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December 1996

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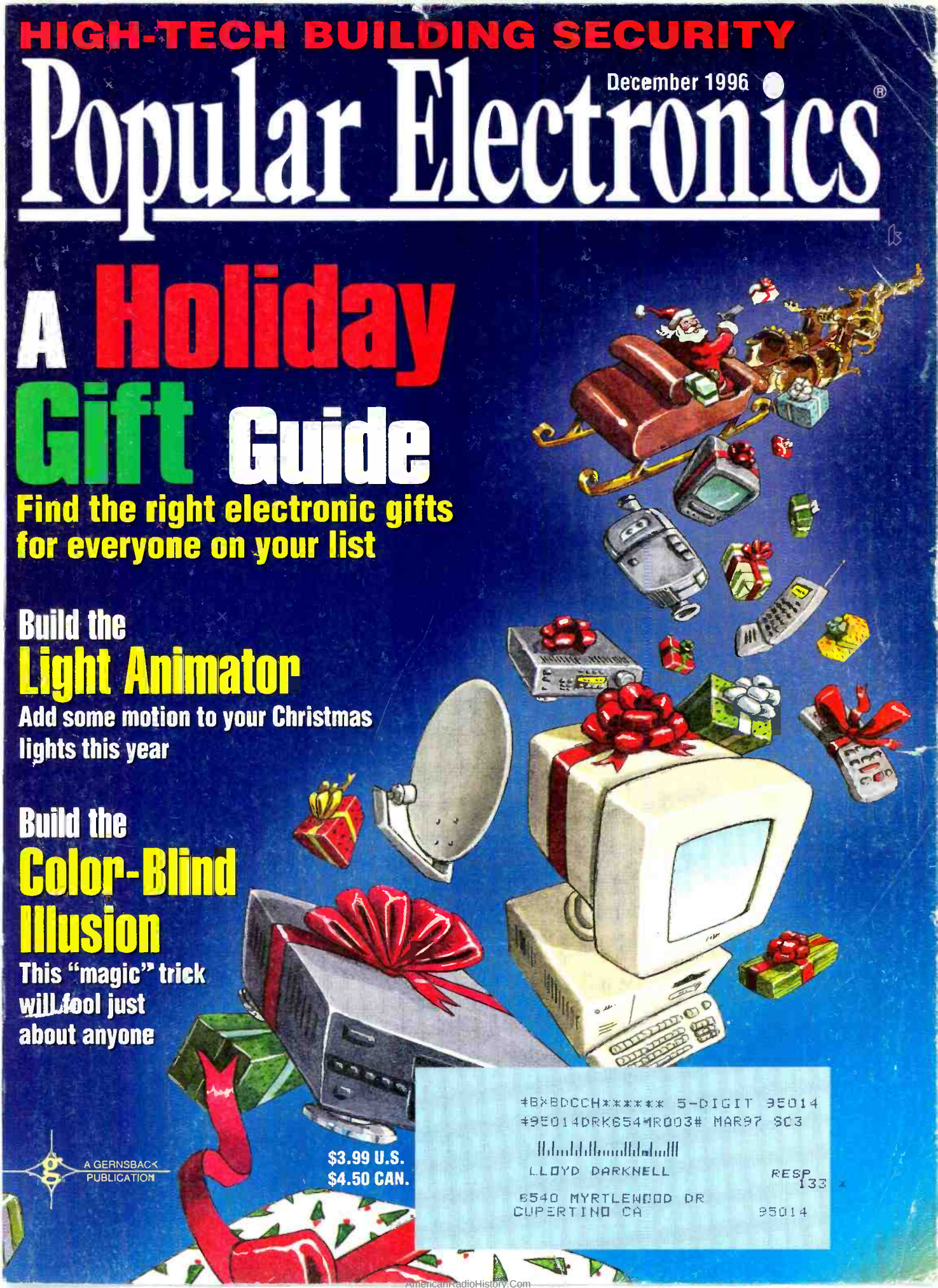
Add some motion to your Christmas lights this year

Build the Color-Blind Illusion

This "magic" trick will fool just about anyone



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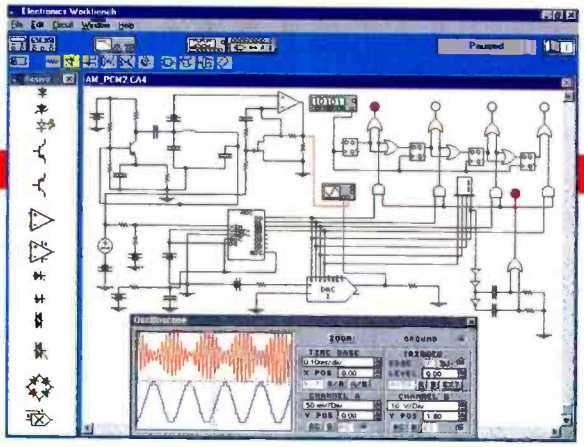

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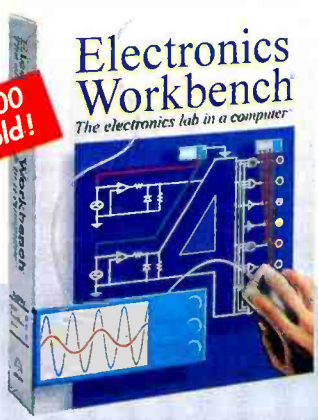

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COVER STORY

23 A Holiday Gift Guide

Let us help you find the right electronic gifts for everyone on your shopping list. There's something in this guide that's sure to match just about every budget and interest—*Teri Scaduto and Christopher Scott*

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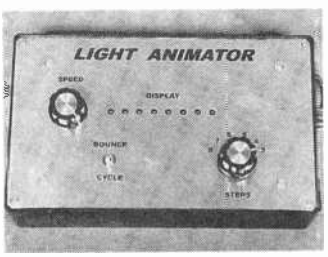
If you want to add some motion and excitement to your Holiday lighting this year, this is the project for you. This circuit will control up to eight strings of lights, letting you create unique animated displays that will make your house the talk of the neighborhood—*Rodrick Seely*

43 Build the Color-Blind Illusion

Here's a neat little "magic" trick that will fool just about anyone. It's an electronic version of the old three-card Monte con game that will keep your friends puzzled for hours. Like those who witness any good illusion, those in your "audience" won't be able to believe their eyes—*Rick Duker*



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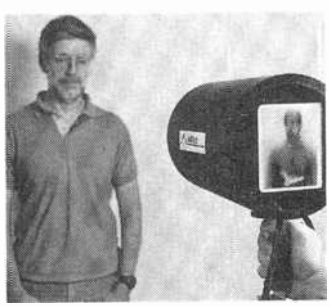
39 High-Tech Electronic Building Security

What can technology do to prevent terrorism and crime? You'll find some answers to that and other questions here as we explore how electronics help provide public safety by detecting guns, explosives, and bad guys before they get a chance to enter a building—*Bill Siuru*



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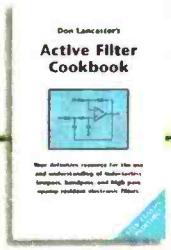

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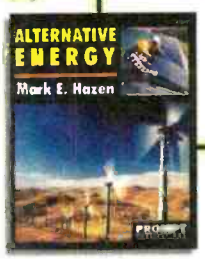

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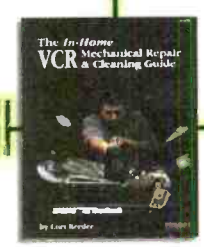

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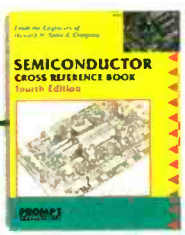

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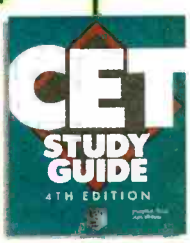

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by Joseph A. Risse and Sam Wilson
An essential resource for those preparing to take a Certified Electronics Technician (CET) exam, this guide reviews three-terminal amplifying components, digital and linear circuits and more, and provides three helpful practice exams. (McGraw-Hill)
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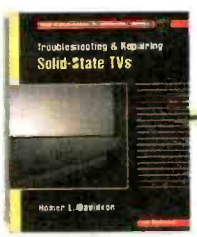

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Editorial

Here Come the Holidays

The wheel of the year has spun around once again, and the Holiday season is upon us. It's a time for being with loved ones, sharing gifts, and for enjoying light and warmth in the dark, cold nights of winter. In keeping with the spirit of this magical time of year, **Popular Electronics** would like to offer some ways to make the season a bit more enjoyable.

First there's our Holiday Gift Guide. After all, before we can get to those relaxing days around the end of the year, there are quite a lot of shopping days to get through! This Guide should help you find just the right electronic present for each loved one on your list. Whoever's been nice and not naughty will really appreciate the goodies in these pages. The story begins on page 23.

Then, for those who like to keep their soldering irons warm, we have a project that's sure to brighten up the Holidays. Called the Light Animator, it's a circuit that can control up to eight strings of lights, making them appear to "move." This allows you to make some great looking displays. Create a waving Santa, shooting stars, or whatever else you think will enhance the look of your home, and bring some cheer to your block. The story begins on page 32.

Also, to help with your shopping needs, this month's *Net Watch* focuses on a couple of hot spots on the Web where you can do your Holiday gift buying. If you'd prefer not to put up with long lines in stores (and sometimes even in parking lots), you should check out this column, which begins on page 12.

On behalf of everyone at **Popular Electronics**, I'd like to wish you and yours a very happy Holiday season.

Dan Karagiannis

Dan Karagiannis
Editor

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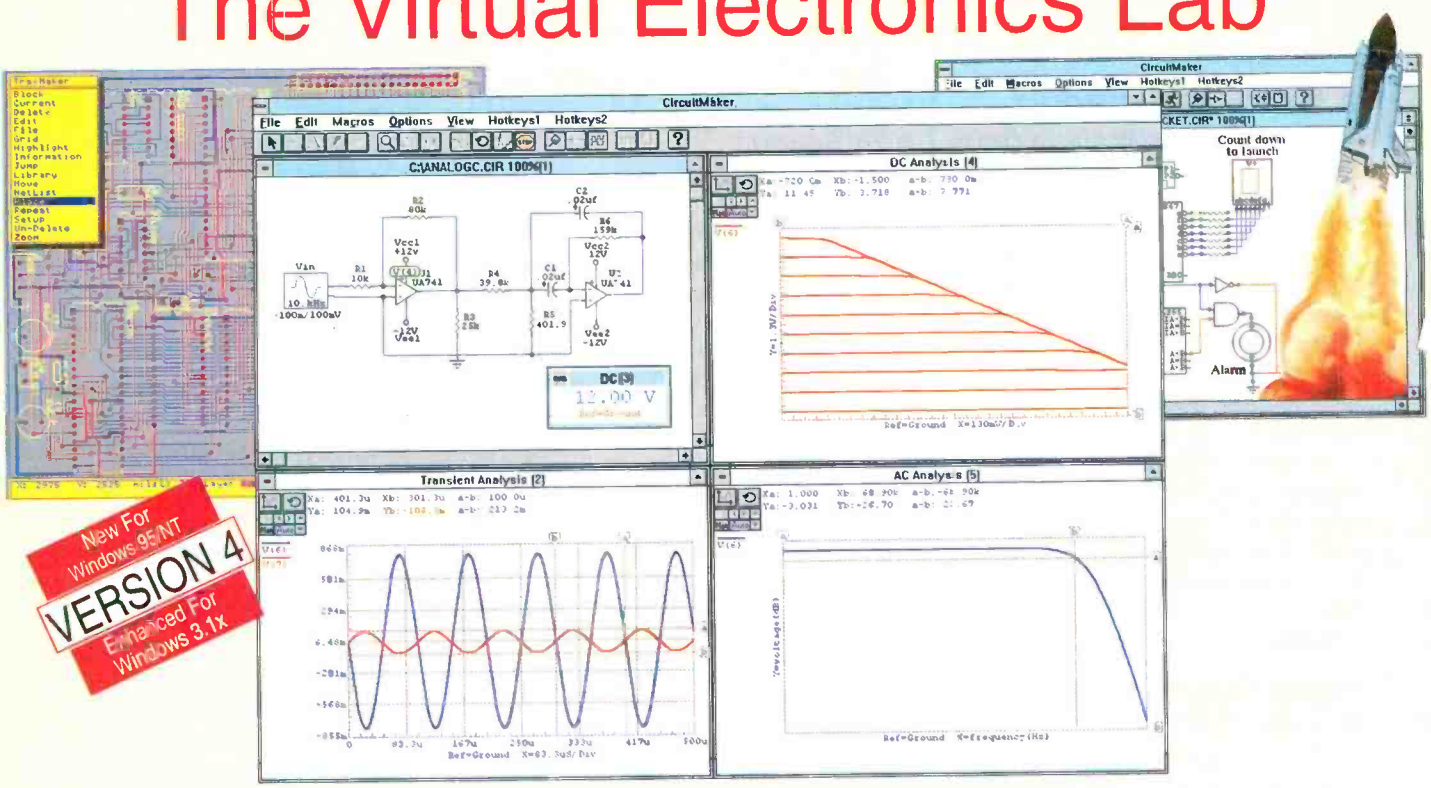

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LETTERS

The Naming Game

A MISNAMED CIRCUIT

The circuit described as a clamping circuit (*Circuit Circus*, **Popular Electronics**, June 1996) is not a clamping circuit. It is a shunt clipper.

The circuit clips off the signal above or below a certain level (in this case, at the cut-in voltage of the diode because it is unbiased) by effectively shorting out the output. In general, the peak-to-peak voltage of the signal is reduced.

In the case of a clamping circuit, the average or DC level is shifted, but the peak-to-peak voltage stays about the same. A clamping circuit has a capacitor in addition to the diode.

S.B.D.
Teaneck, NJ

THINK TANK ALARM CIRCUIT

There are some errors in my Think Tank alarm circuit in the September 1996 issue. See Fig. 5 on page 67 of that issue. Switch S12 should allow you to switch R14 to ground, not +12V. Also, switches S5 through S7 should be labeled as "normally closed," and switches S9 through S11 should be labeled "normally open."

Here's an extra suggestion for the circuit: At a remote location where the alarm siren may not be heard, the relay's +12V line could be used to trigger an automatic phone dialer, available at RadioShack. Some of the alarm switches could also be wired to temperature sensors to warn of too high or low a reading at a site.

Thanks.—Roger W. Hamel

HAVES & NEEDS

I'm searching for an SN 74185 AN IC that is no longer being manufactured. It is an essential component in an electronic scoreboard that I am maintaining.

I only need one. I'd be delighted to pay shipping and handling costs as well as a reasonable price for a functional chip.

Many thanks.

RICHARD J. SCHEICH
20220 Beaufait
Harper Woods, MI 48225

I have been in electronics for more than 50 years, and a subscriber to Gernsback publications as well.

Now I am trying to locate an RCA part #158770 42-pin IC for an RCA Model PJR-500-SR TV made in 1984. The chip is labeled NEC 8351E6/D1705C-520.

I will pay the cost of the chip as well as shipping. Please help!

Thanks.
HOLLAND BOST
310 Deer Haven Drive
China Grove, NC 28023

I have a DeForest DT-600 crystal set without the box, and I'm wondering if anyone might have one. I also need a case for a World War I crystal set, Signal Corp BC-14A. I will pay a fair price.

Thank you.
GALEN FEIGHT
3104 S.E. 20th
Portland, OR 97202

I repair my own household appliances, but I've been having trouble fixing my TV because I don't have the schematic diagram of it. The TV set I own is a Zenith System-3 model 14-1167-8.

I'd be very grateful if any readers would send me a copy of the diagram. I'd gladly pay for all costs.
MIGUEL A. TORRES
1308 Bayview Circle
Ft. Lauderdale, FL 33326-3336

We have enjoyed **Popular Electronics** over the years, and we hope some fellow readers might be able to help us out.

We deal in old televisions and need a source of short-run, custom-built flybacks. We're also seeking someone who rebuilds electrostatic CRTs.

Can anyone possibly supply leads?

Thank you.

HARRY POSTER
VINTAGE TV's AND RADIOS
P.O. BOX 1883
South Hackensack, NJ 07606

I have enjoyed reading **Popular Electronics** for many years now and hope you will continue its winning format. Please don't become another computer magazine!

I need help with the following items. I'm seeking a manual for a Tektronix 549 storage oscilloscope and operating instructions for the storage function. I also need schematics for a Model 6050A power supply from Power Designs Inc. (Westbury, NY), and a Data Pulse 101 pulse generator made by Systron Donner Corp. of Culver City, California.

I also have a couple of items that might be of interest to other readers. I have a 1973 booklet written by Don Lancaster (TV Typewriter) that I will send to someone if $1.50 in postage is included. And I have for sale the 1821A time-base and sweep delay generator with 1804A four-channel vertical amplifier plug-in for Hewlett-Packard oscilloscopes models HP 180 or 181 or OS-189/USM 281. Anyone interested can write to me for the price.

Thank you very much.
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Convert any electrical outlet into a high-speed Internet gateway...

The Wireless Modem Jack, from Phonex Corporation, turns an outlet into a phone jack, letting you connect your modem in every room of your home!

by Mark Peters

Although we both have full-time jobs, my wife and I enjoy having a home office. Whether it's balancing the checkbook, bringing work home or "surfing" the Internet, we spend an hour or two on our computer each evening.

The dilemma. In our new house, there were only three jacks in the house—one in the downstairs bedroom, one in the kitchen and a third in the master bedroom upstairs. We wanted our office in one of the upstairs bedrooms, but obviously not our bedroom. We discussed our options—run a phone line ourselves from one jack through the walls and ceiling, pay the phone company to install a jack or put our office in the downstairs bedroom. None of those scenarios were acceptable, but what choice did we have?

The solution. Phonex Corporation is proud to unveil the answer to this dilemma. It's called the Wireless Modem Jack—an amazing device that turns any electrical outlet into a phone jack instantly.

Easy installation. In less than five minutes, you'll have your Wireless Modem Jack completely installed. Plug the transmitter (the unit with two jacks on the right side) into an electrical outlet that's close to a phone jack. Then connect it, with the enclosed six-foot phone line, to that jack. Then simply plug your telephone into the transmitter's second port, and the Wireless Phone Jack is ready to transmit. Now just plug the receiver (the unit with just one jack on the side) into any electrical outlet in your home, plug your modem in it and bingo! You've just converted an electrical outlet to a phone jack.

PLUG YOUR MODEM INTO ANY OUTLET...

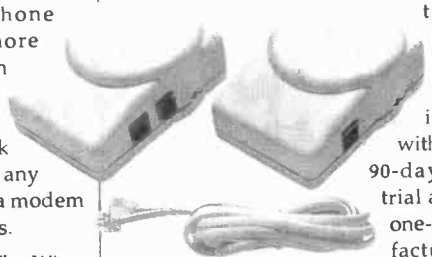
Connect the transmitter by plugging it into a phone jack and an outlet. Plug your phone into the transmitter.

Adding a receiver is easy! Plug it into an outlet and connect your modem. Now you can fax or access the Internet from any room in your home! (For fax modem applications, you must manually receive faxes.)

Complete freedom. The Wireless Modem Jack gives you the true "freedom" you've wanted when it comes to your home office equipment. No more are you constrained by the location of traditional phone jacks in your home. No more expensive phone company visits. No more miles of phone line woven around the inside and outside of your home. The Wireless Modem Jack lets you turn an outlet in any room in your home into a modem gateway in a few minutes.

High-speed access. The Wireless Modem Jack can support a 28,800-baud modem, perfect for surfing the Internet. You didn't settle for a bottom-of-the-line modem, so why would you want a wireless jack device that couldn't support it? The Wireless Modem Jack is virtually "invisible" in terms of the speed and clarity of your data transmissions—it works so well you'll forget your modem isn't hard-wired to a traditional jack!

Risk-free. If you'd like the convenience of being able to connect your modem and computer in any room of your home, the Wireless Modem Jack is the answer. Try it for yourself! Of course, it comes with Comtrad's 90-day risk-free trial as well as a one-year manufacturer's warranty. If you are not satisfied, just return it for a full refund, "No Questions Asked."



The Wireless Modem Jack system consists of a transmitter (left), a receiver (right) and a six-foot phone cord. That's all you need to put your modem in any room of your home!

Wireless Modem Jack system . $99 $9 S&H
System includes one transmitter and one receiver.

Mention promotional code **1981-PL-6677.**

For fastest service, call toll-free 24 hours a day

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To order by mail, send check or money order for the total amount including S&H. To charge it, enclose account number and exp. date.

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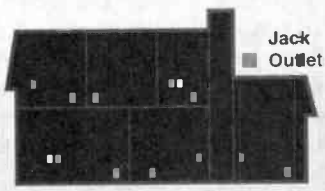
Midlothian, Virginia 23113

HOW THE WIRELESS MODEM JACK CAN SET YOU FREE

With all the advancements that are being made in terms of the portability of your personal computer equipment, why should you be tied down to a phone jack? Unlike electrical outlets, phone jacks are scarce in most homes. That's where the Wireless Modem Jack comes in. Just plug the transmitter into a phone jack and an outlet. Then plug a receiver into any outlet into your home and it instantly becomes a phone jack! Plug it into your modem, and with its 28,800-baud capabilities, you'll be "surfing" with the same speed and clarity as if you were plugged into a standard jack.



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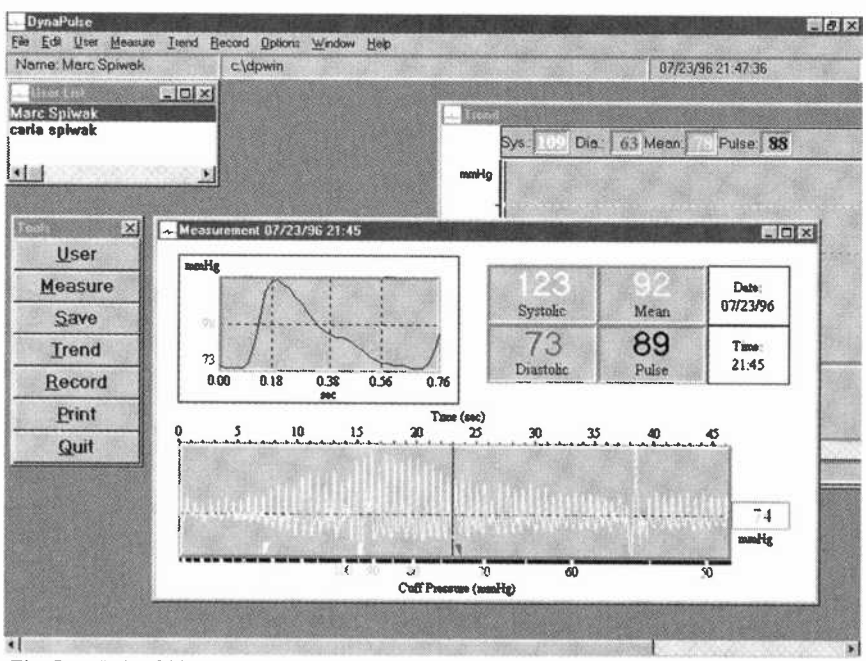
MULTIMEDIA WATCH

Checking your Blood Pressure via PC

BY MARC SPIWAK
TECHNICAL EDITOR
WINDOWS MAGAZINE

I find that more and more unusual devices make use of personal computers—that is, they use the smarts of a PC to control something. I've seen TV and radio tuners, appliance timers, construction toys, electronic test equipment, and more, that all require a computer to control things or to record data. The latest such gadget I've played with is called *DynaPulse 200M*. Made by Pulse Metric, Inc., it's a computer-controlled blood-pressure monitoring system that not only displays results on your PC, but it also keeps track of the records. The device connects to a PC or Mac computer.



The DynaPulse 200M is a computer-controlled blood-pressure monitoring system that displays results on your PC and keeps track of the records.

The kit comes with an inflatable, adult-sized cuff and inflation bulb that plugs into the side of the DynaPulse unit, which connects to the computer via a serial cable. I tested DynaPulse on a PC running Windows 95 and in minutes I was taking readings, printing charts, and storing records.

The pressure of the blood flowing through the arteries varies as the heart beats. When the heart pushes blood out, the pressure increases, and the systolic, or maximum blood pressure is achieved. When the heart relaxes, the pressure in the artery decreases, and the diastolic, or minimum pressure is reached. When stating blood pressure, systolic blood pressure is given first followed by the diastolic blood pressure—or systolic/diastolic in mmHg. Normal blood pressure typically has a systolic from about 130 to 139 and a diastolic from 85 to 89.

The inflatable arm cuff included with DynaPulse, just like the one your doctor uses, presses on the artery in your arm to the point where blood stops flowing. At some point as pressure is released, blood starts flowing again. At this point the blood flow causes variations in pressure that DynaPulse can detect. The point where blood starts to flow is measured as the high pressure point (systolic). As pressure is released, the turbulence ceases and the lower pressure point (diastolic) is measured.

DynaPulse lets you immediately get to measuring blood pressure or you can enter new users into a database. Each new user gets their own password and set of records. The software prompts you to wrap the cuff around your arm, tighten the air valve on the bulb, start pumping, stop pumping and wait, and then to loosen the valve and release the air. The process takes about 30 seconds. Results appear onscreen and can be saved or printed.

A clinical DynaPulse version ($499) is designed for hypertension screening in clinical environments with the ability to store a virtually unlimited patient database and other special features. An educational version ($295) comes complete with curriculum and lab material. A home version ($179) can keep track of up to six people. Any application that requires measuring blood pressure can be simplified greatly by using DynaPulse, and it's another really neat techno-gadget you can add to your collection.

NEW STUFF

I've got two new discs this month from Books That Work, both intended to help you keep your home looking beautiful, inside and out. The *Home Improvement Encyclopedia* is loaded with tips and tricks to help you keep up with the repairs and maintenance that are necessary when you own any home. The disc contains information on installing lighting, building paths, wiring outlets, choosing paint, installing phone jacks, building decks, repairing broken windows, fixing leaky roofs, "oiling" squeaky floors, and a whole lot more.

Once you're done sprucing up the inside of your house (does anyone ever actually reach this point?), and when the weather warms up, *Garden Encyclopedia 2.0* is ready to help you landscape your property. This latest update tells you everything you need to know about the needs of different plants, trees, shrubs, vines, flowers,

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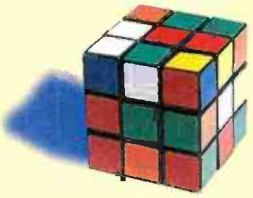

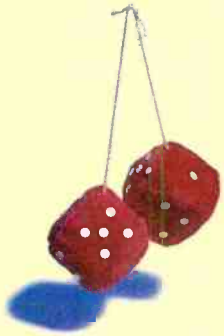

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CIRCLE 158 ON FREE INFORMATION CARD

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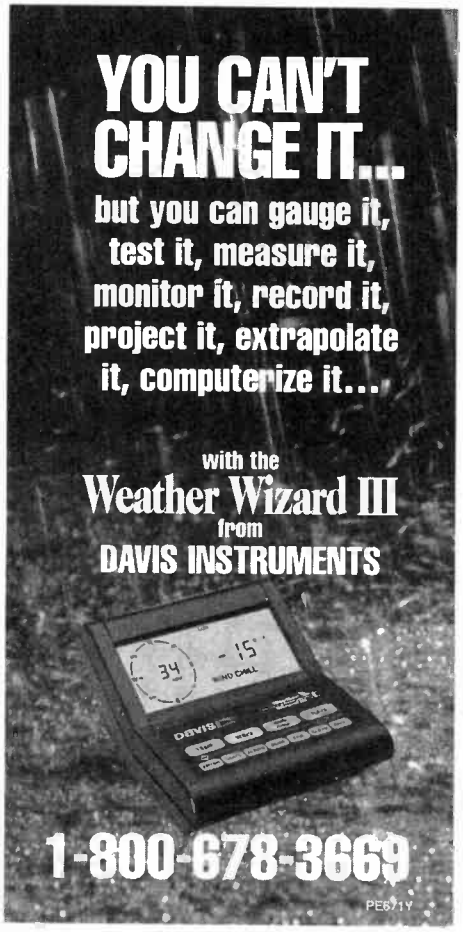

CIRCLE 162 ON FREE INFORMATION CARD

and more. It tells you how to select the right plants for your geographic location and how to care for them so they will be around for years to come. It even helps you design gardens and floral arangements.

I recently received the *1996 Edition of the Guinness Multimedia Disc of Records* from Grolier Interactive. This latest version has been spruced up with a new appearance and pumped up with new records, facts, photos, and more. What's the oldest DNA, most expensive teddy bear, fastest land animal, or smallest airplane? Answers to those questions and thousands more can be found on this CD-ROM. There's over 15,000 records, 1200 photographs, 60 short movies, and a lot more to discover.

Children's software and multimedia are one and the same thing. That's because children's software is usually chock full of multimedia, or at least it should be. Children love pictures, cartoons, music, funny characters, puzzles, and more, just like the rest of us. Multimedia has also provided new ways of telling *timeless* children's stories. *The Sleeping Beauty* on CD-ROM, from Memorex Software, puts a multimedia spin on this classic. As modern as the delivery method is, however, the story is brought to life with colorful drawings reminiscent of late 19th-century children's books. Kids can absorb the story while at the same time improving their reading and vocabulary skills. They also get to see definitions of highlighted words, watch animations and hear sound effects, sit back and relax and take in the animated "movie" version of the story, and even solve puzzles that relate to the story. To top it all off, you only have to shell out $14.99 for this disc.

If you're interested in ancient civilizations, then you might want to check out Sumeria's new CD-ROM, *Exploring the Lost Maya*. This title focuses on the period from 2000 BC to 1500 AD in Mayan culture. It covers history, evolution, culture, and the demise of the Mayans, in 37 sites in four countries. Interactive maps, timelines, narrations, slide shows, video, and photography complete the score. This hybrid Mac/Windows disc sells for $49.95.

I've talked about a lot of CD-ROMs over the years that let you play golf on your PC. Some of these simulations are so real that it's almost like playing the real game. However, this month I've got a new CD-ROM title that is intended for people who prefer to play the real game. *Golf Digest's Best Places to Play* from Creative Multimedia provides golfers with essential information on over 14,000 golf courses across the U.S., Canada, and the Caribbean. Courses are reviewed by readers of Golf Digest, so you can take their word for it as to which are the best courses to play on. The disc also lets you search for the best courses to play on according to value. Get tour dates, trivia, and more, for only $29.95.

I don't use Windows NT all that often, but I'm learning more and more about it all the time. At some point I think we'll all be running some form of NT, but let's worry about that when the time comes. In the meantime, if you've already invested in NT and would like some tools to enhance your investment, then consider Symantec's Norton NT Tools. The software works with workstation or server installations and provides assistance for detecting and eliminating viruses, managing files, monitoring information, and more. You can get these tools for $49.95.

I haven't taken a look at *CorelDRAW* in quite some time. Well, *CorelDRAW 6* is the latest update to this awesome suite of do-everything software, and it's designed for Windows 95. This package contains everything you need to produce text documents, drawings, desktop publishing, video editing, morphing, and plenty more. Software written for Windows 95 always runs better than older versions for Win 3.1x, and this Corel update is no exception. The *CorelDRAW 6* package includes *CorelDRAW 6, Corel Photo-Paint 6, CorelDREAM 3D 6, Corel Motion 3D 6*, and *Corel Presents 6*, all of which allow you to do nearly anything that's considered to be productive. Unfortunately the price for this all-inclusive suite is a hefty MSRP of $695. But add up the features and it becomes a relative bargain. ■

WHERE TO GET IT

Books That Work
2595 E. Bayshore Road
Palo Alto, CA 94303
CIRCLE 60 ON FREE INFORMATION CARD

Corel Corporation
The Corel Building
1600 Carling Avenue
Ottawa, Ontario, Canada K1Z 8R7
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Creative Multimedia
225 SW Broadway, Suite 600
Portland, OR 97205
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Grolier Interactive, Inc.
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Danbury, CT 06816
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Memorex Software
18000 Studebaker Road, Suite 200
Cerritos, CA 90703
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San Diego, CA 92121
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Sumeria, Inc.
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There's nothing more frustrating. You're curled up on the couch with your favorite snack as you turn on a great show or movie...only to be met with a blurry, distorted picture. You can fiddle and fuss with the controls, wiggle the antenna... but the problem won't go away. Now, there's finally something you can do about it: **imageLock**™, the simple solution to the oldest of TV reception problems – ghosting.

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Yes, even cable subscribers can experience poor reception, as some of you well know. But **imageLock** is designed to decode the Ghost Cancellation Reference (GCR) signal sent by broadcast and cable networks throughout the U.S. This eliminates signal contamination from cable and antenna by digitally restoring your picture to optimum clarity. So put this advanced Emmy® Award-winning technology to use in your own home. The result will be the sharper, clearer picture you've always wanted. And we back this promise up with our no questions asked 30 day return policy. Your satisfaction is always completely guaranteed.

Easy to install and use.

Easy to follow instructions will come with your shipment showing you how to hook **imageLock** to your TV through your VCR. Plus, you'll have a toll-free hotline to call with any questions or problems. Magnavox is committed to helping you every step of the way.

Once **imageLock** is installed, you will see an end to blurring, ghosting, color distortions and most other reception problems forever...or your money back.

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There may be reception problems in your area that imageLock cannot overcome. If that proves to be the case, simply return it within 30 days for a full refund, including shipping and handling. But chances are excellent that imageLock can give you the clear, clean picture you've longed for. You're invited to put imageLock to the test for 30 days without risk or obligation.

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Performance may vary according to broadcasting and ghosting conditions. Requires transmission of the GCR signal by broadcast and cable networks. Television images are simulated.

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NET WATCH

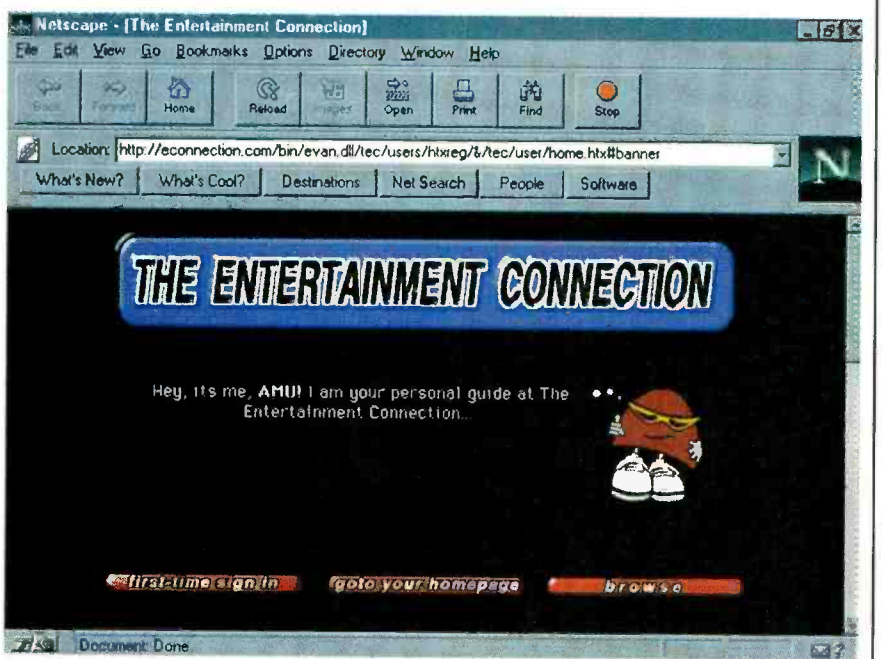
Holiday Shopping Spots

BY DAN KARAGIANNIS

Christmas is fast approaching. And we all know what that means: Lines, lines, and more lines at the stores.

However, if you're connected to the Net, you just might be able to avoid that ruckuss this year. Instead of running around with your arms full of packages, and your shopping list clenched between your teeth, try sitting at your computer and taking care of all your gift buying with only a keyboard and mouse below your fingers. We'll look at two sites this month that let you do just that.

So fire up your Web browser, and have your credit card or checkbook handy. It's shopping time...



Welcome to The Entertainment Connection, where little Amu will help you find all the music and videos you're looking for.

THE ENTERTAINMENT CONNECTION

Music and movies make great gifts for people of all ages. Whether you want to get your main squeeze the new CD by The Cure, or your little daughter the latest video from Disney, a store that stocks both audio and video prerecorded media is a convenient place to check out at the Holidays. Especially if that place is The Entertainment Connection (TEC).

This easy-to-navigate "virtual" megastore and service allows you to custom design your shopping experience, depending on the musical or movie preferences of those on your list (or depending on what you like, if you're shopping for yourself). Such customization is not necessary, of course, but be warned: The inventory you have to search from is enormous, to say the least; well over 250,000 cassettes, CDs, videos, and music-related books and clothes are available.

When you first log on, you'll be asked to set up a free account, and choose a password. Then, you'll meet Amu, your personal shopping assistant. Depending on where you move through the site, Amu will remember your preferences, suggest specials or new releases, and even take you to favorite areas of TEC. The greatest thing about Amu is that he is helpful and present at each step you take, without getting on your nerves.

To personalize your account, you can enter Your Journeys and let TEC know the names of your favorite musical artists. That way on subsequent visits or through e-mail you can be notified when something new comes out by your favorites.

But when it comes to Holiday shopping, you'll be most pleased with TEC's powerful search feature, which appears at the bottom of every page you enter, after you access your account. That lets you perform keyword searches for anything the store. In the music category, you can enter an album or song title, or an artist's name. To look for a movie, search by actor, film title, director, or even character name. You can also search for books and clothing featuring your favorite musicians.

If there are any special imports or other unique types of merchandise available by a certain artist, you'll learn about it once you execute a search. For example, while searching for one of my favorite bands, Amu let me know they had a rare import available from Japan. He added that it was a "hot" release, and even had some sweat on his red brow to help make his point.

Each search generates several other choices as well. If you find an artist in TEC, a list of all that artist's releases will be presented, including compilations they appeared on. Any videos, clothing, or books relating to that artist will be presented as well. And if you feel like reading more about what you're buying, text from the *All Music and All Movie Guides* is available.

Want to listen before you buy? Well, TEC has RealAudio clips available of the top-100 albums. I've covered RealAudio before in this column; it's a free program that lets you listen to audio as you download it. There are 30-second tracks of all the top-100 albums, which should give you a good idea what each song sounds like before you shell out your money. Most record stores you visit in person won't let you hear samples of more than a dozen CDs.

Finally, I saved the best feature for last. Ever notice how, once you finish

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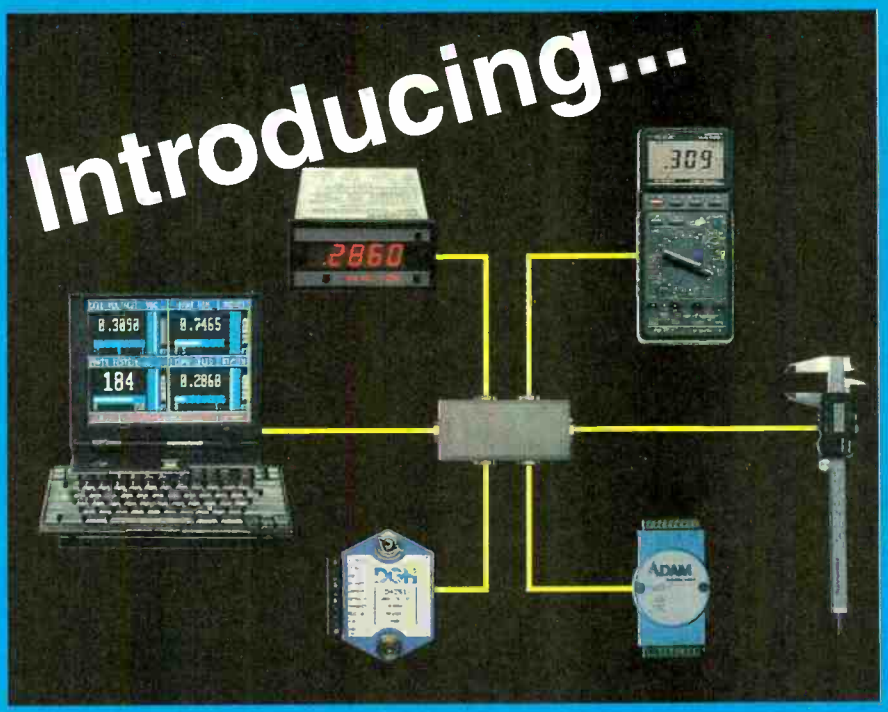

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Build test and measurement systems from conventional off-the-shelf instruments quickly and inexpensively.

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The MeterBOSS PC software combines conventional measuring devices and power supplies into a versatile, expandable test and measurement system. The readings from serial port-equipped multimeters, signal conditioners, panel meters and scales can be recorded and/or used as controls for the self-contained logic sequencer. The sequencer can operate low-cost serial port equipped power supplies, relays and I/O modules to perform user designed application specific tests. MeterBOSS can automatically run test sequences, log data, monitor processes, linearize data, and create new meters from other meters. It is truly a low-cost alternative to IEE 488 systems and it does not require programming.

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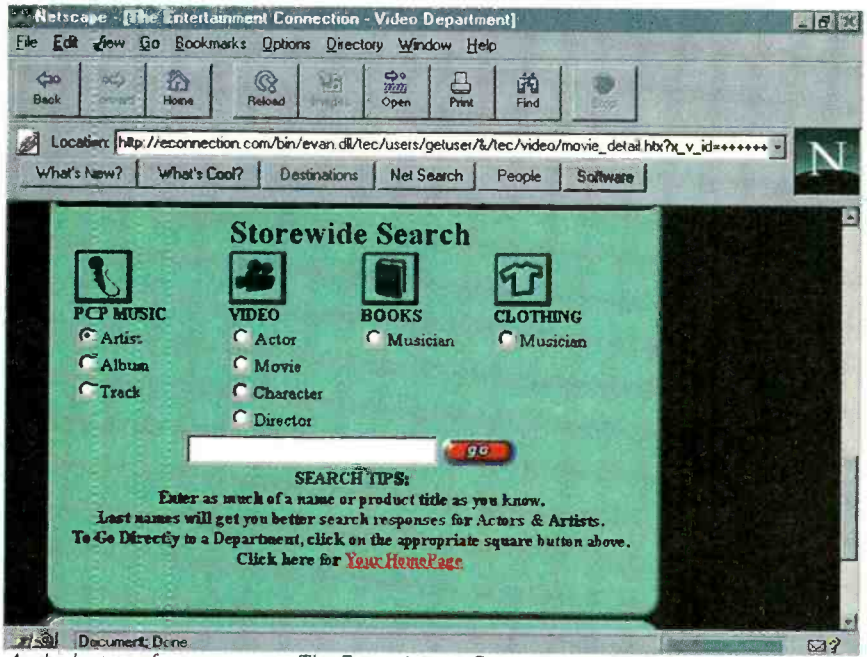
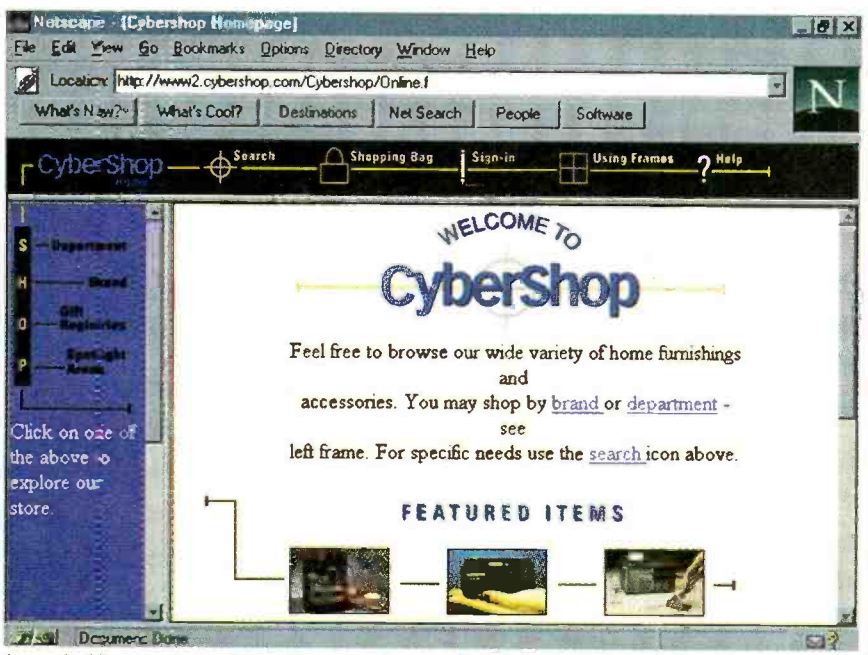


At the bottom of every page on The Entertainment Connection, you'll find a powerful, keyword search engine.

shopping, it's often difficult to actually wrap and get all those gifts to their recipients before the Holidays? That's especially difficult with relatives who live out of town. There are always gift-wrapping stands and the Post Office; however, that's just asking for more lines and frustration. TEC has the solution to that problem.

In your personal account you can set up an address book for sending gifts. At the time of your purchase, you can have the present wrapped and shipped with a personal note. That will save you time and money.

Before we move on, you might be wondering: How are the prices? To answer that I first have to explain two things: First, shipping is $2.95 for the first item, plus $0.50 for each additional item up to a maximum shipping charge of $5.95. Second, merchandise prices are about the same or less than found in most stores. So if you buy more than one item, you won't really be spending any extra money for the shop-from-home convenience you're getting.



Instead of braving the malls and department stores this Holiday, enjoy the large selection of products found at the CyberShop Online.

CYBERSHOP ONLINE

Go to any mall around the Holidays and you're sure to find the longest lines in the big department stores. That's because most people find the large selection of merchandise available to be quite convenient. Get Mom a blender, Dad a VCR, etc. Now, do it all at CyberShop Online.

The first thing you'll notice about this site is how attractive it really is. Frames and graphics provide a nice appearance, but best of all are the crisp images of the products located in each of the store's departments. And there are quite a few departments to visit.

Choose from Bed & Bath, Beauty & Fitness, Children, The Dining Room, Electronics, Furniture & Home, Gourmet Food, Jewelry & Watches, The Kitchen, Office & Travel, Outdoor Living & Sports, and Personal Gifts. Each department has many subcategories to choose from; so many in fact, that there isn't even room here to list them!

Some of the subcategories in Electronics, for example, are TVs, VCRs, Word Processors, Audio, etc. Just what you'd expect to find in Macy's or another department store. Click on any product picture under one of the categories, and a larger image of the product along with a detailed description will appear on your screen. Of course, that includes ordering information.

Like many other online shops, the CyberShop gives you a virtual shopping basket that you can put your merchandise into. Then, when you're ready, you can arrange to buy all of it at once.

Prices at CyberShop are pretty much on par with those of other department stores. In other words, I've found some of the items are cheaper at the site, and some are a few dollars more.

You can send e-mail to me at peeditor@gernsback.com, or send snail-mail to *Net Watch*, **Popular Electronics**, 500 Bi-County Blvd., Farmingdale, NY 11735. Also visit our Web site : http://www.gernsback.com. ■

HOT SITES

The Entertainment Connection
http://www.econnection.com

CyberShop Online
http://www2.cybershop.com/Cybershop/Online.f/

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Why pay for cellular phone service if you only want it for emergency use?

The SOS phone offers a 24-hour call center to connect you with your emergency roadside service, 911 service or family members in the event of an emergency.

Press the Tow button and your emergency road service will be dispatched to tow your automobile.

To tell you the truth, I am not interested in owning a cellular phone...*except for use in an emergency.* What would I do if my car broke down on the interstate or ran out of gas on some deserted back road? How would I get help? Like most women, I have the safety of my children to consider.

Last month, I inquired about cellular phone service. I was surprised to find out how expensive it was, even for the most basic calling plans! I just couldn't justify spending that much for something I may never need. Then a good friend told about a product she thought would solve my problem. It's the SOS Phone—a cellular phone service designed exclusively for emergency use!

What does it do? With the touch of a button, the SOS Phone will connect me to a roadside emergency service, a 911 service or a trained SOS operator, 24 hours a day. If I ever need help, I know it's just a phone call away.

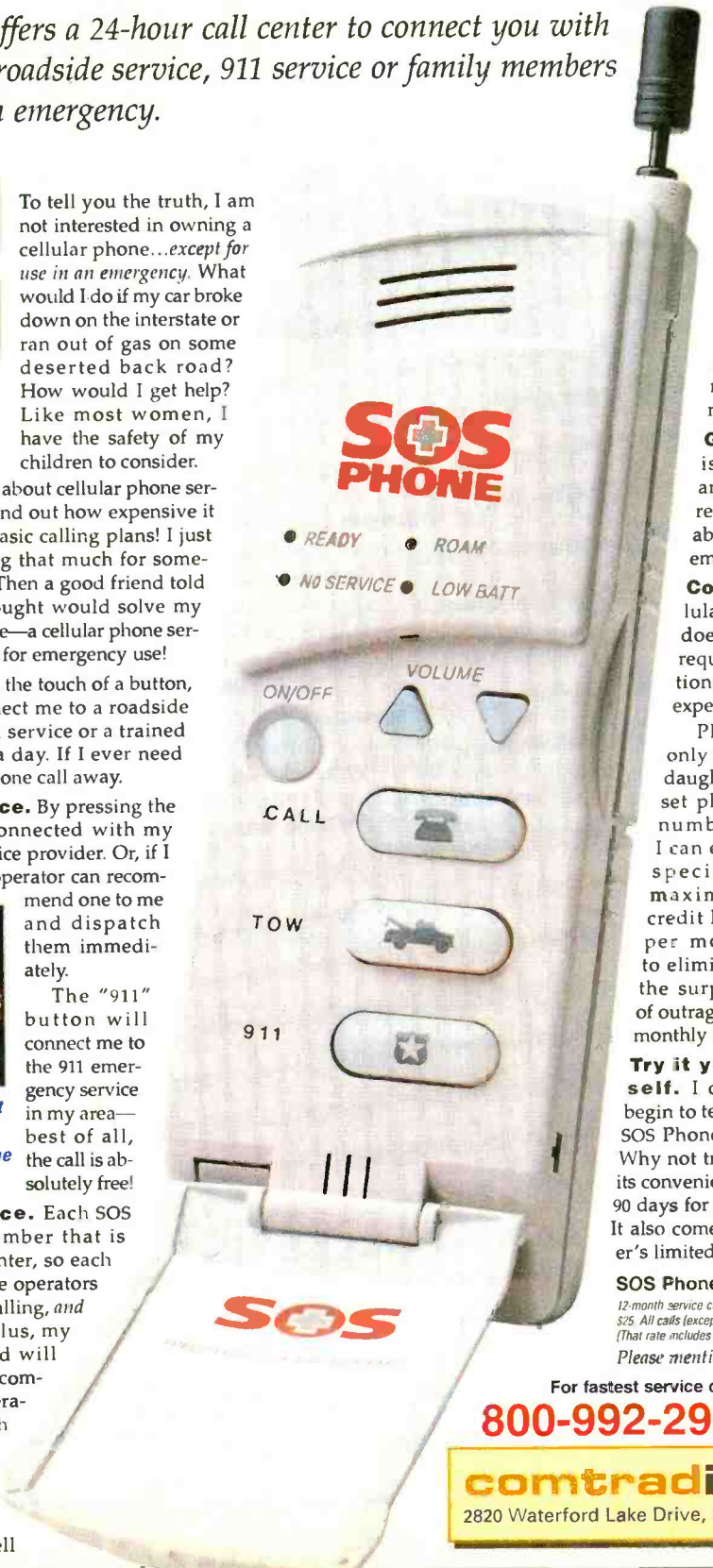
Emergency assistance. By pressing the "tow" button, I'll be connected with my emergency roadside service provider. Or, if I don't have one, the SOS operator can recommend one to me and dispatch them immediately.

The 911 button will connect you to 911 police or other emergency services, and the call is absolutely free!

The "911" button will connect me to the 911 emergency service in my area—best of all, the call is absolutely free!

Personalized service. Each SOS Phone has a serial number that is recorded at the Call Center, so each time I use my phone, the operators will know that it is me calling, *and will greet me by name.* Plus, my SOS Emergency Record will appear instantly on the computer screen and the operator will connect me with the person or emergency service I need.

Not just for emergencies. If I just want to call home to tell my husband that the kids and I are running late, I can! By pressing the "agent" button, I'll reach an operator. When I ask the operator to call home, I'll be connected automatically. And because the Call Center has my list of 10 most-used phone numbers, I don't even have to recite the number!



Great for teens. The SOS Phone is also a great thing to have around for my stepdaughter. I can rest assured that she'll always be able to get in touch with us (or an emergency service) if she needs to.

Cost control. Unlike ordinary cellular phone plans, the SOS Phone doesn't have any minimum usage requirements or any other stipulations that could change the price I expect to pay each month.

Plus, without my password, the only non-emergency calls my stepdaughter can make are to our 10 preset phone numbers. I can even specify a maximum credit limit per month to eliminate the surprise of outrageous monthly bills!

Use the Agent button to talk to an SOS operator or be connected to someone on your preset list of numbers.

Try it yourself. I can't begin to tell you how much confidence the SOS Phone has given me and my family. Why not try it yourself? If you don't enjoy its convenience and security, return it within 90 days for a "No Questions Asked" refund. It also comes with a three-year manufacturer's limited repair or replacement warranty.

SOS Phone..... **$14.95/month** $12 S&H

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PRODUCT TEST REPORT

Hitachi VT-FX613A Hi-Fi VCR

BY STEPHEN A. BOOTH

It tips the scales at just about eight pounds. However, like many boxers in the lower weight classes, Hitachi's VT-FX613A gives you your money's worth in performance.

In fact, a year ago, a Hi-Fi VCR with this combination of features and top-rank electrical measurements carried a price tag of $550—and the one we tested here didn't even have an illuminated remote control! The curious thing is that the VT-FX613A isn't even the top-shelf model in Hitachi's line. But all it lacks, compared to the company's high-end UltraVision VCRs (such as the VT-UX617A, $399), is Commercial Advance (to bypass recorded commercials) and DSS compatibility (remote control over DSS satellite receivers, to perform unattended recording).

The Hitachi VT-FX613A performs on par with top-of-the-line VCRs, only lacking commercial advance and remote control of DSS receivers.

FEATURES

The VT-FX613A is the most loaded VCR in Hitachi's new High-5 lineup. These VCRs are characterized by a so-called "efficient chassis" design. Among other things, this means some controls perform multiple functions. For example, the up/down channel selector buttons on the front panel that let you go through the 181-channel tuner (that's in the U.S.; in Canada the tuner has 178 channels) also control manual tape-tracking during video playback.

Additionally, having 20 percent fewer parts than other VCRs, the High-5 design outboards many functions—they're activated via the infrared remote control instead of front-panel buttons and switches. Consequently, you'll program the VCR for unattended timer-recording through the remote. But if you're rushing to tape a show that's about to begin, and don't have time to use the on-screen programming (in English, French, and Spanish), a convenient (if tiny) Instant Record button on the front panel is good for up to four hours, in 30-minute increments.

Hitach's zapper is a delight to use in a darkened room, thanks to green-backlighted buttons for TV and tuner controls and red-glowing ones for VCR transport functions. It also sports a shuttle dial, duplicated on the front panel, for forward/reverse tape search at variable speeds, as well as single-frame advance. Although this model lacks the Commercial Advance feature for automatically fast-forwarding through commercials that have been recorded, it does have a Video Skip feature. This advances one-minute's worth of tape before resuming play. The tape counter is in real time, and can display the tape-remaining time.

Other features of the VT-FX613A include Gemstar's VCR Plus+ C3, for easy timer-programming via codes printed in TV-schedule guides. This version also controls outboard cable-boxes. If you're taping in the EP mode, Hitachi says the 19-micron recording heads and Dynamic Picture Enhancement circuitry in this deck will record better images than you'd expect from the slow-speed mode.

The VT-FX613A also has automatic clock setting, if a station in your area is transmitting the time via the Vertical Blanking Interval in its signal, as well as a one-hour battery backup. Auto Blue Screen displays a blue field on the TV and mutes the audio for channels where there is no signal, or where the broadcast day has ended. Among other conveniences, the VCR has front panel A/V inputs, for dubbing from a

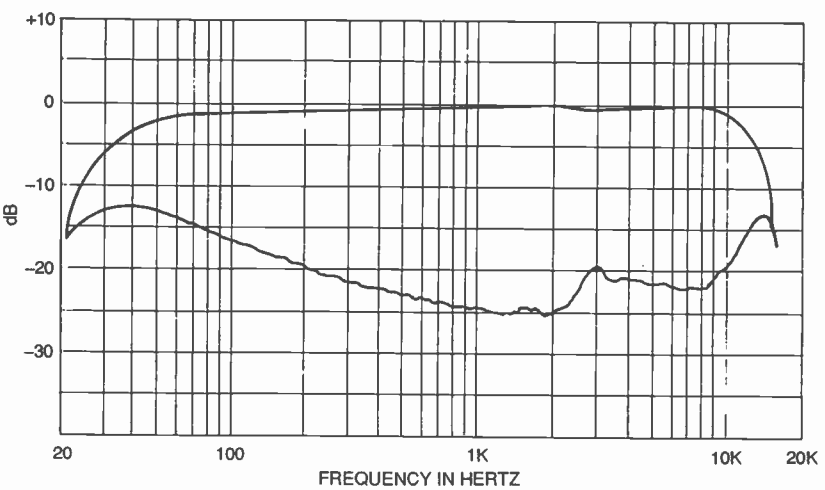

Fig. 1. As this frequency response trace shows, the VT-FX613A has consistent 20 dB of separation from 200 Hz through 9 kHz.

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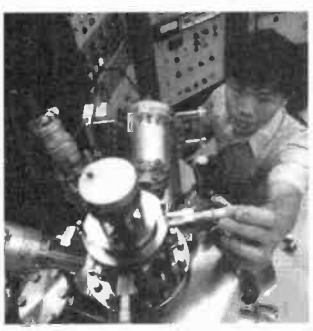

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TABLE 1—TEST RESULTS

The following test results were furnished by the Advanced Product Evaluation Laboratory, an independent testing facility located in Bethel, CT.

Brand:	Hitachi
Model:	VT-FX613A VHS Hi-Fi VCR
Price:	$299.95
VIDEO MEASUREMENTS (SP MODE)	
Frequency Response:	-1.34 dB @ 2.0 MHz
	-15.0 dB @ 3.0 MHz
Signal-to-Noise Ratios:	
Luminance Level:	
@ 100 IRE	44.0 dB
@ 50 IRE	43.8 dB
@ 10 IRE	42.9 dB
Chroma AM	48.2 dB
Chroma PM	42.5 dB
AUDIO MEASUREMENTS (HI-FI RECORDING)	
0-dB Reference Level:	(1 kHz)
Output:	2.31 volts
THD:	0.76%
Flutter (DIN):	
Average:	0.021%
Peak:	0.024%
Signal-to-Noise Ratio:	83.8 dB
Frequency Response (-3 dB):	20 Hz to 20 kHz
Record/Play THD (@ -10 dB):	
@ 100 Hz	0.23%
@ 1 kHz	0.27%
@ 5 kHz	0.35%
AUDIO MEASUREMENTS (CONVENTIONAL RECORDING)	
0-dB Reference Level:	(1 kHz)
Output:	0.36 volts
THD:	1.87%
Flutter (DIN):	
Average	0.38%
Peak	0.40%
Signal-to-Noise Ratio:	50.5 dB
Frequency Response (-3 dB):	155 Hz to 11.5 kHz
Record/Play THD (@ -10 dB):	
@ 100 Hz	0.58%
@ 1 kHz	0.42%
MTS STEREO TV DECODER MEASUREMENTS	
(Stereo Mode/Left Channel)	
Signal-to-Noise Ratio:	
(re 100% modulation)	60.5 dB
THD (@ 1 kHz, -20 dB)	0.38%
Frequency Response*:	36 Hz to 11.2 kHz
Separation*:	24.2 dB
*Measured using real-world reception conditions of -20dB relative to 100% signal modulation.	
(Mono Mode)	
Signal-to-Noise Ratio:	
(re 100% modulation)	61.7 dB
THD (@ 1 kHz, -20 dB)	0.53%
Frequency Response:	
(re 100% modulation)	36 Hz to 3.0 kHz
(S.A.P. Mode)	
Signal-to-Noise Ratio:	
(re 100% modulation)	69.5 dB
THD (@ 1 kHz, -20 dB)	0.94%
Frequency Response:	
(re 100% modulation)	540 Hz to 2.4 kHz
ADDITIONAL DATA	
Fast Forward Time (T-120 tape):	2 min. 02 sec.
Fast Rewind Time (T-120 tape):	2 min. 00 sec.
Power Requirements:	19 watts
Weight: 8 lbs.	
Dimensions (inches):	$3\text{-}5/8 \times 14\text{-}15/16 \times 11$

camcorder or another VCR. Fast forward and rewind are speedy—about two minutes for a T-120 cassette.

TEST RESULTS

Superb video and audio: That's the verdict from the test-bench at the Advanced Product Evaluation Laboratory (APEL), an independent testing facility in Bethel, Connecticut.

As you can see from the numbers in Table 1, video frequency response is fine at 2 MHz, and still plenty sharp at the 3-MHz point—this VCR delivers the 240 lines of horizontal resolution available from the conventional VHS format. The fine resolution does not come at the expense of video noise: Signal-to-noise ratio for Luminance is quite good—44 dB at the 100 and 50 IRE luminance levels. For color (red field chroma) the numbers are excellent: 48.2 dB for AM.

Audio performance is on par with the video—especially in the VT-FX613A's MTS Broadcast Stereo decoder. Signal-to-noise ratio in stereo (60.5 dB) put it in the top class of VCRs. More important, though, is frequency response and channel separation in the stereo mode.

Here, Hitachi's deck scores 24.2 dB of separation (at the 1-kHz point). Frequency response is flat over a broad range—36 Hz to 11.2 kHz. What's impressive, as shown in the frequency response trace (see Fig. 1), is the consistent 20 dB of separation from 200 Hz through 9 kHz. Accordingly, you'll get pleasing results if you're running this VCR's audio through a home-theater system with Dolby Surround decoding.

The MTS decoder posts just average numbers in the Monaural and SAP modes. Signal-to-noise ratios are just dandy, but over the very restricted bandwidth we've come to expect in VCRs over the past few years.

In Hi-Fi Stereo recording, the VCR's measurements are good, though not the best APEL has seen. Frequency response runs the usual 20 Hz through 20 kHz, and S/N ratio is 83.8 dB at the 1 kHz measuring point—no less than you should expect, but the lab has measured 90 dB in some decks. The VT-FX613A is exceptional in mono recording: S/N ratio is 50.5 dB, and frequency response is broad: 155 Hz to 11.5 kHz. Distortion levels in all modes are insignificant. Bottom line: This is a very quiet deck, electrically and mechanically. ■

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NEW PRODUCTS

DIGITAL VOICE RECORDER

No larger than a credit card and only 1/2-inch thick, Machina's Cardcorder 600 digital voice recorder uses microchip technology instead of tape to store up to 10 minutes of memos, dictation, telephone numbers, and appointments. Flash memory safely stores the recordings until they are erased, even if the batteries are removed or run out. Even if you accidentally delete a memo, it can be recovered.

Four channels allow related recordings to be filed and labeled by name for easy retrieval. Thumb-operated buttons make it easy to instantly go forward or backward, and repeat or delete recordings selectively. The Cardcorder 600 can fast-forward at double speed for quick memo review, or slow to half speed for detailed listening, without any change in voice pitch. Recording automatically pauses during silences to maximize recording time. Digital volume control allows you to set the playback level for quiet or loud environments.

A backlit LCD readout tracks all memos by number, length, and channel, and always shows the amount of available memory. All memos are referenced with a time/date stamp that is displayed during playback. Other clock functions include an alarm that you can set to sound a soft tone that builds in volume or your own pre-selected voice message.

The Cardcorder 600, including batteries and a leather carrying case, has a suggested retail price of $120. For further information, contact Machina, Inc., 21 South Park, San Francisco, CA 94107; Tel. 800-223-4340; Fax: 415-243-4359.

CIRCLE 80 ON FREE INFORMATION CARD

SATELLITE RADIO RECEIVER

The same satellites that carry hundreds of channels of television to American homes also carry audio and data channels that cannot be received by home satellite receivers. Tuning SCPC, or single channel per carrier, on satellite is like tuning a whole new world of shortwave broadcasts, but without the noise and fading. Many international broadcasters use SCPC to reach remote sites. SCPC signals carry hundreds of audio program services, including syndicated radio shows, network feeds, and sporting events.

SatScan Electronics' SCPC Explorer provides professional-quality audio reception of SCPC and FM signals from C- and Ku-band satellites. The receiver tunes the entire satellite band and provides a direct digital readout of the tuned frequency. A special software algorithm provides digital automatic frequency control to compensate for drift. A 100-channel memory comes preloaded with many favorite stations, such as BBC and NPR.

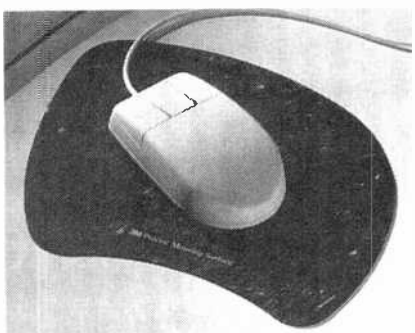
The SCPC Explorer is a superheterodyne receiver using a digital synthesizer to tune to and demodulate SCPC signals provided at the output of a block downconverter. The Explorer can also be used as a stand-alone UHF receiver for the reception of wideband FM modulated signals. The audio output is designed to be connected to the input of a stereo sound system.

The SCPC Explorer costs $479. For more information, contact SatScan Electronics Corporation, P.O. Box 1109, Sultan, WA 98294-1109; Tel. 360-793-7533; Fax: 360-793-0359; e-mail: info@satscan.com; Home page: http://satscan.com.

CIRCLE 81 ON FREE INFORMATION CARD

IMPROVED MOUSE PAD

3M's Precise Mousing Surface is a super-thin mouse pad designed to improve computer-mouse—and computer-user—performance. Based on the company's patented microreplication technology, the pad's surface allows users to maintain accurate contact between the mouse, the pad, and the software, making mouse movements faster and more precise. Microreplication is used to create microscopic, precisely shaped, three-dimensional structures on surfaces such as plastic film. A magnified view of the mouse pad's surface reveals rows of peaks and valleys. The design allows the mouse's trackball to roll over the peaks while hand oil, dust, and dirt fall into the valleys. That keeps the trackball clean and rolling smoothly.



The thin, flat pad also has a special shape, based on 3M hand/motion studies, that allows the user's hand to remain in a natural, relaxed position when moving the mouse. That provides maximum comfort and gives users the ability to finely control cursor placement.

The 3M Precise Mousing Surface has a suggested retail price of $15. For more information, contact 3M Consumer Stationery Division, 530 Fifth Avenue, New York, NY 10036; Tel. 800-3M-HELPS; e-mail: innovation@mmm.com; Web: http://mmm.com.

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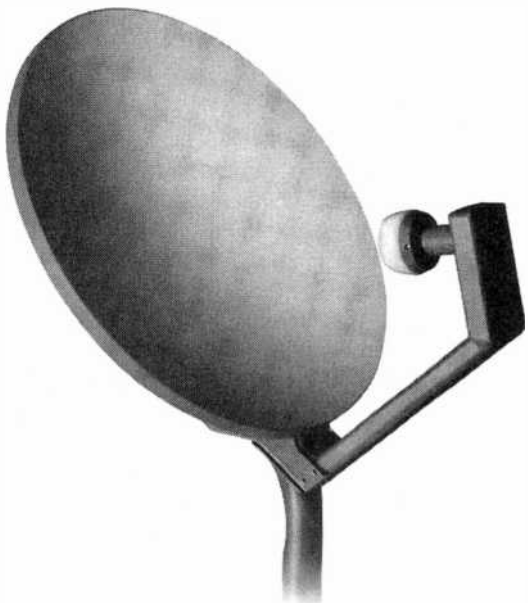

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Popular Electronics

Holiday Gift Guide

BY TERI SCADUTO & CHRISTOPHER SCOTT

You'll find something for everyone on your list on the next few pages, starting here with audio/video gifts that you might want to include in your own letter to Santa.

SURROUND YOURSELF WITH SOUND

Looking for a "totally immersive home theater experience" without the fuss and expense of a multi-speaker surround-sound system? The *Spatializer HTMS-2510* turns an ordinary TV, stereo, and speaker pair into a true home theater by providing the same 3-D surround-scund technology used in some of Hollywood's blockbusters. Spatializer's 3-D stereo technology, used with any stereo source and just two speakers, makes music sound as if it is coming from all around the listener, and sound effects as if they are coming from precise positions far outside the speaker boundaries. Because there's no need to mess with additional speakers, amplifiers, decoders, complex adjustments, or specially encoded broadcasts or tapes, it's a great way to create the home-theater experience in your bedroom. The selfcontained system has a suggested retail price of $249.95.

AUDIO ARCH DE TRIOMPHE

For those who want their music to look as good as it sounds, Marantz offers the Arch integrated music system. Merging form and function, the arch-shaped central section houses an AM/FM stereo tuner and a six-disc CD changer that's hidden behind a motorized door. A discreet fluorescent display indicates program status or, when in standby mode, the time of day. Two bi-amplified speakers can be placed directly beside the central section, or placed elsewhere in the room. Each speaker is powered by its own 30-watt amplifier, and contains a five-inch high-compliance woofer and a ¾-inch soft dome tweeter in a ported enclosure. A "dual-personality" remote control groups basic functions on one side and more advanced functions on the other. One external audio source can be accommodated. Available in your choice of walnut veneer or faux black marble finishes, the Arch has a suggested retail price of $1599.99.

TOUCH-PAD HOME THEATER

Is technophobia keeping your family from installing a sophisticated home-theater system? Kenwood's Stage 3 KC-Z1 tuner/preamplifier will change that. Based on what the company calls "Human Touch Technology," the KC-Z1's handheld touch-pad controller allows you to operate an entire home-theater system through icons, menus, and prompts displayed on its LCD screen. The touch pad uses RF signals to communicate with the tuner/amplifier, which then sends infrared commands to IR-controlled system components. The touch pad can save and recall each family member's personal preferences and automatically adjust the system's audio and video characteristics, activate specific components, and adjust the volume level accordingly. Once it "learns" the components that each person tends to adjust most, the touch pad puts those components at the top of the personalized menu. The tuner not only features Dolby Pro-Logic and the Dolby AC-3 digital surround system, but also meets Home THX standards. It accepts six video inputs, five analog audio inputs, four digital audio inputs, and an AC-3 RF input. A two-channel stereo preamp output can supply audio to amplifiers and speaker systems in other rooms. The KC-Z1 has a suggested retail price of $2800.

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ALL THE WORLD'S A STAGE

... and your family will think the New York Philharmonic (or Hootie and the Blowfish) is playing on their living-room stage—if it's equipped with the *Bose Lifestyle 901* music system. Using Bose's helical voice coil (HVC) driver and Acoustic Matrix enclosure, the system's speakers come close to recreating the sound of a live concert. The injection-molded plastic enclosure ports each of the HVC drivers into a separate chamber, which, in turn, is ported through one of three reactive air columns. The Lifestyle 901 system is controlled by a music center that features a six-disc magazine CD changer, an AM/FM tuner with 30 presets, four audio/video inputs, and full two-zone listening capability. Bose's signature RF remote control works through walls and around corners, without aiming. Integrated signal processing provides deep, well-defined bass at all listening levels by compensating for the ear's decreased sensitivity at low volumes. The Lifestyle 901's electronics are tucked out of sight in the left speaker pedestal, with one simple connection to the right accessory speaker, so there's no unsightly clutter of bulky components. The Lifestyle 901 costs about $4200.

Put a new PC under the tree, or treat your family and friends (or yourself) to new software or peripherals!

DESTINATION: THE LIVING ROOM

So long, home office! *Gateway 2000's Destination PC* is destined for use in the living room or family room. Billed as a multimedia theater system, it combines all the benefits of a full-feature multimedia PC with the impact of a large-screen (31-inch) television. Use it to watch TV, play games, run multimedia applications, or surf the Web—all from the comfort of your favorite armchair. Computer and television functions can be controlled from 10 to 15 feet away through a touch-pad-equipped wireless keyboard and a wireless "FieldMouse" remote control/mouse. The Destination's big screen will also make an impact on corporate and educational presentations. Configured for consumers (with a 120-MHz Pentium processor, 16-Megabytes DRAM, 1.2-gigabyte hard disk, 1.44 floppy drive, 6X CD-ROM, 28.8 fax modem, PCI VGA graphics adapter with integrated TV tuner, hi-fi audio adapter, the wireless keyboard and FieldMouse, Windows 95, and a special software bundle that includes an electronic TV program guide), the Destination PC costs less than $4000.

A PURPLE PC?

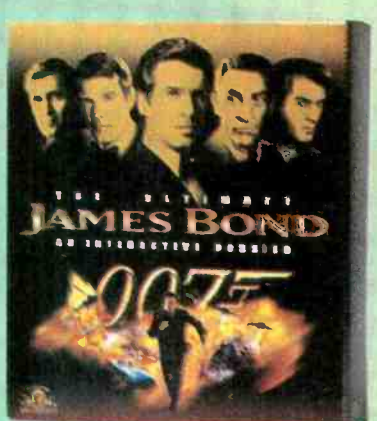
Sony's first entries into the multimedia PC market stand out from the crowd at first sight, thanks to their lavender-and-gray color scheme and VAIO signature mark. VAIO, which stands for Video Audio Integrated Operation, represents Sony's intention that PCs be integrated into the home audio/video environment. A 3-D graphic user interface called VAIO Space, which complements Windows 95, allows users to access video, audio, and communications capabilities and provides a menu of application programs. The *PCV-70* and *PCV-90* are mini-tower-systems. Future Sony PC peripherals will match and be stackable, like stereo components. The 166-MHz Pentium PCV-70 (16 megabytes of RAM, and a 2.1 gigabyte hard drive) and 200-MHz Pentium PCV-90 (32 megabytes RAM, and a 2.5-gigabyte hard drive) each feature a 28.8 DSVD modem, MPEG decoding, an 8X CD-ROM drive, and a comprehensive software bundle. The visually pleasing computers are competitively priced between $2000 and $3000.

FREEDOM TO MOVE

Give the gift of gaming freedom with *Vivitar's WJ2000* wireless joystick. Designed for use with PC games, the joystick uses microcontrollers and a patented "sensing technology" to determine its position relative to game action. Its unique, one-piece design (there's no need to hold onto a base unit in your other hand) also eliminates all moving parts and any need for recalibration. Gamers are freed from tangled cords and the hand strain associated with hours of game playing. Switchable analog and digital modes accommodate different players' style and sensitivity of hand movement. The joystick has a range of 12 feet, is powered by three "AAA" batteries, and can be used with any PC game. The suggested retail price is $129.99.

KEYING FREEDOM

Keyboards are also cutting the cord. These two wireless keyboards from *Key Tronic* each has an added bonus: The *Model LT WLS Tpad* includes a wireless touchpad, while the *LT WLS Tball* has a wireless trackball built in. Aimed at power users and graphics professionals, the Wireless Touchpad keyboard features 500-counts-per-inch resolution and "trigger-edge tracking," which allows you to drag to the pad edge and hold to scroll—without tipping or running out of space. You can even use the pad surface instead of mouse buttons to make your selections by tapping, double-tapping, and dragging. On the wireless trackball keyboard, the trackball is conveniently located below the space bar, where it can be used without lifting your hands



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from the keyboard. Both keyboards allow you to input information from up to 50 feet away, and provide two operating modes: The 4-foot mode is used for normal computing, and the 50-foot mode is for group presentations. The LT WLS Tpad and LT WLS Tball have street prices of $150 and $130, respectively.

SECRET AGENT MAN

The name is Bond—*The Ultimate James Bond: An Interactive Dossier*. The name of the game is getting to know the ultimate secret agent, inside and out. *MGM Interactive's CD-ROM* lets you explore eight different categories of James Bond's movie life through actual film clips, trivia, photos, and some never-before-seen material. The "Gadgets" section, for instance, highlights his arsenal of unusual espionage tools, including a ski-pole rifle, fake fingerprints, and the combination buzz-saw/magnetic Rolex that Bond used to unzip a woman's dress in *Live and Let Die*. The "Women" section reveals the likes, dislikes, and hidden agendas of all the "Bond Girls." You can also explore the high-tech vehicles, evil villains, and exotic locales. The CD-ROM includes clips from all 17 "007" movies, and profiles the five actors who portrayed Bond. The Ultimate James Bond costs $44.95.

LAPTOP FOR KIDS

Tired of surrendering your PC when your kids need to do their homework? Looking for a way to keep soda and peanut-butter-and-jelly sandwiches out of your keyboard? Why not buy the kids their own laptop—the *ComQuest Plus* from *Team Concepts*. Aimed at kids 9 and older, the lightweight, portable, battery-operated electronic learning aid has word processing, memory, a full-size keyboard, icon- and menu-driven activity selection, great sound effects, and a mouse. Its PC Link accessory ($39.99) allows children to upload files onto the family PC and print out the homework they did on the laptop. Kids can write letters and stories, and even add graphics, on the ComQuest Plus. Besides graphics, the software includes 38 multi-level and multi-player activities. A save-and-store feature gives kids the option of keeping documents in their own laptop. There's also a perpetual calendar and scheduler; an address book; a world time clock and world atlas; metric conversion; and word, strategy, logic, math, and trivia games. The ComQuest Plus has a suggested retail price of $149.99.

JUST CRUISIN' ALONG

Fisher-Price teamed up with *Compaq* to bring kids the *Wonder Tools Cruiser*, a brightly colored "dash board"—complete with steering wheel, throttle, horn, and "radio stations"—that allows children to navigate through specially created software adventures. By replacing the point-and-click motions of a standard mouse—which can be troublesome for young users—the Cruiser gives kids real control of the multimedia environment. The steering wheel is used to drive through each adventure; the throttle changes the speed; the joystick selects things and moves them; and the horn clears obstacles from the child's path. "Spruce Squirrel's Hiccup Mix-up," a program that lets kids explore the worlds of land, sea, and space, is included in the $150 suggested retail price.

ON-SCREEN IN-LINE SKATING LESSONS

If you're buying your kids in-line skates this year, you just might want to splurge

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for *L3 Interactive's Real-Line CD-ROM*, hosted by, and featuring performances by, world-class skaters. Other top skaters are shown demonstrating and teaching step-by-step tricks and tips on everything from the most basic moves to radical maneuvers like skating down steps. The action-packed skating footage is accompanied by music by top alternative-rock bands (none of whom, we hate to admit, the aging baby boomers here at Gizmo have ever heard of). The CD-ROM uses the "Learning Cube" graphic user interface, which allows users to move through lessons and access many animated rows and blocks by selecting icon panels on a colorful, swirling cube. Real-Line has a street price of $34.95.

GIVE 'EM GOOSEBUMPS

R.L. Stine's best-selling book series has gone interactive in *Goosebumps: Escape from Horrorland*, a Windows 95-based CD-ROM aimed at kids aged 8 and up. *DreamWorks Interactive's* disk combines detailed, miniature 3-D sets with live-action, big-star video. Jeff Goldblum stars as Count Dracula, and Isabella Rossellini portrays Lady Cadaver, in this interactive sequel to the hit novel *One Day at Horrorland*. Players are thrust into the Horrorland "scream park" at night, and creepy characters from the book come to life. Non-linear action, thousands of hot spots, and 16 levels of arcade-style fun allow players to explore Horrorland in any order they choose. Goosebumps is available at a not-too-scary suggested price of xxx.

CHITTY CHITTY BANG BANG PACKAGE

MGM Interactive's Chitty Chitty Bang Bang's Adventure in Tinker Town CD-ROM for both Windows 95 PCs and Macs comes bundled with a free, full-length videocassette of the film *Chitty Chitty Bang Bang*, starring Dick Van Dyke. The CD-ROM takes kids into an enchanting world where they use animated tools to fix and explore colorful, larger-than-life versions of common household appliances—and learn how

the world around them functions while they're at it. The game also challenges children to solve 15 puzzles designed to help them develop oral comprehension, science, safety, and memory skills. Three levels of difficulty accommodate different age groups. The CD-ROM and video have an estimated street price of $29.95.

Digital Video's time has come, and here are a few ways to make it come your way for the holidays!

YOU BETTER SHOP AROUND

If a *Digital Satellite System* topped your list last year—as it did ours—but Santa didn't come through, perhaps he was simply being frugal. Anyone who waited to

buy a DSS system now has more brands to choose from, and often at greatly reduced prices. With DSS systems available from several major manufacturers, and competition from relative newcomer DBS systems like EchoStar and AlphaStar, the price wars are in full swing. As we go to press (in late summer), AT&T has been offering its long-distance customers complete DSS systems for just $399 (if they promise to stick with the phone service, that is). EchoStar is offering its satellite dish and receiver for just $199 to customers who pay $300 for a year's subscription to programming. To keep DSS prices in line with those of the competition, DSS program suppliers DirecTV and U.S. Satellite Broadcasting are expected to begin subsidizing equipment suppliers, as well as sending buyers a rebate. That should bring the price of basic DSS hardware down to the $199 level by the time you read this. With the purchase of $300 of subscription programming, you can now buy a DSS system for $199. How low can they go? Keep watching! Along with lower prices, expect advanced features on newer DSS systems.

Toshiba's Model TSS-222, pictured here, offers the StarSight on-screen program guide and a dish with dual LNBs, making it easy to add a second receiver for multiroom DSS viewing. Its suggested retail price (before any subsidies or rebates have gone into effect) was $699.

BE THE FIRST ONE ON YOUR BLOCK

... to bring home a new *DVD* player. Many of the biggest names in consumer-electronics are backing the new DVD format and, as we go to press, are hoping to have their products on the shelves in time for Christmas 1996, along with hundreds of DVD titles from major Hollywood studios. DVD delivers better

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resolution and color purity than laserdiscs or even professional studio masters, and supports six-channel discrete Dolby Digital Surround Sound as well as Dolby Pro Logic and high-fidelity stereo. With a much larger storage capacity than that of current CDs or CD-ROMs, a single DVD disc can easily accommodate just about any full-length film. The DVD format offers a few other bonuses: users have a choice of viewing options (4:3, letterboxed, or 16:9); movie producers can present soundtracks in as many as eight different languages, and up to 32 distinct subtitles; more than one story line can be included on a single disc, allowing different endings or R- and PG-rated versions; and a parental-control feature automatically shows the edited version selected by parents. DVD is not just for video—it will be used in a broad range of computer-based multimedia applications as well. Finally, your new DVD player will play all current audio CDs. *Toshiba's SD-3006*, pictured here, is expected to carry a suggested retail price of $699.

PHOTO SCANNER

Put this year's holiday photos—and some shots from graduation ceremonies, vacations, and other family events—in next year's Christmas letter, with *Polaroid's PhotoPad* digital photo scanner. It scans any 35mm or Polaroid photo, up to 46 inches in size, into any PC document. Once the photo is placed on the scanner, it requires only one step and takes less than a minute to scan an image. The digitized image can be dragged and dropped into place in documents created in many popular word-processing and presentation programs, including Microsoft Word, WordPerfect, Microsoft Works, and Microsoft Powerpoint. Won't your friends and relatives be impressed when they receive your annual greeting, complete with photos, via e-mail or the Internet! The PhotoPad digital scanner, complete with easy-to-use software, has a suggested retail price of $299.

DIGITAL DARKROOM

Give the photography buff on your list a complete, plug-and-play home digital darkroom. *Fargo Electronics' FotoFUN!* digital color photo printer combines all the hardware and software needed to create photo-lab quality color prints up to 46 inches in size, using your Macintosh, Amiga, or Windows PC. Color-matching software automatically adjusts the color of an image according to pre-configured printer and default system profiles. With optional accessory kits, FotoFUN can be used to create color-photo postcards, coffee mugs, and labels. A print film kit, including ribbon and paper for 36 prints, is included in the average purchase price of $499.

MULTIMEDIA SNAPSHOTS

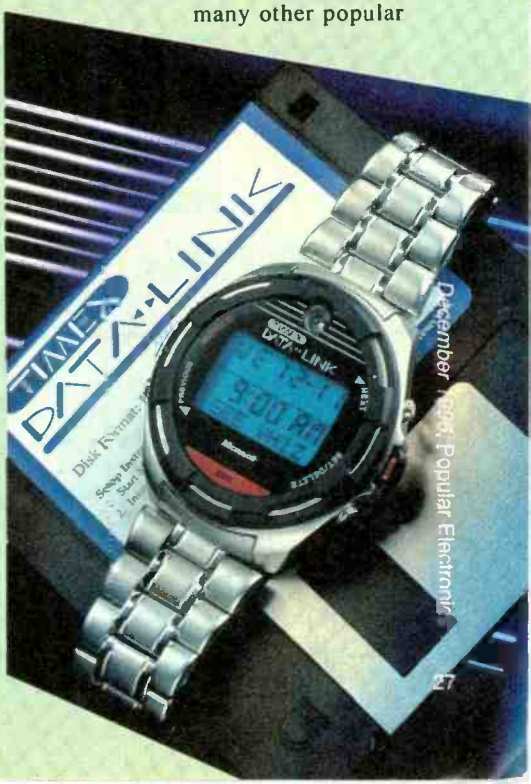
Put your photographs on video or publish them on the Internet, with *Casio's QV-30* digital camera. The camera stores up to 96 images in flash memory. You can view them instantly on its 2.5-inch, high-resolution, active-matrix color LCD. Or have your subjects star in multimedia presentations, by transferring the images to a Windows or Macintosh computer, or outputting them to a TV or VCR. All the necessary

connectors and cables are included. So is Adobe PhotoDeluxe software, which makes it easy to modify and personalize your photos. The camera features a two-position lens: 46mm for wide-angle, and 105mm for telephoto shots. The LCD replaces the standard viewfinder, making it easy to compose pictures without missing out on any of the action. You can view either one, four, or nine images on a single screen, and consecutive images can automatically be displayed one-by-one on a TV. The QV-30 has a suggested retail price of $999.

Anyone who travels frequently on business trips will surely appreciate receiving any of the gadgets on this page!

BUSINESS-CARD READER

How do you organize those stacks of business cards that are spilling out of your pockets and briefcase after a few days at a trade show or convention? *Seiko's Smart Business Card Reader* scans individual business cards and stores the images into its own full-featured database, or into many other popular



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contact-management data-base programs. The reader features a 400-dot-per-inch resolution in an 8-bit gray scale (256 shades of gray). You can wait until you get back to your office, or take the 7- × 2.75-inch device along to scan on the road, and leave all those business cards in the hotel room wastebasket. Business cards in either landscape or portrait formats are scanned at up to four cards per minute. The built-in software recognizes the card data and inserts it into the appropriate fields in about 15 seconds. You can then view a complete image of the card on a PC monitor, or view and verify the contacts in database or list format. You can add notes to the cards and search for contacts based on those notes, easily calling up everyone to whom you promised to send more information on your company's products. Cards can be saved in user-defined categories, sorted by a field or multiple fields, and printed as an address book, phone book, or labels. The Smart Business Card Reader has a street price of about $200.

FRAUD-PREVENTION CELL PHONE

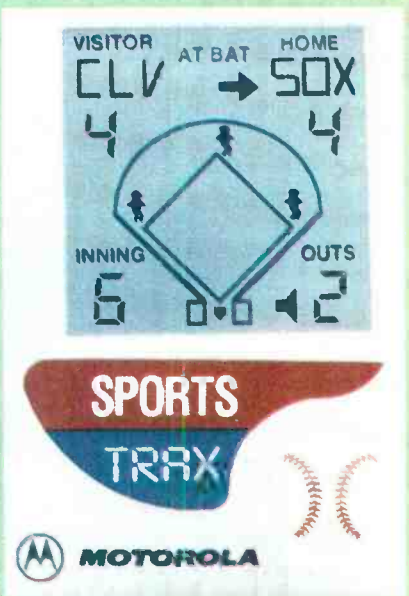
AT&T's Model 3740 cellular phone features a Bell Laboratories-patented authentication feature, or "A-Key," designed to reduce cellular phone fraud. The new A-Key method is expected to be much more effective than the current practice of transmitting an equipment serial number before each call. Thieves with cellular scanning devices can intercept a standard phone's serial number and then program it into other cell phones, which then charge all their calls to your account. That's why, in areas with high cell-phone fraud rates, customers are required to enter a personal identification number (PIN) before every call. No PIN will be required with A-Key-equipped cell phones. The AT&T 3740 has on-screen instructions for its sophisticated calling features, which include caller ID, short-message service, and voice-mail indicator, where those services are offered by the cellular service provider. It also has one-button dialing of up to nine numbers, a 60-number alphanumeric memory, 70-minute talk time, 10-hour standby time, a call log, and preprogrammed insertion of a calling card number. Contact your local AT&T dealer for the costs of the 3740 and cellular service.

COMMUNICATIONS DOUBLE PLAY

How many people on your list rely on both cell phones and pagers? Consider giving them *Motorola's RSVP*, a full-featured numeric pager that's built-into a cellular telephone battery. Although they are both powered by the same source, the pager and the phone function independently. The user can be paged even when talking on the phone. By keeping the telephone off and giving out the pager number only, RSVP can be used as a call-screening device as well. RSVP has a suggested retail price of $259.

WATCH IT!

Lighten someone's briefcase load by giving them the *Timex Data Link*—a wristwatch that doubles as an electronic organizer. Don't be scared off by the thought of entering data on a watch-sized keypad. Built-in software (created by Microsoft and Timex) lets you input appointments, phone numbers, important dates, and to-do lists



on your PC, and download the data to the watch in seconds, without any cables or connectors. The watch's sensor reads flashing bars of light on the monitor. The Data Link watch requires Windows 3.1 or better, and is fully integrated with Microsoft Schedule+ for Windows 95, which is now part of Microsoft Office for Windows 95. Up to 150 entries can be entered, then read on a 31-character scrolling message line. Watch functions include a stopwatch, countdown timers, and Timex's "Indiglo" night light. The Data Link 150 costs about $139.

LAPTOP PRIVACY

Anyone who uses a laptop on an airplane or in other crowded public places knows how annoying it is to have the stranger in the next seat read whatever's on screen. *Glare/Guard's Traveler 2000* notebook privacy filter makes it virtually impossible for anyone not seated directly in front of the screen to read what's displayed. A film coating restricts the viewing angle by diffusing the image. The Traveler 2000 also has a multi-layer, anti-reflective coating that reduces glare by 95%, while increasing contrast, maintaining resolution, and reducing eye strain. The lightweight filter fits any notebook computer with a diagonal screen measurement of up to 10.4 inches. Its suggested retail price of $69.99 includes a protective carrying pouch.

PERSONAL TRAVEL PLANNER

For the frequent traveler on your list, consider the *Triplink* from *Ultradata Systems Inc.*, a pocket-sized "travel computer" that can replace the stacks of maps, guidebooks, auto-club handouts, and phonebooks used for planning business or pleasure trips. The Triplink system consists of a CD-ROM disc and the portable travel computer. The traveler plans the trip at home or in the office using the included CD-ROM and a desktop PC. The personalized trip and route information is then downloaded into the handheld travel computer, where it is available instantly at the traveler's fingertips. The user enters the starting point and destination, including any planned stops along the way—"New York to Orlando, via Washington, D.C.," for instance. To personalize the trip, he can choose from the fastest, most scenic, or shortest route and can enter more than one point of interest to stop at along the way. The Triplink CD-ROM then calculates the route, directions, and mileage; provides information about services; and lists facts about the cities along the route. The traveler can find out where the nearest McDonald's or 24-hour copy center is located, get directions to his or her hotel, and see emergency phone numbers and resources. Triplink also provides detailed information and directions for more than 80 major U.S. and Canadian cities, including lodging, dining, tourist attractions, convention centers, sports arenas, and such services as gas stations and pharmacies. Triplink has a suggested retail price of $139.95.

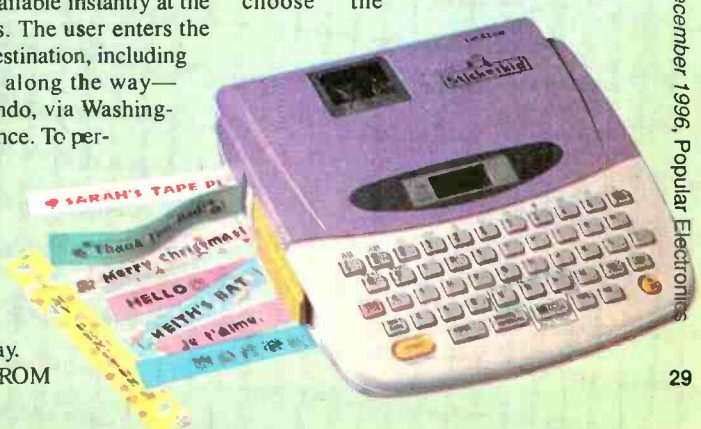
There's always someone on your list who has you totally stumped. Here's a sampling of some interesting and unusual products that just might suit an otherwise hard-to-fit person.

FAMILY MESSAGE CENTER

Instead of buying a bunch of small gifts for every member of a busy family, why not try to simplify their hectic lives with the *Family Message Center* from *Voice It Worldwide*. Four separate digital channels allow spoken messages and reminders to be grouped by name or message category. For instance, whoever drinks the last of the milk can just say "milk" into the grocery list category. An indicator light flashes when new messages are waiting, and a clock and display panel show when they were recorded. The Family Message Center, which can be mounted on a wall, or placed on the refrigerator to replace all those scribbled reminders held by magnets, has a suggested retail price of $119.

PRIVATE COOKING LESSONS

Does your family eat out or order in all the time because no one knows how to prepare a decent meal? For those who are truly desperate for some home cooking, consider the *Kitchen Coach* from *Jericho Promotions*. The Kitchen Coach is an integrated TV, CD player, and "dedicated computer brain." When you insert one of its special video CDs, it guides you, step-by-step and in real time, through the process of cooking. You can choose the



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MANUFACTURERS

AT&T Consumer Products
5 Wood Hollow Road
Parsippany, NJ 07054
Tel. 800-232-5179

Bose Corporation
The Mountain
Framingham, MA 01701-9168
Tel. 800-444-BOSE

Brother International Corporation
200 Cottontail Lane
Somerset, NJ 08875
Tel. 908-356-8880

Casio, Inc.
570 Mt. Pleasant Ave.
Dover, NJ 07801
Tel. 201-361-5400

Compaq Computer Corporation
P.O. Box 692000
Houston, TX 77269-2000
Tel. 713-514-0484

County Line Limited
4543 Taylor Lane
Warrensville Heights, OH 44128
Tel. 216-765-1234

DreamWorks Interactive
640 North Sepulveda Blvd.
Los Angeles, CA 90049
Tel. 310-234-7000

Fargo Electronics, Inc.
7901 Flying Cloud Drive
Eden Prairie, MN 55344
Tel. 800-327-4622
Web: http://www.fargo.com

Fuji Photo Film U.S.A. Inc.
555 Taxter Road
Elmsford, NY 10523
Web: http://www.fujifilm.com

Gateway 2000
610 Gateway Drive
P.O. Box 2000
North Sioux City, SD 57049-2000
Tel. 800-846-5253
Web: http://www.gw2k.com/destination

Glare/Guard Division
Optical Coating Laboratory
2789 Northpoint Parkway
Santa Rosa, CA 95407-7397
Tel. 800-545-6254

ITT Night Vision
7635 Plantation Road
Department P
Roanoke, VA 24019
Tel. 800-448-8678
Web: http://www.ittnv.com

Jericho Promotions, Inc.
924 Broadway
New York, NY 10010-6007
Tel. 212-260-3744

Kenwood USA Corp.
P.O. Box 2745
Long Beach, CA 90801

Key Tronic Corporation
P.O. Box 1468
Spokane, WA 99214-0687
Tel. 800-262-6006

L3 Interactive
3000 West Olympic Blvd.
Santa Monica, CA 90404
Tel. 800-644-CUBE
Web: http://www.learningcube.com

Marantz America, Inc.
440 Medinah Road
Roselle, IL 60172
Tel. 708-307-3100
Fax: 708-307-2687

MGM Interactive
2500 Broadway Street
Santa Monica, CA 90404-3061
Web: http://www.mgmua.com

Motorola
Paging Products Group
3301 Quantum Blvd.
Boynton Beach, FL 33426-8292
Tel. 800-724-3638

Polaroid Corporation
575 Technology Square
Cambridge, MA 02139
Tel. 800-343-5000

Seiko Instruments USA, Inc.
1130 Ringwood Court
San Jose, CA 95131
Tel. 408-922-5900

Sony Electronics
1 Sony Drive
Park Ridge, NJ 07656
Tel. 201-930-1000

Spatializer Audio Laboratories, Inc.
20700 Ventura Blvd., Suite 134
Woodland Hills, CA 91364
Tel. 818-227-3370
e-mail: info@spatializer.com
Web: http://www.spatializer.com

Team Concepts North America, Ltd.
1101 San Antonio Road, Suite 414
Mountain View, CA 94043
Tel. 800-486-0898

Timex Data Link
P.O. Box 310
Middlebury, CT 06762-0310
Tel. 800-367-8463

Toshiba America Consumer Products, Inc.
82 Totowa Road
Wayne, NJ 07470
Web: http://www.toshiba.com

Ultradata Systems Inc.
9375 Dielman Industrial Drive
St. Louis, MO 63132
Tel. 800-759-8486
Web: http://www.ultradatasystems.com

Vivitar Corporation
1280 Rancho Conejo Blvd.
P.O. Box 2559
Newbury Park, CA 91319-2559
Tel. 805-498-7008

Voice It Worldwide, Inc.
2643 Midpoint Drive, Suite A
Fort Collins, CO 80525
Tel. 1-800-876-4699, ext. 45
Web: http://www.voiceit.com

type and speed of the lesson using a water- and grease-proof remote control that also allows you to switch from "coach" mode to regular television programming while the turkey roasts. Six video CDs are included: *Stocking Up, Chef's Secrets, Classic Accompaniments, Essential Gourmet Techniques, Meals in Minutes,* and *Low-Fat Healthful Cooking.* Future CDs will include ethnic menus, barbecuing and grilling, and choosing wines. You'll have to forego a lot of restaurant meals, however, to cover the Kitchen Coach's hefty retail price of about $950.

NIGHT EYES

Campers, star-gazers, nighttime boaters, and wildlife buffs—as well as those who'd like to be able to spot a possible burglar without turning on all the lights—would love to get *ITT's Night Quest 100 Night Vision* viewer. Using the same technology used by the U.S. military and police forces, it allows users to survey the area they can't see with the naked eye as a clear "picture" in near-daylight conditions. At the heart of the Night Quest 100 is a three-component image-intensifier tube that multiplies thousands of times the minute amounts of ambient light (from stars, the moon, or artificial lights) collected by an objective lens. The weather-resistant viewer offers a 52-degree field of view. Weighing in at just 10 ounces, the compact viewer won't add much weight to a backpack. The Night Quest 100 has a suggested retail price of less than $800.

ELECTRONIC BIRD-FEEDER

Is one of the 63 million Americans who enjoys bird watching and bird feeding on your holiday gift list? The perfect gift for that person is the *WingSong* bird feeder from *County Line Limited.* The Colonial-style feeder has a patented wireless microphone and transmitter located under its roof. A portable receiver/speaker placed inside the bird watcher's house allows the song of every bird that comes to feed to be heard. A large overhanging roof keeps birdseed dry, windows on all six sides makes it easy to see the level of seed, and two perch sizes accommodate both large and small birds. The WingSong (*Model BF3*) bird feeder can be yours to give for less than $100.

POCKET-SIZED PLAY-BY-PLAY

Baseball fans can easily follow their favorite team with the *SportsTrax* wireless sports newswire monitor from *Motorola.* The pocket-sized devices display continuous, commercial-free game updates originating from the game-side press box, in real time. They allow the user to keep track of a game at a glance, without neglecting work or family obligations. SportTrax displays the current score, the inning, the team

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at bat, and the number of outs—and a graphic of a baseball diamond shows the positions of the base runners. Audible alerts let the user know when an inning is ending, a run is scored, a home run is hit, a game is starting, or a rally is taking place. About the size of a pager, SportsTrax can be used anywhere in the country, allowing fans to monitor their home teams while traveling. The retail price of $199 includes the device and complete coverage of three seasons of regular games, and playoffs, and the World Series. A basketball version is also available, although the NBA has initiated a lawsuit to block the unit's distribution.

STICKER MAKER

Kids love those stickers they sell in stores—imagine how much more they'll like stickers they design and make by themselves. *Brother International's Stickerkid* lets kids create personalized stickers for school projects, dressing up gifts, or making customized labels for personal items. The purple, handheld device offers many of the features found on its adult counterpart, the Brother P-Touch labeler. A typewriter-style keyboard is used to enter letters, more than 300 built-in symbols, and framing styles. Stickers are viewed on the device's LCD and printed out onto adhesive-backed, "crack-n-peel" style tapes, available in six colors and four patterns. Stickerkid offers seven fonts, five type-styles, ribbon pattern-making capabilities, and a special code function for encoding and decoding "secret" messages. Stickerkid is quite affordable, costing less than $100.

STATE-OF-THE-ART CAMERAS

Cameras are perennial favorite holiday gifts, and the new Advanced Photo System (APS) cameras make good gifts even for those who already own a camera. APS cameras provide photographers with a choice of three print formats: the standard 46 inches, a slightly larger 47 inches, or a 410-inch panoramic shot. When the film is developed, a proof sheet is included, making it easy to order reprints in the format the picture was shot in, or either of the other two formats. *Fujifilm's* line of *Endeavor* APS cameras include one for every price range. The basic *Endeavor 10*, with a 23mm fixed-focus lens and built-in flash, has a suggested retail price of $69.95. The top-of-the-line *Endeavor 400SL*, a 4X zoom single-lens reflex camera aimed at pleasing advanced amateur photographers, features TTL autofocusing and light measurement, stop-action and portrait modes, multi-programmed flash, red-eye reduction, night-portrait mode, and data input (date and time, title, print quantity, format selection, and shooting data). The top-of-the-line camera has a suggested retail price of $849.95. ■

Wavetek. The Way Value Is Measured.

For the best values in digital multimeters everyone is turning to the Wavetek XT Series. Each of these full-function DMMs measures voltage, current, resistance, and also a set of additional electrical or electronic properties you work with every day. Inductance. Capacitance. Frequency. Temperature. There is an XT Series DMM right for you.

With oversized character displays, these DMMs are as easy to read as they are to use. All have fully-fused current inputs and input warning beepers to protect you and the meter. Each comes with safety test leads and are approved to IEC1010-1 safety standards.

Our commitment to reliability and high-quality is backed by the industry's only "No Hassle" warranty program. If your XT Series meter requires warranty service, your local dealer replaces it immediately. Call today for full details and the names of your local Wavetek distributors. You'll find that when it comes to Wavetek performance and price, nothing else measures up.

27XT
A unique combination of DMM and component checking in a single meter.
- *Inductance*
- *Capacitance*
- *Logic*
- *Frequency*

23XT
Electronic and electrical test functions for general duty and HVAC/R.
- *VAC Safety Tester™*
- *Temperature*
- *Capacitance*
- *Logic*

25XT
A full C-meter in a DMM, and more! Ideal for A/V, cell-phone & antenna matching, component inspection.
- *Full Capacitance 0.1pF to 20mF*
- *Capacitance Zeroing & Test Slots*

28XT
A thermometer + DMM for HVAC/R, building or plant maintenance.
- *Temperature*
- *Capacitance*
- *Frequency*
- *Max-Hold*

85XT
A precision True-RMS reading DMM, ideal for equipment like copiers.
- *4 1/2 digit*
- *0.05% Accuracy*
- *True-RMS*
- *Frequency*
- *Duty Cycle*

LCR55
Full-function LCR, extra test features for "best-buy" in a component checker.
- *Inductance*
- *Capacitance*
- *Resistance*
- *Transistor*
- *Dual Diode*

Accessories include current clamps, RF & HV probes, temperature converters, holsters, boots and carrying cases.

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(800) 854 2708

WAVETEK

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BUILD THE LIGHT ANIMATOR

Add some excitement to your holiday lighting this Christmas.

BY RODRICK SEELY

Here's a fun project for the holidays that will dazzle your friends and neighbors: it's called the *Light Animator.* With this ultimate lighting accessory, your home or yard can rival that of the Griswold family from the movie *National Lampoon's Christmas Vacation.*

What do we mean? Well, by plugging strings of lights into the Light Animator and arranging them into shapes and patterns, you can create such animated effects as waving Santas, flying reindeer, or shooting stars! That's possible because the Light Animator is a chaser, or sequencer, which controls up to eight outputs. Each output can drive multiple light strings to create many interesting effects.

The unit features an LED display, adjustable rate control, a mode-selector switch, and a position-selector switch. The position switch selects from 3 to 8 steps in the animation sequence, and the mode switch selects between "bounce" mode and "cycle" mode. Bounce mode flashes the light strings back and forth, and cycle mode flashes the lights in one direction. Now let's look at how that's accomplished.

Circuit Description. The schematic for the Light Animator is shown in Fig. 1. That circuit consists of a 5-volt power supply, an oscillator, some control logic, and eight triac-based power-control circuits (only one is shown; the others are identical).

Power for the circuit is taken from a 117-volt AC outlet. That source passes through a 3-ampere fuse and is used in two different ways by the circuit. For one, transformer T1 steps the power down to a 6-volt AC source, which is rectified by bridge rectifier BR1 and filtered by capacitor C3. The voltage is then regulated by IC5 to provide a stable 5-volt supply. As for the other use of the power, the hot and neutral lines from the outlet are also fed to AC-sockets SO1–SO8, which are in the eight power-control circuits.

A 555 timer, IC1, is configured as an oscillator, which controls the sequence rate. The oscillator's frequency is determined by the formula:

$$f = 1.44 / (R1 + R3 + 2R2) \times C$$

The frequency range with the values shown is about 1.3 Hz to 14.1 Hz. Potentiometer R3 can be changed to set the maximum speed.

The heart of the circuit's logic control is IC3, a binary up/down counter. Switch S1 is used to select the circuit's mode. In cycle mode, IC3 is operated as an up-counter that is reset after it has counted up to the last position in the sequence. In bounce mode, IC3 counts up to the last position in the sequence, then counts back down. The clock pulses from the oscillator are steered to the up- and down-counting pins of IC3 by quad NAND gate IC2. A flip-flop is formed by IC2-c and IC2-d that toggles IC3 between up and down counting in bounce mode. In cycle mode, IC2 controls the up counting and reset inputs of IC3.

The binary outputs of IC3 are decoded by IC4, which is a 3- to 8-line binary decoder. The last six outputs of the decoder are connected to rotary-switch S2, which is used to select the number of positions or steps in the sequence. Those decoder outputs are also used to drive the eight power-control circuits, which actually manipulate the light strings. Because IC3 is a 4-bit up/down counter, a 4- to 16-line decoder (*i.e.* a 74LS154) could be used to provide 16 positions instead of 8 in the circuit. Of course, a rotary switch with more positions would also have to be used with the Light Animator.

Each of the eight power-control circuits consists of an MOC3040 opto-isolator (IC6–IC13), a Q4004L3 triac (TR1–TR8), and a red display LED (LED1–LED8). The opto-isolators provide isolation, triac-driving circuitry, and zero-crossing detection. The zero-crossing feature protects the light bulbs by ensuring that each triac will turn on at the instant when the AC voltage is at zero volts, rather than at the AC peak voltage.

Note that the arrows with numbers in them, which are connected to the decoder's eight outputs, match the arrows in each power-control circuit. Only one circuit is shown, and therefore only arrow 1 is drawn solid, but in each consecutive circuit, the arrows connect at the same point (*i.e.* arrow 2 in circuit 2, etc.). The same holds true for the open circle connections to resistor R5 and the +5-volt source. Match each open circle with the open circle in the corresponding power-control circuit (i.e., circle 1 goes with circle 1 in circuit 1, etc.).

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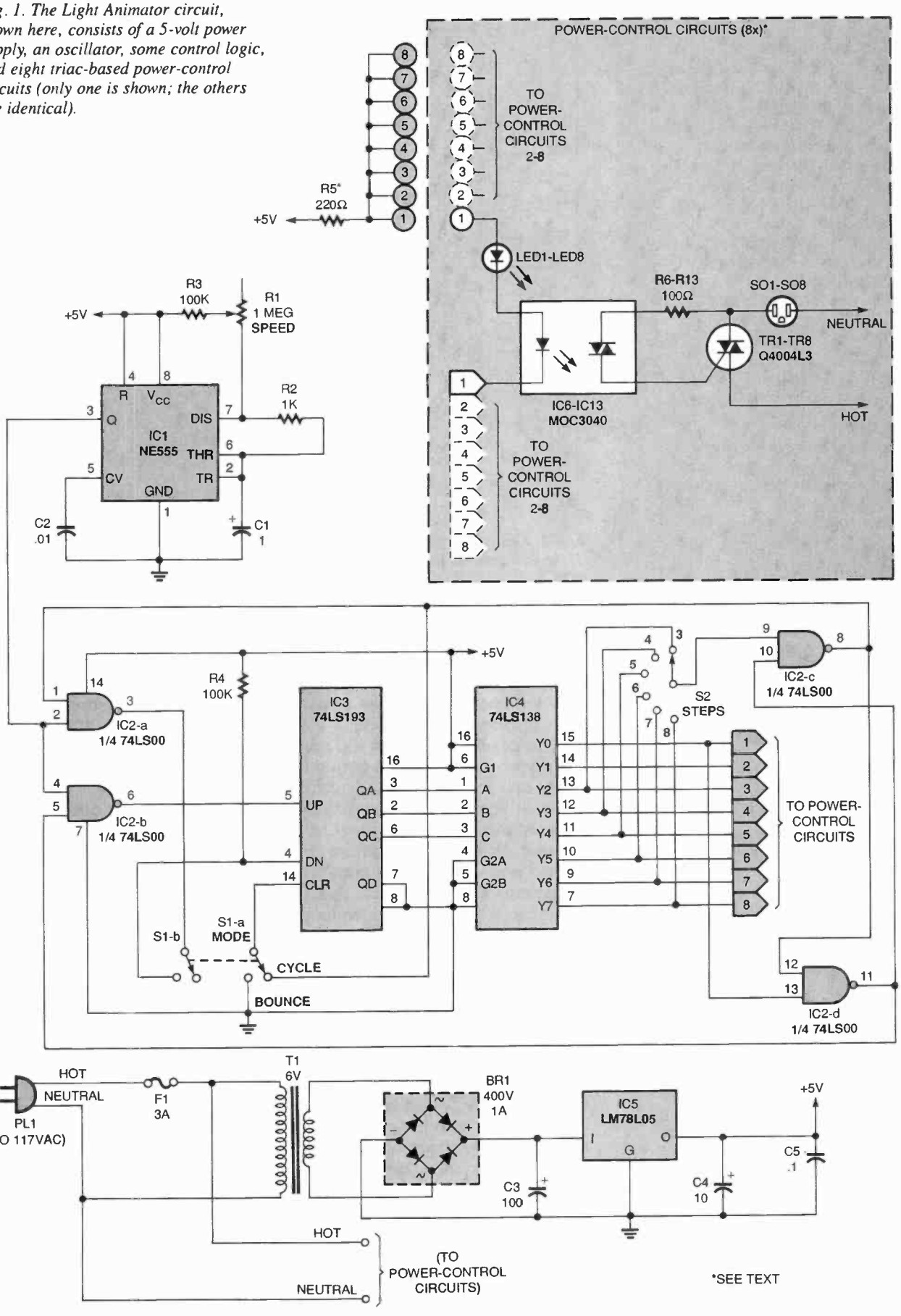
Fig. 1. The Light Animator circuit, shown here, consists of a 5-volt power supply, an oscillator, some control logic, and eight triac-based power-control circuits (only one is shown; the others are identical).



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PARTS LIST

SEMICONDUCTORS

IC1—NE555 timer, integrated circuit
IC2—74LS00 quad NAND gate, integrated circuit
IC3—74LS193 binary 4-bit up/down counter, integrated circuit
IC4—74LS138 binary 3- to 8-line decoder, integrated circuit
IC5—LM78L05 5-volt regulator, integrated circuit
IC6–IC13—MOC3040 opto-isolator triac driver, with zero-crossing, integrated circuit
TR1–TR8—Q4004L3, 400-volt, 4-amp isolated tab triac
LED1–LED8—Light-emitting diode, red
BR1—Full-wave bridge rectifier, 400-volt, 1-amp (DB104 or equivalent)

RESISTORS

(All fixed resistors are ¼-watt, 5% units, unless otherwise noted.)
R1—1-megohm linear potentiometer, PC-mount
R2—1000-ohm
R3, R4—100,000-ohm
R5—220-ohm, ½-watt
R6–R13—100-ohm

CAPACITORS

C1—1-μF, 16-WVDC, electrolytic
C2—0.01-μF, Mylar
C3—100-μF, 16-WVDC, electrolytic
C4—10-μF, 16-WVDC, electrolytic
C5—0.1-μF, Mylar

ADDITIONAL PARTS AND MATERIALS

T1—117- to 6-VAC transformer
F1—3-ampere fuse
S1—DPDT toggle switch, PC-mount
S2—2P6T rotary switch, PC-mount (only one section used, see text)
SO1–SO8—AC socket, two-terminal
PL1—AC plug, two-terminal
Printed-circuit materials, enclosure, spacers, knobs, fuse holder, AC line cord, strain-relief grommet, wire, solder, hardware, etc.

Note: The following items are available from Lynn-Eren Electronics (17093 SW Lynnly Way, Sherwood, OR 97140; Tel. 503-625-2205; Web: http://www.teleport.com/~lynneren): complete kit of parts including all electronic components, an etched, drilled and plated-through PC-board, and a pre-drilled enclosure with screen-printed front panel—$129; PC-board—$20; enclosure—$45. Please add 5% shipping and handling. Check or money order, VISA and MasterCard are accepted. Oregon residents please add appropriate sales tax.

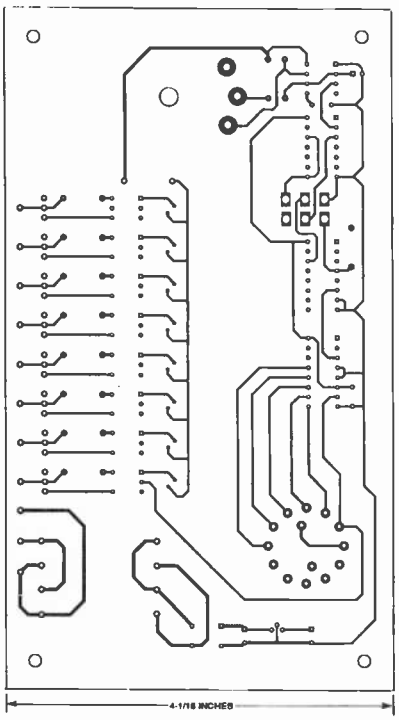

Fig. 2. This is the solder side of the Light Animator PC board, reduced by 50%.

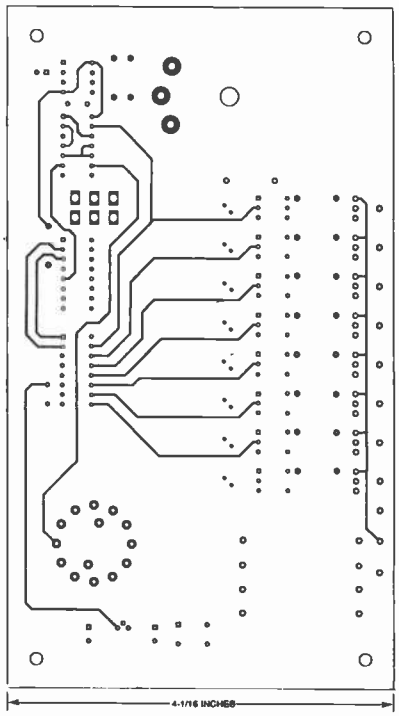

Fig. 3. Here's a 50% reduction of the component side of the double-sized PC board.

Construction. The author's prototype for the Light Animator was built on a double-sided printed-circuit board. Doing the same will ensure ease of assembly, and reduce the chance of wiring mistakes. You can make your own PC board from the solder- and component-side patterns shown in Figs. 2 and 3, respectively (they are shown at 50% of their original size). Or, you can purchase an etched and drilled board from the source mentioned in the Parts List.

The circuit board is designed for a PC-mounted transformer and potentiometer, as well as board-mounted switches. That eliminates a lot of messy wiring. If those parts are not available, however, you can of course use chassis-mounted components and insulated wires.

If you're building the unit on a PC board, use the parts-placement diagram shown in Fig. 4 as a guide. Note that some components have connections on both sides of the circuit board, so both connections need to be soldered on those parts. Begin by installing sockets for IC1–IC4 and IC6–IC13. Note that for opto-isolators IC7–IC13 you will need to bend pin 5 on each socket away as there is no mounting hole for it.

Solder all the fixed resistors and capacitors to the board next, being careful to orient the polarized capacitors correctly. Install the bridge rectifier, making sure it is oriented properly as well.

Mount the potentiometer and two switches next, as shown. Note that in the case of S2, the board was designed for a two-pole, six-position rotary switch; only one pole is actually used, however. The board was designed that way because two-pole rotary switches are much easier to obtain.

Solder short, insulated wires to the board to facilitate connections to the sockets, fuse, and AC cord, as shown in the parts-placement diagram. Note that transformer T1 mounts on the solder side of the board. Install that part at this time.

Continue with assembly by soldering the eight LEDs to the board. Because the PC-board will be mounted directly to the front panel of the enclosure using ½-inch spacers, make sure the bases of the LEDs stand about ⅜-inch off the board. That way the lenses will reach the front panel. Solder the eight triacs to the board, next. Then insert the opto-isolators into their sockets. You will have to bend the tri-

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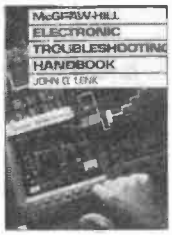

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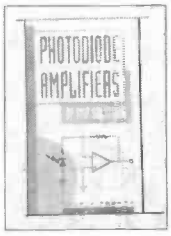

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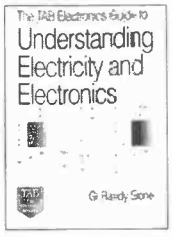

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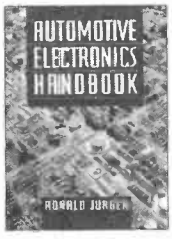

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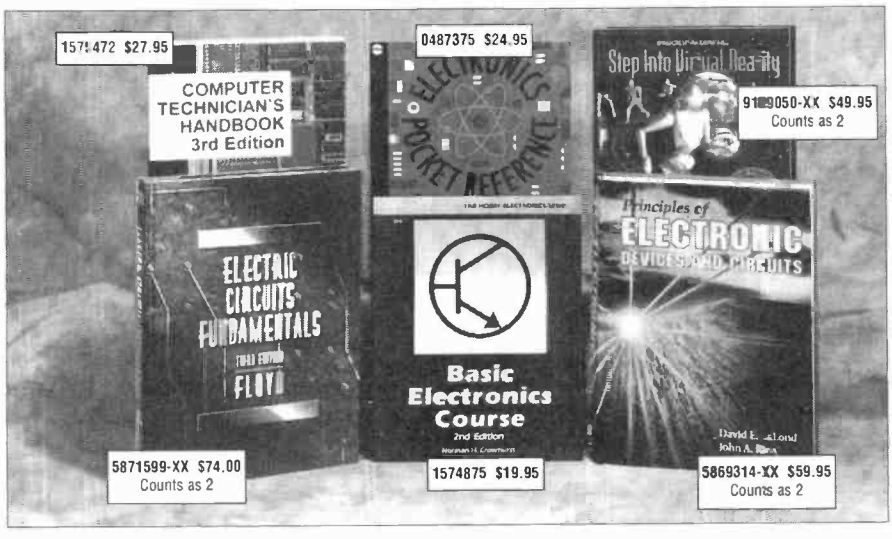

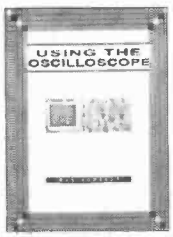

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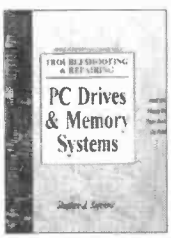

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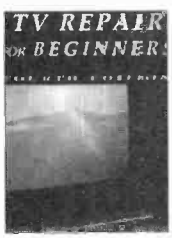

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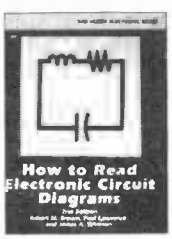

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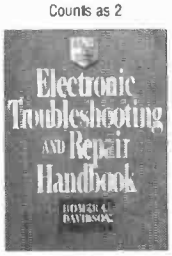

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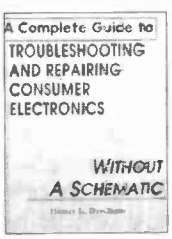

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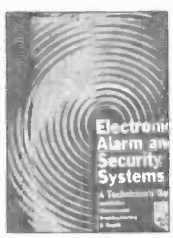

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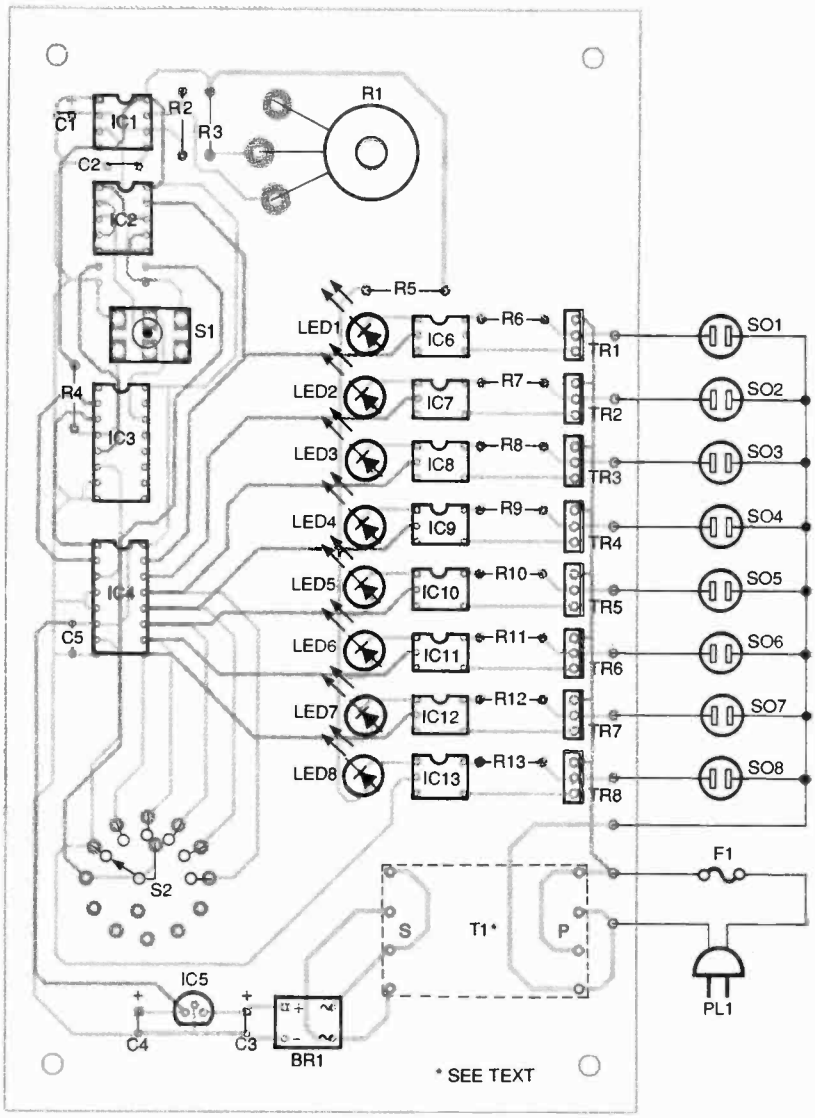

Fig. 4. Use this parts-placement diagram as a guide when building the Light Animator. Note that transformer T1 mounts onto the solder side of the board.

acs over so that they stand less than ½-inch off the board. The heat sinks of the triacs will then partially cover the opto-isolators, which is why the isolators have to be inserted before you bend over the triacs. Make sure the LEDs and triacs are all oriented correctly.

Install IC5 next, as shown in the diagram. Then, to complete on-board assembly, insert IC1–IC4 into their sockets.

Once all the PC-board components are installed and you've double-checked the wiring, install sockets SO1–SO8 and a fuse holder to the enclosure you selected for the Light Animator. Run an AC line cord through a grommet into the case, as well (attach PL1 to the other end of the cord). Then wire those parts to the leads you soldered to the board. Use the parts-placement as a guide to make sure you make the correct connections. Note that you will need to connect all the neutral sides of the sockets together with a wire. **The AC sockets, fuse holder, and line cord must be wired correctly to prevent electric shock and fire hazard.**

You will now need to prepare the front panel of the Light Animator case. To do that you will need to drill holes to accommodate the potentiometer, switches, and LEDs. As you would do with any other project, measure the distance between the components that require holes and mark those points on the inside of the case cover. Then use a drill bit of the correct size for each different part. You'll probably need to use a 5/16-inch bit for R1's hole, a ¼-inch bit for S1, a ⅜-inch bit for S2, and a 3/16-inch bit for the holes for the LEDs. Once the panel is complete, make sure it matches up with the board, but do not assemble the case yet.

Testing and Final Assembly. Clear an area for testing, and arrange the PC-board so it does not touch any of the high-voltage components in the chassis. Plug in the unit and verify the operation of the LED display, speed control, and switches. **Be careful not to touch the circuit board while the unit is plugged in.** Unplug the unit before final assembly or troubleshooting. If the unit does not function properly, check the orientation of all polarized components, and make sure the parts are soldered on both sides of the PC-board where necessary.

With the unit unplugged, mount the PC-board to the front panel using ½-inch spacers. A guide for drilling the front panel is shown in Fig.4. The front panel and PC-board assembly can then be mounted in the case. After the unit is fully assembled, the outputs can be tested with a lamp or light string.

Installation and Use. Because the Light Animator operates on 117-volts AC, extreme care must be taken to avoid the risk of electric shock. Set up the unit only in an area where it will stay dry.

Multiple light strings can be connected to each output, but the maximum safe current capacity of the power-control circuits is about 3 amperes, or 350 watts. The fuse rating of 3 amperes should definitely not be exceeded.

Some unique animation effects can be achieved by arranging light strings into shapes and figures on wood or wire forms. Trees and fences also make good forms for creating lighting displays and effects. Holiday greetings can even be set in motion by forming letters with separate light strings.

Experiment with the two modes of the Light Animator and its various speed settings to find what works best for your own applications. In no time at all, you'll be creating stunning displays and brightening up the holidays in your neighborhood! ■

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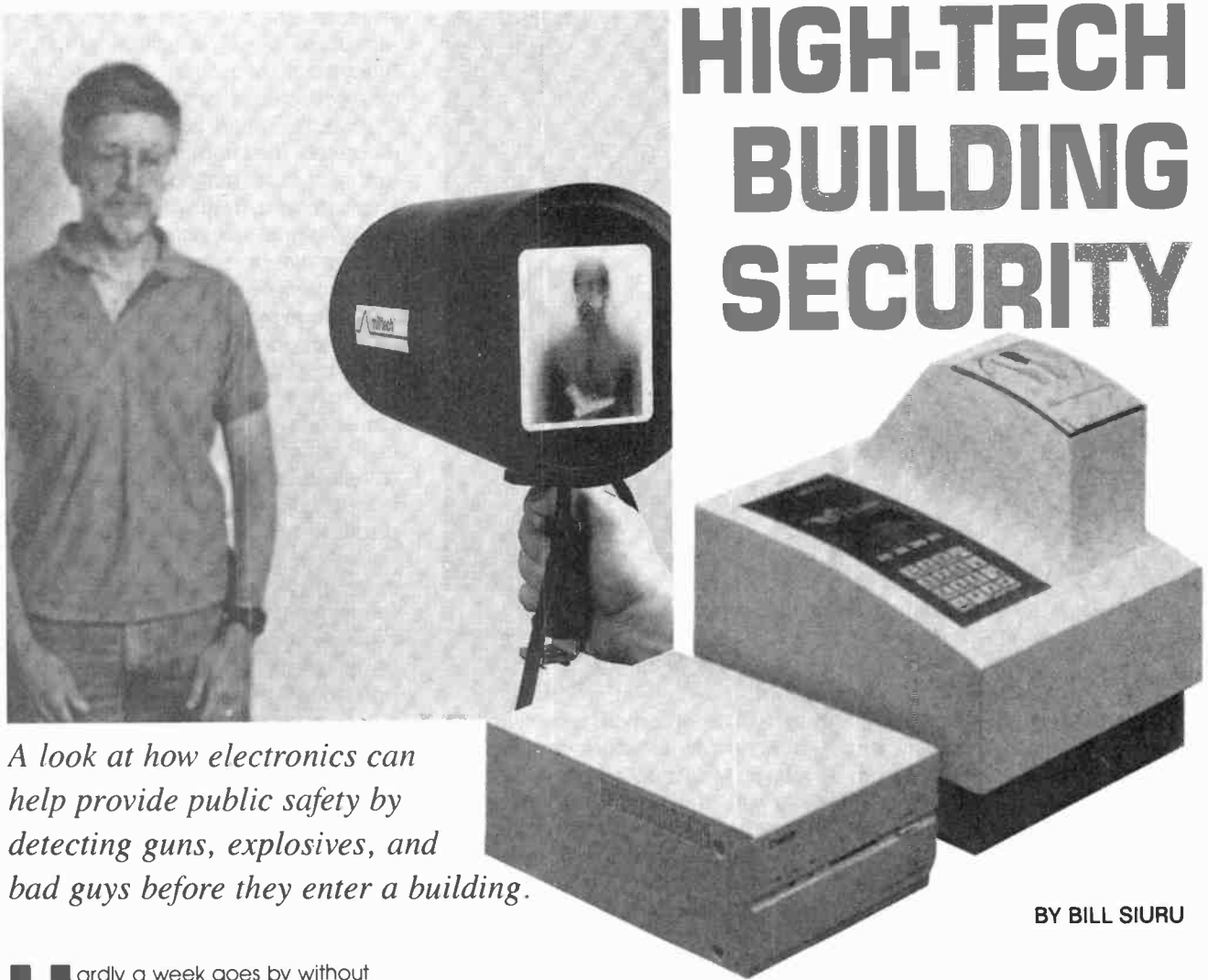

A look at how electronics can help provide public safety by detecting guns, explosives, and bad guys before they enter a building.

BY BILL SIURU

Hardly a week goes by without someone entering a courthouse, police station, post office, school, or other public building armed with a weapon and evil intentions. Less frequent, though even more dangerous, are threats of bombings like those that occurred in Oklahoma City, at the World Trade Center in New York City, and at the 1996 Olympics in Atlanta.

Many government facilities, especially courthouses, have metal detectors to screen individuals for weapons as they enter. Most of these detectors use active electromagnetic (EM) induction techniques to sense metal objects. While they detect the presence of metal, they provide no information on the massiveness of metal objects or their location on a person. Therefore, these detectors cannot discriminate between a concealed weapon, an intricate bomb, and a pocketful of coins. Many false alarms are generated and each event has to be resolved by attendants. These searches make the total detection process very labor intensive and quite costly. Also, there is the loss of time and annoyance suffered by honest people who have to wait on lines.

The U.S. Department of Justice is responding to the growing terrorist threat with its two-million dollar plus "Concealed Weapons Detection Initiative." The Millitech Corporation, Raytheon Company, and Idaho National Engineering Laboratory were commissioned to develop three different technologies for detecting and identifying concealed weapons.

Passive Imaging. Millitech is using millimeter-wave, passive-imaging technology. All objects naturally emit a broad spectrum of electromagnetic radiation. The human body is an especially good emitter at millimeter wavelengths, whereas metal objects are very poor emitters. The emission properties of plastics, ceramics, plastic explosives, and powdered drugs lie between metals and flesh.

The technique can theoretically detect not only metal guns and knives, but also plastic explosives, ceramic knives, powdered or liquid drugs in vials or plastic bags, tape recorders, explosive detonators and other contraband that is easy to conceal on a person. These harmful items can be found even when concealed under multiple layers of clothing (see Fig. 1). However, while passive-imaging detection can detect powders, solids, and liquids, it cannot determine their chemical composition.

Passive-imaging detection is a promising candidate since reasonably sized sensors can provide adequate resolution, and because of the high transparency of virtually all clothing in the millimeter wave

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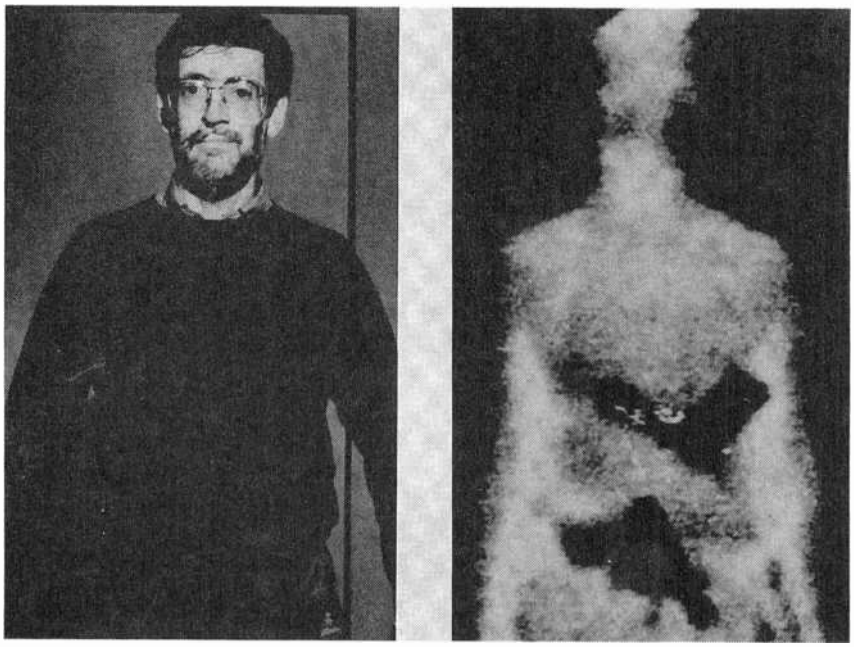

Fig. 1. The image on the left is transformed by passive magnetic-field sampling technology into the transparent view on the right. You can see the two hidden weapons as dark silhouettes in his chest area.

lengths, and the extraordinarily high emissivity of human flesh compared to the vast majority of other materials. While the passive-imaging devices literally see through clothing, the display need not reveal intimate anatomical details. Additionally, to ensure individual privacy and protection from unreasonable search implications, actual images of people being observed need only be displayed if a suspicious item is detected by an automatic image analyzer. Most people could be cleared without operator intervention or without any image being displayed.

The passive-imaging detection system could be used with another sensor, like a walk-through metal detector. Then if a suspicious item sets off the metal-detector alarm, passive-imaging detection could be used for more detailed scrutiny.

The passive-imaging technique relies solely on existing natural emissions from objects. Thus the person under inspection, system operator, or others in the vicinity of imaging system are not subjected to any man-made electromagnetic fields or other radiation sources. Passive imaging eliminates health and safety concerns that are associated with x-ray or other types of active electromagnetic sensors.

Passive imaging is quite adaptable, so a variety of camera systems can be designed for different applications. Currently, a proof-of-concept camera with a 300mm aperture and a monitoring console for fixed entrance-way surveillance is being developed by Millitech to demonstrate the technology. Also being considered are a hand-held camera with a video screen; a totally portable, battery-powered camera; and a stand-off camera system that can be used from a police car.

A great feature of portable detectors is that they allow for remote "frisking." Police officers could use the system when they don't want to heighten tensions by direct physical contact with a suspect. They could remotely examine a suspicious person for concealed weapons as he or she leaves a vehicle. Officers could also perform a remote "pat-down" without the fear of being pricked by a contaminated hypodermic needle.

Low-Frequency EM. Raytheon's concealed-weapons detection system uses low-frequency electromagnetic radiation. While EM-based, the Raytheon system does not require people to walk through a portal equipped with the EM sensor. Therefore, the hardware can be installed unobtrusively so people would not be aware that they are under surveillance. The subject is illuminated with a low-intensity, electromagnetic "Heaviside" pulse. Then the re-radiated (reflected) energy from any metal objects carried by the person is measured. The intensity and the time decay of this radiation can then be characterized. Resulting re-radiated energy "signatures" can be identified, for example, as a gun or non-threatening metal objects.

Raytheon plans to demonstrate the feasibility for discreet concealed-weapons detection. Raytheon will determine the occurrence of such parameters as probability of detection and false-alarm rate. The evaluation of these parameters will establish that the technology can provide sufficient discrimination to meet "probable cause" requirements for a subsequent physical search for weapons. The system is ideal for both screening people at large gatherings and for use in small buildings like stores and banks. Raytheon also plans to show that technology can be used for portable and "standoff" weapon-detection devices.

Magnetic Gradiometers. The Idaho National Engineering Laboratory (INEL) is using its extensive experience with magnetic gradiometers in its weapons-detection system. Extremely sensitive magnetometers can passively sample the earth's magnetic field to detect and measure local aberrations in the magnetic field produced by ferromagnetic objects. For instance, INEL's Rapid Geophysical Surveyor (RGS) technology uses fluxgate gradiometers to locate buried ferromagnetic wastes and buried structures like underground storage tanks. Likewise small aberrations produced by metal guns and knives can be sensed by extremely sensitive, commercially available magnetometers.

Compared to EM detection now used, which is generally sensitive to the size of the object, magnetic-based sensing tends to be sensitive to the mass of the object. Thus magnetic sensing can detect and locate heavy, compact objects such as handguns. The technique requires "target recognition software," which includes simple algorithms to compare actual magnetometer measurements against a catalog of electronic sig-

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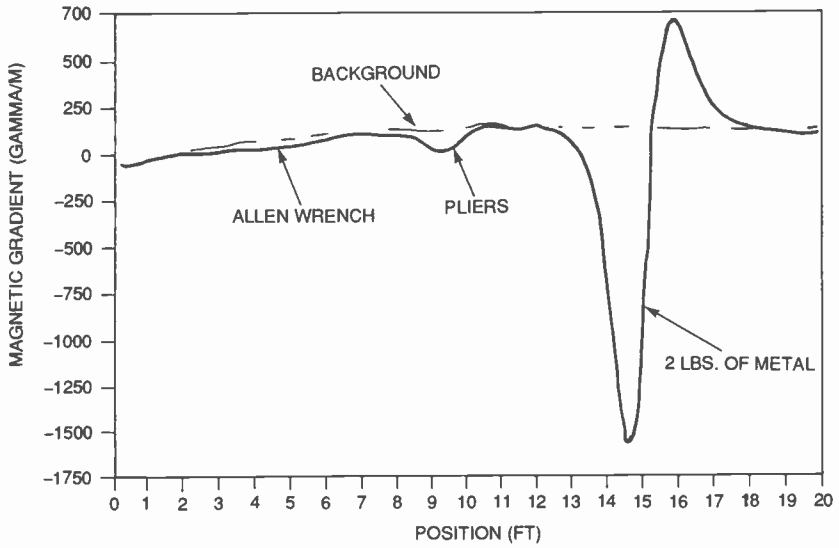

Fig. 2. Extremely sensitive magnetometers can distinguish between various size and mass. Here's a charted magnetic gradient from a sensor that was exposed to a small, stainless-steel allen hex wrench; a heavy pair of carbon-steel pliers; and two pounds of carbon steel used to simulate the size and mass of a large handgun. They were all hidden on a person.

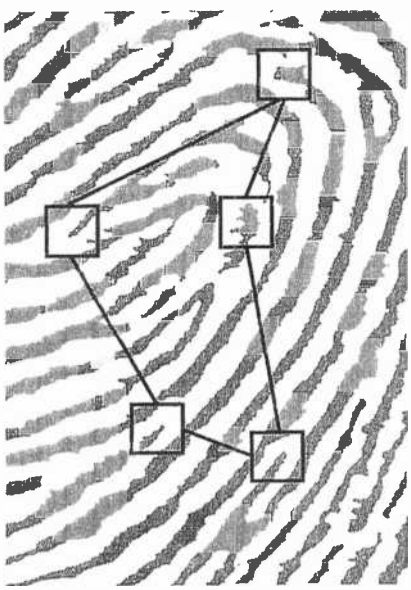

Fig. 3. With digital technology, a number of points where two fingerprint ridges meet are digitized and then analyzed based on factors such as ridge crossings, and distance and direction from each other.

natures or magnetic profiles of known objects. An important part of INEL's effort is developing these signatures for weapons as well as items such as keys, change, etc. In very rare situations, weapons made from aluminum, copper or ceramics would escape detection.

Typically, a series of magnetic gradiometers would be incorporated into a magnetic weapons-detection scanner that looks much like the EM scanners now used in courthouses and airports. Or the system could be more inconspicuous by installing it in a doorway or hallway. Measurements from all the sensors provide a top-to-bottom magnetic profile of a person that could be displayed on a computer screen (see Fig. 2). Because false alarms are greatly reduced, scanners located at all entrances to a courthouse could be monitored by a single operator to reduce personnel costs.

Detecting Explosives. A simple method to detect explosives has eluded scientists for over thirty years. Vapor detection of explosives is difficult because of the explosive's extremely low vapor pressures and bulk detection is not sensitive to trace amounts of explosives. Also, vapor detection typically requires large, expensive instruments. The dramatic increase in car-, human-, and letter-bomb incidents involving both terrorists and deranged individuals demands real-time, low-cost, portable detection equipment. This equipment must be simple to use, very accurate and sensitive to *micro-tiny* amounts of explosives.

Scientists at the Los Alamos National Laboratory have developed a new technique for detecting explosives that could meet these requirements. The technique relies on two properties of explosives: their "stickiness" and their unique burn traits. While only demonstrated in prototype apparatus so far, the technique could be incorporated into portable devices for screening packages, mail, luggage, vehicles, or people for explosive residues. The most logical of them seems to be a vacuum cleaner-like device to pick up minute samples.

Because of the explosive's stickiness, surfaces contacting explosives during storage, handling, or device fabrication become contaminated with explosive residues. The presence of explosives remains on human hands even after several washings. Also, surfaces are contaminated through contact with explosive ingredients. For instance, individuals were tied directly to the World Trade Center bombing through the large amount of ammonium nitrate (AN) residue found on rental-car documents. They handled the AN and redeposited traces on to paper. Reportedly, a suspect in the Oklahoma City bombing had significant amounts of explosives PETN (pentaery thritol tetranitrate) and AN residues on his clothes and inside his vehicle.

There are two characteristics that result in significantly different burn rates for explosive and non-explosive materials. Because of their high oxygen content resulting from a pre-mix of fuel and oxidant, and simple, rapid-combustion kinetics, explosives burn very rapidly. In contrast, most common non-explosive materials require atmospheric oxygen for combustion and/or have complex combustion kinetics so they burn more slowly. Burning an explosive results in a high-intensity, short-duration emission. For non-explosives, the emission is a low-intensity, low-duration burn. Some explosives may emit a characteristic emission spectrum that may be used for identification.

To demonstrate a technique, explosive residue was collected and burned in a light-tight enclosure. The light flash from the tiny burning specks of explosive produced unique optical signatures that were detected with a photomultiplier tube and recorded on an oscilloscope for analysis. Numerous substances were tested: gun powder, pyrotechnic powder, match heads, paper, sugar, engine oil, hair, and dust. In the analysis, the ratio of

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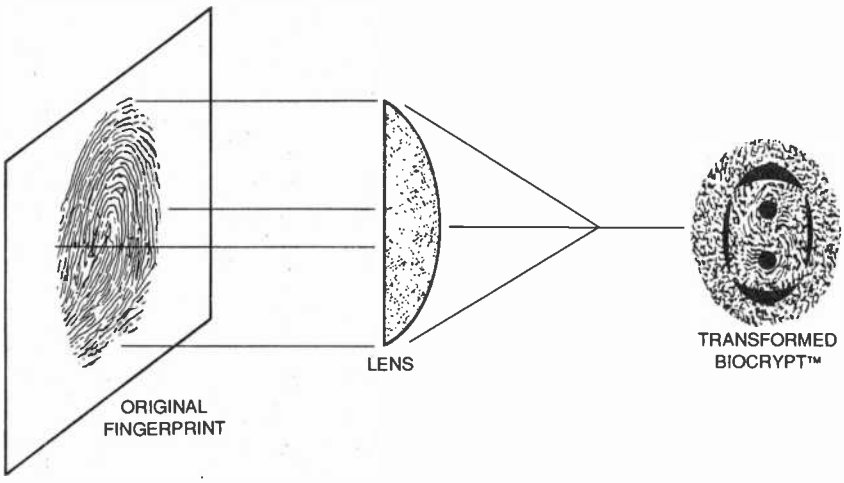

Fig. 4. The only way to match an individual with a Biocrypt is to turn his or her fingerprint into a Biocrypt and compare the two.

the emission brightness to the time duration was nearly six orders greater for gunpowder than non-explosive materials, indicating a potential identification parameter for a quantitative evaluation of the emissions. Sugar, hair, some paper samples, and a majority of dust particles did not produce any visible emissions. These results indicate that gunpowder, and possible other explosives, can be uniquely detected and differentiated from non-explosive material due to their rapid, high-intensity burn traits.

Fingerprints. Because they provide virtually absolute positive identification, and are impossible to forge, fingerprints are the key technique for biometric verification systems. Biometric verification, forecasted to become a multi-billion business by the end of the decade, is already used for controlling access into public buildings and prisons, and across national borders. The technique is even used to ensure the right person picks up the right child at day-care centers.

Mytec Technologies, Inc. has developed a fingerprint-verification system that overcomes limitations found with most other systems, while assuring absolute privacy. Its Zebra Recognition system uses optical computing versus digital processing employed in other fingerprint-verification systems.

In digital-based techniques, comparisons for verification are based on a selected number of points where two fingerprint ridges meet (see Fig. 3). Those points are digitized and analyzed on the basis of characteristics such as ridge crossings, and distance and direction from each other. The problem is in choosing the same points every time the fingerprint is read for verification. Therefore, the technique can be inaccurate or refuse verification if there are dirt particles, scratches, or cuts on the fingerprint.

In contrast, with the Zebra optical approach, the entire fingerprint is used for verification so there is no problem if a few points of the fingerprint are destroyed by a cut or covered with dirt. Compared to digital processing, which takes a finite amount of time, optical computing processes fingerprint information at the speed of light. That means verification is completed in a fraction of a second.

Another important feature of Mytec's system is the Biocrypt, short for "biometric encryption," process that assures absolute privacy. This overcomes the public's fear that fingerprints of ordinary citizens might be mixed up with those of criminals or allow the government to amass central files on individuals.

With Mytec's proprietary process, each individual fingerprint is transformed into a Biocrypt (see Fig. 4). This Biocrypt is stored in the system—not a digital record, image, or template of the actual fingerprint. In the Biocrypt there is no visual resemblance to the original fingerprint. Instead, the Biocrypt is a unique, random-appearing pattern that cannot be retrieved as an original fingerprint or identified as belonging to a particular individual.

Biometric encryption is similar to the encryption technology used in secure-data transmissions and thus it's extremely difficult, if not impossible, to decipher a stored Biocrypt or restore it to an image of the original print. The only way the Biocrypt can be used is in comparison with another Biocrypt made from a live fingerprint of a person. If the Biocrypts match, the same person made both Biocrypts.

When used as an access-verification system, fingerprints of authorized users are "biocrypted" and stored in the system's memory. When access is required by someone, he or she places a finger over the lens on the Zebra True Recognition terminal. The Biocrypts are compared and access is either permitted or denied depending upon the match.

One local terminal can store thousands of Biocrypts or the terminal can be interfaced with a PC or another computer to store an unlimited number of Biocrypts. The Zebra True Recognition system is a stand-alone unit that does not require additional hardware, software or separate power supply.

The system is especially valuable when used with a "smart" card for identification for welfare services, medical records, or financial transactions. An optical card can hold a person's complete medical records without difficulty. For instance, the Cannon Optical Card can hold three megabytes of information. In this

(Continued on page 46)

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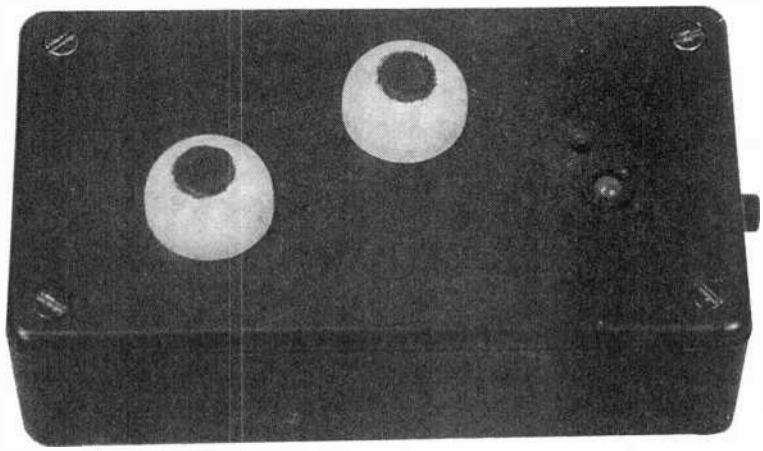
BUILD THE COLOR-BLIND ILLUSION



Here's a neat little electronic magic trick that will fool just about anyone.

BY RICK DUKER

People enjoy magic. You might have noticed the large audiences that illusionists such as David Copperfield attract; that only proves that fact. But have you ever considered performing a magic trick yourself?

If you're an electronics hobbyist (as most of our readers are), you might want to consider using your abilities to create an electronic illusion of your own. The Color-Blind Illusion described in this article is just such a project. The portable unit lets you perform a trick at a moment's notice, because you can carry it with you wherever you go.

The Trick. The Color-Blind Illusion is a modern version of the famous three-shell game and the three-card Monte trick. Many unsuspecting people in the past were swindled out of their money because they thought they could outsmart the swindler. We hope you have fun fooling, but not swindling, your friends with this electronic version of the trick.

Here's how the trick is performed. You display a black box with three unlit lights (LEDs) on top. Then you cover the lights with three wooden covers or shells so that the LEDs are hidden from view. Switching on the unit, you explain that under the first shell is a green light, and that under the other two shells are red lights. You have the spectator lift each shell in turn to confirm this fact. The audience is then asked to remember where the green light is.

Using a ball-point pen as a pointer you instruct the spectator to uncover the green light. Much to their surprise the light is now red and from this point on the green light continues to be elusive. Only you know under which shell the green light is. Finally, you explain to your audience that they could all be color blind or that maybe there was never a green light. Your friends lift away all three covers to reveal that all three lights are red, and now they believe the green light was an optical illusion.

Circuit Description. The circuit for the Illusion is shown in Fig. 1. At the heart of the circuit is IC1, a type 4093 quad NAND Schmitt-trigger inverter. Triggers IC1-a, IC1-b, and IC1-d along with R2–R7 and C4–C6 form debounce networks for magnetic switches S1, S2, and S3.

In its normal state, each magnetic switch is an open circuit that causes each NAND gate Schmitt-trigger inverter to be at a logic high. With a magnet held close to a switch, it closes and the inverters switch to a logic low. As the magnet is moved away from the switch, the inverters toggle high, clocking (triggering to the next steady-state condition) sections of IC2 and IC3, which are dual, D-type, flip-flop circuits. The three flip-flop circuits are IC2-a, IC2-b, and IC3-a; IC3-b is not used. Section IC1-c, along with R1, C3, and D1, is used as a set/reset network for the flip-flop circuits.

Capacitors C1 and C2 filter the power supply. Switch S4 is a slide-type, on/off switch. When power is first applied to the circuit, there is a short delay before the output of IC1-c goes low to set the D-type flip flops. The delay ensures that the Q outputs of each flip-flop in IC2 and IC3 begin at a logic high.

The light-emitting diodes used in the circuit are dual color—green and red. When the unit is first turned on, LED2 and LED3 are red, and LED1 glows green. Resistors R8–R10 limit the LED's currents. Each time a flip flop is clocked by the opening of a magnetic switch, the Q and $\overline{Q}$ outputs reverse logic states. That reverses the polarity of the dual color light-emitting diode, changing its color from green to red or from red to green. The circuit is wired so that S1 toggles LED2, S2 toggles LED3, and S3 toggles LED1.

Construction. The author's prototype for the Illusion was built on a printed-circuit board. If you'd like to do the same, you can either use the

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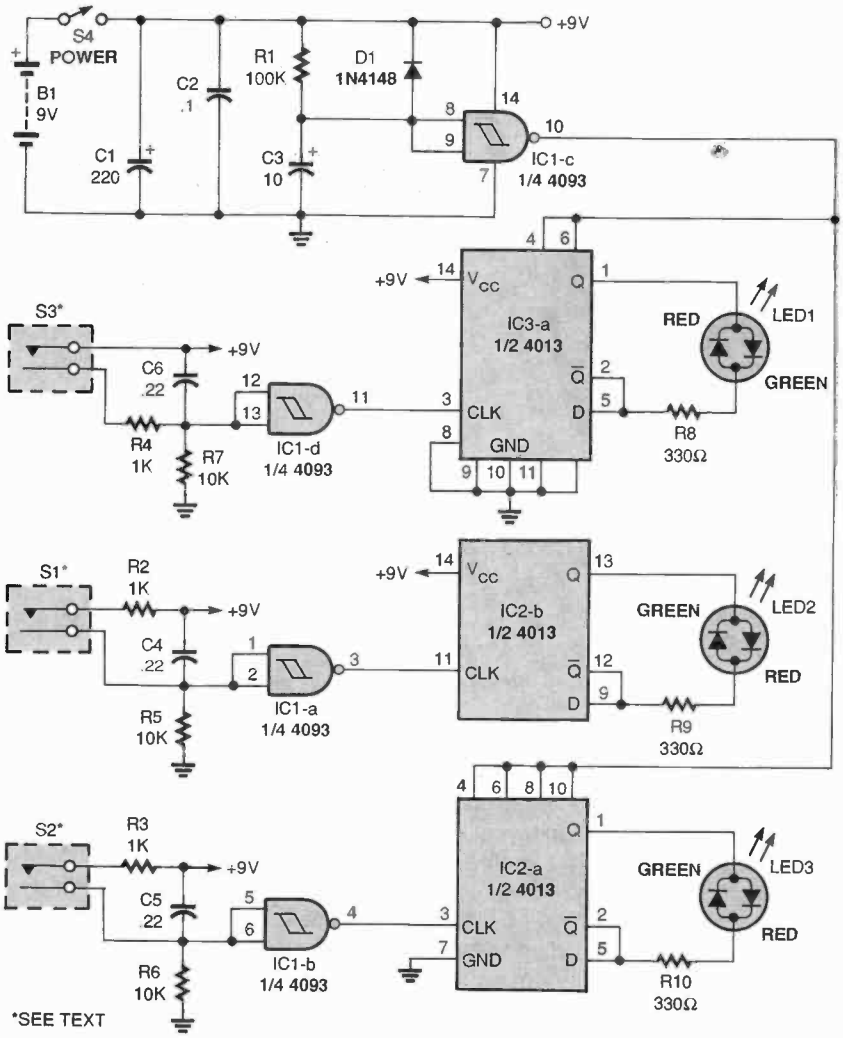

Fig. 1. Here's the schematic for the Color-Blind Illusion. The colors of the LEDs are changed by three magnetic switches (S1–S3) and three flip-flop sections of IC2 and IC3.

foil pattern shown in Fig. 2 to etch your own, or you can order a board from the source mentioned in the Parts List.

If you're building the unit on a PC board, use the parts-placement diagram shown in Fig. 3 as a guide. Begin assembly by mounting sockets for the ICs, noting correct orientation. Install all capacitors, making sure that C1 and C3 are properly oriented. Then solder D1 and all resistors vertically on the board.

Attach wire leads to switch S4 and connect the ends to the PC board. Trim the battery-clip leads to a 2-inch length, then connect them to the PC board. Solder 3-inch leads to each LED lead, close to the base. Trim the excess leads and insulate the solder joint. Next, attach each of these leads to the PC board, noting correct polarity (the R's on the parts-placement indicate which side of the tri-color LED is

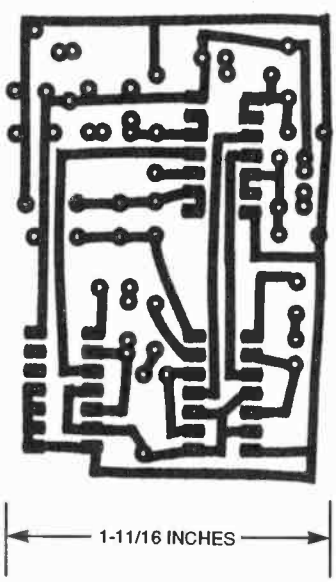

Fig. 2. If you'd like to etch your own PC board for the Illusion, use this full-size template.

PARTS LIST FOR THE COLOR-BLIND ILLUSION

SEMICONDUCTORS

IC1—4093 quad NAND Schmitt-trigger, integrated circuit
IC2, IC3—4013 dual flip-flop, integrated circuit
D1—1N4148 switching silicon diode
LED1–LED3—Tri-color light-emitting diode, red and green elements

RESISTORS

(All resistors are ¼-watt, 5% units.)
R1—100,000-ohm
R2–R4—1000-ohm
R5–R7—10,000-ohm
R8–R10—330-ohm

CAPACITORS

C1—220-µF, 16-WVDC, electrolytic
C2—0.1-µF, ceramic-disc
C3—10-µF, 16-WVDC, electrolytic
C4–C6—0.22-µF, ceramic-disc

ADDITIONAL PARTS AND MATERIALS

S1–S3—SPST miniature magnetic switch (normally open)
S4—SPST switch
B1—9-volt alkaline battery
Printed-circuit materials, plastic enclosure (4- × 2½- × 1-inch, or similar), ¼-inch-diameter cylindrical magnet, ball-point pen (Bic Round Stic, or similar), LED holders (3), foam tape, wooden half-sphere covers (see text), wire, solder, hardware, etc.

Note: The following are available from Quantum Research (17919 77 Ave., Edmonton, Alberta, Canada T5T 2S1): etched and drilled PC board—$10.00 plus $3.00 shipping and handling; kit of parts and PC board (no battery)—$44.50 plus $5.00 shipping and handling; and assembled and tested unit–$59.50 plus $6.00 shipping and handling S & H. All prices quoted in U.S. funds.

red). The lead on the flat end of the LED lens is the anode of the green LED and the cathode of the red LED. Connect that lead of LED1 to pin 1 of IC3. The same leads of LED2 and LED3 connect to pins 1 and 13 of IC. The other leads are connected as shown to R8, R9, and R10.

Clip the leads of the magnetic switches to approximately 2-inches long and strip the ends. Attach each pair of leads to the board; the switches are unpolarized.

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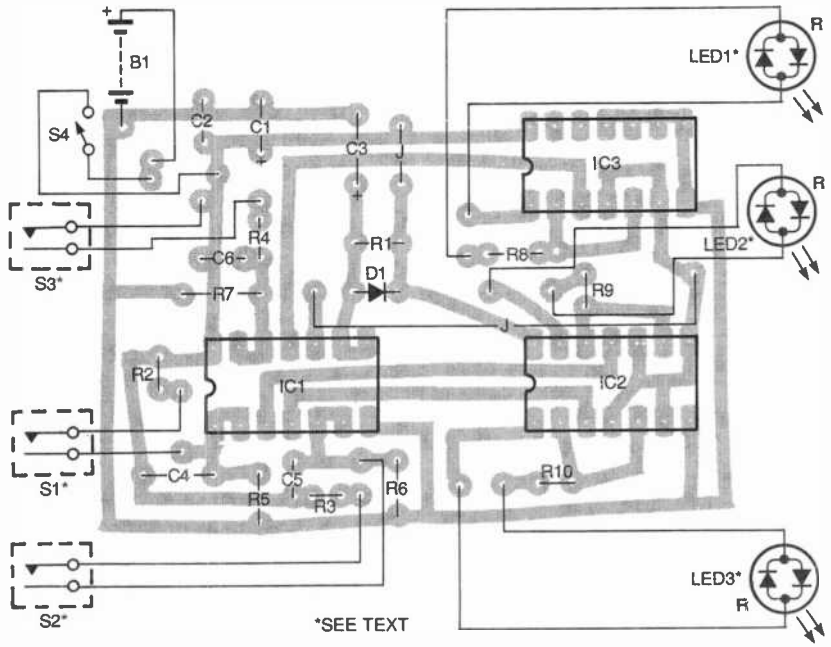

Fig. 3. This parts-placement diagram should make assembling the board simple. Note the "R's" that indicate which sides of LED1–LED3 are red.

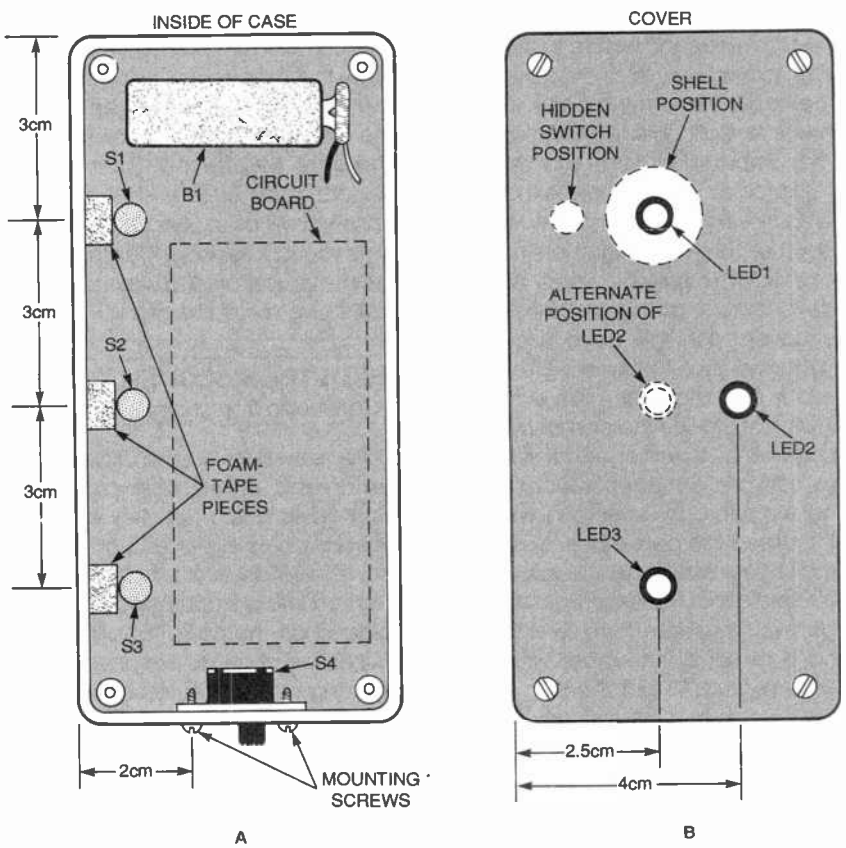

Fig. 4. The inside (A) and cover (B) views of the case shown here indicate where to mount all the off-board components.

Finally, insert the three ICs into their sockets, noting proper orientation. The board is now ready to be mounted.

Prepare an appropriate plastic enclosure by drilling holes for switch S4 at one end (see Fig. 4A). To prepare the case cover, drill three ¼-inch holes to accommodate LED holders (see Fig. 4B). Install S4 from the inside and allow the slider to protrude through the connecting holes. You may need to enlarge this opening slightly for the slider to move freely. Secure the switch with two mounting screws.

Position the PC board in the enclosure. Cut three 1-inch pieces of foam tape and stick them to the insides of the case where the magnetic switches will be positioned (see Fig. 4A). Remove the front backing of the tape and secure each switch to its piece of tape. The tops of the switches should protrude slightly from the top level of the case to bring them as close to the cover as possible.

Install LED1–LED3 using mounting grommets. Install a fresh 9-volt alkaline battery into the clip holder. Put the cover in place and fasten it with the four corner screws.

Now you have to build the three wood covers and the magic pen. The covers in the author's prototype are wooden half spheres with a hollow inside to allow space for the LED. Wooden units like that give the project some old-fashioned charm; however, any hollow object of suitable size can be used.

The magnet that controls the switches in the unit is concealed in the end of a ball-point pen that is used as a pointer. Here's how to make the "gimmicked" pen: Obtain a ¼-inch-diameter cylindrical magnet. That should fit in many pens, including Bic "Round Stic" pens, one of which was used in the prototype. Make sure the pen you use has an inside diameter of at least ¼-inch diameter.

Remove the ball-point tube assembly and discard it. Apply some adhesive to the side of the magnet, then insert it into the pen body until it is flush with the opening. Paint the exposed end of the magnet the same color as the opposite end of the pen body. Now push the pen cap onto the end opposite the magnet. The pen now appears as an ordinary pen except it is capped in reverse. This fact should go unnoticed.

Checkout. To test the device for correct operation, turn it on and note LED1 is green, while LED2 and LED3 are red. Place the end of the pen with the magnet near the first magnetic switch and then remove it. LED2 should change color to green. Now bring the pen near the second switch and then

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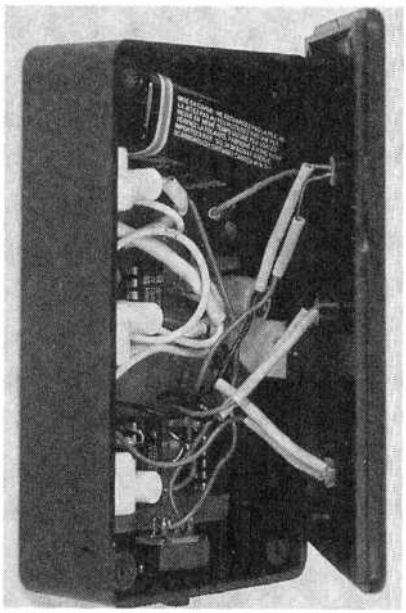
remove it. This time LED3 should change color to green. Repeat this move with switch 3 and note LED1 changes to red. If you now repeat the entire above procedure, all the light-emitting diodes should return to their original colors.

With all the shells in place, resting the pen on the enclosure over the position of a magnetic switch is how you point to the specific LED cover. As you remove the pen to point at the next cover, the LED color will change. Practice this move until you can do it smoothly and without hesitation. When required to point to a cover without changing the LED color, keep the pen higher above the enclosure or lightly tap the cover itself.

Presentation. To present the Color-Blind Illusion to spectators, place the unit in front of you and position the shells. Switch on the power and casually remove the pen from your pocket. Here is a basic routine that you should master before developing your own routines. Practice the routine until it becomes second nature to do it. Only then are you ready to show someone the illusion. Performing a trick well and never revealing its secret are the two most important rules in magic.



Here's the inside of the Color-Blind Illusion. Note the placement of the magnetic switches.

Explain to your audience that there are three lights, one under each shell. Say that "Two of the lights are red, and one light is green." Point at each cover in turn, asking the spectator to uncover each light as you do so. This will reveal that light one is green, light two is red and light three is red. It is important to use the pen as a pointer consistently whether or not you use it to activate a hidden switch. You do not want to draw special attention to the use of the pen, otherwise it could make your audience suspicious.

Explain that this is a simple memory game; say something like "All you have to do is remember where the green light is." Point the pen behind shell 3 (which changes the color of light 1) and ask the spectator if the green light was there. They will answer no. Point behind shell 2 (which changes the color of light 3) and ask the spectator if the green light was there. They will again answer no.

Then ask the spectator to uncover light 1. They will be amazed to see that light 1 is now red instead of green. Instruct the spectator to uncover light 3. When that is done it will reveal that this is the new position of the green light. Say, "It is easy to mix up light 1 and light 3. Don't worry, I'm sure you won't let that happen again."

Then go on to say, "How about we mix things up a bit." Have the spectator exchange shell 3 with shell 2. Point to each shell but do not do a color change. Now point behind shell 2 (this changes the color of light 3 to red) and say to the spectator(s), "Now please exchange shell 2 with shell 1." Point to shell 1 but do not effect a color change. After this exchange light 1 is red, light 2 is red, and light 3 is red as well. At this point ask the spectator, "Have you been following the green light? I'm sure you know where it is this time. Can you please point to the green light's position?"

Because all the lights are red, the spectator cannot win. Allow the spectator to lift the shell where he or she believes the green light to be. Say, "Sorry you missed the green light again. My guess is that the green light is here." Indicate the shell of your choice, then immediately point behind the preceding shell, changing the light you chose to green. Say to the spectator, "Please lift this last shell." The light will be red. Then ask the spectator to lift the shell that you chose. It will of course be green.

As your audience will learn, the magician or illusionist always wins. Just don't give away the secret! ■

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(Continued from page 42)

compressed form, both Old and New Testaments of the Bible plus all the comedies and tragedies of Shakespeare could be stored on a single card. The individual's fingerprint transformed into a Biocrypt would also be placed on the card. "Enrollment" requires less than 30 seconds to read the fingerprint and store the necessary information on a card.

With the fingerprint and information on the card and not stored anywhere else, the only way anyone can access the information is if the individual is there with his or her fingerprint. The user's fingerprint is the only "key" that can open the gateway to the information stored on the card. People can carry out their transactions in a "blind manner," without any way to electronically trace a person's activities. That ensures total privacy. ■

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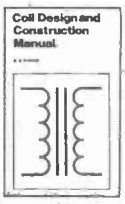

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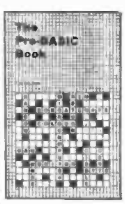

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COMPUTER BITS

Hypertext Wrap-Up

BY JEFF HOLTZMAN

We've been talking for several months now about hypertext as implemented by the Windows Help system and by the Web. I want to wrap up that discussion, and talk about some hot new products.

WINHELP IS DEAD

Most engineers, including software engineers, hate few things worse than doing documentation. One thing Windows programmers hate worse than doing documentation is doing help files. As we have discussed here in bloody detail, creating help files is a complex activity akin to programming in hexadecimal machine language.

The good news is that WinHelp is dead, or at least dying. Taking its place is HTML and browser technology. It won't happen right away, and many software packages will probably continue to support WinHelp for the next year or two. But Microsoft has publicly stated that it is evolving its whole user-interface paradigm to browser technology, and that the help compiler and related tools will receive no more updates. In addition, the help systems of all major MS apps are moving to HTML.

This is all good news because it means that instead of the quirky, non-visual tools that have traditionally dominated the WinHelp market, we'll now see more tools like Microsoft's own FrontPage. Big market (*i.e.*, the Web) attracts big vendors with lots of creativity and R&D budget to push the tool envelope. We benefit. Enough said.

QUICKVIEW PLUS

If you use Windows 95, you've probably seen QuickView, a mini-app you can pop up from the Explorer to quickly view the contents of disk files. The problem with QuickView is that it's not very quick, and it offers only limited views of your files. However, the company that wrote QuickView, Chicago-based Inso Corporation, has introduced QuickView Plus, which greatly enhances the Win95 version. QVP can view documents (including HTML), spreadsheets, databases, graphics, presentations, compressed files (ZIP etc.), and executable files. Coverage is very good, but there are some lapses. For example, the program can display Access 2 databases, but not the more recent Access 7 format. QVP can also integrate itself with several Win95 shells, including Norton Navigator and MicroHelp's PowerDesk. In fact, I consider PowerDesk (with its enhanced Explorer) and QVP my only indispensable Win95 utilities. Highly recommended.

BURNING CDs

Nowhere is the rapid evolution of technology in the computer industry more apparent than with optical storage. Just two or three years ago, CD-ROM recorders (CD-R) cost ten to twenty times what they do now. It's not hard to find units for under $800, and there are predictions that there will be $500 units soon. At least one vendor (Gateway 2000) is already selling a machine that includes a CD-R as part of its base configuration.

One high-quality unit, the Deltis CD-R2, is manufactured by Olympus Image Systems, Inc. The CD-R2 is a double-speed device with a 1-MB buffer. It can record in most CD formats, including CD-ROM, audio CD, Photo CD, CD-I, and more. The review unit came with a 16-bit ISA Future Domain SCSI controller, which I had no trouble integrating into my test system, even though that system already contained an Adaptec SCSI controller. In fact, setting up the hardware was completely uneventful. However, the documentation is a bit rag-tag, with several different manuals for the various hardware and software components, and little to tie it all together.

A copy of CD Mastering software called Gear comes with the unit. It provides a compact user interface for specifying what to record and how to record it. While some packages emphasize ease of use, Gear's strength is the variety of formats and configurations it supports. In short, Gear plus the CD-R2 can write any standard format: ISO-9660, CD-ROM Mixed Mode, CD XA, CD Plus, Mac Hybrid and HFS, CD Digital Audio, and MMCD. It also supports CD-I, CDTV, Photo CD, and just about any other predefined or custom format in existence in the following ways: single-session,

Deltis CD-2R from Olympus delivers double-speed CD-R burning at an attractive price.

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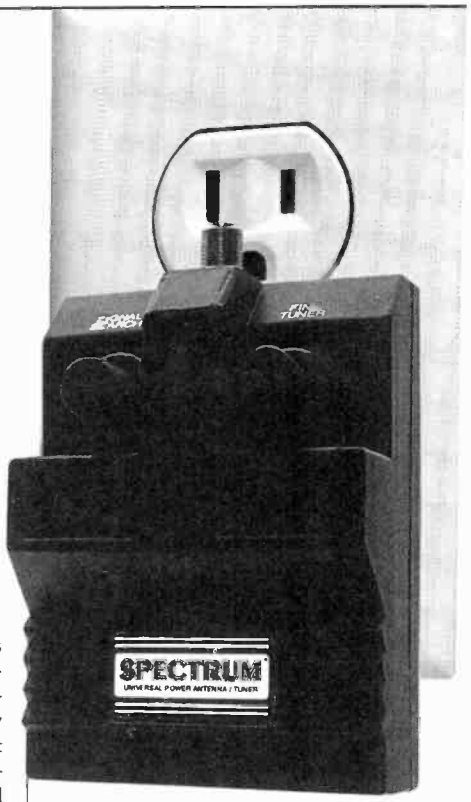
Fifteen years of microelectronic research makes conventional antennas a thing of the past!

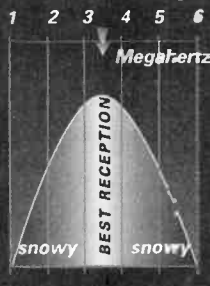
This little box uses your home's electrical wiring to give non-subscribers, cable subscribers and satellite users better TV reception!

by David Evans



Technology corner

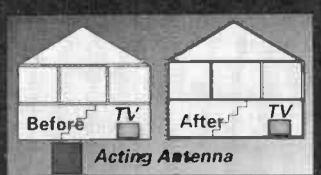
1. Why don't conventional antennas work as well as the Spectrum?



■ When TV signals are tuned at the TV channel's center frequency, optimum tuning has been achieved.

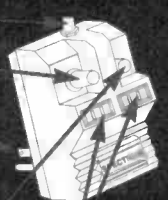
■ Other antennas can't offer center frequency tuning like the Spectrum Antenna can. They only offer such tuning up to the edge of the center frequency. As a result your TV picture remains snowy.

2. How does Spectrum use a home's electrical wiring as an antenna?



Believe it or not, the Spectrum Antenna simply "activates" the giant antenna that already exists in your home. Essentially, it uses all of the wiring throughout your home's walls and ceilings to make an antenna as large as your house for unbelievably clear reception of local broadcasting.

3. Spectrum antenna features



Parallel 75 ohm resistance
For minimum loss of signal

Signal search control
For selecting multiple antenna configurations

Polarized three-prong plug for grounding
For optimum signal grounding to eliminate noise and static

Resonant fine tuner control
For dialing in crisp, clear TV/stereo reception, eliminates ghosting

Dual AC outlets with built-in surge protection
For plugging in additional TVs, stereo equipment guarding against damage and electrical surges

Until recently, the only convenient way to guarantee great TV reception was to have cable installed or place an antenna on top of your TV. But who wants to pay a monthly cable fee just to get clear reception, or have rabbit-ear antennas that just don't work on all stations? Some people just aren't interested in subscribing to cable. Or they may live in an area where they can't get cable and TV-top antennas aren't powerful enough. And what about those people who have cable or satellite systems but still can't get certain local stations in clearly?

Now, thanks to fifteen years of microelectronics research, a new device has been developed that is so advanced, it actually makes conventional antennas a thing of the past. It's called the Spectrum Universal Antenna/Tuner.

Advanced technology. Just imagine watching TV and seeing a picture so clear that you'd almost swear you were there live. Just plug the Spectrum Antenna into a standard AC outlet and plug your TV into the Spectrum. You can remove the unsightly clutter of traditional TV-top devices gathering more dust than television signals. Get ready for great reception. Your TV will suddenly display a sharp, focused picture thanks to its advanced design "Signal Search" and "Fine Tuner" controls.

Uses your home's electrical wiring. The Spectrum Antenna is a highly sophisticated electronic device that connects into a standard wall outlet. The outlet interfaces the Spectrum Antenna with the huge antenna that is your home wiring network. It takes the electrical wiring in your house or apartment and turns it into a multi-tunable, giant TV reception station which will improve your TV's overall tuning capability. The results are incredible. Just think how much power runs through your home's AC wiring system—all that power will be used to receive your local broadcasting signals.

How it works. Broadcast TV signals are sent out from the local broadcast station (ABC, CBS, NBC, etc.). They interface with your home's AC power line system, a huge aerial antenna network of wiring as large as your home itself. When the Spectrum Antenna interfaces with the AC line, the signal is sent to its signal processing circuit. It then processes and separates the signal into 12 of the best antenna configurations. These specially processed signals route themselves into 12 separate circuits. The Spectrum Antenna includes a 12-position rotary tapping switch, the "Signal Switch" control, which gathers twelve of the best antenna configurations.

The "Signal Search" offers varying antenna configurations for the user to select from the best signals of all those being sent. The signal then passes through the Spectrum Antenna's special "Fine Tuner" circuit for producing crisp, clear reception.

Risk-free offer. The Spectrum Universal Antenna/Tuner comes with our exclusive 90-day risk-free home trial and a 90-day manufacturer's warranty. Try it, and if you're not satisfied, return it for a full "No Questions Asked" refund.

Who can use Spectrum?

- ***Cable users-You have cable but you can't get certain local stations in clearly.***
- ***Non-cable users-You don't have cable and want the stations to come in more clearly***
- ***Satellite users-You have a digital satellite system but can't get local stations in clearly***

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multi-session, multi-volume, incremental (packet) write, track-at-once, and disk-at-once.

You can copy tracks from audio CDs and create your own greatest hits disc. You can also build combined audio/data CD-ROMs. By creating a custom image file, you can literally create your own format. Gear also supports batch processing for low-volume production runs, although at $7 to $8 apiece, CD-R blanks are still relatively expensive.

In general, burning a CD-R is more involved than copying files to floppies, because there are precise timing and data-throughput requirements. Basically, once recording starts, it better not stop except when planned. Otherwise, the disc becomes an expensive Frisbee. The combination of the 1-MB buffer and Gear's intelligent buffering scheme allowed me to create discs with no problem under Windows 95 on a relatively slow system (a 60-MHz Pentium VLB with 24 MB of RAM and a 3-GB hard drive).

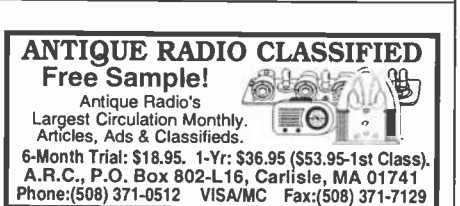
Since I completed my tests, the company has released an updated version, CD-R2x4, which provides a faster CD-R mechanism, a different software package, and which costs $100 less. The mechanism now reads at quad speed, although it still writes at only double speed.

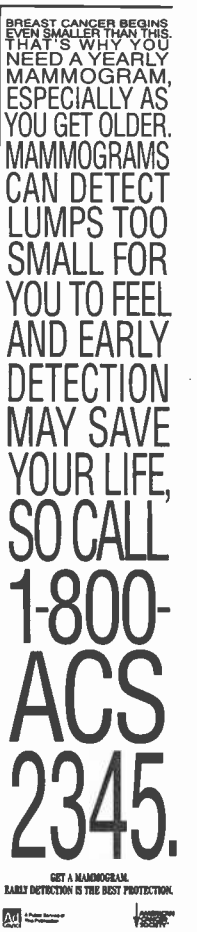
Instead of industrial-strength Gear, the CD-R2x4 includes Corel's CD-Creator, a package renowned for its ease of use. The package also includes a new technology created by Sony, called CD-RFS (CD Recordable File System). CD-RFS takes advantage of the incremental-write capability of the CD-R writer and lets the user write CD-R discs just like magnetic media. Copying files can be as simple as drag-and-drop from the Win95 Explorer, although maximum disk utilization requires a more planned approach.

The only question at this point is what kind of life the CD and CD-R are going to have, with DVD just around the corner. ■

I see. So a computer virus ate your answer to question number three.

CIRCLE 164 ON FREE INFORMATION CARD





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Antique Radio on the Internet

BY MARC ELLIS

As often happens during the summer months (yes, I am writing my December column in midsummer!), I haven't been at my workbench much recently. Yard work and other outside maintenance, radio meets, vacation trips, and other activities claim time that might otherwise be used for delving into antique-radio circuitry.

That's why I didn't get enough done on our current restoration project (a *Knight Star Roamer*, rescued from an ignominious end in a landfill by a friend of mine) to devote a column to it this month. Instead, I'm going to discuss a topic that I've wanted to touch on for some time: antique-radio resources on the Internet. To say that there is a gold mine of information for new and advanced collectors is putting it mildly indeed!

If you have already been on line and started to explore the Internet, you probably won't find much new information here this month. But if you've been thinking of getting in and need to be pushed, cajoled, encouraged, or otherwise motivated to make that fateful connection between your computer and the modular telephone jack in your den, read on!

INTERNET PROVIDERS

Now let me say at the outset that I'm not really billing myself as a computer guru. If you come across something by a **Popular Electronics** computer columnist or other *bona fide* author in this field that contradicts something here, take it seriously! All I'm going to do is share my own very personal experiences with you.

To get started on the Internet, you are going to need a provider (someone who gives you access to the Net through a dial-up number). There are several different types of services available through providers, and a complete discussion of them certainly doesn't belong in this column. But I've had some experience with two of the common "extremes."

One extreme gives you an e-mail address, access to the Internet, and perhaps some basic third-party software. You're then left on your own to log onto the Net facilities that are of interest to you. You'll find providers of this kind operating both on a local and a national level. Prices seem to be coming down all the time, and most offer at least two pricing structures. You can order unlimited (untimed) service for a flat monthly fee. My provider, for instance, charges $30, but recently cut it to $25 for customers willing to pay automatically by credit card. Or you can opt to get a given number of hours (usually 5) for a flat fee per month (usually in the neighborhood of $10). Additional time is metered and charged for at an hourly rate; $2.50–$2.75 per hour is typical.

The other type of provider, usually national, offers an integrated software package that includes proprietary menus for accessing various Internet facilities. Special services unique to the provider—such as on-line news, stock quotations, encyclopedias, and "chat rooms" where you can meet other subscribers to the service—are also offered. America Online (AOL) is the provider I am familiar with, but services such as Prodigy and CompuServe must be similar. AOL does not offer an untimed service rate at this time. Right now the fee is $9.95 a month for five hours, with additional hours costing extra. A new flat rate for a larger number of hours has recently been announced.

The AOL type of service is perhaps more user friendly and is typically used by families. An interesting feature is that different family members can have different e-mail addresses at no extra charge—thus ensuring mutual privacy.

HARDWARE REQUIREMENTS

I use a local provider of the "you're on your own" type, and first got started with a very minimal computer (a 16-MHz 386 SX with 8 MB of memory and a 14.4-Kbps modem). I was (and still am) running Windows 3.1. With that setup, I got reasonably satisfactory results, although access times to various services were a bit slow.

When I opened up an AOL account for a member of my family who need-

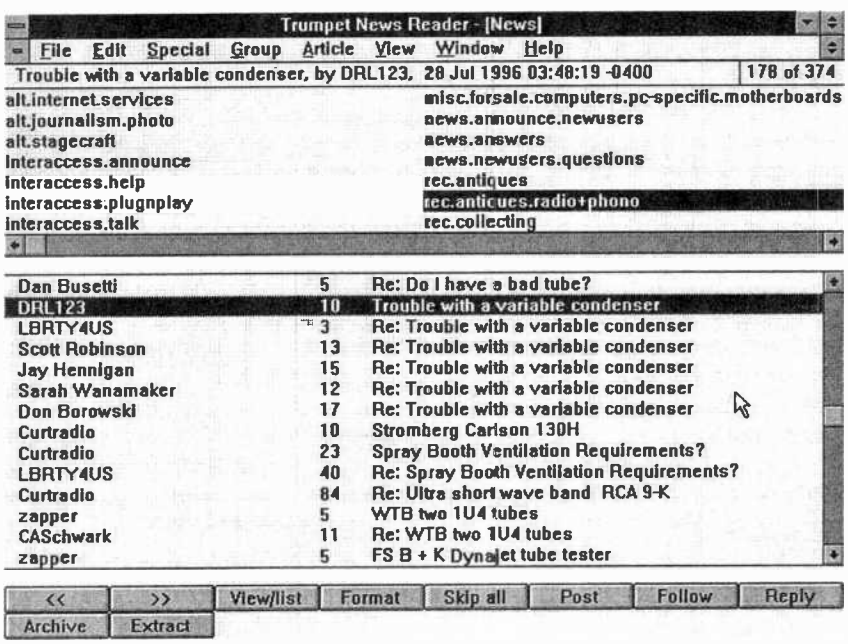

Fig. 1. The main menu for the news reader I'm using at the moment. Groups subscribed to are shown in the top third of the screen, with postings to the "rec.antiques.radio+phono" group listed below.

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ed it, that setup proved to be quite unsatisfactory. The AOL log-on menu took *several minutes* to appear on the screen and, once logged on, access to many of the features required an impossibly long wait. Around that time, I had the opportunity to upgrade the motherboard to a 120-MHz 486 DX. Even though I'm still using my original ISA-bus controller and graphics cards, access speeds are *dramatically* faster and quite reasonable.

Bottom line: If you now have a 386 computer, don't hesitate to try it on the Net. But if you are buying a PC for Internet access, I certainly would recommend that you get nothing less than the fastest 486 DX you can find (with at least 8-MB of memory). 486 PCs are becoming available at closeout prices now that the hardcore folks have changed to Pentium-based PCs. As for modems, don't try to make it with anything less than a 14.4. If you are buying now, spend the extra money and get a 28.8. Prices on these are also coming down all the time.

INTERNET NEWSGROUPS

Okay, so you have Internet access. Now how do you tap into the rich vein of antique-radio lore that I promised? Perhaps the most obvious route is through the newsgroups. Newsgroups are international discussion groups, devoted to specific topics, where people with common interests can exchange ideas. The newsgroups are accessed through a piece of software called a "news reader."

A newsgroup is like a bulletin board: You don't talk "live" on it. Instead, you electronically post your question, comment on someone else's post, or answer someone else's question. To make a post, you simply click on a convenient "post" button. Replying to someone else's post is done similarly, via a "reply" button. Sometimes the questions, comments, answers, and comments on answers go on for weeks, forming what is called a "message thread" devoted to a single topic.

Figure 1 is a screen captured from my news-reader software. Some of the newsgroups that I "subscribe" to are shown in the top third of the screen (above the horizontal scroll bar). Several of them are just administrative question-and-answer groups set up by my provider; others reflect various special interests. The group highlighted by the black bar (rec.antiques.radio+phono) is of interest to us here.

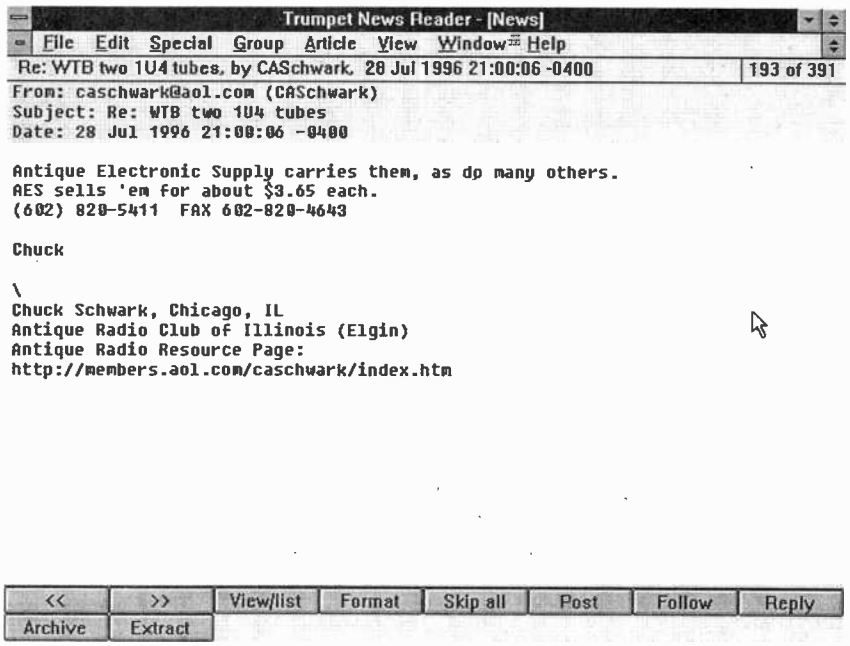

Fig. 2. A typical newsgroup message. This one, whose title appears near the bottom of the postings list shown in Fig. 1, responds to the previous post of a person looking for 1U4 tubes.

This group is one of the most popular of those dealing with antique radio, and the lower two-thirds of the screen shows some of the typical posts to it. Of course, you are seeing just the menu containing the titles of the postings. To read an actual message, you would click the mouse on the title desired—whereupon the title menu would disappear and the message would fill the screen.

Note the message thread starting near the top of the screen. The person identified as DRL123 (highlighted by the black bar) was having trouble with a sticking variable capacitor (I know this because I read the post) and was seeking advice on how to correct it. Below his post are responses from five different people. If I were to log on tomorrow, I might find responses to the responses!

Near the bottom of the tube is a post from "Zapper," who wants to buy a couple of 1U4 tubes. Below that is a response, which happens to be from my friend Chuck Schwark, suggesting a source. I'm showing the text of Chuck's response in Fig. 2 so that you can see what an actual newsgroup message looks like.

Note that at the very bottom of his message, Chuck has the address of his "Antique Radio Resource Page." That is Chuck's personal "home page" on the World-Wide Web. I had intended to cover the Web in this column, but I'm fast running out of space. It looks as if this Internet orientation is going to need a "Part 2!"

Getting back to the newsgroups for a moment, you are probably wondering how to discover and identify groups that you'd like to join (or "subscribe to," as it is called). Well, I'd certainly like to suggest that you subscribe to rec.antiques.radio+phono right away, and begin reading posts there. Once you begin monitoring those posts, you will get leads to other groups that might interest you.

However, there is another, more direct, way to look for newsgroups. Most news readers have a "search" function that allows you to look for newsgroup names that contain certain key words or strings (for example, "antiques," "collectibles," "antique radios," etc.). After you activate such a search, all the names that match the list of newsgroups carried by your provider will come up on your screen. Just click on the ones you want to subscribe to.

Incidentally, the term "subscribe" is a bit of a misnomer because there is no cost involved. Just click on the ones you want and, from then on (unless you "unsubscribe" at some point), the names of those groups will appear on your list of possible selections every

continued on page 67

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Think Tank

Block Diagrams and Readers' Requests

BY JOHN J. YACONO
TECHNICAL EDITOR
WINDOWS MAGAZINE

We've been discussing components for so long that I thought it'd be nice to take a break and talk about methods of design. Using block diagrams is a surefire way to design and troubleshoot circuits quickly. If you make your documentation clear and keep it well organized, you can quickly design new circuits using blocks from your *repertoire*.

For troubleshooting, checking a circuit block by block can quickly lead you to the failed section. Using blocks also eliminates duplicated effort at the drafting table, and reduces the burden of having to organize your documentation.

That said, let me demonstrate with a couple of blocks. Figure 1A shows a monostable timer based on one section of a 558 quad timer. To summarize the circuit's operation, if a falling edge is detected by the trigger input, the output goes high for a period determined by R1, R2, and C1 as shown. (For a more complete explanation, see *Think Tank*, September through November, 1992.) Note I listed the pins for each of the 558's sections for reference. Pins 5, 12, and 13 are shared by all the sections. I've labeled points where the circuit will connect to other circuits—the inputs and outputs—with descriptive names. Then you just obscure the circuit detail in a "black box" like the one in Fig. 1B, and you've got a monostable block ready to go. Because there's only one reset input per four 558 sections, only one output of four monostable timer blocks will show a reset input.

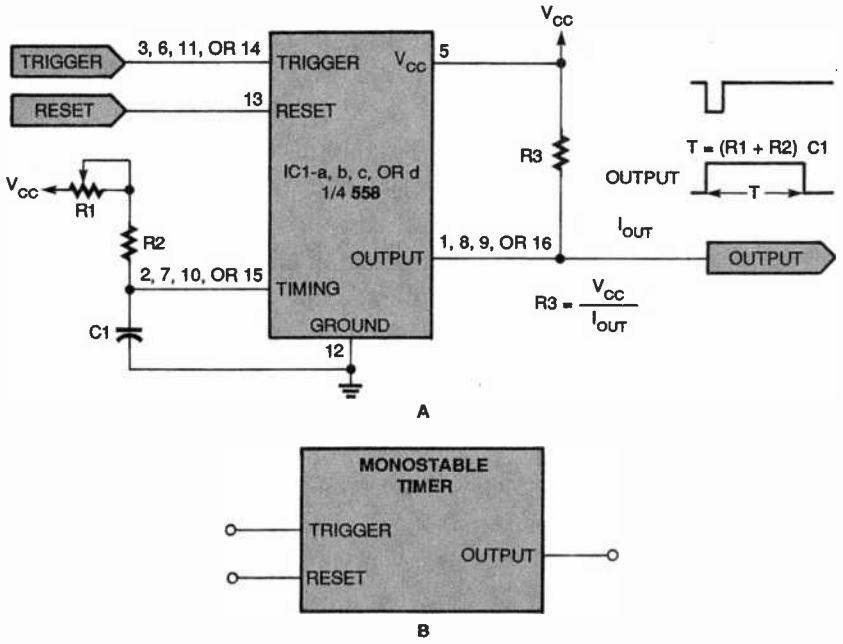

Fig. 1. Here's a monostable timer based on one section of a 558 quad timer (A). Note how it can be converted into a block diagram (B).

In Fig. 2A, we've shoved a generic AC-load block into a schematic to make it more flexible. This demonstrates how a block can be mixed with discrete components. In Fig. 2B we've taken all of Fig. 2A and turned it into a single AC-load controller block. That means the AC-load controller block contains the AC-load block, demonstrating how blocks can be nested. Now let's see how they can be used to answer some of our readers' letters.

ALTERNATING-OUTPUT CIRCUIT

Could you provide a schematic for a dual 110-VAC, 400-watt output circuit. These outputs would alternate between on and off. I would need to be able to adjust alternating time between these two outputs for two to five seconds. I would prefer to use SCRs or TRIACs to control the AC output, and I'd like to power the control circuit from 110 VAC.

—Don Witchelhouse, Woodhaven, MI

Well, I'll leave the parts values

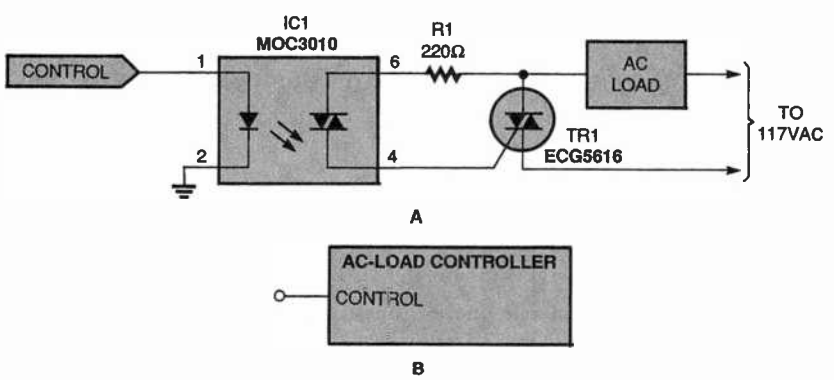

Fig. 2. This opto-coupler-based circuit (A) can be turned into a single AC-load controller block (B).

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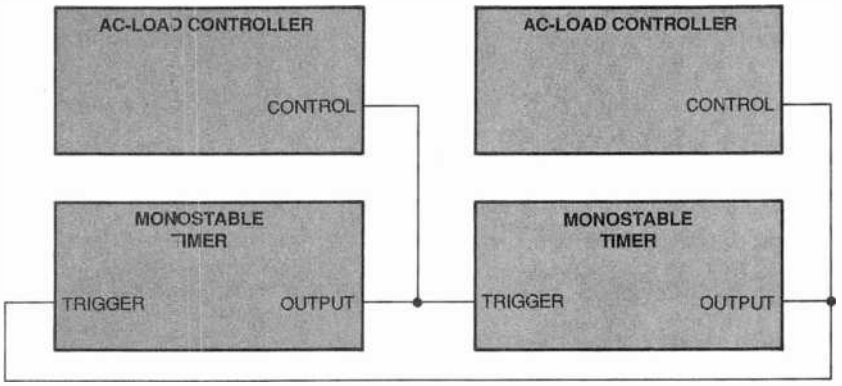

Fig. 3. In this alternating-output-circuit block, when either monostable unit times out it triggers the other.

and DC supply to you, but your circuit can be summarized by the blocks in Fig. 3, which form an astable oscillator. When either monostable times out, it triggers the other. You can use the variable resistors (shown in the detailed view in Fig. 1A) to adjust the timing of each section independently. If you need the on-time of each output to be equal, then use a stereo potentiometer—one section for each monostable timer block. If the output times must be complementary, share one linear potentiometer across both sections (connect the wiper to VCC, and connect the remaining terminals to R2 of each section). Oh, and select R3 to limit IOUT to less than 15 mA.

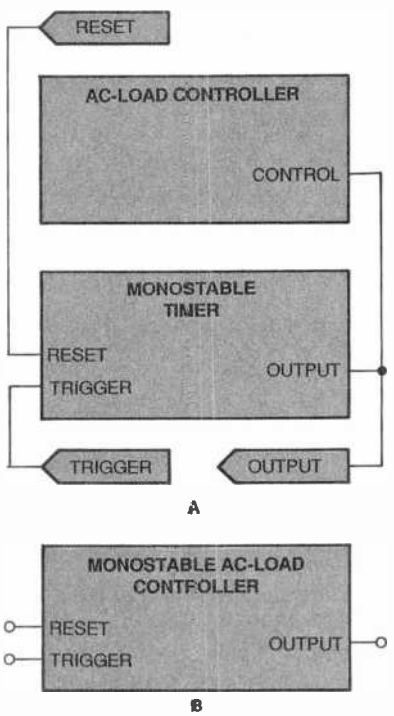

Fig. 4. Here the AC-load-controller and monostable-timer circuit blocks (A) are combined into a super block of sorts (B).

RED LIGHT, GREEN LIGHT

I am an antique auto collector and like many other members of old-car clubs, collecting automobilia has grown into as big a hobby as collecting antique cars. An item that has become popular at many auto-related flea markets is the familiar three-color traffic light. I have purchased one that I would like to use in my son's bedroom. The street light consists of three colored lenses: red, yellow, and green. Each lens is lit by a standard 75-watt, 120-volt light bulb.

I would like to have a timer circuit that switches between each color in the proper sequence over and over. I would also like to be able to control the on time for each light, with the red and green lights on for approximately 15-30 seconds, and the yellow light for 5-8 seconds. If possible I'd like to use solid-state components and avoid relays.

Any help you may provide for a timer circuit would be greatly appreciated.

—Peter DiPasquale, Wyckoff, NJ

For simplicity, let's start by combining the AC-load controller and monostable-timer blocks (see Fig. 4A) into a super block of sorts (shown in Fig. 4B). You're controlling three lights, so you need three sections. They work in sequence, so let's connect the sections in sequence. Then we add a reset switch to start the sections and a trigger switch to get the ball rolling. The result is the block diagram in Fig. 5. You should be able to figure out the parts values from the equations, but here's a hint: for your application, R1 in each section should equal its companion R2.

558? WHAT'S THAT?

I've read your articles on the 558 timer and found them really interesting. Where do you get information such as this? I had never heard of the 558 until you wrote about it.

—Roger Steortz, Alexandria, LA

I came across that part while trying to figure out how a joystick controller card worked. I looked up the chip in a manufacturer's data book, which I sometimes do just for educational purposes.

Sometimes I'm inspired to hit the books by a project I want to build. I start with a block diagram of the basic sections I'll need, and then I decide on what parts will fill each block by checking the data books. For example, if one block is a timer circuit with features that would make it hard to build using ICs I already know, I look for timer ICs in my data books.

If you want to start your own collection of data books, try contacting the vendors listed in the "Data-Book Sources" box in this column. Approach them in a businesslike manner; type a letter that clearly and

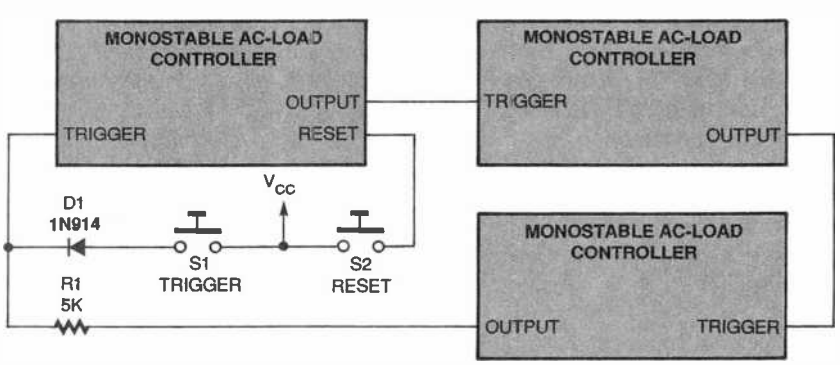

Fig. 5. Three of the super blocks from Fig. 4B can be used together to control a three-lamp traffic light.

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DATA-BOOK SOURCES

Advanced Micro Devices, Inc.
One AMD Place
Sunnyvale, CA 94088

Allegro Micro Systems, Inc.
115 N. Cutoff
Worcester, MA 01615

Cypress Semiconductor Corp.
3901 North First St.
San Jose, CA 95134

GEC Plessey Semiconductors
1500 Green Hills Rd.
Scotts Valley, CA 95066

GoldStar Technology, Inc.
3003 N. First St.
San Jose, CA 95134

Harris Corp.
Semiconductor Sector
PO. Box 883
Melbourne, FL 32902-0883

Hitachi America, Ltd.
2000 Sierra Point Parkway
Brisbane, CA 94005

Ideal Semiconductor
P.O. Box 442
Liberty Lake, WA 99019

Integrated Device Technology, Inc.
2975 Stender Way
Santa Clara, CA 95054-3090

Lansdale Semiconductor, Inc.
2929 South 48th St., Ste. #2
Tempe, AZ 85282

Maxim Integrated Products
120 San Gabriel Dr
Sunnyvale, CA 94086

Micrel
1849 Fortune Dr
San Jose, CA 95131

Mitsubishi Electronics America
1050 East Arques Ave
Sunnyvale, CA 94086

Motorola Semiconductor Products
2100 East Elliot
Tempe, AZ 85284

National Semiconductor Corp.
2900 Semiconductor Dr.
Santa Clara, CA 95052

NJR Corp.
Div. of New Japan Radio Co. Ltd.
340-B East Middlefield Rd.
Mountain View, CA 94043

Panasonic Industrial Co.
Matsushita Electric Corp.
of America
1616 McCandless Dr.
Milpitas, CA 95035

Performance Semiconductor Corp.
610 E. Weddell Dr.
Sunnyvale, CA 94089

Philips Semiconductors
811 East Arques Ave.
Sunnyvale, CA 94088-3409

Quality Semiconductor
851 Martin Ave.
Santa Clara, CA 95050

Rochester Electronics, Inc.
10 Malcolm Hoyt Dr.
Newburyport, MA 01950

Rockwell International
4311 Jamboree Rd.
Box C
Newport Beach, CA 92658-8902

Samsung Semiconductor, Inc.
3655 North First St.
San Jose, CA 95134

Sharp Electronics Corp.
5700 N.W. Pacific Rim Blvd.
Camas, WA 98607

Siliconix, Inc.
2201 Laurelwood Rd.
Santa Clara, CA 95056

STC Components
Maidstone Rd.
Sidcup, Kent, United Kingdom
DA14 5HT

Teledyne Electronic Technologies
1274 Terra Bella Ave.
Mountain View, CA 94043

Texas Instruments, Inc.
P.O. Box 655303
Dallas, TX 75265

Toshiba America Electronic
Components, Inc.
9775 Toledo Way
Irvine, CA 92718

Universal Semiconductor, Inc.
1925 Zanker Rd.
San Jose, CA 95112

VTC, Inc.
2800 E. Old Shakopee Rd.
Bloomington, MN 55425

briefly explains what you what. Don't discuss your technical savvy, personal experiences, or hobby interests. If you are a part of the electronics industry, use company letterhead for impact.

PARTS SOURCES

On pages 29 and 30 of the February 1995 **Popular Electronics**, in the article on the "Low-RF Switch" you mention a Soldering-Iron Controller that supposedly appeared on page 53 of the May 1994 issue. I could not find that article on that page, but I want to build a controller like the one you mention (see Fig. 6). The soldering-iron controller I use is causing interference.

Also, would you please state where I can find a 25-ohm potentiometer and IC1, the TL783? (I can not find a replacement for IC1 in the *ECG Master Replacement Guide* or in the *SK Solid-State Replacement Guide*.) And, can I use a higher amperage diode than the 1N4001, and what is the wattage of R1 and R2?

I have been a subscriber for a long time.

—*John Baird, Granite City, IL*

Sorry about that misprint. The article was actually in the May 1992, issue.

I got the 25-ohm potentiometer from RadioShack. Chances are, if they no longer carry them, you'll find them at Digi-Key. Call them at 1-800-DIGI-KEY for their hefty catalog or to check for parts availability.

The potentiometers typically used as crossover components so audio-parts dealers are another good bet. The TL783 (for which I know of no replacement) is available from Active Electronics. Give them a ring at 1-800-677-8899.

Using a diode specified for higher amperage won't gain you anything. The TL783 can only handle low-current loads, and the fixed resistor in the circuit programs IC1 for a maximum current of about 0.25 amperes.

As built, the fixed resistor was a $^1/_4$-watt unit; the potentiometer was a 5-watt unit.

HELP!

I have been looking through some old issues of **Popular Electronics** and came across a circuit on page 27 of the July 1990 issue that I would like to build (see Fig. 7). The only trouble is I'm an old vacuum-tube man dating back to the days when almost anything

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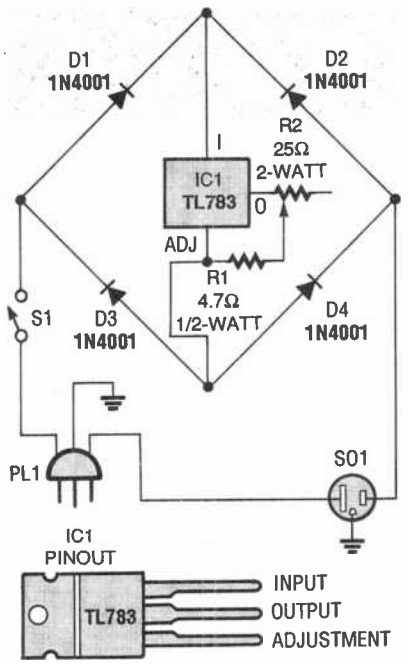

Fig. 6. Here's the elusive Soldering-Iron Controller that ran in the May 1992 (not 1994) issue of this magazine.

could be found in one of the catalogs from Allied Radio or Lafayette.

Where do I get the 555s? Can I use any kind of LED? Is this an 8-ohm speaker? Will I need an amplifier with this circuit or is it loud enough to be used as a car alarm?

Along with this circuit I need a small mechanical timer switch that is normally closed but which can be opened for thirty to sixty seconds. I have seen these advertised, but I need a source for this and the other parts.

—David B. Holzinger, Houston, TX

Never fear, the 555 timer is a very popular part that can be purchased from almost any large IC retailer you're likely to find advertising in this magazine. They're definitely available off the shelf at RadioShack.

About LEDs, almost any LED will work in a typical circuit requiring one, as almost all can handle about the same amount of current. The exceptions to the rule are few and far between. The speaker is indeed an 8-ohm unit, which is the magazine's default when we don't specify a rating, and yes, you'll definitely need an amplifier to use the circuit as a car alarm.

I haven't come across the switching circuit you need, but requesting catalogs from our advertisers is a good start to your hunt for that and the other parts.

MIXED REACTIONS

I need to make an audio mixer and I don't care if it's mono or stereo. My problem, though it may seem simple, is that every mixer I have tried to make buzzes uncontrollably (especially when "jiggled" or when parts are touched), and for some reason, I still can hear faint audio coming out even when I turn off the main mixer section. I even get "buzzy" signals and that faint trace of my inputs even if I turn them off individually. Should I try using integrated circuits, such as op-amps to mix audio signals? Up to now I've tried circuits that are 98% passive.

As a beginner, I could use some extra advice. For one thing, why are my circuits so touchy? I even put them in entirely plastic cases, but they still buzz when I touch anything metal. What kind of mounting techniques should I use?

One more thing, (this is a pretty big one, so I'll understand if you don't have the time to answer this). I really have a hard time understanding negative voltage. I know circuits use negative voltage, so I figure I'll get used to making negative supplies for those circuits. However, I would just like to be able to understand it. The books that I have read (Forrest Mimms) didn't explain negative voltage, so I still am in quite a state of curiosity.

I know this is a really tall order, but I have faith. If it makes you great people any more helpful, I would just like you to know that after I read one issue of **Popular Electronics**, I bought a subscription for two years, and when that runs out I will buy another two years. **Popular Electronics** is the only magazine I need. I find the other magazines just not as helpful and interesting as this one. God bless you all!

—Jon Hildenstein, Omana, NE

After looking at the rough schematic you sent in, the solution is quite clear. You're grounding the center of the RCA jacks, using the outer conductor for the signal path. Because the standard audio equipment your mixer connects between is wired just the opposite way, the audio signal is traveling through your mixer's ground path as it passes through the mixer, not the desired signal path. If you connect the jacks properly and use a metal enclosure, you can shield out the hum you hear.

There's not really much to say about negative supply voltages. Just as a positive supply pulls electrons up from ground through circuitry, electrons travel from a negative supply

continued on page 59

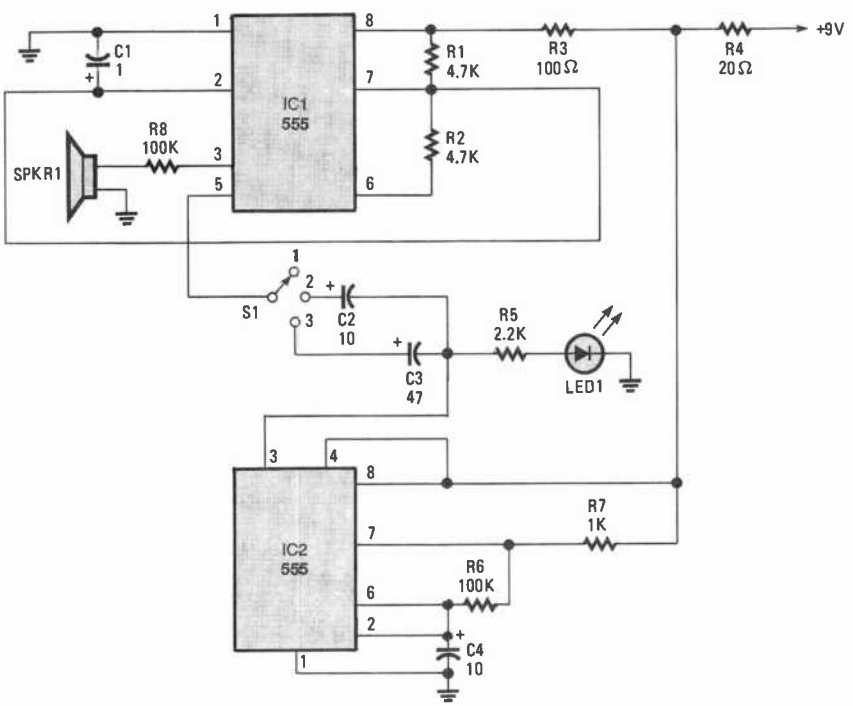

Fig. 7. To use this 555-based oscillator for any real volume, you'll need an amplifier.

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DX LISTENING

Far East Broadcasting Company

BY DON JENSEN

The Far East Broadcasting Co. dates back a half century to the end of World War II, when American GIs were returning from combat in the Pacific Theater. Among them were John Broger and Bob Bowman, who felt called to establish a religious ministry via radio. Their target was China.

By March 1946, the two men were in Shanghai, trying to get their programs broadcast over local radio stations. It took nearly a year to get the first one on the air. Soon, though, it became apparent that the civil strife tearing China apart would doom that effort. Eventually, the Nationalist government retreated to Taiwan, and China had a Communist regime headed by Mao.

Here's a photo of the Far East Broadcasting Company's transmitter building at Iba, in the Philippine province of Zambales. If you'd like to check out other views of the station, visit FEBC's website at http://www.febc.org/febchom.html.

Broger searched Asia for a more congenial home for FEBC. The Philippines, at the time developing its independence from the United States, as a brand new nation was willing to let the broadcaster establish its headquarters in Manila.

The first broadcasts over a local AM radio station, then called KZAS, went on the air from Manila on June 4, 1948. Shortwave broadcasts to China began in 1949, and have since expanded to cover most of Southeast Asia, as well as Russia. Since these early years, FEBC operations have expanded to include local AM and FM stations in Manila, and ten regional outlets throughout the Philippine provinces. There are six shortwave transmitters in the Philippines. Three 50-kilowatt units and a 100-kilowatt transmitter are located at Bocaue, and there is a pair of 100 kw'ers located at Iba.

In 1972, FEBC established a high-power medium-wave station on the South Korean island of Cheju, which has become the mainstay of this religious broadcaster's coverage of China, although it also serves Asiatic Russia and Japan. Later, another powerful medium-wave companion station was set up at Inchon, outside the Korean capital of Seoul.

FEBC developed another shortwave site on the island of Saipan in the early 1980s. The station, called KFBS, has four 100-kilowatt transmitters serving Russia, China and other targets in Southeast Asia. An associated operation, the Far East Broadcasting Associates, or FEBA, transmits to Africa on shortwave from the Seychelles, an island group in the Indian Ocean.

The Far East Broadcasting Co. says it broadcasts in an astonishing 151 languages and dialects—from Arabic and Akha, a Chinese tongue, to Vietnamese and an African dialect called Yao.

FEBC can be heard on shortwave in North America, although its signals, beamed to listeners elsewhere in the world, don't exactly boom in. It is scheduled in English on 11,635 kHz from 0930-1100 UTC; 11,995 kHz from 1300-1600 UTC; and 15,450 kHz from 0000-0200 UTC, all from Philippines transmitter sites. KFBS on Saipan has English scheduled on 9,465 kHz at 1830-1900 UTC. FEBA's English broadcasts from Seychelles are aired on 9,810 kHz from 1500-1600 UTC; 12,090 kHz from 1500-1545 UTC; and 15,555 kHz from 0500-0545 UTC.

PUTTING OUT FIRES

When I see what is happening in the world of international broadcasting today, I'm reminded of the small rural volunteer fire department in the community where I once lived. They would arrive at the scene of a prairie fire, its flames swiftly racing across a field of dry grass.

It was hot, hard work, but the firefighters usually managed to halt the onrush of the grass fire. With the danger seemingly over, they set about extinguishing the final patches of fire, beating out the last small flames with shovels. But just as they finished, a

CREDITS—Brian Alexander, PA; Rich D'Angelo, PA; David Clark, ONT; Bob Fraser, MA; Charles Rippel, VA; North American SW Association.

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puff of wind would reignite smoldering embers a bit further down the fire line.

So they rushed to the new site and, again, beat out the rekindled fire. Only by that time, another hot spot had flared up. Time and again, just when they thought it was out, the fire popped up again, somewhere else.

As funding for broadcasting worldwide gets tighter and tighter, shortwave listeners have responded to one alarm after another as this or that shortwave service announces it will have to cut back programming or shut down entirely because its government has axed the budget.

Earlier this year it was the popular Radio Canada International whose broadcasting life was on the line. It was touch and go, but in the end, funding somehow was found. A good bit of the credit goes to SWLs in North America and elsewhere, who bombarded the Canadian government with fervent pleas to "Save RCI."

That fire was beaten back! But the flames have rekindled elsewhere. This time it is Radio Australia that is in peril.

How serious is the threat? At this writing we know only that the Australian newspaper, the Melbourne Herald-Sun has reported that the international broadcaster faces closure because the government considers shortwave broadcasting outmoded and not worth the expenditure of tax money.

So it's time, once again, to put on the fire helmets and boots, grab the shovels, and try to stamp out another blaze. If the RCI situation taught us anything, it was that letters help. Tell Radio Australia that you don't want to lose their SW service. Give the station some useful "ammunition" for its budget battle with the Australian government.

Radio Australia's address is GPO Box 428G, Melbourne, Australia 3001. Or your can send your comments via e-mail—raust3@ozemail.com.au. Radio Australia also has a New York Bureau; you can reach them at 1 Rockefeller Plaza, Suite 1700, New York, NY 10020 (Tel. 212-332-2540; Fax: 212-332-2546).

PROGRAM NOTES

I've mentioned before Richard Cuff's excellent "Easy Listening" column, which appears regularly in the monthly Journal of the North American SW Association. It is a great guide to some of the better programs heard on SW stations around the world.

If you think that you might be interested in joining NASWA to read its excellent Journal regularly, you can get membership information by sending a stamped, self-addressed envelope to NASWA, 45 Wildflower Road, Levittown, PA 19057.

In a recent column, Cuff observes that Radio Sweden offers "a quick take on news and events in Scandinavia" on its 60 Degrees North program. It is a weekday half-hour program about Sweden and its neighboring Nordic countries.

On Friday, the program features a week-in-review wrap-up, Richard notes. Tuesday it includes *Sportscan*, a feature focusing on sports relevant to Swedes. On Wednesdays, you'll find included in the program a business and economics feature called *Money Matters*.

Richard says he finds Radio Sweden's morning transmissions at 1230 and 1330 UTC transmissions "easy listening." At this writing, the former broadcast is heard on 13,740 and 15,240 kHz; the latter transmission on 9.835, 11,650 and 15,245 kHz.

Or, if you prefer to try for Radio Sweden during the evening hours, look to 6,065 kHz at 0030 UTC; 7,120, 7,290 and 9,435 kHz at 0130 UTC; 7,290 kHz at 0230 UTC or 7,115 kHz at 0330 UTC.

DOWN THE DIAL

Here are some listening targets to try for:

BANGLADESH—9,548 kHz. Radio Bangladesh has been heard in English, signing on at at 1227 UTC with a tuning signal and identifications, news, and subcontinental-type music.

BRAZIL—15,265 kHz. Radio Nacional do Brasil is reported in English with a program covering Brazilian current events.

MONGOLIA—12,085 kHz. Radio Ulaanbaatar has English scheduled at 1200 UTC, but interference then makes reception nearly impossible. Try a half hour earlier, at 1130 UTC, when it is transmitting in Japanese.

TAHITI—15,167 kHz. RFO Tahiti is heard on this frequency during the late night hours. Rumor has it that this longtime exotic SW voice may leave the air forever. Try it now.

TURKEY—9,655 kHz. Voice of Turkey was noted in English at 2230 UTC with a program called *The Veiled World*, which is actually the music of the sultans. ■

THINK TANK

(continued from page 57)

through components to ground. Same concept only the direction of the current flow might seem to be a bit confusing.

A BARKING LOT?

The item "One Good Turn" in *Think Tank*, March 1992, brings to mind a project I've been planning to build. I live in a place where people have a nasty habit of backing their vehicles into pedestrians: I would like to assemble a back-up warning system, the same as big trucks, with an audible warning system, but adding a strobe light so people will not only hear, but also see the vehicle.

Parking lots are terrible with backing-up collisions, so I'm asking if you could help with this project: a simple system, with an independent horn and flashing strobe, to mount on the rear bumper (underneath), but using the existing electrical system. Your help would be greatly appreciated in this matter.

Thanks.

—*Charles Lucas, Wilmington, NC*

If you're not interested in reinventing the wheel, RadioShack sells an anunciator/bulb assembly that replaces one of your back-up bulbs that lights when you're in reverse. They also have a 12-volt-powered outdoor strobe for alarm systems (No. 49-527) that you could run in parallel with the other back-up light.

Frankly, though, I advise against using a strobe on a vehicle. At night, it can briefly impair the vision of other drivers or the pedestrians you're concerned about, making conditions much more hazardous than if you were simply to look around a lot (no pun intended).

That closes this month's column Remember, if you'd like to receive a book, contribute schematics and text for working circuits to *Think Tank*, **Popular Electronics**, 500 Bi-County Blvd., Farmingdale, NY 11735. Send enough quality items to fill a column, and you'll get a kit and MCL1010 chip, too. ■

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HAM RADIO

An Old Friend Revisited

JOSEPH J. CARR, K4IPV

A long time ago, in a neighborhood not so far away, I learned a bit about radio. Ham radio, in fact. My income was from a paper route, and one of my customers had this odd antenna mounted on the side of his house. Fascinated, I asked the boyish question of Mac Parker: "What's that?" He showed me his ham rig and I was hooked for a lifetime.

Mac had the mentor's heart and took me and several other youngsters and adults under his wing. Mac taught us Morse code, along with a bit about radio theory and good operating practices. He also gave me my first copy of a book that has been a friend down the years: The *ARRL Handbook for Radio Amateurs* (ARRL, 225 Main Street, Newington, CT, 06111-1494; ISBN 0-87259-173-5, ARRL Order No. 1735, 1158 pages, $38; e-mail: info@arrl.org).

The Handbook comes out annually. Although there is not any radical difference from one year to the next (nor should there be: E still equals I × R after all), over time changes follow changes in amateur-radio technology. What does change from year to year is the construction projects. If you are interested in building ham projects, especially things like linear amplifiers, receivers, and ham-station accessories, then the Handbook is a primary source of both detailed plans and ideas.

In the 1996 Handbook (shown in Fig. 1), which I just bought, there are topics that weren't even dreamed of only a few years ago. I buy a new one every year, principally because it's a research reference for me. Most of my old copies are well-worn and dog-eared because of the use they have had over the years. Others buy a new edition every four or five years. I recommend buying it a little more often because of changes in radio technology that almost overrun us (perhaps every two or three years).

One nice thing about recent editions is that they provide printed-circuit patterns for the projects that require them. All the patterns are placed at the back of the book so they can be removed without major damage to the book, or be easily photocopied. Of course, if you are not very keen about making your own printed-circuit boards, then FAR Circuits (18N640 Field Court, Dundee, IL, 60118) will provide them for you. Write to FAR for their price list of project boards. By the way, FAR also makes boards for magazine projects and will also do your own designs if you prefer.

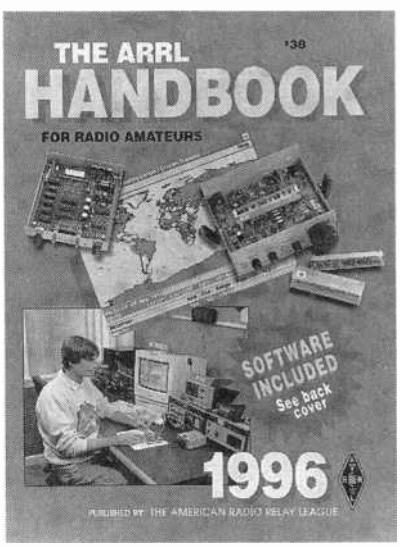

Fig. 1. This is the 1996 edition of the ARRL Handbook for Radio Amateurs. By the time you see this, the 1997 edition should be available.

There are several new features in this year's Handbook. I find the layout is improved over past editions (the topics seem better grouped). There are chapters on safety practices, real-world component characteristics (which often differ from theoretical components), and even a chapter on radio mathematics. The math chapter is useful for people who need to know the type of math needed for radio and general electronics calculations, but don't have the inclination to take a full-up math course.

A feature found in most recent editions is instructions and information that makes it possible for you to design your own high-pass, low-pass, band-pass, and notch filters, even if you are not a math whiz. Basically, if you can do division on a calculator you can design the types of filters that ham operators often need.

A feature that was new in 1996 (and will probably be continued when the 1997 edition comes out) is a software diskette for IBM-PC compatible DOS computers. It contains programs on pi-network design, slow-scan TV, shortened dipole design, a true-north aid, solenoid filter design, and active-filter (*e.g.* audio filter) design.

If you were to visit my basement library you would see ARRL Handbooks on the shelves dating back to 1959 (the one Mac Parker gave me for passing my Novice test).

UHHHH...YOU'RE KIDDING, OF COURSE

I get some interesting mail from time to time. One that landed in my e-mail box was from a newcomer to the hobby who was thinking about using about 100 feet of white 75-ohm coaxial cable that someone gave him to hook up a scanner receiver to a rooftop antenna. A local expert told him that coaxial cable with white insulation has higher loss than black coax because it has a lower resistance to solar ultraviolet radiation. Someone is sucking wind, I'm afraid. Although I've seen white coax weather to a pukey color, it's not less effective radio-wise. After all, white cable has been used for TV antennas for decades. Indeed, my local cable company uses white cable from the drop box, all around the house, to the service entrance (I see fine on my TV).

However, there might be a real reason to be wary of TV-type coaxial cable. Television cable usually has an aluminum-foil outer conductor, rather than braided wire. The foil does not take solder very well. So it is restricted to uses where a crimp-on connector can be used instead of solder. If you have crimp-on connectors, and intend to use it solely for reception (not transmitting), then the TV-type coaxial cable should

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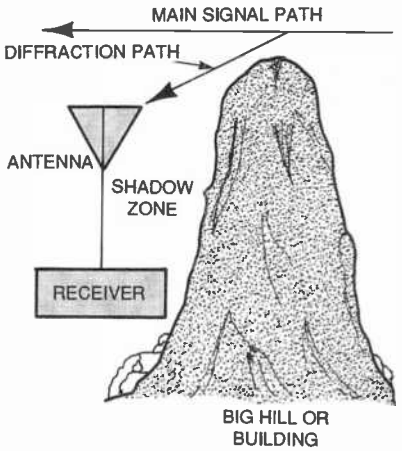

Fig. 2. Diffraction over a hill can sometimes make VHF/UHF reception possible in what you would normally think is a blackout area.

work fine. If your receiver doesn't mind 75-ohm coax (it won't), then use it with confidence. I don't recommend it for transmitting, however, even at low power levels.

OVER-THE-HILL REPEATER HITS

Another question that I received in my e-mail box concerned reception of the local 2-meter repeater when there is a large hill in the way. The only thing I can recommend that will definitely work is to go to the top of the hill and install a remote-controlled transceiver of your own. Hardly practical for most of us. Yet some people do, in fact, "see" through hills on VHF and UHF frequencies.

Take a look at Fig. 2. This is a sectioned view of the landscape. Suppose you are down in the valley, or somehow manage to get a QTH on the wrong side of some mountain or big honkin' hill. The direct signal passes over the mountain into the wild blue yonder. The receiver antenna in Fig. 2 is in the shadow zone because of that hill.

The only way to get the main signal path, either receiving or transmitting, is to stick an antenna into the path. Unfortunately, that means a remote station on top the hill or one heckuva tower mount for your antenna. In some rare cases, the VHF/UHF signal will diffract (*i.e.* the path bends a small amount) as it comes over the crest of the hill at an angle that can be picked up by your valley-imprisoned receiver.

I've heard from some hams in nearby West Virginia that such things happen rather regularly. In most cases, they can hear a repeater, but cannot key it up because the diffraction doesn't necessarily work as well both ways. Also, many years ago I was in the TV business, and antennas was one job I seemed to get a lot. I've seen odd reception situations in the TV business that could only be explained by diffraction phenomenon.

Another case is a bit more practical for most of us. Figure 3 shows a situation where a big hill, building or other obstacle stands between you and the VHF or UHF repeater. Normally, one does not expect to see much signal on the shadow side of the hill. But in some cases, the signal will be 5-by-9 even in the shadow. The reason is that there is some other object or hill that causes a reflection of the original signal. It is this "multipath" signal that you pick up. In this case, the transmit and receive paths are probably the same, so by aiming your antenna at the reflecting object, you can work the repeater on the other side.

I learned about this trick back in my TV days. My area is rather hilly, so there are many spots where a hill shadows the TV transmitters. An old antenna guy named Jack showed me how to aim the antenna at a water tower, opposite hill, high-rise building or other structure. Often, the reflected signal was a lot stronger than the direct signal. We also used that tactic to eliminate ghosts. Sometimes, with the multipath signal stronger, the antenna would work better against the reflected signal than the direct signal.

Sometimes, the reflector idea is used artificially. Microwave operators have used it in mountainous areas for years. I've seen the technique used with amateur-radio equipment, commercial land-mobile communications gear, and television receivers. In those cases, a billboard-size aluminum passive reflector is erected on the top of a mountain. Because the thing is just a big hunk of plywood (or several pieces), some 2 × 4 lumber and a lot of aluminum foil (or sheet aluminum), it uses no power, does not need a transmitter or receiver, but works nonetheless. The idea is to install the reflector so that it reflects the signal down in the valley. And because it's a reflector arrangement, it will take your signal out of the valley as well.

I've seen two non-commercial applications of the passive reflector. One was in southwestern Virginia where a friend of mine installed one to bounce television signals into his valley. Recently he used a TVRO satellite dish (and probably has the newer 18-inch style TV disk by now). In the mountain states, the TVRO dish is called the "state flower" from all the dishes seen in those valleys.

The other installation that I personally saw was in rizona a few dozen

continued on page 64

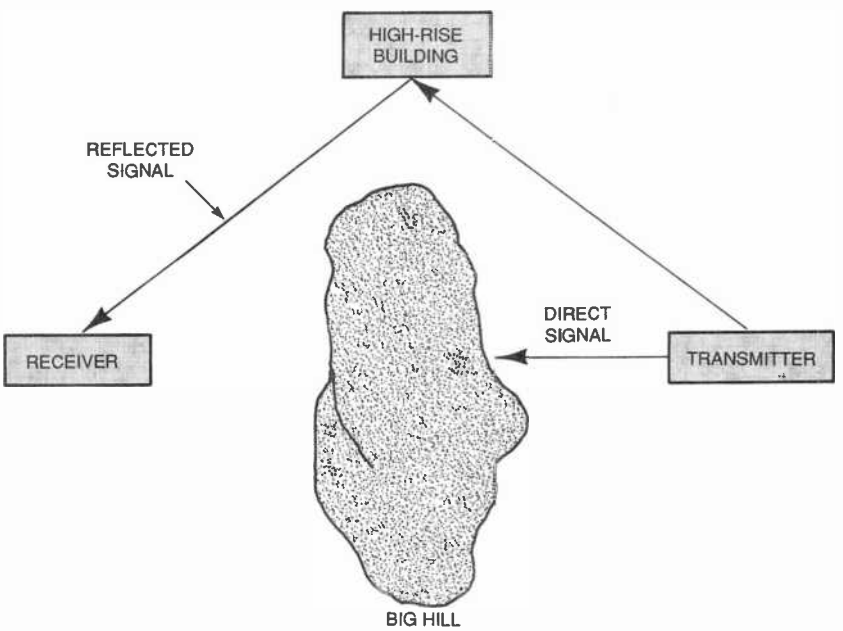

Fig. 3. A passive reflector often makes two-way communication possible where natural geography does not cooperate.

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CIRCUIT CIRCUS

More Crystal Sets

BY CHARLES D. RAKES

If you tuned in last month you'll remember that we were deep into crystal-radio circuits that our grandpas would have built. I don't know about you, but working with these primitive receiver circuits brought back many pleasant memories of times past.

Long before becoming a teenager, I can remember building numerous crystal sets and one tubers from parts taken from Dad's stash of old radios stored in stacks in our attic (those radios would now be considered classics of the twenties). I would snip out beautiful green coils wound on bakelite forms and remove large brass tuning capacitors as well as other components that would tie together on the end of a wooden orange crate. No AC, no batteries, just pure radio magic.

The saga continues this visit with more simple receiver circuits. We'll add an active device or two, a DC power source, and see what improvement these modern devices bring to crystal radio.

Our first two items are add-on amplifier circuits for the crystal radios covered in last month's column. Let's get to them:

HEADPHONE AMPLIFIER

The amplifier circuit shown in Fig. 1 will increase the volume of a weak or distant station to a useful level for headphone listening. Power for the circuit can be provided by a 5- to 9-volt DC source.

Amplification is provided by a 2N3904 NPN transistor, Q1. For Z1, use 2000-ohm headphones.

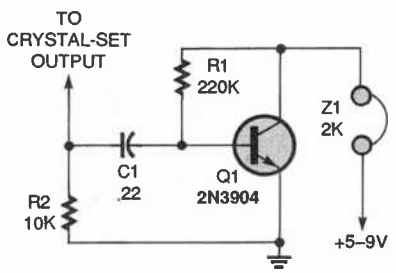

Fig. 1. This simple circuit should make it easier to hear in headphones those faint stations that your crystal set is receiving.

PARTS LIST FOR THE HEADPHONE AMPLIFIER (Fig. 1)

Q1—2N3904 NPN transistor
R1—220,000-ohms, 1/4-watt, 5% resistor
R2—10,000-ohm, 1/4-watt, 5% resistor
C1—0.22-µF, Mylar or similar capacitor
Z1—2000-ohm headphones
Power source, wire, solder, etc.

If you'd like to hear your crystal set at a comfortable room-filling volume, hook it up to this amplifier. Our second amplifier, shown in Fig. 2, will increase the audio signal of a crystal set to a level that is sufficient to drive an 8-ohm speaker. With an LM386 amplifier (IC1) connected as shown, the IC's gain is set at 50. The gain can be increased to 200 by removing R3 and connecting the positive side of C4 directly to pin 1.

If a gain of 50 or 200 turns out to be too high, then the gain can be reduced to a minimum figure of 20 by removing C4, C6, and R3. The combined gain of Q1 and IC1 is several thousand, so keep all of your leads short and neat. Potentiometer R4 is used to control the volume.

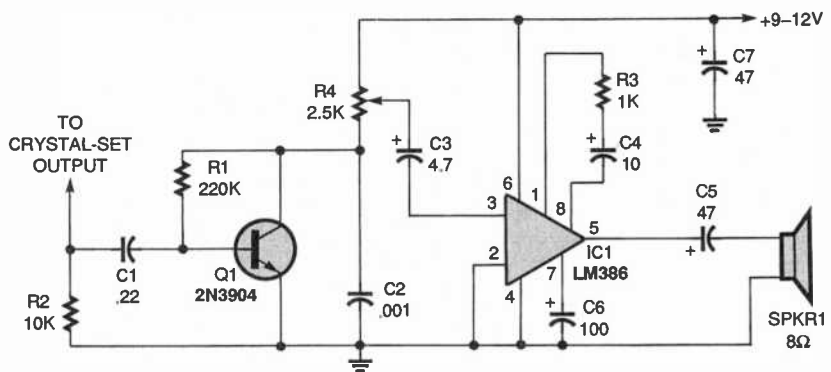

Fig. 2. If you'd like to hear your crystal set at a comfortable room-filling volume, hook it up to this amplifier.

PARTS LIST FOR THE SPEAKER AMPLIFIER (Fig. 2)

RESISTORS
(All fixed resistors are 1/4-watt, 5% units.)
R1—220,000-ohm
R2—10,000-ohm
R3—1000-ohm
R4—2500-ohm potentiometer
CAPACITORS
C1—0.22-µF, Mylar or similar
C2—0.001-µF, ceramic-disc
C3—4.7-µF, 16-WVDC, electrolytic
C4—10-µF, 16-WVDC, electrolytic
C5, C7—47-µF, 16-WVDC, electrolytic
C6—100-µF, 16-WVDC, electrolytic

ADDITIONAL PARTS AND MATERIALS
IC1—LM386 audio power amplifier, integrated circuit
Q1—2N3904 NPN transistor
SPKR1—8-ohm speaker
Power source, IC socket, wire, solder, etc.

SPEAKER AMPLIFIER

TAPPED COIL

Figure 3 shows a winding diagram for a coil that will be used in the rest of the receiver circuits this month. You can cut the coil form from a 2-1/2-inch-diameter piece of PVC pipe. Make it 3 inches long. If this material is not readily available, any similar diameter and length of plastic tubing will do. Other sources for the coil form can be pill bottles, plastic drinking glasses, and discarded toys.

Wind 50 close turns of 19- or 20-gauge enamel-covered copper wire on the plastic form. Bring out a tap at the 10th and 20th turns, and your coil is ready to use.

RF AMPLIFIER RECEIVER

There are two easy methods that can be used to increase the output of

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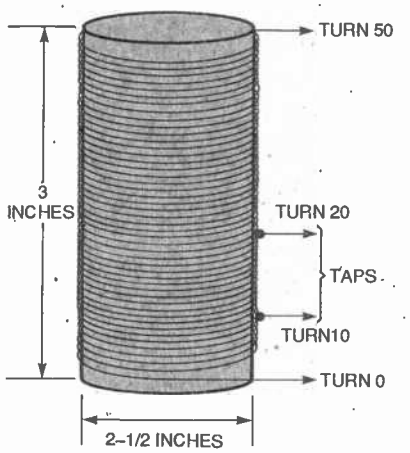

Fig. 3. This 50-turn coil, which is used in the receivers in this month's column, has taps at the 10th and 20th turns.

PARTS AND MATERIALS LIST FOR THE TAPPED COIL (Fig. 3)

2-1/2-inch PVC pipe, 3-inch length (see text)
19- or 20-gauge enamel copper wire

a crystal radio. One method is to add an audio amplifier, like those shown in Figs. 1 and 2, at the detector's output. Another way is to add a radio-frequency (RF) amplifier in front of the detector circuit, as shown in Fig. 4.

The desired radio-frequency signal is selected by tuning C5, which may be any 365-pF, or larger-value, tuning capacitor. Older AM broadcast receivers are a good source for salvaging these type of capacitors. Also you might want to check out your local hamfest, where often you will find a good selection of variable capacitors and many other useful components just looking for a new home.

Capacitor C6, a 5- to 50-pF unit, helps in matching the antenna to the tuned circuit and optimizing the circuit's sensitivity and selectivity. Adjusting C6 to its maximum capacitance will yield maximum sensitivity in the circuit. And when C6 is adjusted to a workable minimum setting, the selectivity will be at its best. As in any receiver, there's always a compromise between sensitivity and selectivity.

The RF signal is tapped off at the 10th turn up from ground on L1, and is fed to the base of Q1. That transistor amplifies the RF signal, which drives the dual diode-detector circuit. The detected audio drives the headphones (Z1).

The antenna I used with this single-transistor receiver consisted of about 25 feet of 26-gauge copper wire that I ran across the ceiling. That's not exactly an ideal antenna for my location, however, as I'm over 100 miles from any powerful AM transmitter. My ground circuit consisted of a single ground-rod setting in dry rocky soil. That certainly isn't an ideal ground system either. But even with these two major deficiencies, the simple little receiver performed well. Try the circuit; the cost is small and the excitement is contagious.

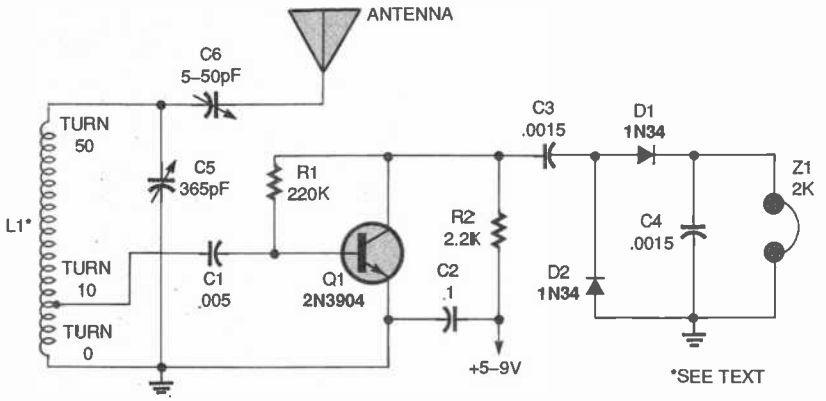

Fig. 4. Here's a receiver that contains an RF amplifier. The desired radio-frequency signal can be selected by tuning C5.

PARTS LIST FOR THE RF AMPLIFIER RECEIVER(Fig. 4)

CAPACITORS
C1—0.005-μF, ceramic-disc
C2—0.1-μF, ceramic-disc
C3, C4—0.0015-μF, ceramic-disc
C5—365-pF, or similar-value, variable tuning capacitor
C6—5-50-pF, or similar-value, variable tuning capacitor

ADDITIONAL PARTS AND MATERIALS
Q1—2N3904 NPN transistor
D1, D2—1N34 germanium diode
R1—220,000-ohm, 1/4-watt, 5% resistor
R2—2200-ohm, 1/4-watt, 5% resistor
L1—50-turn coil (see Fig. 3)
Z1—2000-ohm headphones
Antenna, power source, wire, solder, etc.

IMPROVED RF AMPLIFIER RECEIVER

Now on to the next receiver circuit (see Fig. 5), which uses an RF amplifier in front of a diode detector, and an audio amplifier behind it. This RF-amplifier circuit is very similar to the one used in the previous receiver, with two exceptions: First, a 2.5-mH RF choke (L2) replaces Q1's load resistor. Second, an RF-gain-control potentiometer, R4, is added.

The RF choke improves the amplifier's efficiency and gain at the AM broadcast frequencies. With the circuit's added RF and AF amplification, R4 serves as the receiver's volume control.

Once you build the receiver, hook up an antenna and ground. Set C7 to about half of its maximum capacitance

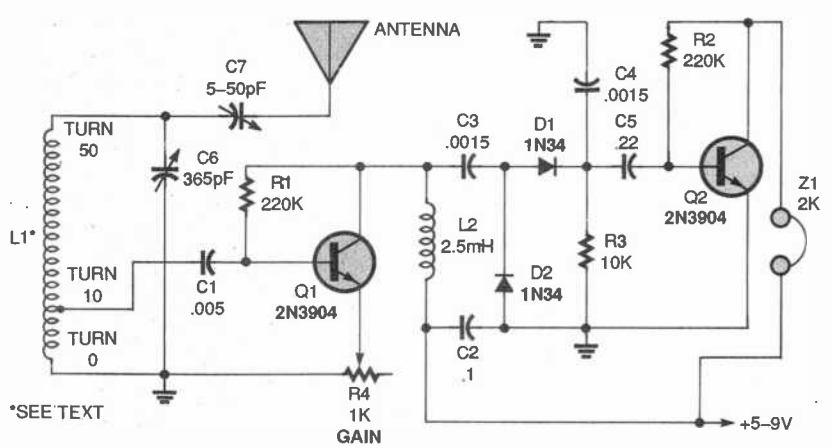

Fig. 5. This receiver allows you to select the gain of its RF amplifier by adjusting R4.

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PARTS LIST FOR THE IMPROVED RF AMPLIFIER RECEIVER (Fig. 5)

RESISTORS
(All fixed resistors are 1/4-watt, 5% units.)
R1, R2—220,000-ohm
R3—10,000-ohm
R4—1000-ohm potentiometer

CAPACITORS
C1—0.005-µF, ceramic-disc
C2—0.1-µF, ceramic-disc
C3, C4—0.0015-µF, Mylar
C5—0.22-µF, Mylar
C6—365-pF variable tuning capacitor
C7—5-50-pF variable tuning capacitor

ADDITIONAL PARTS AND MATERIALS
Q1, Q2—2N3904 NPN transistor
D1, D2—1N34 germanium diode
L1—50-turn coil (see Fig. 3)
L2—2.5-mH RF choke
Z1—2000-ohm headphones
Antenna, power source, wire, solder, etc.

and R1 to its maximum resistance; then apply power. Rotate C6 until a station is heard and adjust R4 for a pleasant listening level. If more than one station is received at the same time, re-adjust C7 for less capacitance; that should help the circuit's selectivity.

If a strong local station overloads the receiver, a trap might be necessary in the antenna circuit. You'll find two easy-to-build trap circuits following our next receiver circuit.

SOLID-STATE REGENERATIVE RECEIVER

Our last receiver circuit, shown in Fig. 6, is a solid-state version of Major E.H. Armstrong's famous regenerative receiver. At its time in radio history, the regenerative receiver reigned supreme and remained so until the Major came out with his superheterodyne receiver circuit. The basic superheterodyne design is the one used in just about all of the commercial radios that are built today.

You will need to modify the coil shown in Fig. 3 to use it with the regenerative receiver. Here's how to do that: Place a single layer of electrical tape around the bottom winding of the coil (L1); wind 6 turns of 19- or 20-gauge wire over the taped winding, leaving 4-inch pig tails. Tape the winding in place. Then connect the modified coil to the receiver circuit as shown in Fig. 6.

The two 2N3904 transistors are connected in a Darlington high-input-impedance circuit configuration to reduce loading of the tuned circuit. Both C3 and C4 perform the same duties as in the previous two receiver circuits.

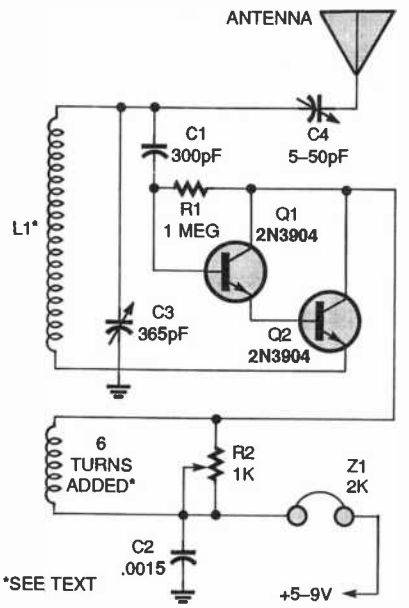

Fig. 6. Here's a solid-state version of a well-known regenerative receiver. You will need to modify coil L1 to use it with this circuit.

PARTS LIST FOR THE SOLID-STATE REGENERATIVE RECEIVER (Fig. 6)

CAPACITORS
C1—300-pF, ceramic-disc
C2—0.0015-µF, Mylar
C3—365-pF variable tuning capacitor
C4—5-50-pF variable tuning capacitor

ADDITIONAL PARTS AND MATERIALS
Q1, Q2—2N3904 NPN transistor
R1—1-megohm, 1/4-watt, 5% resistor
R2—1000-ohm potentiometer
L1—Modified coil (see text and Fig. 3)
Z1—2000-ohm headphones
Antenna, power source, wire, solder, etc.

Potentiometer R2 controls the positive RF feedback. When used like this, a potentiometer is more commonly known as the regeneration control, which also determines the receiver's audio output.

If the receiver seems dead, and only weak signals are heard, try reversing the leads on the 6-turn feedback coil. That might be all that's necessary to do the trick.

RF FILTERS

The two RF-filter circuits shown in Fig. 7 can help reduce the interference from nearby or powerful AM stations. They are slightly different, but work in similar ways.

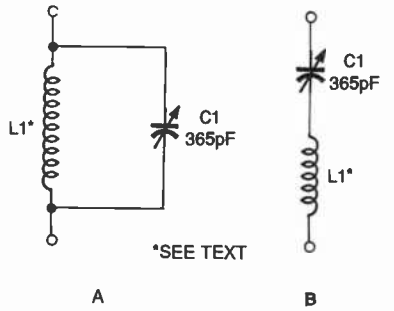

Fig. 7. These parallel-tuned (A) and series-tuned (B) filter circuits can help reduce the interference from nearby or powerful AM stations. Tune C1 to accomplish that.

PARTS LIST FOR THE RF FILTERS (Fig. 7)

C1—365-pF variable tuning capacitor
L1—50-turn coil (see Fig. 3)
Wire, solder, etc.

The parallel-tuned filter circuit, shown in Fig. 7A, connects in series with an antenna and receiver circuit. Tune C1 to reduce or remove the interfering station.

The series-tuned filter circuit, shown in Fig. 7B, also connects in series to the antenna and ground circuit. You can tune C1 in this filter as well to reduce or remove the interfering station.

That's all our time for now. Until next month, try at least one of these simple receivers. I'm certain you'll enjoy them as much as I do.

May your radio only receive good news. ■

HAM RADIO

(continued from page 61)

miles east of Tucson where an amateur radio club erected a 20-foot-high, 40-foot-long passive reflector on a mountaintop so they could work repeaters in desert towns on the other side. I didn't get up to it, but was told that it was relatively cheap to build (about $300), and is used by 2-meter operators all over the area. Heck, I bet even the rattlesnakes like it...it does, after all, provide them with shade for part of the day.

I can be reached by snail mail at P.O. Box 1099, Falls Church, VA, 22041, or by e-mail at carrjj@aol.com. ■

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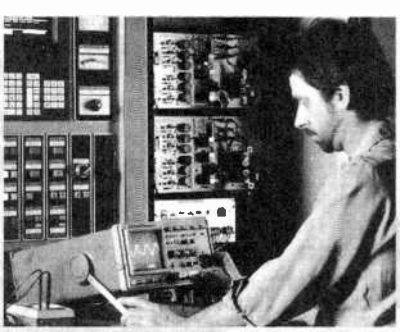

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SCANNER SCENE

Eavesdropper's Delight

BY MARC SAXON

For those who want to be able to eavesdrop on virtually everything, *Icom* offers its brand-new *IC-R8500* super-wide-band all-mode receiver. Think of it as a professional-grade combination VHF/UHF scanner merged with a highly versatile communications receiver. And it's available at an affordable price.

Here's the deal. You get continuous coverage from 100 kHz to 2000 MHz (no gaps). The IC-R8500 can tune in NFM, WFM, AM-W, AM-N, SSB, CW, RTTY, and (with optional narrow filter) CW-N. There are 1000 memory channels and 20 scan-edge channels. The memory channels are set up in 20 banks of 40 each, with 100 channels reserved for automatic memory write scan and another 100 for skip scan. Each memory channel can store frequency, mode, tuning steps, and RF ATT information. You can also store up to five characters of your own alphanumeric information into each memory bank, and eight in each memory channel, for quick reference.

Scanning functions include programmed scan, memory scan, priority scan, selected mode memory scan, auto memory write scan, and selected number memory scan. Scanning speed is 20 channels per second in programmed scan mode and 10 channels per second in memory scan.

Frequencies are selected by a front-panel keyboard or rotary tuning knob. There are selectable tuning steps of 10, 50, or 100 Hz; 1, 2.5, 5, 9, 10, 12.5, 20, 25, and 100 kHz; and 1 MHz.

Additional features include high-frequency stability even when receiving in the GHz range, a noise blanker that eliminates pulse-type noise in the SSB/AM modes, three separate antenna connectors, S-meter, and center indicator for tuning convenience. Options include the UT-102 voice synthesizer, the TV-R7100 TV-receive adapter, and the CR-293 high-stability crystal unit.

What do you think? For more information, please contact your nearest Icom dealer or Icom America, Inc. (2380 116th Avenue N.E., Bellevue, WA 98004; Tel. 206-454-8155).

Icom's IC-R8500 combines a top-of-the-line VHF/UHF scanner with a versatile communications receiver (and at a reasonable price, too!)

ALL IN THE FAMILY

RadioShack came up with the idea for a new radio service and presented it to the FCC. After kicking the concept around for a while, the FCC has decided to approve the Family Radio Service, thus providing us with yet one more type of station to monitor!

Now that it has been approved, the Family Radio Service (FRS) offers the very short-range use of unlicensed half-watt special transceivers by families and groups. There are 14 frequencies allocated to FRS: 462.5625, 462.5875, 462.6125, 462.6375, 462.6625, 462.6875, 462.7125, 467.5625, 467.5875, 467.6125, 467.6375, 467.6625, 467.6875, and 467.7125 MHz. CTCSS tone-code squelch is permitted, although repeaters are not.

Transceivers will certainly be plentiful, with many manufacturers offering them for less than $200. There could be some rather interesting chatter on those channels if you're within range.

HOBBY NEWS

We were taken by surprise upon recently receiving a postcard from the Radio Communications Monitoring Association (RCMA) of Silverado, California, advising members that it was suspending operations. After more than 20 years on the scene, the RCMA now says that its membership rolls have thinned out to the point where it has become impractical to continue bringing out their excellent *Scanner Journal*. A definite loss to the scanning hobby.

However, there's good news, too! A few weeks ago, we were sent a copy of an all-new, bi-monthly newsletter for scanner users, and it looked quite good to us. It's called *The Scanner Club*, and is published and edited by Les Mattson, founder of the well-remembered *North East Scanner News*. The issue we saw had 67 pages with coverage of all aspects of the hobby, with columns and features for all areas of the U.S.

The yearly membership (subscription) to *The Scanner Club* is $24.95 for six issues. Make checks payable to Les Mattson at The Scanner Club, P.O. Box 62, Gibbstown, NJ 08027. If you want more information, the club's phone number is 609-423-1603, and Les Mattson's e-mail address is lesscan@aol.com.

Let's also remind you of *Radio Monitors Newsletter of Maryland*, P.O. Box 394, Hampstead, MD 21074-0394. Their e-mail address is RBscan@aol.com. There's plenty of good frequencies and information in this monthly publication.

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CTCSS TONES

The Scanner Club newsletter offered a number of what it described as "typical federal CTCSS tones." That is, CTCSS tones (or, as some refer to them, "PL tones") that seem to be preferred by specific federal agencies. Because many scanner owners can get readouts of those tones, let's check out some of them here in an effort to get you an ID on any difficult stations.

For instance, the FCC uses a CTCSS of 173.8 Hz; the Department of Energy uses 77.0 Hz; Commerce has 127.3 Hz; and the DEA has 156.7 Hz. Immigration and the Customs Service use 100.0 Hz, while the FBI and HHS both use 167.9 Hz. The Secret Service uses 103.5 Hz.

The Scanner Club also reminds us of those ten medical channels that are now so heavily used between ambulances and hospitals. Channels Med 9 and 10, which are 462.95 and 462.975 MHz, are the calling channels, where communications are established and a working channel (Med 1 through Med 8) is assigned. Channel Med 1 is 463.000, Med 2 is 463.025, Med 3 is 463.050, Med 4 is 463.075, Med 5 is 462.100, Med 6 is 463.25, Med 7 is 163.150, and Med 8 is 463.175 MHz. The working channels may be used for voice communications, as well as for sending EKGs or other digitized data from the ambulances to the hospital staff.

Keep in touch with us here at *Scanner Scene*! Please send along your frequencies, questions, suggestions, and opinions. We are always on the alert for input from our readers. Our address is *Scanner Scene*, **Popular Electronics**, 500 Bi-County Blvd., Farmingdale, NY 11735. ■

ANTIQUE RADIO

(continued from page 52)

time you activate your news reader.

Before leaving the subject of newsgroups, a few ground rules should be mentioned. The culture of most groups requires you to behave in a reasonably intelligent and considerate manner. If you post something thoughtless, or if you "flame" (insult) a member of the group, you might hear from the group moderator or become, yourself, the target of multiple flames.

Many groups strongly discourage overtly commercial postings (although private buy, sell, or trade ads are usually acceptable). Naive questions asked by newcomers (or "newbies") sometimes draw testy responses. To avoid the latter, see if the group has posted an FAQ (list of answers to frequently asked questions). Most groups have FAQs and post them at regular intervals. If you don't see one, post a message asking when you can get it. And when it does become available, print it out—or save it to a file—so that you can study it at your leisure.

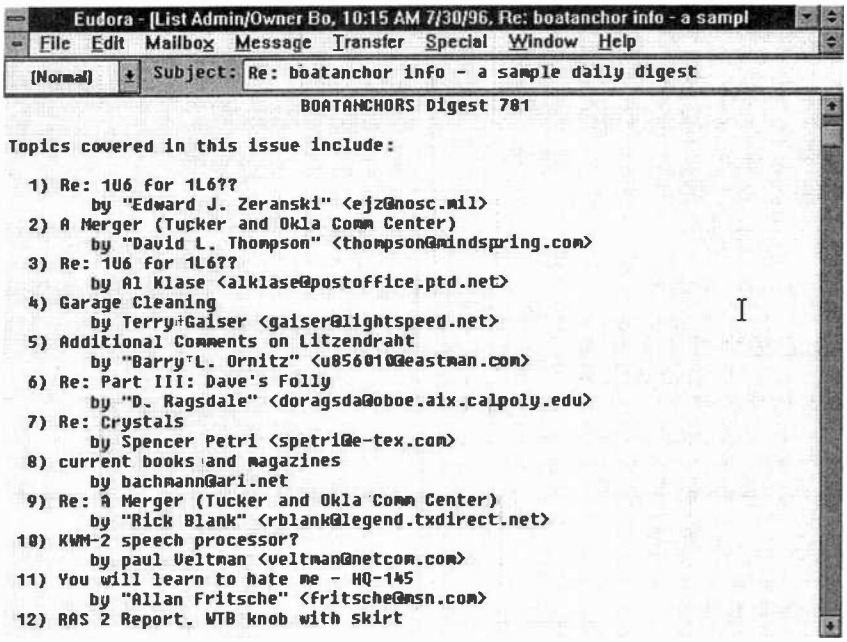


Fig. 3. Here are about half of the postings (see text) in a typical Boatanchors mailing-list digest.

MAILING LISTS

Mailing lists are similar in concept to newsgroups, but a lot less public. Postings to a mailing list, or replies to the posts of others, are made by sending them to a special e-mail address. The list owner or manager, in turn, blanket-forwards all postings to the e-mail addresses of all list subscribers—perhaps after editing or organizing the message in some manner.

It's not as easy to locate mailing lists as it is to find newsgroups, although "lists of lists" have been compiled. One way to access them is to search the World-Wide Web (to be covered next time). To join a list, you have to have the e-mail address of the owner/manager so that you can request information on how to become a member. There may or may not be a membership fee.

One well-known list of definite interest to antique-radio hobbyists is known as "Boatanchors." Quoting from the Boatanchors new-subscriber welcome message: "This mailing list is devoted to a discussion of vintage communications equipment, which we fondly refer to as 'Boatanchors,' and closely related subjects. The central theme is vintage amateur-radio equipment using vacuum-tube (firebottle) technology, but we have been known to drift into discussions of such things as entertainment boatanchors, antennas, telegraph keys, classic electronic/radio books, and radio history."

To join Boatanchors, there is a small annual fee ($12). You may elect to receive each new posting as it arrives or, instead, choose the "digest" option. In digest mode, the list manager holds your e-mail until the accumulating group of new postings reaches a certain size. It is then forwarded to you, accompanied by a "header" listing the titles of the posts, so that you can skip directly to the items you'd like to read immediately.

Part of the header of a sample digest sent to me by the list owner/manager is included here as Figure 3. It shows about half of the titles in the group. For information on joining Boatanchors, e-mail listown@ jackatak.theporch.com.

And speaking of message threads, it looks as if this Internet orientation will have to be continued next time, when we will examine the amazing resources waiting for you on the World-Wide Web! ■

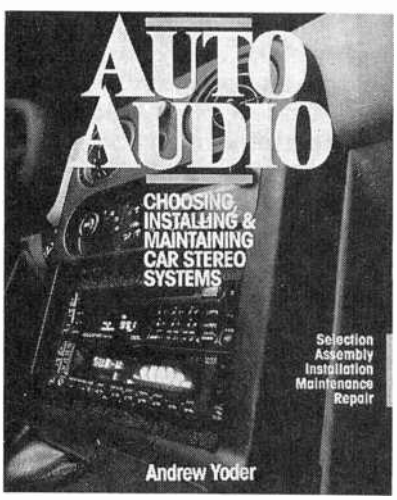
AmericanRadioHistory.Com

Electronics Library

AUTO AUDIO: Choosing, Installing & Maintaining Car Stereo Systems

by Andrew Yoder

Regardless of your level of expertise, or your budget, this book will help you put together a great-sounding car stereo system. It helps consumers minimize the confusion they experience when confronted by the dizzying array of available components, and avoid paying a premium for professional advice. The book arms you with the information you need to make intelligent choices without spending a small fortune.



The book is filled with practical advice on how to select and install car-stereo systems, as well as how to keep them trouble-free and sounding great. It presents all the information you'll need in terms that a lay person can understand. The book begins with a detailed discussion of how to choose an audio system that meets your demands, followed by helpful advice on where to shop, including the names and addresses of equipment sources. There are complete chapters on amplifiers; speakers and speaker enclosures, filters and crossovers; antennas; wire, cabling, connectors, and transmission systems; installations; and maintenance and repair. Also covered are some less-common car-audio components, such as MiniDisc players, and the radio display system (RDS), and shortwave receivers.

Auto Audio: Choosing, Installing & Maintaining Car Stereo Systems costs $24.95 and is published by McGraw-Hill, Inc., 1221 Avenue of the Americas, New York, NY 10020; Tel. 800-2-MCGRAW.

CIRCLE 90 ON FREE INFORMATION CARD

THE ARRL EXTRA CLASS LICENSE MANUAL

edited by Larry D. Wolfgang, WR1B

Even though there are some juicy DX stations and a lot of contest stations in the bands reserved exclusively for Extra class users, many amateurs put off taking the Extra class exam because they don't think they can understand the theory, or master 20-word-per-minute code. If you're willing to make the commitment to study and practice, however, you can do it, and this book can help.

The book teaches you everything needed to pass the Element 4B written exam. It provides clear explanations of the theory you'll need, along with the complete and up-to-date question pool. This edition features the revised question pool as released by the Volunteer Examiner Coordinators' Question Pool Committee for use beginning July 1, 1996. The question-pool answer key is printed next to the questions for easy reference. The book also clearly explains all the FCC rules you'll need to know for the exam, and recommends Morse-code study materials.

The ARRL Extra Class License Manual For the Radio Amateur costs $12 and is published by The American Radio Relay League, 225 Main Street, Newington, CT 06111-1494; Tel. 860-594-0200; Fax: 860-594-0303; e-mail: pubsales@arrl.org; Web: http://www.arrl.org/.

CIRCLE 91 ON FREE INFORMATION CARD

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from Ameco Corporation

You can use your IBM-compatible PC to prepare for the FCC Ham Radio license written exams with Ameco's FCC Test Packages. All possible exam questions are presented word-for-word as they will appear on the actual exams. The software includes a friendly interface, mouse support, and full-time online help. Sample VEC tests can be viewed on-screen or printed out. There are colorful graphs and all required schematic diagrams, quizzes on every topic, and complete explanations for every question. An Ameco FCC Test manual is included as part of every Test Package.

Ameco Test Packages for No-Code Technician Class, Technician Class, General Class, Novice Class, Advanced Class, and Extra Class exams are priced starting at $24.95 and are published by Ameco Corporation, 224 East Second Street, Mineola, NY 11501; Tel. 516-741-5030; Fax: 516-741-5031. ■

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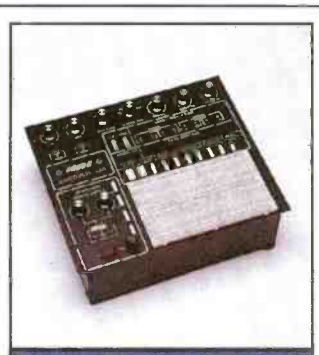

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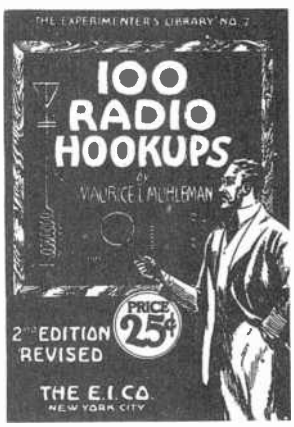
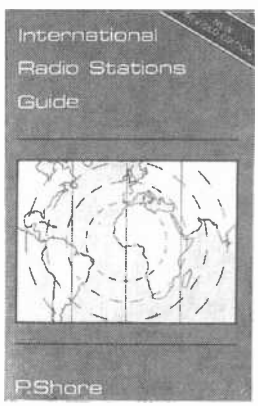
☐ 100 RADIO HOOKUPS —#7—$3.00

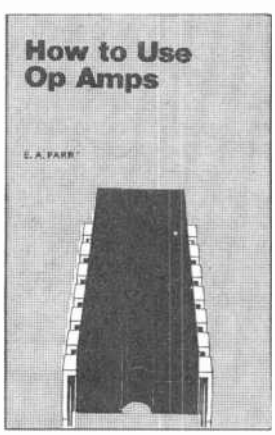
First published in May, 1923 this popular booklet went into reprint editions nine times. It is packed with circuits, theory, antenna installation and tips on consumer radio receivers that were popular in the early 1920's. Antique radio buffs and those inquisitive about the early days of radio will find 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.



☐ INTERNATIONAL RADIO STATIONS GUIDE—BP255 —$9.95

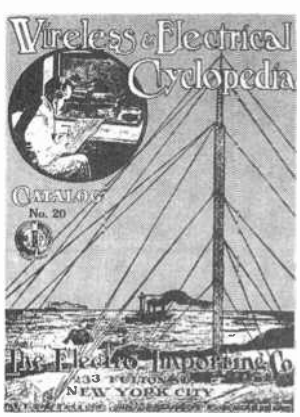
Provides the casual listener, amateur radio DXer and the professional radio monitor with an essential reference work designed as a guide for listening tothe complex radio bands. Includes coverage on Listening to Shortwave Radio, ITU Country Codes, Worldwide Radio Stations, European Long Wave and Medium Wave Stations, Broadcasts in English and more.





☐ HOW TO USE OP AMPS —BP88—$5.95

The engineer's best friend is the op amp. This basic building block is found in many circuits, analog and digital alike. The op amp finds many useful purposes such as: oscillators, inverters, isolators, high- and low-filters, notch and band-pass filters, noise generator, power supplies, audio, MIDI, and much more. Prepared as a designer's guide, some limited math is used, however engineers and hobbyists alike find it a useful text for their design needs.



☐ WIRELESS & ELECTRICAL CYCLOPEDIA —ETT1—$5.75

A slice of history. This early electronics catalog was issued in 1918. It consists of 176 pages that document the early history of electricity, radio and electronics. It was the "bible" of the electrical experimenter of the period. Take a look at history and see how far we have come. And by the way, don't try to order any of the radio parts and receivers shown, it's very unlikely that it will be available.

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General

Display: 3-1/2 Digit LCD, 21mm Figure Height with Automatic Polarity
Overrange Indication: 3 Least Significant Digits Blank
Temperature for Guaranteed Accuracy: 23°C±5°C RH<75%
Temperature Ranges:
Operating: 0°C to 40°C (32°F to 104°F)
Storage: -10°C to 50°C (14°F to 122°F)
Power: 9V Alkaline or Carbon-Zinc Battery(NEDA 1604)
Low Battery Indication: BAT on Left of LCD Display
Dimensions: 188mm long x 87mm wide x 33mm thick
Net Weight: 400g

DC Voltage (DCV)

Range:	Resolution:	Accuracy:
200mV	100µV	
2000mV	1mV	
20V	10mV	±(1%rdg+2dgts)
200V	100mV	
1000V	1V	

Maximum Allowable Input: 1000V DC or Peak AC.

DC Current (DCA)

Range:	Resolution:	Accuracy:
200µA	100nA	
2000µA	1µA	±(1.2%rdg+2dgts)
20mA	10µA	
200mA	100µA	
10A	10mA	±(1.2%rdg+2dgts)

Overload Protection: mA Input. 2A/250V fuse.

AC Voltage (ACV)

Range:	Resolution:	Accuracy:
200V	100mV	±(1.2%rdg+10dgts)
750V	1V	

Frequency Range: 45Hz-450Hz
Maximum Allowable Input: 750V rms
Response: Average Responding. Calibrated in rms of a Sine Wave.

$19.00 any qty

Resistance (Ω)

Range:	Resolution:	Accuracy:
200Ω	100mΩ	
2000Ω	1Ω	
20KΩ	10Ω	±(1.2%rdg+2dgts)
200KΩ	100Ω	
2000KΩ	1KΩ	
20MΩ	10KΩ	±(2%rdg+10dgts)

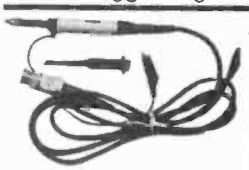
Maximum Open Circuit Voltage: 2.8V

Diode Test
Measures forward voltage drop of a semiconductor junction in mV test current of 1.5mA Max.

hFE Test
Measures transistor hFE.

CAT NO	DESCRIPTION	PRICE
9300G	Rugged High Quality DMM with Rubber Boot	$19.00

Switchable Scope Probe Sets



(Selectable X1/Ref/X10) These high quality scope probe sets are for oscilloscopes up to 60MHz (model HP 9060) or 150MHz (model HP9150). Both sets include a handy storage pouch and include an IC test-hook adapter for the probe. The BNC connector rotates to avoid cable tangle or kink. Cable length is 1.4 meters.

		PRICE EACH		
CAT NO	DESCRIPTION	1	10	100
HP-9060	Scope Probe Set DC~60MHz	$16.49	$14.49	$11.58
HP-9150	Scope Probe Set DC~150MHz	24.95	21.95	18.62

Positive Photo Resist Pre-Sensitized Printed Circuit Boards

These pre-sensitized printed circuit boards are ideal for small production runs. They provide high resolution and excellent line width control. High sensitive positive resist coated on 1oz. copper foil allows you to go direct from your computer plot or art work layout. No need to reverse art.

Single-Sided, 1oz. Copper Foil on Paper Phenolic Substrate

		PRICE EACH		
CAT NO	DESCRIPTION	1	10	50
PP101	100mm x 150mm/3.91" x 5.91"	$2.55	$1.90	$1.70
PP114	114mm x 185mm/4.6" x 6.6"	2.98	2.45	1.98
PP152	150mm x 250mm/5.91" x 9.84"	5.40	3.98	3.60
PP153	150mm x 300mm/5.91" x 11.81"	6.15	4.48	4.10

Single-Sided, 1oz. Copper Foil on Fiberglass Substrate

		PRICE EACH		
CAT NO	DESCRIPTION	1	10	50
GS101	100mm x 150mm/3.91" x 5.91"	$ 3.90	$2.98	$2.60
GS114	114mm x 185mm/4.6" x 6.6"	4.80	3.49	3.20
GS152	150mm x 250mm/5.91" x 9.84"	8.69	5.98	5.78
GS153	150mm x 300mm/5.91" x 11.81"	10.20	7.20	6.80

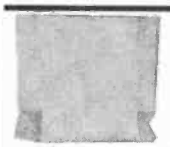
Double-Sided, 1oz. Copper Foil on Fiberglass Substrate

		PRICE EACH		
CAT NO	DESCRIPTION	1	10	50
GD101	100mm x 150mm/3.91" x 5.91"	$ 5.07	$3.68	$3.38
GD114	114mm x 185mm/4.6" x 6.6"	5.95	4.29	3.99
GD152	150mm x 250mm/5.91" x 9.84"	10.47	7.39	6.98
GD153	150mm x 300mm/5.91" x 11.81"	11.95	8.69	8.30

Etching Chemicals/Ferric Chloride

A dry concentrate that mixes with water to make 1 pint of etchant, enough to etch 400 sq. inches of 1oz board.

		PRICE EACH	
CAT NO	DESCRIPTION	1	5
ER-3	Makes 1 pint	$3.50	$2.75



Developer This product is used as the developer on our positive photo-resist printed circuit boards. Includes instructions. 50 gram package, mixes with water,

		PRICE EACH		
CAT NO	DESCRIPTION	1	10	25
POSDEV	Positive Developer	$ .95	$ .80	$ .50

Etching Tank This handy etching system will handle PC boards up to 8"x9", two at a time. Ideal for etching your PCB's! System includes an air pump for etchant agitation, a thermostatically controlled heater for keeping etchant at optimum temperature and a tank that holds 1.35 gallons of etchant. A tight fitting lid is also supplied to prevent evaporation when system is not being used. Typical etching time is reduced to 4 minutes on 1oz. copper board!

REDUCES ETCHING TIME!

CAT NO	DESCRIPTION	PRICE
12-700	Etch Tank System	$37.95

Desoldering Pumps

These powerful plastic body desoldering pumps are designed for easy one hand operation for fast, efficient desoldering. Double O-ring piston seals for maximum suction.

		PRICE EACH		
CAT NO	DESCRIPTION	1	5	10
08-366S	Large Desoldering Pump	$15.89	$13.49	$11.95
08-366E	Regular Desoldering Pump	10.89	8.59	7.39
08-366TIP	Replacement Tip	1.95	1.95	1.95

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Electronic Soldering System

Here's the ideal solution when **Temperature Control** is required. Easy to use slide control allows user to set system from 300°F to 840°F. Voltage to iron from control unit is 24V Iron heating power is 48W. Replaceable 5.3mm tip is standard. Replacement irons and tips are available.

AS LOW AS $50.00

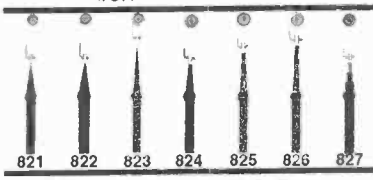
CAT NO	DESCRIPTION	PRICE EACH 1	5
SL10	Temp Controlled Soldering Iron	$56.00	$50.00
SL24V	Spare 24V Soldering Iron	10.50	7.50

Electronic Soldering System with LED Display

Deluxe temperature controlled system with LED display for maximum accuracy. Temperature is adjustable from 160°-480°C (320°-900°F). Iron heating power is 48 Watts. Runs on 24V from controller unit. Replacement irons and tips are available. Tip size is 5.3mm.

AS LOW AS $75

CAT NO	DESCRIPTION	PRICE EACH 1	5
SL30	Deluxe Soldering System w/LED	$86.00	$75.00
SL24V	Spare 24V Soldering Iron for SL10 or SL30	10.50	7.50

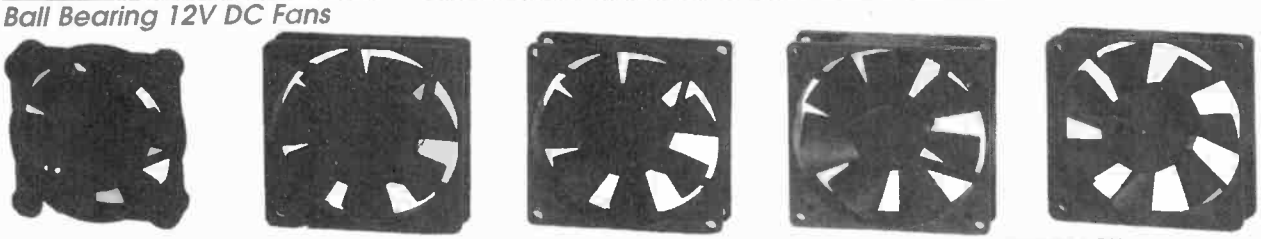


Replacement Tips for SL10/SL30

We now offer a variety of replacement tips for the SL10/SL30 soldering stations.

CAT NO	DESCRIPTION	PRICE EACH 1	5
821	1/32" Pencil Tip	$1.39	$1.19
822	1/32" Pencil Tip	1.39	1.19
823	1/64" Pencil Tip	1.39	1.19
824	1/16" Chisel Tip	1.49	1.29
825	1/8" Chisel Tip	$1.49	$1.29
826	3/64" Chisel Tip	1.49	1.29
827	3/64" Pencil Tip	1.59	1.39

Ball Bearing 12V DC Fans



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

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

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We stock high quality 60/40(Sn%/Pb%), .031" and 63/37, .031" diameter. This is prime JIS certified solder that we maintain as a regular stock item (It is not "Left-overs, Rejects or Surplus") and you can buy it from us at a fraction of the price that you are used to.

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CAT NO	DESCRIPTION	PRICE EACH 1	10	25
RH60-1	1-lb. Spool, .031", 60/40	$ 6.90	$ 5.96	$ 5.30
RH63-1	1-lb. Spool, .031", 63/37	6.95	6.10	5.41
RH60-4	4.4-lb. Spool, .031", 60/40	24.00	21.90	17.92
RH60-TUBE	6-oz. Tube, .031", 60/40	.99	.89	.79

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This black and white monochrome CCD Camera is totally contained on a PCB (70mm x 46mm). The lens is the tallest component on the board (27mm high from the back of the PCB) and it works with light as low as 0.1 lux. It is IR Responsive for use in total darkness. It comes with six IR LED's on board. It connects to any standard monitor, AUX or video input on a VCR or through a video modulator to a TV. Works with a REGULATED 12V power supply (11V-13V). Hooks up by connectiong three wires: red to 12V, black to ground (power & video) and brown to video signal output.

CAT NO	DESCRIPTION	PRICE EACH 1	5
CA-H34A	PCB Mounted IRCCD Camera	$125.00	$109.00

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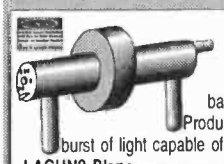
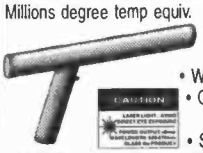


Handheld, battery operated. Produces an intense burst of light capable of burning holes.

LAGUN2 Plans $20.00
LAGUN2K Kit / Plans ..... Price on Req

Visible Beam Gas Lasers



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• 12/115V
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BTC3K Kit/Plans with coil $299.50
BTC30 Assbld Ready to Use $399.50
BTC4 Plans, 500KV unit $20.00

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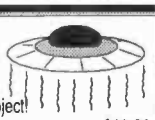

Levitate an object! Great science fair project!

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GRA1K Power Supply Kit/Plans ... $99.50
GRA10 Assbld Kit/Plans $149.50
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HEP10 ->
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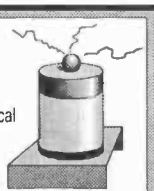

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Parabolic dish to BUG Mother Nature and more!

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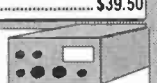

System detects intrusions and turns on a sonic field of pain, causing disorientation, acute paranoia, nausea and more. The perpetrator - man or animal - soon vacates! Protects 4 individual areas up to 5000 sq ft. Non hazardous when used as instructed.
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1 MHZ FUNCTION GENERATOR

Features

• Wider than specified frequency response • High deflection factor of 1mV/div.• Wide dynamic range up to 30MHz without waveform distortion • Algebric sum of CH1 and CH2 • Low drift with compensation circuit • Superb trigger sensitivity • Maximum sweep rate of video signals with internal TV sync. separator • Jittless trigger circuitry • CH1 signal output terminal available • Variable trigger hold-off • High precision X-Y phase difference measurement up to 50kHz • Built-in function generator with BNC output of 50Ω and TTL • Three kinds of waveform are available with 50Ω output • Flat output waveform frequency up to 1MHz

Specifications:

Vertical deflection: • Bandwidth :DC coupled (DC to 20MHz normal), AC coupled :(10Hz to 20MHz normal) • Deflection factor: 5mV/div to 5V/div in 10 calibrated steps of 1-2-5 sequence • Rise time: 17.5nS or less **Horizantal deflection:** • Time Base A: 0.2µs to 0.2S/div in 19 calibrated steps.1-2-5 sequence • Uncalibrated continuous control between steps of at least 1: 2.5.

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STRD-1005	SANKEN	1	4.15
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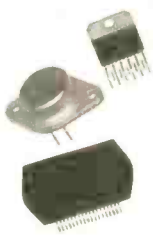
STRS-6301	SANKEN	1	8.50
TA-7777N	TOSHIBA	1	6.96
TDA-2005	SGS	5	1.49



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Capacitance: 1pF-200µF
Frequency: 1Hz-20MHz
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Capacitance: 0.1pF-20,000µF
Resistance: 1mΩ-20MΩ
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SMD and chip component test probe $25.00

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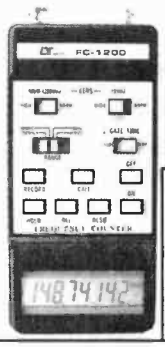
0.1pF, 1µH, 10mΩ resolution



Frequency Counter FC-1200 $129.95

Frequency:0.1Hz-1.25GHz
Display: 8 digit LCD
Period: 0.1µs-0.1s
Records Max/Min/Average
Data hold, relative mode
Telescoping antenna $8.00
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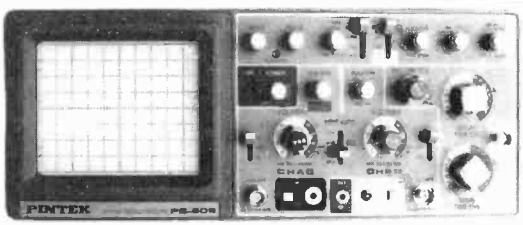
Also Available:
AC/DC clamp meter,Light meter, Thermometer, pH meter, High voltage probe, Digital caliper, Anemometer, Electronic scale, Force gauge,Tachometer, Stroboscope, Humidity & EMF adapter, Sound level meter, Frequency counter, SWR/field strength/power meter, Dip meter



20 MHz Oscilloscope with Delay Sweep PS-205 $429.95

Dual Trace, Component test, 6" CRT, X-Y Operation, TV Sync, Z-Modulation, CH2 Output, Graticule Illum, 2 probes each has x1,x10 switch. Best price with delay sweep.

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PS-405	40 MHz DELAY SWEEP	$569.95
PS-605	60 MHz DELAY SWEEP	$769.95
PS-1000	100 MHz DUAL TRACE	$999.95

Scope Probe: 60MHz x1, x10 $15, 100MHz x1, x10 $22
250MHz x1, x10 $29, 250MHz x100 $39

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Switchable between digital and analog modes
2 K word per channel storage
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Expanded Timebase 10ms/div - 0.5 s/div
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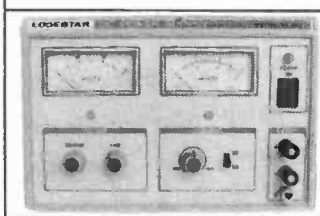
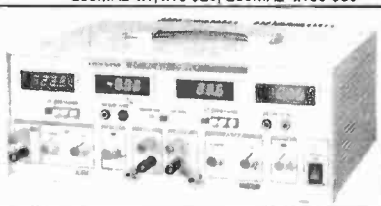
Plotter control



DC Power Supply PS-303 $159.00

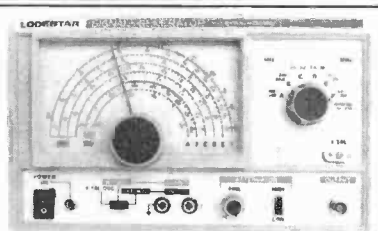
0-30 VDC , 0-3A output

Constant voltage & constant current mode
0.02% + 2mV line regulation
0.02% + 3mV load regulation
1 mVrms noise and ripple
Short circuit and overload protected
PS-8200 with digital voltmeter $179.00
Also available: 30V/5A, 60V/3A, 60V/5A 16V/10A, 30V/10A



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
Constant voltage and constant current mode
Four digital meters for volt and current display
Excellent regulation and low ripple
Short circuit and overload protected
Also available: 30V/5A triple output $549.95
Dual tracking 30V/3A, 30V/5A, 60V/3A, 60V/5A



RF SIGNAL GENERATOR SG-4160B $124.95

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 $124.95

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
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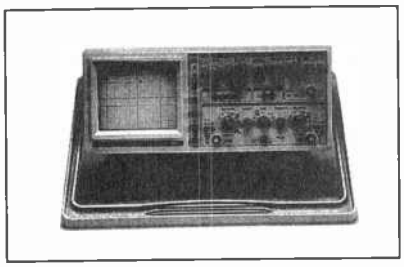

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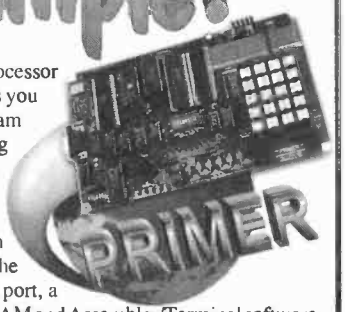

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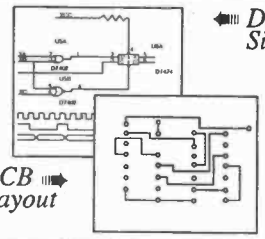

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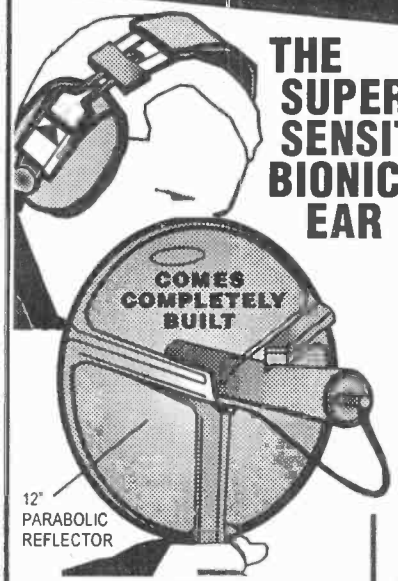

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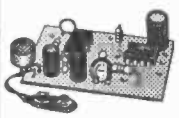

Listen through walls, hear conversations across the room. Add a parabolic reflector and hear blocks away. The BIG EAR can be hidden about anywhere. Makes an ultra sensitive intercom. Can be used as a 1.5W AMP. We supply a mini-electret mike in the kit. Power requirement 6 to12v DC. SIZE:1.75"x 1"

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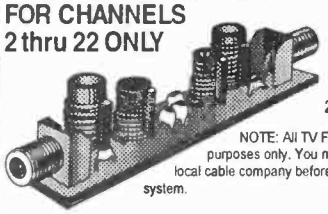

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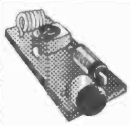

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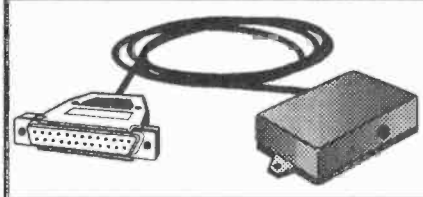

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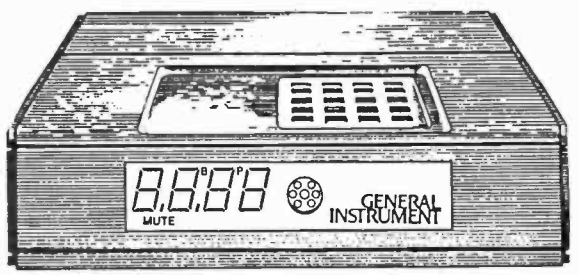

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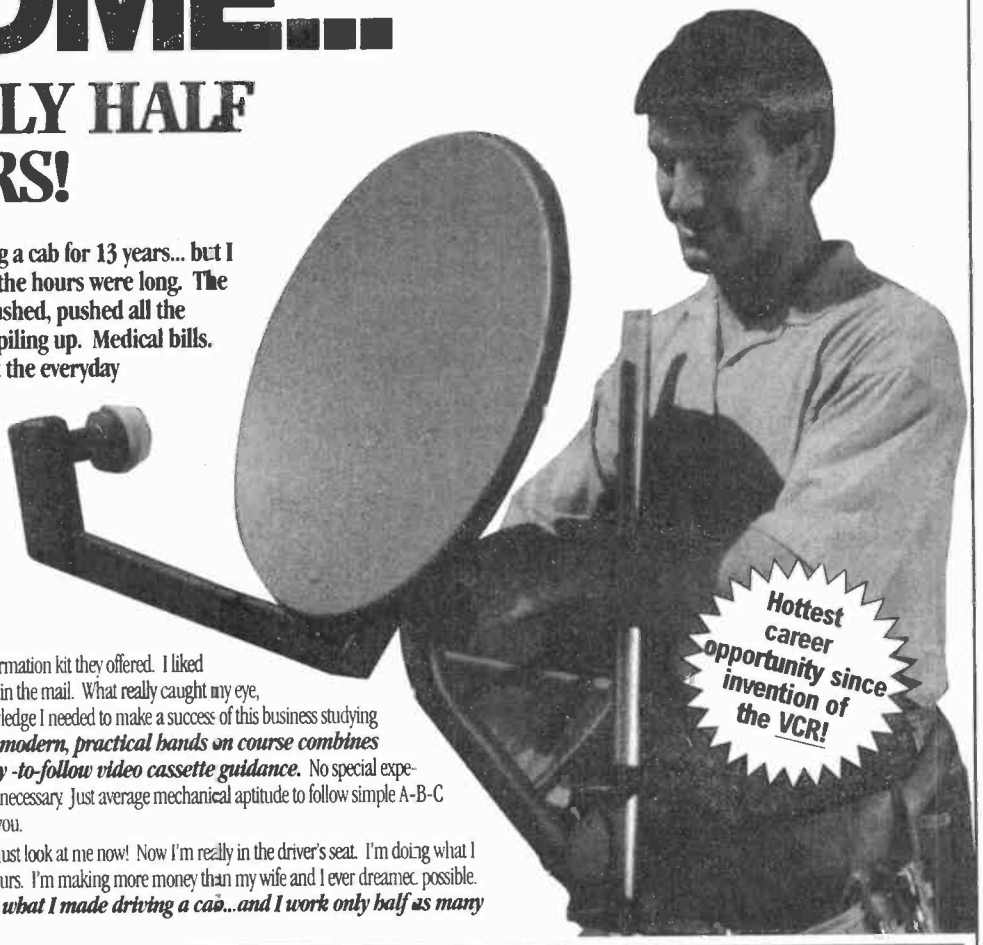

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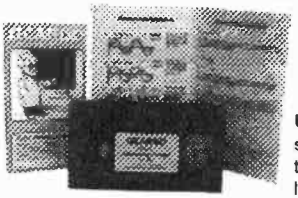

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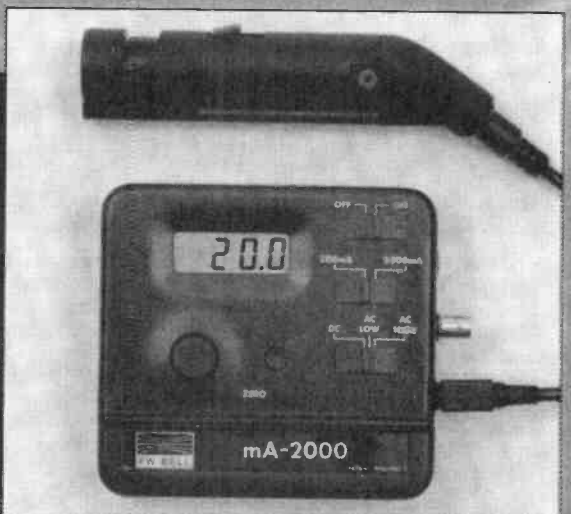

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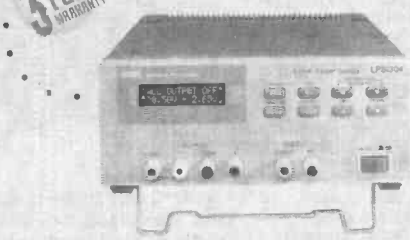

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- ST-5 - Screw Driver Slotted 3/16"
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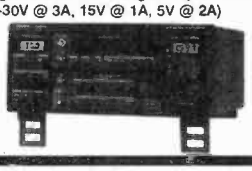

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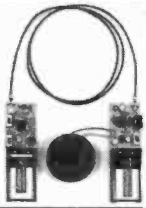

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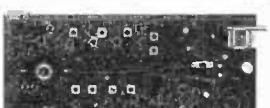

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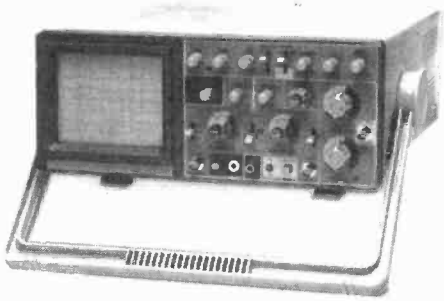

60MHz

DS-603 $1350
- Analog / Digital Storage
- 20MS/s Sampling Rate

S-1360 $749
- Analog with Delayed Sweep

40MHz

S-1345 $569
- Analog with Delayed Sweep

S-1340 $475
- Analog

2 Year Warranty

25/30MHz

DS-303 $1095
- Analog / Digital Storage

S-1330 $439
- 25MHz Analog
- Delayed Sweep

S-1325 $325
- 25MHz Analog

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ANALOG

Model	Bandwidth MHz	Sensitivity (max)	No. of Channels	Sweep Rate Max ns/div	Delayed Sweep	Video Sync	Component Tester	Beam Find	Time Base
S-1360	60	1mV/div	2	10ns/div	Yes	Yes	Yes	Yes	2
S-1345	40	1mV/div	2	10ns/div	Yes	Yes	Yes	Yes	2
S-1340	40	1mV/div	2	10ns/div	No	Yes	No	No	1
S-1330	25	1mV/div	2	10ns/div	Yes	Yes	Yes	Yes	2
S-1325	25	1mV/div	2	10ns/div	No	Yes	No	No	1

DIGITAL STORAGE

Model	Bandwidth MHz	Analog Sen (max)	No. of Channels	Sampling Rate	Memory Channel	Internally Backed Up	Pretrigger %	Output
DS-303	30	1mV/div	2	20MS/S	2K	Yes	0, 25, 50, 75	RS232
DS-603	60	1mV/div	2	20MS/S	2K	Yes	0, 25, 50, 75	RS232

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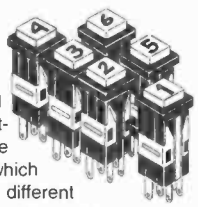

Twelve push-on/push-off switches (only 6 pictured). Each switch has a 0.6" square yellow lens with a 0.25" high black numeral 1 through 12. They are lighted by a 28 volt, #85 wedge base incandescent lamp which can be easily replaced if a different voltage is desired.

CAT #PBL-12 $15.00 per set of 12

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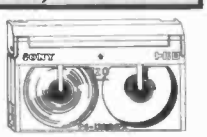

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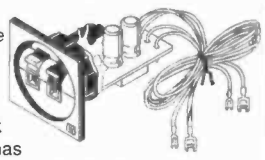

JBL # 70561
No specs available on this two way crossover made for JBL speakers. 2.38" square black plastic backplate has color-coded spring lever terminals and fits a 1.95" diameter hole. Crossover is attached to backplate and extends 3.17" behind mounting plate. Color coded wire leads.

CAT # LX-70561 $3.50 each

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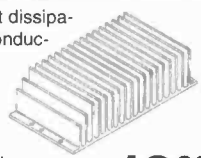

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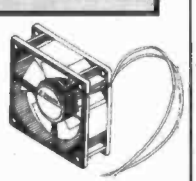

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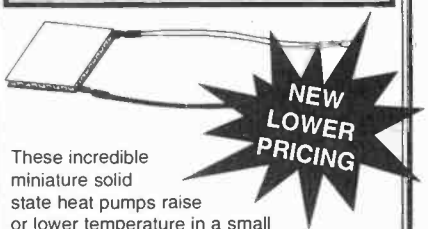

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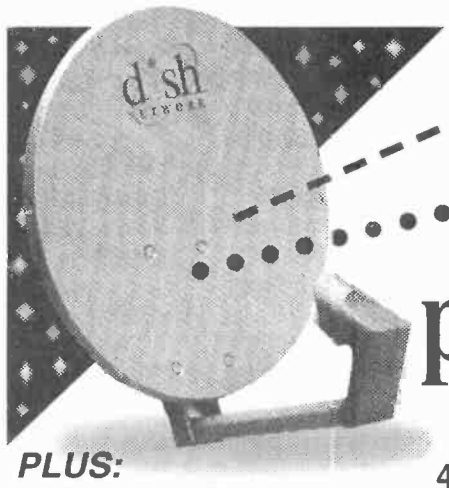

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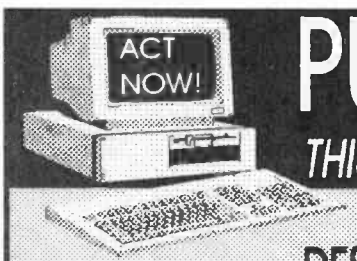

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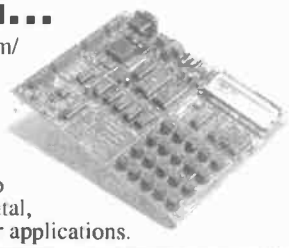

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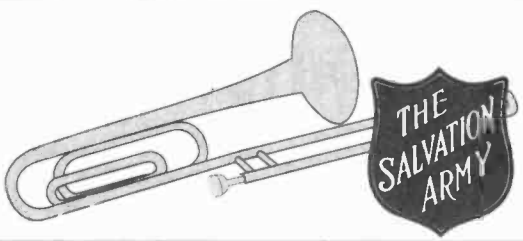

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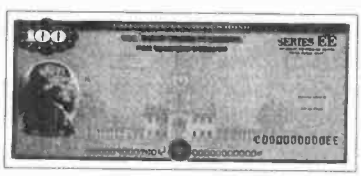

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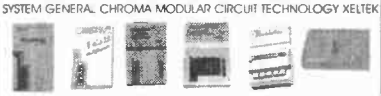

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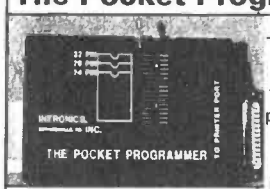

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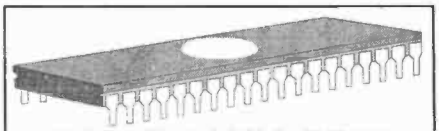

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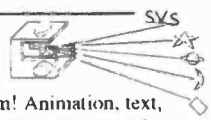

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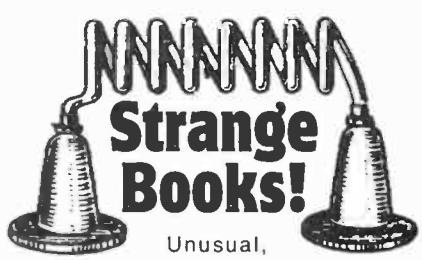

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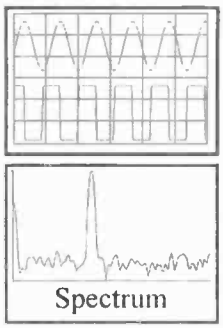

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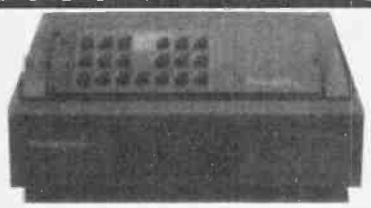

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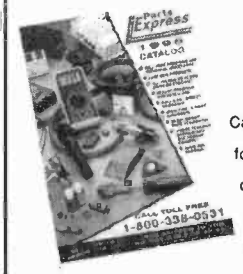

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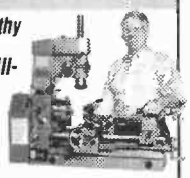

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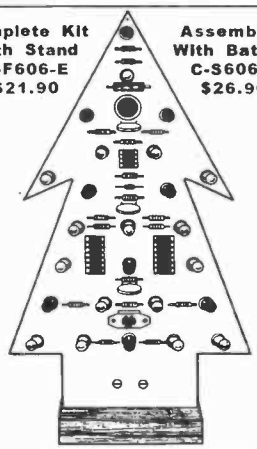

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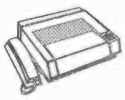

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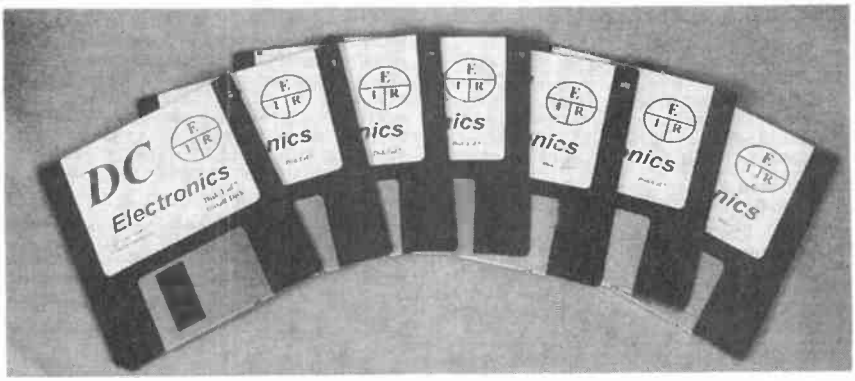

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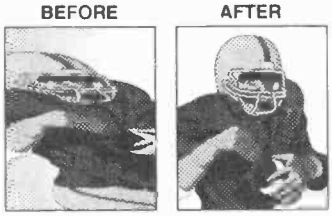

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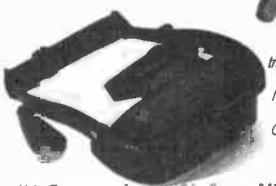

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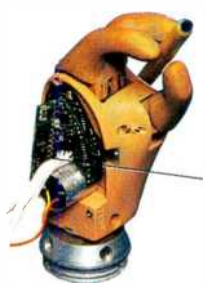
John McLean uses BASIC Stamps to gather data in Lechuguilla Cave (America's deepest cave, located in Carlsbad Caverns National Park).

Charles Walsh and his students in Great Falls, Montana, use BASIC Stamps in robotics projects.



Although it may be difficult to see here, that's a BS1-IC next to the white wires.

Issac Kurtz and John Bishop use BASIC Stamps in artificial hands at the Bloorview MacMillan Centre in Toronto, Canada.

BS1-IC™ Module — $34

- 8 I/O lines
- 80 instructions max.
- 2000 instructions/sec.
- 2400 baud serial I/O
- 14-pin SIP module

I/O instructions for pushbuttons, potentiometers, pulse measurement, PWM, serial I/O, sound, etc.

FaxBack #6002

Programming Package — $99

Contains programming materials needed to program BASIC Stamps; includes cables, PC software, manuals, and free tech. support.

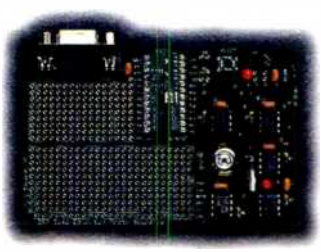
Carrier Boards — $15-$20

Provide small prototyping area, 9-volt battery clips, and programming connector. Not absolutely necessary, but recommended to make programming easy.

BS2-IC™ Module — $49

- 16 I/O lines
- 500 instructions max.
- 4000 instructions/sec.
- 50k baud serial I/O
- 24-pin DIP module

Same I/O instructions as BS1, plus touch-tones, frequency generation, pulse counting, serial shift registers, X-10 powerline control, etc. I/O functions common to both modules have a higher resolution on the BS2-IC, due to its faster clock speed.



Data Collection Board — $179

This nifty board from Scott Edwards Electronics provides everything you need to use the BS2-IC as a data logger. Includes ample prototyping area, two 12-bit analog inputs, a real-time clock, and 32K bytes of EEPROM storage. BS2-IC module not included.

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