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PEACE ON EARTH

In the space of little more than a week, nearly 75 years of Communist rule was swept away in the Soviet Union. This second Russian revolution was made possible by the courage of the people in that country, but it is important to recognize the role that technology played, and how things might have been different if the coup leaders had realized the many paths of communications now available to their country's citizens.

By failing at first to completely control their nation's electronic media, the coup leaders allowed the country to see the acts of defiance at the Russian Parliament of Boris Yeltsen, and others. Eventually, of course, most of the TV and radio stations, as well as the print media, were either silenced or brought into line.

However, an underground electronic network of fax machines and computer bulletin boards, which allowed uncensored news and information to speed across the country and around the world, was never silenced. Those continued to operate throughout the coup, and helped rally the opposition that eventually caused it to fail.

As this is being written, the Soviet Union as we've known it has apparently ceased to exist. The form and character of the entity or entities that replace it is still to be determined. Because of that, and because of the power vacuum that now exists, these may be among the most dangerous times in the history of the World.

However, these are also exciting and hopeful times. While we can't be sure how events will ultimately play out, there is at least a chance that mankind's dreams of "Peace on Earth" may be a little closer to coming true. As we enter this holiday season, I can't think of a better gift for all of humanity.

Carl Laron
Editor
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DECEMBER 1991
A HAPPY E.E. STUDENT

I am an Electrical Engineering student in my senior year. I would like to thank Harry L. Trietley for his fine article titled “What Do Electrical Engineers Do?” (Popular Electronics, September 1991). That article gave me a better understanding of what I might be doing as an engineer. It also helped me to choose the department where I would prefer to work (design, production, research, etc.). I feel that every E.E. student should read the article. It gave a very clear picture of what’s coming after college. A very instructive article, indeed.

P.N.
Bronx, NY

AN UNHAPPY SUBSCRIBER

I have just received my first subscription issue of Popular Electronics (September 1991), and I am already disgusted by the amount of space devoted to computers. If I had wanted computer information, I would have subscribed to a computer magazine instead. In the Letters column, you promised A.L.M. of Honolulu that you would not expand computer coverage. Yet on page 26, there’s a feature article on the Macintosh. Get with it on electronics—not computers, please!

W.T.G.
Baton Rouge, LA

AND... A HAPPY NEW SUBSCRIBER

I recently discovered Popular Electronics and was immediately drawn to it, especially because of the simple layman’s language used. Although I have no formal science background, I understood the content of most of the articles perfectly.

At present, I work at a television station as a presenter and producer. I recently had the urge to get behind the camera, and I want to understand the electronic intricacies I also want to get into computers. So coming across Popular Electronics was a godsend. I intend to start subscribing to your magazine right away.

B.A.
Ogun State, Nigeria

NOT-SO-SIMPLE LASER POWER SUPPLY

Looking at the schematic for the “Simple Laser Power Supply” (Popular Electronics, September 1991), there seems to be something missing. What supplies base drive to the power transistor (Q2)? I see nothing to do that in either the schematic or the PC-board layout. Thinking that perhaps I was missing something, I built the PC board and circuit anyway. When I tried the board combined with the coil, there was no “whine,” and looking with a scope showed, as I suspected, that the base of Q2 was not toggling. To fix the circuit I put a 330-ohm resistor from +6V to the base of Q2. That made the supply operate as advertised.

T.M.
Sherman, TX

The circuit as published suffers from a design error. However, despite that, an assembly error by the author allowed the submitted prototype to work; the 2N2222 (Q1) was installed backwards, an error that was carried through to the parts-placement guide. When Q1 is installed that way, Q2 is driven directly by the 555 through Q1’s base-emitter junction. Assuming Q1 is installed correctly (as shown in the schematic), your fix is one of several that will allow proper operation. You could also eliminate Q1 altogether and tie the R3/C3 junction directly to Q2’s base. We apologize for any inconvenience this error has caused.—Editor

TAKING THE INITIATIVE

A letter called “Electro Guard Installation” (Popular Electronics, September 1991) really made me angry. The idea that it takes some sort of credential to install a domestic fuse box or attachments thereto is ludicrous. Where would we be today if Bell, Edison, Westinghouse, Edgerton, etc. had been afraid to cremate a few piles of wire or explode a few cans, or were stupid enough to do so? Edison went so far as to burn down his work shop in pursuit of his dreams, but he learned and profited from it. There aren’t any “experts” in the world. There are some people with horse sense and the brains to read books and instructions. A sensible technologist can deal with anything and will do so successfully. Success is a matter of vision.

Without significant training, I have successfully dealt with projects in power-generating stations, steam power plants (chemical), manufacturing, transportation, agriculture, military, aviation, etc., at the technical, engineering, and management levels. What I have accomplished, anyone can accomplish if he will put his head to it. My IQ is only average, but I don’t admit any limits to profitable effort. I saw a kid put together a one-chip heart monitor as soon as op-amps came on the market. I saw hand-built lasers almost as soon as I saw laser literature. There are multitudes of technicians out there who do wonders putting together gadgets that are amazing and useful. The one thing that none of them needs is a paper that says that they are “qualified” to do something. Accomplishment is its own certification.

Across technology we have a plethora of standards and codes to guide people and enhance safety. It is good for specialized technicians to memorize them. It is just as good for the generalist to follow the standard code as needed. It has been my experience that specialists screw up as often as generalists. And specialists often get frozen out of the job market where broader technicians prevail.

No one should think that any technical subset is any more than a tool, a means to an end. The “end” of any project is just a tool for the next project. And on it goes! No one is going to protect his job by trying to exclude others from doing the same thing.

Europeans and Americans used to have a corner on advanced technology, but now other people around the world are making gadgets of the highest technologies (and making more money than we are).

Heads up and eyes forward, America—we are losing an important race.

R.C.G.
Aurora, IL

SERVICE MANUAL SOURCE

I often see letters in Popular Electronics from readers seeking service manuals for assorted electronic gear. Manuals are available from Sams Photofacts, as I’m sure many readers know, but they are expensive and you must accept other material along with each photo fact. However, not many readers are aware of Hi-Manuals in Council Bluffs, Iowa. Hi-Manuals covers only what you need in a service manual. The copies are like new and very reasonable. They have an amazing assortment of hundreds of service manuals, many of which are out of print. A listing of available service manuals can be obtained by sending $1.00 shipping and handling to Hi-Manuals, P.O. Box 802, Council Bluffs, IA 51502.

K.K.
Temperance, MI

HAVES AND NEEDS

I have a 1958 Wollensak stereo tape magnetic recorder (model T-1515, Serial Number 103469), for which I have the schematics, but no owner’s manual. If anyone can help me locate a manual, I’d be very grateful.

Mike Daley Jr.
36 North Shore Avenue
Danvers, MA 01923
This is the 16th edition of an American Radio Relay League (ARRL) book that first appeared in print in September of 1939. Dedicated to providing more and better information about radio antennas, for decades now the book has been popular with both amateurs and professionals. The newest edition contains some of the drawings that accompanied tutorials back in the original, along with a wealth of updated information on antenna design and radiation patterns that's based on computer analysis. This edition also contains an expanded chapter on antenna and transmission-line measurements, and other new material appears throughout its 28 chapters and 736 pages.

The comprehensive book covers virtually every type—mobile and maritime, space-communications, long-wire, traveling-wave, loop, multiband, multielement, broadband, log-periodic, direction-finding, quad arrays, yagi arrays, and portable—of antenna. The basic information needed to understand how antennas work is provided in chapters on fundamental theory, and radio-wave propagation and the Earth's effect on it. Practical advice and information needed to set up antenna systems is presented in chapters on safety, selecting a system, materials and accessories, product suppliers, antenna supports, coupling the transmitter to the line and the line to the antenna, measurements, and Smith Chart (a tool for solving transmission-line problems) calculations. The appendix includes a glossary of terms, definitions of commonly used abbreviations, conversion tables for length measurements, and metric equivalents. A 14-page index helps readers locate material quickly.

The ARRL Antenna Book costs $20.00 and is published by the American Radio Relay League, 225 Main Street, Newington, CT 06111.

The ARRL Antenna Book

The PC Music Handbook:
For IBM PC's and Compatibles
by Brian Heywood and Roger Evan

The personal computing power of the popular IBM PC and compatibles has brought the possibilities of computer music within the budget of most amateur and professional musicians. This book leads you through the creative possibilities of the PC and acts as a guide in selecting both hardware and software for making music.

Aimed at professional musicians, talented amateurs, and curious hobbyists, the book explains the basics of computer music and covers what is currently available in terms of both hardware and software. It explains sequencing, sampling, and notation, and describes just how the PC fits into the music studio. Full of practical tips, the book provides guidelines for programming musical applications, warns of common pitfalls to be avoided, and suggests a number of setups that could bring out the best of your particular musical abilities.

Appendices include discussions of MIDI specifications and online communications and listings of addresses of industry contacts, a glossary of related terms, and suggested readings.

The PC Music Handbook (order number PCP113) costs $17.45 (including shipping and handling) and is published by Electronics Technology Today Inc., P.O. Box 240, Massapequa Park, NY 11762-0240.

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anyone from the comfort of home by accessing hundreds of new databases that trace, track, and provide Social Security numbers, addresses, phone numbers, credit histories, motor vehicle records, real property, marriage, death, divorce, and legal information, as well as forwarding addresses and new reports, on anybody. The book describes the equipment used to snoop, and provides a list of sources for that equipment.

How to Get Anything on Anybody: Book II is available for $38.00 (plus 8% sales tax in California) from ISECO, Inc., 2228 South El Camino Real #349, San Mateo, CA 94403; Voice Mail: 415-513-5549.

Advanced Robotics: Redundancy and Optimization costs $65.75 and is published by Addison-Wesley Publishing Company, Reading, MA 01867; Tel: 617-944-3700.

NEW NO-CODE TECHNICIAN CLASS HANDBOOK by Gordon West

For those who wish to become licensed ham-radio operators under the new No-Code Technician Class rules (which do not require the traditional Morse code test), this book contains the latest questions from the FCC's element 2 and element 3A question pools. To make the material quick and easy to learn, the correct answers are listed after the possible choices, and detailed information is provided on the same page. Besides the official FCC questions and answers, the book includes information and charts describing the Amateur Radio Service and its privileges for the new No-Code Technician Class. In addition, there is information on where the exam is offered and how to complete FCC Form 610 (Application for Amateur Radio Station/Operator License), which is bound in the back of the book.

The New No-Code Technician Class Handbook is published by Master Publishing and sells for $9.95 at Radio Shack stores nationwide.

HOME VCR REPAIR ILLUSTRATED by Richard C. Wilkins & Cheryl A. Hubbard

Most: VCR problems are not difficult to fix—in fact, many involve replacing or repairing only one part. Yet service shops charge a lot of money to make these repairs. This book, written by an electronics service technician who has owned two

Which symbol represents a variable inductor?

What is the principal disadvantage of neon lights?

What are out-of-phase signals?

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CIRCLE 5 ON FREE INFORMATION CARD
VCR-repair shops, shows you how you can make the same repairs at home—for less than a fraction of the cost. The book explains how to find and correct many of the most common VCR malfunctions, such as jammed videocassettes, clogged video heads, blown fuses, and water damage. Trade secrets are revealed for repairing problems with picture and sound quality, fast forward and rewind, DC motors, tension and roller guides, undercarriages, take-up spindles, remote controls, audio heads, and more. No specialized test equipment is required; all repairs can be done using household items and common tools. One chapter is devoted to diagnostics, and most chapters have a review section that provides step-by-step instruction to assist in diagnosing and repairing the part of the VCR that is discussed in the chapter. The book includes many detailed, high-quality photographs that help illustrate the written instructions, and a glossary that defines specialized VCR terminology.

Home VCR Repair Illustrated costs $19.95 and is published by TAB Books, Division of McGraw-Hill Inc., Blue Ridge Summit, PA 17294-0850, Tel. 1-800-822-8138.

CIRCLE 101 ON FREE INFORMATION CARD

HOMEWORKS BY HEATHKIT from Heath Company

The Fall 1991 issue of HomeWorks by Heathkit introduces five new computer courses that offer a fast, easy way to gain a working knowledge of computer applications and include WordPerfect, Windows, Lotus 1-2-3, Word for Windows, and AutoCAD. The courses provide easy-to-read text and step-by-step instructions—plus frequent examples, illustrations, and helpful tips. The catalog also introduces six new home-study video courses that can be used to learn important electronics concepts. The topics include op-amps, linear power supplies, switching power supplies, troubleshooting with oscilloscopes, troubleshooting with electronic test equipment, and troubleshooting microprocessors. A student workbook is included with each video. In addition, the catalog features courses in basic and advanced electronics, laser technology, digital techniques, fiber optics, surface-mount technology, data communications, microprocessors, and other subjects. A variety of Heathkit trainers and trainer accessories, which are used in performing the course experiments, are offered in both kit and assembled form. Each time a student completes a Heath course and passes the optional final exam, Continuing Education Units, which are recognized as job-related certification by many professional and technical organizations, are awarded.

The Fall 1991 HomeWorks by Heathkit Catalog is free upon request from Heath Company, Department 350-057, Benton Harbor, MI 49022, Tel: 1-800-44-HEATH.

CIRCLE 100 ON FREE INFORMATION CARD

THE HOME SATELLITE TV INSTALLATION AND TROUBLESHOOTING MANUAL: Revised 3rd Edition by Frank Baylin with Brent Gale and Ron Long

Written for those who install satellite TV systems for a living—and for satellite dish owners who want to know how to set up their systems and keep them running smoothly—this 326-page book is written in a clear, concise style, easily understood by the layman. The book includes background theory and detailed information on how satellites and TVRO's work. It describes methods of judging and selecting satellite TV components, and provides comprehensive step-by-step instructions—accompanied by all necessary charts, tables, diagrams, and illustrations—for multiple-receiver and multipletelevision setups. The book also covers how to install extra-large antennas. A complete strategy of troubleshooting any satellite TV system is offered. The revised version contains two new chapters on small dish systems and upgrading an existing system. The appendix includes a collection of useful equations, a glossary, and reference books and magazines, and a complete list of satellite-equipment manufacturers.

The Home Satellite TV Installation and Troubleshooting Manual is available for $30 plus $3 for shipping and handling from Baylin Publications, 1905 Mariposa, Boulder, CO 80302.

CIRCLE 98 ON FREE INFORMATION CARD

ANALOG AND DIGITAL ELECTRONICS A First Course: Second Edition by Peter H. Beards

This book is written to provide a single text that covers, in broad terms, the foundation in electronics needed for an electrical/electronic engineering degree course. It offers broad and balanced coverage of both analog and digital electronics, covering all important and up-to-date topics taught in first- and second-year undergraduate engineering courses today. The book covers the analysis and design of discrete and integrated analog circuits, and provides an introduction to combinational and sequential logic. The second edition includes an entirely new chapter on the 16-bit microprocessor, its operation, and applications. Analog/digital interfacing is also discussed. A wealth of worked examples, end-of-chapter review problems, and more than 650 diagrams are used to illustrate and supplement the written material that is presented.

Analog and Digital Electronics: A First Course costs $58.00, and is published by Prentice-Hall Inc., Englewood Cliffs, NJ 07632.

CIRCLE 99 ON FREE INFORMATION CARD

ELECTRONIC PACKAGING AND INTERCONNECTION HANDBOOK by Charles A. Harper

Featuring in-depth information on all aspects of the rapidly evolving technology of electronic packaging and interconnections, this book fully explains the design, manufacture, and application functions. More than 20 specialists in the field contributed articles in their areas of expertise. Those articles tell how to select the most effective plastics, ceramics, and metals; describe how to minimize heat problems in increasingly dense electronic assemblies; and focus on the design of both rigid and flexible printed/wiring boards. Reflecting the interdisciplinary nature of the technology, the articles connect relevant material from the areas of materials science, electronics, and mechanical design. The book provides detailed guidelines on the parameters (electrical, mechanical, and material) of the IC's and semiconductor devices used in packaging and interconnections. Other subjects that are covered in the book include the materials for electronic packaging, the packaging of high-speed digital electronic systems, soldering and solderpaste technology, hybrid microelectronic packaging, the wiring and cabling involved, computer-aided design systems, and more.

Electronic Packaging and Interconnections costs $79.50 and is published by McGraw-Hill Book Company, 11 West 18th Street, New York, NY 10011: Tel 1-800-2-MCGRAW.

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Indeed, no other training — in school, or on the job, anywhere — shows you how to troubleshoot and service computers like NRI.

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11
NEW PRODUCTS

Hand-Held DSO/DMM Combinations

Three handheld test instruments developed jointly by Fluke and Philips, combine sophisticated oscilloscope features with powerful digital multimeter functions, constructed in rugged, sealed industrial cases for use in field-service environments. The models 93, 95, and 97 ScopeMeters each offer a 50-MHz, 25-megasamples-per-second, dual-channel DSO that features a 40-ns glitch-capture time to catch intermittent failures, and storage capabilities of up to 8 waveforms and ten setups. In addition, the ScopeMeters provide such multimeter capabilities as Min-Max recording, which provide simultaneous display of maximum, minimum, average, and present readings; diode test; relative and percent-relative modes; dBm, dBV, and dBW readings; touch hold; and autoranging. Using the included probes, the instruments can make floating high-voltage measurements to 600 volts RMS.

Features such as "Autoset," "waveform," and "set-up memory," combined display of meter results and waveforms, menus, and softkeys simplify operation. In oscilloscope mode, "autoset" automatically sets volts per division, time per division, position, and triggering controls for every input signal. In the meter mode, autoset automatically tracks the input signal for the proper range, time-per-division display, and triggering. Five softkeys allow the user to easily find and select different functions of the instrument. Pop-up menus provide a clear guide through the ScopeMeter's functions.

All three ScopeMeters include probes that come with both high-voltage and high-frequency tips (the same probe is used for both oscilloscope and multimeter voltage measurements), an AC line adapter, a built-in battery charger, a holster, and a tilt stand that can be adjusted to hang over a panel or door. An optically isolated RS-232 interface is provided for instrument calibration. With the model 97, the RS232C interface can be used for remote control, to read waveforms and setups, or to print the display. The model 97 ScopeMeter also features a built-in signal generator, a component tester, and a backlit display.

The ScopeMeters models 93, 95, and 97 have suggested list prices of $995, $1295, and $1597, respectively. For more information, contact John Fluke Mfg. Co., Inc., P.O. Box 9090, Everett, WA 98206.

CIRCLE 104 ON FREE INFORMATION CARD

1000-CHANNEL SCANNER

With frequency coverage from 500 kHz to 1300 MHz, Ace Communications' AR2800 mobile/base receiver allows reception of all broadcast bands, shortwave frequencies, military-communications bands, public-service bands, single sideband, and TV audio. A total of 1000 scan-memory channels can be programmed using 26 front-panel keys, and upper and lower limits for bands to be searched can be stored in ten separate memory locations. The AR2800 also features a selectable priority channel, and keyboard lockout. The backlit display offers 21 different prompts to help you use the unit easily. The compact unit measures 2½ x 5¾ x 7¼ inches, weighs only 12 ounces, and comes with an AC adaptor/charger, a DC power cord, a telescoping antenna, a desk stand, and mobile mounting hardware.

The AR2800 mobile/base receiver has a suggested retail price of $449. For more information, contact Ace Communications Monitor Division, 10707 East 106th Street, Fishers, IN 46038; Tel: 317-842-8794.

CIRCLE 105 ON FREE INFORMATION CARD

ELECTRONICS TOOL KIT

Jensen's JTK-2 kit contains a selection of tools for basic electronic maintenance tasks in the plant or shop. It includes 43 tools needed for electronic assembly and repair, packed in a heavy-duty steel box with a removable tray. The brown enamel toolbox measures 16 x 7½ x 7½ inches has a latch and padlock eye for secure closing.

The JTK-2 electronics tool kit costs $169.95. For additional information, contact Jensen Tools Inc., 7815 South 46th Street, Phoenix, AZ 85044; Tel: 602-968-6231.

CIRCLE 106 ON FREE INFORMATION CARD
LOW-PASS FILTER

Designed to reduce television interference (TVI) caused by harmonics and spurious signals that may be generated by your HF rig, the MFJ-704 low pass filter provides attenuation to frequencies above 40 MHz using a proven nine-pole Chebyshev low-pass filter design. The low-pass filter handles a full 1500 watts of power with low SWR, and insertion loss is less than 0.5 dB. The compact unit measures 8 1/4 inches deep by 2 1/4 inches wide by 3 inches high. The MFJ-704 low-pass filter costs $39.95. For further information, contact MFJ Enterprises, Inc., P.O. Box 494, Mississippi State, MS 39762; Tel: 601-323-5869 (800-647-1800 for orders only); Fax: 601-323-6551.

CROSSOVER KIT

Aimed at serious audio enthusiasts (and electronics hobbyists), the XM-16 electronic crossover network from Marchand Electronics has an eight-order design that results in clean cut-off when dividing the audio spectrum between tweeters, mid-range, woofers, and subwoofers. Available as a D-I-Y kit, or fully assembled, the circuit incorporates a two-section, four-stage filter network with pre- and post-amplification and ambient-signal protection during startup and shutoff. Each audio channel will require its own XM-16. The precise crossover frequency can be set between 20 Hz and 5 kHz using plug-in frequency modules, making it easy to select the right crossover frequency for your system. Signal-to-noise ratio is better than 110 dB, and harmonic distortion at 1 kHz is less than 0.001%. The output level controls are included on the board, but the optional XM-16 PT, a remote cable, connector, and potentiometer assembly, can be used to relocate those controls to your control panel. The kit includes top-quality components, a 3.2 x 5.8-inch double-sided PC board with plated-through holes that includes a ground plane for exceptional audio quality, and detailed assembly instructions and circuit description. The XM-16 crossover network costs $59.95 in kit form (XM-16-K) and $79.95 assembled and ready for installation (XM-16-A). For additional information, contact Marchand Electronics Inc., 1334 Robin Hood Lane, Webster, NY 14580; Tel: 716-265-4930.

BNC CABLE ASSEMBLIES

The 2249 Series of BNC cable assemblies from Pomona feature extra-long, stress-relieved PVC boots molded directly onto the cable jacket and connector body. That design has the advantages of stress protection to prevent failure from excessive bending, flexing, and twisting, and weather-resistant seals between the cable and connector. The cable assemblies are available in four RF cable categories: The 50-ohm RG58C/U has a 4.95 mm (0.195-inch) outside dimension; the 75-ohm RG59B/U has a 6.15-mm (0.242-inch) outside dimension; the 50-ohm RG174/U has a 2.54-mm (0.100-inch) outside dimension; and the 93-ohm RG62/U, 6.15-mm (0.242-inch). Cable ends in all four categories are identical. They feature crimp BNC male connectors with tarnish-resistant, gold-plated brass center contacts and molded, black PVC boots. The cable assemblies have a maximum operating voltage of 500-volts RMS at 50 °C (122°F) maximum.
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If you are concerned about the potential health risks that have cover over it. Once the switch is activated, the lights begin flashing 24 seconds before turning off. You can keep the lights on continuously by pressing the switch for a slightly longer period of time. The switch controls up to 500 watts of incandescent lighting. It is intended for indoor use only, and cannot be used with three-way circuits.

The model SL-6102 Reflex Auto-Off Switch has a suggested retail price of $12.97. For further information, contact Heath Zenith Reflex Brand Group, 455 Riverview Drive, Benton Harbor, MI 49022.

**DIGITAL LCR BRIDGE**

For use in production lines, laboratories, research, and circuit prototype development, Protek's model B-800 digital LCR bridge measures inductance, capacitance, resistance, and dissipation factors with a high-accuracy 3½-digit display for all parameters to 1999 (maximum). The instrument will automatically select parallel or series equivalent circuitry, and produces rapid response measurements of components and circuits. The model B-800 also has a range changeover for automatic manual modes. It has a 1-kHz (±5%) measuring frequency, a one-second measuring time, and a sampling rate of approximately ten times per second.

The model B-800 digital LCR bridge, which comes with a two-year warranty, costs $895. For more information, contact Protek, P.O. Box 59, Norwood, NJ 07648; Tel: 201-767-7242; Fax: 201-767-7343.

CIRCLE 110 ON FREE INFORMATION CARD

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**The 2249 Series of cable assemblies, in 1–9-piece quantities, range in price from $9.90 to $19.00. For more information, contact ITT Pomona, 1500 East Ninth Street, P.O. Box 2767, Pomona, CA 91769-2767; Tel: 714-623-3463; Fax: 714-629-3317.**

CIRCLE 108 ON FREE INFORMATION CARD

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**AUTOMATIC LIGHTS-OFF SWITCH**

For those who are tired of nagging the kids about turning off lights when they leave a room, Heath Zenith has introduced the SL-6102 Reflex Auto-Off Switch. The switch fits in a standard electrical switch box and requires only the connection of two wires to the existing line. An adjustable timer lets you program the switch to turn lights off from one to 30 minutes after you've left the room. A hidden selector switch is used to set the time control period. Once the switch is installed, you can place any decorative outlet
been linked to exposure to low-frequency electromagnetic fields (EMF). Theta Sciences' HFS-Model IV field-survey meter can put your mind to rest. It warns you of the locations and strengths of electromagnetic fields in your home and office, and tells you how far away you should keep to be safe. The battery-operated, handheld unit is easy to use to test everything from your alarm clock to your microwave oven.

The HFS-Model IV costs $75.00 plus $3.00 shipping and handling. For additional information, contact Theta Sciences Inc., 11835 Carmel Mountain Road, Suite 1304-413, San Diego, CA 92128.

CIRCLE 111 ON FREE INFORMATION CARD

ULTRA-SMALL PERSONAL COMPUTERS

Offering full IBM AT and 386SX compatibility in a package no larger than the average hardcover book, Flytech Technology's Carry-1 9000 Series of personal computers provide up to 4 megabytes of RAM on the motherboard; a high-density floppy-disk drive; a hard drive ranging up to 80 megabytes in size; and an expansion slot for a half-length modem, network-card, or other customizing expansion card. An optional LAN adapter connects the system to a network through the parallel port. (Two serial ports are also provided.) Each system comes with the Carry-1 mini-keyboard, which has 101-key functionality with only 81 keys. Nine-inch monochrome and nine- and ten-inch color monitors are available options. According to the company, the small-scaled keyboards and monitors make the complete Carry-1 desktop systems the smallest in the industry. Each system comes with a padded carrying case, a mini tower stand, a user's manual, a DR DCS manual, and diskettes.

The Carry-1 9000 Series of book-sized personal computers range in price from $400 for a complete XT-type system with monochrome monitor and one floppy drive to about $3000 for a 386SX Super VGA system with 4 megabytes of RAM and an 80-megabyte internal hard drive. For further information, contact Flytech Technology, 3008 Scott Blvd., Santa Clara, CA 95054.

CIRCLE 112 ON FREE INFORMATION CARD

CAR SECURITY SYSTEM

Featuring a compact receiver designed for under seat or dashboard installation, Black Widow's Series 4 automotive alarm can be armed or disarmed by remote control. When the alarm is set off, the system's 120-dB siren sounds for 45 to 60 seconds, and then automatically resets and continues to monitor all entries. Other features include two remote transmitters with audible chirp, a starter-disable relay, flashing LED status indicators, a manual override switch, power door-lock output, built-in entry-violation memory, a wiring harness with fuse and fuse holder, 360-degree shock sensor, and a glass-override switch, power door-lock output, built-in entry-violation memory, a wiring harness with fuse and fuse holder, 360-degree shock sensor, and a glass-
break sensor. The Series 4 can be upgraded by adding one or more of the available options, which include a mass-motion sensor, a power door-lock actuator, a starter disable, and battery backup.

The Series 4 remote car security system has a suggested retail price of $199.00. For additional information, contact Black Widow Security, 12753 Moore Street, Cerritos, CA 90701; Tel: 213-404-9998; Fax: 213-404-9698. CIRCLE 113 ON FREE INFORMATION CARD

1.3-GHz MULTIFUNCTION COUNTER

Particularly well-suited for use in the communications industry, B&K's model 1856 multifunction counter makes accurate and repeatable measurements of radio-transmitter frequency up to the microwave range and exceeds the FCC standards for adjusting transmitter frequency, as required for radio stations or land mobile, radio telephone transceivers. Because its range extends to 1.3 GHz, the 1856 even covers the cellular-phone frequency spectrum.

The instrument's precise TCXO (temperature-compensated crystal-oscillator) timebase has 0.5 PPM stability at 23°C, 5°C and 1 PPM stability from 0 to 50°C. The instrument has frequency, period, period-average, and totalize functions. Period-measurement capability allows accurate very-low-frequency readings, for measuring tone encoding frequencies used in many types of communications systems. In the totalize mode, pulses from 5 Hz to 10 MHz are counted up to 99,999,999, which is useful in counting the number of operations performed by production machines or in quality-control tests. Reset and hold can be activated using a front-panel switch or using a remote start/stop input. For plant maintenance, the 1856 meets the needs for testing and repairing electro-mechanical devices, low-frequency audio circuits, and control circuits. A detachable power cord, schematic, parts list, spare fuses, and a user's manual are included.

The model 1856 1.3-GHz multifunction counter has a suggested list price of $495. For further information, contact B&K Precision, 6470 West Cortland Street, Chicago, IL 60635; Tel: 312-889-1448. CIRCLE 114 ON FREE INFORMATION CARD

PERSONAL CONTROLLER

A tiny, single-board controller from Blue Earth, dubbed the Micro-440, is designed for industrial control, home automation, data-acquisition, and OEM applications. Based on a 12-MHz Intel 83C51 or Intel 8051 microcontroller, the Micro-440 can be programmed from a terminal or PC for on-line or remote stand-alone operation. On-chip software allows it to be programmed in either BASIC or assembly language. In addition, its 16-kilobyte ROM includes 32 kilobytes of battery-backed CMOS static RAM, which can be used store programs, operating parameters, and collected data. A RAM write-protect feature can be used with BASIC file commands to lock in user programs for automatic execution.

The real-time clock/calender allows event recording or other date- and time-based operations. A total of 14 digital I/O lines can be used to monitor switches and contacts or to drive transistors, relays, etc. Dual RS-232C serial ports allow simultaneous communication with a PC and a printer. An expansion port can be used to add memory or I/O to the base unit. Up to eight analog inputs can be used to read temperatures, pressure, or other 0-5 volt sensors. The Micro-440 can be powered from almost any 6-16 volt DC source. A lithium back-up battery maintains the RAM and clock for more than 10 years.

The Micro-440 controller is priced at $199; OEM versions start at $59 in 1000's. A complete system-design package—including the Micro-440, Macro Assembler, Symbolic Debugger and Utility programs, user manuals (1100 pages), plug-in type DC power supply, an applications module, and PC cable costs $399. CIRCLE 115 ON FREE INFORMATION CARD

PARALLEL PORT I/O CONVERTER

You can connect your IBM to the outside world—use it to turn on lights or alarms, or to control relays that can turn on any device—with B&K Electronics' model PPIO parallel port input/output converter. The device lets you interface your PC-compatible computer's parallel port to eight discrete inputs or outputs. Any of the eight I/O points can be used to control voltages as high as 50 volts DC with a threshold of 2.5 volts. The input lines can be used to monitor thermostats, relays, or anything else that has a contact that can be opened or closed. The PPIO comes with complete instructions and sample programs, written in BASIC, Pascal, or C, which can be used to test the device and to display the status of the I/O pins. Parts of those programs can be incorporated into your own programs to make interfacing with the PPIO easier. The sample programs are also intended as learning aids for writing your own code to do a similar job.

The PPIO parallel port input/output converter costs $99.95. A power supply (model 232PS) is available for $14.95. For more information, contact B&K Electronics Mfg. Co., 4000 Baker Road, P.O. Box 1040, Ottawa, IL 61350; Tel: 815-434-0846. CIRCLE 116 ON FREE INFORMATION CARD

CAR CASSETTE PLAYER

The Optimus AM/FM auto cassette player from Radio Shack provides 22 watts of power per channel and features a high-performance digital tuner that assures accurate, drift-free reception. For quickly tuning favorite stations, there are 30 station presets that can be easily sampled using the one-touch memory-scan feature. The auto-reverse cassette player has a metal-tape selector for playing Type IV tapes and built-in Dolby-B noise reduction. The Optimus' loudness control boosts high and low frequencies when the player is set to low volume levels. Other features include a local/DX signal enhancer for locking onto weak signals, a fader for balancing the front and rear sound levels, line input/line output jacks for connecting an additional amplifier or equalizer/booster, a remote-mount CD input terminal with 1/4-inch mini-plug jack for connecting a portable CD player to the system, a noise-suppression choke that reduces or eliminates noise that is caused by the vehicle's electrical system, and a "key-off release" to protect cassette tapes that are left in the player when the car is turned off.

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THINK TANK

By John J. Yacono

A while back, I received a letter from someone that had a question about a Triac-operated project that appeared in this magazine. Apparently the sender was concerned that once a Triac was activated, it wouldn’t shut off unless the power was cut off. That letter and another (which will appear here this month) prompted this month’s topic: Triacs and power control. As usual, I’ll throw in a circuit with an inventive twist to further illustrate their operation before we get to this month’s letters.

Triacs are useful devices because they can switch current on. They are multi-layered three-terminal semiconductor devices. Each terminal has a different function.

The three terminals consist of a gate and two “main terminals” (denoted G, MT1, and MT2, respectively) as shown in Fig. 1. When using Triacs, don’t get confused between the two main terminals, they perform entirely different jobs in most circuits. Always remember that MT1 is always illustrated closer to the gate in a schematic.

To help you to understand how they do their job, take a look at Fig. 2, which is a “characteristic curve” of a Triac. The plot illustrates the relationship between current (I) flowing from one main terminal to the other and the voltage (V) across them. Let’s consider quadrant I—the upper right—of the graph first. That’s where the conventional current flows from MT2 to MT1, and the voltage at MT2 is more positive then the voltage at MT1.

As you can see, the main terminals do not conduct significant amounts of current until the voltage reaches a certain value called the “breakdown voltage.” At that point, the Triac’s resistance suddenly drops, allowing current to flow freely with very little voltage drop across the main terminals. The Triac is then said to be “on.” As you can see, that behavior forms a “knee-bend” in the characteristic curve. Current will continue to flow in such an uninhibited fashion unless it falls back down into the knee-bend region. The current level at that transition point is called the “holding current” because it is the minimum current needed to hold the Triac on.

If a voltage is applied to make the gate more positive than main-terminal 1, current flows through the gate. The flow of gate current causes a decrease in the value of break-down voltage needed to turn on the Triac. You can increase the gate current to the point where the knee-bend is hardly noticeable. At that point, it only takes a small voltage across the main terminals to turn on the Triac, so the Triac acts like a low-value resistor. That is called “quadrant II operation.”

The same knee-bend behavior can be seen when the polarity of the voltage across the Triac is reversed, which is represented by the lower half of the plot. In that situation, applying voltage to the gate still reduces the break-down voltage, but the gate voltage must be more negative than main-terminal 1. As you may have guessed this is called quadrant III operation.

For the sake of simplicity and brevity, I won’t discuss quadrant II and quadrant IV operation since not all Triacs can operate in those modes. Suffice it to say that for such operation the gate-voltage polarity will be just the opposite of what it is for the quadrant I and quadrant III modes.

If you use a Triac to control the flow of current in a 60-Hz AC circuit, since the current drops below the holding-current level 120 times a second (i.e. during each alternation of the AC line), the Triac must be turned back on 120 times each second.

Furthermore, the gate voltage must be positive with respect to MT1 when MT2 is more positive than MT1, and negative with respect to MT1 when MT2 becomes more negative. That is almost always accomplished by connecting some electrical component or components between MT2 and the gate. That has the effect of pulling the gate voltage toward MT2, and thus away from MT1, providing the necessary potential with the right polarity between the gate and MT1.

A good example of that technique is shown in Fig. 3. In that circuit, when the LED in the optoisolator receives current it lights up. The light

Fig. 1. Triacs are multi-layered three-terminal semiconductor devices. Each terminal has a different function.
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![Figure 2](image)

**Fig. 2. This is the characteristic curve of a Triac without gate current. It is a plot of the voltage across the main terminals versus the current through them.**

It produces reduces the resistance of the photosensitive Triac driver packaged with it. That pulls the voltage of the gate closer to the voltage of MT2, turning on the Triac.

However, there is a way to apply a potential of the right voltage and polarity between MT1 and the gate, without the assistance of MT2. The circuit in Fig. 4 demonstrates the concept. Ignoring R1 for the moment, if a device plugged into SO1 starts to draw current, the current flows through the diode network. Current will flow through one string of three diodes during positive alterations of the AC line, and through the others during negative alternations.

As you probably know, there is a voltage drop across any diode even when it's forward biased. For common rectifying diodes, that forward-voltage drop is around 0.8 volts. So when the three diodes on the left are forward biased, each drops 0.8 volts, giving a total of 2.4 volts across the entire string of three (3 x 0.8). When the string of diodes on the right is forward biased, it also drops a total of 2.4 volts, but with the opposite polarity.

That voltage looks very much like an AC square-wave if viewed on an oscilloscope. That square-wave is sent to the gate of the Triac and used as a trigger signal. To summarize, if current flows through the device connected to SO1 the diode network supplies the Triac with a voltage-limited gate signal of the proper polarity. The Triac then turns on and supplies power to SO2.

There are brief intervals when the voltage across the diodes is above ~2.4 volts, but below ~2.4 volts. During those times both sets of diodes do not conduct. That would cause the Triac to shut off briefly once the current through the main terminals fell below the holding-current value. Resistor R1 allows some current to flow during those intervals so the Triac can deliver almost continuous current to SO2. Note that R1 can be a low-wattage unit because it never sees more than ±2.4 volts.

The nice thing about the circuit is that it will supply the same gate signal to the Triac regardless of the load connected to SO1. There is another advantage that is not readily apparent: the timing of the gate signal is so precise that the Triac generates almost no electrical noise when it turns on (an annoying characteristic of most Triac-based circuits).

I use a circuit based on this strange concept to power my computer set-up. My computer is plugged into SO1 and its peripherals are plugged into sockets controlled by a Triac just like SO2 is. I leave all the peripheral's power switches in the "on" position so when my computer draws current...
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(i.e., is turned on) the peripherals "come to life" as well.

If you plan to play with Triacs, there are a few safety precautions that you should follow: First, any connections that carry heavy current should be made with 12-gauge wire. Also, keep in mind that substantial current through a wire junction tends to raise its temperature. Since solder will melt at relatively low temperatures, any connections between leads carrying respectable current should be made with a wire nut, not solder. Last, it's always a good idea to add a heat sink to all Triacs that you use.

Now let's look at a few power-control circuits submitted by some of your readers. As usual, their efforts will be rewarded with a Think Tank II book, or something similar from our selection.

WHAT IS IT?

I have a circuit (see Fig. 5) that I found recently at a yard sale. I bought it for only $1, but I've spent $100 in pure agony trying to figure it out. It seems to reduce the power to lamps and also works well as a wattage control for my soldering iron. Before I got it, my soldering iron would get hot enough to lift the traces right off a circuit board.

I really like the circuit because it adjusts my soldering iron from very low heat for ICs, to very high heat for chassis-grounding connections. Maybe this circuit would be of great use to other technicians, if only I knew what type of transistor TR1 was. Please help if possible.

—James Lancaster, Waco, TX

No problem (especially since you provided the ECG number)! The part you've labeled TR1 is a Triac. It receives a gate signal from the later the Triac turns on in each alternation. The later the Triac turns on, the less average power is delivered to the load.

KEEPING IT COOL

I installed a compact ice maker in an enclosure beneath my wet bar. When making a large amount of ice cubes, the cabinet became unduly warm. My solution was to have the ice maker turn on an exhaust fan when it operates. My first idea was to connect the fan supply leads directly across the ice-maker's compressor motor. Upon inspection, that proved to be more of an undertaking than it originally seemed. My ultimate solution was to have a Triac turn on the fan when triggered by the current drawn by the ice-maker's compressor motor (see Fig. 6).

In the circuit, the value of R1 (2 ohms) was chosen so that the current to the compressor (about 2 amps) develops 4 volts across it. I used two 1-ohm 25-watt aluminum-based resistors in series to produce that resistance. Their high wattage allows them to withstand the current surge of the compressor.

Resistor R2 is used to limit the current surge to the gate of the Triac, and was also selected for my particular application. The Triac was selected to easily handle the power requirements of the fan.

I installed R1 in the bottom of a 2-inch deep metal duplex outlet box that acts as a heat sink for R1 and the Triac (which is insulated from the box with a mica wafer). The sockets are on a standard duplex unit with the jumper tab on the hot terminals removed so that the sockets operate independently.

—James W Dowell, Chula Vista, CA

Very nice. Everybody should keep in mind that this circuit was designed only for your particular compressor and fan. To use it on other equipment will take some experimentation on the part of the builder.

A SUPER TIMER

I've been reading Popular Electronics for several

(Continued on page 86)
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In this article, we'll not only tell you how to build and adjust the EZ-curve, we'll also tell you what general characteristics to look for when testing the more common semiconductor and reactive components, and how to measure their important attributes. But let's start by discussing the circuit.

The EZ-Curve Principle. The EZ-Curve circuit is a bit unusual in appearance, so it's a good idea to first present a block diagram of it. As shown in Fig. 1, the circuit is basically an AC signal source connected in series to an active current-limiting circuit, the device under test, and a precision resistor.

As was mentioned, the current limiter is present to keep the current through the component being tested down to a safe level. An active current limiter was used instead of a simple resistor because a resistor would've limited the maximum voltage available to the device under test. That would be undesirable for testing certain components that require more voltage (such as Zener diodes).

Since everything is connected in series, the current flowing through the resistor is equal to the current through the component under test. According to Ohm's Law, the voltage across the resistor is proportional to the current through it. By connecting an oscilloscope across the resistor, you can watch the voltage and thus the current rise and fall as it flows through the component under test and the resistor. Note that we used a lower case 'i' and 'v' in Fig. 1 to indicate that those quantities vary with time.

You can make it easy to read the current right off the oscilloscope if you select the value of R wisely. For example, if R is 1 ohm, by Ohm's Law:

\[ v = i \times R \]

so a 1-volt reading on the scope would mean 1 ampere of current is flowing through the component, a 2-volt reading indicates 2 amps, etc. The voltage across the component under test can be viewed by simply attaching an oscilloscope input across the component.

Now let's say that you put your scope in X vs. Y mode, and you supply the X input with the voltage across the component, and the Y input with the voltage across the resistor. The signal source will supply the component with a current-limited AC sine wave, causing the scope to display the characteristic (V vs. I) curve. Why, you ask? Because the voltage across the device is presented to the X (horizontal) input, and a voltage proportional to the current controls the Y (vertical) input.

There is one catch, however: Scope inputs have a common shield—the shield of one input is electrically connected to the other via the chassis. So the shield on both inputs must be connected at the junction between the device under test and the resistor. The catch is that the polarity of the resistor will be opposite to that of the component, causing the X axis to flip around; its positive side will be on the left and its negative side on the right. That is an aspect of commercial units as well as ours and can only be overcome at the expense of accuracy (and money).

Quite honestly, it wouldn't even matter if the characteristic curves came out upside down. What is important is that the user must know what to look for when viewing a curve, and we'll get into that a little later.

A Look at the Circuit. A schematic diagram of the EZ-Curve circuit is shown in Fig. 2. In that circuit, transformer T1

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**PARTS LIST FOR THE EZ-CURVE**

**SEMICONDUCTORS**

- U1—LM317 adjustable voltage regulator
- D1-D4—1N4001 rectifying diode

**RESISTORS**

- (All fixed resistors are 1/2-watt, 1% units unless otherwise noted.)
  - R1—33,000-ohm, 5%
  - R2—100-ohm
  - R3—1000-ohm
  - R4—10,000-ohm
  - R5—500-ohm, multi-turn potentiometer

**ADDITIONAL PARTS AND MATERIALS**

- J1, J2—Male BNC connector
- J3, J4—Banana jack
- NE1—NE-2H neon indicator
- S1, S2—used SPST switch
- S2—SPST rotary switch
- PL1—AC plug and line cord
- T1—12.6-volt, 300-mA, power transformer
- Perboard material, coaxial cable, project case, wire, solder, etc.

---
acts as a very simple AC signal source. It receives its power from PL1 via the power switch S1. A neon lamp, NE1, is included in the circuit to indicate that the unit is on.

Resistors R2–R4 are precision units that take the place of R in Fig. 1. Switch S2 allows you to choose one of those resistors to get the scale you wish. For example, if you select R3, then a 1-volt reading on your scope indicates a 1-mA current flow. The voltage across that resistor is sent to the scope's Y input through BNC connector J1.

Integrated circuit U1 is the active current-limiting device. It is an LM317, which is normally used as an adjustable positive-voltage regulator, but it can be used as a current regulator when wired as shown. Multi-turn potentiometer R5 sets the maximum current level that the regulator will permit.

The LM317 is a DC device, even when used for current regulation, so diodes D1–D4 are used to steer the AC flowing through the rest of the circuit into the regulator with the right polarity. Keep in mind that only the regulator receives DC, the rest of the circuit is AC. The active current limiter can be removed from the circuit [shorted] by closing S3. That is useful for testing reactive devices, which don't require current limiting and yield a more informative curve without it.

The component that you wish to examine should be connected to the component test terminals, J3 and J4. The voltage across the component is made available to the scope's X input via J2.

**Construction.** Building the EZ-Curve couldn't be easier. That's because so few components are involved. We used a piece of perforated construction board and point-to-point wiring to do the job. Follow Fig. 2 as a wiring guide.

First mount all of the small components on the board, but be sure to leave enough room to mount the transformer on the board as well—leave the transformer for last, because it's easier to work on the board without its added weight. We used a PC-mounting potentiometer for R5 because it must be adjusted only once in the initial calibration of the unit. Therefore, you don't have to have front-panel access to that control.

We included an on/off switch (S1) and neon power-on indicator (NE1) in our prototype. If you don't have them on hand, or don't wish to go for the added expense, then it is perfectly alright to leave them out. In that case, just remember to unplug the unit when not in use.

Switch S2 must have at least three positions. Although the one in our prototype has a lot more than three, we used it because we had it on hand. You can use whatever switch you have on hand, or purchase an appropriate one.

Although shielding is not required on the connections to J1 and J2, we used lengths of shielded cable because it's easier to attach the required BNC connectors to that kind of wire. The BNC's connect to your oscilloscope inputs.

Two binding posts (J3 and J4) are used to connect the component under test to the EZ-Curve. They should be mounted for easy access on the front panel of whatever cabinet you use so that inserting a component to be tested is as simple as possible.

The size of the cabinet is determined by the overall size of the board and the height of the transformer. Since shielding is not a concern, you can use whatever kind of cabinet you like—plastic, metal, etc. The cabinet we used is best suited for front-panel mounting of the controls. However, depending on the cabinet you use, they can be mounted wherever it's most convenient.

**Adjustment and Operation.** The current limiter needs to be adjusted before you use the unit. If not adjusted properly you could damage the precision resistors as well as any component you try to test. Stick to the easy adjustment procedure that follows and no harm will befall you.

Start by connecting an ohmmeter across R5. Adjust that potentiometer to 125 ohms and remove the ohmmeter. Plug the circuit in and turn it on. Switch the scale control (S2) to the 1-mA/V position and make sure S3 is open. Connect J1 to an input on your scope (the scope should not be in X vs. Y mode right now). The scope should display nothing at this time.

Connect (read that "short-out") the component test terminals (J3 and J4) together. You should see a slightly distorted sawwave of around 20 volts peak-to-peak. If not, carefully adjust the potentiometer, R5, being careful not to stray too much higher than 20 volts peak-to-peak.

Now switch to the 10-mA/V position and check the waveform. It should be less than or equal to 2 volts peak-to-peak. If it's higher, adjust R5 to lower the voltage. Remove the wire shorting J3 and J4 and you're all done with the adjustment procedure.

To use the unit, you should connect J1 to your scope's Y input and J2 to its X input. Before connecting a component to J3 and J4, ask yourself this unlikely question: Will the component be harmed by 10-mA? (This is usually only a concern with FETs and other semiconductors with high input impedance.) If the answer is "yes," set the scale switch to the 0.1-mA/V position and leave it there. That will limit the current to less than 2 mA, which is harmless for any device (and is a standard output-current limit for oscilloscope-based component checkers). However, for most semiconductors, you can use any scale that suits you.

If the component is an inductor or capacitor, close S3. That prevents the current limiter from altering the characteristic curve. As you'll soon see, that will allow you to gather the important information contained in the curve. However, this is not an important consideration when testing non-reactive components.
Non-Reactive Characteristic Curves. As was mentioned, a characteristic curve can really tell you how a component functions if you know what to look for. Such plots can also help you to determine whether a part is operating according to its specifications so you can weed-out poor components. If a standard plot is not available, you can compare the plots of suspect components to those of working devices.

Simply put, a characteristic curve is a plot of voltage versus current for a given device. They are very revealing because the relationship between current and voltage is all you need to know to use any component.

To give you more of a feel for what a characteristic curve is let’s start by examining the simplest one possible: the “curve” of a resistor. As you might suspect, the characteristic curve of a resistor (its voltage to current relationship) is based on Ohm’s Law:

\[ V = IR \]

If you were to connect a resistor to an adjustable-voltage source, and plot the current through the resistor versus a number of different input voltages, the resulting “curve” would be a straight line. One over the slope of the line, which would be \( \frac{V}{I} \), would be equal to the resistance. The steeper the slope the smaller the resistance.

Such a plot is not terribly useful (it’s easier to use a multimeter), but it serves to illustrate how the EZ-curve works: If the resistor were connected to the EZ-curve, you would get a straight line. That’s because the EZ-curve would apply a continuously varying (read that “sinewave”) voltage to it and supply the scope with the resulting voltage and current information. If the resistor had a low value, the plot would look like the one shown in Fig. 3. (Remember the X-axis is flipped around.)

Other devices have more interesting and more informative curves. For example, a diode would generate a curve something like that shown in Fig. 4. The forward-bias portion of a good-diode curve should have a steep slope. Furthermore, the knee of the curve, where the diode begins to conduct, should be fairly sharp and close to the origin. Poor diodes will appear to have shallow slopes, wide bends, require too much forward voltage to conduct and/or breakdown too easily when reverse-biased. The last problem will manifest itself as a “tail” hanging off the end of the curve (see Fig. 5).

**Fig. 5.** Zener diodes look like diodes with a poor breakdown region when reverse biased. The breakdown voltage should be approximately the diode’s specified Zener voltage.

**Fig. 6.** This curve is typical of a reactance, whether a capacitor or inductor. The three important data points are marked here.

You can directly read the diode’s reverse-leakage current and turn-on voltage from the oscilloscope trace. You can determine the forward-bias resistance of the diode by finding the slope of the forward-biased part of the curve and dividing it into 1.

Zener diodes will produce the same forward-bias curve as a normal diode, but the reverse-bias part of the trace will have a tail (like the diode in Fig. 5). Such a Zener is actually good. The tail should occur very near the specified Zener voltage, and the diode should be able to handle the rated Zener current at that voltage. Again, that can be determined directly from the plot. Unlike a regular diode, the forward-biased portion of a Zener can be ignored.

Bipolar transistors can be viewed as a pair of diodes tied together: NPN transistors are like two diodes placed anode-to-anode and PNP transistors are like diodes connected cathode-to-cathode. They must be tested one “diode” junction at a time. Regardless of whether its an NPN or PNP transistor, the emitter-base junction should produce a plot like a Zener diode. The collector-base junction should look like a good rectifying diode.

Use the same rules you would use for the two types of diodes to judge transistor junctions. Sharp bends indicate a transistor suitable for switching applications. You should compare several transistors with the same part number to get a feel of what to look for. The wide range of quality (and its absence) that you’ll find among transistors purchased in bulk will probably surprise and perhaps disappoint you.

Reactive Components. As we mentioned, the device can help you determine impedance, Q-factor, and all the other attributes associated with reactive components (capacitors and inductors). You just have to take some readings off the scope and do a little simple math, as we’ll explain.

Unlike the components we’ve already examined, the curves for reactive components look like slightly-tilted ellipses (see Fig. 6). Without getting too bogged down in theory, the ellipse-like shape is due to the fact that current and voltage in reactive devices do not change in step with one another. The slant just indicates that the component contains some DC resistance.

The important characteristics of reactive devices are impedance, Z; reactance, X; resistance, R; Q-factor, Q; and the value of the component: L for an inductor, C for a capacitor. You can determine all of these quantities by taking three measurements off the device’s characteristic curve (look back at Fig. 6) and doing some very simple math. Keep in mind that since the EZ-Curve operates at 60 Hz, the values you obtain for impedance, reactance, and Q-factor are only true at 60 Hz. You will have to do a little extra math to determine those values for other operating frequencies. Of course, once the resistance and the value of L or C are determined, it is easy to determine Q, X, and Z for any desired frequency.

For our purposes, the sign of the quantities should be dropped, so as to make all your readings positive numbers. To further simplify things, the math is the same for both inductors and capacitors when determining Z, X, R, and Q. Only finding the components value, (Continued on page 88)
Popular Electronics

Holiday Gift Guide

Find the perfect electronic gift for nearly every interest and just about every budget in this handy guide to holiday giving

The holiday season is fast approaching. Ideally, that should conjure up images of family and friends, caroling, sleigh rides, parties and tree-trimmings. In reality, those images are often obscured by the dread of shopping without a clue as to what to buy, and visions of frantic shopping expeditions in crowded department stores create unnecessary tension (Who hasn't experienced 10-minute-to-closing-on-December-24th panic?)

Luckily, consumer electronics provides the solution to many gift-giving dilemmas. Here, we'll give you suggestions for people with electronics-related hobbies—videographers and computer buffs, for instance. But we'll also show how electronic gifts can be perfect for just about anyone on your list, from your toddler to your grandmother. And we'll try to show you gifts that will fit in every budget.

Gifts for Kids. Holiday gift-giving, of course, is really for the kids, and no age group is more receptive to electronics than children. Today's kids are exposed to electronic gadgetry from the day they're born—and sometimes even before! They certainly don't suffer the "fear of electronics" that plagues many of their grandparents (and some of their parents).

After all, what's to be afraid of, with such "friendly" gadgets as the My First Sony Clock Radio (Sony, $44.95). So kids won't miss a minute of the busy schedules, it wakes them on time with sound effects—a bird, a train, a dog—or, for kids who hanker for a taste of the rat race, an alarm. To help them learn to tell time the old-fashioned way, the clock sports a face with big hands and big numbers.

Another friendly electronics item for preschoolers is the Rockin' Robot (Play-skool Electronics, $54.99). The AM/FM cassette-recorder resembles a smiling robot, and has an easy-to-grasp handle, large brightly colored buttons, and a microphone so that kids can record their own songs as soon as they're old...
enough to sing. It comes with an audio tape featuring children's recording star Joanie Bartels.

Now that rap music has become overwhelmingly popular, older kids may be fans of MC Hammer or Vanilla Ice. If that's the case, the RAP-1 Rap Keyboard (Casio, $99.95) lets them sound like real rappers. The instrument has a round "scratch table" that simulates the record scratching sounds used in rap music, a voice changer, 25 preset sounds and sound effects, and 30 different background-rhythm patterns.

Music has often been a source of strife between the generations. Have you had it up to here with rap? Are your youngsters playing videogames when they're supposed to be practicing their classical piano lessons? The Miracle piano-teaching system (The Software Toolworks, $379.94 for 8-bit NES or $479.95 for 16-bit NES and Amiga formats) lets them do both at the same time. It hooks up to a Nintendo system or Amiga computer and uses personalized video games and programs to teach kids (of all ages) to play the piano. It focuses on actual songs rather than repetitive exercises, provides a repertoire of songs ranging from the classics to rock, and uses self-paced progressive lessons for customized instruction.

If your children get tired of practicing, tell them "Don't have a cow"—after they're done, they can play The Simpsons: Bart vs. The Space Mutants (Acclaim Entertainment, $44.95) or Bart Simpson's Escape from Camp Deadly ($27.95). Those games bring the ever-popular cartoon star to standard Nintendo Entertainment Systems and Game Boy handheld units, respectively. Cool, man!

If you're even more tired of listening to their videogames than their music, try putting the LaserScope voice-command optical targeting headset (Konami, $39.95) under the tree. It will allow your child to play any Nintendo Zapper Gun games by lining up the target through an "eyescope" and then saying "fire" when ready to shoot—giving a whole new dimension (and sound) to video-game playing. The LaserScope also doubles as headphones for stereo listening, sparing parents from loud music as well as videogame-generated noise.

Kids can also listen to music privately—and make a fashion statement—with the Light Switch stereo headphones (Koss, $9.99). Made of a light-sensitive plastic, the headband, yoke, and cord of the headphones change color in the sun. When biking, roller-blading, or at the beach, the headphones change from light pink to deep purple in a few seconds.

Don't get the impression that children's electronics are all music- or video-game oriented. The board game isn't dead yet—just updated for the 90's. Youngsters nine years and older can travel around the world in the comfort of their living room with Passport to the World (Texas Instruments, $50), an electronic board game that teaches them about geography as they play. Players interact with the "electronic flight controller," which assigns destinations, poses questions, and updates players on their positions on the board. Players move by correctly answering questions about geography, famous people, food, sports, clothing, climate, and inventions. The first player to collect six passports wins—but such setbacks as lost luggage make travel difficult at times, just as in real life.

Finally, here's one you'll be tempted to "borrow" from the kids: The TurboExpress handheld video-game system (NEC, $299) has an optional tuner ($99) that allows it to double as a miniature color TV. The unit plays any 16-bit TurboGrafx-16 games with high-resolution and sharp colors.

Gifts for College Students. Older kids—high school and college students—might appreciate some gadgets to help make their classwork easier. Researching term papers has never been more convenient than with the portable electronic Random House Encyclopedia (Selectronics, under $350). The pocket-sized reference tool lets students scan through its more than 20,000 entries using a key word or subject, and optional cartridges allow the addition of spelling and translator functions.

If your young students have trouble even starting research because they don't know how to spell the subject they're supposed to be researching, then wrap up the Wordmaster (Franklin, $59.95). By typing in a word the way it sounds, the compact thesaurus and spelling corrector displays the correct spelling, the definitions, and synonyms instantly.
for the trip up to college.) With audio and video inputs, the Sentry 2 can act as a monitor. Of course, a remote control is featured, and a sleep timer should prevent tired students from leaving the set on all night.

Sansui “Robot Changer” Mini System

With all those electronic goodies, there will be little space left for an audio system, something no college student can live without. The MC-2000 shelf system (Sansui, $849.95) has a footprint of only about 11 inches square, so it won’t take up much space. Despite its small size, the system includes a 5-disc CD changer—perhaps the smallest on the market. Instead of using a cartridge or carousel, the changer uses a “robot” arm. Up to five discs can be placed in the first well. The arm picks up the top disc and moves it to the second well for play. When the disc is finished, the arm then moves the disc to a third well, and starts the process over again.

Gifts for Videographers. The camcorder has created a whole new group of hobbyists: amateur videographers. With almost three-and-a-half million camcorders expected to be sold by the end of this year, there’s likely to be more than one videographer on your list, and there are plenty of gadgets on the market that are sure to be a hit with them.

There’s also a special camcorder that deserves mention. Sure to be at the top of any serious videographer’s Christmas list is the L1 camcorder (Canon, $2999). As the first to allow interchangeable lenses (just like a 35-mm camera), the L1 provides hitherto unheard of versatility. The Hi-8 camcorder accepts all VL-mount video lenses. With a special adapter, it can also use lenses from Canon’s EOS “EF” 35-mm autofocus cameras. The full range of high-end camcorder features are provided, along with some special digital effects.

The people manning a camcorder are often so busy capturing important family events on tape that they miss all of the festivities themselves. You can give family chroniclers a break with In The Picture (Visionary Products, $299), which tracks the main subject—the proud graduate, the birthday girl, or the guy dancing with a lampshade on his head—automatically. A remote transmitter clips to the subject’s belt, and the receiver attaches between your camcorder and a tripod. As the subject moves around, In The Picture causes the camcorder to swivel on the tripod, tracking the movement while the videographer joins in the fun—and even gets in the picture!

Although a tripod is required to use In The Picture, it is recommended anytime you want to achieve smooth, jitter-free, professional-looking results with any camcorder. The model V-0550 tripod (Ambico, $149.95) is sturdy enough to be used professionally, with even the largest and heaviest of camcorders. It incorporates numerous convenience features including quick-release camera mounts, fluid heads for panning and tilting, bubble levels, geared elevator crank, quick leg-locks, and sturdy locking leg braces. The anti-slip center column extends to a height of almost six feet!

Of course, capturing the action on tape is only half the job. Editing the footage into a cohesive, interesting, or even funny video is the harder part, although the payoff is worth the effort. There’s no question that those clips shown on “America’s Funniest Home Videos” wouldn’t be so amusing without the added sound effects. The Boing Box sound-effects generator (Videonics, $179) lets the videographer on your gift list add not only music and narration, but also 50 digitally sampled sound effects to their favorite videos. A digital sequencer makes it possible to program a series of sounds—footsteps, laughter, a squeaking door, and a “boing” sound, for example—as the action unfolds.

Gifts for Travelers. Whether for business or for pleasure, there’s no question that Americans are on the move. If your gift list includes any frequent travelers, here are a few items that will make their journeys more pleasant.

Have you ever tried to unfold one of those huge roadmaps as you were driving, in an attempt to locate the next exit? Or decided to pass up a rest stop in favor of “the next one”—only to discover the next one is several hundred miles away? The Interstate Tripmate (Whistler, $99.95) is a pocket-sized electronic replacement for roadmaps and guidebooks that provides mileage and directions to key cities. It also provides up-to-date information about locations of gas stations, lodging, restaurants, tourist sites, and visitor information centers. An optional, plug-in memory module allows do-it-yourself information updates.

Know anyone who’s planning a European tour, or whose business involves frequent international travel? They’d get a lot of use out of the Interpreter II (British Boston Marketing, $249.95), a talking, multi-lingual translator. The device translates words and phrases in English, French, Spanish, Italian, and German, and provides variable speed pronunciation so that you can more easily understand the spoken translations.

Anyone who travels on airplanes
knows how uncomfortable those headsets are, and how bad they sound. You can save someone on your gift list from those horrors with the Air-Dapter (Executive Travelware $34.95). The battery-powered amplifier plugs into the headphone jacks on an airplane’s seat, amplifies it, and allows you to use a pair of standard headphones (included) for better, more comfortable sound. (You also save that $4 rental charge on each flight.)

Gifts for Grandparents. It's difficult to categorize a group by any one characteristic (so please bear with the following generalizations), but senior citizens have different needs and lifestyles from other age groups. Retired people often have more time to spend on hobbies. Age often brings some physical problems like a loss in hearing or sight. And older people can be among the most resistant to new innovations in consumer electronics. Yet there are plenty of products out there that can enhance their lives.

Do you know someone with a lot of time on his hands—perhaps a retired person who could use both a hobby and some company? Chesster (Fidelity Electronics, $599) can provide both. Chesster is a walking, talking chess set that not only moves its own pieces, but gives a running commentary on the game in the form of helpful hints and smart-alecky quips. At its highest level of play, the game can beat 95% of the chess-playing population, so the play is always challenging. And Chesster has one big advantage over a garrulous real-life opponent—you can turn off its voice if it gets too annoying.

One of the unfortunate "side effects" of aging is often a loss in hearing. For those on your gift list who have hearing impairments, two devices would be welcome. The TeleCaption VR-100 closed-caption decoder (National Captioning Institute, $130) displays the hidden captions that are available on many live and recorded video programs. The compact decoder works with a VCR, cable converter, or satellite receiver. The TDD 2700 telecommunications device for the deaf (AT&T, $249.99) allows hearing impaired individuals to type messages back and forth over the telephone line. A high-sensitivity switch helps eliminate errors in the incoming message that can be caused by a noisy phone line; a port for connecting an external printer also is provided.

If Grandma’s VCR’s display is still flashing 12:00 AM, that’s a sure sign that the unit isn’t being used to record any programs! One way to get around the cry of “I can’t figure out how to program the darn thing!” is the VCR Plus+ instant programmer (Gemstar, $59.95). With the VCR Plus+, anyone can master timer taping by simply typing in a special code (printed in TV Guide and several major newspapers) that corresponds to the show to be taped. It works with virtually any wireless-remote VCR and most cable-box/VCR combinations.

Copying VHS-C home videos of your kids onto standard VHS tapes so that your parents can watch them on their VCR is time-consuming—and unnecessary if you give your folks a PV-7000 VCR (Panasonic, $499). The unit accepts either standard or compact VHS tapes for recording and playback. No special adapter is required for playing VHS-C tapes.

Gifts for the Executive. Gadget-loving executives will flip for the VoicePrint 50 two-line telephone (Ascom Communications, $209.99). Up to 20 numbers can be stored in memory and recalled by simply speaking the name of the person to be called! Up to 50 other numbers can be stored for push-button speed dialing. The VoicePrint 50 automatically selects the correct line for an incoming call and automatically selects the free line for outgoing calls.

The Rolodex, that indispensable tool found on countless desktops, has been updated. Give the “new and im-
dio input. The idea behind the MasterMind is that pulsating light and sound can force your brain to produce brainwaves of certain frequencies. So, for example, if you want to enter an Alpha state (similar to what is achieved with transcendental meditation), you simply let the MasterMind get your brain to produce brainwaves between 8 and 12 Hz.

MANUFACTURERS' ADDRESSES

Europe America
694 Ft. Salonga Road
Northport, NY 11768
CIRCLE 76 ON FREE INFORMATION CARD

Executive Travelware
P.O. Box 358378
Chicago, IL 60659
CIRCLE 77 ON FREE INFORMATION CARD

Franklin Electronic Publishers
122 Burrs Road
Mt. Holly, NJ 08060
CIRCLE 78 ON FREE INFORMATION CARD

Gates Energy Products, Inc.
P.O. Box 147116
Gainesville, FL 32614-7116
CIRCLE 79 ON FREE INFORMATION CARD

Gemstar Development Corporation
335 North Los Robles Avenue
Suite 870
Pasadena, CA 91101
CIRCLE 80 ON FREE INFORMATION CARD

Goldstar Electronics International
1000 Sylvan Avenue
Englewood Cliffs, NJ 07632
CIRCLE 81 ON FREE INFORMATION CARD

Infrared Research Labs, Inc.
820 Davis Street
Suite 444
Evanton, IL 60201
CIRCLE 82 ON FREE INFORMATION CARD

Koss Corporation
4129 North Port Washington Ave.
Milwaukee, WI 53212
CIRCLE 83 ON FREE INFORMATION CARD

Magnavox
Division of Philips Consumer Electronics
One Philips Drive
P.O. Box 14810
Knoxville, TN 37914
CIRCLE 84 ON FREE INFORMATION CARD

Microsoft Corporation
One Microsoft Way
Redmond, WA 98052
CIRCLE 85 ON FREE INFORMATION CARD

National Captioning Institute
5203 Leesburg Pike
15th Floor
 Falls Church, VA 22041
CIRCLE 86 ON FREE INFORMATION CARD

NEC Technologies, Inc
1255 Michael Drive
Wood Dale, IL 60191
CIRCLE 87 ON FREE INFORMATION CARD

Pacific Data Products
9125 Reeho Road
San Diego, CA 92121
CIRCLE 88 ON FREE INFORMATION CARD

Panasonic Industrial Company
Two Panasonic Way
Secaucus, NJ 07094
CIRCLE 102 ON FREE INFORMATION CARD

Panasonic Company
One Panasonic Way
Secaucus, NJ 07094
CIRCLE 121 ON FREE INFORMATION CARD

Playskool Electronics
Harborside Financial Center
400 Plaza Two
Jersey City, NJ 07311-3962
CIRCLE 122 ON FREE INFORMATION CARD

Pioneer Electronics (USA) Inc.
2265 East 220th Street
P.O. Box 1720
Long Beach, CA 90801-1720
CIRCLE 123 ON FREE INFORMATION CARD

Pioneer Laser Entertainment Inc.
2265 East 220th Street
Long Beach, CA 90810
CIRCLE 124 ON FREE INFORMATION CARD

Radio Shack
Division of Tandy Corporation
One Tandy Center
Fort Worth, TX 76102
CIRCLE 125 ON FREE INFORMATION CARD

RTW International Corp.
1110 Lake Cook Road
Suite 150
Buffalo Grove, IL 60089
CIRCLE 126 ON FREE INFORMATION CARD

Selectronics, Inc.
Two Tobey Village Office Park
Pittsford, NY 14534
CIRCLE 127 ON FREE INFORMATION CARD

Sony Corporation
Sony Drive
Park Ridge, NJ 07656
CIRCLE 129 ON FREE INFORMATION CARD

Texas Instruments
Consumer Relations
P.O. Box 54
Lubbock, TX 79408
CIRCLE 131 ON FREE INFORMATION CARD

Synetics Systems, Inc.
3822 Stone Way North
Seattle, WA 98103
CIRCLE 130 ON FREE INFORMATION CARD

Videoconics
1370 Dell Avenue
Campbell, CA 95008-6604
CIRCLE 132 ON FREE INFORMATION CARD

Whistler
Five Lyberty Way
Westford, MA 01886
CIRCLE 133 ON FREE INFORMATION CARD

Gifts for Hobbyists. What do you get for a fellow electronics and computer hobbyist—or put on the top of your own list? You might start off with the Realistic DX-440 shortwave radio (Radio Shack,
also plays all CD audio discs. Unlike other drives with audio outputs, all the functions of the the CDD461RS can be controlled directly from the front panel, just like a standard CD player.

Even if you buy a CD-ROM drive for yourself, you can make your family happy that you did, with Compton's Family Encyclopedia (Britannica Software, $695). The CD-ROM disc contains all 26 volumes of the 1991 printed version of Compton's Encyclopedia—more than 8-million words in over 30,000 articles, 15,000 images, maps, and graphs, 30 minutes of audio, and an interactive multiple-world window atlas. Webster's Intermediate Dictionary is on line, as is a spell checker. A natural-language search and retrieval system lets users enter questions as they would speak them.

Laser printers were once expensive, esoteric devices. They've come down dramatically in price, thanks mainly to the efforts of Hewlett Packard, which now controls almost three quarters of the low-end laser market. Many users are finding, however, that their laser printers don't offer the flexibility, compatibility, and power that they need—power that is available only in PostScript-compatible printers. PostScript compatibility, however, can be added to HP LaserJet printers simply by plugging in the PacificPage PostScript emulation cartridge (Pacific Data Products, $499). The cartridge is available for all HP printers, and offers 35 scalable fonts and powerful graphics capabilities.

Gifts for the Family. There are many consumer-electronics items with across-the-board appeal that can't be put in any one category. Some of them would make good "family" gifts, others might bring to mind specific people on your gift list.

There was a time in the not-too-distant past when families used to gather around the piano and sing songs together. You can give your family the gift of togetherness without buying a time machine (or a piano), with the CLE-V820 Laser Karaoke player (Pioneer Laser Entertainment, approximately $1000). It allows the whole family to sing along with their favorite songs (with key adjustment to allow them to keep in tune) as the words and MTV-like video accompaniment appear on your television's screen. The unit also plays CD's and laserdiscs (with double-sided play for uninterrupted viewing). With a digital signal processor and surround sound, the CLD-V820 changes the dynamics of your home-entertainment system—creating a home theater environment—as it provides family fun.

Interactive media has hit the consumer-electronics market in the form of CDIV ( Commodore, $999). The interactive multimedia player combines compact-disc and computer technologies, and hooks up to your television set and stereo system to provide audio, graphics, video, and text that you can access using a remote control. Available software ($39–$79) offers something for every member of the family, from cookbooks and gardening guides to MIDI music-making programs, from encyclopedias to sophisticated video games, from classic children's tales to Trivial Pursuit. Besides playing special CDIV discs, the machine also plays standard audio CD's and the newer CD + G (Compact Disc + Graphics) discs.

One thing that any electronics-minded family can do without is remote-control clutter. The Sole Control SC-2000 remote control (Infrared Research Labs, $129.95) promises a solution by replacing all of your present remotes with a single unit. Guaranteed to operate any brand of audio/video equipment, the Sole Control is unique in its dual-sided design—one side controls audio devices, the other operates video devices. Up to 16 individual components can be controlled. Head-to-head programming is not required.

A remote control isn't always the solution, however. If you like to record and listen to your own cassettes, the remote works for only so long—you still have to get up to change tapes. But with the CF WM77R Six-Plus-One Cassette Changer (Pioneer, $510), you won't have to get (Continued on page 92)
The First Shirt-Pocket Radio

By Michael Brian Schiffer

The idea of a radio receiver small enough to fit in a pocket goes back to the beginning of the century, before entertainment broadcasting. The great Nikola Tesla himself envisioned "A cheap and simple device, which might be carried in one's pocket (that could) . . . record the world's news or special messages." He made that statement in 1904.

The pocket radio did not remain just an idea for long. The pages of Hugo Gernsback's radio and science magazines, especially Modern Electrics, Electrical Experimenter, and Radio Amateur News, contain descriptions and pictures of pocket wireless sets built as early as 1909 by amateurs and experimenters. The ingenious designs were not stellar performers, but they advertised the cleverness of their youthful creators. Though compact, these sets, which contained crystal detectors and turers to develop miniaturized tubes and miniaturized batteries.

Among amateurs and electronics enthusiasts, however, the idea of a pocket radio lived on. Radio magazines publicized especially compact sets that enthusiasts built in cigar boxes and camera cases. Throughout that period, Gernsback's Radio News and Radio-Craft magazines continued to urge the miniaturization of portables.

In one famous episode from 1933, Hugo Gernsback himself, using the pseudonym Mohammed Ulysses Fics, reported a new set that seemed, finally, to achieve the ideal. The set was billed as "A Revolutionary Radio Development—The Vest-Pocket 7-Tube Superhetero-Ultradyne," that was attributed to the WestingMouse company. The mini-tubes—about an inch long and ¾ -inch in diameter—were denoted "APR-1" after the month in which the article appeared. Taken-in by the April fool's prank, some readers wrote to Westinghouse seeking to buy their pocket radio. Westinghouse officials were not amused. But Gernsback did get the last laugh: by the end of the decade, tubes as small as the fanciful APR-1 were being produced commercially.

Raytheon Takes the Field. "Subminiature" tubes were the handiwork of Norman Krim and his colleagues at Raytheon; which, in the late thirties, was only a small firm that mostly made radio tubes. After doing some sleuthing in 1938, Krim determined that hearing-aid manufacturers could become a large market for miniaturized tubes. Krim proposed a project to make hearing-aid tubes to Raytheon's President, Laurence Marshall. Marshall asked Krim if he would quit in the event that the tubes failed to pay back the development costs. Krim said yes, and the work began. After months of trial-and-error, the Raytheon team succeeded. Hearing aid companies responded with orders for subminiature tubes, and Krim kept his job.

Subminiature tubes were further miniaturized and "ruggedized" during World War II for use in a variety of secret weapons. Among the most important of these was the proximity fuse, a tiny radio transceiver that triggered bombs and artillery shells when the latter approached their targets.

By the time transistor action was first demonstrated, the first commercial shirt-pocket radio had already come and gone!

not much else, also needed external antennas and grounds, ironically, operation of the pocket "wireless" required wires.

Technology appropriate for making truly portable pocket radios was slow in coming. Throughout the twenties and thirties larger portables with vacuum tubes were sold by many manufacturers; most resembled small suitcases. With few exceptions, there was little impetus from consumers or manufac-

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As the war drew to a close in early 1945, Raytheon executives (which now included Norman Krim) held a strategy session at Laurence Marshall's home to discuss various projects that could maintain the company's prosperity after the war. Many ambitious, high-tech projects were proposed, including microwave ovens (using Raytheon's magnetrons), televisions, and microwave-communications systems. When it was Krim's turn to propose a product, he picked something more prosaic: a shirt-pocket radio.

It is not difficult to surmise where this idea came from. Krim had been a radio amateur and, as a child during the twenties, had devoured Gernsback's radio magazines and built sundry apparatus. Perhaps he had even seen the WestingMouse portable with its subminiature-like tubes, or maybe he had responded to Gernsback's incessant editorials calling for ever-smaller portables. In any event, Laurence Marshall again gave Krim the go-ahead.

Krim assigned Niles Gowell the task of designing the world's first commercial shirt-pocket radio. It would not be a novelty or toy radio, but a superheterodyne unit. Working closely with Lemuel Temple, a battery expert, Gowell created a sophisticated 5-tube set only ¥-inch thick and small enough to slide easily into a shirt-pocket. Hearing-aid parts were used in the audio section, but some new miniaturized components were crafted for the RF and IF stages. The radio also required production of a new family of subminiature tubes. The filaments were powered by two penlite cells, while a small 22.5-volt hearing-aid battery supplied the B + voltage. Like many modern shirt-pocket sets, the radio had an earphone instead of a speaker.

To Market We Go. To manufacture its shirt-pocket radio and other consumer-electronic products (among other reasons), Raytheon bought the Belmont Radio Company of Chicago in 1945. When presented with the prototype, the Belmont people were not impressed; after all, they knew radio and radio retailing. In their view, this high-tech item would have few buyers because it was a novelty item. Despite Belmont's reservations, the pocket radio entered production in late 1945.

A full-page ad in Life magazine, on December 3, 1945, announced the birth of the "Belmont Boulevard." A signed painting pictured the radio, actual size, nestled between a set of keys and gloves. It was a handsome radio, reminiscent of earlier "sport sets" made by hobbyists.

However, as Belmont had predicted, customers did not swarm around stores to await arrival of the first shirt-pocket portable. Total sales reached at most 5,000. Quietly, but quickly, the "proto-Walkman" died.

Although no major U.S. radio company made another shirt-pocket set with subminiature tubes, electronic hobbyists used this most appropriate technology for homebrew pocket radios. Such radios were publicized in Popular Science, Popular Mechanics, Radio and Television News, and other magazines. A few very tiny companies sprang up in the post-war years to exploit the possibilities of the Liliputian radio. The sets they made were novelties and attracted little notice. The Privat-Ear® was the most popular of this genre, enjoying sales from 1951 to about 1954.

Shirt-pocket radios, built with subminiature tubes, failed to find a mass market in the late forties and early fifties. These sets had obvious technical shortcomings, such as poor sensitivity and very short battery life, yet no company invested much effort in improving them. Radio firms judged that a pocket radio with an earphone was not apt to become a necessity for more than a few customers.

As you can see even the more complex subminiature tubes used in pocket radios were very small indeed.

The Privat-Ear® pocket radio, measuring only 3½" x 2½"-incches, could easily fit in a pocket for listening on the go.

(Continued on page 83)
Golden Sound Retriever


We sometimes wonder whether the "home theater" craze is real, or if home theater is simply a catchy marketing phrase intended to boost the sales of audio/video components. We believe in it—but then, we get to try out the best of home-theater equipment. And we know that a plethora of consumer-electronics manufacturers are putting their faith in it. But what about Mr. and Mrs. Middle America?

Sure, they've heard about home theater. It's hard to miss all those large-screen projection and direct-view TV's out there. And not to mention the stereo MTS audio that's become de rigueur for any new video equipment. But have Mr. and Mrs. Middle America experienced it in their own homes, or the homes of their friends?

To recreate that movie-theater experience, a surround channel—and the speakers that accompany it—are necessary. Unfortunately, they present some obstacles to the average consumer. Only one of which is price. There's also the intimidating setup. Unless you're very confident about your "ear," how can you be sure that all those new components will sound the same at home as they do when professionally adjusted and arranged in the showroom? Finally, there's that extra pair of speakers that have to be installed.

Interior designers have never been fond of audio systems, with all those components and speakers that don't fit into any decorating scheme except ultra-modern. Home theater just makes things worse. Besides the oversized TV and the stereo speakers, now there are those rear speakers to worry about—assuming it's not a Dolby Pro Logic setup, which also requires a center channel for the most convincing reproduction, or a very long room, which requires side speakers as well.

We're sure that some interior designers and non-audiophile consumers have wondered why all those speakers, and precise adjustments and placement, were necessary. (They couldn't hear the difference anyway.) Well, some audio-conscious engineers are asking the same question. And the engineers at Hughes Audio Products have come up with an answer—the AK-100 stand-alone Sound Retrieval System (SRS) audio component.

Although the AK-100 is new, the Sound Retrieval System, or SRS, isn't. First introduced in late 1989 in Sony XBR television receivers, and later on some high-end GE/RCA sets, SRS has finally been introduced as a stand-alone component.

The goal of SRS is to produce accurate, three-dimensional sound from two speakers. While effectively turning your audio system into a ventriloquist—that is, making sounds seem to come from outside the physical limits of stereo speakers—might sound like a lofty and impossible goal, it's based on sound principles. (No pun intended.) To understand those principles, we must first understand how our ears normally work to interpret sounds and where they come from, and why microphones don't work the same way.

Let's presume that you are watching a play from near the front of the orchestra section in a small theater. The sounds you hear are primarily direct waves, but your ears are also hit by a number of indirect waves—reflections of the actors' voices and the orchestra that come from the ceiling, side and rear walls, etc.

When you're in the theater, you may not hear any discrete reflections—even if you try to. However, they undoubtedly affect what you hear. If you were to close your eyes, there's no way you could imagine that you were sitting in your living room. Even if you place microphones in the same location where you are sitting and make a recording, that recording won't sound like the live experience when you play it back in your living room. The reason, simply enough, is that the microphones aren't your ears.

Your ears "hear" sounds differently depending on the direction from which they come. That's mainly due to the outer ear (pinna), and the section that leads to the ear canal (chochita). Together, they act as a direction-sensitive filter that emphasizes some frequencies, attenuates others, and even lets some frequencies pass through unchanged.

A manual that accompanies the AK-100 describes a very convincing experiment that you can try for yourself to demonstrate the importance of how our ears perceive sounds depending on the direction of the source. Simply rub your fingers together in front of, but close to, your head. Then bring your hand around to the side of your head. You should notice two things. First, the volume will get louder. Second, you should notice an increased emphasis on high and middle frequencies. The demonstration is a simple, but effective, way to show that we do, indeed, hear sounds differently depending on the direction from which they come.

Omnidirectional microphones, however, have a flat frequency for sounds coming from any direction.

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VCR: The Next Generation


Soon after their introduction in 1975, videocassette recorders quickly gained unprecedented market acceptance—and made a remarkable impact on America's viewing habits. Less than 20 years later, almost three-quarters of American households own a VCR, and many have more than one. Despite that high rate of market penetration, there is still a demand for VCR's. That demand stems primarily from two sources. There are those families who purchase a second—or even a third—unit, to go with a second (or third) TV for family viewing, or so that the kids can have their own VCR's. Then there are those people—and we know quite a few—who have been anxiously awaiting the final demise of the original VCR's that they bought a decade ago. In our experience, those video "dinosaurs," which deservedly earned the entire product category the unsavory reputation of being impossible to program, are rarely mourned. In fact, most owners of defunct first-generation VCR's view their passing as a cause for celebration—and the perfect excuse to go out and buy one of today's dramatically improved models.

Those who are buying a second VCR for their kids would probably opt for the barebones models (most of which, while lacking in bells and whistles, still represent a big improvement over older equipment). Sony is targeting their SLV-585HF at the other segment of the market—those who are looking to upgrade—whether they're replacing worn-out units, or have decided to give the old VCR to the kids and treat themselves to a sophisticated, but easy-to-use, new one.

The SLV-585HF is a four-head, high-quality VHS, hi-fi stereo unit with a host of convenience features. On-screen menus guide you though the setup: from entering the time and date, to automatically presetting all receivable channels (you can manually add or delete others), from changing the audio mode, to selecting the antenna mode. The unit automatically adjusts the tracking, has a built-in head cleaner, provides an indexing system, and has front-panel inputs for a camcorder.

The faces of both the main unit and the remote control (which Sony calls the "UniCommannder") are dominated by a dual-mode jog-shuttle control, with an outer rim, which can be rotated clockwise or counterclockwise, surrounding two large, semicircular Play and Stop buttons. The shuttle is used to control most primary functions, including play, stop, fast forward, and rewind, as well as frame-by-frame advance. Variable-speed slow motion, and high-speed search—all without having to hunt around for a bunch of tiny buttons. By turning the outer rim in various increments, you can move the tape forward or backward in ½-, normal, and 2-times speeds in play mode and at 7- and 21-times speeds in search modes. Besides the jog shuttle, the main unit is starkly clean, with only four buttons (Power, Eject, Pause, and High-Speed Rewind), a display window, and the tape compartment visible on the front panel. Controls hidden in a compartment under the tape well include Mode selector, Sharpness, and Clear (which resets everything); jacks for audio and video are also located there. Several other controls are located inside the door to that compartment, including those for channel selection, recording, tracking, quick timer, and editing. In contrast, the UniCommannder (which can also be used to control other Sony video equipment) has about thirty buttons on its face, plus a 0-9 numbered keypad, but it is fairly well arranged (with one exception that we'll discuss later).

As we began experimenting with the dual jog-shuttle, one feature of the SLV-585HF made itself immediately apparent—the smooth, fast transition from one play mode to the next. Sony's proprietary "Rapid Access Tape Transport System" keeps the tape partially wrapped around the head drum at all times, so the deck goes from stop to play in a fraction of the time needed on most other decks we've

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Cordless Convenience

HELLOSET CORDLESS TELEPHONE HEADSET. Distributed by: Hello Direct, 140 Great Oaks Blvd., San Jose, CA 95119. Price: $399.00

If you have never pulled a telephone off your desk or knocked the coffee pot off the kitchen counter as you stretched the hand-set cord just a bit too far, then you're a rare individual, indeed. Our informal poll didn't turn up anyone who was immune to phone accidents.

We've now added a cordless phone to our arsenal, which lets us walk around our home without pulling the phone off our desk; and without the cord, we don't have to worry about knocking the coffee pot off the kitchen counter. Unfortunately, it's a partial solution at best. First, of course, we knew how easy it is to eavesdrop on cordless-phone calls, so some calls require that we use a standard phone. Second, as hard as it is to cradle our normal handset between our ear and our shoulder with the cord gently tugging it away, our cordless phone, because of its shape, is even more uncomfortable.

Of course, the problem is at its worst in our office, which is where we need the telephone most. There, of course, we can't use a cordless phone—no telephone accessories worked with our office system. At least that's what we thought. Then we heard about the Hello Direct HelloSet Cordless telephone headset, and wanted to give it a try.

The HelloSet Cordless consists of two pieces: a base unit that acts as a battery recharger, and the headset itself, which sits on the base unit when not in use. The system is connected to your telephone via the phone's handset—the handset plugs into the HelloSet's base unit and a short cable supplied with the HelloSet connects that base unit to your telephone's handset jack. (If your PBX phone uses a 2-prong handset jack, you'll have to buy a $20 adapter from Hello Direct.)

The charcoal-colored base is about the size of a small desk telephone, and it is styled to look at home on your desk. The base charges the headset between uses, as well as charging a second battery.

The headset weighs about 7 ounces, and has a wide, comfortable, easily adjusted headband. Although the headset has only one earpiece, it's balanced reasonably well by the battery, which is on the opposite side of the headband, above the other ear. The microphone is mounted on a boom that can swing up over the head when it's not in use. The boom acts as a function switch as well. When it's stored up over the headband, the headset's power is turned off. When it's swung down to chin level, it's linked to the base unit on the 900-MHz band. When swung up half way, the microphone is muted—but you can still hear the party to whom you're talking. A volume control is located by the earpiece.

The base unit is styled to match a standard business telephone, although it's smaller. It acts as a recharger for the headset's battery, and it also stores—and recharges—a second battery, so you'll always have one ready. Although we liked the two recharging bays, we're not sure that we like the base unit as a whole. It's too big. We have too little desk space as it is, and find it hard to increase the required telephone real estate by more than 50%. Also, because of the way the headset mounts on the charging base—it just sits there instead of being held in place—the base must remain flat or the battery won't make sure contact. On a crowded (in other words, messy) desk, the unit often got tipped enough that the battery lost contact. Fortunately, an LED, which lights when the headset is properly mounted, should alert you to the problem. Two potentiometers let you adjust the input and output levels to match virtually any telephone.

The HelloSet Cordless is not a cordless telephone. To make or receive a call, you must be near your telephone. To make a call, for example, you must put the headset on, and then take your handset off the hook and dial as normal. When you're finished with the call, you have to hang up the phone as normal, and move the microphone boom out of the way to turn off the headset. To receive a call, you must also be at your phone so that you can pick up the handset. The HelloSet Cordless does not work with telephones where the dialing is done through the handset.

It seems to us that the HelloSet Cordless would be ideal for someone who spends a lot of time in his office, but who needs his hands to shuffle through papers or books—or use a computer keyboard—while on the phone. And having your hands free while you talk on the phone—and keeping your neck straight at the same time—is something we could get used to.
High-Touch Home Office


There's no question that the home office has arrived. In fact, there are almost 20 million full-time home offices in the U.S. today—and there is someone working at home, whether part-time or full-time in almost a third of all American households. There are several types of home-office workers. Some are simply doing "homework" (tasks that couldn't be finished during regular office hours), some are self-employed or run small businesses from their homes, some work part-time or do freelance work on their own time, and others work full-time at home for an employer. Reflecting the variety in home-workers, there are many types of home offices. Sometimes the space consists of a few square feet carved out of a former closet or a corner of a bedroom, kitchen, or den; a spare bedroom might be pressed into office duty; and occasionally a garage, basement, or attic is converted to office space. Whatever the differences might be between the types of workers, the jobs being done, and the type of space being used, almost every home-office situation has two basic similarities. First, they must be stocked with equipment to meet the demands of a high-tech job market. "Information equipment" (as it's called by the Electronic Industries Association) includes personal computers, facsimile machines, telephones, answering machines, copiers, typewriters, calculators, and personal organizers. Second, in today's smaller homes, office spaces are usually vying for floor space with the rest of the family's needs and hobbies—audio/video equipment, exercise gear, storage space, etc.—so size restrictions are the rule.

An obvious contradiction arises: How do these workers manage to squeeze all those electronic necessities into the tiny space allotted? Canon has come up with an elegant solution. The Navigator HD-40 system integrates the functions of a facsimile machine, a telephone, a digital answering machine, a plain-paper copier, an image scanner, and personal computer into one compact unit. With bundled software designed to meet home-office and small-business needs, an ink-jet printer, and a 40-megabyte hard-disk drive, the Navigator is actually a "desktop office."

After using the Navigator in our GIZMO offices for the past few weeks, we realize that we can't provide details of each of the unit's functions in the space we have on these pages. (Canon requires seven full-length manuals, a quick-reference guide, an introductory booklet, and a video manual to fully explain its scope!) Instead, we'll give you a brief overview of what you can do with the Navigator, and some of our general impressions of it.

For a system that comes with all these manuals, the Navigator is remarkably easy to set up and start using. To a large extent, that is due to the video manual, an hour-long, step-by-step tutorial that leads you through the hardware setup and software installation with clear language and practical demonstrations. Anyone can get the system up and running—if they can lift the 36-pound main unit out of the box!

The telephone and handset, answering machine, fax, thermal printer and paper roll, 40-megabyte hard drive, 3½-inch floppy drive, and 10-inch monochrome CRT are all built into the main unit—so it's less surprising that it's somewhat heavy than that it measures only 14½ x 12⅞ x 13⅜ inches. The 9-inch black-and-white display is smaller than those we're accustomed to, and so is the print on the screen. Despite that, and despite the fact that there's no contrast control (just brightness), the resolution is excellent for text, and the screen is easy to read. Peripherals include a compact Bubble Jet printer, a mouse, a full-size keyboard, and the cables needed to connect it all. Everything is a sleek, flat black.

The compact Bubble Jet printer, which emulates the IBM Proprinter and Canon's BJ-130e, outputs letter-quality text and graphics (360 x 360 dots per inch) on standard bond paper, envelopes, and even transparencies. It includes two internal fonts in three pitch sizes. A replaceable cartridge makes the printer virtually maintenance free, and because it's a non-impact printer, it's incredibly quiet. It is, however, equally slow and, as we discovered one rainy day, the ink is not waterproof.

As soon as the system is up, the main menu, which consists of 24 icons arranged in three rows of eight, appears on screen. To access any function, you simply touch the icon—the touch screen responds. Alternately, you can point and click with the mouse. Nine of those icons represent the Navigator's eight software application processes: Q&A for database and word processing; Publish It! (this one has two icons) for desktop publishing; Deluxe Paint II for drawing and painting; Word For Word to automatically convert document files from one format to another, Backup Pro/Optimize for hard-disk backup and reorganization tasks, Recover for data recovery, a typing tutorial called Mavis Beacon Teaches Typing, and a computer chess game called Chessmaster 2000. The other icons represent telephone, fax, DOS, copier, phone-book, and other basic functions such as "clean screen," which freezes the screen so that you can clean it (with the included wipes) without activating any of the functions—a frequent necessity when you're touching the screen all the time. A touch-screen "button" in the top left corner serves as an "escape" key. In the top right corner are two other "buttons"—Tel and Fax—used to go immediately into the memory-resident phone or fax modes while in the midst of another application.

The Navigator uses two microprocessors. An 8-MHz V50 runs the Navigator touch-screen environment and the phone/fax systems. A 10-MHz 8086-1 microprocessor runs standard DOS applications with IBM XT compatibility.

The answering machine, however, is not handled outside of DOS. In fact, it can be used only if the computer is on—but you can't use the Navigator for any other tasks when the answering-machine mode is on. We can understand why Canon did it that way (Continued on page 8)
Instant Information


The promise has been implied all along: Once you get a computer, you'll have all the information in the world at your fingertips. Well, as the "computer revolution" became more of a real thing, and computers found their place in the offices, classrooms, and homes of regular people, it became obvious that the promise wasn't being fulfilled. People began to realize that the adage "garbage in, garbage out" was true, and that even though computers offered greater ease and speed in countless applications, unlimited access to information remained an elusive dream.

Now, however, a big change is coming about, thanks to CD-ROM. The CD-ROM, although introduced in the mid-1980's, is just now starting to move into the mainstream. Although it's long been considered an ideal tool for serious applications, it now seems that it can also be an ideal tool for families. The trend toward family use of CD-ROM was sparked by two factors. First, today's only slightly sophisticated consumers are accustomed to CD technology, thanks to audio compact discs, and many of them are also used to using computers for work or for game-playing. Second, relatively inexpensive CD-ROM add-ons for PC's have hit the market, along with an array of family-oriented software. That software includes the 1991 New Grolier Electronic Encyclopedia.

The single CD-ROM disc contains all 21 volumes of the Academic American Encyclopedia, which you might find in the young-adult section of your local library. That includes 33,000 articles, over 2000 color illustrations and photographs, and--something not found in the library's tome—audio excerpts.

What's the advantage of the CD-ROM version compared to the traditional version? Well, one obvious advantage is its size. A single compact disc and a small instruction manual don't take up much room. The real advantage, however, doesn't become obvious until you use it. Let's presume, for example, you want to research information on Jimmy Carter. In a standard encyclopedia, you'd probably go right to "Carter." In that article, there might be indications of other related articles to read. But if you want to find out about Jimmy Carter by using the Electronic Encyclopedia, you would simply enter "Jimmy Carter" at the Word Search menu. Within seconds, you would be presented with a list of 50 articles that contain the words "Jimmy Carter." Many of them contain only passing references to the president. But others contain information that is essential to get the overall picture of the Carter presidency.

In the standard encyclopedia, we probably wouldn't have looked at the article "Fuel" for information about Carter, but since it was on the list of 50 articles, we called it up by clicking on it with our mouse. (A mouse is supported, but not required.) We immediately were brought to the portion of the article that contained the reference: a section on the synthetic-fuel program initiated under Carter. We also might not have looked up "Panama Canal Zone" to get yet another side of the Carter presidency, in which he signed a treaty with Panama to return control of the Canal Zone to Panama in 2000.

Actually, the list of 50 articles isn't a complete list of all articles that reference Carter—there are really 54. But since the software allows lists containing a maximum of the 50 "most relevant" titles, we were greeted with a suggestion to narrow our search.

Narrowing the search is simple. The Word Search menu contains 4 lines for search entries. Since we have "Jimmy Carter" on the first line, we can narrow the search by entering another word on the next line. If, for example, we enter "war," then the article list would be cut to eight entries that referenced both Jimmy Carter and war.

We thought that eight seemed like a lot—after all, Jimmy Carter's presidency was a peaceful one. Well, one article, "Neutron bomb," certainly seemed relevant. In another, "Eritrea," we learned that Carter was host to preliminary peace negotiations between secessionist rebels in that province and the Ethiopian government. What did George Meany have to do with Jimmy Carter and war? Well, it turns out that the labor leader was behind the Vietnam War effort and critical of some of Carter's economic programs. Since both words were in the same paragraph, the article came up on our list.

To broaden or to narrow the search to increase the likelihood of coming up with relevant articles, you have several search options. For example, you can call up articles if they have your search words anywhere within, or only if they have the words in the same paragraph. You can restrict the list only to those articles that have the words in the exact order in which you entered them, or you can specify a given maximum distance between the search words.

You can also enter words that you don't want the search function to find. For example, if you were doing a paper on the European arena of the Second World War, you might instruct it to search for articles about World War II, but not about Japan. The "or" logic operator is also supported, and the standard "*" and "?" wildcards are permitted.

Within articles, certain words appear in capital letters. Those are cross-references to articles that you can reference immediately simply by placing your cursor on the word and hitting the Enter key.

Standard encyclopedias, of course, can be fun to just read, even if you aren't researching anything in particular. Fortunately, the Electronic Encyclopedia doesn't take away any of that fun. Instead of searching for specific words in articles, you can simply use a Browse Titles function and scroll through an alphabetical list. At any time you can enter a word that you're interested in. You'll be brought to that title immediately. If that title doesn't exist, you'll be brought to the article alphabetically closest to your choice.

Some of us just like to look at the pictures. That's why Grolier included a Browse Picture Index function. There, you

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It's a DAD!


Calling cards—those cards, imprinted with one's name, used to be used by visitors in Victorian times to say "I just stopped by"—have gone out of style. Sometimes we wish they were still around—especially when we make unexpected stops and no one is home. We usually end up scrambling for some paper and a pen, and then trying to find a place to stick our message where it will be seen and where it won't blow away.

Well, just as telephone answering devices, or TAD's, solved the problem of unanswered telephones, a new product called the MessageCom from New-Tronics does the same for unanswered doors. When a visitor approaches your door, he'll see the "door-answering device," a small, beige box that measures about 4 x 3 inches, mounted on the door. Two buttons along the bottom edge of the unit are labeled to instruct the visitor what to do. One says, simply enough, "Push to hear message;" while the other says "Push and hold to leave message."

On the inside of the door is mounted a second, larger unit, through which the outside sounds are heard. Three buttons along the bottom let you record an outgoing announcement, and use the device as an intercom instead of an answering machine.

MessageCom is supposed to work like this: A visitor comes to the door, and pushes the "hear message" button. Your voice is then played back saying something like, "We can't come to the door right now, please leave a message." The visitor follows the instructions and leaves a message for you, which is recorded digitally for playback.

One of the benefits of such a system is that you can use the door-answering machine just as you would use one for the telephone—to screen visitors. Leaving a message that you can't come to the door doesn't let the visitor know whether your home or out. If the message is from a delivery man or someone you want to see, you can simply go to the door and answer it. If it's from someone you don't want to see, such as a salesman, just let them leave a message.

The MessageCom can also be used as a standard intercom. For that mode, the Intercom button on the inside unit is turned on, and all sounds from the outside are heard. To communicate with the visitor, just press the Play/Talk button.

Although the MessageCom is reasonably easy to use, it's a little more difficult to install, mainly because the two pieces must be hard-wired together. The simplest installation is the one we described, with one piece mounted on the outside and the other on the inside of the door. Then, all you need to do is drill a hole for the wire that connects the units, and two holes for the bolts that secure the units to each other and to the door. Silicone sealant is needed around the outside unit for a water-tight seal.

It's also possible to mount the units separated by considerable distance—up to 1200 feet—as long as you have the required length of 6-conductor cable. The inside unit can be mounted on the wall, or even on a desktop using the rubber feet supplied. Templates supplied with the manual make the installation as painless as possible, and the hardware supplied should fit most installations. We can think of a couple of situations in which the long-distance setup would come in handy: when you live in the upstairs apartment in a two-family house and when you spend a lot of time in your basement workshop.

The MessageCom is powered by five Alkaline "D" cells, which should last about a year. When they have about a month's worth of life left, a "Bat" LED on the inside unit will light whenever any button is pressed.

The total message length, both incoming and outgoing, is 3 minutes, which doesn't sound like much but is actually sufficient. Additional incoming messages will replace the older ones. All messages are stored digitally—there are no tapes to wear out, and no mechanical parts to get hung up by the elements. Once the volume control is properly set, the audio quality is adequate.

The MessageCom works as claimed. The question we have is whether we can get people to use it correctly. The outside unit seems easy enough to operate, but it apparently intimidates some people. Some people will push the recording button, ignoring the clearly stated "push and hold," and we wouldn't be surprised if others simply walked away without even touching the unit.

One complaint we have is that if the unit is in the intercom mode, and the visitor presses the "Push to hear message" button, he won't hear anything. And you won't necessarily hear anything either, unless they use the "Push and Hold to Leave Message" button. And if the visitor correctly uses the message button, you won't necessarily hear it unless you're in the same room—no doorknob-type signal alerts you to the visitor.

Although the MessageCom isn't perfect, we like it nonetheless. Most homeowners don't really need it, but gizmo freaks will have fun with it. The most likely market for the MessageCom, we think, is the small, one-man business. Putting up a sign that says "Back in 15 Minutes" might work sometimes, but most customers won't come back. Given the opportunity to easily leave a message might rescue business that would otherwise be lost. We only wish that everyone we visit would have one so we wouldn't have to scramble for a pencil and paper.
GOLDEN SOUND RETRIEVER

(Continued from page 1)

ing from all directions, and cardiod microphones have a flat response for sounds coming from the sides and front, while ignoring rear sounds. A cardiod microphone might pick up reflected sounds, but when they are played back on speakers that are in front of you, you won't hear them at the right amplitude because your ears will treat them as they would any other sounds that come from in front. In other words, you'll lose any spatial cues that were recorded.

How can you restore those spatial cues? Well, according to Hughes, you just press the AK-100's SRS button.

In the original recording, the ambiance information, including indirect (reflected) and side sounds, are contained primarily in the L - R or stereo-difference signal—the out-of-phase sum of the left and right channels. Those signals are processed by the SRS circuitry to bring back the missing spatial cues and directional information.

The stereo-difference is also used by other surround processors to create a third channel of ambience. One technique (matrix surround) uses the out-of-phase information directly to produce the third channel.

SRS, however, has to produce the ambiance information using only two speakers. So after the stereo-difference signals are extracted from the left- and right-channel inputs, and before they're re-combined with the in-phase information, they're processed to bring back the missing spatial cues and directional information. The spatial information is also equalized to compensate for the ear's own direction-sensitive frequency response.

Another processing section in the SRS circuitry is a "directivity servo," which detects motion information—sounds that move from one channel to the other such as a passing car—and isolates it from stationary information so that it can be steered separately to its proper location.

Two controls. Space and Center, are used to govern most of the SRS effects. The Space control is in the stereo-difference signal-processing path, while the Center control is in the stereo-sum processing path. Essentially, Space controls the amount of SRS ambience in the output to vary the width of the sound stage. As you might have guessed, Center controls the amount of center (stereo-sum) information present in the output.

Additional controls include a Level potentiometer, a 3-D Mono button (to achieve a surround atmosphere with a mono input), and a Rev Trim button that reduces the amount of reverber present in a vocalist's voice. A Filter switch is used to reduce a rumbling noise that is heard on some program material. A Loop Sel button lets you select a second external audio input for processing.

The front-panel display meter is a series of LED's arranged in an inverted "T" to provide an indication of the center and space contents. A Bar/Dot selector lets you select between dot- and bar-mode displays, and a Display button lets you turn off the display—sure to be welcomed by people who find flashing meters distracting. A final control lets you select either processing or bypass modes.

So does all that processing work? The answer is yes, and no. When used with a video system, the effect is quite pleasing—especially when watching movies that are recorded in Dolby Stereo—but not perfect. For example, there's a scene in Bladerunner in which a futuristic flying craft enters the scene from the left rear, flies forward across the screen, and exits at the front (top right). With a Dolby Pro Logic decoder, the sound does the same—you hear it behind you first. With SRS, it isn't quite behind you. To us, it sounded more like it was beside us. But the effect was good nonetheless. In simple stereo, the sound just goes from the left to right side of the screen.

When used with music, the effect is also quite pleasing. When the processing is switched out (and you're returned to stereo) the effect is at least as dramatic as switching between stereo and mono. The SRS processing widened the soundstage and significantly widened the "sweet spot" for acceptable stereo.

We did find one situation where SRS just didn't seem to work: an NFL game broadcast. We don't know how the stereo was being handled by CBS, but the AK-100 had trouble maintaining a constant volume level. A Pro Logic processor didn't have the same trouble—the center channel stayed constant. Reducing the Space level checked the shifting level.

It seemed a bit unfair to us to expect a two-channel SRS system to compete with a 5-speaker Pro Logic setup. But we felt justified after reading a passage in the AK-100's manual that said, "such surround-type matrices are not able to play back material with any sense of REALISM." (Emphasis theirs.)

SRS does have the advantage of a much wider sweet spot, and it is much easier to adjust properly—despite the lack of any remote control that would let you adjust the processor from your listening or viewing position. But when compared to a properly adjusted Pro Logic surround system, SRS comes up short. But not so short that we would write it off. It's a cinch to set up and it does dramatically improve the sound of stereo by restoring ambience that we didn't think was possible with two speakers. It seems like a pretty good compromise to space particularly in situations where those extra speakers are unwelcome.

VCR: NEXT GENERATION

(Continued from page 2)

used. The result is not just less wasted time, but almost no missed action when switching between modes.

It didn't take long for us to get used to looking at the screen, instead of at the little buttons on the remote control, as we used the jog-shuttle to advance (or reverse) the tape at various speeds in search of a particular scene. We quickly memorized the location of one of the little buttons, however. Labeled Skip, and located just to the upper left of the jog shuttle, it speeds through 30 seconds of videotape—a time frame that directly corresponds to most commercials. Three to five taps of the Skip button neatly took us past each commercial break when watching tapes we'd made of network programming.

The SLV-585HF offers some other ways to search for particular points on a tape.

It's possible to insert "index" marks on the tape during recording or normal playback by pressing the Index Mark button; an index mark is automatically inserted at the beginning of any recording. To search to an index mark, you call up the data screen and press the Index button. The words "index scan" come up on the television screen, and flash on the deck's LCD readout. The search is activated by turning the jog shuttle clockwise for a forward search or counterclockwise for a reverse search, and then releasing the dial. The tape fast-forwards (not in play mode), and when the index mark is encountered, it returns to play mode. The data screen flashes the words "index scan" and the number of the index mark, if it is the correct mark. You hit Play to watch from that point. Up to 19 index marks can be inserted on a tape. You can also scan for a particular mark (by a number) or erase marks using the Index Erase key.

Of course, to playback or search, it helps to have some material actually recorded on the tape. With the SLV-585HF you won't have any excuses for not making your own tapes. Programming couldn't be simpler, using the on-screen menu for timer recording, or the Quick Timer button (located only on the main unit's inside control panel) for immediate recording in 30 minute increments. The timer can be set to record eight events over one-month, in the even of a power outage of less than three hours duration, the programmed timer functions will remain in memory. Although the SLV-585HF is quite easy to use, learning to use it is another matter. The manual, while not one of the worst we've seen, is needlessly complex and lacks a comprehensive overview of the unit's features, and contains at least one glaring error. We don't believe that the explanation of how to use the dual-mode shuttle ring belongs in the "Advanced Operation
Section," forty-odd pages into the manual, when that's the first control that any new owner is likely to play with. The very brief mention of the jog dial under "Basic Operations" heading could have been placed in an expanded overview section—along with something about using the Skip button to bypass commercials, something that those who are unfamiliar with the new generation of VCR's might not realize. They also might not intuitively realize that to cause the index display to appear on screen (which the manual says occurs by pushing the Index button), they must first push the Data Screen button on the remote control. Even worse, inexperienced consumers might believe the manual's instructions for searching for indexed points on the tape: "Turn the dual mode shuttle ring clockwise to locate the previous program or counter-clockwise to locate the program ahead." Obviously (to those who are comfortable and familiar with consumer electronics, at least), the ring is turned clockwise for programs ahead and counter-clockwise for previous programs.

Even disregarding that error, the manual was weakest when it came to explaining indexing. We had some difficulty getting the hang of it, and we like to think of ourselves as experienced when it comes to consumer electronics (we certainly have learned how to use quite a few more devices than the average consumer, and we don't suffer from electronics intimidation!). Yet it took us a while to interpret the vague directions and poorly labeled keys. First, we figured out that to be sure an index had been set when we pushed the Index button, we had to either rely on blind faith or push the Data Screen key for visual confirmation. We learned by trial and error that we couldn't be in play mode when searching for index marks, and that when a mark is found, the tape, which is searching at a high speed, must stop and rewind to that point on the tape. When trying to erase an index mark, we discovered (again on our own) that we had to wait until the tape had rewound to the exact mark. We still haven't figured out why the button used to scan for index marks is not labeled "scan" and grouped on the remote with the Mark and Erase buttons under the heading of Index.

Despite the illogical arrangement of those keys, the SLV-585HF expects you to give it only logical commands. To keep the user in line, it displays on-screen warnings whenever you try an illogical operation. For instance, if you try to set a timer recording with no tape in the well, "Please put in a cassette" appears on the screen. Trying to rewind a tape that's already at its starting point brings up "The tape is rewound." Other messages include "You cannot change channels, tape speed or input source during recording." "Please set clock." and "VCR is recording." Those messages can be quite helpful in reducing the frustration experienced by beginners who can't figure out what they're doing wrong.

The VCR also provides minimal editing capabilities, but it does include a Control-S input (for synchronized editing with a similarly equipped VCR) and an edit mode (which reduces the deterioration between successive generations of tapes). If editing is important to you, we'd suggest spending the extra $50 for the SLV-686, a sister model that includes a flying erase head for better editing.

Those are the limits you have to far more video watching than video editing could save money by opting for the SLV-585HF and not be missing a thing. Both picture quality and audio quality are quite good, the smooth transitions from stop to play are a delight, using the dual-mode shuttle is comfortable and easy, and (once you get past the bugs in the manual) the entire unit is a breeze to use.

HOME OFFICE
(Continued from page 4)

way. After all, if you're sitting at your computer working, you are available to answer the phone. But we sometimes prefer to let a TAD pick up the call so that we can screen it and interrupt our work only if it's important. We also don't like having to leave the system on overnight or over the weekend—basically, 24 hours a day, seven days a week—to have full answering-machine coverage. Even though the hard drive shuts itself off after a period of inactivity to save power, no screen-blanking is provided.

The answering machine does have a couple of convenient features. For instance, it can be programmed to call another line with a wake-up call every day. And, when it is activated, the Navigator can distinguish between phone and fax calls, and automatically routes incoming faxes to the fax function. If you're wondering where the answering-machine cassette tapes go, don't. They appear only on the screen. Messages are stored to disk (either hard or floppy). Faxes can be stored to disk as well and printed later (to either the Bubble Jet printer or the built-in thermal printer) or incorporated into other software for desktop publishing, etc.

When you're using the Navigator and answer the phone only to find that it's an incoming fax, you can enter the fax mode manually simply by hitting the Fax "button" on the upper-right side of the display. A fax screen appears, and you can opt to receive a printout of the fax or store it immediately to disk.

For outgoing phone calls, as soon as the receiver (which is located just to the left of the CRT) is lifted off the hook, the phone directory appears on the screen, covering the current application. Once you've input all your frequently-called numbers, speed dialing phone (or fax) calls is a snap. For outgoing faxes, a fax directory appears by pressing the fax icon at the upper right corner of the screen. It includes a "group" setting that lets you program a sub-directory with groups of people to whom you frequently send the same fax, and then send them all faxes with one command. Advanced fax functions—sending at preset times, polling, broadcasting, sending confidential faxes, sending a facsimile previously received to disk, attaching a cover sheet, faxing a document directly from an application program, and viewing and printing faxes received to disk—can be accessed by pressing the extended-fax icon on the main menu.

That gives you an idea of some of the advantages of an integrated machine. You can incorporate graphics received over the fax machine (or scanned in) into a desktop-publishing file, or make copies of faxes on thermal or plain paper. You can scan in a logo to create personalized stationary. The included software gives you even more flexibility, allowing you to manipulate files that are scanned in or created using various programs so that they are compatible with yet other programs. For instance, if you enjoy using the Navigator's built-in data base and word processor, Q&A, but everyone in your company's main office uses WordPerfect or one of the dozens of other popular word-processors, Word For Word Professional makes it easy to convert your files—including both text and formatting commands—to march. Other software also makes it possible to convert scanned image files or those received by the fax into different graphics formats for compatibility with various paint and desktop-publishing software.

You aren't limited to the included software, of course. Even with all of the included software installed, you still have 30 megabytes of free space left on the hard-disk drive to install your preferred programs. And, if you have a favorite word processor, but don't normally use a paint or desktop-publishing program, you can pick one from column A and two from column B—mixing and matching your software and the Navigator's. There is room on the main menu for several additional icons, so you can add custom icons for your favorite non-Navigator programs.

The Navigator brings all of the office equipment that most businesses need into a package that fits on even the smallest of desks. Although we don't think that it's always the most elegant solution—the answering machine is decidedly inelegant—and it is impossible to expand the Navigator with standard add-on cards, you'll be hard pressed to find equipment with equivalent functionality at the same price. You'll never find equipment that will be as easy to set up.
get a list of all of the thousands of pictures on the disc. Fortunately, they are broken down into categories such as "Aircraft," "Mammals," and the like. A host of maps are also contained on the disc, and a Browse Map Index is included.

The sounds included on the disc are a part of what makes the Electronic Encyclopedia a "multimedia" experience. Interestingly, there's no function to browse through the available sounds. As far as we could tell, however, all articles with sound also include a picture. When scrolling through the picture index, any picture with an accompanying sound has an asterisk next to it. Unfortunately, that's not pointed out in the manual.

When reading a given article, an accompanying sound byte is indicated at the bottom of the text, along with an indication to hit ALT-7 to retrieve the sound. So, when researching Abraham Lincoln for example, you can call up 33 seconds of his second inaugural address ("With malice toward none... with charity for all...").

We like the sound capability—it's something that we've never seen in an encyclopedia before. In many cases, it's not all that useful, though. Listening to an actor reciting 33 seconds of Lincoln's second inaugural address doesn't tell us too much that couldn't be expressed in text.

In other cases, sound is used more effectively. Hearing 33 seconds of Dr. Martin Luther King, Jr.'s 'I have a dream' speech does tell you something about his powerful oratorical style. Another practical use for sounds is with bird calls. We, for example, have never seen an eastern bluebird, even though it's the state bird of New York. Maybe if we knew what it sounded like, we'd have an easier time in finding one. Fortunately, the eastern bluebird is one of the species that includes an associated sound byte—eight seconds or so of its calls.

Like traditional texts, you can insert "book marks" at locations where you want to return to without having to reconstruct your search. Since the encyclopedia is electronic, however, you can quickly store article text to a disk file or to a "note pad." You can also print the text out at any time—the entire article, a paragraph, or the current 12-line screen.

Although we used the PC version of the encyclopedia, a Macintosh version is also available. The basic requirements for the PC are: 512K RAM, a floppy disk drive, and a CD-ROM drive with audio outputs. For viewing photos and graphics, a VGA card and monitor are required.

While the New Grolier Electronic Encyclopedia is new now, it won't stay new for long. An annual update, however, is available for $125. Since it's likely that the encyclopedia will be used in schools, a teacher's guide is available for $49.

The new version of the Encyclopedia gives us a good idea of what the future has in store for research encyclopedias. We wonder how our kids will explain to their kids about the days before CD-ROM. We wonder if they'll believe that a set of encyclopedias once required a whole bookshelf, and researching a paper meant at least one trip to the library!  

For more information on any product in this section, circle the appropriate number on the Free Information Card.

**ELECTRONICS WISH LIST**

*In-Wall Video Speaker*

In-wall speakers are nothing new, but there's something different about the MV-30 from Sonance (961 Calle Negocio, San Clemente, CA 92672). The in-wall, two-way speaker is shielded to prevent the magnetic fields present in loudspeakers from interfering with your television's picture. The speaker can be installed alongside, or even abutting, a video monitor without degrading the monitor's picture quality. That makes it a good candidate for a center-channel speaker in a Pro Logic setup. It's small size also makes it well-suited for small dens, kitchens, or bathrooms. The full-range speaker has a frequency response of 65 to 20,000 Hz, ±2 dB, and a nominal impedance of 8 ohms. It requires a minimum of 5 watts and can handle up to 60 watts. Price: $310 per pair, including brackets and grilles.

**CIRCLE 56 ON FREE INFORMATION CARD**

**Gentle Alarm Clock**

Can't stand to be awakened by a jarringly loud alarm? Proton's (5630 Cerritos Avenue, Cypress, CA 90630) RS-325 Clock Radio spares your ears—the alarm or radio can be set to increase gradually in volume over a five-second period. Two separate alarms can be programmed for different wake-up times. The black clock radio has bright controls and a fluorescent digital display that has an automatic light sensor that dims and brightens the display to compensate for ambient light. Designed to take up as little night-stand space as possible, the RS-325 features a slanted front panel that makes it easier to read the display and to hear the speaker. Price: $110.

**CIRCLE 57 ON FREE INFORMATION CARD**

**Large-Button Telephone**

For people with sight, hearing, or dexterity limitations, Lonestar (Division of Planned Technologies, Ltd., 485-31 South Broadway, Hicksville, NY 11801) model 888 telephone features extra-large buttons and a volume-boost control. The phone has a last-number redial button, user-replaceable modular cords, and three ringer-volume levels. It comes in white and can be mounted on a wall or a desktop. Price: $49.95.

**CIRCLE 58 ON FREE INFORMATION CARD**
Automatic A/V Switches

As today's home-entertainment systems get increasingly complex, it's not unusual to have a setup in which both a laserdisc player and a VCR must be connected to a monitor, and the hi-fi and the surround-sound system share a single power amplifier. Not only does the wiring get complex, but the equipment can become difficult to operate—that becomes apparent when you try to teach non-technical family members how and when to switch between two sources. To avoid getting frantic phone calls while you're at work ("I can't make the TV come on and the kids want to watch Sesame Street!"), try using one of the Vi Series of automatic A/V switches from R.F. Engineering, Inc. (9215 Lowell Blvd., Westminster, CO 80030). Each Vi unit allows two different video devices to be connected to one monitor, and detects which source is delivering a signal and routes the signal to the monitor. A sensitivity adjustment allows the Vi to filter out noise that can cause erratic switching, and a delay adjustment is used to prevent switching during the pause between tracks on a CD. The A/V switches can also run on 12 volts DC for automotive or marine applications. Price: $89.95 with RCA connectors or $119.95 with S-Video connectors.

CIRCLE 59 ON FREE INFORMATION CARD

Horizontal Camcorder

The horizontal shape of Sanyo's (21350 Lassen Street, Chatsworth, CA 91311-2329) VMES77 horizontal-design 8mm camcorder makes one- or two-handed operation easier, providing better stability and access to all controls. That design also results in less bouncing when you wear the camcorder suspended around your neck, and fits better in a briefcase. Fuzzy logic technology—which imitates human thinking by considering not just yes and no, but all sorts of "maybe's"—promises to make the camcorder's automatic iris, white balance, and focusing faster and more accurate. The VMES77 has an 8:1 variable-speed zoom lens and an inner-focus lens for close-ups. An adjustable pull-out viewfinder can be adjusted up to a 90° angle. Other features include an on-screen menu, a switchable electronic shutter, 4-lux low-light capability, a title-insertion function, and a flying erase head. Price: $889.99.

CIRCLE 60 ON FREE INFORMATION CARD

SWR/Power Meter

Amateur radio hobbyists are well aware of how important proper antenna tuning is. The Micronta Ham Radio SWR/Power Meter (Cat. no. 19-320) from Radio Shack (700 One Tandy Center, Fort Worth, TX 76102) can be used to optimize antenna settings for handheld transceivers as well as mobile or fixed ham radios. It is specifically designed for use on the popular 2-meter (144-MHz) and 70-cm (440-MHz) amateur-radio bands. The device's low insertion loss allows it to remain connected at all times, and its wide-range accuracy lets the user measure power up to 60 watts. Price: $39.95.

CIRCLE 61 ON FREE INFORMATION CARD

Multi-Disc Player

Besides full-size LD's and standard 5-inch CD's, Panasonic's (One Panasonic Way, Secaucus, NJ 07094) LX-101 Multi-Laserdisc Player is compatible with eight-inch LD's, five-inch CD-videos (CDV's), and three-inch CD singles. The front-panel shuttle-dial makes it easy to scan and accurately find a particular scene or frame. A digital time-base corrector estimates and compensates for horizontal distortion to help eliminate jitter. The unit also digitally separates the luminance and chrominance signals of a video source to help prevent streaking and dot crawl. Audio quality is ensured with a one-bit D/A conversion system, and stereo outputs that allow the unit to be connected to a surround-sound system and external speakers for the home-theater experience. While it lacks a shuttle dial, the 38-key remote control can be used to command all major functions. Price: $600.

CIRCLE 62 ON FREE INFORMATION CARD

For more information on any product in this section, circle the appropriate number on the Free Information Card.
Mousy Notebooks
All three of Royal Consumer Business Products' (765 U.S. Highway 202, Somerville, NJ 08876-1289) notebook personal computers feature a touch-control mouse pad built into the base unit. The screen cursor is easily maneuvered with the touch of a stylus or finger on the pad, providing full use of both traditional and advanced graphic environments, such as Windows and GeoWorks Ensemble. Notebook S20 is based on Intel's 80386-SX and includes a 60MB hard drive. A 16-MHz, 80286-based unit, the Notebook V16, is available with a 40MB hard drive. Both models also feature a backlit, paper-white, VGA-compatible display with 640 x 480 graphics resolution. Their 2MB of RAM is expandable to 6MB using user-installable expansion cards; further expansion is possible by attaching the docking module that houses two full-size AT expansion cards and a standard 5⅛-inch floppy drive. The entry level 286-based Notebook A12 runs at 12 MHz with 1MB of RAM (expandable to 5MB) and a 20MB hard drive. It has a backlit CGA-compatible LCD readout. All three units feature a 3½-inch floppy-disk drive, serial and parallel ports, connectors for external keyboard, mouse, and VGA monitor, and slots for a modem or fax board. Each weighs less than 6½ pounds with the NiCad battery pack. Prices: A12, $3499; V16, $3999; S20, $4999.
CIRCLE 63 ON FREE INFORMATION CARD

Mini Loudspeaker System
For those who prefer their speakers to be heard but not seen, the 10⅛-inch-high by 7-inch-wide SL250 is a two-way mini loudspeaker system that offers "full-range performance and produces an image with outstanding depth, height, and width," according to Signet (4701 Hudson Drive, Stow, OH 44224). The speaker's filter alignment optimizes bass-to-volume ratio for excellent low-frequency response and improves the speaker's low-frequency transient response and power-handling ability. The speaker has a 5⅛-inch paper-cone woofer and a ¾-inch metallized polycarbonate dome tweeter, cooled with ferrofluid. It is finished in black woodgrain vinyl. Price: $150 each.
CIRCLE 64 ON FREE INFORMATION CARD

Audio/Video Care Products
Your electronics gear is more likely to keep running smoothly if it's kept clean, and Bib America (P.O. Box 27682, Denver, CO 80227) offers several products with that in mind. For the audiophile, Pushbutton VHS Video Head Cleaner model VE-40B automatically applies the correct amount of cleaning fluid to the cassette's non-abrasive cleaning material, which runs through the machine and cleans the entire tape path. The model A-655 Compact Disc Restorer Polish has a metered spray applicator containing an ozone-safe, non-abrasive formula and an optical-grade polishing cloth. The formula removes light scratches and foreign substances from the disc's surface and provides anti-static protection. The Audio Cassette Care System model A-632/A consists of a specially designed head- and capstan-cleaning cassette, an applicator of tape-cleaning fluid, and a compact cleaning brush, all used to remove sound-contaminants from audio-cassette players and decks. Prices: From $17.95 to $24.95.
CIRCLE 65 ON FREE INFORMATION CARD

 Travelling Music System
To provide music wherever you roam, Casio, Inc. (570 Mt. Pleasant Avenue, P.O. Box 7000, Dover, NJ 07801) offers the model CD-1050 portable AM/FM stereo dual-cassette recorder with a programmable CD player. For stationary use, the 2-way, four-speaker system is detachable. The unit offers 12 station presets, auto-reverse in the playback mode, a three-beam laser-pickup CD player, a four-band graphic equalizer with three-step preset, and a remote control that operates all major functions. Price: $369.95
CIRCLE 66 ON FREE INFORMATION CARD
Cordless Phone and TAD

Offering the freedom of movement of a cordless phone—and the freedom from answering the phone at all provided by an answering machine—Northwestern Bell Phones' (9394 West Dodge Road, Suite 100, Omaha, NE 68114) Excursion 4200 combines the two in one unit. The cordless phone has a rubber antenna, 10-channel accessibility, two-channel paging, an intercom, 10-number memory, and digital security. The answering machine provides a digital outgoing message and three programmable security codes, along with the basics—memo record. call screening, toll saver, two-way record, and beepless remote. In addition, the Excursion 4200 features “1D Bell” for call selection, which allows the user to program different ringing tones for caller identification. Price: $299.99

CIRCLE 67 ON FREE INFORMATION CARD

Camcorder Light

No, it's not a low-calorie camcorder. But by turning on and off with the camcorder, the Camlite Auto On/Off camcorder light extends battery life up to 25%. The light, from Geneva Group (9909 south Shore Drive, Plymouth, MN 55441), uses the battery that's supplied with the camcorder and adds little weight to a compact camera. Three models are available, to accommodate JVC and Hitachi Palmcorders and Sony 8mm camcorders. Each model has a removable light, but the adaptor can be left mounted to the camcorder. The Sony model offers a light that's adjustable for greater viewing ease. Price: $89.95

CIRCLE 68 ON FREE INFORMATION CARD

LCD Projector

When it comes to projection TV's, brightness is as important as size. Sharp Electronics Corporation (Sharp Plaza, Mahwah, NJ 07430-2135) has introduced a step-up model to their XV-100 (reviewed here in May, 1991). The XV-120ZU features an enhanced optical system, making its 100-inch picture about 70% brighter than that of the earlier model. The new unit is also about 20% smaller and lighter than its predecessor. The portable unit can be set up easily, and its variable zoom lens allows the image to be adjusted from 20 to 100 inches. By connecting the XV-120ZU to any standard or S-VHS video source and an existing audio system, a home-theater system can be created. Price: $3995.

CIRCLE 69 ON FREE INFORMATION CARD

Cable Organizers

If you've got an unwieldy tangle of wires and cords from your computer hanging behind your desk, and an even worse mess in your entertainment system, Curtis Manufacturing Company's (30 Fitzgerald Drive, Jaffrey, NH 03452) Cable Organizers could help. The kit includes one 10-slot cord manager with recessed label slots, two bundler clips to group loose cables safely to the wall or floor, six runner clips, and ten blank peel-and-stick labels. The organizers install quickly with self-adhesive mounting strips. The custom labeling capability makes it easy to identify cables—and avoid unplugging the wrong cord by mistake. Price: $9.95

CIRCLE 70 ON FREE INFORMATION CARD

Cordless Headphones

What do you do when you want to sleep but your wife wants to watch every Tonight Show until Johnny Carson retires? Arkon Resources (11627 Clark Street, Suite 101, Arcadia, CA 91006) is offering a cordless infrared headphone system that just might save your marriage. The IR-500 is specifically designed for private, comfortable listening while watching TV, without disturbing other family members. A microphone adapter makes it compatible with every television. Price: $129.

CIRCLE 71 ON FREE INFORMATION CARD
Have you ever been involved in a phone conversation when halfway through a discussion, you needed to put someone on hold while you retrieve some important information for the other party? Or while in a telephone conversation, one of the children required your immediate attention? Covering the mouthpiece is not only inadequate and awkward, but it's also rude and does not prevent the other party from hearing what's going on at your end. And even if your phone provides a hold function, it is only humane to give the other person on the line something pleasant to hear, rather than dead silence.

Of course, one might feed local radio programming into the system for the party on hold to listen to, but some of the programming now traversing the airwaves can be more offensive to people than silence. The Music-On-Hold Box described in this article is designed for just such occasions. And the circuit, which can be built and installed in one evening (at a cost of less than $11), is easily added to an existing phone system.

The Music-On-Hold Box is built around an L33404 melody chip, manufactured by LSI Computer Systems, that is available in 31 versions, each containing a single tune or medley of tunes. The chips require few support components, and allows customizing of the tune/medley being played. Changing the song is as simple as plugging in the IC containing the new tune or medley.

**Ease-of-Operation.** The circuit is easy to install and operate. Once installed, all you have to do is press a button and hang up the handset to "pipe" music to the other party while he or she awaits your return. And if you have extension telephones connected to the same line, lifting one of the extensions (or the original phone) stops the circuit, allowing you to resume the conversation unimpeded.

The Music-On-Hold Box uses an LED to indicate the status of the call. If desired, the melody, tempo, or volume can be easily changed. In addition, the circuit—which is powered from the phone line so that it requires no external power source—does not load the phone line when it's not in use, so it's virtually undetectable. If desired, an optional transducer can be added to the circuit, so that too can be entertained by the box's melodic output.

**About the Circuit.** Figure 1 is the schematic diagram of the Music-On-Hold Box. A normal one-party phone system uses only two wires—known as tip (which is the positive lead) and ring (the negative lead) in telephone tech talk—of the four supplied to each phone station. When the telephone handset is on hook, there is approximately 48 volts DC (not to be confused with the 90-volt AC ring signal) across the green (tip) and red (ring) wires. When the telephone handset is taken off hook, a load is placed across the line, causing the DC voltage to drop to approximately 6 volts (depending on the subscriber's loop resistance and telephone).

Pressing S1 applies that DC voltage to the gate of SCR1, causing the SCR to turn on, which applies DC to the bottom of T1's 8-ohm winding and allows current to flow through the rectifier, transformer, R1, and LED1. With S1 closed, LED1 lights; when that happens, you may hang up. The circuit essentially becomes a substitute load, deceiving the switching equipment so that it sees the phone as still off hook. At the same time, there is a voltage difference across R1 and LED1, which supplies cur-
Fig. 1. The Music-On-Hold Box is built around a single-melody chip, which is supported by two transistors, an SCR, and a handful of additional components.

### PARTS LIST FOR THE MUSIC-ON-HOLD BOX

**SEMI conducors**
- **U1—LS3404 melody chip, integrated circuit**
- **Q1—BS170 N-channel MOSFET (Motorola)**
- **Q2—MPS2222A or PN2222A general-purpose NPN silicon transistor**
- **BR1—1.5-amp, 50-PIV full-wave bridge rectifier**
- **SCR1—2N5064, 0.8-amp, 200-PIV silicon-controlled rectifier**
- **DI—IN4730A or similar 5.1-PIV, 1-watt Zener diode**
- **LED1—T1, 1-3/4, 2-volt, 20-mA, red diffused LED**

**RESISTORS**
- (All fixed resistors are 1/4-watt, 5% units.)
- **R1—680-ohm**
- **R2—10,000-ohm**
- **R3—10-megohm**
- **R4—27,000-ohm**
- **R5—2-megohm PC-mount potentiometer**
- **R6, R9—2,200,000-ohm**
- **R7—50,000-ohm PC-mount potentiometer**
- **R8—68-ohm**

**CAPACITORS**
- **C1—100-pF, ceramic-disc**
- **C2, C5—0.1-µF, monolithic ceramic-disc**
- **C4—1-µF, 35-WVDC, tantalum**
- **C5—4.7-µF, 50-WVDC, radial-lead electrolytic**

**ADDITIONAL PARTS AND MATERIALS**
- **T1—1000-ohm CT primary to 8-ohm secondary, audio-output transformer**
- **S1—Normally-open, momentary pushbutton switch**
- **B21—Piezo transducer, optional (see text)**
- **Printed-circuit materials, enclosure, 8-pin DIP socket, LED holder, modular telephone cable and connectors (see text), wire tie, shrink tubing, wire, solder, hardware, etc.**

**Note:** The melody chip (U1) is available from Thumb Electronics (PO Box 263, Avoca, MI 48006) for $2 each plus $1.50 shipping and handling per order. A 5-tune assortment of melody chips is available for $11, shipping included. Iron-on resist patterns for Music-On-Hold’s printed-circuit board are available for $2 each with any order. The BS170 MOSFET (Q1) is available for $2 with any order. Thumb also sells the sheets for making your own iron-on patterns for labeling the cover or PC patterns. For a list of melodies in stock or technical assistance, send a self-addressed stamped envelope to the above address.

Rent to the melody chip (U1), and in turn causes it to start playing back across T1. The melody is coupled to the phone line through T1, and transmitted to the receiver on the other end of the line. When the handset is once again lifted off hook, most of the current flowing through the circuit is diverted to the phone. That drops the current through the SCR below Ith (the SCR’s holding current), so the SCR ceases to conduct, thereby turning off U1.

The bridge rectifier (BR1) protects the circuit against polarity reversal when the circuit is connected to the telephone lines. The bridge rectifier is essential for older switching systems where the polarity of tip and ring invert, depending on whether you place or receive a call. Resistor R1 limits the current through LED1, T1, and SCR1. Resistor R8 prevents SCR1 from picking up stray voltages and remaining on when the handset is lifted. Zener diode D1 and capacitor C5 ensure a stable voltage for U1.

The duration of each note can be shortened by reducing the value of R6. Potentiometer R5 controls the tempo and speed of the melody, while resistor R4 sets the pitch. Lowering R4’s value raises the pitch of the tune. Potentiometer R7 limits the volume.

Transistors Q1 and Q2 (an N-channel MOSFET and a general-purpose NPN transistor, respectively) comprise a re-
start circuit, which resets U1 by inverting the voltage at pin 5 of U1 and feeding it to U1's POR [power-on-reset] terminal at pin 8. While the tune is playing, pin 5's voltage is applied to the gate of Q1, biasing it on. That, in turn, holds the base of Q2 low, preventing it from conducting. When the melody finishes, U1 goes to its standby state by removing voltage from all pins. The gate of Q1 then goes low turning it off, and returning base bias to Q2, turning it on. At that point, a pulse is applied to POR terminal pin 8, restarting the melody.

Building the Project. The Music-On-Hold Box was assembled on a small printed-circuit board, measuring 1-7/8 by 2-3/8 inches. A full-size template of the printed-circuit artwork for the board is shown in Fig. 2. If you are not accustomed to producing your own circuit boards from a magazine page, a simple solution is offered in the Parts List: namely, iron-on resist patterns—a process by which the etch-resist pattern is simply ironed onto a copper-clad slug (unetched printed-circuit material). Of course, you'll still have to etch your own board, but at least you won't have to worry about lifting or copying the pattern from the page.

After you've etched and drilled your board, and obtained the parts listed in the Parts List, assemble the circuit using this diagram as a guide.

soldering, it will permit quick melody-IC changes.

Begin assembly by installing an IC socket where U1 is indicated in Fig. 3. Installing the socket first aids in finding the proper locations for the other parts. Next, solder all resistors in place, and be sure not to get the potentiometers mixed up. Follow that by placing the capacitors in their proper locations, keeping in mind that two of them (C4 and C5) are polarized and must be properly oriented. Tantalum and electrolytic units have labels on them designating their polarity.

Next install the semiconductor components, and be sure to observe the proper polarity. Transistors Q1 and Q2, and SCR1 come in the TO-92 package style, so they are nearly undistinguishable from each other, save the part number. So consult the part number and pinout information before installing any of those components, it'll save you some aggravation in the long run. If you are not familiar with bridge rectifier markings, the AC inputs on such devices are always marked with a wavy line or indicated by the letters AC, and the plus and minus outputs are marked + and - accordingly. All diodes are also marked; the cathode end is banded.

Now install the transformer. First straighten the transformer leads. Be gentle; When I untangled my first one, I pulled one wire right out of the windings! Cut each lead to about 3/4-inch and strip about 1/4 inch of insulation from each lead end. Note that although the center tap is not used, a pad is nonetheless provided for that lead. If is recommended that the stranded leads be twisted and lightly tinned before being inserted into their respective circuit-board holes. Tinning helps to prevent bird-caging (fraying) when the leads are inserted. Mount T1 to the board with the center-tapped (3-wire) side toward U1. That insures that the center-tapped primary side is connected to the output of the melody chip. Bend the mounting tabs in toward each other to secure the transformer. Solder all transformer leads in place.

Connect switch S1 to the board through two 4-inch lengths of hook-up wire. Next place a piece of shrink tubing over one lead of the LED, and a second piece over both leads. The first one will keep the LED's leads from shorting. The second will insulate and strengthen both of the leads. Do not heat shrink the tubing at this time. Connect the LED assembly to the board using 3-inch lengths of hook-up wire.

Testing. If you haven't done so already, install the melody chip. Set R5 to its mid-position and R7 fully counter-clockwise. If you are going to listen to the melody while the person on hold does, connect the optional transducer (BZ1) to the board, if you do not intend to use that option, temporarily connect an 8-ohm speaker in its place. Wire the speaker between either of R7's leads and the R5 lead that's furthest from U1. Using a 9-volt transistor-radio battery or DC power supply, apply power to the circuit. The positive side of the supply should go to the pad labeled G and the negative side to the pad labeled R. (Continued on page 85)
A frequency converter, or frequency translator, is a circuit that changes an input frequency to another frequency. Using such circuits, you can receive WWV or shortwave broadcasts on an automobile radio, or you can expand the range of a ham-bands only shortwave receiver to include the very low frequency (VLF) range. Alternatively, you can make an HF shortwave receiver tune to the VHF bands, etc.

Frequency converters are actually a little more common than you might believe. Nearly all serious radio receivers, from the humblest handheld AM-band radio, to the most complex "kilobuck" commercial receiver, contain at least one frequency converter. Such radios are called superheterodyne (or simply "superhet") receivers. The "super" part of that name was probably dreamed up in the advertising departments of early radio manufacturers, but the "heterodyne" part describes its operation.

Radio receivers prior to heterodyne sets were "tuned radio-frequency" (TRF) models. Those radios consisted of two, three or even four separate radio-frequency amplifiers in cascade. Unfortunately, radio circuits (especially in that era) tended to work a lot better at one end of the band than at the other, so performance was very uneven. Also, the techniques that allow a circuit to achieve a high RF gain, a necessity for good sensitivity, also tend to work only at one frequency, or a small band of frequencies. As the radio is tuned away from that "magic" design point, the circuits would become unstable and break into oscillation—complete with screaming, howling, and squawks that became the hallmark of those radios.

By contrast, a superheterodyne receiver converts the RF frequency to an intermediate frequency (IF), where a majority of gain is available. Thus, a high performance radio receiver resulted.

What Is "Heterodyning?" Heterodyning is a process in which two frequencies are combined to produce other frequencies. As a musical metaphor, if you went to a piano and struck a key you would hear a single note with a frequency we'll denote $f_1$. If you struck another key you would hear another single note that we'll say has a frequency $f_2$. If you strike both keys simultaneously, the sound produced is a lot richer because it is an audio concoction consisting of the original notes, plus the sum and difference notes. In other words, the signal will contain $f_1$, $f_2$, $f_1 + f_2$, and $f_1 - f_2$.

To see how a radio receiver takes advantage of this type of behavior take a look at the block diagram of a frequency converter circuit shown in Fig. 1. There are three elements: a mixer, a local oscillator, and a filter. The mixer has two inputs and one output. Suppose that the RF signal ($f_1$) is applied to one input, and a local oscillator signal ($f_2$) is applied to the other input. The frequencies at point "A" in Fig. 1 will be a blend of $f_1$, $f_2$, and other frequencies defined by:

$$mf_1 + nf_2$$

where $m$ and $n$ are integers (1, 2, 3, etc.). For most practical purposes we will concern ourselves only with the case where $n = m = 1$, so the output will contain the two original frequencies, $f_1$ and $f_2$, the difference frequency ($f_1 - f_2$), and the sum frequency ($f_1 + f_2$).

The filter that follows the mixer will select which frequency is passed to the other circuits as the output frequency ($f_{out}$). The filter might be a bandpass filter, or it might be a low-pass filter (to select the difference frequency), or possibly a high pass filter (to select the sum frequency). In a superheterodyne receiver, $f_{out}$ is the IF.

Common IFs are 10.7 MHz for FM-broadcast radios and VHF/UHF scanners, 455 kHz for most AM radios, and 262.5 kHz for AM car radios. Those radios typically use the difference frequency. Other receivers actually upconvert the RF signal to a higher (sum) frequency. For example, a certain HF shortwave radio upconverts the shortwave band (0.5 to 30 MHz) to a 50-MHz IF.

Building RF converters is not as difficult as you may think. In fact, there are a few sure-fire designs that work well with a minimum of "tweaking."
Let's consider an example of a superhet frequency converter. Suppose we have an AM radio with a 455-kHz IF stage. When the radio is tuned to 780 kHz, the local oscillator will simultaneously be tuned to 780 + 455 kHz, or 1,235 kHz. At the output of the mixer, therefore, the following frequencies are present: 780 kHz, 1,235 kHz, 455 kHz, and 2,015 kHz. The filter, typically a tuned transformer, passes the 455-kHz difference frequency to the rest of the circuit.

For the sake of clarity, it should be mentioned that in common "radio jargon," the term "converter" is usually reserved for those circuits in which the roles of the mixer and local oscillator are performed by a single circuit. That is typical of most AM radios. A "mixer-oscillator" on the other hand, is a circuit in which the mixer and local oscillator are altogether separate. However, the result is exactly the same, so for practical purposes permit me to call both varieties "converters."

**Frequency-Converter Circuits.** An add-on converter can expand the range of a receiver by taking incoming RF and converting it to an IF that falls within the receiver's operating band. Figure 2 shows how such a circuit can be connected to a radio receiver. The converter is switched in and out by a switch (S1) that bypasses the converter when normal receiver operation is required. A short piece of coaxial cable between the switch sections carries the bypass signal when the converter is not being used.

Although this method of connecting converters is universal, there are several approaches to designing converter circuits themselves. We'll take a look at three different circuits, all of which can be used over a wide range of frequencies.

Two of the circuits are based on the 40673 MOSFET. The 40673 can be used from very low frequencies up to VHF frequencies in the neighborhood of 200 MHz. It differs from certain other MOSFET devices because it has gate protection diodes built in that allow it to withstand electrostatic voltages that would destroy other MOSFETs. This device is readily available from local and mailorder distributors. It is also used a lot in consumer electronics, so it is available in the NTE and ECG component-replacement lines. In fact, to test some of the circuits I used an NTE222 (the same as the ECG222), which is a replacement for the 40673.

Figure 3 shows a single-stage converter circuit based on a 40673 MOSFET. The RF signal is applied to gate 1 (G1) through a tuned transformer and a DC blocking capacitor. The tuned transformer consists of a low-impedance winding of a few turns, and a larger coil (the secondary) that is used to resonate with the tuning capacitor.

The transformer can be made from a toroidal core, a commercial coil form, or a ready-made coil. Components for coils and RF transformers can be bought from several sources. Two that I've used include Radiokit (PO Box 973, Pelham, N.H., 03076; 603-635-2235; catalog $1) and Amidon Associates (12033 Otsego Street, North Hollywood, CA, 91607). Both companies have catalogs, and Amidon will supply design information for making your own coils (Digi-Key Corporation (PO Box 677, Thief River Falls, MN, 56701-0677; 1-800-344-4539; free catalog available) sells coils and RF/IF transformers including AM-IF FM-IE and TV-IF transformers.

The coil value for a shortwave converter depends on the input RF frequency. I used 3.5 μf for a 15-MHz WWV converter, which resonated with 33 pF. You can roughly scale the coil for your circuit using those values as a guide. Keep in mind that the inductance change is equal to the square of the frequency change. In other words, a 2:1 frequency change requires a 4:1 inductance change.

The tuned circuit must be resonant at the desired frequency. The resonant frequency is:

$$f = 1/(2\pi\sqrt{LC})$$

or, to find L when C and f are known use:

$$L = 1/(4\pi^2f^2C)$$

or, to find C:

$$C = 1/(4\pi^2f^2L)$$

where f is in hertz (Hz), L is in henries, and C is in farads. Keep in mind when selecting that there will be some stray capacitance, so the actual capacitance needed to resonate the coil in the transformer is less than the calculated value. How much less can be found experimentally.

A neat little fact that some experienced hobbyists know is that you can use an IF transformer for the RF input transformer of circuits like Fig. 3. For example, for VLF circuits, a 455-kHz or 262.5-kHz IF transformer from an AM radio will work. For HF shortwave circuits, a 10.7-MHz IF transformer from an FM ra-
dio will work, and for low-band VHF circuits, television-IF transformers in the 49-MHz region work. In some cases, an external capacitor can be used to reduce the resonant frequency by shunting the coil.

Another useful trick is to look at the bottom of the transformer (the end normally hidden from view when the transformer is mounted on a printed-circuit board) and see if there is a little slot with a ceramic tubular capacitor inside. If there is, you can crush the capacitor with a small screwdriver and then either use an external capacitor to select the operating frequency, or use the transformer as a wideband (well, sort of) input coupler for the circuit.

The output transformer in Fig. 3 is similar to the input transformer, but will be tuned to either the sum or difference frequency (most often the difference frequency).

The local oscillator is a crystal-controlled circuit made using the MOSFETs gate-2 (G2) input. The crystal is selected based on the desired input frequency and the desired output frequency. For example, I once built a converter to place the 15-MHz WWV signal at 1 MHz in the AM broadcast band so that the time station would appear on my car radio. A 15-MHz crystal for XTAL1, with a 15-MHz transformer at T1 and a 1-MHz transformer at T2 did the trick.

Sometimes, a single crystal will work for two bands if the input tuning at G1 is adjusted. On both frequencies, the difference signal is picked off, but in one case the RF is greater than the local-oscillator frequency, and in the other the RF is less than the local-oscillator frequency.

A more sophisticated circuit is shown in Fig. 4. In it, the same tuned input and output transformer circuits are used and the crystal is once again connected to G2. However, there is a third tuned circuit, composed of C3 and L3, used as a frequency trap to prevent the signal from the crystal oscillator from appearing at the output. That resonant-tank circuit is designed so that both the coil (L3) and the capacitor (C3) have a reactance of about 490 ohms at the crystal frequency, or mathematically:

\[ L = \frac{490}{(2\pi f)} \]

and,

\[ C = \frac{1}{(490 \times 2\pi f)} \]

For example, if the crystal frequency is 16 MHz, then the capacitor and inductor are 20 pF and 4.9 μH, respectively, to make the reactance approximately 490 ohms.

Figure 5 shows an IC-based converter that can operate from VLF into the VHF region, using either a crystal or variable-frequency oscillator for the local-oscillator frequency source. In the case shown, the local oscillator is a crystal type. The IC used in the circuit, U1, is the Signetics NE602 double-balanced mixer, and it's a very good selection for many applications.

The input circuit is a tuned transformer. If the desired frequency is close to 10.7 MHz, then use a 10.7-MHz IF transformer and refer to either with its own slug-tuning control, or an external capacitor. Otherwise, crush the capacitor inside the transformer (as mentioned before) and use an external capacitor to resonate the circuit. You can also delete both the internal capacitor and C1 to make the input network wideband over a large segment of the high-frequency band.

The NE602 needs a power-supply between 4.5 volts and 8 volts. In the circuit of Fig. 5, a small 78L05 three-terminal IC voltage regulator (U2), with a 100-mA rating, supplies the required DC voltage. Alternatively, you can power the circuit with a 6-volt battery.
How To Choose A COMPUTER

Don't be swayed by sales hype or fall into the trap of overkill. Learn to size up what you need before purchasing a computer

By Fred Blechman

Living in the 1990's, you probably fall into one of two categories: either you've already purchased a personal computer, or you're thinking about getting one. If you're in the first category, you already know the mistakes you've made, if any. If you're still thinking about getting a computer, read this first!

There are some good reasons to get a personal computer, but be careful about getting more power and "glitz" than you need. If all you need to do is word processing for personal correspondence, very simple equipment will do a fine job. So will a pencil, pen, or typewriter! On the other hand, if you own a small business, or you can't live without playing high-speed arcade games in 256 colors, you'll need a relatively sophisticated computer system.

Who Should You Listen to? Let's say all the advertising hype, or a well-meaning friend, have finally convinced you that you need a computer and maybe some add-on's (which computerists call "peripherals"). But before you make a decision, your common sense tells you the smart thing to do is to investigate the situation. You read ads, and go to computer stores and computer shows to ask questions. You may even try to read and understand some computer magazines.

Unfortunately, all that can be a waste of time. Computer ads are frequently so full of jargon that they are difficult to make any sense out of. At stores and shows you may not know enough about computers to understand what the fast-talking salesmen are telling you. Worse yet, a surprising number of salesman don't know much more than you do, but they've learned enough "buzzwords" to sound like experts. Most computer magazines are even harder to understand for just the opposite reason: they know what they're talking about. Long ago they stopped writing for the average person and began to cater to the "power user"—one who mostly uses his computer to do things he doesn't at all need, but which impress him and his associates. He is often times a master at solving problems that he doesn't have!

Unfortunately even good friends can lead you down the wrong path. A good example of well-meant, but misdirecting, advice from a friend or associate is "You must do your word processing with WordStar"—or Word Perfect, or Word, or Volkswriter, or any of dozens of $400-and-up word processing programs that happen to be their personal favorite.

Frankly, I'm appalled at how many people are using word processors (and all kinds of other computer programs)
that are gross overkill for their needs. Most word processing needs can easily be performed with under-$50 word processors. I recently found a word-processing program for under $30 (Spin-naker's "Better Working Wordprocessor") that may be the best computer program I've ever used.

For most users, getting a $400 word-processing program makes about as much sense as buying a Mack truck to go to the store for a loaf of bread! I've written hundreds of magazine articles and five books using a $59 word processor: "ZORLOF The Magnificent Word Processing System" (how's that for a name?) with an old TRS-80 Model III computer using two single-sided 5-1/4" full-height floppy drives. This hardware and software are definitely "trailing-edge" technology, and considered by computerists as obsolete, but it just keeps grinding out stuff with no problems.

On the other hand, trying to do "desktop publishing," which involves combining text and graphics into page layouts, is sheer agony on microcomputers that were the "standard" just two or three years ago.

**The Proper Approach.** The biggest mistake new computer purchasers make is that they buy the hardware first and the software last. This is a no-no! The right approach to getting a computer is really just common sense. A computer without a program is nothing but a mess of wires, boards and electronic gimmickery. The program (or "software") is what makes the computer do its thing. But you can't find a program for your needs until you know what your needs are. Therefore, the first thing you should do is determine your needs(s). In the long run, that will help you decide what hardware and software you should buy.

If you're in business, start by defining what it is now that you do on paper. Invoices? Inventory? Client sales letters? Accounting?

As you become familiar with the wild and wonderful things you think computers can do for you, you'll dream up fantasies of the computer doing your weekly payroll, paying bonuses, printing checks, calculating discounts, sending letters to your customers, automatically gathering your annual income and expenses and filling out your income tax forms, writing your will, generating an estate plan for your children, and leaving you so much free time you'll learn how to fly an airplane with a flight simulator. Yeah, sure!

Trust me, some things are best left to 3 x 5 index cards or simple ledgers. Don't throw away your manila folders or file cabinets. And don't think you won't frequently wish you'd never heard of computers.

This is not to say that computers can't do all the things just described. They can, and do so everyday. But not without some effort and sometimes pain from you. It gets back to first defining your present needs, and going from there to what would be even better. You don't have to limit your thinking to just what you're doing now, but be aware that every new requirement will take time and money to implement.

After you've clearly defined what you need, look for the software/hardware combination that will do the job. Software does not work by itself; it needs hardware, and vice versa. Only by really trying software out can you determine if it meets your needs, and the software that meets your needs pretty well defines the necessary hardware.

Computer software stores and shows are a good place to try the software/hardware combination. Sometimes, unfortunately, you can't try before you buy. In fact, you'll probably go through several software purchases before you really find what you need.

Along the way, be careful that you don't get overawed with the rapture of technology and end up getting romanced into a bunch of software and hardware you may not need. Resist the salesman's desire to load you down with a hard-disk system, EGA or VGA graphics, multi-sync monitor, extra memory, turbo speeds, 2400-baud modem, joystick, mouse, and all sorts of wonderful things—unless you actually need them for your application. For one thing, they will complicate your life. For another, you can add what you may have overlooked later.

**Hardware Hype.** There is a bewildering selection of hardware available, and at prices that keep dropping. You can get an extremely powerful computer with a fast printer and a high resolution color monitor today for the same cost as a wimpy monochrome system with a slow printer two years ago.

I can recall back in 1978 that if you wanted a ready-made computer you had the choice of an Apple, Commodore PET, or Radio Shack TRS-80. None had more than 4K of memory, and only Apple offered a color screen.

(Continued on page 87)
Most of the time, people think of me as the quiet introverted type. So, naturally, every once in a while, I like to do something a little strange just to keep them guessing. This very simple project fits into that category. It's not rocket science, but it does lean to a bit of extroversion.

This holiday season imagine a Santa or Rudolph stick pin with a blinking red nose peering out over your shirt pocket or swinging from your tie. Imagine what your boss, your teachers, or better yet, those extroverted people who always imply that there is something wrong with you because you aren't loud and obnoxious like them will think. The possibilities are endless and you can do it all without saying a word.

Building the project requires a standard paper clip, some hot glue or fast-setting epoxy, an LED, a small button battery, and a stick pin or another paper clip. The battery is a type DL162016 3-volt lithium button-type battery and the LED is a 2.5-volt blinking type. It is essential that the LED will work on 2.5 volts—some don't. Such LEDs are available from Radio Shack (as part #276-036) and Jameco (part #XC5410). The stick pin can be purchased at most hobby or craft stores, or you can fashion one from another paper clip. Just remember that the pin has to be about 2.5 inches long.

Making Your Own. First cut one loop off a standard-size paper clip. It should be a U-shaped loop about one inch long and one-quarter inch wide. Position the loop flat against the base of the LED and wrap a turn or two of the positive lead around the U-loop as shown in Fig. 1A with the negative lead extending through the center of the U-loop. Solder the loop to the positive lead. Trim off the excess lead length as close as possible to the solder connection. Cover the solder joint and the entire base of the LED with a drop of hot glue or fast drying epoxy, resulting in the loop being firmly attached to the base of the LED.

Take the stick pin and coil the negative lead of the LED tightly around the pin (see Fig. 1B). Do this until the pin winds itself down to within a battery's width of the base of the LED. Actually, the spacing at the base of the LED should be a little wider than the battery. Solder the negative lead to the LED by flowing solder over the coils that now

(Continued on page 96)
Improve your reception on the lower frequencies with this easy-to-build, amplified-antenna system

BY DAVE HOLLANDER, N7RK

One of the greatest problems encountered when DX'ing on the lower frequencies—such as 1.8 and 3.5/3.8 MHz—is weak signal reception. That problem is compounded when one lives in a noisy location. Power-line noise can be a real deterrent and, in many cases, may even give rise to second thoughts about DX'ing on the lower bands. But a recent move to a new location allowed me to return to my favorite DX band (80/75 meters).

I put up a pair of phased verticals (¼ wavelength or about 62 feet on 80/75 meters) and, despite having underground utilities, was quite shocked to find an almost constant S9 noise level on 80 meters. The noise was coming from power lines located a couple of blocks away. Although the power company has been cooperative, an alternate receiving antenna was necessary as it can sometimes take them weeks, even months, to fix the problems. Besides, you never know when the noise is going to re-occur (usually when a DXpedition is on from a country you have been trying to log for years).

There have been many schemes for receiving antennas. For instance, a "Beveridge" antenna (developed by and named for Harold Beveridge) would have been ideal. A Beveridge antenna is wire—a minimum of 1 wavelength long—stretched in the direction of the transmitting station, and generally erected only about 5–10 feet above ground. It has a bidirectional pattern if left unterminated. It is for receiving only and is useful for enhancing the signal-to-noise (S/N) ratio when listening to weak signals in high levels of atmospheric noise and interference. It is the most effective antenna for weak signal reception on the 160- and 80/75-meter bands. But because of its size (approximately 260 feet for 80/75 meters, and 520 feet for 160 meters), it is not popular among city dwellers. Its size is a crux of my problem; my backyard is a wee bit too small.

After studying antenna books, the ARRL Radio Amateur's Handbook, and various articles, I decided to build a receiving loop that could be placed inside my shack right next to the operating position. What follows is a very simple, easy-to-build, and inexpensive indoor receiving loop—the Dual-Band Loop Antenna—that covers both 80/75 and 160 meters. Changing bands is accomplished with the flip of a switch. If one is a good scrounger, it can probably be built for under thirty dollars.

About the Circuit. Figure 1 shows the schematic diagram of the Dual-Band Loop Antenna system. The receiving element consists of loops of wire threaded through a child's hula hoop. Switch S1 is used to select either 80/75- or 160-meter operation. When S1 is in the 80/75 position, only a single loop of wire, designated L2, is connected to the balance of the circuit. When S1 is placed in the 160 position, a double loop of wire, designated L1, is placed in series with L2, and all three loops are connected to the circuit. The receiving element is made resonant at the desired operating frequency using variable capacitor C1.

The received signal is passed to a very simple two-transistor preamp, consisting of Q1 (set up as a common-emitter amplifier) and Q2 (configured as a common-base amplifier). When S2 is...
turned on, a small voltage is applied to the base of Q2 through R3 and R2, turning that transistor on. With Q2 turned on, a small voltage is applied to the base of Q1 through R1, biasing it to just below turn on. The incoming signal, along with the bias voltage on Q1, is sufficient to cause Q1 to turn on and off as the incoming signal rises and falls. In that way, the incoming signal is used to modulate the DC voltage at the collector of Q2, producing an amplified version of the original signal at J1.

Power for the circuit is provided by a 9-volt battery, and because the circuit draws so little current, the battery should last at least a year if the circuit is turned off after an operating session. The circuit's operating voltage is not critical; in fact, the circuit could be powered from an inexpensive 6- to 12-volt plug-in power supply, if you wish.

Construction. The electronic portion of the author's prototype was built on a terminal strip, and housed in a metal enclosure (measuring about 2 x 3 x 5 inches), which was mounted to a wooden base to give the assembly stability. The antenna (loop) portion of the system was then mounted to the enclosure. That covers the overall construction of the antenna system, now let's take a more detailed look at the unit's construction.

The loops are housed in a child's hula hoop (which can be purchased at most toy stores). The hula hoop should be approximately three feet in diameter, although that dimension is not very critical.

The first step is to shield the hoop in order to eliminate electrostatic noise from power-lines and other sources. That's done by wrapping tin foil around the hoop and then covering the foil with electric tape, leaving about 2 inches of the foil exposed. Cut the hula hoop at the center of the exposed foil and then bring the ends of the insulated hula hoop into the metal enclosure through electrical-conduit fittings (see Fig. 2). The exposed foil will be used to make electrical contact with the circuit's metal enclosure.

(Continued on page 88)
A fast cursor control for use in places where a mouse won't do

SUNCOM TECHNOLOGIES ICONtroller

I t has often been said that "the big surprises come in small packages." With a footprint of less than four square inches, the "ICONtroller" cursor control seems to fit that adage. It is a miniature joystick-like controller that attaches directly to the side of your IBM PC or compatible keyboard.

The ICONtroller has all the good attributes of a mouse and has several unique features of its own. The most obvious advantage to the device is that it requires less desk space than a mouse. Further, since it attaches to the keyboard you can use it to work on a laptop computer when there's no desk around; try that with a mouse!

It is compatible with any program that normally recognizes a Microsoft or Mouse Systems mouse, and can be used unmodified by either left- or right-handed users.

Description. The ICONtroller takes advantage of much of today's technology. Its brain is a Philips-Signetics 83C751 microcontroller that converts the user's requests into a 1200-baud serial-mouse format. It requires no batteries or power adapter, as it draws between 10 and 15 mA from the serial port. The microcontroller and support circuitry are mounted inside the ICONtroller on a small circuit board.

The case of the ICONtroller (see Fig. 1) looks like a small joystick with a few extra buttons. The three "mouse buttons," as you might guess, emulate those found on a 3-button mouse. A tiny button at the top of the self-centering cursor-control knob (or joystick) can be programmed to act as any one of the mouse buttons as well via the signal-selector switch.

A small slide switch at the front of the ICONtroller (the system-compatibility switch) can configure the unit as a Microsoft mouse or makes it Mouse Systems compatible. In the Microsoft mode, only the left and right mouse buttons are active; in the Mouse Systems mode, all three buttons are active.

Although the stick moves through a 360-degree circle, there are only eight directional switch locations, allowing vertical, horizontal, and diagonal cursor movement. Each of those switches has two steps to achieve two-speed cursor. Tilt the stick a little bit and the cursor moves one pixel at a time in that direction. Tilt the stick further and the cursor leaps forward at any of four faster speeds chosen with the cursor speed control. The speed control is electronically coupled to a small green LED that blinks from one to four times to indicate the selected fast-cursor speed each time it is changed.

All the switches are made of high-reliability conductive rubber, geometrically arranged to give the ICONtroller smooth action. The directional and button switches are rated for one million cycles, while the switch at the top of the stick is rated for 100,000 cycles.

Hardware Installation. The ICONtroller is designed for use with any IBM PC/XT/AT/PS2 or 100% compatible computer with a 9-pin or 25-pin RS-232 serial port. The ICONtroller cable has a 9-pin female connector and comes with a 9-to-25-pin adapter to support computers with 25-pin ports. Each of the female connectors, even on the 9-25 adapter, has finger-tightening knobs to screw the mating connectors together for solid contact. A well-written and liberally-illustrated 12-page booklet provides installations and instructions to help you with the hookup.

The attachment of the ICONtroller to your keyboard depends on whether you have the "desktop" or "laptop" version. The desktop ICONtroller uses a long, straight cord and adhesive clips to hold the cord along the back of the keyboard. A special double-sided ad...
 Anyone familiar with home-audio installations knows that, more often than not, some tonal equalization is needed to make the system sound right. Of course, the simplest type of equalization involves the use of ordinary bass, treble, and, on some amplifiers, mid-range tone controls. But the action of such tone controls is usually too broad to do a proper job of equalization. To solve that problem, many manufacturers offer graphic equalizers, which are really nothing more than sophisticated tone controls that divide the audio spectrum into several increments.

Each of which is individually controlled by a button, slider, or knob. Dividing the spectrum in this way makes it possible to make very detailed corrections in frequency response where it is needed.

The problem with most equalizers of this type is that the user is left to his or her own devices when attempting to correct the overall frequency response of a system. That's where the AudioSource EQ Ten stands out among graphic equalizers. It is a fully electronic, 12-band unit with soft-touch controls, a built-in pink noise generator, and a calibrated electret microphone that will enable you to automatically adjust each band while results are displayed on its spectrum analyzer. The EQ Ten's onboard computer actually analyzes the acoustics of the listening environment and then sets precise equalization settings for optimum sound reproduction.

Alternatively, you can adjust each of the twelve bands manually to suit your personal preference. Favorite equalization curves can be stored in four separate memories and recalled at the touch of a button. Tape-to-tape dubbing and tape equalization are also possible with the EQ Ten. Once properly installed, the EQ Ten can be operated from your listening position using the supplied thirty-two function remote control.

CONTROLS
Above the small power button, at the lower left of the all-black front panel, are eight soft-touch button controls. They activate the pink-noise generator, select tape monitoring, select line or tape input, adjust spectrum-display sensitivity, adjust volume levels, insert equalization when making a tape recording, select dubbing mode (Tape 1 to Tape 2, or Tape 2 to Tape 1), and activate the microphone when using it to analyze the pink noise signal on the spectrum display.

The entire center section of the front panel is dedicated to the graphic/spectrum display. As a graphic indicator, it shows the cut or boost of each individual frequency band; the bands range from 25 Hz to 16 kHz. As a spectrum indicator, it shows the fluctuating output signal in each of the 12 frequency bands as sound passes through the equalizer. Below the display are equalization-level up/down controls. Each of these switches controls one frequency band, allowing the cut or boost to be manually varied by a total of ±12 dB.

To the right of the display are pushbutton controls for storing up to four equalization curves, selecting left or right channel equalization (each channel can be equalized independently with this unit), initiating automatic equalization, instantly restoring flat response, dimming the display, reversing the EQ (equalization) curve (useful if you want to play back an equalized tape recording to hear it with flat response), muting sound, and sequentially altering the display mode from holding highest levels on the display, to freezing the display, to operating continuously while in the spectrum-display mode. A microphone input jack is found at the lower right corner of the front panel.

The supplied remote control duplicates virtually all of the front-panel controls'
functions. However, to operate the equalization-level controls using the remote, you must first activate the band you want by pressing a special frequency button and then altering the level using the EQ + or EQ – buttons. The remote control is powered by two "AA"-size batteries.

**TEST RESULTS**

We first looked at the overall frequency response of the EQ Ten when all controls were set for flat response. Deviation from a perfectly flat response under those conditions was no more than ±0.2 dB and −0.6 dB over the range from 20 Hz to 20 kHz, though somewhat greater deviation was noted below and above the useful audio range.

We next applied a series of 24 separate sweeps, superimposing one over the other while adjusting each of the EQ band controls to its maximum boost and maximum cut settings. Center frequencies of each band corresponded very closely to the control center points specified by AudioSource in their table of specifications. Control range was a bit less than the ±12 dB specified, but was certainly deemed adequate for the applications to which such an equalizer would be applied.

Another specification that deviated from the published specification was the unit's total-harmonic-distortion-plus-noise versus frequency. Using an output level of 1 volt, and with all EQ controls once again set to their flat positions, the THD plus noise remained fairly constant at 0.1% over the 20 Hz to 20 kHz test-frequency range. While that is considerably higher than the 0.08% specified by AudioSource, it is certainly acceptable.

Nevertheless, in order to determine whether the readings obtained were the result of noise contributions rather than actual harmonic distortion, we conducted another test, using the Fast Fourier Transform (FFT) capability of our Audio Precision System One test equipment. Feeding a constant 1-volt, 1-kHz signal into the EQ Ten (with its EQ controls set for flat response), we did a spectrum analysis of the output. By allowing the test equipment to acquire the results in 16 passes, random noise is essentially canceled out, while actual harmonic components stand out in the resulting display. That display showed that the most prominent harmonic, at 2 kHz, was indeed at −60 dB relative to the fundamental 0-dB reference level. Since that corresponds to a distortion level of 0.1%, this test confirms the fact that the earlier readings were actually harmonic distortion and not contributions of random noise.

Further confirmation of the distortion level was obtained when we looked at distortion versus input/output levels. Clipping levels for 1 kHz and 20 kHz occurred at just about 4 volts, the maximum levels claimed for the EQ Ten by AudioSource. A 20-Hz signal, however, caused clipping to occur at around 3.6 volts.

We next looked at the residual noise of the product versus frequency, using a 1/3-octave tracking filter. Random noise was so low as to be totally inaudible under the conditions in which the product is likely to be used. Even the contribution of noise introduced from the power supply (at 60 Hz, 180 Hz, and 300 Hz) was more than 100 dB below the 1-volt reference level used in making the measurement. These results are actually somewhat bet-
ter than the -99.7 dB signal-to-noise level claimed by AudioSource. An overall, A-weighted measurement of S/N yielded a reading of -100.8 dB. A summary of these and other test results is shown elsewhere.

HANDS-ON TESTS

Setting up the AudioSource EQ Ten was relatively easy. We had used many graphic equalizers in the past and the easiest way to insert this one in the signal path of our system was via the tape-out/tape-in jacks on our reference integrated amplifier. Since the EQ Ten itself is equipped with a couple of tape monitor in/out loops, this method of connection did not deprive us of the use of tape monitoring facilities for our two analog tape decks in the system.

We were prepared for a somewhat tedious procedure when it came time to equalize our system/room acoustics, but were pleasantly surprised at how quickly and easily the automatic equalization was performed. Once the microphone was plugged in and the pink-noise generator was turned on, a push of the Auto EQ switch caused the built-in microprocessor to equalize the entire system in a couple of seconds! We allowed the EQ Ten to equalize each channel separately, as recommended by AudioSource and, not surprisingly, since the two speakers in our reference system were positioned some ten feet apart, the setting chosen by the EQ Ten for the left channel differed substantially from those chosen for the right channel.

The equalized settings were stored in the unit's "memory" with the touch of two buttons. Both left- and right-channel settings were stored in a single memory location and were therefore recalled together whenever we wanted those settings. We found that the microphone position was quite critical during this operation, which made it important to use the remote control rather than the front panel controls to do the equalization procedure. We kept the microphone as close to our listening position as possible.

Of course, we experimented with the product by manually adjusting the EQ settings over a wide range. During these experiments we confirmed the advice given by AudioSource regarding over use of the extreme bass or high treble EQ controls. Using these controls for excessive boost can easily overload the capacity of your speakers or amplifier. Remember, a boost of 10 dB (easily within the capability of the EQ Ten) represents a power increase of 10-to-1, so go easy on the controls if you incorporate this or any other graphic equalizer in a home or professional sound system. And if you do use an equalizer such as this one, it's a good idea to keep other tone controls in your system in their flat position or, if possible, bypass or defeat them.

The AudioSource EQ Ten can take the drudgery (and inaccuracy) out of attempting to equalize a sound system. The product takes full advantage of the capability of modern microprocessors and turns a process that used to take as long as several hours into an accurate job that takes only a few seconds.

For more information on the EQ Ten, contact AudioSource (1327 N. Carolan Ave., B URLINGAME, CA 94010) directly, or circle no. 120 on the Free Information Card.
Safety For Restorers: Part 2

By Marc Ellis

Last month, I began to discuss some safety issues for antique-radio restorers. The topic was suggested by a letter received from reader D.K. Owens (Circleville, OH) and discussed in the March 1991 issue. Mr. Owens was particularly concerned about the dangers lying in wait for newcomers to the hobby. And since I strongly agree with this concern, I've been directing my remarks to the inexperienced restorer.

In last month's column, I discussed the all-important subject of cautions to be observed around household AC power lines—voltages that could be life-threatening. Those voltages, required for operation of the vacuum-tube circuitry, are obtained from the AC-line wall socket—either directly or through a step-up transformer that may multiply the line voltage several-fold. The AC voltage is then rectified (transformed to direct current), filtered, and distributed to various points in the receiver.

You're already familiar with the cautions to be observed in the presence of the AC line. Your radio's DC-supply voltages need to be treated with equal respect. The magnitude of these voltages ranges from about 150 for a transformerless (AC-DC) radio to about 350 for a large transformer-powered table-model or console.

And by the way, in a set where 350 volts of direct current is present, the power transformer usually delivers upwards of 800 volts of AC to the rectifier circuit. Most people don't have to be told to be careful around such a voltage source!

And, because they have a feeling for the large amounts of current available at a wall socket (15 amperes or more), most people don't need to be convinced that the 117-volt AC line must be treated with respect. But they may not have as much respect for the DC operating voltages within a radio once they know that those voltages are available only at currents measured in thousandths of amperes.

Although this is not a medical treatise, and I'm certainly not an expert on the medical effects of electric shock, I can assure you of this: Even the lowest DC voltages used by AC-DC radios and battery sets are considered quite dangerous. Depending on the resistance that your body offers to the passage of electric current (which varies with the amount of moisture on your skin, whether current is passing through an open cut, etc.) and the path the shock takes through your body, it's possible for even a 150-volt (or smaller) shock to interfere with the action of your heart and cause death.

Admittedly, most people weather small shocks with no permanent effects, but would you want to risk being the exception? Receiving an electric shock is a very unpleasant experience at best. And the unexpectedness of it could startle you into causing a secondary accident as you jerk your hand away. For instance, you might come in contact with an even higher voltage, subjecting yourself to a stronger shock; you might pull the radio off the bench so that it drops to the floor; or—if holding a test probe—you might overload and destroy a piece of test equipment by touching the probe to the wrong circuit point.

AVOIDING HIGH-VOLTAGE SHOCKS

When we discussed avoiding AC line voltage shocks last month, one of the key points to understand was that the power company grounds one side of the line. Thus, if your feet happen to be grounded (as when standing on a damp basement floor in damp shoes) and you...
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touch a wire connected to the ungrounded side of the line ... ZAP! ... a rather hefty shock passes through your entire body. So the idea is to avoid electrical contact with the ground when working on live equipment.

Protecting yourself from your set's high-voltage DC supply is an analogous situation. Just as with the AC line, one side of the DC supply (called the B-) is grounded. In this case, though, ground means the metal chassis of the radio rather than the earth. The idea is to keep yourself from contacting the chassis and one of the high-voltage (or B+) distribution points at the same time. Otherwise, it's ZAP time again!

But you also have to be careful to avoid contact with earth ground. In the case of AC-DC sets, you already know, earth ground and chassis ground can be one and the same. Even with non-AC-DC sets, earth ground can be connected to chassis ground through a leaky capacitor or (as is very common) through the ground lead of a piece of test-equipment whose chassis is connected to earth ground via a 3-prong plug.

The fear of becoming accidentally grounded is quite ingrained in the electronics experimenter who cut their teeth during the vacuum-tube era. Being one of them, for example, I find the idea of using a wrist ground strap (worn to drain off static charges while working with sensitive integrated circuits) quite appalling—even though semiconductor equipment operates at very low voltages.

Because it is required in virtually every vacuum-tube circuit, high-voltage DC may appear anywhere above or below the chassis of the receiver you are working on. The high voltage may appear even in places where it wouldn't normally be expected. For example, as Mr. Owens pointed out in his letter, on the adjustment screws of early IF transformers.

Defective components or improper modification by inexperienced "repairmen" could cause high voltage to appear in even more unlikely places. So unless you have positive information to the contrary, every metal part or connection should be treated as if it were live.

Through last month's discussion, you already know how to avoid being grounded through your shop floor. As an additional precaution against high-voltage DC shocks, some writers suggest keeping one hand in your pocket at all times while working on a live chassis. If you only have one hand involved, it's a lot harder to contact a ground point and a high-voltage point at the same time. And even if you did, the shock would be a lot less severe when passing through one hand only than if it flowed across your body through both hands.

Others (and I am one of them) feel that working with one hand is too clumsy and would be quite likely to cause other kinds of problems. I need both hands to stay out of trouble, and in well over 40 years of working with tube gear, I can't remember receiving even a single shock. For this, I credit my attitude—which is one of great respect for the working voltages associated with vacuum-tube circuits.

Another precaution that you definitely should take is to make sure that your tools have insulated handles. Of course, doing any kind of work on a live chassis is not recommended. However, if you must use a screwdriver, pliers, or other tool, make sure there is no exposed metal on or near the handle.

As a final caution, keep in mind that your chassis may not be free of high voltage even after you cut the power. The set's filter capacitors can store an electrical charge for quite a long time—enough of a charge to give you a nasty jolt hours after the radio is shut off.

You would be well advised to short the leads of all filter capacitors to ground if you must do serious work on a set just after shutting it off. You'll hear a loud "snap" as the capacitors discharge, and you may see a spark as well.

There are usually at least two filter capacitors, sometimes separate, sometimes combined in one can. Of course, you must be sure that the tool or clip lead you use for this purpose has an insulated handle.

**ANTENNA SAFETY**

Most serious collector/repairers eventually put up an outside antenna, and no introductory discussion of electrical safety would be complete without mentioning antenna hazards. There are two major ones: power lines and lightning. Avoiding them requires only simple, common-sense tactics. Ignoring them invites serious property damage, and very easily could cost you your life.

Most residential power distribution is handled via overhead lines operating at several thousand volts. Such lines are a major hazard to antenna installations. Never install an antenna so that it passes over one—not even the lower-voltage power line from the pole to your house. Don't even install the antenna in close proximity to a power line.

If the antenna wire should accidentally fall across a high-voltage line while you are putting it up, you'd probably be electrocuted instantly. Those lines have little or no insulation and, of course, antenna wire is a very good conductor of electricity. Even if you were able...
to install an antenna wire near a power line without incident, the wire could easily later break in a storm, falling across the line and conducting lethal voltage into your home through the lead-in connection.

If your antenna uses one or more metal masts, be sure to ground them (use one of the systems designed for TV-antenna masts). Then a lightning strike will be more apt to travel through your mast and grounding system on its way to the earth than through your antenna, lead-in wire, house, equipment, and you!

During electrical storms, buildups of static electricity in the atmosphere are more common than actual lightning strikes. The static charge can accumulate on an antenna until enough builds up to arc to ground, either through a receiver connected to the antenna (with destructive effects) or perhaps through an unlucky individual who happens to be handling the lead-in wire.

There are two simple ways to avoid that problem, and I'd suggest using both.

(1) Use a static-discharge device, such as those sold for use with TV twinlead (attach your lead-in to one of the two antenna terminals and ignore the other one). When connected to a good ground, this device will continuously leak static charges to earth—therefore preventing dangerous buildup of static electricity. (2) Use a heavy-duty knife switch to transfer your lead-in wire to a good ground system whenever you are not using the antenna.

Just one final point. Everyone in your family should know that it can be extremely dangerous to try to rescue a victim of electric shock. If you touch the victim while he or she is still in contact with a live wire, you’ll become a victim yourself.

It would be a wise move to set up your workbench with a master power switch and make sure everyone understands that it should be shut off before attempting a rescue. Also explain the possibility, remote that it might be, of contact with a power line via your antenna lead-in. Stress that rescue from such a situation should be attempted only by professionals.

That’s all for this month. We want to be sure to see you all again next time, so please remember to work safely, and send your comments or questions to me at Antiques Radio, Popular Electronics, 500-B Bi-Country Blvd., Farmingdale, NY 11735.
Seemingly simple print jobs, like mailing labels and address lists, can be fiddle word processors, graphics, and desktop-publishing programs. What's really needed are small, focused utilities that don't try to be all things to all people, but rather try to do one job and do it well—and keep the cost down.

Recently I've been using a couple of complementary programs, Avery's LabelPro (which has but one purpose: to print attractive mailing labels, optionally including graphics) and Books, Cards, and Labels (which excels at printing database type attractive features of LabelPro is that you can print labels with graphic images. The program comes with several dozen of its own, including balloons, computers, etc. You can also add your own images to LabelPro's image database. Images must be stored in PCX format, as produced by PC Paintbrush, the Paint program in Windows, and many other graphics programs. The dot-matrix version supports color printers; at this time of the year, that capability would be useful for printing colorful holiday cards.

One useful feature of the program is the ability to merge print labels from a database, which may be in dBASE, WordPerfect, or ASCII formats. LabelPro also has a built-in Data Manager with several predefined databases. However, you can't modify the built-in record structures. The Data Manager might suffice for small jobs, but you'll want a more efficient package to manage a database of any quantity.

Designing a label is simple. You first select a label format, of which the program supports about 30. The supported formats all correspond to labels that Avery sells, which include common address and shipping labels, round formats, formats for diskettes, audio and video cassettes, file folders, and more. You needn't worry about having to fit the predefined label formats, because Avery labels are easy to get hold of, both at local office-supply stores and by mail order.

For each given label format, the program gives you several layout options—whether to include a graphic image, borders, or text. Text can appear in two fonts (a serif font like Times Roman and a non-serif font like Helvetica), in numerous sizes, with italic or bold emphasis, and with various indentions and justifications.

Designing a label is intuitive. The program provides a preview mode with several zoom levels, so that you can see exactly what you're going to get. When your design is satisfactory, you can save it for reuse later. Printing is quick; the program apparently creates a bitmap of one label and then uses LaserJet macro commands to duplicate it across the page.

The documentation is pretty good, albeit a bit verbose. The package includes numerous sample labels and a special calibration sheet for real printing precision, although I had no trouble printing without calibrating my system. LabelPro requires about 1.3 megabytes of hard disk real estate.

I'm pretty happy with LabelPro as it is, but if I were going to revamp the program, I'd build a WYSIWYG (What You See Is What You Get) version that ran under Windows and provided precise control over all layout features.

BOOKS, CARDS, AND LABELS

BCL's claim to fame is its ability to print cross-referenced telephone directories in a wide variety of formats. Two versions of the program are available; one prints data stored in an external database, the other (the version tested) includes its own database.

LabelPro gives you several layout options—whether to include a graphic image (like the computer shown here), borders, or text—and provides a preview mode with several zoom levels.

phonebook listings in a multitude of formats from Useful Software, Inc. Both of the programs stick to a "small is beautiful" philosophy.

LABELPRO

LabelPro comes in separate PC versions for laser and dot-matrix printers: I tested the laser version with an HP LaserJet Series II. A Macintosh version is also available. One of the most
manager. Both versions support numerous laser and dot-matrix printers. Laser-printer support includes cartridge and soft fonts. The program comes with several so-so soft fonts of its own, BCL requires about one megabyte of disk space.

The database manager can import and export data in various formats, including dBASE, ASCII, SideKick, Black Book, Pocket Address Book, etc. The import procedure is rough and poorly documented; it had trouble aligning telephone-number fields without area codes correctly. BCL also has trouble handling foreign-address formats.

The built-in database includes the most extensive set of fields that I've ever seen in a canned list manager, including four names, five phone numbers, two addresses, four "code" fields, two notes fields, and more. There are lots of little extras that make the database structure powerful. For example, each telephone number has an associated single-character symbol that specifies the type. For example, B = Business, H = Home, F = Fax, and C = Car.

You can use the four "code" fields in a number of ways to create subsets of your database. For example, I use the following: C = Commercial, E = Emergency, F = Friends, G = Government, H = Household, J = Job, K = Kin, M = Modem/BBS, N = Neighbors, and several others. I can then create a printout that lists, for example, only "E" (Emergency) numbers to post by the phone, another printout that includes CEF/GHN for a home phone book, another one that includes CG/IM for a business book, and so on.

BCL prints in a wide variety of formats, including some that are predefined for business planners (DayTimer, Franklin, etc.), and others that print on regular 8.5- x 11-inch sheets. A book format prints in landscape mode on both sides of the paper, allowing you to fold it in half, staple it in the middle, and voila, instant phone book. As the name suggests, BCL also prints mailing labels and Rolodex-style cards. It even prints envelopes, albeit without a return address. In addition, Useful Software sells special forms for various printers and planners at reasonable prices.

The documentation for BCL is pretty poor; so you'll have to rely on a fair amount of trial and error to get the printouts you want. Inexperienced database designers would also appreciate much more in the way of examples on the creative use of the various code fields. Another complaint is that navigating the menu structure and data-entry screens is difficult and inconvenient. Due to the multitude of fields on the entry screen, mouse support should be a high priority.

However, in spite of my complaints, I really do like BCL. After four years of procrastination, the program finally convinced me to clean up and consolidate my electronic phone lists. The company promises some updates soon, and I'll be looking forward to them eagerly!
By Fred Blechman

**Flying the Real Thing**

It has been forty years since I was behind the stick of a fighter plane, flying F-4U-5 Corsairs with Fighter Squadron Fourteen (VF-14 "Tophatters"). However, since 1978 when I got my first microcomputer, I've flown every flight simulator I could get my hands on.

I have over 40 flight simulator programs for the IBM PC, and I have frequently reviewed the latest and greatest in this column. But, drawing back on my dim recollection of "real flying," I wondered how these simulators compared with modern flying and air combat. At age 64 it was unlikely that I'd ever fly a fighter again, so I chose the next best thing—I took a six-dogfight flight with "Air Combat U.S.A.," where you fly real airplanes in simulated air combat.

This "Fighter-Pilot for a Day" program (three actual dogfights for $399, six for $495) operates from an airport about 60 miles from my Los Angeles area home. Flying Italian SIAI Marchetti SF-260W Warrior NATO light-attack planes in one-on-one mock combat, and using a patented electronic tracking system for determining "kills," this is as close as any civilian can come to the real thing.

Surprisingly, as I later found out to my chagrin, non-pilots can do this, and do it well! These planes have side-by-side seating, with dual controls. The "guest-pilot" flies in the left-hand seat, with an instructor-pilot in the right seat using the intercom to instruct the guest-pilot when needed.

I signed-up recently to be a guest pilot. After I got fitted with a flight suit (no G-suit), a hard-hat helmet and a parachute, we went into the ready room for a one-hour detailed briefing. "We" included, besides myself, my instructor-pilot (radio call sign "Hollywood"), the other guest-pilot (Larry), his son (Jim, who was giving his father the ride as a Father's Day gift), and my wife (Ev, who would be watching and photographing from an optional $100 Beech Bonanza chase plane). Larry's instructor-pilot, "Dooley," was out on the flight line checking the aircraft.

Hollywood described the various modern ACM (Air Combat Maneuvering) techniques, using model planes on sticks to illustrate flight paths. I don't recall ever hearing about "high yo-yos," "low yo-yos," and "displacement rolls" back in the early 1950's. These are vertical maneuvers we probably did without naming them—who remembers? Anyway, the briefing was very thorough and covered about a dozen typical offensive and defensive maneuvers.

Then we climbed into our neat 260-horsepower SF-260Ws and strapped ourselves in. Hollywood made the take off after various radio and engine checks. I was amazed at the combined chatter with the tower, the chase plane, the other Marchetti, and on the intercom with Hollywood. I had a lot of trouble figuring out who was talking to whom.

Soon after takeoff we rendezvoused and I got to fly close formation—something I hadn't done in all these years, and that most civilian pilots never have the opportunity to do. Hollywood did the throttle jockeying while I worked the stick and rudder. As we approached the "combat area" for this flight (Lake Mathews, south of Riverside), I practiced S-turns to get the feel of the controls, while Larry in the other Marchetti dropped behind and, following Dooley's instructions, had some target practice getting me in his gunsight. Then we reversed positions and I got Larry in my sight a few times.

After some demonstration maneuvers, Hollywood let me take the first dogfight without any coaching. We climbed to 5500 feet and got in position to approach each other from opposite directions, passing wing-to-wing about 500 feet apart. I hauled my plane around the sky, craning my head inside the bubble canopy to keep the bogey in sight.

For the first time in forty years I was pulling well over 4-G, which I found very uncomfortable without a G-
suit. In Corsairs our G-suit started to inflate at 2-G. It took a couple at high and low yo-yos, and lots of buffetting and shuddering as the plane approached stall-ling several times, but I finally pulled the “enemy” into my sights, and squeezed the trigger on the joystick. A solid tone sounded in my headphones, a red light on the panel turned on, and the bogey plumed a stream of smoke. A kill!

My opponent Larry Coles, is a 52-year old who had never piloted a plane. Following Dooley’s prompting, he smoked me in the next three out of five dogfights! How do I know Larry, and not Dooley, was actually flying the plane? A VHS video tape is turned on at engine startup in each plane’s cockpit, using two cameras (including a view through the gunsight!), with all the radio and intercom yakking on the tape. Each guest-pilot gets to take his tape home. Larry sent me his tape, and he really was doing the flying! The rolling, twisting, yanking, banking, and G’s didn’t bother him at all. He even got to fly loose formation, Larry told me after the flight that this was the most exciting thing he had ever done in his life—and that he loved going on roller coasters. ‘No wonder he wasn’t G-sensitive.

Hollywood and Dooley took over and did some additional maneuvers as demonstrations, then we flew back to the airport and had a debriefing. Both cockpit tapes were shown simultaneously on two monitors so we could to see the offensive and defensive actions in each plane. Absolutely fascinating!

Hollywood was cool and deliberate; Dooley was excited and having a ball with such a good student. “Okay,” you say, “that’s nice for you. But how does this real flying compare with flying some of the newer PC flight simulators?” Well, there are several important differences and advantages to each. For one thing, a PC flight simulator doesn’t cost $495 for six dogfights!

You don’t pull any real G’s in a flight simulator. True, some of the more recent programs, like the outstanding “Chuck Yeager’s Air Combat,” will dim and blacken the screen as your simulator pulls high G’s, but you don’t feel a thing. Believe me, pulling G’s is tiring and effects your ability to yank the plane around.

Another big difference is the ability to see the other airplane. “Lose sight, lose the fight!” in a real plane, even though there are blind spots behind and below you, or under the wings, generally you can maneuver your plane and turn your head around to see the other guy. Most simulators you can’t smoothly scan, as you would with your eyes, and you have absolutely no peripheral vision.

If you don’t see the other plane, most simulators give you little or no information on him. If you don’t know where the other plane is, and his apparent path, you’re dead meat. On the other hand, the computer program always tells you where you are, where you’re headed, and your attitude, so you are at a definite disadvantage.

Also, although some simulators now include digitized voices, in a real plane there is a lot of on-the-air chatter that can be confusing and distracting. You really can’t get hurt in a simulator, Yeager lets you be “invincible.” Various simulators let you use many weapons, fly defined custom missions, and navigate between waypoints.

Instead of just smoke you see bit-mapped fiery explosions with pieces flying every which way, just like the combat movies taken from real gun cameras. You can also practice landings—even carrier landings, such as with the great “Jef-fighter II.” And you can always walk away from a crash.

In the final analysis, however, for us civilians it is really nothing to compare with the excitement and realism of Air Combat U.S.A. and “Sky Warriors,” a similar East Coast operation that flies Beech tandem-seating T-34A Mentors. The experience is recommended.

(Air Combat U.S.A., 230 Dale Pl., Fullerton, CA 92633, Tel. 800-522-7590; Sky Warriors, 3996 Aviation Circle, Suite B-3, Fulton County-Brown Field, Atlanta, GA 30336, Tel.404-699-7000. The software mentioned can be ordered from any software dealer, or: Chuck Yeager’s Air Combat, Electronic Arts, 1820 Gateway Drive, San Mateo, CA 94404, Tel.800-245-4525, $59.95; Jefferight II Advanced Tactical Fighter, Velocity Development, RO Box 875, Palatine, IL 60078-0875, Tel.708-991-0594, $69.95.)

NEW FUN SOFTWARE

First, some news: Electronic Arts now offers product support 24 hours a day, seven days a week, through a new 900 service (1-900-228-HINT) that uses push-button commands. It costs 95-cents for the first minute and 75-cents for each additional minute for hints and passwords for Electronic Arts’ most popular titles.

Here are some recently announced programs that you can order from your regular software supplier. Suggested prices, where announced, are shown in parentheses.

Three-Sixty Pacific combat
bines the action and suspense of a combat ac-
tion game with the planning and wit of a stra-
tegic game in "Armor Alley" (IBM, $39.95; Macintosh, $49.95).

Mindcraft has released four products: "The Magic Candle Volume 2: The Four and Forty" is an adventure that has you exploring the dreadd realm of Gurtex, an ancient wellspring of evil (IBM, $59.95; Amiga and Commodore 64/128 to follow); "The Keys to Maramon" has you protecting the island town of Maramon from hordes of horrible monsters (Amiga, $49.95); "Beach 2" is a classic tactical space war-game (IBM, $29.95; Amiga, $49.95); "The Rules of En-gagement" puts you in command of a fleet of starships in 24th Century strategic space combat (IBM and Amiga, $59.95).

Interstel has announced the availability of "Armadia 2525," a multi-player space strategy game that pits players against five human or computer opponents in an interstellar battle to conquer the galaxy (IBM, $49.95; Amiga to follow). Also from Interstel, "Utah Beach" is the first of a series of wargames that allows the player to relive the famous battles of World War II (Macintosh, $49.95; IBM to follow).

Accolade has three new releases. "Elvira II: The Jaws of Cerberus" is a sequel to last year’s critically ac-
claimed fantasy role-playing adventure (IBM and Amiga). "Mike Ditka Power Football" is a 256-color VGA simulation with realistic three-dimensional multi-angle player perspectives (IBM). "Les Manley In: Lost in L.A." is a graphic whodunit mystery adventure in which Les tries to determine who is kidnapping the biggest stars in Hollywood (IBM, $59.95).
By Joseph J. Carr, K4IPV

Build a Spectrum Analyzer

At one time, spectrum analyzers were found only in the most well-equipped engineering laboratories. Spectrum analyzers are devices that are used to display signal amplitude along the vertical axis and frequency along the horizontal axis on an oscilloscope's CRT. Such devices typically cover a rather wide frequency range. That allows them to "spot" signals over wide portions of the electromagnetic spectrum.

When intermodulation occurs, any number of frequencies might be involved. A spectrum analyzer allows the engineer to correlate signals on the CRT with the interference.

Another use for the spectrum analyzer is as a panadapter. Basically, a narrow-band spectrum analyzer that's designed to operate at the intermediate frequency (IF) of a receiver, is connected between the output of the mixer and the input of the first IF filter. The panadapter allows continual visual monitoring over a narrow band of frequencies centered around the receiver's IF allowing you to analyze the spectral content of a single received signal, or it can be used to analyze spectral content over a larger band of frequencies (up to a few hundred kHz). One use for a panadapter in ham applications would be to look for quiet spots on a band.

Sample HOMEBREW Circuit

Figure 2 shows the schematic diagram for a simple spectrum analyzer, whose RF front-end is built around an NE602N double-balanced mixer (U1). (The NE602N is available from Digi-Key Corp., PO Box 677, Thief River Falls, MN 56701-0677; Tel. 800-344-4539.) The NE602N's internal oscillator is used as the VTVFO in this circuit. Its configuration is similar to that used in the band sweeper discussed last month.

Applying a sawtooth waveform to V, causes U1 to sweep from the frequency obtained when the sawtooth is zero up to the frequency obtained when the sawtooth is at its maximum value. The signal produced by U1's internal oscillator as a result of the applied sawtooth waveform is mixed with the incoming signal from the antenna (Antenna), which is coupled through a pair of coils (L2 and L3) to pins 1 and 2 of U1.

There of two options for L2 and L3. The first option is to use a 10.7 MHz, transistor-radio type, IF transformer (IFT) for L2 and L3. To use the IFT in that capacity, the small capacitor must be removed (or crushed). The IFT windings must then be reversed in the circuit, that is the primary of the IFT is connected as the secondary and vice-versa. The

Fig. 1. Block diagram of a spectrum analyzer.

HOW IT'S USED

Federal Communications Commission (FCC) engineers use spectrum analyzers to keep track of signals within an area by detecting stations as they come on and go off the air. They also use spectrum analyzers to see how much second and third harmonics are being radiated from a transmitter, the less, the better. A spectrum analyzer can also be used to determine the effectiveness of a transmitter's tuning circuitry, or to test the effectiveness of antenna-tuning units.

In addition, spectrum analyzers might be used to find the source of electromagnetic interference.

HOW IT WORKS

Figure 1 shows the block diagram of a typical spectrum analyzer. The input is coupled to an RF mixer, where it is mixed with the RF output of a local oscillator (LO) that consists of a voltage-tuned, variable-frequency oscillator (VTVFO), whose instantaneous frequency is controlled by the output of a sawtooth generator; that signal also controls the X-axis deflection on the oscilloscope.

The output of the mixer circuit is filtered to retrieve the difference frequency (RF - LO); or IF, of the analyzer. The output of the filter is then amplified and led to a detector to produce a DC level. As the LO signal mixes with the incoming RF deflections or "blips" on the trace indicate the spectral content of the band of interest.
second option is to wind your own coils. The two coils can be wound on a single a T-37 or T-50 red or yellow toroidal core in transformer fashion. First wind 18 turns of #26 enamel coated wire on the core for L3. For L2, wind 3 to 4 turns of the same wire on the core.

The output of U1 (the difference or IF signal) is applied to FIL1—a 4-kHz wide, 455-kHz (center frequency), AM ceramic filter (also available from Digi-Key), which determines the circuits IF range. From FIL1, the IF signal is fed to U2 (an MC1350P RF/IF amplifier) for amplification. The output of U2 is coupled to D2 (a 1N34 germanium diode), which is used as an AM detector, via T1 (a 455-kHz IF transformer), and is applied to the Y-axis of an oscilloscope.

Diode D1, an NTE614 varactor diode with a capacitance of 33-pF allows U1’s internal oscillator to be tuned from 10 MHz to 15 MHz. The varactor diode used in your unit will depend on the frequency coverage desired. For many HF circuits, diodes with maximum capacitances of 33 pF 100 pF or 365 pF are acceptable, but keep in mind that the frequency change is the square root of the capacitance change. Inductor L1, a 2.5 µH homebrewed unit wound on an Amidon L-57-2 shielded coil form, must resonate at the desired frequency, given the capacitance of D1. The number of turns needed for L1 depends on the wire diameter used and will have to be determined experimentally. To reduce the frequency range, or custom tailor the circuit’s tuning range, a fixed or variable-trimmer capacitor (C13) can be shunted across D1. The value of C13 depends on the desired tuning range.

ALTERNATIONS

The V1 input to the circuit can be altered, as shown in Fig. 3, so that a DC voltage can be combined with the sawtooth waveform. That would allow the center frequency to be altered.

(Continued on page 89)
The holiday period long has been recognized by DX'ers as a prime time for shortwave listening. A lot of that has to do with the fact that we’re in the heart of the winter DX season. In the northern hemisphere, the colder months bring quieter listening conditions—less static and band noise—meaning that the signals often are sharper and clearer.

In addition, the nights are longer and that means more opportunity to tune the lower frequencies, the so-called nighttime shortwave bands that require paths of darkness between the stations and the listener's location. And in addition to improved listening conditions during the Christmas/New Year holiday period, there are opportunities to hear stations that you otherwise might not log too readily.

Christmas Eve, for instance, is a good opportunity to tune in Spanish-speaking stations of South America. Some Latin stations that normally sign off earlier in the evening will stay on the air later to broadcast Roman Catholic midnight Mass from local churches or cathedrals.

Even if church services are not part of the extended broadcasts on Christmas Eve, stations in both Latin America and West Africa may be on beyond their local midnight hour with musical dedications and Christmas favorites. Because of the time differences, listeners in the U.S. and Canada can find interesting listening opportunities from late afternoon on December 24—when midnight arrives in West Africa—to the late night hours when South American stations are still on the air. The programs, of course, are primarily for domestic audiences, so the broadcasts will usually be in a language other than English, with the exception of some African countries, such as Nigeria.

Although the larger international shortwave broadcasters—those high-powered outlets that regularly beam transmissions to North America—probably will not be expanding their scheduled hours during the holiday period, they no doubt will offer special Christmas programming.

How do the Dutch, Swiss, Austrian, and Swedish Christmas traditions differ from our own? Listen to Christmas concerts by orchestras in some of Europe’s magnificent cathedrals, by some of the continent’s finest philharmonics. International broadcasters usually offer plenty of special holiday programming with a local flavor.

For those intrigued by tuning in the unlicensed “pirate” shortwave stations, the holiday period offers a good number of interesting targets. Who knows which ones will turn up? Will they be some of the longtime “pirate” operations or something brand new? I suspect that some, if not many, of the “pirate” broadcasters are students, so the school and university Christmas recess offers the time to get those illicit programs on the air.

Although the enforcement of laws and regulations against unlicensed shortwave pirates is (at best) sporadic, Federal Communications Commission monitoring seems even more lax during the holiday season. In short, the bootleg broadcasters have recognized that they can get away with it easier and more safely during the Christmas-New Year period. So if you’re looking for those holiday “pirates,” a good area of the bands to patrol is between 7,400 and 7,600 kHz during the late afternoon and evening hours.

In Europe—where unlicensed operators have been doing their thing for longer than their counterparts on this side of the Atlantic—there are often special tests arranged for North American SWLs during Christmas time. They, like their Yankee counterparts, use mostly low-powered transmitters. So it is rare that European pirate signals actually make it across the ocean. However, each season, U.S. and Canadian SWL’s living on the eastern part of the continent usually manage to log one or two of those special transmissions.

Christmas tests by British and Continental European “pirates,” or “free radio” as they prefer to be called,

"Alegres Fiestas," or happy holidays, is the wish expressed on this modernistic and electronic greeting sent to SWL’s by Colombian shortwave station, La Voz de Yopal.
concentrate mostly around 15,000 kHz during our daytime hours; around 6,200–6,400 and 7,400–7,600 kHz during our nighttime.

STOCKING STUFFERS

Okay, SWL's, tune out now! This segment is for your spouse who is looking for a little SWL gift to tuck into your Christmas stocking. I presume that most of the holiday shopping is already done. If the plan is to buy your SWL'ing partner that portable SW receiver, I imagine that the purchase already has been made. What I'm talking about here is the relatively inexpensive gift that you can order by phone at the last minute.

How about an SWL clock? Every listener needs one to keep tabs on the time as he or she listens. Preferably, it should be a digital type that displays hours in the 24-hour system (with the PM hours displayed as 13:00 to 24:00). The MFJ-109 is such a clock, with a dual display that shows both local time and Universal Coordinated Time—the "UTC" international reference standard used by foreign broadcasters and SWL's. It has a 24-position slide switch to show the local time in major world cities. The MFJ-109 is battery powered, has an alarm, and is smaller than a paperback novel. It costs under $20 and can be purchased from Universal Radio (800-431-3939).

The 1991 Passport To World Band Radio (a 400-page SW station listing) available in English and other languages gives frequencies and schedules in easy-to-use chart form. One of the best of its kind, it also contains reviews and information on shortwave receivers that are on the market today. A must for every serious listener, it is priced at around $15 and is available in many book shops and electronics dealers, including Grove Enterprises (704-837-9200).

Another book for those who tune the shortwaves to find out what's happening around the globe is Muzzled Media. Its theme is how you can keep up with world news, as it happens and from where it happens, through international broadcasting. It can be ordered for about $9 from the publisher, Tiare Publications (414-248-4845).

Giler Shortwave (800-445-3371) has logging-report forms that are both inexpensive and useful for keeping written records of all the stations that an SWL tunes.

Your favorite SWL can automate his listening with a Novex RC2010 cassette controller. It works with many popular Sony, Panasonic, Sangean, and Realistic portable receivers with clock-timer units. In conjunction with a cassette recorder, it allows a listener to automatically record SW programs while away from home or sound asleep. The cassette controller is available for about $40 from Electronic Equipment Bank (800-368-3270).

And for those chilly winter mornings when your SW'er drags out of bed to tune in some elusive Asian broadcaster, perhaps a sturdy, attractive coffee mug would be the ticket. Universal Radio (see above) has a nice one—blue ironstone ceramic with a map illustration and the slogan, "Listen to the World"—for under $5. With those suggestions, I add my wishes for a happy holiday season for all SWL's and their families!

DOWN THE DIAL

This is the section of our monthly column devoted to what's on the air, and when and where you can tune to find the stations. All times are given in Universal Coordinated Time (UTC). As always, I welcome your comments and questions about SWL'ing. And while you're at it, send along a photo, if you wish, showing you and your SWL'er setup. I'll be running as many of those as I can in future columns.

Write to DX Listening, Popular Electronics, 500-B Bi-County Blvd., Farmingdale, NY 11735.

BANGLADESH—15,208 kHz. Radio Bangladesh at Dacca is noted in the eastern U.S. on this frequency, not the announced 15,200 kHz, at around 1230 UTC. A parallel frequency, 17,750 kHz, is usually covered by interference.

MALTA—9,765 kHz. The Voice of the Mediterranean broadcasts from this island nation with English programming that is heard at around 0645 until a language change at 0700 UTC. There may be some interference, however.

PORTUGAL—9,705 kHz. Radio Portugal International has been heard with its English transmission, news and weather plug, and Portuguese folk music before its 0230 UTC signoff.

TAHITI—11,825 kHz. RFO, which is "shorthand" for Societe Nationale de Radio Television Francaise d'Outre Mer, at Papeete on this mid-Pacific paradise operates on this frequency during the late-night hours in North America. Listen in during the 0500 to 080 UTC period for programming in French and Tahitian, including some wonderful island music!

Credits: Tom Sundstrom, NJ; Mike Hardescu, NC; John Carson, OK; Rufus Jordan, PA; Ernie Behr, ONT; Arthur Cusack, New Zealand; Dan Ferguson, VA; North American SW Association, 45 Wildflower Road Levittown, PA 19057.

Shortwave Listening Guidebook

by Harry Helms

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HighText Publications, Inc., 7128 Miramar Road Suite 15L San Diego, CA 92121

DECEMBER 1991
Seasons greetings circuiters! In keeping with the season, we are going to share a pair of fun circuits. Our first circuit is an animated bell, consisting of several LED's arranged so that they form a three-bell outline. The bell arrangements are electronically controlled so that the lighting sequence gives the appearance of movement. It's just perfect for the coming holiday.

**ANIMATED BELL**

Figure 1 is the schematic diagram of the bell animation circuit. Each of the three bell outlines in the circuit consist of twelve LED's. As each group of LED's is sequentially switch- ed on and off so that the bell outline appears to shift positions, creating the illusion of movement.

To accomplish the apparent animation, two gates (U1-a and U1-b) of a 4017 CMOS quad 2-input nor gate are configured as a low-frequency astable oscillator. Counter U2—which has 10 decoded outputs, but is connected in a count three and recycle configuration—advances one count per pulse, causing pins 3, 2, 4, and 7 (which correspond to outputs 0-3) to sequentially go positive.

The first clock pulse forces pin 3 of U2 high, turning on Q1. That grounds the cathodes of LED's 1-12, causing them to light, producing the first bell outline. The second pulse forces pin 2 of U2 high (and pin 3 low), which, in turn, causes Q2 to turn on, and Q1 to turn off. With Q2 turned on, the second set of LED's (LED's 13-24) light, causing the bell outline to appear to have shifted positions. The third pulse turns Q2 off and Q3 on, lighting the third set of LED's, and gives the appearance that the bell outline has once again shifted.

On the fourth clock pulse, pin 7 of U2 (which is tied to U2's reset terminal at pin 15) goes high. That causes U2 to reset to zero, once again causing pin 3 to go high, lighting the first bell outline, and the sequence is repeated.

Figure 2 shows the basic overlapping three-bell outline. However, if more bell outlines are desired, the basic circuit can be easily modified. Refer to Fig. 3. To change the number of outputs, connect U2's reset input at pin 15 to the output pin that's one greater than the number of bells that are used in your display.

For instance, if you want to use five bells instead of three, you'd have to connect pin 15 to output 5. (Remember output 0 at pin 3 is the first output to go.

---

Fig. 1. The bell-animation circuit contains 36 LED's that are controlled by a 4017 counter/divider, which is clocked by an astable multivibrator that consists of half of a 4001 quad 2-input nor gate.
PARTS LIST FOR THE ANIMATED BELL

SEMICONDUCATORS
U1—4011 quad 2-input nor gate, integrated circuit
U2—4017 decade counter/divider, integrated circuit
Q1—Q3—2N3904 general-purpose silicon NPN transistor
LED1—LED36—Light-emitting diode

RESISTORS
(All fixed resistors are 1/4-watt, 5% units.)
R1—R9—470-ohm
R10—R12—1000-ohm
R13—47,000-ohm
R14—100,000-ohm potentiometer

ADDITIONAL PARTS AND MATERIALS
C1—470-µF, 16-WVDC, electrolytic capacitor
C2—0.1-µF ceramic-disc
C3—0.1-µF ceramic-disc
C4—47-µF, 16-WVDC, electrolytic capacitor
Perfboard materials, enclosure, IC sockets, 9-volt power source, wire, solder, hardware, etc.

Fig. 2. The 36 LED’s of the bell animation circuit are grouped by 12 and arranged to form three bell outlines. Here is the layout of the basic overlapping three-bell outline.

Fig. 3. Additional LED-bell outlines can be added to the circuit using this diagram as a guide. Simply connect pin 15 of the counter to the output that corresponds to the number of bells plus one. See the text for more information.

high, which in this instance is considered as the first output) If you want to use all 10 of U2’s outputs, tie pin 15 to ground. Of course, any increase in LED strings, must be accompanied by a corresponding increase in driver transistors. You can also use the basic circuit to animate other objects, such as a star, a ball, or even a Christmas tree.

TONE CHIME
Our second circuit for this month is a simple add-on musical-chime. You can add the chime circuit to the animated bell circuit in Fig. 1 to jazz up the project, making the bell appear to ring as it swings.

In Fig. 4, half of an LM1458 dual op-amp (U1-a) is configured as a modified active filter whose gain is controlled by R6. If the gain is set too high, the circuit will go into oscillation at the filter’s resonant frequency. By adjusting the gain to just below the point of oscillation, the circuit can be triggered with a positive pulse, causing it to give out a short ringing signal at the filter’s resonant frequency.

The chime-oscillator’s output is buffered from external loading by the second op-amp, U1-b, which is configured as a voltage follower. The input of the chime-oscillator circuit can be activated by the output of the clock generator or any of the 4017’s outputs in the animated bell circuit. Connect the chime’s input to the desired trigger source and set R6 for a ringing output. The chime oscillator’s frequency may be increased by lowering the values of C1 and C2, or decreased by increasing the values.

Fig. 4. The tone chime circuit shown here can be added to the animated bell to give the original circuit that extra flare.

PARTS LIST FOR THE MUSICAL CHIME

RESISTORS
(All fixed resistors are 1/4-watt, 5% units.)
R1—1000-ohm
R2—1-megohm
R3—100,000-ohm
R4, R5—2200-ohm
R6—1000-ohm potentiometer

CAPACITORS
C1, C2—0.1-µF ceramic-disc
C3—0.1-µF ceramic-disc
C4—47-µF, 16-WVDC, electrolytic

ADDITIONAL PARTS AND MATERIALS
U1—LM1458 dual op-amp, integrated circuit
Perfboard materials, enclosure, IC socket, 12-volt power source, wire, solder, hardware, etc.
We know of something that will fit just beautifully into that stocking that you've hung by the chimney with care. And, when the family comes over to visit for the holidays, it will give you a good reason to hide in your room so you won't have to kiss Aunt Bertha.

It's the new ACE Communications handheld scanner known as the AR-1000-XC. Coverage? You want coverage? Try 1000 memory channels and a frequency range that begins at 500 kHz and goes straight through to 1300 MHz. No gaps in frequency coverage means that it starts out at the low-frequency end of the AM broadcasting band, goes up through the shortwave (HF) bands, into all of the scanner bands, the FM/TV bands, and right on into microwave frequencies.

AM, NFM, and WFM modes may be selected at any frequency. Twenty-six front-panel keys are used to program the AR-1000-XC. Pairs of upper and lower limits for bands to be searched can be stored in ten separate search-memory locations. All information is stored in a permanent memory. Other features include a selectable single priority channel, keyboard lockout, BNC antenna connector, and a backlit display for night use. The LCD readout itself offers 21 separate prompting annunciators to aid the user in operating the unit.

The scanner measures less than 7 inches high by 2½ inches wide by 1½ inches deep, and weighs 12 ounces. The published specifications for sensitivity are better than 0.35 µV at 12-dB S/N in NFM mode, and 10-µV at 10-dB S/N in AM mode. The suggested retail price is $429, and that includes a 120 VAC-to-12 VDC adapter/charger, a DC cigarette-lighter plug/charger cord, a flexible antenna, a carrying case, and rechargeable batteries. For further information, contact Ace Communications, 10707 East 106th Street, Fishers, IN 46038.

SCORE ONE FOR SCANNER USERS

Sometimes scanner owners take some flak for listening to police transmissions, but there's a flip side to that coin. A number of readers were thoughtful enough to send us a clipping from the Muskegon Chronicle, in Michigan.

It told the story of a man driving his truck who spotted a bicycle lying out in the middle of the country road. When he stopped and got out to investigate, he thought he spotted a few teens hunched over in the nearby woods. He yelled over to ask about the bike. Getting no reply, he yelled over again.

At that point, one of the figures stood up. It was a man who ran deep into the woods. The other person in the woods was a woman, who had earlier been walking along the road when the man on the bike rode up, stopped, got a bear hold on her, and dragged her into the woods in an attempted assault. She was hysterical, and covered with scratches and scrapes.

Sheriff's deputies and police were immediately summoned, and a description of the suspect was broadcast over area agency radio systems. A police tracking dog was also put on the trail. Many residents in the area heard the sus-
pect's description on their scanners and came forward to report to police information concerning the suspect's direction of travel. He was captured after a chase. Sgt. Daniel Jacobsen, of the Muskegon Township Police, was quoted as stating, "If it hadn't been for citizens listening to their scanners, we probably wouldn't have caught him."

FREQUENCY FINDER
We enjoy finding frequencies for readers, but sometimes the requests that come in look to be geared to make it as difficult as possible for us to answer. For instance, Greg Pruitt of Alpharetta, GA wants to know the frequency of the Scottish Rite Hospital. Maybe if we were more familiar with the geography of Georgia, we'd have known that the hospital is an Atlanta facility. (Greg never mentioned that.) We spent quite a bit of time attempting to run the place down in Alpharetta, without success. Finally, we located the hospital in Atlanta and found that it's licensed on 464.525 MHz, plus all of the MED channels between 463.00 and 463.125 MHz.

Next, Andy Peterson, Elburn, IL, hoped we could let him know the frequencies used by the State Youth Center Prison not far from his location, and also the frequency used by the high school he attends. Andy supplied a very detailed description of the radios used by the school personnel, but gave not one clue as to the name or location of either the school or the prison. Simply checking listings under the community of Elburn produced no likely candidates, so it looks like we drew a blank on Andy's requests simply because of insufficient information supplied as clues.

We don't need a lot, and we are anxious to help. But, please give us as much information as possible and don't assume that just because local information is second nature to you, we are able to fill in all of the blanks here at our end.

ALL AT SEA
Ship-to-shore (marine-operator) telephone calls can get interesting at times. In addition, stations offer some good opportunities for seeing how many different stations you can copy from your location. The stations dot the North American coastlines, navigable rivers and inland waterways, and larger lakes. Most areas are within range of at least several of these stations, and some busy areas have stations using several different frequencies.

The warmer months cause these channels to become so jammed with stations that much of what you hear is total chaos. In the winter, though, the channels are still active and you can get a much better chance to hear some of those distant operators, and to see how efficient your station is.

The channels used for ship-to-shore calls start at 161.8 MHz, and go up in 25-kHz steps to 162.00 MHz. Note that 162.025 MHz is used only in limited areas, including Puget Sound, the St. Lawrence Seaway, and the Great Lakes (except Lake Michigan).

SEE YOU NEXT YEAR!
Let me close for this month by wishing everyone a joyous holiday season and a happy New Year. Let's hear from you in the coming year! Send questions, ideas, frequencies, clippings, or whatever to Scanner Scene, Popular Electronics, 500-B Bi-County Blvd., Farmingdale, NY 11735.

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SHIRT-POCKET RADIO
(Continued from page 36)

few buyers, and so any further technical development would be a wasted effort.

Radios this small also had a serious image problem. In the post-war years, Americans, finally freed of the great depression and the privations of wartime rationing and shortages, were not clamoring for downsized products of any kind; "big" was in. Adding to the shirt-pocket set's difficulties was its resemblance—in appearance and earphone-only operation—to late-forties' hearing aids. Few trendy adults would have been eager to embrace such a product.

Luckily that interpretation did not last. In fact, during the late 1950s, transistor shirt-pocket radios were selling annually by the millions; a mass market had finally materialized. Ironically, it was American teenagers who were putting these sets in their pockets (and purses) and earphones in their ears. The shirt-pocket radio became the badge of rock-and-roll's first generation. Long championed by youthful experimenters, the shirt-pocket radio had come home to young Americans.

SW/VHF CONVERTERS
(Continued from page 58)

or other source within the allowable range and dispense with the voltage regulator IC.

You can modify this circuit to operate in the low-band VHF region. First you must dispense with the local-oscillator components (C3, C4, and X1) and use a 49-MHz TV-IF transformer with the capacitor crushed for T1. Then connect the voltage-tuned oscillator circuit shown in Fig. 6 to pin 6 on U1, leaving pin 7 of that chip unconnected. The oscillator circuit can be tuned over a wide range because it uses a "varactor diode" instead of a mechanical variable capacitor. A varactor is a diode that has a junction capacitance that is a function of the applied reverse bias voltage (which is derived from V2). Any of several available varactor diodes can be used at VHF frequencies, including the NTE610 and the NTE614.

Frequency converters are often considered "magical art" circuits, but in reality they are quite simple. The guidelines in this article should be enough to help you design and build your own converters and take the mystery out of the "magic."

---

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Press switch S1; the LED should light and stay lit until power is removed. The music will begin to play within two seconds of closing S1. Don't worry (if you are using a speaker) if the volume isn't loud enough to hear comfortably; the chip requires an additional transistor to drive a speaker. There will be ample drive power when the circuit is hooked to the phone line via the transformer. Reverse the power leads and verify that the circuit still works.

If the circuit does not operate as described, go back and recheck your work. If you get no sound or LED indication, check that placement of R1 and D1. Be sure that they are properly oriented. If the LED lights, but you get no sound, verify that you've oriented all of the semiconductors, including U1, correctly. Check the setting of R5. If your LED is not lit, but you do have sound, swap the wires going to the LED.

Adjust the melody's tempo, using R5, as needed. Allow the tune to play all the way through. Once the entire melody has played, it will replay after a short delay. If that does not occur, be sure that the voltage at pin 8 of U1 is at a low state and that transistor Q2 is biased on only when the music finishes. Once everything checks out, remove the temporary power supply, and if necessary, the speaker, and shrink the tubing on LED1.

Connect a short length of modular cord (with modular plug) to the board: The green and red wires go to the pads marked G and R, respectively. Connect the phone and the projector to the same phone line via a duplex adapter, Y-connector, or similar accessory. Suitable products are available from Radio Shack and elsewhere.

It's also possible to wire the circuit directly to the connector block where the phone line enters the room. The wires are color coded. This method is the most inexpensive way to hook up the circuit, but may require excessively long wire runs.

Verify that the circuit operates as expected when connected to the phone lines. If the circuit doesn't shut off when you pick up your handset after having been on hold, ground the gate of the SCR. If that solves the problem, reduce the value of R8 to 47 ohms or less. Resistor R1 could be also replaced with a 1k to 2k unit to lower the current through SCR1, thereby preventing excessive holding currents. Expect reduced brightness of the LED if that becomes necessary.

As the volume of the circuit is increased, the load placed on the phone lines also increases. If you get unwanted oscillations in the music, increase the value of C5. The final setting of the volume and speed controls (R5 and R7) should be done with someone on the line. If after an honest effort, you can't get the circuit to work properly, send a self-addressed-stamped-envelope to Thumb Electronics (see address in Parts List), detailing your problem. All requests for assistance will be forwarded to the author. List the voltage readings at points G, R, around the SCR, and U1. Once the circuit is working completely to your satisfaction, drill the enclosure for the LED and switch.

Cut a 3/4-inch wide by ½-inch deep notch from the upper edge of the enclosure where the lid mounts. That provides passage for the wire going to the phone line. Since both potentiometers face the sides of the enclosure, it is possible to drill holes in the sides of the case to accept a screwdriver for external adjustments. You may wish to fasten the circuit to the side of your phone with velcro. If it is to be put on a table top, use rubber feet on the bottom of the enclosure to prevent scratching.

Other Possibilities. By examining the schematic diagram, it is easy to see how to use the circuit as either a hold circuit or music circuit. You could develop a circuit to have hold with no sound, or add music from a radio or tape player, or add your own taped special hold message or musical preference would be played.

The Music-On-Hold circuit is inexpensive, and easy to build and use. Once in service you will wonder "Why did I go this long without one?"
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THINK TANK
(Continued from page 22)

years and I noticed that we share an affection for simple but elegant circuits. Well, here's one that I came up with (see Fig. 7). It's a delay timer with mucho versatility.

Both 556 sections are configured as monostable timers and are triggered simultaneously. Since both of their outputs go high when they are triggered, the optoisolator remains initially off. Assuming U1-b's period is set shorter than U1-a's, when U1-b times out it acts as a current sink while U1-a acts as a current source for the optoisolator, turning it on. The period of U1-b acts as a turn-on delay. The optoisolator will remain on until the remainder of U1-a's period passes.

You can use the circuit to control AC devices by replacing the transistor-output optoisolator with a MOC3010 Triac-driven optoisolator and a Triac. With a few modifications, this type of circuit can be used for many jobs. Think it's worth a book?

—Mike Houston,
Ridgecrest, CA

I certainly do think it's worth a book. For those of you interested in using this circuit for AC-power control, replace the optoisolator with the circuit in Fig. 3.

Well, that takes care of another month. Remember, if you wish to participate in the fun, just write to Think Tank, Popular Electronics, 500-B Bi-County Blvd., Farmingdale, NY 11735.

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Ridgecrest, CA

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Well, that takes care of another month. Remember, if you wish to participate in the fun, just write to Think Tank, Popular Electronics, 500-B Bi-County Blvd., Farmingdale, NY 11735.
CHOOSE A COMPUTER  
(Continued from page 60)

All three were around $600 and you would have to spend another $600 for a printer. Floppy-disk drives with very limited capacity were available, but expensive, and hard-disk drives were beyond most pocketbooks.

Today you have, just in the IBM micro-computer world alone, the PC, XT, AT, 80386, 80486, and various models of the PS/1 and PS/2. Floppy-disk drives store from 360K to 1.44MB and hard drives go from 20MB to well over 100MB of storage. Memories go from 256K to 4MB, and beyond. Monitors include monochrome, CGA, EGA, and VGA (with some variations on each).

To add to the confusion are the enormous number of combinations of hardware—including many that refuse to work with each other. The most common lie told in the microcomputer world is “it’s compatible.” The facts are: most monitors will only work with certain video cards; disk drives (hard or soft) need controllers that mate with a drive’s capacity and speed; 8088, 80286, 80386, and 80486 microprocessors are not the same, and require different BIOS’s (Basic Input Output Systems). Furthermore, programs that work with one configuration absolutely refuse to work on another. This is only part of the compatibility trap.

Where To Buy. Fortunately, a very high percentage of these compatibility problems can be avoided by buying a complete assembled system—computer and monitor together with peripherals or add-on’s like a printer, mouse, modem, etc.—from a single source. That will probably be more expensive than buying different things at the lowest price each, and then trying to make them work together. However, buying a complete system from one place eliminates squabbles with vendors as to whose equipment is causing you trouble.

If you’re in a small town, your best bet is mail-order. Many computer magazines have page after page of ads offering complete systems, and all kinds of peripherals to add to existing systems. Many have toll-free phone numbers. While they can’t tell you what you need, once you’ve determined your needs, you can inquire about price, delivery, guarantees, and support. Watch for traps like a 3% surcharge for credit cards or excessive shipping and handling charges. Once you know what you need, check with friends or associates to see who they bought from, and their degree of satisfaction.

If you’re in a big town, computer stores, as mentioned earlier, will let you look and feel—but beware of sales hype. Your best defense is some homework. Look at the prices in computer magazine ads, so you have some idea of equipment costs, but expect to pay more at a store for their convenience and local support.

Short Cuts. There is a better way, but it may not be available to you. Find a “mentor”—a trusted, wise and faithful advisor, friend or teacher—who will take the time to help you with your specific needs. If your needs are fairly sophisticated and you’re willing to pay, there are lots of consultants you could hire as well.

Perhaps the best way to find both is to go to some local user-group meetings and ask questions. You can usually find information about user groups from computer stores, computer magazines, and local newspapers.

The Time Trap. You will have a natural tendency to put off the buying decision due to your uncertainty, and dropping prices. Also, you may be waiting for the next wonderful breakthrough just over the horizon. Don’t let yourself get into a mirage mentality.

Get some facts, make a decision, make conservative purchases, learn by doing, and then upgrade to what you really need as time goes by. You will probably never find out what you really need by research, only by experience. And (at all horrors) you might find all you really need is some 3 x 5 index cards and a typewriter!
DUAL BAND ANTENNA
(Continued from page 63)

The hula hoop may be slightly undersized for the conduit fittings and may need to be shimmed. The author wrapped 10-mm copper strips around the tin foil to make up the difference.

After affixing the shielded hoop to the enclosure, it's time to wind the loops. To begin, pass one turn of wire through one end of the hoop, returning to the enclosure through the other end. That wire loop is for 80/75-meter operation. Note that neither the size nor type of wire that is used is critical. For example, I used 18-gauge speaker wire in my prototype.

Connect one end of the antenna wire to the junction of C1 and C2 and the other end to the center (wiper) contact of S1. Feed two more turns of antenna wire through the hoop. One end of that double loop of wire will be connected to ground and the other end goes to one of S1's contacts; the switch's remaining contact is tied to ground. The second loop is for 160-meter operation. Remove about 1-inch of the foil shielding from top dead center of the hoop to allow signal reception, while preventing the hoop shielding from acting as a shorted turn to the desired electromagnetic field.

Assemble the rest of the circuit using Fig. 1 as a guide. In the author's prototype, all of the other components—except S1, S2, B1, J1, and C1 (it's too big)—were placed on a terminal strip that was mounted (with one or two of its lugs grounded) to an inside wall of the enclosure. Point-to-point wiring was used to interconnect the components. You could also assemble the circuit on perfboard, if you prefer.

In any event, keep all lead connections as short as possible. Note that, although 2N3904 transistors are used in the schematic diagram and an alternate unit is listed along with the aforementioned transistor in the Parts List, the transistors are not critical; any general-purpose NPN transistor can be used in the circuit.

Once the circuit is complete, check your work for possible wiring errors; misconnected components, short circuits, etc. When that's done, mount the assembly to a piece of wood, which will serve as a stabilizing base. The author used a 1 × 12 × 12-inch piece of wood (which he just happened to have laying around).

Operation. The operation of the Dual-Band Loop Antenna is very simple. Connect it to the antenna jack of your receiver or to your transceiver's auxiliary-antenna jack. In the event that your transceiver does not have an auxiliary-antenna jack, you'll have to build some type of antenna-switching arrangement before using the project.

Warning. Whatever you do, do not transmit using this antenna; doing so will destroy the transistors in the preamp.

Apply power to the circuit by closing S2; then set S1 to 80 meters. Adjust C1 until the noise level peaks. You should now be able to hear signals by tuning around the band. If you detect any power-line or other noise, rotate the loop until you find a null in the noise. Be sure to take your time as the null will be very sharp. In some cases, the noise can be reduced from an S9 to S0.

The loop can also be used to reduce the effects of extremely strong signals from local amateur installations. In addition, the loop can be used to lessen the high QRN from thunderstorms. By rotating it away from the direction of the storm, the QRN level is lowered several S-units, which may make the difference between a good copy and no copy at all.

The loop does have its limitations. If there is more than one source of noise, the loop will not be effective. When using the loop on 160 meters, you may have several false peaks when adjusting C1. The correct setting is determined experimentally. The correct peak will be obvious. But with incorrect settings, you will hear all kinds of broadcast garbage.

SIGNS OF TRACER
(Continued from page 28)

When used with a scope the EZ-Curve Signare Tracer can diagnose the condition of a variety of components.

C or L involves using one of two different equations.

The easiest procedure to follow, which reduces the math to a minimum, is to take a reading or two, do some math to find a value, perhaps take another reading, and use your previous results to find yet another quantity. With that in mind, the first thing you should do is measure the maximum current (denoted Imax) and the maximum voltage (denoted Vmax) on the scope. Note that the maximum current and voltage do not occur at the same point on the curve. From the two readings you can determine the impedance:

$$Z = \frac{V_{\text{max}}}{I_{\text{max}}}$$

Next, measure the current at which the curve crosses the vertical axis (I0). You can use that measurement and the value you got for Z to find the reactance:

$$X = Z \times I_0$$

From the reactance and the impedance, you can find the value of the component's internal resistance:

$$R = \sqrt{Z^2 - X^2}$$

From X and R you can determine the device's Q factor:

$$Q = \frac{X}{R}$$

You can also find the value using this equation for an inductor:

$$L = X/(180\pi)$$

or this equation for a capacitor:

$$C = 1/(180\pi X)$$

That's a lot of data from three points on a curve!

We're sure that you'll find the EZ-Curve to be a very useful device. But even if your scope already has a component checker, you now know exactly how that feature works and how to take full advantage of it.
HAM RADIO  
(Continued from page 77)

quency of the swept region to be set by a 10k potentiometer, while the sweep width is set by the sawtooth amplitude.

One of the problems with a varactor-tuned oscillator is that the relationship between voltage and frequency is nonlinear. A somewhat improved version of the tuned circuit is shown in Fig. 4. In that variation of the V, input, a pair of identical varactors (D1 and D3) are connected cathode-to-cathode. That circuit is more linear (hence is more suitable) for spectrum analyzer and panadapter circuits.

However, the capacitance seen by L1 is one-half the capacitance of either diode alone. That phenomenon occurs because the coil effectively sees two identical capacitors in series, so the total capacitance is half of either unit.

The circuit in Fig. 4 also serves as a decent radio receiver, especially if you provide an audio amplifier to follow the detector. An LM386 low-power audio amplifier should do for that.

Ramsey Electronics (793 Canning Parkway, Victor, NY, 14564; Tel. 716-924-4560) offers low-cost, varactor-tuned, NE602/LM386 receiver kits. They can be modified to make a panadapter or spectrum analyzer that operates within the tuning range of the kits. I’ve built one and reported on it in this column previously. I also modified it by adding a sawtooth to the tuning voltage, making it into a sweep receiver.

One thing that voltage tuning of a receiver or spectrum analyzer offers is the potential for computer-driven tuning. If you use a voltage output digital-to-analog converter (DAC), it is possible to use an eight-bit binary word from a computer port to drive the tuning of the receiver/ana-
lyzer to a desired frequency.

Note: Most signal generators do not have a sawtooth output. Also, many of the published circuits produce a poor sawtooth. I have a circuit for a digitally controlled sawtooth generator. Send an SASE for a free copy of the schematic to Cio Ham Radio, Popular Electronics, 500-B Bl-Coun-
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CONtroller

(Continued from page 62)

hesive strip holds the CONtroller solidly to the side of the keyboard. If you should later decide to remove this adhesive strip, it comes off without leaving a residue.

The laptop version uses a short 1-foot coiled cable and locking adhesive pads. These separable plastic pads have hundreds of tiny molded hooks that mesh together and hold much more tightly and firmly than Velcro, since any sponginess would interfere with CONtroller action. The pads are pre-cut to the proper shape, and three are supplied to use the CONtroller with two machines, such as a laptop and a desktop. Since a desktop would require a longer cord to reach the RS-232 port (usually at the back of the computer), a 5.5-foot extension cable is included, with 9-pin connectors on each end. This version also comes with a carrying case for easy travel.

Regardless of the version, should the CONtroller need support to match the height of your keyboard, an adjustable screw-in foot is provided.

Using the CONtroller. Once connected, you'll need a mouse driver to use the CONtroller. This is either a separate driver, or may be included in your application program, such as Windows 3.0. If you have a Microsoft or Mouse Systems driver program, it will work with the CONtroller. If you don't, included in the CONtroller package are both 3.5-inch and 5.25-inch diskettes with a Microsoft-compatible mouse driver called ICN.COM, as well as a tutorial demonstration program.

At first it's a good idea to run Suncom's SETUP program, which uses both pictures and text to take you through all the CONtroller features, and gives you some practice. Actually, SETUP is poorly named, since you do not have to run this program to use the CONtroller. It should be called DEMO or TUTOR. However, you'll need a graphics display adapter (Hercules, CGA, EGA, or VGA) to run SETUP.

I tested the CONtroller with a variety of programs that normally use a mouse or trackball. Using just one finger I was able to easily and quickly manipulate the screen cursor in Windows 3.0 and GeoWorks Ensemble, two programs that absolutely require a pointing device. Although the sensitivity and two-speed action of the CONtroller take some getting used to, I found it comfortable after only a little orientation.

There is virtually no substitute for the CONtroller in using a laptop away from a desk or table. If you have not been using Windows or GeoWorks with your laptop because of the lack of a pointer, your problem is solved.

Although the CONtroller does not allow movement except in eight directions, there are some advantages to this. It is very easy to move horizontally and vertically without wandering off track. I found no compatibility problem with any program that accepts a mouse.

If you are happy with a mouse or trackball without ballistic control, and have the space for them, the CONtroller can still offer you its two-step speed function. Furthermore, it doesn't wander like a mouse. Also if you have a laptop that you normally use on your lap, with no operating space for a mouse or trackball, the CONtroller stuck to the side of your keyboard can open up new vistas for you.

The "desktop" version of the CONtroller has a suggested retail price of $84.99, and comes with everything you need, including software. The "laptop" version, sells for $99.95. For more information on either model, contact Suncom Technologies (6400 W. Gross Point Rd., Niles, IL 60648; Tel. 1-708-647-4040) or circle number 119 on the Free Information Card.
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up until you've listened through all seven tapes! The multi- and single-play, auto-reverse cassette changer accommodates six cassettes in deck one and one cassette in deck two. It's equipped with Dolby HX Pro as well as Pioneer's CD-deck synchro function for continuous taping. It seems ideal for your next family party.

It's difficult—and expensive—to try to provide good sound in every room in the house. But not if you can move that sound around from room to room. That's just what the Acoustic Wave Series II Music System (Bose, $997) lets you do. The sleek, one-piece unit, which proves that big sound can come in small packages, provides AM and FM radio, equalization, amplification, loudspeakers, and a CD player. An optional case, power pack, and power cord make it completely portable for use outdoors or in a car or van.

If you love your current stereo system, but the speakers are getting in the way of your wife's interior-design plans, perhaps a new set of speakers could make a good gift for you both. The Heco Libero satellite/subwoofer system (EurolSon, $599) takes up much less space than standard speakers without sacrificing sound quality. The trick is that the low frequencies are reproduced by a single subwoofer, which can be stored out of the way—even under a chair. The higher frequencies are reproduced by the small, two-way "satellite" speakers. The setup works, and sounds good, because our ears are very poor at locating the source of low-frequency sounds—all of our directional cues come from higher frequencies.

Anyone who drives alone (particularly at night, or in unfamiliar areas, or in a less-than-reliable car) is uncomfortably aware of the dangers of a breakdown. Cellular telephones provide emergency communications without leaving the relative safety of the automobile—but the monthly service charges can be prohibitive, especially if the phone is only used occasionally. The S.O.S. model 39 PLUS portable CB radio (Cobra, $89.95) provides the security of two-way communications at a reasonable price. Although it is a full-function citizen-band radio (40 channels, electronic digital tuning, large LED channel display), those who are interested in it primarily as a safety device, and not for on-the-road chatter, can keep it stored under a seat or in the trunk when it's not needed. In times of distress, the S.O.S. can be quickly plugged into the cigarette lighter, and a magnetic-mount telescopic antenna set up. The Instant Channel-9 switch provides immediate access to the CB emergency channel.

If someone on your gift list worries more about getting caught in a speed trap than about breaking down, then the Solar Stealth RD-6000 radar detector (Cobra, $319.95) should be more than welcome. The Stealth's major claim to fame is that it's the world's first solar-powered radar detector. A built-in solar panel keeps the internal batteries charged. To keep power drain to a minimum, a built-in motion detector automatically shuts off the unit when it detects no motion for three minutes. Cobra also claims that the Solar Stealth is the least detectable model they've ever produced.

There are those, of course, who don't care about breakdowns or getting speeding tickets as long as their car is equipped with a great audio system. For them, there's the model 7915 in-dash FM/AM compact-disc player (Alpine, $520). The 8-times oversampling CD player offers Alpine's "Hybrid IDAC" D/A conversion system. The tuner offers some interesting features, including the ability to store both AM and FM presets on the same band, and an automatic memory mode that stores the 6 strongest stations. The amplifier offers "source tone memory," which memories the bass and treble settings for each source (FM, AM, and CD). Dual pre-amp outputs make it easy to set up and expand the system.

For the exercise-crazy member of your family, consider the Pulse Meter wristwatch. (Sanyo, $129.95). For accurate readings, even during heavy exercise, the Pulse Meter uses a chest sensor, which is held in place by an adjustable elastic strap. Signals from the sensor are sent to the wristwatch by RF signals—no cumbersome wires are needed. A pulse-rate memory stores maximum, average, and minimum heart rates. An alarm can be set to ring if the heart rates exceed or falls below preset limits.

**Electronic Stocking Stuffers.** Here are some items that are perfect for grab-bags or stocking stuffers, or for the paperboy or babysitter—all are priced under $20:

- Charging batteries can be done anywhere with the SlimCharger (Panasonic Industrial Company, $14.95 or $19.95 with a set of rechargeable batteries). The charger weighs less than 3½ ounces, is about the size of an audio cassette, features a flip-out plug, and fits easily in a pocket or purse. It will charge four AA or AAA rechargeable batteries in six hours.
- Audio cassettes remain the best-selling music format, so a "Buy Five, Get One Free" six-pack of Ferro Extra C90's (BASE $4.99) makes a good (and thrifty) gift for teens and other frequent tapers.
- Dirty video-game cartridges can cause problems such as power flashes, blank screens, and scrambled graphics. The Ninja Game Cartridge Cleaner (Technitron, $7.95) comes with a liquid cleaner and swabs for cleaning all brands of video games.
- If you can't remember what your teens look like without their personal stereos, the Millennium ChargeMan RapidCharger (Gates Energy Products, $14.95) belongs in their stockings. The pocket-sized three-hour charger includes two AA Millennium Power Cells and a rebate offer for two free back-up cells.
- Static electricity can damage computers, office equipment, home-entertainment components, and appliances—and so can dust and dirt. StatX spray cleaner's (RTW $7.99) dual-action formula cleans electronic gear while protecting it from static buildup.
- The Slotless CD Organizer (Allsop $9.95) makes it easy to add a new disc to your alphabetized CD collection without having to move each one, slot by slot. Spring-loaded retention fingers hold single discs or multiple-disc sets securely, yet allow sliding movement of one or several discs at a time. Each stackable unit holds up to 25 CD's.
- Print out a computer-generated "Happy Holidays!" banner on Banner Band continuous, nonperforated paper, and you won't have to worry about it tearing down the middle when you hang it up. The paper comes in white, parchment, assorted pastel and fluorescent colors, and with borders or all-over designs, in 45- and 150-foot lengths.

**Happy Holidays!** So get out there and hit the electronics stores before the holiday mob scene. Then relax, put up your feet, and enjoy a glass of eggnog. Happy holidays from **Popular Electronics**!
ELECTRONICS MARKET PLACE

FOR SALE
OUR monthly picture flyer lists quality surplus parts at low prices. You'll like it. STAR-TRONICS, Box 683, McMinnville, OR 97128.

CABLE descrambler liquidation. Major makes and models available. Industry pricing! (Example: Hamlin Combo's, $44 each. Minimum 10 orders. Call WEST COAST ELECTRONICS, 1 (800) 628-9656.)

CABLE TV descramblers, converters, lowest prices guaranteed, best quality, free catalog, CNC CONCEPT INC., Box 34563, Minneapolis, MN 55434. 1 (800) 535-1843.

HUGE page communications catalog of short-wave, amateur and scanner equipment. Antennas, books and accessories too. Send $1.00 to: UNIVERSAL RADIO, 1280 Aida Dr., Dept. PE, Reynoldsburg, OH 43068.

SAVE money. DON'T RENT!
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CONVERTERS all major brands into orders 1 (800) 782-0562 FREEWAY INC. (s.m.p.), PO Box 3636, Burnsville, MN 55337. No MN sales.

CABLE decramblers/converters. Bargain headquarters — all brands. Absolutely the lowest prices! Call us! ADVANCE ELECTRONICS, 2140 Shattuck Ave. #2082, Berkeley, CA 94704. Order now! 1 (800) 659-3018.

REMOTE car starter or plans: ($12.75) all vehicles. SCHLITZER, 414 Alva, Grand Prairie, TX 75051. (214) 642-0338.

INSIDE information, cable television converters, decramblers, traps, VCR, hook-ups and more. $7.95. One free "any cable question answered guaranteed" book, all others $3.00 each. ONLINE ENTERPRISES, Box 740778, Avada, CO 80066.

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Ired transmitters! Detectors! More! Kits/As-
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DESCRAMBLERS kits. Complete cable kit $44.95. Complete satellite kit $49.95. Add $5.00 shipping. Free brochure. No New York sales. SUMMIT PE, Box 489, Bronx, NY 10465.

CABLE DESCRAMBLERS OAK M358 COMBO $39.95
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ing star. Schematics, PCB layout and part sources included. $10.00, CONTINUOUS CONCEPTS, PO Box 66414, San Diego, CA 92166. CA residents add 7% tax.

GERNSBACK — 1932. two tubes, plug-in coils, DX, shortwave radio. Free plan. BOB RYAN, PO Box 3039, Anaheim, CA 92803.

SATELITE TV desccrambler. Build your own. Easy to follow instructions, parts list, circuit board and wiring diagram. Send: $8.95. ABG ENTER-
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FM-stereo transmitter kit. Broadcast any audio signal, CD player, VCR to FM radio through out home/yard. PCB board and components; $22.00. TENTRONIC, 3605 Broken Arrow, Coeur d'Alene, ID 83814.

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BUILD — 0 to 15 watts programmable power supply. Include transformer, x-port and instructions! Easy to build. $2.00 — JAS, PO Box 8274, West Chester, OH 45069.

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teries or DC adapter. PCB board only $35.00, com-
pletes kit including metal frame, $125.00. See Radio-Electronics December 1990 or the 1992 Electronics Engineer's Handbook, or write ART WORKS, 415 Emerson Street, Saint Francis, KS 67132.

TRANSFORMERS Build your own transformers for your electronic projects low voltage, high voltage, 22 pluses, $14.00. Maps for any need, send features.

GUILLERMO BUSTAMANTE, 825 NE 20th Avenue, Portland, OR 97232.

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CHRISTMAS lighting controller project. controls up to 24 sets of midget lights, 8 AC SCR-controlled channels, fully editable requirements, 100% of pre-
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UPDATING YOUR RESUME? For tips that work send $5.00. Chickens, Box 704 Aberdeen, WA 98520.

USA'S WEIGHTLOSS PROGRAM is $39.95, and SASE. PO Box 1387, St. Petersburg, FL 33733.

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CUITS, PO Box 80043, Valley Forge, PA 19485.

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SION, 2008 CollegeWay, Ferguson Falls, MN 56577, 1 (800) 334-6455. (See full page ad the Market Cen-
ter).

VC-2 board exchange and repair service, tracker V satellite receiver $869.00. Call for phone quotes. We will not be undersold. SATELLITE TELEVISION, 120 W. W. Centennial, IN 47303. (317) 288-0074 tech support 11-5 E.

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chure $1.00. MICRO Thinc., Box 63-6025, Margate, FL 33063. (305) 752-9205.

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SORRY, No orders accepted outside of USA and Canada.

Mail price of merchandise
Add Shipping
Add Sales Tax (NYS only)
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Name ____________________________
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City State Zip

Deadline Jan. 1991
FLAShING LApEL PIN
(Continued from page 61)

Fig. 2. Shown here are two full-size templates of the faces used by the author. Each has a 3/8-inch hole in the nose, through which the LED will protrude.

hold the stick pin. The non-pointed end of the pin should line up with the ends of the "U" loop and be parallel with them. Optionally, you can bend the non-pointed end of the stick pin into a loop as shown. Doing so helps to hold the battery in place.

Next fill the space between the base of the LED and the stick pin with glue (see Fig. 1C) covering the solder and the base. Before the glue dries, pinch the end of the pin and the ends of the U-loop together so that the non-pointed end of the pin is between both ends of the U-loop and on the same plane.

PARTS AND MATERIALS LIST FOR THE FLAShING LApEL PIN

2.5-volt blinking red LED (Radio Shack 276-036, Jameco part #XC5410, or equivalent)
3-volt lithium battery (type DL1620 or DL2016)
Christmas face (see text)
Standard paper clip
Stick pin
Glue (hot or epoxy)

Note: Die-cut, color-print Santa Claus and Rudolph faces are available for $0.25 each, plus $1.00 postage and handling per order from J.B. Gismo, Box 1084, Jones OK, 73049. Oklahoma residents please add appropriate sales tax.

Blinking LED's are available from Radio Shack as part #276-036 and Jameco Electronics (1355 Shoreway Road, Belmont, CA 94002) as part #XC5410

Either Santa Claus or Rudolph (shown here) can add a light-hearted touch to your holiday fun.

That tapering gives the pin enough "spring" to hold the battery tightly between the pin and the U-loop after the glue dries.

Finally, photocopy the templates in Fig. 2, color and cut them out, punch a 3/8-inch hole in the nose and push over the LED. You may want to reinforce the paper cut outs by laminating them between two sheets of contact paper, or you may want to draw them directly on a heavier stock of paper, either way will work fine. Die cut, full color artwork is also available from the source in the Parts List. Put the battery between the pin and the U-loop and you're done.
Never before has so much professional information on the art of detecting and eliminating electronic snooping devices—and how to defend against experienced information thieves—been placed in one VHS video. If you are a Fortune 500 CEO, an executive in any hi-tech industry, or a novice seeking entry into an honorable, rewarding field of work in countersurveillance, you must view this video presentation again and again.

Wake up! You may be the victim of stolen words—precious ideas that would have made you very wealthy! Yes, professionals, even rank amateurs, may be listening to your most private conversations.

Wake up! If you are not the victim, then you are surrounded by countless victims who need your help if you know how to discover telephone taps, locate bugs, or "sweep" a room clean.

There is a thriving professional service steeped in high-tech techniques that you can become a part of. But first, you must know and understand Countersurveillance Technology. Your very first insight into this highly rewarding field is made possible by a video VHS presentation that you cannot view on broadcast television, satellite, or cable. It presents an informative program prepared by professionals in the field who know their industry, its techniques, kinks and loopholes. Men who can tell you more in 45 minutes in a straightforward, exclusive talk than was ever attempted before.

Foiling Information Thieves

Discover the targets professional snoopers seek out! The prey are stock brokers, arbitrage firms, manufacturers, high-tech companies, any competitive industry, or even small businesses in the same community. The valuable information they filch may be marketing strategies, customer lists, product formulas, manufacturing techniques, even advertising plans. Information thieves eavesdrop on court decisions, bidding information, financial data. The list is unlimited in the mind of man—even if he is a thief!

You know that the Russians secretly installed countless microphones in the concrete work of the American Embassy building in Moscow. They converted

The professional discussions seen on the TV screen in your home reveals how to detect and disable wiretaps, midget radio-frequency transmitters, and other bugs, plus when to use disinformation to confuse the unwanted listener, and the technique of voice scrambling telephone communications. In fact, do you know how to look for a bug, where to look for a bug, and what to do when you find it?

Bugs of a very small size are easy to build and they can be placed quickly in a matter of seconds, in any object or room. Today you may have used a telephone handset that was bugged. It probably contained three bugs. One was a phony bug to fool you into believing you found a bug and secured the telephone. The second bug places the investigator when he finds the real thing! And the third bug is found only by the professional, who continued to search just in case there were more bugs.

The professional is not without his tools. Special equipment has been designed so that the professional can sweep a room so that he can detect voice-activated (VOX) and remote-activated bugs. Some of this equipment can be operated by novices, others require a trained countersurveillance professional.

The professionals viewed on your television screen reveal information on the latest technological advances like laser-beam snoopers that are installed hundreds of feet away from the room they snoop on. The professionals disclose that computers yield information too easily.

This advertisement was not written by a countersurveillance professional, but by a beginner whose only experience came from viewing the video tape in the privacy of his home. After you review the video carefully and understand its contents, you have taken the first important step in either acquiring professional help with your surveillance problems, or you may very well consider a career as a countersurveillance professional.

The Dollars You Save

To obtain the information contained in the video VHS cassette, you would attend a professional seminar costing $350-750 and possibly pay hundreds of dollars more if you had to travel to a distant city to attend. Now, for only $49.95 (plus $4.00 P&H) you can view Countersurveillance Techniques at home and take refresher views often. To obtain your copy, complete the coupon below or call toll free.

HAVE YOUR VISA or MC CARD AVAILABLE

what was to be an embassy and private residence into the most sophisticated recording studio the world had ever known. The building had to be torn down in order to remove all the bugs.

Stolen Information

The open taps from where the information pours out may be from FAX's, computer communications, telephone calls, and everyday business meetings and lunchtime encounters. Businessmen need counselling on how to eliminate this information drain. Basic telephone use coupled with the user's understanding that someone may be listening to recording vital data and information greatly reduces the opportunity for others to purloin meaningful information.

RADIO-ELECTRONICS VIDEO OFFER

Please rush my copy of the Countersurveillance Techniques Video VHS Cassette for $19.95 plus $4.00 for postage and handling.

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All payments in U.S.A. funds. Canadian add $4.00 per VHS cassette. No foreign orders. New York State residents add applicable sales tax.

The professional discoveries seen on the TV screen in your home reveals how to detect and disable wiretaps, midget radio-frequency transmitters, and other bugs, plus when to use disinformation to confuse the unwanted listener, and the technique of voice scrambling telephone communications. In fact, do you know how to look for a bug, where to look for a bug, and what to do when you find it?

Bugs of a very small size are easy to build and they can be placed quickly in a matter of seconds, in any object or room. Today you may have used a telephone handset that was bugged. It probably contained three bugs. One was a phony bug to fool you into believing you found a bug and secured the telephone. The second bug places the investigator when he finds the real thing! And the third bug is found only by the professional, who continued to search just in case there were more bugs.

The professional is not without his tools. Special equipment has been designed so that the professional can sweep a room so that he can detect voice-activated (VOX) and remote-activated bugs. Some of this equipment can be operated by novices, others require a trained countersurveillance professional.

The professionals viewed on your television screen reveal information on the latest technological advances like laser-beam snoopers that are installed hundreds of feet away from the room they snoop on. The professionals disclose that computers yield information too easily.

This advertisement was not written by a countersurveillance professional, but by a beginner whose only experience came from viewing the video tape in the privacy of his home. After you review the video carefully and understand its contents, you have taken the first important step in either acquiring professional help with your surveillance problems, or you may very well consider a career as a countersurveillance professional.

The Dollars You Save

To obtain the information contained in the video VHS cassette, you would attend a professional seminar costing $350-750 and possibly pay hundreds of dollars more if you had to travel to a distant city to attend. Now, for only $49.95 (plus $4.00 P&H) you can view Countersurveillance Techniques at home and take refresher views often. To obtain your copy, complete the coupon below or call toll free.
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