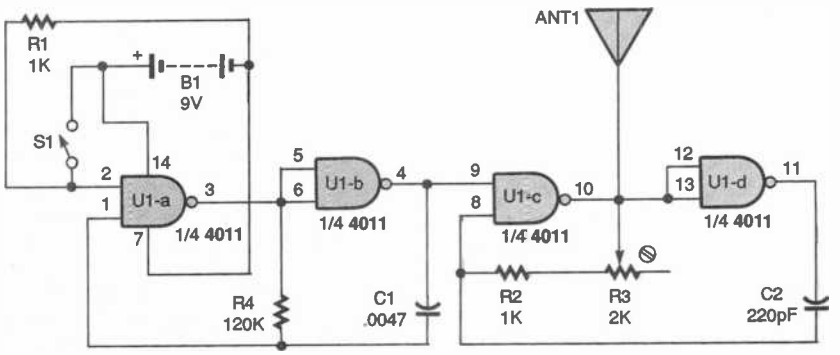

Fig. 1. This is the schematic for the Poor-Man's Transmitter. The circuit gets its name because of the extremely low parts count (and the low prices of those parts).

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cillator composed of U1-c, U1-d, R2, R3, and C2 on and off. When on, the RF oscillator runs at 1 MHz. The resulting output is sent out ANT1 as an AM signal (see Fig. 3). Note that except for R3, the AF and RF circuits are laid out exactly the same. The purpose of R3 is to tune the RF oscillator.

When momentary-contact, push-button-switch S1 is released, the AF oscillator is turned off. Resistor R1 pulls the voltage on pin 2 of U1-a low, disabling the circuit. When S1 is pressed again, pin 2 goes high. That causes the circuit to once again start flipping between its two stable states. The first of those states is when the output of U1-a is high and the output of U1-b is low. The second state is when the output of U1-a is low and the output of U1-b is high.

Capacitor C1 is included in the circuit to control the speed of the transitions between the two states. If the capacitor weren't used, the circuit would oscillate at an unpredictable, and extremely rapid rate. The frequency would be affected by the temperature of the room, the shape of the wires connecting the circuit together, and even the nearness of your hand to the IC. Here's how C1 controls the frequency of the changing states:

When U1-a flips and tries to change the circuit from the first state to the second one, C1 keeps the circuit in the first state for a little while, thereby slowing down the frequency. The capacitor does that because it is connected to the input of U1-a, just as R4 is. As long as C1 is charged up, it can "overpower" R4, preventing it from changing the input of U1-a. Gradually, C1 loses enough charge through R4 and allows U1-a to flip to the second state.

Figure 4 shows the waveform of the voltage appearing across C1; the curving sloping region occurs when C1 is keeping the circuit from flipping to the next state. Figure 5 shows the waveform of the voltage at the output of U1-c; remember, U1-c is part of the RF oscillator. Notice the bumps on the leading edge of the squarewave in Fig. 5 and on both edges of the sawtooth wave in Fig. 4. The bumps are there because the electrical circuit is behaving in a similar manner to a mechanical switch. When the circuit switches rapidly from off to on, it bounces a bit.

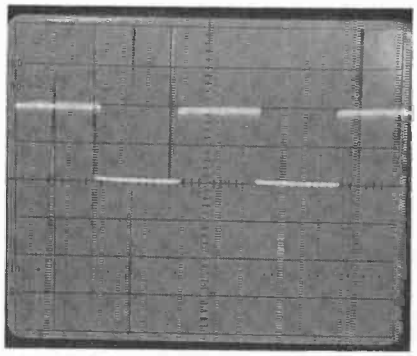

Fig. 2. When you press S1, the AF oscillator in the Transmitter generates an audio signal; here's the waveform.

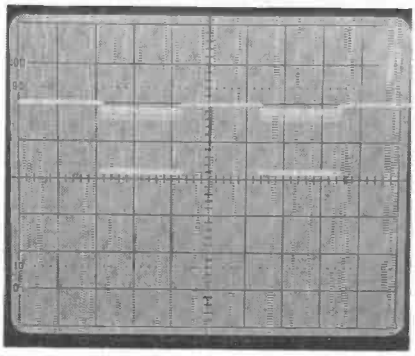

Fig. 3. Shown here is the waveform of the Transmitter's output AM signal.

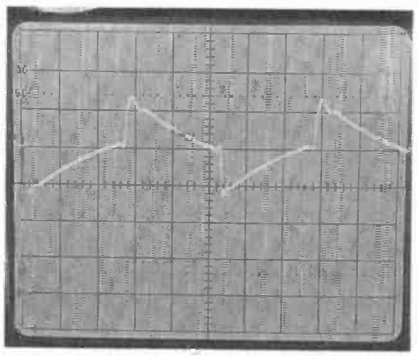

Fig. 4. Here's the waveform of the voltage appearing across capacitor C1. The curving sloping region occurs when C1 is keeping gates U1-a and U1-b from switching between two states (see text).

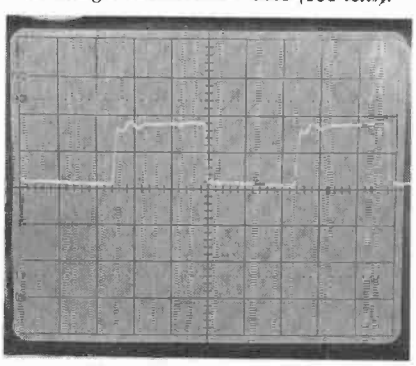

Fig. 5. This shot shows the waveform of the voltage at the output of gate U1-c, which is part of the Transmitter's RF oscillator.

PARTS LIST FOR THE POOR-MAN'S TRANSMITTER

RESISTORS

(All fixed resistors are ¼-watt, 5% units.)

R1, R2—1000-ohm

R3—2000-ohm, 15-turn trimmer potentiometer

R4—120,000-ohm

ADDITIONAL PARTS AND MATERIALS

U1—4011 quad 2-input NAND gate, integrated circuit

C1—0.0047-µF, ceramic-disc capacitor

C2—220-pF, ceramic-disc capacitor

ANT1—Four feet of stiff, 22-gauge wire (see text)

S1—SPST, momentary-contact, normally open pushbutton switch

B1—9-volt alkaline battery

Modular IC breadboard (Radio Shack 276-175 or equivalent), 22-gauge solid wire, 24-gauge stranded cable (2-conductor), battery snap with leads, solder, hardware, etc.

Construction. Building the Transmitter is a very simple task. As you can see in the photo at the beginning of this article, the author's prototype was built on a breadboard. The components were simply pressed directly onto the breadboard, and small jumper wires were used to make connections between components.

If you want a more permanent circuit, you can assemble the circuit on a perforated board. If you decide to go that route, use an IC socket for U1 to make sure that it doesn't get damaged. Also, install the resistors, the potentiometer, and the capacitors before you insert the IC into its socket.

Solder long leads of stranded, small-gauge wire to switch S1. That will allow you to hold it in your hand when keying the Transmitter on and off. Stranded wire is flexible, so you can move the switch easily.

Next install the battery-snap leads. Both the snap and the switch have stranded-wire leads. If you are using a breadboard to build the project, you will have to first tin the ends of the wire to stiffen them. That makes it easier to insert the wires into their holes.

For those who don't know, tinning a wire is pretty simple. Strip the insulation of the wires back about ¼ inch and twist the strands together. Then

(Continued on page 91)

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EXPLORING THE INTERNET

BY KARL T. THURBER, JR.

If you're not surfing the Net, or not sure what it is, then these basics can help you get started. Prepare to learn how best to access, cruise, work with, communicate over, and explore the Internet.

Is the turn of the century bearing down on you, even though you've yet to venture out onto the "Information Superhighway?" That cyberturnpike is on almost everyone's mind, and for good reason: it heralds a new age of information exchange that's revolutionizing the way we all live, work, and play. And the good news is that today you don't have to be a computer genius to hop on board the Internet.

For those who don't know, cyberspace—the catchword for the interactive computing and communications available on the Internet—is the "space" you enter when you go online. It's the virtual arena where computer-mediated communications occur. And, until something better comes along to absorb or replace it, the Internet is cyberspace. It might not reach everywhere, as the writer who coined the term in 1984, William Gibson, imagined it would, but it comes very, very close to doing so.

Part of the curiosity arising about the Internet has built on Vice President Gore's promotion of a National Information Infrastructure, the NII. The NII is intended to be a web of communications networks, computers, consumer electronics, and databases that will put vast amounts of information at everyone's fingertips. Also, the NII will help foster an information revolution that will change forever the way we work and interact with one another.

But What is The Internet? While the Internet seemingly is practically everywhere today, you might be puzzled about what it is and what it means to you. So, then, just what is this thing called the Internet?

The Internet is the world's largest computer network—one that serves about four times the number of people as do all of the commercial online services like CompuServe, America Online, Prodigy, and Delphi combined. But the Internet is more than just a network: It's also a mailbox, business tool, library, newspaper, shopping mall, and much more.

The Internet is the world's largest computer network—one that serves about four times the number of people as do all of the commercial online communications utility services like CompuServe, America Online, Prodigy, and Delphi combined. But the Internet is more than just a network: It's also a mailbox, business tool, library, newspaper, shopping mall, and much more, as we'll see.

Technically speaking, the Internet is a set of protocols, or communications rules, that govern basic interactions between interconnected computers. Those protocols allow every make and model of computer—from the home-based microcomputer to the hulking mainframe—to swap e-mail and files. It really doesn't matter what kinds of chips, software, or languages are used.

A person sitting at a personal computer or terminal equipped with the proper software communicates across the Internet by placing data in an Internet Protocol (IP) packet—an electronic envelope—and "addressing" the packet to a particular Internet destination.

Even though it might sound simple so far, the Internet is does present some problems. For one, the Net is largely an uncensored free-for-all, and its content often is tasteless, foolish, or misleading—and there are no warnings, movie-like ratings, or other restrictions. Also, even with new, point-and-click graphical user interface (GUI)-based Internet software such as Netscape and Mosaic, it's still difficult to smoothly navigate ("surf") the Net. And, because it requires access to both a computer and a modem or other communications link, the Internet is beyond the reach of millions of people.

Security on the Internet seems to be another problem. Companies that engage in "electronic commerce" are concerned with Net security, and have to use various schemes to keep financial transactions private. Security issues have prompted them to keep sensitive information systems off the Internet, even setting up computer "firewalls" that prevent outsiders from gaining access to protected data through the Net.

Another problem is protection of copyrighted material. It's a thorny one because anyone can easily download text and other data through the Internet. Some companies encrypt valuable data they sell over the Net, providing decoding keys only to bona fide buyers.

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A Little Cyber-History. We'll examine further, later on, what the Internet is today. But first, let's take a look at how it all got started in the 1960s. The Internet has its roots in a 1969 cold-war research project conducted by an arm of the U. S. Department of Defense, the Defense Advanced Research Projects Agency (DARPA). Military planners, scientists, and engineers wanted a computer network that would interconnect information resources and researchers and that also could withstand partial destruction, as would surely occur during a nuclear attack, yet still function as a viable network.

One theme of the network planners was fault tolerance and reliability. The planners reasoned that centralized data flow through just a few "hub" computers would leave the system too open to disruption. And they wanted every computer on the network to be able to communicate, peer-to-peer, with all other computers on the network. ARPAnet created many redundant routes among the computers so that messages and data could arrive at their destinations using any possible route, not a single fixed path.

Under that "robust interconnection" arrangement, if a part of the network were destroyed, the surviving parts would automatically reroute communications through different pathways. That solution also was attractive to potential users outside the military, and effectively set up the infrastructure for what we know today as the Internet. The original ARPAnet initially consisted of just four computers, but by 1972, about 50 universities and military research sites were on the network.

The "DARPA Internet" escaped from the Pentagon and its university contractors in the early 1980s, when it split into two networks, ARPANet and Milnet, a military network. The Internet spread like wildfire during the early years of the PC boom, doubling in size each year. A combination of technological advances in software, hardware, and communications made Internet connections very economical by the late 1980s.

Designers had to develop a means by which the interconnected computers would have a standard language and set of rules by which information is communicated over the network. They developed a communications protocol known as Transmission Control Protocol/Internet Protocol (TCP/IP). TCP/IP became the major protocol used by ARPANet (now the Internet) beginning in 1983.

Also in the 1980s, the National Science Foundation (NSF) developed a network, NSFNET, which was a nationwide "computer backbone." In the late 1980s NSF built five supercomputer centers to give researchers access to computers previously available only to military contractors. The NSF's networks, based on TCP/IP technology, interconnected the five regional centers and hundreds of university networks. Soon the network connections were used for other purposes, such as e-mail.

Eventually, all of those networks, public and private, were interconnected to enable any computer on any one of the sub-networks to access computers anywhere in the entire network. Some date the birth of the Internet as we know it today to be March 1986, when the old ARPAnet was dismantled.

How Big is the Internet? Today the Internet combines multiple networks of the academic, military, government, business, and industrial sectors. No one really knows how big the Internet is: size estimates vary widely. But some of the statistics are telling.

Looking back 14 years to the dawn of the PC era, in 1981 there were only about 200 directly connected host computers on the Internet. But the number of computers connected to it grew dramatically: by 1991, there were more than 300,000 of them. By late 1993, about 2.2 million computers were reachable via the Internet, with over 25 million users. One recent estimate put the number of host computers alone on the Internet at some 5 million!

In the mid-1990s, 40 to 50 million people in more than 160 countries have indirect or at least e-mail access to the Internet, and more than 30,000 computer networks in over 75 countries have full access. In Japan and some parts of Europe the number of users has grown more than 1000 percent in the past 3 years.

Regardless of how you figure it, the Net is growing at a dizzying pace. By

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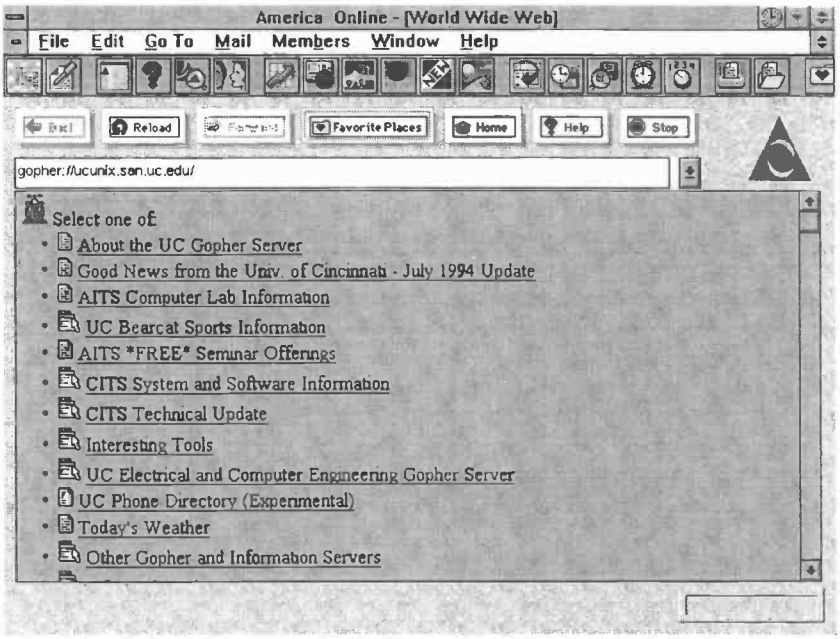

Fig. 1. Shown here is a Gopher menu graphically displayed by AOL's Web browser. While Gopher is a menu-based approach to browsing the Internet, the Web browser offers you a graphic, easy-to-use alternative. It makes it easy to find information and move among non-Web Internet resources such as Gophers, FTP files, USENET newsgroups, and more.

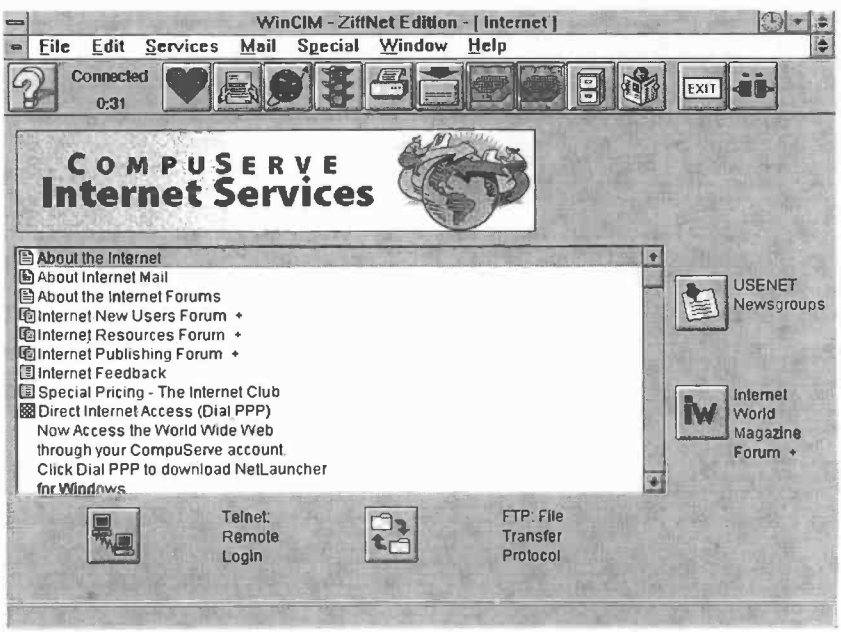

Fig. 2. Here's CompuServe's Internet Services welcome screen as viewed by their WinCIM software; it offers access to all the service's Internet features except the Web. Presently, you access the Web separately using the CompuServe edition of the SPRY Mosaic browser, called NetLauncher.

some estimates, the Internet population grows by an estimated 10 percent or more each month; the World-Wide Web alone reportedly is *doubling* in size every 53 days or so. By the year 2000 the Internet might have as many as 100 million servers (central computers that store volumes of information and serve it out to so-called "clients"), which are mostly PCs like your own rather than room-filling mainframes.

Who Owns the Internet? One factor fueling the Internet's remarkable growth is its grassroots structure. Most conventional computer systems are closed, hierarchical, undemocratic, and proprietary; they run on copyrighted software in a tight, pyramid-like structure that empowers the system operators (SYSOPS) at the top of the pyramid.

The Internet, by contrast, is open, non-proprietary, and democratic; it crosses national boundaries and answers to no government. No one owns the Internet and no single organization controls it, although the National Science Foundation (NSF) has provided a good deal of the money and computing infrastructure to make the Internet possible. (Recently, NSF has reduced its funding contributions and management of the central computer networks or backbones, with connectivity becoming the responsibility of other providers, including commercial ones.)

Besides the NSF, the Internet is overseen loosely by The Internet Society, a group of individual and corporate volunteers. But they don't own it. Neither does the Electronic Frontier Foundation (EFF), which is concerned with policies that maintain and enhance First Amendment, privacy, and other democratic values.

The great flexibility of that decentralization is what enables the Internet to grow rapidly, with very little central management or blueprints for the future. In some respects, the Internet represents a partial return to the so-called "hacker ethic" of free and open information flow that characterized the early, "wild and woolly" computing of the 1960s and 1970s.

Computer-Industry Implications. Many observers have likened the Internet to an already launched rocket or a missile: no one can stop it, even if they wanted to. Some even consider that the future of computing is defined by the Internet, and it's not hard to see why.

Thanks to a powerful software scheme called the World-Wide Web, or simply "the Web," the Internet is beginning to eclipse, or even embrace, the PC. Eventually, the Internet and the NII will be so widespread and transparent that we'll simply take them for granted, as we now give little thought to electrical power, cable, telephone, and other utility systems.

In fact, the Internet, with its low-cost, open technology could very well be the modern equivalent of the "PC rev-

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olution." Like the IBM PC of 1981, the Internet of today might reshape the whole computer industry; and also like the PC, the impact will be felt on individual users like you and me as well as on business and industry.

The Information Superhighway—the NII—is supposed to meld a wide variety of technologies into a single, digital data stream. But while it remains a work in progress, the Internet is a real-world, working prototype of the future, and it offers a solid test bed for advanced communications. Already, the Internet is absorbing practically every improvement in computer hardware and software performance that reaches the marketplace.

The industry vision is that within the next few years all major software programs will be Internet-aware and will depend on it for a continuous stream of new data and even software updates. Ultimately, you might not even have to make a conscious decision to access the Internet, as you must today.

In particular, software makers will adapt to the World-Wide Web so that most word-processing programs, spreadsheets, databases, and operating systems will work seamlessly across the Web. Eventually, your software applications will simply reach into the Web for a piece of data, a movie clip, a new program, or whatever else you might need at the moment—and retrieve it.

Most likely, the Internet era won't be marked by the kind of dominance that Microsoft now has in software or IBM has enjoyed with mainframes. Rather, the Internet is open to any brand or type of computer, to any software, to almost infinite geographical expansion, and to practically any use that can possibly be conceived.

The Internet has already grown so large that industry giants like Microsoft, IBM, Intel, and others couldn't dominate or fight it if they wanted to. Rather, they're figuring out how to best capitalize on the Internet. IBM, for example, has made Internet access an integral feature of its OS/2 Warp operating system and Microsoft has done the same with Windows 95.

Using the Internet. Designed by and for research and technical users, the Internet admittedly isn't very friendly. It's basically a creature of the mainframe era and was designed by academics and techies for their own purposes. Until very recently, to effectively use the Internet you needed a "frontier mentality"—if a neat and orderly universe is important to you, you probably haven't enjoyed any encounter you might have had with the Net. The Internet can be chaotic, haphazard, and seemingly random, and it's still best learned by those familiar with the main-frame-based, UNIX computer-operating system.

Just going online with the Internet, learning where to look for information, finding what you want, and retrieving it, can be highly frustrating. But that fact hasn't kept thousands of edu-

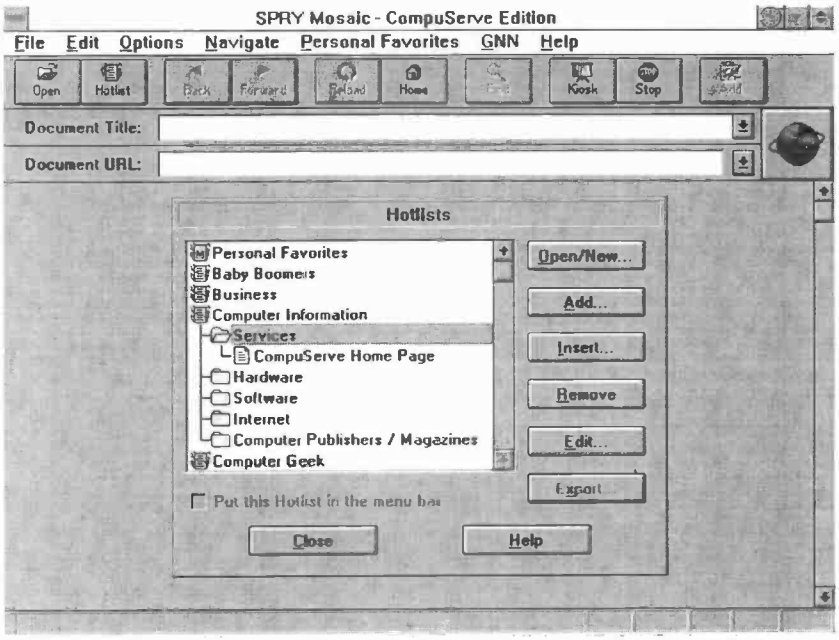

Fig. 3. CompuServe users can acess the Web using a special edition of SPRY Mosaic. One of the software's strongest features is its ability to organize the information you find on the Web. You can use SPRY Mosaic's "hotlists" and its user-customizable document folders, subfolders, and documents to remember Web-site locations so you can easily access and use them again and again.

Fig. 4. Here's America Online's Internet preview area, which offers you free Web-access-software downloading and a multimedia sampler. AOL offers considerable Internet access, including USENET newsgroups, e-mail, Gopher, and the Web; Telnet, MUD, and IRC are planned. Unlike CompuServe, Web browsing is integrated in the AOL software.

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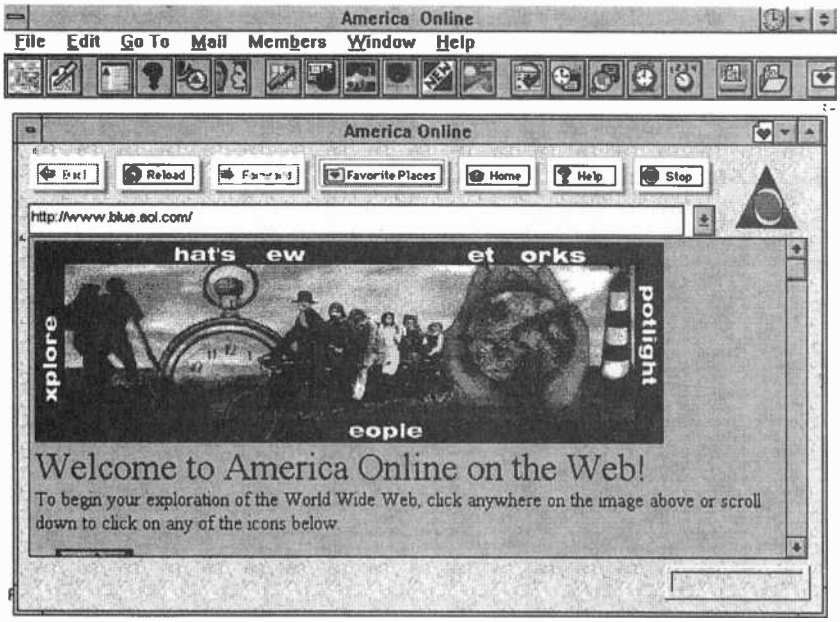

Fig. 5. America Online offers Web access and has integrated a Web browser in its main access software. The new all-in-one AOL software includes a Personal Filing Cabinet in which you can store e-mail messages and Favorite Places. Shown here is a portion of AOL's own home page.

cators, scientists, professionals, computer geeks, activists, and "just plain folks" from putting the Internet to good use.

Happily, things slowly are changing as more casual users seek convenient, uncomplicated access. Today, you might be able to hook up to the Internet through an existing direct connection at work or at school, or you might gain access through a commercial online service, a bulletin-board system (BBS), or a public-access service provider.

The really compelling characteristic of the Internet is that it lets you interact with the whole world. That enables communication among millions of people and organizations who are "plugged in" through Internet-connected computers. Today, anyone with a PC, a modem, and a little online knowledge can benefit from Internet resources, including communication throughout the world, tapping into robust research databases, and downloading articles from online archives.

The Internet puts a world of information at your fingertips for as little as a $10–$25 per-month access fee to a provider (there's no charge to use the Internet itself). While you're online, you can send and receive e-mail, do research and browse for information, transfer or download files, and even view and hear multimedia files and hold video conferences, if you're so equipped. As the Internet evolves, it's likely to become intimately involved with, or even take over, your telephone, FAX machine, home-entertainment console, and other electronics and communications systems as it ultimately merges into the NII as envisioned by Vice President Gore.

The Internet is a huge repository of information for individuals and businesses. For many professional, business, educational, and governmental users today, the Net truly is an indispensable tool.

The U.S. government, especially, posts more and more information, such as Commerce Department data and patent filings, on the Internet—information that could be very difficult and sometimes expensive to obtain. Also, many universities are converting large libraries of data, including their card catalogs, to electronic form for browsing and distribution on the Internet.

As we've hinted, the Internet represents a new marketing opportunity that's arguably even more exciting and revolutionary than was the original IBM PC. There's hardly any product or service that isn't getting developed for or actually being delivered over the Internet. The only limit seems to be one's imagination. The economics of communication via the Net shortly will be too compelling to ignore.

Today, companies are scrambling to get aboard one of the newest Internet facilities, the World-Wide Web. Most computer companies, publishers, and communications firms, as well as many banks, insurance companies, government agencies, and mail-order and retail firms, are setting up Web sites or "home pages." They sense, with good reason, that the Internet in particular, and cyberspace in general, will be one of the driving forces for economic growth as we move toward the next century.

The Web will cause many changes in the industry—for example, how PC software is sold and delivered. Instead of shipping floppies or CD-ROMs, software publishers likely will advertise, take orders and payments, ship program code, and provide technical support over the Net. They'll use the Web and its increasingly sophisticated browsers as the "universal portal" into the Internet's vast resources (more on the Web later).

Basic Internet Features and Services. While there's no comprehensive directory of everything you'll find on the Internet, you can access government documents (including library catalogs and databases), White House press releases, weather maps and forecasts, sports schedules, ZIP codes, and much, much more.

Some of the more popular Internet features and services include information browsing using Gopher and the World-Wide Web; automatic information delivery via distribution lists; information-searching with WAIS, Archie, and Veronica; real-time written interactions using Internet Relay Chat (IRC); file transfers; directory lookups to discover network addresses; and even multicasts of audio and video programs.

So, by now you have a general understanding of the Internet. But we still need to explore further some of the unique terms, features, services, and other resources of the Net:

Electronic Mail (e-mail): Thanks to e-mail, you can transmit a variety of communications and correspondence such as letters, memos, graphics, and spreadsheets over a network to other users. Not only can you send

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simple messages, but you can attach files to them, get receipt acknowledgment, and send information copies of your messages to others.

To use e-mail, you must be electronically accessible to others. You need an e-mail address, which is the set of commands used to route messages through gateways until they reach a recipient. Each electronic service or organization offering e-mail has its own address format. Using it, e-mail can be sent from users on one interconnected service to users on another service.

It helps to have an e-mail program on your PC to check for mail waiting, read the mail, reply to and forward messages, and compose and send new messages. Several commercial and shareware programs to handle those tasks are available. One of the best shareware products is Eudora, which has a graphical interface for the Apple Macintosh or Windows-based PC; look online for EUDORA14.EXE for Windows or Eudora 1.4.2 for the Mac.

LISTSERV Mailing Lists: Internet mailing lists are topic-oriented discussion groups that use e-mail for communications. The mailing lists consist of people who have signed up to receive mail on a specific topic. If the process is automated so that a computer adds an individual to a list after that person sends in a specially formatted e-mail request to subscribe to the list, it's called a LISTSERV mailing list, or simply a LISTSERV.

In that case, instead of mail being sent to a specific individual on the list, messages are sent to an automated LISTSERV address for mass distribution via e-mail to everyone who subscribes to the list. (The term LISTSERV also refers to the UNIX software used to manage much of the process.)

USENET Newsgroups: USENET newsgroups are a series of discussion groups that focus on a specific subject; they're the Internet's equivalent of forums on the online services and BBSs. There are over 10,000 such discussion groups distributed over the Internet and devoted to practically every conceivable subject.

It's useful to have a program to help with the mechanics: locating newsgroups, searching through and reading messages, and composing and posting messages. One such inexpensive shareware newsreader program is Trumpet News Reader.

It's a good idea to read the newsgroup traffic before jumping in. Make sure you have a good idea as to what type of messages are posted to a group before you post a message as well. That will keep you from immediately being spotted as a "newbie" and possibly being attacked ("flamed") by members of the newsgroup because of your manners.

FTP: There are several ways of copying files from other computers on the Internet to your own PC, such as by saving newsgroup messages or e-mail messages that have files attached to them, or by logging onto remote computers that allow downloading using Telnet. But the most flexi-

INTERNET BOOKS AND BOOK/DISK PACKAGES

As the Internet continues to grow at a phenomenal rate, you might find yourself scrambling to uncover how to best use its immense resources for your benefit. The following sampling of books and book/disk software packages should get you started on the Internet and the World-Wide Web.

Books

The Complete Idiot's Guide to the World-Wide Web, by Peter Kent, Alpha Books (Macmillan, 201 West 103rd Street, Indianapolis, IN 46290; Tel. 800-428-5331), 1995, $21.99.

Creating Successful World-Wide Web Sites with Mosaic, by John R. Vacca, Addison-Wesley (1 Jacob Way, Reading, MA 01867; Tel. 800-358-4566), 1995, $28.95.

Curious About the Internet?, by Ned Snell, Sams (Macmillan), 1995, $14.99.

The Instant Internet Guide, by Brent Heslop and David Angell, Addison-Wesley, 1994, $14.95.

The Internet Companion: A Beginner's Guide to Global Networking, Second Edition, by Tracy LaQuey, Addison-Wesley, 1994, $12.95.

The Internet Yellow Pages, Second Edition, by Harley Hahn and Rick Stout, Osborne McGraw-Hill (260 Tenth Street, Berkeley, CA 94710; Tel. 800-227-0900), 1995, $29.95.

Netscape Quick Tour, by Stuart Harris and Gayle Kidder, Ventana Press (P.O. Box 13964, Research Triangle Park, NC 27709-3964; Tel. 800-743-5369), 1995, $14.00 (Mac or Windows edition).

Student's Guide to the Internet, by David Clark, Alpha Books (Macmillan), 1995, $14.99.

Teach Yourself HTML Web Publishing in a Week, by Laura Lemay, Sams (Macmillan), 1994, $25.00.

The Whole Internet User's Guide & Catalog, Second Edition, by Ed Krol, O'Reilly & Associates (103 Morris St., Suite A, Sebastopol, CA 95472; Tel. 800-998-9938), 1994, $24.95.

Book/Disk Packages

Internet in a Box: The Complete Internet Solution, produced by SPRY, Inc., O'Reilly & Associates, 1994, $149. The software package includes three guidebooks.

Internet Starter Kit for Windows, Second Edition, by Adam C. Engst, Corwin S. Low, and Michael A. Simon, Hayden Books (Macmillan), 1995, $30.00. The kit includes three disks of Internet software and tools.

Mosaic Quick Tour, Second Edition, by Gareth Branwyn and Sean Carton, Ventana Press, 1995, $19.95 (Mac version) or $24.95 (Windows version). The package includes a diskette with Ventana Mosaic software.

Phoenix Internet, Phoenix Technologies, Ltd. (Three First National Plaza, Suite 1616, Chicago, IL 60602; Tel. 312-541-0260), 1994, $39.95. The package includes InterNaV Windows software, *The Official Delphi Internet Guide*, and the *What to Do on the Internet* tour guide.

Special Edition Using the World-Wide Web with Mosaic, by Bill Eager and Mary Ann Pike, Que (Macmillan), 1995, $45.00. It includes a CD-ROM with SuperMosaic software and utilities.

The Windows Internet Tour Guide, Second Edition, Ventana Press, 1995, $29.95. The Guide includes a diskette with Ventana Mosaic software. A Macintosh version also is available.

Note: In addition to the above resources, there are several online Internet tutorials and reference guides you can download from the commercial online communications utility services, some BBSs, and various Internet resources. Some of the more interesting tutorials and guides you can download include Brendan P. Kehoe's book, *Zen and the Art of the Internet* (look for ZEN10.ZIP); Clyde Grotophorst's *InfoPop* (IPWIN121.ZIP for Windows and INFPOP27.ZIP for DOS); and the Merit Network's *Internet Tutorial* (MERIT.ZIP). Also, you can find most of the Internet shareware software programs and files we mentioned in the text of this article in the same online places.

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ble downloading is by File Transfer Protocol, or FTP.

FTP is a standardized method of transferring files between computers on the Internet. "Remote host" computers known as FTP sites let you download from on-screen lists of files that are available for download. Anonymous FTP sites are especially good in that they let you access the remote computer without already having an account established at that site. A good Windows shareware FTP program is WS—FTP, found online as WS—FTPZIP; it even comes with a starter selection of popular FTP sites.

Archie: A disadvantage of FTP is that it's hard to use unless you know what you're looking for and where to look among the millions of available files on the net; Archie can help. Archie is a file-finding, FTP-indexing aid that helps you locate and copy files on the Internet, something like the software file finders on the online services.

You can call up an Archie server to try to locate a given file using all or part of the filename and other information you specify, by searching groups of lists of files at various FTP sites. If the search is successful, Archie shows you where to go.

Gopher: Figuring out how to find a resource, accessing it, and learning the quirks of that resource's menu and command system is challenging. Gophers can help you with that problem.

Named for the mascot at the University of Minnesota where it was developed, Gopher is a tool that enables you to browse more than 25,000 Internet sites by creating a system of easy-to-use menus in an environment popularly known as "gopherspace." You can navigate the Internet using Gopher by selecting the desired item from a series of lists or layered menus.

You can continue in a series of lists or menus until you locate the information you're seeking, and you even can insert an "electronic bookmark" to tag places of interest. Many Internet public-access service providers and online utilities set up their own Gophers to assist you in burrowing or tunneling for information. If your connection supports graphics, you can use one of the many graphical Gopher programs, such as WinGopher.

Veronica: What would Archie be without Veronica? Veronica is to Gopher as Archie is to FTP. Veronica, which means "Very Easy Rodent-Oriented Netwide Index to Computerized Archives" (really!) helps you search for and locate information and Gopher-accessible resources; it's a built-in Gopher tool to help you find the Gopher server(s) with the information you need.

Veronica lets you specify a search term to find Gopher menus and items on a subject. After finding matching menu items, it creates a custom menu that lists the terms that match; you choose an item from that menu and burrow to it using Gopher. You can browse a Veronica menu as you would a Gopher menu.

Telnet: Telnet is a facility used to access other Internet computers. It's a tool that lets you log onto remote computers, access files, and even execute commands and run applications on the remote host as though logged in locally.

In effect, you can—within limits, of course—legitimately use your computer to drop in on selected computer systems and run them much as though they were your own. That procedure is known as a remote login, and it often requires that you be registered with the computer system and obtain a username and password.

But many systems allow limited access after you fill in an online questionnaire; such guest logins typically restrict the types of actions you can take at that site. There's also another use for Telnet: it's possible to log into your own computer from a remote

NAMES AND NUMBERS

Public-Access Internet Providers and Online Services

America Online
8619 Westwood Center Drive
Suite 200
Vienna, VA 22182
Tel. 800-827-6364

California Education and Research Federation Network (CERFNet)
P.O. Box 85608
San Diego, CA 92186-9784
Tel. 800-876-2373

CompuServe
5000 Arlington Centre Blvd.
P.O. Box 20212
Columbus, OH 43220-0212
Tel. 800-848-8199

Delphi Internet Services
1030 Massachusetts Ave.
Cambridge, MA 02138
Tel. 800-695-4005

GEnie Services
401 N. Washington Street
Rockville, MD 20850
Tel. 800-638-9636

Netcom On-Line Communications Services, Inc.
3031 Tisch Way
San Jose, CA 95128
Tel. 800-353-6600

NetManage
10725 North De Anza Blvd.
Cupertino, CA 95014
Tel. 408-973-7171

Netscape Communications Corp.
501 E. Middlefield Road
Mountain View, CA 94043
Tel. 415-528-2555

Performance Systems International, Inc. (PSI Net)
510 Huntmar Park Drive
Herndon, VA 22070
Tel. 800-827-7482

The Pipeline
150 Broadway
Suite 1710
New York, NY 10038
Tel. 212-267-3636

Prodigy
P.O. Box 791
White Plains, NY 10601
Tel. 800-284-5933

Internet Organizations and Groups

Computer Professionals for Social Responsibility (CPSR)
P.O. Box 717
Palo Alto, CA 94302-0717
Tel. 415-322-3778

Electronic Frontier Foundation (EFF)
1667 K St., NW
Suite 801
Washington, DC 20006-1605
Tel. 202-861-7700

Federation of Academic and Research Networks (FARNET)
114 Waltham Street
Suite 12
Lexington, MA 02173
Tel. 670-890-9445

The Internet Society
12020 Sunrise Valley Drive
Suite 270
Reston, VA 22091
Tel. 703-648-9888

National Public Telecommunication Network (NPTN)
P.O. Box 1987
Cleveland, OH 44106-0187
Tel. 216-498-4050

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location, using your own username and password.

Telnet is limited in that it remains in the text-based realm, and when you're hooked up to another computer system, its commands are the commands you need to use. Telnet slowly is going out of favor as other access methods—FTP, Gopher, and the Web—eclipse it in popularity.

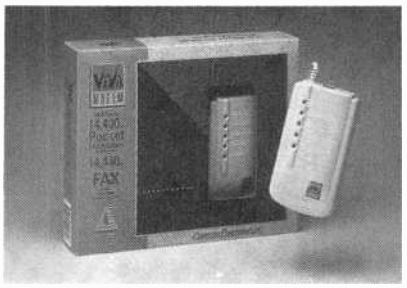
Wide Area Information Server (WAIS): WAIS (pronounced "ways") is an Internet-based research system. WAIS lets you search more than 500 Internet databases by what's actually in the documents, rather than by just the document name. You can do a keyword search using WAIS to retrieve all matching documents and then read them. After typing in a few keywords from the document you're looking for, WAIS will find all the documents on those computers that contain those words within their text. You can access WAIS servers using Gopher, Telnet, or the Web.

Internet Relay Chat: This is a CB-like Internet feature in which people meet and chat in real time with one another. But instead of using a microphone, you use a computer keyboard and monitor screen to engage in conversations online.

Using IRC, you can chat with people in America and around the world; it's similar to CompuServe's CB Simulator and comparable features on other online services. One caution when chatting: don't assume anyone you meet online is who or what they say they are—you can assume any identity you want online.

MUDs, MUSHes, and MOOs: These are simulated online environments comparable to the role-playing games many people play on their PCs. There are MUDs (Multi-User Dimensions), MUSHes (Multi-User Shared Hallucinations), and MOOs (MUD Object Oriented). In them, the essential idea is that you create characters and do battle with dragons or spaceships, save princesses, or whatever. The difference with computer role-playing of the past is that there are other live players gaming online, and you can interact with those cyberplayers.

The World-Wide Web: Recently, the red-hot place to be on the Internet for both individuals and businesses has been the World-Wide Web, which seemingly came out of nowhere in 1994 to stand the Internet on its ear. Based on a new set of protocols, the Web is helping the Internet deliver the multimedia features that PCs are capable of: classy typography, multicolor graphics, convenient radio-button interactivity, and sound and video.



Here's a Computer Peripherals Viva 14.4/FAXp Pocket Modem that features automatic speed negotiation. Some commercial services still limit their access to 14,400 bps.

Shown here is a Practical Peripherals 28,800 bps PM288LCD stand-alone modem, which makes use of the fastest speed available over conventional telephone lines.

While Gopher is a menu-based, textual approach to browsing the Internet, the Web offers you a graphic alternative that can become a globe-traveling experience. As a pre-established system of links that simplifies the task of navigating among the resources of the Net, it's hooked into the rest of the Net in such a way—through a series of home pages—that lets you treat it as an interactive window on the whole Internet.

The Web has become an organizing system that makes it easy to find information and move among various Internet resources such as Gophers, FTP files, Telnet sites, USENET newsgroups, and more (see Fig. 1). It adds structure to the confusing reality of the Internet to help you navigate its fragmented resources.

How does it do all that? The Web lets you browse the Internet by using hypertext links, created using a special protocol, HTML, or HyperText Markup Language, something like a Windows help file. When you a select a hypertext link by clicking on color-coded highlighted words or buttons, you can jump to another place in the same location or to another computer to browse that information or topic. As a user you don't need to know where any of the documents or other information are physically stored. (The Web also uses another special protocol, HyperText Transfer Protocol, HTTP, which supports fast network file transfers.)

Browsing in Style. The hypertext, hypermedia, and multimedia services offered by the Web are best utilized through a software tool known as a Web browser. It's a computer program used to find and display the hypermedia resources of the Web. It presents Web information in a visually attractive format familiar to Windows, Macintosh, and other graphical user interface (GUI) users.

What you see when you load most browsers looks like a magazine page. There are bullet-style lists of places and things, icons and images, upon which you can click. Clicking on highlighted words sends you to another page. That subsequent page could be local or found on a server halfway around the world. You can then download images or text.

A bonus you get with a browser is that you can use it for more than just browsing the Web. You also can download files, access Gopher sites, read USENET newsgroups, do Archie-like keyword searches, and much more using its GUI capabilities.

The original Web browser, Mosaic, was developed at the National Center for Supercomputing Applications (NCSA) at the University of Illinois in Champaign-Urbana. Because the NCSA Mosaic program was de-

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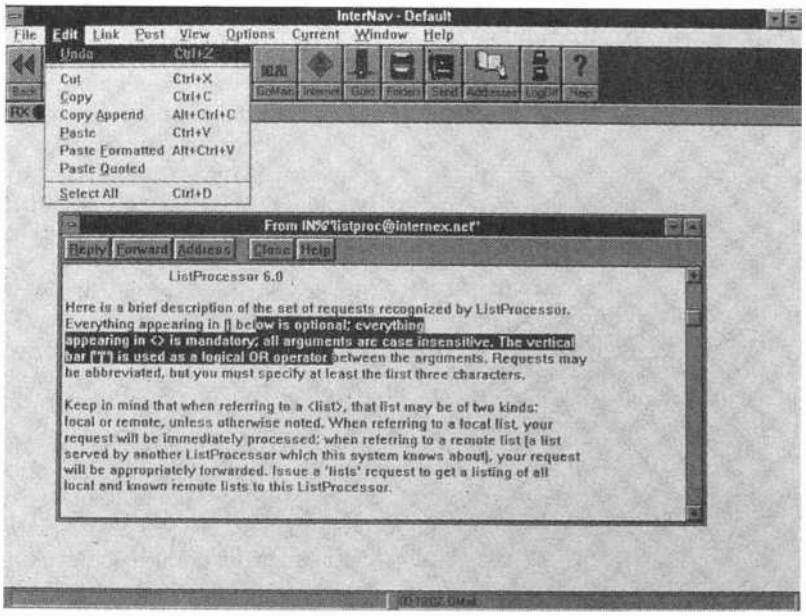

This screen shot shows the InterNaV Windows software from Phoenix Technologies, Ltd. The software comes as part of a book/disk package called the Phoenix Internet, *which includes 10 free hours on the Delphi Internet Service.*

veloped with government funds, it was placed in the public domain and spread like wildfire over the Internet, where it was posted everywhere for free downloading. (The latest version of Mosaic is available online; look for MOS20B1.EXE.)

Various proprietary NCSA Mosaic offshoots have been developed. Those include SPRY Mosaic, Cello, Netcom NetCruiser, Netscape Navigator, Pipeline, Spyglass Enhanced Mosaic, MacWeb, NetManage Chameleon/WebSurfer, and others. Often NCSA Mosaic or a derivative browser is distributed free or at low cost when you open an account with an Internet public-access service provider. (There's also a text-only hypertext browser called Lynx that you can use if you can't use graphics on your system.)

How difficult is it to create Web pages? Hypertext electronic publishing is easily within the capability of most anyone who can use a word processor (Microsoft and WordPerfect offer HTML editors as free add-ons to their word-processing software). And a number of excellent home page how-to books are available from a variety of publishers (see the "Internet Books and Book/Disk Packages" box). The Prodigy online service also has developed a feature, known as Home Page Creator, that lets members create their own Internet home pages without even knowing the HTML programming language.

Connecting to the Net. As the computer world regroups around the Internet, access is being taken for granted. IBM's OS/2 Warp operating system offers a built-in connection via the company's own Advantis network, while Microsoft's Windows 95 offers an Internet connection through the newly launched Microsoft Network. Just about any fast, modem-equipped, Windows-based PC or any Mac offers all the horsepower you need for Internet browsing.

As little as a year ago, if you were on the Internet at all you might have had to settle for a tenuous telephone connection that reduced your PC to little more than an old-style, text-only, "dumb" terminal. You could log onto someone else's computer, send e-mail, and read text files, but not much more. An explosion of new Internet software has changed that, putting a full-fledged Internet connection within reach of practically anyone.

Internet access now is available via a variety of media paths, from simple telephone dial-up to high-speed fiber-optical connections. Direct connection using permanent, high-speed links still is the most practical and desirable for businesses, universities, and government organizations. If you can use such direct connections, great. But you also can surf the Internet and its Web yourself, from your own home. All you need is your own PC, a modem, an ordinary telephone line, the right software, and a provider.

For most individual users, the simplest and best route to Internet access probably is through commercial online services and through public-access service providers. We'll take a look at both.

Commercial Services. There are around 8 million people who subscribe to commercial online services. Those services have been around for about 15 years and offer a great deal for the money, which now typically runs about $10 per month for basic service. They're like large "pay BBSs" and offer their own news, weather, and sports; e-mail; shopping; travel; bulletin boards and forums; games; chatting; educational services; information and reference databases; files; and now, an Internet connection.

The majors, like America Online, CompuServe, Prodigy, and Delphi offer you varying degrees of Internet access; they're all aiming for complete access in the near future. Most online services are limited to 9600 or 14,400 bits-per second (bps)—9600 bps is about the slowest you can use on the Web—but are beginning to offer 28,800 bps service. There also are plans to offer high-speed Integrated Services Digital Network (ISDN) access at up to 128,000 bps, but those fast-lane telephone line upgrades are months away, at least, and ISDN access is expensive.

Let's briefly examine the major online services that have varying types and degrees of Internet connectivity:

CompuServe: This sprawling H&R Block subsidiary's wide variety of services and databases makes it a first choice among many researchers, PC power users, businessmen, and professionals. It gives you access to an immense array of travel services, financial information, software, online shopping, and more. CompuServe also has several hundred online forums.

CompuServe offers a high level of Internet access, including USENET newsgroups, FTP, Telnet, e-mail, Gopher, and now the Web (see Figs. 2 and 3). Both the Mac and IBM PC are

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supported. CompuServe's basic rate is $9.95 a month, which gives you unlimited access to about 100 basic services and three free hours of Internet access a month.

America Online: AOL is a rapidly expanding online service that challenges industry leader CompuServe in many areas, especially with its very attractive GUI. New services are added regularly, and there's almost complete access to the Internet.

The AOL software supports the Mac, DOS, and Windows, and the service recently integrated a derivative of BookLink Technologies' Interworks in its access software. AOL's base rate is $9.95 per month, which includes 5 hours of access time. It offers unlimited e-mail privileges and considerable Internet access, similar to that offered by CompuServe (see Figs. 4 and 5).

Prodigy: The Prodigy Information Service is a joint IBM-Sears online venture. It's become one of the largest services, mainly due to the colorful, easy-to-use access software. The software is available in Mac, DOS, and Windows versions.

Prodigy features full Internet access and was the first to offer a Web browser. With a click of your mouse, you can jump from the regular Prodigy service to the Web. Prodigy's basic service costs $9.95 per month; that includes unlimited access to "core services" and 2 hours of "plus services." Prodigy also offers a novel feature that lets you easily create your own Web home page. Non-Prodigy members can access those home-made Web pages using a list searchable by member name and state.

Delphi: Delphi Internet Services was the first major online service with a full-featured Internet connection. It offers text-based access to all major Internet resources, but a new graphical interface should be available for Web browsing by the time you read this.

There are two access options. One includes 4 hours of non-prime-time connect time for a $10 basic monthly service charge; prime time hours are $9. A second plan is the 20/20 plan; $20 per month gives you 20 hours of non-prime connect time. Both plans charge $3 a month extra for Internet access.

Major Public-Access Providers. If you want Internet dial-up access without the trappings of an online service, you often can get more hours—sometimes even unlimited access—for less money with this type of service provider.

There are two distinctly different types of service you can sign up for, although often a single provider can offer both types of service as alternatives. Typical basic account charges range from about $10 to $50 per month, depending on the plan.

The more robust access option is a direct dial-up account. That type of account offers TCP/IP access, either through a SLIP (Serial Line Internet Protocol) or PPP (Point-to-Point Protocol) account. Those types of service include a dial-up connection, and thus let you connect your computer to the Internet using an ordinary telephone line and modem, the next best thing to a direct Internet connection. Both SLIP and PPP, a newer and some say better form of connection than SLIP, let your computer use the industry-standard TCP/IP protocol.

To use such a dial-up connection, you must run a TCP/IP program unless TCP/IP support is built into your operating system. Thus, you'll probably need to have a shareware program called Trumpet WinSock, short for "Windows Sockets" (look for TWSK20B.ZIP online), or other "TCP stack" connectivity software that tells your PC how to talk to a dial-up connection.

Such connectivity software effectively makes your PC a temporary part of the Internet. That means that you can take advantage of all Internet services, including transferring files directly to your own PC and using advanced software tools like the Web browser. You also might need a dialer program to connect.

A second type of account is a basic dial-up terminal account known as a command line or "shell" account. Such accounts are simple to set up but don't give you the flexibility or the ability to run Internet tool software (such as a Web browser) on your PC—you're limited to what your service provider offers on its system. Command line or shell interfaces are relatively "dumb" and non-graphical, and so might be harder for beginners to use productively. However, those with somewhat less powerful PCs and modems have no choice but to use those more limited Internet access accounts.

Until recently, SLIP/PPP connections have been a pain for you to set up and configure. But a number of new, easy-to-set-up software and service packages are offered by national providers and by a host of local and regional providers. Both can offer you the essential software you need to start, along with any needed set-up and technical support. Here are a few examples:

Netcom: Netcom On-Line Communications Services offers you custom software that gives convenient access to major Internet features, including the Web. There's a $25 setup fee plus $19.95 per month. That includes 40 hours of primetime use, and 380 hours of non-primetime and weekend hours. The software for Netcom's NetCruiser provides a full range of Internet access.

Pipeline: User-friendliness is promised by the Pipeline, a provider with slick Windows point-and-click software. The service costs $15 a month with five free hours and $2 for each additional hour, $20 a month for 20 hours, and $35 for unlimited access.

Performance Systems International: Another popular service provider is Performance Systems International, with its PSI Net. PSI Net offers full-featured dial-up connections and the Instant InterRamp access software, which includes access to the Web and other Internet features. Costs are $9 setup, $9 per month for 9 hours, and $1.50 per hour over 9 hours.

Local Access Providers and Free-Nets: With most service providers, you have to dial a long-distance number, a local access number, or an 800 number that results in a long-distance toll or communications surcharge. Those charges are in addition to the provider's basic fees, and they can add up fast.

If you're lucky enough to live in an area where there are local service providers who offer the type and level of service you need, check them out. You might even find their service to be as good as the nationals. Of course, the advantage of using a local provider is that you don't have long-distance telephone tolls or communications surcharges to contend with.

(Continued on page 91)

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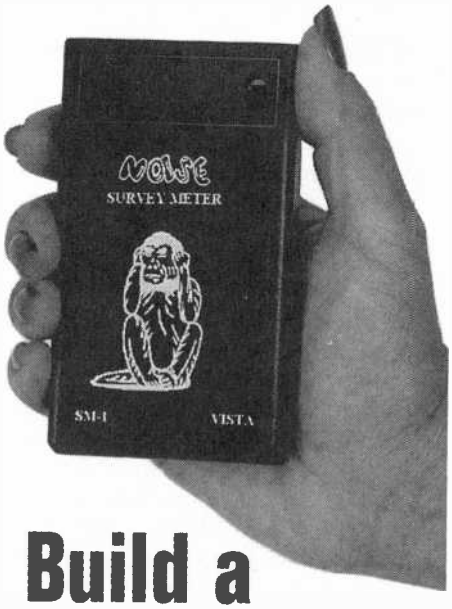

Build a Sound-Level Meter

BY RICHARD PANOSH

Use it to find out just how safe your surroundings are for your hearing.

While still in the womb, we are first exposed to the sounds of our mothers' breathing as well as the pounding of their hearts. From that point, through birth and on, we are constantly surrounded with sound. But not all of the sounds we are exposed to each day are completely safe for our hearing.

It is common today, for example, to see people jogging while immersed in sound from a set of headphones connected to a portable CD player. However, chances are you will also be able to hear their music selection as they pass by, which is a good indication that they might be damaging their hearing. Similarly, while car manufacturers have tried to reduce road noise and wind noise, they have also surrounded drivers and passengers with multi-speaker stereo systems that can achieve levels dangerous to hearing.

What can you do to make sure your surroundings are safe for your ears? Well, you can either walk around with earplugs on, just in case, or build the practical *Sound-Level Meter* described in this article. The unit provides a visual readout of just how many decibels (dB) you're absorbing, using a solid-state LED bar graph with a dynamic range from 30 to 120 dB. It is shirt-pocket sized and highly portable, so you can take it with you to work, to a club, or even to the theater.

Sound and Hearing. Just about everything that moves through the air produces vibrations that we perceive as sound. In nature, the loudest sounds are produced by hurricanes, volcanic eruptions, and of course, thunder. Sounds made by humans are the most intense as well as the most persistent, though. Anyone who listens to a jack hammer for half an hour or who goes to a rock concert can attest to that.

At frequencies below 500 hertz, almost any part of the body can detect vibrations; the fingertips are especially sensitive to such vibrations. But the vibration required to stimulate the hearing threshold is still far more sensitive. At the human-hearing threshold, the vibration of the eardrum causes a displacement of one-billionth of a centimeter, less than the diameter of a single hydrogen atom.

The sensitivity of a high-impedance microphone is generally expressed as so many dB down from a reference. Usually that reference is:

$$0\ dB = 1V_{rms}/\mu Bar$$

where 1 atmosphere of air pressure = 1 Bar at 1 kHz. The Panasonic WM-52BM microphone used in the Sound-Level Meter has a rated sensitivity of -64 ± 2 dB, and will provide $631 \pm 147\ \mu V_{rms}/\mu Bar$. Today the proper unit for that microphone is -44 ± 2 dB where the reference is 0 dB = $1V_{rms}$/Pa (pascal) at 1 kHz. Pascal units increase the older μBar units by exactly +20 dB.

A human ear operates exactly like a microphone to detect sound-pressure waves and convert them to electrical signals that are sent to the brain for processing. The intensity of those pressure waves is interpreted as loudness while the frequency of the wave produces the tone of the sound. Now, the sound intensity perceived by the ear cannot be directly measured, but it has been related to a sound-pressure level (SPL) through careful measurements.

The threshold at which we can perceive a 1-kHz tone is taken as the 0-dB SPL that corresponds to 0.0002 μBars. That is a remarkably small pressure change that indicates the extreme sensitivity of human hearing.

Table 1 illustrates the SPL levels of typical sounds and environments. Ordinary breathing at 10 dB corresponds to a pressure change of 0.0006 μBar. At the other extreme, a space launch produces a pressure vibration of 140 dB, over three million times larger, or 0.002 Bar. Sounds above 100 dB are disagreeable to most people, and prolonged exposure to intensities above 80–90 dB can produce noise-induced hearing loss. Those losses begin with the higher frequencies and progress downward to lower frequencies. A person might recover from such noise-induced hearing loss after a period of rest in a quiet environment, but routine ex-

TABLE 1

Perceived Sound and the Decibel Scale	
Decibel	Description
0	Threshold of hearing
10	Ordinary breathing (barely audible)
20	Rustling leaves in a gentle breeze
30	Country house (quiet)
40	City house
50	Classroom, quiet restaurant (moderate)
60	Large store, ordinary conversation
70	Factory, inside car in heavy traffic (noisy)
80	Downtown street at rush hour, vacuum cleaner
90	Large truck that is 45 feet away (very noisy)
100	Subway train
110	Construction site (nearly intolerable)
120	Jet plane taking off from 180 feet away
130	Machine gun fire at close range (intolerable)
140	Space launch, thunder with nearby lightning stroke (painful)

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posure to that condition over a prolonged duration will lead to permanent hearing damage.

At an SPL level of 100 dB, the pressure changes become 100,000 times larger (20 μBars). It is not surprising, then, that sound pressures of extreme intensity can damage our hearing. The level at which damage is sustained is also a function of duration. Federal, state, and local agencies have established standards on acceptable levels and duration. Table 2 presents one standard from the U.S. Department of Labor for noise regulation. Amplified rock music can easily exceed those limits at just 100 dB(A) for a couple hours.

Note that in Table 2 and in several places in this article the dB measurements are given in terms of dB(A). Here's what that term refers to: The greatest sensitivity of human hearing occurs just above 1 kHz; that sensitivity decreases as frequencies go lower or higher. A device designed to follow the response of the human ear works on a weighted curve—an A-weighted curve. Therefore, the unit is dB(A).

Because sound waves generally radiate spherically outward in all directions, the SPL decreases as the square of the distance. The distance between the source of sound and the point of measurement is, therefore, very important. Table 3 gives the dB attenuation for several convenient measuring distances. Notice that when the distance increases ten times, the dB attenuation is just −20 dB (that relationship only holds for spherical waves in a large room without reflections). The 10-dB-per-segment display of the Sound-Level Meter and its large dynamic range can be easily used to demonstrate that relationship.

TABLE 2

Acceptable Noise Levels (U.S. Department of Labor)	
Sound level (dB(A))	Duration per day (Hours)
90	8
92	6
95	4
97	3
100	2
102	1.5
105	1
110	0.5
115	0.25 or less

TABLE 3

Increase in distance	Sound pressure reduction (dB)
2 times	−6.02
3 times	−9.54
4 times	−12.04
5 times	−13.98
6 times	−15.56
7 times	−16.90
8 times	−18.06
9 times	−19.08
10 times	−20.00

Logarithmic Amplifiers. The design of the Sound-Level Meter is based upon the successive log-detection amplifier used in the Signetics NE614 high-frequency IF amplifier. That IC was originally designed for cellular-telephone applications. It belongs to a family of related devices, one of which also includes an NE602-type mixer on a single die to make a complete, low-power, single-chip, high-performance receiver.

The successive log amplifier provides a detected output signal, referred to as the RSSI (Received Signal Strength Indicator), which is proportional to the received signal strength over about a 90-dB dynamic range. In cellular telephones, that feature is valuable to indicate the operating extremes of the communications channel and to indicate the proper times to exchange cells to maintain a solid signal-to-noise ratio.

Logarithmic amplifiers fall into a category between linear amplifiers that can handle perhaps a 20-dB dynamic range and limiting amplifiers, where most of the amplitude information is lost through clipping action. What also makes a logarithmic amplifier ideal for this project is that it offers instantaneous signal compression with fast response as compared to an automatic gain-control stage or a range-changing amplifier.

Circuit Description. Figure 1 shows the schematic diagram of the Sound-Level Meter. Power for the circuit is provided by B1, a 9-volt battery. Total battery current is 14.5 mA, so an alkaline battery should last about 250 hours.

Audio signals are picked up by microphone MIC1. The output of MIC1 is buffered by Q1 to maintain the 3000-ohm load of resistor R2. The input impedance at pin 16 of the NE614 (U1) is 1600 ohms; R4 provides an additional 1600 ohms of resistance to reduce the gain on the high end and preserve the RSSI linearity. Capacitors C2 and C3 provide low- and high-frequency roll-off, respectively (that allows the unit to follow an A-weighted curve).

Capacitors C4 and C7–C9 are used as filters to bypass internal bias voltages within U1. An external coupling scheme is used between pins 14 and 12 of U1 to couple the first, internal, IF-amplifier stage to the second-stage limiter amplifier.

The RSSI signal is a current source that flows through R6 to establish a voltage at pin 5 of U1; the RSSI output voltage is a function of the input SPL. Capacitor C10 filters that voltage to remove high-frequency components. The slope of the RSSI line is nominally 0.084 V_{cc}/10 dB. Op-amp U2-b is configured as a non-inverting voltage buffer with a gain of 1.2; that gain, multiplied by the RSSI slope, produces a slope of 0.1V_{cc}/10 dB to the remaining circuitry, which includes the display and the power supply.

The components connected between U2-b and U2-a make up a low-pass filter to give the meter a slow response. A slow response is desirable so that the unit responds to an average of the noise and not the peak.

The display, DISP1, is a ten-bar LED that is used to indicate sound level in 10-dB increments from 30 to 120 dB(A). The display is driven by an LM3914 linear bar-graph driver, U5. The internal voltage regulator of U5 functions by establishing a constant current through R15, because the voltage between pins 7 and 8 is maintained at 1.25 volts. The resulting voltage at the emitter of Q2 is about 5 volts, which powers U1, U3, and the internal voltage-divider string of U5 at pin 6.

While the divider string is temperature dependent, the division ratio is very stable and accurate. When powered from Q2 at a constant voltage (V_{cc}), U5's voltage steps remain stable at a slope of V_{cc} divided by the ten steps. The resulting slope is therefore 0.1 V_{cc}/step, which compares nic-

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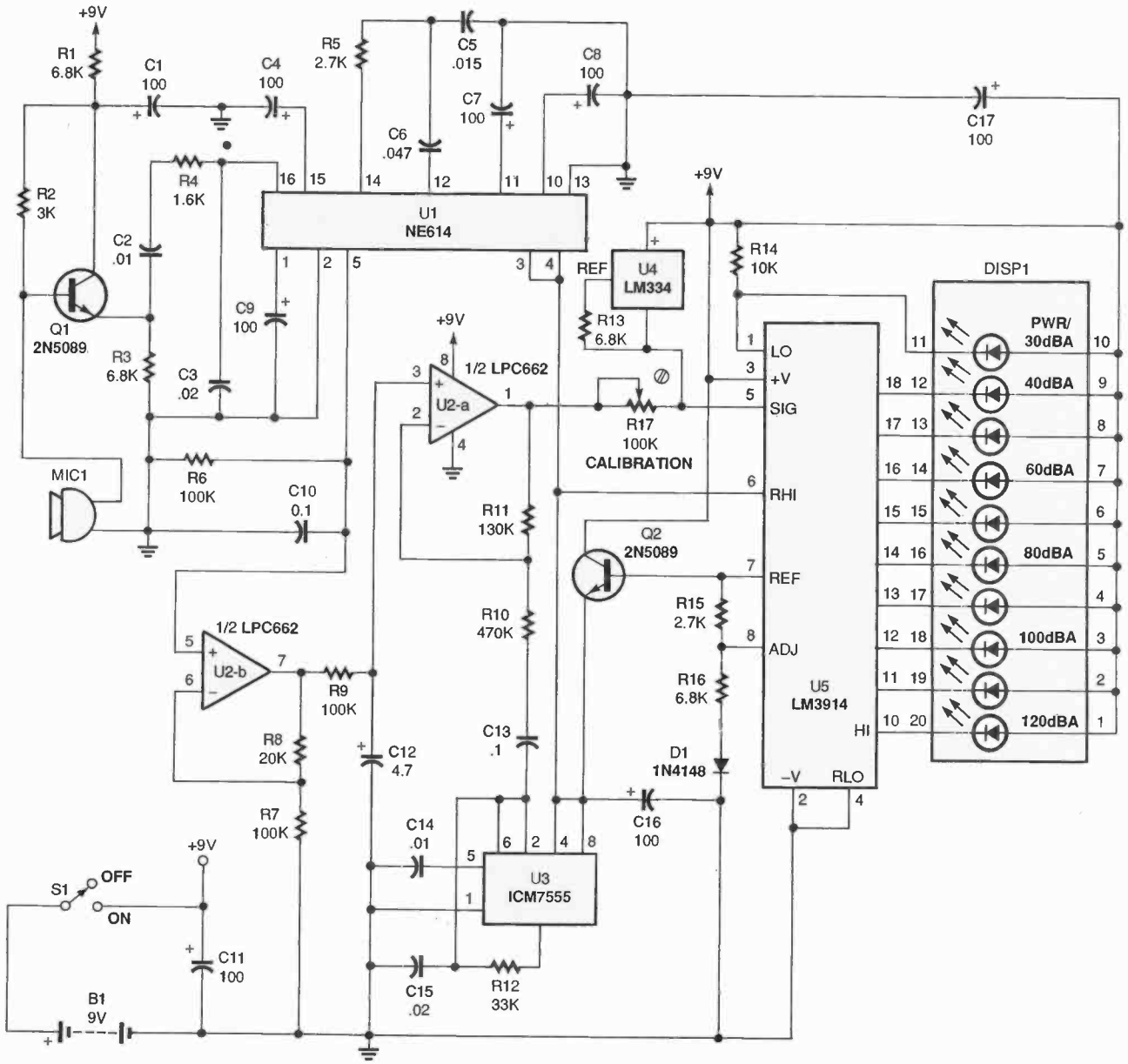
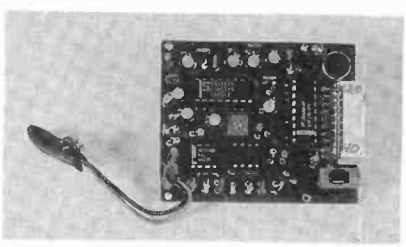


Fig. 1. Here's the schematic for the Sound-Level Meter. It uses an electret condenser microphone, MIC1, to pick up noise in a room. The unit then measures the level of that noise and displays it on DISP1, an LED bar-graph disply.

ely with the RSSI signal slope of 0.1 V_{cc}/10 dB. Therefore, each segment of the display will increase by 10 dB, independent of the exact magnitude of V_{cc}.

While the slopes of the display driver and the RSSI signal are the same, they might not have the same offset. For that reason, an LM334, U4, is used to source a constant 10-microamp current through R17 to generate a fixed offset voltage on top of the composite RSSI voltage at the output of U2-a. By adjusting the value of potentiometer R17, differences in microphone sensitivity can be accommodated so that the display reads properly from 30 to 120 dB(A). The proper readout of the display is also ensured by an ICM7555 timer, U4, which is configured as a self-excited, squarewave oscillator; the resulting peak-to-peak, 1-kHz signal of the timer is almost one step size of DISP1 (that's the equivalent of an LED bar).



This board shot shows how DISP1 looks when mounted properly.

Construction. The author's prototype for the Sound-Level Meter was built on a double-sided printed-circuit board. Building the Meter on a PC board with a good ground is strongly recommended because the NE614 is a high-frequency IC. If you would like to make your own PC board, you can use the solder- and component-side templates shown in Figs. 2 and 3, respectively. An etched and drilled board is also available from the source mentioned in the Parts List.

A parts-placement diagram is shown in Fig. 4. Cut the pins of the LED display to a length of approximately 3/16-inch. Mount the LED display sideways with pins 11 through 20 lined up

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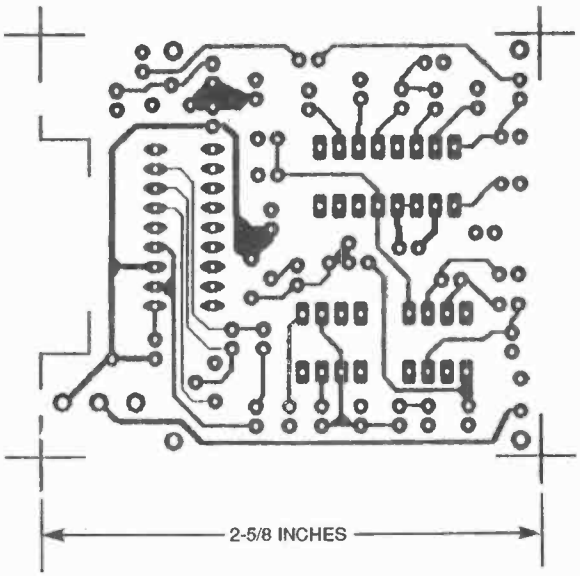

Fig. 2. This is the full-size foil pattern for the solder side of the double-sided PC board.

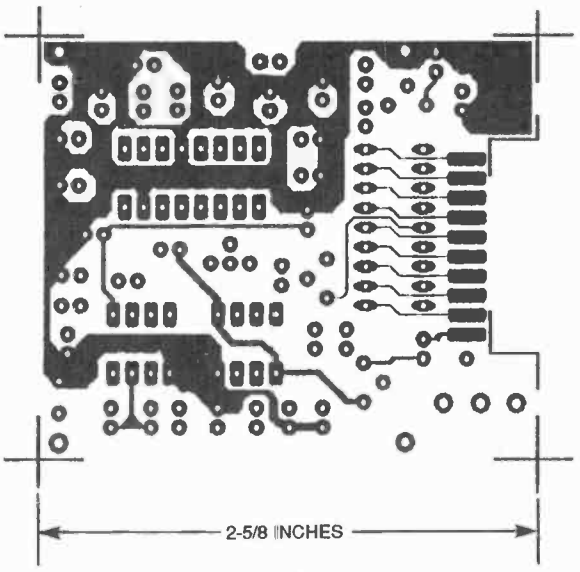

Fig. 3. Here's the component side of the board.

PARTS LIST FOR THE SOUND-LEVEL METER

SEMICONDUCTORS

U1—NE614 high-frequency IF amplifier, integrated circuit
U2—LPC662 dual operational amplifier, integrated circuit
U3—ICM7555 timer, integrated circuit
U4—LM334 constant-current source, integrated circuit
U5—LM3914 linear bar-graph driver, integrated circuit
Q1, Q2—2N5089 NPN transistor
D1—1N4148 silicon diode
DISP1—Ten-LED bar graph

RESISTORS

(All fixed resistors are ¼-watt, 5% units.)
R1, R3, R13, R16—6800-ohm
R2—3000-ohm
R4—1600-ohm
R5, R15—2700-ohm
R6, R7, R9—100,000-ohm
R8—20,000-ohm
R10—470,000-ohm
R11—130,000-ohm
R12—33,000-ohm
R14—10,000-ohm
R17—100,000-ohm trimmer potentiometer

CAPACITORS

C1, C4, C7, C8, C9, C11, C16, C17—100-µF, 10-WVDC, electrolytic
C2, C10, C13—0.1-µF ceramic-disc
C3, C15—0.02-µF ceramic-disc
C5—0.015-µF ceramic-disc
C6—0.047-µF ceramic-disc
C12—4.7-µF, 10-WVDC, electrolytic
C14—0.01-µF ceramic-disc

ADDITIONAL PARTS AND MATERIALS

MIC1—Electret condenser element (Digi-Key part no. P9970-ND or equivalent)
S1—SPST slide switch
B1—9-volt battery
Printed-circuit materials, project enclosure, battery snap with leads, IC sockets, wire, solder, hardware, etc.

Note: The following items are available from Vista (P.O. Box 1425, Bolingbrook, IL 60440; Tel. 708-378-5534): NE614 IF Amplifier—$4.50 (plus $3.00 shipping and handling); pre-etched PC board (NOISE-BRD)—$10.00 (plus $3.00 shipping and handling); kit of all parts including prepunched case with silk screen and battery (NOISE-KIT)—$48.00 (plus $5.00 shipping and handling); a fully assembled version is available with battery (NOISE-ASSEM)—$59.00 (plus $5.00 shipping and handling). Illinois residents please add 7.5% sales tax. Check, money order, and credit cards are accepted. For fast check verification, please provide street address (no P.O. boxes), telephone number, and driver's-license number and state of issue.

with the pads along the component side of the board. The face of the display should be pointing away from the board, and pins 1 through 10 should be located above the component side of the board. Solder those free pins together with a wire and connect that wire to the solder pad closest to pin 20 of the LED display (see Fig. 4).

Next mount sockets for the U1–U4, making sure to observe proper orientation for each. The smaller, monolithic capacitors should be mounted next. Do not substitute other values for the capacitors, as most of the values tailor the bandwidth. Next, vertically mount the fixed resistors.

Mount the trimmer potentiometer, diodes, transistors, and the constant current source (U4). The electrolytic capacitors should be mounted next; make sure to match the proper polarity as shown in Fig. 4. Next install slide-switch S1 so that about 1/16 inch of the leads protrude through the PC board. That will give the switch the proper height and clearance for the SerPac M6 case that comes with the Sound-Level Meter kit.

Trim the battery-snap leads to approximately 2½ inches, and solder them to the board, using the parts-placement diagram as a guide. You might want to apply silicone rubber to where the leads attach to the board to reduce the strain on the joint.

Clean the board of residual flux before installing the microphone (make sure that the component doesn't make contact with any cleaning solvents). The microphone used is a Panasonic WM-52BM (Digi-Key part

(Continued on page 94)

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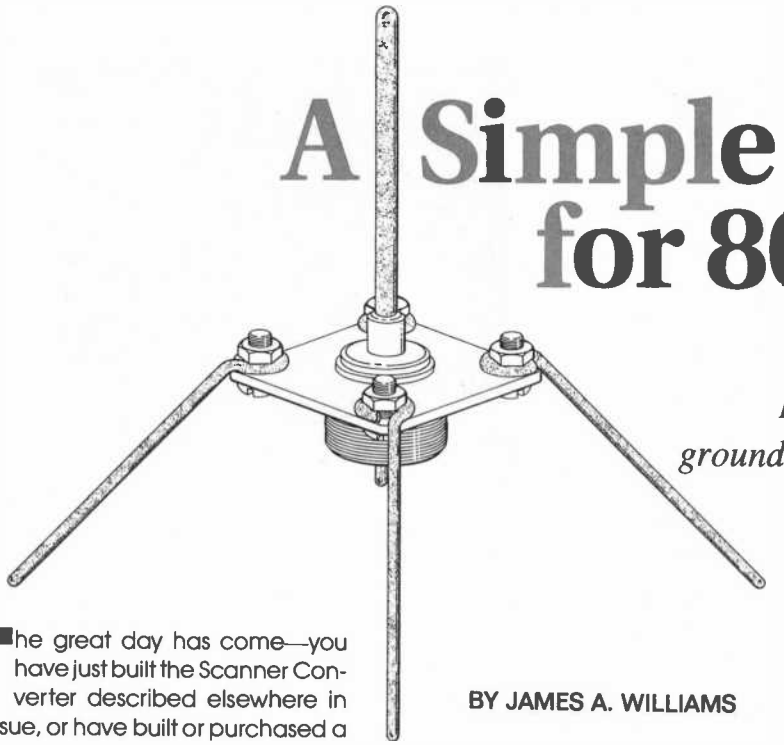
A Simple Antenna for 800 MHz



Build this simple quarter-wave ground-plane antenna and hear what you've been missing on the 800-MHz band.

BY JAMES A. WILLIAMS

The great day has come—you have just built the Scanner Converter described elsewhere in this issue, or have built or purchased a similar unit. You hook it up, thinking about all of the new frequencies you are going to be able to listen to, only to be disappointed in the apparent performance. All seems to be working properly, so what went wrong?

Then it hits you—it's the antenna! Your old antenna is not optimized for your new frequencies. Not to worry; you have a couple of alternatives. One is to buy a commercial 800-MHz antenna. Those are great; commercial antennas are well made, durable, and have excellent performance. But they do have one disadvantage, they're expensive.

The second alternative is to build your own. The *800- to 900-MHz Scanner Antenna* described here can be built in a couple of hours, or less, and costs around $5.00. While it is tweaked for the range of 800–900 MHz, it also does a great job for local reception on the other VHF/UHF bands. Building your own antenna also gives you the opportunity to get more involved with your radio/scanner hobby.

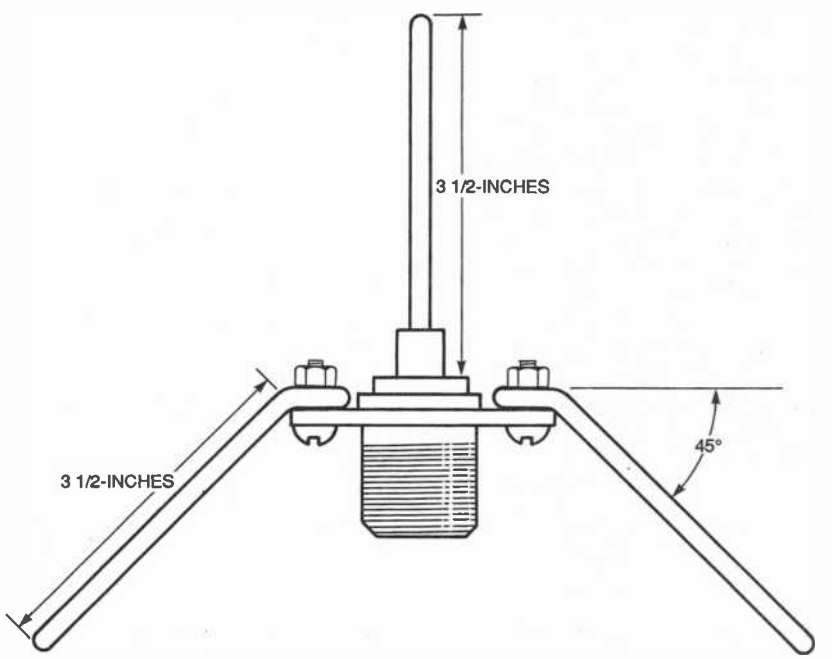


Fig. 1. This simple quarter-wave antenna can improve performance on the 800-MHz band and can be built in just a couple of hours.

A Quarter-Wave Ground Plane. The antenna described here and shown in Fig. 1 is a quarter-wave ground plane. That simple and popular design is sometimes called an omnidirectional or non-directional antenna because it can receive RF signals from all compass directions.

The antenna consists of a radiator element that is ¼-wavelength long and has four radials that are also ¼-wavelength long. The radials at the bottom of a vertical antenna act as a ground under the antenna. That is the reason those antennas are called ground-plane antennas.

The required lengths for the radiator element and the radials can be found from the simple equation:

$$L(\text{feet}) = 234/f(\text{MHz})$$

Assuming a center frequency of 850 MHz, the radiator and radial lengths should be about 3.5 inches. Because this is a receiving antenna, not a transmitting one, an approximate length is sufficient, making measuring and cutting the elements a lot easier.

Building an Antenna. Enough of the technical talk; lets make an antenna! First you will need the items given in the Parts and Materials List. Be sure to use a silver-plated SO-239 connector as specified; the less expensive and commonly available nickel-plated ones will not work. Once you have gathered all the items, start by cutting

(Continued on page 94)

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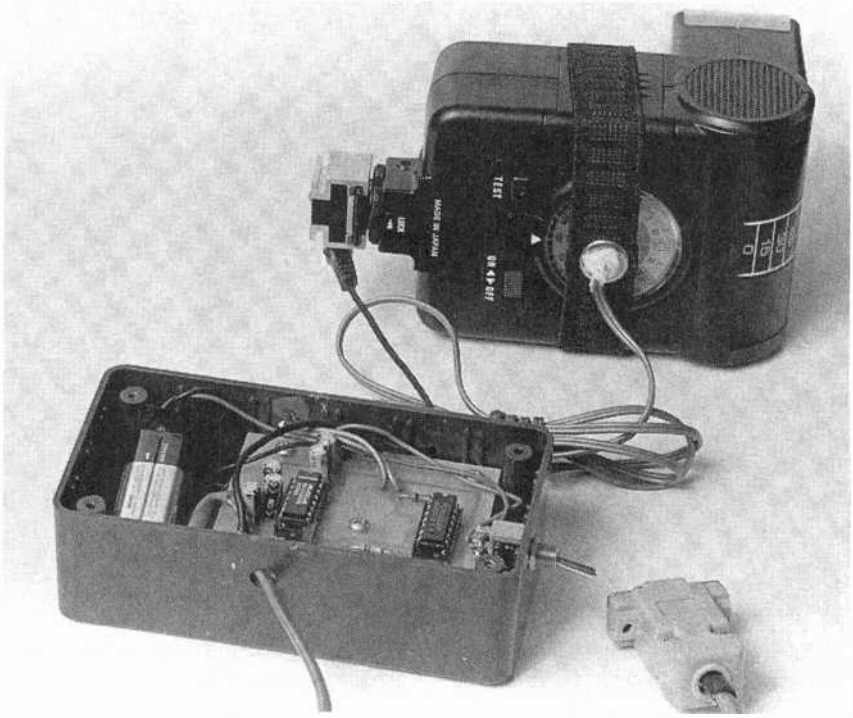

BY JAMES BAILEY

Build a Flash-Battery Tester

Just how good are the batteries you're using in your flash? Use this project and your PC to find out.

Want to know exactly how a particular brand or type of battery performs in your electronic flash? Well, if you have a PC, you can use it and the *Flash-Battery Tester* described in this article to evaluate different batteries in your flash and get a permanent record of how well they did.

With the Tester, there's no need to invest in or build an expensive analog-to-digital converter or data-acquisition system. Neither will you need to write several pages of complex code to do the testing. Just enter into your PC the short BASIC program listed within this article, plug the Tester into the computer's serial port, and you're all set.

Battery Differences? We'll get to how the Tester works in a moment. But first, let's just take a brief look at how different types of batteries behave in different ways when used with a camera flash.

Figure 1 contains a graph showing how one brand of "AA" alkaline batteries compares with "AA" lithium ones. As you can see, lithium batteries maintain a shorter recycle time for a greater number of flashes. After 150 flashes, an alkaline battery takes almost 29 seconds to recycle the flash, while a lithium battery only takes 10 seconds to recycle after the same number of flashes.

But the differences don't end with types of batteries. Different brands of the same type of battery can perform significantly better or worse than each other as well. So, as you can see, there are lots of tests to perform with the Flash-Battery Tester.

Circuit Description. The schematic for the Flash-Battery Tester is shown in Fig. 2. Power from a 9-volt battery, B1, is fed to a 78L05 regulator, U3. The IC then produces a regulated 5 volts to power the rest of the circuit.

A cadmium-sulfide photocell, PC1, conducts when a connected flash's ready light comes on and illuminates it. When current flows through PC1, U1-a and U1-b, two sections of a 74HC132 quad Schmitt trigger NAND gate, produce a sharp-edged TTL high. A MAX232, U2, converts the high to an RS232 low that is compatible with the PC's serial port. The MAX232 also takes an incoming serial-port pulse and converts it to TTL levels to fire the flash via SCR1, a C106D2 silicon-controlled rectifier.

As mentioned earlier, the circuit works with a BASIC program (see Listing 1). That program fires the flash by sending a brief pulse through plug PL1 to the serial port's DTR pin. The program then starts timing how long it takes for the flash to recycle. In other words, the program "looks" at the CTS pin over and over until it sees that it went low. That happens when the photocell is lit by the flash's ready light. The program records the elapsed time and then continues counting until one minute elapses.

At that time the DTR pin is cycled again to fire the flash and the process is repeated. The test concludes when the recycle time exceeds 45 seconds.

Construction. There is nothing critical about the layout of the Tester, so any project-building method can be used. For those who would like to etch a PC board, however, a full-size template is shown in Fig. 3.

If you use a PC board, refer to the parts-placement diagram in Fig. 4 when installing the components. Begin by mounting IC sockets for U1 and U2. Make sure they are oriented properly. Then, go on to install the resistors and capacitors, making sure to match the polarity of the latter with what's shown in Fig. 4.

Next go on to solder U3 and SCR1 to the board. Make sure to follow the orientation shown for the components in the parts-placement diagram.

Now we get to a slightly more tricky part, the photocell assembly. Cut an elastic strap to a length of approximately 7 inches. Sew the strap so that it makes a band or loop, and then cut a hole in it.

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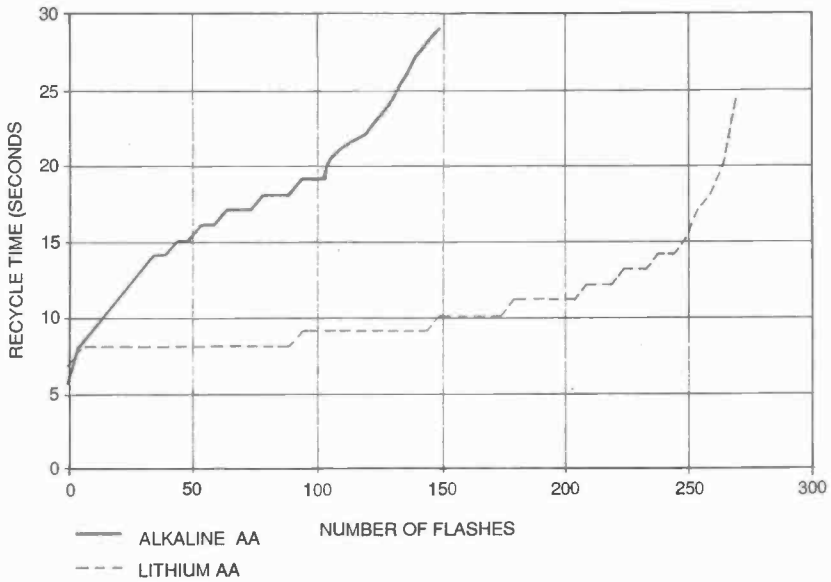

Fig. 1. As this comparison chart shows, typical lithium batteries keep shorter flash recycle times for a greater number of flashes than do alkaline ones.

using a large center punch.

Solder two-conductor wire to the photocell's leads. Unless the photocell's leads are very short, insulate the connections with shrink tubing. Center the photocell in the eyelet so that the sensor points into the band, and epoxy the photocell in place. When the epoxy is cured, you might want to reinforce the leads with more epoxy or silicone caulk.

When the photocell assembly is ready, take the loose ends of the wire and attach the conductors to their appropriate points on the board (see the parts-placement diagram). The elastic band should easily slip over your flash.

Use one end of a flash sync cord to connect the Tester to your flash (sync cords are available at any photo

LISTING 1

```
10 ' ********** RECYCLE TEST **********
20 KEY OFF
30 C$="                    "
80 '
90 '
100 ********** ESTABLISH DISK FILE **********
105 '
110 '
115 CLS: LOCATE 1,1:INPUT"ENTER DATA FILENAME
";FILENAME$
120 FILENAME$="A:"+ FILENAME$+".PRN"
130 OPEN FILENAME$ FOR APPEND AS #1
140 N%=0
150 INPUT "ENTER SAMPLE DESCRIPTION
";SAMPLE$
160 PRINT #1, SAMPLE$
170 PRINT #1,"FLASH #";",";"SECONDS"
180 '
190 '
200 ********** ARE YOU READY? **********
205 '
210 '
215 CLS:LOCATE 1,1:PRINT "PRESS ANY KEY TO
START TEST"
220 A$=INKEY$:IF A$="" THEN GOTO 220
230 CLS
240 '
250 '
260 ********** FIRST SHOT **********
270 '
280 '
310 F=TIMER
320 OUT &H3FC,(&H1 OR INP(&H3FC))
330 FOR I%=1 TO 10 :NEXT I%
340 OUT &H3FC,(&HFE AND INP(&H3FC))
350 FOR I%=1 TO 1000: NEXT I%
360 '
370 '
380 ********** CHECK FOR READY **********
390 '
400 '
405 LOCATE 1,1:PRINT C$:LOCATE 1,1:PRINT
"FLASH IS CHARGING"
410 T%=(INP(&H3FE)AND &HFF)
415 IF T%>5 THEN GOTO 420
417 LOCATE 1,1:PRINT C$:LOCATE 1,1:PRINT"READY
LIGHT IS ON"
420 LOCATE 2,1:PRINT C$:LOCATE 2,1:PRINT USING
"##.##";TIMER-F
430 IF T%>5 THEN GOTO 405
440 B=TIMER-F
450 N%=N%+1
460 GOSUB 1000:' ********** SAVE READING TO
DISK **********
465 ' ********** IF RECYCLE TIME IS >45 SEC, THEN
TERMINATE TEST ******
470 IF B>=45 THEN GOTO 9000
500 ' ********** NEXT CYCLE
**********
515 LOCATE 5,1:PRINT"ELAPSED TIME= "
520 LOCATE 5,17:PRINT USING "##";TIMER-F
530 IF TIMER-F>=60 THEN GOTO 550
540 GOTO 520
550 CLS:GOTO 310
995 '
1000 ' ********** DISK DATA STORAGE
**********
1005 '
1010 PRINT #1,N%;",";B
1020 RETURN
8990 '
8900 ' ********** CLOSE DISK FILE AND END TEST
**********
8910 '
9000 CLOSE #1
10000 END
```

Pass one half of a brass eyelet through the hole in the band, and put a few drops of white glue around the edges of the hole to keep the edges from fraying. Slip the other half of the eyelet through the first half's opening. Secure the halves together using a swagging tool or by hammering them store). Cut off the end that doesn't go to the flash, strip the exposed leads, and solder them across SCR1 as shown in Fig. 4.

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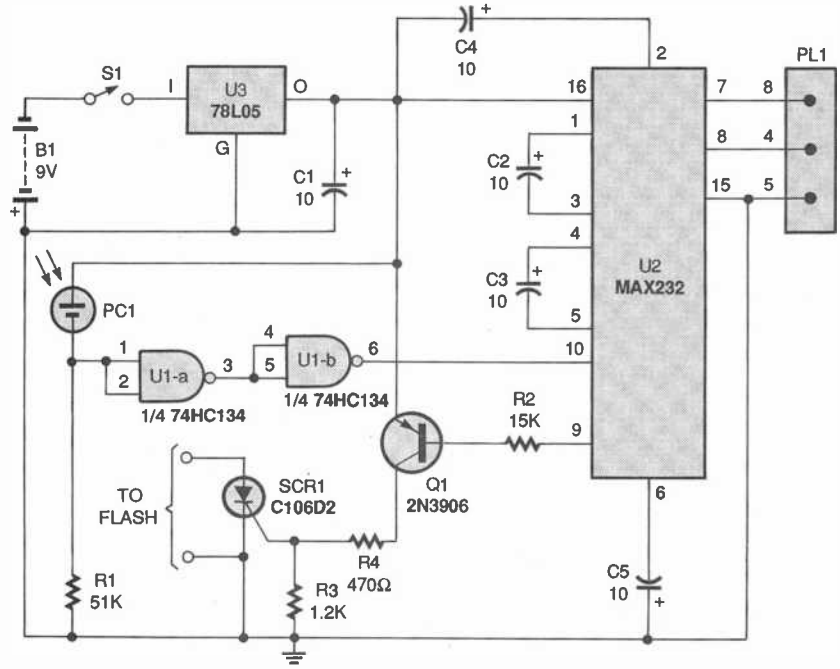

Fig. 2. This is the schematic for the Flash-Battery Tester. A MAX232 (U2) and a 9-pin D plug (PL1) provide a simple interface to a PC.

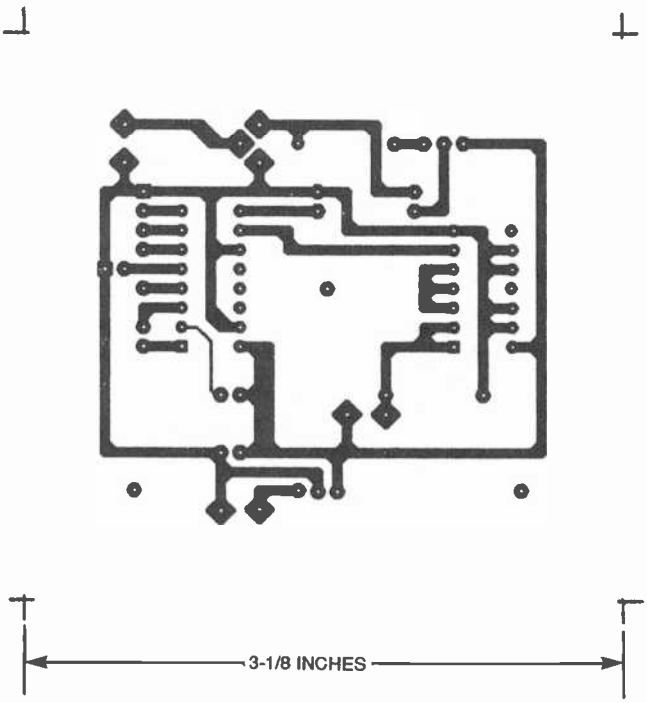

Fig. 3. Layout of the Tester is not critical, but if you'd like to build the project on a PC board, use this template to etch your own.

Mount the board in a suitable project enclosure. Using the parts-placement diagram as a guide, attach a battery snap and leads for switch S1 to the appropriate points. Mount the switch to the enclosure and connect that component to the leads you just mounted.

The last step is to attach the proper pins of PL1, the 9-pin D plug and shell, to their proper points on the board. Use a four-conductor wire to accomplish that.

Checkout. Install a 9-volt battery and turn S1 on. Connect a voltmeter between pins 5 and 8 of PL1. Be sure that the photocell is somehow kept dark. The voltmeter should read between 8 and 10 volts, and pin 8 should be positive. Shine a flashlight at the photocell; the voltmeter should now read the same voltage, but pin 8 should be negative.

Strap the photocell around your flash so the photocell sits directly over the ready light. Turn on the flash. When the ready light comes on, pin 8 of PL1 should again switch from positive to negative.

Temporarily connect pin 8 of PL1 to pin 4. Keep the photocell dark. Connect your flash to the sync cord, and turn on the flash. Measure the voltage across SCR1; it will be between 5 and 250 volts, depending on the type of synchronizing interface the flash has, but the actual voltage is not important. What is important is that the anode of SCR1 must be positive with respect to its cathode. If not, disconnect the flash, turn off S1, and reverse the wires from the sync cord to SCR1.

Reconnect the flash, if necessary, and turn on S1 and the flash. After the flash's ready light comes on, shine the

(Continued on page 93)

PARTS LIST FOR THE FLASH-BATTERY TESTER

SEMICONDUCTORS

U1—74HC134 quad Schmitt trigger NAND gate
U2—MAX232 RS232 interface
U3—LM78L05 5-volt regulator
Q1—2N3906 PNP transistor
SCR1—C106D2 silicon-controlled rectifier

RESISTORS

(All resistors are ¼-watt, 5% units.)
R1—51,000-ohm
R2—15,000-ohm
R3—1200-ohm
R4—470-ohm

ADDITIONAL PARTS AND MATERIALS

C1–C5—10-µF, 16-WVDC, electrolytic capacitor
PC1—Cadmium-sulfide photocell
S1—SPST miniature toggle switch
PL1—9-pin D plug and shell
Printed-circuit materials, project enclosure (Radio Shack 270-222 or equivalent), electronic flash-sync cord (should fit your flash), IC sockets, 9-volt battery and connector, two-conductor wire (such as speaker wire) for photocell, four-conductor wire (such as telephone wire) for D plug, elastic strap, brass eyelet, epoxy, wire, solder, hardware, etc.

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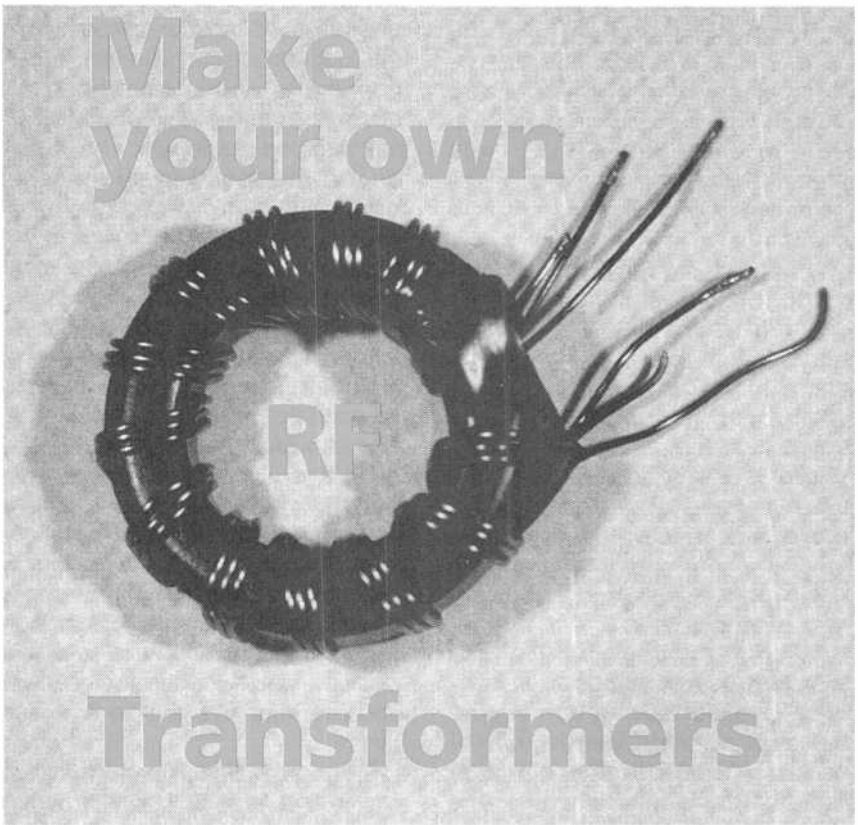

Here's how to make your own BALUN, matching, and other broadband RF transformers.

BY JOSEPH J. CARR

Broadband radio-frequency (RF) transformers are used extensively by SWLs and ham operators to match the impedance of antennas to the 50-ohm system impedance that is standard on most receivers and transmitters. In some cases, those transformers also convert a balanced load to an unbalanced one consistent with coaxial-cable use. Such transformers are called BALUNs (for BALanced UNbalanced). Not all RF broadband transformers are BALUNs, however, even though it is common among both SWLs and hams to use the term "BALUN" universally. There are also balanced-to-balanced (BAL-BAL) devices and unbalanced-to-unbalanced (UN-UN) devices.

For those who are not familiar with the concept, a "balanced" device means that the signal voltage is not referenced to ground or any common point. An example is the feedpoint of a half-wavelength dipole. Conversely, in "unbalanced" devices the signal voltage is referenced to ground. An example is the coaxial antenna input of a receiver.

While one can buy RF transformers, especially BALUNs, in certain standard versions (*e.g.* 1:1 and 4:1 impedance ratios), odd versions are harder to find. In addition, receiver owners might not like the bulky transformers used by ham operators. Those transmitting transformers are large because they have to handle high RF-power levels. A receiver can make do with much smaller transformers.

Transformer Basics. A transformer is an electronic component consisting of at least two magnetically coupled windings of wire wound over a common core (see Fig. 1). The winding connected to a source of electrical current is the primary winding, while the winding connected to the load (resistor R_L in the figure) is the secondary winding.

In a radio-receiver antenna system, the antenna is the "signal generator" and the receiver is the load, but otherwise the setup is conceptually very similar to Fig. 1. When a primary current (I_P) flows, it sets up a magnetic field around the winding. That field induces current I_S into the secondary winding, and that current flows in the load resistor.

Transformers come in a wide variety of types and uses, but for this article the class that we will concern ourselves with are broadband RF transformers. Those transformers are wound over a variety of different core types, including: air, powdered iron, and ferrite. Those materials are efficient at RF, but not at lower frequencies.

There is a very definite relationship between the voltages and currents found in the primary and secondary windings. The voltage across the secondary winding is directly proportional to both the voltage applied to the primary winding, and the turns ratio between primary and secondary windings; *i.e.* the ratio between the number of turns in the primary (N_P) and secondary (N_S):

$$V_P/V_S=N_P/N_S$$

The currents in the two windings are inversely proportional to the turns ratio, or:

$$N_P/N_S=I_S/I_P$$

If you combine those two equations, you will find that $V_PI_P=V_SI_S$, which is a constant.

Impedance-Matching Transformers. Transformers not only change voltages and currents, but they also can transform impedances. When you find yourself dealing with a 12-ohm impedance at the feedpoint of a quarter-wavelength vertical antenna, and need to match it to a 50-ohm receiver input or transmitter output, then an impedance transformation of 50/12, or about 4:1, is needed. As in our earlier discussion, the impedance transformation is a function of the turns ratio:

$$N_P/N_S=\sqrt{Z_P/Z_S}$$

Suppose we need to match a 500-ohm long-wire antenna to a 50-ohm receiver input (a 10:1 impedance transformation), working the above equation shows us that the primary to secondary turns ratio needs to be about 3.2:1.

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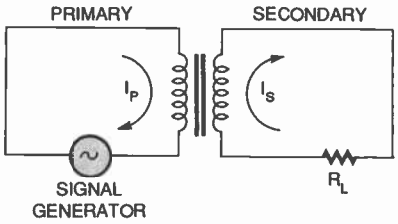

Fig. 1 The circuit of a basic transformer consists of two (or more) windings of wire over a common, magnetically coupled, core.

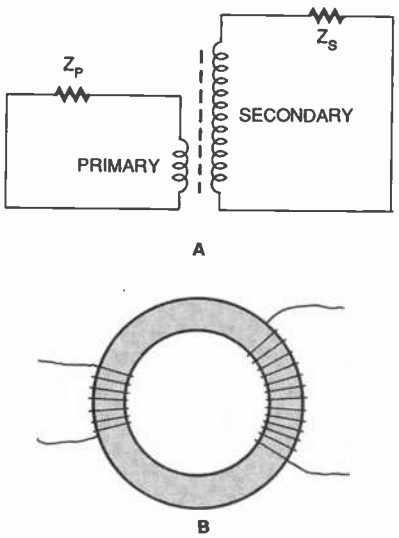

Fig. 2. A basic step-up (or step-down if reversed) transformer is shown in A, while B shows how such a transformer could be wound on a toroidal form.

We sometimes speak of the load impedance being "reflected" into the primary circuit. That term refers to the apparent impedance seen looking into the transformer primary when a given impedance is connected across the secondary. Consider Fig. 2a in which an impedance, Z_S, is connected across the secondary of the transformer; the primary has fewer turns than the secondary, so the impedance reflected is less than the load impedance.

Figure 2b shows one way such a transformer can be wound on a toroidal coil form. The primary and secondary windings are wound separately, and are magnetically coupled through the form. They could also be wound over one another, or in a bifilar fashion; that is, two parallel windings wound together over the core.

BALUN Transformers. The purpose of a BALUN transformer is to convert a balanced load impedance, such as a dipole or a push-pull RF amplifier, to an unbalanced load such as a receiver antenna input, transmitter antenna output, or a single-ended amplifier. Those transformers are bilateral, so one can also turn them around backwards and match an unbalanced load to a balanced output circuit.

A popular use for BALUN transformers is to connect the center feedpoint of a dipole to a coaxial transmission line. Tests in antenna chambers and in the field demonstrate clearly that practical dipole-antenna patterns approach the ideal "figure-8" only when connected to a BALUN transformer. When the coaxial cable is connected directly to the feedpoint, the currents flowing in the shield radiate signal, and that distorts the antenna pattern.

BALUN transformers are typically specified according to the impedance ratio that they will convert. The two most common varieties are 1:1 and 4:1. A 1:1 BALUN transformer reflects the same impedance into the primary circuit as is connected to the secondary circuit. Thus, a dipole's 75-ohm, balanced, center impedance will be reflected as a 75-ohm unbalanced impedance for connection to the coaxial cable. The 4:1 BALUN transformer, on the other hand, reduces the reflected impedance by four. A folded dipole, which has a balanced feedpoint impedance of about 300 ohms, will, when connected to a 4:1 BALUN, reflect a 75-ohm unbalanced impedance for coaxial cables.

The circuit for a 4:1 BALUN transformer is shown in Fig. 3. It consists of two bifilar wound coils of wire. The dots on each coil indicate the same ends. To make BALUN transformers for the high-frequency (HF) shortwave bands, wind ten bifilar turns of wire around a ferrite or powdered-iron coil form. The actual number is not terribly critical. If the antenna is for the upper end of the HF spectrum (higher than 18 MHz), then you can use as few as five turns, and if it is only for the lower end (less than 7 MHz) use eighteen turns.

There are a few different methods for winding 4:1 BALUN transformers. A solenoid-wound transformer wound on a powdered iron or ferrite core is shown in Fig. 4. It is called a solenoid-wound transformer because the length of the unit is greater than its diameter. A 4:1 BALUN wound on a toroid is shown in Fig. 5. Note that both of the BALUNs are wound in a bifilar fashion. Also, as indicated in the figures, it is a good idea to use two different-colored wires in order to keep them identified when winding the coil.

A 1:1 BALUN-transformer circuit is shown in Fig. 6. That transformer can

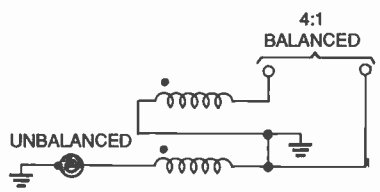

Fig. 3 Here's the circuit diagram for a typical 4:1 BALUN transformer. It is called a BALUN because it converts a balanced load to an unbalanced one.

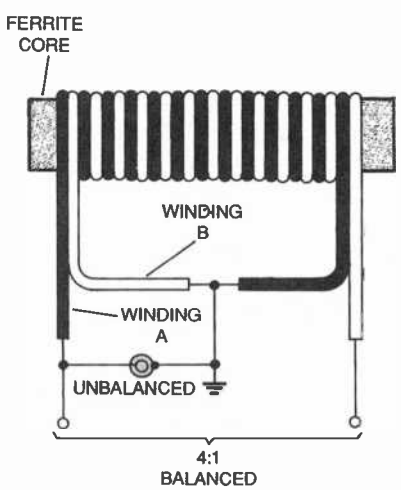

Fig. 4. Here's a 4:1 BALUN wound over a ferrite solenoid core. Note that the unit is bifilar wound.

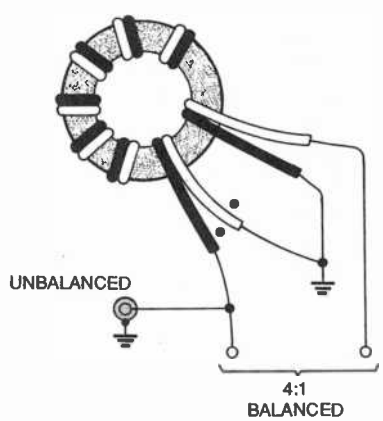

Fig. 5. Here's the same 4:1 BALUN wound over a toroid core. Use different-colored wire to make it easier to keep track of the windings.

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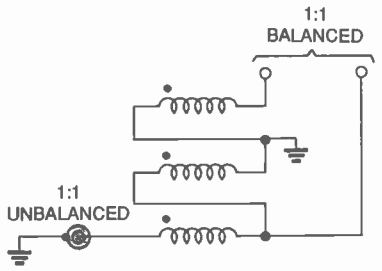

Fig. 6. A 1:1 BALUN requires a trifilar winding; that is, three coils wound together in parallel.

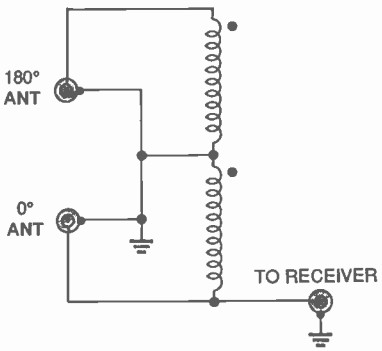

Fig. 7. This phase-shift transformer, based on the 4:1 BALUN circuit, overcomes the transmission-line problems associated with feeding two antennas out-of-phase.

be wound using the same methods as the 4:1 BALUN, but requires trifilar windings; that is, three parallel wires wound on the same form. Those windings can be either parallel, or twisted, as you prefer. One practical use for a 1:1 BALUN is at the center feed point of a standard half-wavelength dipole.

Phase Reversal Transformers. A number of shortwave listeners and ham-radio operators sometimes build phased antennas to enhance, or vary, directional characteristics. A common version of that theme is to place vertical antennas a half-wavelength apart. When those antennas are fed in-phase with each other, the reception and radiation pattern occurs at right angles to the line between the verticals. But if the antennas are fed 180 degrees out of phase with each other, the direction of radiation or reception flips 90 degrees and appears along the line between the antennas.

There are several ways to feed the two antennas, but nearly all of them pose problems that the authors of books and articles somehow fail to mention. For example, to feed the antennas 180-degrees out-of-phase with each other, the recommendation is to connect the coaxial cable from the receiver or transmitter to one antenna, and then connect that junction to the other antenna through a half-wavelength piece of coaxial cable. Unfortunately, that recommendation fails to account for the coax's velocity factor, which tends to be something on the order of 0.66 or 0.80. That means under the best of circumstances that a half-wavelength piece of coax will only be 80 percent of the required length.

Another popular suggestion is to use three half wavelengths. The problem there is that such a scheme distorts the current distribution in the antenna—because of coax losses—and the antenna patterns are valid only for equal currents.

Of course, there is a better way! Run equal lengths of identical coax (that is important) from each antenna to the receiver, and then combine the signals in a 180-degree phase-shift transformer. There are a couple of different ways to accomplish that. A simple version is shown in Fig. 7. There, a bifilar-wound RF transformer, identical to the 4:1 BALUN transformer, is used, but it is turned around backwards. One antenna is connected to the 180-degree port, while the other antenna is connected to the 0-degree port.

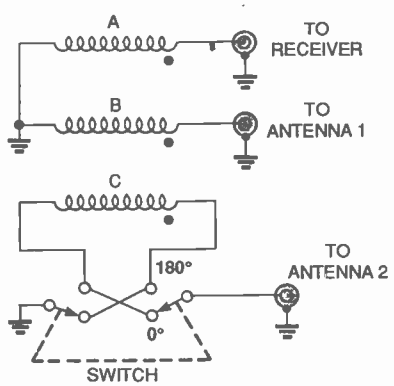

Fig. 8. This trifilar phase-shift transformer allows two antennas to be fed either in phase or 180-degrees out-of-phase.

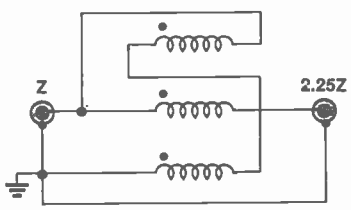

Fig. 9. This transformer is useful when working with certain half-wavelength dipole antennas. Note that it is a BAL-BAL unit.

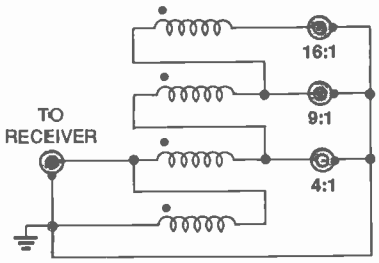

Fig. 10. This BAL-BAL transformer could be used to match multiple impedances. It can be made even more versatile by adding taps and a switch to the top (fourth) winding.

Another scheme is shown in Fig. 8. In that circuit, the phase-shift transformer consists of three trifilar windings similar to the way a 1:1 BALUN is wound. Winding "A" is connected between ground and the antenna input of the receiver (or antenna output of the transmitter); winding "B" is connected to one antenna ("antenna 1"); and winding "C" is connected to a double-pole double-throw (DPDT) switch and the other antenna ("antenna 2").

When the DPDT switch is in the position shown, the dotted end of winding C is grounded, so antenna 2 is 180-degrees out-of-phase with antenna 1. Alternatively, when the DPDT switch is in the other position, the undotted end of winding C is grounded, so it has the same phase sense as winding B.

Other Impedance-Ratio Transformers. The 1:1 and 4:1 BALUN transformers are probably the most commonly used, but are by no means the only ones required. There are a number of practical situations where the impedance ratio is other than 1:1 or 4:1, and for those cases a different transformer is needed. Examples include vertical antennas other than quarter wavelength, some quarter-wavelength verticals (the feedpoint impedance is determined by the particular installation), dipoles that are mounted close to the ground, beverage and long-wire antennas, some random-length wire antennas, and some loop antennas. Solid-state RF amplifiers might also require some unusual impedance transformations.

(Continued on page 93)

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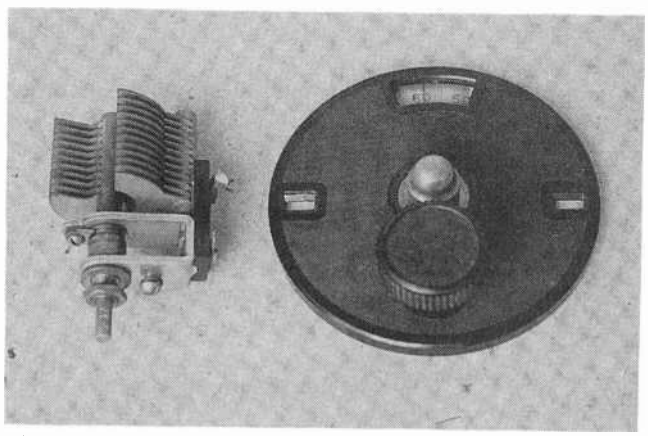
ANTIQUE RADIO

By Marc Ellis

Scrounging Parts For the 1930 Ham Receiver

Last month, we introduced our latest *Antique Radio* project: the construction of a starter ham receiver as recommended by the Amateur Radio Relay League circa 1930. Appropriately designed for the limited experience of the prospective builders and the leanness of depression-era family budgets, this was a simple radio. It required only a handful of parts, most of which could be salvaged from one of the battery-operated broadcast sets then being made obsolete by the new AC-operated receivers.



The "midget" 23-plate tuning capacitor with 10-1 vernier dial is ready for installation on the front panel.

Yet, such was the state of the electronic art back in those simpler times, that this "beginner's set" could really be quite competitive on the bands. In the introduction to the construction article, the ARRL stated "... It may surprise you to know that this tuner, with occasional slight modification, is used in probably 90% of the amateur stations in this country... ."

I set about getting together the parts and materials for this radio just as the original builders did—by scrounging. Of course, the battery sets that those folks took apart with such abandon are now valuable antiques; no one would dream of cannibalizing one now unless it was a total junker.

Like most of us in the hobby, though, I've gradually acquired a fair collection of fragments of vintage sets—both commercial and home-built—over the years. I was reasonably sure that my "junk box" would yield virtually all of the needed components. Not only was that indeed the case, but the scrounging process and associated detective work turned out to be quite a lot of fun!

THE "CHASSIS"

As discussed last month, the radio is intended to be built "breadboard" style—that is, with most of the parts surface-mounted on a flat wooden board. The 10- × 14-inch board used for the project constituted half of a standard "breadboard" (used to roll out dough for baking projects) of the era.

Such boards were smooth, attractive, knot-free—and probably inexpensive. But I couldn't find an affordable one on today's market. I settled for a length of 1- × 10-inch common pine.

Lumber being what it is today, I had to buy a four-foot piece to obtain a relatively knot-free 14-inch section. As it turned out, I could have used narrower lumber. After placing the parts on the board to check for spacing, I decided that the 10-inch width was much too generous and ripped it down to 7 inches.

The original construction article suggested that the controls could be mounted on brackets attached to the breadboard, but I decided that it would be classier (and easier!) to have a front panel. Antique Electronic Supply turned out to be out of stock on the black lucite panels they sell as "Bakelite look-alike" material. So I cut a 6- × 14-inch panel from a scrap of ¼-inch plywood and plan to spray-paint it with gloss enamel. After all, aren't we supposed to be building with scrounged materials?

TUNING CAPACITOR AND DIAL

I really lucked out on the tuning capacitor. It was specified as a "23-plate 100 mmFd *midget* condenser (equivalent to a 5-plate condenser of standard size." I decided to check out a small owner-installed variable capacitor that I had removed from a Pilot Super Wasp while restoring it for this column a few years ago.

The capacitor was a nice little Hammarlund unit. It certainly looked like a midget compared with the standard variable capacitors of the era; it had 23 plates, and, wonder of wonders, my Sprague Tel-Ohmike confirmed that it had a capacity of 100 μF with plates fully closed!

In the original model of this set, the tuning "dial" was simply a large gradu-

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ated knob as used on the old "3-dialers." But knowing how touchy regenerative sets can be to tune, I thought it would be a good idea to install a vernier dial. That would be quite easy to do in view of the fact that I was going to have a front panel, and it would also provide more reliable frequency calibration.

The "junk box" coughed up a usable and interesting vernier unit. It has a 10-to-1 reduction, which means that you turn the knob through five revolutions to move the variable capacitor through its half-revolution of travel.

At first, I couldn't figure out how the dial was to be installed. It has a set screw for securing its drive hub to the capacitor-control shaft, but there is no provision for securing the body of the dial to the front panel.

It finally dawned on me that the dial must have been designed as a quick-conversion unit for sets with direct-drive knobs. All one had to do was to remove the old knob and install a small screw (or possibly a special "stop" supplied with the dial and designed to be installed from the front of the panel) ¾-inch below the control shaft. The drive hub of the new dial was then slipped over the control shaft and the dial pressed flat against the front panel, whereupon the head of the newly installed "stop" would be captured in a socket that I found molded into the back of the dial.

Tightening the set screw on the drive hub completed the installation. The dial was now secured against the set's front panel solely through its attachment to the capacitor's control shaft. But it was prevented from turning with the shaft by the panel-mounted "stop" captured in its socket.

REGENERATION AND FILAMENT-VOLTAGE CONTROLS

The variable resistance used for the regeneration control (R3 in the schematic printed last month) was specified as a "volume-control Clarostat" (no value given). I thought that was rather an ingenuous way to specify a component, but later came across some period Clarostat advertising that explained things. It seems that the Clarostat controls covered such a wide resistance range that a value didn't have to be specified. You could get whatever you wanted at the twist of a knob!

So instead of specifying Clarostats by value, one had only to specify them by function! Special models were made to serve as grid leaks, volume controls, B voltage controls, etc.

Not having a Clarostat available to me, I checked specifications for this receiver published in other sources and found that the typical value for a regeneration control was 50,000 ohms. Diving into the junk box, I was able to put my hands on a dual 50,000-ohm unit (from a slightly later period than the receiver, but not too anachronistic looking).

A proprietary device called a "Lynch Equalizer" was specified as a filament voltage control (R2 on the schematic). But I'll substitute a conventional 20-ohm rheostat found in that invaluable junk box.

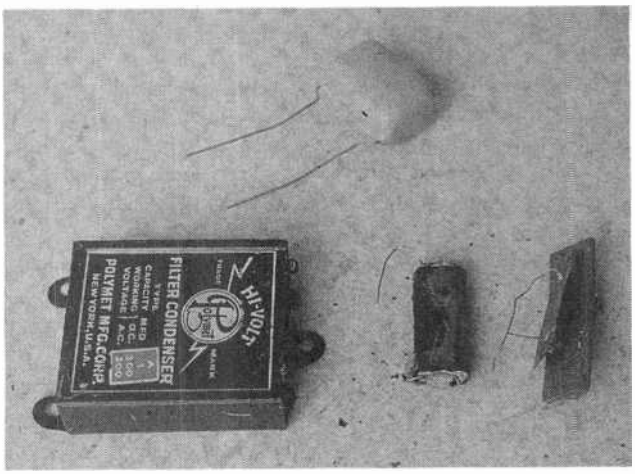
REMAINING COMPONENTS

The audio transformer could be "any ratio" according to this construction article, but other ARRL publications of the time specified unusually high turns ratios (from 1:9 to 1:20) for transformers used in similar circuits. I'll go with a 1:15 FADA unit I had on hand.

The capacitor (C3 on the schematic) bypassing the regeneration control was specified as 1 μF. I found a 1-μF capacitor of the era housed in the typical flat rectangular can. However, it tested at only 0.1 μF on the Tel-Ohmike! Opening the can, I saw that I could easily slip out the old capacitor—which was embedded in a paraffin block. A Sprague "Orange Drop" unit of the proper value will be installed in its place.

A grid capacitor (C2) of the correct 0.00025 value was located, complete with clips to hold the 2-megohm grid leak resistor (R1), which I also found in the junk box. Finally, I was able to put my hands on a couple of 4-pin sockets (for the 01-A tubes) designed for breadboard mounting, as well as Fahnestock clips for connections to power, phones, antenna, and ground.

That's about everything we'll need except for the coil "makings"—which will be covered next month.



The old 1-μF capacitor (bottom center) as removed from its case (bottom left) and paraffin embedment. A new orange drop capacitor (above) will be installed in the case and wired to the original terminal board (bottom right).

NEW REVISION OF CLASSIC RADIO PRICE GUIDE

Sonoran Publishing, Inc., a new firm founded by Antique Electronic Supply co-founder and former co-owner George Fathauer, Jr., has recently released the Second Edition of a 1986 classic: *The Radio Collector's Directory and Price Guide*. Written by university professor and 50-year veteran radio ham Robert E. Grinder, it shares insights gained from years of experience in vintage-radio collecting and restoring.

The original 1986 guide listed 8500 radios, with about 600 trade names, manufactured between 1921 and 1941. The current edition covers radios from 1921 to 1965, and includes data on over 20,000 models representing over 1400 trade names.

The guide is divided into three broad categories: "Radio in America, 1921-1965" is a six-chapter overview of technical developments, regulations involving radio, and the effects of broadcasting on people's lives; "The Radio Directory and Price Guide," which comprises most of the book, provides basic data on all listed models;

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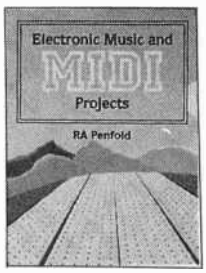

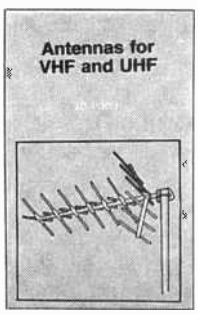

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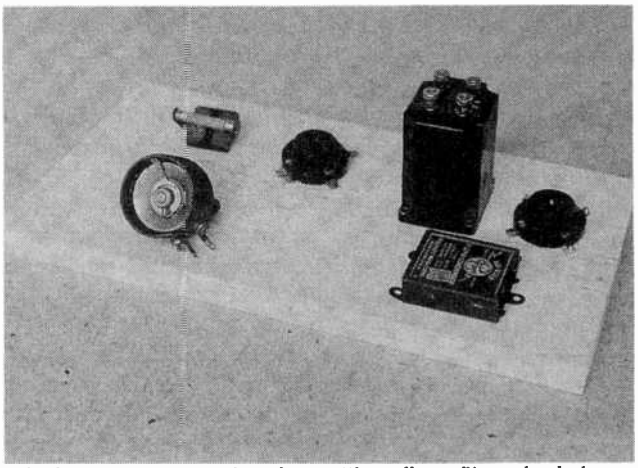

The basic parts were placed on a "breadboard" to check the layout. The board has been ripped down to a 7-inch width (10 inches had been specified) for a more compact parts arrangement.

and the "Trade Name Directory" is a very useful index listing manufacturers by trade name and trade names by manufacturer.

The directory section is the reason that collectors will want to carry this book to swap meets, flea markets, and auctions. It is organized into five columns listing models by manufacturer, year of introduction, power source, style, and price range. The "style" listings indicate the set's cabinet style (table model, console, portable, breadboard, mantle, etc.). "Midget," radio-phono combination, and clock radios are specifically identified in that list, as is the cabinet material of table model and portable sets (plastic, wood, leatherette, etc.).

The all-important price column offers a six-step set of "value ranges" on which to base a judgment. That is a sensible approach because the pricing of antique radios is far from an exact science. Unlike rare coins or stamps, whose values depend on easily catalogued attributes, the going price of an antique radio depends on a number of intangible factors. Perceived condition of the radio, rarity, the buyer's emotional response to that particular model or style of set, and the would-be seller's desire to get rid of it all play a part.

The *Radio Collector's Directory and Price Guide* will be a valuable addition to the library of any serious radio collector. It is also of great value to beginning collectors because of the orientation it provides to the antique-radio hobby. The 5½ × 8½-inch, 530-page *Guide* is softbound and sells for $26.95.

FREE RADIO COLLECTOR INFO SHEET

Readers who would like a free information sheet on my antique-radio newsletter, *The Radio Collector*, can request it by either mail or "snail-mail." The e-mail address is ellis@interaccess.com. Send conventional mail to *The Radio Collector*, P.O. Box 1306, Evanston, IL 60204-1306. But please don't use either address for comments or inquiries regarding this column! Those should be addressed, as always, c/o *Antique Radio*, **Popular Electronics**, 500 Bi-County Blvd., Farmingdale, NY 11735. ■

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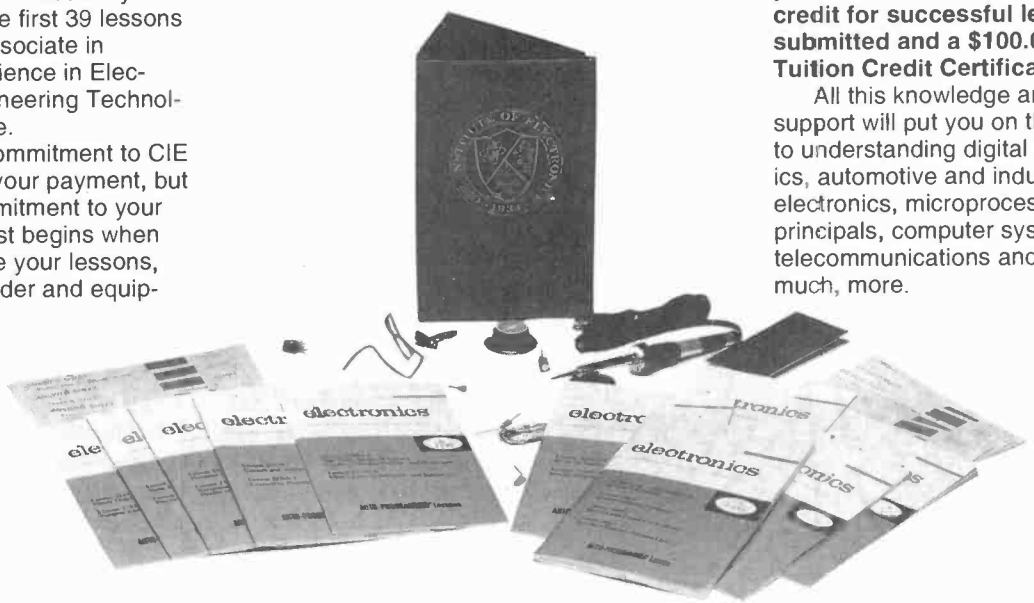

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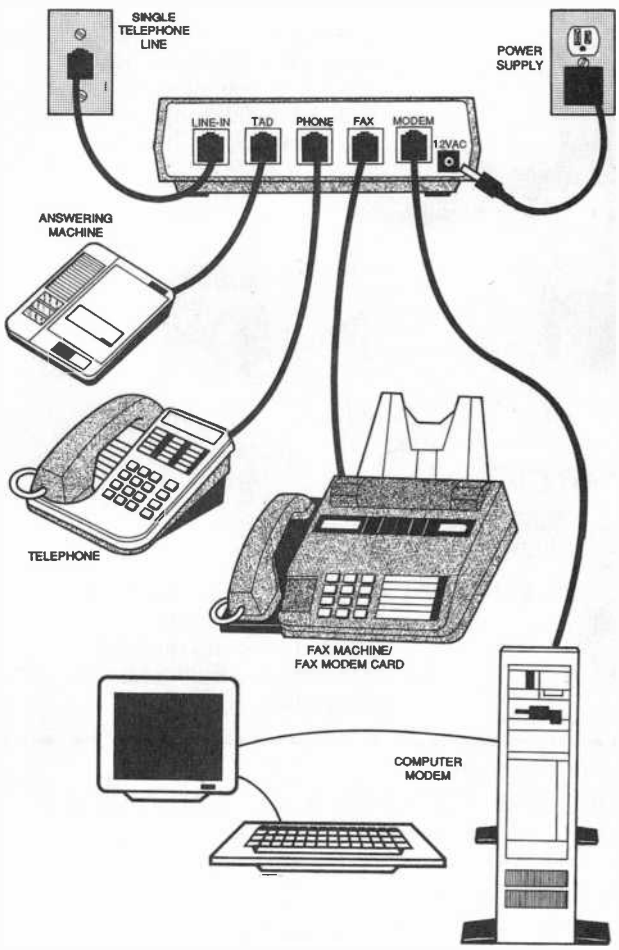
COMPUTER BITS

By Jeff Holtzman

Command your Telephone System

Telephone-line management has been a pain for years. If you had one line and multiple devices (telephone, answering machine, modem, and fax), sharing that line among those devices in a convenient and reliable manner has been almost impossible. However, a new breed of intelligent yet low-cost (under $100) line switches has recently come to market; those devices do a really impressive job. For example, I've been using the *ComShare 750*, made by *Command Communications*, for the past several weeks, and am extremely impressed with its operation.



The ComShare 750 intelligently and inexpensively shares a single telephone line among a telephone, answering machine, fax, and modem.

Physically, the ComShare 750 is a little smaller than an external modem. It has four status LEDs on the front panel, and five RJ-11 jacks on the back. (The telephone and answering machine jacks are simply wired in parallel.) Also, there is a 12-VAC power jack on the back.

To use it, you connect your phone line and as many as four devices to the labeled jacks on the back of the unit. Apply power, and you have instant line sharing. When the C750 detects an incoming call, it answers, but continues to supply a ring signal to the calling line. Meanwhile it listens for modem or fax tones. If it detects one or the other, it routes the call to the appropriate jack, and simultaneously lights the appropriate status LED.

So far so good; that's pretty standard stuff. The C750 also helps manage outgoing calls. For example, if you start a modem transmission and then pick up a telephone line, you get a busy signal. Without the C750, you'd probably kill your modem connection and have to restart. That feature alone has saved me both time and money.

The C750 has several additional features. For example, it can respond to Distinctive Ring Service (DRS) calls. DRS is a service offered by the phone company that allows one physical telephone line to respond to several different telephone numbers. At any one time, only one number can be active because there is only one physical line; while one line is active, incoming calls on another line would ring busy. At the user's end, DRS provides different ring-signal patterns to distinguish the different telephone lines. Typically, there is a single ring for the main line, and a double ring (beep-beep, beep-beep) and a triple ring (beep-beep-beep, beep-beep-beep) for the subsidiary lines. The C750 can detect those ring patterns and route each to a different port.

Another interesting feature is Remote Message Notification (RMN), which allows the C750 to dial a remote number after it receives a call on a particular port. You could use RMN to notify you via cellular phone when a telephone, fax, or modem call had been received.

What really distinguishes the C750 is its programmability. Using an attached touch-tone telephone, you can set numerous characteristics of the device. For example, if you were using DRS, you could program which ring pattern corresponds to which port.

Returning to our modem example above, using another feature called Open-Line Notification, you could program the C750 to provide a short ring to the telephone device after the modem transmission is completed. A related feature is reverse modem detection. Using regular modem protocols, the answering modem "speaks"

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first. In reverse mode, the originating modem speaks first. That could be useful as a security measure. For example, if you wanted to use the C750 to provide remote access to your computer system, by putting both calling and answering modems (and the C750) in reverse mode, it would be more difficult to "hack" your system.

Other functions allow you to transfer a call to a given port. For example, in the default configuration, if the C750 receives a DTMF "11" during an active call, it will transfer that call to the fax port. If it receives a DTMF "22" during an active call, the call goes to the modem port. Both transfer numbers are programmable, both locally and remotely. In addition, you can program a security code that must be entered before any changes can be made remotely.

LASER FAX

Another useful telephone-type gadget I recently picked up is the *Fax-Me* cartridge (typically about $70) made by *Practical Peripherals*. It simply plugs into a slot on an old LaserJet (most models from the Series 2 and 3 lines), and subsequently allows the laser printer to function as a receive-only Fax.

The primary advantage of the Fax-Me is, of course, the ability to print faxes directly on plain paper. The cartridge has three modes of operation: Printer, Fax, and Automatic. In the Automatic mode, the cartridge automatically switches the LaserJet from Printer to Fax mode whenever an incoming call is received.

There are a few nice extras as well. For example, Fax-Me can optionally print a status box at the top (or bottom) of each received fax page, showing current time and date, page number, sending fax number, etc. The cartridge has a built-in clock, so you only have to set time and date once. Fax-Me can also print a status page, showing the status of all settings. Together, Fax-Me and ComShare 750 have substantially improved my small-office environment. I highly recommend both. ■

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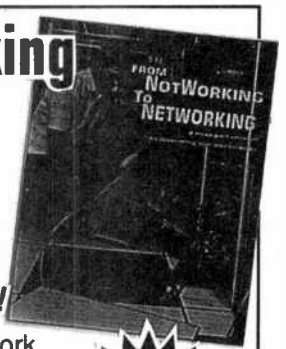

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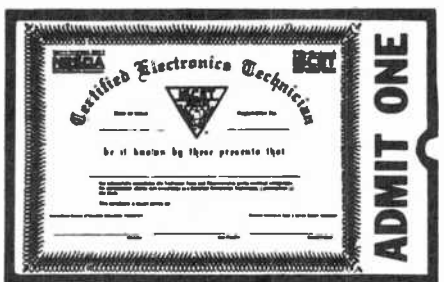

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THINK TANK

By John J. Yacono
Technical Editor
Windows Magazine

High-Voltage Projects

While this column, with its tutorial and letters, will be the same as always, I'd like to propose something new for an upcoming column or two: a contest! There are a few really industrious hobbyists out there who send me multiple circuits in a given month, but up to now I've only presented one or two circuits per month from each. What I propose is that if I get enough really good circuits (say, four or five) from an individual in one letter, I'll devote a column to his/her work. That month's participant will receive a free kit and the bizarre (but individually wrapped) MCL1010 chip in addition to a book from our Think Tank library.

What if you don't have enough stuff for an entire column? Keep sending those great ideas in. I'll only do tribute columns when a submission warrants it. What if only three of your four or five circuits are really cool? I'll break up your letter across multiple columns and you'll get a book for each circuit I publish. What if you think my idea stinks? Please let me know; this is your column, I prepare it for you, so what the majority says goes.

In our last tutorial, I mentioned that capacitors can only be charged so much—they have a limited charge "capacity." That raises the question "what determines a capacitor's capacity, or more correctly, its *capacitance*?" Mostly it's geometry. The larger the plates, the more electrons they can accommodate. The closer the plates, the more alluring the charge across the gap is.

From an engineering standpoint, there's only so much benefit to be derived from playing with the geometry of the plates to gain capacitance. You could make the plates out of foil so you can roll them up in a tight bundle like an old newspaper, but a high-capacitance unit built that way would still occupy significant volume.

Fortunately, the material between the plates also plays a role in determining a capacitor's value. Up to now, I've presented capacitors as though they had a vacuum or just air between their plates, but a large number of capacitors feature an "electrolytic" material in the gap. An electrolytic enhances capacitance. Some common electrolytic materials are

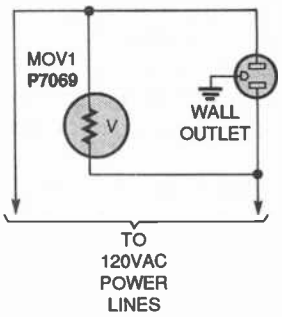

Fig. 2. Placing an MOV across an electrical outlet's terminals is a good way to protect any device you plug in.

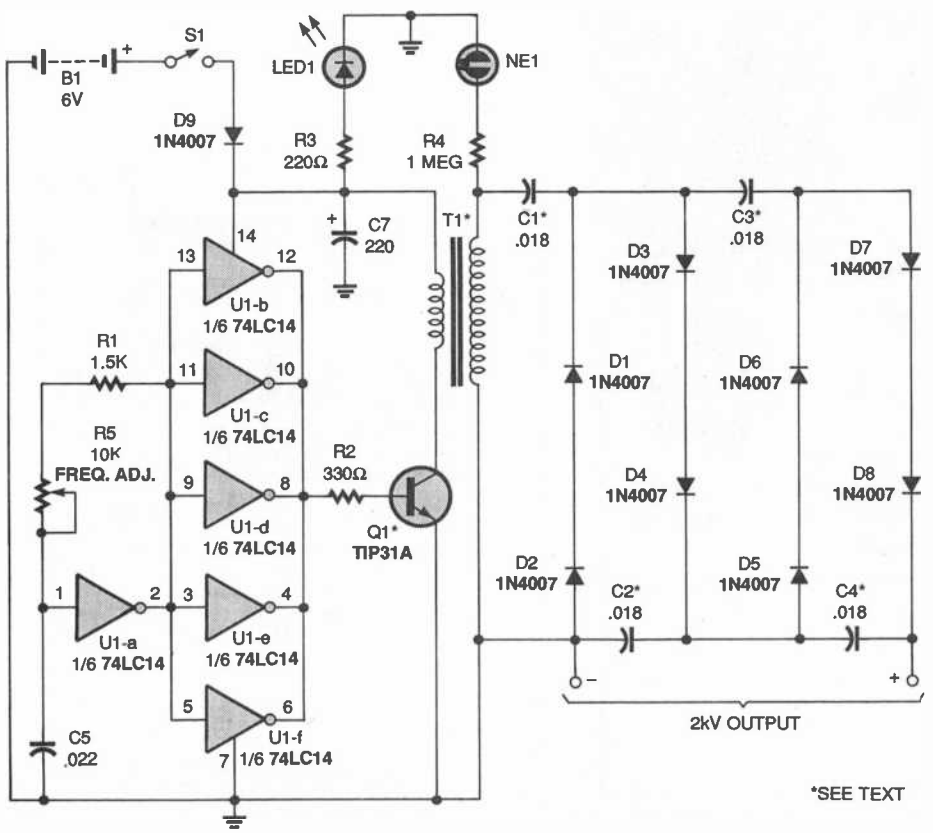

Fig. 1. This circuit uses a transformer to generate a high-voltage output (up to 20,000 volts) from just four C-cells.

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paper, oil, paper/oil, Mylar, and polyester. Some of those materials (for example, oil) carry the added benefit of allowing a capacitor to be charged to higher voltages—voltages that would cause sparks to shoot across the gap of a simple air-filled capacitor.

Speaking of high voltages, before we get to this month's circuits, a word of caution is in order. **Don't build high-voltage circuits unless you know what precautions to take.** If you don't know how to handle high voltages, check your local library or school for books on the subject before proceeding.

OZONE FOR EVERYONE

Included herein are plans for a 2000-volt inverter that operates from four 1.5-volt "C" batteries, or any equivalent 6-volt source (see Fig. 1). The circuit operates at frequencies from 2–20 kHz. For best performance, adjust R5 until just past the point where NE1 ignites. That sets the circuit's operating frequency to about 15 kHz.

If transistor Q1 gets hot, you might want to heatsink it. **Caution:** This circuit will induce a painful shock if the output is touched.

Transformer T1 is available from Images Company (P.O. Box 140742, Staten Island, NY 10314; Tel. 718-698-8305) as part No. COR-6B for $1. The 3000-volt capacitors, C1 through C4, are available from The Electronic Goldmine (P.O. Box 5408, Scottsdale, AZ 85261; Tel. 602-451-7454) as part No. G5374 (that's six of them for $1).

—Alex Belenky, Brooklyn, NY

Great! To explain a little more, C5, R1, R5, and U1-a form an oscillator. The oscillator's signal is passed on to U1-b through U1-f, which drive Q1 in parallel. Transistor Q1 pulls current through T1 and shuts off abruptly, causing high-voltage spikes to appear at T1's secondary. The high-voltage is sent to a voltage quadrupler before it is output.

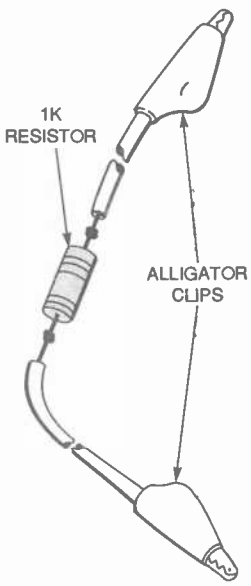

Fig. 3. You should always discharge electrolytic capacitors before fiddling with a circuit. This little tool allows you to do that quickly and safely for moderate-sized units.

THE SPIKE STOPS HERE

Those who have microwaves, computers, TV sets, VCRs, and other equipment they wish to protect against power-line surges usually wind up buying expensive power strips with built-in surge-protection devices. My solution for that: Turn off the power to the 120-volt outlet you wish to use for protection. Remove the faceplate and the outlet itself. Connect an MOV directly across the two outlet terminals that power the equipment you wish to protect (see Fig. 2). Keep the leads as short as possible.

Replace the socket and faceplate. When re-installing the outlet, be careful to avoid shorting or grounding any of the leads. Turn on the power. The MOV that I used was a P7069. That unit has an operating voltage rated at 140-volts AC and 180-volts DC at 6500 amps. It offers a bit more surge protection than normally offered in power strips. You can get the MOV from Digi-Key (P.O. Box 677, Thief River Falls, MN 56701).

Is this simple idea worth one of your Think Tank books?

—William B. Hopf, Jr., Knoxville, TN

I don't judge circuits by simplicity, just usefulness or uniqueness. Yours certainly rates. A word of caution to users: Follow Mr. Hopf's advice about shutting down power. Also, be sure to insulate the MOV's leads with slip-on insulation. By the way, I like to place MOVs in wall cubes to provide protection I can take with me.

DISCHARGER

I just read an issue of **Popular Electronics** magazine for the first time and I was so fascinated with it that I ran down to the library and got a few back issues. I really enjoy your magazine except for the fact that most of it is over my head. Could you please tell me some names of more-elementary electronics magazines? Myself and other electronics hobbyist-wanna-bes would

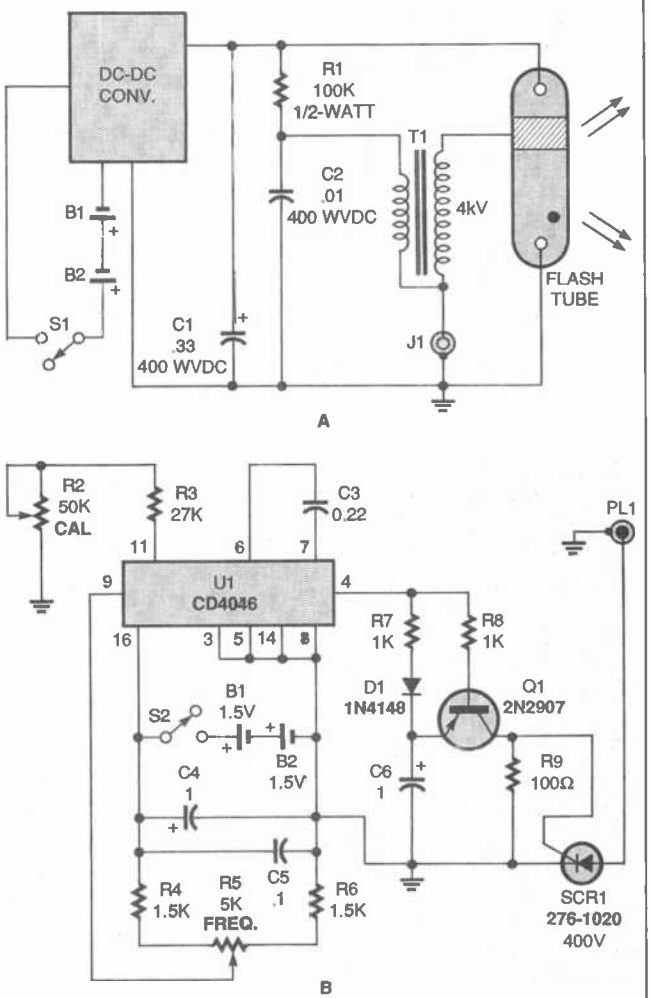

Fig. 4. If you retrofit a flash unit as described in A, it can accept signals from the circuit in B to operate as a precision stroboscope.

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greatly appreciate it.

The tool that I made is for discharging capacitors. From personal experience I can say that discharging high-voltage capacitors can be real shocking, and can sometimes destroy the capacitor leads. My tool is fairly simple (see Fig. 3), just take two pieces of insulated wire and solder them to each end of a 1000-ohm resistor and then put any type of contact on the end of the wires like alligator clips.

Thanks for the great magazine.

—Chad Heim, Green Bay, WI

Frankly, I recommend books rather than magazines for beginners. Unless they run a series just for beginners, the other magazines seem to concentrate on the experienced builder. If my tutorials aren't what you're looking for, try your local library for more basic fare.

By the way, for heavy-duty capacitors, don't use light-duty alligator clips. They'll just melt away after a few uses. Try using the kind that look like small jumper-cable clips instead.

POCKET STROBOSCOPE

If you happen to have an electronic camera flash handy (those are available for peanuts at garage sales), you can easily convert it into a precision stroboscope capable of measuring from 0 to 6000 RPM. Also, it could be used for some interesting multi-image photography!

Refer to Fig. 4A and carefully open up your flash unit, after first removing the batteries. Discharge all of the capacitors—they might still hold a 300- to 400-volt charge. Don't touch the flash tube or the reflector—fingerprints can cause high-voltage leakage problems. Trace back from the flash tube and locate the parts that correspond with T1, R1, C2, and C1, which will be off the PC board.

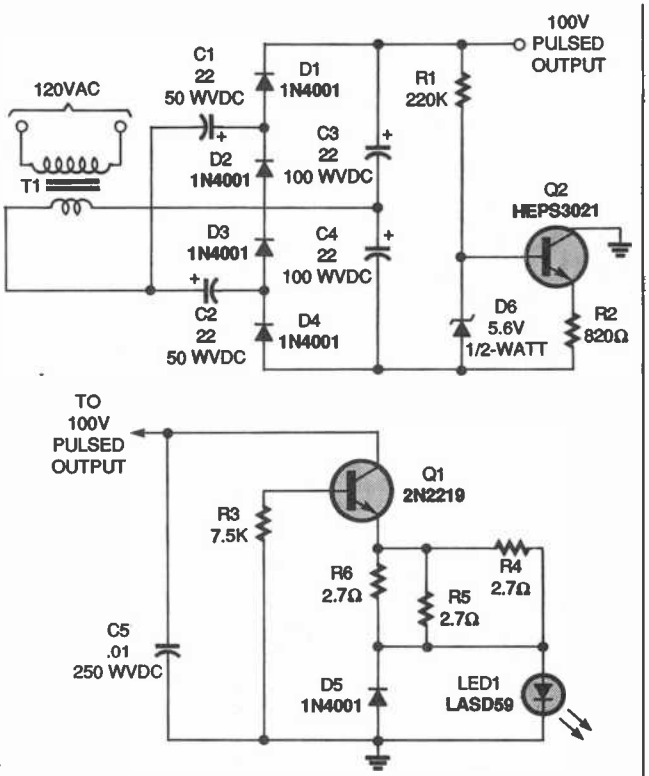

Fig. 5. This laser pulser consists of two main circuits: a voltage booster and a driver.

Replace C1 with a 0.33-µF, 400-WVDC Mylar or similar capacitor, and replace R1 with a 100,000-ohm, ½-watt resistor, so that the circuit matches Fig. 4A. Those modifications reduce flash output and duration by approximately a factor of 1000, and allow the flash to fire at high speeds, up to 100 flashes per second.

Refer to Fig. 4B to build a timing circuit for the driver. Use a circuit board small enough to fit in the area vacated by the original capacitor used for C1. Mount R5 on an external bracket if needed. Batteries B1 and B2 can be 1.5-volt coin cells or replaced by a single 3-volt lithium cell. Capacitor C3 should be Mylar, and C4 and C6 should be Tantalum. Integrated circuit U1 is a CD4046 chip in which we use the VCO only. The VCO rate of 0 to 6000 FPM (0 to 100 Hz) is set by R5, and is linear with R5's rotation. Capacitor C6 is alternately charged by the VCO and then discharged through Q1 to trigger SCR1. That 400-volt SCR fires the flash tube.

To calibrate the driver, turn on S2 only, set R5 to maximum (6000 FPM), and set trimmer potentiometer R2 for 100 Hz at pin 4 of U1. If you have a ten-turn potentiometer of at least 5 kilohms (scale R4 and R6 to match), replace C3 with a 0.1-µF capacitor, and calibrate the circuit at 6000 FPM, as above. Above all, be extremely careful around the high voltages in this circuit!

—Skip Campisi, S Bound Brook, NJ 08880

Nice retrofit. I've got lots of gutted flash units lying around. You might have helped me breathe new usefulness into them.

Now we'll shift gears, turning from high-voltage circuits to something just as hazardous: lasers. **Again, educate yourself in proper handling procedures before dealing with lasers.**

LASER DRIVE

The "old-style," single-hetero-structure, pulsed, injection-laser diode has always been a trial to fire up. However, the simple circuit in Fig. 5 is easy to build and use. The diode I used was an LASD59 with a threshold current of 10 amps (40 amps maximum) and an output of 5 to 9 watts at 904 nM, which is an invisible, infrared beam. The maximum allowable pulse width is 200 nS at a 0.1-percent duty cycle.

As shown in the schematic, T1, a 24-volt-AC wall transformer, drives a full-wave quadrupling rectifier, which produces an output of 120-volts DC. Components R1, R2, D6, and Q2 form a 5.7-mA constant-current sink. Use a heat sink on Q2, which can be any 1-watt or higher transistor with a V_{CE} of 150 volts or more.

Components C5, R3–R6, D5, LED1, and Q1 form an avalanche oscillator that runs at 4 to 5 kHz. Transistor Q1 must be selected for a breakdown voltage of between 90- and 110-volts DC.

Build the power-supply section on a separate circuit board using standard methods. Resistors R4–R6 must be carbon, ½-watt units, or can all be replaced by a single 1-watt, 1-ohm, carbon unit. Use short leads throughout on this assembly to avoid current undershoot. Use a socket to mount Q1, and a female pin for the anode of LED1. (Note: the LASD59's cathode is it's case.)

Before installing LED1, Q1 must be selected: short the female pin to ground, install

(Continued on page 90)

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CIRCUIT CIRCUS

By Charles D. Rakes

Ham-Radio Circuits

Every so often, I like to share a few simple ham-related circuits with you, and that's just what we're going to do for this visit. Even if you are not now an amateur-radio operator, or even thinking about becoming one, these circuits might just spark an interest in that direction.

A SIMPLE ANTENNA TUNER

Antennas and tuners remain one of the areas of this high-tech hobby where we can still "build it ourselves" and obtain excellent results. The simplest antenna of all is the long-wire antenna. Unfortunately, for a length of wire to qualify as a true long-wire antenna, it must be longer than the wavelength at which it is to be used; for high-frequency work, that can be unwieldy in many typical situations. Of course, if you have enough room, you should make your antenna as long as necessary, but if you do not, and you must do with a much shorter antenna, all is not lost.

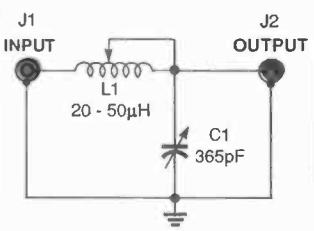

Fig. 1. This simple tuner can properly match anything from a bedspring to a long-wire antenna. Be sure to use a voltage transmitting-type unit for C1 if more than 5-watts of output power is to be used.

The antenna tuner shown in Fig. 1 is especially suited for tuning random lengths of wire to match the output impedance of most modern solid-state transceivers. Anything from a bed spring to a 300-foot length of wire can be tuned with that simple "L"-network tuner.

The inductor, L1, can be a rotary inductor or a bare-wire, space-wound, fixed inductor with taps. In any event, L1 should have a minimum inductance of 20 µH. Larger inductors will allow broader frequency coverage.

For QRP (low power, five watts or less) operation, the tuning capacitor can be a 365-pF unit removed from an old broadcast receiver. When operating at higher output powers, such as the 100 watts or so of a typical solid-state rig, a special high-voltage tuning capacitor must be used. The best place to locate such a capacitor is at a hamfest or local ham store; that's also a good place to get a rotary inductor.

A 40-METER LOOP

If you live in an apartment building, the compact, 40-meter, 30-inch diameter mini-loop shown in Fig. 2 could be your magic conduit to the world. The loop is formed from a 95-inch length of ¼-inch copper tubing; the finished loop should have a 1-inch gap at the bottom end. The loop can be mounted to a wooden "T" with the vertical leg extending three to four feet below the bottom of the loop. Add a simple support to the leg so the loop will stand vertically.

The matching transformer, T1, is wound on an Amidon Associates (3122 Alpine Ave., Santa Ana, CA 92704) T50-2 toroid core. The primary consists of 4 turns of 18-gauge enameled copper wire, while the secondary consists of 12 turns of 20-gauge enameled copper wire. Close wind the secondary and the primary, and make sure that the two windings do not overlap.

The matching transformer and tuning capacitor must be located as close to the loop's gap as possible. Solder one end of the primary (4-turn) winding directly to one end of the loop and keep the leads between T1 and C1, and C1 and the other end of the loop as short as possible, and, under any circumstances, no longer than 3 inches. Use an SO-239 connector for J1.

The best way to tune the loop is with your transceiver in the receive mode. Set C1 to mid position and tune the receiver to the middle

PARTS LIST FOR THE ANTENNA TUNER (Fig. 1)

C1—365-pF, air-variable tuning capacitor, see text
L1—20- to 50-µH rotary inductor or fixed inductor with taps, see text
J1, J2—SO-239 chassis-mount coaxial connector
Wire, solder, enclosure, etc.

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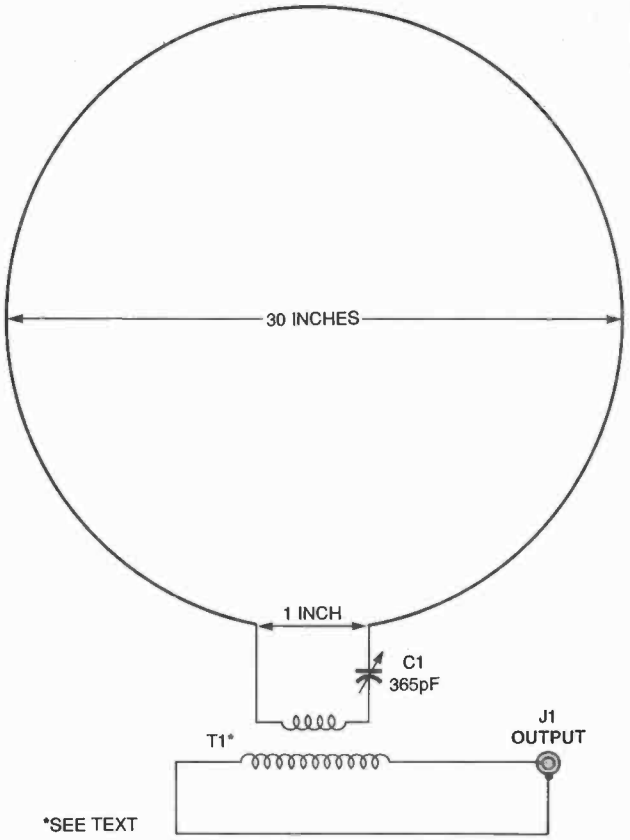

Fig. 2. A cliff-dweller's dream, this 40-meter loop can get apartment-based hams on the air. It also makes a great receiving antenna.

PARTS LIST FOR THE LOOP ANTENNA (Fig. 2)

C1—365-pF, air-variable tuning capacitor, see text
T1—see text
J1—SO-239 chassis-mount coaxial connector
Copper tubing (see text), wood support, wire, solder etc.

of the 40-meter band and to a spot where no stations are heard. Slowly tune C1 for the maximum receiver noise output. The tuning will be very sharp, so go slow as you adjust C1.

The loop when built as shown will handle power levels up to about 25 watts if you use a high-voltage tuning unit for C1. If a broadcast tuning capacitor is used, don't operate at power levels over 5 watts or the capacitor will likely arc over.

The mini-loop is an excellent receive-only antenna. Its high "Q" factor reduces adjacent-frequency interference and out-of-band noise. Also, in some cases, rotating the loop can help in reducing interference from another station on or near the same frequency, or interference coming from a specific location or direction.

FIELD-STRENGTH METER

Our next entry, shown in Fig. 3, is a field-strength meter that can be useful in tuning an antenna or transmitter. A 24-inch pull-up rod antenna, ANT1, picks up the transmitted RF and the 1N34 germanium diode, D1, rectifies the signal, which is then indicated on the 50 μA meter, M1. Sensitivity is controlled by varying the length of the antenna.

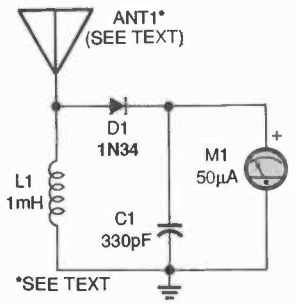

Fig. 3. This simple field-strength meter is great for tuning transmitters or antennas. It's a tool no ham should be without.

QRP TUNING MONITOR

Our next circuit, see Fig. 4, is designed to be used as a tuning monitor for very-low-powered stations (QRP). It is based on the field-strength meter of Fig. 3.

If you compare the two circuits, you will note that two transistors have been added to the original circuit, and the meter has been replaced with a piezo sounder, BZ1. A 24-inch telescoping antenna is again used for the pick-up antenna (ANT1).

PARTS LIST FOR THE FIELD-STRENGTH METER (Fig. 3)

D1—1N34 germanium diode
L1—1-mH choke coil
M1—50-μA meter
ANT1—24-inch telescoping antenna
Wire, solder, enclosure, etc.

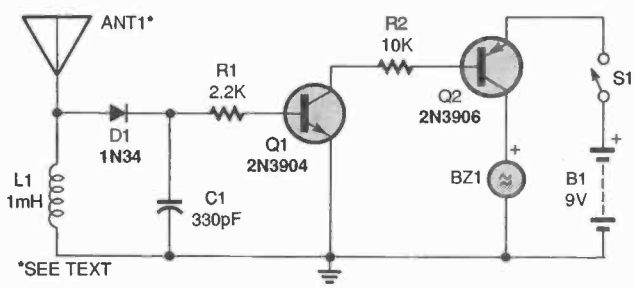

Fig. 4. With the modifications shown here, the field-strength meter makes a great tuning monitor for QRP (low-power) use.

PARTS LIST FOR THE QRP TUNING MONITOR (Fig. 4)

D1—1N34 germanium diode
Q1—2N3904 NPN transistor
Q2—2N3906 PNP transistor
R1—2200-ohm, ¼-watt, 5% resistor
R2—10,000-ohm, ¼-watt, 5% resistor
C1—330-pF ceramic-disc capacitor
L1—1-mH choke coil
BZ1—Piezo sounder
S1—SPST switch
B1—9-volt battery
ANT1—24-inch telescoping antenna
Wire, solder, enclosure, etc.

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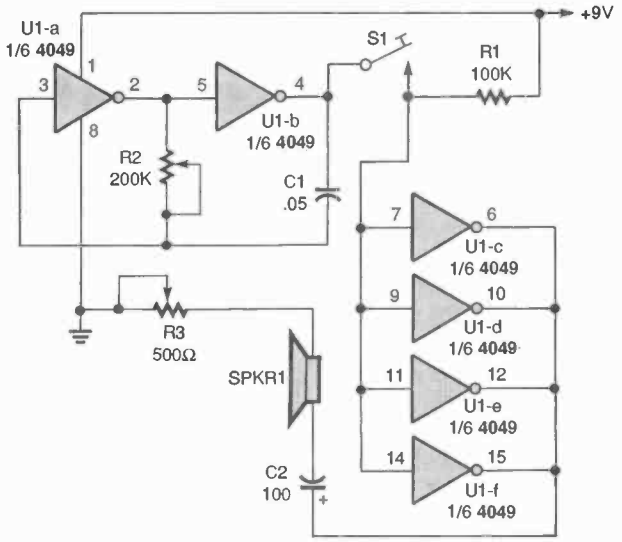


Fig. 5. This versatile code-practice oscillator is great for use by individuals or small groups wishing to learn Morse code. Note that switch S1 is a telegraph-type Morse-code key.

PARTS LIST FOR THE CODE-PRACTICE OSCILLATOR (Fig. 5)

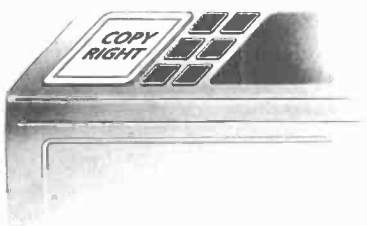
U1—4049 hex inverting buffer, integrated circuit
C1—0.05-µF, Mylar capacitor
C2—100-µF, 16-WVDC, electrolytic capacitor
R1—100,000-ohm, ¼-watt, 5% resistor
R2—200,000-ohm potentiometer
R3—500-ohm potentiometer
SPKR1—8-ohm speaker
S1—CW key
9-volt battery or power source, wire, solder, enclosure, hardware, etc.

CODE-PRACTICE OSCILLATOR

Our last entry this time around is a versatile code practice oscillator that has a variable frequency and volume control. The unit is especially suitable for use by small groups that we are interested in learning and practicing the code.

A single 4049 CMOS hex inverting buffer is the heart of the oscillator, with inverters U1-a and U1-b making up the variable audio-oscillator circuit. The oscillator's output is coupled to the speaker-driver circuit through the CW (Morse code) key, S1. The audio frequency of the oscillator, and hence its tone, is varied by potentiometer R2, while potentiometer R3 is used to vary the speaker's volume.

Well, it's time to close for now. If you are not one already, maybe these circuits could inspire you to become a radio amateur. Ham radio is a fun and fascinating hobby through which you could make many life-long friends. In any event, good circuitry until next time. ■



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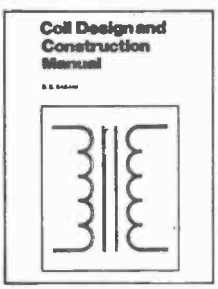

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DX LISTENING

By Don Jensen

The Club of Clubs

More years ago than I like to admit, a new radio-hobby organization was born. Its full name? The Association of North American Radio Clubs, which usually is abbreviated to just its initials, ANARC.

Because this author served as that organization's first executive director, it's not surprising that I've had more than a passing interest in ANARC over the years. The club's current chief executive is Richard D'Angelo, of Wyomissing, PA.

In Russia's Cyrillic alphabet, this vintage QSL card reads "Radio Moscow."

ANARC is not just another shortwave-listening club. Rather it is a club of clubs, an umbrella organization affiliating most of the listeners' clubs in the United States and Canada. Now in its 31st year, ANARC continues to promote close links between the various hobby-listening clubs of North America, and to serve as spokesman for the listening hobby to broadcasters, equipment manufacturers, the news media, and the public.

ANARC encourages listening hobbyists to join one or more of its affiliated clubs. Those clubs cover various aspects of the radio hobby, whether one's interest is tuning shortwave, medium-wave, longwave, or VHF/UHF scanner frequencies.

If you've thought about becoming a member of one of these international, national, or regional radio clubs, you can get a list of them, their addresses, membership fees, the type of listening activities covered, and how you can get sample copies of their newsletters to look over before you decide to join. A copy of that list is available for just a stamped, self-addressed envelope from the Association of North American Radio Clubs, 2216 Burkey Drive, Wyomissing, PA 19610.

IN THE MAIL

The first letter this month is from Raji Lakshman who lives in Anchorage, Alaska. Raji writes:

"I came to the U.S. last year from India, where I did quite a bit of shortwave listening. Now that I'm here, though, I haven't been able to make contact with anyone else interested in DXing on the shortwave bands. I read your column in **Popular Electronics** and decided to write. I would be happy if you could give me the names of any DXing clubs up here in Alaska, or if there are none, then some clubs in the lower 48."

Unfortunately, there are no Alaskan listener clubs, Raji, as far as I am aware. However, one of the ANARC-affiliated regional clubs that you might find of special interest is the Pacific Northwest, British Columbia DX Club. The PNBCDXC was founded in 1982 to encourage fellowship and information exchange among DXers. It publishes a newsletter 10-12 times a year. Annual membership dues are $9 for U.S. members, and $10 for Canadians. The club's address is 9705 Mary NW, Seattle, WA 98117.

Next, Rex Blasingame, Carbondale, IL, has a question about Iranian shortwave:

"I've been interested in SW radio for a number of months now. But so far, I haven't been able to hear any programming from Iran. Are they on shortwave? If so, when and where should I tune?"

Indeed, the Voice of the *Islamic Republic of Iran*, as the shortwave service is called, broadcasts from Teheran and even has an English-language North-American service. Look for VIRI from 0030 to 0130 UTC on 7,260, 9,022, and 9,670 kHz.

MORE ABOUT MOSCOW

Albert Samuelson, New York City, writes: "I've been paying more attention to *Radio Moscow International's* air schedules after reading the August column. I think there have been even further cutbacks in shortwave broadcasting for Russia."

Yes, Albert, you're right. Radio Moscow International/Voice of Russia is down to 30 foreign languages in its overseas

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services. Gone are programs in two African languages (Swahili and Hausa), and five Asian tongues (Tamil, Sinhalese, Nepalese, Indonesian, and Khmer). Also gone from the Russian broadcaster's SW schedule is Swedish. In addition, there have been reductions in the broadcasting hours for 17 other languages.

Still, most North-American SWLs will be primarily interested in the Voice of Russia's English-language World Service. As of this writing, here are some times and frequencies where you might find that programming:

- 0000 to 0100 UTC—5,940, 9,530, 9,720, 11,750, 15,180, and 15,425 kHz.
- 0100 to 0200 UTC—9,530, 12,050, 15,180, 15,425, and 15,580 kHz.
- 0400 to 0500 UTC—12,050 kHz.
- 1000 to 100 UTC—9,835, 11,800, 12,050, 17,765, and 17,870 kHz.

William Reilly, Daytona Beach, FL, writes to observe that he's been hearing the *Voice of Vietnam* with good signals recently. "That's not a station I've tuned before," he says.

You didn't mention the frequency, Bill, but I'd hazard a guess that you're listening to Hanoi's English programming on 7,360 kHz sometime after 0400 UTC. The reason for the good signal at that hour seems to be that Vietnam, like many other countries, is renting air time on powerful transmitters located in what not-so-long-ago was the Soviet Union. In that case, according to reports, the Voice of Vietnam's English programming is being relayed by Russian facilities at Krasnodar.

*CREDITS: Jerry Berg, MA; Richard D'Angelo, PA; Marie Lamb, NY; Harold Levison, PA; North American SW Association, 45 Wildflower Road, Levittown, PA 19057.

DECISIONS, DECISIONS

Next we have a letter from Canadian listener, John Banks, who writes from Kingston, Nova Scotia:

"Please advise," he says, "on a good make and model receiver for the SWL. I'm not out to save money by purchasing a cheap radio but I am interested in eliminating all the frills and getting the best for the money. Your opinion would be greatly appreciated."

Well, John, your question is typical of many I receive from *DX Listening* readers asking for advice on which SW receiver to buy. It sounds like an easy one to answer, but it's not.

Simply put, there is no one best receiver. Which set you ultimately select depends on a number of personal factors. I can no more advise you which radio to buy than I could tell you which tie to wear, what car to buy, or who you should marry! To help you along, however, here are a few questions you should ask yourself:

How much signal sensitivity do I need? How important is it to be able to separate weak stations in a really crowded SW band? Is good audio quality important to me? What about ease of tuning? Do I want a top-of-the-line table-top model or a lightweight portable? And, of course, how much can I spend for a shortwave radio?

Every receiver on the market—and there are many—represents a different compromise among often conflicting design elements. To give you some idea what's out there, the new Universal Radio Inc. (6830 Americana Parkway, Reynoldsburg, OH 43068) mail-order catalog lists some 15 pages of SW receivers, ranging from SONY's *ICF-SW10* at just under $50, to the Watkins-Johnson *HF-1000*, with preselector, at nearly $4,400.

As you can see, you've got some homework to do before you decide which is the right set for you. For that, I recommend the easy-to-understand but detailed and candid receiver reviews in the just-published **1996 Passport To World Band Radio** (International Broadcasting Services Ltd., Box 300, Penn's Park, PA 18943).

DOWN THE DIAL

Here are some SWLing targets to try:

AUSTRALIA—5,955 kHz. **Radio Australia** is noted here at 1200 UTC with world news and feature programs.

ETHIOPIA—9,335 kHz. *Radio Fana* has been logged at 0326 UTC with a music-box interval signal, then identifications and news in the Amharic language.

UKRAINE—17,655 kHz. *Radio Kiev* has been noted with decent signals here at 2320 UTC with English programming.

VANUATU—3,945 kHz. *Radio Vanuatu* is a rare and exotic Pacific-region SW station to try. It has been logged in east-coast North America at 1055 UTC identifying in both English and Pidgin languages. ■

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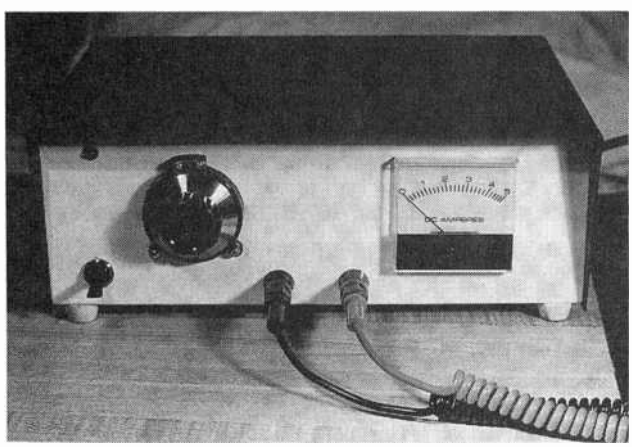
HAM RADIO

By Joseph J. Carr, K4IPV

A DC Power Supply For Hams

Very few workbenches would be complete without a low-voltage DC power supply. I've got several on my bench, all but one of them homebrewed (indeed, some have appeared in various **Popular Electronics** articles over the years). DC power supplies are essential for building new circuits, doing projects, and in some cases building kits. They also can be used for troubleshooting gear. It's obvious that a bench DC supply is needed when working on low-powered mobile rigs and accessories, and hand-held or other portable rigs, that normally operate from either internal batteries or a vehicle power system.



Here's "The Crusher," a variable voltage, high-current supply that can come in handy when testing or using ham gear.

Not so obvious is the fact that a DC supply can be used to replace the DC supply in a rig as a troubleshooting ploy. Many problems could be traced to DC power-supply problems, so it's fairly standard practice to disconnect a piece of equipment's internal power supply and then substitute a "known good" bench power supply. If the rig works on the alternate power source, then the problem is in its power-supply section.

Among the DC power supplies that I own are a dual polarity ±12-volt DC, 1-ampere unit (nice for op-amps). I've also built a big power supply that produces a fixed voltage of 5-volts DC at 3 amperes; fixed voltages of 6-, 8-, 9-, 12-volts DC (times two), all at 1 ampere; and 1.26- to 30-volts DC variable voltage (times two) at 1 ampere. All of those sources are independent and separately switched, and all are housed inside a large Hammond cabinet intended for mounting in a 19-inch rack. There are also a pair of ±12-volt DC, 100-mA, power supplies mounted inside my Heath and Ace breadboards.

For general hobbyist work you need ±12-volts DC, +5-volts DC, and a few other DC power supplies. Typically, those are designed for 100-mA, 500-mA, or 1-A current levels. However, have you ever tried to power a small hand-held transceiver from one of those DC supplies? It won't work, because they need more than 1 ampere of current. That's why I built the 1.26 to 30-volt, 5-ampere supply I am about to describe. I modestly call it *The Crusher*!

THE CRUSHER

The circuit for the Crusher is shown in Fig. 1. The unit is powered from a 25.6-volt AC, 5-ampere transformer (T1). The bridge rectifier (BR1) is a 50-volt PIV, 6-ampere unit. It has two AC inputs that are connected to the secondary winding of transformer T1, and two outputs (designated − and +). The negative output (−) is connected to chassis, although some people prefer to leave it floating and only ground it when needed.

The output of the rectifier is pulsating DC, which is almost as useless for powering electronic devices as AC. It must be filtered and regulated before it is useful. The ripple filter capacitor is C1. The general rule for the main pre-regulator filter capacitor is to select one that is at least 1,000 µF/ampere. For standard 1-ampere power supplies, use either 1000-µF or 2000-µF units, but for a 5-ampere DC power supply like this one, at least 5000 µF should be

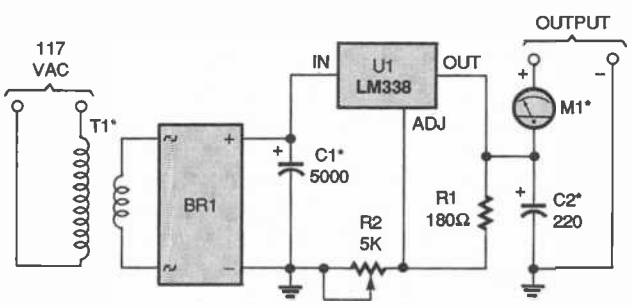


Fig. 1. Here's the schematic for The Crusher DC power supply. The outputs are front-panel-mounted banana jacks.

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used, as shown.

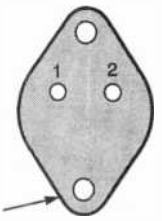
The voltage regulator for this power supply is an LM338. It will produce output voltages from 1.26 to 32 volts, although here the output voltage "top end" is limited by the transformer secondary voltage; its current rating is 5 amperes. The LM338 is easily available from local dealers, and from many **Popular Electronics** mail-order advertisers, so you shouldn't have any problems finding one. If for some strange reason you can't locate one, and have access to the ECG/NTE line of industry-standard replacement parts, a direct substitute is the NTE-935/ECG-935. If you are planning to build just a 3-ampere supply, you can use the NTE-970 or ECG-970 instead.

The output voltage for the LM-338 is:

$$V_{OUT} = 1.26 + (R2/R1 + 1) \text{ volts}$$

In standard practice, R1 is either 180 or 240 ohms, and R2 is a 5000-ohm, linear-taper potentiometer. To help make setting the supply output precisely easier, I mounted a 0–100 vernier dial on the potentiometer shaft; alternatively, a 10- or 15-turn precision potentiometer could be used with good results.

The LM-338 device comes in the TO-3 power diamond-shaped transistor package (see Fig. 2). The output terminal in that package type is the case itself, so that case must be insulated from ground. Also, even though the device is rated at 5 amperes, if you try to run it consistently at anything close to 5 amperes it will run more than a trifle hot, which is never good for electronic devices. To help reliability, it is a really good idea to use a finned heatsink. One way to accomplish both the insulation requirement and the heat sinking is to mount the heatsink on insulated stand offs. A small fan might also be in order, although I didn't use one on this project.



1. ADJ
2. V_{IN}
3. V_{OUT} (CASE)

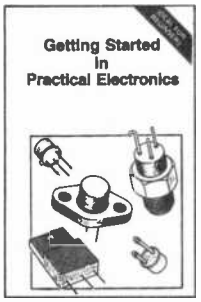
Fig. 2. The LM338 voltage regulator used in the circuit comes in a TO-3 package. In that package, the case itself is the output terminal.

The output metering is not really up to par on this project. I used a 0- to 5-ampere DC meter. What would be more useful is an output voltmeter (0- to 30-volts DC). Because that is missing, I use a digital multimeter to set the output voltage. The outputs for the supply are two standard, front-panel-mounted banana jacks.

The Crusher is an easy power supply to build and use; I used perfboard construction when I built mine. Plan to use 14-gauge wire, rather than the normal 22-gauge hook-up wire for all 5-ampere circuits; 22-gauge wire could be used for the control circuits (R1 and R2) if you wish.

That's all there is to it, except for a brief cautionary note. Remember that this device is powered from the 117-volt AC-power lines, which can be lethal if contacted. As with all 117-volt AC projects, be very cautious when working on this circuit. After all, we want all of you to be with us when we meet here again next month.

You can Build Gadgets! Here are 3 reasons why!



☐ **BP345—GETTING STARTED IN PRACTICAL ELECTRONICS .$5.95**
If you are looking into launching an exciting hobby activity, this text provides minimum essentials for the builder and 30 easy-to-build fun projects every experimenter should toy with. Printed-circuit designs are included to give your project the professional touch.

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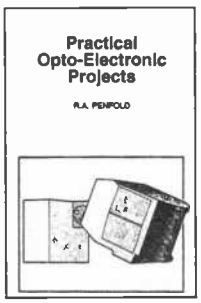
If you shun opto-electronic projects for lack of knowledge, this is the book for you. A bit of introductory theory comes first and then a number of practical projects which utilize a range of opto devices, from a filament bulb to modern infrared sensors and emitters.



☐ **BP363—PRACTICAL ELECTRONIC MUSIC PROJECTS $5.95**
The text contains a goodly number of practical music projects most often requested by musicians. All the projects are relatively low-in-cost to build and all use standard, readily-available components. The project categories are guitar, general music and MIDI.

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SCANNER SCENE

By Marc Saxon

Tuning in to GMRS

Among the groups of stations that have recently captured the monitoring imaginations of scannists are GMRS (General Mobile Radio Service) stations. So this month, let's take a look at them.

GMRS is a two-way UHF radio service that has been around for a while, but has been allowed to remain rather dormant. Yet, within the past year or so, GMRS has unexpectedly become a fabulous "overnight" success. We can thank companies such as Radio Shack, Maxon, and other giants, who have decided to market GMRS radios to the public. Let's also thank the public, which is snapping up GMRS equipment and bringing lots of new activity to the formerly quiet communications frequencies. *Heh-heh!* All the more stations for you and I to monitor!

Radio Shack's entry into the GMRS market has given that sleeping giant new life. Tune those scanners to 462 MHz, gang!

Essentially, GMRS is a personal communications service. Years ago, it originally had been called (by the FCC) "Class A CB Radio," but the government probably decided to ditch the CB appellation when they saw the antics on the 27-MHz Class D CB channels. The FCC's hope has always been that GMRS (established with FM, and in the 460-MHz band) would bring to reality the agency's dream of a really useful, inexpensive, two-way personal radio service with simple license procedures for the general public.

Unfortunately, that dream couldn't happen until the public forgot the chaos, noise, anarchy, and cacophony of the FCC's first personal communications experiment—CB on 27 MHz. Only hobbyists, truckers, and motorists seem to find ways to enjoy 27-MHz CB. While they do it with gusto, many others seeking to meet personal two-way needs receive a long-lasting sour taste for those communications. Justifiably so, perhaps.

But now GMRS has renewed and recaptured the public's interest. Things are perking. Time to start monitoring the GMRS. There are repeater frequencies, as well as simplex frequencies for your listening pleasure.

Repeater frequencies (also available for simplex) are 462.55, 462.575, 462.60, 462.65, 462.675, 462.70, and 462.725 MHz. Frequency 462.675 MHz has been selected, unofficially, as the national travelers' assistance, emergency, and safety channel. It's used and monitored by the many REACT and rescue teams, and other volunteer groups. That channel is available for use by all individual licensees in need of emergency assistance. Repeater inputs are 5-MHz higher (*i.e.* 467.55, 467.574 MHz, etc.).

Simplex-only channels are reserved for direct unit-to-unit communications. Operations on those frequencies are restricted to handheld units, which normally operate with 2 watts, or (maximum) 5 watts. Those frequencies are 462.5625, 462.5875, 462.6125, 462.6375, 462.6625, 462.6875, and 462.7125 MHz. The very popular Radio Shack GMRS handheld units are sold equipped to operate on

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462.6375 and 462.7125 MHz, so those are the best bets for monitoring.

GMRS stations are required to have FCC licenses, although the FCC has been considering allowing the stations to be used without licensing, or perhaps requiring licenses only for repeaters.

Meanwhile, Radio Shack has asked the FCC to create a new radio service, similar to GMRS, to be known as the Family Radio Service. Radio Shack suggests that it would use the frequencies 467.5625, 467.5875, 467.6125, 467.6375, 467.6625, 467.6875, and 467.7125 MHz. The proposal has not been approved nor rejected by the FCC at this point.

There's a lot here to monitor, and more to come as the service continues its rapid growth. Punch up those GMRS channels and see what they have to offer! Certainly, the 462.675-MHz national emergency channel is, at the very least, an immediate winner.

ABOUT THOSE MODIFIABLE SCANNERS

There's been a never-ending stream of questions regarding which specific scanners can be modified to unblock the two 800-MHz cell-phone bands that were factory locked out during the manufacturing process. As we all know, there are many high-end scanners that can be easily unlocked. Nevertheless, other less-sophisticated scanner models never could. Certainly not any of the latest scanners can be unlocked. That's because the FCC ruled that all scanners manufactured or imported after April 1994 could not be easily user-modified to receive cellular frequencies. The result of that rule has been an overwhelming amount of confusion and misinformation circulating in the hobby regarding which scanners can, and which cannot, be unlocked.

Please allow me to unravel the mess and clarify things.

The following Radio Shack scanners are known to be able to be unlocked with no problem: PRO-34, PRO-37, PRO-39, PRO-2004, PRO-2005, PRO-2006, PRO-2027, PRO-2030, and PRO-2032. The following scanners can be unlocked only if the label on the back contains the identification 1A4, 2A4, #A2, or #A3: PRO-23, PRO-46, PRO-51, PRO-2026, PRO-2030, and PRO-2032. Other Radio Shack scanners are not able to be unlocked, as far as we now know.

The following Uniden Bearcat scanners can be unlocked with no problems: BC-200XLT, BC-205XLT, and BC-950XLT. The BC-2500XLT scanner can be unlocked if the manufacturing code on the unit does *not* end in the letters "OBID," although other endings with the code letter "D" should work out OK. The following scanners cannot be unlocked if the manufacturing code on the set contains the letter "D": BC-700A, BC-700XLTA, BC-760XLT, BC-855XLT, and BC-890XLT. No other Uniden Bearcat sets are known to be able to be unlocked at this time.

The Regency 1600 and 4030 can be unlocked without problems.

The standard modification guides for easily unlocking scanners are CRB Research's popular books by Bill Cheek: *Scanner Modification Handbook, Volumes 1 and 2* ($18.95 each, plus shipping and handling). Cheek's newly published 242-page *The Ultimate Scanner, Volume 3* ($29.95, plus shipping and handling) picks up where his first two books ended. All three are available from CRB Research Books, Inc., P.O. Box 56, Commack, NY 11725-0056; Tel. 516-543-9169; Fax: 516-543-7486. Write or call for a catalog, or order by phone with a Visa or MasterCard.

LET'S HEAR FROM YOU

We hope you'll send us your questions, ideas, and local frequencies. This column is as good as you help us make it, and we want to keep it tops! We continue to seek your valued assistance.

Write to us at *Scanner Scene*, **Popular Electronics**, 500-B Bi-County Blvd., Farmingdale, NY 11735. ■

NEW PRODUCTS

(Continued from page 6)

grated wireless remote control. A built-in test mode offers quick and easy adjustment of speaker volume and balance. Additional features include three surround mode choices (Pro Logic, hall, or matrix), a subwoofer output with built-in crossover, and line level outputs for each channel.

The SS-Five surround-sound processor has a suggested retail price of $349.95. For further information, contact AudioSource, Inc., 1327 North Carolan Avenue, Burlingame, CA 94010; Tel. 415-348-8114; Fax: 415-348-8083.

CIRCLE 103 ON FREE INFORMATION CARD

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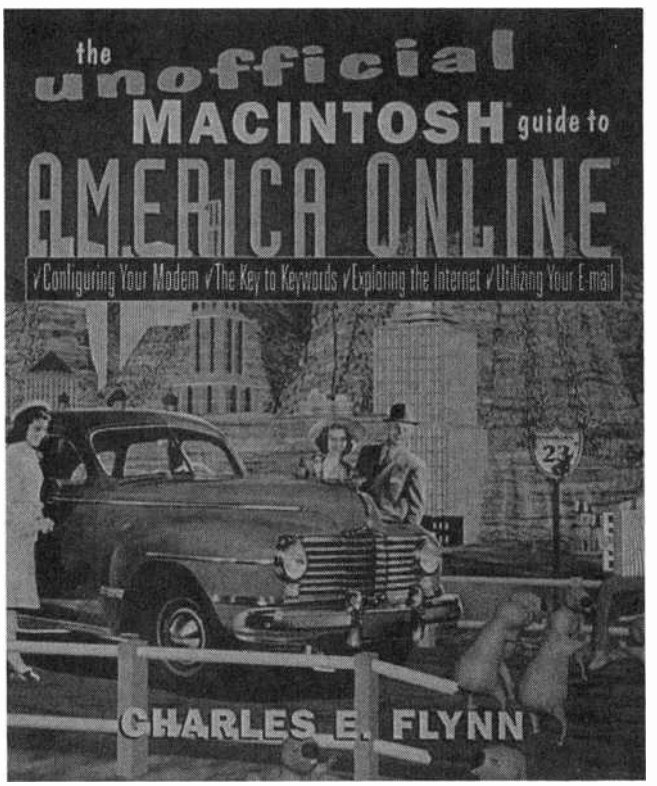
ELECTRONICS LIBRARY

The Unofficial Macintosh Guide to America Online

by Charles E. Flynn



Mac users can stop wasting valuable time and expensive online hours using trial-and-error to find their way around America Online. This book, written by the "answer man" on AOL's Members Helping Members bulletin board, is packed with undocumented tricks, money-saving hints, and troubleshooting tips, all intended to streamline the Mac user's journey through AOL.

Informative and often irreverent, the book provides working solutions to the problems Mac users are likely to face with their AOL accounts, with pointers on everything from installing their AOL accounts to navigating the Internet using AOL. It explains how to address, send, unsend, receive, and save e-mail messages; adjust modem settings to hook up at the highest speed; find interesting departments and forums; set up AOL sessions to do work *off-line*; and download files and transfer files with non-AOL subscribers.

The Unofficial Macintosh Guide to America Online costs $19.95 and is published by John Wiley & Sons, Inc., 605 Third Avenue, New York, NY 10158-0012; Tel. 800-CALL-WILEY.

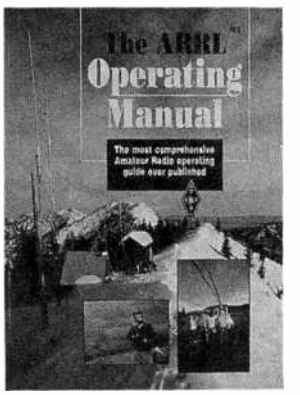
CIRCLE 90 ON FREE INFORMATION CARD

THE ARRL OPERATING MANUAL: Fifth Edition

edited by Steve Ford, WB8IMY

Amateur-radio enthusiasts will find this book an invaluable resource. Newcomers to the hobby will refer to it often as they begin their explorations, and veteran hams will find it opens the door to new experiences. Its more than 550 pages are packed with information on shortwave listening, basic operating techniques, antenna orientation, DXing, contesting, operating awards, HF digital modes, packet radio, FM and repeaters, VHF and UHF operating, satellites, emergency communications, traffic handling, amateur TV, and more.

The fifth edition has been updated to reflect the many changes that have occurred in amateur radio in the last five years. For instance, VHF and UHF operating have become more popular, as have amateur satellites and new HF digital communication modes. Most chapters have been revised, but some, such as the chapter on shortwave listening, have been completely rewritten. A new chapter called "HF Digital Communications" covers everything from RTTY to G-TOR.



The ARRL Operating Manual: Fifth Edition costs $22 and is published by The American Radio Relay League, 225 Main Street, Newington, CT 06111; Tel. 203-666-1541; Fax: 203-665-7531.

CIRCLE 91 ON FREE INFORMATION CARD

DOOM GAME EDITOR

by Joe Pantuso

Written by the creator of the Doom Editor software, this book/CD-ROM set gives you all the information and software you need to create new levels for Doom I and Doom II—even if you have no programming experience. The package lets you breathe new life into the game by creating new Doom levels, graphics, and sound, right from Windows.

The book shows you how to build complex mazes and devious traps, create new sound effects and wall textures, and populate the game with nasty demons and monsters. It also provides a complete reference to every element of a Doom game—from developing monsters and creating ominous lighting and atmosphere to adding new music and inventing a powerful arsenal of weapons and ammunition. It offers a be-

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hind-the-scenes look at how Doom was invented, and gives you plenty of ideas for creating your own fun and challenging mazes.

The CD-ROM features a collection of software to help you build your levels. Doom Editor is the Windows program that allows you to create your own Doom mazes with a point-and-click interface. Doom Audio Editor lets you add your own music and sound effects. The disc also contains the Graphics Inserter and more than 1000 .WAD data files.

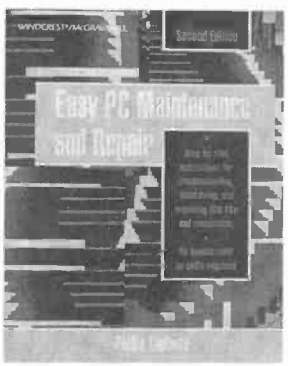
The Doom Game Editor book/CD-ROM package costs $24.95 and is published by John Wiley & Sons, Inc., 605 Third Avenue, New York, NY 10158-0012; Tel. 800-CALL-WILEY.

CIRCLE 92 ON FREE INFORMATION CARD

EASY PC MAINTENANCE AND REPAIR: Second Edition

by Phillip Laplante

This information-packed book was designed to take the fear out of computer repairs. Using step-by-step instructions, it teaches even technical novices to perform routine maintenance, complete upgrades, and troubleshoot and repair their systems, without using any fancy equipment or tools. The book covers virtually every element of a PC, including keyboards, memory, mice, monitors, floppy and hard drives, power supplies, controllers, modems, ports, batteries, clocks, and the DOS operating system.



The new edition covers everything from XTs to Pentium-based PCs. It has been updated with new material on CD-ROM drives, tape backups, "floptical" disks, multimedia, sound cards, scanners, LANs, and ISA and EISA technologies. Using this manual and the documentation that came with their PCs, users will be able to save money, minimize downtime, and prolong the life of their systems.

Easy PC Maintenance and Repair: Second Edition costs $17.95 and is published by Tab Books Inc., Blue Ridge Summit, PA 17294-0850; Tel. 800-233-1128; Fax: 800-932-0183.

CIRCLE 98 ON FREE INFORMATION CARD

INDUSTRIAL ELECTRONIC COMPONENTS CATALOG

from Mouser Electronics

More than 53,000 in-stock, factory-authorized product selections from over 100 quality-conscious manufacturers are featured in this 316-page catalog. It offers semiconductors, passive components, electromechanical devices, resistors, capacitors, switches, transformers, inductors, wire and cable, connectors, publications, equipment, and supplies. Intended as a guide for buyers, engineers, and manufacturing managers, the catalog provides specification drawings, a Quick Index on the front cover, and a comprehensive index.

The Industrial Electronic Components Catalog (Purchasing Manual 582) is free upon request from Mouser Electronics, 958 North Main Street, Mansfield, TX 76063; Tel. 800-992-9943. ■

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NET WATCH

(Continued from page 29)

HOT LINKS

Electronic Design Software
http://engr-www.unl.edu/ee/eeshop/cad.html

Harris Semiconductor
http://www.semi.harris.com/

Ivex Communications
http://www.ivex.com/

Point Communications
http://www.pointcom.com/

Science Fiction Channel: Dominion
http://www.scifi.com/cgi-bin/rbox/incgif.prl/

part of the Sci-Fi Channel On-Line, is an absolute must. It contains eight zones, each of which is satisfying in its own particular way.

The Edge is where you'll find information about upcoming specials and feature series on the Sci-Fi Channel. It's also where you can access the channel's on-air programming grid. Sci-Fi Originals is another zone that's loaded with information about the channel's original programming series. In addition, facts about many special events are located there. If you are not familiar with the channel, those first two zones will change that.

But if your true love of science fiction and the bizarre comes from books you've read (as is the case with me), then you have to check out the Pulp zone. You'll find more articles, reviews, and excerpts from print relating to the world of science fiction, fantasy, and horror than you can handle.

If you'd like to choose from an assortment of downloadable images, and audio and video clips, then click on the FreeZone. Just make sure you have some free hard-disk space and plenty of time—it's addictive collecting all of those digital freebies.

Moving on, you'll find Bboard—a bulletin board where you can contact like-minded people. If you'd like, you can send comments regarding the Dominion by entering the Feedback zone. Also, there's a neat Trader zone where you can shop for tons of Sci-Fi goodies.

One of the best zones, however, is Orbit. There you'll find a collection of locations relating to imaginative fiction in all its forms, and items of interest to cybernauts. Choose from several site links under the following categories: Gothic/Horror (my favorite), Interactive Sites, Internet News, Literature, Movies, Other Science Fiction Resources, Paranormal, Science Fact, Television, and Internet Search Engines.

And that's it for this month. But be sure to join us here each month for a look at the best of the Net. If you have any questions, comments, or suggestions for what you'd like to see covered, you can s-mail (that's snail mail) them to me at *Net Watch*, **Popular Electronics**, 500 Bi-County Blvd., Farmingdale, NY 11735-3931. We'll be publishing an e-mail address soon; watch for it! ■

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MULTIMEDIA WATCH

(Continued from page 24)

ages 6 to 12, Edmark's *Thinkin' Things Collection 2* on CD-ROM helps build thinking skills. Kids can learn how to read and make rhythms, strengthen auditory and visual memory, build visual perception and spatial awareness, and more, all in a colorful, animated presentation.

Also geared toward children is *Simon the Sorcerer* from Activision. The game features fully digitized audio that lets you engage Simon, the 13-year-old hero, in witty conversation with friends and enemies in his quest of becoming a sorcerer. You can explore over 100 illustrated scenes, solve puzzles, and interact with a variety of characters. Simon the Sorcerer is priced at $29.95.

So far this month we've been concentrating on entertainment software. To keep things in perspective, let's finish up with some business/productivity titles.

The *1995 IC Master Plus* on CD-ROM from Hearst Business Publishing is one of the best sources of information on ICs that you can find anywhere. The disc includes information on 108,000 integrated circuits. It runs in DOS or Windows so you can take your pick. The disc's powerful search capabilities allow for quick device selection. Also included on the disc is the 1995 Directory of IC Manufacturer's Data Pages and the 1995 Alternate Source Directory. The 1995 IC Master Plus on CD-ROM can be purchased for an introductory price of $395.

Microsoft's *Bookshelf '95* is the latest update to this versatile reference disc. The disc includes updated versions of The American Heritage Dictionary, The Original Roget's Thesaurus, The Columbia Dictionary of Quotations, The Concise Columbia Encyclopedia, Hammond Intermediate World Atlas, The People's Chronology, The World Almanac and Book of Facts 1995 Edition, and the National Five-Digit Zip Code and Post Office Directory. All very useful stuff, and convenient to have right at your PC.

Last this month is *MyProfessionalBusinessCards* from MySoftware Company. This neat little $49.95 package lets you design and print your own business cards on laser or ink-jet printers. You can customize a card any way you want, use dozens of professionally designed layouts, view colorful designs on-screen, select from a library of logos, or import your own graphics. The software works with business-card stock from Avery, Paper Direct, Beaver Prints, Imageplus, and others. Included in the package are 200 ready-to-print business card samples so you can get to work immediately printing your own custom cards. ■

THINK TANK

(Continued from page 78)

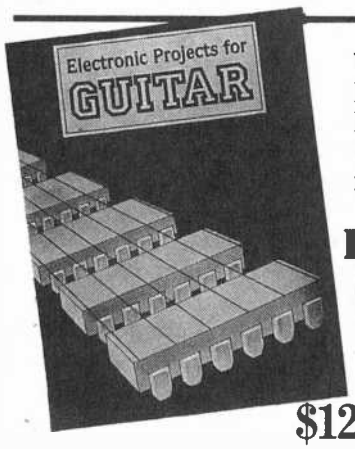
Q1 (2N2219, 2N3053, etc.) and apply power. With your DC voltmeter between ground and the collector of Q1, the reading will be ½ of Q1's breakdown voltage. You want a reading of 45- to 55-volts DC; that will give you pulses of 50 nS at 20–25 amps. If you have a scope, the job is that much easier.

After you have selected Q1, clip on a heatsink; also install LED1 on a heatsink. Use extreme caution around the laser beam and also the high-voltage supply! Use a Radio Shack (no. 276-0099) infrared-sensor card to locate the beam, and to aim optics.

—Skip Campisi, S Bound Brook, NJ 08880

Wow, another really neat circuit! In case some regular readers haven't figured it out, Skip is one of those devoted contributors with more submissions than I can put in a given column.

Now remember if you've got a number of plausible circuits for *Think Tank*, you could walk away with a kit as well as a book. At the very least, you might get a bunch of books. I only have 13 kits, so don't wait too long. Send your work in to: *Think Tank*, **Popular Electronics**, 500 Bi-County Blvd., Farmingdale, NY 11735. ■



Whether you wish to save money, boldly go where no guitarist has gone before or simply have fun building electronic gadgets designed for your musical pleasure, then read

Electronic Projects for GUITAR

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Some of the add-on guitar gadgets you can build are:

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Anyone with some previous electronic project building experience should have no problem assembling the projects.

ELECTRONICS TECHNOLOGY TODAY INC.
P.O. Box 240, Massapequa Park, NY 11762-0240

Yes, send my copy of ELECTRONIC PROJECTS FOR GUITAR by RA Penfold to the address at right. I am enclosing $12.95 plus $4.00 for shipping charges in USA and Canada. All payments must be made in US funds. Sorry, no orders accepted outside of USA and Canada. New York State residents add local sales tax. Allow 6-8 weeks for delivery.

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MA10

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EXLORING THE INTERNET

(Continued from page 55)

There also are some providers who charge no fee at all, being supported by equipment donations by computer and communications companies and relying on volunteers. Those "FreeNets" might not offer all the support and features of the commercial providers, and you might often encounter your share of busy signals, but it's worthwhile to see if there's one of those FreeNets in your local dialing area.

To find out, check with your local computer stores and computer user groups to see if there's a nearby FreeNet. Or contact the National Public Telecomputing Network (NPTN) for a list of FreeNet providers; their e-mail address is info@nptn.org. Three popular FreeNets are the Cleveland, OH, FreeNet at 216-368-3888; the Mobile, AL, Area FreeNet at 334-405-4636; and the Tallahassee, FL, FreeNet at 904-488-5056; all those are modem numbers. There are dozens more FreeNets around the country, located in at least 42 states. Furthermore, there are about ten countries have FreeNets.

Where Do We Go from Here? The Internet is changing rapidly, and much recent development has focused on the consumer-oriented "home pages" of the World-Wide Web. To some, the Internet is turning into a gigantic cyberspace version of a shopping mall. But unless conveniently accessing and using the Internet proves to be a total bust for both individuals and business, that commercialization is quite likely to continue.

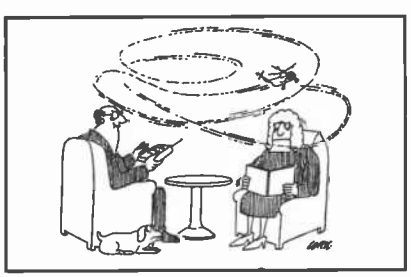
Today, you'll find that practically every conceivable non-profit and for-profit use for the Internet is either underway or being envisioned. There's hardly any product or service that isn't getting developed for or actually being delivered over the Internet. Many businesses operate exclusively within cyberspace, being in the business of creating, supplying, selling, receiving, or manipulating electronic data, rather than something that's physical.

Tomorrow, who knows? The existing Internet is far from being a be-all and end-all. Already, some far-out Internet-based applications are in development. For example, connecting multiple, three-dimensional virtual reality environments, called multi-CAVEs (Cave Automatic Virtual Environments), has been tested by the Argonne National Laboratory and others. That project, dubbed I-WAY (the Information Wide Area Year) involves connecting two or more supercomputers at different locations, but it requires wide-area networks that can handle very-high-intensity communications, and those aren't quite ready just yet.

MCI is working on high-intensity communications, and has developed a network known as vBNS, which hooks up five supercomputer sites for scientific applications. Those might be used to handle multi-CAVEs and could become the basis for a much-improved Internet. But we'll just have to wait and see if that's the case.

It might be that as we drive further down the Information Superhighway, or to use the formal term, the National Information Infrastructure (NII), the Internet as we know it today might no longer exist. In fact, as we unify our communications networks, we might even replace our familiar telephone lines and cable TV connections with a single, very fast, high-capacity communications network that would subsume and supplant our present-day cable TV systems, telephone systems, and the Internet itself. Only time will tell what ultimately will emerge from the realm of virtual cyberspace into the "real world."

So, as you can see, the Internet is currently ushering in a new sub-era in the computer era's short but colorful history. Both global and universal, the Internet offers a way to the best of the past and a nearly limitless, futuristic window on cyberspace. But to take advantage of the Internet, you need to hop aboard, and you should do it now! ■



POOR-MAN'S TRANSMITTER

(Continued from page 44)

apply solder to the twisted strands until the exposed wire is completely covered. It will appear silvery when that occurs (tin colored). Do not apply too much solder, because that will make the wire thicker, and more difficult to insert into the breadboard.

The antenna can be made out of 4 feet of stiff, 22-gauge wire. If you would like to have the antenna take up less space, wrap the wire around a 1-inch-diameter form, and remove the resulting coil. Attach the antenna to the proper point in the circuit.

Tuning and Use. Okay, so you got this thing assembled, now what? Well, like most transmitting devices, the Poor-Man's Transmitter has to be tuned.

Start out by turning on an AM/FM radio and tuning to a frequency on the AM band where there are no other signals. Place your Transmitter near the radio and attach the battery. Then, while holding down S1 with one hand, start turning potentiometer R3 with the other. You will hear an audio tone come in and out of tune as you adjust R3.

Now try this: Set the radio to FM and tune R3. You'll find that you can pick up the signal in the FM band as well, in fact it seems to be all over the place in the FM band, while it just came through on one setting in the AM band. Try turning on a CB, it will come through that as well. It will also come through the VHF stations of your TV, causing horizontal bands in the picture and odd tones in the sound.

Why can you pick up the signals from this 1-MHz AM transmitter on every communications device in your house? Because it is transmitting a squarewave that is, electronically speaking, very dirty. A squarewave is made up of an infinite number of sinewaves, in different proportions. A sinewave is very clean, and is the type of wave that most radio transmitters send.

So, although you might have R3 set to transmit at 1 MHz, you are also generating harmonics (component sinewaves) at 2 MHz, 3 MHz, and so on up to 100 MHz. That covers the FM radio band, the CB band (27 MHz), and the TV VHF band (54–88 MHz). ■

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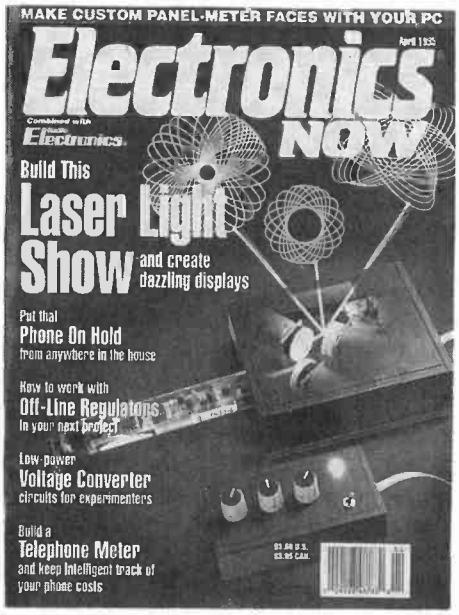

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RF TRANSFORMERS

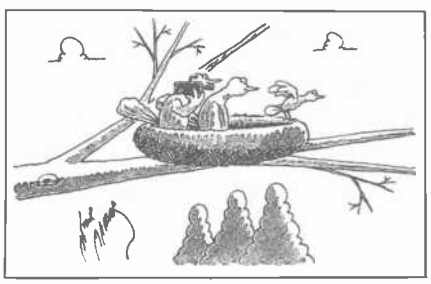
(Continued from page 69)

Figure 9 shows a modification of the trifilar wound 1:1 transformer that yields an impedance ratio of 2.25:1. That type of transformer can be used to match 50-ohm coaxial input, which is standard for most receivers, to impedances in the 120-ohm range. Impedances of that order are found in half-wavelength dipoles at some discrete heights (relative to wavelength) and in large loop antennas.

A tetrafilar wound (*i.e.* four separate windings wound parallel to each other) multiple-impedance transformer is shown in Fig. 10. As shown, that transformer can be used to match impedance ratios of 4:1, 9:1, and 16:1. If an impedance between 9:1 and 16:1 is needed, a tap could be added to the top winding at the appropriate point. If multiple impedances in that range are required, multiple taps and a switch could be added, making this circuit a variable-impedance transformer. When making the taps, be careful not to damage the insulation on the adjacent windings.

Note that the transformers shown in Figs. 9 and 10 are not BALUNs because they do not transform a balanced impedance to an unbalanced impedance. Rather, they work between two unbalanced (e.g. coax to coax) impedances.

Conclusion. Wideband RF transformers are very useful to anyone working with RF circuits or doing antenna work. While BALUN transformers can be bought, commercial units are most often intended for ham-transmitter operation, so are terribly bulky for receiver applications. Besides, it is easy to obtain some of the special sizes that you require when building them yourself. ■



FLASH-BATTERY TESTER

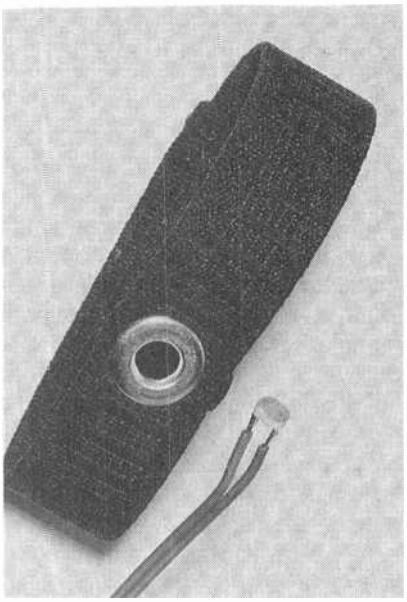
(Continued from page 66)

flashlight on the photocell. The flash should fire. If so, the Tester is ready to use.

Testing the Batteries. Put the batteries to be tested into your flash. Again, strap the photocell around your flash so that the photocell sits directly over the ready light. Then connect PL1 to your computer.

Enter the program in Listing 1 into your computer. If you have a modem, and don't feel like typing the program in yourself, you can download it instead from the Gernsback BBS (516-293-2283).

Load and run the program. Be sure that a formatted diskette is in drive A.



Here's what the elastic band looks like before the photocell is inserted into it.

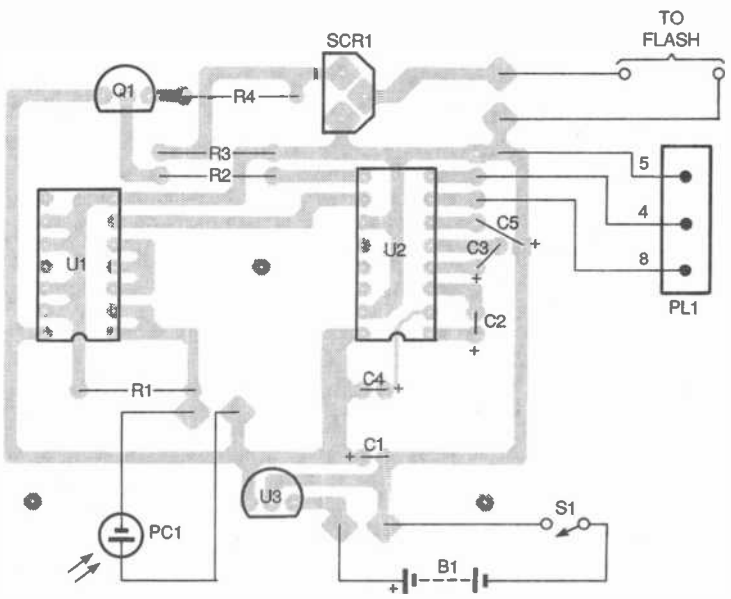


Fig. 4. If you're building the project on a PC board, use this parts-placement diagram as a guide.

All data collected by the program is stored on a disk in that drive in comma-delimited ASCII format. That makes the data easy to use with any spreadsheet program. At the prompts, name the disk file, enter the battery description, and then press RETURN.

Turn on the flash. Once the ready light comes on, press the spacebar as prompted on the screen. The test will continue until the flash takes more than 45 seconds to recycle. That's because when the batteries get that weak, their useful life is over. The computer shuts off the test and closes the disk file.

When the program ends, you can shut off the flash. Then import the data file into Lotus 123, Microsoft Works, Excel, or some other spreadsheet for analysis. That's all there is to it. ■

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SOUND-LEVEL METER

(Continued from page 59)

number P9970-ND) electret condenser element specified at −44 dB sensitivity into a 3000-ohm resistive load (the frequency response is flat within 3 dB to 16 kHz). It should be mounted with the leads just protruding through the board for maximum height. A small drop of silicone rubber can be mounted under the front edge of the microphone to support it more securely. Do not substitute any other electret microphone that might have a different sensitivity, load, or frequency response.

When the board is completed, mount it in its enclosure. The four internal mounting posts of the SerPac M6 case fit through the four larger outer corner holes. If you use a different case, you will have to come up with an alternative method.

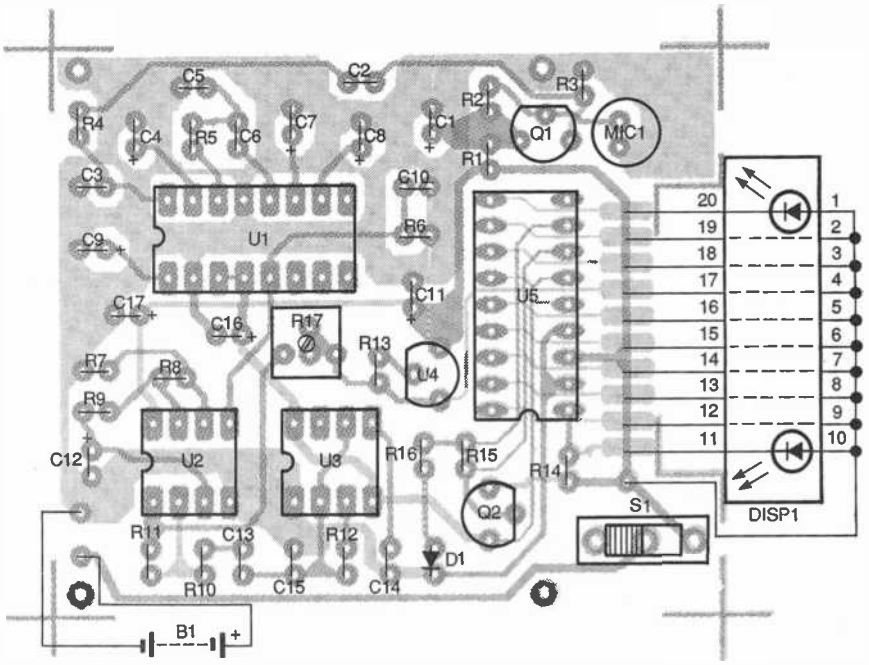

Fig. 4. When installing components to the PC board, use this parts-placement diagram as a guide. The LED display, DISP1, is mounted sideways, off board. The row of pins not connected to pads are connected together by a wire that is then soldered to the pad shown.

Testing and Calibration. Measure the V_{CC} voltage; it should be approximately 5 volts. Under very quiet conditions, the RSSI voltage should be under 0.2 volts at pin 5 of U1. Sounds should drive the RSSI voltage upward and light the bar graph progressively. Note that the low end of the display is located closest to the switch, so that the display reads properly (left to right) when the microphone is facing away from the user and towards the source.

Calibration is performed by adjusting R17, the offset potentiometer, so that a given signal level coincides with the proper bar display. Because the slope of the RSSI signal and the display are already equal, only one point of the display need be calibrated. The lowest point (the first LED) is almost in the noise of the amplifier, so that merely adjusting R17 to just fully light the first bar in a very quiet room will generally be adequate. The voltage measured across R17 should be about 0.44 volts. ■

800-MHz ANTENNA

(Continued from page 60)

the 36-inch, 3/16-inch brass rod into five 4-inch pieces. Those pieces are a little longer than you need, but give you some room for the next steps. Sand one end of each of the rods.

Form a small loop at the sanded ends of four of the rods using the needle-nose pliers; those four pieces will become the radials, and the loops will be used to fasten the radials to the SO-239 connector. Next, solder the sanded end of the remaining 4-inch brass rod to the center conductor of the SO-239 connector. You'll need to use a propane torch or high-wattage soldering gun for that.

Your SO-239 panel-mount connector should have four mounting holes, one at each corner. Attach the looped ends of the four radial elements to the SO-239 connector at those points with the 4-40 machine screws and nuts. After the four radials are attached, solder the radials and the mounting machine screws and nuts to the SO-239 connector, again using the propane torch or a high-wattage iron. Once they have cooled, bend the radials at about a 45° angle, trim the radiator and the radials to 3.5 inches.

MATERIALS LIST FOR THE 800-MHz ANTENNA

- SO-239 panel-mount coax connector, silver plated (see text)
- Brass rod, 36-inch length, 3/16-inch stock
- Four (4) 4-40 × ¼-inch machine screws
- Four (4) 4-40 nuts
- High-wattage soldering iron or propane torch, needle-nose pliers, rosin-core solder, ruler, hacksaw, sandpaper, connectors (as required, see text), etc.

Using your Antenna. The way that you mount the antenna to your scanner is up to you. On a hand-held scanner, you can obtain the adapters needed, a double PL-259 and a PL-259-to-BNC adapter, and connect the antenna directly to your scanner's BNC connector.

On base stations or converters use a short piece of RG-8 coax with the proper connectors (PL-259) and hang the antenna by a piece of fishing line from the ceiling. You can also use a piece of PVC pipe and a compression-type hose clamp as a mast. If you will use the antenna outside, be sure to weatherproof it by using outdoor RF-connector sealant. Use the sealant where you soldered the radiator to the center conductor of the SO-239 connector. ■

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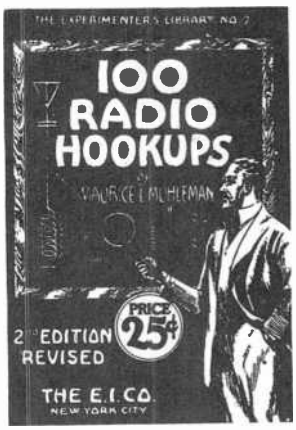

First published in May, 1923 this popular booklet went into reprint editions nine times. It is packed with circuits, theory, antenna installation and tips on consumer radio receivers that were popular in the early 1920's. Antique radio buffs and those inquisitive about the early days of radio will find this booklet an exciting, invaluable and excellent reference into the minds of early-day radio listeners. Sorry, we cannot honor the original 25-cent cover price.

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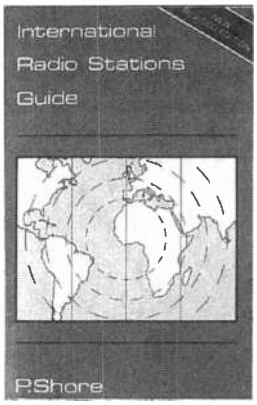

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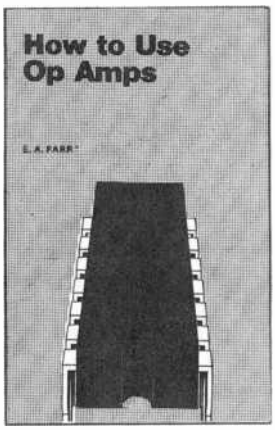

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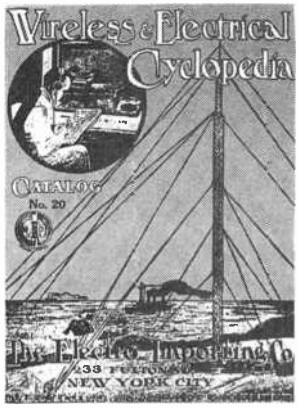

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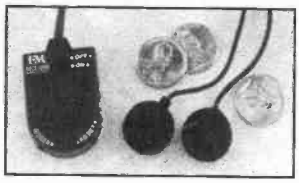

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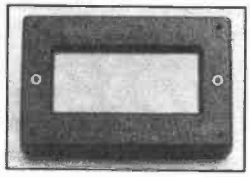

This meter has many useful applications such as Voltmeter, Thermometer, Db Meter, Watt Meter, Current Meter, Capacitance Meter, Lux Meter and LCR Meter. Features include: 200mV full scale input sensitivity, single 9VDC operation and decimal point selectable. In addition, it has 13mm figure height, automatic polarity indication, guaranteed zero reading for 0 volt input and high input impedance (>1OOM ohms). Specifications: Max input 199.9mV DC-Max. Display: 1999 counts (3-1/2 digits). Measuring method: Dual slope integration A-D converter system, plus many other features.

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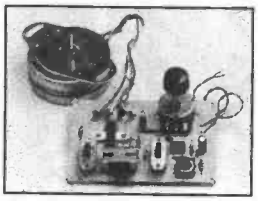

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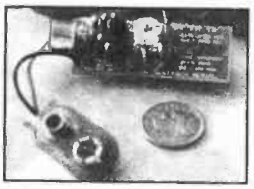

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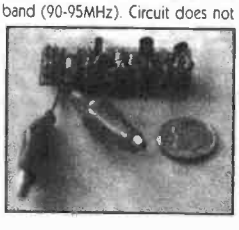

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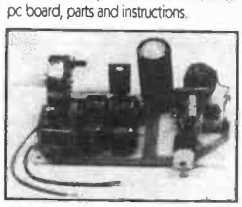

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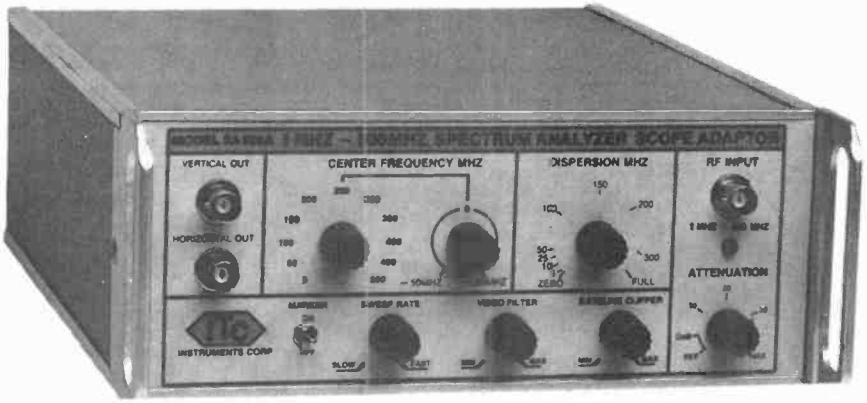

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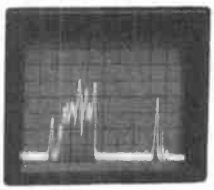

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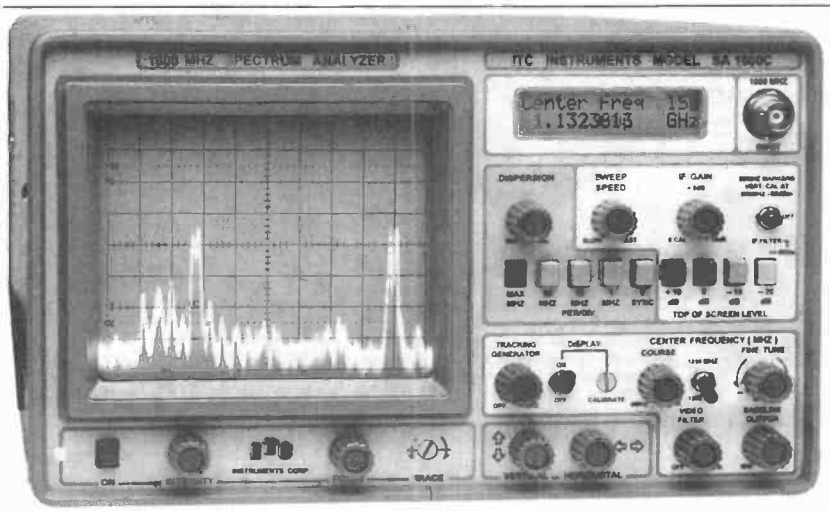

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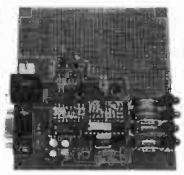
- Control 2 Lights and One Appliance From A Completely Wireless Remote You Can Carry Around
- Installs In Seconds... Just Plug In - No Wiring Required

It allows you to remotely control 2 lights and one appliance. Lights can be dimmed from the keypad. Appliance module (built into the wireless base unit) can be used to remotely control coffee makers, fans, radios or another light (without dimming).

HAS-1053 EZ Starter Pack #3 **Only $62.95**

Retail Value of $84.97

Computer Serial Port Interface Kit for X10



Write your own two way X10 control programs for your PC. It handles the complex timing of the X10 signals that are sent and received by the TW523 module and translates it into buffered ASCII code. Reading X10 activity or sending an X10 command becomes as simple as reading and writing ASCII codes to the serial port. Use virtually any programming language that provides access to the serial port to send and read X10 signals. Space is provided on the circuit board for your own experimental circuitry. A TW523 module (HAS-1135), a RJ11 cable, and a serial cable, (not included) are required to complete the system. Kit requires assembly. Full instructions and sample source code is provided.

HAS-1150 X10 Serial Port Interface Kit $69.95
HAS-1152 X10 Serial Port Interface Kit
Fully Assembled $139.95
HAS-1155 DB9 Serial & RJ11 Cable $9.95
HAS-1135 X10 2 Way Interface Module (TW523) $22.95
5 or more $18.99

Wireless Infra-Red Remote Control of Lights/Appliances & Audio/Video

- Control 2 Lights, 1 Appliance, and Your TV/VCR/Stereo With One Wireless Infra-Red Remote
- Installs In Seconds... Just Plug In - No Wiring Required

Up to 5 audio/video components (select from TV, VCR, Cable, LaserDisc, Satellite, Audio Receivers, CD Players) as well as X10 controlled lights and appliances are at your command by simply pointing the remote at the command console.

HAS-1054 EZ Starter Pack #4 **Only $97.95**

Retail Value of $138.95

X10 Powerhouse Wall Switch

- Easy 2 Wire Connection
- Can Be DIMMED From X10 Transmitter

Replace your existing wall switch with this unit and you will be able to turn the light ON/OFF directly from the switch (Press once for ON, press again for OFF) as well as remotely from any X10 compatible transmitter. DIM/BRIGHT control is available when controlled from X10 transmitters which have DIM/BRIGHT buttons. This switch will also respond to the ALL LIGHTS ON and the ALL UNITS OFF commands. Handles up to 500 watts of incandescent lighting. Wall trim plate not included.

HAS-2031-1 X10 Powerhouse Wallswitch (Ivory) $11.56 each (Retail $15.99)
Only $9.95 each 4 or more

Protect Your Home & Family With A Top Rated Security System That Installs in Minutes!

Sale

- Security System Sounds Siren, Flashes Lights & Calls 4 Telephone Numbers You Select (No Monthly Monitoring Fees)
- Installs Within Minutes With Just One Screwdriver
- (Sensors Are Radio Frequency (RF) Wireless)
- Monitor Up to 16 Separate Zones (LED's show status)
- Supervised Sensors Report Low Battery or Tampering
- AC Powered With Battery Backup
- Up to 8 Keychain/Handheld Remotes for Family Members
- Remotes Can Also Turn On House Lights

7 piece system Includes:
Console, motion detector, 2 door/window sensors, remote, key-chain remote, lamp module, batteries, phone cable, and security warning stickers

HAS-7301 7 Piece Security System Set **Only $179.95**
(Retail$266)

X10 Compatible Dimmer Switch

- Can Be Dimmed at the Switch (press & hold to dim)
- Responds to X10 On/Off, Dim/Bright Signals

Press & release for ON, press again for OFF. Press & hold the switch and the light will dim down. Keep holding the switch and the light will go to dim level 0% pause and then increase brightness back to 100%. Release the switch at any point and it will maintain that dim level. Easy 2 wire installation. Rated at 500 watts. This switch will also respond to the ALL LIGHTS ON and the ALL UNITS OFF commands. Wall trim plate not included. (Fluorescent version does not dim. Requires neutral wire)

HAS-2201-AC X10 Dimmer Switch (White or Ivory) **$35.95**
or **$31.99** ea. 5 or more **$28.99** ea. 10 or more
HAS-2206-AC X10 Fluorescent Light Switch (Wh/Iv) **$43.99**
or **$38.99** ea. 5 or more **$35.99** ea. 10 or more

PLATO For Windows Starter Pack Computer Control of Your Lights & Appliances

- Control 2 Lights and One Appliance From Your Computer And Automatically (Expandable to 256 Lights/Appliances)
- 128 Timers - Computer Can Be Turned Off After Programming. Timers Will Continue To Function
- Save Different Schedules for Different Days/Months
- Draw Floorplans of Your Home or Import Scanned Photos Overlay Icons Representing Lights Appliances Just Click on Icon to Turn On/Off or dim.

Puts a virtual representation of your home on your computer. Click on icons in the familiar intuitive Windows interface to turn devices ON/OFF or to DIM/BRIGHT lights. Program lights and appliances to turn on & off automatically with its 128 built-in timers. Includes Plato for Windows Software, CP290 Home Automation Interface, 2 Lamp & 1 Appliance Module.

HAS-1055 EZ Starter Pack #5 **Only $127.95**

Retail Value of $168.87

X10 Compatible Stanley® Lamp Module

- Special Purchase Low Price!

Plug your incandescent lamp into the socket at the bottom of this module and then plug the module into any standard 110V wall outlet. Set the code you want that lamp to respond to, and you can then control that lamp from anywhere in your house that you have a X10 compatible transmitter or timer. Gives you ON/OFF and DIM/BRIGHT control for incandescent lamps up to 300watts. Manual Override feature allows you to manually turn the lamp on at the lamp even if the module has been turned off. Ivory color.

HAS-2100 Stanley X10 Lamp Module $11.20 (retail $19.99)
$8.99 each for 4 or more

The Ultimate Wireless X10 Remote Mega-ThirtySix

X10 Remote

- Control Thirty Two X10 Devices From One Remote!
- The Only Wireless X10 Remote With All Lights ON/OFF

Control Up to 32 X10 Receivers or 26 X10 Receivers and 10 Relays With One Wireless Remote. Remote has 16 ON/OFF buttons, DIM/BRIGHT and ALL ON/ALL OFF. The button description panel on the left side flips open, revealing another description panel for another 16 functions and a toggle switch to switch to the 2nd bank of 16 functions. Five of the keys on the first bank can be used for controlling the 10 relays. Uses 32 X10 addresses on 2 consecutive house codes. Requires Mega-36 Base/Repeater for X10 Functions, Mega-36 Relay Module for Relay Control. Will not work with other X10 wireless bases. However, you can use the Mega 36 Remote/Base in coexistence with the other wireless X10 remotes & bases as long as they are on different house codes.

HAS-4310 $29.99 **Only $25.50 each 3 or more**

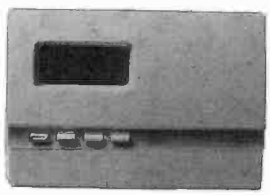
Mega-36 Base/Repeater

Receives RF signals from Mega-36 remote and converts them into X10 commands. Plugs into any 110V wall receptacle. Can also be used as a repeater to extend the range in large homes.

HAS-4320 $29.99

New! X10 Controllable HVAC

- *set temperatures 42 - 90 deg. F with X10 signals*
- *control heat, cool, auto and off functions*
- *manual override at thermostat itself*



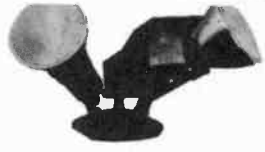
Set any temperature between 61 and 90 deg. F, a freeze protection setting of 42 deg. F, as well as control heat/cool, auto and off functions by X10.

X10 Code	Temp.	X10 Code	Temp.	X10 Code	Temp.	X10 Code	Temp.
1 Off -	OFF	10 Off -	65	3 On -	74	12 On -	83
2 Off -	HEAT	11 Off -	66	4 On -	75	13 On -	84
3 Off -	COOL	12 Off -	67	5 On -	76	14 On -	86
4 Off -	AUTO	13 Off -	68	6 On -	77	15 On -	88
5 Off -	42	14 Off -	69	7 On -	78	16 On -	90
6 Off -	61	15 Off -	70	8 On -	79		
7 Off -	62	16 Off -	71	9 On -	80		
8 Off -	63	1 On -	72	10 On -	81		
9 Off -	64	2 On -	73	11 On -	82		

HAS-3035 X10 Controllable HVAC System (incl. thermostat, controller panel, TW523 Module & power supply) $199.95

Scare Away Unwanted Visitors

Stanley X10 Motion Detector Floodlights



- Turns Floodlights On When Motion Is Detected
- Sends Motion Activated Signals to 4 X10 Addresses
- Sends Dusk Activated Signals to 4 X10 Addresses
- Adjustable Sensitivity & On Duration
- Manually Activate Floodlights From X10 Transmitter
- Use With Chime Module As An Automatic Doorbell
- Turn On Lights All Over Your Home When Motion Is Detected In One Area

HAS-4080 Stanley X10 Motion Detector with floodlights $42.95 (retail $63.75)
3 or more **Only $35.95 each**

1/2 Credit Card Video Camera

- 0.25lux, 384 TV lines
- pinhole and regular lens available

Use this tiny B & W camera to build your own video camera at a very reasonable price. Install them inside everyday items such as smoke detectors, clocks, speakers, books to build your own covert video camera. Pinhole version sees through a hole about the size of a pinhead. Regular lens version has slightly better clarity and sensitivity than pinhole version.

HAS-7570 1/2 Credit Card Pinhole Video Camera $189.95
4 or more only $159.95 each
HAS-7571 1/2 Credit Card Video Camera Std Lens $189.95
4 or more only $159.95 each
HAS-7590 12VDC 500mA Power Supply $7.95

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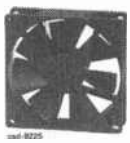
csd-6025

csd-8025


csd-9225

csd-1225

These High Quality Fans feature Ball Bearings and Brushless DC Motors. All of them are designed to meet UL, CSA & VDE Standards. Design these fans into power supplies, computers or other equipment requiring additional air flows for heat removal. These fans are regular Circuit Specialists stock items — they are not surplus.

INDUSTRY BEST PRICING!

CAT NO	PRICE EACH 1	10	25	100
CSD 4010-12	$ 9.88	$ 6.38	$5.48	$4.87
CSD 6025-12	9.38	5.91	5.41	4.71
CSD 8025-12	8.88	5.85	5.19	4.49
CSD 9225-12	8.95	6.14	5.29	4.59
CSD 1225-12	11.45	8.96	7.82	6.85

O.E.M. PRICING!

Specifications

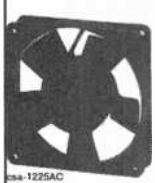
CAT NO	DIMENSIONS (MM)	RATED VOLTAGE (V)	START VOLTAGE (V)	INPUT CURRENT (A)	AIR FLOW (CFM)	STATIC PRESSURE (INCH-H_2O)	SPEED (RPM)	NOISE LEVEL (dB)	WEIGHT (g)
CSD 4010-12	40x40x10mm	12	7	0.06	5.1	0.19	5,500	26	20
CSD 6025-12	60x60x25mm	12	5	0.13	13.7	0.165	4,500	28	65
CSD 8025-12	80x80x25mm	12	5	0.16	37.8	0.177	3,000	31	80
CSD 9225-12	92x92x25mm	12	5	0.32	42	0.18	2,800	37	95
CSD 1225-12	120x120x25mm	12	5	0.35	62	0.180	2,500	42	135

Ball Bearing AC Fans

csa-8038AC

Size: 80 x 80 x 38.5mm (3.15 x 3.15 x 1.5")
Weight: 370±10gm (0.82lb.)
Frame/Housing: Aluminum
Impeller: Glass reinforced thermoplastic UL94V-O
Bearing Type: Ball Bearing
Dielectric Strength: 1 minute at 1,500VAC/50-60Hz
Operating Temp: -20°~+85°C
Life Expectancy: 50,000 Hrs (at 25°C, 65%RH)
Motor Protection: Impedance Protected
Safety Approvals: Meets UL, CSA, VDE Standards

CAT NO	PRICE EACH 1	10	25	100
CSA8038AC	$15.26	$12.92	$10.98	$9.73


csa-1225AC

Size: 120 x 120 x 25.5mm (4.71 x 4.71 x 1.00")
Weight: 390±10gm (0.86lb.)
Frame/Housing: Aluminum
Impeller: Glass reinforced thermoplastic UL94V-O
Bearing Type: Ball Bearing
Dielectric Strength: 1 minute at 1,500VAC/50-60Hz
Operating Temp: -20°~+85°C
Life Expectancy: 50,000 Hrs (at 25°C, 65%RH)
Motor Protection: Impedance protected
Safety Approvals: Meets UL, CSA, VDE Standards

CAT NO	PRICE EACH 1	10	25	100
CSA1225AC	$15.28	$12.94	$11.01	$9.88

Specifications

CAT NO	DIMENSIONS (MM)	NOMINAL VOLTAGE (V)	FREQUENCY (HZ)	SPEED (RPM)	INPUT POWER (W)	AIR FLOW (M3/MIN)	STATIC PRESSURE (MM)	NOISE LEVEL (dB)
CSA8038AC	80x80x38.5	110/120	50/60	2300/2600	9/7	0.63/0.72	3.5/4.5	31/34
CSA1225AC	120x120x25.5	110/120	50/60	2000/2300	12/10	1.56/1.70	4.6/4.8	23/36

Cool your 486 or Pentium CPU's with one of these CPU Cooling Fans.

NEW LOWER PRICES!!

CAT NO	DESCRIPTION	PRICE EACH 1	5	10
CC-M3	Cooling Fan for 486 CPU's	$7.50	$6.00	$5.00
PENTIUM FAN	Cooling Fan for Pentium CPU's (Will not fit Pentium 60 or 66MHz)	9.50	8.00	7.00

Plastic Fan Filter Assemblies

These fan filter packages consist of a guard, foam filter media and media retainer for tubeaxial fans. The retainer is easy to install without removing the fan or guard while the foam filter is also simple to clean and change. Use these kits to protect your equipment from airborn contamination and reduce external fan noise.

CAT NO	DESCRIPTION	PRICE EACH 1	10	25	50
GRM 60	Plastic Fan Filter Kit for 60mm Fans	$1.76	$1.42	$1.20	$ .98
GRM 80	Plastic Fan Filter Kit for 80mm Fans	2.20	1.75	1.48	1.28
GRM 92	Plastic Fan Filter Kit for 92mm Fans	2.60	2.05	1.74	1.40
GRM 120	Plastic Fan Filter Kit for 120mm Fans	2.92	2.19	1.84	1.56

Fan Power Cord

2' Length, SPT-1, AWG18 x 2C, UL/CSA

CAT NO	DESCRIPTION	PRICE EACH 1	10	25	50
C180	Fan Power Cord	$1.28	$1.14	$ .94	$ .78

Metal Fan Filter Assemblies

For use with tubeaxial fans. These wire formed fan guards provide extra safety.

CAT NO	DESCRIPTION	PRICE EACH 1	10	25	50
FG40-2	Wire Formed Fan Guard for 40mm Fans	$1.72	$1.29	$1.09	$ .86
FG60-4	Wire Formed Fan Guard for 60mm Fans	1.92	1.44	1.19	.96
FG80-5	Wire Formed Fan Guard for 80mm Fans	2.00	1.50	1.24	.99
FG92-5	Wire Formed Fan Guard for 92mm Fans	2.28	1.71	1.39	1.14
FG120-15A	Wire Formed Fan Guard for 120mm Fans	2.52	1.89	1.57	1.26

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ARE YOU BEING "BUGGED?"

EVEN AS YOU READ THIS, countless individuals and firms are being enormously damaged by having their private conversations overheard, monitored, and\or recorded.
Almost without exception and AFTER the fact, the victims make a statement something along the lines of "But, I never thought it could happen to ME!

OUR FINEST

Counter-Surveillance Device

THE ULTIMATE IN "BUG" DETECTION EQUIPMENT "DEBUGS" ROOMS AND TELEPHONES!

If you require GUARANTEED PROTECTION against electronic telephone monitoring devices and COMPLETE CONFIDENTIAL PRIVACY in certain rooms and areas, we highly recommend the COUNTER-SURVEILLANCE DETECTOR CSD-18.

CONDUCT A PROFESSIONAL SEARCH...ANYTIME...ANYWHERE!

Every newspaper and magazine article and every radio and TV story discussing some new episode involving "Bugging" devices, continues to increase the ever growing demand for electronic Counter-Surveillance "sweeps" and equipment. The very limited supply of competently trained and equipped Counter-Surveillance specialists has created a situation where "sweep" rates exceeding $250 per hour are now considered reasonable and appropriate.

This is an exciting, immensely interesting and profitable field that you can enter with a minimum investment. Two hours actual practice with the CSD-18 will have you "reading" and "clearing" telephones and rooms with professional ease and competence. The average fee for "debugging" a single telephone is over $200.00 It requires about 45 minutes to complete the job and once it gets around that YOU can provide this service, you'll quickly have more clients than you can handle.
Even if you choose to provide "sweeps" for only a small number of friends and associates, your initial investment will quickly be returned many times over.

EXTREME SENSITIVITY!

This is our finest piece of detection equipment! The CSD-18 quickly locates electronic eavesdropping devices in telephones, homes, offices, vehicles, boats, or concealed on the body. It will actually pick up many eavesdropping transmitters at ranges up to 25 ft! Extreme sensitivity is obtained via ultra-efficient amplification circuitry directly following the RF detection stages. Excellent quality dynamic headphones exclude all external sounds to further enhance detector output.

Encompassing an extremely wide-band frequency coverage of under 1 Mhz to over 3 Ghz, the CSD-18 quickly "homes-in" on any eavesdropping transmitter and immediately pinpoints its location. The closer you get to the "bug", the further the needle moves to the right. It's as simple as that.

FULL RANGE DYNAMIC HEADPHONES

"FLASHING" LED WARNS YOU INSTANTLY!

And, for maximum telephone security, the CSD-18 automatically analyzes a pre-programmed series of electronic measurements along the telephone line and converts the analysis into an easy to follow, step by step, test procedure. No technical knowledge is required or necessary. A visual indication (via a flashing LED) immediately reveals the presence of the various types of telephone "taps" and the flashing sequence identifies the actual type of eavesdropping device.

DETECTS THE LATEST "SUPER-BUGS"

Exclusive GSS proprietary circuitry assures the utmost privacy protection possible today. The CSD-18 detects even the very latest ultra-sophisticated eavesdropping devices specifically designed to defeat detection, including sophisticated "Frequency Hoppers" and "Burst Bugs". Also includes multi-line option for testing business phones.

FREE WITH ORDER!

SUBMINIATURE "BODY WIRE" DETECTOR!

If you fear the possibility of being overheard and/or recorded during private conversations and require "silent" notification, we've also included our SBD-5 (regularly $225) as a FREE GIFT! Only 3" x 2" x 1", this exciting new development in micro-miniaturization will instantly detect hidden body wires at ranges up to 10 ft and alert you via a silent vibration.

BIG MONEY OPPORTUNITIES!

Also, complete information describing the fantastic opportunities now open to trained Counter-Surveillance technicians and how a number of individuals are reaping a Bonanza in this booming business! You'll learn exactly how the ever increasing use of Electronic Listening Devices by investigative agencies, government agencies, jealous suitors and unscrupulous business competitors, etc. has created huge demand for this service.

FASCINATING HI-TECH INFORMATION PACKAGE!

A detailed analysis of a variety of extremely fascinating hi-tech devices and procedures used for ultra-sophisticated audio and video eavesdropping including micro-wave and laser device monitoring; new methods for listening thru walls; all about scramblers, voice changers and exactly how neighbors eavesdrop. How missing persons are found, confidential data banks are broken into, lie detectors deceived and much more!

A comprehensive information package JAM-PACKED FULL of some of the most exciting and fascinating reading imaginable. Reads like a James Bond novel, with one important exception...IT'S NOT FICTION!

THE ONE "BUG" TO FEAR MOST!

While most individuals are now somewhat guarded in their telephone conversations, they still rather naively feel secure in the "privacy" of their own home or office. However, the most common type of "tap" presently used by eavesdroppers now picks up ALL SOUNDS AND CONVERSATION WITHIN A ROOM ... **WITH THE TELEPHONE STILL ON THE HOOK!**

Due to this devastating capability, this "Infinity" tap (variously referred to as Infinity Transmitter, Hookswitch Bypass, 3rd Wire, Harmonica Bug, etc.) has become the "bug of choice".

In flagrant violation of federal law prohibiting their use and sale, these devices in various forms are openly advertised in many technical publications for as little as $30. Literally thousands of these devices are now in the hands of unscrupulous individuals all over the country!

In response to this ever-growing threat, a uniquely engineered feature of the CSD-18 now also detects Infinity type devices anywhere "down the line".

In other words, if ANYONE ... ANYWHERE ... is utilizing the telephone tip and/or ring wires to monitor your private room conversations while your telephone is on the hook, you'll immediately be made aware of it via a flashing LED!

100% POSITIVE INDICATION

The CSD-18 also flawlessly detects "Series" and "Parallel" telephone transmitters and "Telephone Recording Devices". And, a separate feature silently indicates when extension phones are picked up or being used. The CSD-18 completely eliminates all doubt and guesswork.

EXCLUSIVE "LISTEN-IN" FEATURE!

The CSD-18 will even allow you to "listen-in" to exactly what the eavesdropper is surreptitiously monitoring. And, without the eavesdropper ever becoming aware that he has been detected! We are unaware of ANY other detection equipment having this combined capability AT ANY PRICE!

MAXIMUM PROTECTION

The CSD-18 detects and locates ALL major categories of surveillance equipment including:
BUMPER BEEPERS,
"BODY" TRANSMITTERS
TELEPHONE RECORDING DEVICES
SERIES & PARALLEL PHONE TRANSMITTERS
"INFINITY", MICRO-WAVE AND "LASER" BUGS
& ALL TYPES OF CONCEALED TRANSMITTERS
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CSD-18 **$495** Complete

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LOWE

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SANGEAN

ATS202		$99.95
ATS606P	w/Ant60	$169.95
ATS808		$137.95
ATS818		$147.95

REALISTIC

PRO62	(CALL)	$239.95
PRO2035	(CALL)	$359.95

Bearcat® SALE!!!

BC3000XLT 25-550/760-1300MHz[1]

- Scan 100ch/sec, search 300ch/sec, 400 memory channels, 20 x 20 banks.

LIST $499.95 **EEB $369.95**

BC9000XLT 25-550/760-1300MHz[1]

- Alpha numeric LCD on all 500 memory ch. Scan 100 ch/sec, search 300 ch/sec, data skip, attenuator 15dB, COR recorder control.

LIST $769.95 **EEB $389.95**

BCT-7 All Band 26-956MHz[1]

- A must for the frequent highway travellers. 7135 pre-programmed chs., search by state & service. Police, HP, DOT, Fire, News, WX, CB, plus 100 User memories, scan 100 ch/sec.

LIST $319.95 **EEB $169.95**

Other BEARCAT Scanners...

BC120XLT	$129.95	BC760XLT[1-2]	$199.95
SC150Y/B[1]	$169.95	BC860XLT[1]	$169.95
BC148XLT-1[1]	$99.95	BC890XLT[1-2]	$229.95
BC220XLT[1]	$224.95		

(1) Cellular Block (not restorable)
(2) Cellular Block, but can be restored
(3) Un-Blocked O.K. to qualified buyers (Govt., Export, etc.)

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The new Scout 40 version 3.1 and the AOR AR2700/AR8000 scanners gives you the intercept power in your hands, that just a few years ago could only be a dream. Imagine having your scanner hop on a signal the instant someone presses the mic button. The Scout will reaction tune your AOR scanner in a blink of an eye to any locally generated signal.

WHERE is the Scout most effective? Sporting events, car races, air shows, NEWS gatherings, accident scenes, air ports, railroads, marinas, fast food drive-thrus, many more applications. Everywhere you turn today there's a walkie-talkie in use. Listen in, it's your world.

WHO needs the Scout/AOR System? NEWS service, local TV/Radio stations, Police, DEA, Air ports, anyone that wants to know what is being transmitted in the immediate area, plus thousands of scanner listeners, FBI, Law enforcement, SWAT team, and surveillance.

WHAT do you need? 1. Scout 40 version3.1
2. AOR AR2700/AR8000 3. Input jack, modification to scanner
4. Interconnect cable. 5. Scout 40 V3.0 requires CB-AR cable $49.00

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• SCOUT 40 v3.1	list $449.95	EEB $419.95

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Very Versatile DMM

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Dissipation factor indicates leakage in capacitor and Q factor in inductor
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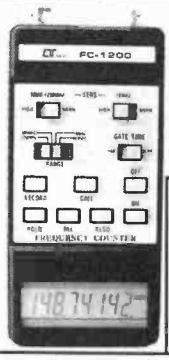

Frequency Counter FC-1200 $129.95

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Display: 8 digit LCD
Period: 0.1µs-0.1s
Records Max/Min/Average
Data hold, relative mode
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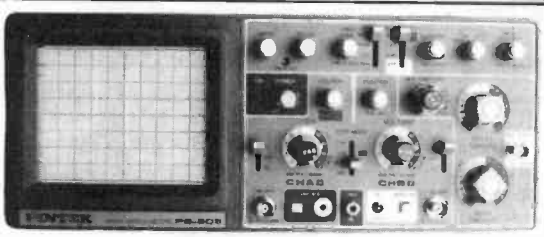

20 MHz Oscilloscope with Delay Sweep PS-205 $429.95

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PS-405 40 MHz DELAY SWEEP	$569.95
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Scope Probe: 60MHz x1, x10 $15, 100MHz x1, x10 $22
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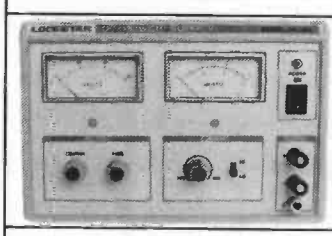

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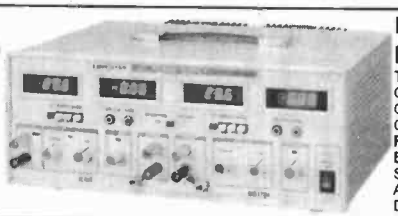

DC Power Supply Triple Output PS-8202 $499.95

Two 0-30 VDC , 0-3A outputs
One fixed 5VDC, 3A output
Capable of independent or tracking operation
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Short circuit and overload protected
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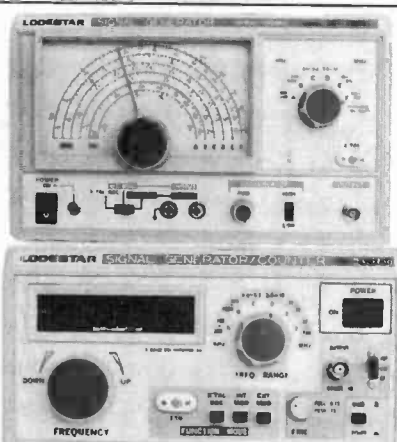
Dual tracking 30V/3A, 30V/5A, 60V/3A, 60V/5A



RF SIGNAL GENERATOR SG-4160B $119.00

100 kHz-150MHz sinewave in 6 ranges
RF Output 100mVrms to 35 MHz
Internal 1kHz, External 50Hz-20kHz AM modulation
Audio output 1 kHz, 1 Vrms

RF SIGNAL GEN./COUNTER SG-4162 AD $229.95

Generates RF signal same as SG-4160B
6 digit frequency counter 1Hz - 150 MHz for internal and external source Sensitivity <50mV

AUDIO GENERATOR AG-2601A $119.00

10Hz - 1MHz in 5 ranges
Output: 0-8Vrms sinewave
0-10Vp-p squarewave
Synchronization: ±3% of oscillation frequency per Vrms
Output distortion:
0.05% 500Hz - 50kHz
0.5 % 50Hz - 500kHz
Output impedance: 600 ohm

AUDIO GEN./COUNTER AG-2603AD $229.95

Generates audio signal same as AG-2601A
6 digit frequency counter 1Hz-150MHz for internal and external sources Sensitivity <50mV

FUNCTION GENERATOR FG-2100A $169.95

0.2 Hz -2 MHz in 7 ranges
Sine, square, triangle, pulse and ramp
Output: 5mV-20Vp-p
1% distortion, DC offset ± 10V
VCF: 0-10V control frequency to 1000:1

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Generates signal same as FG-2100A
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Feature TTL and CMOS output

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Function Generator Blox
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By Elenco
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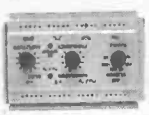

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Sine, Triangle, Square Wave

Learn to Build & Program Computers with this Kit

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From scratch you build a complete system. Our Micro-Master trainer teaches you to write into RAMs, ROMs and run a 8085 microprocessor, which uses similar machine language as IBM PC.

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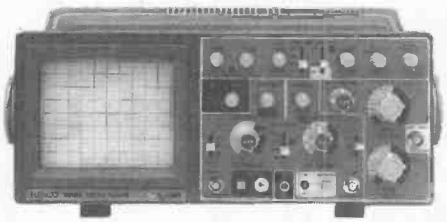


60MHz

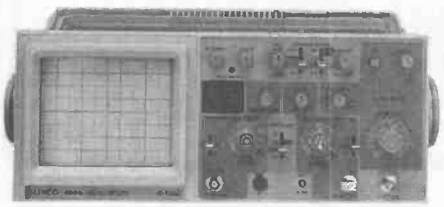
S-1360 $775

Delayed Sweep

S-1365 $849

Cursor Readout

- Voltage, Time
- Frequency differences displayed on CRT



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2- Channel

S-1345 $575

Delayed Sweep

- Beam Find
- Component Tester

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Delayed Sweep

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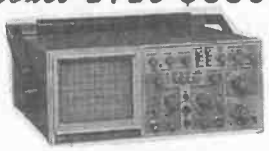

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- 1mV/div sensitivity
- Video sync separators
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- Single sweep
- V mode-displays 2 signals unrelated in frequency

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- Sweep to 5ns/div
- Dual time base
- Signal delay line
- Component tester
- V mode-displays 2 signals unrelated in frequency

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Model 2190

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- Sweeps to 2ns/div
- Dual time base
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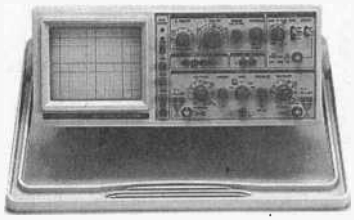

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Bandwidth	20 MHz	40 MHz	60 MHz
Model	OS-3020	OS-3040	OS-3060
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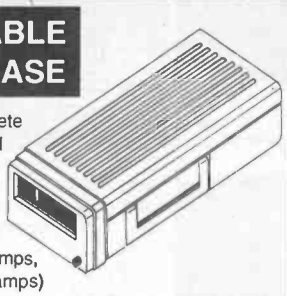
PORTABLE SCSI CASE



Nearly complete case for SCSI device. Includes 40 watt power supply (5 Vdc @ 3 amps, 12 Vdc @ 2 amps) with cooling fan, power switch, fuse holder, LED socket, power input receptacle, two standard 50 pin SCSI interface jacks, molex-type power connectors, interior cable with 50 pin socket connector and interior mounting rails. Front face plate is an aftermarket piece that doesn't quite go with the box but serves the purpose pretty well. Absent from the case is the switch in back which specifies the device's position in the chain. This can be easily bypassed with a few 0.1" shorting jumpers (our CAT# SJ-1). Also not included is a standard IEC power cord (our CAT# LCAC-60). Off-white case is 14.25" X 7.38" X 3.26" and has a folding handle for easy carrying.

$19.95 each

CAT# SCSI-1 — 2 for $36.00

30' CABLE

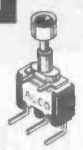
A GREAT DEAL!

Originally made to connect Digital Audio Tape machine to a remote controller, this "snake" cable consists of four separate 9 conductor plus drain wire, foil-shielded cables in one jacket. The conductors are stranded 24 AWG wire. Each end of each smaller cable is terminated with DB-9P connectors. The cable is well-made and quite flexible for its size. Snake cable nominal O.D. is 0.52". Interior cable O.D. is 0.15". The outer jacket can be slit and removed if only the 9 conductor cable is required. DB-9 connectors include thumbscrew hold-downs. If you are using multiconductor shielded cable this is a great deal.

$5.50 each

CAT# CBL-3 — 2 for $10.00

SPDT PUSHBUTTON

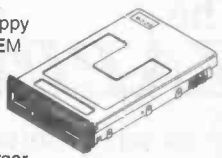


Alcoswitch # MPS103D-R S.P.D.T. miniature pushbutton switch. Push-on/ push-off, snap-action switch. Unthreaded, 0.24" diameter X 0.33" long bushing. Green 0.4" dia. cap. Right-angle pins for PC board mounting. Contacts rated 3 amps @ 115vac.

$1.00 each

CAT# MPB-22 — 25 for $22.50

720K 3.5" INTERNAL FLOPPY DRIVE



Sony # MP-F11W-2Z Brand new 720 KB floppy drives. Built for an OEM product, these are, in every way, compatible with PC/XT/AT computers except that the faceplate is slightly larger than those on exact replacements. The faceplate size on these is 4.04" X 1.23". (Normal size is 4" X 1"). The faceplate is removable and can be trimmed if desired. In some cases it may work without trimming. Also, we have found that, when used in 5.25" bays with the adapter kit below, the adapter can easily be modified to accommodate the unit. Because of this slight inconvenience, we are selling these drives at an incredibly low price.

$14.00 each

CAT# MPF-11SF — 10 for $120.00

INSTALLATION KIT for MPF-11SF allows for installation into 5.25" drive bays. Simply cut and remove three plastic gussets to install. **CAT# FDD-3.5** $3.50 each

"HI-8" VIDEO CASSETTE (USED)

8 mm Video Camcorder Users!.

SONY Hi-8 Top quality, metal particle 120 minute video cassettes. Used for a short time, then bulk-erased. Each cassette has its own plastic storage box. *Satisfaction Guaranteed!*

$3.00 each

CAT # VCU-8 — 10 for $28.00, 100 for $250.00

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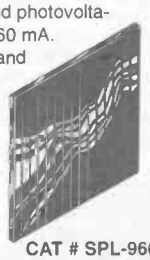
9 VOLT 60 MA SOLAR PANEL



These 6" X 6" glass enclosed photovoltaic panels produce 9 Vdc at 60 mA. Ideal for charging batteries and powering small devices. Put two or more together for more current and voltage. Includes metal connectors and instructions for soldering directly to panel.

$5.25 each

CAT # SPL-960

9 FOOT DUAL AUDIO CABLE

LARGE QUANTITY AVAILABLE!

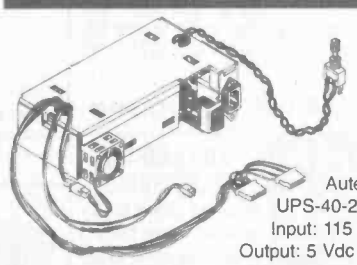
9' shielded dual audio cable with color coded (red and yellow) RCA style pin plugs either end. Black cable.

$1.00 each

CAT# DCB-108

10 for $8.50 • 100 for $75.00
1000 for $500.00

40 WATT FAN COOLED SWITCHING SUPPLY



Autec # UPS-40-2002 Input: 115 Vac Output: 5 Vdc @ 3 amps, 12 Vdc @ 2 amps (4.5 amps peak). 7" X 4.25" X 2.16" metal enclosure with cooling fan, EMI filtered input module, fuse holder, on/off switch, LED socket and two 4 pin power connectors. UL and CSA listed.

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CAT# PS-2002

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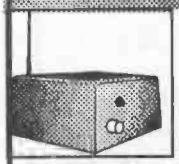
RAINBOW KITS



FM STEREO TRANSMITTER

Own your own FM radio station. Any stereo signal you plug into the FMST-100 will be transmitted to any FM radio tuneable from 76 to 108MHz FM. Transmit a wireless link through an auditorium, from your car to your camper, listen to your CD's while mowing the lawn, Play music on one channel sing on the other. Clarity is excellent, aprox. 40dB stereo separation. Length of antenna determines the distance of transmission. Complete with stereo input level controls & crystal for stereo separation. 9v battery operation. SIZE: 1.5" x 2.5" x 3"

FMST-100 KIT **$29.95** / Cabinet **$8.95**

PHONE TRANSMITTER

Small but mighty,it fits anywhere. Phone line powered, never needs batteries. Transmits both sides of a phone conversation loud and clear, wireless, to any FM radio at great distances. Variable tunes from 70MHz to 130MHz FM. You can also use it as a speaker phone. SIZE:1.25" x .6".

TEL-B1 KIT **$12.95** BUILT **$29.95**

SUPER SNOOPER BIG EAR

Listen through walls, hear conversations across the room. Add a parabolic reflector and hear blocks away. The BIG EAR can be hidden about anywhere. Makes an ultra sensitive intercom. Can be used as a 1.5W AMP. We supply a mini-electret mike in the kit. Power requirement 6 to12v DC SIZE:1.75" x 1"

AA-1 KIT **$10.95** BUILT **$29.95**

WIRELESS FM MICROPHONE

Small but mighty this little jewel will out perform most units many times its price. It really stomps out a signal. The WM-1 kit is a buffered wireless mike that operates from 80MHz to 120MHz FM, the frequency of any broadcast FM radio. Includes a mini-electret mike. 6 to 12v DC. SIZE: 1.25" x 1"

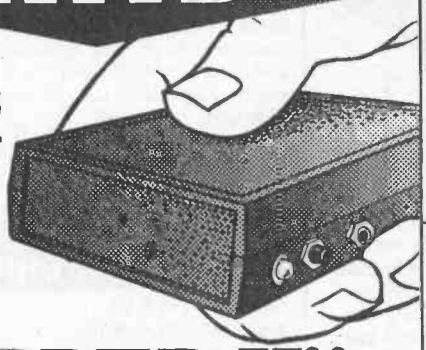
WM-1 KIT **$14.95**

DC VOLTAGE MONITOR

If battery status is important, you need this kit. This kit uses 7 LEDs to monitor 12v DC in 1v, 1/2v, or 1/4v steps. Monitor 8v or 5v in 1/4v steps. Great for boats, motor homes, model planes or race car ni-cads. All parts and instructions are included. SIZE: 1.3" x 2.7".

VM-1 KIT **$7.95**

The 10GHz Transmitter is back...



The "ZAPPER II"

With it's new and improved design it will not only test your radar detector...BUT it's tuned to the amateur radio band.

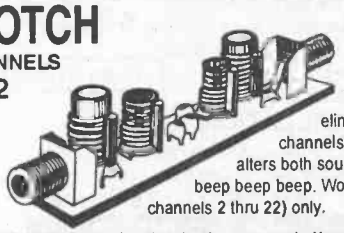
- While your out on American highways personally test yours and your fellow travelers radar detectors.

The "ZAPPER II" is a 10.450 GHz to 10.550 CW oscillator. It has a code key jack installed for those who want to send Morse code.

BUILT **$49.95** KIT **$39.95**

TV NOTCH FILTERS

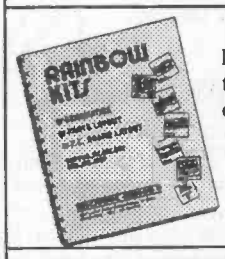
FOR CHANNELS **2 thru 22** ONLY



Our TV filters eliminate unwanted TV channels or interference that alters both sound and video with a beep beep beep. Works on cable channels 2 thru 22) only.

NOTE: All TV Filter Kits are sold for educational purposes only. You must obtain permission from your local cable company before using these filters on your cable system.

DF-222 KIT **$14.95**



This Manual contains schematics, parts lists & P.C. board layouts for many of the Rainbow Kits. Use your own parts to construct our kits.

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5K

STROBE LIGHT

Do you need an attention getter, warning light,or flashing light for model airplanes? Then this kit is for you. Use it as an emergency light for your auto, radio tower, even use it on your bicycle. Has a variable flash rate. Power requirement 6 or 12v DC . Size 3.5"x1.9"

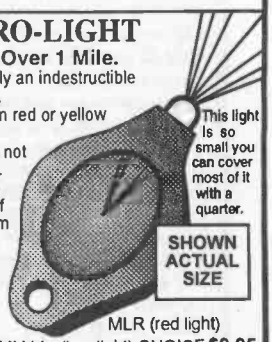
ST-1 KIT **$9.95**

MICRO-LIGHT

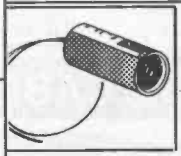
Visible Over 1 Mile.

This is truly an indestructible flash light.

- Comes in red or yellow light.
- Bulb will not burn out.
- Uses a 5 year shelf life lithium battery.
- Case made of tough ABS.



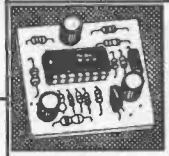
MLR (red light)
MLY (yellow light) CHOICE **$9.95**



4.0 mW Laser Diode

Great for making a gun sight, use as a transit, makes a super experimenters project. The beam is visible with a wavelength of 670 nm. Size of beam is 6mm at 5 meters. Power requirement 3 volts DC at 85mA. Size: 10.5mm x 18.5mm

LDM-5 New Low Price **$59.95**



VOICE ACTIVATED SWITCH

This VOX circuit can be used to operate a tape recorder, ham radio, CB radio, or turn on an alarm. The VOX-1 kit has 100MA of output that operates a relay, light, motor, ? What could you do with a sound activated switch?Power requirement 7.5 TO 18vDC. SIZE: .1.5" x 1.3"

VOX-1 KIT **$6.95**

WIDE BAND PREAMP

The ideal preamp for scanners, hand held radios, frequency counters. Amplifies low level (weak) signals. If the signal is extremely low 2 amps can be used in series. 1MHz to 2.5GHz @ 2.8dB NF. 1dB compression = +0 dBm. Gain: 1MHz=20dB to 2.5GHz=6dB. Power requirement 12v DC @ 6Ma. SIZE: 1.2" x .8"

WBA-6 KIT **$19.95**

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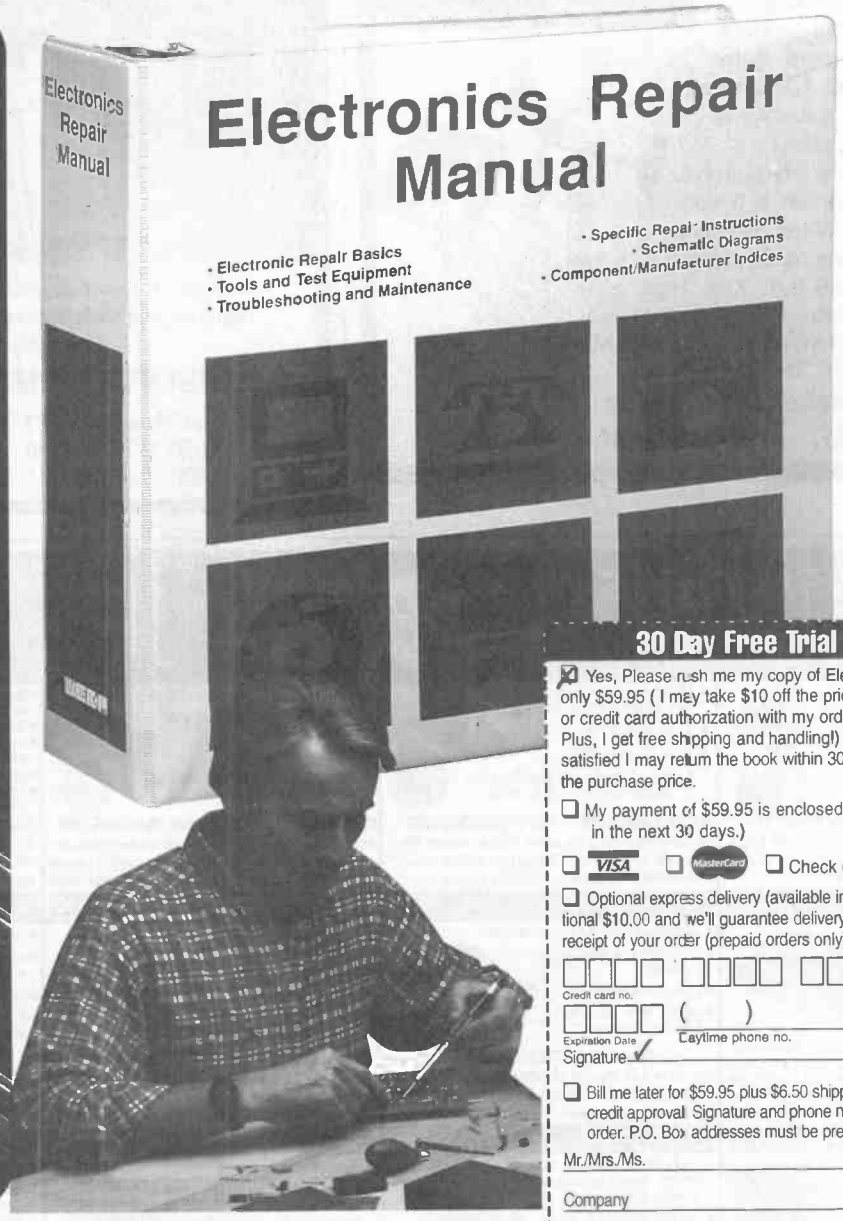

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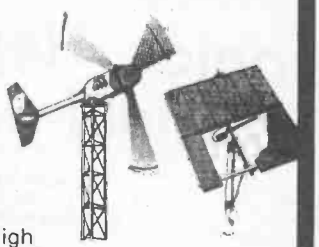

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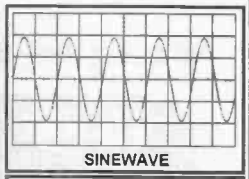

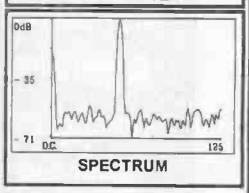

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- Sensitive, picks up sounds at the level of a whisper.
- Up to 1 mile range.
- Requires 9V battery. (Not incl.)

SUPER-MINIATURE FM TRANSMITTER
Super small FM transmitter. Use with any FM broadcast receiver. Easy to assemble, all chip (SMT) parts are pre-assembled to the circuit board.
XST500 (E-Z) Kit $44.95

- Miniature photo battery mounts right on circuit board. (Included
- Tunes 88-108 MHz.
- Up to 1/2 mile range.
- Sensitive 2 stage audio amplifier, picks up sounds at the level of a whisper.

MICRO-MINIATURE FM TRANSMITTER
Including the battery, this is the Worlds smallest FM transmitter. Use with any FM broadcast receiver. Easy to assemble, uses pre-assembled circuit board.
XWB1000 E-Z KIT $49.95

- Up to 1/2 mile range.
- Miniature photo battery mounts right on circuit board.
- Transmits al 143 MHz.
- Amazing audio sensitivity, picks up sounds at the level of a whisper.

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Including the battery, this is the Worlds smallest crystal controlled FM transmitter. Transmits to any scanner type receiver. Easy to assemble, uses pre-assembled circuit board.
XTL1000 E-Z KIT $69.95

- Smallest Phone transmitter anywhere!
- Tunes 88-108 MHz.
- No batteries required, powered by phone line.
- Up to 1/4 mile range.
- Attach to phone line anywhere in house.

SUPER-MINIATURE PHONE TRANSMITTER
Worlds smallest FM phone transmitter. Use with any FM broadcast receiver. Easy to assemble, all chip components are pre-assembled to the circuit board.
XSP250 (E-Z) Kit $34.95

- Dial your phone from anywhere and listen to the sounds inside your home.
- Two digit Touch Tone code for secure operation.

TELEPHONE SNOOP
The latest in home or office security. Call home from anywhere, enter a two digit security code, and hear the sounds in your home . Automatically turns on without ringing the phone, verifies code, then activates for one and a half minutes.
XPS-CASE KIT $13.95
XPS1000 (C) KIT $49.95

- Transmits a continuous beeping tone.
- Adjustable from 88 to 108 MHz.
- Up to 1 mile range.
- Works with any FM broadcast receiver.

TRACKING TRANSMITTER
Only 0.7 by 2.4 inches, the XTR100 operates at voltages of 3 to 18 Volts and is ideal for use in locating lost model rockets, bicycles, automobiles, games of hide and seek, and contests.
XTR100 (C) Kit $33.95

- Uses sensitive microwave transistor amplifier.
- Covers 1 to 2,000 MHz.
- Compact hand held unit.
- Includes miniature loud speaker for audio indication of detected signals.

SUPER SENSITIVE BUG DETECTOR
When the XBD200 intercepts a signal in the 1 to 2,000 MHz range, it emits a growl that increases to a high pitched squeal as the signal strength increases.
XBD200 (C) Kit $49.95

- Use with any FM broadcast receiver.
- Hear every sound in an entire house!
- Up to 1 mile range
- Powerful 2 stage audio amplifier.

MINIATURE FM TRANSMITTER
The XFM100 has a super sensitive microphone and is capable of picking up sounds at the level of a whisper and transmitting them to any FM broadcast receiver.
XFM100 (C) Kit $32.95

- Digital voice changing: male to female, female to male, adult to child, child to adult.
- Anonymity on any call.
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STOP THOSE ANNOYING TELEPHONE CALLS!
Sound older and tougher when you want to. Not a kit. Fully assembled. Single phone operation only.
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- Digital voice changing: male to female, female to male, adult to child, child to adult.
- Use with any modular phone.
- 16 levels of voice masking.
- Connects between handset and phone.

VOICE CHANGING ACCESSORY
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- Works with any scanner that can receive 400 to 550 MHz.

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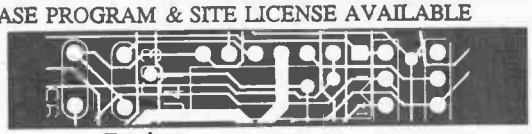

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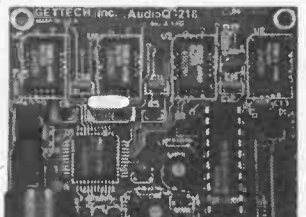

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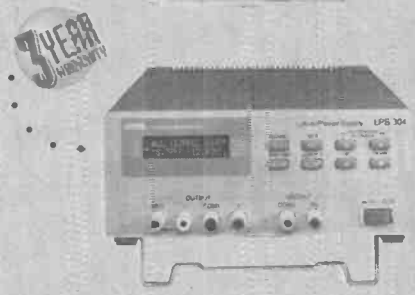

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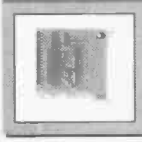

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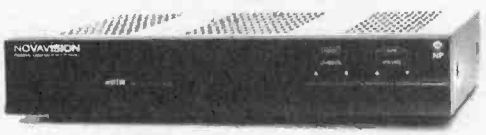

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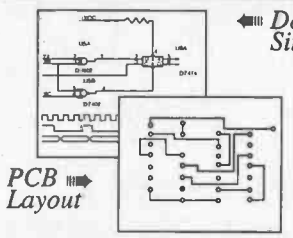

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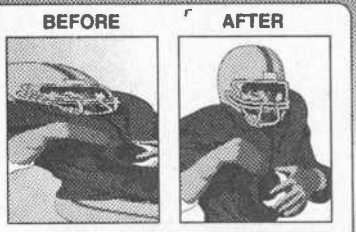

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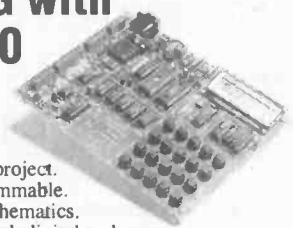

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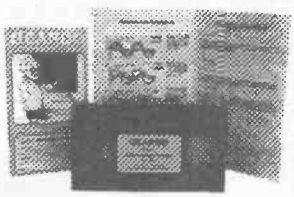

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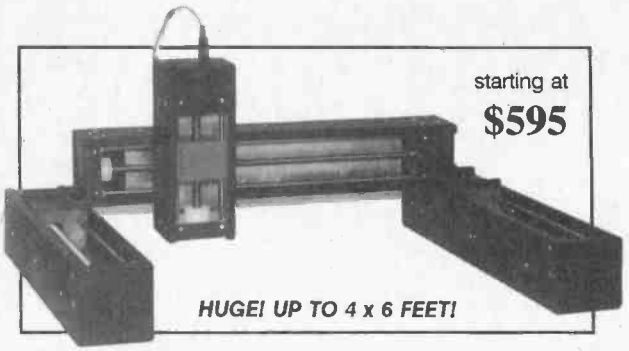

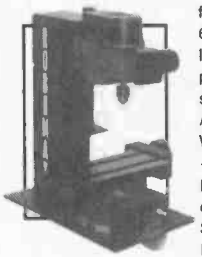

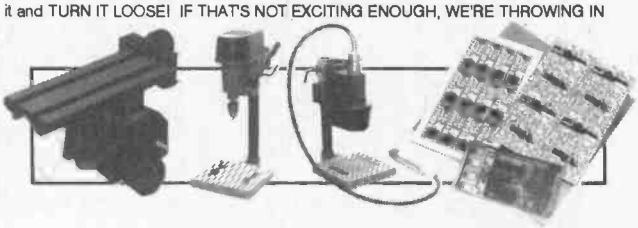

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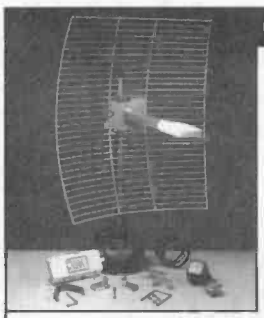

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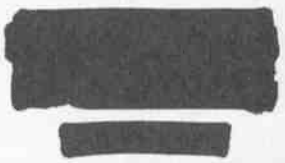

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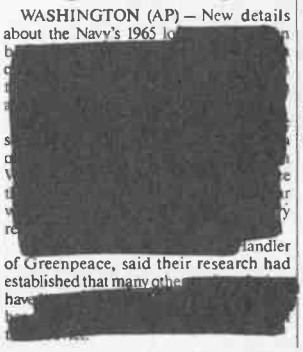
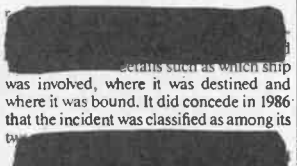
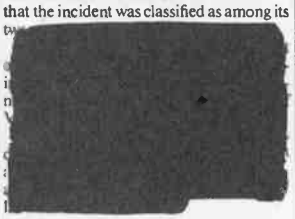


handler of Greenpeace, said their research had established that many othe



details such as which ship was involved, where it was destined and where it was bound. It did concede in 1986 that the incident was classified as among its



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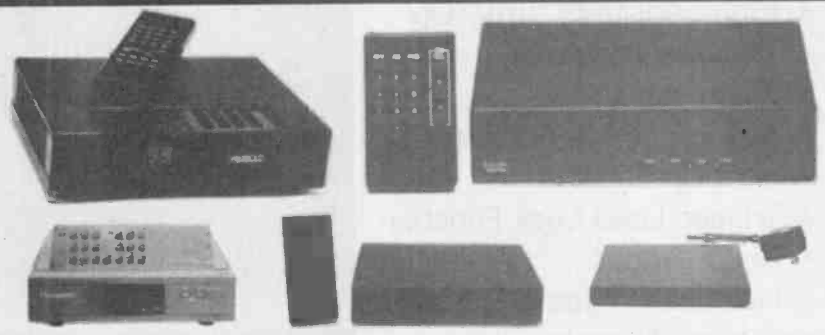

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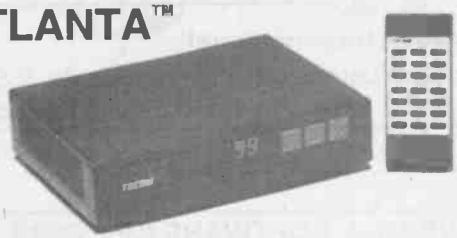

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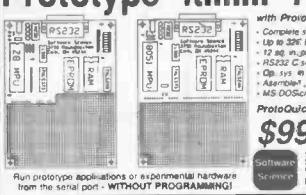

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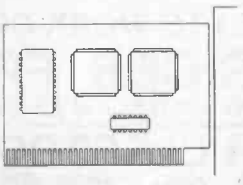

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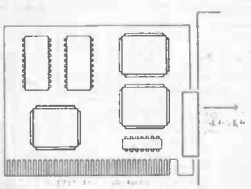

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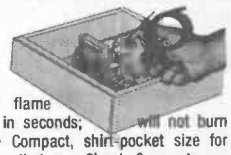

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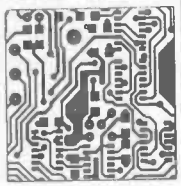

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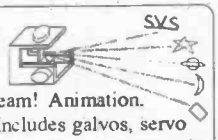

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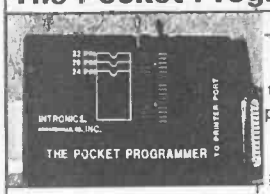

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It's 7 p.m. in your Chicago hotel room and you're catching up on the news from Radio Moscow

Whether you're home or travelling the globe, get up-to-the-minute news, weather, sports or music from all over the world.

by Matthew Ziehl

Keeping in touch with the news isn't easy. You can read the paper, but to get the latest news you have to wait until the next morning for the latest edition. TV news broadcasts are only truly up-to-date if they are live, otherwise the same information soon becomes "old news." The last way you'd keep yourself informed is the radio. The only way you can hear the news is between music or on a good AM station—if you can find one and tune it in.

Radio revolution. Now the new Grundig Yacht Boy 400 AM/FM/shortwave radio will change the way you think about radio. The Grundig world travel radio keeps the most current news and financial information coming in from all over the world. It broadcasts directly to you whether you're in Paris, Texas or Paris, France.

The Yacht Boy 400 is portable and small enough to fit into a jacket pocket or a purse and weighs only two pounds. You can take it with you absolutely anywhere. It operates on three AA batteries, but also has a port for an external power source.

Broadcasts from around the world. The Yacht Boy 400 is truly a technological innovation. To receive broadcasts from around the world, the Yacht Boy 400 covers *all* shortwave bands (1.6-30 MHz) without gaps. To listen to your local radio station, simply switch to AM or FM tuning. Tune in signals using the dial or the built-in keypad. Plus its 40 randomly programmable presets allow for quick access to favorite stations.

Clock radio. The Yacht Boy 400 radio can be programmed to automatically turn on or sound an alarm by using the *auto on* feature. If you want to catch an early program or just wake up for work, simply set the alarm. Other features include *sleep* and *snooze* and dual alarm modes: radio and beeper. With the multi-function Liquid Crystal Display (LCD) you can easily check the time in the dark.

Use it all day long. Imagine your typical day. It's 5 a.m. and you are awakened by the radio on your Yacht Boy. While you're getting ready in the bathroom you tune in to BBC London and listen to all the latest events before work. After your morning meetings you pick up some amateur radio. In the afternoon you have some time to catch a few minutes of the soccer game between Spain and Italy. On the way home you flip on the news again, but this time it's Radio Beijing. After dinner you tune in to an exotic music special coming directly to you from West Africa. Finally, before bed you set the Yacht Boy alarm.

Risk-free home trial. The Grundig Yacht Boy 400 is backed by Comtrad's exclusive risk-free home trial. Try it. If you're not completely satisfied, return it within 30 days for a full "No Questions Asked" refund. The Yacht Boy 400 is also backed by a one-year manufacturer's warranty. Most orders processed within 72 hours.

> *World Radio & TV Handbook* calls Yacht Boy 400 "the best value portable radio on the world mark[et]."

Special limited-time offer. If you order the Grundig Yacht Boy now you will receive it at the factory-direct price of only $199. In addition, you'll receive FREE: a carrying case, telescoping antenna and advanced external compact reel antenna, three AA batteries and the *Grundig Shortwave Listening Guide*. Call today to take advantage of this limited-time offer.

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TOP FIVE REASONS TO REPLACE YOUR RADIO WITH THE YACHT BOY 400

1 Legendary Sound Quality. Grundig is famous throughout the world for its sound quality. The Yacht Boy 400 has a built-in telescoping antenna and an external reel antenna.

2 40 Programmable Presets. Forty programmable memory presets allow for quick access to favorite stations. Plus PLL-synthesized tuning delivers solid frequency stability.

3 Ultra-wide Range. Continuous shortwave from 1.6 to 30 MHz (with no tuning gaps) covers all existing shortwave bands plus FM-stereo, AM and longwave. Shorter amateur, aeronautical and maritime two-wave communications can be heard.

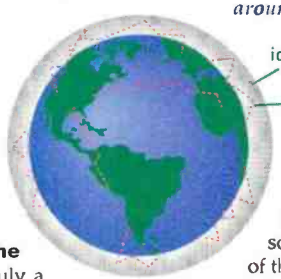
4 Programmable Sleep Timer. LCD simultaneously shows time, frequency, band, automatic turn-on and sleep timer. Sleep timer is programmable in 15-60-minute increments. It features dual alarm and dual clocks which show time in 24 hour format.

5 World News. Listen to news broadcasts, including the BBC, live from around the world without commercial interruption.

HOW DOES SHORTWAVE RADIO WORK?

Shortwave signals depend on factors such as the sun, the ionosphere and even the earth itself to broadcast around the world. The ionosphere is a cloud-like layer surrounding the earth consisting of ions and electrons. The process by which these radio waves travel is called radio wave deflection and ionospheric propagation. In simple terms, radio waves travel the earth by bouncing around. Once transmitted from earth, the radio waves travel up, bounce off the ionosphere back down to earth and up again. This process repeats several times. Because this takes place at low angles, radio waves travel great distances with every bounce taken.

Many of the major countries use shortwave radio to transmit broadcasts for worldwide listening. There are international broadcasts that are specifically intended to be heard by North American audiences.



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