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RESP

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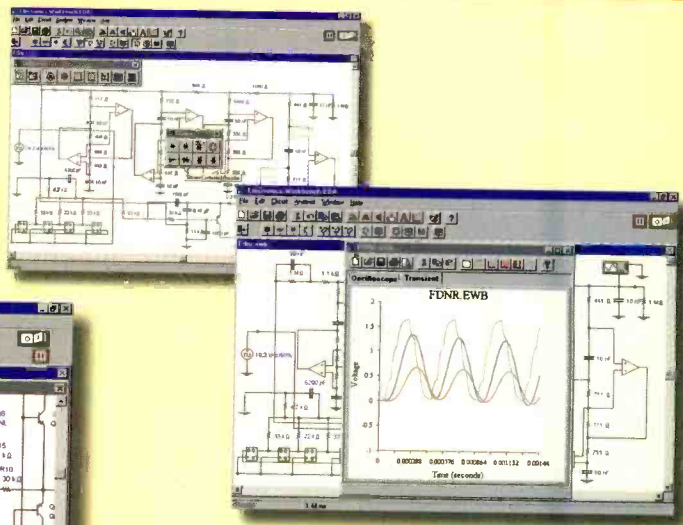
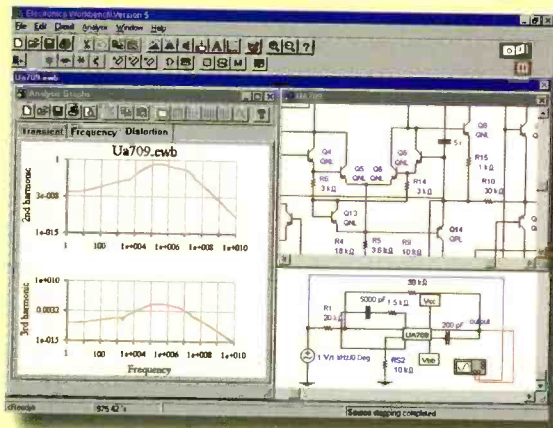
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Vol. 14, No. 9



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COVER STORY

33 Build The Time-Off

Armed with this simple count-down timer, you can cut your electric bills, keeping a greater share of your hard-earned money, even if you fall asleep with the lights on or rush off to work each morning, leaving all sorts of appliances on until the evening—*D. Derek Verner*

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45 The PC Parallel-Port Relay

Home automation can help free you from some of those repetitive tasks around your home. All you need is an old PC and the PC Parallel-Port Relay board, which we'll show you how to build, and your home will practically take care of itself—*Marc Spiwak*

50 The Electronic Garage Door Opener

A simple four-digit code along with the easy-to-build circuit presented here can take the place of your "emergency key." Now you won't lock yourself out of the house, and you can allow friends and relatives to enter when you can't be there—*James E. Tarchinski, N8PTG*

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31 Smart Airbags

While airbags save lives and reduce injuries, they can also be extremely dangerous to small children riding in rear-facing infant seats. Read how new technology is making airbags less of a hazard to your vehicle's smaller passengers—*Bill Siuru*

40 Radio Resources of the Information Superhighway

Bring a cyberworld of radio information to your radio shack with these handy resource listings. This article shows how to find and access amateur radio, shortwave, and scanning information and resources on BBSs, the online services, the Internet, and the World Wide Web—*Karl T. Thurber, Jr.*



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How to make your car invisible to radar and laser...legally!

Rocky Mountain Radar introduces a device guaranteed to make your car electronically "invisible" to speed traps—if you get a ticket while using the product, the manufacturer will pay your fine!

by Phil Jones



■ **The Phazer will "jam" both radar and laser guns, preventing police from measuring your speed.**

If your heart doesn't skip a beat when you drive past a speed trap—even if you aren't speeding—don't bother reading this. I can't tell you how many times that has happened to me. Driving down the interstate with my cruise control set at eight miles over the limit, I catch a glimpse of a police car parked on the side of the road. My heart skips a beat and for some reason I look at my speedometer. After I have passed the trap, my eyes stay glued to my rear view mirror, praying the police officer will pass me up for a "bigger fish."

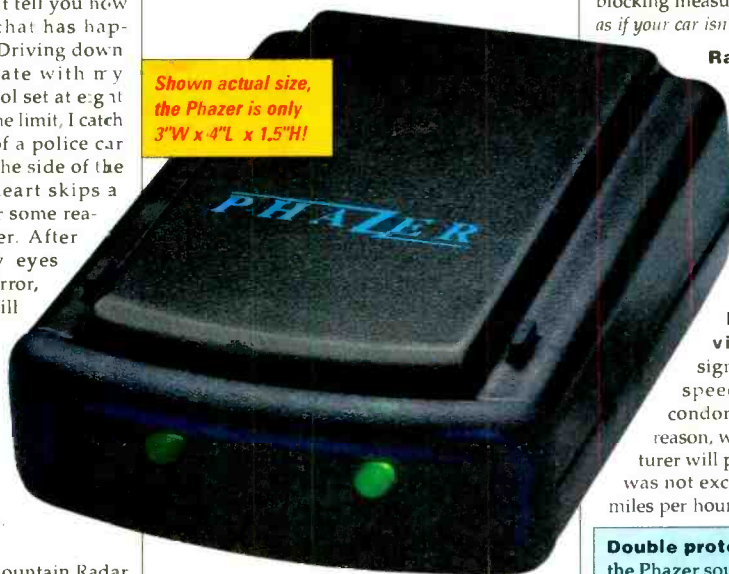
It seems that as speed-detection technology has gotten more and more advanced, speeding tickets have become virtually unavoidable. And although devices exist that enable motorists to detect these speed traps, they are outlawed in many states... including mine.

The solution. Today, Rocky Mountain Radar offers drivers like me a perfect solution—the Phazer. Combining a passive radar scrambler with an active laser scrambler, the Phazer makes your automobile electronically "invisible" to police speed-detecting equipment.

The radar component works by mixing an X, K or Ka radar signal with an FM "chirp" and bouncing it back at the squad car by way of a

waveguide antenna, effectively confusing the computer inside the radar gun. The laser component transmits an infrared beam that has the same effect on laser Lidar units.

Shown actual size, the Phazer is only 3"W x 4"L x 1.5"H!



Perfectly legal. Some radar devices have been outlawed because they *transmit* scrambling radar beams back to the waiting law enforcement vehicle. The Phazer, however, *reflects* a portion of the signal plus an added FM signal back to the police car. This, in effect, gives the waiting radar unit an electronic "lobotomy." Best of all, unless you are a resident of Minnesota, Oklahoma or Washington, D.C., using the Phazer is completely within your legal rights.

HOW TO MAKE YOUR CAR DISAPPEAR

Radar and laser scramblers are devices that foil speed traps by making vehicles electronically "invisible" to police radar. Radar scramblers mix a portion of the radar signal with background clutter and reflect it back to the squad car. This technique, pioneered by Rocky Mountain Radar, creates an unreadable signal that confuses the computer inside the radar gun.

The laser scrambler in the Phazer works in a similar manner. It transmits a special infrared beam with information designed to scramble the laser signal. The result? Readouts on police radar and laser guns remain blank. As far as the police officer is concerned, your vehicle is not even on the road.

■ **The Phazer makes your car invisible to police radar and lasers or the manufacturer will pay your speeding ticket!**



How it scrambles radar.

Police radar takes five to 10 measurements of a vehicle's speed in about one second. The Phazer sends one signal that tells the radar the car is going 15 m.p.h. and another signal that the car is going 312 m.p.h. Because police radar can't verify the speed, it displays no speed at all. *To the radar gun, your car isn't even on the road.*

Works with laser, too! The Phazer also protects your vehicle from Lidar guns that use the change in distance over time to detect a vehicle's speed. The Phazer uses light-emitting diodes (LEDs) to fire invisible infrared pulses through the windshield. Laser guns interpret those pulses as a false indication of the car's distance, blocking measurement of your speed. *Again, it's as if your car isn't even on the road.*

Range up to three miles.

The Phazer begins to scramble both radar and laser signals as far as three miles away from the speed trap. Its range of effectiveness extends to almost 100 feet away from the police car, at which point you should be able to make visual contact and reduce your speed accordingly.

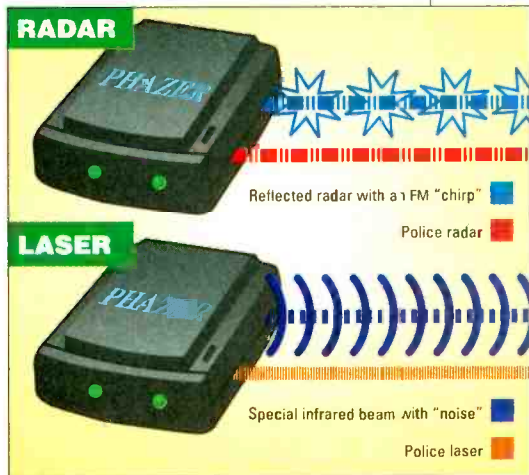
Encourage responsible driving.

While the Phazer is designed to help you (and me) avoid speed traps, it is *not* intended to condone excessive speeding. For that reason, within the first year, the manufacturer will pay tickets where the speed limit was not exceeded by more than 30%, or 15 miles per hour, whichever is less.

Double protection from speed traps.

If the Phazer sounds good, but you prefer to be notified when you are in range of a police radar, the Phantom is for you. The Phantom combines the Phazer (including the Ticket Rebate Program) with a radar detector. It's legal in every state except Minnesota, Oklahoma, Virginia and Washington, D.C. Ask your representative for more details!

4"W x 4"L x 1.5"H



Risk-free. Thanks to Rocky Mountain Radar, speed traps don't make my heart skip a beat anymore. Try the Phazer or the Phantom yourself. They're both backed by our risk-free trial and three-year manufacturer's warranty. If you're not satisfied, return them within 90 days for a full "No Questions Asked" refund.

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Editorial

Getting Your Input!

At an editorial meeting this summer, the staff was evaluating its past plans and considering plans for the future. At such meetings all input is welcome. The reason is obvious—with volumes of quality input, future plans are more apt to be successful.

For example, back in 1968, there were ripples of interest in CB radio. The staff became aware of these ripples from their own interest in this growing no-code, two-way radio service that began in 1958. However, additional input came from the readers in the guise of numerous letters chatting about CB radio. As a result, our staff planned to cover CB radio long before the great 1972 boom!

Things are no different today. The editorial staff gives considerable input to the plans for the next issues and to goals for the coming years. We are very knowledgeable about our hobby areas because we are hobbyists.

But, we don't want to fool ourselves. Many of our thoughts are governed and swayed by you—our readers. Your letters and telephone calls have done much to direct the path our editorial ideas take. This fact came out at our summer meeting, and an editorial neophyte said, "Why don't we get our readers to talk to us on the Web?"

Yes, why not? We have a Web page that you can reach: www.gernsback.com. You can send a letter to the Editor addressed to peeditor@gernsback.com. However, we ask a special favor of you: Please keep your message as brief and to the point as possible. We'd like to answer every letter, but it is a physical impossibility to do so. Nevertheless, your thoughts are important to us. Give it to us straight, and we'll put it into the hopper with everyone else's views and come up with a consensus that will be reflected in the editorial pages of **Popular Electronics** in the coming months.

Your ideas foster our plans for tomorrow.

Julian S. Martin
Editor

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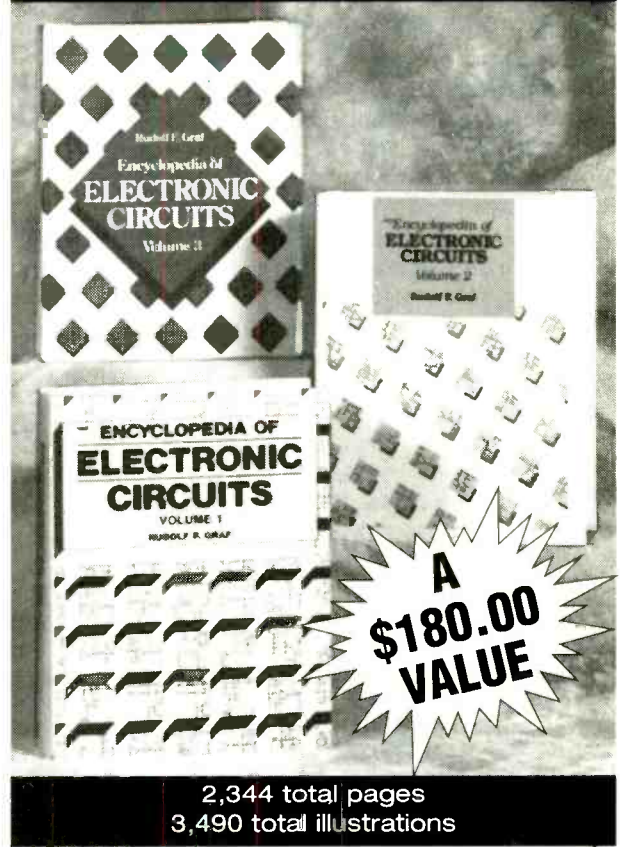
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LETTERS

Think Tank Correction: Protected -Overload Power Supply

Thanks to the "eagle-eyes" of K. Kulberg, the following error was noted in the June 1997 issue of **Popular Electronics** on page 69. The push-button switch "S1" shown in Figure 5, should be a **normally-closed SPST** switch for the circuit to work as described. I would hate our readers to have to keep their finger on the original switch button all the time!

Don't be bashful! When you see what you believe is an error, write to us and give the details. Your help is greatly appreciated.—Editor

MS-Trap Unraveled

I'm writing in response to the letter titled "MS-TRAP" that appeared in the May issue of **Popular Electronics**. A CD-ROM is a read-only device. Therefore, the software cannot check to see if it has been loaded before.

The writer's problem might lie in the fact that it is an OEM CD. OEM is a designation that refers to new machines, as opposed to upgrading an older machine. If he backs up the files he wants to keep, then formats the hard drive, it should load properly. If he goes to a local PC shop and asks nicely, they might even give him a copy of an OEM disk. This is a floppy that has the CD-ROM driver on it so it isn't necessary to load DOS prior to Windows because DOS 7.0 is in Windows 95.

G.K.

Jackson, MS

Kindred Spirit

When I read Julian Martin's editorial in the May 1997 issue of **Popular Electronics**, I wanted to shout out loud: "Yes! Finally somebody else has experienced what I am experiencing now!" I am a network engineer with American Express and I agree; technology is changing so fast that it's not a lot of fun anymore. And that's what makes **Popular Electronics** so popular.

I just received my second issue, and I am already considering going back to college to finish my Electronics Engineering degree. I hold degrees in Economics and Statistics, but while computers have always been a hobby, they

are now my occupation. That is where **Popular Electronics** saves the day. K.N.S.

Greensboro, NC

Questions & Answers

Q: How do I delete a bunch of files from a directory in Windows 95? Doing it one at a time is too time consuming. B.J.

Oklahoma City, OK

A: If you need to highlight a lot of files in a Windows application, simply highlight the first file, move to the last file, hold down the shift key, and click on the last file. All files in between will be highlighted. This comes in handy if you need to delete a lot of files or move them to another directory. It's also convenient for deleting a lot of messages in your mailbox.

Q: I have two TVs and four VCRs. Can you tell me how to hook up two VCRs to each TV and have all of them work off one master antenna? I'd like them all to work at the same time without interfering with each other.

A: The best way to learn is to experiment! Go ahead with the hookup and check out the results. If done correctly, you will note that each hookup of a TV and VCR would work independently without interference!

Q: Where can I find a schematic or a kit to build a Citizen's Band radio? It is for a project in my electronics class.

A: You can't build your own CB transmitter, as there is a law against doing so without FCC certification. It will be

quicker and much easier to buy an assembled unit—but then you will have to come up with another class project!

Have's & Needs

For some time now, I've been hoping a magazine would come up with a "Have's & Needs" column. I was glad to find one in **Popular Electronics**. I need several MM5314 clock chips. I would appreciate any help in finding them. Thank you.

Jim Martin

1003 South 13th Street
McAlester, OK 74501

I have a few Tektronix CRTs that I am willing to give away to anyone willing to pay for shipping costs. I have four type T5430-2 part number 154-175s, and one type T5030-2, part number 154-265. They are new units, in their original shipping boxes.

Leon Howe CET, AH2AG

P. O. Box 4413 AAFB Br.

Yigo, Guam 96929-4413

I have an old Hallicrafters #S76 that needs help. I'm looking for a copy of the schematic and service manual. Thanks for any help.

Bernie Stalp

114 Stout Road

Silver Lake, WA 98645

Some time ago, I acquired an Eico oscilloscope, DC wide band, Model 460. There was no documentation with it. Can you help me find the needed book(s)? In particular, I'd like to get my hands on the operator's manual. I appreciate your help!

John R. Howell

141 Leonard Lane

Midwest City, OK 73110

I'm looking for a Commodore 64 with a power supply. I hope someone can help me out. Thank you.

Jose L. Torres

275 Madison Ave.

Suite 718

New York, NY 10016

Does anyone have the original Heathkit "lunch box" CB set? I'd like to acquire one.

Write to editor, please!

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FLOPPYTUNE DIAGNOSTIC SOFTWARE

*Is your computer's floppy drive in a proper state of repair?
Find out with FloppyTune diagnostic software.*

As anyone who has been around computers for the past decade can tell you, one of the most likely components to fail on an aging computer is the floppy disk drive. And, ironically, you can consider yourself lucky if your floppy drive fails, because hard drive failures can be tragic.

A hard disk drive is a sealed unit that is impervious—or is supposed to be—to outside contamination. It is designed so that dust, lint, smoke, and other debris can not get inside and cause it any harm. A floppy disk drive, on the other hand, is exposed to the outside elements, and is subject to contamination every time a diskette is inserted. These contaminants, along with deposits from diskette surfaces, build up on the heads and other moving parts of a floppy drive and lead to premature failure or general read/write errors.

A floppy drive is also not made with the precision of a hard drive. That fact, plus the effect of outside contamination, can lead to drive heads and other parts going out of alignment. A drive that's out of alignment will often have trouble reading disks and might also create disks that are unreadable in drives in other computers, and contrariwise.

While there's not much you can do to prevent floppy drives from becoming contaminated, there is something you can do to help remove the dirt and deposits that can collect inside a drive. You can also monitor the mechanical condition of a drive and know when it's ready for servicing or replacement,

avoiding upcoming diskette problems altogether. If you know how to make mechanical adjustments to floppy drives, you can keep yours in tip-top condition for years. And if



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you run a computer repair shop, you can repair more drives in less time and make more money. You can do all of this with *FloppyTune*, the software and diskette package that helps you clean, test, and align floppy drives in minutes.

FloppyTune. A company called Data Depot, Inc. (1710 Drew Street, Suite 5, Clearwater FL, 34615-6213, 800-767-3424) manufactures a kit called FloppyTune. A basic kit includes three PC-compatible diskettes and a user's manual for \$149 (street price may be lower). One disk contains the FloppyTune software, a second diskette is a spiral-track alignment disk, and a third diskette cleans drive heads. You can order the above kit containing either 3 1/2 or 5 1/4-inch disks, or the deluxe kit is also available that

includes the disks in both formats for \$239. Each disk size will work for drives of any density in that size.

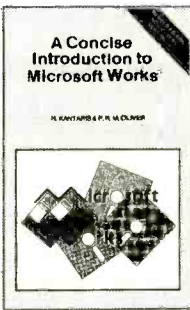
The software contained on the first disk is what allows you to make a floppy drive perform "tricks" that would otherwise not be possible. The tricks are performed while the second disk containing spiral-shaped tracks is inserted in the drive. Tracks on a floppy disk are normally arranged in perfect circles around its center axis. The center of a spiral-shaped track gradually moves into and then out of proper alignment with respect to the drive head, and can thus be used to test the read/write limits, or tolerances of a drive.

The spiral diskette is precision-made and a lot more costly than a normal disk. All disks wear out with use, so the spiral disk is guaranteed to produce accurate test results for a maximum of 300 uses. A built-in counter system warns you when only 50 uses are left and when the 300 are up. The disk can still be used after 300, but the test results might not be perfectly reliable. It is therefore recommended that a new spiral diskette be purchased from Data Depot for \$99 after 300 uses. Any attempts to write to the spiral disk other than those made to special areas of the disk by the test software itself will ruin the disk.

Many times a malfunctioning drive simply has dirty heads. The head-cleaning diskette looks like a regular diskette except that inside is a disk of non-woven polyamide fiber in a cross-hatch pattern. The material scrubs particles and oxide deposits off the heads as the disk

Buyers' Budget Books Better Buys

BP294-A Concise Introduction to Microsoft Works \$6.95. In the shortest and most effective way, you can use the word processor to advantage to type, edit, print and save documents. It goes on to explain how Works can be used to build up simple spreadsheet examples, edit them, save them, print them and retrieve them. It informs you how to create simple macros, and enables you to simplify long repetitive tasks and to customize the program to your own needs.



BP349-Practical Opto-Electronic Projects \$5.95. If you shun opto-electronic projects for lack of knowledge, this is the book for you. A bit of introductory theory comes first and then a number of practical projects which utilize a range of opto devices, from a filament bulb to modern infrared sensors and emitters.

BP350-Electronic Board Games \$6.00. Twenty novel electronic board games that you can build from the plans in this book. Whether you are interested in motor racing, searching for buried treasure on a barren island or for gold in Fort Knox, spinning the wheel of fortune, or doing a musical quiz—there is something for you to build and enjoy!

BP351-WordPerfect 6 Explained \$6.95. This is a practical, hands-on, book and the routines described will help you get the most out of WordPerfect 6. The book explains the hardware requirements for the package and steps you through a standard installation. It guides you through the WordPerfect program environment to enter, edit and enhance text and shows how to get the best from the three different operating modes, depending on the type of PC you are using. The formatting codes, button bars, ribbon, tabs, graphic manipulation and styles will no longer be a mystery.

BP388-Why Not Personalize Your PC? \$6.95. Find out how to: Set up and organize groups of programs and data files, and change the opening logo; use the Control Panel to personalize your working environment; use screen savers and wallpaper files; manage the DOS prompt; and transfer your customization files to a new Windows installation. In DOS, you discover how to: Write batch files and create specialist programs using the debug program, design professional looking menus, and more.

BP367-Electronic Projects for the Garden \$6.95. Electronics enters the Garden! New exciting book points out how gardeners can build simple gadgets to promote success where the elements work against you. Some of the projects are: over/under temperature monitoring, dusk/dawn switching, automatic plant watering, warming cables, etc.

BP368-Practical Electronics Musical Effect Units \$5.95. There is a constant hullabaloo for musical effects projects by the hobbyist community. This book provides practical circuits for several projects that range in complexity and are sure to work. All the circuits are easy to build and use readily-available parts.

BP363-Practical Electronic Music Projects \$5.95. The text contains a goodly number of practical music projects most often requested by musicians. All the projects are relatively low-in-cost to build, and all use standard, readily-available components. The project categories are guitar, general music and MIDI.

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BP385-Easy PC Interfacing \$6.95. The built-in ports in your PC provide an easy and hassle-free way of interfacing your circuits. This book provides useful PC add-on circuits including the following: Digital input/output ports; analog-to-digital and digital-to-analog converters; voltage and current measurement circuits; resistance and capacitance meters, temperature measurement interface, biofeedback monitor, and many other useful interfaces.

BP393-Practical Concise Introduction to UNIX \$5.95. If you are using or intend to use the UNIX multi-user operating system and want to get the most out of your computer system in terms of efficiency and productivity, then you must learn its operating system. The book explains how the UNIX operating system is structured so that you understand what happens when you first approach your computer.

BP396-Electronic Hobbyists Data Book \$5.95. This book provides a wide range of data. If, for example, you require details of a modern five-band resistor code or an old color code for a ceramic capacitor, the formula for parallel resistance, or basic data on an NE5534AN operational amplifier, it is contained within these pages. The subjects covered are numerous and widespread to cover all hobbyist interests.

BP343-A Concise Introduction to Microsoft Works for Windows \$7.95. The book explains and details: How the Works for Windows package fits into the general Microsoft Windows environment; how to use the word processor to advantage; how to use Microsoft Draw to create and edit graphics and place them in your documents; how to build up simple spreadsheet examples; and how single, and multiple charts, or graphs, of different types can be generated. And there's much more!

BP282-Understanding PC Specifications \$7.25. This book explains PC specifications in detail, and the subjects covered include the following: Differences between types of PC (XT, AT, 80386, 80486, Pentium etc.); math co-processors; input devices (keyboards, mice, and digitizers); memory, including both expanded (EMS) and extended RAM; RAM disks and disk caches; floppy disk drive formats and compatibility; hard disk drives; and display adapters (CGA, Hercules, super VGA, etc.).

BP298-Concise Intro to the Macintosh System and Finder \$6.25. Although the Mac's WIMP user interface is designed to be easy to use, much of it only becomes clear when it is explained in simple terms. The book explains: The System and Finder, what they are and what they do; how to use the System and Finder to manipulate disks, files and folders; configuring and printing files from the Finder; getting the most from the system utility programs; and running MultiFinder.

BP301-ANTENNAS FOR VHF AND UHF \$6.00. From installing a TV or FM antenna to setting up a multi-antenna array for shortwave listening or amateur radio, this book explains the essential basics of VHF and UHF antenna operation and installation. In easy-to-understand terms it helps you understand how antennas work, the advantages of different antenna types, and how to get the best performance out of an antenna.

BP316-Practical Electric Design Data \$7.95. A builder's bargain book—a comprehensive ready-reference manual for electronic enthusiasts with over 150 practical circuits. It covers the main kinds of components (from pig-tail leads to surface mount), pin-outs, specs and type selection. Basic units are defined and most used formulae explained. Five additional sections are devoted to circuit design, covering analog, digital, display, radio and power supply circuits.

BP319-Making MS-DOS Work For You \$6.50. This book could help you improve your system set-up and provide you with a simple-to-use, but professional looking, menu system. The routines described will help you understand more of the workings of MS-DOS and help you get the most out of your computer in terms of efficiency, productivity and enjoyment.

BP341-MS-DOS 6 Explained \$7.95. The book covers: How the DOS operating system of your computer is structured so that you can understand what happens when you first switch on your computer; How directories and subdirectories can be employed to structure your hard disk for maximum efficiency; how to use the DOS Shell program, and much, much more.

BP345-Getting Started In Practical Electronics \$5.95. If you are looking into launching an exciting hobby activity, this text provides basic essentials for the builder and 30 easy-to-build fun projects with which every experimenter should toy. Printed-circuit designs are included to give your project the professional touch.

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rotates. One function of the test software is to simply make the drive spin the cleaning disk when it's inserted. It is recommended that the cleaning disk be used prior to each use of the expensive spiral diskette.

The cleaning disk is factory-treated with a dry lubricant that properly treats the heads of a drive. There is no way that too much of the lubricant can be applied. The cleaning disks are guaranteed to cause less than 25 microinches of head wear in 92 hours of continuous use, which is less wear than a typical floppy diskette would cause. A cleaning disk requires about ten seconds of spinning to clean the heads, and it is usable for at least 180 ten-second cleanings. Additional cleaning disks are available for \$19 each.

Diagnostic Tests. The test software runs in DOS and lets you perform many individual tests that you select or lets you run all of them as a package. A main menu presents you with a group of tests and a group of options. The options include running all tests, running a series of tests, defining a group of tests, cleaning the heads, switching to an auto-test menu, printing a screen capture, changing drive parameters, changing drive side, getting help, or exiting the program.

Main menu tests include clamping, track zero, read/write, speed, cam linearity, hysteresis, alignment, write protect, head-read span, file access, and interference. The clamping test verifies that the centering cone and clamp in the drive can position and hold a disk exactly on-center. The software reports in mils (0.001-inch) the distance a disk is off-center. The clamping test should be performed before any other individual test because clamping errors will reduce the overall accuracy of *all* other tests.

The track zero test measures the distance between track zero on the test diskette (the outermost track) and the track-zero detector in the drive. If this distance is too great, the drive will not allow a disk to boot the system. A deviation of more than 1.5 mils indicates potential boot problems.

The overwrite/read test is a pass/fail test that verifies a drive's ability to read and write data. First a track known to contain good data is read to make sure there are no read problems. Then the data is written to an adjacent track and read back to make sure the track has been properly overwritten. The process is repeated several times with two different data patterns.

The drive speed test measures the speed at which a disk spins in rotations per minute, or rpm. Normal drive speed is 300 rpm, and there should be no more than 1.5 percent deviation from that speed—or plus or minus 4.5 rpm.

The cam linearity test verifies that the head actuator steps the heads exactly the same distance from one track to the next. Track separation distances are measured from the outermost (0 track), middle (16 track), and innermost (35-track) tracks. A linear actuator will give identical readings at all three positions.

The hysteresis test measures the distance in mils that the head actuator overshoots the ideal stopping points when seeking the middle track from the outside and inside edges. Hysteresis error should not exceed 1.5 mils. If the hysteresis error is excessive, overwriting of tracks can occur.

The alignment test is the most accurate and demanding test. It verifies that the heads are perfectly centered on and perpendicular to the middle track. It measures the distance in mils between the actual position of the head and the center of the middle track as defined by the ANSI standard for that size diskette. The alignment test runs repeatedly for a continuous alignment readout. Adjustments can be made to a drive while monitoring the alignment readout.

The write-protect test verifies that a drive can identify a diskette that has been write-protected. You can do this yourself by simply trying to write to a protected disk. The head-read span test measures in mils the width of the read/write area of the head. The file-access test determines whether a drive can properly load files by loading an 8K file and keeping track of all errors and

retries, which are not normally visible to the user. The interference test effectively measures the strength and quality of the signal of the data being read.

Who Needs It? The software runs in DOS only and has a dated appearance and somewhat clunky interface. It does, however, get the job done. The user's manual includes brief descriptions and diagrams of how to make certain adjustments to some, but not all, drives. However, this information shouldn't even be used by someone unfamiliar with basic alignment procedures because you can end up in more trouble than you started out with. However, for basic cleaning and mechanical checkups, the average PC user will find this package useful and dollar-worthy.

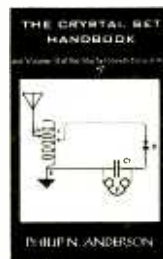
Network administrators might want to monitor the health of the drives in their machines and have them repaired or replaced before they cause trouble. People who service computers for a living might find the FloppyTune diagnostic software to be a valuable time-saver. ■

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MULTIMEDIA WATCH

New Job, New Products, New Software!

For the past year and a half I worked as a technical editor for Windows Magazine, which mostly involved testing computer hardware and software and writing reviews. I recently moved over to a sister CMP Media publication, Computer Reseller News (CRN), working in the CRN Test Center as an associate reviews editor. The title doesn't give it away, but now I'm even more involved in testing computer products, and some of it is

under a non-disclosure agreement in late March or early April, and the system Quantex sent me was the faster 266. It's remarkably faster than a Pentium 200, MMX™. But technology advances quickly in the computer industry. Within weeks of receiving the 266, I benchmarked, and was blown away by, a prototype motherboard running two matched Pentium II processors, each one at 300 MHz—much faster than the “measly” 266 in my sys-

is 512K of sync burst random access memory (SBRAM) L2 cache built into the cartridge.

The Quantex 266 MHz Pentium II system is very, very fast, regardless of anything on the horizon. It literally blows away a 200 MHz Pentium, with or without MMX. A benchmarking program I use: *Wintune 97*, available free from the Windows Magazine Web site at www.winmag.com, shows that Pentium 200s with MMX generally run somewhere around 390 million instructions per second (MIPS). But the PII/266 blasts through at 559 MIPS. Like I said, they're fast! But the most amazing thing is that this cutting-edge power is so very affordable. A high-end system sells for roughly the same \$3000 that it did when I bought a 486/50 in 1992.

Picture my 1992 PC—a 486 DX2/50 with ISA video—not VLB! If it were alive and running today, it would choke to death on multimedia software. Thank God it doesn't boot anymore! It died peacefully in its sleep. Multimedia hardware was absent from the system because, aside from crude sound cards, it didn't really exist. It had a 200 MB hard drive and 8 MB of memory. Oh, and a 15-inch color monitor. That was all for around \$3000, and I paid \$200 extra for a 14.4 modem that didn't work.

Now picture the Quantex Pentium II system: it's much faster than a speeding Pentium 200, and it packs 64-MB of memory, a 3.8-GB hard drive, Matrox Millennium Pro PCI video, a Toshiba 12x CD-ROM drive, wavetable sound, a powerful Altec Lansing subwoofer speaker system, a 33.6 modem, and a 17-inch Magnavox monitor. You get all that for only \$3099! Quantex builds fast systems and sells them at very low prices. I recommend Quantex if you want to buy a cutting-edge system and want to save money at the same time.

Hot Wheels Mouse

I happen to collect Hot Wheels. I like cars in general, and some Hot



The Quantex 266 MHz Pentium II system has 64-MB of memory, a hard drive, and a lot more.

heavy-duty stuff. CRN is basically a weekly newspaper, and what I write can hit print the following week. That brings me to the problem I have here: this column gets into your hands toward the end of July—but it's the end of April as I write. So, unfortunately, I could not tell you any sooner about Intel's new baby—the Pentium II, otherwise known as *Klamath*. I'm playing with one now (in April), and Intel will officially announce it in early May.

Intel's Pentium II

Quantex Microsystems was nice enough to lend me a Pentium II system, and a fast one at that. Systems running Intel Pentium® IIs in 233 MHz and 266 MHz flavors became available

tem! You might even be able to buy what I'm talking about by the time you read this, but it will surely command a premium price.

A Pentium II is basically a Pentium Pro with MMX. MMX can accelerate specially coded multimedia functions by as much as 40 percent. So the Pentium II gives you the benefit of the faster Pentium Pro core logic—especially good for running NT, plus the benefit of MMX. In the Pentium II, the Pentium Pro CPU has been redesigned into a brick-like, heatsinked assembly that fits into a new type of slot on a new type of motherboard. The processor's cartridge packaging puts an end to the pin grid array (PGA) form that's been used since the 386. There

Wheels become valuable especially when you don't open the package. And I figure at a dollar apiece, how can I go wrong? Anyway, Mattel has had a *Hot Wheels Mouse* on the market for a while, and I finally got around to checking one out. It's a real, working mouse that looks like my real Camaro, and it has working headlights and taillights, a revving, vibrating "motor," and a lot more than most mice. It runs on two AA batteries. A *Hot Wheels Rally CD-ROM Game* is included. It's DOS 5.0, Windows 3.1 and Windows 95 compatible. Special drivers are included that enable the unusual features. Kids would love to use this mouse all the time. I tested it and it is neat, but now I simply keep it on display near my computer. Maybe some day it will be worth a fortune.

Movies For Your PC

Like to watch movies on your PC but can't find video CDs for sale anywhere? Don't worry, because there's a new kid in town: the *MovieCD*. Sirius Publishing is using motion pixels software-compression technology to produce near-VHS quality video that plays back full screen on almost any PC. You don't need any additional hardware such as MPEG. What you do need is a multimedia PC with a minimum 486 DX-66 processor, 2x CD-ROM drive and local bus video. The movie player offers a choice of playback options and sizes to fine-tune playback on most platforms, whether wimpy or fire breathing.

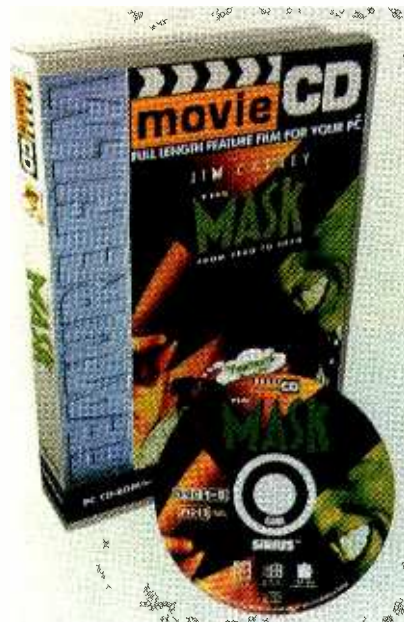
Movies generally come on two-disc sets and sell for \$9.95 to \$19.95. There's something for everyone, from science fiction to horror to comedy. Many popular titles are offered, including *The Lawnmower Man*, *Jason Goes To Hell: The Final Friday*, *Dumb and Dumber*, *The Mask*, *House Party*, *Pump Up The Volume*, *Mortal Kombat*, *Seven*, and many others. There are also rock video movies, comedy collections, children's titles and more. *MovieCD* is like having a VCR connected to your PC.

New Stuff

Board games were popular when I was a kid—we didn't have Nintendo or virtual reality back then. Today, computer games are popular with kids and adults. So it makes sense then that many of the old board games are now



The Hot Wheels Mouse looks like a Camaro, and it has working headlights and taillights, and a revving, vibrating motor.



MovieCDs produce near-VHS quality video that plays back full screen on almost any PC.

available as multimedia software. Hasbro Interactive is offering many of the old favorites on CD-ROM, and now they're spruced up with sound and animation. You can't lose the pieces, either! You'll find all of these Hasbro Interactive games at toy and software stores everywhere.

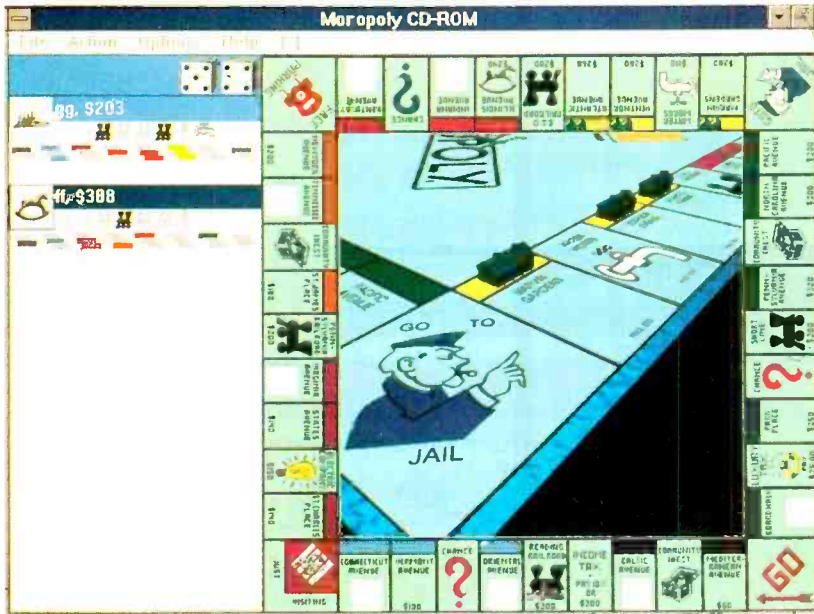
To start with, there's *Risk*, *The Game of Global Domination*. This is the game where you seize territories, build up troops, and destroy your enemies. The disc includes two games: *Classic Risk* looks an awful lot like the old familiar board game, and then there's *Ultimate Risk*, with realistic terrain, storms, and lots more added to make the game more interesting. There's also *Scrabble* on CD-ROM. I don't have to explain what this game is, but I might mention that the disc includes things that are unavailable in the board game. For example, you can play *Scrabble* against your computer or against a friend over a LAN or the

Internet. This disc also includes a dictionary, music, and sound effects that are very useful.

Battleship was another of my childhood favorites, and it, too, is now on CD-ROM. This is the game where you call out locations on your opponent's grid and fire missiles at the coordinates hoping they hit. The CD version of *Battleship* lets you play your computer, as well as up to four players, over a LAN or modem-to-modem. You also get different game scenarios, difficulty levels, and picture-in-picture technology that lets you watch the destruction you've caused to the enemy ships. Last but not least, there's *Monopoly* on CD-ROM. Adults like the board game more than kids do, but that might change with the CD version; it's loaded with animation and sound that make the game just a bit more exciting than the old days.

I've got another new software title this month from Mattel Media, which is intended for girls. Of course boys are welcome to play, too. *Barbie As Rapunzel* is an updated version of the classic fairy tale told as an interactive storybook adventure. It's the story of Rapunzel who saves Prince Galen and breaks the wicked witch's spell. Designed for children ages four and up, *Barbie As Rapunzel* is filled with games and puzzles that keep kids entertained for hours. Kids can simply hear the story and read along with it, or advance through it at their own pace. Scenes from the story can be printed for kids to color and share with friends. This title is available for \$29.99.

I've always liked the show *Invention* seen on the Discovery Channel; most readers of this magazine probably do as well. In every episode they discuss some kind of mechanical or electrical device, and describe how it came into existence. They also get into what makes it tick. Anyway, Discovery Channel Multimedia is now offering a CD-ROM based on the TV series. Their product, *Invention Studio*, helps kids ages 9 to 14 learn about and invent things, from robots to rockets, in an interactive 3-D laboratory. Users must go through every step of the invention process, from coming up with ideas and doing research on past inventions, to testing the scientific principles in the machine shop. You can also get right to work in the lab, where you design, build, and test anything



Monopoly on CD-ROM features animation and sound, plus the usual wheeling and dealing. This venerable game is fun for tycoons of all ages.

you can think of. In the testing ground, inventions are tested under simulated real-world conditions. Once something is built and working, it's off to the patent office. *Invention Studio* is available for an estimated street price of \$34.95.

Every gardener has his woes, whether it's termites, too much water, too little light, or pesky animals. Now gardeners can turn to their PC and *The Ortho Home Gardener's Problem Solver* on CD-ROM from Books That Work. This indispensable resource provides guidance in keeping your garden healthy. A database of nearly 700 gardening problems, each with a full color photo, lets you quickly identify and solve plant ailments. You can even create your own gardener's journal to keep track of maintenance schedules and to-do lists. With the right amount of care, you can prevent botanical problems before they occur, which, of course, is the best medicine. You'll find *The Ortho Home Gardener's Problem Solver* at stores nationwide for around \$30.

Also new from Books That Work is *Better Homes and Gardens Kitchens & Bath 2.0*. This disc lets homeowners harness the power of 3-D computer-aided design on a home PC and visualize a new kitchen or bathroom without ever picking up a tool, other than a mouse, that is. Your design is accurate right down to the paint colors, materials,

and textures, with over 2,000 to choose from. First you design a floor plan, then add fixtures and furnishings, and then decorate. You can then view photorealistic images of your dream room from any angle, and even use your mouse to "walk through" the room and take snapshots. This disc is well worth the \$40 it costs if you're planning on doing any kitchen or bathroom remodeling. For old rooms, the paint color selection and varied choices is a winner.

With the recent re-release of the Star Wars Trilogy Special Edition movie, there is tremendous interest in Star Wars products—toys, games, you name it. One new game on CD-ROM from LucasArts Entertainment is *Yoda Stories*, which chronicles Luke Skywalker's adventures as he trains to become a Jedi Knight under Yoda's instruction. The game uses world-generator technology that creates countless varied short game scenarios, with new puzzles, characters, locations, weapons, and sounds. Each game begins as Luke lands his X-wing in the swamplands of Dagobah and starts to search for Yoda, who then advises Luke and sends him on a quest. Players must explore each world and interact with the other characters, collect supplies, combat stormtroopers, and so on. Each game can be completed in about an hour. Players can call upon R2-D2 for help at any time. Also included on the *Yoda Stories* disc is *Making Magic*:

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A Behind-the-Scenes Look at the Making of the Star Wars Trilogy Special Edition. This includes a look at how the movies were enhanced for re-release as well as some of the new clips that appear in them.

NET WATCH

Downloadable Games

DAN KARAGIANNIS

While watching a recent TV news report on cable TV, I wasn't surprised at all to hear the topic: computers. These devices are permeating all of our lives and are mentioned in news-casts a couple of times daily. The reporter was asking people what they use their computers and Internet connections for. What was the number-one answer? In a word—games!

People of all ages have been using their desktop (and more recently laptop) boxes of silicon to play games since the first microcomputers were made available. I still remember picking up those first packages of "public domain" disks from the local computer store in the early '80s. They were designed to run on my brand-new Epson computer, which used the CPM/80 operating system, and more than half of the programs were games. Sure, they were primitive text-based adventures, but, still, they were early forms of what have become everyone's favorite PC time-wasters.

But that last statement was a little harsh. Countless executives in Fortune 500 companies will spend at least some of their computing time moving cards around *Solitaire* or chomping on energy pellets in *PacMan*. Why? Maybe because games provide us all with a little break every now and then. If you do anything for eight hours in a row, you're likely to get more than a little tense. So minimize *Word* or *Excel* every once in a while, and let off a little steam by blasting aliens. Wreck a sports car or two. It's fun!

But whatever you do, don't run out to the store and spend over \$50 on a game ... yet. If you don't like it, you're often out of luck with an open software package. Instead, first try visiting one of the sites mentioned here and downloading a demo version of a game you're interested in. Then, if you like it enough, plunk down your hard-earned money knowing you are buying hours of enjoyment. Sometimes you'll even find free, complete versions of games online. That's obviously rewarding, but regardless of whether they're demos,



Navigating around the Games Domain is simple. But once you see how many free games and demos are there, it's getting off your computer that won't be so easy!

shareware, or freeware, they're out there. All you have to know is where to look.

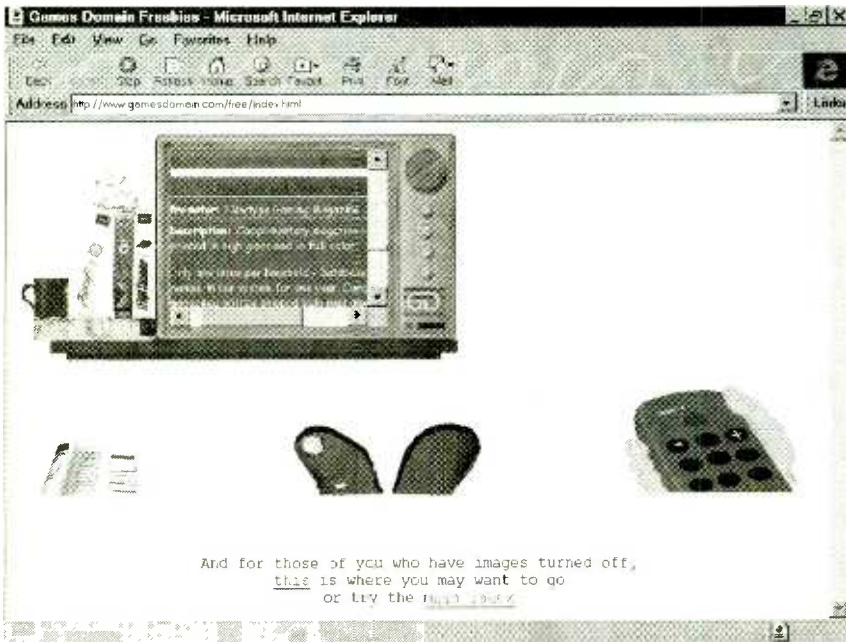
GAMES DOMAIN

If you're looking for *the* place for games you should visit the site with the name that says it all. This is definitely the domain for games of all kinds, providing you with links to every kind of action and adventure application you can imagine. I just hope you have a dedicated phone line just for your modem, because otherwise you'll be tying up all lines of communication in and out of your house for hours when you see just how many games you can download through *Games Domain*.

When you first type in the easy-to-remember URL, you'll be presented with an array of little graphics that link you to all of the Domain's features. In the center there's even a colorful ticker-tape-type banner that lists what's new to the site and lets you click directly on a statement of interest. For example, if the banner says "Check out over 600 PC Demos" and you click

it, you'll be presented with ways to do just that. It was neat to see a banner you can interact with; sometimes it's little things like this that are my first clue as to how innovative a site is that I'm visiting. When you're dealing with a Web presence that is designed to help you find files and download them, whether they're games or not, it's nice to have an easy way to sort through hundreds and thousands of downloadables that can certainly eat up your gaming time. For this reason, I like to be able to search with a high level of discrimination.

The *Games Domain* has a Search button as its first link in the upper left-hand corner of the icons. When you choose this feature, you'll be taken to an intelligent engine that accepts not only keywords but simple logic functions as well (AND, OR, NOT). For example, you might type in the game *Quake* AND *demo* to see a list of items relating to this product's demo only. Using more than one search term here is a good idea because the site will return not only links to a game itself, but to documents relating to the pro-



Playing around with this virtual remote will help you find just the right freebie to fill up some of that space on your hard drive.



The Gamecenter provides you with downloads and news from the world of gaming by using a magazine-like interface.

gram as well. This is a good thing for serious gamers, though, as you might find tips and tricks for winning your soon-to-be favorite game also.

Click on the Games link for more tip-type information. Here you'll find cheats and hints, literally hundreds of fully indexed bug fixes and patches, as well as complete walkthroughs of games meant to entice you into actually playing them.

If you want just files, then you

should click on the Direct Download icon. Here you'll find thousands of games and gaming resources waiting for you to link to them. Select a platform and work through the intuitive, hierarchical search to find what you're looking for. For the newest demos, though, you'll want to go to yet another link from Direct Download. This one, PC Demos and Previews, helps you find only "that game everyone's talking about" without having to worry too

HOT SITES

Games Domain

<http://www.gamesdomain.com>

The Game Center

<http://www.gamecenter.com>

much about what you enter for your search. Odds are, for instance, that there won't be too many new games with the word "castle" in them at any given time.

THE GAMECENTER

This second site is a little different than *Games Domain* in that it's anything but static-looking. C/NET's *Gamecenter* is designed to look almost like a magazine site, with headlines that change regularly, and graphics that are put up for certain key "stories" of the day. For example, if the game "Tomb Raider" were being covered at the site, you would probably find a picture of the adventure's female archaeologist at the top of *Gamecenter's* opening contents page.

But don't think this means the site is not a powerful one. Links are provided for doing, in some form, all of the things that we described for the *Games Domain*, so we won't go into those types of features here. We will go into what *Gamecenter* offers exclusively. For one, you can always search among 40 of the hottest available downloads. If you visit the site often, this section will seem new to you on a regular basis, as it's always being updated.

Another great feature is that there are dozens of little headlines you can click on to get more information. These alert you to brand new game downloads, as well as in-depth reviews of some of them with screen shots. Demos are lately becoming as large as 35 MB to download (that's in compressed format!), which could take hours with a decent connection. The reviews help you decide if you really want to go to that trouble or not.

All in all, *Gamecenter* always gives you the feeling that anything could pop up at the site on any day.

So until next time, happy game hunting and playing! Feel free to e-mail me at netwatch@comports.com, or snail-mail me at *Net Watch*, **Popular Electronics**, 500 Bi-County Blvd., Farmingdale, NY 11735. ■ 15

NEW PRODUCTS

EASY-GRIP SOLDERING IRON

The Antex Model G/3U miniature soldering iron features a thin plastic handle that is easy to hold, regardless of hand size. The handle stays cool because the heating element is located under the iron's tip. Equipped with a heat shield for added protection, the precision soldering iron accepts a wide variety of special-purpose tips.



The G/3U is just 6.5-inches long and weighs less than 0.75 ounces. It heats up to 750° in only 45 seconds and recovers instantly after soldering. Tips are offered in more than 40 styles, including spades, chisels, cones, and needle points. The precision modeling soldering iron is well-suited for electronics assembly and field service.

The Antex Model G/3U miniature soldering iron has a list price of \$22.55 including a standard tip. For more information, contact M.M. Newman Corporation, 24 Tioga Way, P.O. Box 615, Marblehead, MA 02945; Tel: 617-631-7100; Fax: 617-631-8887.

CIRCLE 80 ON FREE INFORMATION CARD

Recordable Compact Disc

TDK's CD-RXG74 is a consumer audio CD-R that offers 74 minutes of high-quality digital recording time, comparable to the length of commercially produced audio CDs. The new 74-minute recordable disc, as well as the previously introduced 60-minute version (CD-RXG60) bring a high level of sonic quality and flexibility to the home recording market. The increased recording length of the CD-RXG74 makes it possible for up-and-coming bands to record full-length demo discs using consumer CD-R decks, which are becoming more affordable. The record-



able discs can also be used for making a copy of a commercial CD for personal use, creating "mix" music-compilation discs, recording live music, and archiving irreplaceable tapes and LPs.

Once recorded using a consumer CD recorder, the CD-RXG74 discs can be played back on all existing CD audio players, with access to the full range of functions such as random access, scan, skip track, and the like. The discs can be used for audio recording only, and not for other types of CD formats (CD-ROM, Photo CD, etc.). A write-once medium, the discs are also equipped with the Serial Copy Management System, which limits digital copying to one generation.

The CD-RXG74 discs have a suggested retail price of \$12. For additional information, contact TDK Electronics Corporation, 12 Harbor Park Drive, Port Washington, NY 11050; Web: <http://www.tdkonline.com>.

CIRCLE 81 ON FREE INFORMATION CARD

Motion-Measurement Tool

Designed as a teaching tool for middle- and high-school math and science teachers, the Texas Instruments Calculator-Based Ranger (CBR™) is an easy-to-use motion-data collection system that connects directly to TI graphing calculators. It provides students with a hands-on, real-time experience. For instance, they might observe a free-falling ball, and then quickly and accurately obtain the measurements needed to determine the slope and intercept. In the past, they might have had to use a yardstick and stopwatch to try to make such measurements. Now, they can change different variables and immediately see how the changes

impact the graphed results. They can develop and test hypotheses in a matter of minutes and can apply the concepts to variables in one class period.



The CBR, with its built-in program, is ready to use out of the box. It measures distance, velocity, and acceleration, at up to 50 samples per second and from distances up to 20 feet (measured distance will affect the maximum sample rate). Visible and audible status indicators allow for easy status identification. A pivoting sensor head can be pointed toward the movement being measured, and a clamp allows the CBR to be mounted to a table, door, or lab stand.

The CBR's built-in program includes automated plots for distance-time, velocity-time, and acceleration-time. An interactive graphing activity for younger students challenges them to match a randomly generated plot by walking in front of the CBR. Teachers can easily transfer the program to their TI-82, TI-83, TI-85, TI-86, or TI-92 calculator with the push of a button.

The CBR, complete with an instructional booklet suggesting classroom activities for different skill levels, has an estimated price of less than \$100. As part of TI's educator support program, teachers can "test drive" the CBR at no cost by calling 972-917-6411 (416-250-5287, option 3, in Canada). For further information, contact Texas Instruments, Inc., Personal Productivity Products, P. O. Box 650311, M/S 3919, Dallas, TX 75267; Tel: 972-917-6278; Fax: 972-917-1592; Web: <http://www.ti.com/calc>.

CIRCLE 82 ON FREE INFORMATION CARD

(Continued on page 82)

25 REASONS WHY NRI TRAINING IN COMPUTER SERVICING IS YOUR BEST CHOICE FOR CAREER SUCCESS

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17 You have access to NRI's brand-new "cyberschool" to contact your instructor, download supplemental materials, participate in online seminars, and more!

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21 You can prepare for the A+ Certification exam with NRI's exclusive CD-ROM!

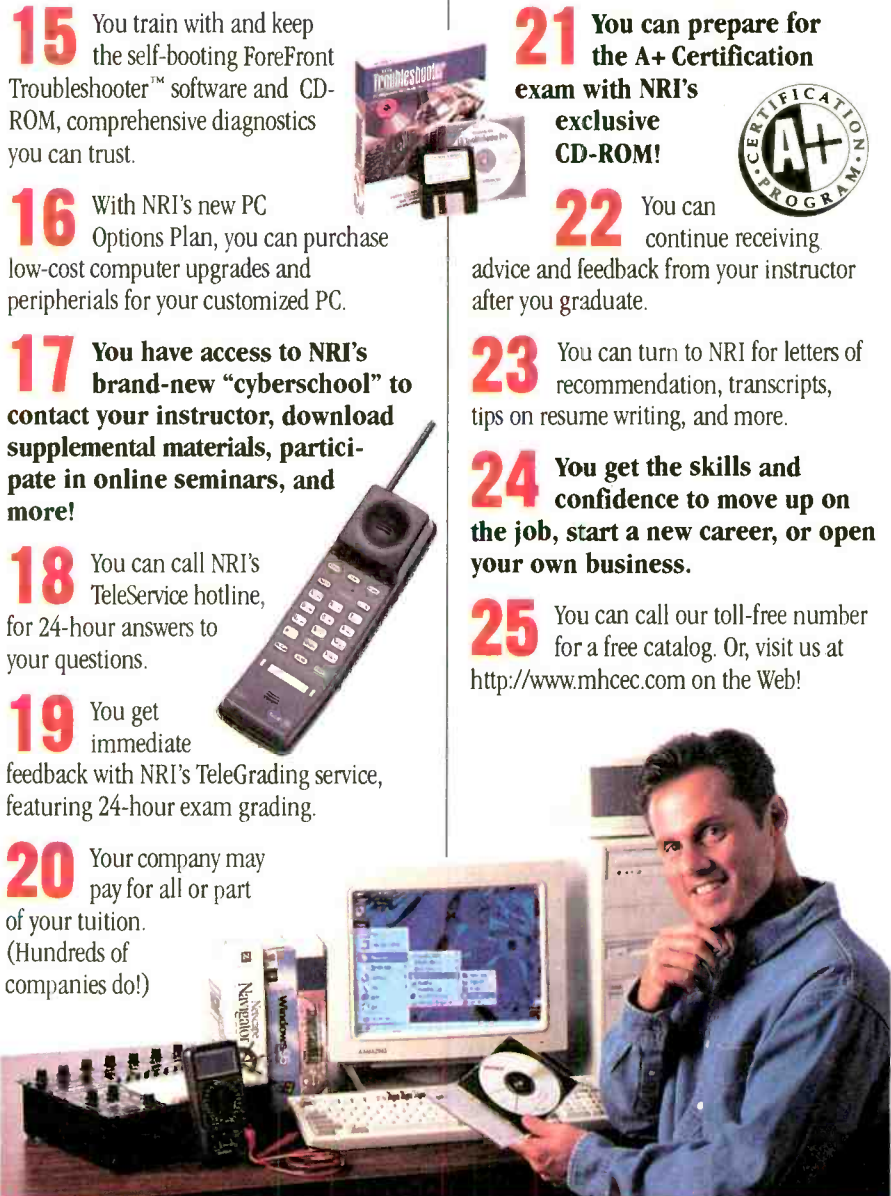


22 You can continue receiving advice and feedback from your instructor after you graduate.

23 You can turn to NRI for letters of recommendation, transcripts, tips on resume writing, and more.

24 You get the skills and confidence to move up on the job, start a new career, or open your own business.

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ELECTRONICS LIBRARY

Beginning Linux Programming by Neil Matthew & Richard Stones

Linux is a free, UNIX-like PC operating system that was developed through collaboration over the Internet and has taken the UNIX world by storm. Consisting of a kernel by Linus Torvalds, the family of GNU tools, X Windows, and several other free and shareware programs, it offers everything you could want, and more.



The book is written for people who know the basics of C and want to program for UNIX. It assumes that you have installed Linux or have access to a version of UNIX. The book teaches UNIX programming in a simple and structured way, using Linux and its associated development tools as the main platform.

Starting with the basic UNIX tools—the GNU C compiler, libraries, and help pages—the book teaches you to use the UNIX C libraries to work with files, get information about the UNIX environment, handle input and output, and manage data. It explains how to use debugging tools, make files, and implement source-code control software.

The book goes on to describe the multiuser, multitasking UNIX environment and its processes and signals. It shows how to use pipes and system V interprocess communications to talk with other programs and how to program client/server applications. Networking programs using sockets are also discussed. A concise survey of HTML allows you to use your Linux box as a CGI server. The book also covers the use of two rapid development

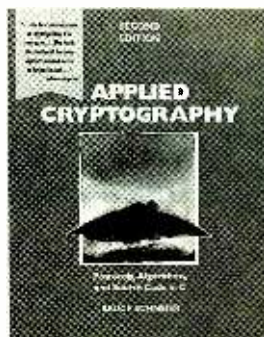
tools—the shell and Tcl—and provides a brief overview of X Windows.

Beginning Linux Programming costs \$36.95 and is published by Wrox Press Ltd., 2710 West Touhy, Chicago, IL 60645; Tel. 312-465-3559; Fax: 312-465-4063; e-mail: feedback@wrox.com; Web: http://www.wrox.com/.

CIRCLE 91 ON FREE INFORMATION CARD

Applied Cryptography: Protocols, Algorithms, and Source Code in C, Second Edition by Bruce Schneier

The Internet is particularly susceptible to online troublemakers, leaving businesses open to corporate espionage and other security breaches, and individuals in danger of financial fraud. Sensitive business information, medical records, and credit-card numbers are all available to anyone determined to find them. Yet, according to a recent survey of 320 companies polled by the Computer Security Institute, 39% of all companies connected to the Internet have no firewall; 20% have experienced some type of break-in during the past year; and 83% give e-mail access to all employees.



This book helps businesses and individuals to correct those security lapses by using cryptography to protect important data from prying eyes. It presents practical information on using the latest protocols and algorithms to implement a variety of impenetrable encryptions. The book covers the U.S. government's Clipper Chip and other potential encryption standards, along with new encryption algorithms.

Applied Cryptography, Second Edition, costs \$44.95 and is published by John Wiley & Sons, Inc., 605 Third Avenue, New York, NY 10158-0012; Tel. 800-225-5945; Web: http://www.wiley.com/compbooks.

CIRCLE 92 ON FREE INFORMATION CARD

Method for the Theremin: Book 1 Basics

by Robert B. Sexton

Although it has been more than 70 years since the theremin was invented, there has been virtually no published material on how to play it. For the most part, the theremin has been treated as an eerie sound-effects machine, a laboratory curiosity, or a novel instrument used to play totally unsuitable romantic salon repertoires. And, while the best way to learn to play any musical instrument is through first-hand instruction from an experienced musician, in the case of the theremin, finding such an individual can be a challenge.



This playing method book for the theremin represents the first of several—known collectively as the Thin Air Series—to bridge the gap between would-be thereminists and the knowledge they seek. The book is aimed at students with both the ability to read music and the basic fundamentals of music theory and history.

Method for the Theremin: Book 1 Basics is available for \$24 plus \$4 shipping and handling from The Tactus Press, P.O. Box 9704, Austin, TX 78766-9704.

CIRCLE 93 ON FREE INFORMATION CARD

GIZMO®

The MiniDisc Revisited

Is there a place for MiniDisc in today's audio world?

It was six years ago, almost to the day, that we attended a press event at which Sony unveiled a new digital audio format: the MiniDisc. Back then, we were convinced they had a winner on their hands. After all, the MiniDisc combined the recordability and portability of the ever-popular audio cassette with the superior sound quality and digital convenience features of a compact disc. It seemed to us to represent a logical step in the evolution of personal music—and a highly desirable product.

Alas, here we are in 1997, and MiniDisc has not become the next Walkman. That's not to say the product is languishing on the shelves, or it's relegated to consumer-electronics Never-Never Land with the Betamax. In fact, about 3.5 million MD players and player/recorders were sold worldwide in 1996. That's nothing to sneeze at—but most of those sales were in Japan, where there's a much greater percentage of early adopters in the general population. The second largest selling arena is Europe, with the U.S. trailing somewhere behind. (Sony was not very forthcoming with American sales figures for MD hardware or software.) And, with only one company—Sony Music—producing prerecorded MiniDiscs for the U.S. market, the format is now being marketed primarily as a recording medium.

What's going on? We love making our own recordings, and MiniDisc is obviously a much better choice for doing so than audio tape. Those two facts alone made us assume that the MiniDisc's viability was assured.

But the fact is that not many people share our enthusiasm for home recording—not of audio, video, or even backing up their computer disks. A recent study con-



ducted by the Consumer Electronics Manufacturers Association (CEMA) revealed that only 52% of Americans whose stereo systems include both a CD player and a cassette deck ever make audio recordings, and less than 20% of those do so frequently. And the most frequently recorded material is not CDs, but other audio cassettes.

MiniDisc has a few other things going for it besides recordability. In this issue of *Gizmo*, we'll examine the technology behind the format and take a close-up look at a boxed set of MiniDisc components from Sony.

BIG SOUND, SMALL PACKAGE

The MiniDisc itself is a 2.5-inch opti-

cal disc that is housed in a protective plastic caddy, which looks like—but is smaller than—a computer diskette. The entire package is about half the weight of an audio cassette.

The discs are sturdy—highly resistant to drops, scratches, warping, shocks, and vibrations. They are long-lived—they won't wear out like analog cassettes tend to, and recordable MDs can be erased and re-recorded innumerable times with no loss of sound quality. They are convenient, offering one-second random access to any music selection. And, thanks to audio-compression technology, each tiny disc can hold up to 74 minutes of digital music, with sound quality that's nearly as good as that of a compact disc.

To fit the same amount of music on a 2.5-inch MD as is found on a standard 4.72-inch compact disc. Sony developed a digital audio compression technology called "ATRAC" (for Adaptive Transform Acoustic Coding), which has five times greater signal encoding efficiency than the 16-bit linear technique used in the CD format.

In 16-bit linear encoding with a 44.1-kHz sampling frequency, the analog signal is sampled about every 0.02 milliseconds (ms), and a 16-bit number stored, regardless of the amplitude or frequency content of the signal—or whether or not a signal is even present. ATRAC takes that same 16-bit data and analyzes it differently, examining the waveform content of segments of the data. Based on its analysis, ATRAC extracts and encodes only those frequency components that are audible to the human ear.

In layman's terms, ATRAC trims the fat from a recording. In psychoacoustic terms, it applies such principles as "threshold of hearing" and the "masking effect." The threshold of hearing, which varies with frequency, is the level below which the human ear cannot detect a sound. ATRAC identifies those components of an audio signal that lie below the threshold of hearing and removes them. The masking effect refers to what happens when a loud sound and a soft sound are produced simultaneously—the loud sound "masks" the soft one, rendering it inaudible. Again, ATRAC removes the sound that can't be heard anyway.

According to Sony—but subject to some debate in the audiophile community—removing those "inaudible" elements from the original signal has virtually no effect on perceived sound quality. We don't claim audiophile status. But we do have quite a bit of experience with various audio formats, and we find ourselves hard pressed to distinguish between CD and MD recordings, be they prerecorded or re-recorded.

There are actually two completely different types of MiniDiscs: Magneto-optical media is used for recordable MDs, and CD-type polycarbonate discs for prerecorded music. They look and sound the same, but you cannot (deliberately or accidentally) record over prerecorded MiniDiscs, which are mastered in much the same way as compact discs. Home-recordable MDs, however, require an

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entirely different recording system—one based on "magneto-optical over-write technology"—to be built into MD recorders. The technology allows previously recorded data to be erased and new data recorded simultaneously. What's more, that is accomplished with only one laser, keeping the hardware compact and affordable. A dual-function laser pickup is able to read both magneto-optical and prerecorded MiniDiscs.

During playback—in portable and car MiniDisc systems particularly—both prerecorded and recordable MDs benefit from shock-proof memory. The ATRAC decoder can process data faster than the MD pickup can read it. That difference in processing speed allows a buffer of several seconds to be placed between the pickup and the decoder. If the player is jostled and the pickup mistracks, the correct audio information continues to be supplied to the decoder from the buffer, and the listener is unaware that a problem even exists.

Durability, convenience, easy portability, skip-free play—MiniDisc has a lot going for it. Now let's take a look at how those features translate to real-life components: Sony's MD BUNDLE3. ■

Bundle of Joy

MD BUNDLE3. Manufactured by Sony Corporation, 1 Sony Drive, Park Ridge, NJ 07656; Tel: 1-800-222-SONY; Web: <http://www.sony.com>. Price: \$599.95.

Buying into a new format represents a big investment on the part of the consumer. In the case of MiniDisc, you need, at the very least, a player and some discs. To take full advantage of the format's benefits, a recording deck is also required—particularly when you take into account the current limited availability of prerecorded MDs.

So, some decisions must be made. Do you buy a portable MD player/recorder so that you can make your own recordings and listen to them on the go? After all, the format is touted as being highly portable. Or, do you buy a home MD deck for convenient recording and at-home listening?

Sony has relieved some of that decision-making angst by marketing the *MD BUNDLE3*, a package that includes the *MDS-JE500* home deck, the *MZ-E40* portable player, and a couple of 60-minute *MDW-60A* blank MiniDiscs. Offering the best of both worlds at an affordable price, the package allows you to take the MiniDisc plunge and enjoy the format wherever you happen to be.

The *MDS-JE500* home deck is a stan-

dard-sized component, with a large display on the left side of its front panel, the disc well in the center, and most of the controls arrayed along the right side. It offers all of the playback features you'd expect to see on a CD player, all the recording features of a high-end tape deck, and a whole lot more.

For instance, when you insert a disc, the display shows not only its length, but also its title. And you can also see the title of each song as it begins, or any time as it plays. An "Erase All" feature allows you to delete every track on a MiniDisc, leaving it blank to record again. And "Smart Space" limits the gap between tracks to no more than three seconds, eliminating annoying pauses in play.

But we're getting ahead of ourselves. Let's take a look at the basics first.

The *MDS-JE500* has one set of line-level audio inputs and outputs and one set of optical digital inputs and outputs. For best results, the digital jacks should be used. However, if your CD deck does not offer a digital output, you must use the analog jacks to record. In reality, you would be hard pressed to tell the difference between a recording made through the analog inputs and one made through the digital input. The deck includes a sampling-rate converter that converts digital signals recorded at a different sampling rate—say, for example, the 48-kHz rate used in DAT recordings—to the MiniDisc's default 44.1-kHz sampling rate.

Playing a prerecorded MiniDisc—or one of your own MD recordings—from start to finish is a simple matter of inserting the disc and pressing **PLAY**. When the MD is inserted, its title and the artist's name scroll onto display, followed by the total number of tracks and total disc playing time. A 25-square "music calendar" grid remains in the display to indicate total number of tracks. A level-sync meter also remains on the display for use during recording. As the song plays, the time played is indicated.

There are several ways to reach a specific track on the disc. While it is in either play or stop mode, you can press the fast-forward and reverse buttons on the remote control, or turn the **AMS** (Automatic Music Selector) knob on the front-panel to move to the next or preceding track. As you move through the disc, the title of each track will appear in the display along with its number. You can also select track numbers directly by inputting them on the remote's numeric keypad. In stop mode, you can press the **M.SCAN** button on the remote control to hear the first six seconds of each track and then pressing **PLAY** to select the song you want. (It's also possible to program the *MDS-JE500*'s music scan function to play the



first 10 or 20 seconds of each song.) You can also move to a particular point in a track using the FORWARD and BACK (double arrow) buttons found on both the front panel and the remote.

The MDS-JE500 offers four play modes that will be familiar to anyone who's ever used a CD player: continue, shuffle, repeat, and program. Continue is used to return to normal play from any other mode. Shuffle plays all the tracks on the disc in random order. Repeat mode allows you to repeat either all the tracks (when in normal play mode), all the tracks randomly (in shuffle mode), or a program of songs. By pressing REPEAT until "REPEAT 1" appears in the display, you can repeat just the current track. You can even repeat just a portion of a track by pressing the A-C button to create beginning and end points. That can be useful as an aid in learning lyrics (or to really bother other family members). To create your own program, you can use either the numeric keypad on the remote or the AMS knob on the front panel to select tracks. The total program time is tallied and displayed.

What won't be familiar to CD users, even those who are accustomed to recording audio tapes, are the MD-JE500's abundant recording and editing features. Some of those features, however, work only when your source is equipped with a digital output and connected directly to the MD deck's digital input. For instance, if you're recording a CD or MD through the deck's digital input, track numbers are automatically marked as they appear on the source recording. (When recording through the analog input—or when recording DATs or satellite broadcasts through digital in—the source material will be recorded as one single track. You can later divide it into separate tracks either manually or using the deck's "Automatic Track Marking," which marks a new track whenever the signal level drops for two or more seconds and

then rises again.)

The "Auto Cut" and "Smart Space" features also work only in digital recording mode. When there has been no sound input for 30 seconds, Auto Cut replaces that half-minute of silence with a three-second blank, and the deck switches into recording pause mode. Smart Space automatically replaces any period of extended silence—extended meaning more than four and less than 30 seconds—with a three-second blank space and continues recording. Both of those functions can be overridden.

Recording through the digital inputs, there should be no audible difference between the source material and your newly recorded MiniDisc. But don't get any ideas about setting up a bootleg recording studio. The MD-JE500 employs the SCMS (Serial Copy Management System), which means that MiniDiscs recorded through the digital input connector can't be copied onto other MDs or DAT tapes through the digital output connector.

The MD-JE500 has several recording features that work regardless of which input you use. For instance, you can select "Time Machine Recording" and get a two-second time buffer when you're trying to record from FM radio or a satellite broadcast. You don't have to worry about missing the first few seconds while you're fumbling with the RECORD button. The two most recent seconds of audio data are constantly being stored and updated. The actual recording begins two seconds before you press RECORD. The deck also offers synchro-recording, and can be set up for timer recording—but only with an optional timer.

The MD deck also offers a host of editing features. One of the advantages of the format is that MiniDiscs can be erased and re-recorded as many times as you like with no degradation of quality. The MD-JE500 allows you to easily erase a single track or all tracks on a disc. You can also

use the deck's divide function to mark segments within a track, and then delete only that portion of a song. You also can combine two consecutive tracks into one, change the order of the tracks, and create titles for the tracks you've recorded.

Labeling your discs and tracks is a tedious process, but well worth it if you enjoy seeing that information displayed as the disc plays. Labeling can be done as a song is playing, when the disc is paused, or during recording. In play or record modes, however, you must make sure to finish inputting the title before the track ends, or the MD-JE500 won't accept any of the information at all. From the front panel, you press DISPLAY/CHAR to choose between uppercase and lowercase letters, or numbers. Turning the AMS knob causes the characters to appear sequentially on the display (A,B,C,...; a,b,c,...; or 1,2,3,...). When the character you want appears and is flashing, you press the AMS knob to select it, and then proceed to the next letter until you've input the whole title. The NAME, CHAR, and NUM keys on the remote control can be used in a similar fashion to label discs and titles.

If you've made a mistake during editing and catch it right away, you can probably fix it. As long as you haven't pressed the RECORD, MUSIC SYNC or CD-SYNC STANDBY buttons or turned off the power, you can use the deck's undo function by pressing the front-panel EDIT/NO button until "Undo?" appears in the display. A press of the YES button then prompts another message, asking if you want to undo an erase, divide, combine, move, or label edit. Press the YES button again, and the problem is fixed.

Once you've recorded a disc, the MD BUNDLE3 lets you listen to it wherever you happen to be, using the MZ-E40 MD Walkman. The slim, pocket-sized MiniDisc player measures about 5×1×3/4 inches, and runs on two "AA" batteries. A nickel-metal-hydride rechargeable battery can also be used. The batteries aren't included, nor is an AC adaptor/charger.

The MD Walkman does come with foam-padded headphones as well as a carrying case designed for easy access to the display and the play controls that are found on the player's top panel. The display is a diminutive 1/2×1-inch, but we didn't have to squint (or bend over) to read it at waist level—even when the case was strapped shut. The strap, which covers the display, features a clear plastic panel for easy viewing. Next to the display are the PLAY, FORWARD, REVERSE, and STOP/CHARGE. Along the top edge of MZ-E40's front surface are volume control buttons, also left accessible by the case.

The portable unit doesn't have all the bells and whistles found on its stay-at-

home big brother. It does display the titles of the disc and each track on it. During playback, it indicates the track number and time remaining on that track. A battery icon lets you know how much power remains.

A few controls located on the back of the unit give you some additional playback options. A press of the DISPLAY button makes the title of the track scroll across the display. Four different play modes—normal, repeat all, single-track repeat, and shuffle repeat—can be accessed with repeated presses of the PLAY MODE button. The play mode is indicated in the display. There's also a MEGA BASS slide switch that offers three levels of bass emphasis, and an AVLS switch that activates the automatic volume limiter system prevents hearing damage from excessive volume. Finally, there's a LOCK switch that, when slid into position, prevents any of the other settings from being accidentally changed while you're carrying the player around.

One of the best features about the MZ-E40 is that you can't make the music skip. We tried—*really tried*, tossing it about, shaking, jiggling, jumping up and down. We don't advise dropping the unit—when we did, the batteries popped out, which did interrupt play. But nothing else we tried did.

The third "component" in the MD BUNDLE3 is a pair of blank 60-minute MD discs. The discs look more like computer disks than CDs. They're enclosed in hard plastic cases measuring $2\frac{1}{16} \times 2\frac{3}{16} \times \frac{1}{16}$ -inch. The cases make them more durable than CDs—a definite bonus for portable applications, and a necessity if you plan to make good use of their re-recording potential by reusing each disc for years to come. If you want to be sure to save a recording for posterity, however, you can slide the MD's record-protect tab to open the slot on the side of the disc; that will prevent the MD from being accidentally erased or re-recorded.

The MD Walkman is easy to use, and the headphones are light and comfortable. And, like the MD-JE500, it sounds terrific, whether you're listening to a pre-recorded MD or one of your own creations. We like the idea of packaging the home and portable units together—but we'd like Sony to take the idea a step further. As is the case in many households across the country, one of us listens to music primarily in the car, while the other uses a portable radio/cassette player a few hours a day. Sony does offer the MD PKGME2 home/car MiniDisc bundle, but we'd like to see something along the lines of an MD BUNDLE4 with home, Walkman, and car MiniDisc units included. ■

Family Chatters

Family Radio Service Radio Model FRS-105. From RadioShack, 700 One Tandy Center, Ft. Worth, TX 76108; Tel: 1-800-THE-SHACK. Price: \$179.99.

The kids have been begging for years, it's been months in the planning, and now the whole family is finally at Disneyworld. Your wife has taken the two younger children to the mellow attractions—"It's a Small World" and those cute little spinning teacups. You and the pre-teens are tackling the more exciting rides before meeting the rest of the gang for lunch at noon.

When you get your group to the restaurant, however, there's no sign of the others. It turned out that those teacups (not to mention the big pretzel and the cotton candy) were a bit much for little Sarah's stomach, and they had to return to the hotel room unexpectedly. Your wife had no way to let you know what happened, and you were left waiting, worrying, and wondering if you'd gotten the rendezvous time or place mixed up—putting a damper on your family's dream vacation.

That wouldn't have happened if you'd been equipped with *RadioShack's Model FRS-105 (part number 21-1805) Family Radios*. She'd have been able to call you, arrange to drop poor Johnny—who really didn't want to get dragged back to the hotel just because his sister got sick—with you and the older kids, and gone to the room for a change of clothes and a short rest without leaving you in the lurch.

Although they resemble traditional walkie-talkies, the RadioShack Family Radios are actually representative of a relatively new, license-free, two-way radio service. In July 1994, RadioShack petitioned the Federal Communications Commission to establish the Family Radio Service "in response to the growing public demand for an affordable and convenient means of direct communications between individuals and families." The FCC approved the petition for "very short distance two-way voice radio" in May 1996, and Family Radio Service, or FRS, became a reality a month later.

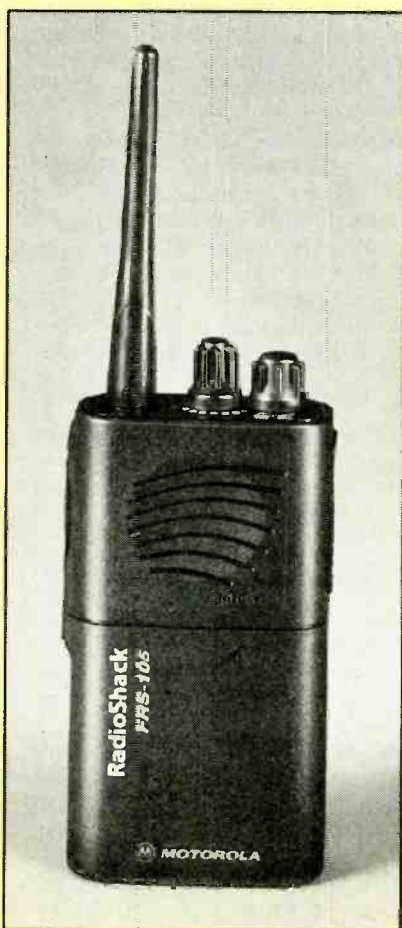
FRS is not the only short-distance two-way radio service in existence. Citizens Band radio, which offers a range of one to five miles, has been around for decades. There's also the General Mobile Radio Service (GMRS), at 462 MHz, with a range of 5 to 25 miles.

The Family Radio Service is actually a new CB service that operates on 14 channels in the 460-MHz band. Traditional CB radio uses AM or SSB modulation, which are subject to a lot of interference. FRS, on the other hand, uses FM for clear, clean, squawk-free transmissions. And, unlike GMRS users, FRS users are not required to get a license or pay any type of operating fees.

Instead of the usual narrow-band FM deviation of 5 kHz, Family Radio Service channels are set at 2.5 kHz apart. That's to avoid interference with GMRS stations. The 14 FRS channels are 462.5625, 462.5875, 462.6125, 462.6375, 462.6625, 462.6875, 462.7125, 467.5625, 467.5825, 467.6125, 467.6375, 467.6625, 467.6875, and 467.7125 MHz. Those channels are used on a "take turns" basis, with no channel assigned to any specific person or group.

The FCC ruling spelled out quite a few technical parameters for the new service. FRS units, which are required to be labeled as such, must be handheld and equipped with "rubber-duck"-style antennas. Internal and external modifications—including the addition of any other antenna or an amplifier—are completely prohibited. Maximum output power is $\frac{1}{2}$ watt.

Family Radio Service is intended to allow individuals or small groups to conduct two-way voice communications with



another person or group—to send an emergency message, provide traveler assistance, send voice pages, or simply have a conversation. Emergency messages, however, must always be given priority status. FRS units can be used to transmit tones to contact or continue communications with another specific FRS unit—the radios can be set to ignore transmissions that don't carry the tones. Audible tones can last no longer than 15 seconds, while subaudible (300 Hz or less) tones can be transmitted continually for the duration of the conversation. Not surprisingly, you are not allowed to use FRS in connection with any type of illegal activity.

Not that you'd want to use it to set up a drug buy or plan your next bank heist—there's really not much privacy on the FRS channels. But if you're planning to use your Family Service Radio to let your kids know it's time to leave the park and come home for dinner, or to tell the friend who's helping you rewire the upstairs bedroom by waiting at the circuit box in the basement that it's okay to turn the circuit back on, or inform the other members of your ski group that you've decided to take a different trail back to the lodge—well, those communications don't require confidentiality. And that's the type of chat for which the Family Radio Service is intended.

RadioShack's FRS-105, which is manufactured by Motorola, is an unpretentious device. It stands 4½ inches tall, is about an inch thick and 2½ inches wide. Its top sports a 3½-inch flexible rubber antenna and two knobs. The one closest to the antenna is the channel selector. Channels are clearly labeled 1 through 7 (the FRS-105 uses only half the available FRS frequencies, those just above 462.5 MHz). To the right of the channel selector is a knob that doubles as the power and volume control. The microphone and speaker are found on the front of the unit. Its left side features the self-explanatory PUSH TO TALK button, and a MONITOR button that overrides the radio's auto-squelch feature to allow you to hear everything that's happening on a channel. On the right side is an accessory cover that lifts to reveal earphone and microphone jacks. The FRS-105 runs on three "AA" batteries, which go into a compartment in the bottom front of the radio, accessible by opening two side latches and sliding the cover down and off. (Batteries, earphone, and microphone are not included. Nor is there any provision for recharging batteries, although rechargeable batteries can be used.) A removable molded-plastic belt clip is found on the back of the unit.

Using the FRS-105 is straightforward and easy. To carry on a two-way conversation, two radios, tuned to the same

channel, are needed. To talk, you simply hold down the PUSH TO TALK button and say whatever comes to mind. Release the button to listen to the response. If someone else is using the first channel you try, simply switch to another. If you want to hear all the chatter on a channel, press the MONITOR button; that shuts off the unit's auto-squelch feature and allows weak transmissions and radios set to a different "quiet code" to be received.

The FRS-105 allows you to select a quiet code, which, in effect, creates a sub-channel within each channel. When you use the quiet feature, you can communicate only with people whose radios are set to the same channel and the same quiet code. To set a quiet code, you must remove the battery-compartment cover and the batteries to access the code dial. You can use either your thumbnail or the side of a coin to turn the dial from the factory-preset "no-code" setting to one of the codes (labeled "A" through "G"). Now you won't be bothered by other FRS users' chatter—unless you feel like eavesdropping by pressing the MONITOR button.

One thing that we found sadly lacking on the FRS-105 was a power-on indicator. There are plenty of times when you won't be actively conversing, but you'll leave the radio on to be open to communications. It's very easy to leave the unit on, and accidentally wear down the batteries without realizing it. (There isn't a low-battery indicator either.) The unit does have a power-save mode—but that seems to be primarily for people who talk too much, not for those who are forgetful. If you transmit continuously for more than two minutes, the radio automatically stops the transmission, and goes into power save mode. When you push PRESS TO TALK again, it returns to full power mode.

The catalog claims that the FRS-105 has a "range up to several miles;" the manual boasts "clear communications up to 1 mile." In reality, there's quite a difference between line-of-sight range, and communications in crowded urban or suburban settings. Steel buildings and automobiles, for instance, can greatly limit range.

In our tests, we found that the units worked great when we needed to communicate between the house and the office (located in a garage about 50 feet away). We had no problems talking with friends around the neighborhood, and found that the FRS units came in handy on Friday pizza nights. We could remind the person getting the pies to pick up a bottle of soda or six-pack. When someone went home halfway through the evening to feed the cats, she took the radio with her for both security (even the safest areas are not immune to crime these days), and to pre-

vent the inevitable (and not free) "While you're home, could you ...?" phone call from her husband. Our child is too young to use the radio, but we found that neighborhood kids starting at about age seven could be trusted to use them properly (and not lose or abuse them in the process).

We then went on an evening stroll—together yet alone. Equipped with our handy FRS-105s, we each took off in a different direction, and maintained communications until we were about 1½ miles apart. The woman who does her daily power walk at 7 AM while her husband and kids are home eating breakfast and getting ready for work and school could stay in touch by bringing along an FRS radio (although she might prefer not to be bothered with "Honey, where do we keep the Cheerios?" or "Mom, I can't find my socks, book report, lunch box, etc." as she exercises!). Anyone who jogs at night or in semi-deserted places could carry along an FRS-105 for safety.

There are dozens of possible uses for Family Radio Service. Hunters can keep in touch with their buddies; camping pals can communicate with those in other tents; bird watchers can quietly inform their friends of an interesting sighting. You can: keep scouts together during an overnight trip, family members in touch at amusement parks, coordinate activities at a family reunion or company picnic; let your kids talk to their friends without tying up your phone line, track down your kids who are playing somewhere in the neighborhood, check up on kids who are "camping out" in the backyard without going out to check up on them, ask your wife to bring you up another tool from the basement when you're working on a project upstairs, "tag along" when your kids go trick-or-treating on Halloween, or stay in touch with other members of your neighborhood patrol group.

The FRS-105 can also serve as a particularly convenient shopping aid. For instance, you can split up and cover twice the ground at antique shows, flea markets, and ham fests. ("Old quilts in aisle seven." "Great price on T-shirts at booth A-11." "Check out the tube selection at the table with blue awnings near the hot-dog vendor.") Or give your Christmas shopping expedition a high-tech edge. FRS-armed family members can fan out, buying and checking off items on their individual copies of the master list: "I got Grandma's bathrobe at Macy's." "I'm in line at Sports Authority—Uncle Bill and his kids, Dave, Barbara, and Steve are taken care of." "Can't find that cookbook for Aunt Ellen at Barnes & Noble—who's closest to WaldenBooks?"

If your family needs a new way to keep in touch—at home, on vacation, or at the mall—FRS fits the bill. ■



Astern is Astern is A Stern?

CROSSWORD PRO MODEL LB-1000B.
From Oregon Scientific, 18383 South
West Boones Ferry Road, Portland, OR
97224; Tel: 1-800-869-7779. Price:
\$149.95.

We love doing crossword puzzles. They're a pleasant distraction, an enjoyable way to pass the time waiting in a dentist's office or while traveling. They keep our hands (and our minds) occupied while we watch TV. The one in the daily paper (along with a couple of cups of strong coffee) gets our brains moving every morning. A too-tough (or too-easy) puzzle makes an effective sleeping pill at night. And, unlike other time-fillers (solitaire, sit-coms, reading pop fiction), crossword puzzles are guilt-free. After all, solving them hones our word skills—as writers, we can even view them as off-the-job training.

We don't mean to suggest that we're champion puzzle solvers. We have managed to finish The New York Times Sunday puzzle a few times, but that's the exception, not the rule. We work puzzles in pencil, not pen, and we make frequent

use of the eraser.

Oregon Scientific offers pencil- and eraser-free puzzle solving with its *Crossword PRO* electronic handheld crossword puzzle. From its database of more than 30,000 different clues and answers, the handheld device can create over a million puzzles. It features a built-in spell checker and offers help solving individual letters, words, or the entire puzzle.

The Crossword PRO measures just over 4½ inches square by ¾-inch thick, and weighs just six ounces. The LCD puzzle display is about 1½-inches square, allowing puzzle grids of 13×13 squares. To the right of the display is a round, multidirectional cursor control. Above it is the ON/OFF button; below it is the blue ? button used to display clues. A small QWERTY-style keyboard spans the bottom of the unit. At its bottom-right corner is a large FUNCTION key and two smaller buttons marked with arrows, one pointing up and the other to the left.

Besides moving the cursor around the screen, the multidirectional control, when used in conjunction with the FUNCTION button, adjusts the contrast on the LCD. We had no trouble seeing the puzzles or reading the clues, indoors or out. There is no back light, however, so if you like to work crosswords while watching TV, you'll need to keep on some lights.

If you don't press any buttons for sev-

eral minutes, the unit automatically shuts itself off to conserve power. (It uses four "AAA" batteries, which are included.) When you power it up again, it returns to the game you were playing when it shut down.

The Crossword PRO is very easy to use—we didn't even glance at the manual until after we'd played a game at each of the three levels of play (and then only to be sure we weren't missing anything that should be included in this review). Several of the letter keys have secondary functions, for which they are clearly labeled. For instance, the "Q," "W," and "E" keys double as "solve" keys. Press FUNCTION with "Q" to solve the entire puzzle, with "W" to solve the word(s) on which the cursor rests, and with "E" to see the letter on which the cursor rests. The "I," "O," and "P" keys, in conjunction with the FUNCTION key, are used to select the game-play level: easy (I), medium (O), or difficult (P). Press the "T" with the FUNCTION key to see if you've spelled a word correctly; misspelled letters will be highlighted. There are even a few "electronic erasers"—just press FUNCTION and "Z" to delete an entire word, or use the up and left arrows to delete the letter above or to the left of the cursor.

To begin, you press FUNCTION and either "I," "O," or "P" to select the level of play. A puzzle grid appears on screen, with the cursor flashing in the top left corner. Use the cursor control to position the cursor anywhere within a word, then press ?. The grid disappears, to be replaced by the clue and, in parentheses, the number of letters in the answer. If any of the letters in the answer have already been filled in, you'll see them displayed "Hang Man"-style above the clue, separated by dashed blanks. By positioning the cursor at the intersection of two words before pressing ? you can see both clues displayed at once.

We started out at the easiest level, expecting to be somewhat bored as we zipped right through it. We were surprised—though not entirely pleasantly—to find ourselves stymied by many of the clues. When we used the Crossword PRO's electronic helpers to fill in the answers we were unable to solve on our own, we found out that we hadn't somehow lost our puzzle-solving skill. Many of the clues were obscure, particularly for easy mode (nine-letter word for licentious: abandoned). Others pushed the limits of definitions (12-letter word for editing: amelioration). There were a few crossword no-nos: the clue itself was part of the answer (eight-letter word for sight: eyesight—why not use "vision" as the clue?), for instance, or the clue was an adjective and the answer a noun (five-let-

ter word for astern: stern), or vice versa. Stern is not a synonym of astern! And one clue was the exact opposite of the answer (five-letter word for ebb: flood). Our dictionary defines ebb as "the flowing back of the tide as water enters the sea." The primary definition of flood is "a great overflowing of water, especially over land not usually submerged"; other definitions include "to flow or pour *in*."

After faring so poorly on the easiest level, we felt some trepidation about trying the other two. But we just took a deep breath and dove right in to the hardest level. There we were confronted with such "stumpers" as "do, as laces (3)" (tie), and "Baltimore nine (7)" (Orioles). Even the longer answers were relatively easy: "scarecrow's place (4,5)" was corn field, and the 12-letter answer for relief was satisfaction. But there were also a few obscure ones: The eight-letter solution for capital was Canberra—wouldn't "Aussie capital" or "capital down under" be a better clue?

By now, we were curious to see what awaited us at the medium level. Actually, it was difficult to distinguish it from either of the other two levels. We were able to get just about all the squares filled in, but, once again, we were confronted with clue-answer pairs that simply wouldn't pass muster in most of the puzzles we do regularly. Nature goddess (4): Isis. We (and our dictionary) were under the impression that Isis was the goddess of fertility. A fugitive from the front (4): AWOL. The clue is a noun; the answer, a descriptive phrase.

We are not by nature nit-pickers. Nor are we thrown by a few off-beat clues. In fact, we are big fans of "Puns and Anagrams" and "Cryptoquote" puzzles, in which round-the-bend thinking is required to unravel clues that are tricky as can be. We liked it whenever the Crossword PRO tossed in a clever clue like: "Forward, a lake; backward, a country" (the answer is "Erie.") And obscurity is fine on the more difficult levels of play. But, as far as we are concerned, crossword answers should be synonymous with their clues—not different forms of the same word or, heaven forbid, antonyms. (A good *editor* might have been able to *ameliorate* the problems.)

We have one further complaint. We found it disconcerting to have to toggle between the crossword grid and the clues, and to see a maximum of two clues displayed at once. We find we do our best crossword solving when we see out of the corner of our eyes a clue we've looked at a dozen times before. Suddenly, a light goes on in our heads, we fill in that answer, and a whole section of the puzzle comes together like magic as our eyes flick back and forth from clues to grid.

That magic is lost in the button pushing and screen switching required by the Crossword PRO.

For all our griping, however, by the time we sat down to actually write this, several hours and dozens of crosswords had gone by without our realizing it. The Crossword PRO can be addictive—frustrating, yes, but also difficult to put down. ■

How Suite It Is

MGI PHOTOSUITE VERSION 8.0. Published by MGI Software Corp., 40 West Wilmot Street, Richmond Hill, Ontario, Canada L4B 1H8; Tel: 888-MGI-SOFT; Web: <http://www.mgisoft.com>. Price: \$49.95.

MGI PhotoSuite is an easy-to-use photo-editing software package that promises to change the way you think of photography.

One of the hallmarks of MGI PhotoSuite is the MGI Activity Guide, a

visual menu that makes it easy to access the most popular photo-editing and -enhancement activities. It includes photographic icons labeled Get Photos, Edit or Enhance Photos, View an Album, View a Slideshow, Print Your Photos, Create a Sports Card, Create a Greeting Card, Create a Calendar, Create a Magazine Cover, and Fun with your Photos.

The Activity Guide makes it easy for novices to get started quickly and to have fun with photos almost immediately. However, experienced users will probably not have too much use for it. Fortunately, they're not forced to use it. Simply click on the Work on your Own button, and you're immediately presented with a traditional Windows interface.

Some activities are actually more easily accomplished with the MGI Activity Guide. A single button click will let you switch back to it.

The traditional desktop features a menu bar across the top, right below the title bar. A button bar below that provides shortcuts for the most commonly used features, including rotate, zoom, and special effects. A tool bar down the left side

mgi PhotoSuite
Version 8.0

The Easiest Way to Edit, Capture, Catalog and Transform Your Photos!

- Photo Editing & Effects
- Photo Lens Kit
- Image Capture
- Photo Slide Show
- Internet Helper
- Photo Album and Catalog

BOWLS!
FREE Multimedia Library

Kodak Get your Photos on a DIGITAL Kodak Picture Disk, Free!

32-BIT APPLICATION
18-BIT APPLICATION
Data Ver-Bias Included!

of the window contains traditional image-editing tools including selection tools (select by ellipse, rectangle, freehand, or color) and drawing tools (freehand, straight line, and filled and hollow ellipse, rectangle, rounded rectangle, and polygon). Freehand draw, flood fill, air brush, eraser, text, and clone tools round out the tool bar.

There are some additional control panels that can be displayed or hidden. For example, a Pen Settings panel can be used to select the size and shape of the pen's "point."

Most of the tools worked as we expected. We were happy that MGI PhotoSuite used accepted icons and procedures for getting things done. For example, an eyedropper is used to select a color by "picking it up" from the image. A paint pail is used to represent a flood fill. And a magic wand is used to select an area of an image by its color. MGI PhotoSuite contains a way to fine-tune your selection by adding and subtracting from the selected area.

Let's say, for example, that you wanted to remove an ex-girlfriend from a group photo. In the picture, she was wearing a bright yellow jumpsuit and brown shoes, and the background was a city street. The easiest way to edit her out would be to use the magic wand to pick out the yellow jumpsuit, and then also use it or, perhaps, the freehand selection tool to get the shoes, her face, and hair. MGI PhotoSuite allows us to do that by using the Shift and Control keys in combination with selection tools.

MGI PhotoSuite can work on individual images—which you can acquire from a Twain device such as a scanner or digital camera—or from images you open that are stored on your hard disk or on a CD-ROM. It also works with "albums" or collections of images. It seems sensible to us. After all, that's how we store our normal photographs. The advantage of albums in PhotoSuite is that thumbnail images are created, so you can identify the image you want to work on with just a glance. Creating an album is a quick and easy process, and descriptive notes can be added to each thumbnail.

One of the interesting applications suggested for the album utility is to catalog Internet sites. To do this, you would open a catalog under MGI PhotoSuite, and then launch your browser and go to a site. Then you would insert items into the catalog by pointing to your browser's cache directory.

Conversely, albums can be converted into a Web page in one easy step. The default page appears with thumbnails. Clicking on a thumbnail brings up the image and any saved descriptions. Of course, any HTML editor can be used to further enhance the page.

Preparing a photo for use on the Internet is easy with MGI PhotoSuite's Convert to Web format command. It allows you to control the resolution of the picture by selecting the exact number of pixels, or by selecting common sizes such as 640×480 pixels with a single click. Selecting JPEG conversion is also a single-click operation.

MGI PhotoSuite contains a built-in feature that allows it to connect directly to PhotoNet, an online photo service that allows your local developer to process your film into electronic images that you can retrieve via the Internet.

A collection of 22 special effects is included in the program. You can posterize an image, or create a "coloring book" line drawing of it. You can sharpen or soften the edges, or put the photo under smoked glass. A cartoonize selection runs photos into what look like color cartoons. Distortion tools let you stretch images, swirl them, and otherwise distort them.

Creating posters, calendars, greeting cards, and such items as sports trading cards is made easy with MGI PhotoSuite. A host of such templates as magazine covers, frames, and other images are supplied on a CD-ROM. Additional images are available to registered users via MGI's Web site.

MGI PhotoSuite is quite well done. It has so many features and effects that we weren't able to try them all. The tools provided were robust enough that we could really make photos better, and their operations were intuitively understandable. It has a robust file-format compatibility, and its HTML album conversion is slick. It is the most "Internet ready" of the programs reviewed here. Our one complaint is that it allows you to undo only a single operation. It would be nice if they could change that for the final release. (We examined a beta version of the software.) Otherwise, MGI PhotoSuite is a strong contender for low-cost photo editing. ■

ELECTRONICS WISH LIST



Yamaha RX-V2092 Receiver

Fujifilm Picture-It



Dolby Digital Receiver

Yamaha Electronics Corp. USA's (6660 Orangethorpe Avenue, Buena Park, CA 90620) flagship receiver, the *Model RX-V2092* incorporates Dolby Digital processing. The seven-channel receiver also features exclusive "Tri-Field Processing," which applies DSP to the front signals and to each surround channel independently to create realistic movie-theater sound in the home from a Dolby Digital Source. For true sound from any source, the receiver also includes Dolby Pro Logic, Cinema DSP, and digital sound field processing. It offers 13 music and movie-theater modes. The amplifier delivers 100 watts each to the five Dolby Digital channels, plus 25 each for the two front effects channels used in some Yamaha Cinema DSP setups. The receiver provides second zone audio and video outputs and comes with a second room remote for multi-room installations. Its wide array of outputs makes it a flexible component. Price: \$1599.

Photographic Print Maker

The *Print-it* photographic print maker from *Fuji Photo Film U.S.A., Inc.* (555 Taxter Road, Elmsford, NY 10523) delivers high-quality prints from both video and digital sources onto real photographic paper. Its unique digital and video capability allows printing from sources ranging from a camcorder or digital camera to a television, Macintosh, or PC. Photo manipulation and adding text to images is easy using the incorporated editing tools or the bundled Adobe PhotoDeluxe image-editing software. *Print-it* uses Fujifilm's Thermo-Autochrome technology, a process that requires no inks, toners, or ribbons. Price: Under \$700.

ELECTRONICS WISH LIST

Movie Pass VCR

The popcorn's popped, soda's poured, lights are dimmed. You press "play"—and then have to sit through (or fast forward through) 10 or 15 minutes of previews before you can watch the movie you rented. If your VCR was the *Model VTUX-627A* from *Hitachi Home Electronics (America), Inc.* (3890 Steve Reynolds Blvd., Norcross, GA 30093-3012), you wouldn't have to lift a finger. The VCR is equipped with a unique Movie Pass feature that automatically bypasses all the previews and goes directly to the main feature. It then automatically rewinds the tape when the movie ends—and does so in less than a minute and a half. The VCR also features Hi-Fi stereo sound, dual azimuth heads, front-panel A/V inputs, a commercial-advance jog/shuttle combination, UltraVision picture-enhancing circuitry, and two record speeds and three playback speeds. Price: \$349.



Movie Pass VCR

Full-Featured Camcorder

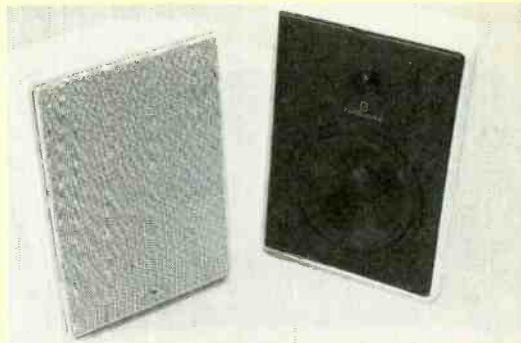
Canon U.S.A., Inc.'s (One Canon Plaza, Lake Success, NY 11042) *ES270* is a feature-laden entry-level 8mm camcorder. It includes a 16 \times optical zoom—the strongest in its price class—for shooting group shots, macro closeups, and landscapes. The 4-64-mm lens' wide-angle capability gives the user a wide array of recording options. Canon's exclusive FlexiZone AF/AE feature provides precise focusing and exposure anywhere within the viewfinder frame, instead of just at the center as with traditional autofocus systems. A "joystick" controller is used to move a white-framed box within the viewfinder frame, letting the user know exactly where the camcorder is focusing. A touch of the FlexiZone Auto Exposure button automatically adjusts for proper exposure of the subject, even in extreme lighting conditions. The camcorder provides digital special effects including art, black-and-white, sepia, and negative conversion. The negative conversion effect is designed to work with the optional FP-100 Film Adapter to create a film and slide image-transfer system that allows users to transfer 35mm negatives and slides to video. Other features include pre-set titles, a color viewfinder, hi-fi stereo, a LANC editing terminal, record search and review, line-in recording, and back-light compensation. Price: \$599.



8mm Camcorder with 16 \times Optical Zoom

High-End Outdoor Listening

Parasound's (950 Battery Street, San Francisco, CA 94111) *Nomad Ten* is a rugged outdoor speaker designed to provide hi-fi sound on patios, decks, and pool areas, or at frigid mountain cabins or humid beach houses. For open-air listening, the two-way acoustic suspension speaker has a subtle 2-dB bass boost, wide dispersion characteristics, excellent dynamics, smooth response, and low bass distortion at high output levels. The speaker's fiberglass-reinforced, molded ABS plastic enclosure has an unusual stepped shape that, compared to traditional flat-sided designs, reduces panel resonances and internal standing waves. The speaker grilles and mounting brackets are made of rust-proof stainless steel, and the heavy-duty five-way binding posts are gold-plated to resist corrosion and optimize connections. The Nomad Ten is designed for amplifiers rated from 10 to 120 watts rms per channel. Price: \$499/pair.



High-End Outdoor Speakers

Net Board

The *NetBoard™* from *iSi North America* (30 Chapin Road, Pine Brook, NJ 07058) is an ergonomically designed mouse pad intended for surfing the Net. The surfboard-shaped pad can be used on a desk, but it's really intended to sit on the user's leg. A set of feet allows it to nestle on top of the leg. Its polypropylene surface—which comes in a choice of four outrageous graphic designs—offers total control of the mouse and full range of use without ever having to lift it from the surface. Designed for people who spend a lot of time on the Internet, the NetBoard lets them use a mouse more effectively and more comfortably. Price: \$11.95.



NetBoard Mouse Pad

ELECTRONICS WISH LIST



Easy View Remote Control

Easy View Remote

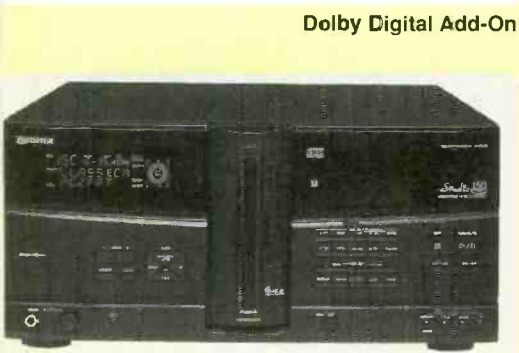
Aimed at baby boomers and their parents, the *One For All Easy View URC-3300* remote control from *Universal Electronics Inc.* (1864 Enterprise Parkway West, Twinsburg, OH 44087) features buttons that won't have users reaching for their reading glasses. Its large, numerical shaped keys, and channel and volume toggle switches make it easy to operate a TV, VCR, and cable box. A built-in sleep timer can automatically turn off the user's video gear, even if the original equipment does not include that feature. The Easy View is preprogrammed with a comprehensive library of remote codes, so the original remote controls are not needed. Price: \$19.99.



Dolby Digital Add-On

Dolby Digital Add-On

Yamaha Electronics Corporation, USA's (6660 Orangethorpe Avenue, Buena Park, CA 90620) *DSP-E492* is an add-on processor/amplifier that can be connected to anything from a standard stereo amp to a multichannel A/V receiver or processor to create a home-theater component ready for Dolby Digital or other discrete 5.1-channel formats. It provides three channels of amplification and has built-in Dolby Pro Logic decoding, Yamaha's Digital Sound Field Processing, and Cinema DSP. The DSP-E492 can take any amplifier with two channels or more and upgrade it to a high-performance home-theater power and processing center. The only requirement is that the amp providing the main channels has pre-main couplers. Once installed, the system is ready to accept the output from Dolby Digital decoders. Price: \$399.



Studio 150 150-Disc CD Changer

150-Disc CD Changer

The *DAC-1506 Studio 150* CD changer from *Fisher Audio/Video* (21350 Lassen Street, Chatsworth, CA 91311-2329) features tri-level programming and load-during-play capability. It safely stores up to 150 discs in a dust-free environment, and makes it easy to locate and play CDs by up to 14 preset or up to 50 user-input categories, by artist, and by CD title. The remote control includes most category search and playback functions as well as two-speed search capability to quickly scan through automatically alphabetized category and disc titles. The remote can be used to program categories from a distance while viewing the Studio 150's large, bright fluorescent display. Access time for CDs is about the same as most carousel CD changers. The unit's bi-directional radial transport quickly rotates standing discs both forward and backward for faster playback. A security code protects programming data by preventing unauthorized users from changing categories or ejecting discs. Studio 150 also offers 80-track programming, repeat play, intro scan, and a headphone jack with volume control. Price: \$349.95.



Kid-Sized Boom Box

Kid-Friendly Boom Box

Part of *Thomson Consumer Electronics'* (10330 North Meridian Street, Indianapolis, IN 46290-0124) line of RCA-brand products designed specifically for children, the *Model RP-7701K9* mini-AM/FM-cassette recorder is packaged with a small stuffed Chipper—the younger half of RCA's canine mascot team. The baby boom-box features one-button record for easy taping, automatic end-of-tape shut-off, cushion eject to simplify inserting and removing cassettes, and a headphone jack. It is brightly colored in red, yellow, and blue, and offers large, easy-to-use buttons, just the right size for young children. Price: \$34.99.

SMART AIRBAGS

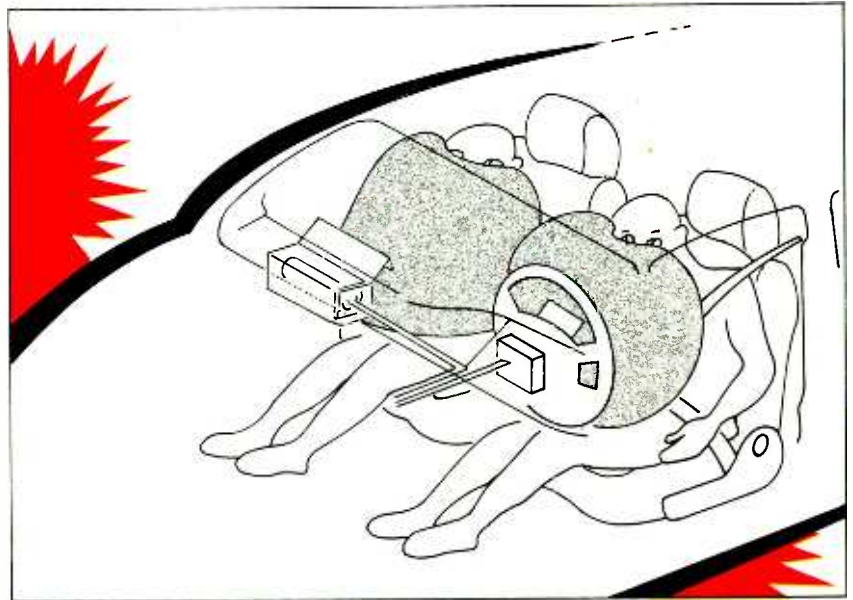
Nearly everyone has heard by now of the potential dangers that airbags may pose to children. Read how new electric technology is making airbags safer.

BILL SIURU

Just about every car and light truck now comes with driver's side airbags, and, in most cases, airbags for passengers as well. While airbags definitely save lives and reduce injuries, they can be extremely dangerous to children riding in rear-facing infant seats. Rear-facing infant seats must never be used with a functional front airbag, since the back of these seats can be struck by the inflating bag, possibly injuring the child. An airbag explosively inflating in milliseconds can transmit a strong enough force to severely injure or even kill a small child. There are several solutions, the best of which is to secure the infant seat in the back seat away from harm. However, this is not possible in the popular pick-ups today, as well as in sports cars without back seats.

Some automakers are installing an on/off switch so the passenger-side airbag can be deactivated when the baby seat is strapped in. This has the disadvantage in that the driver has to remember to use the switch manually. Cut-off switches should be designed so that the airbag is automatically on each time the engine starts. Turning off the bag should be a conscious decision—not a forgetful error. A much better approach is a system that detects the seat and automatically deactivates the airbag.

Airbag Detection Considerations. Automakers and their airbag suppliers have developed several detection approaches, which will start appearing on cars and trucks



soon, to determine whether the front seat is empty versus occupied by an infant seat. These include foils in the seats, radio frequency detectors, pressure sensors to weigh what is on the seat, acoustic sensors, or even a Charge-Coupled Device (CCD) video camera. In most cases, infant-seat detection is part of a system that detects other occupants. Preventing unnecessary deployment when no one is in the seat is important, because airbags are expensive to replace—anywhere from \$600 to over a couple of thousand dollars.

What the Manufacturers Have Developed. The new Mercedes-Benz SLK sports car will be the first car to feature a system that can sense the presence of a child seat in the passenger seat and automatically turn off the passenger-side airbag. The system does not require a special infant seat, one from Britax, Europe's largest child seat manufacturer, which is now marketed in the United States. The system, developed by Siemens Automotive, uses a small built-in "resonator" that works somewhat like security tags used in clothing

stores. A low-power electronic signal from the passenger seat prompts a return signal from the resonator in the infant seat, which automatically turns off the airbag. Since the signal from the car is "reflected" back by the resonator, no battery or power hookup is required in the infant seat. A light on the center console confirms "airbag off." In the event of a collision, the child is restrained by the child seat and the regular seat belt system. The SLK's side airbag still inflates automatically; it has no signal turnoff, since it is only about one-tenth the size of the front airbag.

In a similar concept by Siemens, the integrated Child Seat Presence and Orientation Detection (COD) and Passenger Presence Detection (PPD) system, illustrated in Fig. 1, uses a pressure-sensitive resistive foil in the passenger seat. If this force-sensing foil does not sense the weight of a passenger, the airbag will not be triggered in a collision. The system includes two antennas that correspond with twin resonators installed in the base of the child seat. The resonators

(Continued on page 77)

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BUILD THE

TIME-OFF

With this simple count-down timer circuit, you won't have to worry that the local electric company is pocketing a greater share of your hard-earned money just because you tend to fall asleep, and leave the lights on all night, or you rush off to work in the morning, leaving all sorts of appliances on until the evening.

D. DEREK VERNER

Everywhere you look, the cost of living is shooting up at an astronomical rate, while wages continue to stagnate. Nowhere is the rising cost of living more acutely felt than in the "sting" of your monthly utility bill. It seems that utilities raise their rates at least once a month (more often, if you ask me). Well, if you enjoy reading a good book, watching television, or listening to music in bed, but hate to wake up in the morning with the light or the set still on, then the *Time-Off* is for you.

The *Time-Off* is a simple project that can be programmed to turn off any appliance after an interval (ranging from one second to over an hour and a half) designated by its user.

The circuit is not limited to lights, TVs, and radios. Electronics hobbyists can benefit from the circuit as well. Simply plug your soldering iron into it during your next workbench session and you won't come back three days later to find a pitted, burned tool and a higher electric bill. Use it to control your holiday lights at Christmas time or, if you build it according to instructions, to handle loads as heavy as space heaters or air conditioners. It makes a better darkroom



timer than most of the commercially available units, because it not only can operate your enlarger, but, since it has such a large range, it can be used to time the various processing steps in film developing.

You can even hook the Time-Off up to a solenoid valve salvaged from an old dishwasher or washing machine and use it to turn off the water to a print or film washer after you have gone to bed. Or, you can connect the solenoid valve to a garden hose to automatically shut off your lawn sprinkler after a predetermined time.

How It Works. The heart of the Time-Off is an inexpensive stop watch/count-down timer that is available from RadioShack (see Parts List for RS part number). (Any similar timer unit can be used as long as it has a piezo alarm that shuts off automatically.) There is no point in designing and building a similar timer. The parts would cost far more than the commercially available unit and it would be much larger (not to mention uglier).

A schematic diagram of the Time-Off is shown in Fig. 1. Aside from the timer, the circuit is comprised of a pair of relays (RY1 and RY2), a transistor (Q1), two neon lamps (NE1 and NE2), a pair of diodes (D1 and D2), a switch (S1) and some support components.

When S1 is pressed two things happen. First it shorts out the red and black leads of the timer (more about these later) together, initiating the countdown sequence. At the same time, that sequence causes relay RY1 (a DPDT unit), which self-latches through one set of its contacts, to energize. The other set of contacts, when closed, powers whatever device is plugged into SO2. When the selected time interval has elapsed, a 4-kHz pulsing signal (that was formerly fed to the piezo) is routed to transistor Q1 through diode D1. Diode D1 rectifies the 4-kHz signal and capacitor C1 removes the ripple from D1's half-wave, rectified DC output. The rectified DC is fed to the base of Q1 through R3 (a 1k resistor), causing it to saturate. When Q1 is driven to saturation, relay RY2 turns on.

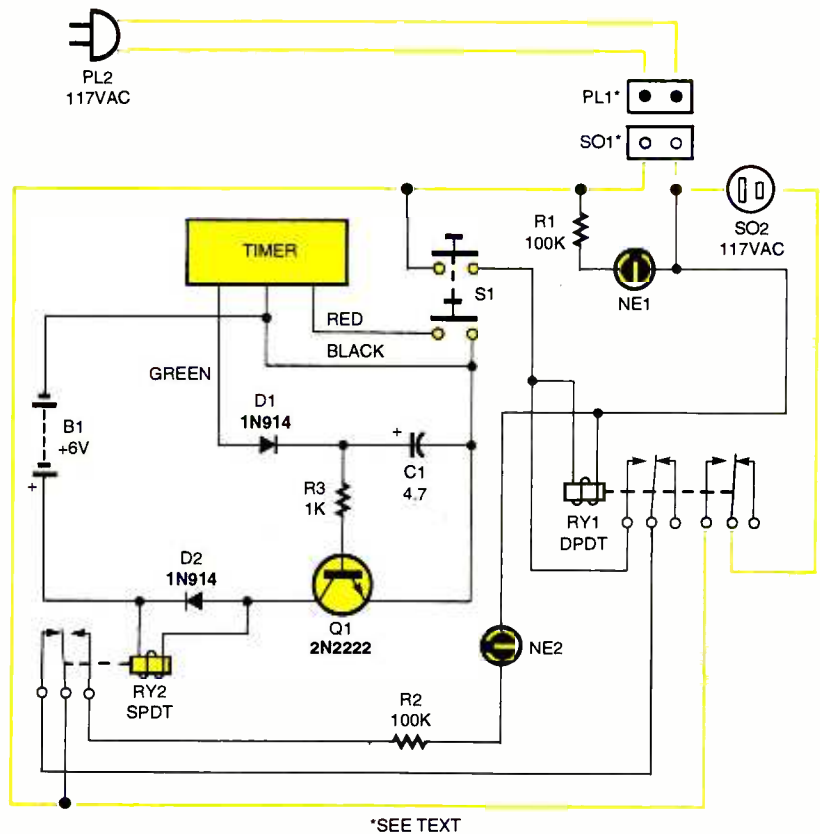


Fig. 1. As this schematic diagram of the Time-Off shows, the circuit is comprised of a timer, a pair of relays (RY1 and RY2), a transistor, two neon lamps (NE1 and NE2), a pair of diodes, and a few additional support components. Note that diode D1 is used to rectify the output of the timer, while diode D2 prevents the inductive spike from damaging transistor Q1.

Diode D2 prevents inductive kick-back (created when the magnetic field of the relay collapses) from damaging transistor Q1. When RY2 operates for the first time, it interrupts RY1's latching circuit, causing it to drop out and remove power from SO2. As RY2 continues to pulse, it flashes neon indicator lamp NE2, providing a visible as well as an audible alarm. The flashing stops by itself after 30 seconds, or it can be ended sooner by pressing any one of the buttons on the timer.

Note that lines shown in bold in Fig. 1 are load lines. When assembling the circuit, those connections should be made with heavy insulated wire, No.16, so that they can handle the current load.

Construction. Remove the battery from the timer and open up the back. The next step must be done very carefully so as not to damage the timer. Place it face down and, starting at the bottom, remove all

but the top two screws holding the circuit board in place. Pressing down on the back of the circuit board, gingerly remove the last two screws. Release the pressure and gently lift off the circuit board without disturbing the readout. There are two little resilient strips holding the readout in place. The upper one contains almost invisible connectors that press against the traces on the circuit board. If it is shifted even slightly, they will no longer make contact with the traces and the timer won't function properly when reassembled.

Turn the board over and locate the traces that lead to the inter-laced pattern that represents the start/stop switch. One side of the switch goes directly to the integrated circuit. Find a place nearby where you can drill a small hole through the board without damaging any traces. Scrape off about a 1/4-inch length of the green protective coating and solder a small red

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wire to the trace. I used a 5 inch length of No. 30 wire wrap wire. Feed the free end of the wire through the hole you drilled and carefully fasten the circuit board back in place. You should check your work at this point by placing the back cover on and installing the battery. There is no need to put the screws back yet, but the cover should be on because it contains a small tab that prevents the battery from shorting out. If the readout is still visible, you are in business.

Remove the cover again and solder a length of black wire to the little spring that contacts the center portion of the piezo sounder. This spring is common to the switch and to the output to the sounder. Solder a green wire to the other spring. Remove the belt clip and magnet from the cover by pushing out the hinge pin. Remove the spring wire that holds the support stand and cut off the plastic protrusions that held the belt clip. Remove the sounder by cutting through the melted over portions of the plastic securing it in place. Save the sounder for another project. Pass the three wires through the hole in the cover where the clip was attached and fasten the cover back in place.

The author's prototype of the Time-Off was housed in a cut down plastic project box (available from RadioShack) that originally measured $2\frac{1}{2} \times 5 \times 1\frac{3}{8}$ inches and sported an aluminum cover. The box can be cut down by repeatedly scoring it with an X-acto knife. Once the scoring is deep enough, the unwanted portion can be snapped off along the scored line. Use a pair of diagonal cutting pliers to cut from the edge to the scored line. Figure 2 shows the dimensions of the author's enclosure modifications. Save the pieces you removed; they will be used later. Smooth out the rough edges of the enclosure with a file. The sloping portion of the enclosure should be slightly shorter than the height of the timer, so that when the timer is fastened in place, it holds down the upper edge of the control panel. The lower edge of the panel is held in place with two of the screws that come with the box.

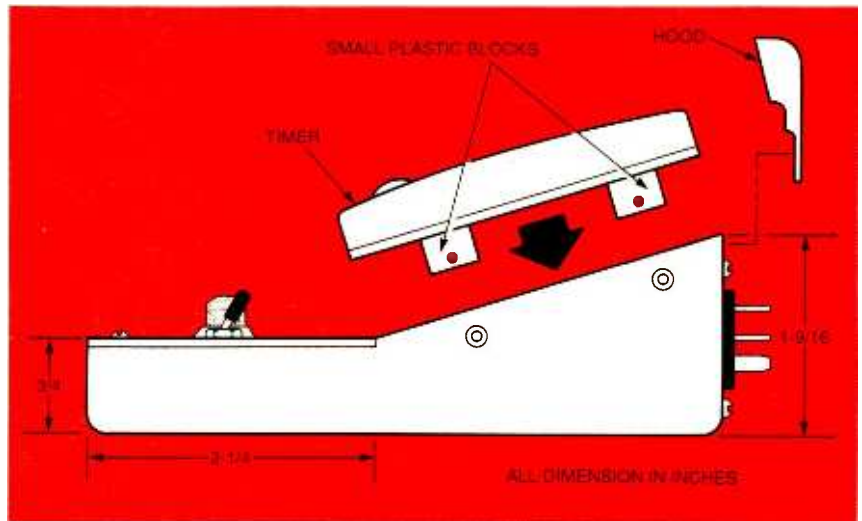


Fig. 2. The author's prototype of the Time-Off is housed in a cut-down, plastic, project box, whose original dimensions were $2\frac{1}{2}$ inches (W) \times 5 inches (L) \times $1\frac{3}{8}$ inches (H). The enclosure was cut to the shape and dimensions shown here, and then filed to smooth the rough edges.

Once the enclosure has been reshaped, cut the lower set of screw posts to the new height of the box, and file the upper posts at an angle to match the slope of the sides of the box. Cut holes for a polarized plug and a polarized receptacle at the rear of the enclosure, and mount them side-by-side in the rear of the box. It is not absolutely essential that these items be polarized, but it is good electrical practice to do all switching of 117-volt AC circuits only on

the hot side of the line. A polarized two wire plug has the wider prong connected to the neutral side of the line, while a polarized receptacle has the wider slot connected to neutral. That is if it is installed correctly.

Many houses have receptacles installed with the neutral and hot leads transposed. You can check yours out by measuring the voltage between each slot and the metal screw securing the outlet cover in place. You should read a voltage when connected to the narrow slot, but none when connected to the wide slot. If you get no reading in either case, but get one between the two slots, you don't have a ground connection. Perhaps your house was wired before a grounding wire was required, and house mains were grounded through the metal sheathing of the BX cable. Often the screws securing the cable corrode over time and make a poor connection. House wiring that fails any of those tests is unsafe and should be repaired.

If you are using a different enclosure and have the room, it would be even better practice to use a grounded three prong plug and receptacle. Follow the wiring scheme laid out in the schematic diagram with regard to connecting the neutral and hot wires—including which side of the line connects

PARTS LIST FOR THE TIME-OFF

- B1—4 AAA cell
- C1—4.7- μ F, 10-WVDC, electrolytic capacitor
- D1, D2—1N914 small-signal, general purpose, silicon diode
- SO1—Polarized male jack (see text)
- SO2—117-volt polarized receptacle
- RY1—120-volt, 10-amp DPDT relay
- RY2—5-volt 1-amp SPDT micro relay
- NE1, NE2—NE-2 neon lamp
- PL1—Polarized female plug (see text)
- PL2—Polarized 117-volt AC line cord with plug
- Q1—2N222A NPN transistor
- R1, R2—100,000-ohm, $\frac{1}{8}$ -watt, 5% resistor
- R3—1000-ohm $\frac{1}{8}$ -watt, 5% resistor
- S1—DPST normally open, momentary contact, pushbutton or toggle switch
- Timer (RadioShack catalog # 63-897 or equivalent), enclosure, perfboard, plastic, pilot jewel, line cord, wire, solder, etc.

to R1 and R2. The reason for that is to assure that if the unit is dropped—breaking one of the neon lamps, there is no chance of a shock. If you are using a three prong plug and receptacle, connect the green (or ground) wire directly from SO1 to SO2. If you are using a metal enclosure, connect the grounding (green) wire to the enclosure as well. Plug PL1 and socket SO1 should be an interlocking matched set. A good source for such a matching set is from a discarded television or a connector from some other appliance. If you use a TV connector that is not polarized, devise some way so that the plug can only be inserted into the socket one way. At worst, identify the correct orientation with matching dabs of paint.

Mount the 120-volt relay next. The author used a 10 amp plug-in relay,

The platform (or lower cover) of the enclosure, on which the switch and indicator light are mounted, is made from 1/8-inch black plastic. The plastic was scoured with steel wool to remove the gloss so that its finish matched that of the enclosure. Do not use the aluminum cover that came with the box. It is much too flimsy, and because it fits *inside* the edge of the box, it would have no support. If you can't locate the plastic, use a piece of rigid aluminum or brass cut to the outside width of the box. Cover both sides of the metal sheet with black Contact paper. You must cover the back to insulate it from any possible contact with the 117 volts.

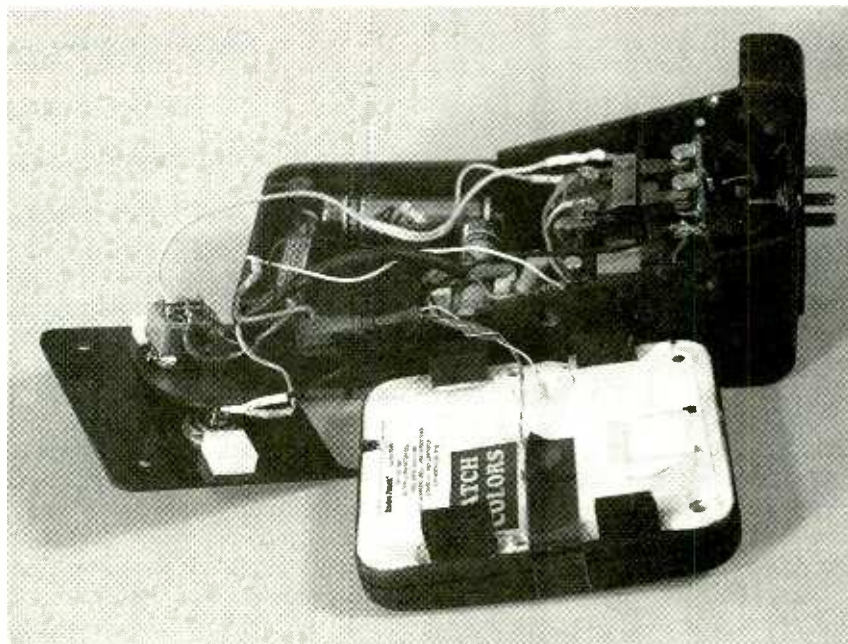
According to the schematic diagram, wire D1, D2, RY2, R3, C1, and Q1 on a small piece of perfboard. The AAA cells can be installed around the perimeter of the box. If

resistor. In the author's version, there wasn't enough depth, so a jewel from another pilot lamp was installed with a piece of plastic (mounted via the switch) used to hold lamp NE2 in place.

The little hood holding NE1 and serving to illuminate the readout can be fabricated from the leftover pieces cut from the box earlier. One of the corner pieces makes a neat curved back for the hood. Use solvent type liquid model cement to assemble the hood and to cement it to the back of the box. Paint the inside white to reflect the maximum amount of light. The resistor goes inside the box and is connected to the hot side of the line. Slip spaghetti over the leads and glue the lamp in place with silicone adhesive. If you are going to use the unit in a darkroom, note that most photographic paper is not very sensitive to the color of ionized neon, but keep the paper out of close proximity to the light anyway. When total darkness is required, as in developing sheet film in a tray, simply pull the plug. Entering the time can be done in the dark because you can hear the relay click each time a seconds or minutes entry is made and you can feel which button is which.

I chose to paint the timer flat black to make it match the rest of the unit and to confine the light from NE1 to the readout and the buttons. Krylon® is the best paint for the job because its solvent seems to bond to the plastic of the timer case. If you choose to paint the case, do it when it is being reassembled during the attaching of the wires described earlier. With the circuit board held in place with the top three screws, you can flex the board enough to remove the plastic and conductive rubber parts of the buttons with a pair of tweezers. Slip a piece of paper behind the board to mask the overspray from the circuit traces and place masking tape over the readout. Do not paint the back as you will have to cement plastic blocks to it as shown. The blocks fit snugly against the sides of the enclosure and are drilled and tapped for 4-40 flat-head screws, which will be used

(Continued on page 79)



Most of the components that comprise the Time-Off (D1, D2, RY2, R3, C1, and Q1) were assembled on a small piece of perfboard, and mounted to the bottom of the enclosure, with room for the four AAA cells that power the circuit, and for the larger relay (RY1).

whose plastic cover had been removed to conserve space. If you plan to use the Time-Off with high wattage appliances—a 1500-watt electric space heater, for example—substitute a relay with a higher contact rating. Use No. 16 wire when indicated (bold lines) in the schematic diagram; that includes the line cord. The rest of the circuit can be wired with ordinary hookup wire.

there is interference with the switch or the indicator assembly, cut away the lower portion of the screw posts so the cells will fit under them. The cells can be soldered into the circuit because they will last a long time as they only supply power when setting the time and during the alarm period. If there is room in the enclosure that you've chosen to house your version, NE2 can be a neon lamp assembly with built-in

RADIO RESOURCES OF THE INFORMATION SUPERHIGHWAY

Bring a cyberworld of radio information to your radio shack with these handy resource listings. This article shows how to find and access amateur radio, shortwave, and scanning information and resources on BBSs, the online services, the Internet, and the World Wide Web.

KARL T. THURBER, JR.

How much "digital stuff" is on the Internet? No one knows for sure. Estimates vary widely, from about 1 to 10 terabytes of information, that is, 1 to 10 trillion bytes—which perhaps is one half of the estimated 20 terabytes in the books of the Library of Congress! A small but significant portion takes the form of radio resources on the "Information Superhighway." You can use local bulletin board systems (BBSs); several features of the Internet, including the World Wide Web; and online communications utility services, to obtain information to make your radio hobby more fun. A good way to keep up with special interest areas of the radio hobby is to go online in one of the many ways that now are available. The information is out there—you just need to know how to find it.

Bulletin Board Systems. Although the Internet is all the rage today, we don't want to overlook BBSs, which lately have taken a definite "back seat." But they still can be sources of information for scanner monitoring buffs, shortwave listeners (SWLs), and amateur radio operators. Many BBSs have programs,

datafiles, and frequency lists to download, as well as compilations of *frequently asked questions* (FAQs), tips on new and used radios, reviews of new radio equipment, and classifieds.

BBSs make good starting points for your online activities and they are dedicated to a single theme or hobby. Unfortunately, many have disappeared. The relatively few that are left mostly have gravitated to the Internet. BBSs are free, but a few of the large national boards charge a fee.

Most BBSs are organized hierarchically; the main menu is the starting point for most functions. Another type of is the "room BBS," which has a "lobby" as an entry point and hallways and areas (rooms) leading from the lobby. You can go from room to room, sending and receiving messages, performing most functions from the room you're in.

Many computer hardware and software vendors have dedicated, "company store" style BBSs to support their products. These let you read questions and answers of other product users, and they also offer libraries of technical notes,

problem solutions, and update files.

Online Services. The Online Communications Utility Services are large computer networks that let you tie into a variety of services and databases. As a subscriber, online utilities let your PC keep in touch with the rest of the world in a fairly structured fashion. This contrasts sharply with the Internet, which often seems unstructured, confusing, and chaotic. The major online communications utility services offer you a variety of features. These include news, weather, and sports; e-mail; shopping; travel; conferences, roundtables, and forums; games; online chat; investment advice; education; information and reference databases; files; and much more.

Popular services include Prodigy, CompuServe, America Online (AOL), Microsoft Network (MSN), Delphi Internet, The WELL, and Genie. Most of the online services began to offer Internet access in 1995, seeking to merge their offerings seamlessly into the Net. Probably the most popular features of the online services are the structured forums that allow you to talk

with others via messages posted in the forums. Company-sponsored forums also allow members to communicate directly with computer manufacturers and software publishers for the latest information and updates.

Today the future of the online services (and conventional BBSs) is cloudy, due to the pervading influence of the Internet and all it offers, though in a much less organized format.

The Internet. The Internet is a worldwide "network of networks" linking hundreds of millions of people and their computers, including several million host computers (ones connected directly to a network) at government agencies, businesses, universities, Internet Service Providers (ISPs), and other organizations worldwide. The computers interact with one another, transparently communicating and sharing services. But the Internet is much more than just a network: by virtue of its highly pervasive nature it's also a mailbox, business tool, library, newspaper, shopping mall, and much, much more. That's one perspective.

The Internet also is a set of protocols, or rules, that govern interactions between connected computers—from the home-based PC to the mainframe, in order to swap information. A person sitting at a PC or terminal equipped with the proper software communicates across the Net by placing data in an Internet Protocol (IP) packet, a sort of electronic envelope, and "addressing" the packet to a particular Internet destination.

Today, anyone with a PC and a modem can benefit from Internet resources. The Net puts a world of information at your fingertips for just the small payment a month you pay to an online service or ISP—there's no charge to use the Net itself (at least not yet)!

Several distinctive features of the Internet are of interest to amateur radio operators, SWLs, scanner monitors, and other radio hobbyists. These include FTP and Gopher sites and capabilities; Usenet newsgroups; mailing lists; Telnet; Internet Relay Chat (IRC); and, of course,

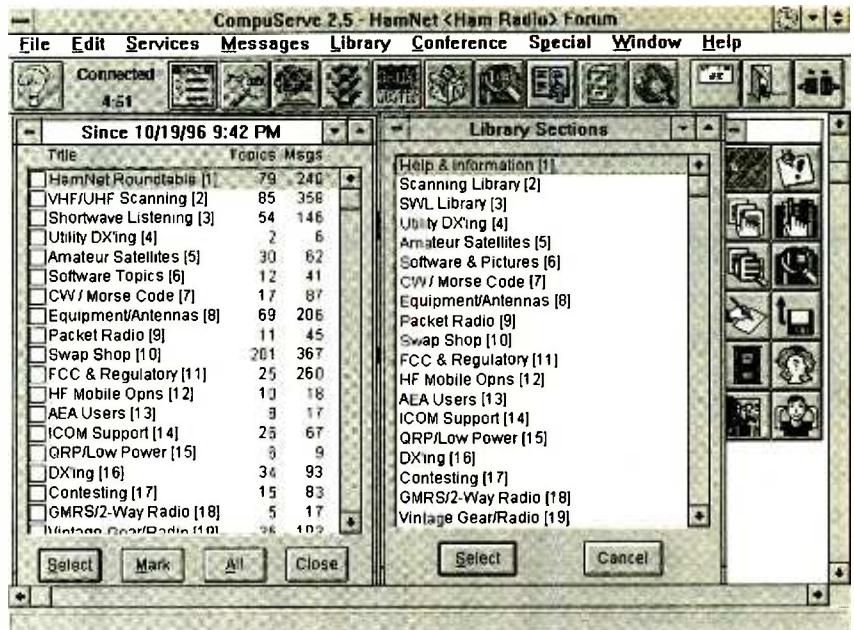


Fig. 1. The CompuServe HamNet Forum is dedicated to amateur radio; however, SWLs and scanner buffs aren't forgotten. The Forum can boost your enjoyment of the hobby by answering questions, providing public domain and shareware software, updating DX and satellite information, and more. You also can access the affiliated HamNet Companion Web page, which has links to many HamNet Forum resources.

the Web. Let's look at them:

FTP: File Transfer Protocol (FTP), around since 1973, is a method of transferring files between computers on the Internet. "Remote host" computers, FTP sites, let you download from on-screen lists of files. So-called "anonymous FTP" sites are especially good; they let you access the remote computer without already having an account with the site operator. It's all a little like logging onto someone else's hard disk and copying files to your own PC.

Gopher: Named for the mascot at the University of Minnesota where it was developed in 1991, Gopher lets you browse thousands of sites by creating a system of easy-to-use menus in "gopher-space." You navigate by selecting the desired item from a series of lists or layered menus. You continue in a series of lists or menus until you arrive at the information you seek. Gophers are great, but Web-based sites are crowding them out.

Usenet Newsgroups: A part of the Internet since 1979, Usenet newsgroups are discussion groups on a specific subject, like forums on online services and BBSs. There are over 20,000 such discussion groups on the Internet devoted to practi-

cally every conceivable subject or topic.

Mailing Lists: The Internet is a "natural" for hooking up people with similar interests. The Internet boasts thousands of electronic mailing lists, or e-mail discussion groups, that are broadcast to all who place themselves on the lists of interest to them. Special software programs (such as *Listserv*, *ListProcessor*, and *Majordomo*) maintain one or more of these automated mailing lists, acting as "list servers." Such programs automatically distribute messages to all members of that list. When you subscribe, your name and e-mail address is added to the list. From that time on, you receive all mail postings; you may simply follow the discussions or actively join in. You can unplug ("unsubscribe") from a list just by sending a message.

Telnet: Developed in 1972, Telnet is one of the oldest Internet protocols. It lets you log onto remote computers, access files, and even execute commands and run applications on the remote host as though you were a local user. While this procedure often requires that you be registered and obtain a username and password, many systems allow limited access to any-

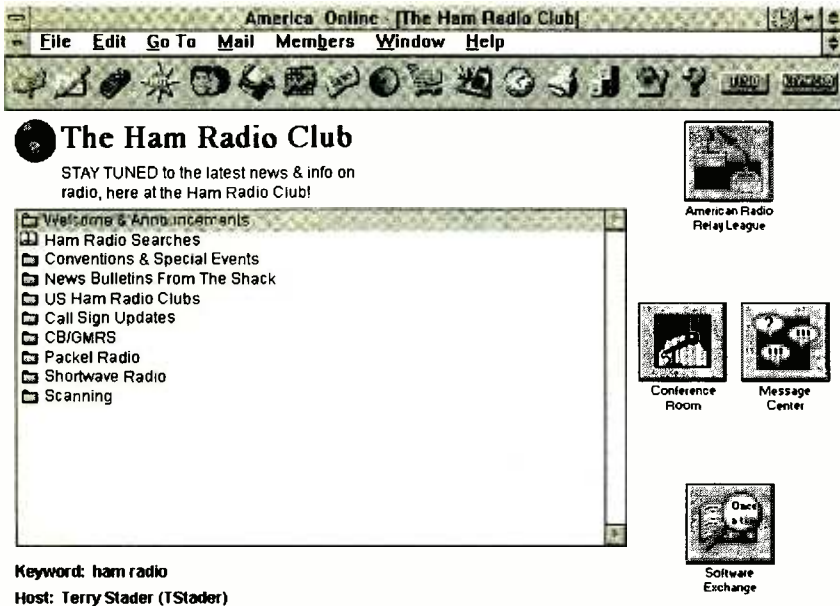


Fig. 2. If you're an AOL member, check out the America Online Ham Radio Club and the ARRL areas on AOL. You also can access the Ham Radio Club area from the AOL Entertainment Channel's Radio Forum area or the Hobby Central area.

one; guest log-ins restrict the actions you can take while logged on. Telnet remains text-based, and when you're hooked up to another computer system, its commands are the commands you must use. Telnet slowly is going out of favor as other access vehicles eclipse it.

The World Wide Web. The World Wide Web seemingly came out of nowhere from its 1992 release to turn the Internet (and the world as a whole) upside down. The Web is helping the formerly drab, text-based Internet deliver the graphics-rich, multimedia features that PCs are capable of producing. The Web offers you a graphic, point-and-click system of links that simplifies and organizes navigating among myriad Internet resources. It's hooked into the rest of the Net in such a way, through a series of "pages," that allows you to treat it as an interactive window on practically the whole Internet. It adds structure to the Net to help you navigate its fragmented resources.

The multimedia services found on the Web are actually realized through a Web browser. What you see with a browser looks like a magazine page. There are bullet-style lists of places and things, icons and images; clicking on highlighted words sends you to another page,

which may be anywhere. You also can use the browser as a sort of one-stop tool to download files using FTP, access Gopher sites, read Usenet newsgroups, send and receive e-mail, do keyword searches, and more.

Amateur Radio Resources. There is a gold mine of radio-related information on the Information Superhighway if you just know where to look for it, so we'll give you some tips and suggestions. While there's no way we can catalog all that's available to you, we'll focus on a number of resources that offer the greatest diversity and the opportunity for you to find still other resources through them.

You can access radio hobby information via the online services. The CompuServe HamNet Forum and HamNet Companion are dedicated to amateur radio and related interests. It helps you find others who share your interests and who can answer questions, provide public domain and shareware software, offer comments about new equipment, update DX information, and more. GO HAMNET on CompuServe to access the Forum (see Fig. 1). HamNet's message area is organized into sections and, within each section, into "threads" of topics. The file libraries contain

software, text information, and other files, also organized by topic. Besides the Forum proper, there also is an affiliated HamNet Web home page at http://www.web.comcom/~sjl/HamNet_Companion. (Note: Website addresses are given in italic type and usually begin with "http:.")

If you're an AOL member, check out the America Online Ham Radio Club (keyword: HAM or HAM RADIO) and American Radio Relay League (ARRL) areas (found in the Ham Radio Club) on AOL. You also can access the area from the AOL Entertainment Channel's Radio Forum area (keyword: RADIO) or the Hobby Central area (keyword: HOBBY). Some features of the AOL Ham Radio Club (see Fig. 2) include listings of amateur radio conventions and special events, news bulletins, radio clubs, callsign updates, online conferences, and ARRL news (see also the ARRL Technical Information Service box). Downloadable software is available, and forums and articles are searchable. The club also covers CB, shortwave radio, and scanning.

If you subscribe to the GENie Radio and Electronics Roundtable service, you can enjoy this online place for shortwave, amateur radio, electronics, commercial broadcasting, antique radio, and ARRL information. A variety of radio- and electronics-related topics are covered, including scanner monitoring, electronic experimentation, audio, CB communications, and more.

There are numerous Amateur-Oriented Internet Web sites and pages you can visit. Here are a few:

TRS Consultants Hot Links: This impressive, has-it-all "first stop" site has excellent links to not only amateur radio sites, but to shortwave and scanning pages, as well as major broadcasters, press agencies, businesses, and software. http://www.pics.com/trs/trs_link.htm.

Amateur Radio Web Page: This is another good "first stop" for your browser. It has numerous "hot links" to go to many other amateur radio and shortwave Web sites, callbook servers, and Usenet newsgroups. <http://www.mcc.ac.uk/Radio>.

Ham Radio Links: You'll find hot

links galore at the "Radio Resources on the World Wide Web" site. It lists callsign servers, organizations, clubs, and other links. <http://www.wb5fnd.tech.uh.edu/links.html>.

Amateur Radio Web Server: Check out the many links on the Amateur Radio Web Server, also known as "World of Internet Amateur Radio". It includes the Amateur Radio NewsLine newspaper, the HF/DX Operator's Page, the Online Repeater Database Project, and more. <http://www.comacs.ncsu.edu/HamRadio>.

FCC Home Page: The FCC Home Page is the number one source of official radio regulatory information for radio hobbyists. Its online site map and searchable nature make it easy to navigate the site. <http://www.fcc.gov>.

Shortwave Resources. There aren't quite as many SWL-oriented Web sites as there are sites catering to radio amateurs, but there are enough to keep you busy, and many of the amateur radio sites we listed have active shortwave sections. Here are a few excellent Web sites featuring shortwave topics:

The Shortwave/Radio Catalog: You'll find this user-friendly, attractive Web page is filled with useful links to go to various shortwave radio, AM and FM broadcasting, and satellite radio sites. <http://itre.ncsu.edu/radio>.

The Internet Guide to International Broadcasters: This SWL-oriented page features a large directory of international broadcasters that have a presence on the Internet. <http://www.informatik.uni-oldenburg.de/thkoch>.

The World Wide Web Shortwave Listening Guide: This is a comprehensive, searchable listing of worldwide shortwave broadcasts in English and other languages. <http://www.anarc.org/naswa/swl-guide>.

SWL/Scanner Clubs List: Here you may be able to find a SWL or scanning-oriented radio club near you: contact points, mailing addresses, and telephone numbers are offered. <http://itre.uncecs.edu/radio/faqs/clubs.faq.html>.

Scanning Resources. There are a number of great Scanning-Oriented Web Sites that are yours for the accessing. A sampling of these sites include:

scanning refrence: *this attractive page offers you a good deal of information about scanning, lists frequencies in several different formats, and discusses hardware and software (see fig. 3). Special emphasis is on the New York City area.* <http://www.panix.com/clay/scanning/index.html>

KC5KTO's Radio Page: Tom Harrell, KC5KTO's Radio Page features information about agencies, scanners and scanner modifica-

tions, and frequency lists. There also are FAQs and links to other sites. <http://www.zianet.com/kc5kto/scanner.html>.

Long Island Area Scanning Resources: This Northeast regional resource boasts a wealth of general and aviation scanning information, including frequencies and radio codes, and many links to other scanning pages and resources. <http://www.li.net/~j4dice/scanli.html>.

Grove Enterprises GroveLink: This multi-featured, searchable Web page is offered by a major scanner dealer. It contains useful scanning and shortwave information in an

COMMERCIAL ONLINE COMMUNICATIONS UTILITY SERVICES

While the Information Superhighway buzzword today is "Internet," commercial online communications utility services let your PC keep in touch with the world in a more structured way than does the Net. Here's a sample of what the major services offer. Keep in mind they're in flux, "cybershifting" to reinvent themselves and adapt and adjust, weaving Internet content and access into their offerings:

America Online. AOL, with about 8 million members, has more subscribers than any other service. It has good messaging and an attractive, consumer-oriented graphical user interface (GUI), which generally requires you to use their proprietary software. There's access to the Internet, and services are added almost daily. On the downside, AOL is struggling to provide its customers with reliable communications. Recent studies report that AOL has the least reliable connection rate for the major access providers. <http://www.aol.com>.

CompuServe. With about two-thirds of AOL's membership, CompuServe offers a variety of services and databases. These make it popular among businessmen, researchers, PC power users, and professionals. There are over 2000 forum areas, and more than 1300 PC hardware and software companies are represented in them. Recent reports show that ComuServe has the best connection rate among the providers. <http://www.compuserve.com>.

Prodigy. Prodigy has had an "up and down" history, with the company changing hands last year. It offers many consumer, entertainment, lifestyle, and hobbies-oriented options that are easy for

computer beginners and students to navigate. <http://www.prodigy.com>.

Microsoft Network. MSN opened in 1994 with the rollout of Microsoft Windows 95. For the moment, to fully access MSN you must use Windows 95 with its proprietary 32-bit access software: soon MSN should be accessible to anyone with an Internet connection as MSN repositions itself as an Internet access provider. MSN offers a number of services, such as forums, chat areas, and files. <http://www.msn.com>.

Delphi Internet. Delphi Internet is a small online service that offers a connection to the Internet plus the functions of an online communications utility. There are over 150 information and communications services; its "Custom Forums" let you create and host forums yourself. <http://www.delphi.com>.

The WELL. The WELL (meaning the "Whole Earth 'Lectronic Link") is essentially a computer conferencing system, with more than 260 BBS-style conferences. Other features are e-mail, real-time conversations, software, and Web self-publishing. Recently, The WELL separated out Internet access, to allow flat-fee conference membership to those who already have Internet access. <http://www.well.com>.

Genie Online and Genie Interactive. Another of the smaller services, Genie Online boasts e-mail, software libraries, games, audio and video teleconferencing, and dozens of special interest forums and bulletin boards, which are known as GENIE RoundTables. <http://www.genie.com>.

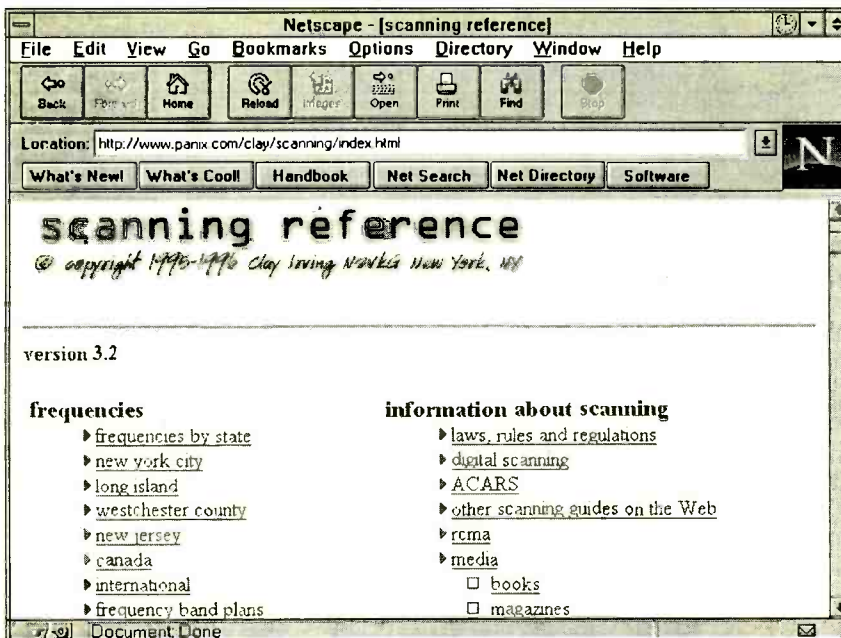


Fig. 3. The Scanning Reference Web Page by Clay Irving, N2VKG, provides a good deal of information about scanner monitoring. It lists VHF and UHF frequencies in several different formats and intelligently discusses hardware and software issues.

online catalog and buyer's guide plus postings from *Monitoring Times* and *Satellite Times* magazines. <http://www.grove.net>.

Finding Radio Resources Yourself. We've told you about lots of "ready-to-go" resources you can use to find radio topics. Another way is to search the Net yourself.

Little of what's online, except the contents of online services like AOL and CompuServe, is organized. This is where a variety of tools come into play, especially on the Web. Here, there are two basic ways for you to find stuff and navigate the Net: (1) with Internet Directories or Indexes; and (2) with Search Engines.

Web directories are like yellow page directories, where you pick a particular category or subcategory, then peruse the entries within the categories to find what you're looking for. When you find it, you click on the hyperlink the directory provides to take you directly to that entry. With a Web search engine or index, you enter the term(s) or keyword(s) you're looking for. The search engine then displays a list of "hits"—the Web pages in its index that contain your search words. Search services all work about the same way, but there are considerable differences in terms of the quantity,

depth, and breadth of their indexes. Here are a few:

RiceInfo: This is a good starting point: a comprehensive, menu-like, hot-linked directory of most of the best Internet navigation tools. It tells you what vehicle to use and where to go to find resources by subject, keyword, location, and type. You can find FAQ lists, newsgroups, mailing lists, and people; its hot links take you directly to the search vehicles. <http://riceinfo.rice.edu/Internet>.

Yahoo! The Yahoo! service, at <http://www.yahoo.com>, is both a directory and a search engine. Its entertainment index is broken down into several radio-relevant categories. Try the amateur listings at http://www.yahoo.com/yahoo/Entertainment/Radio/Amateur_Ham_Radio.

Yahoo also has specialized Usenet newsgroup listings, found at http://www.yahoo.com/Entertainment/Radio/Amateur_Ham_Radio/Usenet.

MetaCrawler and AltaVista: MetaCrawler is a mega-searcher, a "search engine of search engines." It lets you search "in parallel" several other search engines, including the superfast, powerful AltaVista (at <http://www.altavista.digital.com>). MetaCrawler itself is at <http://www.metacrawler.com>.

NAMES AND NUMBERS

America Online

8619 Westwood Center Drive
Vienna, VA 22182-2285
800-827-6364

CompuServe

PO Box 20212
Columbus, OH 43220-0212
800-848-8990 or 800-848-8199

Delphi Internet

1030 Massachusetts Avenue
Cambridge, MA 02138
800-695-4005
Online information: 800-695-4002

GEnie

401 N. Washington Street
Rockville, MD 20849-6403
800-638-9636
Online information: 800-638-8369

ISYS/Odyssey Development, Inc.

The Denver Technological Center
8775 East Orchard Road #811
Englewood, CO 80111
303-689-9998

Microsoft Network (MSN)

One Microsoft Way
Redmond, WA 98052-6399
800-386-5550

Prodigy Services Company

40 Grissom Road
Plymouth, MA 02360
800-776-3449 or 800-213-0992

The WELL

1750 Bridgeway
Sausalito, CA 94965
415-332-9200
Online information: 415-332-6106.

FTP Search: This is a highly flexible search engine. It searches not Web sites but FTP sites instead, to help you find sites that have that software program you're looking for. <http://ftpsearch.ntnu.no/ftpsearch>.

To start with Newsgroups Finders, you can use Yahoo's built-in Usenet listings of amateur radio-related newsgroups, or you can cast a wider net by searching for newsgroups with AltaVista. You also can use one of the popular, such as:

Deja News: Deja News is a Web interface to newsgroups that gives you a way to browse, search, find, and read newsgroups that may interest you. The site has help pages
(Continued on page 80)



Control things in your home automatically by computer with this project.

Modern life is not easy. There's always one more thing to do before the day is done; dump the garbage, feed the cat, pay the bills, water the plants, shut off the lights, and more. But wouldn't it be nice if some things could take care of themselves? Imagine arriving home to find the lights already turned on, heat or AC at a comfortable level, your plants watered, and other small jobs already done. Minor as those tasks may seem, it's still pleasant not to have to worry about them.

Another problem occurs when you leave home for several days. Who will feed the pets or water the plants? A timer will turn on a light at night, but that wouldn't fool thieves. A random display of lights, TV, and other appliances turning on and off would do a much better job of mimicking someone being home. The only problem is that when you're not home, who is going to do those things for you? Surely you don't want to pay someone to sit in your home every night and turn appliances on and off. So what's the alternative?

Home automation is the alternative, and this article presents a simple circuit that lets you set up your own custom home-automation system. Christened the *PC Parallel Port Relay*, the circuit is basically just a bunch of relays (eight of them) that

can switch loads of up to 117-volts AC at 10 amps each. The relays and their control circuitry are attached to a single-sided printed-circuit board that contains screw terminals for accessing the relay contacts. All the board needs to operate is a 12-volt DC power supply and a spare PC to control it. Who's got a spare PC? Lots of people do these days—all the circuit needs is a lowly PC or XT. Of course, any PC rated higher will also work, and many people even have old 386s or old DOS-operated laptops collecting dust. The PC Parallel Port Relay will bring those old PCs out of retirement, and place them into a new line of work.

The PC Parallel Port Relay is available in kit form from Marlin P. Jones & Associates for \$59.95. That price includes the board and all parts required, plus control software for both DOS and Windows. That's why it's especially neat if you have a spare computer lying around that can run Windows. It doesn't matter how fast it can run Windows, just as long as it can run it. The Windows software is a lot easier to use, and it's a bit more flexible as well.

The computer controls the relay board via the printer's parallel port. You can have your computer perform double duty as a work computer and as a controller for the relay board, but it's just easier if you can dedicate an old computer to

drive the relay board. All the computer has to do is to output a hex byte at the parallel port every so often, which isn't very hard work for any computer.

You can build the relay board from the kit just mentioned. Then all you'll have to provide is a 12-volt DC power source to operate the relay board. Of course, you'll also have to provide the components that connect your appliances to the relays—an AC input and output (more on that later). The same software included with the kit will also be found at the ftp site:

<ftp.gernsback.com/pub/PE>
in case you decide to build your unit from scratch.

Circuitry. A possible system block diagram is shown in Fig. 1. A high signal from the PC's parallel port turns on a transistor that energizes a relay, causing the relay contacts to switch. In the diagram, two sets of relay contacts control 117-volt AC to power a lamp and a fan. Another set of contacts close the thermostat's circuit, thus providing heat for the building. Each relay operates independent of the other relays.

The relay board contains eight identical channels, each containing a relay whose contacts are rated at 10 amperes (see Fig. 2). The eight channels are controlled by pins 2-9 (D0-D7) of the input

Centronics connector (J11). A Centronics connector is used so that the relay board can be connected to a computer with a standard printer cable.

The PC running the control software outputs a hex byte to pins D0-D7 that turns on one or more relays. Any pin that goes high turns on a transistor, which, in turn, energizes its associated relay. For example, let's say the computer outputs the byte "0000 0001." That signal places a low (0) on all of J11 lines except one (D0 at pin 2). That high is then applied to the base of transistor Q1, turning it on. When Q1 turns on, the ground path for relay RY1 is completed. At that point, RY1 energizes, closing its normally-open contacts, and thereby turning on the device connected to the first channel. Likewise, when the computer outputs "0000 0010," RY2 turns on; "0001 0000" turns on RY5, and "1000 0000" turns on RY8. Basically, whichever line is a "1," or high, will activate that channel. More than one channel can be turned on at the same time as well. For example, the byte "0001 0001" turns on relays 1 and 5, while "1111 1111" turns on all of them (RY1-RY8). Any combination is workable.

Whenever a particular output (let's say D0) is activated, its associated LED lights to give a visual indication that the channel is active. When the D0 line returns to a low state, the relay reverts back to its normal state and the circuit to LED1 is opened. All the other channels are identical and operate in the same fashion.

Construction. The relay circuit is very easy to build, especially if you go with a PC board; one is included in the kit referred to in the Parts List or you can make one from the full-size foil pattern shown in Fig. 3. The circuit is simple enough so that you can use point-to-point wire to assemble the circuit if you so desire. A parts-placement diagram is shown in Fig. 4. Install all the resistors first, followed by the diodes, LEDs, transistors, and finally the jacks and relays. Check the polarization of the relays, diodes, and transistors before soldering them in place. The relays (RY1-RY8) used in the project

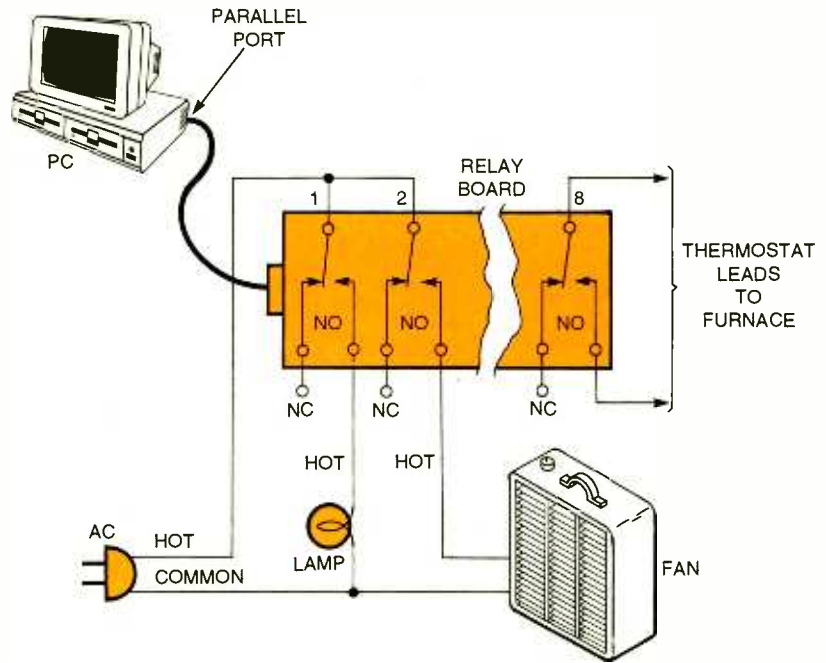


Fig. 1. This functional block diagram illustrates the basic operation of the PC Parallel Port Relay. The PC sends a trigger signal to the appropriate relay, closing the relay's contacts, which, in turn, energizes the device connected to them.

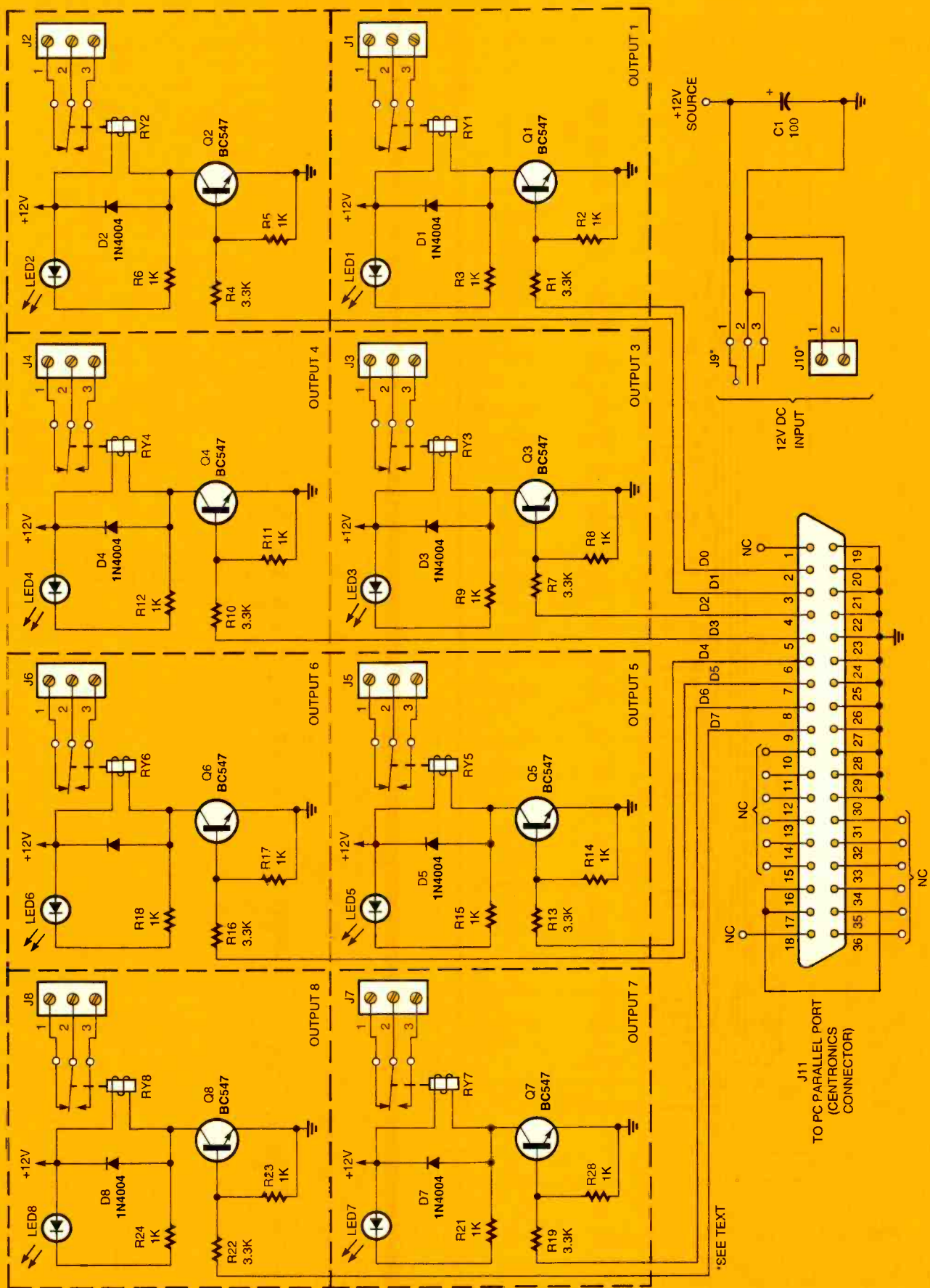
(which also come as part of the kit) are SPDT 12-volt DC coil units with 10-amp, 120-volt AC contacts; they can be replaced by either Omron part # G5LE-114P-PS-DC12, Digi-Key part # Z777-ND, or their equivalents. If you substitute relays other than the ones included with the kit, you might have to modify the PC board slightly by drilling the holes larger or by wiring the relays off-board. Be very careful when soldering, especially when soldering the pins of the Centronics connector (J11).

The kit for the project originally came with a 4700-ohm resistor for R1 (likewise for resistors R4, R7, R10, R13, R16, R19 and R22 in the other channels). When it came time to test the board connected to a parallel port, the port could not turn the relays (actually the transistors) on and off. It turned out that the resistance was too high, at least for the PC port I was using. A better value for those resistors is 3300 ohms. The kit should include the lower valued resistors by the time you read this article. However, if you come across a kit that contains 4700-ohm units, try them first. If the relays won't switch when connected to your computer, replace them with 3300-ohm units instead.

Actually, most values between 2200 ohms and 4700 ohms should work. Basically, you want to use the highest resistance that will let the circuit work while keeping transistor current as low as possible.

Recall that the relays require a 12-volt DC source to operate. That source must be provided by the builder. Actually, the relay power source's voltage is not too critical—anything between 9 and 15 volts should do. In the author's unit, an AC-to-DC adapter that was specified as outputting 9-volts DC was used. The actual output voltage of the adapter (as measured by the author) was well over 12 volts DC with no load. And relay coils certainly do not present an apprecia-

Fig. 2. As shown by this schematic diagram of the PC Parallel Port Relay, the project is little more than a series of redundant relay circuits that interface to your computer's parallel port through a Centronics connector, J11. The circuit allows any one or combination (including all) of its eight outputs to be activated at a time. To activate a particular relay (or device), the computer sends a high to the base of its associated transistor through J11. When the transistor turns on, the relay's ground path is completed, energizing that relay, and thereby closing its normally-open contacts.



*SEE TEXT

ble load, so the power supply turned out to be perfect for this application. Note that the relay

coils draw roughly 30 milliamperes apiece, so the DC supply must be capable of delivering at least eight

times that, plus a little something extra for the LEDs. A 500-milliampere, 12-volt supply should be more than adequate. No power switches are required, as the PC Parallel Port relay must remain powered at all times when it is in use.

A wiring diagram of the prototype unit is shown in Fig. 5. Note that only four AC outlets are connected to the board, even though the circuit is designed to accommodate up to eight. Using only four AC sockets makes assembly easier and leaves four channels to be used as switches for things that don't require AC power. For example, turning a furnace on according to a daily schedule rather than according to temperature.

Another consideration is the fact that only one line cord supplies power to all four outlets. With each relay capable of handling up to 10 amps, the total load could be 40

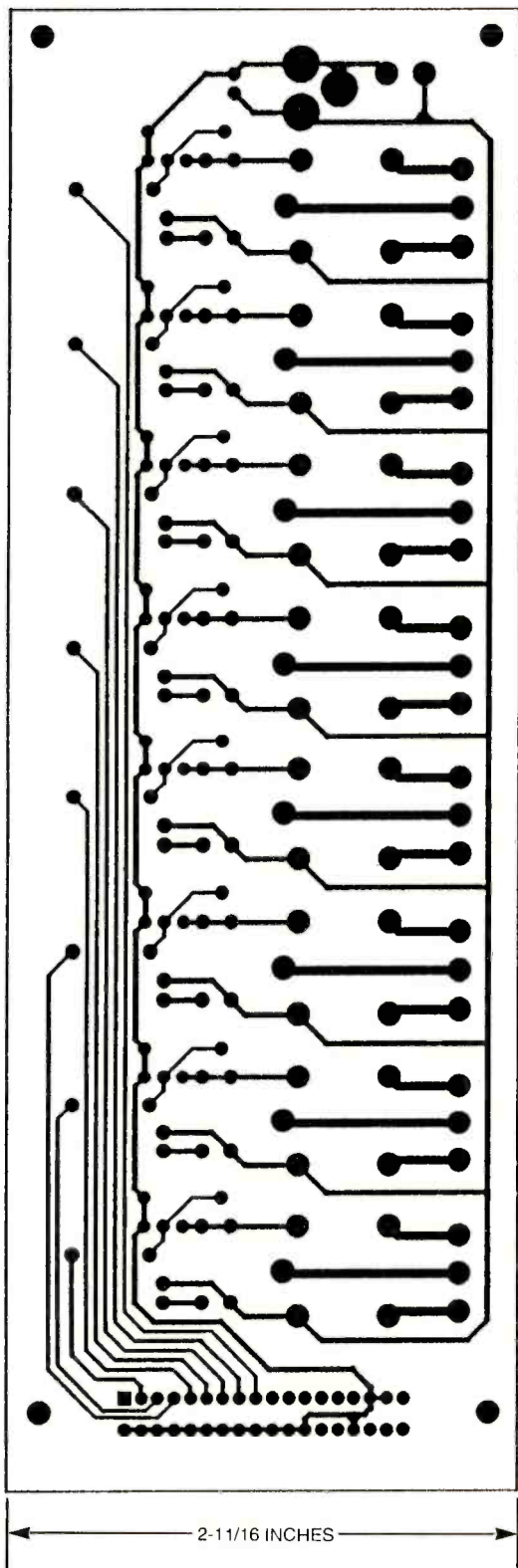


Fig. 3. The PC Parallel Port Relay was assembled on a printed-circuit board measuring $2\text{-}\frac{11}{16} \times 7\text{-}\frac{3}{4}$ inches. The template for that printed-circuit pattern is shown here full size. The circuit is simple enough so that you can use point-to-point wire to assemble the circuit if you so desire.

PARTS LIST FOR THE PC PARALLEL PORT RELAY

SEMICONDUCTORS

D1-D8—1N4004 1-amp, 300-PIV, silicon rectifier diode

LED1-LED8—Red light-emitting diode

Q1-Q8—BC547, NTE123A, or equivalent NPN silicon transistor

RESISTORS

(All resistors are $\frac{1}{4}$ -watt, 5% units unless otherwise noted.)

R1, R4, R7, R10, R13, R16, R19, R22—1000 ohm

R2, R3, R5, R6, R8, R9, R11, R12, R14, R15, R17, R18, R20, R21—3300 ohm (see text)

ADDITIONAL PARTS AND MATERIALS

C1—100- μ F, 25-WVDC, electrolytic capacitor

J10—Two-position screw-terminal block

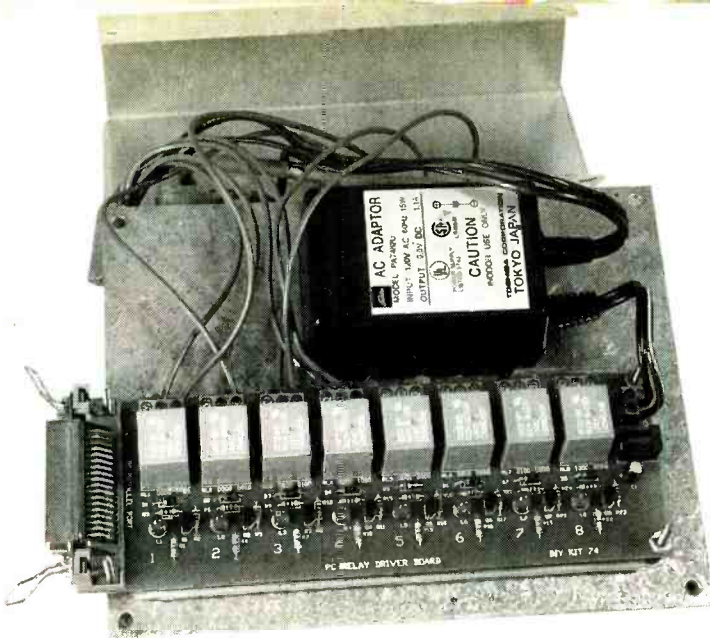
J11—Right-angle PC-mount Centronics connector

J1-J8—3-position screw-terminal block

J9—2.5mm DC power jack

RY1-RY8—SPDT relay, with 12-volt DC coil, 120-VAC 10-amp contacts (see text)

Note: A kit of parts for the PC Parallel Port Relay (#6074-KT) is available for \$59.95, plus \$5.00 shipping and handling, from Marlin P. Jones & Associates, Inc., PO Box 12685, Lake Park, FL 33403; Tel. 407-844-8764.



Once assembled, the PC Parallel Relay's printed-circuit board fits neatly into its wood/metal enclosure, along with its 12-volt DC power source (an AC-to-DC adapter). The enclosure requires cutouts for the four AC sockets and the Centronics connector, as well as eight little holes for the LED indicators.

amps. That's too much current to draw through one normal-duty line cord, so it's important that the circuit not be used to power four heavy loads at once.

If you intend to turn appliances on and off, use a separate line cord for each—and don't plug them all into the same wall outlet either. (Most household circuit breakers or fuses are rated for a maximum of 15 amps; exceeding that rating will trip or blow the protective component.) One possible configuration would be to get eight heavy-duty extension cords, expose and cut the hot lead mid-length in each cord, and connect the ends to the

relays. Then plug one end of each cord into a wall outlet and an appliance in the other end.

Software. Software for both DOS and Windows is provided to control the relay board. The software is included on diskette in the kit and it's also found at the ftp site. Figure 6 shows the control panel for the Windows program. The program can be set up to run two different timing programs at the same time (the Program A and Program B buttons on the right). File options let you open existing programs or save new ones containing the current timer values as whatever filename

you like. The Port option opens a window that lets the user select the port address that the relay board is connected to (usually LPT1). Help text is available in case you can't figure out what to do, which is highly unlikely.

The panel has eight rows of controls, one for each relay on the board. We will describe the first row; the other seven are exactly the same. There are two modes of operation—Manual and Timed. Clicking on the Manual check box for the relay will disable the timer operation for that relay and have no effect on the other seven. Clicking on the Status button will then toggle the relay on or off. Clicking again on the Manual check box returns the channel to Timer mode.

Programs A and B are independent of each other and programmed separately. To set up a program, you click on the Program A or Program B button, and then fill in the start, duration, and day-of-week information. You must use a 24-hour format, with no colon, for both start and duration time. For example, 1:15 PM would be filled in as 1315. Hours must be from 00 to 23 and minutes must be from 00 to 59. There must also be at least one day of the week specified. Once everything is set, you press the End program button to store the values. After the timer programs are set up, you click on the Run button to start the timer. When any relay's start

(Continued on page 80)

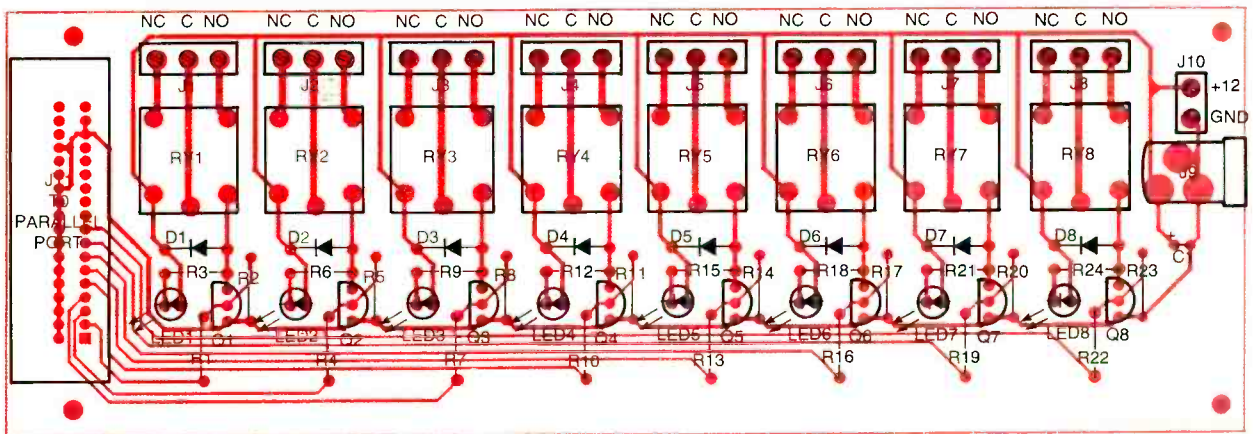


Fig. 4. Assemble the printed circuit board for the project guided by this parts-placement diagram. When assembling the circuit, start with the resistors, followed by the diodes, LEDs, transistors, and finally the jacks and relays. Be sure to check the polarization of the relays, diodes, and transistors before soldering them in place.

THE ELECTRONIC

GARAGE DOOR OPENER



With this circuit, you can transfer your home's "emergency key" from under the front doormat to the safety of your locked garage. A simple four-digit code prevents you from locking yourself out, or allows friends and relatives to enter when you can't be there.

Americans are hooked on remote controls. Remotes, or clickers as they've come to be known, allow you to control a number of household gadgets without ever leaving the comfort of your favorite chair or having to move from wherever you happen to be. Remotes can be great time- and effort-savers—that is, of course, provided that you happen to be near the remote in the first place. That's not always the case.

The remote control for my automatic garage door opener always seems to be where I am not. For example, after a bike ride, it's necessary to get into the garage to put the bike away, but the garage door is generally closed and the remote control is locked inside the car. At that point I have two choices; I can either unlock my car to get at the remote, or I can open the front door to the house, go through the house to the garage, and then open the garage from the inside. Both methods are a real pain.

The *Electronic Garage Door Opener* described in this article was designed to overcome that hassle by eliminating your dependence on both keys and remote controls. In addition to freeing you

JAMES E. TARCHINSKI, N8PTG

from the burden of remembering where you left your keys or remote control, the Electronic Garage Door Opener can be interfaced with your existing garage door opener. That allows you to enjoy the convenience offered by this project without large out-of-pocket expenses. Connecting the Electronic Garage Door Opener to your existing garage door system, allows you to control access to your garage by simply entering a secret code on an electronic keypad.

Now that's convenience—no keys to be carried, and no remotes to be found. All you have to do is remember a four digit code that you select and change at will. There can also be other benefits to installing the Electronic Garage Door Opener. For example, you could give the code to a friend or relative over the phone, allowing them to enter your house without a key. That could come in handy when you're out of town and wondering if you left the iron on, or when you know you'll be late getting home and you don't want visiting relatives left standing around

in inclement weather waiting for you.

Long-term security of your home won't be compromised even if you decide to give out the access code. The Electronic Garage Door Opener can be re-programmed with a new access code with just a few short keystrokes. Reprogramming completely overwrites the old code, so that anyone having knowledge of the old code is again locked out of your castle.

The Hardware. The Electronic Garage Door Opener is both simple and complex at the same time. On the one hand, the project can be viewed as simple because the circuit contains very few components. On the other hand, it can also be considered complex because the entire design centers around a single integrated circuit—a 68HC705K1S microcomputer. The idea of dealing with a microcomputer might be a little intimidating, particularly if you've never used one before. Fear not! It's not as bad as you may have been lead to believe.

Those of you who've never built a project containing a single-chip microcompute have two options.

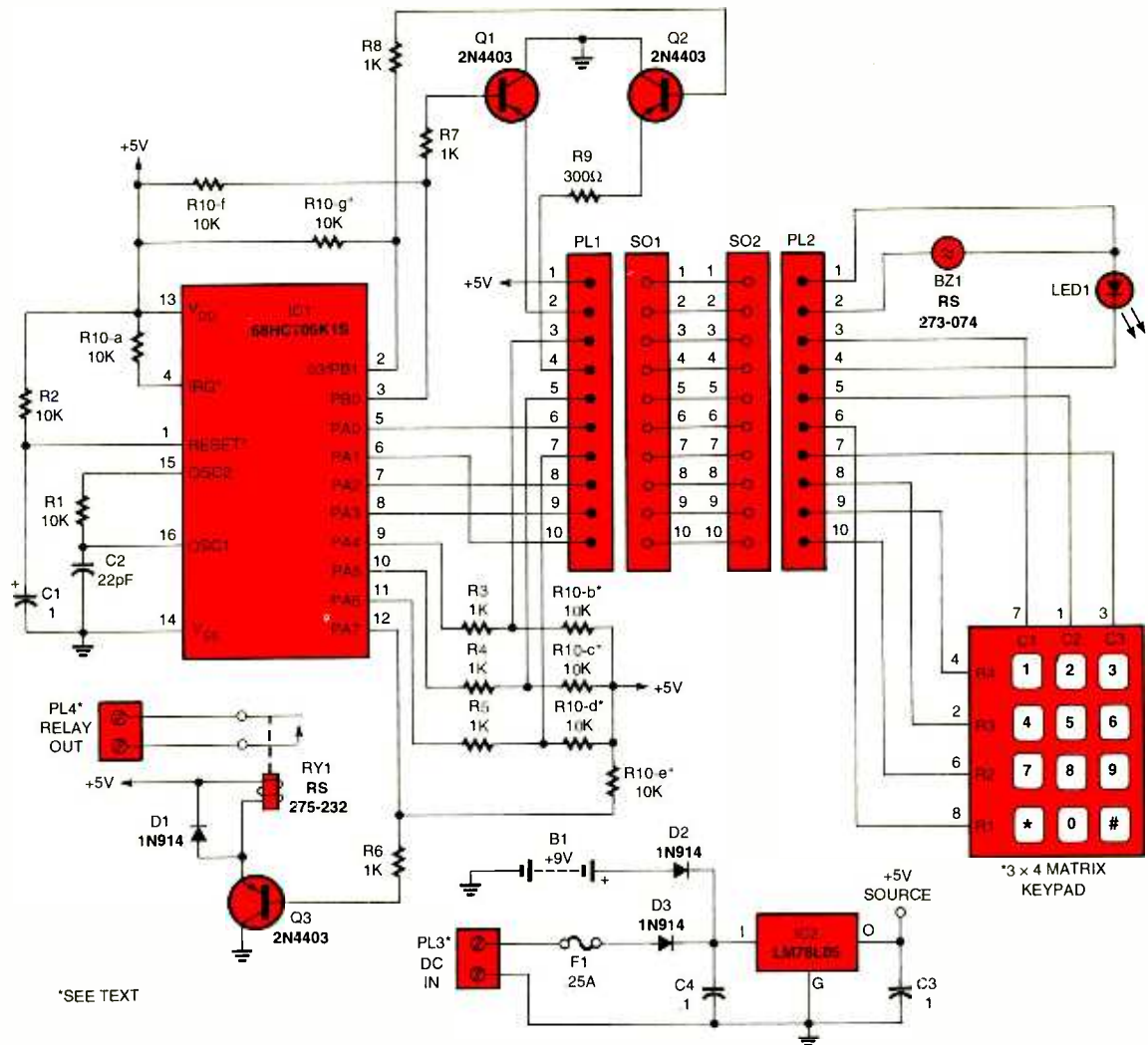


Fig. 1. At the heart of the Electronic Garage Door Opener is IC1—a 68HC705K1S single chip microcomputer—which, when programmed with a special instruction set, acts as an electronic “guard dog,” preventing unauthorized persons from entering your property. When a valid access code is entered via the circuit’s matrix-type keypad, the microcomputer (IC1) triggers a relay (RY1) through a transistor (Q3) that, in turn, causes the electronic garage door to open. The main power for the circuit is supplied by a DC adapter, which feeds 9 volts DC through PL3 to a positive 5-volt regulator (IC2). The regulator, coupled with C3 and C4, provides a relatively ripple-free voltage to IC1. The circuit also has a battery backup (B1), which is used to maintain the microcomputer’s memory during power outages.

First, you could use this project as a catalyst to help you learn something new. The Electronic Garage Door Opener is the perfect get-your-feet-wet project for those wishing to learn what it takes to put a microcomputer to work. If you’re not ready to take the plunge (making the leap into the world of microcomputers), you can still build and enjoy the Electronic Garage Door Opener. For those who are not yet ready to take the leap, a pre-programmed microcomputer can be purchased from the source

given in the Parts List. A schematic diagram of the Electronic Garage Door opener is shown in Fig. 1. In addition to the microcomputer, the circuit contains a matrix-type keypad (through which the microcomputer is programmed and the access code is entered). Only matrix style keypads are supported by the Electronic Garage Door Opener. As shown in Fig. 2, a matrix keypad is configured so that every row and column has a unique electrical connection associated with it. When a button is

pressed, one of the row lines is shorted to one of the column lines, generating a unique output that is fed to the microcomputer. Finding that type of keypad is not a problem, as it is the one of the most common types manufactured. The keypad that was selected for the prototype is a membrane type device that’s manufactured by AMP. That type of unit was selected because the switches are completely sealed, hence they are ideal for this type of application. Other types of switches are not

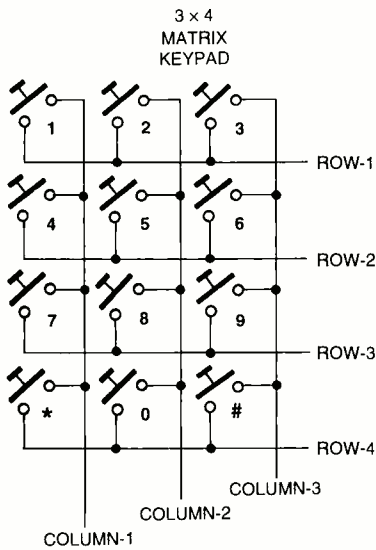


Fig. 2. The Electronic Garage Door Opener is designed to be used with a matrix style keypad—a configuration that connects a row with a column to produce a unique electrical connection (data). The data generated by the connection is internally decoded by the microcomputer, and is used to control access to the secured property.

designed to survive for extended periods outside, where they are constantly exposed to sun, wind, rain, and snow. If you decide to use another type of keypad, be sure that the switch assembly is installed so that it is protected from the elements as much as possible.

A buzzer, BZ1, is also included in the circuit to give audible feedback concerning the current status of the circuit. The buzzer sounds to indicate that a key has been pressed and also to signal that a correct code has been entered. Also included in the circuit is a light-emitting diode (LED1), which lights to indicate that the unit is waiting for a new code character to be entered. Both the LED and the buzzer are driven by 2N4403 transistors because of their (relatively) high current requirements.

When a key is pressed, the signal produced is transferred to IC1, which, determined by the programmed software, either accepts or rejects the entry. If all four digits of the access code are correctly entered, pin 12 of IC1 goes low, turning on Q3. Turning Q3 on provides a ground path for relay RY1, causing

its normally-open contacts to close, completing the automatic garage door circuit, and causing the door to open. On the other hand, if an incorrect code is entered, the microcomputer denies access by holding its pin-12 output high. That reverse bias is applied to the base of Q3, keeping it turned off so that RY1 remains de-energized. So, of course, the garage door does not open.

Power for the circuit is provided by a 9-volt DC power adapter, whose output is fed through PL3 (a two-conductor screw connector) and D3 (a 1N914 general-purpose silicon diode) to the input of IC2 (an LM78L05 5-volt, 100-mA regulator). The regulator, in conjunction with two filter capacitors, C3 and C4, provides a very constant voltage to the circuit, which is needed for microcomputer-based designs.

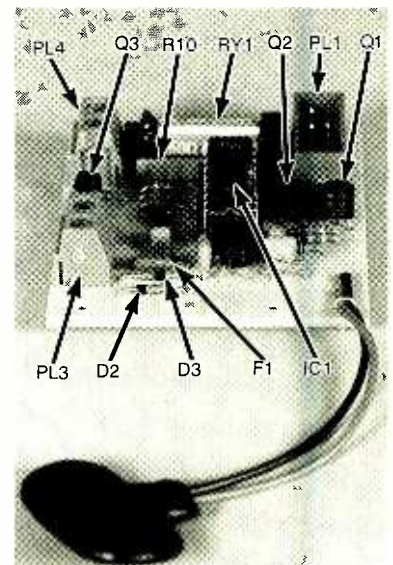
A 9-volt battery (B1), placed in parallel with the power adapter, serves as a backup power source in case of a power failure. That approach ensures that the user's secret code will be retained in the 68HC705K1S's internal RAM during a power outage. Because the Electronic Garage Door Opener draws only about 30 mA, the battery alone could provide memory-retention power to the circuit for a long-duration. A software feature was also designed into the program to handle a loss of power condition—that feature will be explained soon.

The Software. The software that is needed to drive the Electronic Garage Door Opener must be programmed into the memory of IC1 before the chip can be used in the circuit. If you have the know-how and equipment to program the 68HC705K1S microcomputer, a file containing the S-record software can be downloaded from either the ftp site: ftp.gernsback.com/pub/PE—as file "EGDP1.ZIP" or you can order a copy of the program on disk directly from the author (see the Parts List for details). In either case, please check the README.TXT file within the zipped file—it will contain any last minute information about the software for the project. If you do not have the

equipment or the know-how to program the 68HC705K1S, a pre-programmed chip is also available (see Parts List for complete ordering information).

Building and Testing. The Electronic Garage Door Opener was assembled on two separate circuit boards: the main microcomputer board and the I/O (input/output) board. The microcomputer board contains the parts needed for the user interface. That division of the circuit resulted from a problem that was encountered with an early prototype. The first incarnation of the project was assembled on a single circuit board. The keypad was plugged into a pair of sockets on the top side of the board. That arrangement completely covered the rest of the components, which was the intent of the design. That produced a very compact unit.

Unfortunately, that arrangement did not provide sufficient security when it was installed. Since the cir-



The software-controlled 68HC705K1S microcomputer, along with the relay, three transistors, a few diodes and assorted support components (which includes a 7- \times 10k SIP resistor network) are mounted to a small printed circuit board. The microcontroller board is connected to the I/O portion of the circuit through a length of 10-conductor ribbon cable, plugged into PL1 on this board and PL2 on the I/O board.

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cuit was mounted on the side of the garage, all a would-be thief would have to do is pry off the keypad, exposing the two wires connected to the circuit's relay. Then the relay could be triggered, opening the garage door, by simply shorting the two exposed wires. The two-board design eliminates the possibility of defeating the system by that method.

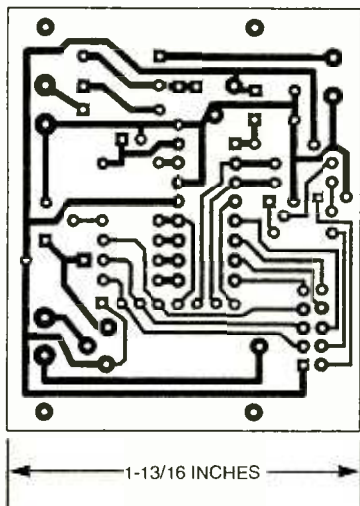


Fig. 3. The author built the Electronic Garage Door Opener on two separate boards—with the microcomputer and control circuitry on one board, and the I/O and indicator circuitry on the other—to prevent the enterprising thief from bypassing the security mechanism. A full-size printed-circuit template for the author's layout is shown here. Note: No printed-circuit pattern is provided for the I/O portion of the circuit; the layout of the board will depend on the size and configuration of the keypad selected for your unit.

In the current rendition, only the I/O board—which doesn't contain any wires or components that could be used to open the door—is mounted on the outside of the garage. The microcomputer board is mounted on the inside of the garage, keeping the two switch wires very well protected.

The microcomputer portion of the unit was assembled on a printed-circuit board, measuring $1\text{-}\frac{13}{16}$ by $2\text{-}\frac{3}{16}$ inches. A full-size template of the author's layout is shown in Fig. 3. That pattern can be copied or lifted from the page, and used to etch your own printed-circuit board. The I/O board was also assembled on a printed-circuit

board; however, no printed-circuit layout is provided, since its design depends on the style of the membrane switch selected by the builder. Therefore, you'll need to design and build a special I/O board for whatever keypad you end up using.

If you don't relish the thought of designing your own I/O board, one possible alternative would be to wire the three components (keypad, LED1, and BZ1) of the board in "space," or mount them on a piece of perfboard. The determining factor in the decision, as to whether to design a special board for the I/O components or to wire the components in "space," is how the project will eventually be mounted near your garage door. With a PC board as a backplane, it is relatively easy to mount the keypad on the wooden frame of a garage door. Without the printed-circuit board another mounting method will have to be devised. (However, with only three components on the I/O board, either method will work well.)

In any event, once you etched your board(s) and gathered all of the parts listed in the Parts List, construction can begin. A parts-placement diagram for the author's microcomputer-board layout is shown in Fig. 4. It is recommended a socket be provided for the integrated circuit (IC1), but do not install the chip until told to do so. Note that only PL1, PL3, and PL4 appear on the microcomputer board's parts-placement diagram. PL1 is a male, PC-mounted 10-conductor connector, while PL3 and PL4 are 2-conductor, PC mounted screw terminals.

Install the polarized parts (transistors, diodes, electrolytic capacitors, etc.), taking care to make sure that they are properly oriented, followed by the other support components. Note: R10 is a 7- by 10k SIP bus resistor network (which is available from Mouser Electronics, as well as other sources), F1 is a PC-mounted subminiature 0.25-amp pico fuse (available from Mouser Electronics), and RY1 is a PC-mounted reed unit (available from RadioShack). Don't forget to attach a 9-volt battery connector

PARTS LIST FOR THE ELECTRONIC GARAGE DOOR OPENER

SEMICONDUCTORS

- IC1—68HC705K1S microcomputer, integrated circuit
- IC2—LM78L05 positive 5-volt, 100-mA, voltage regulator, integrated circuit
- Q1—Q3—2N4403 small-signal, general-purpose, PNP silicon transistor
- D1—D3—1N914 small-signal, general-purpose silicon diode
- LED1—Light-emitting diode

RESISTORS

- (All fixed resistors are $\frac{1}{4}$ watt, 5% units unless otherwise noted.)
- R1, R2—10,000-ohm
- R3—R8—1000-ohm
- R9—300-ohm
- R10—10,000-ohm SIP resistor network (see text)

CAPACITORS

- C1—1- μ F, 35-WVDC, miniature tantalum
- C2—22-pF, ceramic disc
- C3, C4—0.1- μ F, ceramic disc

ADDITIONAL PARTS AND MATERIALS

- B1—9-volt transistor radio battery
- BZ1—9-volt piezoelectric buzzer
- F1—0.25-A PC-mounted subminiature pico fuse
- PL1, PL2—Male, PC-mounted, 10-pin connector
- PL3, PL4—PC-mounted, 2-position, screw-type terminal block
- RY1—Reed relay (RadioShack No. 275-232 or equivalent)
- SO1, SO2—Female 10-pin connector (see text)
- Printed-circuit materials, matrix-type membrane keypad, 9-volt battery connector, DIP socket, enclosure, stand-offs, ribbon cable, solder, hardware, etc.

Note: The following items are available from Aurora Software, PO Box 080133, Rochester, MI 48309-0133: a pre-programmed microcomputer (IC1) for \$12.00; a 1.44MB disk containing the S-record software for \$5.00. Please add \$2.00 S/H for all orders. Sorry, no Michigan orders can be accepted.

where indicated in Fig. 4. Once all of the components have been installed, check your work for the usual construction errors—misoriented polarized components

Once the microcomputer board is completed and you are satisfied

that there are no construction errors, but before the 68HC705 is installed, apply power to the circuit by connecting the 9-volt battery to the unit. Test for voltage on pins 1, 4, and 13 of the microcomputer socket, and at pin 1 of connector PL1—all of those points should read +5 volts DC.

If all is well, remove battery voltage and attach the I/O board (or its equivalent) to the microcomputer board via its ribbon cable. You'll need to make the cable long enough to reach from the outside of your garage, where the I/O board will be located, to the inside where the main board will be placed. Try to minimize the distance between the two boards to reduce the risk of running into electrical noise or line-loss problems.

With the two boards connected, again apply battery power to the circuit. Use a small piece of wire as a test jumper between pin 14 (ground) and pin 2 of the socket for U1. If everything is wired correctly, shorting those two pins should cause transistor Q2 to turn on, in turn causing LED1 to light. Similarly, applying ground to pin 3 of the socket should sound the buzzer, while applying ground to pin 12 should close the relay RY1.

As a final test before installing IC1, disconnect the battery and then apply power to the circuit via the "off board power adapter." You should again read a constant five volts on pins 1, 4, and 13 of the IC1's DIP socket, and at pin 1 of the connector PL1. Chances are everything is wired correctly if this is the case.

Power down the circuit and install the pre-programmed microcomputer, and again apply power. You now need to fully test the circuit by running the Electronic Garage Door Opener through its paces. So what exactly is "its paces?" Good question. Let's answer it by looking at how the Electronic Garage Door Opener is intended to be used once it is installed on your garage.

Mounting. In the author's installation, a router was used to counter-sink into the 2-by-4 stud of the garage frame. The I/O board was easily mounted in this recessed area. A wooden "bezel" with cutouts

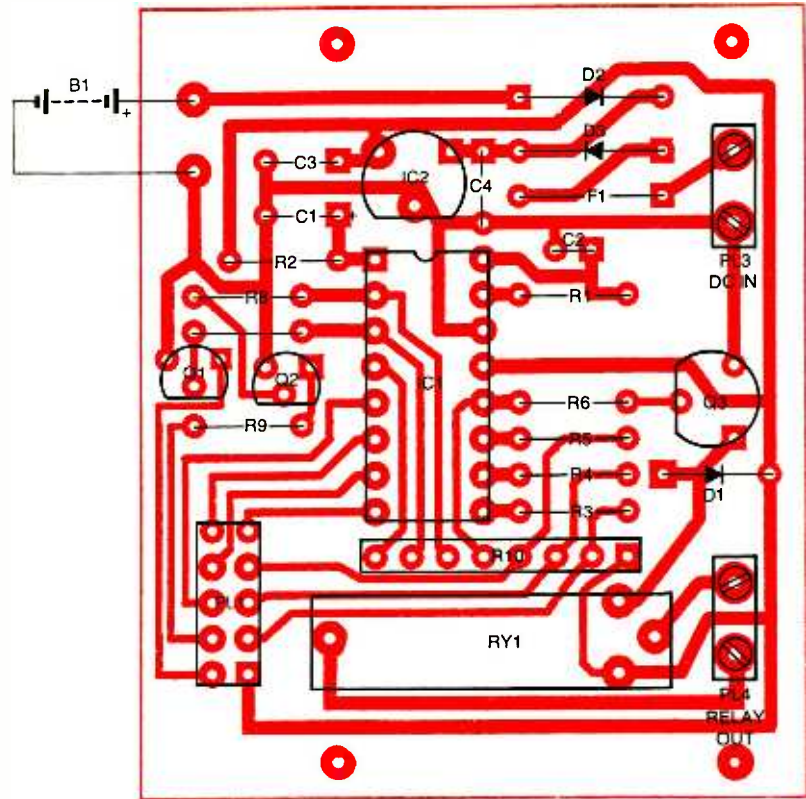


Fig. 4. Assemble the microcomputer board, using this parts placement diagram as a guide. When installing the polarized parts (diodes, electrolytic capacitors, etc.), take care to make sure that they are properly oriented. Note: R10 is a 7- by 10k SIP bus resistor network, F1 is a PC-mounted subminiature 0.25-amp pico fuse, and RY1 is a PC-mounted reed relay.

for the keypad and LED, and holes for the buzzer sound to escape, was placed over the I/O board. To protect the assembly from the elements, the outside of the bezel was caulked, and a hinged cover plate was placed over the entire area.

The Electronic Garage Door Opener is connected to your garage door opener via two wires tied in parallel to the garage door's open/close switch. The other side of these lines is connected to the common and normally open contacts of a small relay. Whenever the correct code number is entered on the keypad, the 68705 briefly turns on Q3, sending current to the relay, and shorting these two lines together. This has the same effect as pressing the garage door's existing open/close switch: the door will open if it is closed, or close if it is open. Because a relay is used, the Electronic Garage Door Opener and your garage door opener are completely isolated from one another electrically, so there is no possibility of unwanted interactions.

In addition to the switch wires, power and ground lines need to be connected to the microcomputer board. If you do not have a 120 volt outlet adjacent to where you plan on mounting the microcomputer board, you might consider running a 4-conductor cable to your garage door opener. Those two lines could then be used for switch lines. The other two could be connected to your 9-volt power adapter, which would then be plugged into the same outlet as the garage door opener.

Use. Once power is applied to the circuit, you have 30 seconds to enter its default four digit code: 2-6-8-4. With each key press, you should hear a short beep emanating from the buzzer of the I/O board. Once you've entered all four digits, press the "*" key.

Both the asterisk ("*") and pound ("#") keys act somewhat like a "return" key for this project, although they both have distinct special meanings. The asterisk key is

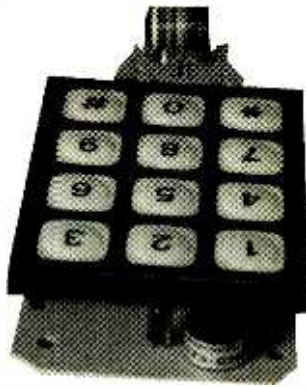
used to tell the unit that you want to change its four digit code, while the pound key indicates that you want to actually toggle the state of the garage door. Those two keys are only effective if you've previously correctly entered the full code.

If you have not entered the correct code prior to pressing either of the "return" keys, the microcomputer will assume you are trying to guess the correct code. Therefore, as a security measure, it will only allow three sequential incorrect attempts—after that, it locks out the keyboard for 15 minutes. Provided you've entered the correct code, pressing the asterisk key should cause the LED to light, indicating that the Electronic Garage Door Opener is waiting for you to enter a new code.

Any series of four or more numerical keys may now be pressed. Once the pound key is pressed, the system will record the last four digits entered as being the new code. If, after pressing a series of numbers, you decide you don't want to change the code after all, pressing the asterisk key will clear the microcomputer's buffer and cause the system to revert back to the last code it had learned. In other words, when the LED is lit, the pound key acts like a return key, while the asterisk key acts like the escape key of a computer.

If you want to toggle the state of the garage door (that is, open it if it is closed or close it if it is open), the sequence is nearly the same as for entering a new code number. Start by pressing the digits of the current code number, and then press the pound key. The system will respond with a longer buzzer sound and simultaneously close the contacts of the RY1 relay. Under control of the 68HC705, the relay contacts stay closed for about half a second, and then open up. That is sufficient time for your automatic garage door opener to recognize that its "push button" has been pressed, and hence it will activate the door appropriately.

More Security. The threat of a power outage caused two major design changes from earlier versions of the circuit. The more obvi-



The keypad (a membrane type device that's manufactured by AMP), the buzzer (BZ1), and the light-emitting diode (LED1) are all mounted on the I/O board. Both the LED and the buzzer are driven by 2N4403 transistors, which are mounted to the microcomputer board. This I/O board is interfaced to the microcomputer board using a 10-conductor cable that connects to PL1 on the microcomputer board and PL2 on this board.

ous, has to do with the retention of the microcomputer's memory. For example, let's say two home-owners each install the system. After a power outage, either would be able to unlock the others' garage, since upon the reapplication of power the circuit defaults to a single code. To avoid that potential security risk, the software was written to allow only 30 seconds from the time power is applied to the time the correct default code number is entered. After that period the keypad is disabled (via software) until the power is again removed and then reapplied. To defeat that algorithm, a potential burglar would have to know the default code, be at your house just as a power outage was ending, and then enter the code to gain access to your garage. I don't think so.

The algorithm worked extremely well on my garage door until spring Michigan weather caused several power outages in the span of only a week or so. The system continued to work as designed, but I got tired of reprogramming new code numbers. That's when I decided to add the memory-keep-alive battery. Still, it is good to know that the system is safe even if the backup battery happens to die on the job.

One final note on security. Because you never know when you'll need to give out the lock's

combination, I'd suggest you never use the default code of 2-6-8-4. This code should only be used for initialization; after that it should be changed to something only you and your family know.

Burglar Math. In closing, let me go over a little "burglar math." When I'd completed this project a friend of mine asked why the code number is only four digits long. After all, he correctly observed, by adding another digit the correct code would be make ten times harder to guess. I promptly explained my algorithm for locking the keypad after three incorrect access attempts. He slowly nodded and then persisted, "but still, ten times safer is safer."

So look at the numbers. A four digit code has 10,000 possible solutions (because 0-0-0-0 is a valid code, even if it is a poor one). Therefore, in order to have a 50% chance of guessing the correct code, a potential burglar would have to make 5000 attempts. Because the system locks up after only three incorrect access attempts, the thief would have to wait 15 minutes about 1666 times (5000 divided by the allowed three incorrect attempts). Fifteen minutes multiplied by 1666 works out to 25,000 minutes or 416.6 hours, or over 17 days straight! A "smart" crook would break a window long before he'd start guessing at code numbers.

Most garages only have a thousand dollars or less worth of items in them worth stealing in the first place. So for all those "dumb" crooks out there, if you spend over two weeks straight attempting to break into a garage, the chance are you'll be making less than minimum wage for you efforts. And, if you are caught in the process, you'll obviously wind up making even less.

With a little ingenuity you can find other uses for this circuit. Add a low-current solenoid and you can use it as an electronic lock for any door in your house. Or, it can be connected as the front-end of a complex home alarm system to activate the alarm when you leave or to disarm it when you return. ■

ANTIQUE Radio

Digging Into the NR-5

MARC ELLIS

In the July 1997 **Popular Electronics** issue, we introduced the *Freed-Eisemann Model NR-5*—a classic “three-dialer” battery set with Neutrodyne circuitry. The Neutrodyne circuit was an important breakthrough by L.A. Hazeltine, a professor of electrical engineering at Stevens Institute of Technology. It was an elegant method for controlling self-oscillation, then a

serious problem in RF amplifiers (caused, in part, by the high internal capacitance of early triode tubes). By coupling some of the RF amplifier’s output back to the input through a small capacitor, the Neutrodyne had the effect of neutralizing the internal capacitance, suppressing the tendency to self-oscillate. Hazeltine’s innovative circuit made it possible to build a good tube radio without infringing on the closely held Armstrong regenerative patents.

exterior of the set pictured in that article looks virtually identical to my own NR-5. However, the *QST* set has a different mounting arrangement for the neutralizing capacitors and, in contrast to the mostly concealed and insulated wiring of my set, contains a forest of exposed and bare bus-bar hookups. The layout of the components is otherwise very similar.



The NR-5 prior to its removal from the cabinet. In spite of its very plain design, I think that this is one of the most elegant-looking three-dialers ever made.

serious problem in RF amplifiers (caused, in part, by the high internal capacitance of early triode tubes). By coupling some of the RF amplifier’s output back to the input through a small capacitor, the Neutrodyne had the effect of neutralizing the internal capacitance, suppressing the tendency to self-oscillate. Hazeltine’s innovative circuit made it possible to build a good tube radio without infringing on the closely held Armstrong regenerative patents.

One of the first firms to make use of the new technology was Freed-Eisemann, which up to that point had been manufacturing simple crystal sets. As a matter of fact, an early production (or, perhaps, pre-production) Freed-Eisemann NR-5 was used to illustrate *QST Magazine’s* April, 1923, reprint of Professor Hazeltine’s paper on the Neutrodyne as presented before the Radio Club of America (March 2, 1923). The

I could not imagine doing any kind of in-depth coverage on three-dialers without involving an NR-5, but up until recently I hadn’t been able to acquire one. It’s not that they’re that rare or expensive; it’s more like I can be rather penurious at times and hadn’t felt like shelling out the cash on the occasions when I did come across a decent example. The NR-5 now in my hands was abandoned by the “successful” bidder (who disappeared without paying for it) at a radio club auction. Apparently he’d had a change of heart after getting a good look at it. That made it possible for me to acquire it on very advantageous terms. It does have a few problems (you get what you pay for), but none that will interfere with my using the set as an example of a classic three-dialer.

A First Look At Our NR-5

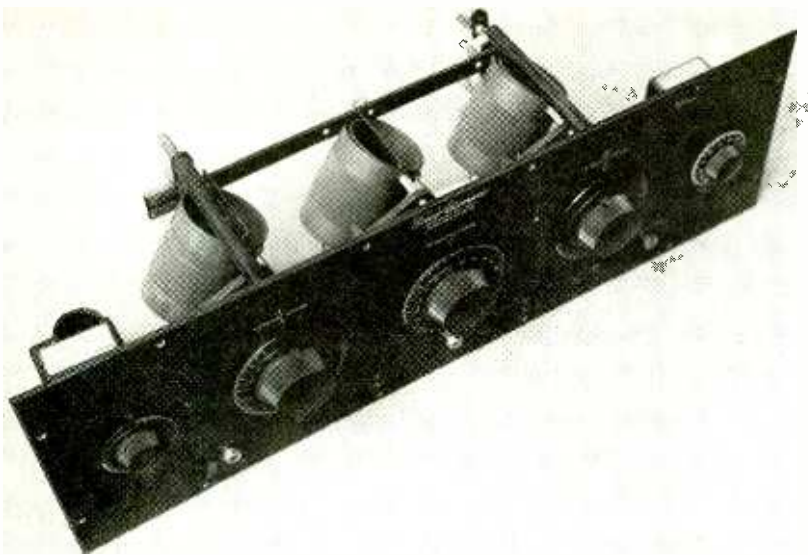
One of the most striking features of the Freed-Eisemann radios of this peri-

od are their mirror-finished and beautifully engraved Bakelite front panels. The company logo, spelled out in cursive script, is, I think, one of the most elegant ever put on a radio. I should have taken a close-up of it for this article, but did not think of it in time. Watch for it in a future installment!

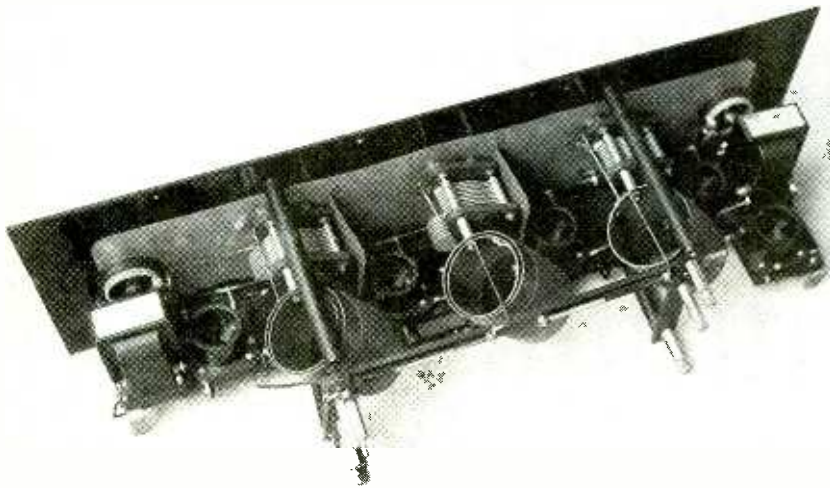
The finish of the panel on this example does show a smudge pattern around each of the control knobs. Obviously, this is a set that had a fair amount of use. Whether the grime can be removed or has permanently etched the finish is yet to be determined. Perhaps more discouraging is the fact that one corner of the panel is cracked, probably from a fall, and there’s even a spot (luckily, a small one) where the thin outer finish has de-laminated and fallen off—exposing the rough core material. I’ll be looking for a way to fill in and polish the panel at that location.

The filament control rheostats, which are located at opposite ends of the panel, are labeled “AMPLIFIER TUBES” (left) and “DETECTOR TUNER” (right). The three large tuning knobs are labeled (left to right) “ANTENNA TUNING,” “1ST NEUTRO-STAGE”, and “2ND NEUTROSTAGE”. The three phone jacks, located along the bottom of the panel, are labeled (from left) “2ND AUDIO,” “1ST AUDIO,” and “DETECTOR.” You’ll find a basic discussion of the NR-5’s circuitry in the July, 1997 column.

The cabinet is very plain, but nicely finished and outfitted. I’m not a wood expert, but I will hazard an opinion that it is made of solid walnut. The usual lift-up lid pivots on three nickel-plated hinges and has an attractive nickel-plated prop to hold it up. When closed, it is held shut by a pair of spring-loaded detents that pop into metal-lined sockets. A finger well set into each side of the cabinet makes it possible to get under the lid to push it up and release it from the detents. The lid on this NR-5 is slightly warped, so it doesn’t close quite flush with the cabinet. Apparently, there also has been some shrinkage because it doesn’t fit tightly enough for



With the cabinet out of the way, you can see the 60-degree positioning of the RF coils (see text), the top two strut-support dowels, and the horizontal strut supporting the neutralizing capacitors.



The rear view of the set highlights its odd layout. The detector stage and first audio transformer are at the left end of the chassis; the audio stages, including the second audio transformer, are at the right end.

the detents to engage. I'm not much of a cabinet-maker, so I'm not sure how that problem can be solved. Luckily, the defects are not that unsightly or obvious. Lifting the lid and inspecting its bottom surface, one can see a pattern of holes where the large cardboard hook-up diagram was once tacked in place. It was probably removed (alas) to finish off someone else's NR-5.

The NR-5 is built so that the binding posts for antenna, ground, and power protrude through the back of the cabinet, a very nice arrangement that keeps the connecting wires out of sight. The binding-post knobs (one of which has disappeared—probably to complete the same NR-5 that was the

recipient of the hookup diagram) are nicely finished in nickel and generously proportioned for easy gripping.

Behind The Front Panel

To remove the set from its cabinet, one has to back out no less than 12 wood screws set around the periphery of the panel. That accomplished, the set can be slid out for inspection and repair. Among the most obvious features of the set are the three large tuning coils, each set at an angle of about 60 degrees from vertical. That geometry was worked out by Professor Hazeltine as a method of minimizing unwanted coupling between the coils.

The neutralizing capacitors, as well

as the binding posts mentioned above, are mounted on a framework of struts made of Bakelite or other composition material. The framework is supported by four horizontal rods, made of similar material, fastened to the top and bottom of the front panel. One of the struts is broken off just below its attachment point to a rod (which is also damaged). It looks like the result of yet another fall. Some way will have to be worked out to get all this back together. That might be harder than it seems, because Bakelite and similar plastics do not take glue or epoxy very well.

Another somewhat sour note was struck by the two audio transformers. They are Rauland brand units of about the right vintage, but they didn't look original. A closer look confirmed that. Although carefully installed, it was quite obvious that the neat pattern of the bus-bar wiring had to be disturbed to accommodate them. Disconnecting one wire from each of the primaries and secondaries, I did a continuity check to make sure that the replacement units had not also blown. They were okay and, through resistance measurements, I was able to confirm that their turns ratio was 1:4. I don't know what the specifications of the original Freed-Eisemann units were, but 1:4 seems about right for this application.

I also checked the wiring of the replacement transformers against the Rider's schematic for the set. It was correct, except that the primary leads were reversed in both cases. It was obvious that this was done because the locations of the "P" and "B+" binding posts of the replacement transformers were reversed with respect to the originals and it would have been quite a problem to transpose the bus-bar wiring to accommodate the difference. I really don't see that the reversed installation would have made any difference in the functioning of the radio.

While I had my ohmmeter out, I removed and checked the 2-megohm grid leak (a typical clip-in type) located under the set's Bakelite chassis. I was a little surprised to see that it bore an original Freed-Eisemann part number. I can only assume that its hidden position under the chassis kept it from being swapped out. In my experience, the grid-leak resistor was one of the most frequently experimented-with and changed components in the early bat-

(Continued on page 79)

HAM Radio

It's Science Fair Time (A Little Aside for the Start of School)

JOSEPH J. CARR, K4IPV

Every year most school systems hold a round of science fairs in which students compete against each other for prizes. They progress from the local school level to an area fair, a regional or a state fair, up to the international fair. If you see the kinds of projects that make it to the International level or to events like the Westinghouse science talent search, you will be quite impressed. At each level there is a sorting out process in which some of the students are selected to go forward. I usually judge three to six fairs in my area (including one area level fair) depending on my available time. It's really rewarding to see kids who work in a disciplined manner to ferret out some bit of truth about nature. While few of them will ever earn a Nobel prize or even take up science and technology as a career, there is a distinct learning process going on. Students who negotiate the rigors of even high school science learn to think critically and to organize facts and data. That not only sets them up for careers in later life but also for citizenship in a free country.

Participating in a Science Fair

Science fairs are not only personally rewarding, but they can also steer youngsters into electronics in general and amateur radio in particular. Perhaps your local ham radio club ought to sponsor a special prize, a scholarship, or even just a certificate for the best project of the fair related to your interests. It would certainly get some publicity for the hobby. It would especially be useful if the prize is restricted to students who do something related to radio, or who are amateur radio operators, or something else that is relevant.

Most science fairs have a time (usually in the afternoon) for special judging by professional societies and other interested groups. This is the time for the radio club or other group to offer the prize. Also, if you are a member of any other technical organization, then you might want to suggest they be a spon-

sor (my local chapter of the American Society for Quality Control sponsors a prize in our locale). The local fair coordinator can get you the information (contact the head of the Science Department in a local high school for details or a contact person). If you are a high school student, have a high school student in your household, or know and mentor ("Elmer?") a student, then you might want to give this article to your science fair coordinator.

Winning a Science Fair

Science fairs are about science, so scientific method counts for a great deal. A project that does not follow the scientific method is not science, so it will not progress very far. The basis for scientific method is the *hypothesis*. A hypothesis is a falsifiable statement of what you are looking for. The term "falsifiable" means that it is capable of being proven false. Indeed, it is often easier to falsify a null hypothesis (that is, the statement that something cannot occur) than it is to falsify the hypothesis itself. As an example, suppose the hypothesis is that "...all Irish males have red hair." No matter how many red-haired Irishmen you present it is still not possible to claim that "all" have red hair. But if you hypothesize that "...Irish males cannot have red hair," then all you have got to do is call my friend Sean and point to his glowing red mane to disprove the null hypothesis.

Another example is from my book *The Art of Science*—but **please, please, please do not** try this experiment at home. Suppose the hypothesis is: "Kerosene in an open dish cannot be ignited by tossing a lighted match into it." You can toss a thousand matches into it and see them doused without knowing for sure that the hypothesis is correct. But, if you rephrase the question to, "Kerosene in an open dish can be ignited by a lighted match....," a different situation is found. If a single match lights off the kerosene, then the original hypothesis ("cannot") is falsified.

A Dozen Rules for Science Fair Success

Here is a list of rules that I recommend should be followed when preparing for a science fair or any serious technical presentation:

1. The hypothesis should be written out before the experiment is designed and conducted. It's all too easy to "see" significance in data after the fact, so it's bad practice to do an experiment and then see if there is anything significant in it. Indeed, some would say "impossible."

2. When planning the experiment, decide in advance what data constitutes sufficient proof of the hypothesis and/or null hypothesis.

3. If data collection involves some ambiguity, make a prior decision on how to count each datum. For example, if the relevant data are temperatures, and you classify "above 100 degrees" and "below 100 degrees," then specify beforehand where readings of exactly 100 degrees will go. Some people will place all of the exact readings in one class or another, while others alternate back and forth (namely, the first 100 degree reading goes in one class, the next in the opposite class). Still others randomly assign the data point to one class or the other.

4. Do enough trials of the experiment to ensure that the results are significant. Doing three or four trials is probably not sufficient. Perhaps 20 or 30 is better. No one expects high school students to have the resources and time to do some more complex experiments with a number of repetitions that statisticians would like or that professional scientists would use—but "only a few" is clearly suspect.

5. It is also critical to do your own work. While that should go without saying, there are always those who have someone else do their work and submit it as their own idea! Of course, sometimes judges make errors. I recall one youngster, whom I knew personally, who built an electronic project too

well. Some judges claimed that he had to have had his mother or father do it for him, because the quality of construction was too good. But I knew the kid had done a lot of projects other than the science fair project, so I intervened and convinced them that his parents did not do it. Neither parent has either hobby or professional electronic backgrounds, and neither was a ham operator. The kid's project might as well have been in Greek for all the parents knew about it.

6. Another good trick is to keep a complete notebook on the project. Professional scientific or engineering notebooks are available, but are too costly for most high school projects. A simple bound composition notebook is sufficient. The standard in science is to use a bound notebook so that other people can tell if pages, perhaps embarrassing pages, were removed. One of those speckled black and white "composition notebooks" are just fine at the high school level.

7. Make all entries in the notebook in ink. Do not attempt to erase erroneous entries. Cross them out, in ink, note the date of the correction and place your initials by the correction. Close to the same spot, write in the correct data, if available.

8. Make good use of statistics. If you don't know anything about statistics, then get an introductory book. I can immodestly recommend my own book, *The Art of Science*. It has a lot of very good information for the budding scientist, and is well within the intellectual reach of even average high school students.

9. Also learn what "significant figures" means. If you measure a potential of 1-volt and a current of 3-amperes with the usual measuring instruments, the answer $R = E/I = 1/3$ -ohms, is not "0.33333333" (or however many digits your calculator can carry), but "0.33" or "0.333" at most; in some cases it might even be "0.3-ohms." Not only are the judges unimpressed with such seeming precision as "0.33333333," but will be sufficiently unimpressed as to count off significant points for such sloppiness.

10. The display that you prepare should be as professionally done as possible. If you have the resources, use your computer graphics and word processor programs. Mount everything on styrofoam-backed poster paper (or

Suggested Reading

The Art of Science

by Joseph J. Carr

ISBN: 1-878707-05-1

Publisher: Hightext Publications

Bookmaster

P.O. Box 388

Ashland, OH 44805

Tel: 800-247-6553

Price: \$19.95 plus \$4 (shipping/handling)

even use one of those three panel "science fair" displays made from foam-backed poster paper). If you don't have the resources, then handwrite, or print, everything as neatly as humanly possible. Judges are generally not impressed enough with the display to award a higher place for bad science, or reduce the place for good science, but, in borderline cases, the display can make the difference. And if you are good enough to go to the regional or state science fair, appearance becomes a lot more significant. At that level, all of the competition is good.

11. Above all, know your subject and be prepared to answer some questions. If you don't know the answer, then don't try to scam the judge—it won't work. "I don't know" is an acceptable answer if it is the truth, especially when followed by "...but I intend to find out." *"The essence of good science is the confession of ignorance, coupled with the integrity to admit it out loud, and the energy to go find the answer."*

12. Have fun, and, above all, don't take yourself too seriously. After all, it is a learning exercise, not a contact sport like football or armed combat.

An Afterword

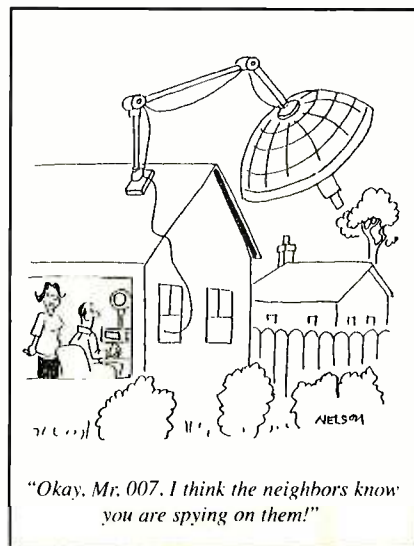
Winning one of the higher awards in a science fair takes a lot of work, but can be done by anyone who wishes to try it. Several years ago the coordinator of one junior high school science fair called me with a special request. A student wanted to enter a project in the eighth grade fair, but one of the two science teachers called him a "moron" and wanted to discourage him. The other science teacher wasn't so close-minded. She requested that the coordinator have the "electronics judge" make an appointment with the parents and go see the project, and then report back.

What the student had done was build a computer arithmetic logic unit

capable of adding together two two-bit numbers and then displaying the result in binary form on a series of light emitting diodes (on for 1, off for 0). I asked him where he'd gotten the idea, and he showed me a book from RadioShack. At first I thought that he had just copied the project, which for an eighth grader was still an accomplishment (especially a "moron!"). But then I counted the transistors and there were not enough on the perf-board. The reason, according to the youngster, was that his allowance didn't allow him to buy more than a few transistors, so he redesigned the circuit to make it work with only two-thirds as many transistors! He won the right at the junior high level to go to the area fair, and then won a second place in the area fair.

I've never quite forgiven that first science teacher for calling that kid a "moron," when his only problem was what computer people would call an "I/O" problem. He had difficulty communicating, but he was no moron. Lesson: Don't ever count anyone "out" before the end.

In an era when the news one hears about teens is mostly negative, it is refreshing to see the good ones—in the majority. The participants of science fairs, especially in grades 6 through 10, are not always the brightest in the school, but they are among the more energetic...and are a pleasure to watch. They are the kind of kids we should be recruiting for ham radio (hint). That's it for this month! I can be reached by snail mail at P.O. Box 1099, Falls Church, VA, 22041, or by e-mail at carrjj@aol.com. ■



Getting Organized, Part II

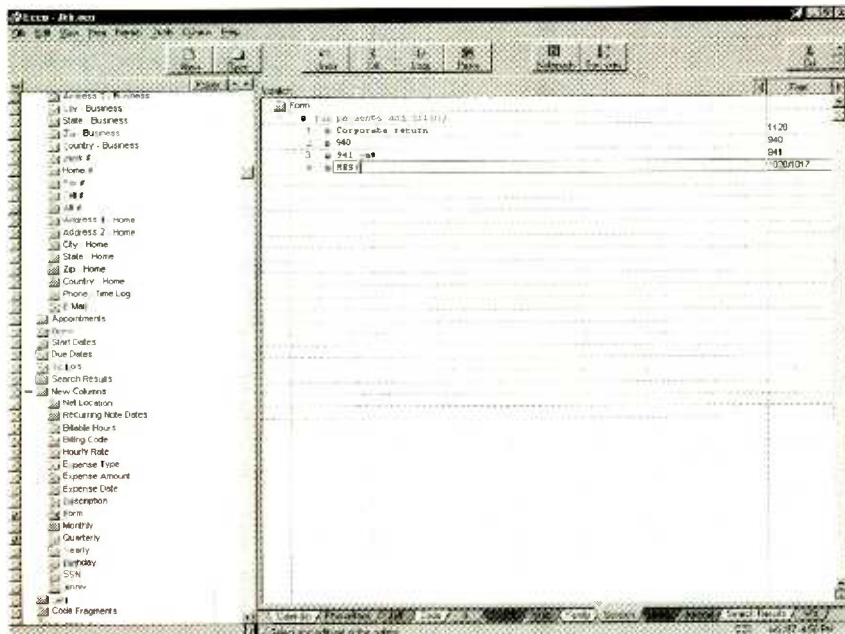
JEFF HOLTZMAN

In last month's column, I talked about my recent efforts to get better organized using Personal Information Manager (PIM) hardware and software. After a fair amount of experimenting with various solutions, I finally decided to go with a US Robotics, *PalmPilot*[™] organizer as my portable data-input and display device. But I still needed some sort of back-end database to track everything and make it available to me. I ended up taking a pretty close look at three products: *InfoSelect 3.0*, *Outlook 97*, and *Ecco Pro 4.0*.

sions of each program, followed by my choice and justification.

InfoSelect 3.0

InfoSelect 3.0 is an amazing little beast. Whereas the other products I reviewed require from 20 to 50 MB of space, *InfoSelect* ships on a single floppy disk. It has an extremely powerful system for creating hierarchical info-bases and cross-referencing them. You can also create more traditional row/column databases for things like address books. On the minus side, its user interface requires a number of



Ecco Professional 4.0 is a PIM program with a strong hierarchical bent. Doing easy stuff is easy, but going beyond that is harder than it should be. It will be interesting to see how the program evolves.

As I said last time, the hardest part of picking a PIM is not picking a PIM. It is figuring out what your needs are. My requirements boiled down to:

- A dynamic, hierarchical, hyper-linked, full-text searchable database
- Basic scheduling functions
- Task tracking, prioritization, and reminders.

I also wanted portability, time-billing, convenient information capture, and overall integration of all the information sources. What follows are brief impres-

operator selections. Worse was the fact that I had trouble importing data into the program from my original sources.

If *InfoSelect* supported the *Pilot*, I probably would have gone with it, and lived with the user interface. The company is working on version 4.0, which should be out by the time you read this. The user interface will be cleaned up and made more consistent with current conventions. But, as of this writing, there was still no planned support for the *Pilot*.

Outlook 97

Outlook 97, available with *Office 97* and as a stand-alone item, is an extremely ambitious offering from Microsoft. Some people expect a browser interface to become our primary means of interacting with a computer. Personally, I expect to see something much like *Outlook*, if not *Outlook*, perhaps wrapped in a browser shell.

Outlook hooks itself into the operating system and major Microsoft applications to provide not only traditional PIM functions, but also e-mail, file management, document management, and an innovative journal system for tracking just about everything you do—assuming you do it with Microsoft products.

Outlook has a huge footprint, and, to be used effectively, would literally have to become the launch-point for every computer-related activity you did. Despite the rich functionality offered by the program, I find it intrusive and overbearing. I'm sure the PIM vendors are watching *Outlook* closely, and I would be surprised not to see many of its features migrate into other products.

Ecco Pro 4.0

Ecco Pro 4.0 is the current leader in the PIM category. It has an attractive user interface, follows user-interface conventions better than *InfoSelect*, and it has lots of power. However, it is not nearly as intuitive to use as *InfoSelect*—but it does support the *Pilot*!

In addition to the traditional calendaring, task-tracking, and address-book modules, *Ecco* provides dual concepts of folders and notepads, both of which provide hierarchical views of data. As best I can determine, folders are intended more for use as high-level organizers, with notepads containing detailed data. The documentation does a very poor job of distinguishing between folders and notepads, and determining when the use of each is more appropriate.

Anyway, folders provide interesting,
(Continued on page 78)

CIRCUIT CIRCUS

Looking at Optoelectronic Devices

CHARLES D. RAKES

This time around we're going to take a look at a few optoelectronic devices to see how they work and what they can do for us. Optical devices are by no means new in the electronic field. Long ago, when television was an

have been partners since the golden age of radio and no doubt will be with us for a long time. The technology that has developed—the coupling of functional electronic devices by light beams—is known as optoelectronics.

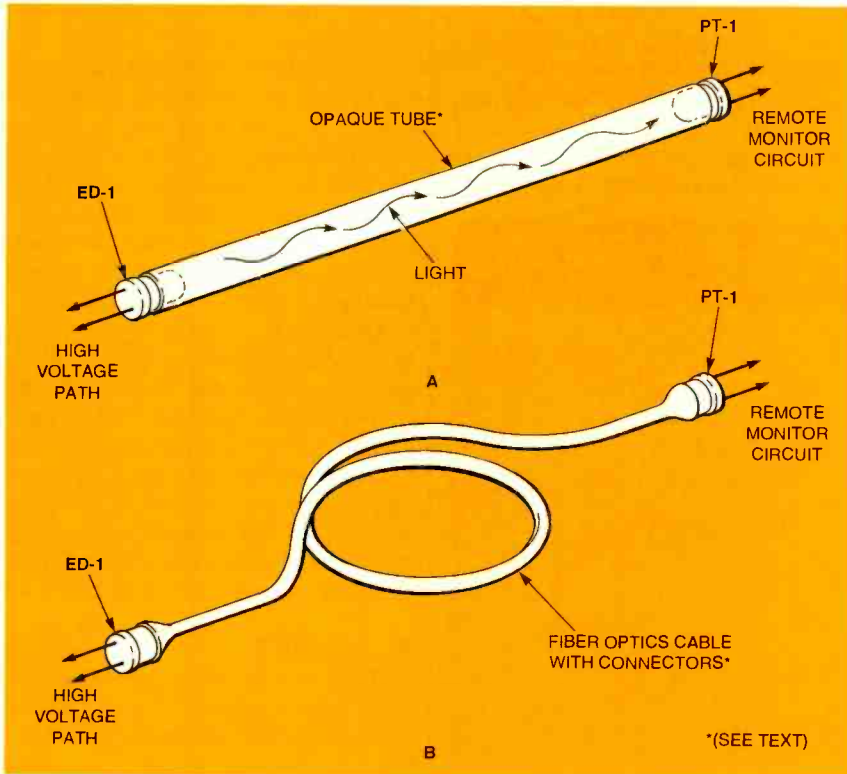


Fig. 1. Here are two simple examples of optocouplers for monitoring high voltages remotely. The one in A uses a rigid line-of-sight opaque tube between the emitter and detector, while the one in B makes use of low loss, flexible fiber optic cable.

experimental medium and the modern picture tube had yet to appear on the scene, the first attempt at transmitting and receiving pictures used two optical electrical devices. A vacuum tube photocell was used to pick up the crude video images scanned by a spinning disk that produced as few as 48 lines per frame. This analog video signal was then broadcast via an AM transmitter and received by a standard AM radio of that period. The video signal was amplified and fed to a specially constructed neon tube that reproduced the crude picture. Optical and electrical devices

PARTS LIST FOR THE OPTOCOUPLER MONITOR (Fig. 1)

ED-1—IR emitter diode (Mouser 512-LED55B or equivalent)
PT-1—Phototransistor (Mouser 512-L14G1 or equivalent)
Opaque tube to fit snugly over optoelectronic devices, fiber optic cable and connectors, etc., (see text)
Experimental fiber optic kit, Mouser 5871-IF-E10, from: **Mouser Electronics**, 958 North Main Street, Mansfield, TX 76063-4827, Tel: 800-346-6873, Web: <http://www.mouser.com>

Optocoupler Monitors

Fast forward to the present day and look at our first two optoelectronic circuits shown in Fig. 1. Here are two simple optocoupler devices that can be constructed for any circuit or special project application. The optocoupler circuit in Fig. 1A is designed to monitor current in a high voltage circuit. The infrared (IR) emitter diode, ED-1, is placed into a path in the high voltage circuit so that the current flowing through it is proportional to the high voltage to be monitored. To be on the safe side, this high voltage application requires a greater spacing between the IR emitter diode and the phototransistor than would normally be found.

The actual length of tubing will depend on the voltage between the high voltage source and the monitoring circuitry. With the two semiconductors suggested, this distance may be several inches. The opaque tube must be ridged and straight for the optocoupler to function properly. The IR diode concentrates its light in a narrow

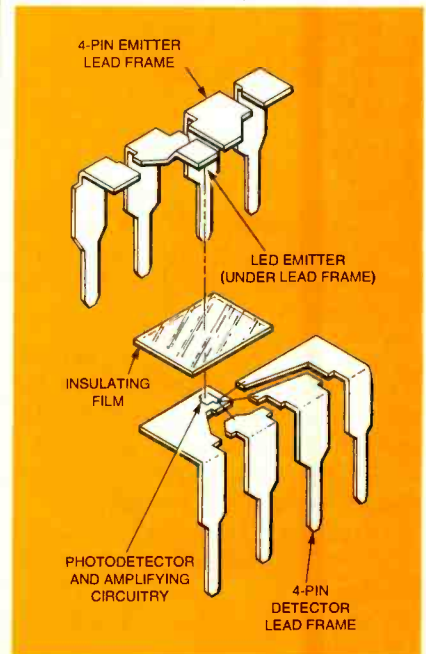


Fig. 2. Exploded view of 8-pin DIP optoisolator.

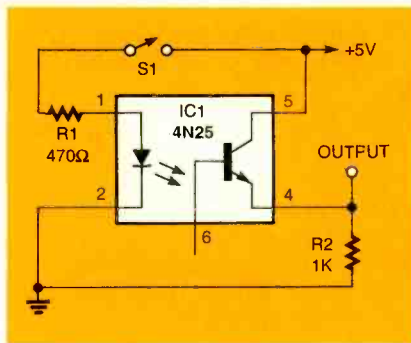


Fig. 3. This little circuit shows how an optoisolator can switch a 5-volt level.

PARTS LIST FOR THE VOLTAGE CONTROLLER (Fig. 3)

- IC1—4N25 optoisolator, NPN transistor output (NTE3040, SK2040, or equivalent)
- R1—470-ohm, 1/2-watt, 5% resistor
- R2—1000-ohm, 1/4-watt, 5% resistor
- S1—SPST switch

beamwidth with high on-axis intensity. On the other end of the tube, the phototransistor, PT-1, is an amplifier whose gain is proportional to the amount of light present, which is derived from the monitoring of the high voltage.

By the way, don't expect to see any light coming from the IR diode. Unlike display LEDs, which operate in the visible portion of the spectrum, these optocoupler devices operate at infrared wavelengths which are lower than visible light.

If a greater distance between the source and monitoring location is required, the optocoupler setup in Fig. 1B offers several advantages. Here the data travels through a low loss fiber optic cable, and the length between the emitter and detector can be much greater than the optocoupler setup in Fig. 1A. Special fiber optics connectors are available to provide proper coupling into and out of the optoelectronic devices. Getting acquainted with fiber optics is an easy task thanks to its prolific use throughout the communication industry. Mouser Electronics offers an inexpensive fiber optic experimental kit (special order part number 5871-IF-E10). This kit comes with a 1-meter fiber optic cable, matching LED emitter and photodetector with connectors and instructions—all for less than ten dollars.

The phototransistor output configuration is probably the most common of

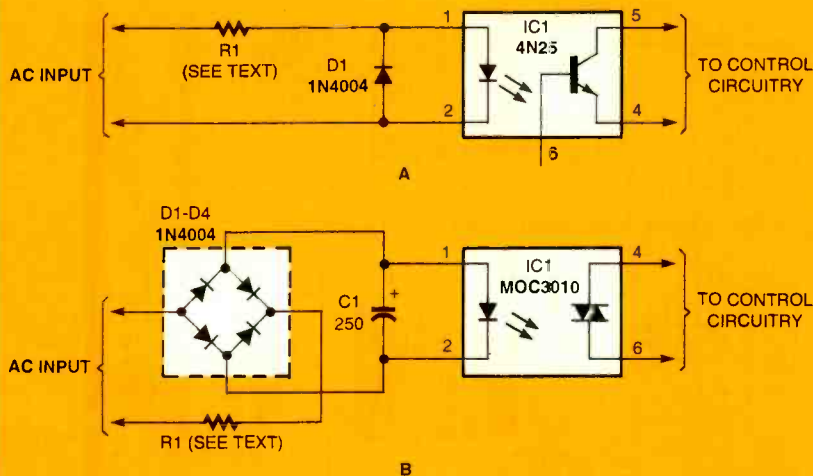


Fig. 4. These circuits show how optoisolators can use an AC input signal to control an external circuit. In A, the half-wave rectifier turns on a phototransistor driver, while in B the full-wave rectifier turns on a triac driver.

PARTS LIST FOR THE AC VOLTAGE CONTROLLER (Fig. 4A)

- D1—1N4004 diode
- IC1—4N25 optoisolator, NPN transistor output (NTE3040, SK2040, or equivalent)
- R1—Resistor (see text)

the optocoupler products in use today. Photodetector outputs are available in a number of configurations, such as high voltage, high-speed, dual outputs, Darlington output, relay output, and many other similar combinations. And most of these may be purchased for less than a buck each.

Applications with Different Optocoupler Devices

Optoisolator devices generally consist of an IR LED optically coupled to either a photosensitive detector or a phototransistor circuit that is sealed in a single light-tight package. As its name implies, an optoisolator physically isolates these two circuits from one another and external noise, while transferring the desired signal from input to output. Isolation resistances exceeding 1,000-megohms are common. Most of these optoisolators are configured in 6- or 8-pin DIP packages. The output stage can be obtained in a number of different configurations, including a transistor output, Darlington output, SCR output, triac driver, diode output, or most any other driver function. Figure 2 shows an exploded view of a typical 8-pin optoisolator.

PARTS LIST FOR THE AC VOLTAGE CONTROLLER (Fig. 4B)

- C1—250-μF, 10-WVDC, electrolytic capacitor
- D1-D4—1N4004 diode, or single bridge module (RadioShack 276-1173)
- IC1—MOC3010 optoisolator, triac output (NTE3047, Mouser 512-MOC3010, or equivalent)
- R1—Resistor (see text)

Our first IC optoisolator circuit, shown in Fig. 3, separates one voltage source from another. When switch S1 is opened the output at pin 4 is zero, and when S1 is closed the output is slightly less than 5-volts. The input/output isolation voltage for the 4N25 is over 5000 V_{RMS} . The base lead at pin 6 is normally left unconnected, since IC1's base-collector current is generated internally by photo-electric effect.

The two circuits of Fig. 4 illustrate how an AC input signal can be used to control operation of another circuit or device. In Fig. 4A, the positive half of the AC waveform supplies current to the 4N25's LED, which in turn generates its beam of light. During the LED's on-time, pulses on the output transistor control the external circuitry. This circuit is only useful for a half-cycle output control. R1 is selected to limit the LED's operating current to about 20 mA.

In a related application, the AC operated circuit in Fig. 4B uses an optoisolator IC with a triac output—the Motorola MOC3010. A full-wave bridge

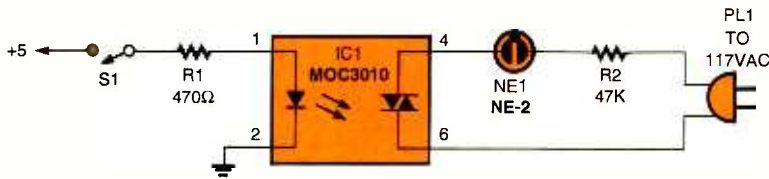


Fig. 5. In this figure, a DC input controls an AC output.

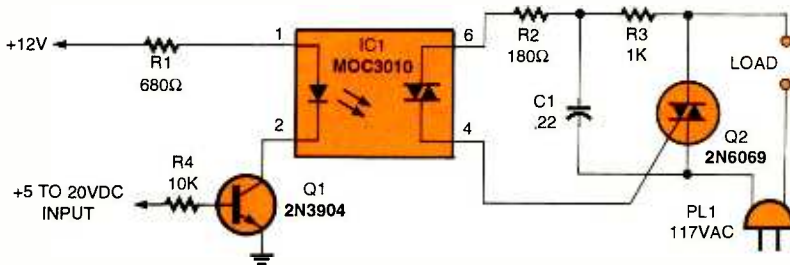


Fig. 6. Want to control some heavy-duty AC loads with a low-level DC circuit? Try this arrangement of an optoisolator and a triac.

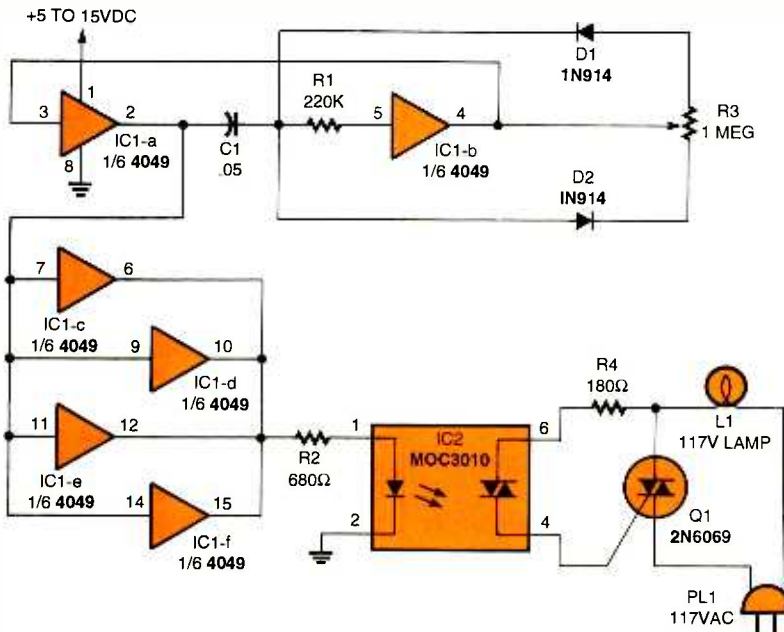


Fig. 7. Here's a novel way of constructing a lamp dimmer.

rectifier, comprised of diodes D1 through D4, furnishes a pulsating DC output, which is smoothed out by filter capacitor C1. This DC voltage lights the LED of IC1 and turns on the triac to control the external circuit across pins 4 and 6. Resistor R1 is chosen to limit the input current to about 20 mA, and C1 is added to keep the output chatter-free. You will see this IC used in many circuit applications where a high AC voltage controls low voltage DC circuitry.

The reverse case is shown in Fig.

5. Here a low voltage DC source controls a high voltage AC device. The MOC3010 optoisolator controls a neon indicator lamp that is operated from a 117-volt AC power source. When switch S1 is closed, the MOC3010 LED activates the triac, turning on the neon lamp. In most circuit applications, S1 would be replaced with a switching transistor or a logic gate output to supply power to the optoisolator.

Our next circuit, Fig. 6, uses a transistor to activate the MOC3010 optoisolator, which in turn controls an inductive or resistive load operating

PARTS LIST FOR THE DC VOLTAGE CONTROLLER (Fig. 5)

- IC1—MOC3010 optoisolator, triac output (NTE3047, Mouser 512-MOC3010, or equivalent)
- NE1—Neon lamp (type NE-2, NE-51, or equivalent)
- R1—470-ohm, 1/2-watt, 5% resistor
- R2—47,000-ohm, 1/2-watt, 5% resistor
- S1—SPST switch

PARTS LIST FOR THE AC INDUCTIVE VOLTAGE CONTROLLER (Fig. 6)

SEMICONDUCTORS

- IC1—MOC3010 optoisolator, triac output (NTE3047, Mouser 512-MOC3010, or equivalent)
- Q1—2N3904 NPN transistor (NTE-123AP or equivalent)
- Q2—2N6069 triac, 6-amp, 400-volt (RadioShack 276-1000, or equivalent)

RESISTORS

(All fixed resistors are 1/4-watt, 5% units, unless otherwise noted.)

- R1—680-ohm
- R2—180-ohm
- R3—1000-ohm
- R4—10,000-ohm

PARTS LIST FOR THE OPTICALLY-CONTROLLED LAMP DIMMER (Fig. 7)

SEMICONDUCTORS

- D1, D2—1N914 diode
- IC1—4049 inverting hex buffer/convertor (NTE4049 or equivalent)
- IC2—MOC3010 optoisolator, triac output (NTE3047, Mouser 512-MOC3010, or equivalent)
- Q1—2N6069 triac (6-amp, 400-volt, RadioShack 276-1000 or equivalent)

RESISTORS

(All fixed resistors are 1/4-watt, 5% units, unless otherwise noted.)

- R1—220,000-ohm
- R2—680-ohm
- R3—1-megohm potentiometer
- R4—180-ohm

ADDITIONAL PARTS AND MATERIALS

- C1—0.05-μF, mylar or similar capacitor
- Lamp, lamp socket, line cord and plug, etc.

from 117-volt AC power source. This circuit may be used to operate AC motors, lamps, relays, solenoids, or any other similar devices within the power limitations of the 6-amp triac

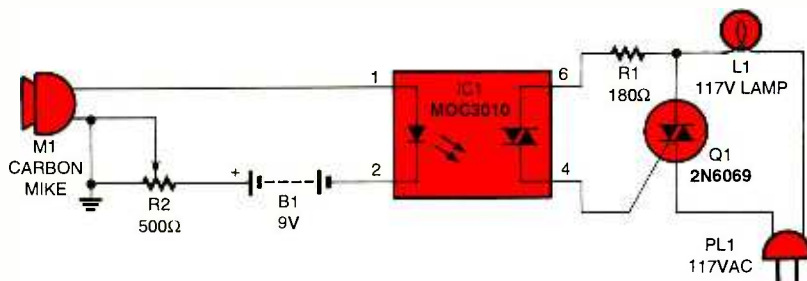


Fig. 8. Watch your voice modulate the light with this circuit!

PARTS LIST FOR THE MICROPHONE-MODULATED LAMP (Fig. 8)

- B1—9-volt transistor battery
- IC1—MOC3010 optoisolator, triac output (NTE3047, Mouser 512-MOC3010, or equivalent)
- Q1—2N6069 triac, 6-amp, 400-volt, (RadioShack 276-1000 or equivalent)
- R1—180-ohm, 1/4-watt, 5% resistor
- R2—500-ohm potentiometer
- Carbon microphone, lamp, lamp socket, line cord and plug, etc.

PARTS LIST FOR THE TELEPHONE IN-USE INDICATOR (Fig. 9)

- D1-D4—1N4005 diode or equivalent single bridge module
- IC1—4N25 optoisolator, NPN transistor output (NTE3040, SK2040, or equivalent)
- LED1-LED4—Light-emitting diode, any color, any type
- R1—270-ohm, 1/4-watt, 5% resistor

Hopefully one of these simple optocoupler circuits will fill a need in one of your projects. If not, just keep them in mind for the future. The old clock on the wall says it's time to close for now. Good circuitry until we meet here again next month. ■

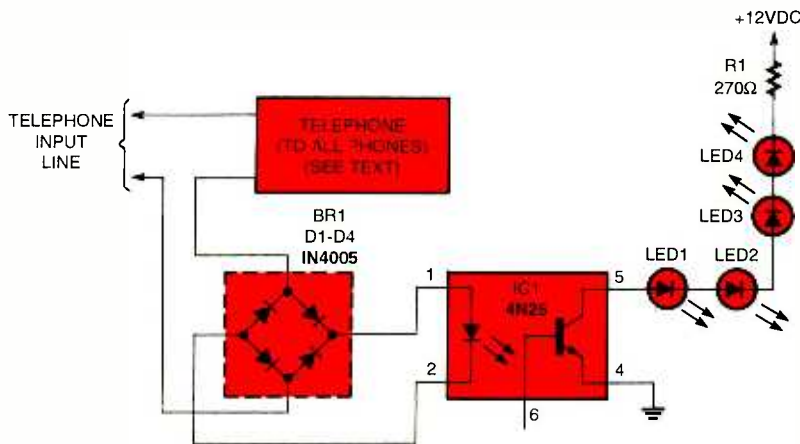


Fig. 9. Need a visual indication when a telephone in your house is being used—try this circuit out.

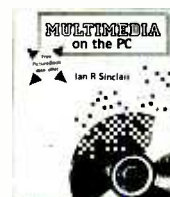
specified. Input transistor Q1 may be driven from just about any DC source with an output of 5 to 20 volts.

A lamp dimmer circuit using the MOC3010 is shown in Fig. 7. Buffers IC1-a and IC1-b of a 4049 inverting hex buffer/converter IC are connected as part of a variable pulse width square-wave oscillator circuit. The oscillator's output at pin 2 of buffer IC1-a drives the inputs of the remaining four buffers. The outputs of these four buffers are parallel-connected to drive the optoisolator input LED of IC2. For operation of this circuit, resistor R3 controls the oscillator's output pulse width. Setting R3 for the widest negative output pulse at pin 2 of IC1 produces the maximum brilliance in the 117-volt AC lamp. The negative pulse output at pin 2 is inverted by the four parallel-connected buffers to a positive output that drives the MOC3010's input LED.

Our next application for the MOC3010 can be turned into an interesting project for the youngsters in the house. In Fig. 8, a carbon microphone modulates the current flowing through

IC1's input LED, and the results are seen in the lamp's output. Resistor R2 sets the LED's static operating current, and it may be adjusted while speaking into the microphone for the best light output response.

The last optoisolator circuit shown in Fig. 9 uses a 4N25 optoisolator with phototransistor output to light a row of LEDs when any one telephone on the same phone line is in use. Since the display LEDs are wired in series, one can be positioned at each phone location to operate as an in-use indicator. The input circuit is connected in series with the incoming phone line. Four 1N4004 diodes make up a full-wave bridge circuit that guarantees the correct voltage polarity reaches the input LED of the 4N25. When all phones are on the hook, there is little or no current flowing through the phone lines. When any phone is taken off the hook, this automatically bridges the phone line causing current to flow through the system. This current also will flow through the diode bridge and LED of IC1, turning on the phototransistor and lighting the four LEDs.



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SCANNER SCENE

Tricks and Treats

MARC SAXON

A fine new CD-ROM now available for the scanner owner lists all FCC licensees (except amateurs, ships, and aircraft) operating between 25 and 1300 MHz. It covers the entire United States and territories. This enormous FCC database is found on a CD-ROM known as *Mr. Scanner*. Unlike other databases we have seen that require tricky installation, this one requires absolutely *no* installation or

state, city, county, or service. In addition to the FCC database, the CD-ROM includes the Betty Bearcat National Police Directory, and also many useful radio signals and codes from all areas of the nation. The system requirements are Windows 3.1, Windows 95, or DOS 3.3 or higher; 640K base memory, 1-Meg minimum of extended memory, and a CD-ROM drive, 2x speed or higher.

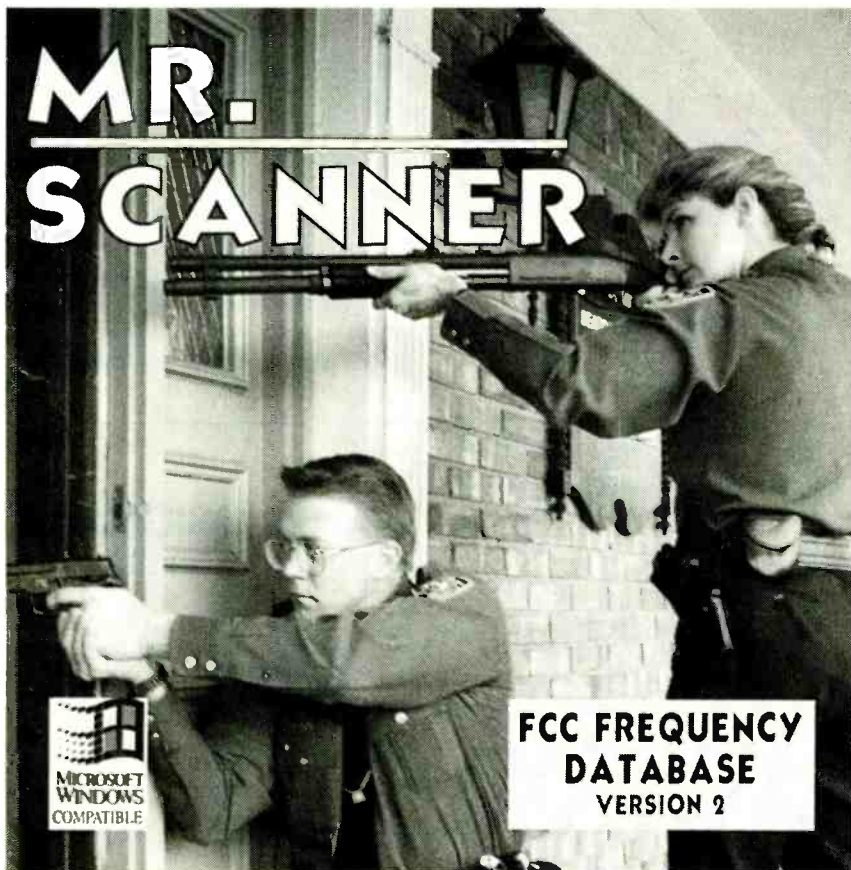
believe this is true of their scanners, if only they could learn the magic sequence. As far as we have been told, there are two known new tricks that you can get a PRO-60 to perform by tinkering around with its keypad. If you hold down "1" and "ENTER" during power up, the radio thinks things over for a few seconds, then everything on the display lights up. After that, when you press a number or "MANUAL," the radio goes into scan with 98 different test frequencies between 30 and 999.95 MHz, operating in FM, NFM, and AM modes. If you hold "2" and "ENTER" during power up, this sequence acts as either an on or off toggle to control the beep sound. One can but daydream about the myriad of other possible hidden delights available by depressing other numerals and "ENTER" while powering up. Probably nobody has had the courage yet to try it!

Those who own Uniden Bearcat BC9000-XLT scanners have advised me of a few interesting idiosyncrasies that it has. While you power it up, the radio enters a test mode if you press the "DLY," "2," and "9" keys. In that mode, in the event you happen to simultaneously press the "LOCK" button and the "C" button, you erase all of the memories stored from channel 1 to channel 250! Also in the BC9000-XLT unit, cellular phone call images reportedly come in quite well between 360 and 385 MHz.

What's in a Name?

As you might (or might not) know, military and other federal stations in the United States do not require FCC licenses. Many of those stations are known to one another on the air by so-called "tactical identifiers," which are like code names. This subject came up in a question from Hank Boileau, of New Jersey, who hears a wide variety of those identifiers when he monitors the 225-to 400-MHz military-aeronautical band.

For instance, Hank mentions hearing "Drognet," "Drognet Tango," "Drog-
(Continued on page 78)



Besides covering all FCC licensees operating between 25 and 1300 MHz (except amateurs, ships, and aircraft), the Mr. Scanner CD-ROM contains the complete Betty Bearcat National Police Directory.

setup. It's very easy to use—simply insert it into your computer's CD-ROM drive, and it's ready to go. Of course, you can call up an on-screen owner's manual, too.

The CD-ROM allows you to search and print by frequency, city, county, call letters, or radio service code. You can export data to ASCII or dBASE files by

Scanner Tricks Department

Every now and again, rumors begin circulating about supposedly fabulous operating enhancements that can be added to specific scanner models when the keypad buttons are pressed in certain sequences. Most recently I have received cards and letters indicating many RadioShack PRO-60 owners

DX LISTENING

Tune In Space Talk

DON JENSEN

Fourteen years ago, members of the Goddard Amateur Radio Club (GARC) located at NASA's Goddard Space Flight Center in Greenbelt, MD, together with the Amateur Satellite Corp. devised a plan to retransmit live, air-to-ground audio from space shuttle flights over ham-radio frequencies. Ever since, Hams

audio on the amateur radio bands beginning about an hour before the Shuttle launch and continues periodically through the flight and landing. The rebroadcasts can be heard during the hours when the Shuttle astronauts are awake. Some missions have two teams aboard, however, so communication is maintained around the clock.

286-6673. For the latest information on Space Shuttle flight schedules, check in with the GARC's computer website: <http://garc.gsfc.nasa.gov/www/garc-home-page.html>.

Forty Years of DX

This year, Hungarian broadcaster R. Budapest marks the 40th year of the station's DX show intended for SWLs. The first DXers' program in English was aired on Oct. 4, 1957. Its inspiration was *Sweden Calling DXers*, one of the pioneer programs for SWLs aired by R. Sweden.

R. Budapest's DXers' program is credited to the hard work and dedication of two men, Andras Tardos, former head of the Foreign Language Department of the station, and Dennis Herner, who worked with the Hungarian resistance during World War II. Herner compiled clandestine news bulletins by monitoring broadcasts from the BBC, VOA and R. Moscow.

Herner edited the program until his death in 1991. In 1965, the R. Budapest Short Wave Club, made up of faithful listeners, was founded. Today, the station says, it has more than 12,000 members around the world.

This year, special 40th anniversary events have been scheduled. Long-time listeners to the DX program are invited to write in with their memories of early broadcasts from R. Budapest. Quiz programs have been aired.

In September and October, the main event is a R. Budapest DX-40 contest, with winners announced on Oct. 4, the day of the anniversary. And a special QSL is to be issued.

Check with the station at 0210 UTC Monday or Thursday on 9,840 kHz.

In the Mail

Your letters to this column are always welcome. Send along your listening tips, your questions about short-wave listening, and photos of you and your equipment. I would like to include your photos in this column in the future. My address is **DX Listening, Popular**

(Continued on page 81)



This photo from the Goddard Amateur Radio Club's computer website shows WA3NAN's Shuttle Retransmission Studio at Greenbelt, MD. Carolyn Keydash, N3DON, is at the controls.

and SWL enthusiasts have been able to tune in to real-time transmissions from space during the shuttle flights.

The first broadcast of the space shuttle communications began on August 31, 1983, and was heard only in the Washington, DC area, via a 2-meter repeater station. But on November 28 of that year, with the next mission, the retransmissions expanded into the shortwave frequencies.

Using GARC's callsign, WA3NAN, the club transmits live Space Shuttle

Although I have followed the Shuttle communications from many of these missions (they number in the 80s) over the years, they still fascinate me. SWLs who haven't yet come across these broadcasts have a treat in store. If you want to tune in during the next Space Shuttle flight, here are the frequencies to try: 3,860 kHz, LSB; 7,185 kHz, LSB; 14,295 kHz, USB; 21,395 kHz, USB; and 28,650 kHz, USB.

Yes, WA3NAN QSLs are available for correct reception reports of these amateur radio retransmissions of the Shuttle communications. Your reports, with a stamped, self-addressed envelope, can be sent to the Goddard Amateur Radio Club/WA3NAN, PO Box 86, Greenbelt, MD 20768-0086. During the missions, you can call 301-

CREDITS: David Clark, Ont.; William Flynn, OR; Marie Lamb, NY; Harold Levison, PA; George Maroti, NY; Don Moore, MI; John Rogers, MA; North American SW Association, 45 Wildflower Road, Levittown, PA 19057.

Think Tank

More From Craig

Craig Sellen has sent in enough quality circuits to fill this month's column, so he will receive a kit, a MCL1010 chip and book from our library. Remember you can win the same by sending schematics and explanations of your circuits to Think Tank, **Popular Electronics**, 500 Bi-County Blvd., Farmingdale, NY 11735. Last month, while discussing diode

forward biased, allowing current to flow through the load in the direction shown. During the next half-cycle, the polarities are reversed, BB is more positive than AA, and diodes D3 and D4 are reverse biased—they can now be ignored. Under this condition, diodes D2 and D1 are now forward biased, allowing current to flow through the load in that same direction.

ing DC output) and sold as a single module called a "full-wave bridge rectifier." Our symbol for a bridge rectifier is "BR1" and is illustrated in Fig. 1B—this module replaces the four discrete diodes. Let's now turn our attention to Craig's submissions!

Four Channel Audio Mixer

Once the initial thrill of recording is over, the owner of a tape machine quickly realizes that a single microphone input for each channel imposes severe limitations for amateur musicians. Even good performances may sound like the kindergarten fife and wood-block corps when recorded with a single microphone. For professional sounding tapes, you've got to be able to mix several sound sources—so you need a mixer.

The mixer circuit I designed (Fig. 2) has four low-level inputs and two high-level inputs. Any combination of program sources can be mixed into a single output. There is a level control adjustment available for each channel. Note that the inputs use LF353 dual junction field-effect transistor (JFET) operational amplifiers (op-amps). An equivalent JFET is the Thompson SK7641 or RadioShack 276-1715. These devices feature very high input impedance, almost as high as that of a vacuum tube, which means you can use crystal or ceramic microphones with the mixer. The input impedance of each microphone channel is determined by resistors R1, R5, R9 and R12, which are 2.2-megohms each. You may increase or decrease the value of these resistors to match the impedance of the microphone(s) used.

You can also mix a high-level signal—another tape recorder or ceramic cartridge—into two of the channels, by connecting the high-level source to either jack J5 or J6. Note that each jack disables the microphone input associated with that channel. For example, connecting a high-level source to J5 disables the microphone plugged in J3.

To ensure proper output, a high-level

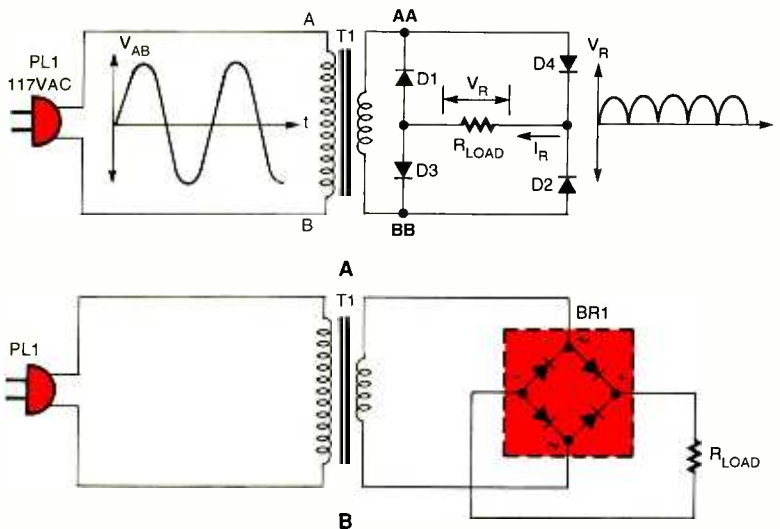


Fig. 1. A non-center tapped transformer (A) is used with four diodes. Pulsating voltage appears all the time across the load resistor. The four-diodes (B) are conveniently packaged into a single module, BR1, called a "full-wave bridge rectifier."

theory, I asked how you could arrange four diodes and a plain (non-center-tapped) transformer to generate pulsating DC. The circuit that achieves the desired result is shown in Fig. 1A. In this circuit (as with the full-wave center-tap rectifier circuit discussed in last month's issue), current (I_R) flows through the load (R_{LOAD}) from right to left regardless of its polarity when it exits the secondary terminal of transformer T1. Assume a positive half-cycle of the primary voltage input V_{AB} , when terminal A is positive with respect to B. On the secondary terminals of T1, the voltage at AA is more positive than BB so diodes D1 and D2 are reverse biased and you can ignore them—it's as though they aren't in the circuit. During this time, diodes D3 and D4 are

This transformer/diode configuration forms a full-wave rectifier circuit, which is used extensively in power supply circuits. Like the center-tapped transformer/two-diode circuit, it produces pulsating DC. The pulsating DC output is not sufficiently constant in amplitude to prevent hum, or noticeable ripple, corresponding to these pulsations. Power supply filters are then required between the four diodes and the load to smooth out these ripples into essentially a constant DC voltage. The four-diode configuration itself is called a "bridge-rectifier" circuit. It is such a popular arrangement for power supply use that the four diodes are often integrated into a four-pin package (two leads for the input AC connections and two for the pulsat-

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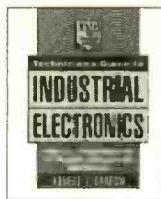
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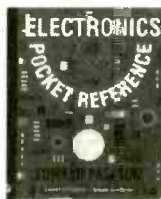
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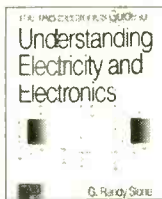
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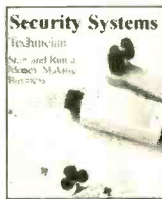
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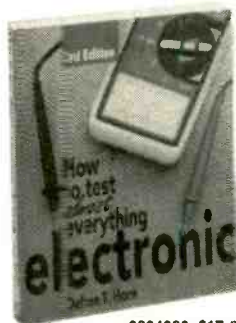
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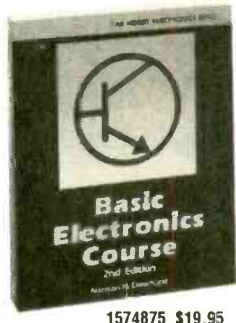
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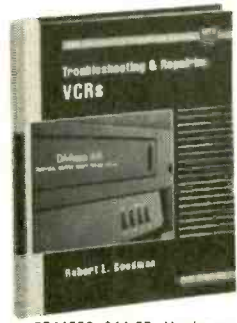
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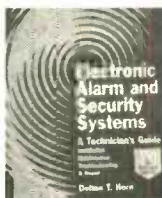
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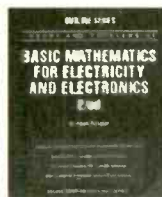
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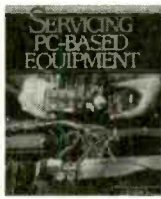
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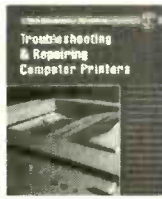
0317917 \$60.00



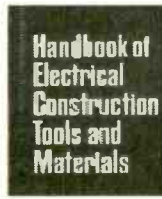
0304122 \$17.95



5869349 \$44.00



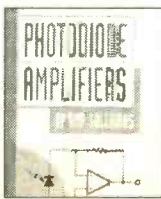
0057311 \$44.95
Hardcover



0699208 \$65.50



0052387 \$28.95
Hardcover



024247X \$49.00



0497060 \$29.95
Hardcover



5871890 \$12.99



0242046 \$39.95
Hardcover



0116113 \$40.00

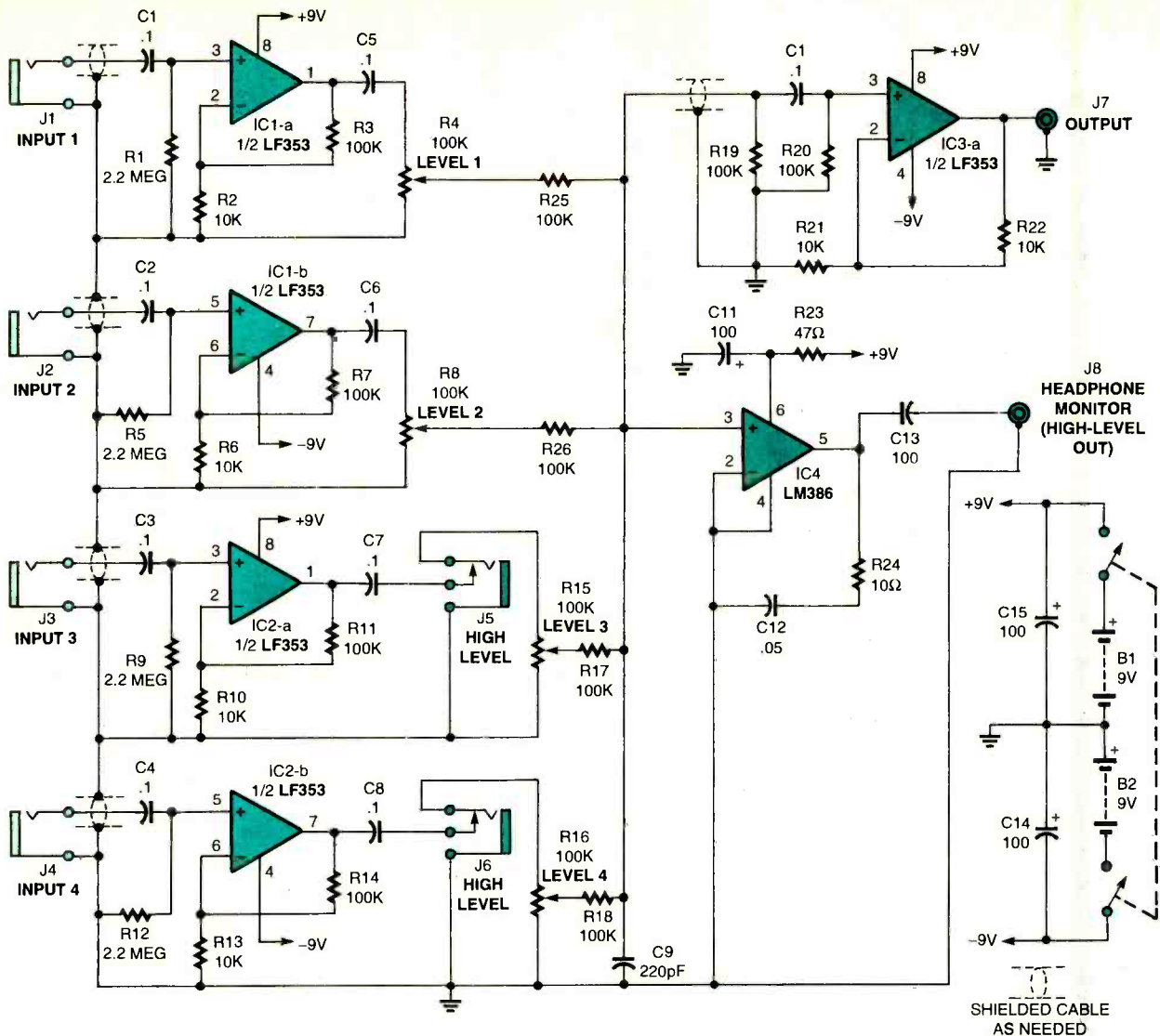


Fig. 2. Here's the perfect answer to professional audio mixing. This circuit allows four signals to be combined in a number of different ways. Each input has its own level control, and a high level output is available for headphone monitoring.

headphone monitor jack is supplied at the output of the LM386, the low voltage audio power amplifier IC (Thompson equivalent, SK9210). The signal level at jack J8 (about 1 V_{RMS}) is more than adequate for a comfortable headphone volume. Use headphones with an impedance of 2-k ohms. You can connect the output at this jack into any high level amplifier input designed to accept a 1 V_{RMS} single source; however, distortion and noise level at jack J8 are slightly higher than at the lower level output from J7. If you want to make the mixer portable and hum-free, the circuit can be battery-powered with the two nine-volt batteries as shown in the schematic.

—Craig Kendrick Sellen, Waymart, PA
Nice work; I like the fact it's portable.

74 I wonder if there's a quad-package

equivalent to the LF353. Use shielded cable (at least at the op-amp inputs) to reduce hum.

Relaxation Oscillator

If you've ever built a neon lamp flasher circuit, you already know that you can make a simple relaxation oscillator by connecting a resistor and capacitor to a negative-resistance component. The circuit in Fig. 3 shows how this can be done using an optoisolator as the negative-resistance component.

Operation begins with the capacitor charging through the 10-k potentiometer until the negative resistance circuit switches on. At that point, the capacitor discharges through the circuit and the system resets to the off-state to repeat the cycle. For best results, select any optoisolator with NPN transistor output,

such as a Thompson SK10331, or similar devices found in the Digi-Key catalog, but then use the other component values specified in the schematic. A Thompson SK3466 can be substituted for the 2N3906 PNP transistor. You can monitor the operation of this circuit with a scope connected across the LED portion of the optoisolator and/or a 1-k resistor inserted between the emitter of the isolator's transistor and ground.

After you get the circuit working, experiment with different capacitor values to change the frequency range of the circuit. With the values shown, I got a frequency range of about 3- to 8-kHz with the potentiometer adjusted for a mid-scale resistance of about 5-k. Changing the capacitor's value to 1 μF resulted in a frequency range from about 120-Hz to 1.8-kHz.

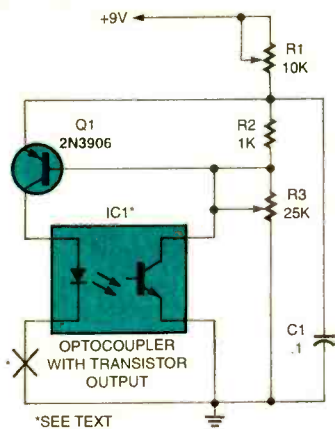


Fig. 3. You can have lots of fun with this audio oscillator. With a minimum of components, you can produce very strange noises!

—Craig Kendrick Sellen, Waymart, PA
This reminds me of a circuit that used an incandescent bulb as a negative resistance component. I think it was a sine wave oscillator.

Signal Injector

Need to find the defective stage of a multi-stage radio or audio amplifier? You don't need a shop full of test equipment—just the signal-injector circuit in Fig. 4. The heart of the injector is a 2N2646 unijunction transistor (or Thompson SK9123), which generates a basic 600-Hz pulse-type signal. This frequency is ideal for probing audio work. Harmonics up to 30-MHz are produced by the circuit for troubleshooting RF stages.

The component layout is not critical and may be changed to suit any housing. My injector is housed in an easy-to-hold, inexpensive, plastic toothbrush case. If you wish to do the same, cut a hole in one end of the case to accommodate the neck of phone plug PL1. The phone plug is used to provide the probe tip. Carefully solder a ground plug on the neck of the plug inside the case. Solder a length of insulated wire to PL1's center pin. Mount the SPST slide switch S1 at the right end of the lid. Position the battery temporarily near the switch to determine the remaining space. Cut a piece of perforated board to fit inside the case, include the necessary solder clips on the board, and then install the board in the case. Connect PL1's ground plug to a solder clip on the board to provide mechanical support. Make sure the connecting wires to S1 are long enough to allow the case to be opened easily. Do not use a low-volt-

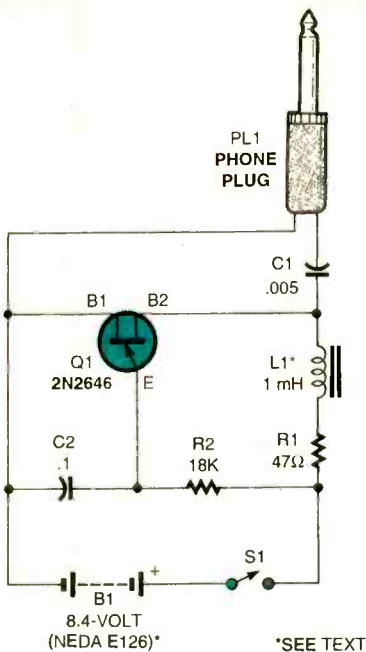


Fig. 4. When I need a companion to my signal tracer, I pull out this compact little signal injector. This handy item can be built inside a toothbrush case. It's great for troubleshooting any multi-stage radio or audio amplifier. Just probe around and listen for the tone.

age capacitor for C1. I used a 1000-WVDC capacitor for C1 to prevent the injector from being damaged should PL1 accidentally touch a high-voltage DC node.

A 8.4-volt mercury battery is used in the unit. I selected this non-conventional battery since I found its cylindrical size fit nicely into my toothbrush holder. Since the circuit can work with any 9- to 12-volt supply, I am sure other equivalent power sources can be found. (Editor's note: Another source, perhaps more readily available, is a 12-volt battery obtained from RadioShack [23-144], but you might also have to get their "type N" holder [270-405]).

The output voltage of the injector depends on the impedance of the stage to which it is connected. Without a load, the amplitude of the pulses is 4-volts peak-to-peak. Since the output impedance of the injector is high, it will work best with high-impedance tube circuits or FET input devices. On the other hand, it cannot be used to check low impedance devices such as speakers. To use the signal injector, clip PL1's ground shell to the chassis or board of the unit under test, place PL1's center pin on the grid or base of a tube or transistor (with the volume

control at maximum gain), and listen for a signal in the speaker of the unit under test. Always start near the output in the case of a radio, and then work your way back towards the input. When the signal disappears, you have located the inoperative stage. For some RF and low-gain audio circuits, the level of the signal from the injector can be increased by touching your finger to PL1's outside shell.

—Craig Kendrick Sellen, Waymart, PA
Replacing S1 with a normally-open pushbutton switch might save a battery or two. Locating this switch so that it can be operated by your index finger would really be convenient. Craig further advises us that L1 is a subminiature 1-mH iron core RF choke that can be obtained from J.W. Miller Co. as part number 70F103A1.

Switchless Intercom

A switchless intercom lets each party break into the conversation at any time. It's like the telephone, but with a loudspeaker-volume control. The overall circuit is shown in Fig. 5, which represents one part of a hands-free duplex intercom system. Since both intercoms are identical, only one unit is illustrated (in Fig. 5A) along with a common power supply (in Fig. 5B) and system diagram (in Fig. 5C). An equivalent part for the 741op-amp is RadioShack 276-007; the CA3020 IC, which is usually supplied in a TO-5 style 12-lead metal, can be found as Thompson SK3524 or NTE 784. Although a LM7806 6-volt regulator (equivalent Thompson SK3669) is shown in the power supply, you can run these intercoms from any 6- to 9-volt DC supply.

When you talk into the microphone, the signal should travel to the other intercom, but not to the local speaker. So the audio from your microphone is amplified by the 741 op amp IC1, and applied to IC2, which is a CA3020 wide-band audio power amplifier. The output from IC2 appears at both pins 4 and 7, the collector output of the device. These two output signals, which are 180 degrees out of phase, appear on both sides of balance control R11. At some point on the wiper of R11, these signals cancel each other out. That point is where R11 must be set for minimum feedback, as we will explain later. Since there's hardly any of the signal from your microphone at that point,

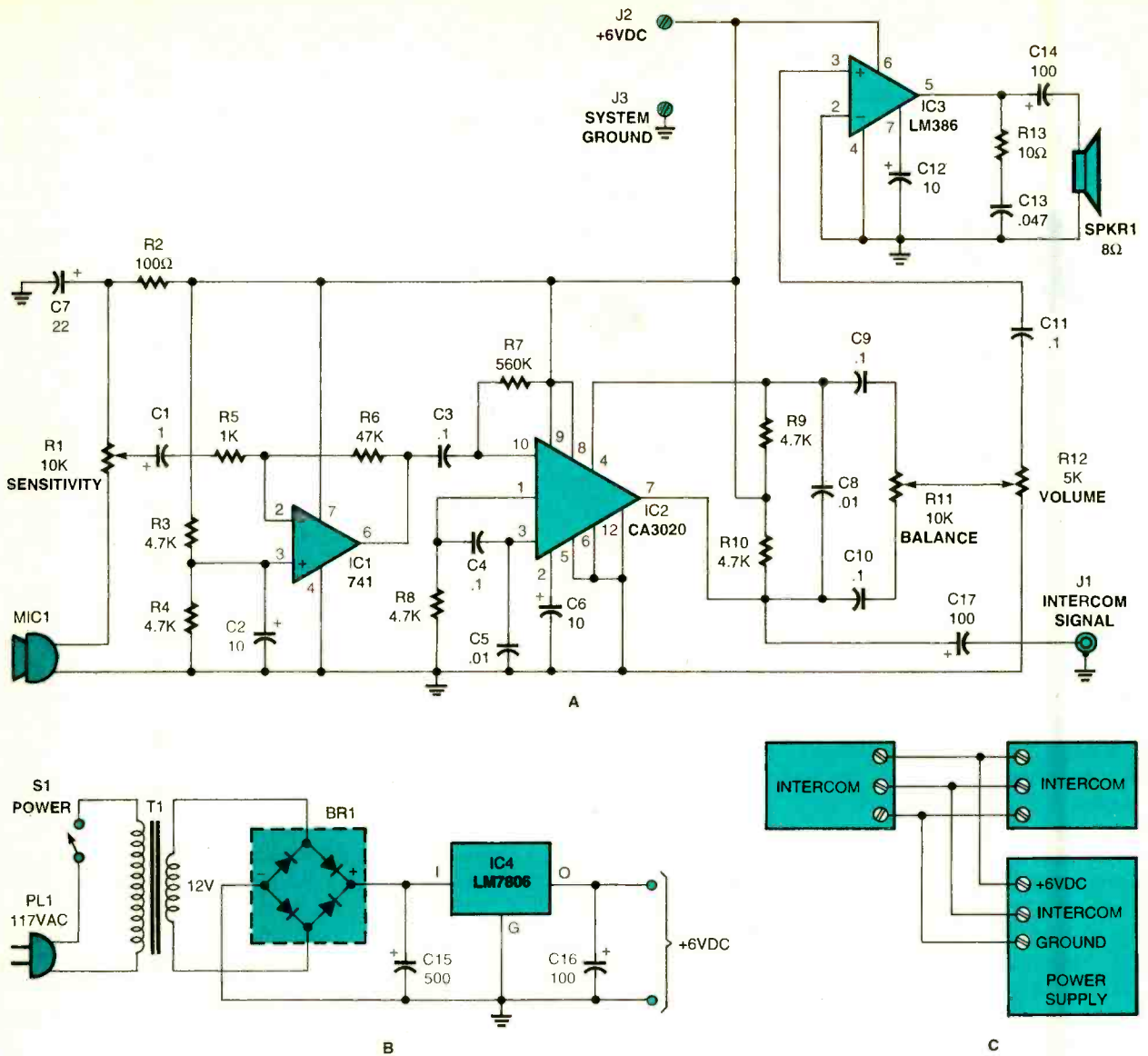


Fig. 5. This duplex intercom system is almost like having your own private telephone system throughout the house!

none of the audio gets through to your speaker and there won't be any feedback at your unit. Remember, however, your signal also appears at pin 7 of IC2. There the signal is not canceled out, but coupled through C17 to jack J1 and fed to the other intercom.

Let's see what happens at the other unit that is identical to yours. The incoming signal at J1 goes through C17 to pin 7 of IC2. Since this signal cannot go through IC2 due to the isolation of the amplifier, it is not canceled out at R11. Instead this signal goes through C10 to R11 and its dual control R12, and on to IC3, a LM386 low voltage audio power amplifier which drives the speaker. In a nutshell then, the outgoing signal to your own speaker is

canceled out at R11, but is fed to the other intercom through C17. The incoming signal passes through C17, C10 and R11, goes into IC3 where it is amplified, and then to the speaker.

After both intercoms one of which is shown in Fig. 5(A) and the common power supply (Fig. 5B) are completed, connect all similarly marked external terminals (ground, signal, and +6-volt DC supply) with lengths of 3-conductor wire, as shown in Fig. 5C. For convenience, the terminals J1, J2, and J3 can be included as part of a screw terminal barrier strip.

To adjust the controls, place the units in separate rooms and close some door between them, (feedback will occur if the two stations "hear" each

other). The microphone should be located about two feet to the side of the intercom. With power turned on, turn the volume control on one unit all the way up. Chances are you will hear howling feedback. Reduce it by slowly turning balance control R11. At some point near the middle of the R11 rotation, the feedback should stop or become very weak. Now repeat this procedure at the other intercom with both intercoms connected. If there is no feedback, the microphone can be installed a few inches from the speaker. The sensitivity control, R1, is adjusted for best room audio pickup.

—Craig Kendrick Sellen, Waymart, PA
See you all next month and please keep those great ideas coming!

SMART AIRBAGS

(Continued from page 31)

reflect back a magnetic signal to the antennas to determine not only if a baby seat is present, but also its orientation. If the seat is facing rearward, a signal is sent to the airbag electronic control system to automatically prevent the passenger-side airbag from inflating.

Takata Total Safety Systems and Telefunken Microelectronics (TEMIC) use infrared (IR) ranging techniques in their occupant-detection systems. Takata's SafetyShield™ includes the

measured capacitance. A similar system developed by Breed Technologies also uses capacitive sensors, in this case to detect the presence of the seat occupant's head. Mounted between the headliner and vehicle roof, their Occupant Sensing System (OSS) is hidden from passengers. The capacitive sensors differentiate objects with different dielectric constants than air. The human body is about 80 times more conductive than air. Since other objects are significantly less conductive (or have a lower dielectric constant) than a human head, the system does not detect them, and the airbag is not

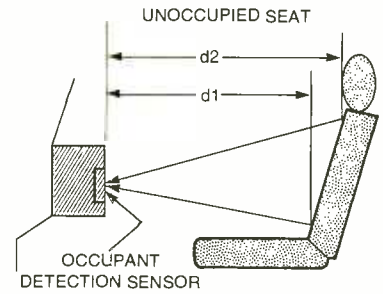


Fig. 2. In TEMIC's Occupant Detection Sensor, IR ranging techniques measure distances ($d1$ and $d2$) to an unoccupied seat, convert this measurement to pulses, and store data for reference.

PASSENGER AND CHILD SEAT DETECTION

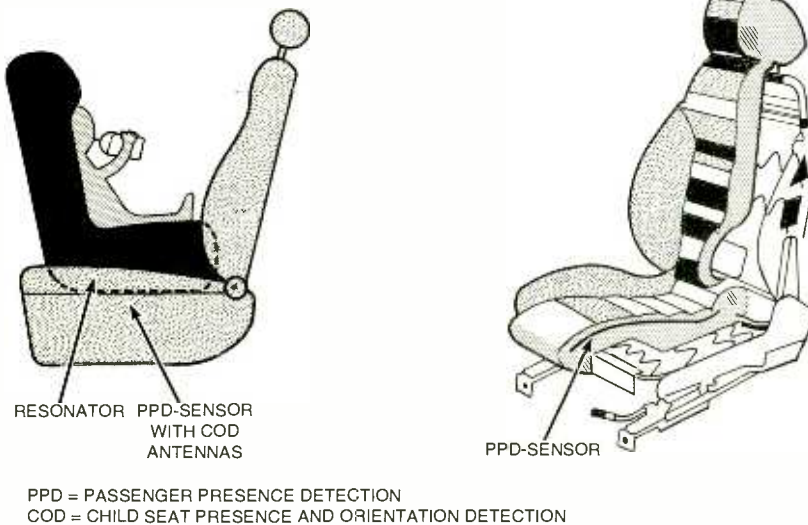


Fig. 1. Siemens Automotive uses a resonator installed in a special infant seat in its passenger and child seat detection system. This system determines not only if a baby seat is present, but also its orientation.

Intelligent Occupant Position Sensing System (IOPSS) mounted in front of each seating position. This system employs a ranging algorithm to determine distances. These distances indicate the nature of the object in the IR beam's path, such as a properly or improperly positioned human, an inanimate object, or a rear-facing child seat (illustrated in Figs. 2, 3, and 4).

Bosch Corporation's Automotive Occupancy Sensor (AOS) uses a capacitive sensing method that measures changes in capacitance if the seat is occupied. The passenger airbag is enabled for deployment at a threshold level of mea-

enabled. The system is not fooled, when, for example, the person is wearing a hat, wet clothing or sunglasses.

When an occupant is in the passenger seat, a signal is sent to the vehicle's Sensing Diagnostic Module (SDM) to enable the airbag and ready it for a crash should one occur. The "no occupant detected" signal is sent when a head is not detected, meaning an empty seat, an out-of-position passenger or a rear-facing child seat. The Breed system would now "look" for an object in the range of the initial bag deployment. If a rear-facing seat is detected, the system sends a dis-

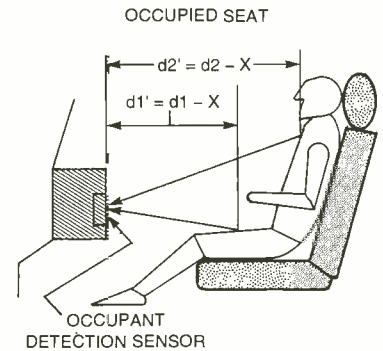


Fig. 3. A different set of measurement pulses ($d1'$ and $d2'$) are obtained and recorded for an occupied seat.

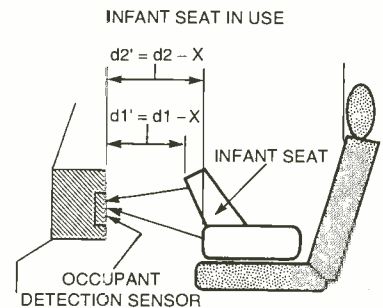


Fig. 4. A ranging algorithm using a measured set of pulse values determines if a passenger is present and/or positioned properly, if occupant is in a rear-facing child seat, or whether an inanimate object is in the seat.

able signal to the SDM to prevent the airbag from deploying.

NEC Automotive Electronics' Passenger Sensing System uses flexible copper tape sensors that transmit and receive a low-level electric field. Measured differences in field

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COMPUTER BITS

Continued from page 63

unexpected views of data. For example, viewing the Address Book from a folder-view provides a sequential listing (in a Notepad) of all entries in the address book. But if you expand the Address Book folder, all of its subfolders are the fields of the address book database (name, address, phone, and so on). Then, if you double click on a subfolder, you get a notepad view of the names of all the address book entries that have data in that field—but not the data itself. So if you double click on Home Phone, you get a list of every record that has a Home Phone entered, but not the numbers themselves. Why is that useful? Got me!

Thus Ecco suffers from an all-things-to-all-people mentality. It's tremendously flexible and powerful, but going beyond the basics is difficult and confusing. Nonetheless, the basics by themselves are plenty powerful. Ecco provides tight integration among the modules and a powerful cross-module search facility. You can also create your own databases, and columns (such as phone number) appear to be shareable across data-

bases. Now why is that useful?

The Envelope Please

If you haven't guessed, I have settled on Ecco (for the time being). It meets all my software requirements, and it talks to Pilot. As time goes on, I probably will learn how to put the advanced features to use.

Should I decide to go with another product in the future, I'm not worried about the prospect of having to transfer information. One thing I have learned in this exercise is that the overall quantity of data is relatively small. What took time and effort was figuring out what I wanted to track, gathering and entering the information, and developing an organizational scheme that works for me. That scheme continues to evolve. But Ecco (and any PIM worthy of the name) provides powerful tools for aiding that evolution—and side-stepping it when necessary.

Of the products I reviewed, *InfoSelect 3.0* is 16 bit, *Outlook 97* is 32 bit, and *Ecco Pro 4.0* comes in both flavors. Also, prior versions of both Ecco and InfoSelect are available from the respective vendors. In addition, Ecco and Outlook are multi-user programs that could be useful for scheduling meetings, sharing resources, and

VENDOR INFORMATION

The prices shown below are suggested retail prices.

Ecco Pro 4.0 (\$139), NetManage, 10725 North De Anza Blvd., Cupertino, CA 95014. Tel: 206-885-4272.

Web: <http://www.netmanage.com>

InfoSelect 3.0 (\$149.95), MicroLogic, P.O. box 70, Hackensack, NJ 07602. Tel: 800-342-5930, 201-342-6518.

Web: <http://www.miclog.com>

Outlook 97 (\$99.95), Microsoft Corp., One Microsoft Way, Redmond, WA 98052-6399. Tel: 206-882-8080. Web: <http://www.microsoft.com>

PalmPilot (\$299), **PalmPilot Pro** (\$399, includes built-in memory upgrade), (\$129, memory upgrade alone), (\$129, snap-on modem). U.S. Robotics, 1565 Charleston Road, Mountain View, CA 94043. Tel: 800-881-7256. Web: <http://www.usr.com/palm>

sharing common databases. All three suffer a dearth of documentation—what there is never provides a clear overview of the product and how its makers intended it to be used—that's one reason it is so hard to compare and contrast these products!

This was the first time I've written about PIMs. It won't be the last. ■

SCANNER SCENE

Continued from page 68

net Sierra," "Huntress," and "Northern Lights." Those tags are used by various U.S. Air Force air and ground stations. The "Dragnet" stations are E-3A AWACS aircraft out of Tinker Air Force Base in Oklahoma. "Huntress" is at Griffiss Air Force Base in Rome, New York, and is the identification of the North American Aerospace Defense Command (NORAD), Northeast Region Operations Control Center (ROCC). "Northern Lights" is the Northeast Air Intercept Control Center. Other ROCC identifiers that are often heard, depending upon where you live, include: "Oak Grove" in the Southeastern and Gulf states; "Goliath" in the Midwest and some Canadian areas; "Ringmaster" in the Central Plains states and parts of Western Canada; "Big Foot" in the Pacific, Northwest and British Columbia; and "Sierra Pete" in the Southeastern states.

NORAD communications are inter-

esting to monitor. They include the AWACS aircraft calling out the positions of unidentified aircraft ("bogies") they have detected, and then the F-16s rushing off to intercept these bogies to simulate the launching of missiles at them. Just practice, of course, but it sounds very eerie.

In addition to AWACS aircraft and F-16s in this band, you'll hear B-52s, flying tankers, transports, and numerous others flown by Air Force and Air Guard personnel. Dozens of frequencies are used by NORAD, each ROCC having its own assignments. A search across the band should reveal some in your area. NORAD's frequency—364.2 MHz, is known as the Air Intercept Control Common (AICC) channel and is active in all areas.

Digital Radio Broadcasts

Paul B., of Kentucky, writes that the satellite digital audio radio service (satellite DARS) is said to be on the way. He wants to know the frequency of the service and if it can be monitored on a scanner.

VENDOR INFORMATION

Mr. Scanner (\$35 plus shipping and handling and applicable state tax) MasterCard and Visa are accepted. CRB Research Books, Inc. P. O. Box 56 Commack, NY 11725-0056 Tel: 516-543-9169

No joy, Paul. Satellite DARS is going to operate in the S-band (2320 to 2345 MHz), beyond the coverage range of scanners. Although it will offer compact disc quality sound, transmissions will be (like the name says) "digital," and our scanners still can deal only with analog signals. However, popular-priced receivers for that service will surely be readily available to the public as soon as programming begins. The satellite DARS broadcast licenses are just now being issued by the FCC.

Keep us Posted

Please send scanner-related information to *Scanner Scene*, **Popular Electronics**, 500 Bi-County Blvd., Farmingdale, NY 11725. ■

TIME-OFF

Continued from page 39

to secure the timer to the enclosure. When the paint is dry, replace the button parts with tweezers and reassemble the case.

Depending upon how light a sleeper you are, you may find the clicking of RY2 to be too loud to sleep through. If so, mount its perforated board on a small block of foam with silicone cement. That way you can only hear the click if you are listening for it.

Using The Time-Off. With the controlled appliance plugged into the receptacle, set the timer by pressing the minutes and seconds buttons. Each time a button is pressed, RY2 will click and the time will increment by one digit. If the button is held down, the digits will cycle quickly. If both buttons are pressed

at the same time, the readout will reset to zero. Start the timing cycle by pressing S1. When the time cycle is complete, RY2 will click for about 30 seconds. The clicking can be stopped by pressing any of the timer buttons. A nice feature is the memory, which resets the timer to the last entered setting unless purposely reset to zero. If you set the timer to zero and start it with S1, the appliance will turn on and stay on while the timer counts up and not down. The unit will *not* turn off even after the count reaches 100 minutes (00-00).

At any time, pressing the minutes and seconds buttons simultaneously will shut off the appliance and reset the timer to zero. Avoid using that feature as an on/off switch with an appliance permanently connected to the unit, because relay RY1 is drawing about 15 mA all the time that the appliance is on. While that will not add appreciably to

your electric bill, it will cause a build-up of heat inside the enclosure. The enclosure does not take well to heat, and if left on long enough it may distort. If you want to permanently connect the Time-Off to an appliance, you can add another (heavy duty) switch in parallel with the set of RY1's contacts that control power to SO2. With the relays, RY1, not energized, the added switch will control the appliance in a normal fashion.

You can detach the power cords and use the timer as it was originally intended, as a portable stopwatch or countdown timer. The neon lamps won't operate, but the relay will still click to serve as an alarm.

It doesn't matter whether you use the unit with a sun lamp, a coffee maker, or for watching television in bed: after all, it's your life and what you choose to do with your Time-Off is entirely up to you. ■

ANTIQUÉ RADIO

Continued from page 60

tery sets. However, though this part has remained untouched for the better part of 75 years, it won't stay in place much longer (at least in its original form). It reads about 500,000 ohms on the ohmmeter. At first, I was surprised to find that the resistance had become *smaller* with age; somehow, intuitively, I would have expected it to *increase*. On reflection, though, I can see that moisture might have infiltrated the carbon composition of the resistor and caused the reduction.

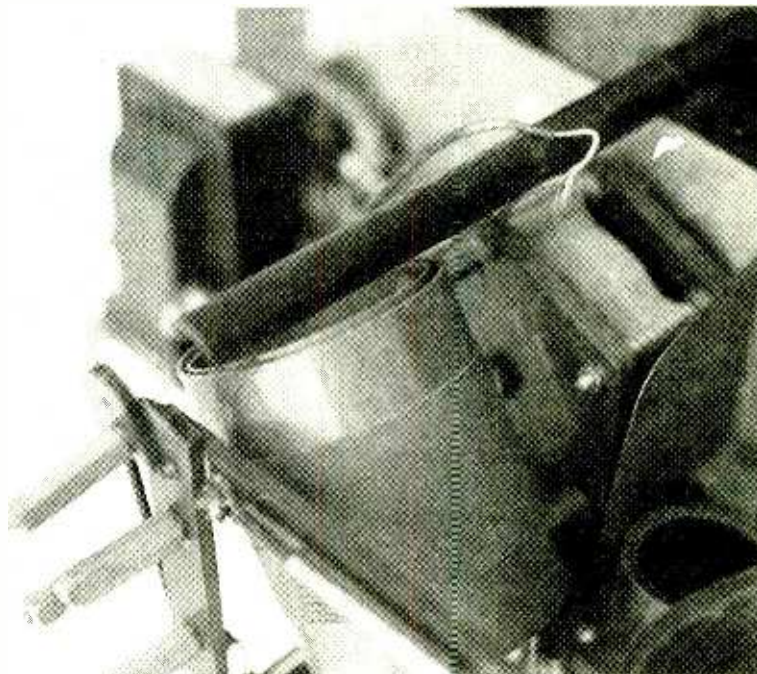
I might try carefully dismantling the grid leak and installing a modern 2 megohm resistor inside the glass tube. And I definitely plan to gut the metal-cased 1- μ F plate bypass capacitor and hide a modern unit within. I've run into enough of those babies to know that it is either open or reduced to a fraction of its rated capacity. The three or four smaller-capacity metal-and-mica sandwich units are likely okay, and I plan to accept them on faith. This is a solid bet!

That about brings you up to date on my observations on the NR-5, except for one thing. While tracing the wiring, I was surprised at the odd layout of the receiver stages. Everything proceeds in

an orderly manner from the antenna through the two stages of RF amplification, through the detector tube and the first audio transformer (the latter is seen at the extreme left of the behind-the-panel photograph). From there, the audio is routed *all the way across the set to the other end*, where the two stages of audio amplification and, of

course, the second audio transformer, are located. Maybe that was done to achieve a pleasing symmetrical positioning of the filament-control rheostats—or perhaps to balance out the weight of the two audio transformers—we'll never know!

More on the NR-5 project next month. ■



Close up of the broken vertical (binding-post) strut and support dowel. The tubular device on the horizontal strut is one of the neutralizing capacitors.

RADIO RESOURCES

continued from page 44

and informational documents to guide you. <http://dejanews.com>.

Tile.Net: Tile.Net is a comprehensive reference to Usenet newsgroups, and it also offers FTP site, mailing list, and vendor listings. <http://tile.net>.

Reference.COM: Reference.COM lets you search for information in thousands of Usenet newsgroups and mailing lists. <http://www.reference.com>.

One of the most difficult things to find is personal or business e-mail, telephone, address, and callsign finders, but a variety of e-mail finders have sprung up to meet this challenge. Here are a few:

Four11 and Switchboard: These customizable finders let you register and search for personal and business e-mail addresses, telephone numbers, addresses, etc. Switchboard is found at <http://www2.switchboard.com>; Four11 is at <http://www.Four11.com>.

The QRZ! Callsign Database: This radio amateur callsign database lets you search for calls and attach your e-mail address to your listing. <http://www.qrz.com>. Another callsign database, *Buckmaster's World Wide HamCall* server, has similar capabilities and is found at <http://www.buck.com>.

Callsign Servers: This Columbia University page is a linked list of all the online callsign servers where you can look up FCC amateur radio callsigns online for free. <http://www.columbia.edu/~fuat/cuarc/callsign-servers.html>.

What do you do when the directory, the index, or the finder you tried doesn't locate the information or resources you seek? Well, you can try both a directory or index and a searcher, to find information in contrasting ways; try a different directory, searcher, or finder; use a mega-searcher (like MetaCrawler); or just take a guess at a site's address. Some hints: Take the time to write down the Universal Resource Locators (URLs), or simply the addresses of interesting Web sites you find. Don't rely on your browser to save them. ■

PARALLEL-PORT RELAY

(Continued from page 49)

time and day matches the current time and day, that relay is ener-

be able to automate nearly any kind of electrical device. Obviously lights are a prime candidate, whether you want them on while you're away or on and waiting for you to arrive home. A custom

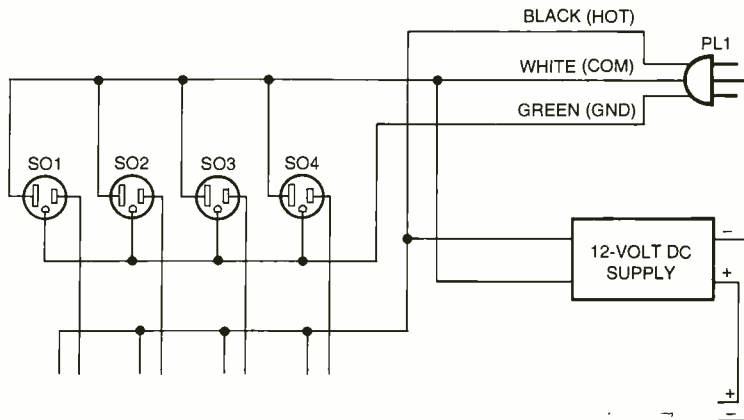


Fig. 5. This wiring diagram shows how the project can be wired to independently control four AC outlets (although the circuit can handle eight such sockets). That arrangement leaves four channels available for use as switches for things that don't need AC power. Note that a single AC line cord supplies power to all four outlets, as well feeding the 12-volt power source (used to operate the relays).

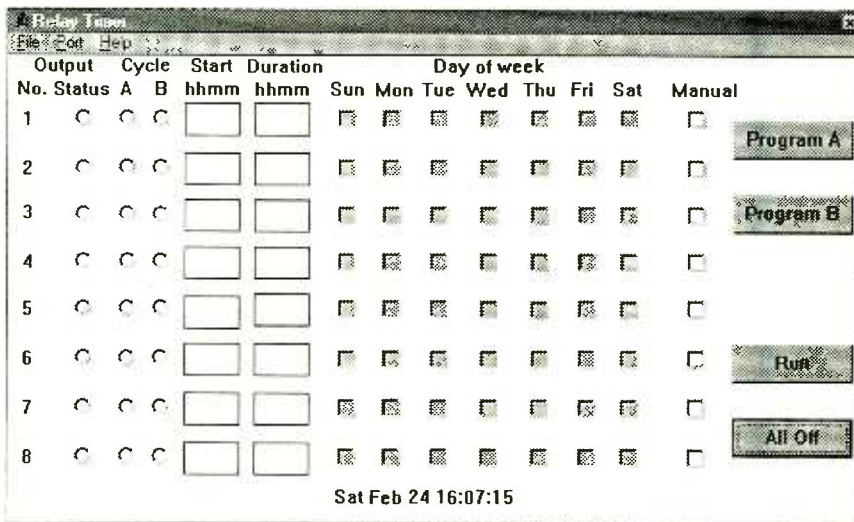


Fig. 6. This is the screen that pops up when the Windows version of the control software (which is included on diskette with the kit and is also posted on the Gernsback BBS at 516-293-2283). Though this control panel, the program can be set up to run two different timing routines (Program A and Program B) at the same time. See the text for details.

gized. The DOS software is a bit different, but the manual directions are easily understood.

Conclusion. You'll find that the PC Parallel Relay is a very convenient device to have around the house. With a bit of imagination, you should

Christmas light display is another idea. Other possibilities include the operation of ventilation equipment, pet feeders, and plant watering devices. Nearly anything is possible with the PC Parallel Port Relay, and you'll be the first one on your block to have a house of the future. ■

DX LISTENING

Continued from page 69

Electronics, 500 Bi-County Blvd., Farmingdale, NY 11735-3931.

Leo Evans, a regular reader of DX Listening, lives on the island of St. Lucia in the West Indies. Leo sent along a list of some of his recent SW loggings. "I hear Croatian R. on 5,895 kHz, at 0200 UTC. The program has a female announcer with news in English," Leo reports. "Spanish National R. can be heard on 6,055 kHz, at 0100 UTC or earlier with programs in English. RAI, Italy is heard with English news at 2206 UTC on 9,570 kHz."

Our West Indian monitor also hears R. Netherlands news about Holland on 6,030 kHz at 0000 UTC, and R. Sweden's regional news and weather at 0230 UTC on 6,195 kHz.

Chile Today

Juan Carrera writes from Orlando, FL, to say that he's a native of Chile, now living in the United States.

"I would like to hear on SW radio some stations of my homeland," he writes. "Can you suggest some times and frequencies that I should try?"

Four Chilean SW stations are reported active currently. They are:

R. Triunfal Evangelica, on nominal 5,825 kHz, broadcasting from 2100 to 0000 UTC, five days a week, with no broadcasts on Sunday and Thursday.

R. Santa Maria, on nominal 6,030

kHz, on the air Monday through Saturday, 0900 to 0300 UTC, and from 1000 UTC on Sunday.

R. Patagonia Chilena, broadcasting on 6,080 kHz, Monday through Saturday, 0930-0000 UTC; Sunday, 1000-0000 UTC.

R. Esperanza on 6,090 kHz, daily, 24 hours.

There's More

From Jim Smythe, Charleston, SC, comes this note, "I read recently that Mauritius, an island country in the Indian Ocean, is going to get a shortwave station. That sounds like real DX to me, if true."

Years ago, Jim, the Mauritius Broadcasting Corp. did broadcast on SW and it was, truly, a very nice catch for DXers. I understand that MBC has plans to get back on SW with a new 100-kilowatt transmitter. It is reported that a transmitter site has been purchased. The same announcement says that 9,710 kHz will be used during daylight hours; 4,855 kHz at night. The purpose is to promote economic trade with Mauritius.

Down the Dial

Looking for some listening targets. Give these a try.

ANGUILLA—6,090 kHz, Caribbean Beacon is the new religious broadcaster now on the air, though somewhat irregularly, during the evening hours.

BRAZIL—15,445 kHz, R. Bras has English programming at 1200 UTC.

Abbreviations

DX—distance, long distance reception
DXer—hobbyist seeking long-distance reception
GARC—Goddard Amateur Radio Club
kHz—kilohertz
LSB—lower sideband, single-sideband transmission mode
NASA—National Aeronautics and Space Administration
QSL(s)—postcard or letter communication verification
R.—Radio
SW—shortwave
SWL(s)—shortwave listener(s)
USB—upper sideband, single-sideband transmission mode
UTC—Coordinated Universal Time

Carnival music and a program called "Brazilian Panorama" have been noted. **GUATEMALA**—4,835 kHz, R. Tezulutlan is logged here around 0100 UTC and later with marimba music.

GUYANA—3,290 kHz, Guyana Broadcasting Corp. is heard shortly before 0600 UTC with popular songs and English identification.

VENEZUELA—5,000 kHz, YVTO is Venezuela's equivalent of the WWV time signal station,

with which it shares this frequency. This radio clock can be identified, usually through interference, by its Spanish language time-signal announcements.

ZIMBABWE—3,306 kHz, Zimbabwe Broadcasting Corp. has been reported around 0320 UTC, with *hifite* rhythms and talk in an African language. ■

SMART AIRBAGS

Continued from page 77

strength because of interference indicate an empty seat, a baby seat or an occupied seat. Special infant seats are not needed, and the system is not affected by light reflectivity, temperature, air quality, dust, or noise.

Occupant sensors could do more than just determine if the seat is occupied and whether the airbag should be deployed. One example is TRW's occupant sensing system that monitors the occupant's weight, distance from the airbag, and crash severity. The latter is determined from several factors including change in vehicle speed and seat-belt play-out. Using this

information, a microprocessor tailors the deployment of airbag to the size and weight of the individual by managing the volume of gas in the airbag as it deploys. It also pre-tensions the seat belt to position the occupant properly. Finally, it prevents airbag deployment should no one be occupying the seat, or if there is a rear-facing infant seat. This adds up to a more comfortable response, which absorbs energy more effectively, reduces the load on the occupant's head and neck, and optimizes the airbag protection.

Driver Responsibility. No matter the technique or system, ultimate reliability is paramount. The airbag must deploy when needed and not inflate when it could cause injury or death. The automobile dri-

ver must assume final responsibility for child protection. For automobiles equipped with passenger-side airbags, never install rear-facing child seats in this front seat. Seat belts and child seats must be used correctly. In the next few years, automobile child safety seats are planned that will be easier to install and "user-friendly".

According to the recommendations of the American Automobile Association (AAA), "The gadgets change, but the advice does not. Wear seat belts across the chest and lap, with no slack; children 12 and under should sit in the back seat; rear-facing seats must never go in the front seat; and, if a child must sit in the front, move the passenger seat as far back as possible, and be sure the belt is snug." ■

NEW PRODUCTS

Continued from page 16

HOME REMOTE CONTROLLERS

Have you ever sat down to watch a film on your VCR when you realized that you forgot to turn on the popcorn maker? Armed with Thomson Consumer Electronics' RCA Home Control System, you could push a button on a universal remote control and start popping that corn without leaving the comfort of your armchair. The system allows you to control lights and small appliances with the same remote you



use for your TV, VCR, and cable box.

The Home Control system consists of two main parts—a base and individual extensions. The base is plugged into one wall outlet while each appliance connects to an extension that is plugged into another outlet. Then the remote control sends a signal to the base that instructs the extension to turn the appliance on or off. The remote uses two transmitters: An infrared signal for home-entertainment gear, and an RF signal that works through walls and floors to control both inside and outside lights and appliances.

The Home Control starter kit, *Model HCKIT1*, includes a remote control and a base module that controls one appliance or incandescent lamp. The remote, whose electro-luminescent keypad gives off a bright blue glow, is programmed with universal TV, VCR, and cable codes. Also, the base can operate up to 16 different extensions (sold separately) that control incandescent lamps, lights, or appliances. Other accessories include a two-way wall switch that dims lights turned on and off from one location, a three-way wall switch that dims lights turned on and off from two locations, and a keychain

transmitter that can control two lights from outdoors within a 75-foot range.

The Home Control starter kit *Model HCKIT1* has a suggested retail price of \$59.95. Additional extensions have suggested retail prices from \$14.95 to \$19.95. For more information, contact Thomson Consumer Electronics, 2000 Clements Bridge Road, Deptford, NJ 08096.

CIRCLE 83 ON FREE INFORMATION CARD

HANDHELD DIGITAL MULTIMETER

Wavetek's *Model 85XT* is a high-resolution, 4-1/2-digit (± 1999 counts) digital multimeter with true-RMS measuring. Other measuring functions include frequency, duty cycle, diode test, and continuity. Accuracy is 0.05%.



The *Model 85XT* features automatic power-off, data hold/max hold, a continuity beeper, a low-battery indicator, and a spare fuse. Its 0.7-inch high display digits are the largest of any DMM in its class.

The *Model 85XT* digital multimeter costs \$179.95. For more information, contact Wavetek Corporation, 9045 Balboa Avenue, San Diego, CA 92123; Tel. 619-279-2200; Fax: 619-565-9558.

CIRCLE 84 ON FREE INFORMATION CARD

DC POWER SUPPLY

Protek's *Model 3005* is a compact, single-output DC power supply that covers an output range from 0 to 30 volts, at up to 5 amps. It offers precise current and voltage level settings. Two three-digit LED readouts allow simultaneous monitoring of voltage and current, plus an overload indicator. The instrument also



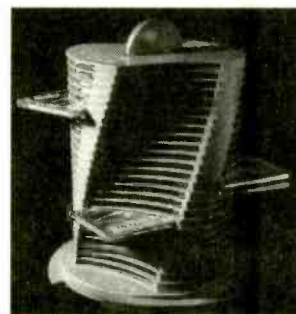
features a special "energy-saver" circuit design for cooler, more efficient operation. The *Model 3005* displays excellent line and load regulation as well as noise and ripple specifications. It is furnished with three five-way output binding posts, coarse and fine voltage controls, and a set of cables.

The *Model 3005* power supply costs \$367. For additional information, contact HC Protek, 154 Veterans Drive, Northvale, NJ 07647; Tel. 201-767-7242; Fax: 201-767-7343.

CIRCLE 85 ON FREE INFORMATION CARD

CD Storage with a Spin

For music lovers whose collections of CDs have gotten out of hand, the Memorex Vortex offers a stylish solution. The Vortex can hold up to 100 compact discs. It fits on a shelf or desktop and can be rotated for full access to CDs on all four sides. With a simple twist of its top, the Vortex transforms from a basic, vertical style to a spiral shape.



The Memorex Vortex has a suggested retail price of \$39.99. For additional information, contact Memtek Products, Inc., 10100 Pioneer Blvd., Suite 110, Santa Fe Springs, CA 90670; Tel: 310-906-2800; Fax: 310-906-2877.

CIRCLE 86 ON FREE INFORMATION CARD

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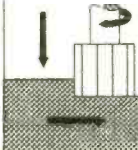
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Caller ID / RS-232

Connects between a telephone wall jack and an RS-232 serial port. Decodes the caller ID data sent over the phone line and sends it to your PC/Mac, in a pre-formatted ASCII character string. Create your own program to log the name, number, date, and time of all incoming calls. Block out unwanted callers to your BBS/modem. \$34.50

Telephone Call Restrictor

Connects to telephone wall jack. Disables all phones on the line if attempting to either: dial a number that has been stored in memory 'Block' mode or, dial a number that has not been stored in memory 'Allow' mode. Use touch-tone phone to enter telephone numbers into memory, and choose mode. Program from any phone on the line using your password. \$35.00

50 MHz Frequency Counter

Reads frequency from 1Hz to 50MHz and displays up to 7 digits on a 16x1 character LCD display. Auto-range feature provides floating decimal point and automatic placement of suffix (Hz, KHz, or MHz). Microcontroller based provides for very small parts count, only 2" x 3" big. \$48.50

Telephone Scrambler

Scrambles your voice before sending it over the telephone line. Prevent eavesdropping from an extension or tap. Connects between your telephone and wall jack. No modifications are required to your telephone. Full duplex operation. \$43.00

IR Remote Control Receiver

Learns and records the data patterns emitted by standard infrared remote controls used by TVs, VCRs, Stereos, etc. Lets you control all your electronic projects with your TV remote. Seven individual I/O pins can be assigned to any button on your remote, and can be configured for either 'toggle' or 'momentary' action. \$32.00

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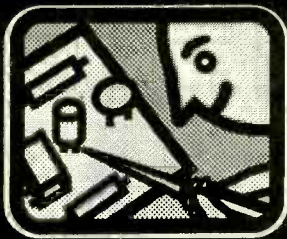
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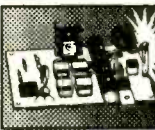
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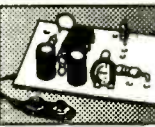
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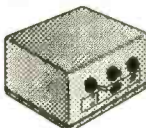
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Here is the solution! Just hook up the Phone Sleuth to your phone line, then at your leisure, down load the numbers called on your phones to your computer using the RS-232 Serial Interface Module unit. Keep track of the calls and no one but you will know the phone numbers are being monitored and stored. The Phone Sleuth saves every number dialed, even all local calls. Works great with scanners, voice mailbox, answering machines, modem access numbers and decodes tones stored on a tape recorder. It even records credit card numbers entered through your phone key pad. The Phone Sleuth can be used to record cellular or repeater phone numbers heard over your phone. Size: 1.6" H x 2.5" W x 3" D

• Decodes all DTMF Tones from 0 thru 9, #, *, A, B, C. • Stores the last 490 Digits it receives. • Information stored by the Phone Sleuth can be displayed on your computer, saved to a disk or sent to your printer, using our RS-232 Serial Interface unit. Power by 9v battery.

PNS-1 BUILT \$84.95 KIT \$64.95

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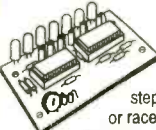


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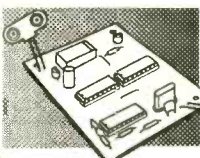
- Easy to operate.
- One push button programming.

To use your Phone Tone Genie unit in any capacity you must have a device which answers the phone line such as an answering machine. When the answering machine completes the connection, and the code is entered, the Phone Tone Genie takes over and performs the function it is designed to do.

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- Perhaps you need to Listen for any sounds in your house with the AA-1 Super Snooper Big Ear.
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PTG-1 BUILT \$139.95 KIT \$99.95
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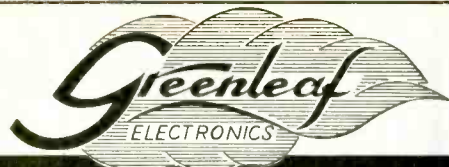
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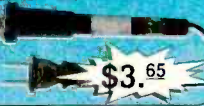
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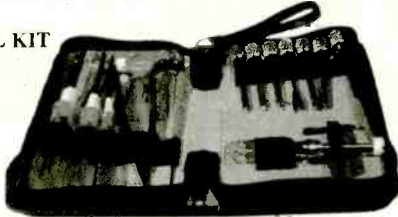
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- ◆ Limited availability. ◆ Net weight 9 lbs.
- ◆ Frequency response: 20-18KHz.



#PO-319-030 \$169⁹⁵ EACH

Home Theatre In-Floor Subwoofer

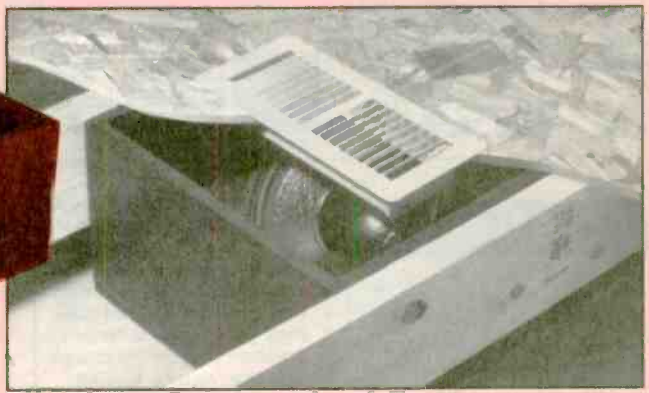
To fully appreciate the potential of movie soundtracks, a dual voice coil subwoofer is a must! Many film special effects are extremely demanding in the low frequency range and require a subwoofer that can duplicate explosions, earthquakes, even the footsteps of Tyrannosaurus Rex! This subwoofer fits the bill by featuring a 10" dual voice coil woofer for true stereo operation and high pass filters for your main speakers. The most unique feature of this subwoofer is the fact that it is designed to be mounted in between the floor joists in new and existing home constructions. Simply mount the in-floor sub to the joists and mount a heat register grill above opening in subwoofer front enclosure. The subwoofer is now totally out of view and ready to rumble! Includes detailed installation manual.



Specifications: 10" dual voice coil treated paper cone woofer with poly foam surround ◆Frequency response: 30-100 Hz ◆Nominal impedance: 8 ohms per coil ◆Power handling: 100 watts RMS channel/140 watts max ◆SPL: 89 dB 1W/1m ◆Dimensions: 27" C x 14-5/8" W x 9" H ◆Net weight: 29 lbs.

#PO-300-445 \$139⁹⁵ EACH

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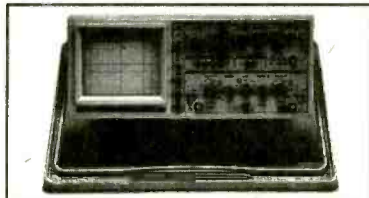
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- Burst Operation
- External 30 MHz Frequency Counter

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B + K Precision 1476 10 MHz \$229.00
Great Starter Scope!

Tektronix 465	100 MHz	\$599.00
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Tektronix 475	200 MHz	\$799.00
Tektronix 475A	250 MHz	\$899.00

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- 6 Month Warranty - The Longest Available!

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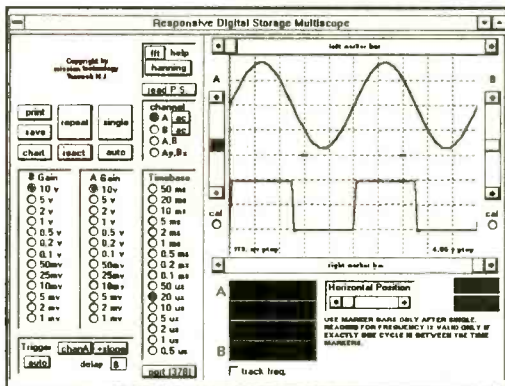
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FEATURES:

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Transmits continuous beep-beep-beep
Ideal for locating lost or stolen items
Range up to 1 mile

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- Ultra-miniature surface mount construction.
- E-Z kit approach makes assembly a snap.
- Miniature battery and holder will mount directly to the circuit board.
- Transmit to any scanner type receiver

BUG DETECTOR

XBD500 \$129.95



- Professional quality.
- Assembly is a snap.
- Covers 1 to 2,000MHz.
- Uses new Microwave Integrated Circuit amplifier.
- Adjustable sensitivity.
- Audio jack for privacy ear phone.

Any intercepted signal causes an audio tone that increases from a low pitched growl to a high pitched squeal as the signal strength increases.

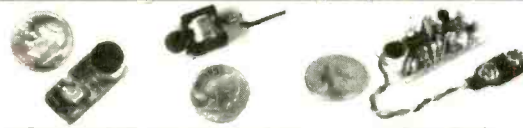
88-108 MHz FM RECEIVER

XMR2000 \$29.95

- Worlds smallest FM radio.
- As small as a hearing aid.
- Weighs less than 1/4 oz.
- Digital touch tuning.
- Ideal for use with our 88-108MHz FM transmitters



88-108 MHz FM TRANSMITTER KITS



XST 500EZ \$49.95 **XWB 1000EZ \$46.95** **XFM 100C \$21.95**



XSP 250EZ \$34.95 **XTR 100C \$29.95** **XTT 100C \$19.95**

XST 500 Voice transmitter. Range up to 1 mile. Supersensitive mic. Uses 9 volt battery. Uses surface mount components.

XWB 1000 Voice transmitter. Range up to 1/2 mile. Includes mic and battery on circuit board. Uses surface mount components.

XFM 100 Voice transmitter. Range up to 1 mile. 9 v battery and leaded components.

XSP 250 Super-miniature telephone transmitter. Range 1/4 mile. Powered by phone line. Uses surface mount component.

XTR 100 Tracking transmitter. Range up to 1 mile. Uses 9 volt battery. Transmits a BEEP - BEEP tone

XTT 100 Telephone transmitter. Range up to 1 mile. Uses 9 volt battery.

NEW!!

XPC 200 PIN HOLE CAMERA 400 LINE RESOLUTION

- Audio and Video outputs.
- See entire room through pin sized hole.
- Use with any TV or VCR with audio & video input connectors.
- Other models available.

Assembled \$169.95



XVS100 TV TRANSMITTER

- Use with XVC200, VCR, Camcorder, etc.
- Power cube included.
- Uses VHF TV Band.
- Transmits video & audio.
- Up to 100 foot range.

E-Z Kit \$29.95

**"THE ENFORCER!"
NEW!**

XXE-1000
as a kit \$39.95
assembled \$49.95

Use it to test radar detectors in other cars from your own vehicle! 10.450 to 10.550 GHz hand held transmitter. Extra high output level. Includes an input connector for keyed amateur band operation.



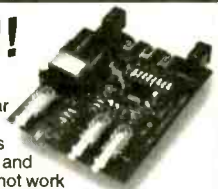
PHONE VOICE CHANGER KIT

16 levels of digital voice changing. Sound tougher, older or younger, female or male.

NEW!!

Works with regular or multi-line phones. Connects between handset and phone. Note: will not work with cordless or cellular type telephones.

XVC-2005C \$59.95



XANDI ADVANCED HOBBY KITS

XPS 1000C \$55.95

TELEPHONE SNOOP KIT

- Dial home from anywhere and hear inside your home.
- TouchTone coded for secure operation.
- Stop burglars and intruders.
- Reliable 24 hour protection.



XLC 900C \$49.95

SCANNER CONVERTER KIT(800-950MHz)

- Uninterrupted coverage of the 800 to 950 MHz band!
- Works with any 400-550MHz scanner.
- Gain: 6 dB typical.
- Noise figure: 3 dB typical.



XVA 250C \$49.95

VOICE-STRESS ANALYZER KIT

- See at a glance if your being lied to!
- Subject need not be present. Works with voices from recordings, TV or radio.
- Has built-in microphone.
- Easy to use LED display output.



XFS 108C \$39.95

88-108 MHz FM STEREO TRANSMITTER KIT

- Separate level control for both left and right channels.
- Output level circuit with test points for quick and easy tuning.
- Transmit from any stereo audio source to most any FM stereo receiver.



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Don't let the price fool you. This meter is a digital multimeter designed for engineers and hobbyists. Equipped with 5 functions and 19 ranges. Each test position is quickly and easily selected with a simple turn of the FUNCTION/RANGE selector rotary switch.

Rubber Boot Included

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 (NEDA1604)

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

200V 100mV

1000V 1V

Maximum Allowable Input: 1000V DC or Peak AC

DC Current (DCA)

Range: Resolution: Accuracy:

200µA 100nA

2000µA 1µA

20mA 20µA

200mA 100µA

10A 10mA

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

AC Voltage (ACV)

Range: Resolution: Accuracy:

200V 100mV

750V 1V

Frequency Range: 45Hz-450Hz

Maximum Allowable Input: 750V rms

Response: Average Responding. Calibrated in rms of a Sine Wave



Our Best Offer Ever on a

High Quality Full Sized DMM

\$19.00 any qty

Resistance (Ω)

Range: Resolution: Accuracy:

200Ω 100mΩ

2000Ω 1Ω

20KΩ 10Ω

200KΩ 100Ω

2000KΩ 1KΩ

20MΩ 10KΩ

Maximum Open Circuit Voltage: 2.8V

Diode Test

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

ohFE 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.

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

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.

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



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

CAT NO	DESCRIPTION	PRICE EACH		
		1	10	50
PP101	100mm x 150mm/3.91" x 5.91"	\$2.55	\$1.90	\$1.70
PP114	114mm x 165mm/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
PP1212	305mm x 305mm/12" x 12" NEW!	12.78	10.65	8.52

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

CAT NO	DESCRIPTION	PRICE EACH		
		1	10	50
GS101	100mm x 150mm/3.91" x 5.91"	\$ 3.90	\$2.98	\$2.60
GS114	114mm x 165mm/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
GS1212	305mm x 305mm/12" x 12" NEW!	18.88	15.73	12.59

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

CAT NO	DESCRIPTION	PRICE EACH		
		1	10	50
GD101	100mm x 150mm/3.91" x 5.91"	\$ 5.07	\$3.68	\$3.38
GD114	114mm x 165mm/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
GD1212	305mm x 305mm/12" x 12" NEW!	22.09	18.35	14.68



Developer This product is used as the developer on our positive photo-resist printed circuit boards. Includes instructions. 50 gram package, mixes with water, makes 1 quart.

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

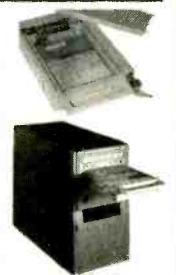


Etching Tank This handy etching system will handle PC boards up to 8" x 9", two at a time. Ideal for etching your PCB's! System includes an air pump for etchant agitation, a thermostatically controlled heater for keeping etchant at optimum temperature and a tank that holds 1.35 gallons of etchant. A 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!

CAT NO	DESCRIPTION	PRICE

Removeable Hard Drive Racks

The ideal solution for protecting highly sensitive data. Or, buy one computer and allow individual users to keep their hard drive with their own applications and set-ups. Just turn the system off, lift the handle and the hard drive pops right out. Key lock included to avoid accidental or unauthorized removal. Includes hard drive activity LED's. Rack includes mounting hardware, keylock, front panel LED, convenient pull out handle. Made from high impact ABS plastic. Fits in 5.25" bay.



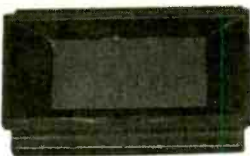
Features: • Ideal for Hard Drive Portability • Solve Software Data Security Issues • Carry Your Hard Drive Between Home and Office • Each User Can Have His or Her Personal Hard Drive

CAT NO	DESCRIPTION	PRICE
SpecialHDRACK-IDE	For IDE Hard Drive	\$14.95

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Digital Panel Meters (LCD & LED)

Don't let the prices fool you. These digital panel meters are not surplus, so even if you design them into an ongoing manufactured product, you can be assured of continued availability. These high quality digital panel meters are decimal point selectable with guaranteed zero reading at zero volts input.



3-1/2 Digit LCD 3-1/2 Digit LED 4-1/2 Digit LCD

PM-328: 4-1/2D LCD Digital Panel Meter

Features

- 200.00mV Full Scale Input Sensitivity
- Single 9V DC Operation
- Decimal Point Selectable
- 11mm LCD Figure Height
- Automatic Polarity Indication
- Low Battery Detection and Indication
- High Input Impedance (>100 Mohm)

Applications Include:

- Voltmeter
- Thermometer
- pH Meter
- dB Meter
- Watt Meter
- Current Meter
- Capacitance Meter
- LUX Meter
- LCR Meter
- Other Industrial & Domestic Uses

PM-128: 3-1/2D LCD Digital Panel Meter

PM-129: 3-1/2D LED Digital Panel Meter

Features

- 200mV Full Scale Input Sensitivity
- PM-128 - Single 9VDC Operation
- PM-129 - Single 9VDC Operation
- Decimal Point Selectable
- PM-128 - 13mm Figure Height
- Automatic Polarity Indication
- Guaranteed Zero Reading for 0 Volt Input
- High Input Impedance (>100Mohm)

Specifications - PM-128/PM-129

Maximum Input	: 199.9mV DC
Maximum Display	: 1999 counts (3-1/2 Digits)
Indication Method	: PM-128 - LCD Display PM-129 - LED Display
Measuring Method	: Dual-Slope Integration A/D Converter System
Overrange Indication	: "1" Shown in the Display
Reading Rate Time	: 2-3 Readings per sec.
Input Impedance	: >100 Mohm
Accuracy	: +/-0.5% (23+5°C, <80% RH)
Power Dissipation	: PM-128 - 1mA DC PM-129 - 60mA DC
Decimal Point	: Selectable w/Wire Jumper
Supply Voltage	: PM-128 - 9V DC PM-129 - 9V DC
Size	: 67mm x 44mm

Specifications - PM-328

Maximum Input	: 199.99mV DC
Maximum Display	: 19999 counts (4-1/2 Digits)
Indication Method	: LCD Display
Overrange Indication	: "1" Shown in the Display
Input Impedance	: >100 Mohm
Accuracy	: +/-0.05% (23+5°C, <80% RH)
Power Dissipation	: 1mA DC
Decimal Point	: Selectable w/Wire Jumper
Supply Voltage	: 9V DC
Size	: 67mm x 44mm

AS LOW AS \$5.25 ea.

CAT NO	DESCRIPTION	PRICE EACH				
		1	10	25	100	250
PM-128	3-1/2 Digit LCD Panel Meter	\$ 9.90	\$ 7.09	\$ 6.40	\$ 5.86	\$ 5.25
PM-129	3-1/2 Digit LED Panel Meter	11.49	9.54	8.67	7.95	6.95
PM-328	4-1/2 Digit LCD Panel Meter	19.88	16.40	14.90	13.66	11.93



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 ₂ O)	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

- SOLDER • SOLDER • SOLDER
- SOLDER • SOLDER • SOLDER

Westock 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.

Tired of Paying Inflated Prices for Solder?

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

CAT NO	DESCRIPTION	PRICE EACH	
		1	5
CA-H34A	PCB Mounted IRCCD Camera	\$99.00	\$85.00
A34	Power Supply Regulating Kit	\$6.95	

CCD Camera - IR Responsive

As Low As \$85!!

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 connecting three wires: red to 12V, black to ground (power & video) and brown to video signal output.



Power Supply Regulating Kit for CA-H34

This simple kit is designed to fit onto the back of the CA-H34 CCD camera. It resolves the problem of hooking up the camera to an UNREGULATED supply (which damages the camera) by providing safe regulated power from any 12V-14V DC supply. It also provides regulated 12V DC from a 12V AC source.

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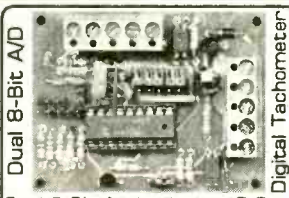
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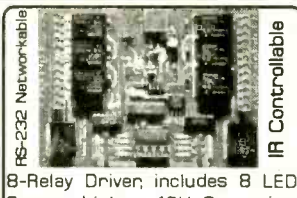
NCD, Box 384, Osceola, MO 64776



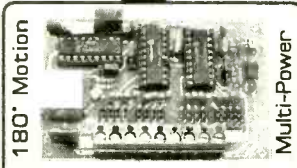
High-Power DC Motor Controller: 9-12 Volt Operation for Motors Up to 4 Amps. Forward/Reverse 64 Speeds. With Infrared Receiver. Hexfet H-Bridge Driver stage.
NCD-M1 Kit \$89 Asm \$149



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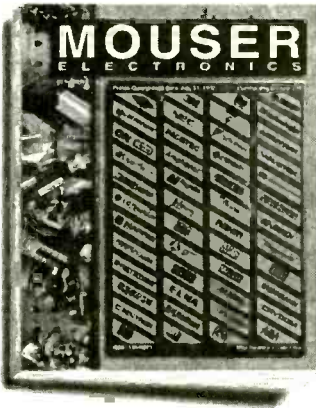


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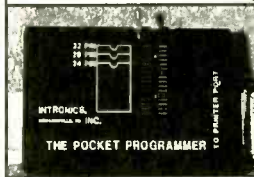
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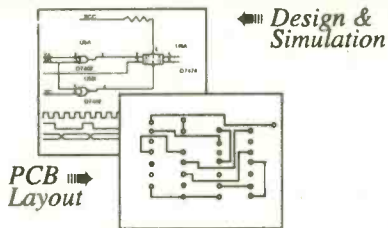
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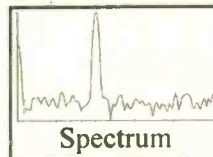
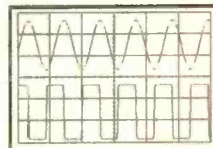


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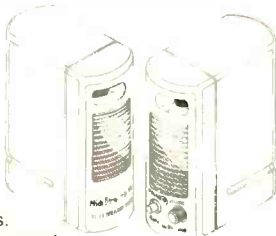
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\$4.50 each

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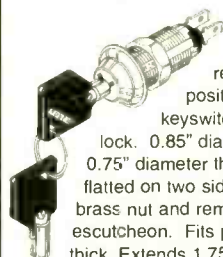


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\$2.00 each

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200 for \$320.00

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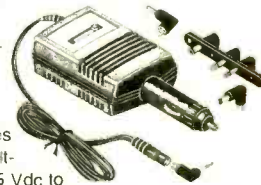


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We cannot bill for classified ads. **PAYMENT IN FULL MUST ACCOMPANY YOUR ORDER.** We do permit repeat ads or multiple ads in the same issue, but, in all cases, full payment must accompany your order.

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

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Our classified ad rate is \$1.75 per word. Minimum charge is \$26.25 per ad per insertion (15 words). Any words that you want set in bold are each .40 extra. Indicate bold words by underlining. Words normally written in all caps and accepted abbreviations are not charged anything additional. State abbreviations must be post office 2-letter abbreviations. A phone number is one word.

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

For firms or individuals offering Commercial products or Services. **Minimum 15 Words.** 5% discount for same ad in 6 issues within one year; 10% discount for same ad in 12 issues. **Sorry, no discounts on credit-card orders. Boldface (not available as all caps), add .40 per word additional. Entire ad in boldface, add 20%. Tint screen behind entire ad, add 25%. Tint screen plus all boldface ad, add 45%. Expanded type ad, add \$2.25 per word.**

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

DEADLINES

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

CONTENT

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

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190 - Cable TV	360 - Education	540 - Music & Accessories	710 - Telephone
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9 - \$26.25	10 - \$26.25	11 - \$26.25	12 - \$26.25	37 - \$64.75	38 - \$66.50	39 - \$68.25	40 - \$70.00
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			FLUKE DMM <table border="1"> <tr> <th>Hand Held</th> <th>Scope Meter</th> </tr> <tr> <td>12 \$ 84.95</td> <td>92B \$ 1,399</td> </tr> <tr> <td>70-II \$ 75.95</td> <td>96B \$ 1,699</td> </tr> <tr> <td>73-II \$ 97.95</td> <td>99B \$ 1,999</td> </tr> <tr> <td>75-II \$ 129.00</td> <td>105B \$ 2,499</td> </tr> <tr> <td>76-II \$ 175.00</td> <td>863E \$ 469</td> </tr> <tr> <td>77-II \$ 155.00</td> <td>867E \$ 659</td> </tr> <tr> <td>79/29-II \$ 175.00</td> <td></td> </tr> <tr> <td>87 \$ 287.00</td> <td></td> </tr> </table>	Hand Held	Scope Meter	12 \$ 84.95	92B \$ 1,399	70-II \$ 75.95	96B \$ 1,699	73-II \$ 97.95	99B \$ 1,999	75-II \$ 129.00	105B \$ 2,499	76-II \$ 175.00	863E \$ 469	77-II \$ 155.00	867E \$ 659	79/29-II \$ 175.00		87 \$ 287.00		SPECIALTY <table border="1"> <tr> <td>• Sound meter \$169.95</td> <td>• Watt Meter \$129.95</td> </tr> <tr> <td>• EMF Tester \$69.95</td> <td>• High Voltage Probe \$59.95</td> </tr> <tr> <td>• Conductivity \$169.95</td> <td>• pH Meter \$79.95</td> </tr> <tr> <td>• Thermometer \$69.95-\$89.95</td> <td>• Light Meter \$80-\$90</td> </tr> <tr> <td>• Humid./Temp meter \$169.95</td> <td>• Light Adapter \$49.95</td> </tr> <tr> <td>• Press. meter \$299.95</td> <td>• Anemometer \$179.95</td> </tr> <tr> <td>• Electr. scale \$89.95</td> <td>• Anemometer adapter (And More) \$89.95</td> </tr> </table>	• Sound meter \$169.95	• Watt Meter \$129.95	• EMF Tester \$69.95	• High Voltage Probe \$59.95	• Conductivity \$169.95	• pH Meter \$79.95	• Thermometer \$69.95-\$89.95	• Light Meter \$80-\$90	• Humid./Temp meter \$169.95	• Light Adapter \$49.95	• Press. meter \$299.95	• Anemometer \$179.95
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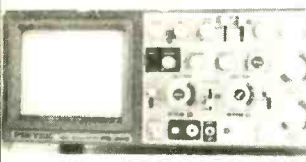
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Digital Scope

- DS-303 30MHz Digital, 20 Samples/sec \$849.95
- DS-303P RS-232 interface, 30Mhz \$1,049.95

Scope Probe:

- HP-9060 (60MHz) \$15, HP-9150 (150MHz) \$22, HP-9250 (250MHz) \$29, HP-9258 (250MHz, 100:1) \$39



AUDIO/RF/FUNCT. GENERATOR

RF Generator


- SG-4160 (\$124.95) 100kHz-150MHz sinewaves in 8 ranges, 100mV at 35MHz
- SG-4162 (\$229.95): Generate same signal as SG-4160, but with int. counter (150MHz).

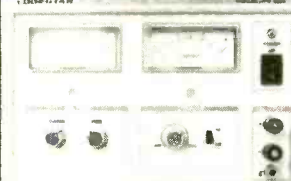
Audio Generator

- AG-2601 (\$124.95) 10Hz-1MHz, 0-8Vpp sine, 0-10Vpp squarewave
- AG-2603 (\$229.95): Same as AG-2601, but with additional counter and digital display.

Function Generator


- FG-2100A (\$169.95) 2Hz-2MHz, 5mV-20Vpp
- FG-2102AD (\$229.95) same as FG-2100A, but with int. counter and TTL, CMOS output
- FG-2103 (\$329.95) Sweep 0.5Hz-5MHz, linear/log, VCG, GCV, and int. counter



POWER SUPPLIES	Single Output DC Power Supplies	Dual Tracking	Triple Output
	<ul style="list-style-type: none"> • Short Circuit and overload protected • Constant current, constant voltage mode • 0.02%+2mV line regulation; 0.02%+2mV load regulate <p>Analog Meters Display</p> <ul style="list-style-type: none"> PS-303 (\$159.00) 30V/3A PS-305 (\$219.95) 30V/5A PS-8110 (\$289.95) 60V/5A PS-8112 (\$399.95) 60V/5A PS-1610 (\$289.00) 16V/10A PS-8107 (\$399.95) 30V/10A <p>Digital Voltage, Analog Current</p> <ul style="list-style-type: none"> PS-8200 (\$179.95) 30V/3A PS-8201 (\$239.95) 30V/5A <p>Digital Volt & Current Display</p> <ul style="list-style-type: none"> PS-8300 (\$199.95) 30V/3A PS-8301 (\$259.95) 30V/5A 	<ul style="list-style-type: none"> • Short Circuit & overload protected • Constant current & constant mode • Independent or Tracking <p>Dual Tracking (Analog V & I Displays)</p> <ul style="list-style-type: none"> PS-303D (\$314.95) 30V/3A/30V/3A PS-305D (\$399.95) 30V/5A/30V/5A PS-8108 (\$549.95) 60V/3A/60V/3A PS-8109 (\$699.95) 60V/5A/60V/5A 	<ul style="list-style-type: none"> • One fixed 5VDC, 3 Amp output • Parallel to double current output (PS-8102 & PS-8103 only) <p>Triple Output (Analog displays)</p> <ul style="list-style-type: none"> PS-8102 (\$399.95) 30V/3A/30V/3A PS-8103 (\$489.95) 30V/5A/30V/5A <p>Digital Displays</p> <ul style="list-style-type: none"> PS-8202 (\$499.95) 30V/3A/30V/3A PS-8203 (\$549.95) 30V/5A/30V/5A

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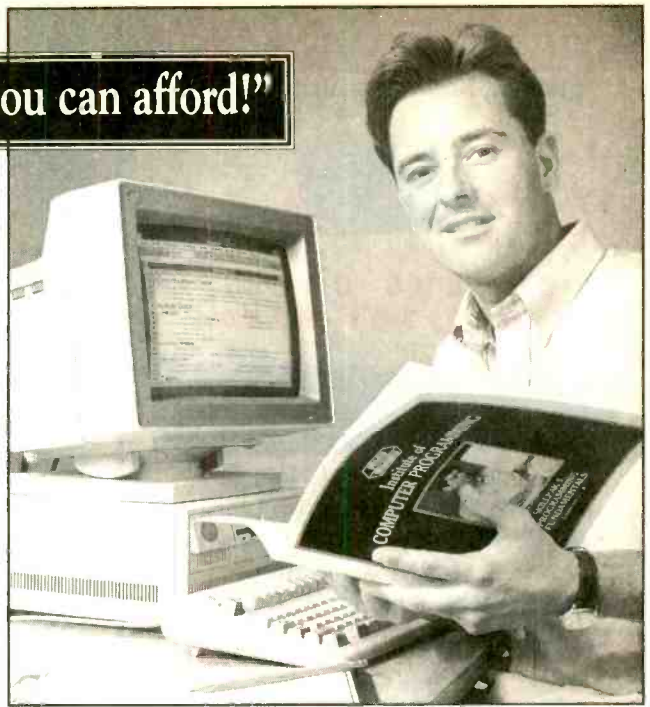
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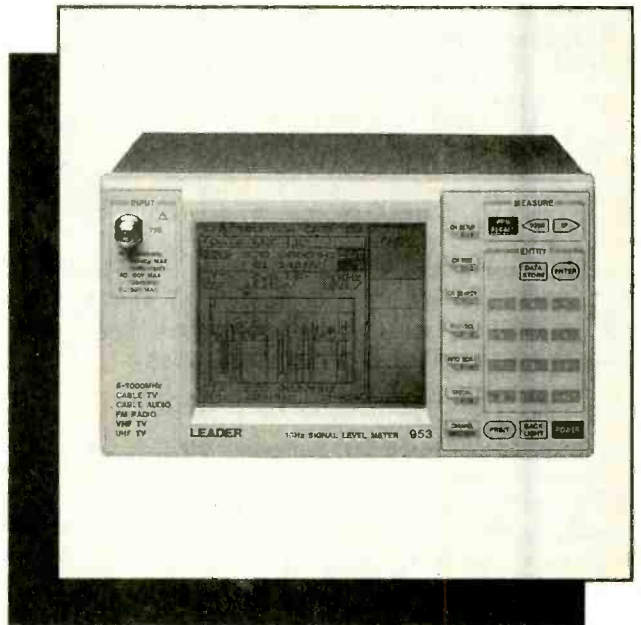
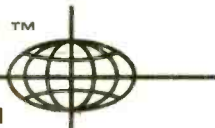
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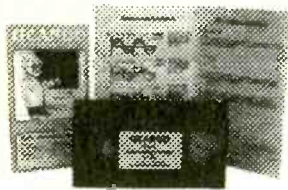


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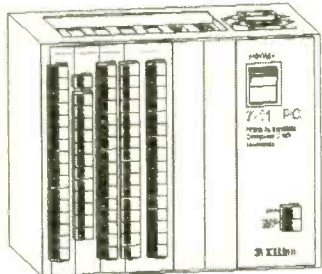


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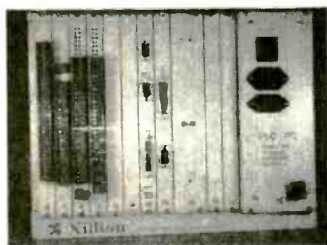
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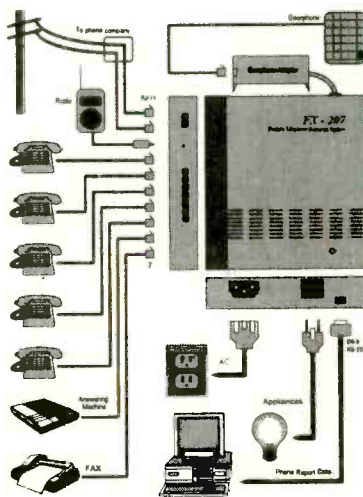
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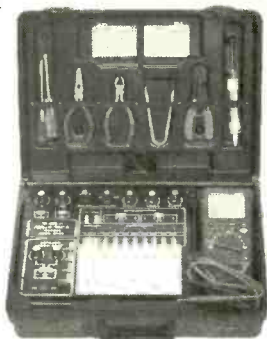
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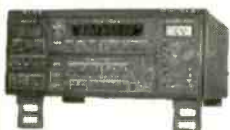
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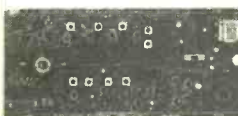
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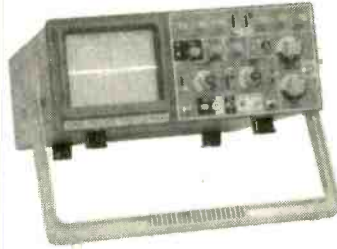
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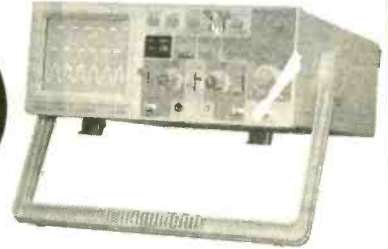
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Model	Bandwidth MHz	Sensitivity (max)	No. of Channels	Sweep Rate Max ns/div	Delayed Sweep	Video Sync	Component Tester	Beam Find	Time Base
S-1360	60	1mV/div	2	10ns/div	Yes	Yes	Yes	Yes	2
S-1345	40	1mV/div	2	10ns/div	Yes	Yes	Yes	Yes	2
S-1340	40	1mV/div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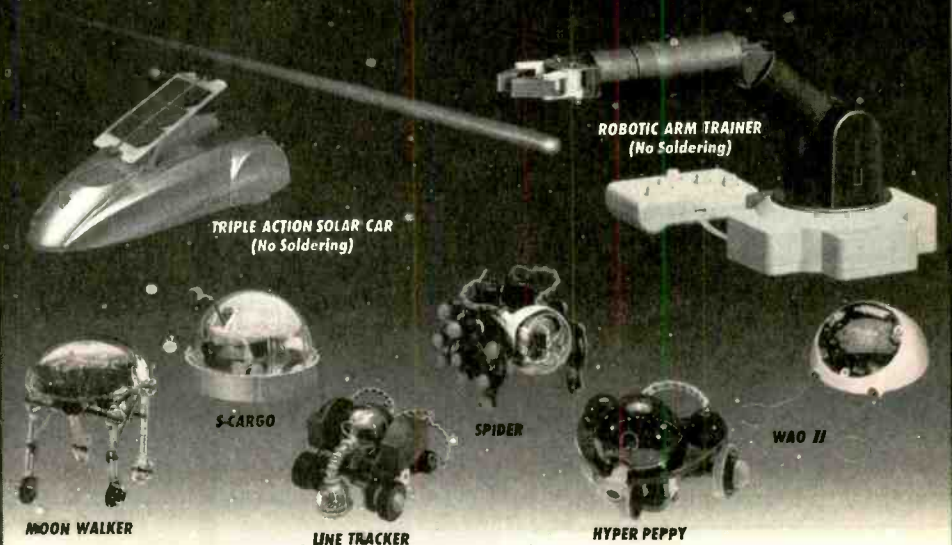


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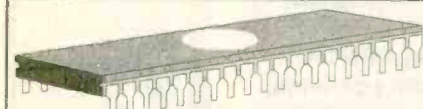
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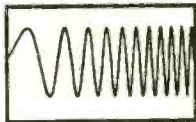
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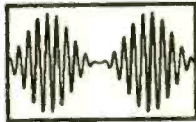
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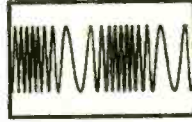
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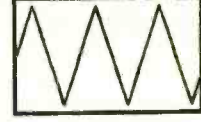
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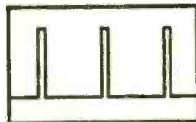
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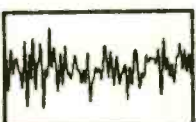
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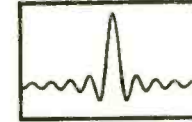
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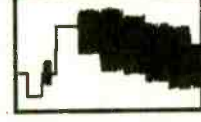
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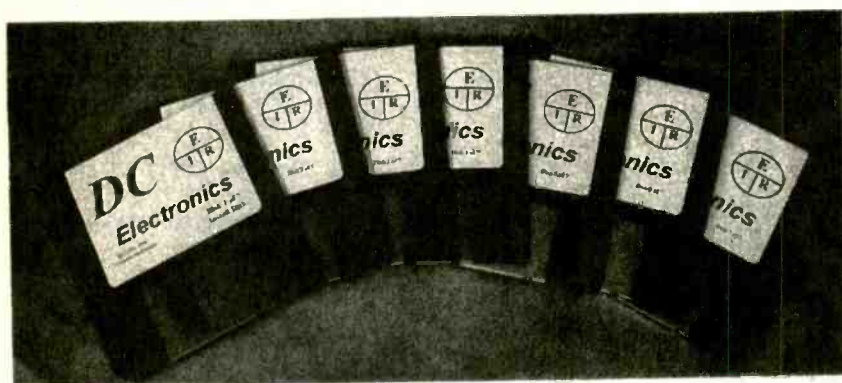
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Press the Tow button and your emergency roadside service will be dispatched to tow your automobile.

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.



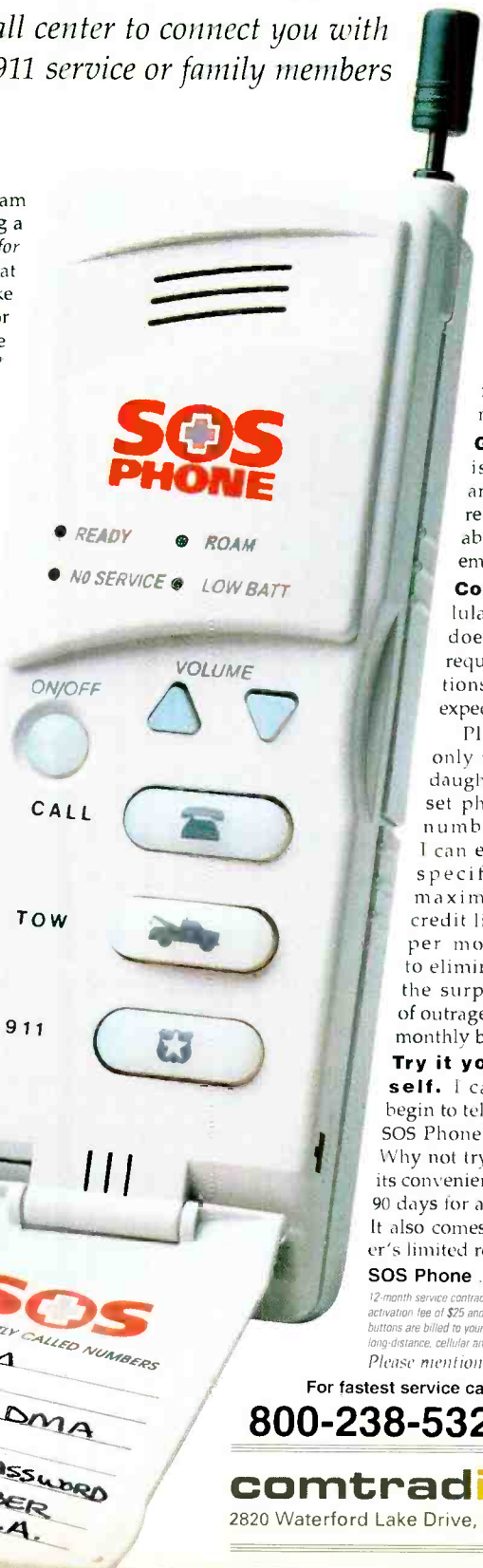
The 911 button will connect you to 911 police or other emergency services, and the call is absolutely free!

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

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.



my husband that the kids and I are running late, I can! By pressing the "call" 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.

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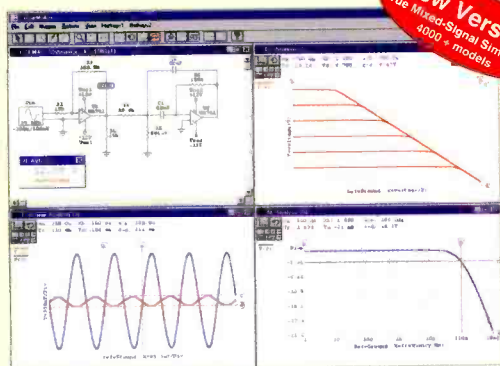
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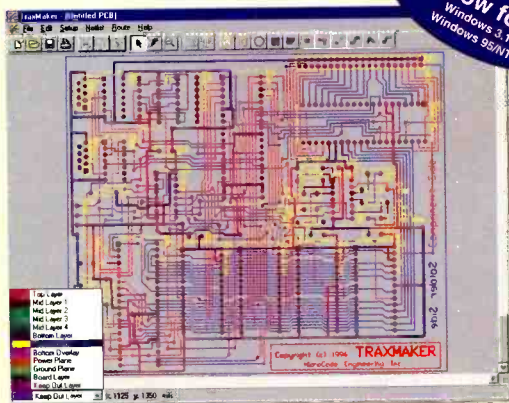
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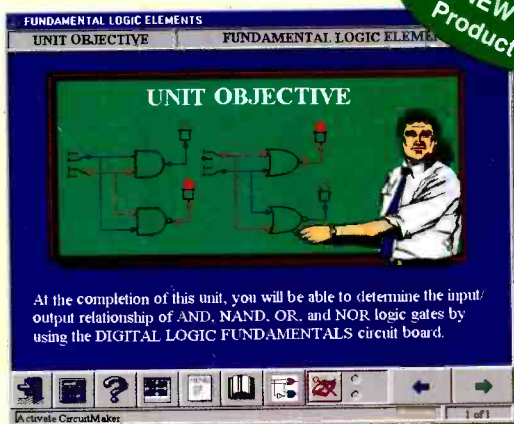
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