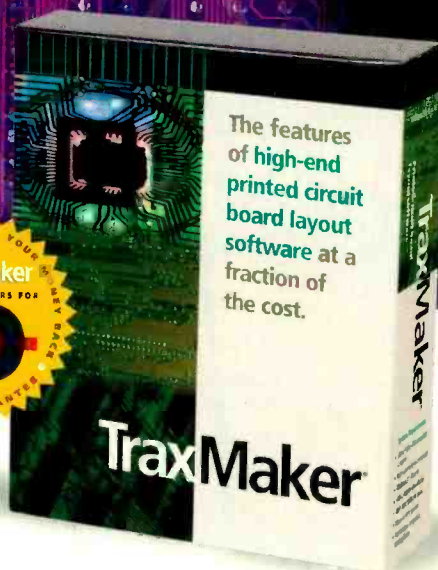
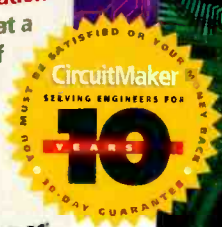
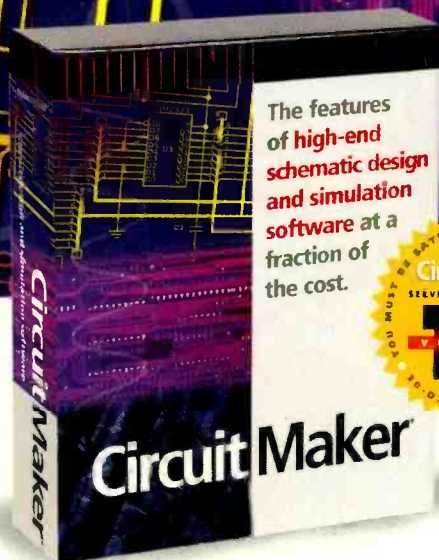




# High-end features. Low-end price.

**\$299**

**CircuitMaker 6:**  
Schematic design  
and simulation  
software



**\$299**

**TraxMaker 3 :**  
Printed circuit  
board layout  
software

*CircuitMaker Version 6 and TraxMaker Version 3 give you the features of professional, high-end software at a fraction of the cost. Plus, with exceptional ease-of-use, you'll spend less time learning to use the software and more time designing. Both applications are compatible with your existing design software, and feature outstanding technical support. Call now for your free functional demo.*

**CircuitMaker 6 is a powerful schematic design and simulation program featuring:**

- Professional schematic features including printout borders, title block and barred pin names
- Symbol editor and Macro feature for custom devices
- Fast, accurate SPICE3f5/XSPICE-based simulation
- Complete array of analysis types, including Fourier, AC, DC Parameter Sweep, Transient and more
- Virtual instruments including a digital oscilloscope, multimeter, Bode plotter, curve tracer and more
- Extensive library of over 4,000 devices
- Tight integration with TraxMaker® for quick PCB layout
- Output PCB netlists in Protel®, Tango®, and TraxMaker®, formats for use in a variety of PCB layout programs
- Windows 3.1, 95, 98 and NT

**TraxMaker 3 is a powerful printed circuit board layout program featuring:**

- Over 2,000 component footprints in a fully-documented, indexed library. Documentation shows footprints actual size
- Built-in autorouter and Design Rules Check
- Supports up to 6 signal layers plus power and ground planes, silk screen overlays and solder and paste masks
- Board sizes up to 32"x 32", with no pin limitations
- Intelligent manual routing with unrout capabilities
- Import any PCB netlist in CircuitMaker®, Protel® or Tango® format
- Output RS274X Gerber files, Excellon N/C drill files and Bill of materials
- Print to any Windows compatible printer or plotter
- Windows 3.1, 95, 98 and NT

**CircuitMaker** For free demo software, or to order, call **1-800-419-4242**

CUSTOMER SERVICE CENTER 5252 N. Edgewood Dr #175 • Provo, UT 84604 • Tel 801.224.0433 • Fax 801.224.0545 • [www.microcode.com](http://www.microcode.com)

©1999 Protel International Pty Ltd. All rights reserved. CircuitMaker, TraxMaker and SimCode are registered trademarks of Protel International Pty Ltd. All other brand and product names are trademarks or registered trademarks of their respective companies.

CIRCLE 133 ON FREE INFORMATION CARD

[www.americanradiohistory.com](http://www.americanradiohistory.com)

# Poptronics®

GERNSBACK  
PUBLICATION

500 Bi-County Boulevard • Farmingdale, N.Y. 11735 • (516) 293-3000 • Fax: (516) 293-3115

The millennium is upon us. The year 2000 is right around the corner. What will it bring? —  
*Poptronics* — the magazine for the hands-on electronics activist!

Today's challenging electronics marketplace does not leave room for a variety of competitive publications aimed at the hands-on kind of electronics activist — the professionals who design, build, maintain, and repair all of the electronics gear that fills our lives, the experimenters who build projects, the computer enthusiasts who want to know what's in the latest gear, the activists who want to and are building robots, audiophiles who want to test new circuits and designs, ham-radio operators looking for what's out there to communicate with.

That's why Gernsback Publications is melding our two publications — *Electronics Now* and *Popular Electronics*, into the new, exciting and timely monthly magazine — *Poptronics* — that you will soon be holding in your hands. Coincidentally it will be the January 2000 issue. What a way to enter the new millennium! (Yes I know the millennium actually starts January 1, 2001.)

It's evolution! Starting with the January 2000 issue *Electronics Now* will become *Poptronics*, the magazine for the hands-on electronics activist! No matter what your specific electronic interest, *Poptronics* will be the magazine for all electronics activists in the 21<sup>st</sup> Century. We've been here since the beginning, when we began in April 1908 with the first issue of *Modern Electrics*. We're still going to be here for the start of the next millennium, the year 3001, with *Poptronics* or its future descendant.

We have brought together all of the very best elements of our existing magazines into *Poptronics*. It is designed to deliver to you, our readers the very best editorial variety we can assemble. We have packaged *Gizmo*, *Prototype*, *Hands-on Reports*, *Service Clinic*, *Peak Computing*, *Robotics Workshop*, *Amazing Science* and other key columns; and wrapped them around a main editorial package of construction projects, product lab reviews, how it works and how to do it articles, to create a wonderful new world of electronics!

Our web site at [www.gernsback.com](http://www.gernsback.com) will still be there too. The forums, searchable index, and links will stay as they are, but you may find a lot of "under construction" signs in other areas. Keep logging in to keep up with what is happening. I believe that you will find it even more useful than before. We will continue the forums that bring thousands of readers to exchange ideas, get questions answered, and find the latest updates on contents in the magazine. It's a great place to search the index for old articles and to download current articles and artwork from the current issue.

If you are a current subscriber to *Electronics Now*, you will automatically receive upcoming issues of *Poptronics* (starting with January 2000) until your current subscription is fulfilled. If you also subscribe to *Popular Electronics* we will combine your subscriptions (if you have 10 more issues of *Electronics Now* to go, and 5 issues of *Popular Electronics* — for example — you will receive the next 15 issues of *Poptronics*).

If we goof and you get two copies of *Poptronics* next month, just cut off or copy the labels on the front cover of both magazines and send them to me. I'll see that your subscription is merged without you losing a single copy.

An exciting new world of electronics publishing begins with the January 2000 issue of *Poptronics*. Be our partner in progress. Stay with us and see just how great our electronics industry can be. We will be bringing you all of the latest electronics news as it happens.

Larry Steckler, EHF,CET  
Publisher



# Poptronics

THE MAGAZINE FOR THE HANDS-ON ELECTRONICS ACTIVIST!

## FEATURES

### 15 CALLER-ID ALARM SYSTEM

With this complete setup, you'll always know when there's trouble at home or the office. It calls you at any Caller ID-equipped phone number you select—even a cell phone—if someone breaks in.

— Dennis Hewett



### 23 THE WATCHDOG

Protect your vehicle with this easy-to-install alarm circuit.

— Anthony J. Caristi

### 30 ELECTRONIC PADLOCK

Forget about keys you can lose. Use this cutting-edge digital lock instead. — Jon Varteresian

## PRODUCT REVIEWS

### 4 GIZMO®

Mini DV Viewcam, scaled-down WEGA TV, affordable surround sound, and more

### 6 HANDS-ON REPORT

Digital Video Recorders—Head to Head

## DEPARTMENTS

### 8 PROTOTYPE

Time-reversal waves, bacteria biosensors, electronic nose technology, optical networks, and more

### 61 ROBOTICS WORKSHOP

Using and Hacking Robots with Lego Mindstorms

### 63 AMAZING SCIENCE

Speech-Recognition Interface Circuit

### 66 TECH MUSINGS

PostScript Integration, X-ray Fluorescence, Preventing CD-R Blowups, and more

### 73 BASIC CIRCUITRY

Receiver and Detector Circuits

### 77 SERVICE CLINIC

VCRs

## HANDS-ON COMPUTING

### 43 COMPUTER SECURITY IN THE HACKER AGE

Our look at hardware and software that can help you keep your files and data safe from invasion.

— Konstantinos Karagiannis

### 39 PC TECH®

This Month Featuring:

Free Web Access Options

PC Gizmo®

Putting a Scanner to Work

Sony Vaio Slimtop PCV-L620

CD-R Expands



## AND MORE

3	EDITORIAL
12	Q&A
60	NEW LITERATURE
72	NEW GEAR

PS1	PRO SERVICE MAGAZINE
81	POPTRONICS SHOPPER
120	ADVERTISING INDEX
120A	FREE INFORMATION CARD

Poptronics (ISSN 1526-3681) Published monthly by Gernsback Publications, Inc. 500 Bi-County Boulevard, Farmingdale, NY 11735. Second-Class postage paid at Farmingdale, NY and at additional mailing offices. One-year, twelve issues, subscription rate U.S. and possessions \$24.99, Canada \$33.15 (includes G.S.T. Canadian Goods and Services Tax Registration No. R125166280), all other countries \$33.99. Subscription orders payable in U.S. funds only, International Postal Money Order or check drawn on a U.S. bank. U.S. single copy price \$4.99. Copyright 2000 by Gernsback Publications, Inc. All rights reserved. Hands-on Electronics and Gizmo trademarks are registered in U.S. and Canada by Gernsback Publications, Inc. Poptronics trademark is registered in U.S. and Canada by Electronics Technology Today, Inc. and is licensed to Gernsback Publications, Inc. Printed in U.S.A.

Postmaster: Please send address changes to Poptronics, Subscription Dept., P.O. Box 459, Mount Morris, IL 61054-7629

A stamped self-addressed envelope must accompany all submitted manuscripts and/or artwork or photographs if their return is desired should they be rejected. We disclaim any responsibility for the loss or damage of manuscripts and/or artwork or photographs while in our possession or otherwise.

As a service to readers, Poptronics publishes available plans or information relating to newsworthy products, techniques, and scientific and technological developments. Because of possible variances in the quality and condition of materials and workmanship used by readers, Poptronics disclaims any responsibility for the safe and proper functioning of reader-built projects based upon or from plans or information published in this magazine.

## That Secure Feeling

Welcome to the first issue of **Poptronics**, the magazine for the electronics activist. As mentioned in our publisher's letter on page 1, this new title represents the merger of our favorite content from *Popular Electronics* and *Electronics Now*, with a few new surprises thrown into the mix. We're determined to have our expanded coverage be your primary source for cutting-edge projects, consumer technology, hands-on computing, and "future-science."

If you want to be a part of modern electronics ... want to remain ahead of the accelerating techno curve, you've come to the right place. Feel free to look over the shoulder of our writers each month and apply what you find. In addition to expanding your knowledge of electronics, our magazine might just include projects and ideas that can improve your day-to-day life.

For instance, to kick off the year 2000, we thought we'd address an area of electronics that's a growing concern for many: Security. It's become the Information Age with a vengeance, and there are more than a few ways that old-fashioned theft and modern computer vandalism can harm us in costly ways. Fortunately, electronics advances have also made it easier for those in the know to protect themselves and their privacy.

Our *Caller-ID Alarm System* is a great overall way to protect your home and valuables. Should someone try breaking in, the circuit will call you at any Caller ID-equipped phone you choose (even a cell phone for those on the go). You can then call the cops and have matters resolved, all without costly monthly monitoring. The story begins on page 15.

On the computer front, this month's *PC Tech* section contains a feature detailing hardware and software that can keep your data and even PC safe. For this and other cutting-edge coverage, turn to page 39.

What about your car? Forget about complex alarm systems that are a nightmare to install. Use the *Watchdog*, and its five-minute setup, to protect your car or truck. Check it out on page 23.

Finally, to guard just about anything under the sun, consider adding the *Electronic Padlock*. One day, hopefully soon, we'll all do away with keys and rusty locks and use this and similar devices on doors, ignition systems, and even power switches. Learn more about this lock on page 30.

But security stories are only part of our premiere issue. Scan the Table of Contents and you'll be certain to find an exciting selection of departments you can really dig in to. From robotics to voice-recognition circuitry, from servicing info to musings on all things technical, from gizmos to audio/video reviews, we've got you covered.



Konstantinos Karagiannis  
Editor

Larry Steckler, EHF, CET,  
editor-in-chief and publisher

#### EDITORIAL DEPARTMENT

**Konstantinos Karagiannis**, editor  
**Joseph Suda**, technical editor  
**Robert Young**, technical editor  
**Evelyn Rose**, assistant editor  
**Teri Scaduto**, assistant editor  
**Janine Abitabile**, editorial assistant  
**Michael A. Covington**, N4TMI  
contributing editor  
**Sam Goldwasser**, service editor  
**John Iovine**, contributing editor  
**Selina Kyle**, contributing editor  
**Don Lancaster**, contributing editor  
**Gordon McComb**, contributing editor  
**Ted Needleman**, contributing editor  
**Charles D. Rakes**, contributing editor

#### PRODUCTION DEPARTMENT

**Ken Coren**, production director  
**Kathy Campbell**, production manager  
**Michele Musé**, prepress specialist

#### ART DEPARTMENT

**Russell C. Truelson**, art director

#### CIRCULATION DEPARTMENT

**Gina L. Gallo**, circulation manager  
**Christina M. Estrada**, circulation assistant

#### REPRINT DEPARTMENT

**Janine Abitabile**, Reprint Bookstore

#### BUSINESS AND EDITORIAL OFFICES

Gernsback Publications, Inc.  
500 Bi-County Blvd.  
Farmingdale, NY 11735  
631-293-3000  
Fax: 631-293-3115  
President: **Larry Steckler**  
Vice-President: **Adria Coren**  
Vice-President: **Ken Coren**

#### SUBSCRIPTION CUSTOMER SERVICE/ ORDER ENTRY

800-827-0383  
7:30 AM - 8:30 PM EST

**Advertising Sales Offices  
listed on page 120**

Cover by Loewy Design

VISIT US ON THE INTERNET AT:  
[www.gernsback.com](http://www.gernsback.com)

Since some of the equipment and circuitry described in POPTRONICS may relate to or be covered by U.S. patents, POPTRONICS disclaims any liability for the infringement of such patents by the making, using, or selling of such equipment or circuitry, and suggests that anyone interested in such projects consult a patent attorney.

# GIZMO®

## Mini DV Viewcam

Sharp Electronics' VL-SD20U mini DV Viewcam weighs in at less than 1.25 pounds (without battery pack or cassette), measures just 6.4 × 3.8 × 2.9 inches, and costs under \$1000. The digital Viewcam fits in the palm of a hand and slips inconspicuously into a purse or briefcase.

The VL-SD20U sports a three-inch color LCD screen with low-light reflectivity (one percent) for improved picture quality. It absorbs 99 percent of all reflective light, allowing it to be used both indoors and outdoors. The viewscreen boasts 660,000 pixels and offers up to 500 lines of resolution. The LCD rotates for self-record mode.

Sharp's "Digital Gamma Brightness Correction" circuit is said to significantly improve the quality of the video being shot against a backlit subject. The technology minimizes wash-out by automatically darkening the background light and brightening the subject.

In photo mode, the mini DV camcorder uses "Still Frame Technology" to faithfully capture even fast-moving objects in still shots that are free from video noise. IEEE-1394 technology lets users transfer images between the Viewcam and a computer almost instantaneously, as long as the latter is equipped with a 1394 port.

Sharp Electronics Corp., Sharp Plaza, Mahwah, NJ 07430; 800-BE-SHARP; [www.sharp-usa.com](http://www.sharp-usa.com).

CIRCLE 50 ON FREE INFORMATION CARD



## Playing Tag

The Dymo LetraTag electronic labeler (\$29.99) from Esselte is aimed at consumers who are trying to get organized. It can be used to organize crafts projects, schoolbooks, workshop tools and supplies, and kitchen cupboards, as well as home offices.

The brightly colored label maker features a color-coded keyboard, built-in tape cutter, and split-back easy-peel tapes. The tapes are available in paper, plastic, or metal, in a wide range of colors, and even some seasonal and special-occasion themes. The LetraTag's ergonomic design allows easy handheld operation and lets the unit rest at an angle for easy keyboard access on flat surfaces. An LCD readout lets you preview the label before printing it.

Esselte, 599 West Putnam Avenue, Greenwich, CT 06830; 203-661-9700; [www.dymo.com](http://www.dymo.com).

CIRCLE 51 ON FREE INFORMATION CARD

## Kaboom Box

The RV-B99 Kaboom Box (\$330) from JVC Company of America is a cylindrical portable music system that's available in two-toned black/silver or gray/black. The CD/cassette/radio is equipped with a 1/4-inch jack for a guitar/mic input with level control, allowing users to play or sing along with favorite songs.

The Kaboom Box features JVC's Super Exciter Bass Circuit, a compressor unit that intensifies low frequencies for deep, lifelike bass. Its Active Clear Sound circuitry, which becomes active only when high-frequency signals are present, is said to control high frequencies to reduce noise and deliver balanced response over the entire audible range.

JVC Company of America, 1700 Valley Road, Wayne, NJ 07470; 973-315-5000; [www.jvc.com](http://www.jvc.com).



CIRCLE 52 ON FREE INFORMATION CARD

## Affordable Surround Sound



While multi-speaker surround-sound systems are terrific, they don't come cheap. If you'd rather not shell out as much as a grand on enhancing the sound of your movie experience at home, consider Spectrum Research's *Theater 2000* (\$169.95, MSRP). Attach just two speakers to it, and prepare to be amazed.

The Theater 2000 uses SRS Labs' patented TruSurround and SRS technologies to bring virtually any sound source to life. After you hook up the unit, you'll feel as if car chases and other movie action sequences are happening right in your living room. Best of all, you'll still have enough money left to buy popcorn.

Spectrum Research, 4370 S. Tamiami Trail, Suite 310, Sarasota, FL 34231; 941-921-3484; [www.theatersound.com](http://www.theatersound.com).

CIRCLE 53 ON FREE INFORMATION CARD

## Scaled-Down Wega

We're not quite sure when 27-inchers went from being large- to small-screen sets, or when just under a grand became modestly priced, *but*—for videophiles with limited space and/or budgets—Sony has extended its line of FD Trinitron Wega flat-screen televisions to include “small-screen” sizes such as the 27-inch KV-27FV15 (\$949.99). It contains the proprietary FD Trinitron picture tube, whose innovative CRT technology is said to create a vertically and horizontally flat screen. Other picture-improving features include a three-line digital comb filter that analyzes three TV scanning lines at a time, creating a high-resolution image with minimum noise; “Velocity Modulation” scanning that varies the scanning beam speed for accurate picture transitions; and “Vertical Aperture Compensation” for sharp edge details.

The KV-27FV15 offers an automatic volume control that equalizes the volume levels between programming and commercials. The set's Sound Retrieval System (SRS) creates a wide, three-dimensional effect from its two “Dynamic Acoustic Chamber” speakers and provides Virtual Dolby Surround sound.

The 27-inch Wega provides two-tuner picture-in-picture. Favorite Preview allows you to preview five favorite channels without having to leave the program you're watching, and Speed Surf allows you to press and hold the up/down buttons on the illuminated remote to race through hundreds of channels at high speed.

Sony, 1 Sony Drive, Park Ridge, NJ 07656; 800-222-SONY; [www.sony.com](http://www.sony.com).

CIRCLE 54 ON FREE INFORMATION CARD



The *PhoneMate MA-240* multi-handset phone system from Casio is multiplying, that is. The basic system (\$199) contains a two-line, digital 900-MHz base and one handset. The base unit, however, can support up to 11 additional MH-200 handsets (\$99 each). Those handsets, which are smaller than some cell phones, require only AC power—no phone jacks. Each of the additional handsets comes with a small charging cradle that plugs into an AC wall outlet. That means they can be placed in any room in the house or small office, even where no jacks are available.

Digital Time Division Multiple Access (TDMA) 900-MHz technology allows up to a dozen handsets to be used in close quarters without interference. The

MA-240 system allows convenient handset-to-handset intercom calls as well as call conferencing and call transfer. Both the handset and the base unit display Call Waiting and Caller ID numbers on LCD readouts.

Casio, PO Box 2914, Torrance, CA 90509; 310-618-6821; [www.casio.phonemate.com](http://www.casio.phonemate.com).

CIRCLE 55 ON FREE INFORMATION CARD

## It's Multiplying!





# Digital Video Recorders— Head to Head

*Philips TiVo and ReplayTV provide truly customized video viewing and digital recording.*

There's been a lot of talk lately about HDTV and the coming digital television (DTV) revolution, but for most of us it's been just talk. Our closest brush with digital video technology has been with the DVD player—a significant improvement over the VCR, but not what we'd call revolutionary.

However, two currently available products—*TiVo* and *ReplayTV*—can legitimately make that claim. Both are set-top boxes that fall into the general category of Digital Video Recorder, or DVR. Outwardly resembling a VCR (minus the cassette compartment), they are, in fact, computers equipped with an MPEG-2 chip for video compression, a hard drive for video storage, and an interactive program guide. Like a VCR, they are capable of making time-shifted recordings of your favorite shows. But that's just the beginning.

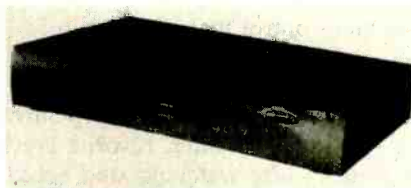
**Smart Recording.** DVRs are also being called Personal TV Recorders or Personal Video Recorders (PTR or PVR—can't have a new technology without a host of new acronyms!). That's because their coolest features are those that let you take total control of your viewing environment. Here are a couple of examples:

Do the kids' bedtime stories routinely stretch into the first ten minutes of *Frasier*? No problem. Record the show at 9:00, come down at 9:10, and start watching from the beginning. The DVR will keep recording the remainder of the show as you watch it in its entirety. Fast-forward through the commercial breaks, and before you know it you'll have caught up with the real-time broadcast.

Like home-improvement shows? Don't have the time or inclination

to peruse the TV Guide to hunt them all down for recording? Let your DVR search them out and record them for you—automatically. Ditto for movies and shows featuring a certain actor, or all of your favorite teams' games. In fact, these machines can learn about your viewing tastes and make independent decisions to record shows that they think you might enjoy!

Miss a touchdown pass? Want to take another look at a controversial play? Just use the instant replay feature and see for yourself if the ref's call was a good one. Fast-forward through the next set of commercials, and you'll be back in real time again.



*ReplayTV offers quality recording of shows and movies, as well as free access to the monthly Channel Guide, which lets the unit intelligently find content you're interested in watching.*

These features are not merely convenient; they can change the very face of TV viewing—and perhaps TV broadcasting as well. Why not *intentionally* start to watch *Frasier* at 9:07 and use the DVR to bypass the commercials? With ads now taking up 16 minutes per hour during prime time, you'll still get to see the whole show by 9:30, and you'll have saved seven minutes of your valuable time. Of course, you also will have bypassed seven minutes of NBC's valuable advertising time, which is why some industry analysts are predicting that DVRs could spell the end of free TV as we've known it.

TiVo and ReplayTV are similar in

that each provides digital recording and an intelligent programming guide that can "learn" viewers' preferences. They are comparable in looks, price, and storage capacity. Both systems store compressed video (from cable, satellite, or antenna) onto a hard drive and provide buffers that allow users to watch from the beginning a show that has already started to be recorded—and to pause, fast-forward, or rewind "live" programs. Both offer several recording modes with different levels of compression. Both use the telephone line for initial setup and to download program information on a daily basis. Neither serves as a long-term archiving device; recordings that you want to save can be downloaded to a VCR.

But there are several key differences between the way the two DVRs function and in some of their features. Let's take a look at what each one has to offer.

**ReplayTV.** Replay Networks' offering is available in three different versions. In its standard recording mode, the 2001, which costs \$699, can store about 10 hours of video; the 2003 version (\$899) can store about 14 hours; and the dual-drive 2004, priced at \$1499, can hold up to 28 hours. The good news is that even in standard mode (lowest video quality, maximum compression rate), ReplayTV records at 400 lines of resolution, comparable to S-VHS. Lower the compression rate and the video quality improves—to an impressive 480 lines of horizontal resolution—but the storage capacity decreases.

The set-top box is connected between the cable box, antenna, or satellite receiver and the TV, and plugged into a phone jack to



enable program information to be downloaded. Any time you watch a program, it is being automatically recorded and temporarily stored in the unit's buffer. That buffer (which holds up to four hours of programming, depending on how much disk space is available on the hard drive) is what allows you to treat live TV as if it were a videotape. But to record a show for prosperity, you must tell ReplayTV to do so, using the onscreen guide.

ReplayTV charges no monthly service fee for its intelligent, interactive programming guide. The Channel Guide shows seven channels divided into half-hour segments per screen. For each program, a plot summary and actors' names are available (although there's no indication if a show is a rerun). If you want to record a show, select it on the guide and press a button on the remote. If it's one of your favorite programs, you can opt to "record all episodes" instead of just one. And you can begin to create personalized "Replay Channels."

If, for instance, you chose to record *Law & Order* every week, ReplayTV would automatically create a "Law & Order" channel. Even better, you can have ReplayTV automatically store all programs featuring a certain actor or theme in other Replay Channels. Ask ReplayTV to search for programming including Tom Hanks, and it would search all available programming to come up with movies (*Forrest Gump*, *Philadelphia*), old reruns of *Bosom Buddies*, and even *That Thing You Do!*, which Hanks directed. You can view an onscreen list of Replay Channels and make your viewing selections directly from it. Perhaps your list might include gardening, NY Giants, and *The X-Files* channels. And, when you go to replay a show, you can bypass commercials using ReplayTV's 30-second Quick Skip function.

ReplayTV tells you precisely how much recording time remains. Recordings are stored for only a few days and then automatically deleted, to prevent the hard drive from running out of space, but you can connect a VCR to the DVR to "archive" any programs you plan to keep. And ReplayTV's back panel features an IEEE-1394 FireWire port



*TiVo learns about your preferences and can even pick shows for you to watch. Like ReplayTV, TiVo records video in MPEG-2 format on a hard drive.*

that is expected, sometime down the road, to allow you to connect an expansion module that will "increase dramatically the number of hours of TV programming that ReplayTV can store."

**TiVo.** Philips offers two models of TiVo: In "Good" (most highly compressed) mode, the *HDR112* (\$499) provides up to 14 hours of recording time, and the *HDR312* (\$999) can hold up to 30 hours. Yes, those prices seem less than those of ReplayTV, but TiVo charges for its program guide. You can pay \$9.95 a month or buy a lifetime subscription for \$199—which would bring the price of the base model in line with that of the ReplayTV model 2001.

TiVo offers four different levels of compression: good, medium, high, and best. Recordings made in "good" mode have a resolution of just 230 lines; "best" mode provides 430 lines of horizontal resolution. Good is adequate for time-shifting soaps and sitcoms, but for fast-action movies and sporting events you'll want to use best quality mode.

The TiVo program guide is not the standard grid used in print guides (and by ReplayTV), and it takes a bit of getting used to. It's

divided into three portions. Across the top, it describes the program currently showing. The bottom left side is a scrollable list of all shows currently on, while the right side lists the seven shows coming up next on the current channel. The onscreen guide is a translucent box that allows you to view video behind it.

As with ReplayTV, recording a show is a simple matter of pressing a button on the remote. But TiVo has a different way of personalizing your viewing experience. It doesn't perform searches by theme or actor—although (unlike ReplayTV) it does allow you to search for shows by title using an onscreen keyboard. The unit lets you rate shows, and uses your input to "learn" your preferences.

TiVo provides "thumbs up" and "thumbs down" buttons on the remote control. You can assign between one and three ups or downs to a show you're watching (or any show that appears on the guide) to indicate how much you like it. Just opting to record a show gives it an automatic thumbs up. Then it puts that insider's information to use and takes the initiative

*(Continued on page 38)*

# Prototype

## Waves That Return to the Past

It's no use crying over spilt milk, as the saying goes. To err may be human, but in the world of wave mechanics, the clock can be turned back; spilt milk can be returned to the saucer. This phenomenon is called a time-reversal wave, and it can be applied to light waves, ultrasound waves, or any other kind of wave.

Consider a uniform set of plane waves. As the waves travel along, they meet various boundaries, which reflect and refract the waves. If the surfaces of these boundaries are perfectly flat, the waves retain their original shape and maintain their original course, but if they are at all irregular the waves' shape becomes distorted and their path deviates. Thus, images transferred on these waves are also distorted.

The easiest way to understand this concept is to consider familiar optical images. Imagine you are looking down on a fish swimming in a pond. As long as the pond surface is perfectly still, the image of the fish is clear, but as soon as a ripple passes over the pond the image becomes distorted, because light rays are refracted as they pass through the broken water surface.

Conventional wisdom would have it that once an image is distorted, it cannot be returned to its pristine form. However, the original image can be restored by using a time-reversal wave.

A time-reversal wave, or phase-conjugate wave, is a wave that has the exact same wave pattern as another wave but is moving in the exact opposite direction. In other words, they are twin waves, whose only difference is that one is right-handed and the other left-handed. The name "time-reversal wave" comes from the fact that this wave behaves like the rewind function on a video player, in effect taking an image back in time. Even if a clean

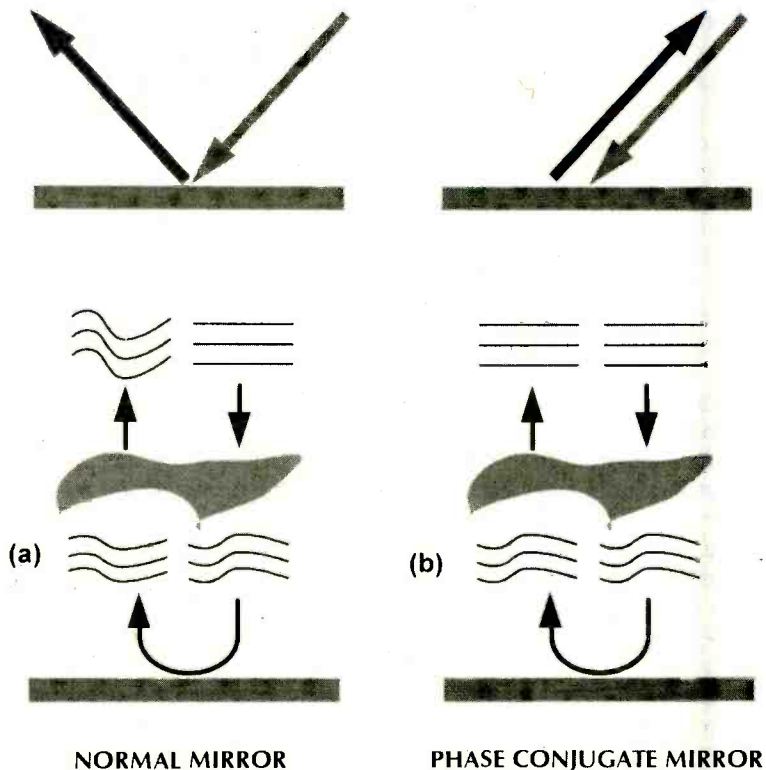


Fig. 1. Reflections off a regular mirror (left) and a phase-conjugate mirror (right).

wave becomes distorted by traveling through some disturbance, the wave can be returned to its original wave pattern by converting it to a time-reversal wave and retracing the same path back through the disturbance. The device that can convert an incident wave to a time-reversal wave is called a phase-conjugate mirror.

Figure 1 compares how waves are reflected off a normal mirror (top left) and a phase-conjugate mirror (top right). The lower diagrams in Fig. 1 show what happens when an object with an uneven surface is placed between the wave origin and the mirror. In the case

of a normal mirror (left), the distortion is amplified, whereas the phase-conjugate mirror (right) actually eliminates the distortion. When the time-reversal wave generated by the phase-conjugate mirror passes back through the wavefront disturber, this new distortion exactly cancels out the first distortion of the wave pattern, thereby restoring the wave to its plane wave state. (To understand how this works, compare the different wavefront of wave a and wave b.)

### Ultrasonic Images

When we think of images, we usual-

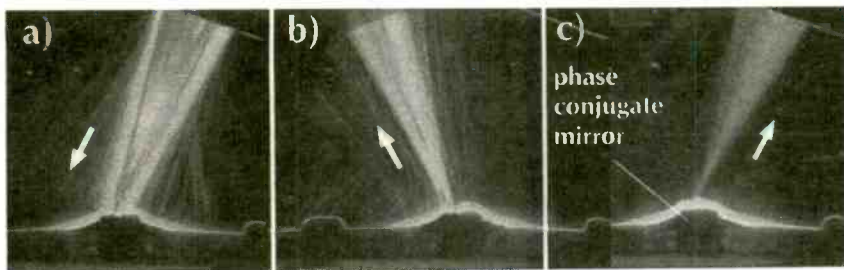


Fig. 2. Frames from a slow-motion videotape of a time-reversal wave. In a) is shown convergent ultrasound waves entering the phase-conjugate mirror; in b) a normal reflection off that same mirror is shown, and in c) you see an image of the time-reversal wave.

ly think of optical images, but optical images only show us the exterior of objects. Ultrasonic images, however, reveal the interior of objects that cannot be penetrated by light. Ultrasonic diagnostic equipment is now found in essentially all hospitals, and ultrasound is also widely used as a non-destructive method of finding flaws and breaks in rails and other materials. Another reason for the popularity of ultrasound is that ultrasonic waves pose far less danger to the human body than do X-rays.

Distortions as discussed above also occur frequently in ultrasonic images. These distortions, too, can be eliminated through the use of time-reversal waves.

The phase-conjugate mirrors used for

ultrasound are made of piezoelectric ceramics. Originally, these materials were used for the emission of ultrasonic waves, so their use in phase-conjugate mirrors represents a highly specialized application. A phase-conjugate mirror is made of a rectangular piece of piezoelectric ceramic material that measures 1cm × 1cm × 5cm. Silver electrodes are soldered on to opposite sides. The top of the mirror is irradiated with an ultrasonic wave with a frequency of  $f$  Hz (around 10 MHz). Simultaneously, an alternating voltage twice that ( $2f$  Hz) is applied to the electrode. When this occurs, a time-reversal wave is emitted from the top of the mirror.

Although this device is referred to as a mirror, the sound wave is not reflected off its surface, but enters the device and is re-emitted after a slight delay. This special device is based on the Schlieren technique. If the time-reversal wave is filmed in slow motion, its unusual behavior can be seen with the naked eye. Figure 2 shows three frames of such a film.

### How Time-Reversal Waves Are Produced

The piezoelectric effect is the phenomenon whereby voltage is converted to energy and vice versa. Generally, voltage is proportional to energy, but there are some nonlinear piezoelectric materials where the conversion is not proportional, but multiplicative instead. The sum of a voltage of  $2f$  and an energy (ultrasound) of  $f$  produces a time-reversal wave of  $-f$ . Piezoelectric ceramics made primarily of lead zirconate or lead titanate are prime examples of materials that fit this equation.

Generally, an ultrasonic image is generated by bouncing convergent ultrasonic waves off an object and picking up the reflected signals, as shown in Fig. 2. The focus of the ultrasonic waves

scans through the object on a zigzagging path, and the reflected waves are displayed on a monitor like the scanning lines of a television broadcast. The difference in the intensity of the reflected waves produces an image of the inside of the object.

Figure 3 is a diagram of ultrasound imaging equipment including a phase-conjugate mirror. The phase-conjugate mirror is attached to the bottom of the water tank. A convergent ultrasonic vibrator is positioned above the tank. The test material is a stainless steel plate inscribed with the initials of the Institute of Industrial Science, University of Tokyo (IISUT). An irregularly shaped object (made of agar) was placed between the ultrasound source and the

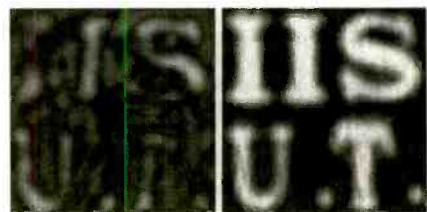


Fig. 4. The initials in the normal ultrasonic image (on the left) are distorted so much that they can hardly be read, while the initials in the time-reversal wave image on the right are clear.

target in order to distort the ultrasonic waves. When the electric voltage to the phase-conjugate mirror is turned off, a normal ultrasonic image is produced; but when the mirror is turned on a time-reversal ultrasonic wave image is produced. Figure 4 shows what these two images look like. The initials in the normal ultrasonic image (on the left) are distorted so much that they can hardly be read, while the initials in the time-reversal wave image on the right are clear. — TAKAGI KENSHIRO (COURTESY OF LOOK JAPAN, MARCH 1999) **PT**

## Biosensors: Detecting Contaminated Meat

**R**ecent incidents of contaminated meat in grocery stores and restaurants have heightened consumer concern. A new bacterial sensing device called a biosensor was developed at the

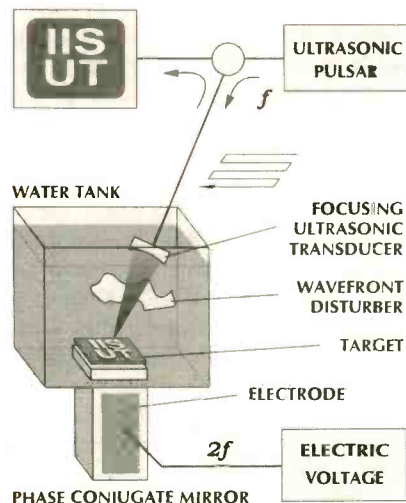


Fig. 3. In this diagram of ultrasound imaging equipment, a stainless steel plate inscribed with the initials of the Institute of Industrial Science, University of Tokyo (IISUT) is placed between a phase-conjugate mirror and a convergent ultrasonic vibrator. An irregularly shaped object (made of agar) was placed between the ultrasound source and the target in order to distort the ultrasonic waves.

## ► What's That I Smell?

Hewlett-Packard Company has signed a collaborative research agreement with Cyrano Sciences, Inc., a company that uses chemical sensors on a silicon chip to mimic receptors in the human nose. Under the terms of the agreement, the companies will work together to develop Cyrano's proprietary sensor technology into products for a variety of markets.

The goal of the collaboration is to produce a portable, inexpensive and rugged handheld "electronic nose" based on an array of chemical sensors composed of conductive polymer composites. Such a product could be used in the medical, food-processing, and chemical industries to detect and classify a broad variety of volatile compounds. The electronic nose could allow food companies to continually monitor batch-to-batch consistency. For chemical companies, a portable tool could be used for efficient detection of leaks in pipelines and storage containers, in contrast to current monitoring techniques that are resource-intensive and cumbersome. The product might also be used to diagnose illnesses, including infections and metabolic conditions.

This technology could evolve into consumer product applications. An electronic nose could be integrated with household appliances such as refrigerators to detect and alert for spoiled food or in microwave ovens to indicate when food is cooked properly. Additionally, emergency crews could use a handheld product to profile hazardous materials sites, allowing them to select the appropriate fire retardant, containment strategies and protective gear.



This portable handheld electronic nose from Cyrano Sciences could have applications in many markets.

interferometric sensor technology upon which the biosensor is based has already been patented by Niles Hartman, a biosensor developer and senior research engineer at GTRI and the Georgia Tech Research Corp. It is also the basis for a chemical contaminant sensing system called E-SMART. That system is also undergoing field tests. The chemical sensor was licensed commercially by the Atlanta-based company Photonic Sensor.

PT

## Is There Life Down There?

In September, researchers conducted an experiment at Yellowstone National Park, WY, in an effort to find tiny multi-cellular organisms that may be living in the Hot Springs. Conventional wisdom says that only single-celled life, such as bacteria, could exist in Yellowstone's boiling waters, according to scientists at NASA's Ames Research Center, Moffett Field, CA.

The main tools that Jonathan Trent, team leader of the Ames Yellowstone expedition, and his team used were two special "baitable" salt shaker-size video cameras built by Deep Sea Power and Light, Inc., San Diego, CA. The cameras are in a NASA-designed package that includes sensors able to detect temperature, acidity, oxygen, and carbon dioxide levels, as well as depth below the surface.

"Part of our ability to anticipate what kind of life may exist on other worlds depends on expanding our knowledge of the ability of Earth life to adapt to extreme conditions," said Trent, an Ames astrobiologist. Astrobiology is the study of the origin, evolution, distribution, and destiny of life in the universe.

"As far as we know, nobody has baited video cameras to try to attract life forms living within the Hot Springs," he said. "We baited our 'mini-monster cams' with local food, such as insects, algae or leaves—things that normally fall into the spring."

A rope was stretched across each hot spring being investigated and the camera and instruments were slowly lowered into the middle of each pool of hot water. Wires carried computer signals and TV pictures to the surface where

Georgia Tech Research Institute (GTRI) and is currently being field-tested. It can simultaneously identify species and determine concentrations of multiple pathogens—including the deadly *E. coli* and *Salmonella*—in food products in less than two hours while in operation on a processing plant floor.

Tests for bacterial pathogens in meat are currently not required by federal or state food industry regulators. A few large companies perform lab tests, but they are costly and slow—sometimes not even yielding results for 48 to 72 hours.

Georgia Tech researchers—in collaboration with Dr. Robert Brackett, a professor at the University of Georgia's Center for Food Safety and Quality Enhancement in Griffin—have been developing and testing the biosensor in their laboratories for about four years.



Researcher Dr. Paul Edmonds, right, tests a biosensor at a Georgia poultry plant.

Laboratory tests have proven the biosensor is extremely sensitive, meaning it can detect pathogens at minute levels of 500 cells per ml. Researchers believe they can improve that sensitivity to 100 cells per ml. Current laboratory methods only achieve sensitivity levels of 5000 cells per ml, and they usually take from eight to 24 hours to yield results. In addition, lab equipment costs \$12,000 to \$20,000 per instrument compared to an estimated \$1000 to \$5000 for a biosensor.

The biosensor can simultaneously detect 12 different pathogens, but researchers are concentrating on six bacterial species for now, including *Salmonella* and *E. coli*. All of these pathogens are associated with stomach illness in humans. When detected, they are usually found in meat, but sometimes occur in produce.

"If pathogens are found with the biosensor, then food processors can make decisions more quickly about applying treatments, such as antiseptics," said Dr. Paul Edmonds, a professor of biology at Georgia Tech. "Or they might divert those products to cooking operations, which could kill the pathogens. And companies could modify their sanitation plans."

Meanwhile, the integrated optic

scientists recorded data and images.

In other efforts to prepare to search for extraterrestrial life forms, investigators across the world have been looking for living things that exist under extreme conditions. Those conditions include extremes of heat and cold. Scientists have found single cell archaea growing at temperatures as high as 234 degrees Fahrenheit.

"By increasing our knowledge of the physical and chemical limits that are favorable to life, we'll expand the possibility of predicting where complex extraterrestrial life forms may exist," Trent said.

Scientists at the Ames Sensors 2000! Project were assigned to develop a probe housing and electronics capable of surviving the boiling water, and yet able to detect and transmit data. "The real challenge has been to develop a probe that can survive in extreme environments of boiling, acidic water," said Fred Martwick, an Ames Sensors 2000! lead engineer for the Yellowstone project. **PT**

## Optical Networks

**C**horum Technologies Inc. has introduced its PolarWave family of advanced optical products for terabit-scale active optical networks. PolarWave's optical switching, routing, and processing technologies dramatically increase the performance, reliability, and capacity of advanced optical networks.

"Using our products and technologies, a new generation of optical networks can be built, where hundreds of channels are dynamically routed, switched, and managed optically, without costly and bandwidth-limiting optical-to-electronic-to-optical conversions," said Scott Grout, Chorum president and CEO.

The PolarWave family of products is comprised of five product lines: Optical Slicers, DWDM Routers, Optical Switches, Optical Processors, and Integrated Optical Systems. Optical Slicers perform advanced optical filtering, called interleave filtering. By using Optical Slicers in long-haul DWDM networks, optical system manufacturers can transmit terabits of information on a single fiber.

DWDM Routers are high-performance all-optical multiplexers and

demultiplexers. With Chorum's DWDM Router products, it is now possible to build modular, passive optical multiplexing and demultiplexing systems that support hundreds of channels at data rates of 10 Gbps and higher. Their line of Optical Switches is based on liquid crystal technology.

With new networks supporting dynamic routing and switching of optical channels, signal conditioning is critical. In addition to each of the product lines, the technologies can be combined to form powerful integrated products. Chorum's Integrated Optical Systems couple switching, filtering and/or processing technologies together for advanced applications, such as optical add/drop multiplexing (OADM) or optical cross-connects (OXC). **PT**

## Large-Screen TVs

**S**ony is changing the look of analog (NTSC) and high-definition (HDTV) programs with the introduction of two new Hi-Scan big-screen TVs. These rear-projection TVs feature Sony's second-generation Digital Reality Creation (DRC) technology for near high-definition pictures from standard definition sources, and a newly designed, high-performance display for viewing HDTV programs.

The 53-inch KP-53XBR300 and the 61-inch KP-61XBR300 big-screen televisions are the first to incorporate the latest generation of DRC technology, a proprietary technology that converts analog signals to near high-definition quality, resulting in clean, sharp images. DRC technology bit-maps the original NTSC and standard definition (480i) signals in real-time, doubling the vertical resolution and increasing horizontal pixel count two times, creating an image with 960i x 1440 pixels.

When paired with a digital television (DTV) set-top decoder box compatible with HD component connections, the new Hi-Scan TVs will have the ability to display 480i/480p plus high-definition signals at 1080i resolution.

Sony's Hi-Scan televisions include such other enhancements as an Extended Definition CRT and optimized positioning of the Velocity Modulation coil, both of which contribute to improved picture quality. Additional picture enhancements



The 53-inch KP-53XBR300 big-screen television from Sony is the first to incorporate the latest generation of DRC technology that converts analog signals to near high-definition quality.

include an advanced Flash Focus full digital auto convergence feature that automatically aligns the picture tubes in just five seconds. A newly designed Lenticular screen along with other screen improvements allows for clear viewing from any angle, while providing higher contrast and less surface glare. **PT**

**MAY THE  
SOURCE  
BE WITH  
YOU**

**D**on't let the dark forces of ignorance defeat you. Right in this galaxy you can tap into the source—the free Consumer Information Catalog. It lists free and low-cost federal publications on a variety of important topics.



So dispel the darkness and get the source. Call toll-free 1-838-8 PUEBLO for your free Catalog.

Or set your coordinates for the Consumer Information Center Web site: [www.pueblo.gsa.gov](http://www.pueblo.gsa.gov)

## Joystick-Port Voltmeter

**Q** I'd like to make a voltage meter out of my PC's joystick port. I've tried something with resistors and a transistor without success. Does anyone have a schematic for a joystick-port-to-voltmeter adapter?—Pekka Paalanen, Finland

**A** Many PCs have input ports for games that use joysticks, which use 0–200,000-ohm variable resistors. To sense the positions of two joysticks, the PC measures the resistance of four resistors; the basic internal circuit is shown in Fig. 1. First the PC removes the short circuit across a capacitor by turning the transistor off, then measures the time that the capacitor takes to charge up to a set level. You can access that reading with the STICK function in QBasic or the appropriate system calls under Windows.

To measure a resistance, you simply connect it across the appropriate pins of the joystick port. I've had fun doing that with thermistors and cadmium-sulfide (CdS) photocells.

Measuring a voltage is harder; you need to replace the resistor with a voltage-controlled current source. The circuit shown in Fig. 2 fills the bill. It was originally published in *PC Techniques*, April/May 1994, and is reproduced here by permission. You must use an op-amp whose common-mode input-voltage range includes ground; the classic LM324 works well. The op-amp must be powered from a 9-volt battery (or from the 12-volt power source inside the PC) so that its output can go all the way up to 5 volts.

Listing 1 shows a QBasic program to make voltage measurements. You must first calibrate the apparatus with two known voltages, preferably near the ends of its range; then you can measure voltages throughout the range. If you don't have QBasic, look on your Windows95 or Windows98 CD; it's there, though not normally installed.

The joystick port has only 8-bit resolution, giving values from 0 to 255. For more accurate voltage measurements, use a serial analog-to-digital converter interfaced to your printer port. See the Q & A column in the October 1996 issue of *Electronics Now* for details. Reprints of that and other issues are

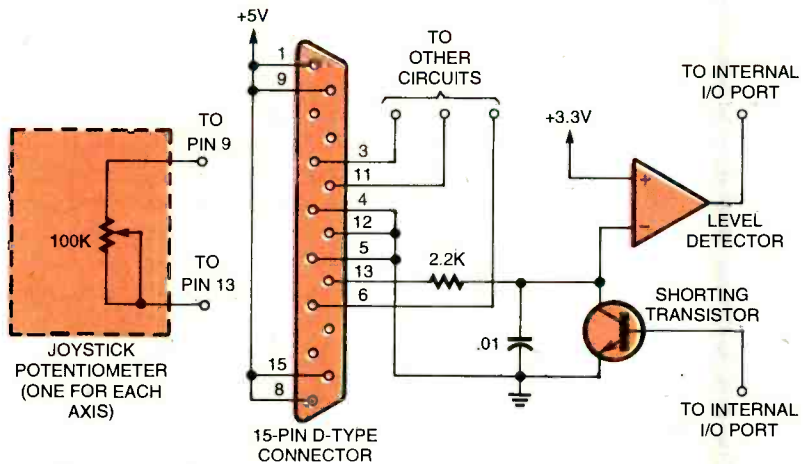


Fig. 1. To measure the resistance of a PC joystick, the computer measures the time taken to charge a capacitor after a short is removed.

available from the Gernsback Reprint Bookstore.

## Reading PICs With NOPPP

**Q** How can I use the NOPPP to read back the contents of a programmed PIC microcontroller?—M. H., East Gosford, N.S.W., Australia

**A** NOPPP, the “No-Parts PIC Programmer,” was featured in the September 1998 issue of *Electronics Now* and is available in kit form from Ramsey Electronics and Oatley Electronics. It programs PIC16F84 and PIC16C84 microcontrollers. For full information and free software, see NOPPP’s Web page: [www.CovingtonInnovations.com/noppp](http://www.CovingtonInnovations.com/noppp).

To read back the contents of a programmed PIC, unpack and install the TOPIC software package that is bundled with the NOPPP. The base software for the NOPPP doesn’t read PICs; TOPIC, written by David Tait, does. Then use the command:

```
topic /d myfile.hex
```

to dump the contents of the PIC onto myfile.hex.

To see what you’ve got, use MPLAB, Microchip, Inc.’s free PIC development software. With no projects open, choose

File | Import | Download to memory. Specify the name of your .hex file and MPLAB will import it. Then go to Window | Program Memory to look at the program in assembly language. Naturally, there will be no comments or named variables, but you’ll be able to see the machine instructions. Some of them may decode incorrectly because MPLAB doesn’t know the context; make sure MPLAB is set for the right kind of CPU. You can use the Windows Clipboard to copy the program to a text file.

## Base-3 Arithmetic

**Q** I’m a high-school junior and an avid reader of your magazine. I’m trying to make a counter circuit that will count in base 3. I’ve tried using a CD4040 counter chip but don’t know how to translate the results into base 3. Any ideas? I’ve looked into Tri-state buffers, but I’m not quite sure how to use them for three-valued logic.—R. W., Pensacola, FL

**A** Rather than generate binary numbers and translate them into base 3, it’s easier to use CD4017 counters with output Q3 (pin 9) connected to the reset line (pin 15). The result is a counter that goes through three states, with Q0, Q1, and Q2 high, respectively. The carry output (pin 12) won’t work because the CD4017 must count to at least 5 in order to produce a signal there, but you

can probably work out a way to use the Q3 output for carry as well as for reset. If you do that, the pulse on Q3 will be quite narrow; it lasts only long enough to reset the chip that is generating it. You should probably stretch the pulse by putting a monostable between the output of Q3 and the two inputs that the reset pulse is to be sent.

How to represent three-valued logic in digital circuitry is a more difficult question. "Tri-state" buffers aren't much help because their three states are "high," "low," and "disconnected." Since digital circuits sometimes substitute a valid logic level for a missing one, it's hard for the next stage to distinguish "disconnected" from one of the others. You might have more success using op-amps as analog-level detectors. In any case, three-valued or multiple-valued computation is worth exploring.

## Origin Of "Ham" Radio Term

**Q** Some time ago I read that ham radio gets its name from the initials of three operators, H, A, and M. Can you give me more details on this issue?—F. F., Sao Paulo, Brazil

**A** Many people nowadays think "ham" must be an abbreviation because so many other technical terms are—but it isn't. All of the dictionaries that I've consulted agree that "ham radio" is derived from "ham actor" (amateur actor), probably because the earliest radio hams transmitted entertainment to the public—a practice that is now prohibited. "Ham actor" in turn derives from one or more songs in nineteenth-century minstrel shows, "The Ham-Fat Man" or "The Ham Tree."

Since the 1970s, a story has been circulating that "ham" is an abbreviation for the names of three people or maybe three ships, but the story can't be substantiated; it does not seem to have appeared until long after the events in it supposedly took place.

## Slotless PCs?

**Q** Here's something I've thought about: Do away with internal PC card slots and make all card slots external. A recent article in NASA Tech Briefs suggests a slotless computing environment. Is anyone develop-

# Wavetek. The Way Value Is Measured.

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

Temperature. There is an XT Series DMM right for you.

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

leads and are approved to IEC1010-1 safety standards.

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

Wavetek, Wandel Goltermann  
9145 Balboa Avenue, San Diego, CA 92123  
(800) 854 2708 • [www.wavetek.com](http://www.wavetek.com)

\*Limited time offer. Contact Wavetek or local distributor for details

# WAVETEK

**27XT**  
A unique combination of DMM and component checking in a single meter.

- Inductance
- Capacitance
- Logic
- Frequency

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

**23XT**  
Electronic and electrical test functions for general duty and HVAC/R.

- VAC Safety Test™
- Temperature
- Transistor
- Logic

**25XT**  
A full C-meter in a DMM, and most ideal for ATX cell-phone & antenna matching inspection.

- Full Capacitance 0.1pF to 20nF
- Capacitance Zeroing & Test Slots

**28XT**  
A thermometer + DMM for HVAC/R, heating or plant maintenance.

- Temperature
- Capacitance
- Frequency
- Max-Hold

**85XT**  
A precision True RMS reading DMM, ideal for equipment like copiers.

- 4 1/2 digit accuracy
- True-RMS
- Frequency
- Duty Cycle

**LCR55**  
Full-function LCR, extra test features for "best-in-class" component checker.

- Inductance
- Capacitance
- Resistance
- Transistor
- Dual Diode



CIRCLE 170 ON FREE INFORMATION CARD

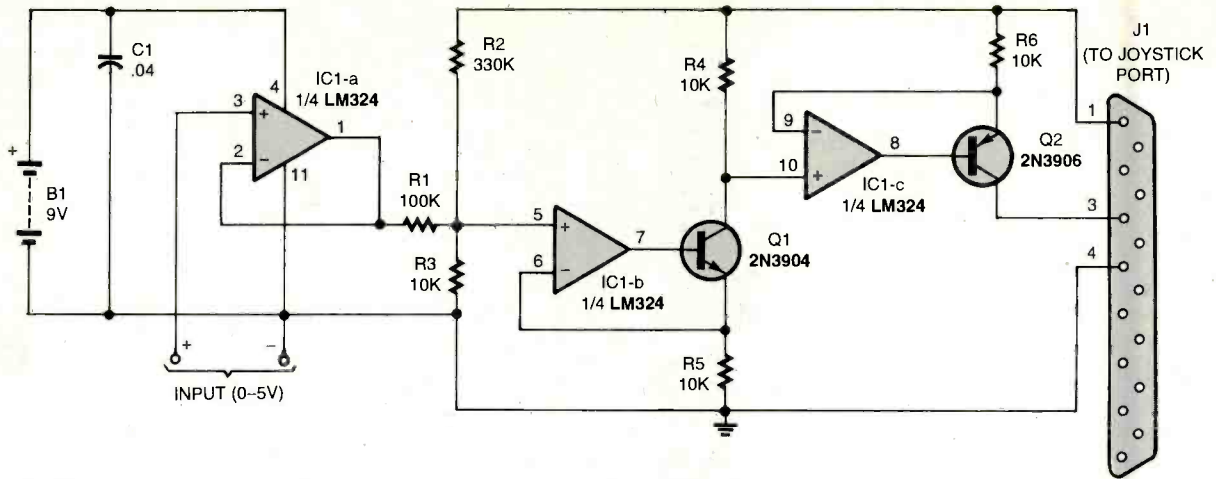


Fig. 2. This circuit will let you use a PC joystick port as a voltmeter in conjunction with the program given in Listing 1.

ing anything along these lines?—T. R., Woodland Hills, CA

**A** As you note, that's what USB and IEEE-1394 are for. It is becoming easier to attach scanners, additional printer ports, and other peripherals to computers without opening the case. External buses such as SCSI have supported disk drives and other peripherals for a long time.

Let's review why computers have slots. The reason is speed. Before the Pentium era, the cards in a PC plugged directly into the CPU's bus. Thus, they could communicate with the CPU at full speed, without anything in the way to delay the signal. That was vital for high performance.

Today, the CPU has a separate bus, and the ISA, EISA, or PCI bus runs slower than that of the CPU. Although it is, in essence, an external bus (like SCSI) that happens to be inside the case, it's still a lot faster than IEEE-1394 or USB.

I think that slots are here to stay, but they will be used only for the fastest devices, such as graphics cards and disk controllers. Most people would rather not open a computer's case to install a scanner or external CD drive.

is connected to his GPS. Why doesn't he buy a PS/2-type mouse and plug it into the mouse port?—Tom Snyder, Los Angeles, CA

**A** Good suggestion! I didn't know whether the T2150CDS had a PS/2 mouse port. My own Toshiba laptop (a Satellite 430) certainly does.

## Mouse Solution Found

**Q** Reader K. W., of Annapolis, MD, asked about adding a parallel port mouse to his Toshiba T2150CDS because the serial port

## More About Talking Books

**Q** I just re-read the Q&A in the June 1999 issue of *Electronics Now* about slowing down a normal cassette player in order to play the Talking Books tapes distributed by the National Library for the Blind. Your answer about a possible torque/speed problem was right on, but there is more to the story.

The tapes are recorded on four monaural tracks, like consumer stereo cassettes. So if the half-speed modification were successful, it would still be necessary to use a stereo playback head and channel switching to sort out the four tracks. That's a lot of work to do when a visually-handicapped person can get a heavy-duty player on long-term loan free of charge from a local or regional library.

Incidentally, these machines are maintained by volunteer GE and Bell Telephone engineers and technicians, most of whom are retired. They are often looking for more volunteer help; volunteers need not be connected with GE or the Bell System.—T. L. Poppelbaum, no location given.

**A** Thanks for writing! Many of our readers would probably enjoy doing some volunteer work and getting some repair experience. The local repair shops can presumably be contacted through public libraries.

(Continued on page 76)

### LISTING 1

```

' V.BAS (M. Covington 1994, 1999) -
  QBASIC
' Measuring voltage through joystick port
CLS
PRINT "Calibration needs 2 known
  values,"
PRINT "preferably near ends of range."

OPTION BASE 1
DIM RDG(2), VALUE(2)
FOR I = 1 TO 2
  PRINT
  PRINT "Connect known value "; I; " and
  press any key..."
  WHILE INKEY$ = ""
    RDG(I) = STICK(0)
    LOCATE CSRLIN, 1
    PRINT "Reading: "; RDG(I); " ";
  WEND
  PRINT
  INPUT "Actual value"; VALUE(I)
NEXT I

FACTOR = (1 / VALUE(2) - 1 / VALUE(1))
/ (RDG(2) - RDG(1))
OFFSET = .5 * (1 / VALUE(2) - FACTOR *
RDG(2) + 1 / VALUE(1) - FACTOR *
RDG(1))

PRINT
PRINT "Factor =", FACTOR, "Offset =",
OFFSET
' Taking readings

PRINT
PRINT "Taking readings continuously. Exit
with Ctrl-Break."
PRINT

WHILE 1
  RDG = STICK(0)
  VALUE = 1 / (FACTOR * RDG + OFF-
SET)
  LOCATE CSRLIN, 1, 0
  PRINT USING "####.###"; RDG;
VALUE;
WEND

```



# CALLER-ID ALARM SYSTEM

*What good is an alarm system if you don't know  
that there's a problem? With this one, the  
alert is only a phone call away!*

DENNIS HEWETT

**W**hen you decide that you need a security system for your home or business, you will find systems starting at "nothing down" to over \$500 with installation. Like cellular telephones, little money is made on the hardware. Most alarm dealers want you to sign a contract for monthly monitoring and/or maintenance. After a few years, that "low-cost" system could add up to a considerable amount.

If, on the other hand, you need something simpler, the *Caller-ID Alarm System* presented here might just be the best solution. Using one IC and a solid-state relay, this alarm system has both a delayed- and an instant-trigger zone, and relies on the local telephone company's Caller ID service to let you know that the alarm has been tripped.

With a low parts count, the unit might be in the running for the world's cheapest and smallest alarm system; the circuit board is barely two inches square.

A requirement for using the Caller-ID Alarm is, of course, a subscription to the Caller ID service at all of the places that the system would call. When the alarm is triggered, it dials the telephone numbers that are programmed in the unit, waits until the caller's ID data is sent (between the first and second ring), and then hangs up. When you see the call data on your Caller ID box, you know automatically that your alarm has been activated. If the call is a toll call, you save long-distance charges by ignoring the call. You can then call the police



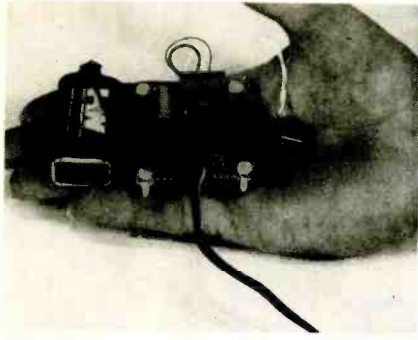
and meet them at the alarm location or set up your own procedures for responding to the alarm.

The system continues the dialing/hanging up routine until all of the stored numbers have been dialed. After a five-minute delay, the dialing process repeats. That continues until the alarm is turned off.

**How It Works.** The alarm system is built around three electrical "loop" circuits called Zone 1, Zone 2, and Key. Those loops are simply wire that

is grounded at one end and connected to the alarm circuit at the other end. Several switches that are closed when the protected items, such as doors and windows, are closed are wired in series with the loops. As long as all of the switches are closed, the loop is grounded. Note that although you can have more than one switch in the Key loop, we'll assume for this discussion that there is only one; that switch arms and disarms the system.

While disarmed (the Key switch



The Caller-ID Alarm System, while small enough to fit in your hand, has several interesting features packed into it.

open), the system tests the three loop inputs. If either zone is open, an LED blinks either once or twice, depending on the zone that is open, repeating after a short pause. If both zones are open, it blinks once, then twice. When both zones are closed, the LED turns on steady.

If you close the Key switch in order to turn on the alarm while either zone is open, a beeper and the LED begin pulsing as a warning that the system was not ready—some window or door might be open.

When the LED is on but not flashing, the system is ready to be acti-

vated. When the Key switch is closed, the beeper begins pulsing at one-second intervals for 30 seconds. That will give you time to leave the house and close the door without triggering the alarm. Both zones are delayed so that you can exit through any door regardless of which zone it is connected to.

After the exit time expires, the LED turns off. Since the unit has a battery in case of an AC power failure, current consumption is kept to a minimum.

Upon returning when no alarm has occurred, enter through any Zone 1 door. The beeper starts pulsing at one-second intervals for 15 seconds. If the Key switch (which should be concealed) is not turned off before the time elapses, the system starts dialing the programmed telephone number or numbers. Using a door that is connected to Zone 1 is important. If your entry door is connected to Zone 2, the system begins dialing without any warning beeps.

**Circuit Description.** As we mentioned before, the Caller-ID Alarm is a simple circuit; how simple it actually is can be seen in the schemat-

ic diagram, Fig. 1. The heart of the circuit is IC1, a 12C508 PIC microcontroller. Of the chip's eight pins, six can be used as input/output lines. In addition, three of those pins can have internal pull-up resistors connected—a feature that is selected by the alarm software that will be programmed into the device. Those pins are used as inputs; the other three are used as outputs.

The three input pins—4, 6, and 7—are connected to the zone loops discussed before. When all of the switches are closed, the pins are grounded. The software sees that logic level as "everything is safe." If any switch opens, the ground is removed. Normally, the result is an open input that is seen by digital inputs as an invalid state. Here is where the internal pull-up resistors come into play; they provide a valid high logic level.

Pins 2, 3, and 5 are used as outputs. Buzzer BZ1 is the audio beeper discussed earlier; the accompanying LED indicator is LED2. Resistor R2 limits the current drawn by LED2. An additional LED (LED1) in series with current-limiting resistor R1 passes the signal from pin 3 to the input of RY1. That

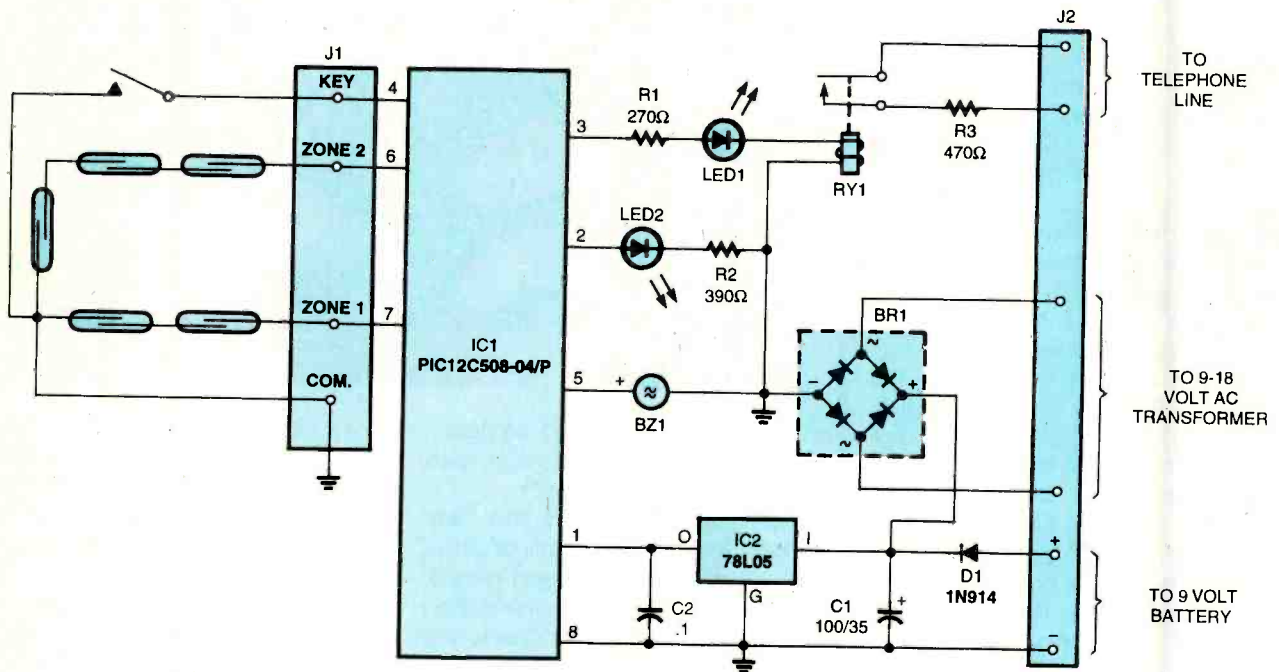
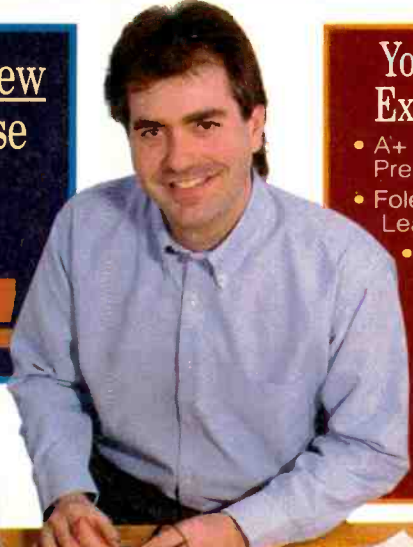


Fig. 1. The Caller-ID Alarm is based on an 8-pin PIC microcontroller. If a switch on either zone is opened, the unit places a telephone call; RY1 and R3 mimic a rotary-dial telephone. After the second ring, the system hangs up. That amount of time makes sure that the telephone company's Caller ID information is transmitted to the called number. A battery keeps the system active in case of a power failure—the system only draws 3.5 mA activated.

# A Trained Computer Repairman Charges \$100 An Hour and More... You Can Get That Training!

Foley-Belsaw's Totally New Computer Repair Course gives you the skills to start earning top pay **FAST!!!!**



You get these Foley-Belsaw Exclusives! At no extra cost!

- A+ Certification Test Preparation Tutor™
- Foley-Belsaw CD-ROM Learning Assistant™
- Business Start-up Resource

**SPECIAL BONUS**  
Inquire now and your course will come with a complete video archive library of early printer and computer repair techniques... at no additional cost.



**No Experience Necessary!**  
Get "hands-on" training in the exciting field of computer repair.

**Train At Home!**  
There's not a more complete-or affordable-PC Repair course that will have you trained and job ready in such a short time.

**Fully illustrated, easy to understand course gives you everything you need to succeed.**

The key to your success lies in providing a service that is in great demand. Even if you have no experience, you can become an expert in a few short months. Foley-Belsaw's computer repair course is broken into small, easy to manage lessons. Each lesson is designed with your success in mind. After you complete the course, you'll have the expert knowledge to earn up to \$100 an hour, or more!

**Latest technologies and insider knowledge available only to Foley-Belsaw students!**

Get the "hands-on" experience you need in Computer Repair. Foley-Belsaw's CD-Rom Learning Assistant™ guides you through each lesson and is always right at your fingertips. The Test Preparation Tutor™ makes preparing for your A+ Certification as

**Take the first step to top pay. Call for a FREE Opportunity Kit today! 1-800-487-2100 Ext #A0007**

or complete this coupon and mail to Foley-Belsaw Institute, 6301 Equitable Road, Kansas City, MO 64120-1395

- Yes!** Send me one of the following **Free** Opportunity Kits:
- Computer Repair, Maintenance, Upgrade, 321 **NEW!**
  - Personal Computer Specialist, 325
  - Professional Computer Programming, 323
  - Professional Saw and Tool Sharpening, 315
  - VCR/DVD Service and Repair, 320 **NEW!**
  - Small Engine Service and Repair, 306
  - TV/Satellite Dish Service and Repair, 322
  - Professional Gunsmithing, 340
  - Home Inspection, 342 **NEW!**
  - Networking Specialist, 324
  - Locksmithing, 307
  - Woodworking, 319
  - Upholstery, 308
  - AC/Refrigeration, 343
  - Electrician, 326

**Satisfaction Guaranteed**  
Foley-Belsaw gives you a **Free 30-Day Trial.**  
Be careful! Most schools charge \$150.00 for this privilege.



World leader in training since 1926, provides at-home, "hands-on" training in high-demand fields.

Name \_\_\_\_\_  
Street \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_  
Phone ( ) \_\_\_\_\_ A0007

relay is connected across the telephone lines, and is used for dialing.

Note that pulse dialing is used; touch-tone dialing would complicate the circuit. Here, the only addition needed is R3 to keep from shorting the telephone line out completely. When dialing, RY1 is pulsed at a rate of 10 times per second to simulate a rotary telephone. Rotary dialing works even if you pay for tone service.

A 9-18-volt AC wall-mounted transformer provides power for the circuit. The AC power is rectified by BR1, smoothed by C1, and regulated by IC2. In addition, a 9-volt battery, protected by D1, is used to keep the Caller-ID Alarm on guard if power is lost. It is important that the DC voltage level at the input of IC2 be at least 12 volts so that D1 is biased off to preserve the battery. With the system activated, the total current draw is about 3.5 mA. With all six pins on IC1 used as input/output, there are no pins left for the microcontroller's clock. In this case, the 12C508 has an internal 4-MHz RC (resistor/capacitor style) oscillator; that circuit is used as the clock source.

**Construction.** The Caller-ID Alarm System can be built on a piece of perfboard using standard construction techniques. A printed-circuit board can also be used; a foil pattern has been included here if you want to etch your own (see Fig. 2). Alternatively, an etched board may be purchased from the source given in the Parts List. If you use either of those sources for a PC board, use the parts-placement diagram shown in Fig. 3 for component location.

Before building the board, you should program IC1. Source code is available on the Gernsback FTP site at [ftp.gernsback.com/pub/pop/caller-id\\_alarm.zip](ftp.gernsback.com/pub/pop/caller-id_alarm.zip). Note that you will have to add an important piece of information to the software: the telephone number (or numbers) that the Caller-ID Alarm will be calling. While you are adding that information, you can also change a few other parameters such as the time delays for arming (30-second default), disarming (15-second default), and dialing delay (five-

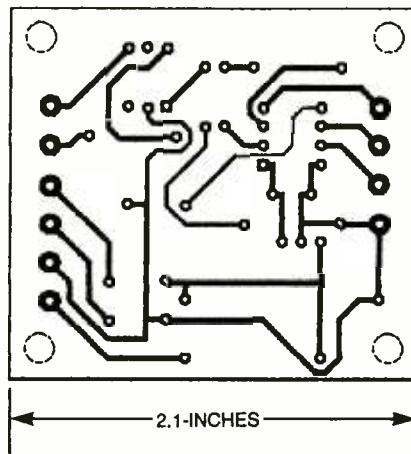


Fig. 2. Here's the foil pattern for the Caller-ID Alarm.

minute default). Those modifications are beyond the scope of this article; the source code, however, is well documented. If you do not understand how to make the changes, you should ask someone who is familiar with microcontroller programming.

The PIC 12C508 microcontroller is available in two basic versions: erasable and one-time programmable (OTP). While the OTP version is much less expensive, it can (as the name implies) be programmed only once. If you need to change

the phone number or make other modifications to the program, your only choice is to throw out the old chip and start with a fresh one.

The erasable version has an advantage in that respect. Simply expose the quartz window on the top of the chip to ultraviolet light of the right wavelength and intensity and the program will be erased; the chip can now be re-programmed. An ultraviolet chip eraser can be expensive unless you have access to one. Also keep in mind that you should cover the window before programming the chip. Exposure to direct sunlight will erase the chip in about two weeks; fluorescent lights will take about three years. However, a single bit can be erased in a matter of seconds, making the system unusable.

If you do not have access to a programmer, a custom-programmed chip with your telephone numbers and other preferences is available from the source given in the Parts List.

Begin by installing J1, J2, and the power-supply components (IC2, BR1, D1, C1, and C2). Connect the power transformer to the appropriate terminals of J2; do not connect the battery. Check for 5 volts at the

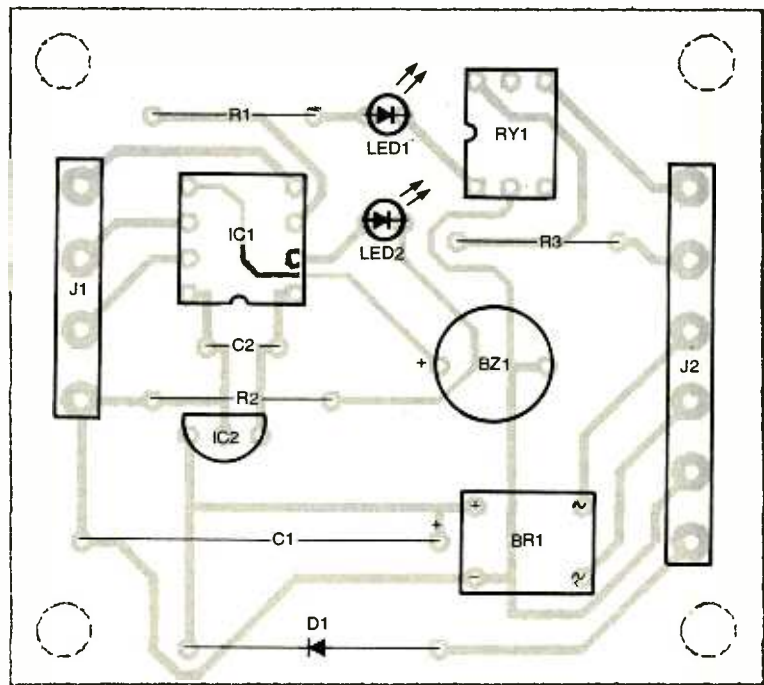


Fig. 3. Use this parts-placement diagram when building the Caller-ID Alarm from the supplied foil pattern or on a purchased PC board. The circuit is small and simple enough to fit on a single-sided PC board that only measures about 2 inches square without any jumpers.

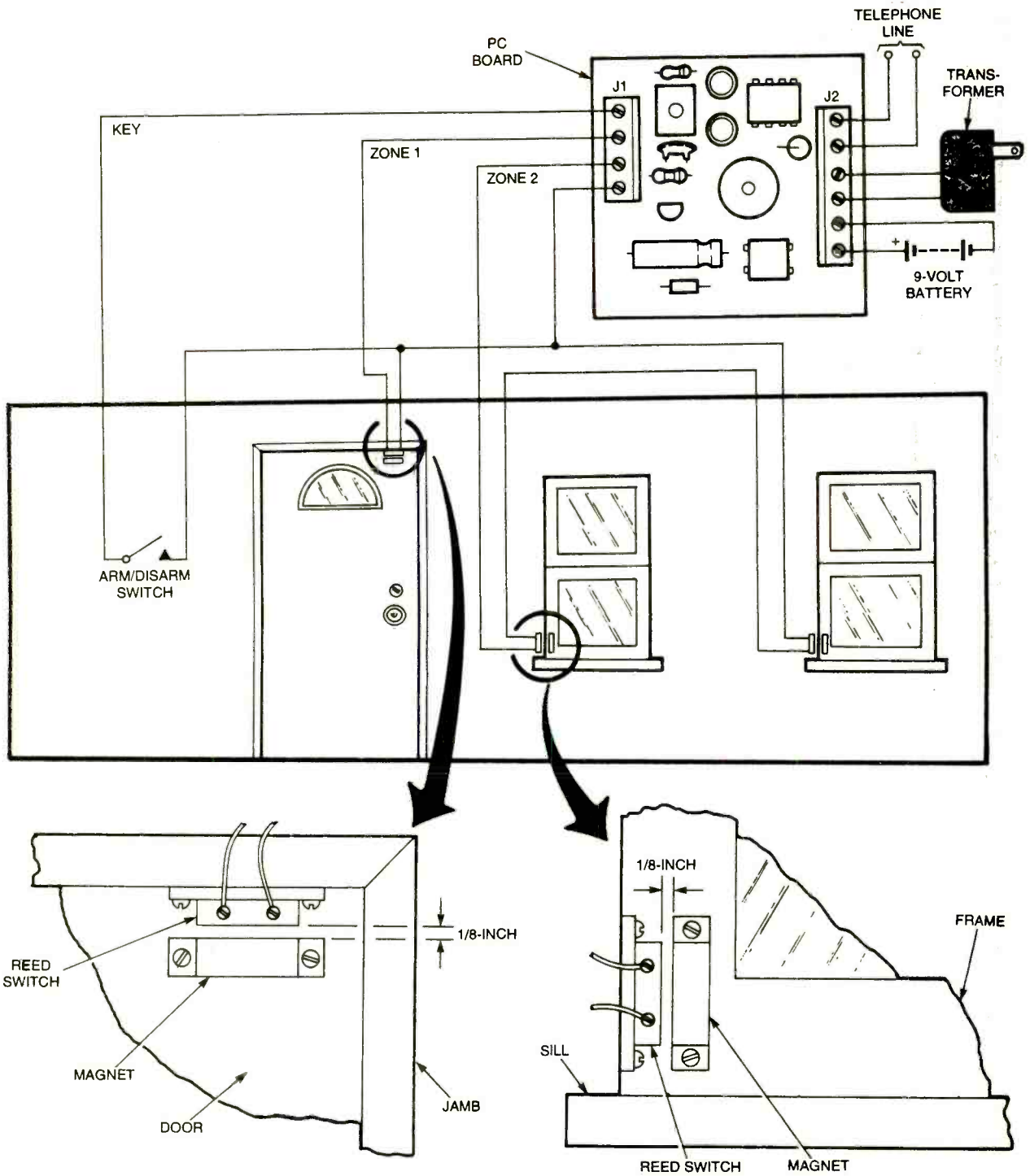


Fig. 4. Although your situation will no doubt be different, this sample shows the basics of wiring a door or window for alarm sensing. You should only wire the entry door to Zone 1 to give yourself time to deactivate the system when you enter the protected area. Windows are good candidates for Zone 2, where the alarm will be instantaneous.

output of IC2. The voltage at the battery terminal of J2 should be zero volts. Any voltage that appears there means that D1 is defective or installed backwards if the measurement is close to the transformer voltage.

Disconnect the transformer and

install the rest of the components. Use a socket for IC1. Once all of the parts have been installed, double-check your work before testing the unit.

**Testing.** Insert three 3-inch wires in the COM terminal of J1. Connect

one wire to Zone 1 and another to Zone 2. Do not connect any wires to the KEY terminal. Power up the system; LED2 should light. If it does not, remove power and check for errors such as solder shorts, mis-wirings, or polarized components that are installed backwards. Correct any

## PARTS LIST FOR THE CALLER-ID ALARM SYSTEM

### SEMICONDUCTORS

IC1—PIC12C508-04/P microcontroller, integrated circuit  
IC2—78L05 5-volt regulator, integrated circuit  
BR1—Full-wave bridge rectifier (Digi-Key DF02MGI-ND or similar)  
D1—1N914 silicon diode  
LED1, LED2—Light-emitting diode, red

### RESISTORS

(All resistors are 1/4-watt, 5% units.)  
R1—270-ohm  
R2—390-ohm  
R3—470-ohm

### CAPACITORS

C1—100- $\mu$ F, 35-WVDC, electrolytic  
C2—0.1- $\mu$ F, ceramic-disc

### ADDITIONAL PARTS AND MATERIALS

BZ1—Piezo beeper with internal drive (Jameco 76064 or similar)  
J1—4-position terminal block  
J2—6-position terminal block  
9—8-volt AC transformer, 9-volt battery clip, 9-volt battery, wire key switch, door and window security switches, wire, hardware, etc.

**Note:** The following items are available from Electronics Hobby Shop, P.O. Box 957, Frontenac, KS, 66763-0957: A complete kit of parts including IC1 and PC board (CIDALM2.KIT), \$39; custom-programmed IC1 (CIDALM2.PIC—please supply your telephone numbers, timer settings and beeper type), \$5.50; etched PC board (CIDALM2.PCB), \$5.50; door and window contacts, \$4.50 per set.

errors before proceeding with the rest of the testing procedures.

When LED2 comes on, disconnect the wire for Zone 1. The LED should start blinking in a one-flash-and-pause pattern. Reconnect the Zone 1 wire and disconnect Zone 2. The flashing pattern should be two and a pause. With both zones disconnected, the pattern should alternate between a single flash and two flashes between the pauses.

Connect both zone wires followed by the Key wire. The system will start beeping once per second as an exit time countdown. At the

end of the exit time; LED2 will go off.

Connect a telephone line to the appropriate terminals of J2 and cut one of the Zone wires, tripping the alarm. The unit should make its calls. The calls should be immediate if Zone 2 was cut or after 15 seconds for Zone 1. When it has finished, check the Caller ID box at the called telephone numbers and verify that the ID data was received.

After five minutes, the Caller-ID Alarm should make another set of calls. Once the second set of calls have been made, reconnect the Key wire; LED2 should be steady and no further calls should be made. Re-arm the system. After about a minute, cut Zone 1. Within 15 seconds, reconnect the Key wire. The Caller-ID Alarm should *not* make any calls.

Now that all of the basic functions of the Caller-ID Alarm have been tested and verified, it can be installed.

**Installation.** Mounting the Caller-ID Alarm will depend on the layout of your home, office, or whatever area you will be protecting. For example, you can mount the PC board directly on a wall in a closet using spacers to keep the terminals from touching the wall. Another method would be to mount the unit in a plastic enclosure and place it on the back of a shelf in an out-of-the-way area.

The Key switch should be installed in a spot that is not easily seen, yet can be quickly reached for disarming. You can use a simple toggle switch, or you might want to consider a key-operated switch for greater security.

The rest of the wiring will depend on how the building is designed. Figure 4 shows a sample installation. The switches shown are standard magnetic reed switches that should be closed when the door or window that they are mounted to is closed. Be sure to protect the lower half of a window, unless you have heard of intruders that climb into a room through the *upper* portion of a window!

Again, keep in mind that every building will be different, and it will be up to you to select the wiring

scheme that suits your particular surroundings.

One thing to consider is the placement of BZ1. Although there is an area for the beeper on the PC board, it is a good idea to mount the beeper away from the system so an intruder could not find and destroy it before any calls can be made.

One final maintenance note concerns the battery. Since there is no battery test built into the unit, you should check the installed 9-volt battery monthly and replace it every year.

**It Called ... Now What?** Before using the Caller-ID Alarm, you should have some sort of procedure in place for dealing with it; the details are up to you. One general suggestion is that unless you are a law-enforcement official or trained security professional, you should never enter a building that might have an intruder inside. Wait until qualified personnel (such as the local police) have searched the building and have deemed it safe for you to enter and investigate the alarm.

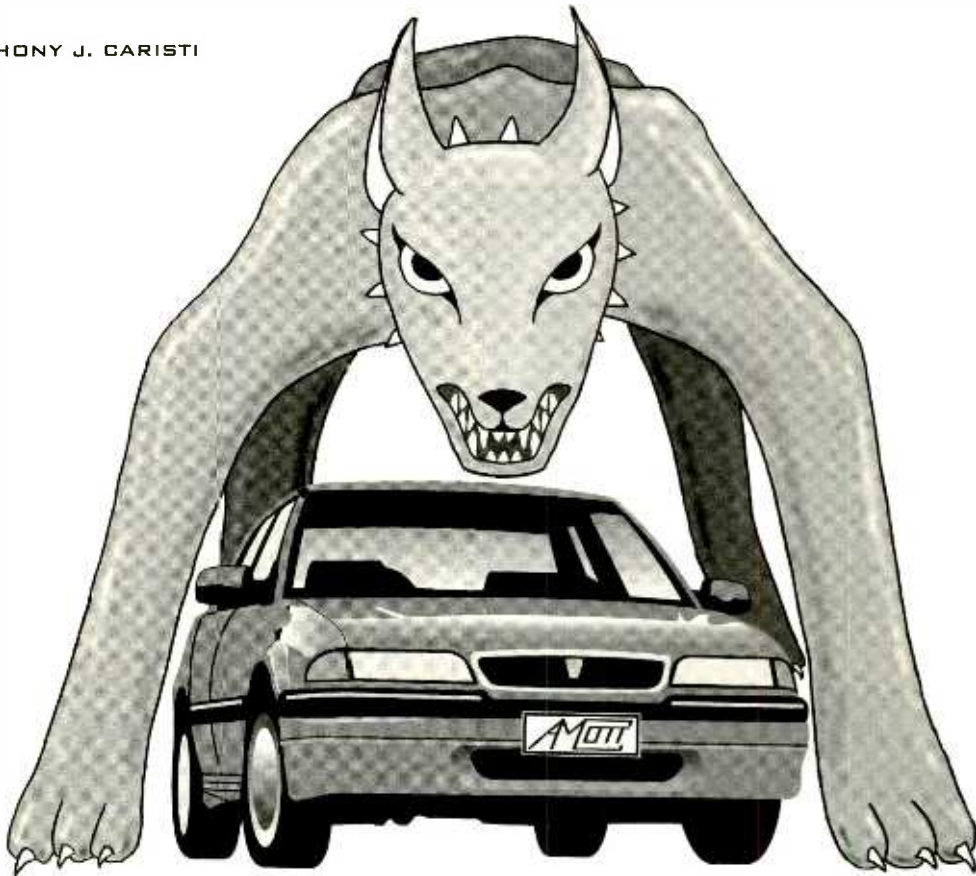
Turn off the system; it will begin flashing the zone (one, two, or both) that caused the alarm. Once the switch that triggered the alarm is closed, clear the alarm memory and disarm the system by turning the system off, then on.

The Caller-ID Alarm System is not meant to replace high-security alarms. If your small business has a remote warehouse, or you have a small cabin or even a storeroom in a high-rise apartment, this unit might just do the job. It could even be modified to ring a bell or siren by replacing RY1 with a high-current relay and modify the dialing portion of the program. It could be reduced to one zone with dialing *and* an additional relay for a bell or siren. The possibilities are only limited by your imagination.

The author would like to acknowledge George Washington (yes, that is his real name), an engineer with the city of Pittsburg, Kansas, who came up with the idea of using Caller ID for the alarm-reporting method.  $\Omega$

# THE WATCHDOG

ANTHONY J. CARISTI



If you own a late-model vehicle, you know how much of your hard-earned money is invested in it. You want to do everything possible to prevent theft; anyone who has had their car stolen knows that all of the theft insurance in the world will not fill that feeling of helplessness and loss.

One of the obvious first steps to take in that situation is to install some sort of alarm system. While there is no way to prevent the professional thief from taking your property, a loud siren will scare off the average joyrider or less-confident larcenist. When it comes down to it, no one likes being the center of attention when breaking the law.

*Protect your vehicle against theft with this easy-to-install, remote-controlled security system.*

One type of alarm system that will protect your vehicle is the Watchdog system presented here. Installation in any vehicle is extremely easy: a two-wire hookup to the vehicle's battery. Although it uses state-of-the-art UHF wireless technology, no radio expertise is needed; readily available low-cost radio-frequency modules make it easy to build. The 418-MHz circuits need no RF-alignment procedures. The entire RF circuitry of both the transmitter and the receiver is contained on low-cost hybrid modules

designed to meet all requirements of Part 15 of the FCC Rules and Regulations that govern unlicensed transmitters.

You might never need the protection that the Watchdog provides, but like its namesake, it's a nice feeling to know it's there.

**How It Works.** The Watchdog is composed of two parts: a digitally encoded portable miniature UHF transmitter "fob" that you keep when you exit the vehicle, and a companion receiver that is permanently installed under the hood of the vehicle. As we mentioned before, two wires connected to the battery of the vehicle are all that is required to install the system. The

receiver draws just a couple of milliamps of current, so it can never run the battery down.

When you leave your car, simply press the "ON" button on the Watchdog's transmitter. The siren then chirps, verifying that the system is activated. Once armed, the system senses the opening of a door of the vehicle, sounding a siren for several minutes before shutting off and rearming itself.

Before reentering the vehicle, you deactivate the system by pressing the "OFF" button on the transmitter. Another chirp from the siren indicates that it is disarmed; you can now enter the car without sounding the alarm.

Another feature of the Watchdog is that it can be used as a panic alarm in case of an emergency. If the transmitter's "ON" button is pressed while the engine is running, the alarm will sound.

**Transmitter.** While its schematic diagram (Fig. 1) might look simple, the Watchdog's transmitter has a fair amount of sophistication built into it thanks to the use of specialized ICs.

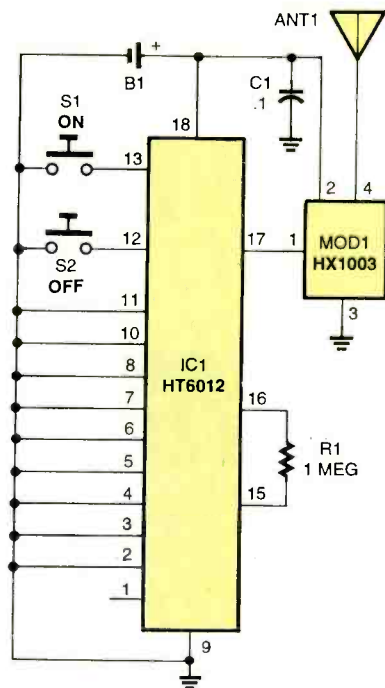


Fig. 1. The Watchdog's transmitter uses a single-chip hybrid module for RF transmissions; no adjustments are needed, and the unit complies with FCC regulations.

The heart of the circuit is IC1, the encoder half of a digital encoding/decoding system developed

by Holtek Microcircuits specifically for wireless applications such as the Watchdog. An encoded "key" is needed to prevent the system from being compromised by interference, other transmitters operating on the same frequency, or unauthorized signals being aimed at the receiver. That key is generated by IC1. Although the Watchdog uses a digital-encoding system, each of the ten bits can have one of three states: logic zero, logic one, or open circuit. With that arrangement, a total of 59,1049 different addresses can be set. Note that in Fig. 1, one address selector (pin 1) is left open, while the other nine (pins 2-8, 10, and 11) are grounded. Any combination of grounded, open, or supply-voltage connections may be selected; especially useful if you want to use several Watchdogs.

Pressing either S1 or S2 activates IC1; an encoded pulse train appears at pin 17. Not only does that pulse train contain the address setting, it also contains the status of S1 and S2. That way, the system knows which button was pressed.

That pulse train is passed to MOD1, a UHF transmitter module.

## PARTS LIST FOR THE WATCHDOG

### SEMICONDUCTORS

- IC1—HT6012 remote-control encoder, integrated circuit
- IC2—3.3-volt regulator, integrated circuit (Digi-Key 158-1088-ND or similar)
- IC3—OPA2340PA op-amp, integrated circuit
- IC4, IC6—LMC555CN CMOS timer, integrated circuit
- IC5—HT6032 remote-control decoder, integrated circuit
- MOD1—HX1003 418-MHz hybrid transmitter, integrated circuit
- MOD2—RX1300 418-MHz hybrid receiver, integrated circuit
- Q1—IRL540N N-channel MOSFET transistor
- Q2, Q3—ZVN3310A N-channel MOSFET transistor
- D1, D5—1N4004 1-amp, 400-PIV silicon rectifier diode
- D2—D4, D6—1N4148 general-purpose silicon diode
- D7—1N5817 Schottky diode

### RESISTORS

- (All resistors are 1/4-watt, 5% units unless otherwise noted.)
- R1—1-megohm, 1% metal-film
  - R2—100-ohm
  - R3, R5—47,000-ohm
  - R4, R6—R8, R13, R15—470,000-ohm
  - R9, R14—1-megohm
  - R10—220,000-ohm
  - R11—10-ohm
  - R12—90,900-ohm, 1% metal-film

### CAPACITORS

- C1—0.1- $\mu$ F, ceramic-disc
- C2—100- $\mu$ F, 25-WVDC, electrolytic
- C3, C4, C6, C11—1- $\mu$ F, 25-WVDC, electrolytic
- C5, C7—0.001- $\mu$ F, ceramic-disc
- C8, C12, C13, C15—0.1- $\mu$ F, ceramic-disc
- C9—220- $\mu$ F, 25-WVDC, electrolytic
- C10, C14—10- $\mu$ F, 25-WVDC, electrolytic

### ADDITIONAL PARTS AND MATERIALS

- ANT1—Insulated wire, 6ft inches

- ANT2—Insulated wire, 6 1/2 or 13 inches (see text)
- B1—3-volt Lithium coin-cell battery, BR1225 or similar
- BZ1—12-volt siren (Mouser 539-PS723 or similar—see text)
- S1, S2—Single-pole, single-throw momentary-contact pushbutton switch (Mouser 101-0461 or similar)
- Transmitter case (Mouser 616-71971 or similar), receiver case, wire, hardware, etc.

**Note:** MOD1 and MOD2 may be purchased from Spectrum Microwave Products, Norcross, GA; Tel: 888-977-3267.

**Note:** The following items are available from: A. Caristi, 69 White Pond Road, Waldwick, NJ 07463: Set of two etched and drilled PC boards, \$24.75; IC1, \$6.75; IC2, \$3.00; IC3, \$6.75; IC4, \$3.00; IC5, \$6.75; IC6 \$3.00. Please add \$5.00 postage/handling. NJ residents must add appropriate sales tax.



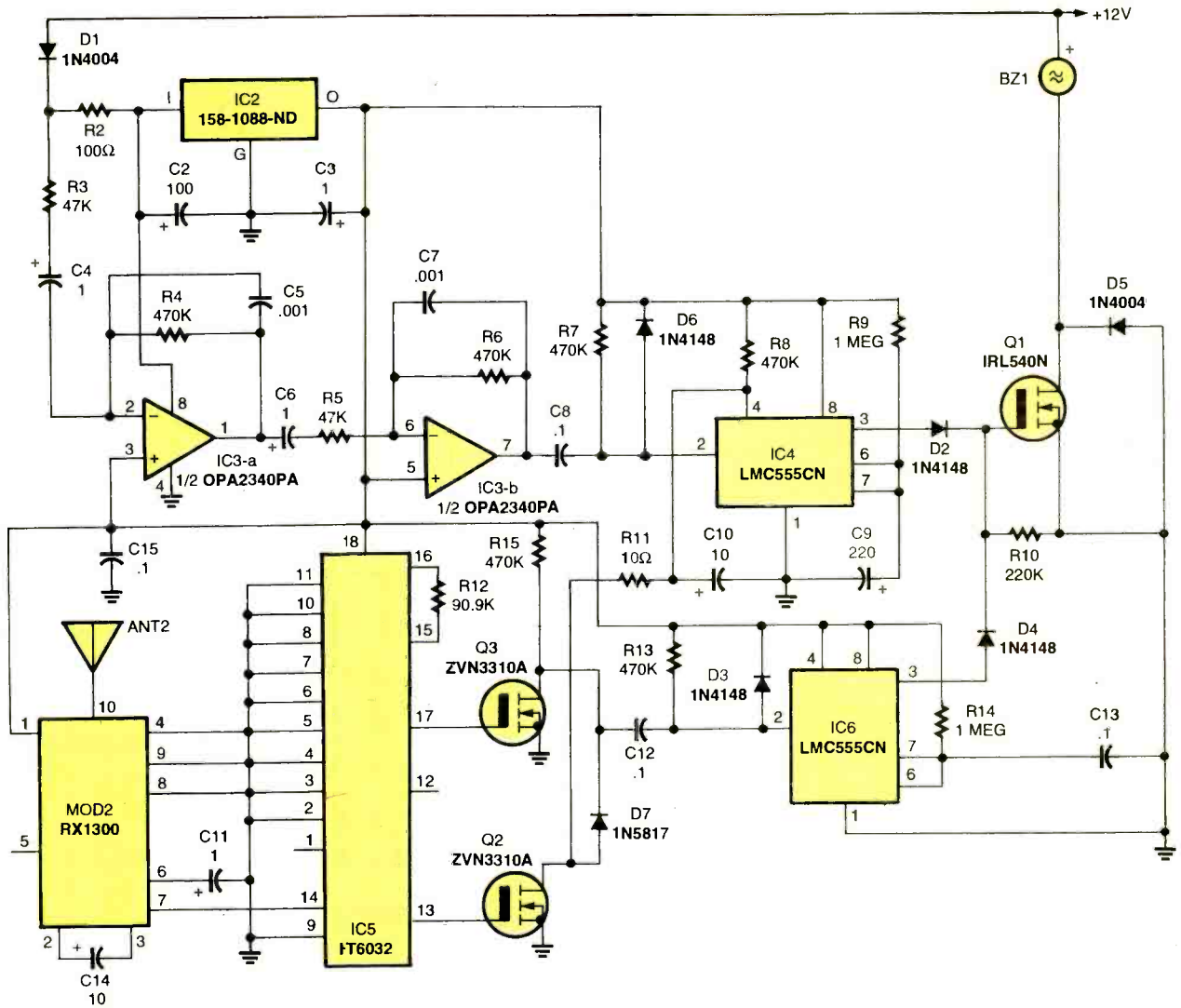


Fig. 2. The Watchdog's receiver senses if a door has been opened by watching for any voltage sag on the battery.

Within that module is a surface-acoustic-wave (SAW) stabilized UHF oscillator. The internal SAW filter is set for a frequency of 418 MHz. A second SAW filter removes any undesirable harmonics from the carrier wave. When the pulse train from IC1 is sensed on pin 1 of MOD1, a series of RF pulses appear on pin 4. That type of modulation is called *amplitude-shift-keying* modulation. The RF signals are transmitted by ANT1, a short antenna wire about six inches long. The hybrid module is capable of delivering about 1 mW peak power at 0 dBm into a 50-ohm load, one of the features that makes the system comply with FCC regulations.

Power for the circuit is provided by a 3-volt lithium coin cell. Current drain during standby periods is only

a microamp or two, so no off/on switch is needed.

**Receiver.** The companion receiver for the Watchdog is shown in Fig. 2. RF signals from the transmitter are picked up by ANT2 and demodulated by MOD2. That receiver module represents a new technology called *Amplified Sequenced Hybrid* (ASH), which was developed by RF Monolithics. The ASH receiver contains a SAW bandpass filter, two RF amplifiers, a SAW delay line, an RF detector, and digital-control circuitry. It is fixed-tuned by the filter circuits so that it operates at only the desired receiving frequency, needing just 3 volts of power. The novel approach to the internal workings of the module hinge around the two RF amplifiers; the output of the

first is connected to the input of the second through the delay line. The digital control turns the amplifiers on and off such that neither is on at the same time. That technique lets the hybrid run at very high gain levels without the possibility of oscillation. The demodulated pulse train is output on pin 7.

The ten address lines of decoder chip IC5 are wired the same as the encoder, so that the receiver responds only to its companion transmitter. Again, note that Fig. 2 is drawn with the same code as the transmitter (Fig. 1). As long as two successive pulse trains contain the correct address, the "valid output" terminal (pin 17) goes high; it remains in that state as long as the transmitter is operating.

The status bits of S1 and S2

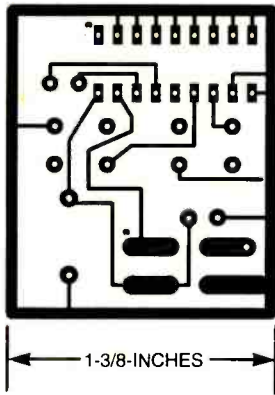


Fig. 3. Here's the foil pattern for the Watchdog's transmitter.

appear on pins 12 and 13. Since we have a "button-pressed" signal appearing on pin 17, only pin 13 is used. The button status remains latched after the transmission stops until a new valid transmission is received.

The Watchdog receiver is powered by the vehicle's battery. Diode D1 protects the circuit from any reverse-voltage transients that might appear in the electrical system. Regulator IC2 provides a 3.3-volt power source for the rest of the circuit.

The battery voltage is monitored by IC3-a and IC3-b, a pair of identical op-amps that are cascaded together and AC coupled. The inverting input of IC3-a is AC coupled to the vehicle's battery so that it can detect a sudden sag in battery voltage that would be caused

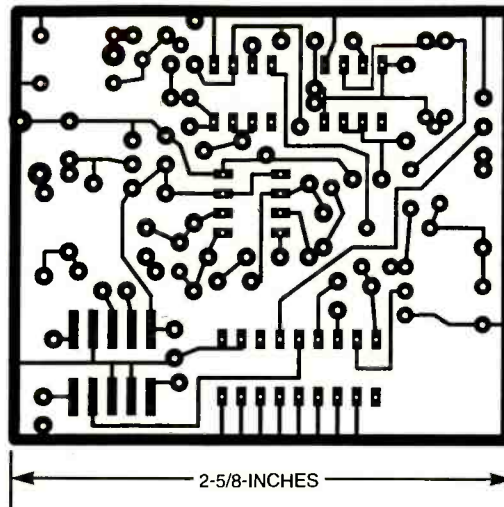


Fig. 5. Here's the foil pattern for the Watchdog's receiver.

by the current draw of the vehicle's dome lamp when a door is opened.

Each op-amp has an AC gain of about 10; the total gain of both stages together is 100. Only a 30-millivolt drop is needed for a 3-volt

negative pulse at the output of IC3-b. That pulse is more than sufficient to trigger IC4.

The enable input of IC4, pin 4, is controlled by IC5's button-data pin. If the "off" button, S1, was last pressed, pin 13 of IC5 will be high, turning on Q2 and grounding pin 4 of IC4. That prevents IC4 from being triggered by IC3-b.

If, on the other hand, the "on" button was the last one pressed, Q2 turns off and pin 4 of U4 slowly rises to 3 volts as R8 slowly charges C10. Once C10 is charged, IC4 will respond

to a trigger pulse, generating a positive-going pulse at pin 3. The duration of that pulse is set by R9 and C9; about four minutes with the values shown.

The output of IC4 turns on Q1, which then powers siren BZ1. When

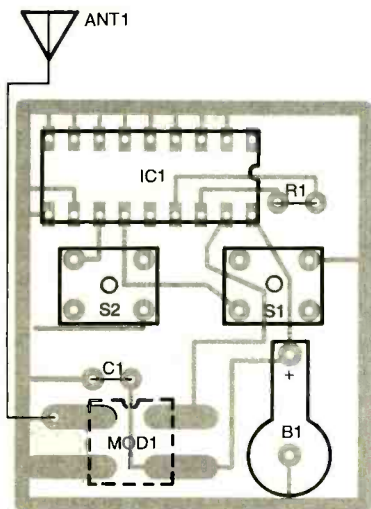


Fig. 4. The transmitter, thanks to its low parts count, is small and compact. Note that MOD1 is installed on the solder side of the board.

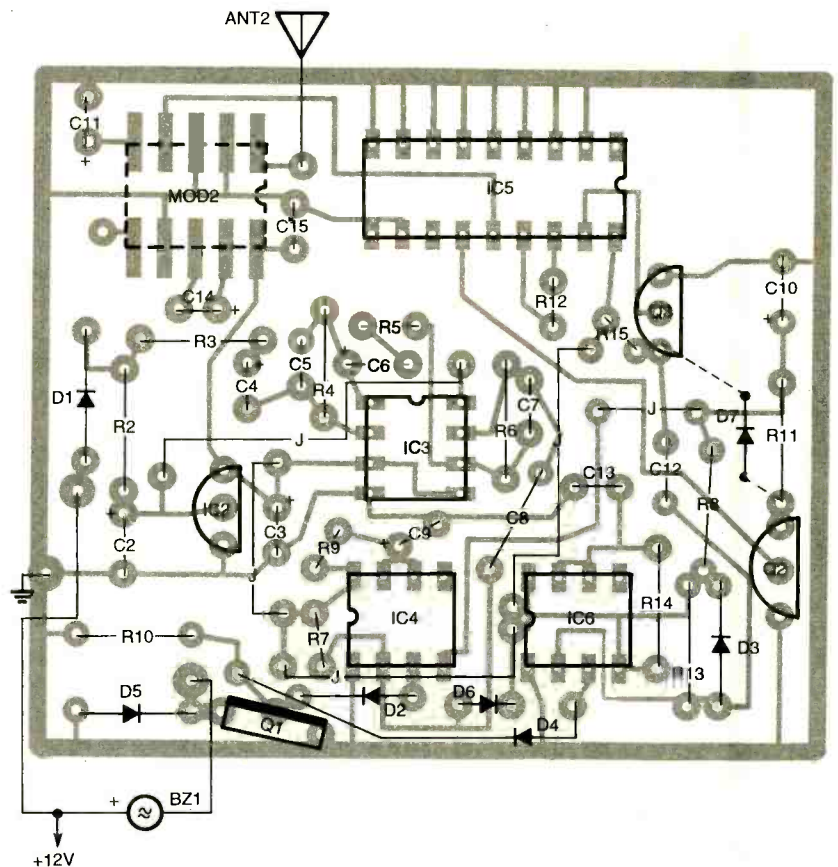
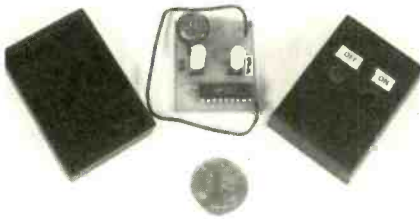


Fig. 6. The receiver, while more complex than the transmitter, also uses a single-sided board; several jumpers are needed. Like its companion on the transmitter, MOD2 is installed on the solder side of the board. Also note how D7 is installed. Likewise, the leads for Q1 will need to be formed to match the hole pattern (see text).



The completed transmitter board is ready for installation in its case. Note how ANT1 is wrapped around the assembly.

IC4 times out, it resets, silencing BZ1; the circuit is ready for another trigger pulse from IC3.

As we mentioned before, pin 17 of IC5 goes high whenever one of the transmitter buttons is pressed. That turns on Q3, which is capacitively coupled to the trigger of IC6. The output pulse of IC6 is 0.1 second long. Through D4, IC6 "chirps" the siren, verifying that both the transmitter and receiver are working.

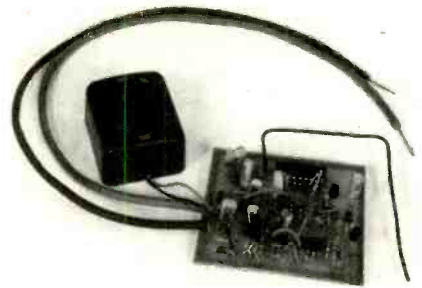
**Transmitter Construction.** The transmitter is best constructed on a printed-circuit board. Perfboard is not practical in this case because of the surface-mount components

involved. If you use the supplied single-sided foil pattern shown in Fig. 3, the parts-placement diagram in Fig. 4 should be followed. If you do not wish to etch your own board, one is available from the source given in the Parts List.

When assembling the board, do not install MOD1 or ANT1; that will be done later. Also, do not insert the battery into its holder until you are told to do so. Be sure to install IC1 the right way around; a reversed part will be destroyed the moment power is applied. The battery holder must also be installed correctly. Note that if you do install it the wrong way, the holes for S1 will be blocked. You may use a socket for IC1 if you wish, although it can be soldered directly to the board.

Locate and drill two holes in the case for the buttons that are mounted to S1 and S2. The completed board and case can be seen in the accompanying photo.

When you are finished with the board, check it over carefully for bad solder connections, and open or short circuits. Any solder joint that



In this photo of the completed receiver unit, you can see how Q1 is installed.

is not smooth and shiny is suspect and should be redone by removing the old solder, cleaning the joint, and resoldering. It is much easier to correct problems now rather than later on should you discover that the transmitter is not working.

Once you are satisfied with your work, set the transmitter board and case aside.

**Receiver Construction.** All of the above instructions relating to building the transmitter apply equally to the receiver. Figure 5 is the foil pattern for the single-sided PC board;

# SENCORE

High Quality Test Equipment At Affordable Prices



SC301

OSCILLOSCOPES

MULTIMETERS



DM500

DM501

POWER SUPPLIES



PS402                      PS400                      PS401

CALL TODAY  
1-800-SENCORE  
or e-mail  
sales@sencore.com



PR570

VARIABLE ISOLATION  
TRANSFORMER & SAFETY  
ANALYZER



CD-ROM  
TRAINING

**SENCORE**  
3200 Sencore Drive Sioux Falls, SD 57107  
1-800-SENCORE • www.sencore.com

CIRCLE 138 ON FREE INFORMATION CARD

www.americanradiohistory.com

# ATTENTION! ELECTRONICS TECHNICIANS

EARN YOUR  
**B.S.E.E.  
DEGREE**



## THROUGH HOME STUDY

Our Highly Effective Advanced-Placement Program for experienced Electronic Technicians grants credit for previous Schooling and Professional Experience, and can greatly reduce the time required to complete the program and reach graduation. No residence schooling required for qualified Electronic Technicians. Through our Special Program you can pull all of the loose ends of your electronics background together and earn your B.S.E.E. Degree. Upgrade your status and pay to the engineering level. Advance rapidly! Many finish in 12 months or less! Students and graduates in all 50 states and throughout the world! Established Over 50 Years! Write or call for free Descriptive Literature. (601) 371-1351

**COOK'S INSTITUTE  
OF ELECTRONICS ENGINEERING**

 4251 CYPRESS DRIVE  
JACKSON, MISSISSIPPI 39212

CIRCLE 282 ON FREE INFORMATION CARD

the parts-placement diagram is shown in Fig. 6.

As with the transmitter, MOD2 and ANT2 are not to be installed at this time. Since the receiver will be installed in the car, it will be subject to much more vibration and temperature extremes than the transmitter. For that reason, it is recommended that the integrated circuits be soldered directly to the board without the use of sockets. Note that D2 is mounted by drilling appropriate holes in the board, inserting the component into those holes, and folding the leads over in the directions shown. Be careful not to cause a short to any of the PC-board traces in the area. Solder the diode leads to the connections shown in Fig. 6.

While it might appear that Q1 is inserted straight into the board, it is not. The gate lead (normally on the left when reading the MOSFET's markings) is bent so that it uses the center hole next to D2 and D4. The center lead (drain) connects to D5. A heatsink is not needed for transistor Q1.

Several jumper wires are needed by the receiver. Use insulated wire for the connections to prevent any accidental shorts as the jumpers pass over the various component leads.

Once you've inspected your workmanship for any mistakes, the Watchdog is ready for testing.

**Siren Selection.** You will need to temporarily attach the siren (BZ1) to the receiver for testing. While the unit given in the Parts List is one possible siren that can be used with the Watchdog, others can be used as long as they do not draw more than two amps. That current level can safely be handled by Q1 without the need of a heatsink.

The suggested unit in the Parts List is rated at 150 milliamps.

**Testing.** To test the Watchdog, make three temporary connections between IC1 on the transmitter and IC5 on the receiver. Connect pin 18 to pin 18 and pin 9 to pin 9. That way, the regulated 3.3-volt power supply on the receiver will power the transmitter as well. In addition, make a connection from pin 17 of IC1 to pin 14 of IC5. That will feed the encoded output of the transmitter directly to the input of IC5.

Connect the receiver to a well-regulated 12-volt DC power source. One ripple-free source is a 6- or 12-volt battery. Whatever power supply that you use should have enough current capacity to drive the siren that you are using; a common 9-volt transistor-radio battery is not suitable.

With power applied, measure the voltage at the positive side of C3. You should be reading about 3.3 volts. If not, disconnect the power and troubleshoot the circuit to locate and repair the fault. Possible areas to check include the orientation of D1, IC2, C2, and C3. Measure the resistance to ground at the positive end of C2 and C3 to be sure that there is no short circuit to ground; you should read in the thousands of ohms. You might need to replace IC2. In any case, do not resume testing until IC2 is properly outputting a regulated 3.3 volts to the circuit.

Press S1 and S2 separately; there should be a short beep from BZ1. If BZ1 doesn't work, check pin 17 of IC5 with a voltmeter or oscilloscope; it should switch from ground to about 3 volts when either switch is held down. If not, the problem could be with IC1 or IC5.

If IC5 is working, check D2-D4, Q1-Q3, and IC6. Make sure that those parts are properly inserted into the board. You can manually trigger IC6 by momentarily shorting pin 2 to ground; there should be a 0.1-second pulse at pin 3. That pulse should be traceable through D4 and Q1 and, ultimately, BZ1. You might need to try a new transistor or IC. Don't forget to check the connections to BZ1.

The final test verifies that the alarm will sound when the 12-volt power-supply voltage sags. The best way to make that test is to connect the receiver/transmitter assembly to the battery of a vehicle with the engine off. Press S1 and then S2 to arm the system. There should be a chirp from BZ1 each time. Wait about 30 seconds and then open the door of the vehicle. The alarm should sound. It will automatically shut off after a few minutes, or pressing the "off" pushbutton can silence it.

If the receiver does not respond to the opening of the door, check around IC3 and IC4. Like IC6, you can manually trigger IC4 in the same way. Check pin 13 of IC5 to verify that it goes to zero volts when the system is on. Also look into Q2, Q3, and D2.

If the Watchdog passes those tests, it is ready for final assembly and installation.

### Transmitter Final Assembly.

Disconnect power from the circuit and remove the temporary wires that connect the transmitter and receiver together. Disconnect BZ1.

Install MOD1 on the solder side of the transmitter board. Start by tinning both the pins of MOD1 and the pads on the PC board. Doing so will help achieve a solid solder connection. When tinning MOD1, keep the application of heat to an absolute minimum.

Place MOD1 on the board, carefully lining up the pins with the

pads. Double check the orientation before proceeding. Solder MOD1 in place using only enough heat to attain a good connection. Do only one terminal first and examine the position of the remaining three terminals. If everything lines up, solder the rest in place.

Use a 6ft-inch piece of insulated wire for ANT1. Wrap ANT1 around the PC board as shown in the photo. Insert B1 into its holder, place the board in the case, and close it up.

**Receiver Final Assembly.** Install MOD2 on the receiver board in the same way that MOD1 was installed on the transmitter board. A similar piece of insulated wire is used for ANT2. You can use a 6 1/2-inch length for a 1/4-wavelength antenna or double it to 13 inches for a 1/2-wave antenna; the longer length will have a greater operating range.

Since it will be installed in the engine compartment of the vehicle, it should be housed in a small plastic enclosure to keep dirt, grease, and other "underhood nas-

ties" away from the circuitry. Holes should be drilled for the power leads, BZ1, and ANT2. The power leads should be of at least 16-gauge wire; red and black colors will help identify which wire is which. The wires for BZ1 can be 18 gauge in size.

Mount the receiver in the engine compartment of the vehicle as close as possible to the battery. Be sure to choose a location that is protected from road hazards such as rain and snow, and keep the unit away from any part of the engine that operates at a high temperature, moves, or rotates. Stretch the antenna wire so that it is reasonably straight.

**Using The Watchdog.** Take the transmitter with you each time you leave the vehicle. After closing and locking the doors, press the "ON" button. A short beep from BZ1 will verify that the Watchdog is armed.

If a door is opened while the Watchdog is armed, the alarm will go off. It will automatically go off after a few minutes, but may be

manually turned off using the transmitter's "OFF" button.

When you return to the vehicle, press the transmitter's "OFF" before entering. The beep verifies that the system is disarmed; the vehicle may be entered without sounding the alarm.

To use the Watchdog as a panic alarm while the engine is running, simply press the transmitter's "ON" button. The alarm will go off after a short delay due to the timing function of R8 and C10.

Normal battery life for the transmitter will depend upon how many times the circuit is activated; it should be a year or more with normal use. If the transmitter seems to be losing range or becomes erratic, replace the battery. Ω



**HOME AUTOMATION KIT**

- Software Included
- Use Existing Wiring
- Simple Inexpensive

1-800-928-5299    [www.marrickltd.com](http://www.marrickltd.com)

**A Convincing Performance at an Unbelievably Low Price!!**

# MOTOR CONTROLLER

**Low Price**



Universal Controller  
**UVC2001 series**



Integrated 2-axis Controller  
**EMC2M**

## Universal Controller

### UVC2001 series

- Multi-functional controller featuring counter, general-purpose I/O interface, analog input and trigger output capabilities, in addition to the basic motor control functions (positioning or rotational control)
- Micro-driver built-in type suitable for stepping motors, and driverless type for servomotors

## Integrated Controller

### EMC series

- RS-232C/RS-485 communications
- 5-phase stepping motor driver incorporated
- 2-/3-axis simultaneous control available.
- Easy multiple-axis control through RS-485 communications (up to 16 units)

URL = <http://www2.dango.ne.jp/onomichi/inh/>

E-mail = [inh@orange.ocn.ne.jp](mailto:inh@orange.ocn.ne.jp)

**INH International Hanbai Co., Ltd**  
22-30 Kanda-cho, Onomichi, Hiroshima, 722-0016, Japan

January 2000, Poptronics

# Electronic Padlock

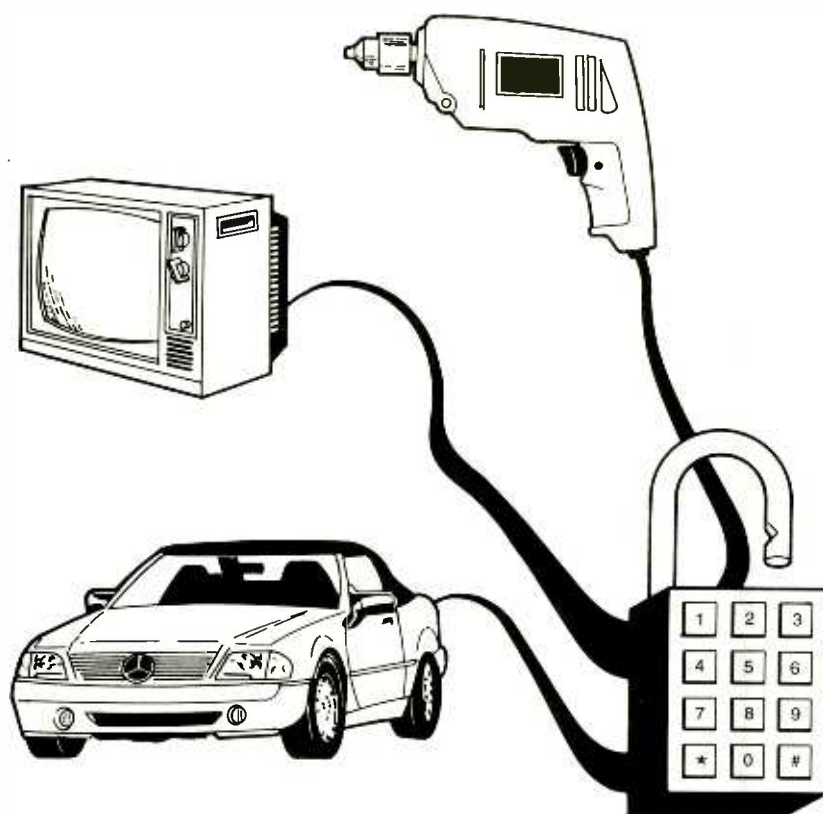
*Electronic locks can block access to your computer terminal, prohibit ignition in your automobile, be used in a host of other applications where preventing unauthorized access to important data or use of expensive equipment is paramount.*

JON VARTERESIAN

**T**here's just no way around it. Wherever you look, electronic gadgets of all types are replacing their mechanical counterparts. For example, mechanical ignition systems in automobiles have been supplanted by solid-state electronic mechanisms. In addition, in many large corporations—where protecting company secrets and other assets is often more important than securing the products they manufacture—old-fashioned keylocks have been replaced by electronically controlled locking mechanisms. Who knows, in a decade or so, keylocks may follow the dinosaur into extinction.

The technology behind electronically controlled, keyless locks has been around for some time now, but is only now finding widespread application in the consumer marketplace—witness the proliferation of electronic doorlocks and lockout mechanisms used in modern automobiles.

In this article, we'll show you how to build your own electronic lock—dubbed the *Electronic Padlock*—which can be used to secure almost all of your valuable possessions. The Electronic Padlock is an extremely useful device designed to help you control the use of your electrical and electronic equipment. Attach one to your power tools to keep your children from accidentally turning them on and causing injury. Connect one to your PC and keep unauthorized people from accessing your data. Add a



solenoid and you have an electronic door lock. Use it in your car or boat as a security system. The applications are limited only by your imagination.

The hardware of the Electronic Padlock is centered around Microchip Technologies PIC16C54A microcontroller. The Padlock contains an EEPROM (electrically erasable programmable read only memory) that stores your personal 4-digit security code. Once it's pro-

grammed, only you can change the security code. Even if power to the Padlock is lost or removed, your code is remembered, and your equipment kept safe. Don't worry, if you forget your code—there is an emergency override built into the hardware.

The Padlock contains a power relay to let you switch an AC or DC load. The relay is rated for 8 amps at 250 volts AC or 5 amps at 30 volts DC. A 117-volt AC to 12-volt DC

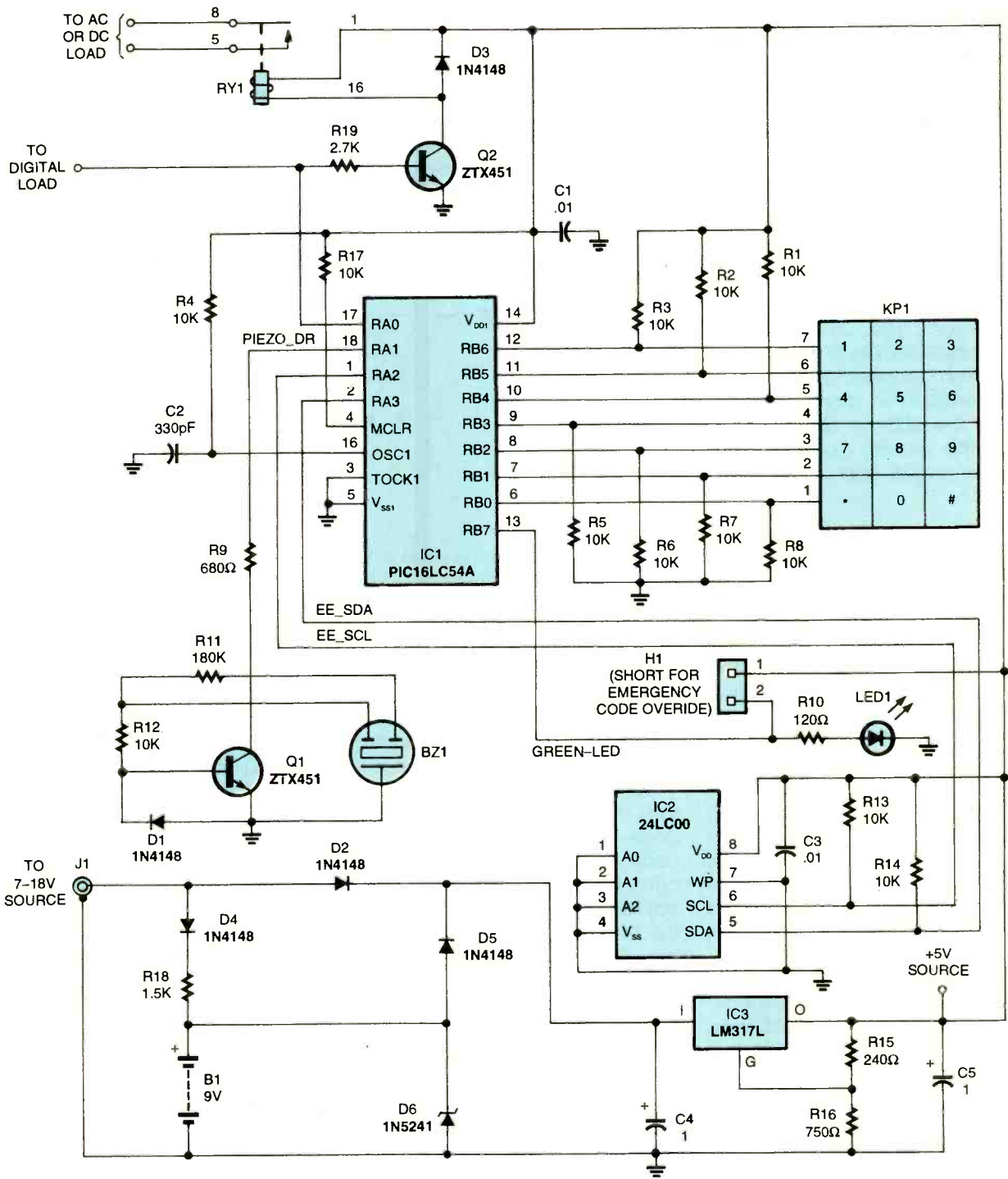


Fig. 1. At the heart of the Electronic Padlock is a PIC16C54A (IC1), a general-purpose microcontroller that features 12 I/O lines, 512 bytes of ROM, and 25 bytes of SRAM.

standard wall transformer (also known as a wall wart or power brick) provides power for the Padlock. The Padlock also will run from a 9-volt NiCd rechargeable or alkaline battery for many hours in case of power failure. When operating from the power brick, the NiCd battery is automatically charged.

**Padlock Operation.** To lock the Padlock, simply enter your 4-digit security code via the 12-key keypad, which causes the Padlock to emit a short beep for each key pressed. The 4-digit security code can consist of any combination of numbers from 0 through 9. Once you've entered the correct security code, the Padlock emits a 1/2-sec-

ond beep, de-energizes the relay, and turns the LED off to indicate that the circuit is in the locked mode.

To unlock the Padlock, simply enter the selected 4-digit code. Once the correct security code is entered, the unit emits a 1/2-second beep, energizes the relay, and turns the LED on, indicating an unlocked

condition. If power to the Padlock is interrupted, the circuit defaults to the locked state.

To change the lock code, the Padlock must be in the unlocked state (i.e., the LED must be on). Once the unit is unlocked, press and release the pound (#) and asterisk (\*) keys simultaneously. At that point, the Padlock emits three short beeps, confirming that it has entered the program mode. The device is now ready to accept a new 4-digit code. Simply type the new code. After the 4<sup>th</sup> and last key has been pressed, the Padlock again emits three short beeps and flashes the LED to confirm code entry. The security code has now been changed and stored in the EEPROM.

**About The Circuit.** The Electronic Padlock is comprised primarily of three integrated circuits—IC1, the PIC16C54A microcontroller; IC2, a 24LC00 CMOS 16 × 8 serial EEPROM; and IC4, an LM317L positive, low-power, adjustable voltage regulator. Also included in the circuit are a pair of ZTX451 bipolar transistors, Q2 and Q1; five 1N4148 general-purpose switching diodes (D1–D5), a 1N5241 11.0-volt, 0.5-watt Zener diode (D6); a light-emitting diode (LED1); a piezoelectric buzzer (BZ1); and assorted support components. A complete schematic diagram of the circuit is shown in Fig. 1.

At the heart of the Electronic Padlock is IC1 (the PIC microcontroller), which features 12 I/O lines, 512 bytes of ROM, and 25 bytes of SRAM. The PIC is responsible for sampling the keypad, controlling the LED and relay, storing and retrieving the security code from the EEPROM, and beeping the piezoelectric buzzer.

Resistor R4 (a 10,000-ohm unit) and capacitor C2 (330 pF) combine to generate the clock signal required for the operation of the PIC (which is configured to operate in RC mode). With the values chosen for R4 and C2, the clock frequency is approximately 256 kHz.

The 4-digit security code is stored in the 24LC00 EEPROM (IC2). The EEPROM contains 256 bytes of data, of which only the first five are

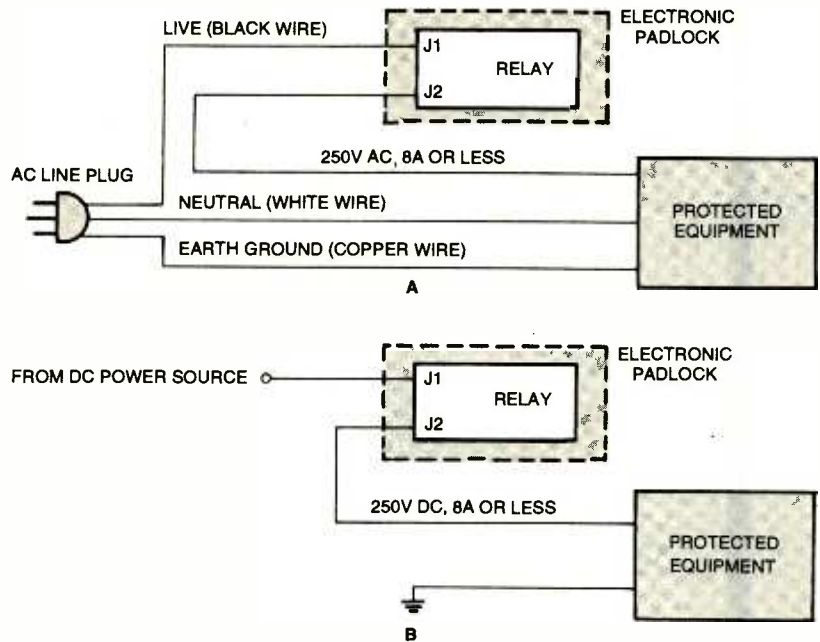


Fig. 2. The load's power source (AC or DC) dictates the manner in which the load is connected to the Electronic Padlock. The diagram in A illustrates how AC loads can be safely connected to the Padlock, while illustration B outlines DC-load connection.

used. As each key on the keypad is pressed, the PIC captures the event and translates the key press into a hexadecimal code, which is compared against the codes read from the EEPROM after a power up.

EEPROM address 0 contains the last digit in the 4-digit security code. For example, if the security code were 1-2-3-4, address 0 would contain the digit 4 (0 × 04), while address 1 contains the third digit of the security code; address 2 contains the second digit and address 3 contains the first digit.

EEPROM address 4 contains the inverted sum of all four digits. That value is used to validate the stored security code. If the inverted sum of addresses 0 through 4 does not equal the value stored in address 4, the code is marked invalid and the EEPROM rewritten with the default code—1-2-3-4. That's how the Padlock initializes the EEPROM for the very first time. In our example of 1-2-3-4, address 4 would

contain INV(0 × 1 + 0 × 2 + 0 × 3 + 0 × 4) or INV(0 × 0A) or 0 × F5.

Resistors R13 and R14 (10K units) are used to pull the EEPROM's clock (EE\_SCL) and data (EE\_SDA) lines (IC1 pins 1 and 2, respectively) to 5 volts when not in use. Communications to and from the EEPROM take place over those two lines. The data line is bi-directional—meaning that the PIC can use the line to communicate with the EEPROM and the EEPROM can use the line to communicate with the PIC. Obviously, something has to ensure that the two won't wind up trying to talk at the same time! That task is accomplished through the

**TABLE 1—RELAY ELECTRICAL SPECIFICATIONS**

PARAMETER	VALUE
Initial Contact Resistance, Max. (6V @ 1A)	30 milliohms
Normal Switching Capacity	8A @ 250VAC, 5A @ 30VDC
Max. Switching Power (resistive)	2000VA, 150W
Max. Switching Voltage (resistive)	380VAC, 125VDC
Max. Switching Current (resistive)	8A
Coil (polarized) 20° Celsius	192mW Min., 300mW Nominal



use of a serial communications standard, known as the Inter-IC Communications protocol or I<sup>2</sup>C, for short.

The I<sup>2</sup>C protocol consists of a two-wire serial interface developed as a joint venture by Philips and Signetics. The original specification, or "standard mode," was developed for data-transfer rates of up to 100,000 bps. An enhanced specification, or "fast mode," supports data transfers of up to 400,000 bps. Both standard and fast modes can coexist on the same serial bus. I<sup>2</sup>C operates in the standard mode. The I<sup>2</sup>C interface uses a comprehensive protocol to ensure reliable transmission and reception of data. When transmitting data, one device is the "master" (generates the clock), while all other devices on the bus act as "slaves."

In the Padlock, the PIC is always the master device, initiating all data transfers. The EEPROM is always the slave device, responding to the PIC's commands. In the I<sup>2</sup>C interface protocol, each device has an address. When a master wishes to initiate a data transfer, it first transmits the address of the device with which it wishes to communicate. All of the slave devices "listen" to see if it's their address, but only the target device responds.

Within the address field, a bit specifies whether the master wishes to read from or write to the target device. In the case of IC2, the EEPROM, there is a fixed constant in the address field. That's because IC2 was designed to be the only slave device on an I<sup>2</sup>C interface bus and, therefore, it does not require an address. In all cases, however, the master device generates the clock for the data transfer. For more detailed information on the I<sup>2</sup>C protocol, refer to the Microchip data-book or to the Phillips/Signetics document, "The I<sup>2</sup>C Bus and How to Use It."

The keypad (KP1) for the Electronic Padlock is a 4-row by 3-column encoded unit that contains a total of 12 keys, designated 0 through 9, plus the "#" and "\*." As each key is pressed, IC1 decodes the signal generated by the pressed key and checks to see if

## PARTS LIST FOR THE ELECTRONIC PADLOCK

### SEMICONDUCTORS

- IC1—PIC16LC54A microcontroller, integrated circuit  
 IC2—24LC00 CMOS 16 × 8 serial EEPROM, integrated circuit  
 IC3—LM317L positive, low-power, adjustable voltage regulator, integrated circuit  
 Q1, Q2—ZTX451 medium-power, NPN silicon transistor  
 D1—D5—1N4148 general-purpose, small-voltage, silicon switching diode  
 D6—1N5241 11.0-volt, 0.5-watt Zener diode  
 LED1—Light-emitting diode (green)  
 BZ1—Piezoelectric buzzer (Digi-Key #P9915)

### RESISTORS

- R1—R8, R12—R14, R17—10,000-ohm  
 R9—680-ohm  
 R10—120-ohm  
 R11—180,000-ohm  
 R15—240-ohm  
 R16—750-ohm  
 R18—1500-ohm  
 R19—2700-ohm

### CAPACITORS

- C1, C3—0.01- $\mu$ F  
 C2—330-pF  
 C4, C5—1- $\mu$ F

### ADDITIONAL PARTS AND MATERIALS

- KP1—Keypad, 3 × 3 (Digi-Key #GH5001)  
 RY1—SPST relay (Digi-Key #DSP1A-DC5V)  
 H1—Two-position header (Digi-Key #A19370)  
 J1—AC/DC connector (Mouser Electronics #16PJ011)  
 B1—9-volt NiCd battery (Digi-Key #P148)  
 Printed-circuit materials, enclosure, front label, 8-pin cable assembly, AC/DC

power pack (part #T509, see text), 9-volt connector (part #BS6I), shorting jumper (part #929950), red and black hookup wire, solder, hardware, etc.

**Note:** The following items are available from JV Enterprises, PO Box 370, Hubbardston, MA, 01452; e-mail: [jventerprises@worldnet.att.net](mailto:jventerprises@worldnet.att.net). A complete kit containing all items listed above (excluding B1), which includes an undrilled chassis, front-panel label, AC/DC power pack, double-sided printed-circuit board with solder mask and silk-screen, programmed PIC with assembly source, 35 page "Users Guide, Assembly and Technical Reference Manual," containing complete schematic diagrams, foil pattern, and unlimited technical support for \$78, plus \$5 postage and handling. Add \$10 for an assembled and tested unit. Standard kit containing all components listed above (except the enclosure, front-panel label, and AC power brick) for \$60, plus \$5 postage and handling. A programmed PIC16C54A with microcode, and HEX file for \$8, plus \$3 shipping and handling. Complete printed documentation package, 35 page "Users Guide, Assembly and Technical Reference Manual," complete schematics, foil patterns, unlimited technical support for \$8, plus \$3 shipping and handling. Enclosure (undrilled) with color label (black plastic box with 9-volt battery compartment) for \$10, plus \$3 shipping and handling. Double-sided printed-circuit board with silk-screen, plated-through holes, solder mask for \$13.50, plus \$3 shipping and handling. Massachusetts residents must add 5% sales tax. Personal check or money order only.

the correct security code has been entered. Resistors R1 through R3 are used to pull the column terminals of the keypad to 5 volts. Resistors R5 through R8 are used to pull the row terminals of the keypad to ground. Therefore, when the keypad is idle (no keys being pressed), the column terminals are at logic high (+ 5 volts), while the row terminals are at logic low (0 volts).

The relay (RY1) is used to control

whether the equipment (or load) connected to the Padlock is energized or de-energized. You can think of the relay as nothing more than a switch. Energizing the relay's coil turns the switch on. De-energizing the relay's coil turns the switch off. The relay specified can handle up to 8 amps at 250 volts AC or 5 amps at 30 volts DC. Refer to Table 1, "Relay Electrical Specifications," for more information.

Figure 2 shows how the device to be protected should be connected to the Electronic Padlock. For AC loads, your equipment should be connected to the relay contacts as illustrated in Fig. 2A; while Fig. 2B shows how to connect DC loads to the circuit. Make sure that the relay's specified limits are not exceeded. Doing otherwise could damage the relay or your equipment, and possibly injure yourself.

As with most relays, highly inductive loads can cause large voltage spikes when switching. The spikes can cause arcing, which can damage the relay and the connected equipment. Motors typically present a large inductive load. If the Padlock is used to switch a motor, it is a good idea to limit the current flow to about 1 amp. That helps to protect the Padlock and the connected equipment. If more than 1 amp is needed, surge suppressors and switching capacitors can be connected to help reduce the switching spikes.

If you are connecting an AC load, **please be careful**. If you are not familiar with the safety practices used when working with AC voltages, find someone who is—AC voltage can and does kill. Remember to always switch the live or hot wire, not the neutral. Refer to the appropriate connection diagram in Fig. 2 for AC and DC loads.

Digital loads can be connected directly to the base of Q2. When the Padlock is locked, the base of Q2 is pulled to ground via pin 17 (RA0) of IC1. When the Padlock is unlocked, the base of Q2 is driven to 5 volts. If a digital load is connected to that terminal, removing the relay from the circuit greatly increases operating time if running solely from the 9-volt battery.

The piezoelectric buzzer (BZ1) is used as a beep generator when keys are pressed, as well as for various other functions. In order for BZ1 to produce sound, it must be excited (driven) from a 2.8-kHz sine-wave signal. Transistor Q1 along with R9, R11, R12, and D1 form a feedback amplifier that oscillates at the exact frequency BZ1 requires.

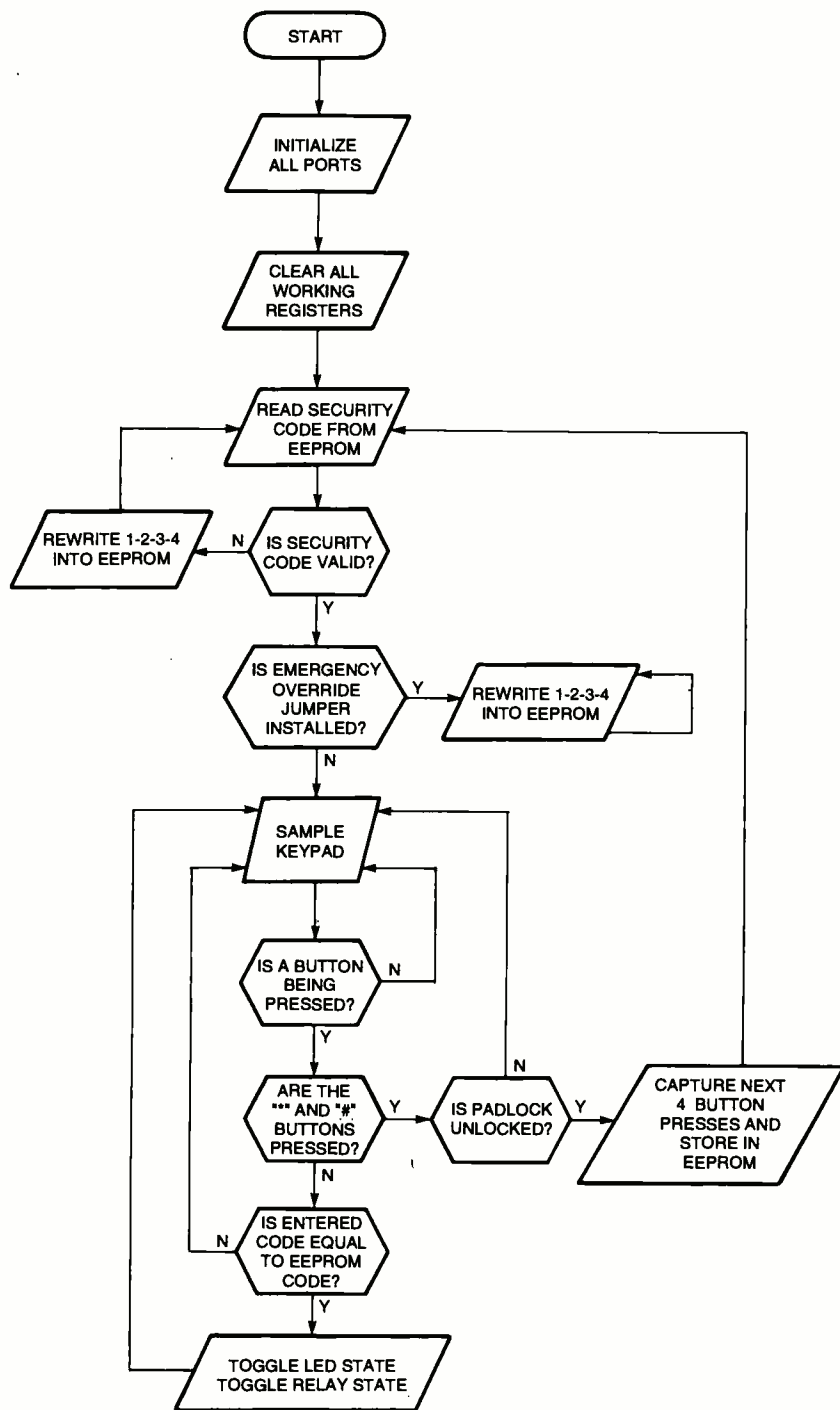


Fig. 3. Shown here is the firmware flow chart for the Electronic Padlock. (Refer to the text for a more detailed explanation.)

Power for the circuit—which can range between 7 volts to 18 volts—is provided by a 12-volt DC wall transformer. The circuit also contains a rechargeable 9-volt NiCd battery (B1), which is used to supply backup power to the circuit in case of a power outage. The battery charges from the main power source during normal operation.

Note: If the source voltage dips below 10 volts, B1 may not fully charge.

When the Electronic Padlock is operating from the wall transformer R18 should be installed. That resistor trickle charges the 9-volt battery with approximately 4 to 7 milliamps. When the wall transformer is removed, or power fails, the 9-volt



battery operates the Padlock. Note: If a 9-volt NiCd battery is not installed in the Padlock, do not install resistor R18. Regular alkaline and carbon batteries do not like to be charged in this manner.

Diode D2 is used to block battery voltage from flowing to the main power source. Zener diode D6 limits the maximum charging voltage across B1 to 11 volts. Regardless of the power source, the raw voltage is fed to IC3 (an LM317LZ adjustable regulator), which is configured to limit the voltage to 5 volts. The 5-volt source is used to operate the rest of the circuitry. Capacitors C4 and C5 (1- $\mu$ F units) are used to filter transients from the raw input and regulated output voltages, respectively.

Resistors R15 and R16 configure the adjustable regulator for a 5-volt output and keep a small amount of current flowing, which is required to stabilize the regulator. The light-emitting diode (LED1) is enabled by the PIC when the Padlock is unlocked. Resistor R10 limits the LED's current to approximately 24 mA. A 2-pin header (H1) is used as a security code emergency override. When a shorting jumper is installed on H1 and the Padlock is powered up, the PIC overwrites the security code stored in the EEPROM to 1-2-3-4.

**The Firmware.** Refer to Fig. 3—the firmware flow diagram for the Electronic Padlock—during this portion of our discussion. When power is first applied to the circuit, the PIC (IC1) configures all of its hardware ports and sets up all of its internal working registers. Once that is complete, the PIC reads the first five locations from the EEPROM. Those locations contain the 4-digit security code. The PIC takes the first four values read, adds them together, and inverts the result (1s complement). If the result matches the value stored in EEPROM address location 5, the security code is considered valid. If it does not match, the security code is considered invalid, and the EEPROM is written with the default code of 1-2-3-4. That happens when the Padlock is powered on for the very first time since there isn't a valid code stored

in the EEPROM. When the code has been re-written for any reason, the PIC will re-read the code from the EEPROM in order to verify that the previous write was successful.

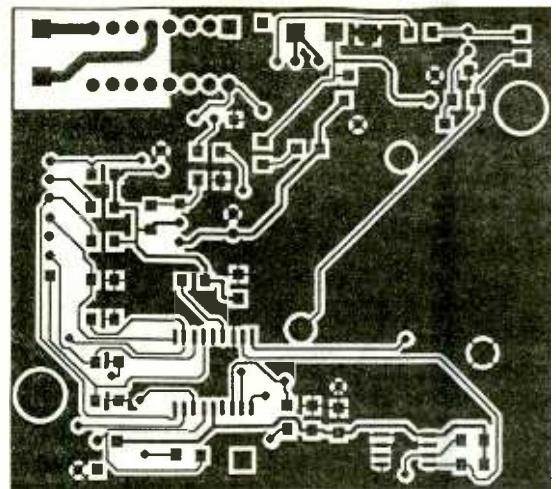
Once the security code has been verified, the PIC then examines the emergency override jumper. That's done by momentarily reconfiguring the pin normally used to drive the LED (RB7) to an input. The PIC then reads the value present on that pin. If the value read is a logic 0, the jumper is not installed and normal code operation begins. If the value read is a logic 1 (due to the pull-up now connected by jumper J7), the jumper is installed. Under that condition, the PIC rewrites the EEPROM with the security code 1-2-3-4 and waits. At that point, the user must re-power the Padlock in order to return to normal operation.

Once the EEPROM and emergency override functions have completed, the PIC enters its main routine. That routine is responsible for sampling the keypad looking for key presses, comparing the entered code against the one read from the EEPROM, and toggling the state of LED1 and RY1 when necessary.

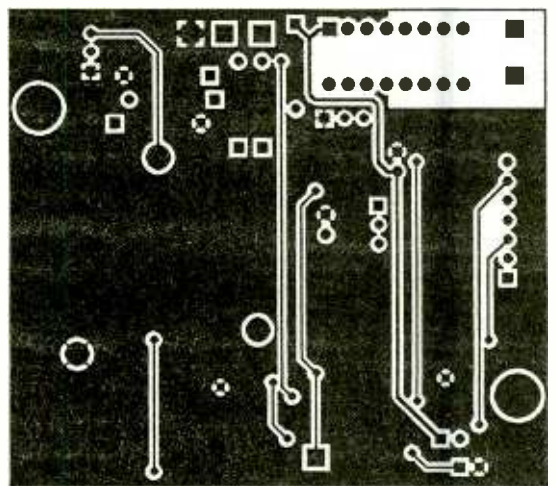
Since the keypad is encoded, the PIC must perform the following steps in order to determine which key(s) is being pressed. The PIC first drives the columns of the keypad to 5 volts and reads the voltages present on the rows. Next it drives the rows to ground and reads the voltages present on the columns. At that point, the PIC has successfully sampled the keypad and has

enough information to determine which key(s) is being pressed. The whole sampling operation takes about 100 ms. Most of the 100-ms period is spent waiting in a tight code loop. That extended period of time ensures that the keypad's electrical signals have settled, and the PIC is not being fooled by key bounce.

Once the PIC has determined that a key is being pressed, it checks to see if the key(s) being pressed is the "#" or "\*." If so, the user has tried to activate the program



A



B

Fig. 4. The Electronic Padlock was assembled on a double-sided printed-circuit board, measuring  $2\frac{3}{4} \times 2\frac{1}{2}$  inches. Full-size templates of both sides of the unit's dual-pattern layout is shown here. The component side is shown in A, while the bottom layer is shown in B.

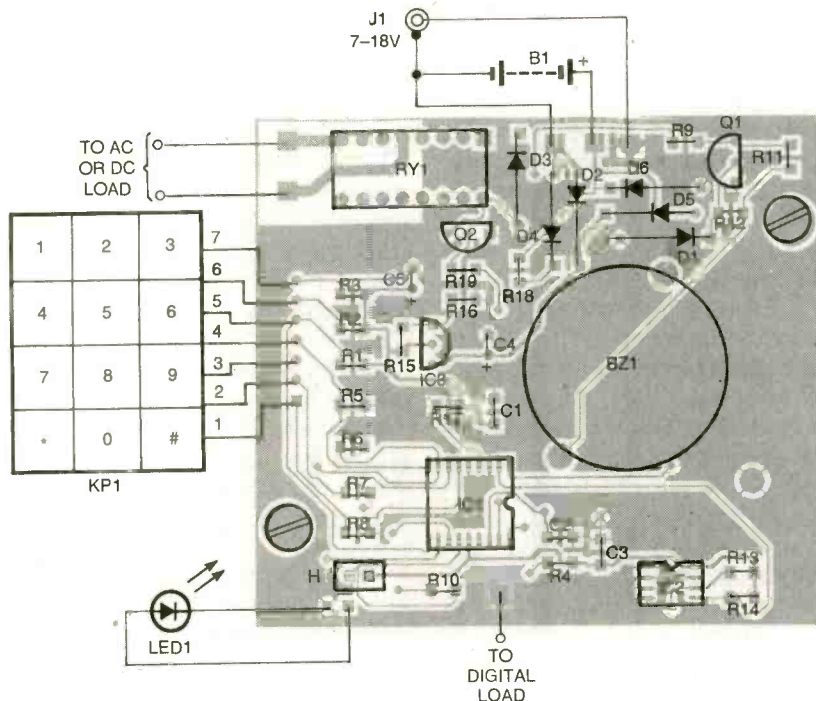


Fig. 5. Assemble the Electronic Padlock, guided by this parts-placement diagram. When assembling this project, be extremely careful of component placement and orientation, as the circuit contains several surface-mount components and you don't want to have to remove any of those tiny components due to construction errors of any form.

mode. The program mode is used to change the security code that is stored in the EEPROM. The program mode can only be activated if the

Padlock is currently unlocked. If the unit is unlocked, the PIC beeps the annunciator three times and activates the program mode. The signals generated by the next four keys pressed are captured and stored to the EEPROM. If the unit was not unlocked when the user requested the program mode, the request is ignored.

Every time a key is pressed and the unit is not in program mode, the PIC compares that key press and the last three presses with the codes read from the EEPROM. When, and if, they match, the PIC beeps the piezo for 0.5 seconds and toggles the state of the LED and relay. That has the effect of either locking or unlocking the Padlock. The PIC won't sample the keypad again until the key being pressed is released. That helps to remove any key "repeat."

The assembly code and hex files for the Electronic Padlock can be found on the Gernsback FTP site at <ftp.gernsback.com/pub/pop/electronic-padlock.zip> or directly from the author at <http://home.att.net/~jventerprises>.

SCANNER USERS • COMMUNICATIONS PROFESSIONALS

# We've Got Your Numbers!

## POLICE CALL

2000 EDITION

COMPLETELY REVISED

CURRENT THROUGH SEPTEMBER, 1999

- 17,000 Codes and Signals.
- Trunking Talkgroup IDs.
- Includes Glossary of Slang and Terms.
- Illustrated Listener's Guide Book.

**GOT A SCANNER? GET POLICE CALL**

At your scanner dealer and all Radio Shack stores.  
Visit our web site at [www.policecall.com](http://www.policecall.com)

More People Buy **POLICE CALL** Than All Other Frequency Guides (VHF/UHF) Combined.



Microchip Technologies' Web page, [www.microchip.com](http://www.microchip.com), contains valuable resources for those who wish to modify the Padlock's firmware or develop their own. It also contains data sheets on all their microcontrollers and EEPROMs.

**Assembly.** The Electronic Padlock was assembled on a double-sided printed-circuit board, measuring  $2\frac{3}{4} \times 2\frac{1}{2}$  inches. A full-size template of the unit's printed-circuit layout is shown in Fig. 4. The component side of the board is shown in Fig. 4A, and the bottom layer is shown in Fig. 4B. Those who are skilled in etching double-sided boards can copy the foil patterns shown and use them to etch a board. For those not so inclined, a kit of parts for the Electronic Padlock is available from the supplier listed in the Parts List. Note, before you go any further, that many of the components used in the construction of this project are surface-mount units. If you have never soldered surface-mount components before, don't worry. This is a great introduction to surface-mount assembly. You should make sure you have a soldering iron with an extra fine tip, as well as thin (0.020 inch) solder, a magnifying glass, and tweezers.

Once you collected all of the components listed in the Parts List, construction can begin. Assemble the Electronic Padlock, guided by the parts-placement diagram shown in Fig. 5. Begin by soldering all passive components to the board first, followed by the semi-conductors. Be careful to get component orientations correct the first time. Once all the components are installed, mount the circuit board in the chassis, connect the power cables, and connect your equipment (the load) to the appropriate pads.

The cable for the keypad specified in the Parts List is an 8-pin cable. Since the keypad only has 7 pins, cut one of the pins off before soldering to the circuit board. Once the assembly is complete, plug the DC power source into J1. (**Note:** If you are building the circuit from the kit, some component designations in the kit will differ from those shown here. For example, LED1 shown in

the schematic diagram of Fig. 1, is designated D1 in the kit, with diodes D1 through D6 becoming D2 through D7.)

Assuming this is the very first time you have applied power to the Padlock with the EEPROM installed, the unit will beep 3 times indicating a write to the EEPROM. That write stores the 4-digit security code 1-2-3-4 to the EEPROM. At this point, the LED should be off and the power to your equipment should also be off.

Now press keys 1-2-3-4. You should hear a beep for each key press and then a longer beep when you have entered the 4<sup>th</sup> digit. At this point, the LED should come on, and the power to your equipment should be enabled. Press the code 1-2-3-4 again and the LED and your equipment should go off again.

If all went as described, your Padlock is ready for operation!  $\Omega$

## HANDS-ON REPORT

*(continued from page 7)*

to record programs that it thinks you might like.

This can be a convenience for viewers who don't have the time or inclination to peruse pages of program guides. And TiVo sometimes finds some shows that really do fit your viewing profile. There's no need to worry about the hard drive filling up with TiVo's selections. When it needs to delete recordings to clear up disk space, TiVo always removes its own choices before any of yours. And, for anyone who finds it annoying (or spooky) to have a machine picking out programs, the feature can be turned off.

**Comparison Shopping.** There are a few other differences between the two systems. ReplayTV's buffer holds up to four hours of video, while TiVo's buffer holds only 30 minutes. ReplayTV also bested TiVo on picture quality and providing the ability to skip through commercials in 30-second increments. TiVo provides three speeds of forward and reverse playback: 3-, 12-, and 60-times. TiVo also provides the ability to view slow-motion and frame-by-frame scenes, which sports fans surely will appreciate. TiVo's remote

control is much easier to use; ReplayTV's is cluttered by TV-control buttons that obscure the ones needed to operate the DVR.

Are you thinking of buying a Digital Video Recorder? If you decide to become an early adopter, these products have something else going for them. Unlike most consumer-electronic products, these first-generation models won't become obsolete. Nor is it necessary to wait for successive models to get one with all the glitches worked out. The same phone-line connection used to download program information is also used to download software upgrades.

As we go to press, for instance, TiVo just began downloading version 1.2.1 to their subscribers. The upgrade allows satellite owners to also support a cable/antenna input, adds a message inbox to allow customers to receive messages from TiVo, allows users to specify at the time of recording how long a recording should be stored, and smoothes out the video during fast-forward and rewind at all speeds.

Be warned: Once you get used to the personalized TV experience, it's hard to go back.

For more information on ReplayTV, contact Replay Networks, 1945 Charleston Road, Mountain View, CA 94043-1201; 800-266-1301; [www.replaytv.com](http://www.replaytv.com); or circle 80 on the Free Information Card.

To learn more about TiVo, contact Philips/TiVo, 1000 West Maude Ave., 4th Floor West, Sunnyvale, CA 94086; 877-367-8486; [www.tivo.com](http://www.tivo.com); or circle 81 on the Free Information Card.  $\square$

## ELECTRONIC GAMES

**BP69**—A number of interesting electronic game projects using IC's are presented. Includes 19 different projects ranging from a simple coin flipper, to a competitive reaction game, to electronic roulette, a combination lock game, a game timer and more. To order BP69 send \$4.99 clearance (includes s&h) in the US and Canada to **Electronic Technology Today Inc., P.O. Box 240, Massapequa Park, NY 11762-0240.** US funds only. Use US bank check or International Money Order. Allow 6-8 weeks for delivery. MA07



# PC TECH

IMPROVING THE COMPUTER EXPERIENCE ... HANDS-ON

INCLUDING  
PC GIZMO®

Computer Security in the Hacker Age..... 43

## PC BODYGUARD

### DEPARTMENTS

PC GIZMO.....40

A PC TABLET?, Pro Video Studio, Pen-Sized Scanner, MPEG-4 Camera, Call-Waiting Modem

SYSTEM DESIGN.....42

Sony Vaio Slimtop PCV-L620

PEAK COMPUTING.....51

CD-R Expands

COMPUTER BITS.....54

Putting a Scanner to Work

NET WATCH.....56

Free Web Access Options



### um Security r Computer

prehensive Protection in th

- Guards Against Sat
- ty
- Protects Against Us
- Significantly Reduce (Total Cost of Own

Resistance Forever

Learning Mode Toggle

Security level

Low 6 High

Gray zone

0% 40 100%

Tablet Mode (800 \* 600 Only)

New ID-PAD  Others

Old ID-PAD

Set

Cancel

# PC GIZMO®

## A PC Tablet?

As great as laptops may be, their form factors are not suited for every application. If you need a mobile computer, but won't necessarily be able to use it sitting down, Aqcess Technologies has come up with the perfect solution. Called the *Qbe* (pronounced "cube"), it's the first Personal Computing Tablet to offer all the functionality of a Windows 98/NT multimedia laptop.

Measuring 14 by 10 by 1.5 inches, the *Qbe* is only slightly larger than a legal pad. Users can use the included stylus to navigate on the 13.3-inch active-matrix, color touch screen and even write thanks to the system's handwriting recognition. If you'd like to enter data faster, consider using the *Qbe*'s voice recognition instead, which can have you entering up to 140 words per minute. The combination of pen and voice input results in wonderfully natural data-entry.

The introductory *Qbe* (\$2995) is available with a 266-MHz Pentium II, 4GB hard drive, and 64MB of RAM. Other configurations will be available with up to the 600-MHz Pentium III chip, a 6GB hard drive, and memory to 512MB. All versions come with a Li-Ion battery that will provide up to four hours of life (an extra pack adds another four), as well as a docking station that offers full desktop functionality via a keyboard and mouse.

Aqcess Technologies, Inc., 3611 South Harbor Blvd., Suite 105, Santa Ana, CA 92704; 888-818-0055; [www.qbenet.com](http://www.qbenet.com).



CIRCLE 90 ON FREE INFORMATION CARD

## Pro Video Studio



Own a Digital Video (DV) camcorder? These devices represent 40 percent of all new consumer video-camera purchases, no doubt thanks to their stellar quality. Now there's another reason to go DV or Digital8: these camcorders can be interfaced with a computer for advanced editing and eventual storage on media such as CD or DVD-RAM. All you need is an IEEE-1394 interface card and appropriate DV software—both of which are found in Pinnacle Systems' new *Studio DV* (\$199).

The included PCI card adds three high-speed IEEE-1394 ports to your system. Connect your camcorder to one of these interfaces and you're all set to capture video. Unlike "professional" DV editors, *Studio DV* captures video at preview quality, storing an entire 60-minute tape in only 150MB of hard-drive space. It is this content that you can cut,

rearrange, add titles and effects to, and even mix with a music or narration track. Editing is made simple with the program's Storyboard system that lets you visually arrange movie elements and scenes.

When you're finished editing, *Studio DV* captures the full DV content from your camcorder, thereby sparing your hard drive from data you were just going to delete anyway. Incidentally, you'd better have some free room on your system for the final process, as full DV is captured at 240MB per minute! But the finished product couldn't look better.

Pinnacle Systems, 280 North Bernardo Ave., Mountain View, CA 94043; 650-526-1600; [www.pinnacle.com](http://www.pinnacle.com).

CIRCLE 91 ON FREE INFORMATION CARD

*PC Gizmo* is published by Gernsback Publications, Inc., 500 Bi-County Blvd., Farmingdale, NY 11735. Senior Writer: Selina Kyle.

40 Copyright 2000 by Gernsback Publications, Inc. *Gizmo* is a registered trademark. All rights reserved.



# PC GIZMO® Pen-Sized Scanner



Capturing data from printed documents cannot always be done from the comfort of a desktop. Whether you're digging up facts at the local library or bookstore or finding yourself encumbered by loose business cards on a trip, having a portable scanner can be a tremendous help. Turn all that paper-based information into data that you can easily carry and even transfer to your computer with C Technologies AB's *C Pen 200* (under \$200, street).

The *C Pen 200* has a built-in Intel StrongARM 100-MHz processor and optical-character recognition (OCR) software engine. As a result, the device can read up to 100 characters per second, storing them as editable text. Using the *C Pen 200* is as easy as using a highlighter. Just drag the sensor across the words you want to capture. As long as the text is 7 to 20 points in size, and in a standard typeface (no calligraphy or handwriting), accuracy is dead on.

With its built-in 2MB of memory, the Pen allows you to store up to 100 pages of text, which you can later transfer via infrared to your computer. But there's no need to always do so. The terrific user interface of the *C Pen 200* lets you organize all those pages of data, making it more than a mobile scanner. It's a personal data assistant with an eye.

C Technologies AB, Ideon Research Park, Scheelevagen 15, SE-223 70 LUND, Sweden; [www.cpen.com](http://www.cpen.com).

CIRCLE 92 ON FREE INFORMATION CARD

## MPEG-4 Camera

Untethered as it may be, Sharp's new *VN-EZ1U Internet Viewcam* (\$699, MSRP) is the world's first digital motion picture and sound camera designed specifically for the Net. Capture sights and sounds, then use them on Web pages, send them via e-mail, or just watch them onscreen. The included SmartMedia Floppy Disk Adapter makes it a cinch to transfer content to any computer.

The *VN-EZ1U* is the first digital camera to use MPEG-4 compression standard, making it possible for the camera to hold up to an hour of video with sound on a 32MB SmartMedia memory card (the unit comes standard with a 4MB card, providing only 7 minutes of storage). Using Microsoft's Advanced Streaming Format (ASF), your recordings can be viewed and heard with *Windows Media Player 6.0* (or higher) as they're being downloaded from a Web site or Intranet page.

The *Viewcam* comes with a 4X digital zoom for recording and a built-in microphone. Thanks to the 270-degree rotating camera lens and 1.8-inch LCD monitor, you can shoot in almost any direction (including at yourself) and still monitor what's being recorded. And you can do so just about anywhere, as the *VN-EZ1U* measures just 3.2 by 3.5 by 1.7 inches and weighs a mere 8.5 ounces with the included four AA batteries installed.

Sharp Electronics Corp., Sharp Plaza, Mahwah, NJ 07430; 800-BE-SHARP; [www.sharp-usa.com](http://www.sharp-usa.com).

CIRCLE 93 ON FREE INFORMATION CARD



## Call-Waiting Modem

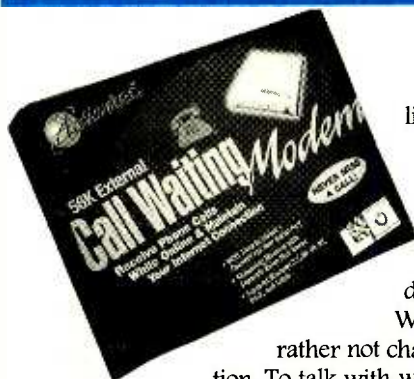
The Internet has brought us a lot, including busy signals. If you have one phone line and would like to be reachable while online, check out *Actiontec's 56K External Call Waiting Modem* (\$124.99).

The unit connects to an open serial port (a USB version is also available) and offers full high-end modem functionality, including: answering machine with multiple voicemail boxes and remote message retrieval, fax send and receive capability, as well as V.90 and K56flex support for high-speed downloads. However, you also get a wonderful extra.

Whenever the phone rings, you can answer it and see who's calling. If it's someone you'd rather not chat with, you have about seven seconds to hang up without losing your Internet connection. To talk with whomever's calling, just let the modem hang up your connection. As long as you don't close down your browser, you should be able to dial up again and resume your Web quest from the same spot.

*Actiontec Electronics, Inc.*, 760 North Mary Ave., Sunnyvale, CA 94086; 408-752-7700; [www.actiontec.com](http://www.actiontec.com).

CIRCLE 94 ON FREE INFORMATION CARD



## Sony Vaio Slimtop PCV-L620

Welcome to the first installment of our new column on system design. Each issue, we'll take a look at a desktop or laptop that incorporates one or more significant new design features. Sometimes, these will be in the components being used; other times, the form factor or aesthetic approach will be what we want to bring to your attention. And, when we're lucky, we'll get a product that is different in both of these respects.

That's just the case with the Sony Vaio Slimtop PCV-L620 that we've chosen for this month's focus. One look tells you that this isn't any ordinary desktop PC. In recent months, there has been a spate of introductions of "all-in-one" PCs. Some of these, such as the iMac and e-Machines' similar one-piece PC, package everything into a large case. Others, such as the NEC Z-1, Gateway Profile, and Chem USA's PC3000 are essentially laptops built on edge, with the CPU, drives, and other components mounted behind the LCD panel. The Vaio Slimtop falls into a different category than all of these.

As with today's coolest PC designs, the Vaio Slimtop offers a 14.1-inch LCD panel that's digitally driven from an ATI RAGE LT PRO 2X AGP chipset with 4MB of video RAM. On the partic-

ular model we tested, however, you must use Sony's LCD—there is no output for a standard CRT. You can, however, also order a version of the Vaio Slimtop without the LCD panel display, which features a standard analog video output.

Along with the LCD monitor, the remainder of the Vaio Slimtop system is in a tiny case, not much larger than a cigar box. Inside this case are the motherboard, hard-disk drive, floppy-

### SMALL IS GOOD

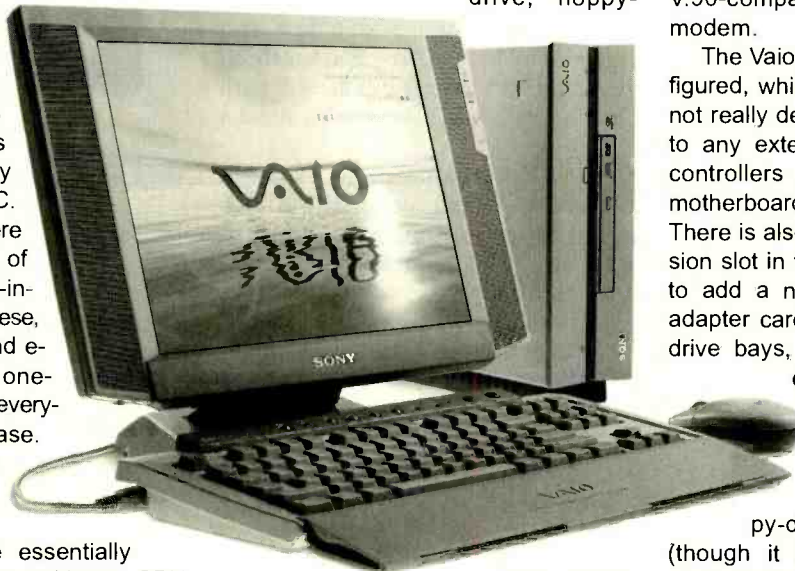
As innovative as the Vaio Slimtop may be, it, of course, has some conventional features. The motherboard, while smaller than even a micro-ATX form factor, uses standard Intel 440BX core logic, and houses a very fast 500-MHz Pentium III CPU. Standard memory on the Vaio Slimtop is 128MB, with a maximum capacity of 256MB of standard PC100 DIMMs. Also included is a V.90-compatible, 56-Kbps fax/data-modem.

The Vaio Slimtop is very nicely configured, which is a good thing, as it is not really designed to be upgradeable to any extent. The video and audio controllers are embedded into the motherboard and are not upgradeable. There is also only a single PCI expansion slot in the case, should you want to add a network interface or SCSI adapter card. There are no additional drive bays, so unless you intend to

eventually replace the 10.8GB Ultra DMA hard-disk drive, you are pretty much stuck with it. A standard floppy-disk drive is included

(though it blends so well into the accent of the case that you really have to look for it), as is a 6X DVD drive. The ATI video chipset provides some hardware motion compensation, which helps smooth out full-screen DVD playback. But MPEG decoding is performed in software, by the DVD Express utility that's included for this purpose.

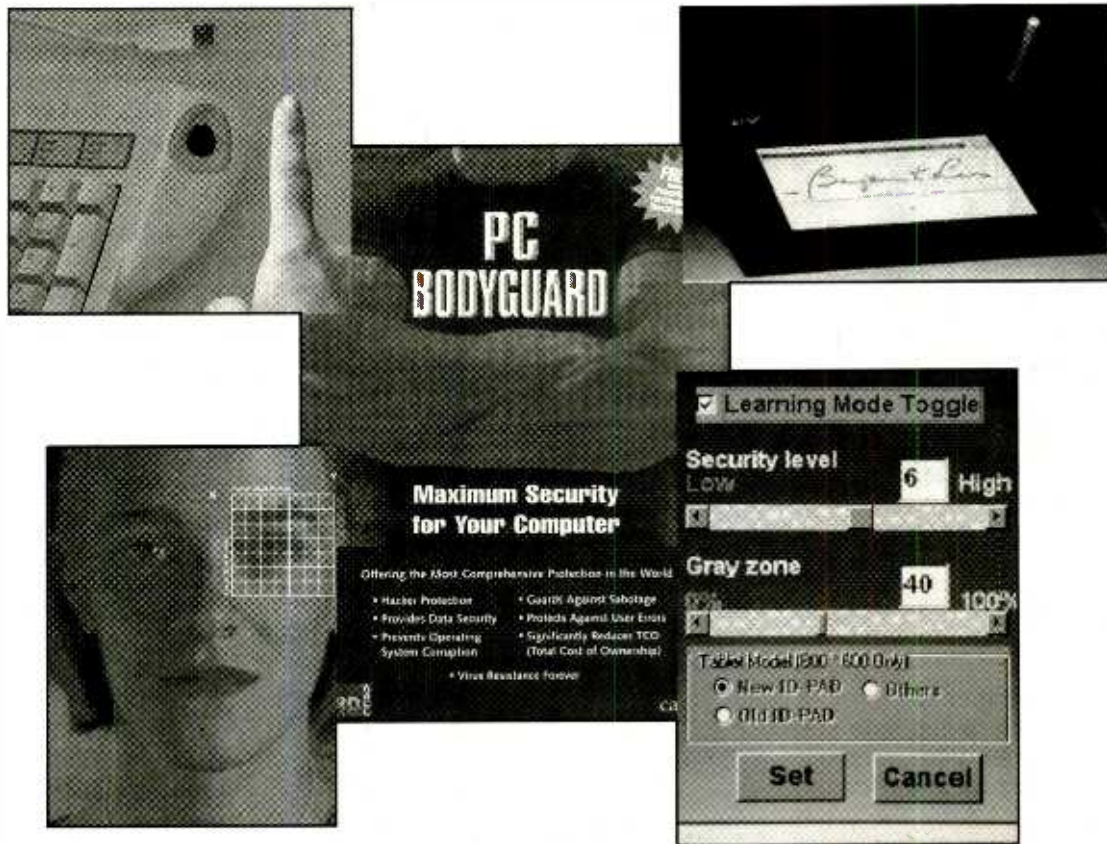
*(Continued on page 58)*



disk drive, and a 6X DVD drive.

The box can be placed normally, like a tiny AT-style case, or you can attach a special base that allows the case to be mounted vertically on its edge. Since the case is only 3.5 inches wide, the combination of LCD panel and case takes up incredibly little desk space.

# Computer Security in the Hacker Age



KONSTANTINOS KARAGIANNIS

The adage that knowledge is power has never been truer. Whether you're an employee of a large corporation or someone who's entered a credit card number into a PC, the data on your machine's hard drive is valuable. With such information, others can do quite a bit of damage to you. Also, should some devious hacker decide to only tamper with and not steal that data, you can be left in quite a bind without a specific report or spreadsheet.

Sure you can back up your data often just in case a virus or other disaster strikes, but what can you do to prevent that data from getting into the wrong hands? Just like knowledge can be used for technological malice, you can apply

*Your PC may be a target for information thieves and prying eyes. Learn what you can do to keep your files and data safe from invasion.*

modern security knowledge to lock up your PC from the outside world.

To this end, in the pages that follow we'll be sharing some computer security methods that are either available or on the horizon. From biometrics, which uses physical traits of users to distinguish who should or shouldn't have access to a machine, to advanced software designed to repel all invasive attempts automatically, you're sure to find a suitable security solution

somewhere in the following pages.

So awaken a healthy amount of paranoia and read on to learn what you can do to ensure your fears are for naught. Get ready to protect your PC.

**Fingerprinting.** One of the most personal traits we own is a fingerprint. Banking on this individuality, manufacturers have been releasing enterprise and consumer scanners that can identify us by the swirls, whorls, and other patterns found on our fingertips (these marks of identification are often called minutiae points). Interfaced to a computer, such scanners help the machine "decide" what resources to allow a user access to, if allowing any access at all.



Some of the world's largest corporations rely on Biometric ID's Veriprint 1000 for their fingerprint-recognition security needs. Consumer products similar to the Veriprint are appearing on the market as well.

On the consumer side, giant Compaq has come up with an affordable and easy-to-use product called *Fingerprint Identification Technology* (\$99, MSRP). The product consists of a small fingerprint scanner (kind of like a mouse with an "eye" on top) and a program called *Identicator*. The package will work with Windows 95/98/NT, and on any PC capable of running one of these operating systems.

The scanner contains an optical CMOS camera and connects to your PC's keyboard and parallel ports. Note that the there is no passthrough provided for the parallel port, so if your system doesn't have two of the latter, you won't be able to use a non-networked printer or a parallel-interface storage device like a Zip. Your options in this case are to either look to USB peripherals for such applications, or maybe get a parallel-port add-on card for your machine (Compaq offers one of these as well).

The *Identicator* software provides a high level of security, carefully discriminating the fingerprint that the scanner presents it with

and allowing access only to users who have the right fingerprint. Incidentally, the program only stores one finger per user, so you have to use the same finger each time, as each finger has a distinct print. Unlike username/password combos, a fingerprint is something a thief can't steal (at least not without resulting to a level of force we'd rather not dwell upon here!).

As simple and accessible as Compaq's product is, sometimes security applications are as personal as fingerprints. This means that not every user is willing to settle for an out-of-the-box solution. Whether you're working with ultra-custom software or are a bit of a mad sci-

entist at heart, you may want something a bit more "tinkerable."

Biometric Identification, Inc. has released a customizable security device, called the *Veriprint 1000*. It's perfect for a do-it-yourselfer who would like to adapt a biometric device to a custom application, from simple logon protection to software interaction (for example, use a thumb print to access specific files or folders). Biometric ID provides developer kits for advanced users and works with manufacturer partners to provide commercial solutions for major companies like Intel and Unisys.

At the heart of the unit is the FingerTIP biometric sensor chip

## VENDOR INFORMATION

### Biometric Identification

5000 Van Nuys Blvd.  
Suite 300  
Sherman Oaks, CA 91403  
818-501-3908  
[www.biometricid.com](http://www.biometricid.com)

**CIRCLE 180 ON FREE INFORMATION CARD**

### Calluna Technology, Inc.

605 E. Tennant Ave.  
Suite F  
Morgan Hill, CA 95037  
408-778-6563  
[www.calluna.com](http://www.calluna.com)

**CIRCLE 181 ON FREE INFORMATION CARD**

### Compaq

20555 State 249  
Houston, TX 77070  
800-345-1518  
[www.compaq.com](http://www.compaq.com)

**CIRCLE 182 ON FREE INFORMATION CARD**

### Curtis Computer Products

2210 Second Ave.  
PO Box 599  
Muscatine, IA 52761  
800-272-2366  
[www.curtis.com](http://www.curtis.com)

**CIRCLE 183 ON FREE INFORMATION CARD**

### Cyber-SIGN, Inc.

2635 North First St.  
Suite 103  
San Jose, CA 95134  
800-876-4605  
[www.cybersign.com](http://www.cybersign.com)

**CIRCLE 184 ON FREE INFORMATION CARD**

### Infineon Technologies Corp.

1730 North First St.  
San Jose, CA 95112  
800-777-4363  
[www.infineon.com](http://www.infineon.com)

**CIRCLE 185 ON FREE INFORMATION CARD**

### Miros, Inc.

572 Washington St.  
Suite 18  
Wellesley, MA 02482  
781-235-0330  
[www.miros.com](http://www.miros.com)

**CIRCLE 186 ON FREE INFORMATION CARD**

### Polaroid

Identification and Transaction Systems  
201 Burlington Rd.  
Bedford, MA 01730  
800-343-5000  
[www.polaroid.com](http://www.polaroid.com)

**CIRCLE 187 ON FREE INFORMATION CARD**

### Sterling Strategic Solutions, Inc.

2203 Timberloch Pl.  
Suite 250  
The Woodlands, TX 77380  
800-427-9422  
[www.sterlingweb.com](http://www.sterlingweb.com)

**CIRCLE 188 ON FREE INFORMATION CARD**

### Symantec Corp.

10201 Torre Ave.  
Cupertino, CA 95014  
408-253-9600  
[www.symantec.com](http://www.symantec.com)

**CIRCLE 189 ON FREE INFORMATION CARD**



Using TrueFace PC, you can affordably protect your own computer with face recognition that's on par with security systems costing thousands.

from Infineon Technologies (formerly Siemens Microelectronics), which Biometric ID has packaged in a self-contained fingerprint-verification module called the MV1100. The total standalone module is smaller than a business card and incorporates an image capture area the size of a stamp.

The FingerTIP chip is a small (18 x 21 x 1.5 mm) IC embedding a 288 x 224-pixel contact sensor array that images the lines and ridges of a fingerprint when a user touches the device. Each pixel has an 8-bit data depth, enabling evaluation of subtle gradations (256 shades of gray) of a fingertip and their translation into a set of indices or key identifying minutiae points. Imaging and data transfer of an impression takes only 100 milliseconds. The chip also incorporates extensive electrostatic discharge (ESD) protection features, making it able to withstand static electricity jolts of up to 8 kilovolts.

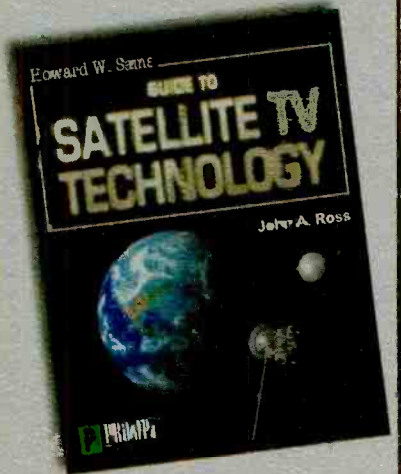
If you're interested in taking advantage of the FingerTIP and Biometric ID's implementations of it, contact either this company or Infineon.

Another company offering a fingerprint scanner for developers is Polaroid. What's interesting about this vendor's PFS-100 is that it works with a USB interface. As a result, expect to see many manufacturers incorporating the sensor into affordable desktop solutions. And they'll be dependable products, too, as the PFS-100 has a 500-dpi CMOS imager, which has a geometric distortion of less than 1 percent over the entire image field.

**Look Into the Camera.** Science fiction fans have come across more than a few movies where a character looks into a retinal scanner to gain access to some guarded room. Thanks to a few innovative products, this form of visual, facial biometrics is no longer an imaginary concept.

While retinal scanners are available, they can cost as much as \$6000, because of the multiple, high-resolution camera system needed for them. The most inexpensive form of visual ID by far comes in the form of total-face comparison software. Commercial applications already exist for this

# EXPAND YOUR KNOWLEDGE



## GUIDE TO SATELLITE TV TECHNOLOGY

by John A. Ross

This book covers all aspects of satellite television technology in a style that breaks "tech-talk" down into easily understood reading. It is intended to assist consumers with the installation, maintenance, and repair of their satellite systems. It also contains sufficient technical content to appeal to technicians as a reference.

**Category: Communications**

**Trim Size: 7-3/8" x 9-1/4"**

**Pages: 464**

**Sams#: 61176**

**Price: ~~129.95~~**

**NOW!  
30% off  
\$27.96**

**To Order, Call 1.800.428.SAMS  
Refer To Offer 61176A**

**PROMPT**  
PUBLICATIONS

technology, with major companies like Polaroid developing systems for motor-vehicle licensing departments and other organizations.

In the home, there's an affordable option. Using a standard parallel or USB PC camera (such as the type used for videoconferencing), commercially available face-recognition software can tell if it's really a legal user sitting in front of a particular machine.

Apparently the best package for consumers is *TrueFace PC* (\$59.95) from Miros, Inc. The company offers enterprise-level solutions, too, but for your own computer *TrueFace PC* is hard to beat. It will work with a Pentium 90 or better that has 16MB of RAM, Windows 95 or 98, and, of course, a camera. The latter need be only a modest unit that can capture a face image of 80 pixels or larger. You'd be hard pressed in today's marketplace (or even that of last year) to find a camera that didn't meet this minimum. Often, you can get one for well under \$100, if not for half that much.

*TrueFace PC* has a simple setup that asks you to turn your head in various ways. After it captures various views of you, it will form an internal register of your face's key identification points. Up to ten users can be specified, should you want different family members to have access, for instance.

Some clever readers might be wondering if holding a photo up to the PC's camera could fool *TrueFace*. Not a chance. The software needs you to move your head and turn it for verification, so no still photo would fool it. Actually, no videotape of you would work either, as pointing a camera at a monitor or TV playing such a tape would result in flashing. The only way around this would be for a vandal to perfectly match the camera's frame-per-second capture rate to the refresh frequency of the playback monitor—unlikely, as monitors refresh at 60 or more times a second, and camera's capture 30 or less frames per second.

In addition to logon protection, *TrueFace PC* can also be used to lock your screensaver while you're away. If you're worried about face-



*Signature recognition, being constantly improved by companies like Cyber-SIGN, is an important security technology for applications like online banking and message-sender ID verification.*

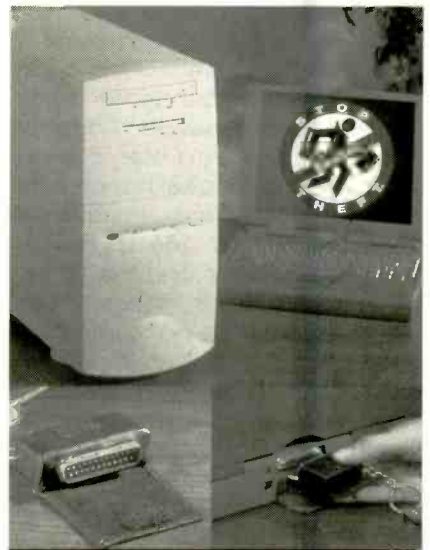
verification slowing you down, especially after each time your screensaver kicks in, have no fear. The ID process takes only two or three seconds on most computers, and even less on the fastest PII and PIII systems.

**Sign Here, Please.** Another biometric way to lock a system is through the use of signature recognition. Unfortunately, to do this you need to have a signature-capture device or tablet with enough resolution and sensitivity to tell your John Hancock from that of a clever imitator. Because of the costs associated with such a device, signature-recognition systems have been released in network-only versions, where volume discounts can take effect. However, we still wanted to touch briefly on one such system to illustrate a more full overview of biometric applications.

Named for its pursuit of this aspect of ID technology, Cyber-SIGN, Inc. has developed a system (also called *Cyber-SIGN*) that can verify identity not only by the shape of a signature, but by the way it was written in real time. Running over a server (either in a network or over the Internet), the software registers the timing changes in pressure, shape, direction, and speed in the signature-verification process. Even

if a thief managed to get your signature just right in appearance, Cyber-SIGN claims it would be very difficult for him or her to get these other particulars just right.

Now, not everyone signs things the same way twice, and some users may have more erratic handwriting than others. For this reason, users can set up the percentage or level of discrimination that the software uses to compare signatures.



*Try locking up your PC with the Data Defender—it's as easy to use as the key that opens your front door. When it's not in your system's parallel port, the machine won't boot.*

# Times Are Tough...



Today's headlines scream of the lack of qualified individuals to fill new and existing high-tech job openings. If you feel the robust economy is passing you by, there is something you can do about it. **Become CIE Qualified.** Since 1934, The Cleveland Institute of Electronics has been providing its students with the necessary technical and academic credentials employers are seeking. In fact, CIE was started in 1934 to fill a similar void in the radio/television industry.

Since then, CIE boasts of over 150,000 worldwide graduates who have benefited from a patented, independent-study program that lets the student complete a Career Course, Associate Degree program, or through our affiliate school

World College, a Bachelor Degree program.

If you are currently "under-employed" and want to increase your level of income, the most proven method is an education. With CIE's independent-study program you study when and where you wish with no time constraints on how quickly you can proceed. And though it is an independent-study program you have the full support of the faculty and staff at CIE's Cleveland Campus.

**To discover all the Benefits, Career Courses and Degree Programs available from CIE send for your Free Course Catalog Today!**

The Cleveland Institute of Electronics has been approved for the training of eligible veterans and active duty military service members, under the G.I. Bill. Military tuition assistance (Up-Front and Basic) is also available under the DANTES Distance Learning Program.

# ...For Employers



**BUSINESS NEWS**  
Employers Searching For  
Qualified Candidates

**F R E E C A T A L O G**



**Cleveland Institute of Electronics**  
1776 E. 17th Street  
Cleveland, Ohio 44114-3679  
Visit Our Web-Site: [www.cie-wc.edu](http://www.cie-wc.edu)

*A School of Thousands.  
A Class of One. Since 1934.*

**YES!** Please send me a catalog. PT01

Name: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

Phone Number: \_\_\_\_\_

Check Box for a Bulletin on Military Education Benefits:

VA Benefits  DANTES Benefits

Of course, you shouldn't set this discrimination too "loose," or else security once again becomes an issue.

Because it runs over a secure server, Cyber-SIGN technology may provide a great solution for online banking and other business scenarios where a signature is needed to close a deal. If you run a network and would like to learn more about enterprise setups from Cyber-SIGN, feel free to contact them.

**Lock and Key.** Moving away from the world of biometrics, we come to a paradigm that's been in use for centuries, and which can still work for certain applications. You use this paradigm every time you return to an empty home or start up your car: the trusty lock and key.

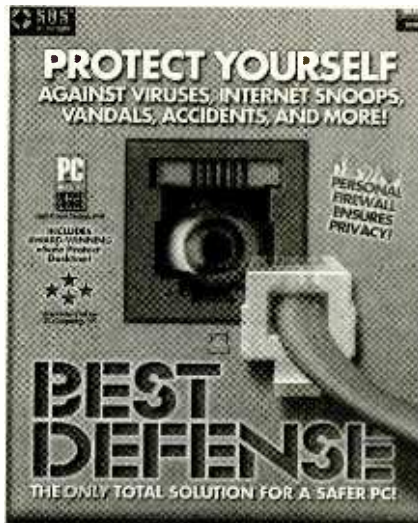
Curtis Computer Products recently introduced a great solution for both desktop and laptop data security—a way to ensure that no one else can ever access your data, even if your machine is stolen. The *Data Defender* (\$149.95) is about the size of a cigarette lighter, yet as potent as a room-sized vault when it comes to protecting your computer.

To use the Defender, you install the security program it comes with onto your hard drive. This app embeds a driver deep into Windows 95 or 98, making it impossible for a devious guest on your machine to remove. With the driver loaded, there's only one way to boot your computer: The Data Defender key must be plugged into the parallel port.

Each Defender key is coded, so another person with a similar device cannot start your system. Should a thief take your computer or even just your hard drive, he or she will be unable to access any of the data on the drive without the key.

Since most parallel ports on desktops are out of reach, Curtis also offers a *Parallel Port Extender* (\$29.95). This dongle cable makes it possible to have a parallel port of sorts on your desk, making it a cinch to connect your Defender. Furthermore, the Extender has a parallel pass-through, allowing you to attach a printer.

While the Data Defender won't be able to return a stolen comput-



*Protect your PC from Web sites that may contain hostile code with SOS Best Defense, the only software package that handles anti-virus, anti-vandal, and Internet-filtering tasks.*

er (none of the products we look at here do that), it will render it useless to anyone else. Further, for day-to-day protection from those just passing by your terminal, it's a wonderful product for keeping others out of your system.

**Viruses, Internet Snoops, and More.** We put our computers through the wringer these days. Once your machine was only suspect to physical information prying, and a good lock on a door plus a password would usually protect a computer. However, the modern wired world is one filled with perils. Downloading programs off the Net can be analogous to inviting a stranger into your home at three in the morning, and just visiting some Web sites can be as dangerous to your privacy as keeping all the blinds off your windows for 24/7.

How do you protect from viruses that can eat up data on your system or sites that want to capture a little too much information from your computer? With protective software, of course. The packages we looked at in this category offer protection against different types of system malfunctions, too, and can help you figure out if your machine is behaving buggy due to some troublemaker's influence.

*Norton SystemWorks 2000 for Windows 95/98 Professional Edition* (\$99) by Symantec is a powerhouse

bundle from the company that's been protecting computers since the first days of Windows. The suite contains full versions of: *Norton AntiVirus 2000 v6.0*, which is arguably the best virus protection around; *Norton Utilities 2000 v4.5*, a killer diagnostics and disaster recovery app that can even optimize system performance (depending on what's causing system slowdowns); *Norton CrashGuard 2000*, to keep your system running; *Norton CleanSweep 2000 v4.7*, for help uninstalling programs and removing unnecessary files; and *Norton Web Services*, which helps you update software and security apps on your machine.

This "Professional" version also has some handy bonuses worth mentioning. *Norton 2000* corrects for many Y2K problems that, depending on when you read this, may already be affecting your computer. For backup purposes (a security must!), you can rely on *Norton Ghost* for disk and file cloning. Another even more security-based feature is *Norton Secret Stuff*, which lets you encrypt e-mail.

Because of the suite's integrated interface, you can access all the aforementioned programs from a single window. Learn the basics of one and be able to easily use all. Also, we have to mention again that such a combo suite eliminates the guesswork about why your system is behaving erratically. And if it is a virus causing trouble, chances are *AntiVirus* will be able to clean it off.

As hinted at in the beginning of this section, viruses do not represent the only online dangers. To protect yourself against Web sites that may contain hostile code, you'll want to pick up Sterling Strategic Solutions' *SOS Best Defense* (\$59.95). This is the only software package that handles anti-virus, anti-vandal, and Internet-filtering tasks. It even protects against certain types of tampering that can only be made "in person" on your machine.

Java and ActiveX controls are programs that run on Web sites and make visiting the latter more visually appealing and interactive. However, this code could contain viruses.

*(Continued on page 58)*



## CD-R Expands

It's not often that a technology can improve the enjoyment of life in seemingly unconnected ways, but CD-R has done just that. Both data and audio applications have made this one cool tech to own at the dawn of the new millennium.

As a data medium, CD-R has made it possible to store hundreds of megabytes of files in a virtually permanent way. With the advent of CD-RW, the ability to rewrite or overwrite data was added, meaning you didn't have to stick with one version of, say, a backup forever.

As an audio medium, CD-R has granted thousands the ability to mix tracks from or just plain copy CDs. And while audio-CD dubbing decks may limit the number of digital copies you can make of a disc, CD-R PC drives free you to dub as you please.

Now CD-R has gotten even better.

If you've hesitated at the thought of adding a CD-R drive to your PC before, reconsider. Memorex has introduced a "bigger" disc to take advantage of it. Upping the ante from 650MB/74 minutes, the new *CDR-DA* can handle 80 minutes of audio, as well as 700MB of data. The new discs have an MSRP of \$27.99 in a 10-pack. Street prices may be lower, making the new CDs about \$2 each in quantity.

Memorex even has a new CD-RW drive that will have you recording and rerecording (though CD-RW is still limited to 650MB) in style. As long as you have a Pentium 133 or better with 32MB of RAM and Windows 95, 98, or NT, you're ready for CD recording.

### 4X2X24X

Don't be stumped by the series of numbers in the subheading you just read. The new Memorex *CD-RW 4224*



*The Memorex CD-RW 4224 drive offers both speed and diverse functionality. Except for DVDs, there isn't a CD-sized media this drive can't handle, and handle well.*

drive (\$199, MSRP) has adopted the standard of indicating the different speeds at which it performs its different functions. Spec one, or 4X, shows that the drive writes to CD-R media at a speed of about 4X—in this case a range from 614–697 KB/sec. The second spec, 2X, indicates that the unit will rewrite to CD-RW discs at 300 KB/sec or 2X. The largest number, 24X, is the speed at which the drive can read all CD media; in this unit, at a maximum of 4233 KB/sec.

The drive comes with a software package, called *NTI CD-Maker Pro 3*, which makes it simple to archive data, create CD audio discs, and even make video CDs. While we were surprised that Adaptec's popular *Easy CD Creator* wasn't included, the NTI offering did work well and is suited to beginners and pros alike.

Also with the drive you'll find mounting screws and an audio cable to con-

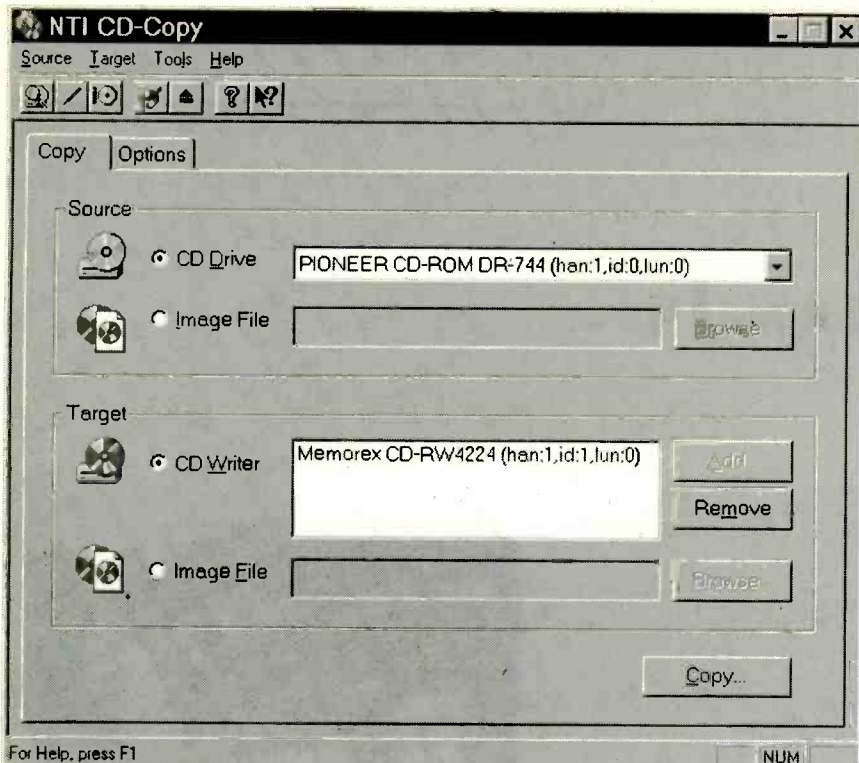
nect it to your system's sound card. Installation documentation is light, but we'll be handling the simple process here anyway.

### BAY DECISIONS

Where will your new drive go? Because it reads at 24X speeds, the 4224 might make a good replacement for most older drives. However, if your installed CD-ROM is significantly faster, or you have a DVD-ROM drive, you will want to only add the 4224 as a second unit.

If replacing a drive, remove the old one from its bay by detaching the audio, data, and power cables, then unscrewing it from the side of the chassis (the drive will be held in by two to four mounting screws). You can then slide the drive out.

Check the back of the 4224 to see if it is set as a Master (the setting that tells your computer not to look for



Chances are you'll be making more than a few copies of CDs with your drive. CD-Copy makes the process a matter of two or three mouse clicks.

another CD drive). This is the standard factory configuration, but you will have to move the jumper if for some reason it wasn't set as such. The top of the drive has a label that shows you how to set the jumper.

When ready to install the drive in place of an old one, use the same cables and screws to make life easier, unless the old audio cable is incompatible with the Memorex drive. In that case, use the new cable. Insert the drive, make the three connections, and screw it into place. That's it.

Those of you installing the drive as a second unit will have to check to see if the IDE data cable attached to the original drive has a second connector. If so, you're set ... if not, go out and buy a ribbon cable with an extra connector before proceeding. Before you run out, though, check to see if you have a free power connector in your PC case. If not, add a Y cable adapter to your shopping list; this way you can siphon power from the other CD drive.

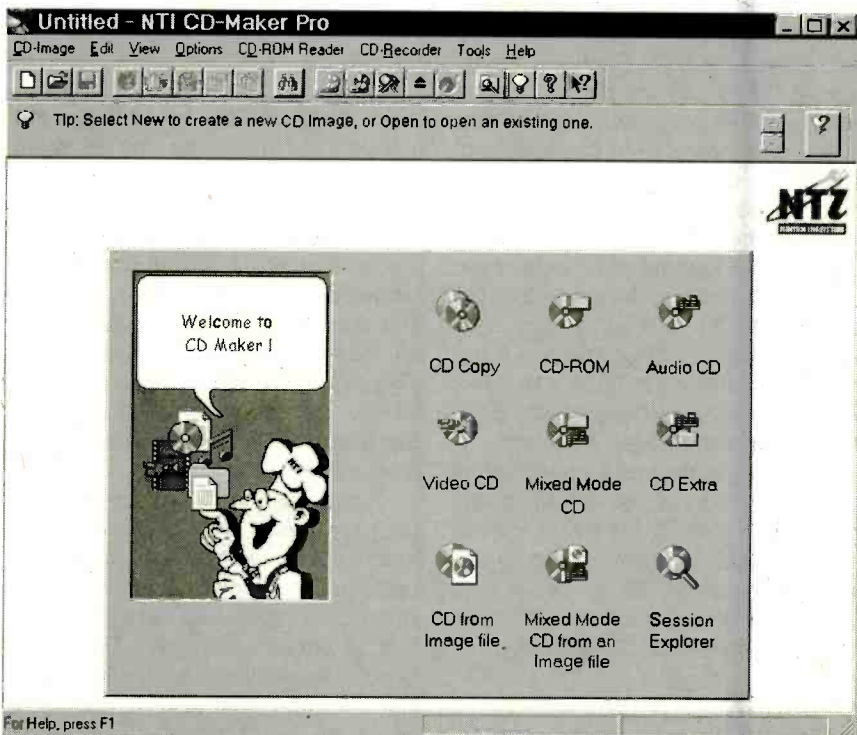
For those keeping that older CD drive, the Memorex unit will be an add-on device. This means that when added as a second drive, the 4224 will have to be set as a Slave (again, check the jumper diagram).

an auxiliary audio connector? If so, you can connect the new drive to it with the included audio cable. If not, you will have to make a choice as to which of the drives in your system you want to be able to play CD audio directly from, and connect only that one. The actual copying of CD audio is done as binary data (zeroes and ones) so you don't need to worry which drive you select for the privilege of playback capability. As most sound cards do have a second or even third connector, you may not have to worry anyway.

Once the drive is screwed into place, you're ready to boot your system.

## WINDOWS KNOWS CD

Pay attention to your boot-up onscreen messages, and you may be surprised to find that your computer recognized the added drive. Further, when Windows loads, it will even assign a drive letter to your new addition. Network users experiencing a conflict as a result of this automatic assignment may want to change the chosen letter by going into Control Panel/System/Device Manager and finding the new drive under CD-ROM. Click on Properties and the Settings tab. You'll see drive-letter pull-down menus that let you pick a different assignment.



CD-Maker Pro is designed to help even novices create perfect results every time, whether you're making a simple data backup or a mixed disc with audio and video files.

## VENDOR INFORMATION

### Memorex

Memtek Products, Inc.  
10100 Pioneer Blvd.  
Suite 110  
Santa Fe Springs, CA 90670  
562-906-2800  
www.memorex.com

**CIRCLE 110 ON FREE  
INFORMATION CARD**

After the new drive is set up, install the NTI software. Do so right off the Memorex drive to verify it's working. Installation is automatic once you run INSTALL.EXE on the CD.

The program package creates a folder in Start/Programs. Access it to click on one of the applications.

CD-Copy is the most straightforward program to use. If all you want to do is make an exact duplicate of a CD, this is the way to go. Here's where there's a benefit to having kept your original drive. You can select the former as the source drive and the Memorex as a target, thereby eliminating the need to copy data to your hard drive first; it's a great time saver. If you have already created a CD copy or image on your hard drive, though, you can of course select that as the source. Using CD-Copy couldn't be easier once your drives are selected. Press the Copy button and wait. A perfect copy is minutes away.

While it offers more functionality, CD-Maker Pro is anything but difficult to master. The opening screen is a Wizard that lets you select the function you want to perform. You can choose CD Copy, if you don't feel like opening the other app we just covered, or access a variety of other features. These include the choice of making a CD-ROM, Audio CD, Video CD, Mixed Mode CD (i.e. containing data and digital audio), CD Extra (a primarily music CD that will run as such, but which contains a data section), CD from Image file, or Mixed Mode CD from Image file. You are then guided step-by-step through the process. If you're new to CD recording, you will be thankful that Memorex chose this software package.

What about the rewriteable functionality? A special application, FileCD, is included to take care of the unique procedures involved in making a CD-RW. Use the program to add files

incrementally to CD-RW discs or to delete files and folders on such media.

## MAKING IT LOOK GREAT

In addition to the quality drive and extra-capacious 700MB discs, the folks at Memorex sent us another wonderful product that you might want to consider adding to your setup. Called the CD LabelMaker Kit (\$29.99, MSRP), it's certain to make your discs look as professional as possible.

The kit comes with a program for PCs and Macs that lets you design killer-looking labels, which will print perfectly on the accompanying label

paper. Included are 18 labels, but you can easily get refills.

After you print out your creation, place it on the cylindrical label applicator along with your CD-R or CD-RW disc. A gentle press will then perfectly center the label on the disc. High-quality results don't come much easier.

That's all the space for this month. Join us here next time for another look at improving that wonderful box on your desk. Until then, you can contact me care of Peak Computing, Poptronics, 500 Bi-County Blvd., Farmingdale, NY 11735, or directly via e-mail at selinakyle@techie.com. **P**

**Get Ready!  
Get Set!  
Go!**

**Design a board with the EAGLE  
freeware version, and see how  
fast you will be productive.**

**Boards designed under EAGLE are found in patient monitoring equipment, chip cards, electric razors, hearing aids, automobiles and industrial controllers. They are as small as a thumbnail or as large as a PC motherboard. They are developed in one-man businesses or in large industrial companies. EAGLE is being used in many of the top companies.**

**The crucial reason for selecting EAGLE is not usually the very favorable price, but rather the ease of use. On top of that comes the outstanding level of support, which at CadSoft is always free of charge, and is available without restriction to every customer. These are the real cost killers!**

**EAGLE 3.5 Light is Freeware!**

You can use EAGLE Light for testing and for non-commercial applications without charge. The Freeware Version is restricted to boards up to half Eurocard format, with a maximum of two signal layers and one schematic sheet. All other features correspond to those of the Professional Version. Download it from our Internet Site or order our free CD.

If you decide in favor of the Commercial Light Version, you also get the reference manual and a license for commercial applications. The Standard Version is suitable for boards in Eurocard format with up to 4 signal layers (max. 99 schematic sheets). The Professional Version has no such limitations.

**http://www.CadSoftUSA.com**

**800-855-8355**

CadSoft Computer, Inc., 801 S. Federal Highway, Delray Beach, FL 33483  
Hotline (561) 274-8355, Fax (561) 274-8218, E-Mail: info@cadsoftusa.com

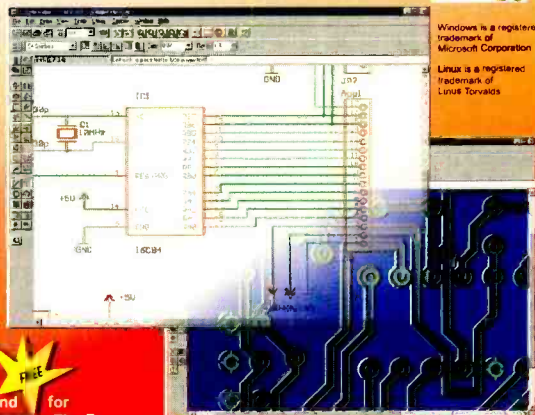


**EAGLE 3.5**

Schematic Capture • Board Layout  
Autorouter

for Windows95/NT

and Linux



Windows is a registered trademark of Microsoft Corporation

Linux is a registered trademark of Linus Torvalds

Prices	Light	Standard	Professional
Layout		199\$	399\$
Layout + Schematic		398\$	798\$
Layout + Autorouter		398\$	798\$
Layout + Schematic + Autorouter	49\$	597\$	1197\$

Pay the difference for Upgrades

CIRCLE 283 ON FREE INFORMATION CARD

## PUTTING A SCANNER TO WORK

Those of you who have been reading **Popular Electronics** know that we've been exploring scanners for a couple of months in this column. We've talked about the technologies used in them, and some of the terms you'll run across when shopping for a scanner.

Last time, in particular, we took a look at a comprehensive scanning utility from ScanSoft called *Pagis 3.0* and walked through the process of performing a simple scan. For those of you who are new to this column or simply missed the last installment, *Pagis 3.0* features a drag-and-drop approach to scanning and includes image-editing and Optical Character Recognition (OCR) tools.

This time around, I'll introduce you to the latest iteration of a great inexpensive photo program, and we'll perform a couple of projects to give you a somewhat better idea of what's involved in using a scanner. None of this stuff is really difficult to accomplish, though, like any other task, the more you do it, the easier it becomes.

### USING THOSE PICS

The most frequent task that the scanners in this household get put to use for is scanning a picture. If this is being performed by one of my kids, the picture winds up being incorporated on the cover of a report for school, or as part of the report itself. Most of the time that I use a scanner, it's to take a photo, crop it, and blow it up as an enlargement.

A fun way, however, to use a scanner is to scan some photos and use them to create custom calendars. I generally like to tape a calendar for the current and upcoming months onto one of my whiteboards, so I can figure out when a particular article is due. I

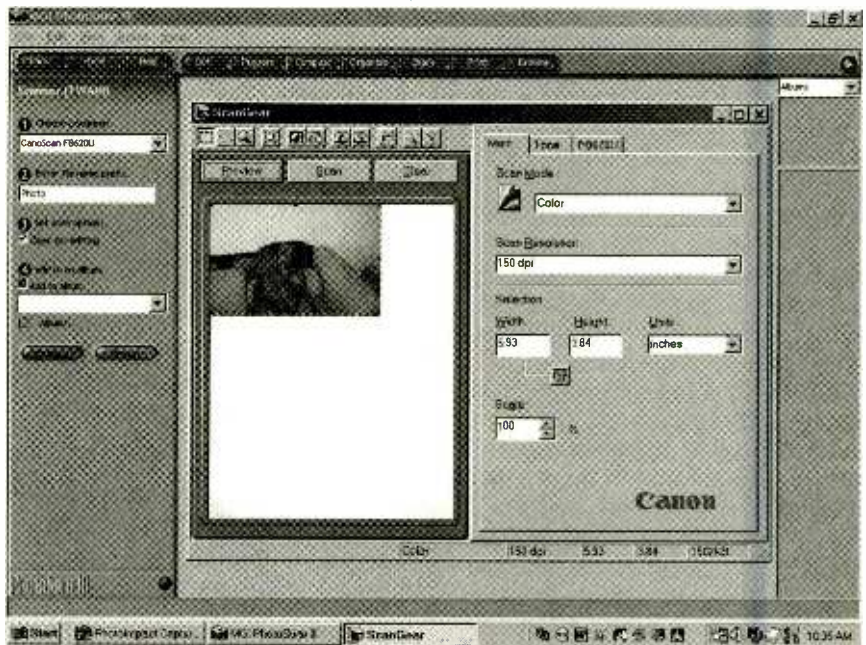


Fig. 1. Clicking on the Get button lets you launch the CanoScan's TWAIN driver.

do try and keep track of deadlines and appointments using a PIM (personal information manager) on my PC, but a calendar gives me a good overview at a glance.

So, to demonstrate how to put a scanner to work, we'll make a January 2K calendar, incorporating a picture of my favorite canine—Sparky the Wonder Dog. Sparky is my office guard dog and faithful companion, so he's a great subject to place in my calendar. Of course, other months would have the rest of my family—the wife and kids.

### STEP BY STEP

For this project, I turned to the newest version of an old favorite: *PhotoSuite III* from MGI Software. As with many packages of this genre, *PhotoSuite III* is a very easy-to-use image acquisition and editing pack-

age. It also comes with lots of project templates, so you can easily make calendars, magazine covers, and even sports trading cards.

Step one is to scan Sparky's photo. You can do this first, but *PhotoSuite III* also lets you do this from within its interface. By clicking on the Get button, you are offered a variety of choices of where to "get" an image from. If you have a digital camera, like the kinds used for videoconferencing, or just want to get the image from a file, you need to specify that here.

We'll choose the CanoScan FB620U (the scanner connected to our system), which will launch Canon's TWAIN driver. This setting panel appears to the left of the main window, and we can set the image type (photo), and click the Scan button to accept the default scan resolution. This, in turn, brings up the

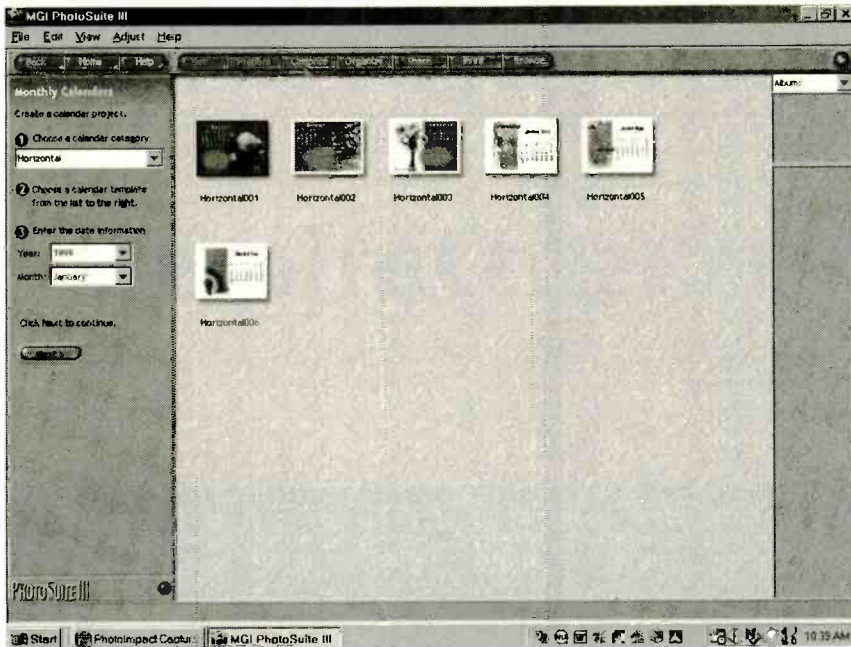


Fig. 2. After you've scanned and cropped an image, select a project template to use it with.

ScanGear scan utility window, where we can preview the scan, make any other desired adjustments, and perform the final scan. Figure 1 shows what this screen looks like.

Once the scan has finished, you are presented with the *PhotoSuite III* editing window. Since I want Sparky in the calendar, but much of the photo we scanned also includes the couch, we'll use the cropping tool to crop out pretty much everything but the dog. Just to be careful, we'll save the new image as a separate JPEG file, using the Save As selection

under the File menu.

Now it's time to use the image. *PhotoSuite III* offers hundreds of different templates into which you can place your image(s). Clicking on the Compose bar brings up a choice of different projects, and if you choose Calendars, you'll first be asked what format (horizontal or vertical) you want, what frequency (yearly, monthly, weekly, etc.), and then be presented with a selection of different styles or templates (Fig. 2). We'll select the one with an apple on the right hand side of the calendar. By

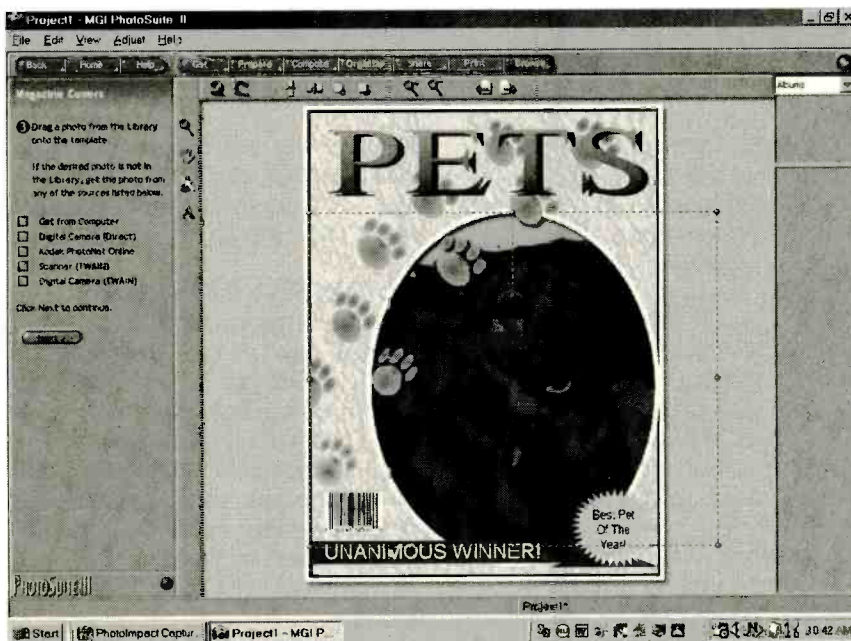


Fig. 3. Here's Sparky on the cover of a mockup pet magazine.

## VENDOR INFORMATION

**Canon USA, Inc.**  
1 Canon Plaza  
New Hyde Park, NY 11042  
800-OK-CANON  
[www.canon.com](http://www.canon.com)

**CIRCLE 100 ON FREE INFORMATION CARD**

**MGI Software Corp.**  
50 West Pearce Street  
Richmond Hill, Ontario  
Canada L4B 1E3  
888-MGI-SOFT  
[www.mgisoft.com](http://www.mgisoft.com)

**CIRCLE 101 ON FREE INFORMATION CARD**

**ScanSoft Inc.**  
9 Centennial Drive  
Peabody, MA 01960  
978-977-2000  
[www.scansoft.com](http://www.scansoft.com)

**CIRCLE 102 ON FREE INFORMATION CARD**

clicking on the subject, we can then delete the current image (the apple), and insert the image we want (Sparky).

The calendar took less than 10 minutes to make, including the process of scanning the photo. Check out the finished product in Fig. 3.

Once we have the image we want, however, we don't have to stop there. After saving and printing our calendar, we can return to the Compose menu, and select another project style, such as a magazine cover. A few more mouse clicks, and Sparky can be immortalized on the cover of a mockup "Pets" magazine!

Keep in mind that MGI's *PhotoSuite III* isn't the only software to offer this type of easy project. Many of the scanners available these days include similar applications, which also have lots of easy-to-do projects, and provide easy image editing (as does MGI's package) to let you get rid of red-eye in photos, or adjust colors that are a bit off. But if you do need a package that's a shade better than the one that came with your scanner, *PhotoSuite III* is a great value at just under \$50.

That's about it for this time. Next month, I'll show you how to set up a simple network without running cables. And you won't even have to open up your PC to do it. And, as always, I welcome your comments. You can e-mail me at [tneedleman@aol.com](mailto:tneedleman@aol.com).

## FREE Web Access Options

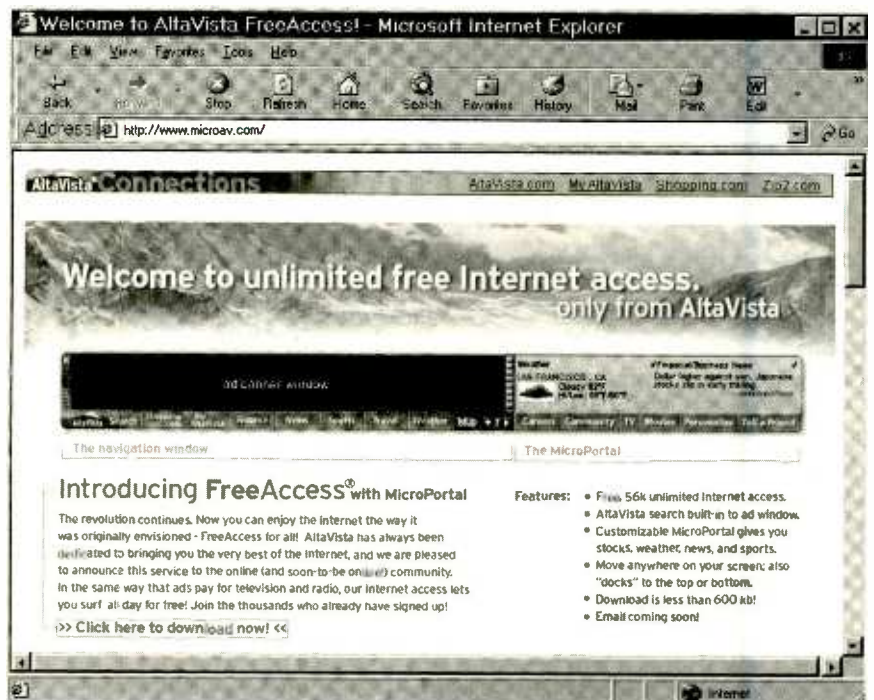
About half a year ago in **Popular Electronics**, we covered a free Internet Service Provider (ISP), expecting that more than a few of our readers would be interested in getting online for nada. However, we didn't expect the deluge of letters that followed the issue. Apparently, the company we covered, NetZero, got rid of its 800 number, resulting in unfortunate confusion we couldn't prevent.

Realizing that plenty of you would still like to get free Internet access, we decided to revisit NetZero as well as cover a new free ISP in this first issue of **Poptronics**. So read on and get ready to stop writing those \$20 checks every month.

### HOW?

Advertising makes the media world go round. You no doubt know this just from watching broadcast television. Beer commercials generate revenue for the NFL, jean commercials are found in just about every teen show on the airwaves, and Saturday morning cartoon shows feature enough toy ads to send children into hysterics over the latest action figure or doll. Besides providing breaks for a bathroom visit or refrigerator raid, commercials pay the millions necessary for keeping broadcast TV free. That's right ... ads pay so you don't have to.

Since the Internet is now competing with TV, and more of us are spending time online, the Net has quickly become a target for advertisers. Whether they're promoting Web sites or real-world stores and services, advertisers see the "ratings" of the online world as valuable. That is, valuable enough to warrant paying big bucks for—big enough bucks to make the Net free of monthly fees.



Check out AltaVista's FreeAccess site, download a small program, and never pay for Web access again.

The providers we look at this month use targeted advertising to ensure that the best penetration per dollar is made into Internet households. To use either AltaVista FreeAccess or NetZero, you will have to complete a profile that records your various interests and specific demographic data. In many ways this beats TV advertising, where you may be forced to watch ads that are of absolutely no interest to you.

After you dial into your free ISP of choice's local number, your e-mail client and Web browser programs will always share screen space with a small advertising window. The latter will be on top of the Net programs and impossible to hide, but it is small enough to position in a screen corner

without biting into too much of your screen real estate. Of the two ISPs, AltaVista's popup window is actually useful. We'll explain why in a moment.

### ALTAVISTA EXPANDS

If you've been online before, then chances are you've come across AltaVista.com. It's a wonderful and innovative search site that features not only a Web and Usenet query engine and customizable start page, but online language translation as well. Like many other sites, AltaVista provides access to Web-based e-mail. Now the site's gone a step further in its offerings.

While its e-mail is still only accessed through a browser,

## HOT SITES

**AltaVista FreeAccess**  
www.microav.com

**NetZero**  
www.netzero.net

FreeAccess now has free dial-up access to the Web itself. Covering practically every area code, the numbers ensure you can get online from almost anywhere in the US (as with any access number make sure the exchange, or first three digits after the area code, is billed as a flat-rate and not a toll call).

To get started with the FreeAccess service, you need to download a small (600K) application that works with Microsoft's Internet Explorer 4.0 (or higher) for Windows 95 or 98. Interestingly enough, you can use any browser to actually surf the Web, but IE must be installed on the system.

System requirements are minimal. Your PC needs to be a 486 or better with 16MB of RAM and have a 14.4 Kbps or faster modem (the dial-up numbers support 56 Kbps).

After you run the installation program, FreeAccess will present you with a chance to choose your dial-up location and username and password. Then, after completing a short questionnaire, you're ready to go online.

The ad window that appears with AltaVista FreeAccess contains some nice extras. On the bottom are located search buttons that make finding Web sites a breeze. To the right is a handy area called MicroPortal, where you can get custom information such as local weather, sports, and news headlines. It's amazing how fast you get used to having this floating window on your Windows Desktop. Best of all, the higher your screen's resolution setting (1024 x 768, for instance), the smaller the ad window will appear.

The only real drawback to AltaVista FreeAccess at the time of this writing is that you have to be online to download the requisite software. Of course, at 600K the program will fit on a floppy, making it simple enough to ask a friend to snatch it off the Web for you.

## NETZERO REDUX

NetZero is another free provider with a software package you'll need to obtain. However, this program, called

# Electronics CD ROMs

## Want to improve your design skills?

produced by  
**matrix**  
multimedia

Then you should consider our range of CD ROMs by best-selling author Mike Tooley.

**Electronic Circuits and Components** provides a sound introduction to the principles and applications of the most common types of electronic components and how they are used to form complete circuits. Sections on the disc include: fundamental electronic theory, active components, passive components, analog circuits and digital circuits. Includes circuit's and assignments for Electronics Workbench.

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

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

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

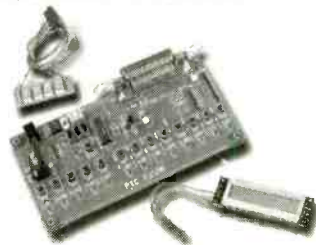
"...hammers home the concepts in a way that no textbook ever could." Electronics Australia

## Interested in programming PIC micros?

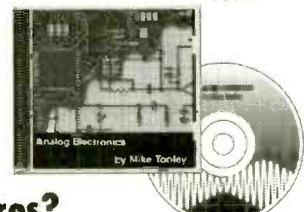
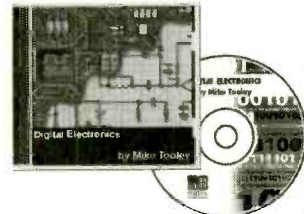
We have the perfect solution:

Our PICtutor CD ROM can teach you how to write assembly language programs for the PIC series of microcontrollers. The CD ROM's 39 tutorial sections will guide you from basic PIC architecture, commands, and programming techniques up to advanced concepts such as watchdog timers, interrupts, sleep modes, and EEPROM data memory use. Over 80 exercises and challenges are provided to test your understanding, and the unique Virtual PIC allows you to write and test programs on-screen.

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



development board (institution version)



## Prices and Versions

Institution versions are suitable for use in schools, colleges and industry. Student versions are for students/home use.

	student version	institution version
Electronic Circuits & Components	\$56	\$159
Digital Electronics	\$75	\$189
Analog Electronics	\$75	\$189
PICtutor (CD and development board)	\$179	\$350

Shipping costs to Canada an additional \$5. Overseas orders please contact CLAGGK Inc. for shipping costs.

see <http://www.MatrixMultimedia.co.uk> for full specs and demos

Please circle the products you would like to buy on the table above right, calculate the total cost, fill in the form below and send it to us. Please allow 4-6 weeks for delivery.

Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Zip: \_\_\_\_\_ Telephone: \_\_\_\_\_  
I have enclosed my check for \$: \_\_\_\_\_  
Please charge my credit card for \$: \_\_\_\_\_  
Note that the delivery address and the address at which the card is registered must be the same.  
Card type: \_\_\_\_\_  
Mastercard, Visa, or Discover only

Signature: \_\_\_\_\_  
Number: \_\_\_\_\_  
Expire date: \_\_\_\_\_

## Order Form



**Claggk Inc., PO Box 4099, Farmingdale, NY 11735-0792**  
Tel: 516-293-3751 email [claggk@poptronix.com](mailto:claggk@poptronix.com)



Once you choose your local phone number and fill out a brief questionnaire, FreeAccess lets you log on as you would with any other dialer. Enter your username and password, and it's off to the Web.

ZeroPort, is a lot larger than that of FreeAccess, requiring five floppy disks to accommodate it. Fortunately, you can get ZeroPort without downloading it. Just call 888-279-8132 (available 24/7) with a credit card handy. NetZero will send the dialer software to you on a CD for a \$6.95 shipping and handling charge. For check or money orders, mail your request to NetZero

local call.

You will then choose a username and password. Your e-mail account will, as a result, be automatically created as *yourusername@netzero.net*. A step ahead of FreeAccess, in this respect, NetZero lets you use a standard e-mail client like Outlook or Eudora to access your e-mail.

Like FreeAccess, prepare to fill in

Inc., Attn: CD Orders, PO Box 3009, Thousand Oaks, CA 91359. Include your first and last name, address, city, state, zip code, and phone number (per NetZero's request). It takes about two weeks to get the disc.

When you run ZeroPort, it will ask for your area code to help you choose the dialup number closest to you. We found one right in the town that our office is located in, but again, do check with the phone company to see if the exchange of the number you find a

some personal details in a questionnaire. Fortunately, it's quick and painless.

Each time you log on, you'll be presented with the AdVantage Window, which measures about 1 by 3 inches on an 800 x 600 display. The 30-second ads that AdVantage displays are not only targeted, but intelligent in relation to what site you're visiting. Visit a book site, for example, and an offer from a company like Amazon.com may appear.

That's all the space we have this month. Here's hoping that NetZero or AltaVista meets your online needs. Feel free to send us any questions or comments via snail-mail to *Net Watch*, Poptronics, 500 Bi-County Blvd., Farmingdale, NY 11735, or e-mail to [netwatch@gernsback.com](mailto:netwatch@gernsback.com). **P**

## SYSTEM DESIGN

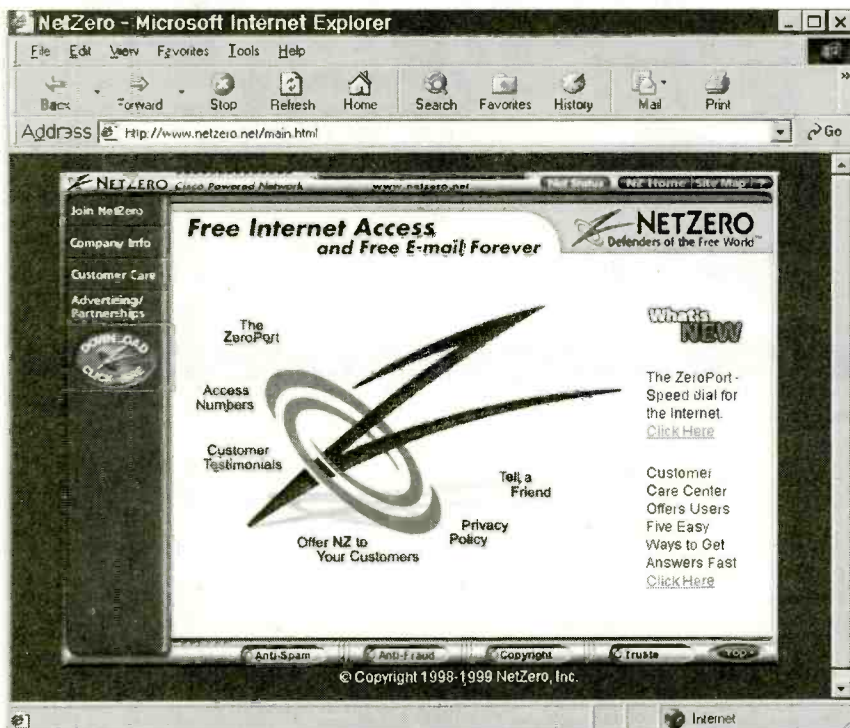
(continued from page 42)

## OUT OF THE ORDINARY

Although the small size of the Vaio Slimtop limits its expandability to a large extent, it is not as limiting to the system's usability as you might guess. The reason for this is that Sony provided a number of alternative ways to hook up peripherals to the Slimtop. In addition to a pair of USB ports—probably one of the easiest ways to add a scanner, printer, or other peripheral—there is a Type II PC Card slot. You can use this slot for memory cards,

## SPECIFICATIONS

- Model:** Vaio Slimtop PCV-L620
  - Price (as configured):** \$2299
  - Vendor:** Sony Electronics, Inc., 3300 Zanker Rd., San Jose, CA 95134; 888-315-7669; [www.sony.com](http://www.sony.com)
  - CPU:** 500-MHz Intel Pentium III
  - Memory:** 128MB SDRAM, expandable to 256MB
  - Storage:** 10GB Ultra ATA/66 hard disk, 1.44MB floppy disk
  - ROM Drive:** 6X DVD
  - Video:** 14.1-Inch LCD panel, ATI RAGE LT PRO with 4MB RAM
  - Audio:** Yamaha YMF-724 wavetable chipset, stereo speakers built into monitor
  - Size:** 3.5 x 11 x 13.25 inches (HWD)
  - Ports:** Parallel, serial, VGA, two USB, IEEE 1394
  - Expansion:** One PCI slot, Type II PC Card slot, Sony Memory Stick slot
  - Other:** Windows 98, software bundle
- CIRCLE 120 ON FREE INFORMATION CARD**



NetZero offers full access to the Web and standard e-mail for free. Download the free dialer or order it on a CD to get started.



network interface adapters, or even external hard disk and tape drives. Also provided is a Memory Stick slot. This is a new rewriteable memory media introduced by Sony last year. And while it has not yet been embraced by large numbers of peripheral vendors, the technology is used by Sony in its own consumer devices, such as digital cameras and an MP3 player. Sony hopes for more general acceptance, but as with all new storage media, only time will tell.

There's one additional feature of the Sony Vaio Slimtop we liked very much: an IEEE 1394 port. Sony calls this an iLink port, while others sometimes call it a FireWire port (though "FireWire" is actually an Apple trademark). Regardless of the appellation you use, it can provide a high-speed link between two systems or make it a snap to transfer digital video between the Slimtop and a digital camcorder. Sony also includes a very comprehensive software bundle, which has applications for both digital still and digital video editing.

This interesting design doesn't come cheap. At the same time, the Sony VAIO Slimtop is not really much more expensive than any other premium brand name 500-MHz Pentium III desktop with an LCD monitor. And it looks much better than most of the competition's more conventional designs. **D**

## COMPUTER SECURITY

(continued from page 50)

Rather than block out such programs and thereby make the host Web sites look dull, the eSafe Protect Desktop in *Best Defense* traps these mini programs in a safe area called a "sandbox." This way, Java and ActiveX apps can run and offer you all the excitement of a cutting-edge Web experience, yet if any of them try any funny stuff your system will be kept safe.

Perhaps you've heard of "cookies"? They're files kept on your system that store personal information to identify you to certain Web sites, for example, a username and password to let you enter the *New York Times Online* without typing authentication. However, sometimes really personal information like your phone number or even credit card number (!) can end up in these

files. The last thing you'd want is for a site you visit to capture such data. The Personal Firewall feature of *Best Defense* prevents any of this info from being given out. The Firewall even keeps hackers from actively trying to penetrate your system while you're online.

Another great feature we touched on just a couple of paragraphs ago is the program's ability to protect from certain types of in-person tampering. If you're afraid of your kids or coworkers messing up your computer's settings, use *Best Defense* to customize your Start menu. If anyone other than you tries to change a system setting or run a program you don't want run, the system will not allow it. After all, some of the biggest threats to a computer can be from a person who just doesn't know any better.

Keep in mind with either of the aforementioned suites that as far as virus protection goes, it's only as good as your latest anti-virus update. You'll need to regularly download virus-identification tables that the software will use to check for the latest online threats being discovered. Should a new one come out between downloaded updates and your machine catches it, well....

However, there is a way to guarantee that a virus, no matter how new, can never ever affect your system. Though it costs a bit more, Calluna's *PC Bodyguard* (\$199) provides a unique approach to warding off those nasty little technodemons.

Rather than rely on virus tables, *Bodyguard* uses a special ISA card to protect your system. Once the card is inserted, you run a cable (included) that lets the card act as a go-between, stepping in between your hard drive and motherboard. The card has its own microprocessor, which cannot be affected by any kind of virus. This chip vigilantly watches over all access and write attempts made to your hard drive. Further, it sets up "hard walls" or protected areas on your hard disk. Should any virus attempt to destroy your data, not only will it likely be stopped immediately, but its attempts will only be made within a particular area. In other words, none of your precious data outside the active area will even begin to

be affected.

Note that protected areas can be set up to allow access only to certain users. This keeps hackers or other invaders from being able to affect, say, the boot sector or operating system. Further, thanks to Write Many Recoverable (WMR) technology, *PC Bodyguard* can recover from any damage made to the primary boot partition. If, somehow, a virus did try to change something in this critical section, all you would have to do is reboot your machine. This is because *Bodyguard* only allows changes to be made to a separate "scratch" area that is wiped on power-down. As a result, no real damage can be done by either confused users or those attempting genuine malice.

The folks at Calluna have come up with a real winner for the security-conscious. As long as you have a Pentium PC or better with a CD-ROM, running Windows 95/98/NT, you're set. Of course, your machine must have an open ISA slot for the card. **Q**

### Get your copy of the CRYSTAL SET HANDBOOK



Go back to antiquity and build the radios that your grandfather built. Build the "Quaker Oats" type rig, wind coils that work and make it look like the 1920's! Only \$10.95 plus \$4.00 for shipping and handling. **Clegg Inc., P.O. Box 4099, Farmingdale, NY 11735. USA Funds ONLY! USA and Canada -- no foreign orders. Allow 6-8 weeks for delivery. MA01**

### Practical PIC Microcontroller Projects



This book covers a wide range of PIC based projects, including such things as digitally controlled power supplies, transistor checkers, a simple capacitance meter, reaction tester, digital dice, digital locks, a stereo audio level meter, and MIDI pedals for use with electronic music systems. In most cases the circuits are very simple and they are easily constructed. Full component lists

and software listings are provided. For more information about PICs we suggest you take a look at BP394 -- An Introduction to PIC Microcontrollers.

To order Book #BP444 send \$7.99 plus \$3.00 for shipping in the U.S. and Canada only to Electronics Technology Today Inc., P.O. Box 240, Massapequa Park, NY 11762-0240. Payment in U.S. funds by U.S. bank check or International Money Order. Please allow 6-8 weeks for delivery. ET10

# NEW LITERATURE

## Digital Home Recording

Edited by Carolyn Keating and  
Craig Anderton

Miller Freeman Books

6600 Silacci Way

Gilroy, CA 95020

Tel: 800-848-5594 or 408-848-5296

Web: [www.books.mfi.com](http://www.books.mfi.com)

**\$19.95**

With the cost of CD-R drives plummeting, the process of making audio CDs can easily be shifted from the professional to the home studio. This practical, all-in-one guide is packed with how-to instructions plus tips and techniques for creating and operating a cost-effective digital recording studio at home, by choosing and using the right digital recorder gear, hardware, and software.



Beginning with the fundamentals of sound and the nature of digital audio, the book goes on to expert tricks for studio setup and maintenance, selecting and protecting equipment, recording, mixing, burning, and troubleshooting. Hands-on instructions present the home recording potentials of digital audio tape (DAT), CD-R, MIDI, samplers, sound cards, and more.

## Radio Science Observing, Volume 2

by Joseph J. Carr

Prompt Publications

Howard W. Sams & Company

2647 Waterfront Parkway, East Drive

Indianapolis, IN 46214-2041

Tel: 800-428-7267

Web: [www.hwsams.com](http://www.hwsams.com)

**\$34.95**

In this expanded edition, there is all new

material covering techniques and methods, hardware design and construction, and more RadioScience theory. In response to readers of the previous edition, related geo-science and planetary scientific activities have been added. The included CD-ROM contains information for making calculations, in addition to audio clips.



Subjects covered include propagation anomalies, electromagnetic fields and safety, finding compass bearings, seismic observations, receiver selection, and radio telemetry on a budget. There is also a chapter written by Dr. Paul Shuch of the SETI League.

## HTML 4.0 Specification

toExcel

620 N. 48<sup>th</sup> Street, Suite 201

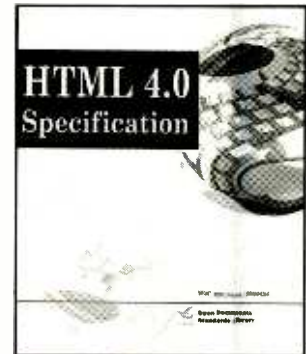
Lincoln, NE 68504

Tel: 877-288-4737

Web: [www.toExcel.com](http://www.toExcel.com)

**\$20.95**

This book contains the complete text of the latest available version of the HTML 4.0 specifications and reference manual. It is designed to be a handy desk-top companion for HTML Web page authors, Internet program developers, information technology managers, and anyone else who publishes documents on the Web. It provides full detail on all



the accepted elements for use in an HTML document, including text, forms, embedded applets, and hyperlinks.

HTML is the most common method to distribute documents on the World Wide Web. HTML gives authors the means to publish online documents with headings, text, tables, lists, and photos; to retrieve online information via hypertext links, at the click of a button; design forms for conducting transactions with remote services, for use in searching for information, making reservations, or ordering products; and include spreadsheets, video clips, sound clips, and other applications directly in a document.

## Digital Logic Gates and Flip-Flops

by Ian R. Sinclair

Electronic Technology Today

P.O. Box 240

Massapequa Park, NY 11762

**\$14.99 (including S&H)**

Gates and flip-flops are the building bricks of all digital electronics, and the knowledge of how to carry out logic actions with gates and flip-flops is needed more than ever. Intended for enthusiasts, students, and technicians, this book establishes a firm foundation in digital electronics by starting from the beginning and treating the topics of gates and flip-flops thoroughly. It is meant for the user who wants to design and troubleshoot digital circuitry based on a thorough understanding of the principles.

Topics such as Boolean Algebra and Karnaugh mapping are explained and more attention is paid to synchronous counters than to less important ripple counters. Also an explanation of microprocessor techniques as applied to digital logic. **P**

**BooksNow**

To order books in this magazine or any book in print. Please call anytime day or night: (800) BOOKS-NOW (266-5766) or (801) 261-1187 ask for ext. 1454 or visit on the web at <http://www.BooksNow.com/electronicsnow.htm>.

Free catalogs are not available.

## Using and Hacking Robots with Lego Mindstorms

**S**ay the word “Lego” and most adults think of a million tiny plastic pieces strewn across a floor, waiting to be stepped on with bare feet. Anyone who has ever had one of those little angle pieces jabbed into their tender arch or break the skin on a heel knows how painful owning a Lego set can be! Still, apart from the occasional torture of walking over hard plastic, Lego sets are wonderful amusements for both young and old. You can build most anything with Legos. And with the help of your PC coupled with the new Lego Mindstorms sets, you can even create your own programmed robots.

In this column, I’ll review the current state of Mindstorms affairs—the different sets you can buy, and how you might use them. I’ll also discuss some of the homebrew hacks that have appeared for the Mindstorms sets, including how to program the Mindstorms robot using Visual Basic.

### A Closer Look

Lego currently sells multiple versions of the Mindstorms kit. The basic kit is the Robotics Invention System (RIS), the original version of which was introduced in 1998. All Mindstorms kits are composed of various Lego building block parts and come with a programmable or pre-programmed “brick” module. The brick is the robot itself and includes the battery power supply and control electronics. Also included with the RIS is a collection of motors and sensors that attach to the brick, plus an infrared transceiver for programming the brick on your PC or laptop and software (on CD-ROM) to assist you in creating a working robot.

The brick, or control unit, of the RIS is called the “RCX.” The RCX is a smart

controller that initially receives its programming from your computer via an infrared transmitter. Then, when totally disconnected from your PC, the RCX runs through its programming, turning motors on and off under the direction of the code stored inside it.

As with most Lego assortments, Mindstorms comes with a booklet of suggested project plans, but you’re free to design almost anything you want. And, because you can use standard Lego parts, you can cannibalize other kits to extend your Mindstorms creations. The basic Mindstorms robot built with the RIS kit is the “PathFinder 1.” Using two motors and two wheels, the robot vehicle is able to move forward and back and can turn in place—that is, it has no turning radius like a car; it just spins to turn.

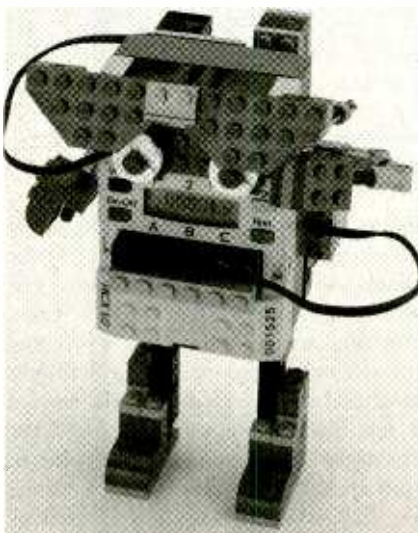
While building the PathFinder is fun

in itself, the real enjoyment—and challenge—comes in programming the thing. Pop the Mindstorms CD-ROM into your computer, and you can design your own programs to control the RCX. The Mindstorms CD-ROM comes with a programming tutorial, but the whole technique is so simple and straightforward that even non-programmers will easily master the basics. To program the RCX, you merely click and drag predefined program blocks, connecting them on the screen like links of a chain. You can move the blocks around and add additional blocks in between.

And, of course, you are not limited to building just the standard two-wheel roving robot. With just the parts included in the RIS Mindstorms kit, you can construct a simple robot arm or even a walking robot. The RCX has three motor-output ports; you can, therefore, add a third motor (available separately) to create more complex robot creations.

One light and two touch sensors are included in the RIS Mindstorms kit, allowing the RCX to interact with its environment (without the sensors, all you really have is an expensive RC toy). You get two touch sensors—they’re really miniature switches encased in a Lego block—and a light emitter/detector pair that can be used to control the action of a motor when a change of light occurs.

All three sensors are controlled using the graphical Mindstorms programming environment. The programming environment treats the input sensors as “events.” When a sensor event occurs, the RCX can be programmed to take some action. For example, suppose you’ve created the basic two-wheeled PathFinder 1 “roverbot.” Your program starts by activating both motors so that the robot travels in a forward direction.



*The basic Lego Mindstorms kit—the Robotics Invention System (RIS)—like all kits in the series is composed of Lego building-block parts that can be fused with other Lego-system components to create elaborate automatons.*

A touch sensor is attached to the front of the RCX. If the sensor is activated—*i.e.*, the RCX strikes an object—your program can reverse the motors so that the robot travels in the opposite direction.

Similarly, a touch sensor mounted on the back of the RCX can be programmed to make the robot travel forward again. In a crowded room, the RCX would likely ping-pong back and forth between objects—fun for a while, but Mindstorms can do more. You can program your robot with time delays, creating even sophisticated movements. For instance, instead of just reversing both motors when a touch sensor is activated, you might activate just one motor for a brief moment. You can then command the motors to both turn on again in the forward direction. That would have the effect of turning the robot by an arbitrary amount, so that its travel around a room is less predictable.

The light sensor can be used to detect the presence or absence of light and is a fun gadget to use when constructing a flashlight-controlled robot. With such a robot, the RCX can be commanded to stop, turn, or reverse directions when a flashlight is directed at the sensor. The sensor includes its own light source, so you can also use it to construct a “line tracing” robot. The RIS Mindstorms kit comes with a large white pad with a black line as a “course” or track for the RCX to follow. You can draw your own line-following track on any light-colored surface.

### Downloading Programs

A unique feature of Mindstorms is that the RCX is a non-tethered controller. That makes it appear much more like an autonomous robot, even though you use your PC as a programming station. There is no control wire for the RCX to get tangled with.

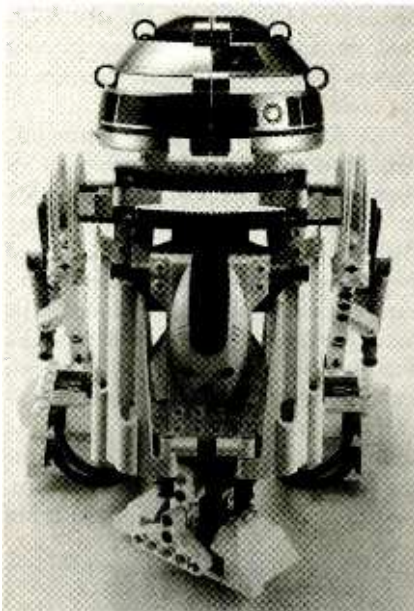
Programs created on your PC are “downloaded” to the RCX via a two-way infrared (IR) transceiver. The transceiver sends program code to the RCX, and the RCX responds to indicate a proper download. For optimum performance, the IR transceiver should be placed no more than about a foot from the RCX, though I’ve successfully used the IR transceiver to download programs to an RCX 6—8 feet across the room.

When you think you have a working program, you place the RCX near the infrared transmitter, and click the “DOWNLOAD” button in the Mindstorms

programming screen. Most programs download in under 10 seconds. When downloading is complete, you merely depress the RUN button on the RCX unit and watch your robot come to life.

If your robot doesn’t behave quite like you expected, you can re-examine your program, make changes, and download the revised code. Once you’ve built a program you like, you can save it for future reference. The RCX can internally store five programs at a time, but you can keep hundreds or even thousands of programs on your computer’s hard-disk drive. Just download them again into any of the RCX’s five program slots when you want to run them.

As mentioned above, you can dramatically increase the apparent intelli-



*For the sci-fi fan, the Lego Droid Developer’s Kit (selling at about \$99 retail) allows you to develop replicas of Star Wars’ R2-D2, a Gungan sub, and a battle droid on a STAP vehicle.*

gence of your Mindstorms creations by attaching program blocks to monitor the touch switches and light sensor. For example, with just a few blocks of code, you can create a robot that will come toward you when you shine a flashlight at it. Add another block of code, change a few blocks here and there, and the flashlight beam might cause the robot to spin around a few times, then continue on. The possibilities are literally endless.

### Alternative Mindstorms Kits

The Robotic Invention System (RIS) may have been the first Mindstorms developed by Lego, but it certainly isn’t

## MINDSTORMS RESOURCES ON THE WEB

### Gordon’s Brick Programmer

[www.umbra.demon.co.uk/gbp.html](http://www.umbra.demon.co.uk/gbp.html)

### Java Tanks

<http://developer.java.sun.com/developer/technicalArticles/ConsumerProducts/JavaTanks/javatanks.html>

### Lego on my Mind

[homepages.svc.fjv.nl/brok/legomind/](http://homepages.svc.fjv.nl/brok/legomind/)

### Mindstorms Add-ons

[www-control.eng.cam.ac.uk/sc10003/addon.html](http://www-control.eng.cam.ac.uk/sc10003/addon.html)

### RCX Internals

[graphics.stanford.edu/~kekoa/rcx/](http://graphics.stanford.edu/~kekoa/rcx/)

### RCX Tools

[graphics.stanford.edu/~kekoa/rcx/tools.html](http://graphics.stanford.edu/~kekoa/rcx/tools.html)

the last. Already, Lego has come out with additional kits to construct specialty-robot creations. (Lego also sells several \$50 add-on kits for use with the RIS: Robosports, to “create robots that can throw, dunk, kick, and score,” and Extreme Creatures, for robots that “bite, sting, pinch, and pounce.”)

Star Wars fans are sure to want to try out the new Droid Developer’s Kit (about \$99 retail), where you can build intelligent Lego replicas of a Star Wars R2-D2 robot, a Gungan sub, and a battle droid on a STAP vehicle. Like the RIS kit, droids you build are based around a programming brick, for this kit called the “Micro Scout.” The Micro Scout has a built-in light sensor, motor, sound, and seven programs. As an added benefit, you can combine the RCX brick and other Lego elements from the RIS kit to enhance your droid creations.

### Hacking The Mindstorms

Not long after Lego introduced the first Mindstorms kit, folks found ways to hack into the RCX and programming software. Among the first hacks on the scene were various ActiveX and programming components for coding the RCX using Microsoft Visual Basic. Lego themselves now offers (but does not actively support) an RCX software developer’s kit using Visual Basic; you can download the documentation and software for free at Lego’s Mindstorms Web page [www.legomindstorms.com](http://www.legomindstorms.com).

The Lego Visual Basic SDK works  
(Continued on page 71)

## Speech-Recognition Interfacing Circuit

Last month we built a 40-word speech-recognition circuit. Those new to this column can either order a back issue of the December 1999 **Popular Electronics** from Gernsback, or get a kit of parts from Images Company (PO Box 140742, Staten Island, NY 10314; Tel. 718-698-8305) for \$100. This month we'll augment that system by assembling an interface circuit that allows the speech-recognition system to control external electrical devices and appliances.

The first consideration in designing such an interface is how many switches or devices the interface circuit is to control. To keep the circuit from becoming too massive and at the same time enhance the robustness and accuracy of the speech-recognition process, we'll limit the interface to controlling ten switches (devices).

Because the speech-recognition system can recognize up to 40 words, we'll design our interface to respond to the speech-recognition system's entire 40-word vocabulary (40 switches). While that circuit might be too large for most hobbyists, such a system can be developed by expanding on circuit ideas illustrated in this month's column.

Using just ten on/off switches lets us use four word spaces for each target (command) word. Each of the four word spaces assigned to a target word will hold a slightly different enunciation of the target word. With four different enunciations, the speech-recognition circuit becomes more robust and word-recognition accuracy increases.

If the word spaces are chosen carefully, the complexity of the interface circuit can be reduced. The word spaces should be chosen so that the least-significant digit of any four target (command) word spaces are the same. An example will make the programming scheme clear. Suppose we are making a voice control for an electric wheel chair and we want to use the following command (target)

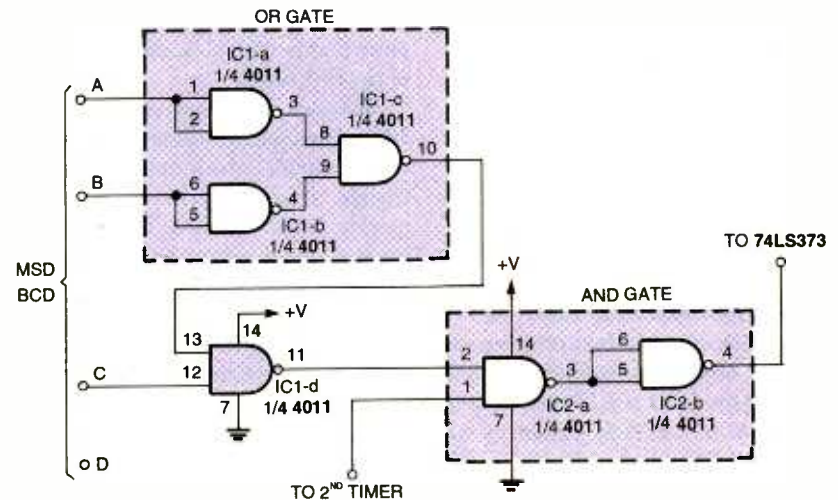


Fig. 1. The error-code detector (ECD) is comprised of OR and AND gates manufactured from common 4011 CMOS NAND gate chips, as shown here.

words: forward, backward, left, right, stop, sleep, on, lock, unlock, and stop. (The command "stop" is so important in this application that it may take up more than one command position—see "Improving Recognition," below.)

The first command we want to train the circuit to recognize is forward. We'll use the following four word spaces: 10, 20, 30, and 40. By dropping the most significant digit of each number, we're left with the least-significant digit (which is the same for all four word spaces), word number 0. Similarly, the next command word, "backward," will use word spaces 01, 11, 21, and 31. Dropping the most significant digit again leaves word number 1.

TABLE 1—ERROR CODE DEFINITIONS

CODE	MEANING
55	word too long
66	word too short
77	no match

Okay, so far so good: This looks workable except when we consider the possible error codes that can be produced by the speech-recognition circuit. There are three error codes (see Table 1) that our interface must recognize, which must not be mistaken for the word numbers 5, 6, and 7. That potential problem can be resolved by using OR, AND, and NAND gates to create an "error-code detector." As shown in Fig. 1, the OR and AND gates are comprised of a total of five NAND gates taken from two 4011 CMOS chips. The error-code detector is connected to the most-significant binary-coded decimal (BCD) number output.

### Interface Output

The interface circuit is designed to provide a logic-high output for each switch. The logic high will propagate through a flip-flop (1-bit memory) to a NPN Darlington transistor. The Darlington transistor will either control the load (circuit) directly or through a relay. The flip-flop on each output line allows multiple devices to be turned on and off without affecting the status of any other output line.

## Connection To Speech Kit

If you buy the speech-recognition system kit, you'll notice it has nine solder holes between IC3/IC5 and IC4 for interconnections between it and the interface circuit. Eight of the nine lines represent the two binary-coded decimal (BCD) numbers; the ninth pad is used for ground. In addition, there's an unused pad near LED1 (represented by a large dot). Soldering a wire from that terminal to the interface circuit (which we'll present shortly) allows a word trigger from the speech-recognition system to be used as an interface enable signal.

Let's look at the interface circuit.

## How It Works

To begin, the interface circuit must be able to react whenever the speech-recognition circuit hears a word. When the speech-recognition circuit hears a word and attempts recognition, LED1 of the speech circuit blinks off momentarily. The nominal voltage on the cathode end of the LED is 3.27 volts. When the cathode of LED1 is pulsed to 4.5 volts, the LED blinks off. Since the LED is pulsed anytime the speech-recognition circuit detects a spoken word, it was deemed suitable for use as an interface enable (or word trigger).

A schematic diagram of the input to the interface circuit is shown in Fig. 2. To use the pulse applied to the cathode

of LED1 of the speech-recognition circuit as a trigger, the pulse is routed to the inverting input (-) of a standard op-amp, which in Fig. 2, is configured as a comparator. A reference voltage (3.64 volts), established by a voltage divider comprised of 5.6K and 15K resistors, is applied to the non-inverting input (1) of the comparator. Prior to pulse application, the output of the comparator is high. But, when triggered by the 4.5-volt pulse from the LED line, the comparator outputs a negative-going trigger pulse that is applied to the trigger input of the first timer.

Speech recognition can take up to 300 milliseconds. During that time, the BCD outputs remain stable and do not change. If our interface operates too quickly, it will already be finished updating the output before the speech-recognition circuit has a chance to update the BCD output. To prevent that possibility, the negative-pulse trigger is delayed by sending it through two 555 oscillator/timers (or one 556 dual oscillator/timer) set up as monostable multivibrators. The negative pulse from the comparator, initiates a 470-millisecond (ms) output pulse from the first timer that is connected to the second timer. The second timer outputs a 220-ms pulse.

The 470-ms pulse allows more than enough time for the new BCD numbers to be outputted. The 470-ms output of

### PARTS LIST FOR THE INTERFACE CIRCUIT

**SEMICONDUCTORS**  
 IC1, IC2—LM555 oscillator/timer integrated circuit  
 IC3—LM741 op-amp, integrated circuit  
 IC4, IC5—4011 CMOS quad 2-input NAND gate, integrated circuit  
 IC6—74LS373 low-power Schottky Tri-state octal D-type flip-flop, integrated circuit  
 IC7—4028 CMOS BCD-to-decimal decoder, integrated circuit  
 LED1-LED10—Miniature light-emitting diode

**RESISTORS**  
 (All resistors are 1/4-watt, 5% units.)  
 R1, R2—10,000-ohm  
 R3—330-ohm  
 R4—5600-ohm  
 R5—15,000-ohm  
 R6-R15—470-ohm

**CAPACITORS**  
 C1—47- $\mu$ F, 16-WVDC, electrolytic  
 C2—22- $\mu$ F, 16-WVDC, electrolytic  
 C3, C4—0.01- $\mu$ F, ceramic-disc

**ADDITIONAL PARTS AND MATERIALS**  
 Printed-circuit or perfboard materials, wire, solder, hardware, etc.

the first monostable is applied to the trigger input of the second monostable, causing it to output a 220-ms pulse. During that time, the interface output is updated provided that the error-code detector is outputting a logic high. The output of the second monostable is fed to one input of a two-input AND gate. The other input to the AND gate is connected to our error-code detector (ECD) circuit. The ECD is connected to the most-significant digit (MSD) BCD number.

Whenever the BCD number equals 5, 6, or 7, the ECD circuit outputs a logic low. For all other numbers, the ECD outputs a logic high. When the output of the ECD is positive, the positive pulse from the second timer allows the least-significant digit (LSD) BCD number to propagate through to the output of the interface circuit. With both inputs to the AND gate high, the output of the AND gate goes high. That high is applied to the enable input of a 74LS373 octal D-type latch, enabling it.

Refer to Fig. 3—a schematic diagram of the interface circuit. With the 74LS373 (IC6) enabled, any number output on the lower BCD number is

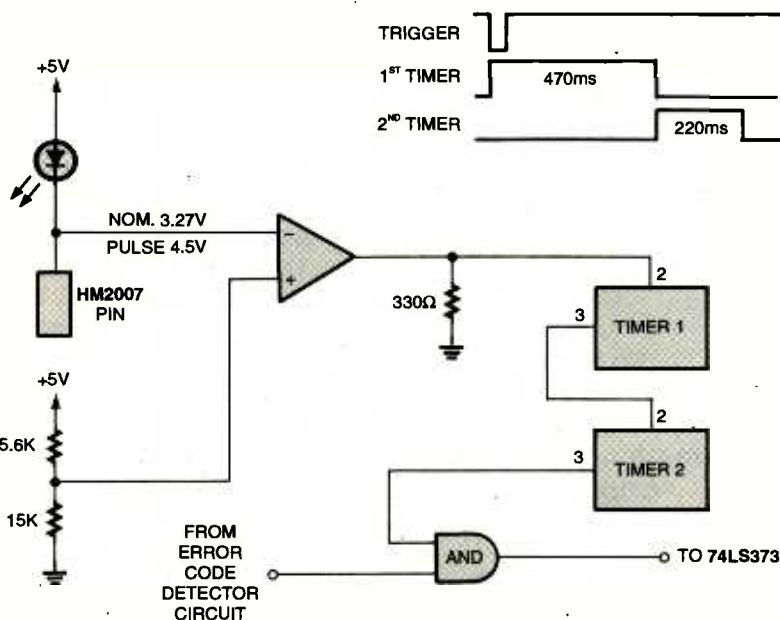


Fig. 2. The interface circuit is designed to monitor the status of the speech-recognition circuit by tapping the cathode voltage of LED1 (in Fig. 1 of last month's column) and feeding it to a voltage-comparator circuit built around an LM741 op-amp.

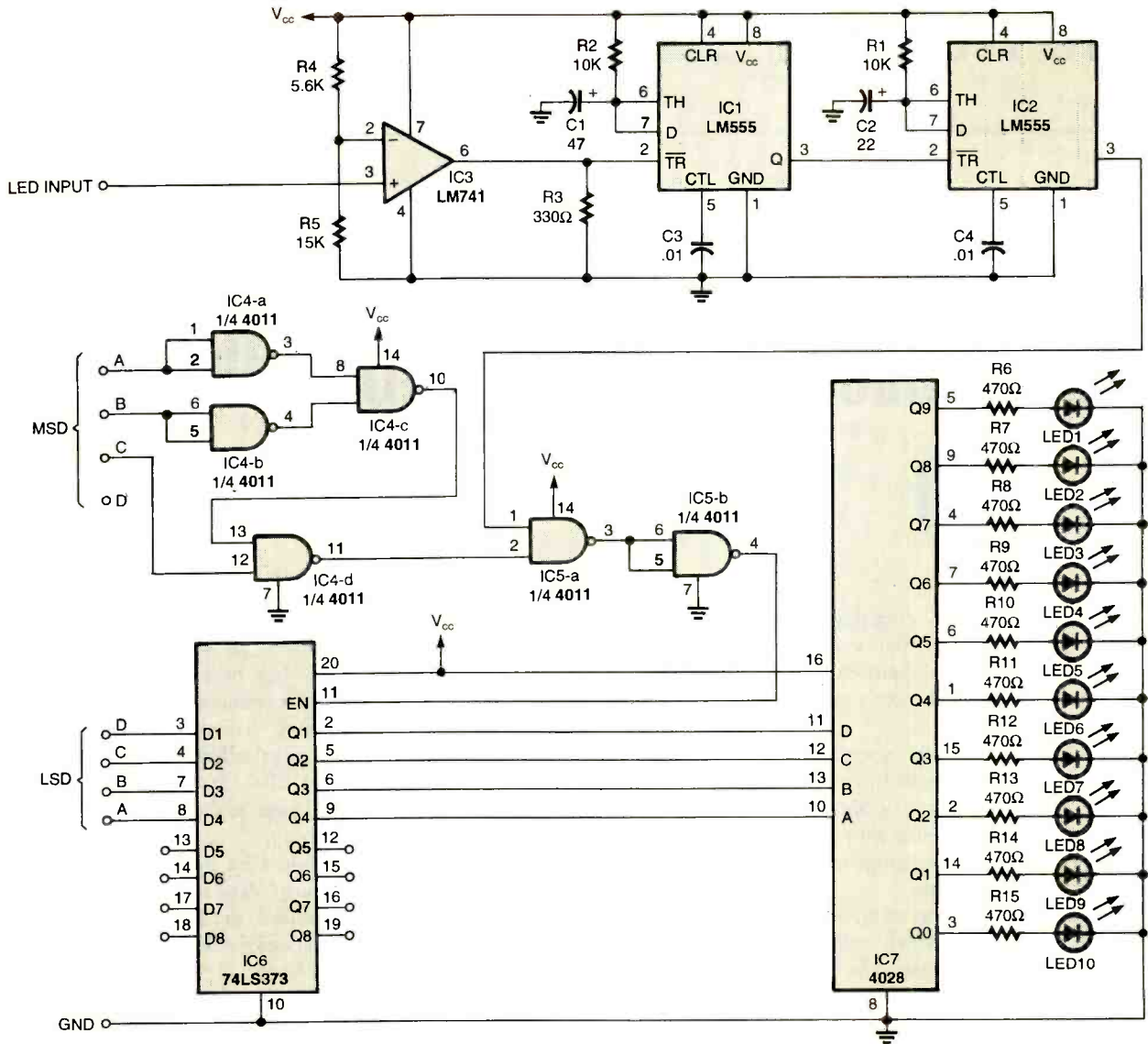


Fig. 3. The interface, which includes the NAND-gate based ECD circuit, is designed to respond to an enable signal from the speech-recognition system.

latched into IC6. Note that only four inputs and four outputs of IC6 are used in this circuit. The four outputs of IC6 are applied to the BCD inputs of IC7, a 4028 BCD-to-decimal decoder, where the data is decoded to generate the appropriate decimal output line (0-9). The outputs of IC7 are applied through a current-limiting resistor to LED1—LED10.

On the other hand, when the output of the ECD circuit is low—which happens when the numbers 5, 6, and 7 are outputted—the corresponding input to the AND gate is low. With the AND gate input kept low, when the positive pulse from the second timer arrives, the output of the AND gate remains low, disabling IC6. With IC6 disabled, the lower BCD number is not applied to

IC7, thereby preventing the numbers 55, 66, and 77 from being mistaken for the words 5, 6, and 7.

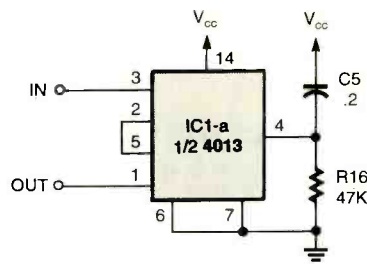


Fig. 4. This signal-latching circuit (based on the 4013 dual D-type flip-flop) can be connected directly to an output of IC7 in Fig. 3, and used to prevent an active circuit from turning off when another is turned on.

### Creating A More Useful Output

The ten decoded outputs of IC7 can be used to control AC and DC loads. However, it is much better to feed the output of IC7 to a flip-flop first. That's because only one of the IC7's ten decoded outputs can be high at any given moment. So whenever the circuit turns something on, whatever device may have been on will be turned off. Not very convenient. A flip-flop connected in series with the outputs of IC7 solves that problem. Once triggered, the flip-flop's output remains high until a second signal forces its output to low. The results of that action is two-fold.

Primarily, one can turn on and off any number of outputs without affecting

(Continued on page 71)

## PostScript Integration, X-ray Fluorescence, Preventing CD-R Blowups, and more

That word “overunity” surely gets kicked around the Web a lot. There appear to be two definitions in current use, both of which aren’t even wrong.

Some folks use the term “overunity” as a code word for a “perpetual-motion machine,” hoping nobody will notice. In that definition, they think that they are describing a machine whose energy output exceeds its energy inputs.

The thermodynamic laws clearly tell us that such a device is extremely unlikely. Much less likely than, say, winning the lottery while getting hit by a big meteor at the Ayatolla’s bar mitzvah.

We know for an absolute fact that that type of overunity has flat out not happened lately. If enough of the output energy gets back to the input, you’ve just created your choice of a jim-dandy supernova or a really neat-o black hole.

A typical claim is a solar-magnetic “energy machine” miracle motor that has been kicking around the budget-motel conference-room circuit. My careful evaluation revealed nothing but wishful thinking, obvious math errors, and a pathetic incomprehension of fundamental electrical and physical principles. Two such examples are the maximum power-transfer theorem as found in the HACK65.PDF file and the differences between rms and average power waveforms (see MUSE112.PDF and MUSE113.PDF). Those files as well as others mentioned here can be found on my Web site: [www.tinaja.com](http://www.tinaja.com).

As a second “overunity” definition, some might fail to account for all of the

input energy sources to a system. For instance, I could easily claim that my car gets 2000 miles to the gallon of windshield-washer fluid.

In theory, an optimized water electrolyzer can accept five units of electrical energy and one unit of endothermic ambient-heat energy. Naturally, the best fuel cell that you can possibly connect to such a system is able to return less than five units of electrical energy at most.

In the real world, of course, you do not get remotely near the breakeven point. The best electrolyzers are so inefficient in comparison to methane reformation that they are not economically usable for commercial hydrogen production. The best fuel cells today are still less efficient than the very newest of multi-cycle heat engines.

As an even better example, a heat pump might be able to move six units of heat energy given only one unit of electrical energy input. But your best possible equivalent thermal-electrical generator has to receive much more than six units of heat energy to give you the one unit of electrical energy back. At least,

that’s what this Sadi Carnot dude claims (as shown in HACK64.PDF), and nobody has been able to prove him wrong for centuries.

Those recent entropy-violation “investment” offers that are now polluting the Web have gotten thoroughly trashed over at the [sci.energy.hydrogen](http://sci.energy.hydrogen) newsgroup.

While a lot more subtle than most “overunity” devices, this one appears to have mixed math errors and wrong assumptions with subtle non-obvious energy flows.

The outcome, of course, was never in doubt in the least.

It is perfectly reasonable to find physical systems that have multiple energy inputs. But should you run these backwards, there clearly is nothing to be gained—despite those outrageous national “snake oil” arena shows now scamming the gullible in an apparent pyramid scheme. Thus, this second “overunity” definition is also no big deal.

A curious fact: Did you know that the word “gullible” is not found in any popular dictionary or spelling checker? More on “overunity” can be found in my BASHPSEU.PDF file.

### NEED HELP?

Phone or write all your US Tech Musings questions to:

Don Lancaster  
Synergetics  
Box 809-EN  
Thatcher AZ, 85552  
Tel: 520-428-4073

US e-mail: [don@tinaja.com](mailto:don@tinaja.com)  
Web page: <http://www.tinaja.com>

### X-RAY FLUORESCENCE SPECTROSCOPY

I have certainly come across some unusual test systems in my surplus wanderings lately. You might do the same by starting with my tutorial in RESBN81.PDF and then using those DRMS1 through DRMS5 link buttons on my Web site or by viewing the actual



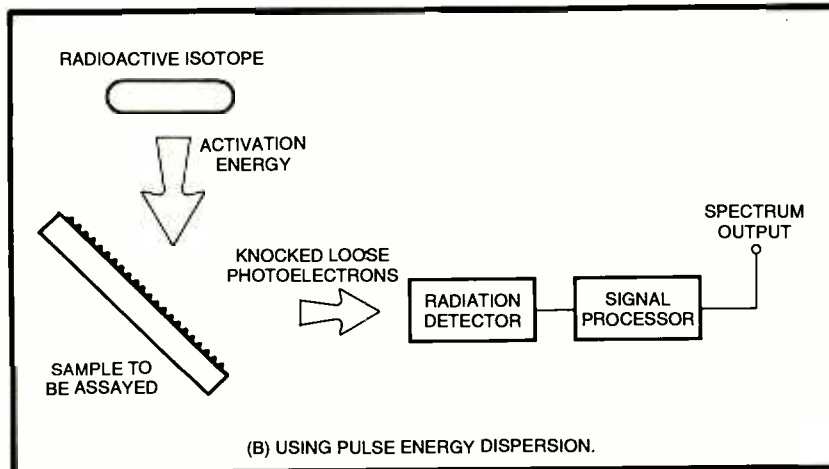
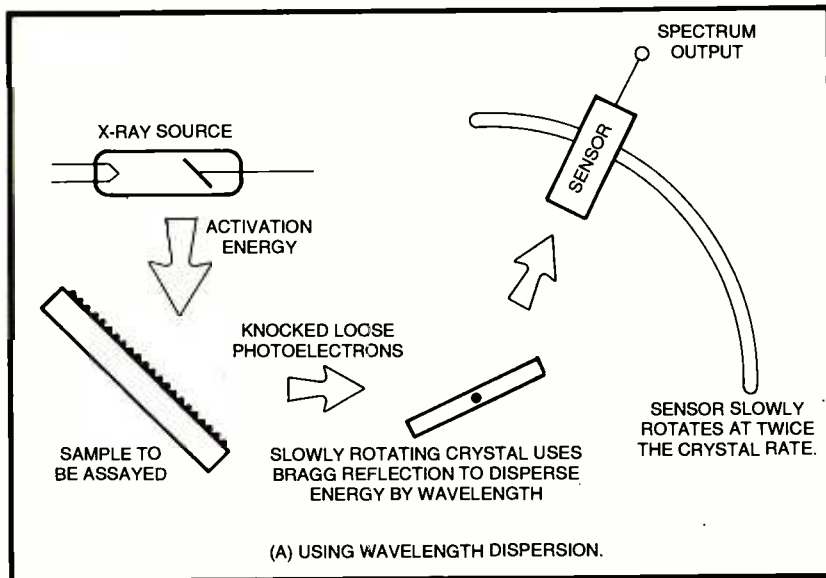


Fig. 1. XRF X-ray fluorescence spectroscopy is a powerful tool to identify the presence and strength of most chemical elements.

goodies up at [www.tinaja.com/hurg01.html](http://www.tinaja.com/hurg01.html).

Spectroscopy can be any of a dozen schemes to do *qualitative* (what) or *quantitative* (how much) analysis of chemical elements. Those methods have broad use for everything from astronomy to forensics to mineral assays to pollution remediation. One more exotic example is called *X-ray fluorescence spectroscopy*, or *XRF* for short.

Heavier chemical elements often will emit characteristic X-rays when bombarded by some external X-ray source. That happens when ejected photoelectrons get knocked loose by incoming energy. There are also very abrupt absorption changes at energies called the K, L, and M edges. They depend on exactly where the electron got ejected. Those emitted photoelectrons can be

directed to any suitable detector.

Typical examples include gas-filled Geiger tubes, scintillation phosphor-fluorescence detectors, photographic plates, or lithium-drifted silicon. By measuring the output, you can interpret which elements are present and in which amounts down to several dozen parts per million or so.

As an analytical technique, XRF nondestructively and accurately gives you simple and independent spectra using minimum sample prep over a wide concentration range. On the down side, the instruments are pricey at \$15,000 or more new, the surface penetration is limited, light elements offer low sensitivity, and element interactions may need fancy computer correction.

Figure 1 shows us the two basic XRF

new from  
**DON LANCASTER**

#### ACTIVE FILTER COOKBOOK

The sixteenth (!) printing of Don's bible on analog op-amp lowpass, bandpass, and highpass active filters. De-mystified instant designs. **\$28.50**

#### RESEARCH INFOPACKS

Don's instant cash-and-carry flat rate consulting service. Ask any reasonable technical question for a detailed analysis and complete report. See [www.tinaja.com/info01](http://www.tinaja.com/info01) for specifics. **\$79.00**

#### CMOS AND TTL COOKBOOKS

Millions of copies in print worldwide. THE two books for digital integrated circuit fundamentals. About as hands-on as you can get. **\$28.50** each.

#### INCREDIBLE SECRET MONEY MACHINE II

Updated 2nd edition of Don's classic on setting up your own technical or craft venture. **\$18.50**

#### LANCASTER CLASSICS LIBRARY

Don's best early stuff at a bargain price. Includes the CMOS Cookbook, The TTL Cookbook, Active Filter Cookbook, PostScript video, Case Against Patents, Incredible Secret Money Machine II, and Hardware Hacker II reprints. **\$119.50**

#### LOTS OF OTHER GOODIES

Tech Musings V or VI	\$24.50
Ask the Guru I or II or III	\$24.50
Hardware Hacker II, III or IV	\$24.50
Micro Cookbook I	\$19.50
PostScript Beginner Stuff	\$29.50
PostScript Show and Tell	\$29.50
PostScript Video & secrets	\$29.50
PostScript Reference II	\$34.50
PostScript Tutorial/Cookbook	\$22.50
PostScript by Example	\$32.50
Understanding PS Programming	\$29.50
PostScript: A Visual Approach	\$22.50
PostScript Program Design	\$24.50
Thinking in PostScript	\$22.50
LaserWriter Reference	\$19.50
Type 1 Font Format	\$16.50
Acrobat Reference	\$24.50
Whole works (all PostScript)	\$380.00
Technical Insider Secrets	FREE

#### BOOK-ON-DEMAND PUB KIT

Ongoing details on Book-on-demand publishing, a new method of producing books only when and as ordered. Reprints, sources, samples. **\$39.50**

#### THE CASE AGAINST PATENTS

For most individuals, patents are virtually certain to result in a net loss of sanity, energy, time, and money. This reprint set shows you Don's tested and proven real-world alternatives. **28.50**

#### BLATANT OPPORTUNIST I

The reprints from all Don's Midnight Engineering columns. Includes a broad range of real world, proven coverage on small scale technical startup ventures. Stuff you can use right now. **\$24.50**

#### RESOURCE BIN I

A complete collection of all Don's Nuts & Volts columns to date, including a new index and his master names and numbers list. **\$24.50**

#### FREE SAMPLES

Check Don's Guru's Lair at <http://www.tinaja.com> for interactive catalogs and online samples of Don's unique products. Searchable reprints and reference resources, too. Tech help, hot links to cool sites, consultants. email: [don@tinaja.com](mailto:don@tinaja.com)  
FREE US VOICE HELPLINE VISA/MC

**SYNERGETICS**  
Box 809-EN  
Thatcher, AZ 85552  
(520) 428-4073

FREE catalog: <http://www.tinaja.com>

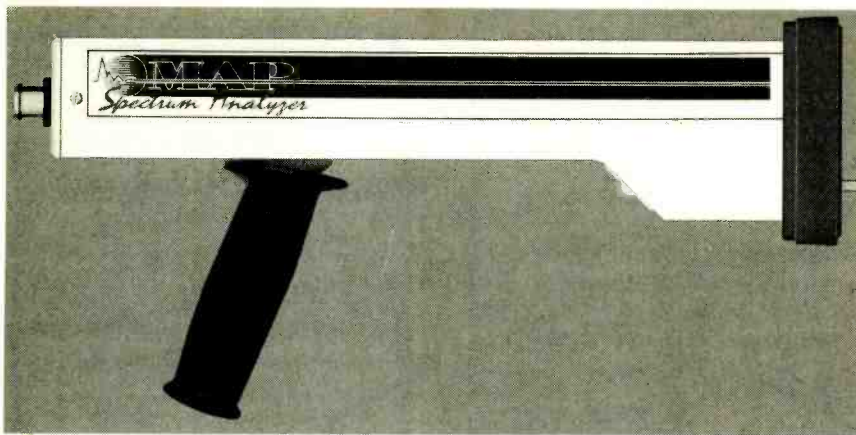


Fig. 2. The C-thru MAP-3 is a handheld XRF instrument. One popular use is finding out how much lead is in older paint.

schemes. In the *wavelength-dispersive* XRF instrument, returned energy from an irradiated sample is sent to a slowly rotating crystal. As the crystal turns, Bragg diffraction should disperse for different wavelengths. Thus, only one wavelength is sent to the detector at a time. The detector rotates at twice the crystal rate to continually catch the correct wavelength. Suitable crystal choices depend on frequency. They include lithium fluoride, silicon, pentaerythritol, a hydrated calcium sulfate, lead sterates, or potassium hydrogen phthalate.

An alternative is *energy-dispersive* XRF in which all of the wavelengths are sent to your detector at the same time. They can get sorted out later electronically based upon amplitudes and pulse shapes.

Figure 2 shows us a typical XRF instrument. This one is a MAP3 model from C-thru (formerly Scitech). One of its most common uses is in finding out how much lead is in old paint. The X-ray source is a nuclear radioisotope. Safety interlocks in the form of a lock and a "must contact the sample" button are present. Both of those interlocks largely prevent the casual release of X-rays.

Suitable radioisotopes and their half lives include iron-55 (2.7 years), cadmium-109 (462 days), cobalt-57 (271 days), or americium-241 (+32 years). Your choice depends on the elements getting analyzed and the instrument-processing algorithms. Those sources can be expensive—especially americium.

Regardless of which method you use, the usual output is a frequency-vs-energy spectrum display. The position of the peaks tell you which elements are involved, while their height tells you

exactly how much of that element is present. Elaborate calibration schemes can be used for accurate results.

In typical use, the radar-speed-gun shaped instrument is held up to a paint, mineral, or soil sample. In a minute or two, the returned spectra is scanned and analyzed. A companion portable computer and data-recording device processes the results, giving you the possible lead (or any other) content down to several dozen parts per million. Several hundred spectra can be stored for later downloading. Battery life in the field is typically ten hours between rechargings.

Used XRF instruments have been cropping up on eBay and LabX for as little as several hundred dollars. Note that a fresh radioactive source will almost certainly be needed, as well as specialized training, a NRC licence, and operating permit. State and local licensing might also be required.

## GUIDELINES TO AVOID UNFIXABLE CD-R BLOWUPS

1. Never eject the CD-R disk with the eject button!
2. Always eject immediately after use via disk icon.
3. Do not use folders until recovery software improves.
4. Do not ever save directly out of MicroSoft Paint.
5. Do not use with other high resource programs active.
6. Close all major programs when saving to disk.
7. Avoid repeated saves to the same filename.
8. Never put more on one disk than you can afford to lose.
9. Copy work-in-progress to several backup disks.
10. Transfer final results to other disks.
11. Watch virtual memory management carefully.
12. Use other backup systems as well.

Yes, you could use XRF to quickly and conveniently assay gold ore with the proper setup. But playing with these instruments is not to be undertaken lightly. The C-thru Technologies Web site is at <http://sciteccorpus.com>. One leading lead-paint-specific competitor to C-thru is RMD; they can be found at [www.rmd-lpa1.com](http://www.rmd-lpa1.com). I've gathered a few spectroscopy resources (XRF and otherwise) for you as this month's resource sidebar. More info on the mentioned books can be found at [www.tinaja.com/amlink01.html](http://www.tinaja.com/amlink01.html).

## THOUGHTS ON CD RECORDERS

The cost of CD-R recordable drives and their disks sure has dropped a lot

### LISTING 1

#### % POSTSCRIPT INTEGRATOR

```
% =====
% Copyright c 2000 by Don Lancaster
% and Synergetics, Box 809, Thatcher,
% AZ, 85552
% (520) 428-4073 don@tinaja.com
% http://www.tinaja.com
% Consulting services available per
% http://www.tinaja.com/info01.html
% All commercial rights and all electronic
% media rights fully reserved.
% Personal use permitted provided
% header and entire file remains intact.
% Linking is welcome. Reposting
% expressly forbidden.
% This utility demo shows how to
% evaluate most any definite integral
% by summing arbitrarily narrow function
% samples.
% Modify with text editor, then send to
```

```
Distiller or GhostScript.
/lowerlimit -0.335 def % lower integration
limit
/upperlimit 3.576 def % upper integration
limit
/a 0.35 def % constant used in this
example
/resolution 0.01 def % narrowness of
samples
/function {dup mul /a mul 2.718 exch exp}
def % integration function
/int 0 def % zero summation start
lowerlimit resolution upperlimit
{function % evaluate function
resolution mul % find small area
int add /int exch store % sum for
total} for int == % report results
% This particular example should return
42.1222.
```

lately. I pictured them reducing my space needed on internal hard drives while simplifying backups and long-term archive storage.

I bought a Philips drive that came with the Adaptec *DirectCD* software and promptly found myself blowing up lots of disks—irrecoverably so. The problems turned out to be a mix of CD-R “gotchas” combined with my flakey old Packard-Bell PC, even flakier Windows software, and poor use policy on my part.

Repeatedly saving larger Microsoft Paint files to similar filenames eventually caused a disk to fail, destroying hundreds of irrecoverable files. The code updates seemed to help little, if at all.

The first problem was Paint itself, which (at least on my machine) occasionally seems to blow up on large files for no apparent reason. Previously, that was not too bad; just go back to your last save and pick up where you left off. But a trashed CD-R disk takes out all of your previous saves as well.

The second big problem is that the Adaptec software that lets you use a CD-R like a “giant floppy disk” leaves its last written file open, apparently to work around writing partial sectors. Should the machine blow up, your files and your whole disk can get corrupted.

The third problem is that the drive-eject button does not act the way you think it does! The proper way to eject a CD-R disk is to right click on the icon in the system tray, and select “eject.” That will correctly close out any remaining or partially-written files. I found that it really pays to close and eject a disk immediately after each save instead of waiting around for another program to cause trouble.

A fourth problem is that there was in fact a bug in resaving to the same filename repeatedly. Supposedly, that problem has already been corrected.

The fifth major problem is that the Adaptec recovery software is grossly unacceptable. It is still unable to deal with folders or subdirectories. Those few times when it works at all seem to be severely limited. Sadly, any low-level RWTS (read and write to track and sector) individual file-recovery routines seem unavailable. A blown disk almost certainly is caused by a blown directory rewrite; none of the previous files or their directories, positions, or readability change. I suggest that they carefully study the *DOS Bag of Tricks* used on the

## SOME SELECTED SPECTROGRAPHY RESOURCES

### PUBLICATIONS:

*Applied Spectroscopy*  
*Applied Spectroscopy Review*  
*Atomic Spectroscopy*  
*CA Selects: Atomic Spectroscopy*  
*CA Selects: Electron Spectroscopy*  
*CA Selects: Infrared Spectroscopy*  
*CA Selects: Raman Spectroscopy*  
*CA Selects: Ultraviolet Spectroscopy*  
*CA Selects: X-ray Spectroscopy*  
*Journal of Applied Spectroscopy*  
*Journal of Electron Spectroscopy*  
*Journal of Molecular Spectroscopy*  
*Journal of Quantative Spectroscopy*  
*Optics & Spectroscopy*  
*Progress in Analytical Spectroscopy*  
*SAS Newsletter*  
*Spectroscopy*  
*Spectroscopy Journal*  
*Spectroscopy Letters*  
*Vibrational Spectroscopy*

### WEBSITES:

[chipo.chem.uic.edu/web1ocol/spec/MS.htm](http://chipo.chem.uic.edu/web1ocol/spec/MS.htm)  
[sdchemw1.ucsd.edu/education/spectroscopy](http://sdchemw1.ucsd.edu/education/spectroscopy)  
[www.apnet.com/spectro](http://www.apnet.com/spectro)  
[www.home.navisoft.com/rheacorp/sp\\_sites.html](http://www.home.navisoft.com/rheacorp/sp_sites.html)  
[www.ijvs.com](http://www.ijvs.com)  
[www.isas-dortmund.de](http://www.isas-dortmund.de)  
[www.library.cmu.edu/usr/Mellon/spectro.htm](http://www.library.cmu.edu/usr/Mellon/spectro.htm)  
[www.rsc.org/lap/rscom/dab/ana002.htm](http://www.rsc.org/lap/rscom/dab/ana002.htm)  
[www.s-a-s.org](http://www.s-a-s.org)  
[wwwchem.uwimona.edu.jm:1104/spec/tra/nmintro.html](http://wwwchem.uwimona.edu.jm:1104/spec/tra/nmintro.html)  
[131.96.145.20/post\\_docs/koen/wir.html](http://131.96.145.20/post_docs/koen/wir.html)

### NEWSGROUP:

[sci.techniques.spectrography](mailto:sci.techniques.spectrography)

### BOOKS:

*Analytical Raman Spectroscopy* (Jeanette Grasselli)

*Applied Spectroscopy: A Compact Reference* (J. Workman)  
*Atomic Absorption Spectrometry* (Bernhard Welz)  
*Atomic Spectra and Atomic Structure* (Gerhard)  
*Fluorescence Imaging Spectroscopy* (Xue Feng Wang)  
*Fourier Transform Infrared Spectroscopy* (Brian Smith)  
*Handbook of Infrared Astronomy* (I. Glass)  
*Impedance Spectroscopy* (Ross MacDonald)  
*Inorganic Electronic Structure and Spectroscopy* (E. Solomon)  
*Introduction to Fluorescence Spectroscopy* (Sharma. Ashutosh)  
*Introduction to Spectroscopy* (Donald Pavia)  
*Modern Infrared Spectroscopy* (Barbara Stuart)  
*Modern Spectroscopy* (Michael Hollas)  
*Molecules and Radiation: An Introduction to* (J. Steinfeld)  
*Nuclear Magnetic Resonance Spectroscopy* (Robin Harris)  
*Optical Astronomical Spectroscopy* (C. Kitchin)  
*Organic Structural Spectroscopy* (Joseph Lambert)  
*Photoelectron Spectroscopy* (Stefan Hufner)  
*Principles of Fluorescence Spectroscopy* (Joseph Lakowicz)  
*Quantitative X-Ray Fluorescence Analysis* (G. Lachance)  
*Solid-State Spectroscopy: An Introduction* (Hans Kuzmany)  
*Total-Reflection X-Ray Fluorescence* (Klockenkamper)  
*Ultrafast Spectroscopy of Semiconductors* (Jagdeep Shah)  
*X-Ray Fluorescence Spectrometry* (Ron Jenkins)  
 For more book details, see [www.tinaja.com/amlink01.html](http://www.tinaja.com/amlink01.html)

Apple IIe to see what decent disk-recovery software looks like. In the meantime, I've collected together my guidelines to reliably use CD-recordable drives in a sidebar. Those extreme measures seem to be working for me now. But earlier and less devastating file closures, useful “in-folder” recovery software, and newer releases of low-level recovery code is sorely needed.

### POSTSCRIPT INTEGRATION

PostScript is by far my favorite general-purpose computer language. I use it for just about everything from hot-tub controllers to all of my ongoing magic sinewave research. That work can be found at [www.tinaja.com/magsm01.htm#](http://www.tinaja.com/magsm01.htm#); the specific file is MSINPROP.PDF.

In general, a new PostScript program is written with a text editor. You then route it over to an interpreter such as Acrobat Distiller or GhostScript and then gather up the results. I have just done a major new resource tutorial that brings you up to date on PostScript fundamentals, new robotic uses, Acrobat PDF, and even newer supervisory controllers. Pick this one up as RESBN92.PDF; find it in [www.tinaja.com/resbn01.html](http://www.tinaja.com/resbn01.html).

Let's look into yet another useful PostScript-as-language example. The math folks talk about *integrals* a lot. An integral is simply finding the area under a curve—an essential task used over and over again in just about any scientific or technical field. Yes, you can play tricks

## NAMES AND NUMBERS

### Adaptec

691 S Milpitas Blvd.  
Milpitas, CA 95035  
408-945-8600  
[www.adaptec.com](http://www.adaptec.com)

### Adobe Acrobat System

1585 Charleston Rd.  
Mountain View, CA 94039  
800-833-6687  
[www.adobe.com](http://www.adobe.com)

### Anritsu Wiltron

685 Jarvis Dr.  
Morgan Hill, CA 95037  
408-776-8300  
[www.anritsuwiltron.com](http://www.anritsuwiltron.com)

### Brother

100 Somerset Corp Blvd.  
Bridgewater, NJ 08807  
908-704-0911  
[www.brother.com](http://www.brother.com)

### C-Thru

415 N. Quay  
Kennewick, WA 99336  
800-466-5323  
<http://sciteccorpus.com>

### Datel

11 Cabot Blvd.  
Mansfield, MA 02048  
508-339-3000  
[www.datel.com](http://www.datel.com)

### Hewlett-Packard

PO Box 10301  
Palo Alto, CA 94303  
415-857-1501  
[www.hp.com](http://www.hp.com)

### ID Systems

174 Concord St.  
Peterborough, NH 03458  
603-924-9631  
[www.idsystems.com](http://www.idsystems.com)

### Labx

700 Dresher Rd., Ste. 100  
Horsham, PA 19044  
204-253-7370  
[www.labx.com](http://www.labx.com)

### Lascar Electronics

PO Box 8204  
Savannah, GA 31412  
912-234-2048  
[www.lascarelectronics.com](http://www.lascarelectronics.com)

### Maxim

120 San Gabriel Dr.  
Sunnyvale, CA 94086  
800-998-8800  
[www.maxim-ic.com](http://www.maxim-ic.com)

### Micro Linear

2092 Concourse Dr.  
San Jose, CA 95131  
408-433-5200  
[www.microlinear.com](http://www.microlinear.com)

### Mitel

2321 Morena Blvd. #M  
San Diego, CA 92110  
619-276-3421  
[www.mitel.com](http://www.mitel.com)

### Photobit

135 N. Los Robles Ave., 7th Floor  
Pasadena, CA 91101  
626-683-2220  
[www.photobit.com](http://www.photobit.com)

### Presenting: Communications

11600 College Blvd.  
Overland Park, KS 66210  
913-469-1110  
[www.presentingav.com](http://www.presentingav.com)

### RMD

44 Hunt St.  
Watertown, MA 02172  
800-Lead-RMD  
[www.rmd-lpa1.com](http://www.rmd-lpa1.com)

### Synergetics

Box 809  
Thatcher, AZ 85552  
520-428-4073  
[www.tinaja.com](http://www.tinaja.com)

### Unitrode

7 Continental Blvd.  
Merrimack, NH 03054  
603-424-2410

some neat PostScript code that can evaluate that or nearly any other integral over any pair of limits you choose. Much more on PostScript-as-language is found in [www.tinaja.com/post01.html](http://www.tinaja.com/post01.html) and in my *PostScript Beginner Stuff*.

## NEW TECH LIT

Anritsu has a free tutorial, *Guide to OTDR Measurements*, which is useful on fiber optics. From Hewlett-Packard, their *Electronic Components Catalog* is available on CD-ROM. Maxim continues with their *Maxim Engineering Journal* that has free sample-request cards. Interesting new chips now include the Mitel MT9315 echo canceller, the Unitrode UCC2750 telephone-ringing generator, the Photobit PB-159 one-IC camera, and the Micro Linear ML4421 induction-motor control.

The Questlink Web service at [www.questlink.com](http://www.questlink.com) has long been the place to go to find integrated circuit technical data. They now have fresh competition from Chipcenter found at [www.chipcenter.com](http://www.chipcenter.com). Access to all data-sheet sites at once is reached by the DATA button on my home page. Be certain to check out my [www.tinaja.com/eeweb01.html](http://www.tinaja.com/eeweb01.html) page for additional resources.

Brother has a new but pricey Stampcreator PRO system for making rubber stamps.

Ready-to-install LED digital-panel meters are getting surprisingly low in cost these days. Two useful sources are Lascar and Datel.

Plans are underfoot to gather up all of the theses and dissertations from everywhere onto one master group of Web sites. While not quite there yet, [www.theses.org](http://www.theses.org) is certainly a good start with the National Digital Library of Theses and Dissertations. These folks currently have nine universities online along with links to a dozen related sites. Also, visit [www.dlib.org](http://www.dlib.org) for background material and the D-Lib electronic magazine.

An attempt at networking qualified consultants should have started up at [www.expertcentral.com](http://www.expertcentral.com). Both free and negotiated-fee services are available. My own resources in this area are at [www.tinaja.com/consul01.html](http://www.tinaja.com/consul01.html) and [www.tinaja.com/info01.html](http://www.tinaja.com/info01.html).

It seems that the "next big thing" on the Web might be SVG, which is short for scalable-vector graphics. SVG is the industry-wide version of Adobe's PDF format used in Acrobat; it gives you

with some integrals to presolve them; that's what tables of integrals are all about. For instance, the integral of  $x^2$  can be found by subtracting the ending  $x^3/3$  value from its starting one.

Some integrals are *not* presolvable in a simple closed form. The *Bezier* curves used with PostScript and other graphics are typical. Although *Bezier* curves obviously have a length, any simple way to quickly evaluate that length appears to be fundamentally impossible. More details on this in [www.tinaja.com/cubic](http://www.tinaja.com/cubic)

*01.html*. Such an integral is said to have no *closed-form* solution, which makes math fun.

Another example is;

$$\int e^{ax^2} dx$$

which often comes up in statistics and thermodynamics. No closed-form solution is known to exist. Instead, you create a table of results by chopping up the function into minute pieces and then adding them all up. Listing 1 shows you

ridiculously better graphics than HTML while requiring nothing special in the way of readers or other software. To get yourself up to speed on SVG, start with the files and news at [www.w3.org](http://www.w3.org).

Featured trade journals this month include *Presenting: Communications* (overhead projectors and such) and *ID Systems* for RFID, barcoding, and related identification products.

For all the fundamentals of active filters, by far the best-selling active-filter book of all time is my *Active Filter Cookbook*, available through Synergetics or at [www.tinaja.com/synlib01.html](http://www.tinaja.com/synlib01.html).

The latest surplus-bargain additions at [www.tinaja.com/barg01.html](http://www.tinaja.com/barg01.html) include borescopes, autocorrelators, accelerometers, plate-through printed-circuit labs, humidity sensors, and a lot more. Many of these are newly-offered in live auctions. Reach them by clicking the AUCTION button.

As usual, most of the referenced items are in the Names & Numbers or the Spectroscopy Resources sidebars. Always check there before calling our no-charge US technical helpline or my email contact. P

## ROBOTICS WORKSHOP

(continued from page 62)

with both the RCX included with the RIS and the CyberMaster brick that accompanies the Lego Technic CyberMaster, a kit designed for educational classroom use. The SDK requires a special ActiveX (OCX) component, SPIRIT.OCX, as an interface between the Visual Basic programming platform and your PC's hardware. From there, you need only a copy of Visual Basic 5.0 or later. (In actuality, most any programming platform that can interface to ActiveX modules can be used with the SDK. However, programming examples are provided in Visual Basic so if you use another language you'll need to do the language conversion yourself.)

Other RIS programming hacks are available as well. For instance, at [www.enteract.com/~dbaum/lego/nqc/index.html](http://www.enteract.com/~dbaum/lego/nqc/index.html) you can download NQC (Not Quite C), a development language that uses a C-like syntax for programming the Lego RCX brick. Versions are available for use under Linux, Windows, and the Mac OS. The NQC language is provided using the Mozilla Public

License, open source license that allows you to copy, improve, and redistribute your own versions of the code. (The Web page has more details.)

Because C can directly work with the computer's serial port (for the RCX's infrared transceiver), no ActiveX or other component is required to interface a NQC program. You do, however, need a suitable C programming development platform, and you need to be fairly well conversant in the C language and syntax.

A unique hack including a 3Com Palm Pilot personal digital assistant (PDA) was unveiled at a recent JavaOne Developer's Conference, hosted by Sun and designed to highlight new uses of the Java programming language. In a demo, players using Palm Pilots played a robotic game of laser tag with remotely controlled miniature tanks built from a Lego Mindstorms RIS kits. The Palm Pilots and tanks were connected into a network using Sun's Jini connection technology. A simple Java applet executing in each Palm Pilot allowed players to maneuver their own tanks around obstacles, tag another tank, and move their tanks out of harm's way. See Mindstorms Resources on the Web for more information. P

## AMAZING SCIENCE

(continued from page 65)

the status of any other line. Secondly, the same command can be used to turn on and turn off a circuit. So instead of having one command for turn on and another for turn off, the same command can be used a second time to turn off the device; *i.e.*, the first utterance turns the connected device on and the second utterance turns it off. In a sense, handling things in that manner is akin to doubling your command vocabulary.

Figure 4 shows a signal-latching circuit (based on the 4013 dual D-type flip-flop) that can be used as outlined above. The input of the flip-flop connects directly to the output of IC7 in Fig. 3.

Figure 5 shows a few circuits that can be connected to the output of the flip-flop(s) to control different types of loads. The circuit in Fig. 5A is an NPN Darlington transistor with a DC source and resistive load. That type of circuit can be used to open and close a relay, as shown in Fig. 5B. The relay can control AC and DC loads (resistive or inductive). The circuit in Fig. 5C can be connected to the output of the 4013, allow-

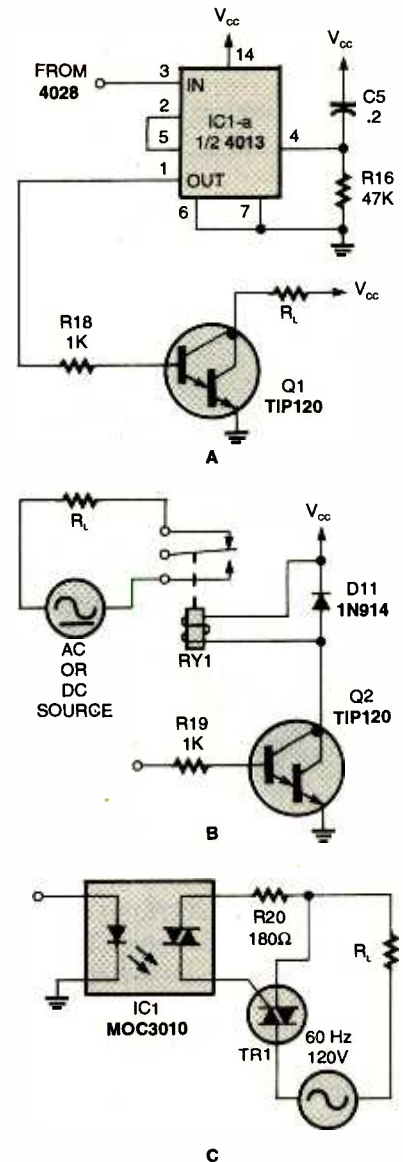


Fig. 5. These circuits can be connected to the interface circuit to allow the voice-recognition system to control different types of loads. The circuit in A uses a flip-flop to latch a Darlington transistor in the on or off condition. By replacing the Darlington in A with the relay configuration in B, the circuit can be used to control high-current resistive or inductive AC or DC loads. The circuit in C, when combined with the flip-flop in A, provides isolation between the load and controlling circuit, while allowing you to latch the AC load on or off.

ing it to control AC loads, while isolating the load from the interface and voice-recognition circuits.

A note on improving recognition: Avoid homonyms—words that sound alike. For instance; red, bed, said, dead, *etc.* In addition, the distance the microphone is away from the speaker should be approximately the same for training and recognition. P 71

# NEW GEAR

USE THE FREE INFORMATION CARD FOR FAST RESPONSE

## Portable Oscilloscope



CIRCLE 60 ON FREE INFORMATION CARD

IDEAL FOR HOBBYISTS, TECHNICIANS, and engineers, the PersonalScope is a compact, portable oscilloscope that measures 4.13 by almost 8 by 1.38 inches. The unit is designed to perform measurements on audio equipment, power lines, voltage applications, digital signals, and all kinds of sensors, and for signal analysis in automotive applications and car stereos. Its ultra-fast full auto setup function, its high sensitivity—down to 5mV/div—and its extended scope function make measuring waveforms very easy.

Users select the desired function with the buttons located on the front of the unit, with the current operating mode displayed onscreen. The high-contrast LCD provides a wide viewing angle and a 64 × 128-pixel display. In auto-mode, the 'scope reacts very quickly to the input signal and adjusts for level and triggering. The marker function allows for measurement of voltage, time, and frequency. In the DVM mode, it will display true RMS, dB, peak-to-peak, and DC volts.

Auto shut-off helps preserve battery life. There is easy access to the five AA or rechargeable batteries. The unit includes a battery-charge circuit. The PersonalScope comes with a basic probe with alligator clips and a soft protective carrying case.

The PersonalScope has a suggested retail price of \$199.95.

### VELLEMAN INC.

7415 Whitehall Street, Suite 117

Ft. Worth, TX 76118

Tel: 817-284-7785

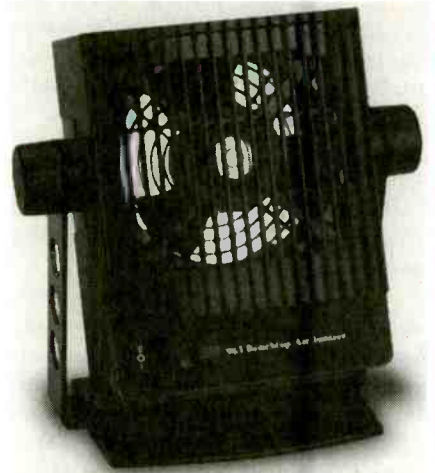
Web: [www.velleman.be](http://www.velleman.be)

## Benchtop Air Ionizer

DESIGNED TO NEUTRALIZE ELECTROSTATIC build-up at ESD workstations, the Model 963 Benchtop Air Ionizer is a self-contained (7 by 9 by 4 inches) intrinsically balanced fan. It ensures that equal levels of positive and negative ions are produced despite variations in line voltage, fan speed, and emitter point condition. This ionizer generates large amounts of ions, neutralizing electrostatic charge within a 2 by 4-foot area.

At high speed, the fan reduces a static charge of 1000 volts to 100 volts in less than one second at a one-foot distance. At low speed, the fan is extremely quiet and may be used without contributing to the workstation's ambient noise. The injection-molded ionizer is constructed of plastic that minimizes static charge build-up on its surface.

The Model 963 Benchtop Air Ionizer has a suggested retail price of \$384.



CIRCLE 61 ON FREE INFORMATION CARD

## 3M ELECTRONIC HANDLING & PROTECTION DIVISION

2982 Cleveland Avenue North  
Roseville, MN 55113

Tel: 800-814-8709

Web: [www.3M.com](http://www.3M.com)

## Digital Light Meter

THE DIGITAL LIGHT METER (Model LM-80) provides a dual measuring capability that measures from 0.01 to 20,000 Foot-candles or Lux. It features both Data Hold and Peak Hold functions. The Data Hold function retains the pre-



CIRCLE 62 ON FREE INFORMATION CARD

(Continued on page PS3A)

# ProService Magazine

January, 2000

NESDA's  
50th Year

An official journal of NESDA (National Electronics Service Dealers Association), and IS CET (International Society of Certified Electronics Technicians).

VOL. XXVI, NO. 1

## PURPOSE

*ProService Magazine*, included in each issue of *Poptronics*, is produced by NESDA, the National Electronics Service Dealers Association, 2708 West Berry St., Fort Worth, TX 76109. It is intended for the enlightenment, education and entertainment of the members of NESDA, IS CET, and other ethical professionals engaged in or connected with the appliance, computer, and electronics service industries.

With the exception of official announcements, the statements and opinions expressed herein are those of the authors and not necessarily those of the associations.

Unless otherwise clearly indicated, neither NESDA nor IS CET endorses any company, product or service appearing in any article in this publication.

## BUSINESS/EDITORIAL OFFICES

2708 W. Berry St., Ft. Worth, TX 76109-2397  
817-921-9061; Fax 817.921.3741  
www.nesda.com

Executive Director: Clyde W. Nabors

Editor-in-Chief: Wallace S. Harrison

Email: ProServEd@aol.com

Associate Editor/Production: M. Merrill

Email: psm\_desk@juno.com

## COPYRIGHT

Copyright © 2000 by NESDA, Inc., all rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means without written permission from NESDA.

## Contents

NESDA/IS CET Officers .....	2
NESDA Code of Ethics .....	3
NESDA Corporate Members .....	3
IS CET Sponsor Members .....	3

## ARTICLES

NESDA Helps with Service Center Survival by Mary Margaret Merrill .....	1
NESDAnet — A Tool for Success by William S. Warren CET/CSM .....	4
Beyond the Cost of Doing Business by Fred Longworth CET, M.B.A. ....	5
NWSN: Service Companies That Would Service the World by Gerry McCann CET/CSM .....	6
IS CET — Preparing Technicians for Today and Tomorrow by William S. Warren CET/CSM .....	7

## NESDA Helps With Service Center Survival

NESDA has a history of service to its members, including education, technical and management training, and discounted business services. It also provides legislative representation on a national level. Independent product servicers *need* that kind of support from an association.

by Mary Margaret Merrill

If you're looking for a trade association for professionals in the business of repairing consumer electronic equipment, appliances, or computers, look no further. The face of The National Electronics Service Dealers Association (NESDA) has changed since its inception in 1950, and membership has grown. But, it is still a group of dedicated professionals that contribute to the betterment of the service industry.

Founded on a strict code of ethics, NESDA's primary goal has been to help members become more profitable in the face of escalating business demands. To that end, management and technical seminars are presented annually to help members keep pace with advancing technology. In addition to business management and technical expertise, training sessions teach participants to recognize and meet the changing needs of discriminating consumers. Through volunteer activities, membership fees are kept to a minimum to allow participation by interested small business owners.

As an organization, NESDA also helps members contend with the increasingly costly requirements of governmental bureaucracies. Concerned members police current national legislation so that the association can challenge proposals detrimental to independent servicers.

## THE MEMBERSHIP

Collectively, NESDA members provide service on all types of electronic equipment. Most fall under the categories of consumer products (including ra-

dios, televisions, and video equipment). Other categories include appliances, antenna and satellite receiving equipment, computers, communications products, bio-medical, industrial electronics equipment, and more. Business sizes vary from the small one-person shop to the large multi-personnel, multi-location establishments.

## THE BENEFITS

NESDA provides a number of programs to benefit its members. New programs are added on an ongoing basis, while programs that are in place are honed to make them more productive. NESDA currently offers:

- **Code of Ethics:** This is a collective membership effort at self-policing, and to help assure the consuming public of competent and ethical service.
- **Website Referrals:** The NESDA website (www.nesda.com) is where consumers seeking competent service can search for NESDA members by zip code. Updated information about NESDA and the service industry is available to non-members, as well as a special section "for members only."
- **NESDAnet Email Network:** A development which allows members to contact all other participating members, forming a vast information network. Queries allow participants to solve tough technical questions through the specialized knowledge of other participants, report on industry problems, or comment on professional concerns. It is, literally, information at your fingertips.

(continued on PS-2)

- **Annual Convention & Trade Show:** The National Professional Service Convention is a week-long fun and learning experience. It presents top-notch technical and business management seminars; an electronics instructors conference; special servicer meetings with manufacturers, service contract administrators, and other services suppliers; one-on-one communications with key manufacturers' service executives; a service-oriented trade show; member-to-member networking and information-sharing; association meetings and officer elections; sponsored meal functions; sports and fun events; hospitality sessions; and a tax-deductible vacation for service professionals.

- **Technical & Managerial Certification:** NESDA provides study materials and testing for managers who wish to improve their professional expertise and become a "Certified Service Manager" (CSM). Through NESDA's technical arm, the International Society of Certified Electronics Technicians (ISCET), technicians may also measure their professional abilities through the "ISCET-Certified Electronics Technician" program.

















- **Liaison with Manufacturers & Service Providers:** Members' concerns and unresolved problems are relayed to high-level representatives of companies and groups that affect the product service industry. Mutually rewarding relationships are cultivated, making things better for servicers, and earning respect from other segments of the industry.

- **Universal Authorized Service Center Agreement:** NESDA officers and staff work for fairness and uniformity in the administration and application of manufacturers' and service contract companies' rules for authorized servicers. This includes the development of a "universal" agreement that is designed to clarify and standardize the contract clauses between manufacturers and service centers. Member dealers can compare a manufacturers' agreement with this "standard" for the purposes of informed negotiation.











- **Professional Aids, Supplies, & Public Relations Materials:** Members receive discounts on books, educational videotapes, business aids, computer software, promotional materials, training sessions, and more. Consumer pamphlets explain servicing concerns, service guar-

(continued on PS-3)

1999-2000 Officers of NESDA: National Electronics Service Dealers Association

	<b>PRESIDENT:</b> Wayne Markman, Markman TV, 1935 State St., Hamden CT 06517; 203-776-9123; Fax 203.785.1562; WAYNEMTV@compuserve.com		<b>VICE PRESIDENT:</b> Mike Webber CSM, Rucker's Radio & TV, 5208 Pershing, Fort Worth TX 76107; 817-738-6568; Fax 817.738.0763; RuckMike@aol.com
	<b>SECRETARY:</b> John Eubanks CET, Quality TV, 5323 Firestone Rd., Suite 3, Jacksonville FL 32210; 904-772-1420; Fax 904.772.9492; fesa@jax-inter.net		<b>TREASURER:</b> Leon Kleinschmit CSM, Millard Electronics, 5060 S. 135th St., Omaha NE 68137; 402-895-4242; Fax 402.895.0407; LeonMillEI@aol.com
	<b>IMM. PAST PRES.:</b> Lane Norman CET, Norman's Electronics, 3653 Clairmont Rd. NE, Chamblee GA 30341; 770-451-5057; Fax 770.455.8337; LaneN@aol.com		<b>EXECUTIVE DIRECTOR:</b> Clyde W. Nabors; NESDA/ISCET, 2708 W. Berry St., Fort Worth TX 76109; 817-921-9061, ext. 10; Fax 817.921.3741; CLYDENESDA@aol.com
	<b>REG. 1 (CT, MA, ME, NH, RI, VT):</b> Brian Gibson CET, Brian's TV Sales/Service; 200 Linden St., Wellesley MA 02181; 781-235-0100; Fax 781.237.0758; brianstv@erols.com		<b>REG. 2 (NJ, NY):</b> Richard Mildenerger CET, Entertainment Electronics, 3459 Lawson Blvd., Oceanside NY 11572; 516-379-3970; Fax 516.536.1813; QUARITUS1@aol.com
	<b>REG. 3 (DC, DE, MD, PA, VA, WV):</b> Bob Bucknell, The TV Shop, 310 Union Ave., Altoona PA 16602; 814-944-4904; Fax 814.949.9533; bbtvshop@aol.com		<b>REG. 4 (AL, FL, GA, KY, MS, NC, SC, TN):</b> John Eubanks CET, Quality TV, 5323 Firestone Rd., Suite 3, Jacksonville FL 32210; 904-772-1420; Fax 904.772.9492; fesa@jax-inter.net
	<b>REG. 5 (IL, IN, MI, MN, OH, WI):</b> William Murphy, Normandy Electronics Center, 21700 Detroit Rd., Suite 3, Westlake OH 44145; 440-871-5061; Fax 440.250.0884; illiam016@ameritech.net		<b>REG. 6 (LA, OK, TX):</b> Larry Parnell, Larry's TV Service, 3520 Fairmont Pkwy., Pasadena TX 77504; 281-988-0122; Fax 281.998.0089; Larry1545@electrotex.com
	<b>REG. 7 (AR, IA, KS, MO, NB):</b> Leon Kleinschmit CSM, Millard Electronics, 5060 S. 135th St., Omaha NE 68137; 402-895-4242; Fax 402.895.0407; LeonMillEI@aol.com		<b>REG. 8 (AZ, CO, MT, NM, SD, UT, WY):</b> Dale Sorensen CSM, Service West, 6651 S. State St., Salt Lake City UT 84107; 801-268-6868; Fax 801.269.0651; leuhn@aol.com
	<b>REG. 9 (CA, HI, NV):</b> Leo E. Cloutier CSM; Electronic Service Center; 4774 W. Adams Blvd., Los Angeles CA 90016; 323-731-5611; Fax 323.731.0906; LALOEESC@aol.com		<b>REG. 10 (AK, ID, OR, WA):</b> Mike McCray CSM; Palmer Electronics, 7215 N.E. Sandy Blvd., Portland OR 97213; 503-288-5356; Fax 503.288.0359; Mmccray@alveus.com

1999-2000 Officers of ISCET: International Society of Certified Electronics Technicians

	<b>CHAIRMAN:</b> Larry Steckler CET/EHF; Poptronix, 9072 Lawton Pine Ave., Las Vegas NV 89129; 702-838-6917; Fax 702.838.6924; Lartronics@aol.com		<b>VICE CHAIRMAN:</b> Joseph Villademoros PhD/CET; ITT Technical Institute; 4809 Memorial Hwy., Tampa FL 33634-7515; 813-885-2244; cwfla@msn.com
	<b>SECRETARY:</b> Dan Mundy CET/CSM, HiFi Buys, Fax 603.687.7861; dmundy@earthlink.net		<b>TREASURER:</b> Del Whiteman Jr. CET/CSM; HEB ISD; (Home) 1225 Scott, Hurst TX 76053; (H) 817-284-3631; (W) 817-354-3542; Fax 817-354-3546; dcwjr@home.com
	<b>IMM. PAST CHAIRMAN:</b> William S. Warren CET/CSM, Warren Electronic Services, 2540 Sutherland Ave., Knoxville TN 37919; 865-546-1128; Fax 865.524.5362; WSWARREN@aol.com		<b>DIRECTOR-AT-LARGE (1st Yr.):</b> Jim Fellows CET/CSM, United Radio, 2949 Erie Blvd. East, Syracuse NY 13224; 315-446-8700; Fax 315.446.8505; JIMFELLOWS@aol.com
	<b>DIRECTOR-AT-LARGE (1st Yr.):</b> George Brownyard CET, Con-Pro Video, 4646 Convo St., #113, San Diego CA 92111; 619-495-0392; Fax 619.495.0395; GBrownyard@aol.com		<b>DIRECTOR-AT-LARGE (2nd Yr.):</b> Jeffrey Reeves CET/CSM, Samsung, 18600 Broadwick St., Rancho Dominguez CA 90220; 310-537-7000, ext. 131; Fax 310.537.5986; jeffr@seala.samsung.com
	<b>DIRECTOR-AT-LARGE (2nd Yr.):</b> Ernest Curtis CET, Curtis Electronics, 259 Park Ave., Garden City Park NY 11040; 516-741-4233; Fax 516.248.6319; ECCurtistv@aol.com		<b>NESDA REPRESENTATIVE:</b> Jack Hopson CET/CSM, First Electronics Service, 5214 Center St., Omaha NE 68106; 402-551-4868; jack@1sttv.com

Also includes ISCET C.E.O. or Designate: Alice Brown, Dir. Member Services



## NESDA's Code of Ethics

- I will conduct my business in a manner to insure the goodwill and confidence of the public that I serve.
- I will not participate in any misleading or false advertising.
- I will maintain adequate equipment and qualified personnel to perform quality service to the public and the trade for fair, equitable and nondiscriminatory charges.
- I will not perform, or cause to be performed, any act which would tend to reflect adversely on our industry, fellow members, competitors or manufacturers.
- I will comply, both in spirit and letter, with rules and regulations prescribed by the law and by government agencies for the health, safety and well-being of my employees and the public.
- I will maintain liability and financial responsibility in order to uphold the guarantee for all work undertaken.
- I will represent manufacturers in an honest and intelligent manner to create an atmosphere of mutual trust and understanding and to best serve our combined interests.
- I will offer clean, attractive and inviting facilities, as well as courteous and competent personnel.
- Accurate statements or invoices will be rendered to the customers and a comprehensive record of all work will be kept. I will readily explain and justify all prices.
- All complaints will be promptly and courteously handled.
- The property of all customers will be carefully handled and adequate insurance will be carried to protect this property while in my custody.
- I will seek always to improve myself, to increase my efficiency and to better my services.
- I will perform only such work as is needed and authorized by the customer, and all parts will be new and first quality unless otherwise specified.
- I will work with the community to improve the public perception of my company and the electronics service industry, to better the community and to improve understanding between these entities.
- I will aid the industry's growth and progress by participating in the activities and public interest efforts of the association.

*This strict code of business ethics should be adhered to by every service dealer, but is adopted as a criteria of membership by every person who joins NESDA.*

*(NESDA Helps, continued)*

antees, extended warranties, and how to select a competent and ethical service company. Also available are membership wall certificates, wallet cards, stick-on decals, lapel pins, door signs, advertising art, etc., that proclaim affiliation with a national network of ethical servicers.

- **Bankcard Program:** Members receive low bank card discount rates.
- **Group Insurance:** Combined buying power provides the coverage servicers need at true group rates on life, health, accident, disability, business, and workers' compensation.
- **Business Forms:** Substantial discounts are offered on universal, manufacturer-accepted invoice for in- and out-of-warranty service billing, and other forms needed by servicers.
- **Discounted Long Distance Service:** Through the NESDAfone plan, most members can receive a discounted, hard-to-beat long distance rate (currently at 6.9 cents per minute).
- **"PRIDE" Business Certification Program:** Provides authentication of those service centers that provide certifiable proof of their excellence in offering prompt, competent, ethical, and guaranteed service to consumers and clients.
- **FREE Magazine Subscription:** *ProService Magazine* is now included in *Poptronics* magazine. Articles are presented on a variety of educational and informational topics of concern to independent servicers, such as business management, tax tips, insurance information, a calendar of industry events, association news, and more. Members receive a free subscription to *Poptronics* with their paid membership.
- **ProService Directory/Yearbook:** An annual directory of useful information containing names, addresses, and contact numbers for key personnel at manufacturers, national parts distributors, service contract vendors/administrators, educational sources, other national trade associations, trade publications, state associations, and key service people, as well as pertinent association information.
- **Periodic Newsletters:** In addition to *ProService Magazine*, members receive informative newsletters throughout the year. The *NESDA Newsletter* carries association news, board actions, officer reports, staff activity, new benefits and programs, letters, and other information.
- **Self-Expression on Issues:** Members have the opportunity to speak up on in-

dustry matters or other topics of concern in the newsletters or magazine, at the annual membership meeting, or on the NESDAnet.

- **Information:** NESDA headquarters is your central location for receiving questions from members, searching for answers, and relaying information.
- **Legislative Vigilance:** Members are advised of federal legislative activity that effects the service industry. Congressional representatives or applicable courts are lobbied on behalf of the service industry.
- **Special "Alert" Mailings:** A "Legislative Alert," when needed, informs or warns members of Congressional acts, or impending legislation that may require action. A periodic "Informational Alert" advises of other industry events that members may need to know of quickly.
- **A Technicians' Division:** IS CET is the technical division just for professional technicians who have passed the IS CET-Certified Electronics or Appli-ance Technician exam.

NESDA invites you to join its success, and the success of its members, by actively participating in these programs, as well as those still in development. Together we form a better, more knowledgeable service industry, and help to assure the future of independent service. §

### NESDA Corporate Members

B & D Enterprises  
 Computer Parts Unlimited, Inc.  
 CQ Communications (ES&T)  
 Diversified Parts  
 Electro Dynamics, Inc.  
 Electronic Software Developers  
 Gernsback Publications  
 Hitachi Home Electronics (America) Inc.  
 Howard W. Sams & Co.  
 Independent Dealer Services, Inc.  
 JVC Service & Engineering Co.  
 KeyPrestige INS, Inc.  
 Metris Direct  
 Moore North America  
 National Electronics Warranty (N.E.W.)  
 Nintendo of America Inc.  
 Pacific Coast Parts  
 Peg Peregó USA, Inc.  
 Philips Consumer Electronics  
 Pioneer Electronics Service Inc.  
 PTS Electronics Corp., Inc. (**LIFE Member**)  
 Sencore, Inc.  
 SFS Corporation  
 Sony Service Company  
 Tandy Retail Services  
 Toshiba America  
 VAC Service Corp.  
 Warrantech CPS Corp.  
 Wood Technologies International

### IS CET Sponsor Members

Gernsback Publications  
 ITT Technical Institute  
 Sencore Inc.

## NEW GEAR

(continued from page 72)

sent reading for future evaluation, and the Peak Hold function retains the Peak signal of a light pulse. The analog DC Voltage output enables the measurement to be recorded on a chart recorder or data logger with a mV DC input.

Results are displayed on a 3½-digit (2000 count) LCD screen for easy viewing. The light meter has a measuring rate of approximately 2 times/sec. It measures 5.31 by 2.83 by 1.3 inches and weighs 8.8 ounces.

The Digital Light Meter (Model LM-80) has a suggested retail price of \$124.85.

### AMPROBE

630 Merrick Road  
Lynbrook, NY 11563  
Tel: 516-593-5600  
Web: [www.amprobe.com](http://www.amprobe.com)

### Video Converter

THE TR-20 AND TR-21 GLOBAL Digital Video Converters are worldwide-ready, featuring a global decoder that



CIRCLE 63 ON FREE INFORMATION CARD

allows conversion from any of the world's TV standards: NTSC 3.58, NTSC 4.43, SECAM, PAL B-G-D-I-K, PAL-N, AND PAL-M. In addition to composite-video in/out, the S-video input and output connectors accommodate Super-VHS and Hi-8 equipment, as well as digital camcorders, DVDs, satellite receivers, VCRs, video cards, monitors, and large-screen TVs. The unit's 4MB of VRAM memory produces high-resolution converted pictures.

The TR-20 and TR-21 Global Digital Video Converter have suggested retail prices of \$729 and \$799, respectively.

### TENLAB

27346 Oak Summit Road  
Agoura Hills, CA 91301-3612  
Tel: 877-TENLABS or 818-706-8120  
Web: [www.tenlab.com](http://www.tenlab.com)

## Ham Radio Power Meter

DESIGNED FOR HAM RADIO ENTHUSIASTS, the GrandMaster Power Meters feature a functional and simple front-panel layout that permits users to select power ranges or bands or to make SWR readings intuitively. The 3¼ × 1¼-inch precision illuminated meter provides easy wide-angle viewing.

All GrandMasters offer peak and average, forward and reflected power readings, and they have selectable power ranges. They're housed in all-metal cases measuring 7½ × 3¼ × 4¼ inches.

The GrandMaster Power Meters have prices ranging from \$94.95 to \$169.95

### MFJ ENTERPRISES, INC.

P.O. Box 494  
Mississippi State, MS 39762  
Tel: 800-647-1800 or 601-323-5869  
Web: [www.mfjenterprises.com](http://www.mfjenterprises.com)

CIRCLE 64 ON FREE INFORMATION CARD **P**

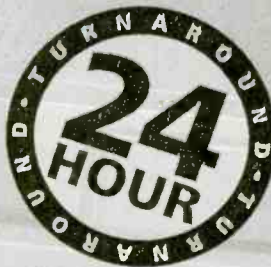
**Are You A Service Center?**  
**Then you need 'nControl!**  
Software for service professionals  
Time clock, automatic tech production, point & click billing  
Electronic billing, credit card terminal built-in, servicetips, manuals, etc.  
Download **Free Trial!** **ServiceSolutions.com**  
**(888) PBS-6288**  
Windows 95/98/NT/2000

# The Professional's Choice!

## SATELLITE RECEIVERS

- DBS and C-Band most makes and models
- World's Largest Inventory of TV Tuners & Mainboards

**CALL 1-800-844-7871 TO RECEIVE OUR LATEST CATALOG**



# PTS Electronics

**Bloomington, Indiana Corporate Headquarters** - 5233 South Highway 37 ■ Bloomington, IN 47401 ■ 800-844-7871 ■ Fax: 800-844-3291  
**Arvada, Colorado** - 800-331-3219 ■ Fax: 303-422-5268  
**E-mail:** [pts@ptscorp.com](mailto:pts@ptscorp.com) ■ [www.ptscorp.com](http://www.ptscorp.com)



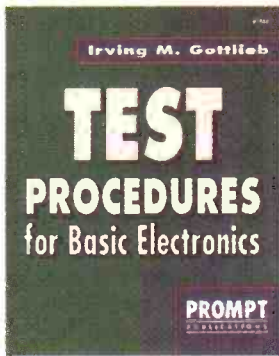
### TV Mainboards

We stock Zenith, RCA & Philips!  
We service Hitachi, Mitsubishi  
Sony and many others



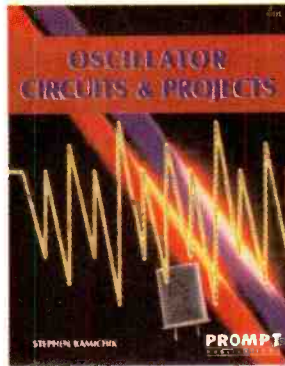
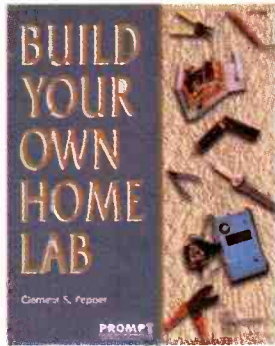
### Television Tuners

We stock over 40 major brands and will save you up to 60%. Orders are shipped the same day they are ordered with free overnight delivery.



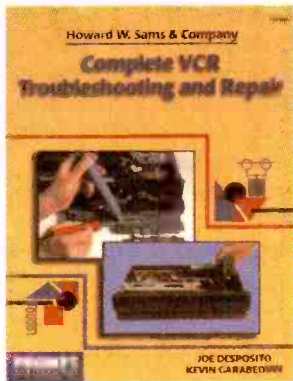
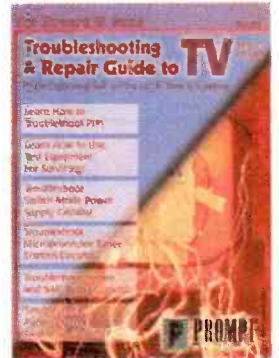
**Test Procedures for Basic Electronics. #61063. -- \$19.95**  
 Many useful tests and measurements are covered. They are reinforced by the appropriate basic principles. Examples of test and measurement setups are given to make concepts more practical. 7 3/8 x 9 1/4", 356 pp, paperback.

**Build Your Own Home Lab. #61108 -- \$29.95**  
 Shows you how to assemble an efficient working home lab, and how to make it pay its own way. Includes projects for creating your own test instruments too. 7 3/8 x 9 1/4", 249 pp, paperback.

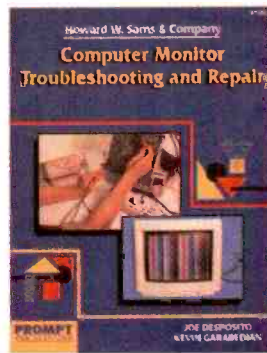


**Oscillator Circuits and Projects. #61111. -- \$24.95**  
 A textbook and project book for those who want to know more about oscillator circuits. You can build and enjoy the informative and entertaining projects detailed in this book. Complete information is presented in an easy-to-follow manner. 7 3/8 x 9 1/4", 249 pp, paperback.

**Troubleshooting and Repair Guide to TV. #62246. -- \$34.95**  
 Repairing and troubleshooting a TV is very simple and economical with help from the information in this book. It is the most complete and up-to-date TV repair book available, with tips on how to handle the newest circuits. 8 1/2 x 11", 263 pp, paperback.

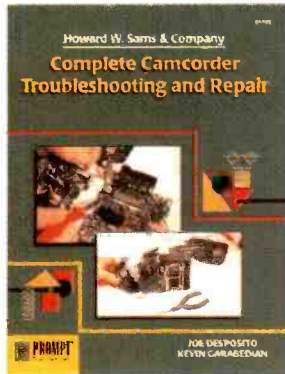


**Complete VCR Troubleshooting and Repair. #61102. -- \$34.95**  
 Though VCRs are complex, you don't need complex tools or test equipment to repair them. This book contains sound troubleshooting procedures that guide you through every task. 8 1/2 x 11", 184 pp, paperback.

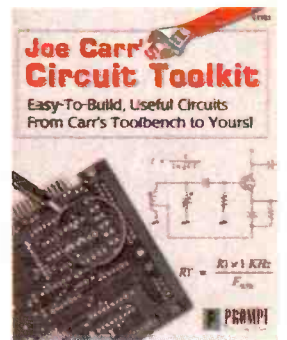


**Computer Monitor Troubleshooting and Repair. #61100. -- \$34.95**  
 This book can save you the money and hassle of computer monitor repair by showing you how to fix it your self. Tools, test instruments, how to find and solve problems are all detailed. 8 1/2 x 11", 308 pp, paperback.

**Complete Camcorder Troubleshooting and Repair. #61105. -- \$34.95**  
 Learn everything you need to know about the upkeep and repair of video camcorders. Start by examining camcorder troubleshooting procedures, then move into more advanced repair techniques. 8 1/2 x 11", 208 pp, paperback.



**Joe Carr's Circuit Toolkit. #61000. -- \$29.95**  
 Easy-to-build, useful circuits from Carr's workbench to you. They will spark new ideas in your day-to-day use of circuits and help solve frustrating problems. 256 pp, paperback.



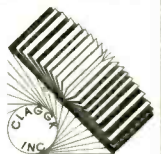
Please circle the products you would like to buy on the page above, calculate the total cost, include shipping charges, using in the form below and send it to us. Please allow 4 - 6 weeks for standard delivery.

Name: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Zip: \_\_\_\_\_ Telephone: \_\_\_\_\_  
 I have enclosed my check for \$: \_\_\_\_\_  
 Signature: \_\_\_\_\_

Please charge my credit card for \$: \_\_\_\_\_ Number: [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]  
 Card Type: \_\_\_\_\_ Expiration Date: [ ] [ ] [ ] [ ] [ ] [ ]  
 Master card, Visa or Discover only

Note: The delivery address and the address at which the credit card is registered must be the same.

**Clagg Inc.**  
 PO Box 4099  
 Farmingdale, NY 11735-0792  
 Tel: 516-293-3751  
 Fax: 516-293-3115  
 email: claggk@gemsback.com



**SORRY** No orders accepted outside of USA & Canada. No. of Books Ordered:

**SHIPPING CHARGES IN USA.**

CANADA ADD	\$5.00
1 Book	\$ 5.00
2 Books	8.00
each add'l book	3.00
2 Day UPS	\$10.00 extra
Next Day UPS	\$20.00 extra

Total price of books.....	\$.....
Shipping (see chart).....	\$.....
Subtotal.....	\$.....
Sales Tax (NYS only).....	\$.....
Amount Enclosed.....	\$.....

All payments must be in U.S. funds! CL04

## NESDANet: A Tool For Success in the Product Service Business

If you want your business to *grow* and prosper, you can't go it totally alone. One of the best "tools" is a collection of your peers who will help you find parts, advise you about equipment, critique your business, and tell you what will and won't work profitably. And, it's available any time you want access to it.

by William S. Warren CET/CSM

Success in the service business: that is the goal we all had when we first opened our service center doors. No one starts out to fail in business, but unfortunately, many do. And in the coming years, an increasing number of servicers will have to close their doors, and shatter their dreams.

There was a time when almost anyone could succeed in consumer electronic service, to a certain degree, based on technical ability alone. Unfortunately, the economics of the business environment today leaves too little room for error. In the past, there were plenty of customers

to go around, and profits were sufficient to cover up some inefficiencies. Nowadays, however, customers are more scarce and profits are thin. Inefficiencies cannot be tolerated. To be successful, the servicer of today and tomorrow must take advantage of all the tools available that can help him or her reach their goals.

There are numerous aids available to managers seeking to grow their businesses. There are books, video tapes, and hands-on seminars that can help their technicians become more proficient, or classes to help managers master management principles. There are software programs that help with store layout, inventory control, parts and labor pricing, rout-

ing, debt collection, warranty payments, and almost any other facet of business.

But, over the past 50 years, the single most important step any manager can take to successful entrepreneurship has been — and remains — membership in an effective trade association. And, for the past 50 years, the most effective trade association has been NESDA, the National Electronics Service Dealers Association.

NESDA offers many, many advantages to any product service business. You can read about some of them elsewhere in this magazine. But of all the benefits of NESDA membership, one of the most important to *me* is access to NESDA's internet-based information-sharing forum, NESDANet.

NESDANet is a nationwide group of servicers who have joined together to share information and experiences to collectively advance the industry and their businesses. It utilizes the power and convenience of the internet to link them together into a group that can advise, help, and even console one another instantly, 24 hours a day, seven days a week.

Need information on an obscure brand? Need technical help on an unusual problem or on a brand you don't have access to factory help on? Need to know

(continued on PS-5)

### Where can you go to ...

- Hear industry news as it happens
- Request advice on specific needs from other servicers
- Locate hard-to-find parts
- Solve problems together
- Expose unfair business practices
- Receive NESDA and association news
- Help formulate industry standards
- Share unpublished warranty policies
- Participate in roundtable discussions

## Be a Part of NESDANet the Professional Servicers' E-Mail Network

### What is it?

NESDANet is a group of astute professionals working together to improve their service businesses.

### How does it work?

Electronic messages (e-mail) are sent via the Internet to the NESDANet computer. The NESDANet computer system then forwards the message to other users.

### Who can join?

Any independent servicer who is also a member of NESDA is welcome. The current membership also includes NESDA headquarters, NESDA board of directors, manufacturers, field service reps, service contract companies, warranty claims processors, parts suppliers, national trade organizations, and association editors.

*With NESDANet, you are never "the only one."*

### What is needed to participate?

Membership in NESDA, a computer, a modem, and a subscription to any Email account.

### What is the cost?

\$60 per year (does not include NESDA membership, Email subscription, or phone-line charges.)

**If you're not a NESDA member, you should be.**

For more information, go online to [www.nesda.com](http://www.nesda.com), or write to:

**NESDA**

2708 W. Berry St., Ft. Worth, TX 76109 • 817-921-9061 • Fax 817.921.3741

## Going Beyond the “Cost of Doing Business” Analysis

Too many service dealers don't know their actual costs of doing business, but of those who *do* know, too many are using the information in the wrong way.

by Fred Longworth, M.B.A.

Sam came back from the cost-of-doing-business (CODB) seminar eager to re-vamp his prices. After a few calculations, it became clear that his flat rate of \$79 labor plus parts to fix a VCR or TV was grossly inadequate. He really needed to charge \$140 labor — just to break even!

Since he'd just opened his business, and the new phone book wouldn't be coming out until Spring, he was getting in only about 20 repairs a month. These were taking approximately 40 hours to complete.

His total monthly overhead came to \$2,000. If he divided the \$2,000 by the 40 hours which he had to sell, he got \$50/hour — or \$100 per 2-hour repair. To this he needed to add the direct cost of his own labor (treating himself as his own employee.) Since, at a bare minimum, he would have to spend \$20/hour, including taxes, workers comp, etc., to replace himself, he figured his own cost at \$40 per job. This upped the “breakeven point” to \$140. Now, as a capitalist, he was entitled to a “businessman's profit,” so he

added another 10% for good measure (\$14). The grand total came to a whopping \$154 per repair.

He knew that a typical VCR or TV billed out at \$25 or less in parts, so he put a big sign in his window: “VCR/TV Repair — Fast 3-Day Service — Most Repairs Under \$179 Including Parts and Labor.”

From that day on, except for an occasional big-screen TV, customer input dropped to zero.

When I met Sam at a trade association meeting, and he told me how slow things were, I said, “Why don't you lower your prices?”

He looked at me like I was crazy.

“I can't do that,” he protested. “I'd lose money.”

The problem is obvious: Sam has priced himself out of the market.

His customers won't pay \$179 — or even \$150 — for an ordinary VCR or TV repair. In Sam's town, you can get lots of business if you can profitably service garden-variety VCR's and TV's for \$90 to \$100. But, with the exception of high-end units, customers will go elsewhere

— or just buy new equipment — when the repair price approaches \$125.

In economic terms, the upper price limit for a repair is established by the marketplace. And the marketplace couldn't care less about Sam's arithmetic.

So, we need to ask: if CODB analysis doesn't define for us where, precisely, to set our price, just what does the analysis tell us? The answer is: it sets the lower price limit, the least amount we can charge and not go in the hole. But, we can't use this “breakeven” number to set our prices. We use it to compare against what we do charge, and thus, to calculate our margin, or our profit.

But, be careful. As we can surmise from Sam's example, CODB analysis gives us inflated numbers if the facility is operating below capacity.

In most cases, the highest profits are made when a product or service is sold at “what the market will bear.” Luckily, there's a standard method for finding this out that provides us with real prices. And, curiously, to get a rigorous number and optimize your profits, you need to plug your CODB values into the formula.

Let me show you by example.

Assume that you currently charge \$50 labor, plus an average of \$10 in retail parts to fix a right-reverse whazzit. You call around in your town, pretend you are a consumer, and find that the competition has a spread of \$55 to \$75 labor, and an average of \$10-20 in retail parts. Okay, now you know that you are the lowest price in a marketplace that generally runs \$65 to \$95 to provide the same service.

(continued on PS-6)

(NESDAnet, continued)

if a manufacturer will negotiate, even though they say they only offer flat rates? Thinking of expanding into a new product service category, but are unsure of the consequences and true costs? Or do you just need a little support to improve that developing tunnel vision, or give you that needed little push to do what you already know you should do?

In each of these cases, NESDAnet is the answer.

The beauty of NESDAnet is its ease of use. Members have the choice of addressing only fellow servicers for semi-private discussions, or the full NESDAnet family for a broader base of potential help. The “open” NESDAnet list includes manufacturers, parts distributors, and extended warranty administrators. There are additional lists that include other sub-

groups, such as the NESDA and ISCET Boards of Directors.

While NESDAnet has its beauty, it also has its principle strength: the immediacy of the internet. It is not unusual for a member to post a request, and have a choice of replies within an hour or less. Strong and beautiful, what more can you ask for?

NESDAnet is *not* a social club, although it is a good place to make and maintain business friendships through ongoing discussions. It is *not* a forum for unchallenged complaints or grudges, but instead is a forum for discussions on policies and procedures that you find objectionable, as well as serious business issues facing servicers today. It is *not* a place for jokes or non-constructive dialog, although our members have been known to respond in humorous fashion. NESDA works dili-

gently to keep NESDAnet a focused group on issues of concern to servicers. It may sound rigid but it isn't. It is member-driven, and our policies reflect the business-professionals who participate.

Participation is easy. You must be a regular member of NESDA, have a valid email address with both send and receive capabilities, and pay a modest fee of \$60 per year. For more information on NESDA, how to join, or how to join NESDAnet, contact the NESDA national office at 2708 W. Berry St., Ft. Worth TX 76109-2397; 817-921-9061, Fax: 817-921-3741 or go on-line at: [www.nesda.com](http://www.nesda.com). §

*Editor's Note: William S. Warren CET/CSM is the NESDAnet Director of Communications and owner of Warren Electronic Services in Knoxville, TN.*

## Representing and Fighting for Independent Service

### You Are Not ALONE!

NESDA is the national association dedicated to the plight and security of the independent service dealer — whether you service appliances, computers, consumer electronics, industrial electronics, MATV, biomedical instrumentation, TVRO, etc.

NESDA engages in fruitful dialogue and mutual cooperation with manufacturers who recognize and respect independents' rights. However, NESDA is also ready to fight unfriendly manufacturers and other monopolists in the halls of Congress or the chambers of the U.S. Supreme Court.



#### When You Join NESDA, You Get:

- Prestigious member identification material for door, wall and wallet
- Free subscription to every issue of *Poptronics*, which includes *ProService*, "news you can use" about the product service industry
- Free copy of the "ProService Directory," 128-pages of service industry contacts
- Free members-only newsletters: "NESDA Newsletter," "Legislative Alert," special bulletins, and more
- Access to manufacturers' key service executives through NESDA's effective industry relations committee
- Access to headquarters staff for personalized advice or referral to authoritative source or knowledgeable members
- Access to the minds of other dealers — and other business experts — willing to share information freely
- Purchasing discounts for members on a variety of business aids, invoice forms, merchandise, and more
- Access to an annual convention and trade show with the industry's best and most cost-effective professional training
- National-level representation to government, manufacturers, etc. on important business and industry issues
- Much, much more (for a full description of benefits and programs, return coupon)

#### When You Join NESDA, You Get Help!

Isn't it time you joined the other professionals in electronics?

I want to find out more. Send information about NESDA, including an application.

Name \_\_\_\_\_

Business \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_

Mail to NESDA, 2708 W. Berry St.,  
Fort Worth TX 76109; 817-921-9061  
or Fax to: 817.921.3741

## NWSN: Service Companies That Would Service the World

If your service business is equipped to provide top quality service, and is willing to *guarantee* 'no unresolved customer complaints,' without exception, you may want to join the NESDA World Service Network.

NWSN members feel they are preparing themselves for future business — and future success — now.

by Gerry McCann CET/CSM

When businesses join NESDA, they increase their abilities to function economically and profitably. And by becoming a small part of a greater entity, they also increase their ability to affect larger

issues, such as politics and marketing. NESDA offers the strength of numbers to its members. More can be accomplished together than individually. Although NESDA offers a complete range of value-driven benefits for *all* members,

(continued on PS-8)

(Beyond CODB, continued)

Since you keep accurate records of the important categories of items you repair, you note that, typically, you service 25 right-reverse whazzits per month. That's a total of  $\$60 \times 25 = \$1,500$  revenue.

To earn this \$1,500 revenue, your CODB analysis tells you that (forgetting the extra capitalist's kicker) you would need to charge an average of \$45 (\$40 labor, plus \$5 wholesale cost of parts) to break even. This comes to  $\$45 \times 25 = \$1,125$ . Subtract this from \$1,500 and you get \$375, which is your profit.

Now, you raise your retail price, say, to \$60 labor and \$10 in parts. You carefully note how this affects customer demand, and you find that demand drops to 24 units a month. That's okay, because your revenues are now  $\$70 \times 24 = \$1,680$ . Your cost equals  $\$45 \times 24 = \$1,080$ , and your profit is \$600.

Flushed with success, you raise your retail price again, to \$80. Now, you lose another couple of repairs — down to 22. But your revenues increase to  $\$80 \times 22 = \$1,760$ . This generates a cost of  $\$45 \times 22 = \$990$ , and a profit of \$770.

Now, you up the retail price another \$10 to \$90. Input decreases to 18 units. Revenues go to  $\$90 \times 18 = \$1,620$ . Cost drops to \$810. Profit increases to \$810.

Finally, you raise the retail price to \$100. Input decreases to 13 machines. Revenues go to \$1,300. Costs go to \$585. Profit drops to \$715.

Empirically, you have discovered a "maximum" (about \$90) on the price/profit curve, a sweet spot above and below which profits decline. Generally, this

price will be within the "spread" or range of other dealers' prices in your market, but occasionally it will be higher or lower. Regardless, you have discovered the point of highest return for a given category of set.

But, don't rest on your laurels. You should continue to monitor price vs. aggregate profit, category by category, always on the lookout for trends or sudden changes.

Now, some manufacturers still require you to provide a cost-of-doing-business analysis to justify your warranty rates. It is, after all, in their self-interest to pay you no more than they have to. And, unless you doctor the numbers — and many do — the analysis forces you to tip your hand. In some states, such as California, a manufacturer cannot, technically, pay you less than the CODB. (However, most will try, if you let them get away with it.)

This connection to warranty rate negotiations was, I believe, how the whole CODB obsession got going in the first place. But, you should know: in business school, a simple CODB pricing model is not encouraged. That's because it is assumed that you are trying to maximize your profits, rather than playing a pleasant little numbers game on paper.

In short: know what your costs of doing business are; don't be a slave to your findings. Use the information intelligently to ensure continued business — and profits. §

*Editor's Note: Fred Longworth CET, M.B.A. is owner of Longworth Consulting and StereoTech in San Diego, CA. §*

# The Electronics Industry is looking for a lot of good people!

Here is your chance to get in on the ground floor as an Associate CET. Is your job title "Electronics Service Technician?" Would you like to have that title? You can prove you qualify for the title with a CET Associate Certificate. It can be your career door-opener and begin your rapid advancement!

A technician or student of electronics with less than a total of four years of basic experience may take the Associate Level Exam. The exam is the basic electronics portion of the full-credit CET exam. The 75-question, multiple-choice test covers basic electronics, math, DC and AC circuits, transistors and semiconductors, instruments, measurements and troubleshooting. A successful Associate CET will receive a wall certificate valid for four years and is eligible to join ISCET as an Associate Member. ISCET is the International Society of Certified Electronics Technicians.

The ISCET Computer-Aided Associate-Level Study Guide prepares you for the Associate CET Certificate by randomly selecting sample questions with appropriate diagrams, provides multiple-choice answers, grades the test and provides a summary of your strong and weak points.

Diskette requires IBM computer or compatible with VGA color monitor, 3.5-in. drive and a hard-disk drive.

## CLAGGK INC. - CET Computer-Aided Study Guide Offer PO Box 4099, Farmingdale, New York 11735

**YES**, I want to step up to a career in servicing. Here is my order for the CET Computer-Aided Study Guide on a 3.5 diskette. I am enclosing \$39.95 (price includes U.S. shipping and handling) in U.S. funds. Canadians and overseas add \$6.00 per order for shipping.

Bill my  VISA  MasterCard Expire Date \_\_\_/\_\_\_/\_\_\_  
 USA Bank Check  US or International Money Order

Card No. \_\_\_\_\_

Signature \_\_\_\_\_

Name (Please Print) \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

New York residents add local sales taxes. Do not send cash. Checks drawn on US Bank and International Money Orders in US funds only. Credit card users may telephone or FAX orders. Telephone 516-293-3751 or FAX 516-293-3115. Price subject to change. Allow 6 to 8 weeks for delivery.

CB06

## Proof Positive that you are a Certified Electronics Technician



**A New**

## Computer Software Program — ISCET Computer-Aided Associate-Level Study Guide

Prepare yourself for the 75-question CET Associate Examination. Model examinations provide the technician with a study program and introduction to the actual examinations. The model examinations are automatically graded in decimal numbers and bar graphs that can be outputted on your printer. The questions for each exam are selected randomly from a loaded data base—no two exams are exactly the same. When you answer a question, the correct answer is displayed and an explanation is given. From the print-outs you will determine whether you need more practice and in which topic areas, or if you are ready to take the real test and continue to promote your electronics career today!

## ISCET – Preparing Technicians for Today and Tomorrow

There is a place for technicians who have proven their abilities through certification. There is a place for proven-professional technicians to continue their training, and help elevate their industry to new levels.

These places are the same one: a professional/fraternal society for concerned and caring technicians.

by William S. Warren CET/CSM

When you were studying to become a technician, you imagined that you would become one of the *best* technicians. After you became a professional, and after you worked on-the-job at restoring the operation of hi-tech equipment, you *knew* you were among the best.

But who else knows? If your skills haven't been measured against others in the industry, how do your customers know that you're not just a parts-swapper? How do you position yourself among the elite in your profession?

The answer to those questions is: certification. As in ISCET-Certified Electronics Technician.

And if you are, or become an ISCET-Certified electronics Technician, how do you continually enhance your professionalism, while promoting the betterment of your industry?

The answer to *that* question is the International Society of Certified Electronic Technicians (ISCET). That may be a long name, but it has a very short meaning: *The Best*.

ISCET's mission is simple: to promote technical certification worldwide, and to provide a place for certified technicians to come together to advance their profession. Technicians wishing to tell the world they are the best can, through ISCET certifications, demonstrate they *are* the best.

Since our beginning, ISCET has taken this simple mandate, and forged ahead to become one of the preeminent technical certification organizations in the world. To date, we have certified over 47,000 technicians in various technical disciplines. While ISCET's roots are in consumer electronics, it has diversified into *all* segments of electronics servicing. ISCET is now a leader in certifications in fields as diverse as advanced audio and bio-medical electronics, to industrial and video. We have an extensive Associate program for stu-

dents and apprentices with less than 4 years experience, to an unequalled Journeyman program for experienced technicians. In addition, we offer a number of journeyman endorsements in specialties such as camcorder, computer networking, and motor control. We are also a major contractor to the Federal Communications Commission (FCC) for implementation of the FCC Radiotelegraph certificates, licenses, and endorsements.

**Not all programs are equal.** ISCET is rightly proud that its certifications carry college credit recommendations by the American Council on Education's (ACE) College Credit Recommendation Service (CREDIT). ACE is not a self-serving trade group. It is the leader in its field, and the service most major colleges and universities turn to for credit recommendations. An official ACE transcript is a permanent, lifetime, computerized record of all exams and courses evaluated by ACE, and the ACE transcript is designed to facilitate the acceptance of ACE credit recommendations by colleges and universities.

**Quick and easy access.** That is IS-

CET's goal. While we offer access to many of our certifications through the national testing firm of LaserGrade, the backbone of our efforts remains our volunteer corps of over 400 members that have agreed to work as certification administrators. We are a professional society — of our members, by our members, and for our members. Our efforts emanate at the grass roots level and carry forward.

**It's not just electronics either.** While electronics is in our name, we also administer the Certified Appliance Technician (CAT) program for the National Appliance Service Technician Certification (NASTeC) program. This program, developed by the Association of Home Appliance Manufacturers (AHAM) and controlled by the Appliance Technician Certification Association is ISCET's latest addition to its stable of certification programs.

**Did someone say training?** The leader in certifications is a leader in technical training as well. ISCET is a source for extensive training for the electronics professional, from sample tests to detailed books; from computerized quizzes to interactive CDROM based training utilizing Electronics WorkBench. In addition, our members receive mailings on everything from job opportunities to technical papers by industry leaders.

Participation is easy. For more information on ISCET, or on how to join, contact the ISCET national office at 2708 West Berry Sreet, Fort Worth TX 76109-2397; 817-921-9101; Fax 817-921-3741. Or, go on-line at [www.iscet.org](http://www.iscet.org). §

*Editor's Note: William S. Warren CET/CSM is the Imm. Past Chairman of ISCET and owner of Warren Electronic Services in Knoxville, TN.*

### Interactive Study Modules Using Electronics Workbench

"Hands-on" study guides offer interactive simulation, and include multiple-choice questions that make use of the virtual lab capabilities

**Note: Student Electronics Workbench is required for use with Study Guides**

Quantity	Member	Non-Member
___ Student Electronics Workbench, Version 5.0	<input type="checkbox"/> \$69.95 ea.	<input type="checkbox"/> \$89.95 ea.
___ Associate Interactive Study Guide (78 questions)	<input type="checkbox"/> \$39.95 ea.	<input type="checkbox"/> \$49.95 ea.
___ Consumer Study Guide (35 questions)	<input type="checkbox"/> \$49.95 ea.	<input type="checkbox"/> \$59.95 ea.
___ Industrial Study Guide (28 questions)	<input type="checkbox"/> \$49.95 ea.	<input type="checkbox"/> \$59.95 ea.

Name \_\_\_\_\_  
 Address \_\_\_\_\_  
 City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_  
 Phone \_\_\_\_\_ Total Enclosed \$ \_\_\_\_\_  
 Member of:  NESDA  ISCET  
 Visa  MasterCard No. \_\_\_\_\_ Exp. \_\_\_\_\_

Please allow 4-6 weeks for delivery when using personal checks. Money orders, cashier's checks and credit cards are processed in 10 days. Prices include domestic shipping. Foreign shipments, please add international postage, and specify Surface or Air. Texas residents multiply dollar amount by 8.25% for tax.

Mail to: ISCET, 2708 W. Berry St., Ft. Worth TX 76109; 817-921-9101; Fax 817-921-3741; [www.iscet.org](http://www.iscet.org)



# ISCET VCR

**Cross Reference**  
VCR Model Number Cross Reference  
and VCR Parts Cross Reference

VCR Cross Reference, Version Eight VCR Model and VCR Parts Cross Reference. 172 pages. Contains 1,972 models and 7,810 parts. Three-hole punched; shrink wrapped. **\$19.95; postage \$4.00**

VCR Cross Reference on Disc Ver. 8.0. One 3 1/2" disc. For IBM PC AT/XT or compatibles. Model search by manufacturer or description. Contains all new models and parts listed in the version eight book. New faster search engines. **\$39.95; postage \$4.00**

Allow 4-5 weeks delivery when using personal checks or VISA and MasterCard. Money orders and cashiers checks processed immediately. Payment:  Check,  Visa,  MC

Amount \_\_\_\_\_ Card Exp. \_\_\_\_\_

Card No. \_\_\_\_\_

Name \_\_\_\_\_

Business \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_

Phone \_\_\_\_\_

Member:  ISCET;  NESDA;  Non-member

Texas residents multiply dollar value x 8 1/4% for taxes.

Foreign shipments please add international postage.

Send to ISCET, 2708 W. Berry St., Ft. Worth TX 76109

## 6.9¢/Minute Long Distance Service

NESDA's new LDS program through MCI/WorldCom offers ...

- interstate rates of 6.9 cents per minute (slightly higher for In-state calls)
- good anytime, every day
- billing increments of six seconds
- calling card rate of only 14.9 cents/minute — and no surcharges (unless using a public pay phone)
- available for home and business; friends and neighbors, too.
- Residential rate 6.9 cents, no minimum usage
- no-cost switching from other carrier
- monthly fee of only \$2 per line, per-month for 800 or 888 service (add'l fee for directory assistance listing)
- rate negotiable for high volume
- no contracts; no monthly charge
- only \$25 per month of L.D. usage to qualify
- Residential service not yet available in most markets

**\$20 Finders Fee:** Receive a \$20 check from Glenwood Communications for each new customer you recruit for the NESDAfone Plan who remains a customer for at least two months.

**Glenwood Communications: 800-460-2242**

**"Ask for the NESDAfone Plan!"**

(Present high-volume customers may be eligible for even lower rates.)

(NWSN, continued)

an elite group of professionals is rapidly emerging from the ranks.

These people are banding together into the NESDA World Service Network (NWSN). NWSN is a quality-service assurance program, and a combined worldwide marketing effort for volunteer companies. For an additional fee (over and above regular member dues), interested NESDA-member service companies can participate in an industry-wide marketing initiative aimed at promoting service industry businesses to consumers.

The new referral program, which involves internet marketing of member businesses, will only be open to NESDA members who wish to pay the additional fee (\$300) and meet all qualifications of knowledge, competency, and certification. Members must employ at least one Certified Service Manager, and one Certified Electronics Technician, although they can be the same person. If prospective participants do not currently meet the rigid qualifications of NWSN membership, they may be admitted if they agree to attain the required credentials prior to August 1, 2000.

NWSN provides a set of guidelines and requirements for participating companies. The primary purpose of these rules is to assure consumers that members are ethical and competent within their stated fields of service. A rather extensive application may be filled out and submitted by email, or may be printed out and mailed into the NESDA office. Questions are gauged to measure each servicer's business longevity, ethical reputation, warranty affiliations, TPW affiliations, and competency for brands serviced, as well as types of service offered. And, as a commitment to quality customer service, each NWSN member agrees that there will be no unresolved complaints from their customers. Each complaint must be handled quickly, professionally, and completely. With proper guidance, NWSN can become the technical and ethical benchmark of reference for Better Business Bureaus, consumer agencies, and states' Attorney Generals' offices. It is hoped that the criteria for membership will be so recognized that it qualifies for national service center status.

The new web site for NWSN, [www.nesda-nwsn.com](http://www.nesda-nwsn.com), will be devoted

to running the search engine behind the idea. Interested consumers will access the web site to search for participating members by zip code, area code, product types and brand names serviced. Each service participant's web site will be linked to the NWSN website to provide additional referral details involving such information as direction maps and hours of operation. In addition, a complete national marketing campaign is being considered that will publicize the concept of NWSN. Tentative lead-generating and service-referral agreements are in the works with a number of emerging manufacturing and sales organizations.

Obviously, NWSN isn't for every service organization. But if you and your company can meet the hard-hitting criteria — criteria that will soon be required by all seekers of services — you should be a part of it. The NWSN is destined to become a vital source of your important future business leads.

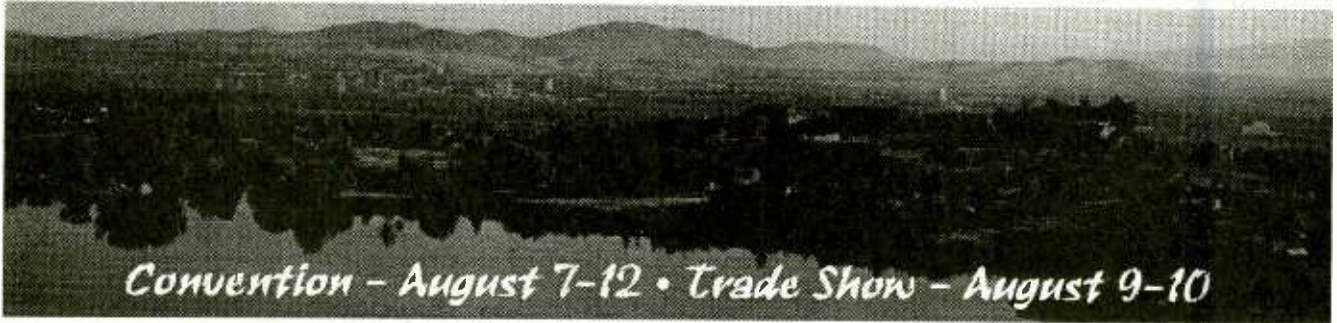
*Editor's Note: Gerry McCann CET/CSM is owner of McCann's Electronics, Metairie, LA, and host of the bi-weekly radio show, Living with Home Electronics.*

# National Professional Service Convention 2000

and Professional Service Trade Show

John Ascuaga's Nugget Hotel — Sparks (Reno) NV

Register for the Full Convention, Any Three Consecutive Days, or Daily



Complete this form, detach and mail to: NPSC 2000, 2708 W. Berry Street, Fort Worth, TX 76109; 817-921-9061; Fax 817.921.3741; www.nesda.com

Full convention registration includes all programmed meals, banquets, door prize drawings, trade show, dealer/manufacturer meetings, seminars and workshops. Activities may be scheduled for optional participation at an extra cost. There is no convention youth program. However, children 17 and under are free.

NOTE: Special Registration Rates are valid ONLY on registrations **completed, fully paid and received before the deadlines** listed. "Three-Day Special" registration is available for any three consecutive days. Children age 17 and under are free. Convention fee schedule per person (ages 18, up):

Name \_\_\_\_\_  
Firm Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_  
Zip \_\_\_\_\_ Phone \_\_\_\_\_

If registered and fully paid by ...	Full Convention Registration	3-day Special	Daily	Totals:
Jan. 31, 2000	\$160	\$120	\$70	\$ _____
Mar. 31, 2000	\$180	\$140	\$75	\$ _____
May 15, 2000	\$200	\$160	\$80	\$ _____
Aug. 3, 2000	\$220	\$180	\$85	\$ _____
At the door	\$250	\$200	\$90	\$ _____

Member of (please check the appropriate boxes below):

- NESDA;  ISCET;  PSA;  NARDA/NASD;  Non-Member;  
 Instructor;  Speaker;  Distributor;  Manufacturer;  Sales Rep;  
 Press;  Dealer;  Technician;  Other \_\_\_\_\_

If registering for a 3-day special, check which 3 days you are registering:  
 Mon.-Wed.  Tues.-Thurs.  Wed.-Fri.  Thurs.-Sat.

Below, please print legibly your name, and the names of all other registrants (including nicknames) as they are to appear on the registration badges:

Check box if first NPSC

	Full Name (The one name you want in large letters)	Badge Name	Youth Ages
<input type="checkbox"/>	_____	_____	_____
<input type="checkbox"/>	_____	_____	_____
<input type="checkbox"/>	_____	_____	_____
<input type="checkbox"/>	_____	_____	_____
<input type="checkbox"/>	_____	_____	_____

### Numbers of Participants/Length of Registration

# Adults Full: _____	# Adults 3-Day: _____	# Adults Daily: _____	Total No. of Days: _____
# Children Full: _____	# Children 3-Day: _____	# Children Daily: _____	Total No. of Days: _____

Make your check payable to NESDA

Visa  MasterCard No. \_\_\_\_\_ Exp. \_\_\_\_\_ Signature: \_\_\_\_\_

**Special Room Rates:** Deluxe room rates at John Ascuaga's Nugget Hotel are \$89 single or double; \$10 per person over 2 in the same room, max. 4. Children 18 years and under stay free with parents. Rates do not include room tax, currently 8%. Rooms are subject to availability. You may call the Nugget directly to make your reservations at 800-648-1177 (tell them you're reserving under the National Professional Service Convention) or by registration card provided by NESDA. Due to a city-wide celebration the week prior to NPSC 2000, our room-block does not begin until Sunday, August 6th. Hotel reservations beginning prior to August 6th are on your own. To guarantee a room at John Ascuaga's Nugget Hotel, reservations MUST be made by June 30.

**REFUND POLICY:** Register in advance. If find that you have to cancel — any time prior to convention — all money prepaid will be refunded except for a 10% processing fee per registered person.

## Receiver and Detector Circuits

Building and experimenting with receiver and detector circuits can be as much fun and as educational today as it was for the electronic pioneer of yesteryear. I firmly believe that the majority of electrical engineers and technicians in the first three-quarters of this century got their start in electronics by building either a crystal set or a tube or transistor broadcast receiver. At least the majority that I've talked to over the years have indicated that fact to me. We learn the best by doing—which is as true today as

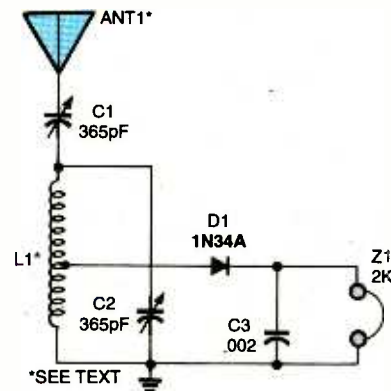


Fig. 1. This simple but functional crystal receiver—comprised of a germanium diode (D1), a hand-wound inductor (L1), and three capacitors (C1–C3)—can tune AM broadcast-band stations transmitting on a frequency ranging between 550 and 1600 kHz.

### PARTS LIST FOR THE CRYSTAL RECEIVER (FIG. 1)

- ANT1—Antenna wire (see text)
- C1, C2—365-pF tuning capacitor (see text)
- C3—0.002- $\mu$ F, ceramic-disc capacitor
- D1—1N34A general-purpose, germanium, switching diode
- L1—See text
- Z1—2000-ohm impedance headphones
- Printed-circuit or perfboard materials, power source, wire solder, hardware, etc.

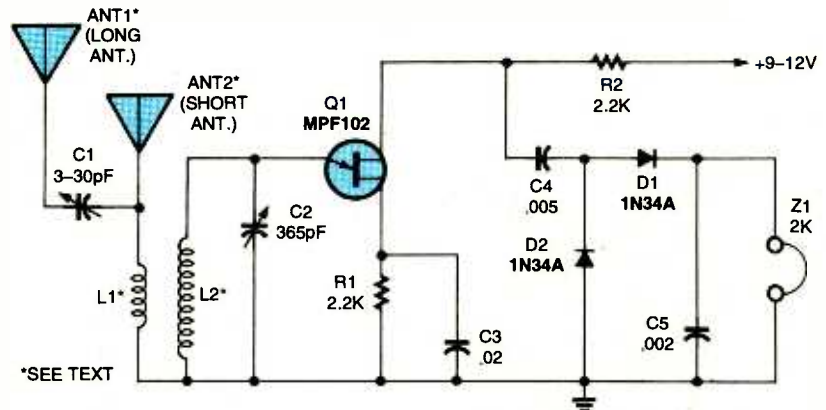


Fig. 2. Unlike the previous circuit, which includes no amplification and uses a single-diode detector—this simple receiver contains a single-stage, tuned-input RF amplifier and a dual diode detector.

it was at anytime in our history.

If you've never built a receiver circuit from scratch and are not sure if your efforts would prove fruitful, then wait no longer because one of our receiver circuits could be your first step to a successful hobby or career. Even if you are an old hand, give one of these circuits a try and see how it compares to receivers of the past.

The first receiver circuit built by so many folks in the early days of radio was the elegant and simple crystal set. The crystal detector is an amplitude-modulated (AM) radio in its simplest form. AM is the only form of modulation that the crystal detector can unravel. CW, FM, single-side-band signals, and all other methods of modulation that are not amplitude in form cannot be received on a crystal radio. That was a problem in the early days of amateur radio because CW was the mode most often used. Only clicks could be heard when CW was received on a crystal radio.

Then along came a true genius, Edwin H. Armstrong, with his famous regenerative detector, which solved the problem. The regenerative detector is truly a multifaceted radio detector—bar none! In its simplest form, the regenerative receiver can unravel many forms of RF modulation, including AM, CW,

### PARTS LIST FOR THE SINGLE-STAGE JFET RECEIVER (FIG. 2)

#### CAPACITORS

- C1—3–30-pF trimmer or similar size variable
- C2—365-pF tuning
- C3—0.02- $\mu$ F, ceramic-disc
- C4—0.005- $\mu$ F, ceramic-disc
- C5—0.002- $\mu$ F, ceramic-disc

#### ADDITIONAL PARTS AND MATERIALS

- ANT1—Antenna wire (see text)
- D1, D2—1N34A general-purpose, germanium, switching diode
- L1, L2—See text
- Q1—MPF102 JFET
- R1, R2—2200-ohm, 1/4-watt, 5% resistor
- Z1—2000-ohm impedance headphones
- Printed-circuit or perfboard materials, power source, wire solder, hardware, etc.

FM, and single-side-band without requiring special circuitry for each mode. Not bad for a 1914 design—long before the general public knew what a vacuum tube was and how it would change their lives.

First things first, the elegant crystal set.

## Crystal Receiver

Our very first receiver entry this month is a simple, but functional, crystal set that can tune American and other AM broadcast-band stations transmitting on a frequency ranging between 550 and 1600 kHz. A schematic diagram of the circuit is shown in Fig. 1. The receiver's tuning range can be modified by changing the values of L1 and C2. Higher component values allow the receiver to tune the lower frequencies, while lower values allow the receiver to tune the higher frequencies.

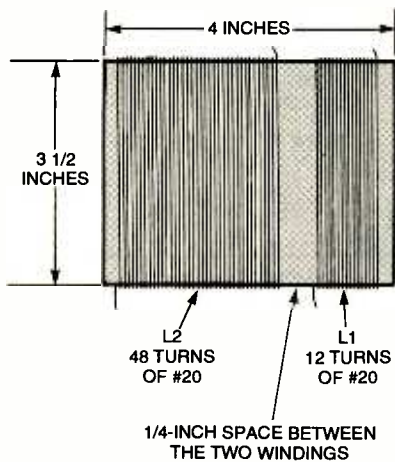


Fig. 3. Details for fabricating the homebrewed coils (L1 and L2)—which are comprised of a total of approximately 60 feet of #20 enameled wire wound on a 4-inch length of 3/2-inch diameter PVC pipe—used in the Fig. 2 circuit is shown here.

If all of the signals present at an antenna were visible, it would no doubt look like the aftermath of an explosion at a spaghetti factory. That's because along with the desired signal you'd find an untold number of other RF signals covering the entire RF spectrum all jumbled together at the same antenna—all of them, of course, vying for a chance to meet your receiver's detector circuit.

The circuit's only frequency-selective elements are L1 and C2, which allow the receiver to select the desired station and to reject all other signals. Of course, in the real world things don't exactly happen that way. Strong out-of-band signals can override weaker signals—crowding out the desired frequency altogether. In addition, stations transmitting on adjacent frequencies, if strong enough, can crowd in and appear at the detector's output. The higher the Q factor or "Q" of the tuned circuit, the better the receiver's selectivity. In spite of all of the

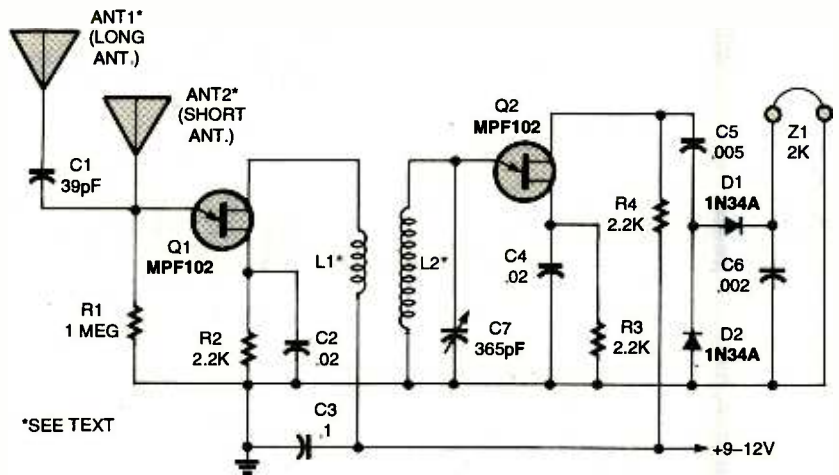


Fig. 4. This receiver circuit, an "evolved" version of our last circuit receiver, uses a pair of JFETs. One JFET (Q1) serves as a broadband RF-booster amplifier, while the other is configured as a tuned RF amplifier.

negative factors, a single tuned LC circuit can still offer ample selectivity in most simple receiver applications. So let's get back to our crystal set and see how it performs in the real world.

A good antenna and ground are a must for any crystal set to perform at its best. But if you live in an area where it's impossible to put up a long-wire antenna or drive a ground rod, it's still possible to receive a few local stations. Just about any length of wire over 20 feet strung around the room can be used for an antenna; the ground for the set can be another similar length of wire strung around another part of the room (to act as a counterpoise) and connected to the receiver's ground input. In any case, since the receiver circuit contains no amplification, the circuit's audio level depends on the strength of the RF signal and the length of antenna used.

Inductor L1 is comprised of about 75 turns of number 22 enamel-covered copper wire wound on a 2-inch diameter plastic form. A length of PVC pipe, a pill bottle, or any similar material can be used as the coil form. The detector tap is made at the 30<sup>th</sup> turn up from the bottom of the coil.

The two 365-pF tuning capacitors can be salvaged from old AM radios or purchased new. Very nice new 365-pF tuning capacitors are available from the Xtal Set Society, Box 3026, St. Louis, MO. 63130, or go to their Web site at [www.midnightscience.com](http://www.midnightscience.com) and look over the number of interesting crystal-set components. The detector diode, a 1N34A germanium unit, is available from RadioShack and most electronic mail-order houses. The circuit layout

### PARTS LIST FOR THE TWO-STAGE JFET RECEIVER (FIG. 4)

#### CAPACITORS

- C1—39-pF, ceramic-disc
- C2, C4—0.02-μF, ceramic-disc
- C3—0.1-μF, ceramic-disc
- C5—0.005-μF, ceramic-disc
- C6—0.002-μF, ceramic-disc
- C7—365-pF tuning

#### ADDITIONAL PARTS AND MATERIALS

- ANT1, ANT2—Antenna wire (see text)
- D1, D2—1N34A general-purpose, germanium, switching diode
- L1, L2—See text
- Q1, Q2—MPF102 JFET
- R1—1-megohm, 1/4-watt, 5% resistor
- R2—R4—2200-ohm, 1/4-watt, 5% resistor
- Z1—2000-ohm headphones
- Printed-circuit or perfboard materials, power source, wire, solder, hardware, etc.

isn't critical, so just about any construction scheme—printed circuit, perfboard, experimenter's board, etc.—can be used as the component substrate.

### Single-Stage JFET Receiver

Our next receiver, see Fig. 2, uses a single-stage, tuned-input, RF amplifier with a dual-diode detector. In that circuit, an MPF102 JFET is used to amplify the incoming RF signal. The output of the amplifier is fed to a two-diode detector circuit that rectifies the amplified RF, sending a demodulated audio signal to the headphones. The Single-

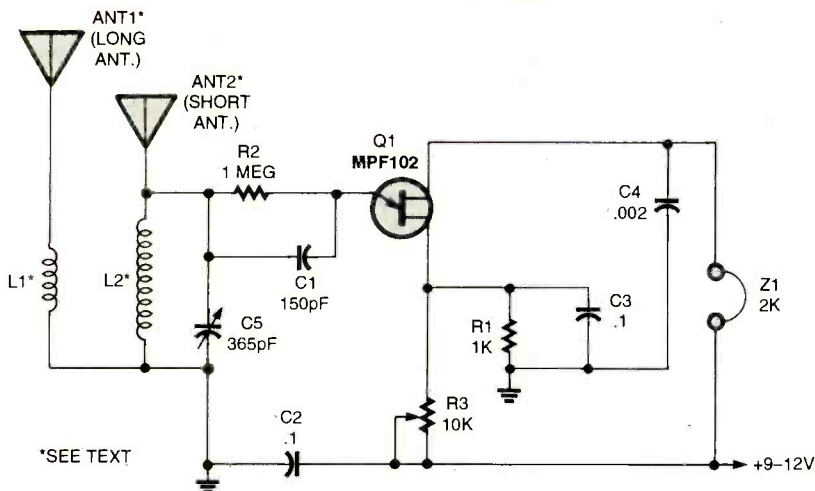


Fig. 5. This solid-state equivalent of a receiver (grid-leak detector) of a bygone era replaces the vacuum tube with a JFET (which operates somewhat like a triode vacuum tube in detecting RF signals).

### PARTS LIST FOR THE GRID-LEAK DETECTOR EQUIVALENT (FIG. 5)

#### RESISTORS

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

- R1—1000-ohm
- R2—1-megohm
- R3—10,000-ohm potentiometer

#### CAPACITORS

- C1—150-pF, ceramic-disc
- C2, C3—0.1- $\mu$ F, 50-WVDC
- C4—0.002- $\mu$ F, 50-WVDC
- C5—365-pF tuning

#### ADDITIONAL PARTS AND MATERIALS

- ANT1—Antenna wire (see text)
- L1, L2—See text
- Q1—MPF102 JFET
- Z1—2000-ohm headphones
- Printed-circuit or perfboard materials, power source, wire solder, hardware, etc.

the remaining receiver circuits. If the suggested wire size isn't readily available, try using the next closest size and adjusting the number of turns in the coil to obtain the desired tuning range. If the low-frequency end of the band can not be tuned, add a few turns to L2, and if

the high-frequency end of the band won't tune, remove a few turns from L2. The best way to start out is to wind extra turns on L2 and remove turns if necessary to obtain the desired tuning range.

### Two-Stage JFET Receiver

Our next entry, see Fig. 4, adds a broadband RF-booster amplifier to the receiver to increase sensitivity for use in a weak-signal area. Transistor Q1, an MPF102 JFET, amplifies all of the incoming RF signals and sends the output to the tuned RF amplifier (built around Q2) through L1 and L2. Inductor L2 along with C7 is used to select the desired frequency. The amplified-output signal of Q2 is converted to audio by a dual-diode-detector circuit, comprised of D1 and D2.

Inductors L1 and L2 are homebrewed coils fabricated as outlined in Fig. 3. The Fig. 4 circuit has more gain than the single-stage one, so it is important to keep all interconnecting leads between components as short as possible to prevent parasitic oscillations.

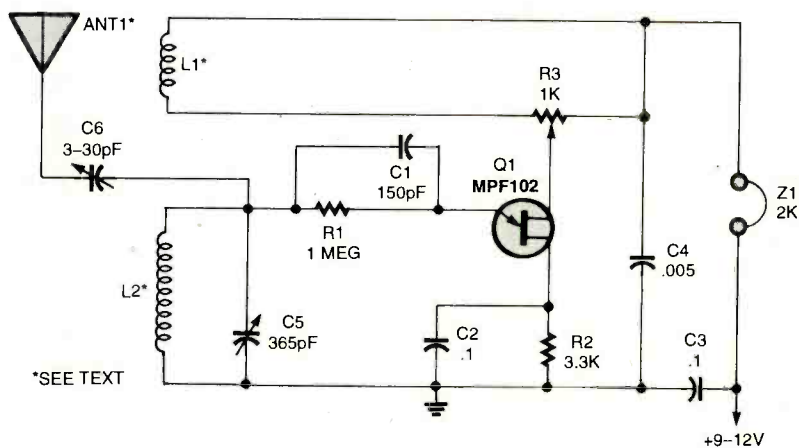


Fig. 6. The regenerative receiver, popularized during the radio era of yesteryear, replaces the vacuum tube used in the original design with an MPF102 JFET.

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

#### RESISTORS

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

- R1—1-megohm
- R2—3300-ohm
- R3—1000-ohm potentiometer

#### CAPACITORS

- C1—150-pF, ceramic-disc
- C2, C3—0.1- $\mu$ F, ceramic-disc
- C4—0.005- $\mu$ F, ceramic-disc
- C5—365-pF tuning

C6—3-30-pF trimmer

#### ADDITIONAL PARTS AND MATERIALS

- L1, L2—See text
- Q1—MPF102 JFET
- Z1—2000-ohm impedance headphones
- ANT1—Antenna wire (see text)
- Printed-circuit or perfboard materials, power source, wire solder, hardware, etc.

Stage JFET Receiver is a good performer that is well suited to receiving local stations using a short antenna and a short counterpoise for the ground.

The inductors in that circuit, L1 and L2, are a pair of homebrewed coils that were fabricated by hand-winding approximately 60 feet of #20 enameled-covered copper wire on a 4-inch length of 3 1/2-inch diameter PVC pipe. Additional details for fabricating the coils are given in Fig. 3. Now would be a good time to wind the two coils, since the very same coils are used in most of

## Grid-Leak Detector Equivalent

Our next circuit, see Fig. 5, is very similar to a popular old vacuum-tube circuit, the grid-leak detector. Here we've replaced the tube with the modern JFET, which operates somewhat like a triode vacuum tube in detecting RF signals. The major difference between the vacuum-tube receiver and the solid-state version is in the operating power. The tube's filament, even on a battery-type tube, alone consumes several times the power the JFET receiver uses.

The desired incoming signal is selected via an LC network, comprised of L2 and C5, and fed to the JFET's gate where it is detected and amplified, after which the signal is sent on to the phones. The JFET operates best as a detector when the gate bias is set near its cut-off value. Since JFET characteristics vary from device to device, the tuning range of R3 allows the bias to be set to its optimum value for RF detection.

## Solid-State Regenerative Receiver

Our next circuit is a solid-state version of Mr. Armstrong's famous regenerative receiver. Figure 6 is typical of the type of circuit that was made famous in the vacuum-tube era. Here we've replaced the vacuum tube with an MPF102 JFET. With R3 set to the end of its rotation at the junction of C4, the receiver circuit operates like a grid-leak detector, without any influence from L1. But as R3 is turned toward the opposite end, RF energy begins to feed back into L2. That in-phase signal raises the "Q" of the L2/C5 tuned circuit and the RF voltage across it. If too much energy is returned to the input, the circuit goes into sustained oscillation and no longer behaves like a detector. Having R3 connected across the feedback winding gives the circuit excellent stability and very little frequency shift when regeneration adjustments are made. The circuit's transition to and from regeneration is very smooth.

Often in the tube-equivalent circuit the potentiometer is connected in a rheostat configuration across the feedback coil (tickler for the old timers), which changed the loading on the main tuned circuit each time the regeneration control was adjusted. That would cause a frequency shift in the tuned circuit each time the regeneration control was turned. P

## Q & A

(continued from page 14)

## Writing to Q&A

As always, we welcome your questions. The most interesting ones are answered in print. Please be sure to:

- (1) include plenty of background information (we'll shorten your letter for publication);
- (2) give your full name and address

on your letter (not just the envelope);

(3) type your letter if possible, or write very neatly; and

(4) if you are asking about a circuit, include a complete diagram.

Questions can be sent to Q&A, **Poptronics Magazine**, 500 Bi-County Blvd., Farmingdale, NY 11735, or e-mailed to [q&a@gernsback.com](mailto:q&a@gernsback.com), but please do not expect an immediate reply (because of our backlog) and please don't send graphics files larger than 100K. Due to the volume of mail, we regret that we cannot give personal replies. P

## HOW TO GET INFORMATION ABOUT ELECTRONICS

**On the Internet:** See our Web site at [www.gernsback.com](http://www.gernsback.com) for information and files relating to our magazines (**Electronics Now** and **Popular Electronics**) and links to other useful sites.

To discuss electronics with your fellow enthusiasts, visit the newsgroups [sci.electronics.repair](mailto:sci.electronics.repair), [sci.electronics.components](mailto:sci.electronics.components), [sci.electronics.design](mailto:sci.electronics.design), and [rec.radio.amateur.homebrew](mailto:rec.radio.amateur.homebrew). "For sale" messages are permitted only in [rec.radio.swap](mailto:rec.radio.swap) and [misc.industry.electronics.marketplace](mailto:misc.industry.electronics.marketplace).

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

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

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

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

**Copies of past articles:** Copies of past articles in **Electronics Now** and **Popular**

**Electronics** (post 1995 only) are available from our Claggg, Inc., Reprint Department, P.O. Box 4099, Farmingdale, NY 11735; Tel: 516-293-3751.

**Electronics Now** and many other magazines are indexed in the *Reader's Guide to Periodical Literature*, available at your public library. Copies of articles in other magazines can be obtained through your public library's interlibrary loan service; expect to pay about 30 cents a page.

**Service manuals:** Manuals for radios, TVs, VCRs, audio equipment, and some computers are available from Howard W. Sams & Co., Indianapolis, IN 46214 (1-800-428-7267). The free Sams catalog also lists addresses of manufacturers and parts dealers. Even if an item isn't listed in the catalog, it pays to call Sams; they may have a schematic on file which they can copy for you.

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

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

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

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

## VCRs

This month we'll begin a series of *Service Clinic* articles on troubleshooting and repairing video-cassette recorders—VCRs. Unlike computer monitors, problems with VCRs are mostly mechanical—dirty or deteriorated rubber parts, gummed up lubrication, and sometimes even strategically placed foreign objects, like toys or rocks, or peanut butter and jelly sandwiches! And, since the VCR mechanism is much more complex than that of a CD or DVD player, some routine maintenance is prudent. We'll kickoff this month with some information on video recording technology, VCR placement, preventive maintenance, and rental tape considerations.

Then, we will delve into the various types of malfunctions that are likely to occur. As with the other types of repair that we've discussed, some of the most catastrophic problems have the simplest solutions!

### Entertainment—Then and Now

Think back 25 years. You went to the theater to see a movie. You watched TV programs when they were broadcast (there was no cable) or you missed them. TV studios and industry had video recording equipment, but it was expensive and cumbersome. Little did you realize at the time, but after some false starts, the modern video revolution was about to be born. Are we better off? Whatever you decide, there is no going back. And we just can't escape the impact that this technology has had on so many aspects of our lives.

The video cassette recorder is a wonderful example of extremely complex, precision technology that has been made affordable through mass production. In general, VCRs are usually quite reliable. Treat a modern VCR with a bit of respect, and it will provide trouble-free service for a long time. Unlike a TV where the power circuits take their toll on circuit components, the electronics in VCRs are generally quite reliable and rarely fail. As mentioned above, most

VCR problems are mechanical—dirt and dust in the tape path, dried lubrication, wear of precision parts including the spinning video heads, and abuse.

### Repair or Replace

While VCRs with new convenience features are constantly being introduced, the basic function of playing a tape has not changed significantly in 25 years. Even the introduction of HQ about 15 years ago does not represent a dramatic improvement. Therefore, unless you really do need a quick start transport, a real-time counter, index search, or the like, repair may not be a bad idea. The older VCRs are built much more solidly than the \$150 models of today. Even high-end VCRs may be built around a poorly designed transport and flimsy chassis. Many older VCRs—for example, 10-year-old Panasonic models (and their clones)—can be kept functional almost indefinitely at minimal cost.

### Video Recording Technology

*Helical scan video recording:* Modern VCRs—both consumer and professional—are based on what's known as helical scan recording. The main technological challenges that confronted the designers of early video-recording machines was achieving the necessary bandwidth (several MHz) to faithfully capture the high-frequency video signal. The first such machines ran normal audio tape past stationary recording heads at high speed (tens of feet per second) in an attempt to solve that problem.

Needless to say, the mechanisms were complex, a finite length of tape could only record a few minutes of video, and the heads wore out almost as quickly. If anything went wrong with the tape transport, you were up to your eyeballs in spilled tape. An alternative technology was clearly needed.

Prior to practical video-tape recording, the only way to preserve a TV show was to use special equipment that essen-

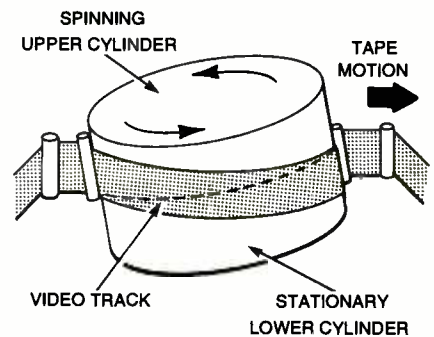


Fig. 1. In the Helical scan format, rather than scanning across the tape, the tape is wrapped a bit over 180 degrees around a rotating drum at a slight angle, allowing successive tracks to be written diagonally across the tape, as illustrated here.

tially made a film of it off of a video monitor. The quality of such recordings was not very good, editing was difficult, the film needed to be developed so playback was not immediate, and, of course, the film could not be erased and reused.

The first successful commercial video tape recorder was introduced around 1956 with the Ampex Quadplex—a \$50,000 machine using 2-inch open-reel tape and a high-speed spinning head with four pickups rotating across the tape. That machine revolutionized commercial broadcasting. However, the technology was much too complex, cumbersome, and expensive for consumer use; and it had a number of technological disadvantages as well.

For a consumer video-tape recorder to be successful, it was felt that three major hurdles had to be overcome:

- Tape loading had to be simple and foolproof using a cassette—none of this open reel stuff.
- A cassette had to hold at least an hour of color video.
- The cost to the consumer had to be less than \$1000 (1970's dollars!) for the machine and perhaps \$20 per hour for the tape.

The rotating heads of the Quadplex machine provided the needed tape-head

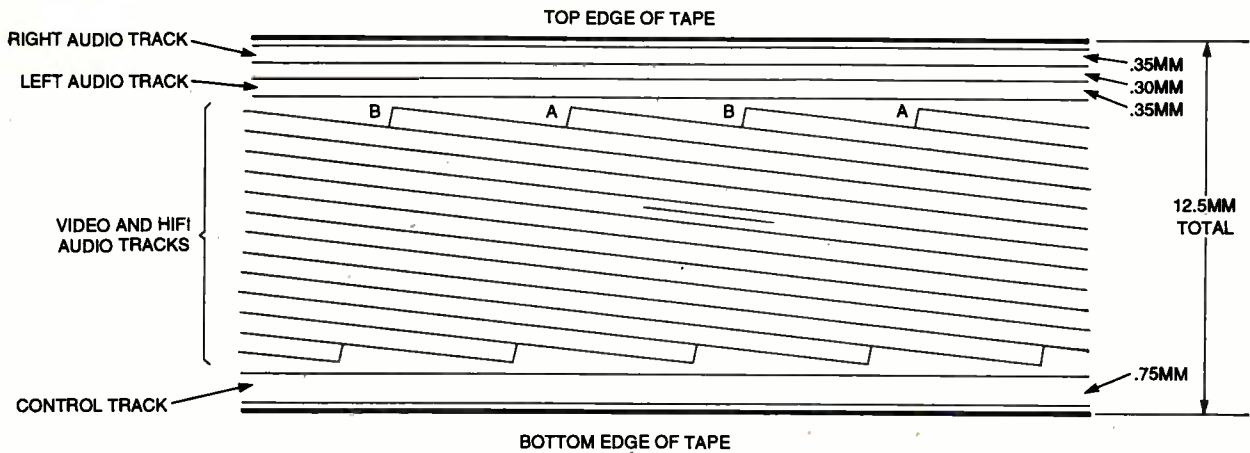


Fig. 2. Each track on a VHS tape corresponds to one field of the interlaced video format. One rotation of the drum corresponds to a complete video frame with the heads designated A and B for the even and odd fields, respectively.

speed to achieve sufficient video bandwidth. However, the transport was much too complex for a consumer machine. Another disadvantage was that since a video frame consists of many adjacent tracks (16) on the tape, special effects like stop motion as well as forward and reverse search were not possible without a frame store. While that would not be out of the question today, the cost of such a device in the 1950's would necessitate the consumer taking out a second mortgage to pay for the equipment.

In addition to those negatives, the 2-inch wide format required too much tape to achieve a cost-effective 1-hour program time and made the design of a manageable cassette an impossibility. With the 2-inch wide format, one would need a separate room to house a modest-size, video-tape library!

Helical scan overcomes most of those problems. Rather than scanning across the tape, the tape is wrapped a bit over 180 degrees around a rotating drum at a slight angle (as shown in Fig. 1). Thus, successive tracks are written diagonally across the tape and can thus be much longer than the width of the tape as in the Quadplex. The tape, therefore, can be rather narrow. The first helical-scan tapes used a 1-inch format, but narrower tape soon followed. The most common formats today are forms of VHS (and Beta) at 1/2-inch, and 8-mm (mostly used for portable applications in camcorders and data storage), and 4-mm tape, which is used for high-quality audio (DAT) as well as data storage.

## VHS Video

78 Most of the following discussion,

unless otherwise noted, applies to the VHS format. Beta—which preceded VHS into the marketplace and has all but disappeared for consumer VCRs—is actually a somewhat better system, from a technological standpoint, with its superior picture quality. Physically, the tape format is similar to VHS, but differs in the details. However, Sony's licensing practices with respect to Beta made it inevitable that VHS would triumph in the marketplace. Too bad in some ways. (The 8-mm format, mostly used nowadays in camcorders, is also a form of helical scan, but has no separate audio and control tracks—they're part of the video track.)

Each VHS track corresponds to one field of the interlaced video format. Generally, two heads opposite each other on the rotating head drum are used. One rotation of the drum corresponds to a complete video frame with heads designated A and B for the even and odd fields, respectively (see Fig. 2). That also provides the ability to easily implement a variety of special effects, including freeze frame, and fully variable-speed forward and reverse motion with a recognizable and, in many cases, quite clear picture. With relatively minor restrictions, that becomes as simple as moving the tape forward or backward or keeping it stationary. (Camcorders and other compact systems may use four heads on a smaller drum to reduce size, but the recorded format is identical.)

The A and B heads are not identical either. Their azimuth angles (see Fig. 3) differs—+6 degrees for one and -6 degrees for the other. That's one of several techniques used to minimize

crosstalk between adjacent tracks. Azimuth angle is how far the head gap is from being perfectly perpendicular to the direction of tape-tape motion. For example, a head with an azimuth such as "7" will ignore most of the information recorded with an azimuth of "\."

Note that the head gap—the distance between pole pieces—is on the order of 1 micron (1  $\mu\text{m}$ )— $1/25,000$  of an inch. As a point of reference, a human red blood cell is about 7  $\mu\text{m}$  in diameter and an average sheet of typing paper is about 100  $\mu\text{m}$  in thickness. The gap is filled with a nonmagnetic material to prevent it from getting clogged and to force the magnetic flux out of the head structure and onto the tape's magnetic coating. That remarkably fine spacing is necessary to achieve the multimegahertz video bandwidth.

The actual tape motion for a VCR is remarkably slow. To someone familiar with audio decks, the tape in a VCR even at the fastest speed (SP) seems to be crawling along. Their first reaction is often one of "There must be something wrong as the tape is moving sooo slooowly." Nope, just amazing technology. The SP speed of a VHS VCR corresponds to a linear tape speed of only 1 1/16 inches per second (ips)—slower than that of an audio cassette deck (1 1/8 ips): EP speed is 1/3 of that— $2/16$  ips. However, the effective tape speed as seen by the video heads is over 15-feet per second due to the spinning video-head drum.

The luminance (Y) and color (C) components of the composite-video signal are recorded differently. Luminance, which is in effect the black and white picture with all the high-resolution



components but no color, is frequency modulated on a carrier at around 3.4 MHz. The deviation is about 1 MHz and the maximum-frequency recorded on a VHS tape is a little over 5 MHz (Beta is slightly different and S versions of Beta and VHS extend some of those to achieve higher bandwidths). The color signal is separated from the composite video and is amplitude modulated on a 629-kHz carrier. That's called the color under system. The "U" in U-Matic, a very popular industrial VCR 3/4-inch format (which predates Beta and VHS and is still in use), stands for that.



Fig. 3. The azimuth angles of the A and B heads differ—+6 degrees for one and -6 degrees for the other—as illustrated here.

### VHS Audio

Sound for the VHS format is not merged into the video signal on the tape. For non-hi-fi VHS VCRs, a separate stationary tape head is responsible for the audio signal. Due to the very slow tape speed, audio quality is not even comparable to a cheap audio-cassette player even at the SP speed. VHS hi-fi overcomes that deficit by FM recording of the audio signal deep in the tape (recorded by a separate set of hi-fi heads just before the video information) and actually buried under the video information. The left- and right-audio channels are recorded in separate frequency bands—centered around 1.3 and 1.7 MHz, respectively. The azimuth angles for the hi-fi audio heads are  $\pm 30$  degrees, which minimizes crosstalk between the recorded hi-fi audio and video information.

Since the head-tape speed for the VHS audio track is the same high rate as for the video track and exceeds that of a typical audio-cassette deck by a factor of more than 100, VHS hi-fi audio reproduction—frequency response, signal-to-noise ratio, and dynamic range—is excellent and approaches that of a CD. In fact, using a T120 video cassette in EP (SLP, 6 hour) mode simply to record stereo music (with the video ignored or blanked) is extremely cost effective. What other media/technology will store a 6 hour concert with nearly perfect reproduction for under \$2? (Note: If

you do that, some VCRs will require some kind of video input to maintain stable tape speed. You can just ignore the video portion on audio playback.)

There are two disadvantages to VHS hi-fi, however: First, there may be some degradation of video quality due to unavoidable interactions with the buried audio, and second, it is not possible to rerecord (dub) only the audio without disturbing the video.

### VCR Servo Systems

Linear tape motion and head-drum rotation must be precisely synchronized during record, play, and special-effects play modes. The general functioning is similar for all, but the source of the basic reference signal differs for play and record. Some of the specific relationships may differ depending on the specific VCR design.

In the record mode, the reference signal is a vertical-sync pulse derived from the video input:

- Head drum rotation is phase locked to vertical sync pulse so that the appropriate head (of the A-B pair) is in contact with the tape during the appropriate video field.
- The speed of the capstan, which moves the tape through the transport, is also locked to the vertical sync pulses so that the selected linear tape speed (SP, LP, or EP) is maintained.
- Control pulses (30 Hz for US NTSC) are recorded along the bottom edge of the tape by a stationary control head.

The play mode reference signal is timing pulse derived from a quartz oscillator:

- Capstan rotation speed is locked to a 30-Hz pulse derived from a precise quartz-crystal oscillator. Head-drum rotation is phase locked to the control pulses now being read from the tape by the control head.
- The tracking control is used to adjust the relative phase of the head drum with respect to the control pulses. That permits the head path across the tape to be aligned with the actual recorded tracks.

### Video Special Effects

For CUE (fast play forward) and REV (fast play reverse), the capstan speed is phase locked to a multiple of the control track. Since the video heads are crossing multiple tracks during these modes, some noise bars are unavoidable.

At SP speed, special-wide or dual-azimuth heads are required to minimize degradation. Thus, only 4-head VCRs can play SP tapes at fast speeds with minimal noise. With EP speed, the tracks actually overlap and a normal video head is wide enough to pick up enough signal from adjacent tracks to produce a mostly noise-free picture. Due to the way adjacent tracks line up with LP speed, most of the special effects cannot be used due to serious tearing of the picture.

The sophisticated processing needed for proper support at LP speed is generally not included in modern VCRs due to the apparent lack of interest in the LP speed (recording support at LP speed seems to be absent in more and more newer VCRs, although they'll all play back LP tapes at normal playback speed).

Really slow speed is usually implemented as a variable-frame advance with the tape fully stopping between frames. Special sets of video heads provide the best quality. Freeze frame (PAUSE) uses the same set of heads. As with CUE and REV, acceptable picture quality is provided even with a 2-head VCR for EP-speed recorded tapes. In all cases, picture quality can be further improved through the use of a digital-frame store.

Note that the servo systems in consumer VCRs are rarely precise enough to implement the kind of instantaneous forward or reverse frame advance that is present in high performance (and high cost) editing decks, which have jog shuttle knobs with instantaneous and precise response.

### Wrapup

That's it for now. Next time we'll begin to deal with some preventive maintenance you can perform on your VCR, as well as take a tour inside a typical VCR. We'll also examine basic cleaning procedures, and the most common problems, like tape eating. Until then, check out my Web site, [www.repairfaq.org](http://www.repairfaq.org). I welcome comments (via e-mail only please) of all types and will reply promptly to requests for information. See you next time!

POPTRONIX

Awaiting your call!

Online Edition

http://www.popttronix.com

# RETAILERS THAT SELL OUR MAGAZINE EVERY MONTH

## Arizona

Circuit Specialists, Inc.  
220 S. Country Club Dr.  
Bldg 2  
Mesa, AZ 85210

Elliott Elec. Supply  
1251 S. Tyndell Ave.  
Tucson, AZ 85713

## California

All Electronics  
14928 Oxnard Street  
Van Nuys, CA 91411

California Electronics  
221 N. Johnson Ave.  
El Cajon, CA 90202

Electronics Plus, Inc.  
823 4<sup>th</sup> St.  
San Rafael, CA 94901

Electronics Warehouse  
2691 Main Street  
Riverside, CA 92501

Ford Electronics  
8431 Commonwealth Ave  
Buena Park, CA 90621

HSC Electronics  
6819 S. Redwood Drive  
Cotati, CA 94931

HSC Electronics  
4837 Amber Lane  
Sacramento, CA 95841

Halted Specialties Co.  
3500 Ryder Street  
Santa Clara, CA 95051

Inland Electronic Suppliers  
1012 N. Carpenter Rd.  
Modesto, CA 95351

JK Electronics  
6395 Westminster Blvd.  
Westminster, CA 92683

Kandarian Electronics  
1101 19th Street  
Bakersfield, CA 93301

Metro Electronics  
1831 J Street  
Sacramento, CA 95814

Minute Man Electronics  
37111 Post St., Suite 1  
Fremont, CA 94536

Orvac Electronics  
1645 E Orangethorpe Ave.  
Fullerton, CA 92631

San Mateo Elec. Supply  
16 W. 42<sup>nd</sup> Ave.  
San Mateo, CA 94403

Sav-On Electronics  
13225 Harbor Blvd.  
Garden Grove, CA 92643

Whitcomm Electronics  
105 W. Dakota 106  
Clovis, CA 93612

## Colorado

Centennial Elec. Inc.  
2324 E. Bijon  
Colorado Springs, CO  
80909

## Connecticut

Cables & Connectors  
2198 Berlin Turnpike  
Newington, CT 06111

Electronic Service Prod.  
437 Washington Avenue  
North Haven, CT 06473

## Illinois

BB&W Inc.  
2137 S. Euclid Ave.  
Berwyn, IL 60402

Tri State Elex  
200 W. Northwest Hwy.  
Mt. Prospect, IL 60056

## Indiana

ACRO Electronics Corp.  
1101 W. Chicago Ave.  
East Chicago, IN 46312

Hutch & Son, Inc.  
300 N. Main St.  
Evansville, IN 47711

King of the Road Elec.  
409 E. Center Rd.  
Kokomo, IN 46902

## Maryland

Mark Elec. Supply Inc.  
11215 Old Baltimore Pike  
Beltsville, MD 20705

## Massachusetts

Electronic Hook-Up  
104 Main St.  
Milford, MA 01757

"You-Do-It" Electronics  
40 Franklin Street  
Neeham, MA 02494

## Michigan

Norwest Electronics  
33760 Plymouth Rd.  
Livonia, MI 48150

Purchase Radio Supply  
327 East Hoover Avenue  
Ann Arbor, MI 48104

The Elec. Connection  
37387 Ford Road  
Westland, MI 48185

## Minnesota

Acme Electronics  
224 Washington Avenue N.  
Minneapolis, MN 55401

## Missouri

Gateway Electronics  
8123-25 Page Blvd.  
St. Louis, MO 63130

## New Jersey

Lashen Electronics Inc.  
21 Broadway  
Denville, NJ 07834

## New York

LNL Distributing Corp.  
235 Robbins Lane  
Syosset, NY 11791

T&M Elec. Supply, Inc.  
472 East Main Street  
Patchogue, NY 11772

Unicorn Electronics  
Valley Plaza  
Johnson City, NY 13790

## Ohio

Parts Express  
725 Pleasant Valley Drive  
Springboro, OH 45066

Philcap Electronic Suppliers  
275 E. Market Street  
Akron, OH 44308

## Oregon

Norvac Electronics  
7940 SW Nimbus Avenue  
Beaverton, OR 97005

## Texas

Computers Electronics Etc.  
110 E. Medical Center Blvd.  
Webster, TX 77598

Electronic Parts Outlet  
3753 B Fondren  
Houston, TX 77063

Tanner Electronics  
1301 W Beltline  
Carrollton, TX 75006

If you'd like to sell our magazine in your  
store, please circle 180 on free information card  
or Contact

Christina Estrada at (631) 293-3000 ext 223

# Poptronics

# SHOPPER<sup>®</sup>

## The Leader In Micro Video Cameras

### Wireless Cameras

**"Portable" Color Wireless System**

**GW-2400S - \$449.95**  
Includes: 2.4 Ghz Color Wireless Camera, Receiver and Built-In Monitor

**GC-2400 \$229.95**  
(camera)

**GM-2400 \$269.95**  
(monitor/receiver)

### Wireless Transmitter & Receiver

**Transmit From:**

- Satellite Receiver
- Camcorder
- Cable TV
- Surveillance Camera
- VCR
- CD Player
- Laser Disc Player
- Wireless Cable
- Digital Video Disc
- A/V Receiver
- Stereo Audio

**WT-2400 Transmitter \$129.95**

**WR-2400 Receiver \$129.95**

Transmits Over 1/4 Mile Range!

### Flat Screen TFT-LCD Monitors

**TFT-4 \$179.95**  
4" Screen. (Size: 6"(W) x 4.5"(H) x 2"(D))  
An excellent monitor for one camera monitoring or for setting up cameras during installation or maintenance.

### Door or Wall Camera

Designed to replace existing Peep-Hole

Outside Inside Video & Power Cable

Camera Lens

Door or Wall

**DV-810 \$199.95**

### Lipstick Cameras

**LP-850p \$119.95**  
Length: 1.37" Diameter: .87" B/W Model

**LP-850i \$109.95**  
Length: 1.9" Diameter: .91" B/W Model

### Cameras with Built-In Infrared Illuminators.

**LP-850w \$169.95**  
Operates on 0.0 LUX in Total Darkness. Weatherproof!

**MB-810B**  
• New BLC  
• Multi-Mount option  
• High Resolution

**- NEW - High Powered IR-LED's. 10 X's the power!**

**MB-810B \$119.95**

**Gooseneck Cameras**

**CMOS 1/3" Gooseneck Camera with Power Supply. Color**

**GN-440c \$119.95**  
B/W  
**GN-440b \$99.95**

**FREE Polar's Product Catalogs**

### Color Lipsticks

Lipstick cameras are equipped with a Video/Power cable connection is for video connection to a Monitor or VCR.

**WP-300**

**LP-850c**  
Weather Proof Models Available

**MB-45cB \$99.95**  
Panasonic Color Video Camera. 4.3mm Lens, 68° Angle of View. Operates on 5 to 12 volts DC.  
Size: 1.25" sq.



**Polaris Industries**  
<http://www.polarisusa.com>  
**800.752.3571**

Polaris Industries 470 Armour Dr. Atlanta GA 30324 • Tech Info: 404.872.0722 FAX: 404.872.1038

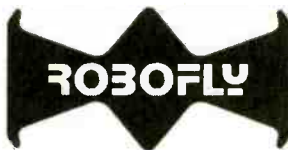
## Feel the THRILL of Virtual Flight

Robofly provides all flight hobbyists with hours of skill testing excitement. It lets you perform real copter missions with maneuvers like take-offs, landing, hovering and transporting. Robofly involves the skills and physical laws needed in real interactive flight, such as centripetal force and gyroscopic action. Robofly can fly at a speed of 18 ft/sec, up to 20 inches high, with a lift force equal to the weight of 2 AA sized batteries. Robofly is the creation of laser technology specialists and electronic enthusiasts and is made with pristine care and high-quality metal parts. Robofly comes with an electromagnetic hook, sky hook, landing skids and a 15 volt dc power supply. Join the Official RoboPilots Club now!



38 inches long  
20 inches wide  
15 inches high  
circular flight path = 64 inches

**\$349**  
plus shipping & handling



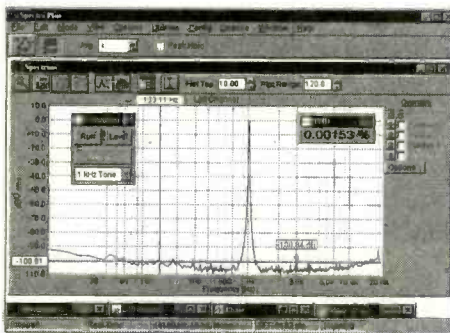
- 1 year limited warranty
- suitable for ages 14 and up
- shipped preassembled
- modular design for future upgradability

To order, call 416.213.8877 or visit our website at [www.robofly.com](http://www.robofly.com)

## Turn Your Multimedia PC into a Powerful Real-Time Audio Spectrum Analyzer

### Features

- 20 kHz real-time bandwidth
- Fast 32 bit executable
- Dual channel analysis
- High Resolution FFT
- Octave Analysis
- THD, THD+N, SNR measurements
- Signal Generation
- Triggering, Decimation
- Transfer Functions, Coherence
- Time Series, Spectrum Phase, and 3-D Surface plots
- Real-Time Recording and Post-Processing modes



### Applications

- Distortion Analysis
- Frequency Response Testing
- Vibration Measurements
- Acoustic Research

### System Requirements

- 486 CPU or greater
- 8 MB RAM minimum
- Win. 95, NT, or Win. 3.1 + Win.32s
- Mouse and Math coprocessor
- 16 bit sound card

**Priced from \$299**

(U.S. sales only – not for export/resale)

**DOWNLOAD FREE 30 DAY TRIAL!**

[www.spectraplus.com](http://www.spectraplus.com)

**PHS** Pioneer Hill Software  
24460 Mason Rd.  
Poulsbo, WA 98370  
a subsidiary of Sound Technology, Inc.



**Spectra Plus**  
FFT Spectral Analysis System

Sales: (360) 697-3472

Fax: (360) 697-7717

e-mail: [pioneer@telebyte.com](mailto:pioneer@telebyte.com)

90,000+ Electronic Components

[www.mouser.com](http://www.mouser.com)

- Heat Sinks • Semiconductors
- Crystals • Optoelectronics • LEDs
- Lamps • Wire • Cable • Connectors
- Sockets • Jacks • Plugs • Cable Assemblies
- Resistors • Potentiometers • Capacitors
- Fans • Power Supplies • Inductors
- Transformers • Switches • Relays
- Speakers • Batteries • Fuses
- Panel Meters • Cabinets
- Knobs • Hardware
- Equipment
- Tools • Kits

**800-992-9943**

[sales@mouser.com](mailto:sales@mouser.com)

Fax: 817-483-6899

958 N. Main St., Mansfield, TX 76063

**MOUSER**  
ELECTRONICS

CIRCLE 218 ON FREE INFORMATION CARD

## COPY RENTAL TAPES WITH OUR VIDEO STABILIZERS

BEFORE



AFTER



FREE  
CABLE TV  
CATALOG!

The clearest picture possible playing back movies. **GUARANTEED** to eliminate copy protection.

- No Rolls/Jitters/Flickers/Fading
- Works on all TV's, VCR's Beta & Cable
- Gold Video Connectors & Cables Included
- 1 Year Warranty
- Money Back Guarantee

**VISION ELECTRONICS**  
**1-800-562-2252**

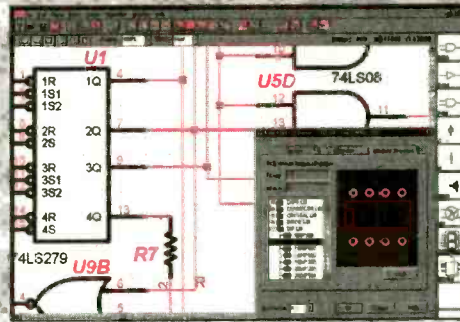
2609 S. 156TH CIRCLE • OMAHA, NE 68130  
<http://www.modernelectronics.com>

# Electronic Design Automation for Windows

**More Features  
More Power  
Less Money**

Ivex 650 pin versions have no feature limitations like other low cost products on the market. Ivex WinDraft and WinBoard are the preferred choice for designers worldwide.

Take the Ivex challenge today. Try WinDraft Version 3.0 schematics for 30 days. We know you will find it to be the most powerful, full featured tool available, Guaranteed or your money back!



**WinDraft<sup>®</sup>**  
Schematics **\$250**  
650 pin version

- Full Featured Tools:**
- Hierarchical designs
  - Part scaling
  - Step & repeat
  - True-type text
  - Auto junction
  - Single click editing
  - Rubberbanding
  - Graphical part editor
  - Update parts
  - Global replace
  - Advanced Bill of Materials with sort options.
  - User Definable Electrical Rules Check
  - Annotation
  - Common netlist formats: (Accel, Protel, Pads, Pcad, Tango, wirelist, spice, etc.)
  - Import Orcad/SDT sheets/libraries
  - Assign net signal properties for PCB layout
  - Visual PCB footprint browser
  - Over 10,000 parts included
  - Windows 95/98/NT

**WinBoard<sup>®</sup>**  
PCB Layout **\$250**  
650 pin version

- Easy to install:**
- Multi layer designs (16)
  - Surface mount designs
  - Advanced Design Rule Check
  - Electrical DRC check and Real-Time DRC
  - Rotate and mirror
  - Single click editing
  - Pad stack editor
  - Global edit
  - Graphical part editor
  - Hundreds of footprints
  - Copper zone pour
  - Uses common netlist formats
  - Edit netlist on the fly
  - Output Gerber photo plot files
  - NC drill report
  - Bill of materials
  - Free web support

**Ivex View**  
Gerber Viewer **\$99**  
App note file

View and print any size file in standard Gerber 274-x format and most 274-D.

Visit the Ivex web site for complete product information and free product demos.



[www.ivex.com](http://www.ivex.com)



Telephone: (503) 531-3555  
e-mail: [sales@ivex.com](mailto:sales@ivex.com)

ADV5\_1

**CALL TOLL FREE**  
**(800) 292-7711**  
**Orders Only**  
**Se Habla Español**

# C&S Sales

**Excellence in Service**

**Look For Other**  
**Monthly Specials**  
**On Our Website**

[www.cs-sales.com](http://www.cs-sales.com)

## Power Supplies

### Elenco Quad Power Supply Model XP-581

**\$79.95**



**4 Fully Regulated DC Power Supplies In One Unit**  
 4 DC voltages: 3 fixed - +5V @ 3A, +12V @ 1A, -12V @ 1A  
 1 Variable - 2.5 - 20V @ 2A

### Elenco Power Supply Kit Model XP-720K

**\$54.95**

- + 1.5VDC - 15VDC @ 1A
- + -1.5VDC - -15VDC
- + 5VDC @ 3A
- + 6.3VAC @ 1A & 12.6VAC center tapped @ 1A



XP-720 Fully Assembled **\$85**

### B&K High Current DC Power Supply

- \* Variable 3-14VDC
- \* Thermal Function
- \* Current Limiting

Model 1686 12A

**\$169**

Model 1688 28A

**\$249**



B&K 13.8V Fixed DC Power Supplies  
 Model 1680 6A ..... **\$42**  
 Model 1682 15A ..... **\$78**

### Elenco DC Power Supply Model SPL-603 3A 0-30VDC

The SPL-603 is a solid-state DC power supply providing the exact output voltage no matter what current you use. Output fully protected from overload.



**\$79.95**

## Soldering Equipment

### Elenco Hot Air SMD Rework Station Model SR-979



The workstation is engineered to meet the needs of today's electronic industry. Wide range of adjustments of air volume and temperature (212°F to 754°F) permits soldering of most surface mount devices. Comes with an A1138 nozzle QFP 28 x 28mm (1.1 x 1.1").

**\$450**

50 watts of controlled power - designed for continuous production soldering.

### Weller Soldering Station Model WES50



**\$119**

### Weller Low Cost Soldering Iron Model WLC-100



- \* Variable power control produces 5-40 watts.
- \* Ideal for hobbyists, DIYers and students.
- \* Complete with 40W iron.

**\$36.95**

### Weller Marksman® 23W Soldering Iron Model SP23



**\$9.95**

## Generators & Counters

### Elenco Sweep Function Generator w/ built-in frequency counter Model GF-8036



**\$225**

This sweep function generator with counter is an instrument capable of generating square, triangle, and sine waveforms, and TTL CMOS pulse over a frequency range from 0.2Hz to 2MHz.

### Elenco RF Generator with Counter (100kHz - 150kHz) Model SG-9500



Features Internal AM mod. of 1kHz. RF output 100mV - 35mHz. Audio output 1kHz @ 1V RMS.

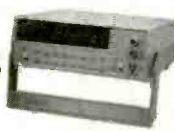
**\$225**

SG-9000 ..... **\$119.95**  
 (analog, w/o counter)

### 10 Function 1.3GHz Universal Counter Elenco Model F-1300

- \* Frequency: 0.5Hz - 1.3GHz 3 Ranges
- \* Period - Can read 60Hz to 80,000,000 F=1/T
- \* Totals - Counts to 199,999,999
- \* RPM - 3 to 200,000 RPM
- \* Duty Cycle
- \* Max/Min/AVG with Time
- \* Stop-watch set .2 sec. to 100 hrs.
- \* Main Functions
- \* Timer - 2 sec. to 99 days
- \* Pulse Width - 0.1ms to 66666.6ms

**\$225**



### B&K 20MHz Sweep/Function Generator with Frequency Counter Model 4040

- \* 0.2Hz to 20MHz
- \* AM & FM modulation
- \* Burst Operation
- \* External Frequency counter to 30MHz
- \* Linear and Log sweep

**\$445**

21.5MHz Model 4070 **\$1295**  
 10MHz Model 4017 **\$319**  
 5MHz Model 4011 **\$249**



**BK PRECISION**

### Multifunction Counter B&K Model 1875



**\$189**

Ultra sensitive synchronous detector bargraph and RF strength. 3 Channels.

Measures Frequency, Period, Data Hold, Relative, Memory (min., max., average). High Sensitivity, Microprocessor Controlled.

### Elenco Handheld Universal Counter 1MHz - 2.8GHz Model F-2800



**\$99**

Features 10 digit display, 16 segment and RF signal strength bargraph.

Includes antenna, NiCad battery, and AC adapter.

## Kit Corner

over 100 kits available

Quantity Discounts Available

### Model RCC-7K

Radio Control Car Kit

**\$29.95**

- \* Fun & Easy to Assemble
- \* 7 Functions
- \* Radio Control Transmitter Included



### Model AK-700

Pulse/Tone Telephone Kit

**\$15.95**



Ideal School Project

### Model AM-780K

Two IC Radio Kit

**\$11.95**



### Model OWI-007

Robotic Arm (Wired Control) Teaches the basic robotic sensing and locomotion principles while testing motor skills.

**\$55.95**



## Oscilloscopes

Free Dust Cover and 2 Probes



S-1325	25MHz	Dual Trace	\$325
S-1330	25MHz	Delayed Sweep	\$439
S-1340	40MHz	Dual Trace	\$475
S-1345	40MHz	Delayed Sweep	\$569
S-1360	60MHz	Delayed Sweep	\$749
S-1390	100MHz	Delayed Sweep	\$995

### DIGITAL SCOPE SUPER SPECIALS

DS-203	20MHz/10Ms/s Analog/Digital	\$695
DS-303	40MHz/20Ms/s Analog/Digital	\$995
DS-603	60MHz/20Ms/s Analog/Digital	\$1295

**Guaranteed Lowest Prices**

UPS SHIPPING: 48 STATES 5%  
 OTHERS CALL FOR DETAILS  
 IL Residents add 8.25% Sales Tax

**C&S SALES, INC.**

150 W. CARPENTER AVENUE  
 WHEELING, IL 60090  
 FAX: (847) 541-9904 (847) 541-C710

**15 DAY MONEY BACK GUARANTEE**  
**2 YEAR FACTORY WARRANTY**



PRICES SUBJECT TO CHANGE WITHOUT NOTICE

CIRCLE 290 ON FREE INFORMATION CARD

[www.americanradiohistory.com](http://www.americanradiohistory.com)

**SAME DAY SHIPPING**  
Secure on-line ordering

# C&S Sales

Excellence in Service

CALL OR WRITE FOR OUR FREE  
64 PAGE CATALOG!  
(800) 445-3201

## Digital Multimeters

### Elenco LCR & DMM Model LCM-1950



12 Functions  
Freq. to 4MHz  
Inductance  
Capacitance  
and Much More

**\$69**

### Elenco Model M-1740 \$39.95



11 Functions:  
• Freq. to 20MHz  
• Cap. to 20 F  
• AC/DC Voltage  
• AC/DC Current  
• Beeper  
• Diode Test  
• Transistor Test  
• Meets UL-1244 safety specs.  
**Model M-2760 - \$24.95**  
(9 functions)

### Fluke 79III



**\$195**

• Capacitance ranges from 99.99nF to 9999 F.  
• Built-in frequency counter of voltage input from 1Hz to over 20kHz.  
• Lo-Ohms range, a 40Ω range with Fluke's proprietary Zero Calibration, offers 0.01 resolution with increased noise rejection.

### Fluke 87III



**\$319**

Features high performance AC/DC voltage and current measurement, frequency, duty cycle, resistance, conductance, and capacitance measurement.

### Elenco LCR Meter Model LCR-1810



**\$99.95**

• Capacitance .1pF to 20 F  
• Inductance 1 H to 20H  
• Resistance .01 to 2000M  
• Temperature to 750°C  
• DC Volts 0 - 20V  
• Frequency up to 15MHz  
• Diode/Audible Continuity Test  
• Signal Output Function  
• 3 1/2 Digit Display

### Elenco Digital Multimeter Kit Model M-1005K



**\$19.95**

• 18 Ranges  
• 3 1/2 Digit LCD  
• Transistor Test  
• Diode Test  
• Training Course

**M-1000B (Assembled) \$15.95**

### Dual-Display LCR Meter w/ Stat Functions B&K Model 878



**\$225.95**

Auto/manual range  
Many features with Q factor  
High Accuracy

### B&K Video Monitor Tester Model 1275



**\$169**

Great handheld unit to test PC and Mac monitors. The model 1275 is ideal for the field or the service bench. Small, portable and very effective, the 1275 generates crosshatch, dots, color bars and raster patterns in green, blue, red, black and white.

## PC Repair

### Introduction to PC Repair Self-Study Course™



#### COURSE CONTENTS

Introduction to Computers  
IBM PC's and Clones  
PC Assembly/Disassembly  
Introduction to MS-DOS

Introduction to Windows 3.1  
Introduction to Windows 95  
Introduction to Networks  
Introduction to the Internet

Provides you with the easiest and most effective way to learn the fundamentals necessary for a profitable and successful career as a PC Repair Technician. Ideal for individuals new to the I.T. profession and as instruction prior to studying for A+ certification.

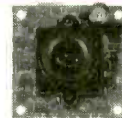
**\$179**

## CCTV Cameras

Cameras have 420 lines (360 color) of resolution, 0.08 Lux, 3.6mm/F2 90° field of view. Power requirement is 12VDC @ 100mA (order SC-1).

### MONOCHROME CAMERAS

### COLOR CAMERAS



**SC-12 - 35mm Lens (1.25"x1.25") \$69**  
**SC-15 - Pin Lens (1.25"x1.25") \$69**

**SC-20 Pin Lens \$69**  
**SC-21 3.6mm Lens \$69**  
360 Lines 1.25" x 1.25"  
Infrared Sensitive, Audio Included

Accessories:  
SC-1 - 12V 100mA adapter \$6.<sup>95</sup>  
SC-2 - 50' cable with connectors \$19.<sup>95</sup>

**\$109**  
Add \$10 for case  
Call for complete catalog.

### A+ Certification Self-Study Course™



#### DOS/WIN Exam

DOS 6.2  
Windows 3.1 Installation and Configuration  
Windows 3.1 Application Support  
Windows 3.1 Devices and Drivers  
Windows 3.1 Networking and Troubleshooting  
Windows 95 Installation and Deployment  
Windows 95 Basic Configuration  
Windows 95 Troubleshooting and Optimization

**\$379**

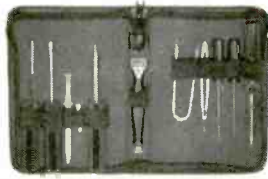
Includes all the technical material, knowledge and interactive exercises needed to pass the A+ exams and excel in the competitive PC repair marketplace.

### 11 pc. Computer Service Tool Kit Model TK-1100

#### Includes:

3/16" Nut Driver  
1/4" Nut Driver  
3-prong Parts Retriever  
Reversible Bit Screwdriver T10 & T15  
Reversible Bit Screwdrivers 3/16", 1/4", #1 & #2 Phillips  
Tweezer  
IC Inserter 14-16 pin  
IC Extractor  
1/8" Flat Screwdriver  
#0 Phillips Screwdriver

**\$12.95**



## TEKK Radios

### Pro-Sport FRS Two-Way Radio Model PRO-SPORT+

Available in Yellow, Blue & Black

No License Required

Talk up to 2 miles!

• 1/2 Watt Output, 14 Channels.  
• TX & RX LED/LCD Indicators.  
• Large LCD Display.  
• 38 Privacy (CTCSS) Tones.  
• Removeable Antenna.  
• Water Resistant.  
• 500mW Output.  
• Palm Sized.

**\$69.00 each or 2 for \$125.00**



Guaranteed Lowest Prices

**C&S SALES, INC.**

15 DAY MONEY BACK GUARANTEE  
2 YEAR FACTORY WARRANTY

UPS SHIPPING: 48 STATES 5%  
OTHERS CALL FOR DETAILS  
IL Residents add 8.25% Sales Tax

150 W. CARPENTER AVENUE  
WHEELING, IL 60090

FAX: (847) 541-9904 (847) 541-0710



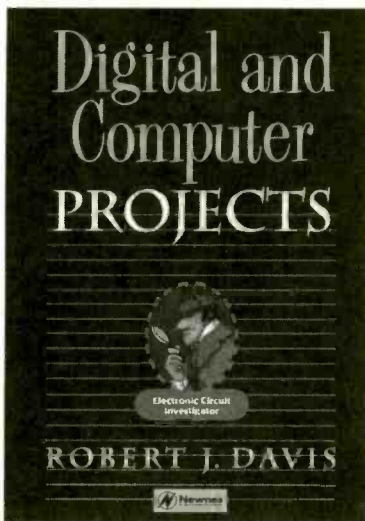
PRICES SUBJECT TO CHANGE WITHOUT NOTICE

SEE US ON THE WEB

www.cs-sales.com

CIRCLE 290 ON FREE INFORMATION CARD

# New ewnes Titles



*Build your knowledge of digital electronics and computer peripherals projects.*

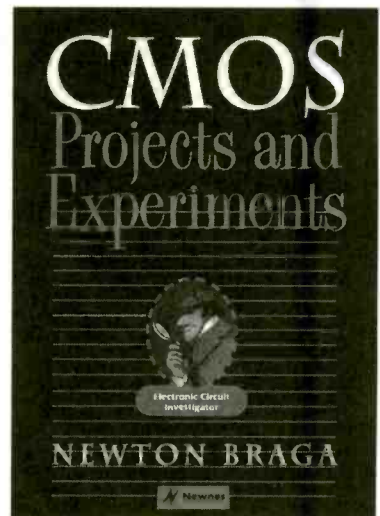
This collection contains the most popular and useful inventions, circuits, software and monitor modifications gleaned from Robert Davis' many years of experimentation. This comprehensive book is divided into digital projects, like Epson copiers and adapters to quiz machines; printer port projects, from a digital storage oscilloscope to an audio mixer; and monitor projects, from VGA adapters to conversion of monitors to 31 KC operation.

June 1999 \* 224 pp \* Paperback  
0-7506-7172-6 \* \$29.95

*Learn how to apply CMOS ICs in their six primary uses while building well-documented projects.*

Chock full of projects based on the 4093 CMOS IC, this detailed book will be of great interest to hobbyists and students. *CMOS Projects and Experiments* includes instructions to build **OVER ONE HUNDRED** unusual and useful projects. It includes audio and RF devices, lamps, LEDs, timers, alarms, inverters and much more. This book offers hobbyists and students a satisfying, practical way of learning about the hottest topics in electronics today.

November 1999 \* 352 pp. \* Hardcover  
0-7506-7170-X \* \$29.95



These Titles and MORE are available at bookstores, electronics distributors and cataloguers or direct from:

Newnes, 225 Wildwood Avenue, Woburn, MA 01801

Call: 1-800-366-2665 or 781-904-2500

Fax: 1-800-446-6520 or 781-933-6333

E-mail: [orders@bhusa.com](mailto:orders@bhusa.com)

Ask for your FREE  
copy of the NEW 2000  
Newnes Catalog  
(Item #645)

 **Newnes**

Promo Code:  
NA01

[www.newnespress.com](http://www.newnespress.com)

CIRCLE 155 ON FREE INFORMATION CARD

[www.americanradiohistory.com](http://www.americanradiohistory.com)



Finally somebody made it easy...

Micro2000

# The Basic PC Learning Course™



**Improve your career or hobby skills!**

This kit is the perfect blend of simplicity and technical knowhow that allows anyone to:

- Understand basic PC principles
- Diagnose
- Repair
- Build PCs from scratch

#### CONTAINS

- Self-study course manual "Basic PC Assembly, Diagnostics & Repair" filled with diagrams and photos. No overly complicated technical talk!
- Award-winning MICRO-SCOPE™ LE diagnostic software. This limited edition version works like the professional full version and lets you diagnose and repair PCs like a pro. Includes full Micro-Scope manual.
- A Tutorial video cassette for Micro-Scope LE software.
- A second video cassette "PC Assembly & Configuration," that demonstrates how to build PCs from scratch.
- Perfect for classroom or individual study programs. Order your kit today!

**Call 1-800-864-8008**

(818) 547-0125 or Fax (818) 547-0397

**www.micro2000.com**

netsales@micro2000.com

*Call for business/government/education volume discounts. Dealer inquiries welcome.*



© 1999 Micro 2000, Inc. All Rights Reserved. MICRO 2000, MICRO-SCOPE, BASIC PC LEARNING COURSE are trademarks of Micro 2000, Inc.

CIRCLE 310 ON FREE INFORMATION CARD

www.americanradiohistory.com



# Cool Wireless Goodies

## World's Smallest TV Transmitters



We call them the 'Cubes'.... Perfect video transmission from a transmitter you can hide under a quarter and only as thick as a stack of four pennies - that's a nickel in the picture! Transmits color & B&W with fantastic quality - almost like a direct wired connection to any TV tuned to cable channel 59. Crystal controlled for no frequency drift with performance that equals law enforcement models that cost hundreds more! Basic 20 mW model transmits up to 300' while the high power 100 mW unit goes up to 1/4 mile. Audio units include sound using a sensitive built-in mike that will hear a whisper 15 feet away! Units run on 9 volts and hook-up to most any CCD camera. Any of our cameras have been tested to mate perfectly with our Cubes and work great. Fully assembled - just hook-up power and you're on the air! These are the units that are being built into hats, pagers, cigarette packs and sold for big \$\$ !!

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



## Doppler Direction Finder

Track down jammers and hidden transmitters with ease! This is the famous WA2EBY DF'er featured in April 99 QST. Shows direct bearing to transmitter on compass style LED display, easy to hook up to any FM receiver. The transmitter - the object of your DF'ing - need not be FM, it can be AM, FM or CW. Easily connects to receiver's speaker jack and antenna, unit runs on 12 VDC. We even include 4 handy home-brew "mag mount" antennas and cable for quick set up and operation! Whips can be cut and optimized for any frequency from 130-1000 MHz. Track down that jammer, win that fox hunt, zero in on that downed Cessna - this is an easy to build, reliable kit that compares most favorably to commercial units costing upwards of \$1000.00! This is a neat kit!!

DDF-1, Doppler Direction Finder Kit ..... \$149.95

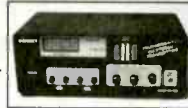
## CCD Video Cameras



Top quality Japanese Class 'A' CCD array, over 440 line line resolution, not the off-spec arrays that are found on many other cameras. Don't be fooled by the cheap CMOS single chip cameras which have 1/2 the resolution, 1/4 the light sensitivity and draw over twice the current! The black & white models are also super IR (Infra-Red) sensitive. Add our invisible to the eye, IR-1 illuminator kit to see in the dark! Color camera has Auto gain, white balance, Back Light Compensation and DSP! Available with Wide-angle (80°) or super slim Pin-hole style lens. Run on 9 VDC, standard 1 volt p-p video. Use our transmitters for wireless transmission to TV set, or add our IB-1 Interface board kit for audio sound pick-up and super easy direct wire hook-up to any video monitor, VCR or TV with AV input. Fully assembled, with pre-wired connector.

- CCDWA-2, B&W CCD Camera, wide-angle lens ..... \$69.95
- CCDPH-2, B&W CCD Camera, slim fit pin-hole lens ..... \$69.95
- CCDC1-1, Color CCD Camera, wide-angle lens ..... \$129.95
- IR-1, IR Illuminator Kit for B&W cameras ..... \$24.95
- IB-1, Interface Board Kit ..... \$14.95

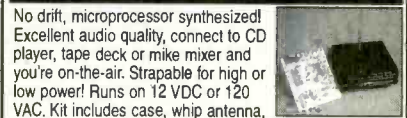
## Super Pro FM Stereo Transmitter



Professional synthesized FM Stereo station in easy to use, handsome cabinet. Most radio stations require a whole equipment rack to hold all the features we've packed into the FM-100. Set freq with Up/Down buttons, big LED display. Input low pass filter gives great sound (no more squeals or swishing from cheap CD inputs!) Limiters for max 'punch' in audio - without over mod, LED meters to easily set audio levels, built-in mixer with mike, line level inputs. Churches, drive-ins, schools, colleges find the FM-100 the answer to their transmitting needs, you will too. Great features, great price! Kit includes cabinet, whip antenna, 120 VAC supply. We also offer a high power export version of the FM-100 that's fully assembled with one watt of RF power, for miles of program coverage. The export version can only be shipped outside the USA, or within the US if accompanied by a signed statement that the unit will be exported.

FM-100, Pro FM Stereo Transmitter Kit ..... \$249.95  
FM-100WT, Fully Wired High Power FM-100 ..... \$399.95

## FM Stereo Radio Transmitters



No drift, microprocessor synthesized! Excellent audio quality, connect to CD player, tape deck or mike mixer and you're on-the-air. Strappable for high or low power! Runs on 12 VDC or 120 VAC. Kit includes case, whip antenna, 120 VAC power adapter - easy one evening assembly.

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

Lower cost alternative to our high performance transmitters. Great value, easily tunable, fun to build. Manual goes into great detail about antennas, range and FCC rules. Handy kit for sending music thru house and yard, ideal for school projects too - you'll be amazed at the exceptional audio quality! Runs on 9V battery or 5 to 15 VDC. Add our matching case and whip antenna set for nice 'pro' look.

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

## Mini Radio Receivers



Imagine the fun of tuning into aircraft a hundred miles away, the local police/fire department, ham operators, or how about Radio Moscow or the BBC in London? Now imagine doing this on a little radio you built yourself - in just an evening! These popular little receivers are the nuts for catching all the action on the local ham, aircraft, standard FM broadcast radio, shortwave or WWV National Time Standard radio bands. Pick the receiver of your choice, each easy to build, sensitive receiver has plenty of crystal clear audio to drive any speaker or earphone. Easy one evening assembly, run on 9 volt battery, all have squelch except for shortwave and FM broadcast which has handy SCA output. Add our snazzy matching case and knob set for that smart finished look.

- AR-1, Airband 108-136 MHz Kit ..... \$29.95
- HFR-1, WWV 10 MHz (crystal controlled) Kit ..... \$34.95
- FR-1, FM Broadcast Band 88-108 MHz Kit ..... \$24.95
- FR-6, 6 Meter FM Ham Band Kit ..... \$34.95
- FR-10, 10 Meter FM Ham Band Kit ..... \$34.95
- FR-146, 2 Meter FM Ham Band Kit ..... \$34.95
- FR-220, 220 MHz FM Ham Band Kit ..... \$34.95
- SR-1, Shortwave 4-11 MHz Band Kit ..... \$29.95
- Matching Case Set (specify for which kit) ..... \$14.95

## Tiny Transmitters



Gosh, these babies are tiny - that's a quarter in the picture! Choose the unit that's best for you. FM-5 is the smallest tunable FM transmitter in the world, picks up a whisper 10' away and transmits up to 300'. Runs on tiny included watch battery, uses SMT parts. FM-4 is larger, more powerful, runs on 5-12 volts, goes up to a mile. FM4,5 operate in standard FM band 88-108 MHz. FM-6 is crystal controlled in 2 meter ham band, 146.535 MHz, easily picked up on scanner or 2 meter rig, runs on 2 included watch batteries. SMT (surface mount) kits include extra parts in case you sneeze & loose a part!

FM-4MC, High Power FM Transmitter Kit ..... \$17.95  
FM-5, World's Smallest FM Transmitter Kit ..... \$19.95  
FM-6, Crystal Controlled 2M FM Transmitter Kit ..... \$39.95  
FM-6, Fully Wired & Tested 2M FM Transmitter ..... \$69.95

## FM Station Antennas



For maximum performance, a good antenna is needed. Choose our very popular dipole kit or the Comet, a factory made 5/8 wave colinear model with 3.4 dB gain. Both work great with any FM receiver or transmitter.

TM-100, FM Antenna Kit ..... \$39.95  
FMA-200, Vertical Antenna ..... \$114.95

## RF Power Booster

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

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

## Touch-Tone Reader



Read touch-tone numbers from any radio, phone line, tape recorder - any audio source! Decoder called numbers on scanners, radio shows, anywhere touch-tones are used. Memory stores up to 256 digits, an 8 digit display window scrolls anywhere in memory. Memory good for 100 years, even with power off! Runs on 7 to 15 volt DC. Available in kit form with optional matching case set or fully assembled in case set. We sell tons of these to private investigators!

TG-1, Tone-Grabber Touch Tone Reader Kit ..... \$99.95  
CTG, Case for Tone-Grabber Touch Tone Reader ..... \$14.95  
TG-1WT, Tone-Grabber, fully assembled with case ..... \$149.95  
AC12-5, 12 Volt DC Wall Plug Adapter ..... \$9.95

## AM Radio Transmitter



Operates in standard AM broadcast band. Pro version, AM-25, is synthesized for stable, no-drift frequency and is settable for high power output where regulations allow, typical range of 1-2 miles. Entry-level AM-1 is tunable, runs FCC maximum 100 mw, range 1/4 mile. Both accept line-level inputs from tape decks, CD players or mike mixers, run on 12 volts DC. Pro AM-25 includes AC power adapter, matching case and bottom loaded wire antenna. Entry-level AM-1 has an available matching case and knob set that dresses up the unit. Great sound, easy to build - you can be on the air in an evening!

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

## Dinky Radios



Everyone who sees one of these babies says they just gotta have one! Super cute, tiny (that's a Quarter in the picture!) FM radios have automatic scan/search tuning, comfortable ear bud earphones and we even include the battery. The pager style unit looks like a shrunken pager and even has an LCD clock built-in. The crystal clear sound will amaze you! Makes a great gift.

MFMT-1, World's Smallest FM Radio ..... \$11.95  
PFMR-1, Pager Style LCD Clock & FM Radio ..... \$12.95

Order Toll-free: 800-446-2295

Sorry, no tech info, or order status at 800 number

For Technical Info, Order Status  
Call Factory direct: 716-924-4560

RAMSEY ELECTRONICS, INC.  
793 Canning Parkway Victor, NY 14564

See our complete catalog and order  
on-line with our secure server at:  
[www.ramseyelectronics.com](http://www.ramseyelectronics.com)



ORDERING INFO: Satisfaction Guaranteed. Examine for 10 days, if not pleased, return in original form for refund. Add \$6.95 for shipping, handling and insurance. Orders under \$20, add \$3.00. NY residents add 7% sales tax. Sorry, no CODs. Foreign orders, add 20% for surface mail or use credit card and specify shipping method.

# AMAZING DEVICES

See and Order from Our "Action"  
Web Site at: <http://www.amazing1.com>

EN10990

## Laser Window Bounce Listening System

Demonstrates a Remarkable Concept allowing you to listen to sounds picked up from a reflecting surface illuminate by a laser. This is accomplished by listening to these varying light reflections of scatter through a sensitive optical receiver. Low cost science project and demonstration systems use our visible red lasers and LLR series low noise ultra-sensitive optical receivers with built in voice enhancement filters. Infra red lasers provide far better performance but require precise initial optical alignment. Actual use is illegal!



- LWB9 Plans and all Data for 3 Laser Window Bounce Systems.....\$20.00
- LWB6K Kit of Complete 100' System for Demo/Science Project.....\$129.50
- LWB60 Above System With Assembled Electronics.....\$159.50
- Those With Lasers Only Need Our: #LLR3K Optical Receiver Kit.....\$69.50 or #LLR30 Ready to Use Optical Receiver.....\$99.50

For Those Wishing to Build a High Performance System, We Offer the Below Modules Requiring Housing And Optics

- \*LLR40 Receiver.....\$199.50
- \*CWL10 10 mw Class IIB invisible IR Laser.....\$149.50
- Higher powered lasers available

## 500KV Stun Gun!!

Intimidatingly effective up to 20' with explosive spark discharge. Easily concealable

SIZZ500.....\$79.95



## Air Taser Gun

More stopping power than most hand guns!! 15 foot knock down range. Easily concealed Uses non lethal technology.

ECG10 Ready to Use.....\$239.95

## Gravity Motor

Electrical charge reactions produce the effect of "anti gravity". You build a model craft from simple parts and levitate it with our ion power source. Battery or 115vac operation. Great science or fascinating research project includes our gravity handbook.

- GRA3 Plans/Book.....\$20.00
- GRA3K Power Source Kit.....\$99.50
- GRA30 Assembled Above.....\$149.95

## Tesla Coil

Produces 30" Sparks

Create a spectacular display of nature own lightning. Many amazing experiments possible. See in action on our web site!!

- BTC4 Plans.....\$20.00
- BTC4K Kit.....\$899.95
- BTC40 Ready to use.....\$1199.95
- Smaller Version (8-10" Sparks)
- BTC3 Plans.....\$15.00
- BTC3K Kit.....\$349.95
- BTC30 Ready to Use.....\$449.95



## Ion Ray Guns

Star Wars Technology Directs Energy



Star Wars Technology Demonstrates Weapons Potential, Force Fields, IonMotors, Antigravity etc. Projects electric shocks without contact!! Conduct many weird and bizarre experiments. Handheld battery operated and easy to operate.

- IOG7/9 Plans.....\$10.00
- IOG7K Kit/Plans.....\$99.50
- IOG70 Assembled/Tested.....\$149.95
- Higher Powered Device
- IOG9K Kit/Plans.....\$129.95
- IOG90 Assembled/Tested.....\$199.95

## TAKE CONTROL Using Electronic Hypnosis

Electronic circuitry induces hypnotic as well as ALPHA relaxed mind states. Place subjects under your control!

- HYP2 Plans.....\$10.00
- HYP2K Kit/Plans.....\$49.95
- HYP20 Ready to Use.....\$69.95

- MIND2 Plans for Mind Control.....\$15.00
- MIND2K Kit/Plans.....\$49.95
- MIND20 Ready to Use.....\$79.95

## Pain Field Pistol

Caution! Do not aim at people!

Blast out rodents with high power ultrasonics. Handheld and battery operated with all controls. Rental units available.

- PPP1 Plans.....\$8.00
- PPP1K Kit/Plans.....\$49.95
- PPP10 Ready to Use.....\$79.95



## Build a Magnetic Cannon!!!

Experiment with and Construct Rail Guns, Magnetic Launchers, Coil and Sleeve Guns, Super High Gravity Pulses, Explode Wires and Water, Antigravity, Levitation, Mass Warping, Magnetic Can Crushing, Plasma Propulsion, High Energy Radio Frequency Guns (Herf), EM/P, Lattice Snapping, and all Types of Electrical Pyrotechnics. Plus Much More!!

- Lossless Charging
- Programmable Energy Control
- Up to 16 Kilojoules at 4 Kilovolts
- Triggered Spark Switch
- 12 VDC/115 VAC Operation

Unit is Shown With Our "Distributed Energy Source"



- HEP3 Plans 500-1Kj @ 1-2 Kv.....\$15.00
- HEP30 Assembled Above.....\$449.50
- HEP3K Kit/Plans with 500 Joules.....\$349.50
- Custom Designs Available on Request
- Related Projects Using Pulsed Magnetics
- HEP9 Plans Higher Powered 1-16 Kj @ 1-4 Kv.....\$20.00
- PPR01 Plasma Gun Plans Shoots a High Velocity Projectile. Exploding Wire.....\$20.00
- MASS1 Mass Launcher / Kinetic Gun / Electric Cannon. Ultra Accelerative Forces.....\$20.00
- CANCRUS1 Can Crusher/ Mass Warping plans. Distort Mass and Shape.....\$15.00
- EGUN1 Build a High Velocity Kinetic Electric Gun.....\$20.00

## Theramagnetic Pulsar

Complex Magnetic waves are claimed to produce many health benefits. Board level, experimental device is sold for research purposes only.

THMAG10 Lab Assembled.....\$24.95

## Burning/Cutting Lasers

Current and Future Weapons Systems

- CO2 Lasers can cut thru most metals
- LC3 Plans Poor Mans System.....\$15.00
- LC7 Plans Lab System 30W+.....\$20.00
- Nd Glass/Yag/Ruby can blast holes thru most metals using pulses.
- LAGUN2 Plans 6kw Pulses.....\$20.00

## Cybernetic Ear!

Provides that "extra edge" for many listening applications. Enhances 3 to 4x of normal.

CYBEREAR.....\$19.95

## Hover Board

28 pages of data related to the most revolutionary advance in transportation. Cutting edge R&D

HOVER Plans and Data.....\$25.00

## Mini TESLA Coil

Lights up a 4' fluorescent tube-all without any contact!! Yet only 3" tall!

- MTC1K Kit/Plans.....\$24.50
- MTC10 Assembled.....\$34.50

## Transistorized TESLA Coil

Amazing and bizarre effects turn a normal light bulb into a spectacular plasma display!! With adjustable frequency control. Safe 12vdc input

- TCL5 Plans.....\$8.00
- TCL5K Kit/Plans.....\$59.50
- TCL50 Assembled and Tested.....\$99.50

## Telephone Line Grabber

Room Listener Controller and Call Diverter

- Listen to your premises. Break in to calls Control household appliances. Remote dial long distance calls-from anywhere!!
- TELCON4 Plans.....\$10.00
- TELCON4K Kit/Plans.....\$99.50
- TELCON40 Ready to Us.....\$149.59

## Attention! High Voltage Modules

- Battery powered for hovercraft, plasma guns, anti gravity, force fields, pyrotech
- MIMIMAX4 4KV.....\$19.50
- MINIMAX3 3KV.....\$17.50
- MINIMAX2 2KV.....\$14.50

## Jacobs Ladder

Pyrotechnical traveling fiery plasma expands over 3" before evaporating into space. Solid state circuitry with adjustable arc control. 115/230 volt operation. Uses safe high frequency energy.

- JACK1 Plans.....\$8.00
- JACK1K Supply, Mtg Blks, Ladders.....\$149.95
- JACK10 Ready to Use.....\$249.95

## 3 Mi FM Voice Transmitter

Crystal clear performance. Many applications. Easy to assemble

FMV1 Kit and Plans.....\$39.50

## PLASMA FIRE SABERS

Patented Moving Light Concept Duplicates the Effect Used in the SCI FI Epic of the Century! Interactive Sound Module Available on Request



- Available Colors \*C\* photon blue, starfire purple, phaser green and neon red.
- MINISAB "C" 15" Active Length.....\$49.95
- SAB24 "C" 24" Active Length.....\$69.95
- \*SAB30 "C" 30" Active Length.....\$89.95
- \*SAB36 "C" 36" Special Request.....\$119.95
- \*Please add \$10.00 for special handling

Information Unlimited PO Box 716 Amherst N.H. U.S.A. 03031

1 800 221 1705 Orders/Catalogs Only! Fax 1 603 672 5406 Information 1 603 673 4730 Free Catalog on Request  
Pay by MC,VISA,Cash, Check, MO, COD. Add \$5.00 S&H plus \$5.00 if COD. Overseas Contact for Proforma

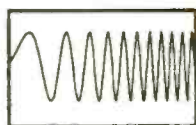
CIRCLE 220 ON FREE INFORMATION CARD

# Any waveform you want!

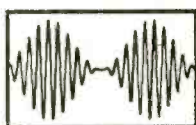


- New Features:**
- ✓ 21.5 MHz
  - ✓ .01 Hz steps
  - ✓ multi-unit phaselock

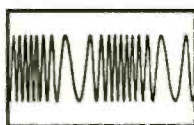
Telulex Inc. model SG-100A



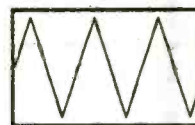
DC to 21.5 MHz linear and log sweeps



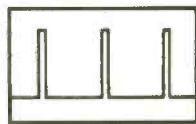
Int/Ext AM, SSB, Dualtone Gen.



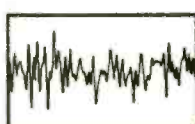
Int/Ext FM, PM, BPSK, Burst



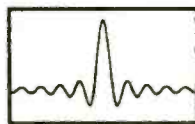
Ramps, Triangles, Exponentials



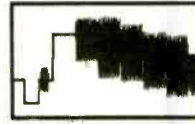
Pulse Generator



Noise



Arbitrary Waveforms



Unlimited Possibilities!

- **Synthesized Signal Generator**  
Clean sinewaves DC-21.5 MHz, .001% accuracy! .01 Hz steps. DC Offset. RS232 remote control.
- **Arbitrary Waveform Generator**  
40 Megasamples/Second. 32,768 points. 12 bit DAC
- **Function Generator**  
Ramps, Triangles, Exponentials & more to 2 MHz!
- **Pulse Generator**  
Digital waveforms with adjustable duty cycle

**Telulex Inc.**

2455 Old Middlefield Way S Tel (650) 938-0240 <http://www.Telulex.com>  
Mountain View, CA 94043 Fax (650) 938-0241 Email: sales@Telulex.com

CIRCLE 311 ON FREE INFORMATION CARD

## BUY FOUR AND GET ONE FREE \*



Hyper Peppy

OWI-969K: \$24.95  
Fast, 3 wheeled robot with a touch/sound sensor



Line Tracker

OWI-963K: \$49.95  
Follows a black line with its infrared sensor



Triple Action Solar Car

OWI-685: \$39.95  
High powered 1.4V - 350mA solar cell included



Robotic Arm Trainer

OWI-007: \$69.95  
Highly acclaimed, award winner



Wao-G

OWI-968K: \$89.95  
48 fuzzy logic programming steps and drawing capabilities



S-Cargo

OWI-936K: \$36.95  
Sound sensor controls it to spin, stop, and go forward



Spider

OWI-962K: \$49.95  
Infrared sensor detects solid obstacles in its path



Wao II

OWI-961K: \$69.95  
Learn how to program in simple Basic language



Moon Walker

OWI-989K: \$34.95  
Will walk when it detects a change in light

**\* While supplies last, purchase any four of the robotic kits shown at left, and receive a Moon Walker Robotic Kit absolutely FREE!**



**Moon Walker**



**ROBOTIKITS™**  
**DIRECT**



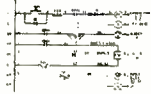
Order M - F:  
8a.m. - 4p.m. PST

17141 Kingsview Ave. Suite B, Carson, CA 90746  
Phone: (310) 515-6800  
Fax: (310) 515-0927  
E-mail: [owi@ix.netcom.com](mailto:owi@ix.netcom.com)  
Web Page: [www.owirobot.com](http://www.owirobot.com)

CIRCLE 212 ON FREE INFORMATION CARD

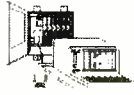
**Start A Career With High Wages,  
Excellent Benefits and Job Security!!**

With UCANDO's extraordinary maintenance training programs you can quickly and easily enter a high paying field as a maintenance technician for a very small investment of time and money.



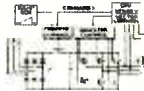
**RC-M ONLY \$165** RC-M is a 15 hour training course on relay ladder logic systems. Includes a 5-part video and workbook. **Great Value!**

**PLC-M ONLY \$198** PLC-M is a 32 hour training course on PLC systems. Includes (2) 4-part video's and workbook. This training is valuable.



**HYD-M ONLY \$209** HYD-M is a 32 hour course on Fluid Dynamics. Includes (2) 4-part video's and workbook. This Module is a must.

**SC-M ONLY \$215** SC-M is a 32 hour training course on AC & DC Servo Controllers. Includes (2) 4-part video's and workbook. Learn everything you need about AC and DC servo Control Systems.



**Electronic Training Videos:** Basic Electronics, Digital Electronics, TV Repair, LASER and Fiber Optic training videos available at very affordable prices starting at **Only \$39.95 each.**

For information or to place an order call:

**1-800-678-6113**

www.ucando-corp.com

UCANDO VCR Educational Products Corp., Greenville, OH

**RS232/RS422/RS485 Converters**



**RS232 TO RS485  
2 wire**

- Makes your RS232 port an RS485 port
- Supports up to 40 RS485 devices
- Automatically determines data direction.
- Signal powered version available

CMC's low cost converters adapt any RS232 port for RS422 or RS485 operation. These converters provide your RS232 device with all the advantages of RS422 or RS485 including reliable high speed operation (upto 200 kbaud) and data transmission distances up to 5000 feet. Two AD422s can be used to extend any RS232 link up to 5000 feet. Completely transparent to the system; no software changes of any type are necessary.

ADA485 (requires 9VDC) \$79.00  
ADA485-1 for 110VAC 89.00  
ADA485L signal powered 84.00

**RS232 TO RS485  
4 wire**

- Converts an RS232 port for use with RS422 or RS485 devices
- Supports up to 40 RS485 or RS422 multidrop devices
- Adds multidrop capability to RS232 devices
- Automatically determines data direction.

**RS232 TO RS422**

- Converts bi-directionally between RS232 and RS422
- Use as a short haul modem
- Plug in and go. No software changes required

AD422 (Requires 9VDC) \$79.00 ADA425 (requires 9VDC) \$89.00  
AD422-1 for 110VAC 89.00 ADA425-1 for 110VAC 99.00

Mention this ad when you order and deduct 5%  
Use Visa, Mastercard or company purchase order



**Connecticut microComputer, Inc.**  
PO BOX 186, Brookfield, CT 06804 (203)740-9890

WWW.2CMC.COM

Fax: (203)775-4595

(800)366-0579

(661)295-5577

fax(661)295-8777

**Roger's Systems Specialist**

24895 Avenue Rockefeller  
Valencia, California 91355



Computer • Communications  
Network • Audio • Video

- > ADAPTORS
- > HUBS
- > SWITCH BOXES
- > PATCH PANELS
- > SCSI CABLES
- > MOTHERBOARDS
- > CPU'S

Case fan system exhaust  
4pin  
**\$12<sup>00</sup>**  
cat.no. TM-FAN-SLOT



**ELECTRONIC CPU SWITCH**

- Includes:
- > One MiniView KVM switch
  - > 2 Sets of Premium Grade
  - > KVM Cables
  - > One PS/2 to AT keyboard adapter
  - > One PS/2 to Serial mouse adapter
  - > One User Guide

- Features:
- > Keyboard & mouse emulation for error
  - > Free PC booting
  - > No external power required
  - > Works virtually with any operating system
  - > Fully hot pluggable

**\$99<sup>00</sup>**

DS-102-KMMPS

**Acer**  
**\$5<sup>00</sup>**  
cat.no. TM-290-PS

**EXTENSIONS, male to female**

CC-VGA-4C	6FT	\$6 <sup>00</sup>
CC-VGA-5C	10FT	\$8 <sup>00</sup>
CC-VGA-25CX	25FT	\$16 <sup>00</sup>
CC-VGA-50CX	50FT	\$28 <sup>00</sup>
CC-VGA-100CX	100FT	\$44 <sup>00</sup>

**SWITCH BOX, male to male**

CC-VGA-3C	6FT	\$6 <sup>00</sup>
CC-VGA-9C	10FT	\$8 <sup>00</sup>
CC-VGA-11C	25FT	\$16 <sup>00</sup>
CC-VGA50MM	50FT	\$28 <sup>00</sup>
CC-VGA100CX	100FT	\$44 <sup>00</sup>

**Triple  
Shielded  
Plug-n-Play**

**Category 5 Patch Cable**

TE-038-L5	3ft. Straight Patch	\$1 <sup>75</sup>
TE-068-L5	7ft. Straight Patch	\$2 <sup>00</sup>
TE-128-L5	14ft. Straight Patch	\$4 <sup>00</sup>
TE-258-L5	25ft. Straight Patch	\$5 <sup>00</sup>
TE-358-L5	35ft. Straight Patch	\$7 <sup>00</sup>
TE-508-L5	50ft. Straight Patch	\$8 <sup>00</sup>
TE-758-L5	75ft. Straight Patch	\$17 <sup>00</sup>
TE-108-L5	100ft. Straight Patch	\$16 <sup>00</sup>

SVGA COAXIAL CABLES

CIRCLE 308 ON FREE INFORMATION CARD  
www.americanradiohistory.com

# EARN MORE MONEY!

## Be an FCC LICENSED ELECTRONIC TECHNICIAN!



No costly school. No commuting to class. The Original Home-Study course prepares you for the "FCC Commercial Radiotelephone License." This valuable license is your professional "ticket" to thousands of exciting jobs in Communications, Radio-TV, Microwave, Maritime, Radar, Avionics and more...even start your own business! You don't need a college degree to qualify, but you do need an FCC License.

**No Need to Quit Your Job or Go To School**  
This proven course is easy, fast and low cost! **GUARANTEED PASS**—You get your FCC License or money refunded. **Send for FREE facts now. MAIL COUPON TODAY!**

Or, Call 1-800-932-4268 Ext. 210

### COMMAND PRODUCTIONS

FCC LICENSE TRAINING, Dept. 210  
P.O. Box 2824, San Francisco, CA 94126  
Please rush FREE details immediately!

NAME \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_

## CONTROL MEASURE INPUT

RELAYS • LIGHTS • MOTORS  
TEMPERATURE • PRESSURE • LIGHT LEVELS • HUMIDITY  
SWITCH POSITIONS • THERMOSTATS • LIQUID LEVELS

MODEL 30 ..... \$79



- PLUGS INTO PC BUS
- 24 LINES DIGITAL I/O
- 6 CHANNEL
- 8 BIT A/D IN
- 12 BIT COUNTER
- UP TO 14K SMP/SEC

MODEL 45 ..... \$189



- RS-232 INTERFACE
- 8 DIGITAL I/O
- 8 ANALOG INPUTS
- 2 ANALOG OUTPUTS
- 2 COUNTERS-24 BIT

MODEL 100 ..... \$279



- 12 BIT 100 KHZ A/D
- 4 ANALOG OUTPUTS
- 3 TIMER COUNTERS
- 24 DIGITAL I/O

MODEL 150-02 .... \$179



- RS-232 INTERFACE
- TRMS, 20 AMPS
- 12 BIT A/D
- OPTO-ISOLATED
- COMPLETE DMM

MODEL 40 ..... \$109



- RS-232 INTERFACE
- 28 LINES DIGITAL I/O
- 8 ANALOG INPUTS
- PWM OUTPUT

MODEL 70 ..... \$239



- RS-232 INTERFACE
- 18 BIT A/D
- 3.5 DIGIT
- UP TO 60 SMP/SEC

## Prairie Digital, Inc.

PHONE 608-643-8599 • FAX 608-643-6754

17 SEVENTEENTH STREET • PRAIRIE DU SAC, WISCONSIN 53178

CIRCLE 219 ON FREE INFORMATION CARD

## DATA ACQUISITION & CONTROL

AFFORDABLE PLUG-IN BOARDS FOR PC'S ISA BUS

ANA100 Analog I/O ..... \$ 99



- 8 Channel 8-Bit
- 0 to 5 Volt Input
- 14 TTL I/O lines
- Analog Output
- 400KHz Sampling

DIG100 Digital I/O ..... \$ 39



- 82C55 PPI
- 24 or 48 TTL I/O Lines option
- Selectable Base Address

ANA150 Analog/Counter... \$ 89



- 8 Channel 8-Bit
- 0 to 5 Volt Input
- 3 16-Bit Counters
- 400KHz Sampling

DIG200 Counter I/O ..... \$ 79



- 3 16-Bit Counters
- 8 TTL Input lines
- 8 TTL Output lines
- Selectable Clock Frequency input

ANA200 Analog I/O ..... \$ 79



- 1 Channel 12-Bit
- 0 to 5 Volt input optional bi-polar
- 100KHz / 300KHz Sampling rate
- 24 TTL I/O lines

ANA201 Analog ..... \$ 119



- 8 Channel 12-Bit
- x1, x5, x10, x50 Programmable Channel gain
- 100KHz Sampling rate

On-Line Product Catalog at Our Web Site

<http://www.Bsof.com>

E-Mail: [Sales@Bsof.com](mailto:Sales@Bsof.com)

## BSOFT Software, Inc.

444 COLTON ROAD \* COLUMBUS, OH 43207  
PHONE 614-491-0832 \* FAX 614-497-9971

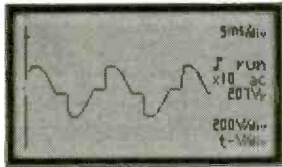
# Electronics made easy & affordable **velleman**

**NEW**

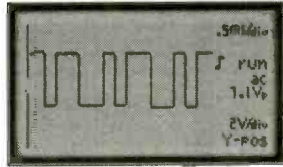
**PERSONAL SCOPE™**

**HP55**

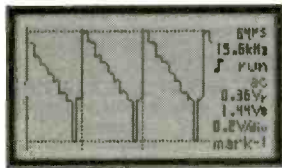
The Velleman **PERSONAL SCOPE™** is a portable fully-functional oscilloscope. At the cost of a good multimeter it gives you the best possible value for the money. The **PERSONAL SCOPE™** provides you with the high sensitivity (down to 5mV/div) often missing in higher or similarly priced units. Together with the other scope functions it makes this the ideal tool for students, hobbyists and professionals.



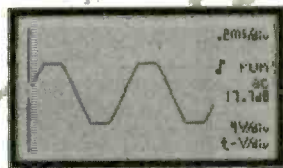
AC MAINS (e.g. phase control)



DIGITAL SIGNALS (e.g. pulse train)



TV AND VIDEO (e.g. composite video signal)



dBm SIGNALS (e.g. amplifier output clipping level)



**\$199.95**

Probe not included

**SPECIFICATIONS:**

- Maximum sample rate: 5MHz
- Input amplifier bandwidth: 1MHz (-3dB at 1V/div setting) 1Mohm //20pF (standard probe)
- Vertical resolution: 8 bit (6 bit on LCD)
- LCD Graphics: 64 x 128pixels
- dBm measurements: From -73dB tot +40dB (up to 60dB with X10 probe) ±0.5dB
- True rms AC measurement: 0.1mV to 80V (400Vrms with X10 probe) ±2.5% accuracy
- Time base: 20s to 2µs / div in 22 steps
- Input sensitivity range: 5mV to 20V/div in 12 steps (up to 200V/div with X10 probe)
- Supply voltage: 9VDC / min 300mA adapter
- Batteries (in option): Alkaline type AA (5 pcs required) NiCd/NiMH rechargeable
- Battery life: Up to 20 hours with Alkaline batteries
- Safety: Meets IEC1010-1, 600°C T1, pollution degree 1
- Dimensions: 105 x 220 x 35mm (4.13 x 7.95 x 1.38")
- Weight: 395g (14oz.) (excl. batteries)

**OPTIONS:**

- Insulated measurement probe x10: PROBE605
- Adapter for 110V AC: PS9D5USA



SERVICE & DEVELOPMENT



CAR DIAGNOSTICS



AUDIC TROUBLE SHOOTING

# velleman

7415 Whitehall Street Suite 117  
 Fort Worth, TX 76118  
 (817) 284-7785 F : (817) 284-7712  
 www.velleman-kit.com email : velleman@earthlink.net

Questions ? Contact us for a list of US distributors or to get your **FREE** catalogue 93

CIRCLE 275 ON FREE INFORMATION CARD

www.americanradiohistory.com

January 2000, Poptronics

**350MHz, TEKTRONIX 2467, MICRO CHANNEL PLATE CRT**

4 Channels, 500ps per div. In normal room light. Displays intermittent waveforms as they happen. Captures the slowest one shot events with 4ns per division or 100 fold increase in the visual writing rate over conventional CRT. Features: 1 ns rise time, 500ps/div time base, 2W/div. Vertical sensitivity at 350MHz, 20ps time interval resolution, 1Wohm / 50-ohm input, 500kHz trigger bandwidth, four channels. On-screen waveform cursors provide vertical & horizontal scale factors. Trigger level, voltage, time, rise, phase, ratio values and mode indication. Complete with 2 probes, pouch, and manual. Mint cond. 90 day warranty. Now.....\$12K Now TEK2467.....\$3250.

**MAGNETIC STRIPE READER with BAR CODE WAND.**

New from United Barcode Industries. MAGSCAN model 190-155000-14-01 on-line magnetic stripe and BAR CODE reader designed for compactness and flexibility. The Magscan connects to the keyboard port via the standard mini-DIN connector. Perfect for use with a laptop. A good read is indicated by an audible beep and a visual signal from its LED. The unit reads track 1, track 2, or track 1 & 2. No software is required. Simply plug it in and start scanning! Ready. Very compact: 5.7" x 2.7" x 1.5". No external power is required. 60 page manual included with complete user configuration info. (Done using the word!) One manual per order. A super hacker device. SPECIAL...\$49ea. or 2 for \$79

**MINIATURE and, PRECISE, PORTESCAP, SWISS, GERMOTOR.**

Store of the art "Ironless" type, mini motor type M11-210-54-0 with approx. 40:1 gearbox. Size: 16mm x 4.45mm L. Operating parameters: @6VDC input, 8mA, 141RPM No Load, @ 12VDC Input, 12mA, 290RPM No Load. PORTESCAP, TYPE B: \$15ea. 2 for \$27, Special...10 for \$125

**ULTRA MINI and WEATHERPROOF "LIPSTICK" CAM**

Sleek black anodized, alum. housing. O-Ring sealed & RAINPROOF. Adj. tilting mount. 1/3" CCD, 380 Lines, 0.3 Lux, AGC, Auto Shutter. 9-12VDC @100mA, 4mm, f1.8, 78° FOV real glass lens. NTSC video. <1000lux I.SENSITIVE. 23mmx35mm, 3/6" cable with BNC video & DC barrel jack.

GM-200K, PIN-HOLE MODEL. So tiny you can install it directly into a door. Only a 0.9" diameter hole! Specs as above. 90° FOV Pinhole lens. 1/2" orcal Size only 23mm x 4x35mm long. Think of the places you could put this little jewel.

GM-200K-STD.....\$99  
GM-200K-PH lens.....\$99

**STEPPER DRIVERS, SUPERIOR ELECTRIC, SLO-SYN Type, 3180-PT125.**

These drivers are removed from equipment and in good condition. They are designed for use with an external inductor. We have no documentation for these units. They are a compact 7"x5"x4". We always sell out of these so don't delay. Very limited quantity. NOW.....\$139ea. or 2 for \$249

**PORTABLE MINI PRINTER, 40 COLUMN, with INTERNAL NI-CAD POWER!**

The model S022Z-1000 is a NEW and very cool, self contained, alphanumeric, impact type printer. It features a standard parallel port and an internal Ni-Cad power supply. Can also be powered via the 9VDC power adapter supplied. Uses standard 2" wide paper rolls available everywhere. Has self test function and diagnostic mode. Can emulate Epson and Citizen 500. It will print from the LPT port of any PC. Very rugged and well made. Perfect for any remote print and on internal Ni-Cad power supply. OUR PRICE.....\$49ea. or 2 for \$75

**"A STRANGE LITTLE DEVICE"**

AT&T Universal Digital Echo Canceller, Model, ATIN20R2-2. If you have a use for this you know they are a quality price. We have several available. They are like new. Standard 6pin RJ style jack for connection. Give us a call if you know how to use this and get one for free. AT&T, UDEC.....\$89ea.

**OPTICAL EXPERIMENTERS DELIGHT, Light Source, Fibre Optics, Two Detectors, Four Bandpass Filters, Stepper Motor, A/D Converter..... What more do you want?**

We are sure this would make an interesting building block for the circuit savvy among you. A precision mini lamp sends light through a pin hole to illuminate a bifurcated D.F. cable. One leg, 2.5' L, goes to the feedback detector, presumably to compensate for any change in the source intensity. The other leg, 12" L, terminates at a mini convex projection lens and illuminates an unknown under scrutiny. Light passing through the subject matter is gathered by another mini lens and directed to a 2" diameter filter wheel with 4 1/2" diam. bandpass filters with pass wavelengths of: 409nm, 450nm, 490nm and 630nm, individually selected with the help of a mini stepper motor and gears. Light passing through the filters is detected via a large area photo diode whose output is presumably passed to the a/d converter (AD7533QR) and the rest of the surface mount components. Very nicely made, shielded and supported on an intricate aluminum extrusion, (block annotated.) Overall size of the assembly is 5.6" x 2.9" x 6.5". Now you know what we know. Must have had a bundle. Our price, less than the cost of one business file.

**SUPER EXPERIMENTERS SPECIAL.....\$39ea.**

**FUTABA, 2X20 VACUUM FLUORESCENT DISPLAY MODULE**

New or like new, model N12025 series. Can directly replace LCD displays. The module includes the YD0, microcomputer and driver. Connects directly to the system bus. Display up to 40 dot matrix, 5 x 7 characters (222 characters and symbols), 5mm H x 3.5mm W with cursor. Display color is green at 505nm. Brightness is 690 cd/m<sup>2</sup> with four level dimming function. Weight: 5 oz. Size: 6.7" x 2.6" x 1" thick. Power required is 5VDC @ 350mA. Serial or parallel interface selectable. Perfect for any high visibility display requirement. With data. SPECIAL FUTABA.....\$15ea. 3 for \$39

**DAYLIGHT/LOW LIGHT MINI CAM & A/I LENS.**

For down "ill" dusk applications. Rugged alum. housing, dual mlg sockets. 1/3" CCD, 420 lines res. 0.1 Lux sens., AGC, 12VDC @120mA. Take full advantage of camera sensitivity with super, 4mm, f1.4, 78° FOV Auto Iris lens included. BNC video out, 50m sq. X 65mm L. With pwr. adapt. SPECIAL, GM-510A/L.....\$189 or 2/\$349

**NEW! 4 or 8 CHANNEL, SEQUENCER**

Model GM34 or GM38. Connect to any four standard video signals and they will be sequentially output to the dual rear panel BNC outputs. From panel user adjustable, variable dwell 1 to 15 sec per channel. Auto or manual switching with channel bypass. Compact only 8.8" x 3.7" D x 1.75" H, or powered, Video loop through. Special, GM-34.....\$69, GM-38.....\$89

**WORLDS SMALLEST VIDEO TRANSMITTER, ON SALE**

Remarkably only 0.9" x 0.8" x 0.37". Transmits crystal controlled hi-res. images with 1000mV output! The transmitter you've been waiting for. Shows actual size. Smaller than the 9V battery which powers it. Draws only 35mA! Factory tuned. Receive on cable channel 59. Will work with color or B&W cameras. UHF Bow line antenna with balun and 3' F cable for TV included. Perfect with our GM1000A. Both will fit in a cig. pack with battery! SPECIAL TXV-100-S159, with GM1000A CAM.....\$209.

**TOROIDAL ISOLATION, STEP DOWN TRANSFORMER**

Nicely made UVECOJUSA model 22432. Thermally protected. Primary is 0-120VAC. Secondary is 0-120VAC 300VA and 18V @50VA includes heavy duty mounting bracket. Size: 5.75" Dia. x 2.75" thick. Weighs in at: 10.5 Pounds. UVECO XFMR.....\$20ea.

**NEW! 0.08Lux, COLOR NIGHT VISION CAMERA UNBELIEVABLE LOW LIGHT PERFORMANCE. Our GMV-2K DOES IT IN COLOR TOO!**

For covert, military & scientific applications that must be color, this is it. Performance is enhanced through low speed electronic shuttering and digital frame memory. With the optional auto iris lens, 24 hour monitoring is possible. Auto sensitivity mode starts as it becomes dark. Eight Gain/Shutter modes are user selectable. Normal, X4, X8, X16, X32, X64, X128. These provide frame rates of 60, 15, 8, 4, 2, 1 and 0.5 per second. Auto/Man. white balance. Alum. housing, dual 1/4" CCD, with 29K pixels, 320 Lines, 12VDC @200mA, sd. video out on BNC. Size: 54mmx50mmx94mm long. With pwr. adaptor. All functions can be externally controlled via an 8 pin mini DIN. Use std. 3-cmm lens not incl. GMV2K.....\$589ea. OPT. 4mm, f1.4 A/I lens w/cable \$119

**CLOCK RADIO, COVERT CAMERA.**

New, Magnavox clock radio with covert low light video camera. Specifications per our GM1000A shown on page one. Connect the output to anything with a "video input" jack via RCA style output. SPECIAL, CRC-1-SD.....\$119. ea

**GRAPHIC LCD DISPLAY, SEIKO Model G191C21R0A0**

Like new, G191 series, monochrome with ETL electroluminescent backlight. These gorgeous FSTN type panels are perfect for direct sunlight applications. They won't wash out! The dot format is 192 x 128. The module size is 98 x 88 x 13.4mm. The viewing area is 76 x 54mm, the dot size is 0.33mm x 0.33mm. Power requirements: +5VDC @ 3.1mA and -12.4VDC @ 2.9mA. The backlight adds 100ma to the +5 current. Weight is 3.6oz. The viewing angle is 40°. Operating temperature range 0°C to 50°C. Now's your chance to design a really high-tech display into your next project. Data included. These are sophisticated devices, please be sure you are capable of integrating them into your device. Please review data at Seiko web page: www.seiko-usa-cad.com/cad/html/graphic/modules/g191c21r0a0.html. All sales final. Current price \$111 each. Very limited quantity. SPECIAL.....\$29ea. or 2 for \$49 or 5 for \$99

**PARKER-COMPUMOTOR, SM231A BRUSHLESS SERVO MOTOR**

New, SM series with optical encoder feedback (1000PPR) Rated shaft output power is 205 watts. Stall current is 2.1 Amps. Rated speed is 7500RPM. Torque at rated speed: 7.37 lb.-in. Shaft diameter: 0.25". Full specs are available on the web at: WWW.compumotor.com/catalog/SMseries598.pdf. Size: 4.1" x 3.31" x 2.25". These are sure to sell out. Very limited quantity. SPECIAL.....\$149ea. or 2 for \$269

**BIO CHEM VALVE CORR.**

Type 100P-250, Solenoid check valve. This unique valve has no contact with the controlled substance. It operates by squeezing a 1/8" diam tubing and the actuator "crimping" it closed when actuated by 24VDC. The action is normally open. (shown right) Size: 1" diam. x 2.8" L With 12" wire leads. Removed from factory. PREDYNE, MINI VALVE, Type A92037-926, 24VDC @200mA solenoid operated, 5/32" orcal, BPS, pass through valve with 1/8" barbed nylon fittings attached. (removable for screw in connection.) 12" wire leads. (Shut left removed from equip. Both are like new condition.) BIO CHEM VALVE.....\$6ea., PREYNE VALVE.....\$6ea.

**NEW, GM960 TIME LAPSE VIDEO RECORDER**

Find a brand new 4 head, 1/4" recorder with all the features at a price you can afford. Features: • Up to 360 hours on a standard 7. 120 VHS tape • 12 different modes for record and playback • Audio recording in the 12H and 24H mode • 300day memory backup • Easy mode setting • On-screen menus • Auto-repeat recording mode • Serial or One-shot recording • Time, Date, Speed, and Alarm indicators on screen. These deluxe units are front loading and are 14" W x 5.5" H x 12.2" D, 110VAC powered. SPECIAL.....\$699ea. or 2 for \$1349

**HAPPY HOLIDAYS!**

**RESOURCES UN-LTD.**

VISA, MC, AMEX, DISCOVER, COD.  
ORDER: 800-810-4070 TECH. 603-648-2499  
FAX: 603-644-7825 E-MAIL unltd4u@aol.com  
300 BEDFORD STREET, MANCHESTER NH 03101

**NEWPORT TRANSLATION STAGES.**

also a few other goodies too!

MODEL:	DESCRIPTION:	EACH:
270	LAB JACK	\$249
RSA-2T	360 deg. Rotary Stage with Clear Aperture.	\$129
625A-4	Laser Holder	\$149
481A	Rotary Stage	\$189
M36	Translation Stage	\$249
480A-XY	X-Y Translation Stage	\$189
M37	3 Axis Trans. Stage	\$289
415	Vertical Trans. Stage	\$129
M360-90	Mtting. Plate 90deg.	\$ 29
M436	Translation Stage	\$199
M150	Magnetic Mtg. Base	\$129
420	Linear Trans. Stage	\$119
HP10703A	INTERFEROMETER	\$129
HP10702A	INTERFEROMETER	\$129
HP10780A	RECEIVER	\$199
RUCKER & KOLLS 2X2	X-Y-Z Micro Positioner	\$ 50

10V @ 2.5 AH SEALED, LEAD ACID, PACK. Each pack has 5, 2 Volt cells. D-size cells are arranged as 1K5 cells. Enclosed in an ABS outer shell. (removed for photo) Perfect for high drain applications. Make custom packs of any rating. Size: 7.5" x 2.8" x 1.5" SALE! 6-five packs for \$20, 40 for \$99

**SUPER, MINI C-MOUNT CAMERAS,**

Super sensitive, GM410 or the general-purpose GM412. The GM412 specs: 88W, size 1.5" sq. x 2.4", 250,000 Pixels, 380 Lines Resolution, Sensitivity 0.3 Lux. The GM410 specs: size only 1.5" sq. x 1.6" >270,000 Pixels, 410 Lines Res., Sens. 0.05 LUX. Both cameras are 1/3" CCD with AGC & Electronic shutter 12V @100mA power. NTSC out. I.SENSITIVE. BNC video out. Both use std. DC pwr. lock. Aluminum housings with dual threaded top and bottom mounting. True performance not hype! These cameras will outperform ANY camera in this magazine. Multi-lens options are available to exploit their superior performance. GM412 shown bottom. GM410 shown top. GM412, less lens \$119. GM410, less lens \$169

**low cost MICRO CAMERAS, w/audio 1/3" CCD, 410 Lines Res. 0.3 Lux sens., AGC, Auto Shutter.**

Pwr. from 9 to 12VDC @100mA, 250K PIXELS, Std. model, 4mm, 78° FOV lens. Pinhole, 90° FOV. A real glass lens. Both focus from 10mm to infinity. Std. NTSC video out, 1/2" orcal SENSITIVE to 0.3 Lux. Std. 1.25" sq. x 1.4", PH is 0.6" d. 1.6M long wiring harness with connectors included. WARNING: Don't confuse these models with LOW RESOLUTION, HIGH LUX C-MOS CAMERAS  
GM-1000A-STD.....\$59 GM-1000A-STD/Aud.....\$64  
GM-1000A-PH.....\$59 GM-1000A-PH/Aud.....\$64  
GM-1000A-CMNT.....\$59 GM-1000A-CMNT/Aud.....\$64

Micro Lenses for GM1000 series

2.5mm, 150°.....\$22	8.0mm, f2.0.....\$22
4.3mm, 78° f1.8.....\$22	12.0mm, f2.0.....\$22
6.0mm, f2.0.....\$22	5.0mm, 70°PH.....\$22

**C-MOUNT LENSES**

LOW LIGHT	STANDARD
16mm, f1.6, 15° FOV.....\$39	4mm, 80° FOV.....\$24
8mm, f1.3, 40° FOV.....\$49	8mm, 40° FOV.....\$24
4mm, f1.4, 78° FOV.....\$49	12mm, 28° FOV.....\$24

Please fax us your list of unique surplus material.

**MOTORIZED ZOOM LENS SPECIAL**

6X magnification, 12x on a 1/3" camera Auto Iris tool. New, fabulous hi-res. optics with std. C-Mount. Superior Fujinon and Vicon lenses. Normally cost from \$600 to \$1500. There is no substitute for good lens! All these motors will operate from 6-12VDC. Aulis has a built in amp which works with any camera video output for control. Type B-6, 12.5 to 75mm, 6X, f1.2 ..... \$179 or 2 for \$349 ZOOM LENS CONTROLLER, NEW ..... \$169

**MINI ROTARY DRIVE with on board LINEAR SLIDE.**

Provides 300° rotation between removable stop. Rotates continuously with-out stop. 2 optical position sensors for start & end. Same stepper as above. Each full step = 0.25° of rotation. Made from cast & machined resin & alum. Attached slide provides 1" travel. Construction similar to slide above. Moves 0.008" per step. Dual optical end of travel sensors. Overall: 7.5" x 8.25" W x 4.5" H MRD-1.....\$39 or 2/\$69

**NEW, TRIPLE OUTPUT, 60W, POWER SUPPLY**

Asics model SA40-D13, outputs of +12VDC @ 3Amps, +5V @ 3Amps and -12V @ 350mA. 110VAC input. Very compact size 3" W x 5" L x 1.3" H. Perfect for many hobby applications as well as an external disk drive power supply. SPECIAL.....\$5ea. or 5 for \$20

**DEL TRON LINEAR SLIDE with CLEVER LEVER**

An interesting assembly, consisting of a Del Tron mini rail bearing slide (2.5" x 1" W x 0.56" H) with 2" travel. Slide is placed next to a 2" diam. stepper mounted wheel. A 1.5" sq. four wire stepper, rated at 4V, 0.95A, 1.8/step. The bottom side of the wheel acts as a cam with raller and moves a spring loaded arm (3.4" L x 1" W) up and down 1/2". All components, including an optical end of travel detector are mounted on precision machined, 6061-T6, black anodized aluminum. Overall size: 8.5" x 3" D x 2.5" H. Ex. Cond. Udy. DelTron-W.....\$39ea.

**COMPACT, THK, LINEAR SLIDE with STEPPER DRIVE.**

A really slick, super precision, THK LW-12 series, recirculating ball drive with a 3/6" long footed rack (HATPI) mounted next to it. The rack moves with a 0.6" diam. nylon drive gear mounted to a compact 1.5" sq. four wire stepper, rated at 4V, 0.95A, 1.8/step. One full step moves the slide approx. 0.050". All components, including an optical end of travel detector are mounted on precision machined, 0.2" thick, black anodized aluminum. Overall size: 5.5" W x 3.3" D x 3.4" H. The system provides 3.1" of extremely rigid travel. Ex. cond. Udy. LS-LWL-12.....\$49ea.



**GENERAL SCANNING, TYPE M3, CLOSED LOOP, GALVANOMETER, LASER SCANNER.**  
Innovative motor design coupled with an advanced capacitive position detector, provides high speed, wide angle and improved stability. Using moving magnet technology this scanner provides low inertia, rigidity and low inductance. Specs include: 1/30" excursion, wobble 1.5rad, Repeatability: 20rad, Coil Res. 4.8 Ohms, Peak current 100mA, Angular sensor sens: 8.1rad/A. A high quality basis for demanding laser displays. Galvo only you provide the drivers. Very limited quantity.  
**M3 GALVO.....\$369ea. or \$699 for a pair**

**VACUUM PUMP, GAST, MAA-V111-HB, OIL-LESS DIAPHRAGM.**  
Self contained, rugged & long life. These 2-stage pumps operate on 115VAC @ 1.7amps. The pump provides 28 IN.HG of maximum vacuum at 0.47CFM open flow. Pump weighs 9 pounds. Perfect for commercial and industrial applications, such as ologators, graphic arts, business machines and laboratory use. Permanently lubricated and maintenance free. Like new, removed from equipment. Very limited quantity. Reg. \$5200, Our price, GAST, V111.....\$89ea. or 169 for a pair.

**UNIQUE, PERISTALTIC PUMP from COLE PALMER, Model 7316-20**  
Heavy duty cast polycarbonate construction. Supplied with flexible shaft coupler for 1/4" drive shaft. You supply the motor. These pumps are self priming, valveless and non-clogging. Tubing pumps are designed for inert pumping of chemicals in such applications as food processing, cable liquids, pool and spa chemicals, metering and high viscosity liquids. Fluids contact only the rollers, moving fluid through the 1/4" O.D. x 1/8" I.D. tube. Estimated flow rate is 0.4 GPH or approx. 20CC / min. Size: 3" x 3.5" x 3.3". Excellent condition, removed from equipment.  
**PERIS PUMP.....\$29ea. or 2 for \$49**

**NOW YOU CAN SEE WHAT THE "FISHES ARE DOING" (down 60 ft.) UNDERWATER B&W CAMERA with INTERNAL, INFRA-RED ILLUMINATOR!** Sleek black anodized BRASS, housing, O-ring sealed & WATERPROOF. Adjustable mount ind. Specs: 1/3" CCD, 400 Lines res., C05 Lux sensitivity, AGC, Auto Shutter, 12VDC @225mA 4mm, 78° FOV lens, A real glass lens NTSC video out. Superior construction, SENSITIVE to IR, Ultra small size only. 1.25" diam. X 2" long. With 60 ft. cable. Perfect as a remote area inspection camera. Great for general outdoor use as well. **GM-300KIR.....\$199**

**NEW, "STEALTH CAM", MICRO SIZE, with AUDIO!**  
The sleek aluminum housing fits like a glove! Removable mfg. bracket & a 1.3M cable with BNC Vid. RCA out, internal mic & DC pow. jack for no sweat hook up. Why fool around with an open PC board? Now you can have the "STEALTH CAM" 1/3" CCD @410 Lines@0.3 Lux AGC\*Auto Shutter\*Pwr. 12V @110mA\*250K pixels\*Std. 4mm, 78° FOV lens\*Pinhole, 90° FOV\*Focus:10mm to Inf.\*NTSC video\*councer\*IR SENSITIVE\*Size Std. 30mm sq. x 29mm d. PH:16mm d. Don't confuse with LOW RES., HIGH LUX C-MOS CAMERAS.  
**GM-200S-STD OR PH. w/aud., .....\$79.00**

**UNUSUAL, DUAL ROTARY MOTION TABLE offers 2 independent drives with 0.02" per step!**  
A heavy duty, 23" x 15.25" W x 5/8" thick black anodized alum. panel serves as the base for two concentrically aligned, rotary motion units. The outer "platter" is 12" dia x 0.1" thick with one drive independent drive. The base provides the perfect area to "breadboard" your mechanical motion. Excellent condition.  
**DUAL PLATTER .....\$69ea. or 2 / \$119**

**NEW! LCD COLOR, TFT, ACTIVE MATRIX DISPLAY offers 5.6" VIEWABLE AREA.**  
You asked for it. Finally we found a unit with exceptional quality at an affordable price. Perfect as a portable, general purpose color monitor for standard NTSC color or B&W video systems. Fully compatible with all our cameras as well as Commodore, VCR's etc. Perfect as a rear view system with any camera. Features include built-in, mirror image function. Completely enclosed unit has adjustments for color, contrast and brightness and a volume control for its internal stereo speakers! Also has a std. 1/4" x 20 Tripod socket and a tilt down stand for table top viewing. Includes: audio I&R and video in/out 1/8" mini jacks. External 12VDC on std. barrel connector. Specifications: 5.6" TFT active matrix LCD with 76.8K Pixels, CCR, backlight with 270cd/m<sup>2</sup> luminance, 500V/VA audio output available on std. 1/8" jack. 12V @600mA powered, 50mV/min. or std. line level audio input. Overall size: 6.4" W x 5.25" H x 2.2" D. New first quality. An optional accessory kit is available which includes: A luggage quality, custom made, ballistic nylon, padded case with dual removable straps for shoulder and/or holding at waist level for portable, hands free viewing. Built into bottom of case is a 4" battery holder for internal power pack, less batteries! Also supplied is a complete set of A/V cables and adapters with remote power switch. **GM-TFT56, with AC power adapter.....\$289ea. GM-ACCYFT.....\$25**

**MINI-BAR CODE SCANNER from SYMBOL TECHNOLOGIES,**  
Like new, removed from equipment. Symbol model LS-6820 Series. A complete 650nm, laser diode based, high speed scanner that fits in the palm of your hand. Leds of goodies inside. Supplied with pinout and power supply data for connector. Operation on a 4.5" battery holder for internal power pack, less batteries! Also supplied is a complete set of A/V cables and adapters with remote power switch. **GM-TFT56, with AC power adapter.....\$289ea. GM-ACCYFT.....\$25**

**NEW GM182, 580 LINE, CCD CAMERA,**  
1/3" CCD, 580 Lines Res. 0.1 Lux Sens., AGC, Auto Shutter, Pwr. 12VDC @120mA, 3.6mm, 71° FOV, Real glass lens, Focus from 10mm to infinity, Standard NTSC video out, 1/2" optical SENSITIVE to IR. Size: 1.75" x 1" d, with 6' leads. 12VDC Power adapter included. Superior performance. **GM182, SPECIAL \$159ea.**

**END FIELD OF VIEW GUESSWORK! 3.5 to 8mm VARI-FOCAL LENS**  
Brand New, super 11.8 lens allows you to smoothly adjust from a 97° FOV @ 3.5mm to a 44° FOV @ 8mm. Now you can frame your area of interest! Just the way you want it! Standard CS-Mount with adjustable focus and iris.  
**SPECIAL.....\$89ea. or 2 for \$169**

**TEKTRONIX 2465-DM, 4 Chan., 300MHz, O'Scope, on screen waveform stats. & DMM READOUT**  
One of the most popular & powerful scopes available at a reasonable cost. Features 500pS/Div vertical sensitivity, 1M ohm / 50-ohm input, 500MHz trigger bandwidth, four channels. On-screen waveform cursors provide vert. & horiz. scale factors, trigger level, voltage, time, freq. phase, ratio values and mode indication Plus complete DMM | Complete with 2 probes, and manual. Excellent condition, 90 day warranty. **\$2295.**

**MICRO CAMERA, with MIRROR IMAGE**  
Perfect for "rear view" 1/3" CCD, with 266K Pixels 410 Lines Res. 0.3 Lux Sens. AGC and Auto/MAN Shutter. Low Power 12VDC @100mA. 3.6mm, 92° FOV; focus from 10mm to infinity. A real glass lens! WHY BUY DISCONTINUED OR SURPLUS? New first quality Standard NTSC video out, 1/2" optical IR SENSITIVE!  
**GM251, with AC power adapter.....\$69ea.**

**MOTORIZED LINEAR SLIDE, offers 0.001" per step travel.**  
A THK, LWL-12 series re-circulating, ball bearing slide with a 4.7" long steel rail is mounted to a 0.2" thick, black anodized, aluminum plate. The slide has a right angle bracket attached to a spring loaded, anti backlash, drive nut. Riding on a 0.37" diam. 10TPI lead screw which is coupled to one end of a dual 1/4" shaft, stepper motor with specs: 1.8"/step, 5V @1amp, 4 wire. One optical end of travel sensor is also in place. Ex. Cond. Ltd. Qty. **LWL12-2, Sdapter.....\$59ea.**

**MOTORIZED LINEAR SLIDE, Provides precise 0.01mm metering up to 1.0ml in 0.01ml steps. As well as 2.5" of 0.001" per step travel.**  
A precision dual port 1ml and 0.1ml syringe assembly with a 1.0ml capacity is mounted to the flip side of a (b)hd above) THK, LWL-12 series re-circulating, ball bearing slide with a 4.7" long steel rail is mounted to a 0.2" thick, black anodized, aluminum plate. The slide has a right angle bracket attached to a spring loaded, anti backlash, drive nut. Riding on a 0.37" diam. 10TPI lead screw which is coupled to one end of a dual 1/4" shaft, stepper motor with specs: 1.8"/step, 5V @1amp, 4 wire. Optical end of travel sensor is also in place. Excellent condition. Ltd. Qty. **LWL12-5YR.....\$69ea. 2/\$129**

**EXTREMELY HIGH VOLTAGE POWER SUPPLIES UP TO 180KV!**

GLASSMAN 180KV Supply w Stack.....\$1495ea. (new condition)  
ELECTRONIC MEASUREMENTS INC./ALE-4060, 0 to 60KVDC @ 100mA. Brand new in original boxes: High voltage driver and voltage multiplier in two separate units. p-p ripple 40 V full load. External programming voltage 0-10VDC. Output V & I monitors. 0-10VDC. **EMC/ALE-4060, 0-60KV Supply.....\$1850ea.**  
Kaiser Systems, model 51-40-12, A state of the art, rack mount with digital readout. Provides 0 to 40KVDC @ up to 12.5mA. Like new.  
**KAISER SYSTEMS, 40KVDC Supply.....\$895ea.**  
TREK-678, 0 to 30KVDC, high voltage, high speed "amplifier" provides high voltage output which follows a 0-10VDC control voltage with fast response and settling time. Rack size. Like new. **TREK-678, 30KV Supply/Amplifier.....\$995ea.**  
TREK-676, 20KVDC, high voltage, high speed "amplifier" provides high voltage output which follows a 0-10VDC control voltage with fast response and settling time. Rack size. Like new. **TREK-676, 20KV Supply/Amplifier.....\$895ea.**  
GLASSMAN 180KV Supply.....\$1495ea. Model: PS/WX20N50, Excellent condition. **GLASSMAN, 20KV Supply.....\$795ea.**  
DELL ELECTRONICS, model 2.5-10-1A, 0 to 2.5KVDC @ 10mA, provides negative output as supplied but can be modified for positive output. Excellent condition.  
**DELL-2.5-10-1A, 2.5KV Supply.....\$59ea.**

**HIGH VOLTAGE MULTIPLIER STACKS, 200,000 VOLTS, PLUS! From Farum, Wallis or Glassman Excellent condition.....\$195ea.**  
**SMOOTH AS SILK, Dual Axis, MOTORIZED LINEAR SLIDES, Provide a 9" x 4.3" work envelope.** Dual THK, LWL-12 series recirculating, ball bearing slides, one with a 6.1" long rail and the other with a 11.5" rail are mounted to each other via a cost, 0.2" thick, black anodized, aluminum 90° bracket. Slide motion as provided via an 8 foot per inch belt drive mounted to each rail and powered by independent stepper motors. The long axis uses a 2.2" diam. size 23, 1.8° per step, 5V @1amp, 4 wire stepper while the short axis uses a 1.8" sq., 1.8° per step, 4V @1amp, 4 wire stepper. Each full step of either motor provides approx. 0.025" travel of the slide. One optical end of travel sensor is attached to the short axis. As can be easily ascertained for use as two separate drives. Excellent condition. Very limited quantity. **Special, DUAL-LWL1.....\$99ea.**

**HAPPY HOLIDAYS!**

**RESOURCES UNLTD.**

VISA, MC, AMEX, DISCOVER, COD.  
ORDER: 800-410-4070 TECH: 603-668-2499  
FAX: 603-644-7825 E-MAIL unltd4u@m20.net  
300 BEDFORD STREET, MANCHESTER, NH 03101

**NEW, 2.4GHz VIDEO+STEREO AUDIO TRANSMITTER with SONY, CCM-PC5 COLOR CAMERA.**  
Originally sold for \$500! Now available for a fraction of that price. Great looking styling. Camera has a very stable, adjustable tilting base, front panel LED pwr. indicator and sensitive built in electret mic. providing excellent audio and video performance from one compact package. Simply connect camera to the completely self contained 2.4GHz transmitter. All cables supplied. You can transmit up to 700 feet clear line of sight (Companion matching receiver works with any TV or VCR internal patch antennas. Camera has adjustable focus 6mm lens. 1" to infinity, macro capable) Auto pwr. off when the privacy shutter is closed. Power is 7-13VDC (all pwr. adapters and cables included) 1/3" CCD, 330Lines res. 35% better than standard VHS! Can also be used to transmit VCR output to another TV for remote viewing.  
**SONY-ASTROVIEW COMBO, \$189ea. or 2/\$339**  
**2.4GHz TRANSMITTER & RECEIVER.....\$129 pair.**  
**SONY COLOR CAMERA with AUDIO.....\$69ea.**

**NEW! GM-7M, HI RES., 600 LINE, 7" MINI MONITOR perfect for rear view system or other DC power applications.**  
NEW GM-7M, 8&W video monitor. Can be operated from 11V to 32VDC. @ 1.5 Amps. These deluxe units feature: • Automatic rear sense line. Turns system on when vehicle is put into reverse • Automatic dimmer for night operation • adjustable brightness • A/V out for recording • glare reducing sun shield • built in speaker • reverse image selectable • Accepts up to two switch selectable NTSC video signals • Adjustable mounting bracket included. Size: 7.2" W x 6.8" H x 6.7" D.  
**For a complete rear view system, order our GM-7B waterproof camera with audio. This exclusive model features • an automatic protection shutter which closes over the lens of the camera to protect it from abuse when not being used • Heater built into camera housing for all weather operation • Up to two camera can be attached to one monitor • Cameras receive their power from the monitor. Camera specs: CCD, 380 Lines Res. 0.3 Lux Sens., AGC, Auto shutter speed, 130° FOV. Superior quality for demanding applications. **GM-7M, MONITOR.....\$199ea. GM-7B CCD CAMERA and GM-7M.....\$369set****

**\$5000 HI-TECH SURVEILLANCE SYSTEM, NOW 83% OFF!**  
THIS SUPER SYSTEM INCLUDES:  
• MOTORIZED, 6X ZOOM LENS  
• MOTORIZED, 360° PAN  
• MOTORIZED, TILT up to 90°  
• PHILIPS HIGH RES. 1/2" CCD-AMF  
• OPAQUE BLACK INNER DOME  
• CLEAR ACRYLIC OUTER DOME  
• ZOOM LENS CONTROLLER with A/I  
• PAN and TILT CONTROLLER

Walk into any major department store and you will see these fully integrated systems. Manufactured by Sensormatic, the same company who supplied the Atlanta Olympic. These are late models, new in the box systems. Virtually ready to use. All you need is power and cable. A quality Philips 1/2", 8&W CCD camera provides 450 lines resolution and 0.5 Lux sensitivity! Anodized aluminum construction. Camera plus Pan & Tilt are powered by external 24VAC via the included Pan & Tilt controller. Super 6X, 1/2" motorized, Zoom, Focus and iris lens provides the capability of "close up" inspections. Zoom lens controller with auto iris control included. Size of dome, 14" diam, includes mounting kit for drop ceiling installation. Sensormatic price \$5000ea.  
**COMPLETE SYSTEM SPECIAL.....\$849ea. or 2 for \$1599**

**6V@12AH SEALED, RECHARGEABLE, BATTERY**  
New Panasonic, LC86V12R. Tough to get at a discount. Very compact, two top mounted 1/4" faston connectors. Perfect for high drain projects. Size: 5.9" x 3.7" x 1.9"  
**2 for \$20, 10 for \$89**

**GIANT WEATHER BALLOONS,**  
Real military surplus. Black latex meteorological instrument balloons. 3 ft., 3/4 pound lift, or the monster >15ft. model with attached shock absorbing section and internal ball stopper at fill port 0.0035" thick. **Manufacturers individual packages. A rare find. Limited Quantity. Please note we recommend filling only to half max size as they are extremely fragile when fully inflated. Instructions included 3ft. diam. 2 / \$15, 15ft. diam. \$24ea. 3 / \$59**

**Brand new, Video Motion Sensor. Model VM10.** Attach to any standard video signal and you've got an electronic "watchman" diligently watching the entire scene. Or any adjustable sized area within the scene. Such as a doorway or even a drawer or cabinet. A state of the art security aid. The unit will close a contact when it senses a change. Use it to turn on a VCR or call the house. Auto or manual reset. Compact, ac powered. Adjustable sensitivity. Video loop through. **NEW, VM10.....\$189ea.**

**SEE IN TOTAL DARKNESS! New, WEATHER PROOF IR FLOODS, Three models cover up to 180 feet!**  
Model WPR-A: 48 powerful LEDs project a 3C deg. FOV beam up to 45 feet.  
Model WPR-B: With the same external package and dimensions as the A model providing over 250% more illumination, distance up to 120 feet! The B model utilizes a Quartz Halogen lamps with a 10' beam spread and a custom made bandpass filter of approx 840nm-1200nm.  
Model WPR-C: Provides illumination up to 180 feet! The C model utilizes a Quartz Halogen lamp with a 30° beam spread and a custom made bandpass filter of approx 840nm-1200nm. Features common to all 3 models include: CBS controlled automatic on at dusk off at dawn! 110VAC power. Rugged anodized aluminum, housing with adjustable mounting bracket for the type A & B. 4x2x3.6" and for the type C: 13.4" x 7.7" x 1.7". Weight for A or B is 3.5lbs. Weight for C is 10lbs. All commercially made and brand new.  
**WPR-A-15ft., \$169. WPR-B-120ft., \$229. WPR-C-180ft., \$359.**  
**All floods achieve excellent performance with the GM-410 shown on the previous page. Only \$149 with the purchase of an IR Flood!**

CIRCLE 246 ON FREE INFORMATION CARD

www.americanradiohistory.com

# PIC and ATMEL micros in Basic!

## New programmer Picstart Replacement with 40pin zif!

# Wow!

### PIC n Basic \$59.95

Program Pics in Basic! Pic n Basic compiler converts your BASIC program to files that can be used to program the Pic micro. Pic n Basic allows you to use true basic stamp I/O libraries on an ordinary Pic instead of expensive stamps. Pic n Basic is more powerful and straight forward than anything else like it.



PIC n Basic Pro \$199.95

### Stamp Replacement \$29.95

The Stamp replacement allows you to use an ordinary Pic 16F84 to replace the Basic Stamp II. Pin for Pin Compatible. 4x Times faster using Pic n Basic!



### PIC Easy Programmer \$39.95

The PIC Easy is a low cost Pic Programmer. It will program all the most popular Pic chips. See website for list of Pics. Software and instructions included.



### ISO Smart Card Programmer \$59.95

Now you can read & write to smart cards. Develop your own smart card security systems. Build smart cards using Pics and AVR's or you can adapt ready made smart cards. You can now explore the smart card world! Programmer will read and write to all ISO 7816 compliant cards.



### ATMEL AVR Basic Pro \$99.00

Program the Powerful ATMEL AVR's in Basic. The AVR's are 25X faster than Pics and now you can program them in Basic. With one AVR you can have up to 32 lines of I/O plus the AVR can handle direct RS-232 serial port with special built-in ports. See website for details on the AVR's.



### ATMEL AVR Prototyping Boards \$24.95

Get AVR projects up and running in a Flash! Houses the ATMEL AVR and all needed parts for operation plus a large prototyping area for your projects. Comes with a socketed ATMEL AVR AT90S8515!

Need a more powerful chip?

Try the ATMEL AVR

### PIC & AVR Pro Programmer \$99.00

The ALLPIC will program almost all Pics without optional adapters! Includes 40 pin zif Socket. Plus it will program Atmel AVR's. Free upgrades for New Chips! See website for list of chips. MLAB compatible. Direct Picstart replacement includes software and manual.



### Visa - MasterCard - American Express

Orders 1-800-773-6698

Outside the US 1-248-473-1182

Inquiries send email to sales@worldwyde.com

Visit us on the web at www.worldwyde.com

21365 Randall St. Farmington Hills, MI 48336

### Combo Deals

Pic n Basic and Pic Easy Programmer  
Combo #1.....\$89.95

Pic n Basic with Pic Easy Programmer and stamp replacement  
Combo #2.....\$109.95

ATMEL AVR Basic Pro and the ALLPIC & AVR Pro Programmer w/40 pin Zif  
Combo #3.....\$179.95

Both Pic and ATMEL Basic with ALLPIC & AVR Pro Programmer w/40 pin zif  
Combo #4.....\$229.95

Visit us on the Web for more combo packages and details

All products purchased from Worldwyde.com include free online tech support and updates when available. Mailed catalogs are the same as the website.

Demo Software available for download

# ALFA ELECTRONICS

## HIGH QUALITY TEST EQUIPMENT

Visit [www.alfaelectronics.com](http://www.alfaelectronics.com) for complete info

Call 1-800-526-2532 for Order and Free Catalog

DMM	LCR/COUNTER	FLUKE SPECIALTY
<p><b>DMM-89S</b> (\$179.00): true rms, AC/DC (V,A), <math>\Omega</math>, bar graph, freq, capac., dBm, logic, diode</p> <p><b>DMM-23T</b> (\$99.95): 4 1/2 digit, true rms, high resol. (10<math>\mu</math>V, 10nA, 10m<math>\Omega</math>), hFE, diode, contin.</p> <p><b>DMM-20</b> (\$74.95): AC/DC (V, A), Freq, cont., Capac, Induct., <math>\Omega</math>, hFE, diode, duty cycle</p> <p><b>DMM-122</b> (\$59.95): DC/AC(V,A), <math>\Omega</math>, hFE, diode, capacitance, freq, logic, continuity</p> <p><b>DMM-123</b> (\$44.95): DMM + capacitance, DC/AC(V,A), <math>\Omega</math>, hFE, diode, continuity</p> <p><b>DMM-10</b> (\$19.95): 3 1/2 digit, DC/AC V, <math>\Omega</math>, hFE, diode, signal output(+3V, -0.5Vsq., 50% duty)</p>	<p><b>CAP-15</b> (\$49.95): 3 1/2 digit, 0.1pF-20mF, 9 Ranges, 0.1pF resolution, zero adjustment</p> <p><b>LCR-24</b> (\$119.95): 0.1<math>\mu</math>H-200H, 0.1pF-2000<math>\mu</math>F, 0.01<math>\Omega</math>-20M<math>\Omega</math>, diode test. <i>New Model.</i></p> <p><b>LCR-131D</b> (\$219.95): autorange, 0.1<math>\mu</math>H-10kH, 0.1pF-10mF, 1m<math>\Omega</math>-10M<math>\Omega</math>, Q Factor, serial/parallel, 120Hz/1kHz testing mode.</p> <p><b>FC-1200</b> (\$129.95): 1.25GHz Handheld, 8 digits display, 10ppm accuracy, sensitivity 5mV (130-350MHz), 30mV (440MHz)</p>	<p>12B \$ 94.95</p> <p>70-III \$ 99.00</p> <p>73-III \$125.00</p> <p>75-III \$155.00</p> <p>77-III \$173.00</p> <p>79-III \$195.00</p> <p>87-III \$325.00</p> <p>92B-III \$1,445</p> <p>96B-II \$1,695</p> <p>99B-III \$2,095</p> <p>105B \$ 2,495</p> <p>123-III \$1,130</p> <p>863E \$ 555</p> <p>867B \$ 740</p> <p>• AC Current Probe \$34.95</p> <p>• DC/AC Current Probe \$79.95</p> <p>• Mini AC Clamp \$59.95</p> <p>• AC Clamp w/temp \$89.95</p> <p>• DC/AC Clamp \$109.95</p> <p>• Thermometer \$69.95-\$89.95</p> <p>• IR Thermometer \$189.95</p> <p>• Sound Level Meter \$169.95</p> <p>• Tachometer \$169.95-\$219.95</p> <p>• EMF Tester \$299.95</p> <p>• Pressure Meter \$299.95</p> <p>• Watt Meter \$129.95</p> <p>• High Voltgae Probe \$59.95</p> <p>• pH Meter \$79.95</p> <p>• Light Meter \$79.95-\$89.95</p>

Single Output DC Power Supplies	Triple Output	AUDIO/RF/FUNCT. GEN.
<ul style="list-style-type: none"> <li>Constant current, constant voltage mode</li> <li>Short Circuit and overload protected</li> </ul> <p><b>Analog Meters Display</b></p> <p>PS-303 (\$159.00) 30V/3A</p> <p>PS-305 (\$219.95) 30V/5A</p> <p>PS-8112 (\$399.95) 60V/5A</p> <p>PS-1610 (\$289.00) 16V/10A</p> <p>PC-3030 (\$499.95)</p> <p><b>Digital Volt, Analog Current</b></p> <p>PS-8200 (\$179.95) 30V/3A</p> <p>PS-8201 (\$239.95) 30V/5A</p> <p><b>Digital Volt &amp; Current Display</b></p> <p>PS-8300 (\$199.95) 30V/3A</p> <p>PS-8301 (\$259.95) 30V/5A</p>	<ul style="list-style-type: none"> <li>Independence or Tracking operation</li> <li>Parallel to double current output (PS-8102 &amp; PS-8103 only)</li> </ul> <p><b>Triple Output (Analog displays)</b></p> <p>PS-8102 (\$399.95) 30V/3A/30V/3A</p> <p>PS-8103 (\$489.95) 30V/5A/30V/5A</p> <p><b>Digital Displays</b></p> <p>PS-8202 (\$499.95) 30V/3A/30V/3A</p> <p>PS-8203 (\$549.95) 30V/5A/30V/5A</p>	<p><b>RF Generator • SG-4160</b> (\$124.95) 100kHz-150MHz sinewaves in 8 ranges</p> <p>• <b>SG-4162AD</b> (\$229.95) with 6 digit counter</p> <p><b>Audio Generator • AG-2601</b> (\$124.95) 10Hz-1MHz, 0.8Vpp sine, 0-10Vpp squarewave</p> <p>• <b>AG-2603AD</b> (\$229.95) with 6 digit counter</p> <p><b>Function Generator • FG-2100A</b> (\$154.95) 0.2Hz-2MHz, 5mV-20Vpp</p> <p>• <b>FG-2103</b> (\$329.95) Sweep 0.5Hz-5MHz</p>

DC POWER SUPPLIES					FUNCTION GENERATOR	BENCHTOP DMM
20 MHz Scope	Cursor Readout	Triple Output	Single Output	Programmable		
<p><b>OS-620</b> \$324.95</p> <ul style="list-style-type: none"> <li>Most economical scope</li> <li>Dual CH/X-Y operation</li> <li>1 mV/div sensitivity</li> <li>Z-axis input, CH1 output</li> <li>TV syn, ALT trigger</li> <li>2 probes (x1, x10)</li> </ul>	<p><b>OS-626G</b> \$599.95</p> <ul style="list-style-type: none"> <li>Readout &amp; Cursor meas</li> <li>Dual CH / Delay sweep</li> <li>Built-in delay line</li> <li>ALT trigger, Hold-Off</li> <li>Z-axis input, CH1 output</li> <li>2 probes (x1, x10)</li> </ul>	<ul style="list-style-type: none"> <li>2 variable out 0-30V, 0-3A</li> <li>One fixed 5V, 3A output</li> <li>Auto track, serial, parallel</li> <li>Const. volt, current mode</li> <li>4 analog or 2 digital display</li> </ul> <p>PC-3030D (\$549.95) digital</p>	<ul style="list-style-type: none"> <li>Const voltage, current mode</li> <li>Voltage regulation <math>\leq 0.01\%</math></li> <li>Current regulation <math>\leq 0.2\%</math></li> </ul> <p>PS-1830 (\$198.95) 18V/3A</p> <p>PS-1850 (\$214.95) 18V/5A</p> <p>PS-1830D (\$214.95) 18V/3A</p> <p>PS-1850D (\$244.95) 18V/5A</p>	<ul style="list-style-type: none"> <li>Auto serial/parall. (PPT ser)</li> <li>Auto track (PPT series), IEEE-488.2 and SCPI compatible command set</li> </ul> <p>PPS-1860G (\$1,149.95) 18V/6A</p> <p>PPS-3635G (\$1,149.95) 36V/5A</p> <p>PPT-1830G (\$1,499.95) 18V/3A</p> <p>PPT-3615G (\$1,499.95) 36V/1.5A</p>	<p><b>FG-8020G</b> (\$209.95)</p> <ul style="list-style-type: none"> <li>0.02Hz-2MHz w/counter</li> <li>Sine/Sqr/Tri/pulse/Ramp</li> </ul> <p><b>FG-8020G</b> (\$209.95)</p> <ul style="list-style-type: none"> <li>0.02Hz-2MHz w/counter</li> </ul> <p><b>FG-8050</b> (\$449.95) Sweep</p> <ul style="list-style-type: none"> <li>0.05Hz-5MHz w/counter</li> <li>INT/EXT AM/FM mod</li> </ul>	<p><b>DM-8034</b> (\$179.95) 3 1/2 dgt</p> <ul style="list-style-type: none"> <li>AC/DC(V,A), C, <math>\Omega</math>, diode</li> </ul> <p><b>DM-8040</b> (\$339.95) 3 1/2 dgt</p> <ul style="list-style-type: none"> <li>ACV to 50kHz, true rms</li> </ul> <p><b>DM-8055G</b> (\$889.95) 5 1/2 dgt</p> <ul style="list-style-type: none"> <li>0.006% accuracy, GPIB</li> <li>dBm, auto, REL, min/max</li> </ul>

ALFA ELECTRONICS  
P.O. BOX 8089  
PRINCETON, NJ 08543-8089

TEL: (800)526-2532 / (609) 897-1135  
FAX: 609-897-0206  
E-mail: sales@alfaelectronics.com

Call / Write / Fax / Email for FREE CATALOG  
Visa, MC, AMEX, COD, PO Accepted. OEM Welcome.  
1 Year Warranty (2 Years for GW/Instek)

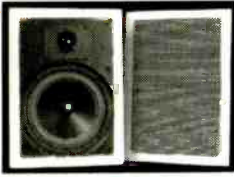
CIRCLE 255 ON FREE INFORMATION CARD

# PARTS EXPRESS

ELECTRONICS & MORE

## 6-1/2" Two Way System

This is our most popular in-wall. You won't believe how good these really sound. Big enough to produce great home theatre sound and still fit everyone's budget. Put a pair in every room of your house. Great for front or rear speakers in your surround system.



The 6-1/2" polypropylene woofer and 1" textile dome tweeter were specially designed with home theatre in mind. The crossover network utilizes a mylar capacitor for crisp clean highs. 3 piece design make installation in new or existing walls a snap. **Specifications:** 6-1/2" polypropylene cone woofer with poly foam surround 1" textile dome tweeter/midrange 8 ohm impedance 3 component L/C crossover network Frequency response: 50-20,000 Hz Power handling capability: 60 watts RMS/85 watts max Sensitivity: 89 dB 1W/1m Overall dimensions: 8-1/2" W x 12" L x 3-1/2" D Hole size: 7-1/4" x 10-3/4" Fits into standard 2" x 4" wall Net weight: 12 lbs. per pair.

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

## Satellite Speaker Stands

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



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

## 5 Function Remote

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



#180-806 ..... \$29.95 (1-3) \$26.35 (4-UP)

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

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



#350-052 ..... 75¢ (1-9) 59¢ (10-UP)

## Gold Plated A/V Cables

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



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

If you haven't received a copy of our current 260 page catalog ... have one added to your order or give us a call and we will send one out to you immediately.



## 6-1/2" Round Coaxial System

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



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

## 3 Amp Power Supply

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



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

## DMM and LCR Meter

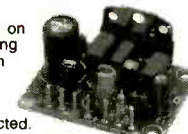
In addition to functions found in regular DMM's, this meter can also measure inductance in 5 ranges (4mH, 40mH, 400mH, 4H, 40H), capacitance in 5 ranges (4nF, 40nF, 400nF, 4uF, 40uF), frequency in 4 ranges (4KHz, 40KHz, 400KHz, 4MHz), TTL logic test, diode test and transistor hFE test. 5 AC/DC ranges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



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

## 2.5W Mini Audio Amplifier

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



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

## Weller WLC100 Soldering Station

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



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

## "44" Solder

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



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

## Pro Wick

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



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

725 Pleasant Valley Dr., Springboro, OH 45066-1158  
Phone: 513-743-3000 Fax: 513-743-1677  
E-mail: sales@parts-express.com

LARGEST SELECTION OF SPEAKER DRIVERS IN THE COUNTRY!

VISIT OUR WEB SITE AT [www.parts-express.com](http://www.parts-express.com)

OR CALL TOLL FREE 1-800-338-0531

# 386 MINI-PC \$83

1K PRICE  
EVAL \$295  
8088 \$27



- includes:
- 5 Serial, 3 Parallel (32bit max)
  - Up to 8 meg ROM (27C080)
  - 32k RAM exp. to 64Mbyte
  - Battery backed RT Clock
  - LCD and Keyboard ports
  - IRQ x15, DMA x2, TIMER x4
  - On-board LED display
  - Industry Standard PC Bus

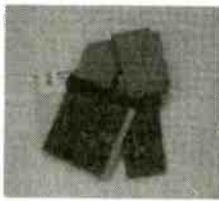
Perfect when a full-size PC is too large, expensive, or power hungry. A fully functional single board computer, needs only program and power source. Runs DOS / WINDOWS. Use Turbo C, BASIC, MASM. All utilities to do this included.

## A to D D to A CONVERTERS

For PC or SBC  
8,12,16 bit resolution  
up to 24 channels  
starting at \$21 OEM (1k)  
eval kit \$75

## \$95 UNIVERSAL PROGRAMMER

FLASH, EEPROM, NVRAM, EPROM up to 8 meg (27C64-080). Adapters for micros, PLCC, etc. Parallel port version for notebook. FAST AND EASY TO USE.



LOW COST... LOW POWER...

# LOW RISC!

QTY 1K PRICE  
\$1.99  
EVAL KIT 7.00

LOWER COST, FASTER, EASIER TO PROGRAM SINGLE CHIP COMPUTER

COMPARE:	16C54	MV1200	
OEM (1K) PRICE	\$2.57	\$1.99	
RS232 PROGRAM DOWNLOAD	NO	YES	PINOUT:
SINGLE CHIP OPERATION	NO	YES	RESET 1 20 VCC
BUILT-IN BASIC	NO	YES	PD0 2 19 PB7
EEPROM DATA MEMORY	NONE	64	PD1 3 18 PB6
PROGRAM MEMORY	768 OTP	1K FLASH	XOUT 4 17 PB5
MATH REGISTERS	1	32	XIN 5 16 PB4
MAX INSTRUCTIONS / SEC	5M	20M	PD2/INT 6 15 PB3
MAX COUNTER BITS	16	18	PD3 7 14 PB2
INPUT / OUTPUT BITS	12	15	PD4/TMR 8 13 PB1/AD1
A TO D COMPARATOR	NO	YES	PD5 9 12 PB0/AD0
HARDWARE INTERRUPTS	NONE	3	GND 10 11 PD6

- LONG WORD INSTRUCTION - FRIENDLY SYMMETRIC ARCHITECTURE -



## PC SOLID STATE DISK

\$21 OEM (1k) eval kit 75.00  
FLASH / RAM / EPROM  
256K-16M PCMCIA/DIPS

No More Hangups...  
**PC WATCHDOG!**  
Reboots PC OEM \$21 EVAL \$75

**VGA LCD** 640x480 controller for PC or SBC  
\$27 oem \$95 eval  
combo LCD/CRT version available



visit our web site: [www.mvsweb.com](http://www.mvsweb.com)

MVS BOX 850  
MERRIMACK, NH 03054  
(508) 792-9507



5yr Limited Warranty  
Free Shipping  
Hrs: Mon-Fri 10-6 EST

# RF Data Modules

### AM Transmitter



- Sub Miniature module
- SAW Controlled
- No adjustable components
- Low current - 2.5mA
- Supply 2.5-12Vdc
- 418MHz or 433MHz
- Range up to 300ft
- CMOS/TTL data input
- 7 x 11 x 4mm!

AM-TX1-xxx... \$12.60

### AM Receiver



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

AM-HRR6-xxx... \$16.33

### FM Transceiver



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

BiM-xxx-F ..... \$87.36

### RS232 Transceiver



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

CYPHERNET .... \$139.30

### AM Transmitter



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

AM-RT5-xxx .... \$12.10



ABACOM  
TECHNOLOGIES

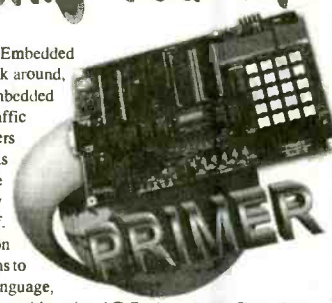


Free Catalog

tel: (416)236 3858  
fax: (416)236 8866  
[www.abacom-tech.com](http://www.abacom-tech.com)  
MasterCard / VISA

# World Passing You By?

Are you interested in Microprocessors & Embedded Control Systems? If not you should be! Look around, just about everything these days has an embedded microprocessor in it. TVs, cars, radios, traffic lights & even toys have embedded computers controlling their actions. The Primer Trainer is the tool that can not only teach you how these devices operate but give you the opportunity to program these types of systems yourself. Examples & exercises in the Self Instruction manual take you from writing simple programs to controlling motors. Start out in Machine language, then move on to Assembler, & then continue on with optional C, Basic, or Forth Compilers. So don't be left behind; this is information you need to know!



- Measuring Temperature
- Using a Photocell to Detect Light Levels
- Making a Waveform Generator
- Constructing a Capacitance Meter
- Motor Speed Control Using Back EMF
- Interfacing and Controlling Stepper Motors
- Scanning Keypads and Writing to LCD/LED Displays
- Bus Interfacing an 8255 PPI
- Using the Primer as an EPROM Programmer
- DTMF Autodialer & Remote Controller (New!)

The PRIMER is only \$119.95 in kit form. The PRIMER Assembled & Tested is \$169.95. This trainer can be used stand alone via the keypad and display or connected to a PC with the optional upgrade (\$49.95). The Upgrade includes: an RS232 serial port & cable, 32K of battery backed RAM, & Assembler/Terminal software. Please add \$5.00 for shipping within the U.S. Picture shown with upgrade option and optional heavy-duty keypad (\$29.95) installed. Satisfaction guaranteed.

# EMAC, inc.

11 EMAC WAY, CARBONDALE, IL 62901  
618-529-4525 Fax 457-0110 BBS 529-5708  
World Wide Web: <http://www.emacinc.com>

1985 - 1998  
OVER  
12  
YEARS  
OF SERVICE

# PIC'n Books

LEARN ABOUT PIC MICROCONTROLLERS



See Table Of Contents: <http://www.sq-1.com>  
Secure Online Ordering is Available

PIC is a trademark of Microchip Technology Inc.

**SQUARE 1 ELECTRONICS**

Voice (707) 279-8881 Fax (707) 279-8883

<http://www.sq-1.com>



**HEAR  
WHAT  
YOU'VE  
BEEN  
MISSING!**

**"I could not believe my ears!"**

AUDIO Magazine

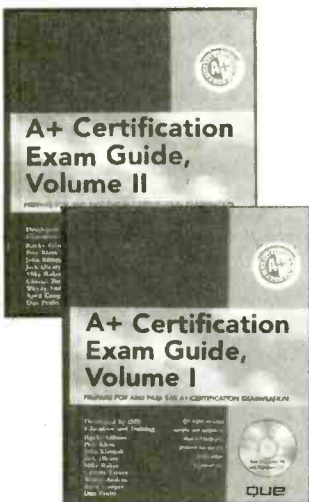


Easily attaches to your EXISTING stereo receiver. Surround your home in pure cinema sound! **THEATER 2000** by Spectrum Research introduces NEW award-winning technology that creates incredible Theater Sound for your 2- or 5-speaker system. This compact unit instantly transforms your TV, VCR, CD, DVD, Satellite or Video games into Sound All Around. Introductory price of only **\$159.95** before retail store release.

**30-DAY MONEY BACK GUARANTEE.**

[www.TheaterSound.com](http://www.TheaterSound.com) or call Toll Free (877) 857-3484

## They Wrote The Book



REGULAR PRICE: \$199<sup>95</sup>

**SPECIAL**  
**\$129<sup>95</sup>**

*The A+ Certification Exam Guide was developed by IBM, the company which set the standard for Personal Computing. It consists of two large volumes and a CD-ROM disk.*

*If your goal is to become a certified Computer Service Technician, the Guide is the only reference you should need to successfully prepare for the certifying exam. Over 2,000 pages, it is thorough, yet not cumbersome to use. And once you become a certified Technician, it is still useful as a reference.*

*The A+ Certification Exam Guide was written by training-education specialists with the experience necessary to guide you through the information that is key to passing the exam. Difficult concepts are clearly explained, and topics and skills stressed on the exam are pointed out. In addition, the volumes include helpful graphics, diagrams, tables and charts.*

*The CD-ROM disk, which is part of the two volume set, not only contains the entire contents of both volumes, but also, hundreds of very useful sample test questions. There are also Self-Assessment sections at the end of each chapter in the Guide.*

*This 2-volume set is also a tremendous reference work for anybody who wants to know how PCs work or what to do when they don't work.*

*The A+ Certification Exam is sponsored by CompTIA.*

**This special price won't last long!!!**

**800-854-7393**

WEBSITE: [www.graymarkint.com](http://www.graymarkint.com)

**Graymark®**



# PLUG IN AND MEASURE

## NEW

500mVolt - 400Volt  
0 - 20MHz  
8 bit



STORAGE OSCILLOSCOPE  
SPECTRUM ANALYZER  
VOLTMETER  
TRANSIENT RECORDER

TiePie introduces the HANDYPROBE model HP 2  
A powerful 8 bit, 20MHz virtual measuring instrument for the PC

Convince yourself and download the demo software from our web page: <http://www.tiepie.nl>

When you have questions and / or remarks, contact us via e-mail: [support@tiepie.nl](mailto:support@tiepie.nl). The HANDYPROBE HP2 is delivered with a user manual, Windows and DOS software.

The price of the HANDYPROBE HP2 starts at USD 199 excl. VAT.

US dealers:

Conway Engineering Inc.: Tel 510-568-4028; Fax 510-568-1397; [www.conway-engineering.com](http://www.conway-engineering.com)

Feedback Incorporated: Tel 800-526-8783; Fax 919-644-6470; [www.fb.com](http://www.fb.com)

Outsite US:

TiePie engineering, P.O. BOX 290, 8600 AG SNEEK, The Netherlands.

Tel: +31 515 415 416 Fax: +31 515 418 819 Web: [www.tiepie.nl](http://www.tiepie.nl)

CIRCLE 217 ON FREE INFORMATION CARD

## MEMBRANE SWITCHES



**Stock Layouts!**

**Eliminates tooling cost...**

**\*\*From 2 to 128 keys\*\***

**Industrial/Commercial/Prototyping**

Popular types are available as complete kits, with bezel, connector & overlay!

4 key DSK-4 kit \$9.60

12 key DSK-12 kit \$13.87

many more layouts...

**Optional Stainless Steel "Clickdomes".**

**Sil-Walker**

(805) 491-0654

FAX (805) 491-2212

P.O. Box 3220

Camarillo, CA 93011-3220

[silwkr@vcnet.com](mailto:silwkr@vcnet.com)

[www.vcnet.com/silwkr/](http://www.vcnet.com/silwkr/)

MASTERCARD/VISA

ABC ELECTRONICS 315 7TH AVE N. MPLS. MN. 55401  
(612)332-2378 FAX (612)332-8481 E-MAILSURP1@VISI.COM  
WE BUY TEST EQUIPMENT AND COMPONENTS.  
VISIT US ON THE WEB AT WWW.ABCTEST.COM

HP 51501A 100MHZ DIGITIZING SCOPE	\$1300.00	HP 4935A TRANS. IMPAIRMENT TEST SET	\$900.00
HP 54201D 300MHZ DIGITIZING SCOPE	\$1000.00	HP 5006A SIGNATURE ANALYZER	\$150.00
HP 54201A 300MHZ DIGITIZING SCOPE	\$1000.00	HP 86602B 1MHZ-1300MHZ RF PLUG	\$460.00
HP 54200A 30MHZ SCOPE/WAVEFORM ANALYZER	\$700.00	EIP 575 MICROWAVE COUNTER	\$1500.00
HP 3312A 13MHZ FUNCTION GENERATOR	\$250.00	FLUKE 95 50MHZ SCOPEMETER	\$550.00
HP 5370A 100MHZ U.T.L. COUNTER	\$100.00	LECROY 7200 100MHZ O-SCOPE	\$1000.00
HP 3386C LEVEL METER	\$750.00	TEK 475 200MHZ O-SCOPE	\$500.00
HP 436A POWER METER W/O SENSOR & CABLE	\$500.00	TEK 4e5 100MHZ O-SCOPE	\$400.00
HP 8550B SWEEP OSCILLATOR MAINFRAME	\$2000.00	TEK 496P 1KHZ-1.8GHZ SPEC. ANALYZER	\$3500.00
HP 3137A 3 SDIGIT SYSTEM VOLT METER	\$250.00	TEK 1240 LOGIC ANALYZER	\$750.00
HP 3155A DIGITAL MULTIMETER	\$250.00	TEK 1DS320 100MHZ DIGITAL O-SCOPE	\$1400.00
HP 3156A DIGITAL MULTIMETER	\$400.00	TEK 11401A 500MHZ PROG O-SCOPE FRAME	\$750.00
HP 3336C SYNTHESIZER LEVEL GENERATOR	\$800.00	TEK 7854 400MHZ OSCILLOSCOPE FRAME	\$500.00
HP 3325A SYNTHESIZER FUNCTION GENERATOR	\$1000.00	TEK 7904 400MHZ OSCILLOSCOPE FRAME	\$250.00
HP 5335A 200MHZ COUNTER	\$600.00	TEK 7A26 200MHZ VERTICAL PLUG	\$75.00
HP 8165A PROGR. GAMMABLE SIGNAL SOURCE	\$1100.00	TEK 7A21 100MHZ VERTICAL PLUG	\$150.00
HP 8558B 181 100K-1500MHZ SPECTRUM ANALYZER	\$1000.00	TEK 7B80 400MHZ TIME BASE	\$75.00
HP 8559B 183 10MHZ-21GHZ SPECTRUM ANALYZER	\$3000.00	TEK 7B92A 500MHZ DUAL TIME BASE	\$125.00
HP 1710A 100MHZ OSCILL. SCOPE	\$250.00	TEK 7512 SAMPLING PLUG	\$250.00
HP 6034A 60VDC-10A POWER SUPPLY	\$750.00	TEK 7L14 10KHZ-1.8GHZ SPEC. ANALYZER	\$1000.00
HP 6020B 40VDC-50A POWER SUPPLY	\$800.00	TEK AM503 CURRENT PROBE AMPLIFIER	\$250.00
HP 6553A 40VDC-12.5A POWER SUPPLY OPT. J01	\$1200.00	WAVETEK 145 20MHZ PULSE/FUNCTION GEN	\$400.00
HP 6632A 20VDC-5A POWER SUPPLY	\$500.00	WAVETEK 182A 4MHZ FUNCTION GEN	\$150.00
HP 6613A 45VDC-1.3A POWER SUPPLY OPT. J03	\$750.00	WAVETEK 955 7.5-12.1GHZ MICROSURGE	\$1100.00

## BRAND DIGITAL POWER METER



Measures overall power consumption and cost of operation

Make informed decisions regarding:

- system sizing,
- appliance selection and replacement,
- the use of equipment in standby mode.

Brand Electronics manufactures digital power meters that are easy to use, reliable, accurate and affordable

Model 4-1850 .....	\$149.95	*Price includes domestic shipping and handling
Model 20-1850 .....	\$249.95	**CT = Computer Interfacing includes RS-232 interface, cable and software
Model 20-1850CI .....	\$299.95	Maine residents add 5.5% sales tax.
Model 21-1850CI .....	\$349.95	

Model 4-1850 displays: 117 VAC circuit loads up to 1850 watts

Watts, KW-HRS, User Cost, Avg Monthly Cost

Model 20-1850 and 20-1850CI displays:

Watt, KW-HRS, User Cost, Avg. Monthly Cost

Amps, Volts, Power Factor, Vars, V-A, Peak Watts

Model 21-1850CI is a data logging unit. It has Model 20

capability plus on board memory to accumulate data

over prolonged periods for download to computer.

Brand Electronics ships customized units on a routine basis. We

welcome an opportunity to discuss your power measurement

applications; AC or DC, any voltage, current, or plug configura-

tion. Remote panel mounting and CT capability optional.

Call today! To order, call toll free 24 hrs.

1-888-433-6600

<http://www.brandelectronics.com>

**Fantastic DMM Offer!**

Don't let this price fool you. This meter is a digital multimeter designed for engineers and hobbyists. Equipped with 5 functions and 19 ranges. Each test position is quickly and easily selected with a simple turn of the FUNCTION/RANGE selector rotary switch. Rubber Boot Included!  
 Display: 3-1/2 Digit LCD, 21mm Figure Height with Automatic Polarity  
 Overrange Indication: 3 Least Significant Digits Blank  
 Temperature for Guaranteed Accuracy: 23°C ±5°C RH<75%  
 Temperature Ranges:  
 Operating: 0°C to 40°C (32°F to 104°F)  
 Storage: -10°C to 50°C (14°F to 122°F)  
 Power: 9V Alkaline or Carbon-Zinc Battery (NEDA 1604)  
 Low Battery Indication: BAT on Left of LCD Display  
 Dimensions: 198mm(L) x 87mm(W) x 33mm thick  
 Net Weight 400g



**ONLY \$19**

#9300G

Get All the Specs From Our Web Site

**Auto-Temp Solder Station with Ceramic Element**

• With Ceramic Heating Element for More Accurate Temp Adjustment  
 • 3 Conductor Grounded Power Cord  
 • 250°C-480°C (470°F-900°F)  
 • Fast Heating Feature



SR-976

ONLY \$39

For More Info See www.web-tronics.com

CTRL - D to bookmark this site

**www.web-tronics.com**  
 Don't forget the dash  
**Circuit Specialists, Inc.**  
 In Business Since 1971

- Easy to Navigate
- Includes a Search Engine
- That Really Works
- New Items Added Constantly

**2GHz RF Field Strength Analyzer**

• Frequency Range: 100KHz to 2,060MHz  
 • Narrow Band FM (NFM), Wide Band FM (WFM), AM and Single Side Band (SSB) Modulated Signals May Be Measured  
 • PLL Tuning System for Precise Frequency Measurement and Tuning  
 • LED Backlight LCD (192x192 dots)  
 • Built-In Frequency Counter  
 • Hand-Held and Battery Operated  
 • All Functions are Menu Selected  
 • RS232C for PC Interface and Printer

**ONLY \$1589**



#3201

See the web site for details

**Removable Hard Drive Rack**

For IDE/Ultra DMA Hard Drives  
 We Sold Over 14,000 in 1998!  
 This product can be used with any 3-1/2 IDE hard drive up to 1" high. It includes an electronic keylock for safe removal and insertion. Made of ABS 707 fireproof plastic. Use this product to protect sensitive hard drive data, take your hard drive between work and home or even set up different users with their own hard drives that they physically insert every time they use a PC. Other models available from C.S.I. include RH10 series and RH20 series. Models are interchangeable within the same interface design (IDE or SCSI). Other Models are Available. See www.web-tronics.com under "hard drive and accessories" for more details and pictures.

**ONLY \$1495**  
any qty.



#RH-10C-IDE

**Removable Hard Drive Rack with Auto Door And Cooling Fan**

• Auto door on the outer frame  
 • ABS material of outer frame, High efficiency cooling fan  
 • Worldwide patent pulling function handle  
 • CE Approved  
 • Coating iron bottom cover  
 • For IDE interface  
 • For 1" high 3.5" HDD  
 • Not compatible with our RH10 & RH20 series. Compatible with our RH17-IDE model.

**ONLY \$1895**  
any qty.



#MR-27

Details at www.web-tronics.com

**CCD B&W Board Cameras**

• ASIC CCD Area Image Sensor  
 • Extremely Low Power Consumption  
 • 0.5 Lux Min Illumination  
 • Built-In Electronic Auto Iris for Auto Light Compensation

**VM1030PA-B**  
 30mmx30mmx25mm  
 Pinhole lens with audio, 12V  
**\$49.00** any qty.

**VMCB21**  
 44mmx38.5mmx28mm  
 with 6 infra-red LEDs, 12V  
**\$49.00** any qty.

**VM1030A**  
 30mmx30mmx26mm  
 Standard lens with audio, 12V  
**\$49.00** any qty.

**VM1035A**  
 42mmx42mmx25mm  
 Standard lens with audio, 12V with back light compensation  
**\$59.00** any qty.

**VM1036A**  
 32mmx32mmx25mm  
 Standard lens with audio, 12V, reverse mirror image feature  
**\$59.00** any qty.

**COLOR CCD Mini Board Cameras**

• Low Power Consumption  
 • 1 Lux Illumination  
 • Built-In Electronic Auto Iris for Auto Light Compensation  
 • Internal Synchronization  
 • 12 Volts  
 • 400 TV Lines

**VM3010PA**  
 33mmx33mmx18mm  
 Pinhole lens with audio  
**\$129.00** any qty.

**VM3011-A**  
 45mmx40mmx24mm  
 Standard lens with audio, single board  
**\$99.00** any qty.

**VM3010-A**  
 33mmx33mmx22mm  
 Standard lens with audio  
**\$129.00** any qty.

Detailed Specs on the Web

**Bullet CCD Cameras B&W and Color**

• Smart Rugged Metal Housing  
 • Extremely Low Power Consumption  
 • 12 Volt  
 • CCD Area Image Sensor for Long Camera Life  
 • Built-In Electronic Auto Iris for Auto Light Compensation  
 • No Blooming, No Burning  
 • 0.1 Min Lux Illumination (B&W), 1 Lux Min Lux Illumination (color)

**VMBLT3025W**  
 Digital Color, Weatherproof  
 20mm(D)x83mm(L)  
**\$189.00** any qty.

**VMBLT1020W**  
 B&W Weatherproof  
 21mm(D)x58.5mm(L)  
**\$79.00** any qty.

**VMBLT1020A**  
 B&W with audio  
 21mm(D)x55mm(L)  
**\$69.00** any qty.

Detailed Specs on the Web

**Protek Series 6500 Deluxe**

20MHz/40MHz/60MHz/100MHz Dual-Trace Oscilloscopes

- Alternate Trigger
- Internal Sync Separator Circuit
- Alt-Mag Sweep
- Delay Sweep (6510)

**Amazing Oscilloscope Offers**

Asia's currencies are devalued against U.S. dollars. Take advantage of GREAT prices while they last!

**#6502 - 20MHz \$289**

**#6504 - 40MHz \$569**

**#6506 - 60MHz \$689**

**#6510 - 100MHz \$799**

For More Information See www.web-tronics.com

**Mini CCDs (B/W & Color)**

Sensational NEW Design for Small Observation Cameras. Smaller and Better!

• Ultra Miniature Design  
 • Black & White Versions Only 25mm x 25mm  
 • Color Versions Only 32mm x 32mm  
 • Available in Standard Lens or Pinhole Lens  
 • All Include Audio  
 • All Include Pre-Wired Cable Harness for Audio, Video & Power  
 • 12V Regulated Power Supply Required (120mA typical power consumption)  
 • 0.1 LUX Rating (B/W), 1 LUX (color)  
 • CCD Area Image Sensor for Long Camera Life  
 • Back Light Compensation Circuit  
 • Built-In Electronic Auto Iris Lens

**VMCW-H11A**  
 32mmx32mmx30mm  
 Color CCD with standard lens, pre-wired cabling for video/audio, 12V DC Power Input  
**\$149.00 \$139.00** 5 or more

**VMCW-H12A**  
 32mmx32mmx19mm  
 Color CCD with pinhole lens, pre-wired cabling for video/audio, 12V DC Power Input  
**\$149.00 \$139.00** 5 or more

Detailed Specs on the Web

**VMPS-718A**  
 25mmx25mmx30mm  
 B/W CCD with standard lens, pre-wired cabling for video/audio, 12V DC Power Input  
**\$69.00 \$59.00** 5 or more

**VMPS-250A**  
 25mmx35mmx15mm  
 B/W CCD with pinhole lens, pre-wired cabling for video/audio, 12V DC Power Input  
**\$69.00 \$59.00** 5 or more

**Our Most Sophisticated DMM**

We Sold Over 700 Last Year! with RS-232 Interface & Software, 3-3/4 Digit, 4000 Count Auto-Ranging with Analog Bargraph

- True RMS Mode
- 10MHz Frequency Counter
- Time Mode with Alarm, Clock, and Stop Watch
- Dual Display
- 10 Location Memory
- Min, Max, Avg and Relative Mode
- Decibel Measurement
- Cap and Ind. Measurement
- Temperature Mode (CF)
- K Type Temperature Probe Included
- Pulse Signal for Logic & Audible Test
- Continuity/Diode Test
- Logic Test
- Auto Power OFF/Keep ON Mode
- Fused 20A Input with Warning Beeper
- Back Light
- Data Hold/Run Mode
- Safety Design UL1244 & VDE0411
- Protective Holder
- Silicon Test Leads

**NOW ONLY \$129**  
 Reg. \$169

More Details on our Web Site

**PROTEK 506**

These deluxe HC Protek oscilloscopes provide the features and accuracy that serious technicians and engineers need at prices well below what you may have expected. These dual-trace, dual-channel scopes have Alt-Mag sweeps and provide simultaneous display of normal and magnified traces. An internal sync separator circuit provides stable triggering of video signals, TV-H (TV line synchronizing feature) and TV-V (TV frame synchronizing frequency) are automatically switched by the Time/Div front-panel control. The user can view parallax-free waveform measurements on the large 6" rectangular CRT that includes an illuminated internal 8x10 Div graticule.

Part No.	6510	6506	6504	6502
Bandwidth	100MHz	60MHz	40MHz	20MHz
Vert. Sensitivity	1mV/Div to 5V/Div	1mV/Div to 5V/Div	1mV/Div to 5V/Div	1mV/Div to 5V/Div
Max Sweep Rate	2NS/Div to 0.2S/Div	0.1S/Div to 0.2S/Div	0.1S/Div to 0.2S/Div	0.2S/Div to 0.5S/Div
Delay Sweep	YES	ALT-MAG	ALT-MAG	ALT-MAG
Vert. Mode Trig.	YES	YES	YES	YES
Cursor Readout	NO	NO	NO	NO
CRT Volts	12KV	10KV	10KV	9KV

**3000 Series Digital R/O Bench Power Supplies**

Low Cost Single Output High Performance Triple Output  
 High stability digital read-out bench power supplies featuring constant voltage and current outputs. Short-circuit protection and current limiting protection is provided. The dual output versions can be used in both serial voltage and parallel current configurations to double maximum outputs. Highly accurate LED accuracy and stable line regulation make the 3000 series the perfect choice for lab and educational use.

Line Regulation: 2x10<sup>-4</sup> +1ma  
 LED Accuracy: Voltage ±1% +2 digits  
 Current ±1.5% +2 digits

Wave Line Noise: ≤1mVrms  
 Dimensions: 291mm x 158mm x 136mm (CS13003 & CS13010)  
 365mm x 265mm x 164mm (CS13003-3 & 3005-53)

**AS LOW AS \$89**

CS13003: 0-30V0-3amp Digital R/O Bench PS, 1x10<sup>-4</sup>+5mV Load Regulation \$99.00 \$159.00  
 CS13010: 0-30V0-10amp Digital R/O Bench PS, 1x10<sup>-4</sup>+30mV Load Regulation \$149.00 \$139.00  
 CS13003-3: Triple Output 2x(0-30V0-3amp)+5V, 3amp Fixed, 1x10<sup>-4</sup>+5mV Load Regulation \$239.00 \$129.00  
 CS13005-3: Triple Output, 2x(0-30V0-5amp) +5V, 3amp Fixed, 1x10<sup>-4</sup>+25mV Load Regulation \$269.00 \$129.00

# SURVEILLANCE

**COUNTERSURVEILLANCE  
Electronic Devices**

*Purchase your Video cameras from one of the largest importers in the U.S.*

- **NEW Waterproof cameras** now available
- **Spy Pinhole Cameras \$99<sup>00</sup>**
- **Wireless Video • Voice Changer**
- **Micro Recorders • Bug and Phone Tap Detectors**
- **Locksmithing • Phone Call Register • Shotgun Mics**
- **Realtime Telephone Recording Systems:**  
8 hour \$99<sup>00</sup>, 12 hour \$139<sup>00</sup>, 15 hour \$149<sup>00</sup>
- **GPS Vehicle Tracking System (nationwide)**
- **And much more—We will not be undrsold**

**Catalog \$5<sup>00</sup>**

[www.spyoutlet.com](http://www.spyoutlet.com)

## SPY OUTLET

P.O. Box 337, Buffalo NY 14226  
(716) 695-8660 / fax (716) 695-7380

**BEST DEALER PRICING!**

# CABLE DIRECT

CONVERTERS • FILTERS  
DESCRAMBLERS

IMPROVE YOUR IMAGE WITH  
**VIDEO STABILIZERS**

**FREE  
CABLE TV  
CATALOG!**

**100%  
MONEY BACK  
GUARANTEE!**

**30 DAY  
FREE  
TRIAL!**

Now you can tune-in your favorite  
cable TV programming  
and **SAVE \$100'S -  
EVEN \$1000'S** on premium  
**CABLE TV EQUIPMENT.**



## MODERN ELECTRONICS

**1-800-906-6664**

2609 S. 156TH CIRCLE • OMAHA, NE 68130  
<http://www.modernelectronics.com>

# Miniature Transmitters and Receivers

## 2 Button / 3 Channel Transmitter



**RF300T**

1....\$22.95  
5....\$19.95 ea  
10...\$16.95 ea

**RF300XT**

1....\$25.95  
5....\$22.95 ea  
10...\$19.95 ea

- 300' (XT), 150' (T) Range
- Frequency: 318 MHz
- 59,049 Settable Security Codes
- 12 Volt Battery and Keychain Included
- Current Draw: 4.8 ma
- Fully Assembled in Case
- Dimensions: 1.25" x 2.0" x .5"
- Push both buttons for the 3rd Channel
- Slide Button Cover Included

## 4 Button / 15 Channel Transmitter



**RF304XT**

1....\$27.95  
5....\$24.95 ea  
10...\$21.95 ea

- 250' Range
- Frequency: 318 MHz
- 6,561 Settable Security Codes
- 12 Volt Battery and Keychain Included
- Current Draw: 4.6 ma
- Fully Assembled in Case
- Dimensions: 1.35" x 2.25" x .5"
- Push combination of buttons to achieve up to 15 channels

## 2-4 Data / 3-15 Channel Receivers



**RF300RL  
RF300RM**

1....\$27.95  
5....\$24.95 ea  
10...\$22.95 ea

**RF304RL  
RF304RM**

1....\$29.95  
5....\$26.95 ea  
10...\$23.95 ea

- Compatible with 300/4 Transmitters
- 11-24 volts DC Operating Voltage
- 13 ma. Current Draw
- Latching (L) or Momentary (M) Output
- Kits Available (subtract \$5.00 ea.)
- Dimensions: 1.25" x 3.75" x .5"
- 2 (300) / 4 (304) Output Data Lines
- Binary to Dec / Hex Converter can achieve up to 15 channels

- Alarm Systems
- Garage / Gate Openers
- Lighting Control

- Magic Props
- Medical Alert
- Monitoring Systems

- Industrial Controls
- Surveillance Control
- Motor Control

- Schematics Available
- Receiver Board Layout Available
- Custom Design Consulting Available

**Visitect Inc.**

(510) 651-1425 Fax: (510) 651-8454  
P.O. Box 14156, Fremont, CA 94539

Email: [Support@Visitect.Com](mailto:Support@Visitect.Com)  
Visa / Mastercard, COD

CIRCLE 314 ON FREE INFORMATION CARD

[www.americanradiohistory.com](http://www.americanradiohistory.com)



# ALL ELECTRONICS

C O R P O R A T I O N

QUALITY PARTS

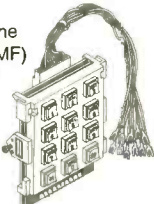
FAST SHIPPING

DISCOUNT PRICING

CALL, WRITE, FAX  
or E-MAIL For A  
**Free 96 Page**  
CATALOG.  
Outside the U.S.A.  
send \$3.00 postage.

## Touchtone Keypad

Farbell# DU200P (A). Standard 12 button telephone keypad with touchtone (DTMF) circuitry. Field replacement for some GTE payphones. White plastic buttons with black numerals and letters. 11 color-coded leads, 9" long with spade lugs.



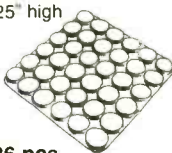
CAT # KP-11

25 for \$75.00

\$4<sup>00</sup> each

## 3/4" Protective Pads

Self-sticking 0.8" dia x 0.25" high black rubber discs. Use as feet, spacers, cushions and protectors. Packaged 36 per sheet.



CAT # RF-341

Minimum purchase 36 pcs.

360 for \$18.00

36 for \$3<sup>60</sup>

## Silent Footswitch

Control International, Inc. Quality, heavy-gauge metal footswitch designed for silent operation. S.P.S.T., normally-open, rated 11 Amps @ 250 Vac. No-slip rubber pad on top surface. 3' cable, 2 conductor 16 AWG, stranded wire. 3.56" X 2.73" X 1.36" high.

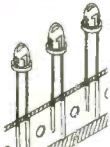


CAT # FSW-9

\$5<sup>50</sup> each

## 3000 MCD ULTRA-BRIGHT RED LED

Everlight # 383URC-2/TR1-C(R) Red, "Ultra-bright" T 1 3/4 LEDs "Tape-and-reel" parts. These are 5 mm diameter water-clear LEDs that light bright red at 20

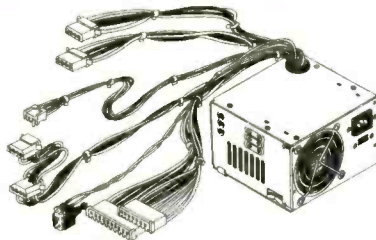


CAT# LED-50

2 for \$1<sup>00</sup>

100 for \$35.00  
1000 for \$250.00

## REDUCED PRICE! 185 Watt Power Supply



Compaq # 172417-002 (172432-001)

Input: 120/ 240 Vac (switchable)  
DC outputs: +5V @ 18A, +3.4V @ 12A, +12V @ 6A, -5V @ 0.15A, -12V @ 0.15A.  
Size: 6.5" x 5.75" x 3.85" Built-in fan. On/off switch on 20" lead. Power cord not included. UL, CSA.

CAT # PS-185

\$7<sup>50</sup> each

## 40 RPM Gearhead Motor

Pittman # GM8212C127-R2. Small, powerful gearhead motor.



187:1 ratio. No load specs: 40 RPM @ 19.1 Vdc, 130 mA. 24 RPM @ 12 Vdc, 160 mA. Overall dimensions 3" long X 1.37" diameter. 0.185" (3/16") diameter X 0.75" long shaft. A brass 0.56" diameter gear with 16 cogs is fastened to the shaft. 17" leads.

CAT# DCM-135

\$15<sup>00</sup> each

10 for \$125.00

## S-VHS Video Tapes (Used)

Super VHS tape users! Save a bundle on name-brand S-VHS, T-120 tapes. These tapes were used for a brief period, then bulk erased. The record-protect tabs have been broken out, so you will have to cover the notch with a piece of tape, but they work great.



CAT # S-VHS

\$3<sup>00</sup> each

10 for \$28.00 • 100 for \$250.00

## 20 Character X 4 Line LCD

Optrax # DMC 20434-CEM

(PWB 20434-CEM)

5 x 8 dot format.  
3" x 1" viewing area.  
3.88" x 2.38" module.

Removed from new equipment. May have felt padding on metal bezel. 14 pin single row header is pre-attached. Spec/hook-up sheet included.



CAT# LCD-46

\$7<sup>00</sup> each

10 for \$60.00

## Snap-In Capacitor

560 UF 400 Vdc - NICHICON CE  
85° C LQ (M). 1.39" dia. X 1.83" h.  
0.4" lead sp.

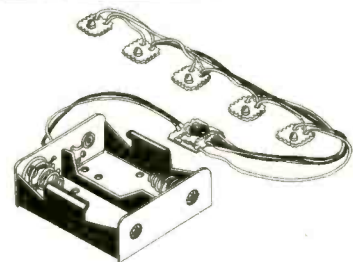


10 for \$3.75 each

\$4<sup>00</sup> each

100 for \$3.00 each

## Five LED Chaser



An inexpensive, eye-catching display. Five bright red LEDs flash sequentially at approximately 1 cycle per second. The LEDs are 3 mm diameter, T-1 size, clear in the off-state. Each led is mounted on it's own 0.7" x 0.85" pc board and is part of a 20" string which can be positioned to suit your needs. The flash rate can be slowed or speeded with the addition of a pot or resistor. Operates on 3 Vdc, or higher with the addition of a resistor. We supply a simple modification sheet for changing flash rate. Includes a battery holder for two D cells.

CAT# CSR-5

\$2<sup>75</sup> each

10 for \$25.00

ORDER TOLL FREE

1-800-826-5432

MAIL ORDERS TO:  
ALL ELECTRONICS CORP.  
P.O. BOX 567  
VAN NUYS, CA 91408-0567

FAX (818) 781-2653 • INFO (818) 904-0524  
SHOP ON-LINE [www.allelectronics.com](http://www.allelectronics.com)  
E-MAIL [allcorp@allcorp.com](mailto:allcorp@allcorp.com)



NO MINIMUM ORDER • All Orders Can Be Charged to Visa, Mastercard, American Express or Discover • Checks and Money Orders Accepted by Mail • Orders Delivered in the State of California must include California State Sales Tax • NO C.O.D. • Shipping and Handling \$5.00 for the 48 Continental United States - ALL OTHERS including Alaska, Hawaii, P.R. and Canada Must Pay Full Shipping • Quantities Limited • Prices Subject to change without notice.

**MANUFACTURERS - We Purchase EXCESS INVENTORIES... Call, Write, E-MAIL or Fax YOUR LIST.**

CIRCLE 215 ON FREE INFORMATION CARD

[www.americanradiohistory.com](http://www.americanradiohistory.com)

# CMM

Monitor/TV Test Equipment

## Checker Pro



There is the Computer monitor tester you have been asking for. Sweep rates to 15-64 kHz, MGA, CGA, VGA, lots of MACs, even video (mono), GRAY SCALE, quick push button operation, "Energy Star" testing, and more. AC or Battery.

**PRICE: \$499.95**

## Checker 12e



Now you can repair and test Computer monitors with ease. With sweep rates up to 64KHz., eight step gray scale, white screen, single color mode. Mac II, EGA, CGA support, you can run almost ANY PC monitor. And it is EASY to use. Color front panel displays show just what you should see. Don't let its' small size fool you. It is the most powerful handheld available, and it supports ALL basic VGA modes (some don't). It is suitable for bench or field operations. Battery or AC operation.

**PRICE: \$295**

## Checker TV Pro & TV Jr.



The TV Pro is just the tool for your repair bench. It provides Video, S-Video, and RF outputs. It also has the most important pattern, GRAY SCALE! You can't set up a color TV without it! All with NTSC standards and COMPLEX sync. The RF output also includes an audio tone and STEREO signaling. With colorbars, gray scale, crosshatch with dots, you can set and test quickly.

**Checker TV Pro...PRICE: \$499.95**

The TV Jr. is a small NTSC video generator with colorbars, crosshatch with dots, white, red, blue, green, and black screens. Small enough to fit in your pocket, powerful enough to drive the largest projection TV!

**Checker TV Jr....PRICE: \$129.00**

**Computer & Monitor Maintenance, Inc.**  
1-800-466-4411  
<http://www.computermonitor.com>

Call Today And **SAVE!** **Unbeatable PRICES!**

# CABLE TV

**DESCRAMBLERS  
CONVERTERS · FILTERS  
VIDEO STABILIZERS**

**FREE** > 30 Day Trial  
**FREE** > Product Catalog  
**FREE** > 1 Year Warranty

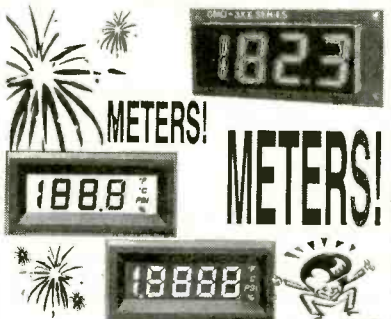
**100% MONEY BACK GUARANTEE**



Let us point you in the right direction ...



**TOLL FREE  
888-554-ARROW**  
888-554-2776



**METERS!**  
**METERS!**  
**METERS!**

**Digital Panel Meter!**  
LCDs • LEDs • 3 1/2 digits  
• 4 1/2 digits • loop powered • adjustable voltage  
Input • bezel mount • surface mount • miniatures  
• big digits • black • red • amber • green • negative  
backlighting • positive backlighting • RF resistant •  
EMI resistant • displayed engineering units • snap-in •

For the best selection...  
We also have Kroy tape and shrink tube labeling systems and supplies!

**800-356-4920**

Visit our catalog on the web  
[www.knsinstruments.com](http://www.knsinstruments.com)  
**KNS Instruments**  
PO Box 10158  
Bedford, NH 03110-0158  
Fax 800-356-1250

# SECRETS!

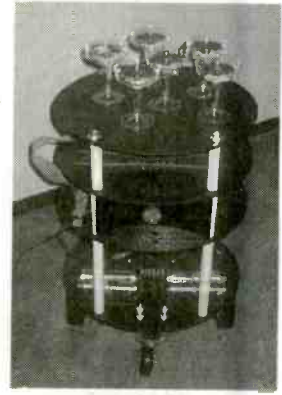
- **Melt Metal!** Incredible plans, lost secrets, forgotten how-to, and strange books! Request a catalog! Melt metal! Be a machinist, blacksmith, mad scientist! Make neon signs, rewind motors.
- **Machine Shop!**
- **Hydrogen!**
- **Homesteading!** Get high power from auto alternators and generators. Run your car on coal and electricity. Build a working solar cell, shortwave radio, robot, Tesla coil, more! Make booze, soda pop, magnets, chemicals, embalm corpses! Homestead! Mold plastic! All books highest quality! Guaranteed! Fast service!
- **Engines!**
- **Radio!**
- **Tesla!**
- **Chemistry!**
- **Much More!**

**BIG CATALOG! WRITE TODAY!** • FAX 815/935-5477  
Send Your Name and Address to

**Lindsay's Technical Books!**  
Box 538-EBK, Bradley IL 60915  
<http://www.lindsaybks.com>

## Max96

Ready for the year 2000!



Zagos Robotics  
PO Box 460342  
St. Louis, MO 63146-7342  
(314)768-1328  
<http://www.zagrosrobotics.com>  
[info@zagrosrobotics.com](mailto:info@zagrosrobotics.com)

## PROGRAMMERS OVER 50 MODELS

ADVANTECH EETOOLS NEEDHAMS DATA I/O ICE TECHNOLOGY HILO SYSTEM GENERAL CHROMA MODULAR CIRCUIT TECHNOLOGY XELTEX



CALL ADVANTECH LABTOOL 629 ICE TECH MICROLV 650 EETOOLS ALLMAX + 409 EETOOLS MEGAMAX 509 EETOOLS MEGAMAX4 369 XELTEX SUPERPRO II 409 XELTEX SUPERPRO II P 249 XELTEX SUPERPRO L 165 XELTEX ROMMASTER II 479 MOD-MCT-EMUPA 739 STAG ORBIT-32

599 EETOOLS SIMMAX 795 CHROMA SIMM/SIP 359 MOD-MCT-EMUPA/R 279 MOD-MCT-EMUP/R 49 EPROM 1G TO 512K 69 EPROM 1G TO 1MEG 99 EPROM 4G TO 1MEG 199 EPROM 16G TO 1MEG 89 EPROM 1G TO 8MEG 129 EPROM 4G TO 8MEG 250 EPROM 8G TO 8MEG



**General Device Instruments**  
Sales 916-393-1655 Fax 916-393-4949 BBS 983-1234  
Web [www.generaldevice.com](http://www.generaldevice.com) E-Mail [icdevice@best.com](mailto:icdevice@best.com)



340 East First Street  
Dayton, Ohio 45402

## Tons of Electronics

Get your FREE catalog today and discover some of the best deals in electronics. We have thousands of items ranging from unique hard-to-find parts to standard production components. Call, write or fax today to start your subscription to one of the most unique catalogs in the industry, filled with super values on surplus electronic and hobbyist type items.

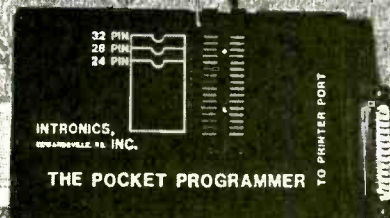
**FREE CATALOG!**

Checkout our 10,000 item on-line catalog <http://www.meci.com>

**Order Toll Free** Why pay more?  
**1-800-344-4465** Call today!  
Fax Order Line  
1-800-344-6324

CIRCLE 250 ON FREE INFORMATION CARD

## The Pocket Programmer Only \$129.95



The portable programmer that uses the printer port of your PC instead of a internal card. Easy to use software that programs Eprom, EEprom, Flash & Dallas Ram. 27(C) / 28(C) / 28F / 29F / 29C & 25XX series from 16K to 8 Megabit with a 32 pin socket. Adapters available for Pic, PLCC, 5-Gang, 874X, 875X MCU's, 40-Pin X 16 & Serial Eprom's, 82/74 Prom's and Eprom Emulator to 32K X 8.

Same Name, Address & Phone #  
for 16 Years... Isn't it Amazing ?

### Intronics, Inc.

Box 13723 / 612 Newton St.  
Edwardsville, KS 66113 Add \$5.00 COD  
Tel. (913) 422-2094 Add \$4.00 Shipping

Fax (913) 441-1623 Visa / Master Charge

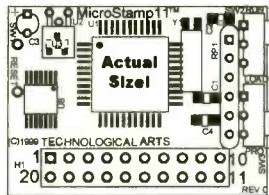
## World's Smallest 68HC11 Microcontroller Module!



### Applications:

- telemetry
- robotics
- smart toys
- animatronics
- model railroads
- automate your home
- many others!

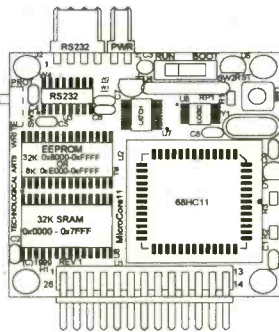
## MicroStamp11™



- tiny 1-inch x 1.4-inch 68HC11 module
- 5V regulator, 8MHz crystal
- choice of 8K or 32K EEPROM
- plugs into your breadboard like a DIP
- SCI, SPI, OCS, ICs, timers, & more
- all 14 I/O lines and 2 interrupts brought out to versatile 20-pin connector
- easy code-loading with Docking Module
- Starter Packages:\*
- with 8K EEPROM (#MS11SP8K).....\$49
- with 32K EEPROM (#MS11SP32K).....\$60
- additional modules from \$34 each

\* includes MicroStamp11, documentation, PC software, serial cable & Docking Module

## MicroCore-11™



- tiny 2-inch x 2-inch 68HC11 module
- 12 inputs/outputs plus 8 analog inputs
- RS232, 5V regulator, 8MHz crystal
- 32K SRAM plus 8K or 32K EEPROM
- plugs into your breadboard like a DIP
- simple program loading from any PC
- motor driver & accessories available
- ideal for MicroMouse robot competitions
- 8K Starter Package #MC11SP8K.....\$75
- 32K Starter Package #MC11SP32K.....\$89

## Technological Arts

Many other modules & accessories available.  
Visit our website at:  
[www.technologicalarts.com](http://www.technologicalarts.com)  
sales@technologicalarts.com  
Phone: (416) 963-8996  
Fax: (416) 963-9179  
Add \$5 shipping & handling within Canada & USA  
Visa • MasterCard • Discover • Amex

## ECL/TTL/PECL

INSTRUMENT-LIKE FUNCTIONS

@

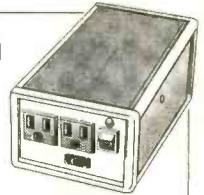
COMPONENT-LIKE PRICES

[www.pulseresearchlab.com/products/bit/default.htm](http://www.pulseresearchlab.com/products/bit/default.htm)

NEW INVENTION!  
BUILD YOUR OWN

## 5,000 WATT INVERTER

Input 12 vdc  
Output 120 volts AC 60 HZ



You can build this simple but POWERFUL inverter with parts you may already have laying around the house! There is no other inverter built like this inverter. Now anyone can afford a 5,000 watt inverter. Run your entire home!

PATENT PENDING

1000 watt plans.....\$25.95  
5000 watt plans.....\$40.00

Send order to: CREATIVE SCIENCE  
PO BOX 557 New Albany, IN. 47151

## CABLE TV BOXES



(WE'LL BEAT ANY PRICE!)  
30 DAY TRIAL\* 1YR. WRNTY. \*FREE CATALOG  
QTY. DISCOUNTS \* DEALERS WELCOME!

**1-800-785-1145**

HABLAMOS ESPANOL



PRIVATE CABLE SYSTEMS

## NetSurf<sup>PRO</sup> wireless keyboard™

100 feet range

Power indicator



Integrated Touchpad

104-key functionality

**\$99  
only**

- 900MHz Wireless RF Technology
- No Line of Sight Requirement
- Encrypted Data Transmission
- Long Battery Life

Ultima Associates, Inc. 45645 Northport Loop East Fremont, CA 94538  
Tel: 510-623-8988 ext 101 • Fax: 710-623-8989 • Email: sales@RFDevices.com • URL: www.RFDevices.com

# Call for your free catalog!

## **BK PRECISION** Digital Multimeter

- Great accuracy
- Built-in counter
- Bargraph
- Good transient protection
- Conform to IEC 1010 class 2 safety compliance
- 3 year warranty
- True RMS
- 50,000 count capability
- Mains disturbance indication
- Wide temperature range
- Displays AC voltage as Resistive Power or dB (impedance selectable)
- Made in France by Metrix



Model	Description	List	Sale
5360/MX53B	Digital Multimeter, Accuracy 0.1%	\$229.00	<b>\$129.00</b>
5380/MX55	Digital Multimeter, Accuracy 0.025%	\$309.00	<b>\$139.00</b>
5390/MX56B	Digital Multimeter, Accuracy 0.025% Resistive power	\$325.00	<b>\$149.00</b>

## **LEADER** PC Scan, NTSC Pattern Generator



- RGB test source
- On/Off control
- Compact & DC powered
- Individual RGB level control
- Auto pattern sequencing
- Includes composite & Y/C drive for NTSC monitors
- Handles VGA, SVGA, XGA, SXGA, MAC13, MAC16, MAC19 & composite, Y/C NTSC

Model	Description	List	Sale
LT 1607	PC Scan, NTSC Pattern Generator	\$995.00	<b>\$895.00</b>

## **HDTV Pattern Generator**

**NEW PRODUCT!**

- Output components available in YPbPr or GBR form with tri-level sync on each of the three feeds
- Test signals include: new monoscope pattern, 100% color bars, crosshatch, dots, 100% flat white field, line sweep, 9, 31 & 255 step gray scale, ramp, circle pattern & field of characters
- Outputs composite tri-level sync, horizontal & vertical drive



Model	Description	List	Sale
LT 449	HDTV Pattern Generator	\$2,995.00	<b>\$2,845.25</b>

**PRINT**<sup>™</sup>  
Products International

800-638-2020 • fax 800-545-0058  
email sales@prodintl.com

More Big Savings at [www.prodintl.com](http://www.prodintl.com)

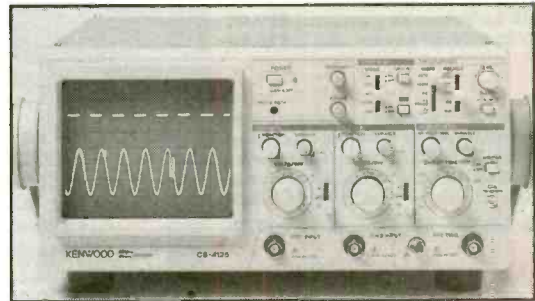
# KENWOOD Analog Oscilloscopes

## CS-4100 Series:

- High Withstand Voltage to 400V
- Wide bandwidth & fast sweep
- VERT mode / FIX triggering
- One touch X-Y switching & Relay attenuator

## CS-5300 Series:

- 2% accuracy & High sensitivity
- Delay sweep for expanded waveforms
- Reliable relay attenuator
- 3 signals synchronized on V mode



Model	Description	List	Sale
CS-4125	20 MHz, 2 ch	\$495.00	<b>\$389.00</b>
CS-4135	40 MHz, 2 ch	\$795.00	<b>\$599.00</b>
CS-5355	50 MHz, 3 ch, delayed sweep	\$945.00	<b>\$799.00</b>
CS-5375	100 MHz, 3 ch, delayed sweep	\$1,295.00	<b>\$1,049.00</b>
CS-5350	50 MHz, 3 ch, delayed sweep with readout & cursors	\$1,095.00	<b>\$949.00</b>
CS-5370	100 MHz, 3 ch, delayed sweep with readout & cursors	\$1,595.00	<b>\$1,299.00</b>
CO-1305	5 MHz, 1 ch	\$385.00	<b>\$309.00</b>
CC-4100	Carrying Case for CS4100 series	\$179.00	----
CC-5300	Carrying Case for CS5300 series	\$179.00	----

## Regulated DC Power Supplies *NEW PRODUCT!*



Model	Description	List	Sale
PAC20-3	0-20 volts/0-3 amps	\$280.00	<b>\$235.00</b>
PAC30-2	0-30 volts/0-2 amps	\$280.00	<b>\$235.00</b>
PAC30-3	0-30 volts/0-3 amps	\$360.00	<b>\$305.00</b>
PAC30-6	0-30 volts/0-6 amps	\$550.00	<b>\$465.00</b>
PAC60-1	0-60 volts/0-1 amps	\$330.00	<b>\$280.00</b>
PAC60-3	0-60 volts/0-3 amps	\$580.00	<b>\$495.00</b>
PAC20-3R	0-20 V / 0-3 A, remote	\$430.00	<b>\$365.00</b>
PAC30-2R	0-30 V / 0-2 A, remote	\$400.00	<b>\$340.00</b>
PAC30-3R	0-30 V / 0-3 A, remote	\$490.00	<b>\$415.00</b>
PAC30-6R	0-30 V / 0-6 A, remote	\$720.00	<b>\$610.00</b>
PAC60-1R	0-60 V / 0-1 A, remote	\$470.00	<b>\$395.00</b>
PAC60-3R	0-60 V / 0-3 A, remote	\$720.00	<b>\$610.00</b>

- Low ripple and low noise characteristics
- Floating output terminals for positive or negative ground
- Series / parallel operation (PAC-R only)
- Voltage & current simultaneous display
- Remote sensing terminals control output voltage / current



800-638-2020 • fax 800-545-0058  
email [sales@prodintl.com](mailto:sales@prodintl.com)

CIRCLE 256 ON FREE INFORMATION CARD

## CABLE SECRETS!!!

### Build your OWN cable box "test" devices!

Why pay \$100.00 or more for a "test" device that someone else made? Make your own! Includes complete source code and plans for the most commonly used cable boxes. *Unlock all of the channels on your box!*

**Or start your own lucrative business!**

Complete source code ..... \$79.95  
Code for individual boxes ..... \$29.95

## DSS SECRETS — Vol. 2

Step-by-step instructions on programming your own DSS access card. *Unlock all channels on your own card!* This is the most current information on the market! Includes software, plans, and hardware sources. Book & CD-ROM.

DSS Secrets Vol. 2 ..... \$49.95

VISA • MasterCard • American Express

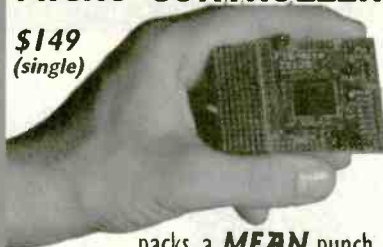
To order, call Worldwyde @ 1-800-773-6698

21365 Randall Street • Farmington Hills, MI 48336

Visit us on the web at [www.worldwyde.com](http://www.worldwyde.com)

## FRIENDLY LITTLE MICRO CONTROLLER

\$149 (single)



...packs a **MEAN** punch  
a.k.a. "Steroid Stamp"

- 39 I/O + 8 A/D (10 bit) •
- 128K SRAM + 128K Flash •
- LCD/Keypad Interface •
- Fast 16 bit Motorola CPU •
- Affordable C Compiler •
- Comprehensive s/w Library •

\*Intec Automation Inc. v: 250-721-5150  
[www.steroidmicros.com](http://www.steroidmicros.com) fx: 250-721-4191

## Globaltech Distributors

THE ULTIMATE ELECTRONIC SAVING STORE

Wholesale Prices Available—Don't Miss-Out

Call Today!---1-(800)582-5116

Computer Acc.	Recordable CD's
Remote Controls	Alkaline Batteries
Semiconductors	4 Wire Harness
IC's & Microprocessor	Anti-Virus Prog.
Radios & Amplifiers	Soldering Stations
Satellite Acc.	Cellular Chargers
Telephone Acc.	Hearing Aids
Anti-Tapping Devices	Laser Pointers
2-Way Radios	Power Supplies

\*Free Internet Service - Free Color Catalog

Buy Direct Buy Today & Save

Order@globaltechdistributors.com



BEST MICROPROCESSOR STOCK DISTRIBUTOR WORLD WIDE.

## COVERT CATALOG2000

### BRAND NEW!

The Latest, Up-to-date, Hands-on Supplier and Source Guide for:

- Electronic surveillance equipment
- Covert video cameras and transmitters
- Counter measures gear
- Entry supplies
- Electronic tracking systems
- Computer surveillance and remote viewing

Equipment, exact addresses and ordering info from 15 countries!! 220 pages — \$39.95

11 3555 S El Camino Real, San Mateo, CA 94403  
Phone 650-513-5549 ■ fax 650-728-0525 or  
[www.intelligence.to](http://www.intelligence.to) (no ".dot.com")

## PIC Programmer Kits

Super Value  
Code: CPS96  
and instructions included. Parallel port of PC is used with straight through (25 pin) cable (not supplied). Kit uses the P16PRO shareware which is downloaded from the web and registered for \$20. Can program 64 pin PICs with adapter (not supplied). For more info and other PIC programmers visit [www.electronics123.com](http://www.electronics123.com)

\$19.95 +S&H \$4.95\*

## Infra Red Link

This Infra Red Door Minder transmits and receives an invisible infra red beam up to 26'. When the beam is broken a relay (rated 110/250V 5A) is switched. This kit is suitable for alarm systems, a proximity sensor or sensing movement through shop doors. Needs 10 to 14VDC. PCB, parts and instructions provided. \*S&H to Canada is \$7.95

\$9.95 +S&H \$4.95\*  
Code: MB097

Toll Free: 1-888-549-3749 (USA & Canada)  
Tel: (330) 549-3726. Request a FREE catalog or visit us at: [www.electronics123.com](http://www.electronics123.com) for more products.  
Amazon Electronics, Box 21 Columbia OH 44408

## 10Hr Phone Recorder \$69

Records both sides of conversation automatically

Telephone Scrambler \$159 ea. or 2 for \$149 ea. Secure phone conversations with this high tech "rolling code" scrambler. Thousands of codes/15 sec connection. Requires one at each end.  
Voice Changer Phone \$99

Disguise your voice with this phone. 16 Pitches/Make your voice deeper or higher. Men can sound like a woman, easy to use.

5 Hr. Phone Recorder Touch-tone decoder \$159

Records both sides of conversation including phone numbers dialed

Phone Information Recorder \$169

Records both sides of conversation along with the number dialed

Records name and number of callers (requires Caller ID service)

PC Telephone Recorder \$119

Use your PC to record phone calls. Windows 95, Sound blaster compatible sound card 486 or higher PC required

Phone Tap detector \$159

Protect your phone against phone taps, eaves droppers and RF bugs.

Mini Bug Detector up to 2Ghz \$119

Detects RF "Bugs", Video Transmitters and wireless microphones from 5MHz to 2 GHz. LED Bargraph and Audible alarm

VISA • MC • Money Orders • US & Canada Only

NO CHECKS • NO COD • Add \$6.95 S/H

[www.mscelectronics.com](http://www.mscelectronics.com)

MSC Electronics

PO BOX 461 Jessup, MD 20794

(301) 497-1600

FAX (301) 497-1925



[www.jm-micro.com](http://www.jm-micro.com)

## PIC In-Circuit Emulator

for the PIC16Cxx from \$295

PIC Programmer \$155

80C552 (8051) Development

Training System \$235

68HC11 SBC \$120

ROMY-16 EPROM Emulator

from \$195

Universal Microprocessor

Simulator/Debugger (including

Assembler, and Disassembler)

\$100 each CPU

J&M Microtek, Inc.

83 Seaman Rd. W Orange, NJ 07052

Tel: (973) 325-1892 Fax: (973) 736-4567

## Press-n-Peel Transfer Film

### PC Boards in Minutes

8.5" x 11" Shts.  
\* Or Photocopy  
\*\* Use standard household iron

1. LaserPrint\*
2. Press On\*\*
3. Peel Off
4. Etch



Use Standard Copper Clad Board  
20 Shts \$30/ 40 Shts \$50/ 100 Shts \$100  
Visa/MC/PO/CK/MO \$4 S&H/Foreign Add \$7

Techniks Inc.

P.O. Box 463, Ringoes NJ 08551

ph. 908.788.8249 fax 908.788.8837

[www.techniks.com](http://www.techniks.com)

Visit Our E-Store On-Line!

## PIC PROJECTS Book & CD-ROM

Many PIC Projects for Beginners & Experts!  
Includes Software, Documentation, and PCB Layout

- LCDs
- X10 — Home Automation
- Keypads
- Serial Port Interface
- On-Screen Displays
- Robotics
- Data Logging
- Serial/Parallel
- And Many More!

Book & CD Only \$24.95

PIC Programmer  
Programs all PIC16C55x/6x/7x/8x/9x, PIC 16F8x, and PIC12C devices. Optional ZIF adapters for SOIC & PLCC. Includes all necessary software. Only \$39.95

We accept VISA • MasterCard • American Express

To order, call Worldwyde @ 1-800-773-6698

21365 Randall Street • Farmington Hills, MI 48336

Visit us on the web at [www.worldwyde.com/pic](http://www.worldwyde.com/pic)

## OWN A MACHINE SHOP!

### Do it yourself!

No more waiting to have parts or repairs done.

¥ Easy to use—Fredraining. You'll be doing quality work right away.

¥ Affordable—5 models starting at \$995.

¥ Versatile—Work metal and wood or plastic.

¥ CNC adaptable



"I can fix most anything. Now I know how I live without it. It paid for itself in no time."

Enjoy the freedom & cost savings of owning a benchtop machine shop.

**FREE**  
Info Pak

CALL TODAY!

**1-800-345-6342**

or write: **Smithy**

Dept. PEB01 PO Box 1517  
Ann Arbor, MI 48106-1517

Visit us at [www.smithy.com](http://www.smithy.com)

## The Hack & Crack Bible on CD-ROM

Includes all Software, Documentation, Plans, and PCB Layouts!

Unlock the secrets of:

- DSS & Smart Cards - Programming & Schematics
- Cable Test Devices
- Sony Playstation - Mod Chip/CD Backups/Emulation
- Backup Sega & SNES Console Cartridges
- Sega & SNES Emulation on your PC or Mac
- WareZ - where to find them on the Internet
- Cellular Hack/Phreak/Mod
- And Much More!

Only  
**\$29.95**

PC & Mac Compatible CD-ROM

We accept

VISA • MasterCard • American Express

To order, call Worldwyde @ **1-800-773-6698**  
21365 Randall Street • Farmington Hills, MI 48336

Visit us on the web at [www.worldwyde.com/hack](http://www.worldwyde.com/hack)

## Science Fair Electronics

- VIDEO CAMERAS
- Electronics Kits
- Science Projects & more

To receive a color catalog with over 150 Different kits that you can build or customize For your Own projects. Please send \$1.95 to:



Science Fair Electronics

9740 CAMPO RD. PMB 209  
SPRING VALLEY, CA 91977



TOLL-FREE 1-877-88-HOBBY

FAX (619) 668-0054

## LASER MODULE



Auto Power Control  
Collimated Laser  
Compact Size  
100,000 hr lifetime  
No Electronics Required

Visible Laser Modules (635-670 nm)  
TTL Modulated Laser Modules  
Line Generator Laser Modules  
Infrared Laser Modules (780-830 nm)

from  
**\$ 29 (US)**

## LASER POINTER



Focus Adjustable  
Elegant Design  
Solid Metal Body

Pen Style Laser Pointer (1500 ft visibility)  
Key Chain Laser Pointer (1500 ft visibility)  
Available in silver and, black finish.

**\$19.95 (US)**

World Star Tech.

Ask for free catalog

Tel: (416) 204 8298 Fax: (416) 596 7819

<http://www.worldstartech.com> e-mail: [info@worldstartech.com](mailto:info@worldstartech.com)

## Locate Bad Caps Fast

### IN-CIRCUIT!!

Lower Costly Service Time  
Reduce Costly Callbacks  
Tame "TOUGH DOGS" in Minutes

**INSIST on the ORIGINAL**  
**Capacitor™**

**WIZARD**

IN-CIRCUIT ESR METER

Large, easy to read analog meter makes for the fastest, most accurate testing available! Unique "Cap GOOD" beeper makes testing caps in Circuit **virtually INSTANTANEOUS!!** Needle sharp **GLD PLATED** stainless steel probes provide **FAST** and **POSITIVE** connection to both **AXIAL** and **RADIAL** caps.



Technicians say the Capacitor Wizard is "the most cost effective instrument on their workbench!"

**ONLY \$179.95**  
**800-394-1984**

For More Information goto  
[www.heinc.com/feinc/cwinfo.htm](http://www.heinc.com/feinc/cwinfo.htm)

**30 DAY MONEY BACK GUARANTEE**  
**Order today! You Can't Lose!!!**

Made in the USA!



**Howard Electronic Instruments, Inc.**

6222 N. Oliver, Kechi, KS 67067

316-744-1993 International

316-744-1994 Fax

Email: [sales@heinc.com](mailto:sales@heinc.com)



## Low Cost PICmicro Tools

New! PIC-X1  
Experimenter/  
Lab Board  
\$49.95 to \$199.95



EPIC Pocket PICmicro  
Programmer - \$59.95

Program PICmicros in BASIC!

PicBasic Compiler - \$99.95

PicBasic Pro Compiler - \$249.95

PICProto Boards make  
prototyping with PICmicros  
easy - \$8.95 to \$19.95



**melabs Engineering Labs, Inc.**

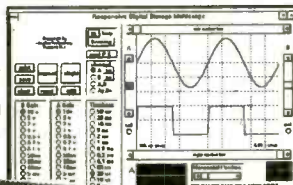
Box 7532 Colorado Springs CO 80933

(719) 520-5323 fax (719) 520-1867

<http://www.melabs.com>

## TURN YOUR PC INTO A DIGITAL STORAGE OSCILLOSCOPE!

The versatile  
PC-Multi  
Scope 2 by  
mission  
technology!  
Windows  
based



above: actual scope screen on PC  
**\$299+** S/H. Visa/MC/Check

Dual channel; up to 20Ms/sec sampling; 10Mhz analog b'width; install thru PC parallel port; strip chart rec'dr/spectr. analyzer modes; built-in ext. trig & DC pwr supply output; VB source code option add \$99

**AMAZE ELECTRONICS CO.**

Tel: 800-996-2008 Fax: 408-374-1737

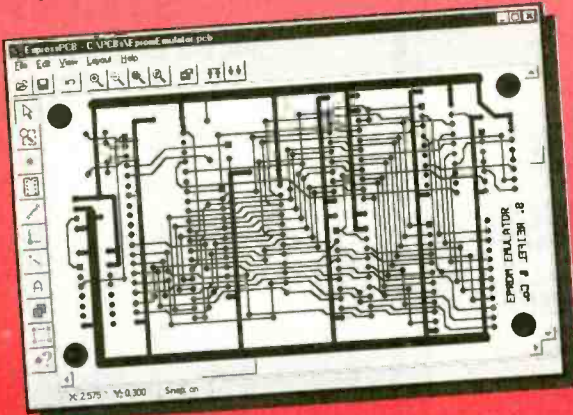
<http://www.hooked.net/users/amaze>

or email: [amaze@hooked.net](mailto:amaze@hooked.net)

# PCB LAYOUT

## Software For Windows - FREE

- 1 Download our board layout software
- 2 Design your 2 sided plated-through PCB
- 3 Send us your layout over the Internet
- 4 In 2-3 business days, UPS delivers your boards, often under \$100



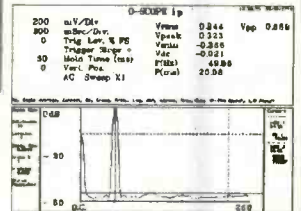
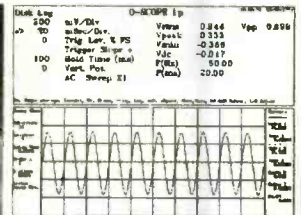
[www.expresspcb.com](http://www.expresspcb.com)

# DIGITAL STORAGE OSCILLOSCOPES

WITH SPECTRUM ANALYZER, DVM, FREQ. COUNTER, AND DATA LOGGER.

from **\$189.**

PORTABLE MODULES CONVERT PC'S INTO MULTIPURPOSE TEST AND MEASURING INSTRUMENTS.



Why lug a scope around? Toss one of our modules into your laptop case or tool kit. For a multi-purpose test device, plug to a PC parallel port and use the PC screen. Continuous, delayed, or triggered sweeps can be frozen on the screen, printed out, or saved to disk. Frequency Spectrums DC to 25 MHz.

Allison now provides PICO TECHNOLOGY Ltd. portable test equipment, including high-speed scopes, and multi channel data loggers. Pico and O-Scope modules accept standard probes and work with 286 or faster PC's.

### FEATURES:

- PORTABLE UNITS TO 25 MHz
- USES PRINTER PORT
- USES STD. PROBES

### OPTIONS:

- PROBE SETS
- AUTOMOTIVE PROBES
- BATTERY PACKS
- SOFT & HARD CASES

O-Scopes Made in U.S.A. Picos Made in U.K.  
Same Day Shipping  
Includes Cable, Software & Manuals

O-Scope Ip (DC-50KHz, single trace) .....\$189.  
O-Scope II (DC-500KHz, dual trace) .....\$349.  
PICO (ADC 200/20) (DC-10MHz, dual trace) .....CALL  
PICO (ADC 200/50) (DC-25MHz, dual trace) .....CALL  
PICO pc based data loggers from \$99.

Shipping within U.S. UPS Ground \$7.50(Second day \$11.50)

SEND CREDIT CARD INFO., M.O., or CHECK, OR CALL

**1-800-980-9806**

Allison Technology Corporation

2006 FINNEY-VALLET, ROSENBERG, TX 77471  
PHONE: 281-239-8500 FAX: 281-239-8006

<http://www.atcweb.com>

**SUPPORTS DEVICES TO 32 MEG**

## EPPROM+

A device programming system for design, repair and experimentation

- ◆ EXCEPTIONAL POWER FOR THE PRO
- ◆ EASY-TO-USE FOR THE NOVICE
- ◆ INCLUDES STEP-BY-STEP TUTORIAL

**Here's what you get:** A rugged, portable programming unit including the power pack and printer port cable both of which store inside the case. A real printed user and technical manual which includes schematic diagrams for the programming unit plus diagrams for all technology family adapters.\* Comprehensive, easy-to-use software which is specifically designed to run under DOS, Windows 3.1, 95 and 98 on any speed machine. The software has features which let you READ, PROGRAM, COPY and COMPARE plus much more. You have full access to your system's disk including LOADING and SAVING chip data plus automatic processing of INTEL, HEX, MOTOROLA S-RECORD and BINARY files. For detailed work the system software provides a full screen buffer editor including a comprehensive bit and byte tool kit with more than 20 functions.

**Broad device support:** FIRST GENERATION EPPROMS (2708, TMS2716\*, 25XX\*) SECOND GENERATION EPPROMS (2716-28C080), 40 AND 42 PIN EPPROMS\* (27C1024-27C160) FLASH EPPROMS (28F29C, 29EE, 29F), EEPROMS (2816-28C010), NVRAMS (12XX, X2210/12) 8 PIN SERIAL EPPROMS\* (24, 25, 85, 93, 95, 80011A) PLUS ER1400/MS8657\* AND ER5901 BIPOLAR PROMS\* (72S/82S), FPGA CONFIGURATORS (17CXXX) MICROCONTROLLERS\* (874X, 875X, 87C5XX, 87C75X, 89C5X) ATMEL MICROS\* (8-40) PIN 89C0501, 89SXXX (AVR) 90SXXX PIC MICROS\* 8, 18, 28, 40 PIN (12CXXX-16CXXX, 16FXX, 17C) MOTOROLA MICROS\* (68705P3/J3R3, 68HC705, 68HC711)

**\$289**

\*REQUIRES SNAP-IN ADAPTER (ORDER FACTORY DIRECT OR BUILD YOURSELF) \$5.00 SHIPPING + \$5.00 C.O.D. 1 YEAR WARRANTY - 30 DAY MONEY BACK GUARANTEE VISA\*MASTERCARD\*AMEX

ANDROMEDA RESEARCH, P.O. BOX 222, MILFORD, OH 45150  
(513) 831-9708 FAX (513) 831-7562 website - [www.arlabs.com](http://www.arlabs.com)

**Video King**

VK-2000

### Digital Video Stabilizer

For Free Information Package and Pricing

Call 219-233-3053

R.C. Distributing, PO Box 552, South Bend, IN 46624



# MCM ELECTRONICS

## The Source For All Of Your Electronics Needs

When ordering, please provide this code: **SOURCE CODE: POP72**

Prices effective Nov. 16, 1999 through Jan. 31, 2000

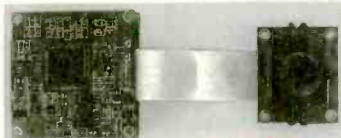
For over 20 years, MCM has been the leading supplier to the electronics service industry. Huge inventory, rapid delivery and competitive prices have made MCM the choice for:

- Hobbyists
- Educators
- Service Technicians
- Installers

Discover the MCM difference, call today for your free literature.

**New!**

Order #82-3930



**DEFENDER SECURITY**

**\$159.00**

### Color PC Board Pinhole Camera

Features include: 3.6mm lens, Automatic white balance, 330 lines horizontal resolution and automatic gain control. Specifications: Sync: Internal. Video output: 1V p-p, 75ohm. Power: 12VDC, 240mA.

•Regular price \$199.00.

**New!**



Order #82-3885

**\$45.00**

**DEFENDER SECURITY**

### PC Board Pinhole Camera

Features a wide angle pinhole lens. Board measures only 1 1/4" x 1 1/4". Camera features 1/8" CCD image device producing over 430 lines of resolution. The built-in 3.6mm pinhole lens provides a viewing angle of 92°. Input voltage: 12VDC, 100mA.

Output: 1V p-p, 75ohm. •Regular price \$69.95.



**CEBEK**

**\$10.75**

Order #28-5170

### One Watt x Two Channel Audio Amplifier

Pre-assembled stereo audio amplifier board can be used for numerous applications. Accepts line level input. Output is 1W x two channels, usable from 4-8ohm. Board dimensions 72mm x 50mm x 20mm. Requires 4-14VDC, 250mA. •Regular price \$14.95.



**\$24.95**

Order #28-4799

### 30 Watt Single Channel Audio Amplifier

Accepts line level input. Output impedance 4-8ohm. Operates with supply voltage from 12-35VDC, 1.5A. Includes oversized heat sink. Board dimensions 92mm x 65mm x 45mm. •Regular price \$29.95.

**New!**



Order #60-9490

**\$60.00**

### Battery Saver Solar Battery Trickle Charger

Converts daylight into electricity to protect and maintain larger deep cycle 12V rechargeable batteries. Features weatherproof design. Reverse current protection prevents battery drain in low light conditions. Includes mounting hardware. Full sunlight produces 350mA @ 15VDC. •Dimensions: 12" (L) x 12" (W) x 1" (D). •Weight: 3.33 lbs. •Model #10009. Regular price \$74.95.



As Low As **\$22.25**

**New!**

### Rack Mount Steel Enclosures

1/2" thick steel front panel is standard 19" width with mounting holes for easy rack mounting. All models (except #28-6250) include rack handles. Steel construction is steel gray epoxy coated for professional appearance and long life. Slotted for ventilation. All enclosures are 16 1/2" wide (external).

Order #	Enclosure Depth	Enclosure Height	Front Panel Height	Reg.	Sale
28-6250	9"	1 1/2"	1.7"	\$33.75	\$22.75
28-6251	9"	3 1/4"	3.5"	43.75	32.50
28-6253	13 1/4"	5"	5.2"	52.95	37.75

**\$99.95**

**New!**



**Emerson**

Order #33-4910

### Stereo Cable Converter

This converter is a 181 channel MTS/SAP stereo cable converter with volume control and remote. 181 channel capability includes 69 off air channels and 125 cable television channels. Features: sleep timer, unlimited favorite channel memory, pass code protected parental controls and stereo audio/video output.

**New!**

**\$49.95**

1 YEAR LIMITED WARRANTY

Order

#72-6634



### TENMA LCR Meter

Features: •Measures inductance, capacitance and resistance •3 1/2 digit (0.5"), 1999 count LCD display •Overrange indicator •Includes test alligator clips and owners manual •Requires 9V battery

### MCM ELECTRONICS

650 CONGRESS PARK DR.  
CENTERVILLE, OH 45459  
A PREMIER FARNELL Company

**SOURCE CODE: POP72**



**FREE Literature!**

**1-800-543-4330**

Secured ordering at: [www.mcmelectronics.com](http://www.mcmelectronics.com)

Hours: M-F 7 a.m.-9 p.m., Sat. 9 a.m.-6 p.m., EST.

**Same Day Shipping!**

In stock orders received by 5:00 p.m. (YOUR TIME), are shipped the same day.



CIRCLE 225 ON FREE INFORMATION CARD

## Automate Your Home Using Your PC and HomeSeer!

### Home Automation Software for Windows

- \* Built-In Web server for Internet Access; remote control your home!
- \* Supports many X10 devices including Leviton, SwitchLinc, RCS HVAC, X10 Pro, CM11A, CM17A
- \* MSAGENT, Voice Recognition, Infrared control, VBScript for Powerful scripting
- \* Send email, launch apps, speak, send infrared in response to X10

**Only \$39.95**

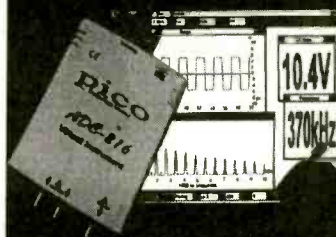
**FREE TRIAL at [www.keware.com](http://www.keware.com)**

**Keware Technologies LLC**

Tel: (603)-471-2816

email: [sales@keware.com](mailto:sales@keware.com)

## Turn your PC into a 16-bit Storage Scope spectrum analyzer, and digital multimeter!



ADC216 turns your PC or laptop into a sophisticated storage scope AND spectrum analyzer AND multimeter. Display on large screen! Print in color! 100MS/s 8-bit, 1.2MS/s 12-bit or 333kS/s 16-bit versions. Great for test depts, schools. Input to Excel. LabView/NT drivers. Get very high precision without high cost!

### osziFOX

handheld 20MS/s Storage Scope

osziFOX is a sophisticated digital storage scope packed into a handy, slim penlike housing. Despite its small size, osziFOX can perform like a service scope with a 20MS/s sampling rate so signals in microprocessor or audio circuits can be measured easily. A built-in backlit LCD shows the waveforms but the recorded signals can also be sent to a PC via a serial interface. Runs from 9V battery or external source. Auto, internal and external triggers. AC/DC voltmeter function too. Only \$129!

also .....

RS232-422/485 converters, self-powered, opto-isolated I2C adapter boards for PC communication with I2C bus mini dataloggers for events, voltages, pressures, etc. Enviromon temperature and environment netwk logger thermocouple and thermistor adapters for PC ports. BASIC-programmable BASIC-TIGER controller modules PCI framegrabbers - switch between 2 inputs locked! lowcost A/D adapters turn your PC into a display scope



### Saelig Company

[www.saelig.com](http://www.saelig.com) [saelig@aol.com](mailto:saelig@aol.com)  
716-425-3753 • 716-425-3835 (fax)

1-888-7SAELIG

## 5 Axis Robotic Arm \$195.00 Plus S&H



### You can build this Robotic Arm

Impressive, fast, accurate, and repeatable motion. Any computer or micro capable of sending 2400 or 9600 baud serial data can control the arm. It can even be controlled from a Basic Stamp. This robot arm makes a great foundation for many AI and motion control experiments. Position the arm in an X, Y, Z, grid with a joystick or keyboard using the new RoboMotion for Windows. The kit includes the hardware, structural components, Hitec servos, pre-assembled SSC servo controller, DOS and Windows software, and an illustrated assembly manual. Camouflage paint not included.

We have many more cool robots, check out our web page or ask for our free catalog!

Lynxmotion, Inc.  
104 Partridge Road  
Pekin, IL 61554-1403  
[www.lynxmotion.com](http://www.lynxmotion.com)



Tel: 309-382-1816  
Fax: 309-382-1254  
[sales@lynxmotion.com](mailto:sales@lynxmotion.com)  
[tech@lynxmotion.com](mailto:tech@lynxmotion.com)

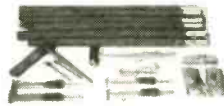
## ELECTRONIC MILITARY SURPLUS



### FAIR RADIO SALES

WEBSITE: [fairradio.com](http://fairradio.com)  
E-MAIL: [fairradio@wcoil.com](mailto:fairradio@wcoil.com)  
PHONE: 419-227-6573  
FAX: 419-227-1313  
1016 E. Eureka - Box 1105  
Lima, OH 45802  
VISA, MASTERCARD, DISCOVER  
Address Dept. ES

## 30 FT MAST KIT



AB-1244/GRC MAST KIT, 12 aluminum alloy on steel sections form sturdy, lightweight 30 ft 1.7" dia mast. Kit includes 5 ea lower and upper sections, 1 ea lower and upper adapter sections, gin pole swivel base, 4 ea 36 and 42 ft guy ropes, 4 guy stakes, 2 guy rings plus 2.5 pound sledge hammer. Part of OE-254/GRC antenna set; 30 lb sh. New, \$139.50 plus shpg.

SEND FOR OUR NEW 1999 CATALOG

Radios - Test Equipment - Tubes - Antennas

## SINGERS! REMOVE VOCALS

Unlimited. Low Cost. Instantly Available Background Music from Original Standard Recordings! Does Everything Karaoke does... Better, and gives you the Thompson Vocal Eliminator. Free Brochure & Demo Tape. LT Sound Dept PE 7988 LT Parkway, Lithonia, GA 30058 Internet: <http://www.LTSound.com> 24 Hour Demo/Info Request Line (770)482-2485 - Ext 49 When You Want Something Better Than Karaoke!

**Poptronics SHOPPER**

## BUGGED??

FAVORITING is unbelievably widespread! Electronic Devices with amazing capabilities can be monitoring your telephone and room conversations RIGHT NOW! Are you sure you're safe? FREE CATALOG tells you fast! Includes Free Bonus details on fantastic opportunities now open in Counter-Surveillance field. Exciting, immensely interesting and EXTREMELY profitable (up to \$250/hr) full/part-time income. Call Now! 1-800-732-5000

## FCC License Preparation

RADIOTELEPHONE LICENSE  
Electronics Tech, Avionics, Marine & Radar  
Homestudy - Fast-Fasy & inexpensive.  
Manuels-Audio-Video-podisks-Q&As  
Guarantee Pass-see at [www.wptfcc.com](http://www.wptfcc.com)  
Details-800-800-7555.WPT Publications  
4701 NE 47ST, Vancouver, WA 98661

## PC BOARDS

Low Cost, Precision-Made PC Boards  
From Your Gerber/NC Drill Files

Put your CAD program to work for you!



- Milling
- Drilling
- Routing

[www.pcbmilling.com](http://www.pcbmilling.com) FAX: (703) 818-0071



**PCB Artwork Made Easy!**

## PRINTED CIRCUIT DESIGN SOFTWARE

For Windows and DOS  
Layout - Autorouting - Schematic - Circuit Simulation

Visit our Website @ [www.pcboards.net](http://www.pcboards.net)

For free DEMO and Information

PCBoards (800)473-7227  
2110 14th Ave. South (205)933-1122  
Birmingham, AL 35205

Perfect for the Pro or Hobbyist!

# End of MILLENNIUM SALE on Our Best Soldering & Desoldering Tools

**DEN-ON SC7000Z Desoldering Tool** Guaranteed to be the **BEST** Transportable Desoldering Tool you will ever own. **Base Station Performance** in a Portable Tool. Very High and Quick Vacuum. Quick cleaning filter.

10% off of our Nationally Advertised Price of \$395

For a Very Limited Time

**\$355.50**



Inspect your SMD work with the Stereo Zoom Microscope from Scienscope. Add different eyepieces and auxiliary lens to get various Magnifications, field of views, and large working distances. Several microscopes listed on our Web site as low as \$495.

**GL-CO-PK4**

Regular Price \$1364.00

Millennium Price

**\$1245.60**



**DEN-ON SS-8200 Temperature Controlled Soldering Pencil** is a hit with everybody who ventures to try it. It is small, lightweight, easy to use, temperature controlled, and has a burn proof cord and long lasting tips. It also has a **200W Ceramic Element** that keeps it at a constant temperature. Check picture and specs. on our Web Site.

**Special Millennium Price \$95.00**

The Best Hot Air Tool Available. Check out the specifications on our Web Site. Temperature controlled from 120°F to 1100°F. Variable speed motor. Hot & Cool switch. LCD Readout for Temperature.

Regular price \$182.00

**Now \$163.80**



**EDSYN's 951SX Industrial Grade Temperature Controlled Soldering Station** is by far their most popular Soldering Station. Sold nationally for as much as \$164.95.

**Our Special Price \$99.00**



**EDSYN's ZD906** includes a **Desoldering Tool**, a **Soldering Pencil** and a **Hot Air Pencil**. Shop air is required. Very small footprint required on your bench. Check out the Specs on our Web Site.

18 Month Warranty  
Regular price \$1179.00  
Save 10% from our low price

**\$1061.10**



Very **REDUCED** Price on the **EDSYN ZD500DX**. Save **\$200.00** on one of the Best Industrial Grade Desoldering Stations available. Completely made in the USA by skilled USA workers. 18 Month Warranty.

Was \$749.95

**Now \$549.95**



**Contract Manufacturers** This instrument was made for you. Check out the specs. on our web site. **Free Trials Available.** Advertised Nationally for \$5000.

Our Regular Price \$4500.00

**Millennium PRICE \$4250.00**



**New Product from EDSYN 971HA SMT Hot Air Station**

Precise adjustment for heat and air flow. Air automatically shuts off when pencil is placed in holder. Excellent for SMD work up to 80 pins. Easily converts to Powerful Solder Station w/large selection of tips.

Our Regular Price \$599.00

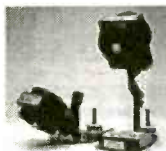
**Now \$539.10**



**Capacitor Wizard ESR Meter** Will be on sale for a **Limited Time Only** **Must Mention this Ad** Regular Price \$179.95 **Now \$159.95**



**Inexpensive but Functional EDSYN Fume Extractor Fans** Uses solder spool for counter balance. Quiet, Efficient and Space Saving. **FXF-11 or FXF-12 \$115.00**



**PDR/Xytronic 710 SolderLight** IR Component Heating w/IR Hand tool IR PCB Preheating W/Bottom Heater All types SMD's and BGA's See Web Site for Specs. **Millennium Madness \$2395.00**



[www.howardelectronics.com](http://www.howardelectronics.com)

**Visa - M/C - Discover - A/E - COD - Terms to Qualifying Companies**  
**30 Day Money Back Total Satisfaction Guarantee**

**HOWARD ELECTRONIC INSTRUMENTS INC**  
Your Desoldering Specialists

Toll Free U.S. and Canada  
**1-800-394-1984**

[www.howardelectronics.com](http://www.howardelectronics.com)  
sales@howardelectronics.com  
International (316) 744-1993  
or Fax (316) 744-1994

CIRCLE 237 ON FREE INFORMATION CARD

[www.americanradiohistory.com](http://www.americanradiohistory.com)

# SECURETEK

**DIRECT FROM MANUFACTURER**

**"WE WILL BEAT ANY COMPETITOR'S PRICE"**

**WORLD SMALLEST  
WIRELESS VIDEO CAMERA**  
(BLACK & WHITE OR COLOR)  
TRANSMITS VIDEO UP TO 1000FT.

CAMERA SHOWN  
ACTUAL SIZE

**WE ALSO CARRY:**

- COVERT VIDEO CAMERAS
- COUNTER-SURVEILLANCE PRODUCTS
- CUSTOM MADE VIDEO SYSTEMS
- IN HOUSE ENGINEERING DEPT.



RUNS ON 9V BATTERY  
FOR UP TO 12 HRS.

**DISTRIBUTOR  
PROGRAM  
AVAILABLE**

**CALL FOR CATALOG:  
SECURETEK**  
7175 S.W. 47TH STREET  
MIAMI, FLORIDA 33155  
TEL.305.667.4545  
FAX.305.667.1744  
[www.securetek.net](http://www.securetek.net)

BREAST CANCER BEGINS EVEN SMALLER THAN THIS. THAT'S WHY YOU NEED A YEARLY MAMMOGRAM, ESPECIALLY AS YOU GET OLDER. MAMMOGRAMS CAN DETECT LUMPS TOO SMALL FOR YOU TO FEEL AND EARLY DETECTION MAY SAVE YOUR LIFE, SO CALL **1-800-ACS-2345.**

GET A MAMMOGRAM. EARLY DETECTION IS THE BEST PROTECTION.

# MONDO • TRONICS ROBOT STORE

**\* KITS \***

Your

**\* BOOKS \***

Mailorder

**\* PARTS \***

Source

**\* VIDEOS \***

For

**\* MODELS \***

Robots!

**\* MORE! \***

(REQUEST OUR FREE CATALOG)

[www.robotstore.com](http://www.robotstore.com)

**800-374-5764**

Or write to us:  
4286 Redwood Hwy PMB #226  
San Rafael CA 94903  
Phone 415-491-4600 • Fax 415-491-4696  
Email [info@mondo.com](mailto:info@mondo.com)

## PRO PLANET CABLE TV CONVERTERS & EQUIPMENT



**FOR ALL MAKES  
AND MODELS**

**LOWEST PRICES**

**DEALER QUANTITY  
DISCOUNT**

**30 DAY MONEY BACK**

**1 YEAR WARRANTY**



[www.cable4you.com](http://www.cable4you.com)

**1-800-888-5585**

## Battery Analyzer



**PC-Controlled Battery Analyzer**  
Cycle, Charge & Test with your PC  
Print reports, plot graphs, expandable **\$398**



Tel: 800-673-3585  
519-472-5566  
Fax: 519-472-1702

Download Demo: **LaMantia Products Ltd.**  
<http://members.home.net/lamantia>  
[lamantia@csi.com](mailto:lamantia@csi.com)

## CABLE TV BOXES

Hablamos Español!  
We'll Beat Any Price!

30 Day Trial • 1yr. Wrrnty • Free Catalog • Qty. Discounts • Dealers Welcome!

**1-800-538-2225**

**Galaxy Electronics Inc.**  
[www.Galaxydescramblers.com](http://www.Galaxydescramblers.com)

### SOLARSPORT RACER KIT

Here is the perfect car for solar powered races and experimenting with solar power. This deluxe car is much more solid than other solar cars on the market today. It doesn't require the builder to cut out or modify parts. In fact, all parts are rigid molded to exact specifications so that every car performs perfectly. Car body is black with a see-through top cowling. Operates from a high power 1.5VDC 400ma solar panel (included) or optional 2 AA batteries (not included). Complete with instructions which include several different experiments, a high quality motor, battery holders, prop for experiments, lamp for experiments, pulley and all car parts. This car differs from the Solar Powered Space Explorer Kit we sell in that it is faster and is designed for races on smooth surfaces and not slowly traveling on uneven terrain like the Space Explorer. The front wheels on the SolarSport Racer can be locked into different positions to allow the car to move in a large circle if desired. Size of SolarSport Racer is about 8 3/4" L x 4" W. Simple to assemble as it requires no soldering! Great gift idea!



**G6821E \$31.95 ea.**



WE ALSO OFFER OVER 150 DIFFERENT ELECTRONIC KITS.

**ELECTRONIC GOLDMINE**  
PO Box 5408  
Scottsdale, AZ 85261

<http://www.goldmine-elec.com>

NOTE: All items subject to prior sale. All prices expire 1-31-99

For Phone Orders Call: **800-445-0697**  
or Fax Your Orders to: **(480) 661-8259**  
For a Free Catalog Call: **800-445-0697**  
e-mail: [goldmine-elec@goldmine-elec.com](mailto:goldmine-elec@goldmine-elec.com)  
Foreign catalog request: send \$5.00

Minimum Order: \$10 (plus min. \$5 Shipping and Handling). We accept MasterCard, Visa and personal checks, however, we cannot accept personal checks on orders outside the U.S. Minimum Foreign Order Amount: \$50 (plus a minimum \$10 S&H)

**FREE!** With any order \$25.00 or more from this Ad, receive a FREE G9880 Safetree Heat Sensor Alarm Ornament (Limit one free G9880 per order, offer expires 1-31-99)

**CALL, E-MAIL, WRITE OR FAX US FOR YOUR FREE COPY OF OUR 96 PAGE CATALOG CONTAINING ALMOST 5,000 PRODUCTS!**

### SOLAR POWERED SPACE EXPLORER KIT

Do you want to have the ultimate go-anywhere solar powered educational car? If so, this is the one for you. This car is the "Sport Utility" type of solar cars, able to slowly rumble like a tank over grass, small stones or obstacles, and up slopes (40° or less)! This easy to assemble solar car has a high torque gear box, a tank type drive mechanism, and decals to customize your vehicle. Includes many fun and exciting experiments and a brief history of space exploration! Perfect for summer fun or as an introduction to solar power. No special tools are required to assemble this car and all of the soldering is already done for you! Size of the space explorer is approximately 9" L x 4 1/4" W. Can operate on 2 AA batteries (not included) or it can operate without batteries with its efficient Solar Panel (included).



**G1492E \$29.95 ea.**

### SAFETREE HEAT SENSOR ALARM ORNAMENT

This holiday ornament is also a heat sensitive alarm that you can hang on your Christmas Tree. If there is a fire, the Safetree will emit a VERY LOUD (90 dBA per meter minimum) alarm when it detects a temperature above 122°F. The unit features very sophisticated IC and transistor circuitry driving a loud Piezo Buzzer. This unit operates 24 hours a day for 21 days on one 9-volt battery (not included). The ornament is silver in color and is about 2 1/2" in diameter. Brand new in manufacturer's box, complete with instructions. We are offering this unique holiday item at an extremely low price. Hurry and get yours today!



**G9880 \$3.95 ea. Sale! \$2.95 ea.**

Compare at \$14.95!

### VA-190 VEHICLE ALARM

When the VA-190 detects sudden air movement (if someone opens your car door or breaks one of your car's windows) it sets the alarm off and flashes a built in strobe for 3 minutes. We could not believe how powerful of a sound was produced by this compact unit! The VA-190 comes with an adapter that you simply plug into your car's cigarette lighter for power. For backup power, or if you do not wish to use your car's cigarette lighter, the VA-190 also operates on one 9-volt battery (not included). The VA-190 Vehicle Alarm has five LEDs (3 red and 2 green) that flash in sequence when the alarm is activated to indicate that your car is being protected. The alarm can be armed or disarmed by the keychain remote from 10 to 15 ft. away. This sophisticated alarm even has a panic button on the remote to



instantly activate the alarm. Comes complete with instructions, cigarette lighter adapter cord, keychain/hand-held remote, arming key, window decals (Vehicle Alarm ARMED) and velcro tape for mounting in your car. Size of unit: 4 3/8" x 4 1/2" x 1". Brand new in manufacturer's box and worth many times more than our low price!

**G9885E \$18.95 ea. Sale! \$8.95 ea!**

### LEVITON 40 FT SPEAKER EXTENSION CABLE WITH CONNECTORS

High quality speaker extension cable consists of a male RCA plug on one end of a 40ft clear jacket 2 conductor speaker wire and a female RCA jack on other end. Makes it very simple to hookup extension speakers for your TV or stereo in any room of your house. Cables can be interconnected together for longer lengths. Remember to buy 2 for stereo applications. Brand new in retail blister package.



**G9974E \$1.89 ea. Sale! 69¢ ea!**

### SENSITIVE PASSIVE INFRARED DETECTOR

This sensitive PIR detector contains a sophisticated 9 IC circuit and a sensitive PIR sensor. The unit operates from 1 9V battery (not included) and is about 5" X 3" X 2". The unit has a built in transmitter which was to transmit the intruder detection alert at 434MHz, however we do not have the receivers. We do provide you with simple directions on how to connect up a relay to this PIR unit to allow you to set off sirens, lights etc. when the unit detects an intruder. This sensitive PIR unit has a detection range of 40 feet with a cone of coverage of about 90° wide. These brand new units cost a fortune originally but we are blowing them out while the supply lasts.



**G1470E \$4.95 ea. Special \$1.99 ea.**

### HANDY WALL POWER SUPPLY

Handy power supply plugs into any standard 120VAC wall outlet and provides the following +5VDC @ .8AMP, +12VDC @ .1AMP, and -12VDC @ .1AMP. Brand new. Has built in 3 prong outlet plug on wall unit and flexible cable with 5 pin Din plug on other end.



**G1041E \$4.95 ea. Sale! \$2.49 ea!**

### 12VDC OPERATED 15KV NEGATIVE ION GENERATOR

Compact negative ion generator cleans air of impurities and provides a fountain of fresh air. Negative ions are produced during a thunderstorm and these are the same type that this 2 1/4" x 1 5/8" x 7/8" module produces. Operates from 12VDC (can even operate from a 9V battery at slightly reduced output). Simple to use, just connect 12VDC to the red and black power input leads and a tremendous quantity of negative ions will be emitted by the needle assembly shown. These are brand new factory fresh prime units perfect for homes, cars, offices, etc.



**G9695E \$12.95 ea. • 2/\$25.00**

**• THE ELECTRONIC GOLDMINE: PO BOX 5408 SCOTTSDALE AZ 85261 • TOLL FREE ORDER LINE: 800-445-0697 • FAX: (480) 661-8259 • ALL OTHER CALLS: (480) 451-7454**

CIRCLE 312 ON FREE INFORMATION CARD

[www.americanradiohistory.com](http://www.americanradiohistory.com)

January 2000, Poptronics

2539 W. 237th Street, Bldg. F, Torrance, CA 90505  
 Order desk only: USA: (800) 872-8878 CA: (800) 223-9977  
 LA. & Technical Info: (310) 784-5488 Fax: (310) 784-7590  
 OEM INQUIRIES WELCOME

# TIMELINE INC.

Over 14 years and 31,000 customers and still growing

Minimum Order: \$20.00. Minimum shipping and handling charge \$5.00. We accept cashiers checks, MC or VISA. No personal checks or COD's. CA residents add 8.25% sales tax. We are not responsible for typographical errors. All merchandise subject to prior sale. Phone orders welcome. Foreign orders require special handling. Prices subject to change without notice. 20% restocking fee for returned orders.

## LIQUID CRYSTAL DISPLAYS

### 240x64 dot LCD with built-in controller.

AND 4021ST-EO. Unit is EL back-lit. \$59.00 or 2 for \$109.00\* or  
 OPTREX. DMF5005 (non back-lit) \$49.00 or 2 for \$89.00\*

20 character x 8 line 7xL x 2xH The built-in controller allows you to do text and graphics.

### Alphanumeric—parallel interface

16x1	\$7.00	20x2	\$10.00	32x2	\$8.00
16x1 (lg. char.)	\$10.00	20x4	\$15.00	40x1	\$8.00
16x2	\$7.00	20x4 (lg. char.)	\$10.00	40x2	2 for \$20.00
16x2 (lg. char.)	\$10.00	24x2	\$10.00	40x4	\$20.00
16x4	\$15.00	32x4	\$10.00	4x2	\$5.00

5V power required • Built-in C-MOS LCD driver & controller • Easy "microprocessor" interface • 98 ASCII character generator • Certain models are backlit, call for more info.

### Graphics and alphanumeric—serial interface

size	Mfr.	price	size	Mfr.	price
640x480 (backlit)	Epson	\$25.00	480x128	Hitachi	\$10.00
640x400 (backlit)	Panasonic	\$20.00	256x128	Epson	\$20.00
640x200	Toshiba	\$15.00	240x128 (backlit)	Optrex	\$20.00
480x128 (backlit)	ALPS	\$10.00	240x64	Epson	\$15.00
			160x128	Optrex	\$15.00

### 6" VGA LCD 640X480, Sanyo LMDK55-22 \$25.00

## MONITORS

### Non-Enclosed TTL

Comes with pinout. 12V at 1.4 Amp input • Horizontal frequency 15KHz. • Ability to do 40 and 80 column.  
 5 inch Amber \$25.00 • 7 inch Amber \$25.00  
 9 inch Amber or Green \$25.00

### 5" COLOR MONITOR \$39.00

• Flat Faceplate • 320 x 200 Dot Resolution • CGA & Hercules Compatible  
 • 12 VDC Operation • 15.75 KHz Horiz. Freq. • 60 Hz Vert. Sync. Freq.  
 • Open Frame Construction • Standard Interface Connector • Degaussing Coil included • Mfr. Samtron



### 9" COLOR SVGA MONITOR \$179.00 Fully Enclosed - Tilt and swivel type.

## POS & BAR CODE

### MAGNETIC CARD READER \$25.00

Includes: • 20 character dot matrix display with full alpha-numeric capability • keypad with full alpha-numeric entry • separate 7.5 VDC/0.5 Amp power supply • standard telephone interface extension cord • lithium battery and flat-cone speaker.

HP bar code wand (HBSC 2300) \$19.00

## HACKER CORNER

### EMBEDDED 486 COMPUTER \$99.00

Complete enhanced Intel 486SX-33 based computer in ultra small (9.78L x 6.5/8W x 3.1/8H) case. Ideal for embedded operations or as a second computer. Features include: • One 16 bit ISA slot • 3 serial ports plus dedicated printer port • Parallel optical coupled adapter port • Built in IBM PC/AT keyboard port • On board VGA video and port • Uses standard SIMM up to 32 MB • BIOS is PC/AT compatible

Unit has a backup Ni-Cd battery system in case of power failure (5 min. backup time) and lockable front cover to prevent floppy drive access. Mounting / interface provisions for standard 3.5" laptop floppy and 2.5 inch hard drives. Comes with very comprehensive manual.

### SONY Miniature Color LCD Display (LCX005BK6) \$29.00

• 1.4 CM (0.55 inch) Diagonal Full Color Display • Built In Horizontal and Vertical Drivers • Delta Dot Pattern for High Picture Quality - 537 dots (H) x 222 dots (V) • Compatible with NTSC & PAL Format and Sync Inputs • 12 VDC Operation with -1 to +17 V RGB Signal and Driver Input Voltage • Excellent Display for Virtual Reality Projects, Viewfinders, and Miniature Test Equipment Displays • Pin Out and Specification Included • Unit Requires Clock, Synchronization and Video

### CELL SITE TRANSCEIVER \$49.00 2 for \$89.00

These transceivers were designed for operation in an AMPS (Advanced Mobile Phone Service) cell site. The 20 MHz bandwidth of the transceiver allows it to operate on all 666 channels allocated. The transmit channels are 870.030-889.980 MHz with the receive channels 45 MHz below those frequencies. A digital synthesizer is utilized to generate the selected frequency. Each unit contains two independent receivers to demodulate voice and data with a Receive Signal Strength Indicator (RSSI) circuit to select the one with the best signal strength. The transmitter provides a 1.5 watt modulated signal to drive an external power amplifier. Channel selection is accomplished with a 10 bit binary input via a connector on the back panel. Other interface requirements for operation are 26 VDC (unregulated) and an 18.990 MHz reference frequency for the digital synthesizer. The units contain independent boards for receivers, exciter, synthesizer, tunable front end, and interface assembly (which includes power supplies and voltage-controlled oscillator). Service manual, schematics and circuit descriptions included.

### 4 INCH LCD MONITOR \$49.00

Compact (4.4" x 3.8" x 1.4") TFT active matrix LCD color monitor including fluorescent backlight. Analog RGB and composite sync input with switchable horizontal / vertical viewing. Low power consumption and long life backlight make it ideal for security and door phone use. Single 8 VDC supply and good resolution allow mobile operations or use with laptops. Standard ribbon cable - Molex connector interface. Complete specifications included.

## NTSC COMPOSITE 4" LCD MONITOR \$69.00

CIRCLE 205 ON FREE INFORMATION CARD

# New and Pre-Owned Test Equipment

## New Equipment Specials

### SIMCHECK® IIse PLUS

Module Tester **Only \$1,995.00!**

- \* Tests SIMMs/168 pin DIMMs
- \* Identifies Module properties
- \* Stand alone/portable
- \* Built-in Serial Interface

### Spectrum Analyzer - Avcom PSA-37D

Satellite Downlink - Installation - Maintenance & Service

- Band 1: 10 - 1750 MHz
- Built-in DC Block & Power for LNA/LNB's
- Band 2: 3.7 - 4.2 GHz
- Line or Battery Powered

**Only \$2,395.00!** (includes carrying case)

### LG Precision Model OS-5100 Oscilloscope

- 100 MHz Bandwidth
- Calibrated Delayed Sweep
- 2 Channel, High Sensitivity
- Includes Two Probes
- TV Synchronization Trigger
- 2 Year Warranty

→ **\$899.00**

### Leader CATV Signal Level Meter Model LF 941

- ✓ TV/CATV Coverage from 46 - 870 MHz
- ✓ Video/Audio Carrier Measurements **\$489.00!**

Just Released! → "Series IV" Digital Multimeters

Fluke Model 87 IV **\$319.00 !!!**

We Buy Surplus  
Test Equipment

## Pre-Owned Oscilloscope Specials

B+K Prec. 1466	10 MHz	\$185.00
Tektronix 465	100 MHz	\$599.00
Tektronix 465B	100 MHz	\$729.00
Tektronix 475	200 MHz	\$829.00
Tektronix 475A	250 MHz	\$999.00

- Professionally Refurbished
- Aligned & Calibrated to Original Specifications
- The Industry Standard of Oscilloscopes
- 1 Year Warranty - The Longest Available!!!
- See Website for Complete Specifications

See us on the Web!

[www.testequipmentdepot.com](http://www.testequipmentdepot.com)

## Test Equipment Depot

A FOTRONIC CORPORATION COMPANY

99 Washington St. Melrose, MA 02176

(781) 665-1400 • FAX (781) 665-0780

e-mail: [sales@testequipmentdepot.com](mailto:sales@testequipmentdepot.com)

(1-800-996-3837)



TOLL FREE 1-800-99-METER

CIRCLE 313 ON FREE INFORMATION CARD

## EZ-EP DEVICE PROGRAMMER - \$169.95

Check Web!! -- [www.m2l.com](http://www.m2l.com)

**Fast** - Programs 27C010 in 23 seconds

**Portable** - Connects to PC Parallel Port

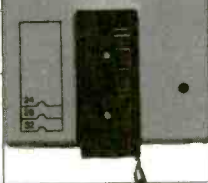
**Versatile** - Programs 2716-080 plus EE and Flash (28F,29C) to 32 pins

**Inexpensive** - Best for less than \$200

- Correct implementation of manufacturer algorithms for fast, reliable programming.
- Easy to use menu based software has binary editor, read, verify, copy, etc. Free updates via bbs or web page.
- Full over current detection on all device power supplies protects against bad chips and reverse insertion.
- Broad support for additional devices using adapters listed below.

Available Adapters	
EP-PIC (16C5x 61,62x 71,84)	\$49.95
EP-PIC64 (62-5,72-4)	\$39.95
EP-PIC12 (12C50x)	\$39.95
EP-PIC17 (17C4x)	\$49.95
EP-51 (8751, C51)	\$39.95
EP-11E (68HC11 E/A)	\$59.95
EP-11D (68HC11D3)	\$39.95
EP-16 (16bit 40pin EPROMS)	\$49.95
EP-Z8(Z86E02, 3, 4, 6, 7, 8)	\$39.95
EP-SEE2 (93x 24x 25x 85x)	\$39.95
EP-750 (87C750, 1, 2)	\$59.95
EP-PEEL (ICT22v10, 18v8)	\$59.95
EP-1051 (89C1051, 2051)	\$39.95
EP-PLCC (PLCC EPROMs)	\$49.95
EP-SOIC (SOIC EPROMs)	\$49.95
Many Other Adapters Available	

**EZ-EP**  
M<sup>2</sup>L ELECTRONICS  
Los Angeles, California



### M<sup>2</sup>L Electronics

970/259-0555 Fax: 970/259-0777  
250 CR 218, Durango, CO 81301  
CO orders add 7% sales tax.  
<http://www.m2l.com>

## BREADBOARD KITS

**USED BY NASA**  
NOW AFFORDABLE TO YOU

**30% OFF**

[www.pulseresearchlab.com/products/breadboarding](http://www.pulseresearchlab.com/products/breadboarding)

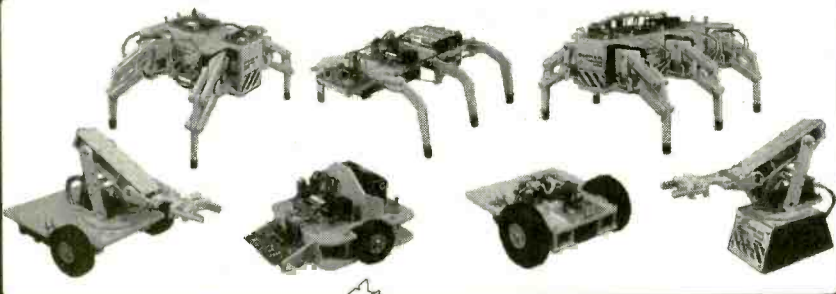
## Do You Repair Electronics?

- |   |   |
|---|---|
| Repair Databases for TV, VCR, Monitor, UL Audio, FCC, and more. | - Over 76,000 records<br>- Private user forums<br>- Live on-line chat rooms |
|---|---|

## RepairWorld.com

Electronics Corp 1 Betsy Sq. Fairborn, OH 45324 (937) 878-9878

## Build Your Own Intelligent Robot, We Make It Easy!



Lynxmotion, Inc.  
104 Partridge Road  
Pekin, IL 61554-1403  
[www.lynxmotion.com](http://www.lynxmotion.com)

**Lynxmotion**

Visit our website or ask for our free catalog!

Tel: 309-382-1816  
Fax: 309-382-1254  
[sales@lynxmotion.com](mailto:sales@lynxmotion.com)  
[tech@lynxmotion.com](mailto:tech@lynxmotion.com)

## Data Acquisition and Control

The ADR series of interfaces allow control of analog, digital and relay I/O via RS232 or RS485. Visit the web site for specs, applications and programs in VB, C, BASIC etc. (705) 671-2652

[www.ontrak.net](http://www.ontrak.net)

Ontrak Control Systems Inc.

New-Old-Stock  
Tubes, Parts, Supplies, Speakers, Books, Transformers, Grill Cloth

**ANTHONY ELECTRONIC SUPPLY**

6221 S. Maple Ave  
Tempe AZ, 85283  
ph. (480) 820 5411  
fax (480) 820 4643  
fax (800) 706 6789

[www.tubesandmore.com](http://www.tubesandmore.com)

XICON JENSEN

**GALEP-III**

One size fits all!  
\$333  
COMPLETE KIT

**CONITEC**

**Best for HIGH PERFORMANCE fieldwork**

**One Pocket Sized Tool Does It All**  
A universal multi-programmer combining performance, flexibility and room for expansion. Optimal for use in the field. Small enough to fit in your pocket, it will output to a wide array of devices.

**Fast, Versatile Field Programmer**  
Programs 8-bit and 16-bit EPROMs, EE-PROMs, Zero Power RAM's, Flash, Serial EEPROMs / GAL, PALCE, ATF/87xxx, 89xxx, PIC12/16/17Cxx / All DIL devices without adapter / Lightning fast parallel data transfer (e.g. 27C512 read/compare 2 sec!)

**With Expanding Output Capability**  
Independent power supply with rechargeable battery / Uses PC printer port / Hex, JEDEC, and binary file formats / Hex & fuse-map buffer editor / Split & shuffle for 8-bit, 16-bit and 32-bit targets / Runs under Win3.1, 95, 98, NT / \*Remote Control\* by DDE scripts / Designed for the future with flexible pin driver technology / new devices added every month / Device list, demo software and lifetime free updates from our website.

**GALEP III / cable, batt. and recharger. \$333.00**  
PLCC adapt. / 8-bit EPROMs / 16-bit EPROMs / GALS each \$149.00

ONLINE ORDERS: [WWW.CONITEC.COM](http://WWW.CONITEC.COM)

**GALEP-III**  
Pocket Multiprogrammer

CONITEC DATASYSTEMS - 1951 4th Avenue, Suite 301 - San Diego, CA 92101 - Tel: 619-702-4420

**SURVEILLANCE HIDDEN CAMERAS**  
DIRECT FROM MANUFACTURER - BEST PRICE IN THE MARKET

Ultra miniature hidden camera, in dome, smoke or motion detector w/ mic. 8/W or Color. Wide view angle. Low light sensitivity + super sharp images, plus video and audio output. From \$159.00. Also 1/2" 8/W Incard Cameras w/ mic, starts at \$79.00 USD. Wireless hidden camera, start at only \$249.00 USD. Plus \$5.95 for S/H. Wholesale Welcome. CDD, Check, Money Order or Visa/MC.

**BOLIDE INTERNATIONAL CORPORATION**  
PH: (800) 355-0895 or (626) 575-8178  
9660 Blair Drive #218, El Monte, CA 91731  
<http://www.bolideintl.com/products/>

**PicC C Compiler \$59**  
for Microchip's PIC microcontrollers  
Supports PIC16C55x, 16C6x, 16C62x, 16C8x, 16C92x PIC families

**SnXC C Compiler \$59**  
Supports **Scenix 8x18ac** and **8x28ac** microcontrollers  
Both compilers based on ANSI C standard. Arrays, unions, structures, pointers, strings, function calls, if, for, switch, while, interrupt vectors, in-line assembler code, 8 & 16 bit variables, etc. Outputs Intel Hex format and assembly code. Code optimizer included. Excellent development tools!

**DebugIDE Debugger \$79**  
C source level debugger for PicC and SnXC compilers. Integrated Development Environment. Step, Run, Stop, Reset. Variable monitoring and modification. Oscillator/cable kit (\$39)  
732-873-1519 fax 732-873-1582 e [grichre@aol.com](mailto:grichre@aol.com)  
Grich RC Inc. 120 Cedar Grove Ln, Ste 340, Somerset NJ USA 08873  
URL: <http://members.aol.com/piccompile>

**3 Axis Motion Control System**  
Complete, ready to run  
**\$ 295.00 + 12.00 S/H**

Build or adapt CNC mills, CNC routers, Robots, Etc. Includes: 3 Stepping motors (70 oz/in 200 steps/rev). External board (connects to parallel port of a PC). Power supply. Cables. Manual and the MAXNC drive software, with linear, circular and helical interpolation, acceleration deceleration, full contouring, 'G' code programming, screen plot, code generation from CAD (CAM), and more.

For more information, phone or write to:  
**MAXNC**  
6730 West Chicago  
Suites 2 & 3  
Chandler, AZ 85226  
Ph (480) 940-9414  
Fax (480) 940-2384

**CABLE BOXES**  
BEST PRICES  
Ship Anywhere  
In U.S.A.  
**1-800-637-4615**  
[www.xxbox.com](http://www.xxbox.com)

January 2000, Poptronics

# TIPS FOR MAIL ORDER PURCHASE

It is impossible for us to verify the claims of advertisers, including but not limited to product availability, credibility, reliability and existence of warranties. The following information is provided as a service for your protection. It is not intended to constitute legal advice and readers are advised to obtain independent advice on how to best protect their own interests based upon their individual circumstances and jurisdictions.

- Confirm price and merchandise information** with the seller, including brand, model, color or finish, accessories and rebates included in the price.
- Understand the seller's return and/or refund policy**, including the allowable return period, who pays the postage for returned merchandise and whether there is any "restocking" or "return" charge.
- Understand the product's warranty.** Is there a manufacturer's warranty, and if so, is it for a U.S. or foreign manufacturer? Note that many manufacturers assert that, even if the product comes with a U.S. manufacturer's warranty, if you purchase from an unauthorized dealer, you are not covered by the manufacturer's warranty. If in doubt, contact the manufacturer directly. In addition to, or instead of the manufacturer's warranty, the seller may offer its own warranty. In either case, what is covered by warranty, how long is the warranty period, where will the product be serviced, is there a charge for service, what do you have to do to obtain service and will the product be repaired or replaced? You may want to receive a copy of the written warranty before placing your order.
- Keep a copy of all transactions**, including but not limited to cancelled check, receipt and correspondence. For phone orders, make a note of the order including merchandise ordered, price, order date, expected delivery date and salesperson's name.
- If the merchandise is not shipped within the promised time**, or if no time was promised, within 30 days of receipt of the order, you generally have the right to cancel the order and get a refund.
- Merchandise substitution** without your express prior consent is generally not allowed.
- If you have a problem with your order or the merchandise**, write a letter to the seller with all the pertinent information and keep a copy.
- If you are unable to obtain satisfaction from the seller**, contact the consumer protection agency in the seller's state and your local Post Office.

If, after following the guidelines, you experience a problem with a mail order advertiser that you are unable to resolve, please let us know. Write to Advertising Department, Gernsback Publications Inc., 500B Bi-County Blvd. Farmingdale, NY 11735.

Be sure to include copies of all correspondence.

## UNITED STATES POSTAL SERVICE Statement of Ownership, Management, and Circulation (Required by 39 USC 3685)

1. Publication Title: **ELECTRONICS NOW**

2. Issue Frequency: **Monthly**

3. Issue Date: **10/17/99**

4. Number of Issues Published Annually: **12**

5. Annual Subscription Price: **\$6.99**

6. Annual Circulation: **117,996**

7. Complete Mailing Address of Known Office of Publication (Street, city, county, state, and ZIP+4): **500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

8. Complete Mailing Address of Headquarters or General Business Office of Publisher (Not printer): **500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

9. Full Name and Complete Mailing Address of Publisher: **GERNSBACK PUBLICATIONS, INC., 500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

10. Full Name and Complete Mailing Address of Owner: **GERNSBACK PUBLICATIONS, INC., 500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

11. Full Name and Complete Mailing Address of Known Bondholder, Mortgagee, and Other Security Holders Owning or Holding 1 Percent or More of Total Amount of Bonds, Mortgages, or Other Securities. If none, check box:  None

12. Tax Status:  For-profit organization  Not-for-profit organization

13. Publication Title: **ELECTRONICS NOW**

14. Issue Frequency: **Monthly**

15. Issue Date: **10/17/99**

16. Number of Issues Published Annually: **12**

17. Annual Circulation: **117,996**

18. Complete Mailing Address of Known Office of Publication (Street, city, county, state, and ZIP+4): **500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

19. Complete Mailing Address of Headquarters or General Business Office of Publisher (Not printer): **500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

20. Full Name and Complete Mailing Address of Publisher: **GERNSBACK PUBLICATIONS, INC., 500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

21. Full Name and Complete Mailing Address of Owner: **GERNSBACK PUBLICATIONS, INC., 500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

22. Tax Status:  For-profit organization  Not-for-profit organization

13. Publication Title: **ELECTRONICS NOW**

14. Issue Frequency: **Monthly**

15. Issue Date: **10/17/99**

16. Number of Issues Published Annually: **12**

17. Annual Circulation: **117,996**

18. Complete Mailing Address of Known Office of Publication (Street, city, county, state, and ZIP+4): **500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

19. Complete Mailing Address of Headquarters or General Business Office of Publisher (Not printer): **500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

20. Full Name and Complete Mailing Address of Publisher: **GERNSBACK PUBLICATIONS, INC., 500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

21. Full Name and Complete Mailing Address of Owner: **GERNSBACK PUBLICATIONS, INC., 500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

22. Tax Status:  For-profit organization  Not-for-profit organization

13. Publication Title	14. Issue Frequency	15. Issue Date	16. Number of Issues Published Annually	17. Annual Circulation
ELECTRONICS NOW	Monthly	10/17/99	12	117,996
a. Total number of copies (net press run)				
b. Paid and unpaid circulation				
c. Total paid and unpaid circulation				
d. Free distribution by mail				
e. Free distribution outside the mail				
f. Free distribution other than mail and other				
g. Total free distribution				
h. Paid circulation				
i. Total paid circulation				
j. Total circulation				
k. Copies not distributed				
l. Total (sum of 13b, 13d, 13e, 13g, 13h, 13i, 13k)				

13. Publication Title: **ELECTRONICS NOW**

14. Issue Frequency: **Monthly**

15. Issue Date: **10/17/99**

16. Number of Issues Published Annually: **12**

17. Annual Circulation: **117,996**

18. Complete Mailing Address of Known Office of Publication (Street, city, county, state, and ZIP+4): **500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

19. Complete Mailing Address of Headquarters or General Business Office of Publisher (Not printer): **500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

20. Full Name and Complete Mailing Address of Publisher: **GERNSBACK PUBLICATIONS, INC., 500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

21. Full Name and Complete Mailing Address of Owner: **GERNSBACK PUBLICATIONS, INC., 500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

22. Tax Status:  For-profit organization  Not-for-profit organization

## UNITED STATES POSTAL SERVICE Statement of Ownership, Management, and Circulation (Required by 39 USC 3685)

1. Publication Title: **POPULAR ELECTRONICS**

2. Issue Frequency: **Monthly**

3. Issue Date: **10/17/99**

4. Number of Issues Published Annually: **12**

5. Annual Subscription Price: **\$6.99**

6. Annual Circulation: **95,277**

7. Complete Mailing Address of Known Office of Publication (Street, city, county, state, and ZIP+4): **500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

8. Complete Mailing Address of Headquarters or General Business Office of Publisher (Not printer): **500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

9. Full Name and Complete Mailing Address of Publisher: **GERNSBACK PUBLICATIONS, INC., 500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

10. Full Name and Complete Mailing Address of Owner: **GERNSBACK PUBLICATIONS, INC., 500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

11. Full Name and Complete Mailing Address of Known Bondholder, Mortgagee, and Other Security Holders Owning or Holding 1 Percent or More of Total Amount of Bonds, Mortgages, or Other Securities. If none, check box:  None

12. Tax Status:  For-profit organization  Not-for-profit organization

13. Publication Title: **POPULAR ELECTRONICS**

14. Issue Frequency: **Monthly**

15. Issue Date: **10/17/99**

16. Number of Issues Published Annually: **12**

17. Annual Circulation: **95,277**

18. Complete Mailing Address of Known Office of Publication (Street, city, county, state, and ZIP+4): **500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

19. Complete Mailing Address of Headquarters or General Business Office of Publisher (Not printer): **500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

20. Full Name and Complete Mailing Address of Publisher: **GERNSBACK PUBLICATIONS, INC., 500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

21. Full Name and Complete Mailing Address of Owner: **GERNSBACK PUBLICATIONS, INC., 500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

22. Tax Status:  For-profit organization  Not-for-profit organization

13. Publication Title: **POPULAR ELECTRONICS**

14. Issue Frequency: **Monthly**

15. Issue Date: **10/17/99**

16. Number of Issues Published Annually: **12**

17. Annual Circulation: **95,277**

18. Complete Mailing Address of Known Office of Publication (Street, city, county, state, and ZIP+4): **500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

19. Complete Mailing Address of Headquarters or General Business Office of Publisher (Not printer): **500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

20. Full Name and Complete Mailing Address of Publisher: **GERNSBACK PUBLICATIONS, INC., 500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

21. Full Name and Complete Mailing Address of Owner: **GERNSBACK PUBLICATIONS, INC., 500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

22. Tax Status:  For-profit organization  Not-for-profit organization

13. Publication Title	14. Issue Frequency	15. Issue Date	16. Number of Issues Published Annually	17. Annual Circulation
POPULAR ELECTRONICS	Monthly	10/17/99	12	95,277
a. Total number of copies (net press run)				
b. Paid and unpaid circulation				
c. Total paid and unpaid circulation				
d. Free distribution by mail				
e. Free distribution outside the mail				
f. Free distribution other than mail and other				
g. Total free distribution				
h. Paid circulation				
i. Total paid circulation				
j. Total circulation				
k. Copies not distributed				
l. Total (sum of 13b, 13d, 13e, 13g, 13h, 13i, 13k)				

13. Publication Title: **POPULAR ELECTRONICS**

14. Issue Frequency: **Monthly**

15. Issue Date: **10/17/99**

16. Number of Issues Published Annually: **12**

17. Annual Circulation: **95,277**

18. Complete Mailing Address of Known Office of Publication (Street, city, county, state, and ZIP+4): **500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

19. Complete Mailing Address of Headquarters or General Business Office of Publisher (Not printer): **500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

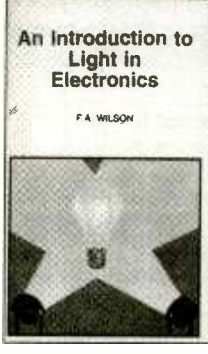
20. Full Name and Complete Mailing Address of Publisher: **GERNSBACK PUBLICATIONS, INC., 500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

21. Full Name and Complete Mailing Address of Owner: **GERNSBACK PUBLICATIONS, INC., 500 BI-COUNTY BLVD., FARMINGDALE, NY 11735**

22. Tax Status:  For-profit organization  Not-for-profit organization

# Plant Trees for America™

## An Introduction to Light in Electronics



Taken for granted by us all perhaps, yet this book could not be read without it, light plays such an impressive role in daily life that we may be tempted to consider just how much we understand it. This book makes a good start into this fascinating and enlightening subject. It has been written with the general electronics enthusiast in mind.

To order Book #BP359 send \$6.99 plus \$3.00 for shipping in the U.S. and Canada only to Electronics Technology Today Inc., P.O. Box 240, Massapequa Park, NY 11762-0240. Payment in U.S. funds by U.S. bank check or International Money Order. Please allow 6-8 weeks for delivery.

## ELECTRONIC SECURITY DEVICES

A great book for project builders. It is quite common to associate the term "Security Devices" with burglar alarms of various types. However in fact it can refer to any piece of equipment that helps to protect people or property. The text is divided into three basic sections: Chapter 1 covers switch-activated burglar alarms and includes exit and entry delays. Chapter 2 discusses other types of burglar alarms and includes Infra-Red, Ultrasonic and Doppler-Shift Systems. Chapter 3 covers other types of security devices such as Smoke and Gas Detectors; Water, Temperature and Baby Alarms; Doorphones, etc. Most circuits are simple, and stripboard layouts are provided.

To order Book BP56 and send \$5.99 includes shipping and handling in the U.S. and Canada only to Electronics Technology Today Inc., P.O. Box 240, Massapequa Park, NY 11762-0240. Payment in U.S. funds by U.S. Bank check or International Money Order. Please allow 6-8 weeks for delivery.

Poptronics, January 2000



# CLASSIFIEDS

## BUSINESS OPPORTUNITIES

**\$400 Weekly Assembling** electronic circuit boards/products from home. For free information send SASE: **Home Assembly-PT** Box 216 New Britain, CT 06050-0216

**TOO MANY BILLS?** Free Debt Consolidation. One monthly payment - reduced up to 50%! **Genus Credit Management - Nonprofit!** 1-800-214-4610 (Ext. 1265).

**EASY Work! Excellent Pay!** Assemble Products At Home. Call Toll Free 1-800-467-5566 Ext. 1190

**HAVE AN IDEA?** National company helps submit ideas, inventions to industry. Trade show. Patent Services. 1-888-439-IDEA.

**FREE MONEY! NEVER REPAY. GUARANTEED. BUSINESS START, EXPANSION, PERSONAL NEEDS, DEBT CONSOLIDATION. FREE PACKAGE 1-888-290-5605.**

**START** your own technical venture! Don Lancaster's newly updated **INCREDIBLE SECRET MONEY MACHINE III** tells how. We now have autographed copies of the Guru's underground classic for \$24.50. **Synergetics Press**, Box 809-C, Thatcher AZ, 85552. (520) 428-4073. [www.tinaja.com](http://www.tinaja.com) VISA/MC.

## CABLE TV

**CABLE TV Descramblers.** One-piece units. Scientific Atlanta, Jerrold, Pioneer, and others. Lowest Prices Around. **Precision Electronics** Houston, TX Anytime. 1-888-691-4610

**PAY TV AND SATELLITE DESCRAMBLING 2000 EDITION.** \$16.95. Hacking Digital Scrambling Systems III (NEW) \$29.95. Scrambling News online \$40.00. Pay TV Series CD (Vol. 1-10) \$59.95. Everything listed here \$99.95. Free catalog. **SCRAMBLING NEWS.** 863-646-2564. [www.scrablingnews.com](http://www.scrablingnews.com)

**Descrambler Blowout-Wholesale Prices-Universal Box.** Works for most Scientific Atlanta, Jerrold, Pioneer, Zenith Models. 412-833-0773

**Cable Notch Filters** all channels, top quality metal cylinder types. Visa, Mastercard, Discover and UPS COD. See these websites. [www.gofilters.com](http://www.gofilters.com) and [www.cabletv-auction.com](http://www.cabletv-auction.com) buy and sell cable equipment on the internet. **Auctions and Classifieds.** 800-235-8080

**NEW!** Cellphone E.S.N. readers \$250 each, cell phone programmers \$175 each, cell phones \$25 each, DSS satellite dish card readers and programmers \$125 each, credit card readers \$250 each, Cable T.V. notch filters 50 cents each, converter boxes \$50 each, magnetic strip card readers for ATM machines, bank cards, drivers license, and all types of data acquisitions all under \$200 each. You pay these super low prices when you deal directly with the manufacturers. When you order "Direct Connection" a 150 page directory published by Ed Treki Publications, you will receive the largest collection of names, addresses, and phone numbers of all the leading American and International manufacturers of these products never before available. Stop paying second, third and fourth hand prices and deal directly with the source!!! Order your copy of "Direct Connection" today for only \$59.95 plus \$5 shipping. All orders are sent C.O.D. Please call Ed Treki Publications 24 hour order hot line 914-544-2829.

**Descramblers, Converters, Activators, Rft's, Ftg's, Bullet Snoopers. All Options Explained, Best Prices, Services, 2 yr. Warranty, Free Catalog. 1-800-854-1674** [www.resourceleader.com/aapc](http://www.resourceleader.com/aapc)

**Cable Tester** Test for opens and shorts up to 60 conductors. Double 7 segment display. For schematic, write to **John Conroy** PO Box 237 Bedford, MA 01730. Include \$9.75 charge for shipping and handling.

**NEW!** Jerrold and Pioneer wireless test units \$125 each, also 75DB notch filters \$19.95 each, quantity pricing available please call **KEN ERNY ELECTRONICS** 24-hour order and information hot line 516-389-3536.

**WHOLESALE PRICES, SUPERIOR QUALITY, INTERNAL/EXTERNAL ACTIVATORS AND CABLE BOXES. FIRST TIME CUSTOMER DISCOUNT, COD ONLY. SALES OFFICE OPEN M-F 9AM-5PM EST. DEALERS WELCOME. CALL LUNAR INDUSTRIES TOLL FREE 1-877-282-7641.**

**CABLE Boxes:** All Models, All Channels. Lowest Prices in United States. Open Seven days a week until midnight, Pacific time. Call toll-free: 877-789-7337.

**DESCRAMBLE CABLE WITH SIMPLE CIRCUIT ADDED TO RADIO SHACK RF MODULATOR AND USING VCR AS TUNER INSTRUCTIONS \$10.00 TELCOM BOX 832PI BRUSHLY, LA 70719**

**ALL** your cable needs, wholesale prices. Dealers Welcome. All makes, models. Fast Service. Call now 1-877-449-3737 Mon-Fri 9:00-5:00 EST - 24 Hour Mess. - 30 Day Guarantee.

**CABLE DESCRAMBLING, New secret manual.** Build your own Descramblers for Cable and Subscription TV. Instructions, schematics for SSAVI, Gated Sync, Sinewave, \$12.95, \$2 postage **CABLETRONICS**, Box 30502 PE, Bethesda, MD 20824.

**CABLE TV DESCRAMBLERS/CONVERTERS. LOWEST PRICES. 30 DAY MONEY BACK GUARANTEE. 1 YEAR WARRANTY. 1-800-785-1145**

**ALL CABLE TV BOXES. WE'LL BEAT ANY PRICE. 30 DAY TRIAL 1 YEAR WARRANTY. FREE CATALOG! [www.galaxydescramblers.com](http://www.galaxydescramblers.com) 1-800-538-CABLE(2225).**

**Cable boxes Low Low Prices. Dealers Welcome, Wholesale Direct to you! Call NOW and SAVE 1-800-765-5777.**

## CB-SCANNERS

**CB Radio Modifications!** Frequencies, kits, high-performance accessories, books, plans, repairs, amps, 10-Meter conversions. The best since 1976! Catalog \$3. **CBCL**, Box 1898P, Monterey, CA 93942. [www.cbintl.com](http://www.cbintl.com)

## BUY BONDS

## EDUCATION

**LEARN ELECTRONICS. HOME STUDY. OUTSTANDING CAREERS. FREE LITERATURE. P.C.D.I., ATLANTA, GEORGIA. CALL 800-362-7070. DEPT. ELA341.**

**THE CASE AGAINST PATENTS** Thoroughly tested and proven alternatives that work in the real world. \$28.50. **Synergetics Press**, Box 809-C, Thatcher, AZ 85552. (520) 428-4073. [www.tinaja.com](http://www.tinaja.com) VISA/MC.

## MISC. ELECTRONICS FOR SALE

**SECURITY** Systems, Radar Detectors, GPS, Telephone Systems. Discount Prices. Secure Orders at [www.youbuy.ezpublishing.com](http://www.youbuy.ezpublishing.com)

**T & M ELECTRONICS.** Large variety of electronic parts since 1966. Visit our Web site at [www.tandmelectronics.com](http://www.tandmelectronics.com)

**Acquire, Control, Display!** Simple, fast and fun systems. [www.industrologic.com](http://www.industrologic.com) (314) 707-8818

**Static Electricity** problems? Control static electricity by using our positive and negative ion generator. Units available for both small and large rooms. Call **Omnivatch Technologies** at 800 539-6664. Fax: 570 286-8304.

## PLANS-KITS-SCHEMATICS

**HDTV HACKING**, unpacking the data stream to decode HDTV, \$19.95. **CABLETRONICS** Box 30502PE Bethesda, MD 20824

**ELECTRONIC PROJECT KITS:** \$3.00 catalog. 49 McMichael St. Kingston, ON., K7M 1M8. [www.qkits.com](http://www.qkits.com) - **QUALITY KITS**

**"HEATHKIT COMPANY"** is selling photocopies of most Heathkit manuals. Only authorized source for copyright manuals. Phone: 616-925-5899, 8-4 ET."

**SILENT, SECRET, SUPER POWERFUL SUBLIMINAL MESSAGE TRANCE INDUCER-Plans** \$21.00 **Dennis Wilson**, PO Box 6604, Delray Beach, FL 33482.

## REPAIRS-SERVICES

**PCB DESIGNS, SCHEMATICS:** Professionally Mastered in "TANGO". **Awesome Designs** PO Box 214 Aurora, Ohio 44202-0214. Visit us at: <http://home.att.net/~awesomedesigns/index.html>

## SATELLITE EQUIPMENT

**FREE** Satellite TV Buyer's Guide. Best Products - Lowest Prices - Fastest Service! Dish Network, C/Ku-band, including 4DTV. Parts - Upgrades - Accessories! **SKYVISION** - 800-543-3025. International 218-739-5231. [www.skyvision.com](http://www.skyvision.com)

**DSS Hacking:** How to construct and program smart cards, with pic 16C84, PCB layout, Complete DSS system schematics, \$16.95. Software \$25. **CABLETRONICS** Box 30502PE Bethesda, MD 20824.

**DSS Test card.** Authorizes all channels for information, plus free bonus. Call toll free 1-888-416-7296.

**Test Equipment Sale!** Complete listing at <http://www.astglobal.com> or call **NOW** to receive list by fax or mail. **AST GLOBAL-ELECTRONICS:** Voice 888-216-7159; Fax 814-398-1776; e-mail: [sales@astglobal.com](mailto:sales@astglobal.com)

## ADVERTISING INDEX

Poptronics does not assume any responsibility for errors that may appear in the index below.

Free Information Number	Page	Free Information Number	Page
- Abacom Technology	98	- M <sup>2</sup> L Electronics	117
- ABC Electronics	100	225 MCM electronics	111
255 Alfa Electronics	96	250 Mendelsons	105
215 All Electronics	103	296 Merrimack Valley Systems	98
- Allison Technology	110	310 Micro 2000	87
- Amazon Electronics	108	- microEngineering Labs	109
- Amaze Electronics	109	- Modern Electronics	102
- Andromeda Research	110	- Mondo-tronics	114
- Arrow Technologies	104	218 Mouser Electronics	82
- Brand Electronics	100	- MSC Electronics	108
- Bsoft Software, Inc.	92	- NESDA	PS-8A
155 Butterworth	86	- PC Boards	112
290 C&S Sales, Inc.	84	257 Parts Express	97
283 Cadsoft, Inc.	53	- Pioneer Hill Software	82
133 CircuitMaker	CV2	- Polaris Industries	81
233 Circuit Specialists	101	219 Prairie Digital	92
- CLAGGK, Inc.	57, PS-3B	256 Print Products Int.	106
- Cleveland Inst. of Electronics	49	- Pro Planet	114
- Command Productions	92	- Prompt Publications	45
- Computer Monitor Maintenance	104	150 PTS Electronics Corp.	PS-3A
- Connecticut microComputer	91	263 Ramsey Electronics	88
- Conitec Data Systems	117	246 Resources Unlimited	94
282 Cooks Institute	28	212 RobotikitsDirect	90
230 Dalbani	CV3	308 Rogers' Systems Specialist	91
- EDE Spy Oultet	102	- Saelig Co. LLC	112
312 Electronic Goldmine	115	- Science Fair Electronics	109
130 Electronic Workbench	CV4	- Securetek	114
- Electronic Tech. Today	35	138 Sencore, Inc.	27
- Emac Inc.	98	- Seven Continents (Robofly)	82
- Engineering Express	110	- Sil Walker	100
- Fair Radio Sales	112	- Smithy Company	109
- Foley-Belsaw	19	- Spectrum Research	99
- General Device Instruments	104	- Square 1 Electronics	99
- Globaltech Distributors	108	- Techniks	108
271 Graymark	99	- Technological Arts	105
- Hollins Radio Data	37	311 Telulex	90
237 Howard Electronics	113	313 Test Equipment Depot	116
- Howard Electronics	109	217 Tie Pie Engineering	100
220 Information Unlimited	89	205 Timeline	116
- Intec Automation	108	- UCANDO Videos	91
- Intelligence I <sup>2</sup> Inc.	108	- Ultima Associates	105
- International Hanbai, Co., Ltd.	29	275 Velleman	93
- Intronics	105	- Vision Electronics	82
309 IVEX Design	83	314 Visitect Inc.	102
- J&M Microtek, Inc.	108	170 Wavetek Corp.	13
- Keware Technologies	112	- World Star Technologies	109
- KNS Instruments	104	- World Wyde	96, 108, 109
- Lindsay Publications	104	- XX Box	117
- Lynxmotion	112, 117	- Zagros Robotics	104

## ADVERTISING SALES OFFICES

**Gernsback Publications, Inc.**  
**500 Bi-County Blvd.**  
**Farmingdale, NY 11735-3931**  
**Tel. 631-293-3000**  
**Fax: 631-293-3115**

**Larry Steckler**  
 Publisher (ext. 201)  
 e-mail: advertising@gernsback.com

**Adria Coren**  
 Vice President (ext. 208)

**Ken Coren**  
 Vice-President (ext. 267)

**Marie Falcon**  
 Advertising Director (ext. 206)

**Adria Coren**  
 Credit Manager (ext. 208)

### For Advertising ONLY EAST/SOUTHEAST

**Megan Mitchell**  
 9072 Lawton Pine Avenue  
 Las Vegas, NV 89129-7044  
 Tel. 702-240-0184  
 Fax: 702-838-6924  
 e-mail: mmitchell@gernsback.com

### MIDWEST/Texas/Arkansas/ Oklahoma

**Ralph Bergen**  
 One Northfield Plaza, Suite 300  
 Northfield, IL 60093-1214  
 Tel. 847-559-0555  
 Fax: 847-559-0562  
 e-mail: bergenrj@aol.com

### PACIFIC COAST

**Megan Mitchell**  
 9072 Lawton Pine Avenue  
 Las Vegas, NV 89129-7044  
 Tel. 702-240-0184  
 Fax: 702-838-6924  
 e-mail: mmitchell@gernsback.com

### Poptronics Shopper

**Megan Mitchell**  
 National Representative  
 9072 Lawton Pine Avenue  
 Las Vegas, NV 89129-7044  
 Tel. 702-240-0184  
 Fax: 702-838-6924  
 email: mmitchell@gernsback.com

**Subscription/  
Customer Service/  
Order Entry**  
 Tel. 800-827-0383  
 7:30 AM - 8:30 PM CST

# Dalbani

Shop on line [www.dalbani.com](http://www.dalbani.com)

**Performance Keyboard**  
IBM PC Compatible 104 keyboard  
Item # 95-7760



**\$6<sup>95</sup>**  
Performance keyboard features three new keys that make Microsoft® Windows® 95 easier to use.  
- Two Windows logo keys.  
- One application key.  
• Use Standard Mini 6-Pin DIN

**Fax Machine**  
Six in one  
Item # 85-2365

Fax, Phone, Printer, Copier, Scanner, PC Fax/Modem

**\$119<sup>99</sup>**

**12 Inch Quad Screen Observation System**

Item # 38-0525

**\$199<sup>99</sup>**



Reg. \$699.00

**Color Board Camera**  
Item # 38-0760

1/4" Color CCD, High sensitivity microphone, 3.6mm/F2.0 lens, operates on 12V DC

**\$99<sup>00</sup>**

**Panasonic DSS Beyond TV Reach**

Allows you to view the same programming on a second TV in another Room

Item # 55-1845

Panasonic Model # TZ-A102RK 900 MHz



**\$49<sup>00</sup>**

2nd Room Kit

**PRIMESTAR**

**Universal Remote Control**  
Item # 82-2415  
Replaces 3 TV, VCR, Cable Box



**\$4<sup>95</sup>**

**Fix Y2K**

Item # 95-8000

A simple Hardware Solution

**\$55<sup>95</sup>**



**Aluminum frame**

Tool Case  
Item # 50-1890

• Black Color

**\$24<sup>95</sup>**



**21 Pieces Service Tool Kit**  
Item # 50-057

**\$29<sup>99</sup>**



**Multimeters**  
Item # 50-3630

**\$9<sup>95</sup>**

*Quality Test Equipment*



**Soldering Station**  
Item # 51-1505

Variable Power Control(5-40W) Interchangeable Tip & Heating Element

**\$34<sup>95</sup>**



**Weller**

**Deluxe Video Dubbing and Enhancement System**

Item # 55-1780

• Stereo / Mono Compatible



**\$14<sup>95</sup>**

**SUPPRESSED 3.5A DIMMER**

Item # 77-1055

This dimmer is used to adjust the speed of a motor vacuum cleaner, or any other motor with carbon brush. A main suppressor is provided eliminating undesirable RFI. PCB dimensions: 45x47mm.



**\$8<sup>99</sup>**

**Wireless Digital Audio/Video Sender with 2.4GHz Transmitter**



**2.4GHz**  
Up to 300ft

**\$99<sup>99</sup>**

Item # 38-0885

Watch movies in another room from your Satellite Dish, VCR DVD, or Laser Disc Player without running cables

**Photo Inkjet Color Printer**

**Okijet® 2500**

Item # 95-7580



**\$115<sup>00</sup>**

Reg. \$189.00

**Digital Video Stabilizer**  
Item # 55-1265



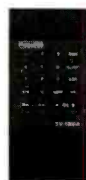
**\$16<sup>95</sup>**

• Eliminates brightening and darkening, blackout, color shifting, jitter, shaking, picture tearing and twisting, line effects and all other symptoms 9V battery (installed)

**ECG®TV-1000 70-Channel Cable Converter With Remote Control**

Item # 55-1405

Transmitter: 9V Batteries not included  
• 70 VHF/UHF/Cable Channels • Last Channel Recall • Infrared Remote Control  
Converter: • Power Consumption: 12 Watts @ 120V AC, 60Hz • Output Channel: Channel 3 or 4 Switchable • Fine Tuning Range: ±3MHz in 125KHz steps



**Philips ECG**

**\$59<sup>99</sup>**

Reg. \$105.00

**Power Inverter, Convert Vehicle DC Power to Versatile AC.**  
Item # 40-1935

This Power Inverter handles Temporary High Surge Loads to Start and Run Electrical Motors, Water Pumps & TVs  
• DC Input Voltage: 10-15V  
• AC Output Voltage: 120V  
• Output Waveform: Modified Signwave  
• output Power: 2500W  
• Continuous Power: 2200W  
• Maximum Surge: 5000W



**\$455<sup>00</sup>**

**\$20.00 Minimum Order not including shipping & handling**

**ups 2ND DAY AIR**

**CALL TOLL FREE**

**1-800-325-2264**

e-mail: [savings@dalbani.com](mailto:savings@dalbani.com)



**3<sup>95</sup>** shipping and \$2.25 handling

Up to 5 lbs anywhere in the U.S.A. Excluding Alaska, Hawaii & Puerto Rico

**SPECIAL SHIPPING RATE**

CIRCLE 230 ON FREE INFORMATION CARD

# The world's most popular simulator just got better.

## MULTISIM SCHEMATIC CAPTURE AND SIMULATION

### Flexible Symbol Editor **NEW**

To add or modify symbols for any component.

### Power Meter **NEW**

Works just like with a real Wattmeter.

### 1000 New Components **NEW**

New families include Electromechanical, Connector, Wideband Opamp, and Tiny Logic.

### Editable Footprint Field **NEW**

Add or change default footprint values directly from the schematic.

### New Analyses **NEW**

AC sensitivity and DC sensitivity help determine the stability of your design.

### Multiple Instruments **NEW**

Now you can have more than one copy of an instrument on the screen at once.

### Enhanced Wiring **NEW**

Improved connections to pins and more intelligent autowiring.

### Analysis Wizards **NEW**

Guide you through an analysis, making it easier than ever to take advantage of these powerful functions.

### Virtual Instruments

Includes oscilloscope, function generator, multimeter, bode plotter, word generator, and logic analyzer.

### 9 Powerful Analyses

To analyze circuits in ways just not possible with real instruments. Includes DC, & AC operating point, transient, fourier, noise, DC sweep and Ac & DC sensitivity.

### 5,000 Components

Wide selection of commonly used components, all complete with simulation, symbol and footprint information.

### Full-Featured Schematic Capture

Industry's easiest-to-use design entry is ideal for generating high-quality schematics.

### Changes on the Fly

The world's only simulator that lets you tweak your circuit during simulation for instant feedback.

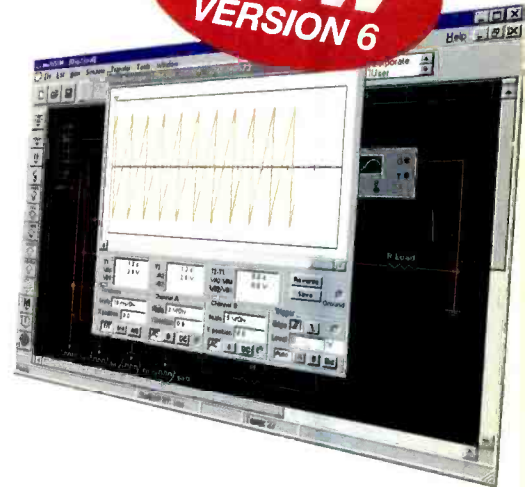
### Analog and Digital SPICE Simulation

Fast, accurate SPICE simulation with no limit on circuit size.

### Custom Model Support

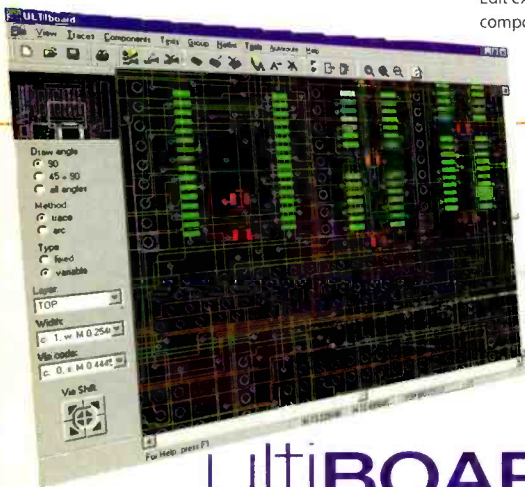
Edit existing models to create new parts, or import components as SPICE models from vendors.

**NEW  
VERSION 6**



multiSIM **\$399**

Call for upgrade pricing



## ULTIBOARD POWERFUL PCB LAYOUT

**Fast Autorouting** Multi-layer autorouter with configurable options for customized performance.

**Real-Time DRC** Automatic Design Rule Check prevents costly errors by monitoring the size and clearance of pads, vias and traces.

**Ideal for all Boards** Built-in board editor to create any shape board up to 50" X 50" in size, with as many as 32 layers.

**Multiple Output Formats** Outputs to the formats you need including Gerber, DXF, plotters, printers, and more.

**Tight Integration with Multisim** Supports forward and back annotation with Multisim, so that the programs share important design information.

**Flexible Editing** Full support of power and ground planes, with or without thermal relief. 'Reroute while move' to move copper without losing connectivity.

ultiBOARD **\$399**

**TO ORDER**

For a **FREE** demo visit [www.electronicworkbench.com](http://www.electronicworkbench.com)

**SAVE  
\$1000**

Call **1-800-263-5552**

Save \$100 when you order the Personal Design Solution  
(Includes Multisim and Ultiboard).



**Electronics  
WORKBENCH**

DESIGN SOLUTIONS FOR EVERY DESKTOP

CIRCLE 130 ON FREE INFORMATION CARD