

# Nuts & Volts

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Exploring Electronics And Technology For The Hobbyist And Professional

July 1998 Vol. 19 No. 7

**ELECTROMAGNETIC  
INTERFERENCE — IF YOU'VE GOT  
ELECTRONIC EQUIPMENT, THEN  
YOU'VE GOT EMI!**

**TURN A \$99.00 CASH  
REGISTER INTO A DYNAMITE  
HOBBYIST COMPUTER**

**UNDERSTANDING  
MICROCHIP'S FAMILY  
OF PIC MICROS**

Check out Robert  
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Robotics Notebook!





**BOTH SINGLE AND DUAL DRIVE  
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**MULTIMEDIA PROCESSOR  
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**EXTERNAL SCSI-II PORT WORKS  
LIKE A STANDARD CD WRITER  
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Instantly duplicate CD-ROM disks for software distribution. Make backup copies of your favorite software on rugged, permanent media. Produce disks quickly and economically. No mastering or multimedia experience is required.

Insert your original disk and press "start." The multimedia processor quickly copies any disk to the internal A/V hard drive. Insert blank disks and make as many copies as you like. You'll produce identical, bit-for-bit duplicates. The system is totally self contained—no connection to a PC or Mac is required. Just

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plug in the power cord and press "start"—it's that easy.

You can even make your own custom audio disks without a PC! Insert your original CD's, select the tracks you want, and CD Dupe-It will copy them to the internal hard drive. Then insert a blank CD, and you'll have a custom audio disk with just the songs you want.

With the included CD mastering software, CD Dupe-It will work overtime as your personal CD

mastering system. Just attach a SCSI cable to your PC or Mac, and you're ready to design and create your own original CD's. Similar systems used in duplication houses cost over \$10,000. Now you can easily copy disks yourself for a fraction of the price.



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Software publishers—ask about our high-volume multi-drive duplication systems.  
CD Dupe-It is sold and intended for backup and in-house design purposes only. Copyright laws must be observed.



# HSC Electronic Supply

Serving  
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...brings you a potpourri of high-tech goodies for the techno-tinkerer!  
For thirty years we have been your source for Silicon Valley exotica!

## Leftover Apple Goodies...

- Macintosh IIc System unit, used**  
◆ Includes 8 MB RAM, 80 MB hard drive, cache card  
◆ Does not include monitor, mouse or keyboard  
◆ Note, some available with larger hard drives at higher price  
**HSC#17394 \$79.00**
- Macintosh Keyboard (used)**  
◆ Macintosh Extended Keyboard II (Mac II series), no cable  
**HSC#17386 \$24.95**
- Macintosh Keyboard (used)**  
◆ Apple Design Keyboard (Performa Series)  
**HSC#96382 \$32.50**
- Macintosh Mouse**  
◆ New in bag, older square-cornered mouse  
**HSC#96380 \$12.50**

## Mini-Scanner Deal!

- Primax Sheet-feed Greyscale Scanner**  
◆ The perfect scanner for laptops on the go!  
◆ Use as input device for your fax software - anywhere!  
◆ Built-in document feeder holds up to ten pages  
◆ Parallel-port cable included -- no special interface cards  
◆ Includes Win 3.1, 95 software, OCR software, AC Adapter  
◆ 300 dpi, new in box, 90-day warranty, unbelievable price!



HSC#17406 \$29.95

## House that Equipment!

- ◆ Bargain on used, knee high 19" rack cabinets!  
◆ 29.5" tall, with room for 21" of vertical instrument height  
◆ 23.25" wide, and 30" front-to-back, textured black finish  
◆ Made by AMCO Engineering  
◆ Units are used, but in good shape  
◆ Best if you pick up (cannot go UPS)  
◆ Last time we had these at \$149.00, and they went fast! Quantity discounts available.



HSC# 17069 \$99.00

## Infrared Connections!

- ◆ IBM "Options" series ISA-Bus and PCMCIA card adaptors will add industry standard infrared communications capability to your desktop PC (with ISA slots) or notebook computer! (Win95 instructions available on our website)  
◆ Allows wireless connection to compatible notebooks, workstations, printers, and other peripherals supporting the Infrared Data Association (IrDA) standard.  
◆ Also will emulate a COM port for cable-less hook-ups  
◆ Communicates up to 115Kbps, or up to 1.152Mbps with the included TranKit Software.  
◆ Operates over distances up to 3 meters (10 ft.)  
◆ Includes Card, transceiver module, driver disk & book  
◆ Both styles new in box, 90-day warranty



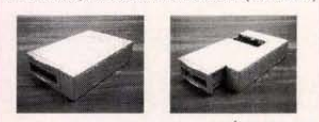
HSC#16483 PCMCIA Version \$19.95  
HSC#16813 ISA-Bus Version \$19.95  
Or a package deal...get both for \$29.95

## External SCSI Drive Cases

- ◆ Bargain case for 5.25" drives, brand new!  
◆ 7" x 4.5" x 10.5" overall size  
◆ 50-pin SCSI connectors  
◆ SCSI ID switch  
◆ 65W Power supply (lots of power for hard drives, etc.)  
◆ Fan-cooled, uses standard IEC Power cord (not included)  
**HSC# 17130 \$39.95**
- ◆ High quality low profile case for 5.25" drives, brand new!  
◆ 7" x 2.25" x 11" overall size  
◆ 50-pin SCSI connectors, RCA Audio connectors  
◆ SCSI ID switch, termination switch  
◆ Tiny 12W Power Supply (5VDC @ 1.4A, 12VDC @ 4A, probably only good for CD-ROM's)  
◆ Fan-cooled, uses standard IEC Power cord (not included)  
**HSC# 17357 \$29.95**



\$39.95



HSC# 17356 \$24.95

## Used IBM PC's - Big Savings!

- IBM Valuepoint computers, various configurations**  
◆ Just removed from a network installation at a hospital  
◆ Several levels of performance to choose from!  
◆ All have system box with VLB / ISA motherboard, CPU, RAM, hard & floppy drive, 2 serial, 1 parallel port, 3-Com token ring card, 101 keyboard, mouse, 90-day warranty  
◆ On-board 1MB SVGA video, plug in your monitor & go!  
◆ Configurations vary, call for availability -- for example:  
◆ 486SX-25 CPU, 8MB RAM, 127MB hard drive: \$129!  
◆ Or: 486DX2-50, 8MB RAM, 270MB hard drive: \$179!  
◆ Or: 486DX2-50, 8MB RAM, 540MB hard drive: \$189!  
◆ Or: 486DX2-66, 16MB RAM, 365MB hard drive: \$199!  
◆ Or: Pentium 60, 16MB RAM, 1GB hard drive: \$279!  
◆ You will need to install the operating system of your choice  
◆ Purchase with one of the Sony CPD-1320 monitors seen above and take 10% off the package price!



## Accelerated Serial Ports!

- ◆ High-speed serial port card for Micro-Channel Computers  
◆ Hayes ESP Dual-Port Communications Accelerator  
◆ Data rates up to 921,600 bps. on-board co-processor  
◆ Supports up to 28,800 bps modems, Win 3.1, New in box  
**HSC#17405 \$29.95**

## X-Windows Terminal!

- ◆ Tiny Axil/Hyundai X/11C smart terminal has big features!  
◆ Connect to Ethernet (Coax or AUI), SLIP, or both!  
◆ Built-in 10Base2 transceiver, 10Base5 AUI interface  
◆ Uses a variety of protocols, TCP/IP, SLIP, TELNET, RARP, BOOTP, XDMCP, or PPP  
◆ Comprehensive self-test and help menus for setup  
◆ Requires 63.775KHz Horizontal, 67.9Hz Vertical (workstation-type) monitor, resolution is 1152 x 900  
◆ RAM can be upgraded to 16MB (4MB SIMM included)  
◆ New in box, includes 101-key keyboard, mouse, manual  
◆ Measures 11.5" x 11" x 2", keyboard is 18" x 7"



HSC#17213 \$149.95

## Monitor Mega-Deal!

- ◆ Just in! Two types of used, high-quality monitors!  
◆ Sony CPD-1320 VGA Monitor -- Genuine Trinitron!  
◆ 14" Super-Fine Pitch (tm) Trinitron tube, 13.24" view area  
◆ Supports 640 x 480 (VGA), 60/70Hz res. (not SVGA)  
◆ Ultra-sharp .25 mm dot pitch for crisp image edges  
◆ Used, tested good, 90-day warranty



HSC#17395 \$69.00



HSC#17396 \$139.00

## Briefcase of Goodies!

- ◆ These handsome hardshell cases were used to carry a laptop-computer estimating system (laptop not included)  
◆ They were used with a Compaq LTE laptop, and provided a SCSI port for a CD-ROM drive with battery back-up  
◆ Large Nicad pack has 10 D-size Sanyo Cadnics cells.  
◆ Built-in 19VDC power supply for battery charging  
◆ Tiny piggy-back PC board seems to be a SCSI interface  
◆ Case measures 18" x 14" x 7", with several compartments  
◆ SCSI II to CEN50 SCSI cable, many great parts inside!  
◆ Buy either the whole assembly, or just the parts you want!  
◆ Not guaranteed to function with laptops -- for parts only!



HSC#17180 Complete Laptop Case \$39.95  
HSC#17182 Empty Hardshell Case \$19.95  
HSC#17181 Nicad Pack, 12.5VDC, 5AH \$17.50  
HSC#17179 SCSI II Cable, 1 ft. long \$12.50

## Little Pump That Could!

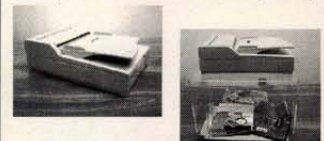
- ◆ Tiny Gast Vacuum/Pressure diaphragm pump  
◆ Model MOA-V112-AE -- oil-less design means clean air!  
◆ Measures 7" long, 3.375" dia., 4.75" tall  
◆ 115 VAC, new in box with installation & parts diagram



HSC#17360 \$74.95

## HP ScanJet Special

- ◆ Wow! HP ScanJet 3P flat-bed greyscale scanners at \$59!  
◆ Complete with stand, SCSI adapter, cables, and optional document feeder, at an unbelievable price!  
◆ SCSI Interface, will work with Mac or PC  
◆ 300dpi resolution (native mode), 1200dpi with dithering  
◆ PC or Mac drivers to work with your scanning program  
◆ Dealer display models & shelf stock returns (boxes may be opened, but scanners are unused)  
◆ Optional 20-page feeder can be installed in place of cover  
◆ Scan rate of 10 seconds for letter-size page  
◆ Factory RMA's from dealers, unused, 90-day warranty



HSC#17392 \$59.00

## Hand-held UV Lamp

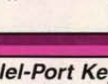
- ◆ "Derma-spec" lamp was made for Avon products to examine the face for "problem" cosmetic areas!  
◆ Works fine for counterfeit bill & credit card detection, mineralogy, fluorescent art effects, etc.  
◆ We wouldn't use these on our faces for too long...



HSC#17383 \$12.95

## Corel Office Professional 7

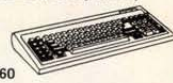
- ◆ Great Software Bundle -- Amazing Value!  
◆ Includes Corel Wordperfect 7, Corel Quattro Pro 7, Paradox 7, Corel Presentations 7, CorelDRAW 6, CorelFLOW 3, Sidekick 95, Netscape Navigator, Dash-board 95, 1000 fonts, 10000 clip-art images, more!  
◆ For Windows 95, Windows NT 3.51 and Windows NT 4.0  
◆ Distributed on CD-ROMs, with hefty manual pack  
◆ New, shrink-wrapped in box, 90-day warranty



HSC#80436 \$47.50

## Parallel-Port Keyboard!

- ◆ Perfect for notebook computers, laptops, palm-tops, etc.  
◆ Full-size 101 keyboard by ALPS, model LPT 101  
◆ Includes manual, installation diskette  
◆ New in OEM box, 90-day warranty



HSC#17160 \$49.95

## Rugged Mike & Speaker!

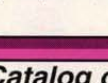
- ◆ Extra-heavy duty hand-held microphone & enclosed speaker for extreme environmental use  
◆ Made by GE for Ericsson EDACS "Orion" mobile radios  
◆ Easily modifiable for your own use (ham, CB, etc.)  
◆ Brand new in box, with custom Ericsson power cable



HSC#17172 \$29.95

## Quick, Cheap, Easy IDE!

- ◆ What more could you want in an IDE controller?  
◆ Creative Technology CT1871 Plug and Play card  
◆ Perfect for CD-ROM's, other non-bootable SCSI devices  
◆ 16 bit short ISA card has minimum parts count  
◆ Supports up to two CD-ROM drives  
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◆ Check out the amazing "Gizmo of the Week" feature!

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- ◆ That's right, get HSC's catalog on the World-Wide Web!  
◆ Simply go to [www.halted.com](http://www.halted.com) and follow the big red link.  
◆ Adobe .PDF files are available for download and viewing.  
◆ Or drop on by and pick one up...we'd love to see you!

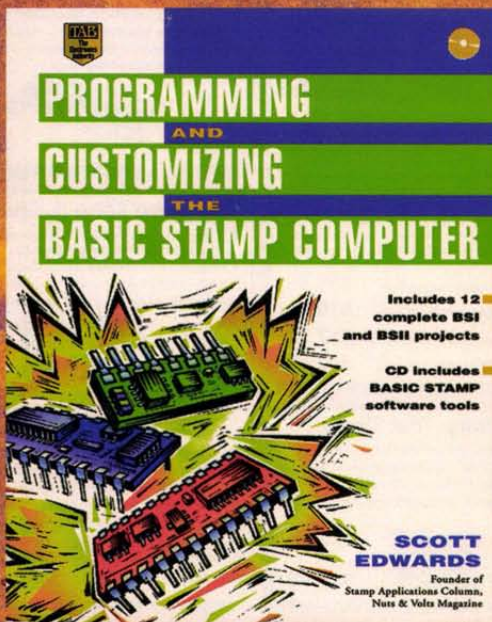
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# WE'VE BAGGED THE BASICS

Bag the BASICS Bundle! (#27801) \$59 **save \$38!**

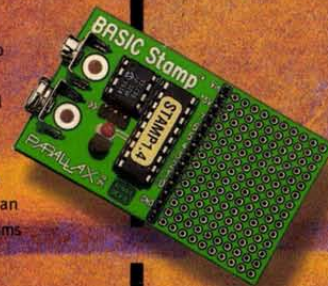
BASIC Stamp Version D, Programming and Customizing the BASIC Stamp Computer by Scott Edwards, software and Parallax manuals on CD-ROM



## Programming and Customizing the BASIC Stamp Computer (#27951) \$34

Want to get started with BASIC Stamps? The new Scott Edwards Programming and Customizing the BASIC Stamp Computer is the anchor of our Bag the BASICS Bundle! The book presents ten new complete projects, a CD-ROM containing the Parallax BASIC Stamp manuals, software and 20+ application notes, and 30 Stamp Applications columns from Nuts and Volts magazine. We've thrown in the BASIC Stamp Version D, and programming cable for an extra \$25, a \$38 savings if you were to purchase the items separately!

In order to receive this offer you must mention Nuts and Volts. Offer valid through August 31, 1998 while supplies of the new Scott Edwards book last!



# PARALLAX

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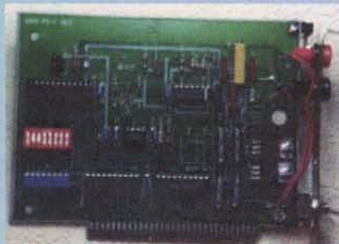
# New Product

Our readers are always looking for new and interesting electronic items. Showcase your NEW PRODUCTS here to help stimulate your product's success. Submit all news releases, product information, and/or photos to:

NUTS & VOLTS MAGAZINE  
NEW PRODUCT EDITOR  
430 PRINCELAND CT., CORONA, CA 91719

## News

### PROGRAMMABLE SUPPLY/DATA LOGGER



**R**KA Systems announces a new, low-cost instrumentation board for the PC that provides a simple programmable power supply combined with a data logger. Also combined on the same board is a virtual digital VOM and a low-frequency ARB generator.

Defined as the PS-1, this device combines a very high integration of test functions on the same board, combined in a very powerful, easy-to-use Windows software environment, and available on a single low-cost PC board.

The innovation of the PS-1 involves the integration of a number of popular instruments into a single board. All power requirements and control software are provided by the PC.

The main component of the system is a programmable sampling power supply. This supply provides programmed bipolar voltages over a range of  $\pm 10$  volts with an eight-bit (or 72 Mv) resolution. Further, the supply is capable of sinking or sourcing  $\pm 100$  mA. The output load voltage and current are continuously monitored, displayed, graphed, and stored.

The device operates by providing 100 controlled voltages levels (samples) each separated in time with a programmed delay. For purposes of analysis, the sampling sequence can be stopped at any time in the sequence, thus allowing single step observation. At each sample, the load voltage and current are monitored, graphed, and stored. Equivalent power and resistance are calculated, and also stored for future processing.

The PS-1 is available immediately. All units ship with a user's manual, Windows95, Win 3.2 soft-

ware, and banana clip leads for easy use. Initial pricing is \$159.95 plus \$7.00 shipping and handling.

For more information, contact:

**RKA SYSTEMS**  
484B WASHINGTON ST., #421  
DEPT. NV  
MONTEREY, CA 93940  
408-663-1604 FAX: 408-663-1604  
1-800-500-0449  
WEB: [www.rkasys.com](http://www.rkasys.com)

### SG-100A FUNCTION GENERATOR



**T**he Telulex SG-100A is the first low-cost function generator to offer data modulation.

Users may download binary messages of up to 960 bits in length from a host computer for FSK or AM digital modulation. The carrier frequencies may be specified from 0 Hz to 20 MHz in .1 Hz steps. The baud rate is adjustable from 1 Hz to 130 KHz in 1 Hz steps. Downloaded messages may be conveniently saved to Flash memory.

The data modulation feature is most useful for testing messaging radio systems such as pagers, remote telemetry equipment, RF modems, and packet radio transceivers.

Based on Direct Digital Synthesis (DDS) technology, Telulex, Inc. model SG-100A signal generators produce DC to 20 MHz modulated and swept sinewaves, functions, pulses, and arbitrary waveforms. A high-speed digital signal processor which has direct control over the DDS system implements an extensive list of modulation modes: AM, FM, PM, SSB, BPSK, Dualtone, and Burst. Frequencies are adjustable

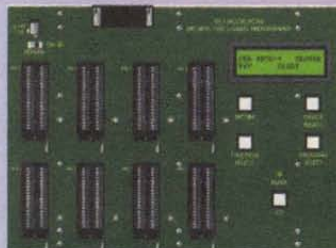
with .1 Hz resolution and are accurate to .001%.

The SG-100A is priced at \$995.00 in single quantities.

For more information, contact:

**TELULEX, INC.**  
2455 OLD MIDDLEFIELD WAY S.  
DEPT. NV  
MOUNTAIN VIEW, CA 94043  
650-938-0240 FAX: 650-938-0241  
<http://www.telulex.com>

### PCXG GANG PROGRAMMER



**T**ECI's PCXG Gang Programmer for the MC68HC705Cx family microcontrollers is an eight-site programmer that may be connected to a PC serial port or may be used as a stand-alone programmer. Data may be transferred by selecting one of 12 programs (already stored in the programmer), or by reading data from a master chip or from a PC.

For more information, contact:

**THE ENGINEERS  
COLLABORATIVE, INC.**  
RT. 3 BOX 8C, DEPT. NV  
BARTON, VT 05822  
802-525-3458 FAX: 802-525-3451  
E-MAIL: [Sales@tec-i.com](mailto:Sales@tec-i.com)

### MODEL HCON-1 REMOTE I/O MICROCONTROLLER MODULE

**J**-Works, Inc., announces the J-Model HCON-1 Remote I/O micro controller module.

The Model HCON-1 accepts command over the RS-485 serial bus to control output drivers and obtain inputs from quadrature encoders, temperature modules,

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## JFETS

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#### I2C BUS

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#### I2C BUS

DW09: Dual digital Stepper Motor controller, position or velocity ramping, EEPROM config. to your motor. Optoisolated outputs to user's driver electronics. \$49.

### AND MORE ....

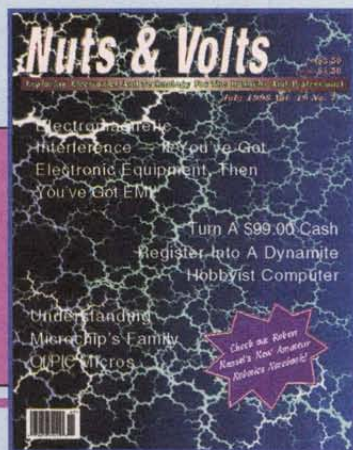
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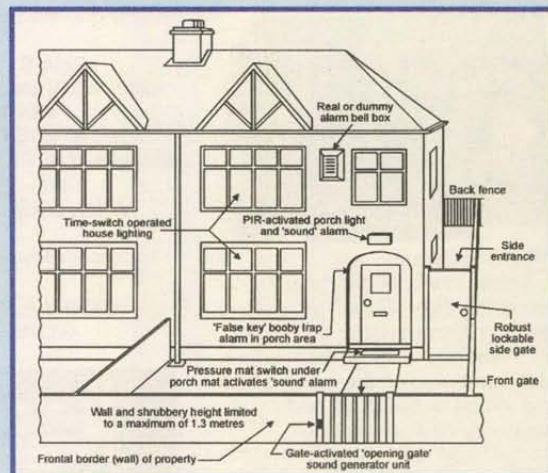
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## EDITORIAL CONTRIBUTIONS

Nuts & Volts Magazine encourages article submissions and queries. Send a SASE for a copy of our writer's guidelines. All submissions should be on 5-1/4 or 3-1/2 inch diskettes and include hard copy as well. If return of materials is requested, include a SASE with your submission. Deadlines should be discussed in advance with the editor, but generally all material should be submitted two weeks prior to the 1st of the month for the next month's issue.

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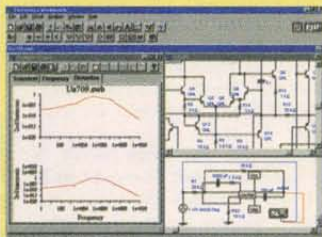
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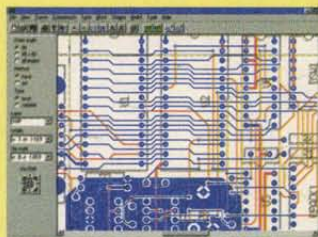
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I'm writing this on my latest machine, a modified Epson IM-403 point-of-sale (POS) cash register computer. This little gem takes less than a square foot of desk space, yet has every available serial and parallel port, and still costs less than \$200.00 total. Besides being both powerful and small, it is great fun to hack on.

## Hitting a home run

The surplus market occasionally turns up some real winners. Sure, the gearhead motors are fun, and you can always use some more gel-cell batteries, but the real kicks come when you score something like the Epson IM-403 computer. This pint-sized 486SX-33 computer assembly originally served as the brains to a retail cash register sold by Epson a few years ago. The IM-403 is now obsolete to the point that the Epson web site (<http://www.epson.com>) no longer lists it, but it must have been a terrific machine in its day.

the day they were built. I knew I had hit a homer when I opened the first box and saw a real, honest-to-gosh User's Manual. You just don't get that kind of info with most surplus buys.

Leafing through the manual quickly showed me how good a purchase I had made. Each IM-403 includes four(!) serial ports, two parallel ports, a floppy disk controller, an IDE hard drive controller, a single 72-pin SIMM socket for memory, a VGA controller, a PS/2 keyboard port, and a single 16-bit ISA slot. All of this fits into a single metal chassis just 10" by 7" by 3"; the cabinet is built with the same quality I've come to expect from all Epson designs. The unit contains a small

Here you see the 3.5" floppy drive bolted into its bracket atop the IM-403 computer. The low metal chassis behind the drive holds the Epson I/O expansion card.



by Karl Lunt

# Hacking the Epson IM-403

Timeline, a regular advertiser in *Nuts & Volts* and other electronics magazines, purchased several hundred of these units and offered them for sale in national ads. Someone at the Dallas Personal Robotics Group (DPRG) bought one, hacked on it a bit, then posted a brief write-up to the DPRG and Seattle Robotics Society (SRS) listservers. Based on his write-up, I decided to order a couple of units at \$99.00 each, just to see if they might prove useful.

I ordered two units because my previous experience with surplus has

switching power supply, and is built to run from a single source of 24 VDC; you even get a lump-in-the-line power supply.

After I had spent some quality time drooling over the unit, I took stock of what was not included. My purchase did not include a hard drive or a PS/2 keyboard, and the SIMM slot contained no memory. I also didn't get a VGA display, but I had a spare one laying around so that wasn't a problem. Ditto for the 3.5" floppy disk, as I had set aside a spare some time ago.

custom made by Epson just for this product. I haven't been able to find one on the surplus market yet, though I'll continue looking. I do know that a normal, PC-sized 3.5" drive is WAY too big to fit inside the bay reserved for it. Rather than wait until I could locate such a floppy disk, I decided to investigate how I could add the regular-sized PC drive.

Obviously, the drive won't fit inside the chassis, but I figured I could bolt it into a bracket and mount the bracket to the top of the metal box. I have a few spare 3.5" mounting brackets laying around, and it seemed simple enough to drill the needed holes in both the bracket and the top of the box.

This, naturally, presented another problem. The box was designed to interface with the custom floppy drive, which uses this eensy connector and special ribbon cable; thus, there is no standard floppy data cable or power wiring.

I decided to drop a multi-I/O card into the ISA slot, and use that card's floppy drive controller.

The BIOS in the IM-403 lets you disable or reconfigure nearly all of its peripherals, so I wouldn't have any problem shutting off the box's floppy drive controller. This plan still doesn't address the problem of getting power to the floppy disk drive, but I'll deal with that in a moment. For now, I was satisfied that I was ready to pick up the last few remaining pieces for my new system.

I stopped by the local Computer City to scope out my options, and

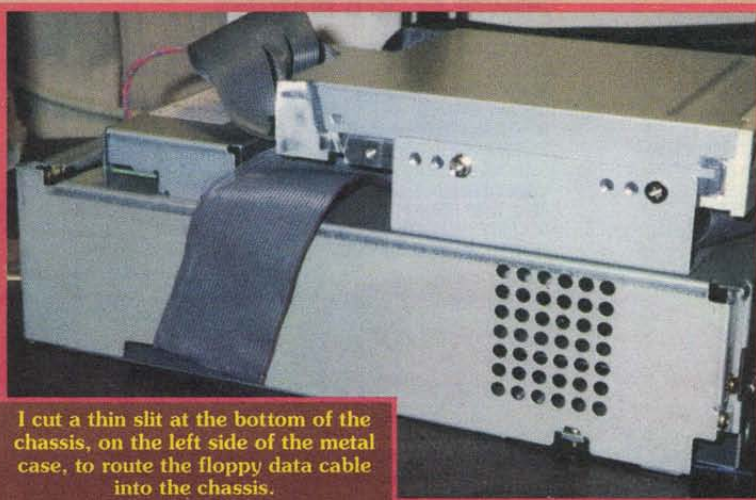
found a dynamite keyboard for less than \$20.00. I'm really fussy about my keyboards, and find most of the cheap keyboards unusable. The keys feel like they're made with rubber, and I can't build up any keyboard speed when I use them. I'm still using a 1980's 101 keyboard with that

**Karl shows how he turned a \$99.00 surplus cash register into a dynamite computer for the hacker or hobbyist.**

beautiful tactile feedback key design, and I've always feared that one day it will simply stop working and I'll have to use one of the rubber keyboards.

Imagine my surprise when I tried out a beautiful black 104-key Windows unit by PC Accessories. The feel is nearly as good as my old keyboard, light and sure with a good snap to the keys. I liked the price so much that I picked up two of them, one for the first IM-403 unit I wanted to hack, and a spare in case my main keyboard goes out any time soon. The package even includes an AT-to-PS/2 keyboard adapter. This purchase alone made the trip into Kirkland worthwhile.

With the two keyboards under one arm, I went in search of a suitable I/O card and found the SI-1132+ board, made by SIIG. This one 16-bit ISA board sports two serial ports, one high-speed bidirectional parallel port, a game port, floppy disk controller, and IDE hard drive controller.



I cut a thin slit at the bottom of the chassis, on the left side of the metal case, to route the floppy data cable into the chassis.

conditioned me to buy a spare to serve as a source of parts when the first one breaks. Little did I know at the time, but these are brand new units. My machines arrived sealed in the original Epson cartons, fresh as

The compact size of the IM-403 is a two-edged sword. Sure, the chassis is so small it's cute, but there is very little spare room inside the box. The prescribed 3.5" floppy disk drive is the Epson SMD-1140, evidently



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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.

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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 670.030-688.980 MHz with the receive channels 45 Hz 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 28 VDC (unregulated) and an 18.980 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.

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Write in 108 on Reader Service Card.

Total cost: \$29.95.

I really like the card's versatility. You can move any of the ports to practically any possible address, or disable any of the controllers or ports. This flexibility, coupled with the similar traits of the IM-403, means I can jumper my way past any configuration problems.

I still needed some memory for my new machine, but I passed up Computer City's price of \$29.95 for 16 megs of RAM, since I can get it from another source for five bucks less. Remember what 16 megs used to cost? By the way, if you're looking to add memory to your own IM-403, keep one important detail in mind. You CANNOT use EDO RAM in this unit! If you try, the machine won't boot. Be sure to use the older, non-EDO RAM.

That left only the hard drive. The user's manual for this machine recommends either of two Toshiba 2.5" notebook hard drives. The MK1722FCV weighs in at 131 MB of space, while the MK1724FCV holds twice that. Note that these are -V drives, which means they measure just 12 mm in height. The height limitation is critical; you don't have room in the bay for the larger, 19 mm drives.

After looking around on the net and asking some questions, I chose to order my drives from Westcoast Computer Products. If you're in the market for a hard drive of any type, be sure to hit their web page at <http://www.wcpdrives.com>. They have a great catalog, fast service, and excellent prices. Their specials page is certainly worth a visit; you might find just what you need there.

Time to begin adding all of these peripherals to my machine. First up is the I/O card. I removed the two ISA card brackets in the back of the machine. This exposed both the 16-bit ISA slot and the PCMCIA expansion slot. I filled both of these brackets with the I/O card itself and its auxiliary bracket filled with I/O connectors. Next, I booted the machine and hit CTRL-ALT-S to enter the set-

up menu. Following the menu's prompts, I disabled the IM-403's hard drive and floppy drive controllers. Then I shut off the power, opened the chassis back up, and began my planning for the floppy disk data cable.

I needed to route the cable from the ISA card inside the box, out of the chassis, and over the top of the case where I could connect it to the floppy disk drive. After some thought, I chose to remove the cover and do a little Dremel surgery. I marked off a short run of chassis on the lower edge of the left side, near where the SIMM socket sits on the main board. I took the cover out into my garage, donned the obligatory eye protection, and fired up the ol' Dremel with a cutting disc in it.

**NOTE: Always, always wear eye protection anytime you use a Dremel or any other high-speed cutting tool. The Dremel cutting disks can shatter, and the flying pieces can easily blind you. Play it safe and wear your safety glasses.**

Working carefully, I shaved a 1/4-inch gap slightly longer than the width of the data cable into the lip of the cover I had marked before. I used a metal file to clean up the edges on the cut chassis, so I didn't damage the ribbon cable later. I then took the cover back to my workroom and ran the cable through the inside of the chassis to the edge where the new cut was made, fitted the cover in place, and made sure I had sufficient clearance so the cable wasn't pinched. Everything looked good, and I had plenty of cable length to reach the intended mounting location of the floppy drive.

That took care of the data cable, but what about the power connection? The tiny SMD-1140 floppy disk gets its power from the tiny ribbon connector,

so there is no conventional four-wire power connector inside the IM-403 chassis. No problem; the voltages needed by the floppy drive are still available on the pins of the ISA card. I pulled the I/O card out of the chassis and set it on my workbench to begin the power wiring hack.

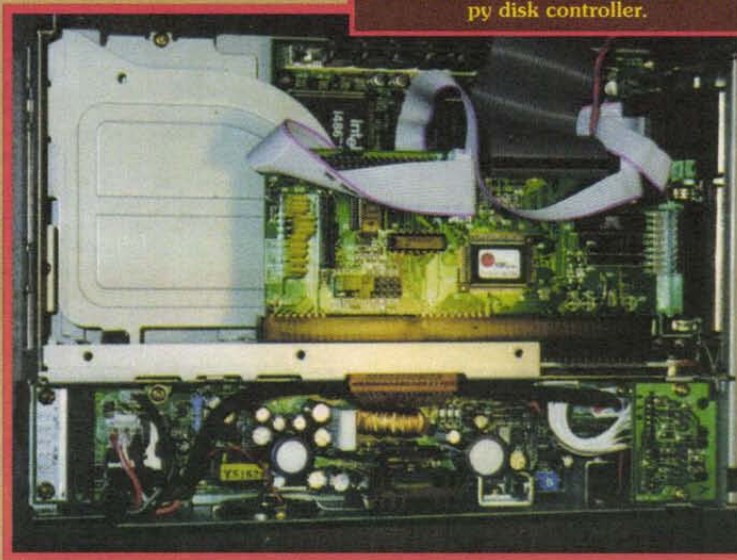
The ISA bus provides a source for +5, +12, and -12 VDC on those cards whose designers choose to supply them. Of the voltages I need, GND appears on pin B-1, +5 VDC on B-3, and +12 VDC on B-9. Note that the ISA pinouts refer to the pins on the larger PCB edge connector as the A pins and the B pins. The A pins face you when you hold the card with the edge connector pointing down and the mounting bracket towards your right. Flip the card so the bracket is pointing towards your left, and you're looking at the B pins. Many cards also have a silkscreened legend that identifies some of the pins by number, to give you more help.

I cut a one-foot length of three-conductor twisted

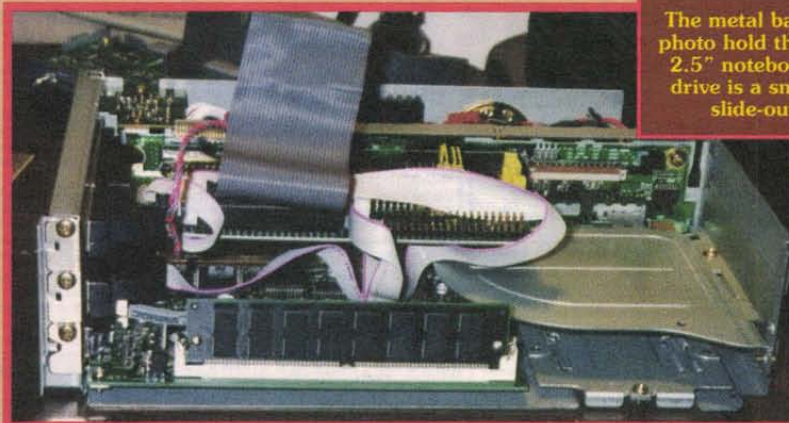
pair, then stripped 1/8th inch of insulation from the wires at one end of the cable. I tinned these ends, then carefully touched just a bit of solder to the very tops of the three B pins needed, as close to the green solder mask as possible. Note that you should use a small amount of solder on these gold fingers, and do not let the solder run down the gold finger as it will contaminate the part of the edge connector that makes contact with the slot connector.

Next, I carefully soldered the three wires to the proper pins, using as little room on each edge finger as possible. I then added crimp-on pins to the opposite ends of the wires, and inserted these pins into a Molex four-pin female connector with suitable pin spacing to match the power connector on the floppy drive. If you have one of those small 3.5" power connectors floating around, use it instead,

**A bird's-eye view of the open IM-403 chassis. The long, narrow PCB is a switching power supply, while the larger SI-1132+ I/O card serves as a floppy disk controller.**







The metal bays on the right side of the photo hold the floppy disk (top) and the 2.5" notebook drive. Adding the hard drive is a snap, since it bolts onto the slide-out bracket shown here.

but my little homebrew connector works fine also.

To mount the floppy drive to the top of the case, I scrounged an old 3.5" drive bracket I had laying around, drilled four 1/8th-inch holes in the bottom of it, marked matching holes in the top of the IM-403 chassis, and drilled 1/8th-inch holes in the chassis top. I used four 4-40 bolts to mount the bracket in place, then bolted the drive into the bracket. Finally, I put the whole assembly back together, taking care to route the power cable and data cable to the floppy drive so they didn't interfere with any of the other IM-403 innards.

Even though I didn't have a hard drive in place yet, the unit was ready for booting. I plugged in my keyboard and VGA display, hooked up the 24 VDC power supply, and inserted a floppy disk I had prepared with a minimal DOS system.

When I hit the switch, my little computer booted perfectly. I had already re-arranged some of the jumpers on the SI-1132+ I/O card, to set up the serial ports as I wanted them. I decided to disable the IM-403's COM1, since that is hard-wired to a bizarre telephone-style jack intended for use with a cash register display. I instead enabled the SI-1132+'s COM1, but disabled its second serial port. I certainly didn't need it active, as the IM-403 already has COM2, COM3, and COM4.

With the jumpers squared away, I loaded a copy of COMit, an old communications program that I've kept around. I like COMit not only as a terminal emulator, but because it can do some pretty exhaustive testing of serial ports to determine if a port actually works. I also loaded an old mouse driver, set up to use COM2 for a serial mouse.

When I ran COMit and asked it to analyze all of my serial ports, it correctly reported that a mouse appears at COM2 and the other ports are

functioning. Just for grins, I hooked an external modem to COM3; COMit found the modem and verified its operation. It also properly reported the change when I moved the modem to COM4.

## Doing DOS

The real fun began the evening the hard drives arrived. I opened the IM-403 box for what seemed like the hundredth time, and undid the bolt holding the slide-out hard drive mounting bracket. This bracket sits just below the fan-shaped support for the floppy drive, and is held in place by a single screw. I installed the Epson-supplied connector to the back of the Toshiba hard drive, then bolted the hard drive to the mounting bracket with four screws. When I slid the drive and bracket assembly back into position, it snapped into place with a comforting little click.

The drive already had a low-level format pattern laid down, so at least I didn't have to deal with that. But I did need to write a DOS partition to it, and I did need to do a high-level format. I could put the decision off no longer; what OS was I going to use?

Sixteen megs is plenty of RAM for Windows-95, but the drive is a little small and this isn't really a Windows machine, anyway. Eventually, I want to turn my other IM-403 into a Linux machine, but for this first box, I settled on a DOS installation. I have a full boxed set of 6.2, so that seemed like a good starting point. Since nothing in this hobby is simple, I didn't expect this to be easy, either, and it wasn't. My DOS 6.2 had been distributed on 5.25" floppy disks.

Rather than bolt yet another, larger floppy drive to this little box, I decided to create a full set of 3.5" floppies, duplicates of the original four floppies. I fired up my big machine and began copying the con-

tents of each large floppy disk to a 3.5" disk. Then I put my minimal boot disk in the drive and hit the power switch. The IM-403 complained of a hard drive error.

After some digging, I decided this was a configuration problem rather than a defective drive or computer. I carefully went back over the I/O card's jumpers and the IM-403's configuration screens, fixed some mistakes, and the computer could "find" the drive. But even with all of the peripheral configurations set properly, the box still could not consistently find the drive. Only after I disabled all of the various standby and power-down options on

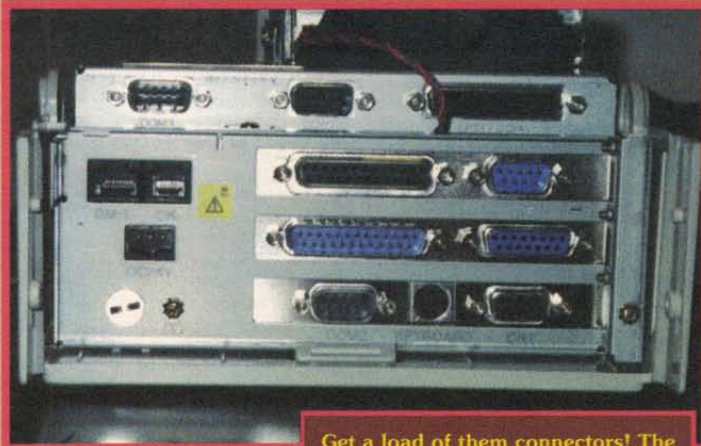
command stripped out all but one of the spaces between DISK and 1. But then I used the command:

**LABEL A:~"**

which caused LABEL to complain about illegal characters in the name, then prompt me for a new field of 11 characters. When I typed the label in again with the embedded spaces, LABEL correctly wrote the new label to the floppy disk. I repeated this operation for the other three floppies in the set, then headed back to the IM-403.

This time, SETUP worked perfectly, taking each floppy in turn. It only took about 10 minutes to do the full DOS install. When it was finished, I could hit the power switch and in a matter of seconds, my new DOS box was up and running, with nearly 250 megs of hard drive space available.

DOS 6.2 provides one very nice utility that you will enjoy using with your new IM-403. The MSD command displays a large screen of infor-



Get a load of them connectors! The IM-403, with its SI-1132+ I/O card, has more ports than you'll probably need. This photo shows all four serial ports, two parallel ports, a VGA port, a game port, and a P/S-2 keyboard jack, among others.

the IM-403 did the problems go away for good. I'll revisit these options some other time, but for now the box functions like a normal PC; everything stays on until you shut off the machine.

With that problem out of the way, I rebooted the machine, again using my minimal boot disk. I then put disk 1 of the 6.2 set into the floppy drive and used its FDISK command to prepare a single large primary DOS partition on the drive. I then used the FORMAT command to do a high-level format of the hard drive. Finally, I used the SETUP command to start the process of copying DOS 6.2 onto the hard drive. Naturally, there was one last problem to solve. The SETUP program kept prompting me for disk 1 of the set, and refused to believe that the disk in the drive was the one it wanted.

Back to the big PC again. I did a directory of the first 5.25" floppy disk and noticed that it was labeled "DISK 1." So, I used the DOS LABEL command to give my first 3.5" floppy the same label. The first try:

**LABEL A:DISK 1**

didn't work, as the LABEL

mation on the various components it finds on your system. You can use this diagnostic tool to verify that your serial and parallel ports are working and are where you think they should be. It also displays IRQ settings — invaluable information when you need to sort out any conflicts.

## Winding down

I haven't really done a lot of hacking on this machine yet. Epson did such a wonderful job on their engineering that it only took about four hours of play (oops, make that work) on my part to get the unit up and running as a PC. It sits here next to my VGA monitor, its little fan humming away, waiting for me to hook up a GameBoy cartridge programmer or a robot interface. And even though I only have about \$200.00 total in the machine, I expect it to give years of good service in light of its designer's reputation.

So, if you'll excuse me, I need to get back to work now. Where did I put that floppy disk of SBasic ... **NV**

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If you'd like to discuss IM-403 hacking, send me  
E-Mail at: karllunt@seanet.com  
You can stop by my web site at:  
<http://www.seanet.com/~karllunt>



# reader FeedBack

Dear Nuts & Volts:

The Gordon West WB6NOA, column on mobile antennas and antenna tuners is right on target!

I am an avid HF mobile antenna enthusiast, and I completely agree with his statement that the bigger and taller the whip, the better the results!

Without question the "Texas Bug Catcher" mobile antenna is most respected for its long-range capabilities.

To clarify exactly where this antenna comes from, I give you the following: Manufactured by **GLA Systems**, Henry Allen WB5TYD, P.O. Box 425, Caddo Mills, TX 75135. Order phone number **1-800-LUV-BUG1**; information number, **903-527-4163**; E-Mail: **WB5TYD@topher.net**

I think Gordo gave another source for where this antenna might be ordered, but I suggest everyone go directly with the manufacturer — Henry Allen — and enjoy a massive signal with this massive antenna system.

GLA Systems also offers the "Texas Twister," and this is yet another great antenna that Henry has tried and proven. Gordo says he is soon to have one on his comm van, and will give us a big report shortly.

I have also spotted some look-alikes to the "Texas Bug Catcher" — for me, I go with the real thing, and Henry stands behind everything he sells.

Keep up the great Gordon West columns. It's fun to read *Nuts & Volts Magazine* where experts can say it just like it is and give honest product reviews. That's for me!

**Marvin Rohrs**  
Balboa Island, CA

Dear Nuts & Volts:

Thanks for the new series by Robert Nansel.

I have just four words for building amateur robots: "LEGOS" and "HOT MELT GLUE."

I have found Legos to be a perfect building sub-system. They have all the parts one could ask for; blocks, wheels, gears, motors, and even computer interfaces, and the new RCX Lego Computer Brick.

I use slow-set hot melt glue to fasten all my sensors, BASIC Stamp computer, and extra breadboards.

For automation, I have used servos with Lego blocks glued

to the sides and control arm horns (works great).

I am starting to scan photos of my robotic attempts to put on my web page. If you are interested in my scans or techniques I would be happy to share.

I would really like to see an article using Legos. I think the ease of use and versatility of the Legos system could bring a lot of new people into robotics who are "afraid" of the mechanical design part of building robot hardware.

Some Resources: Pitsco and Lego Dacta, 1-800-362-4308. A great source of educational Lego supplies. <http://www.pitsco-lego.com>.

Lego Shop At Home 1-800-453-4652. Good source of kits and single parts. <http://www.lego.com>.

Lego robots. <http://www.coginst.uwf.edu/lego/other.html>.

Lego Brick Info. <http://www.cs.colorado.edu/~l3d/systems/legosheets/Home.html>.

**Tim Griffin**  
Internet

Dear Nuts & Volts:

A small note that wasn't included in any of the first three answers to Tech Forum question #49814 is a band stop fil-

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ter for ambient light.

Answer #4 does include this essential filter for room ambient light which contains enough infrared to partially drive the circuit into saturation, which lowers the output of these circuits due to the signal-to-noise ratio.

Some store bought receivers such as the one Mr. Goodwin mentions (and Mr. Moell) already come with these red filters, but not always. In bright light situations, the repeater output is lowered significantly and may not even work.

**Chris**  
Bieber, CA

Dear Nuts & Volts:

Your magazine has been very helpful in my work of repair and designing devices for

customers.

However, I'm somewhat taken a back at some of the articles on controlling equipment through WIN95.

Whenever I have tried using older cards or devices with WIN95, it wouldn't configure the system for the cards, even though in DOS, the cards and system would be configured correctly.

Also, I wish you would publish better information on some of the latest computer technology information. For example: Pentium II, New Video Bus Standard (AGP); the PII has been out for at least two years now. Also, the New Power Supply & Computer Case Standard (ATX).

**Terry Baker**  
St. Paul, MN

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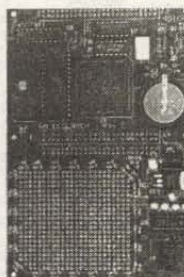
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HP 3315A-002,003 100 MHz/100 nS Univ. Counter, battery power, 1 GHz C-ch	\$650.00
HP 3315B 100 MHz/100 nS Universal Counter	\$500.00
HP 3316A 100 MHz/100 nS Universal Counter, HP1B	\$600.00
HP 3316B 100 MHz/100 nS Universal Counter, HP1B	\$1,000.00
HP 3334A 100 MHz/100 nS Universal Counter, HP1B	\$850.00
HP 3334A-010,030,050 100 MHz Univ.Counter; OCXO, DVM, 1.3 GHz C-ch., rear in	\$1,000.00
HP 3334B-010,060 100 MHz Universal Counter, HP1B, OCXO	\$1,000.00
HP 3335A 200 MHz Universal / Statistical Counter	\$1,200.00
TEK DC5004 Programmable 100 MHz/100nS Counter/Timer, TM5000 series	\$250.00

TEK DC5009 Programmable 135 MHz Univ. Counter/Timer, TM5000 series	\$400.00
TEK DC5010 350 MHz / 3.125 nS Universal Counter, TM5000 series	\$1,200.00
TEK DC503A 125 MHz/100 nS Universal Counter, TM500 series	\$275.00

### FREQUENCY COUNTERS

EIP 575 18 GHz Source Locking Counter, GPIB	\$2,500.00
EIP 578-opt.02,05 26.5 GHz Source Locking Counter; power meas., OCXO	\$5,000.00
HP 5340A 18 GHz Frequency Counter	\$1,200.00
HP 5342A 18 GHz Frequency Counter	\$2,400.00
HP 5342A-001 18 GHz Frequency Counter, OCXO reference	\$2,500.00
HP 5342A-001,011 18 GHz Frequency Counter, OCXO reference & HP1B	\$2,600.00
HP 5342A-003 18 GHz Freq.Counter, +22 dBm, -20 dBm dynamic range	\$2,400.00
HP 5342A-01,04,05 24 GHz Frequency Counter, OCXO, DAC	\$3,250.00
HP 5343A-001 26.5 GHz Frequency Counter, OCXO reference	\$4,500.00
HP 5345A/5355A/5356B 26.5 GHz CW/Pulse Frequency Counter	\$4,000.00
TEK DP501 1.3 GHz Prescaler, divide by 16, TM500 series	\$225.00

### STANDARDS

HP 105A Quartz Oscillator, 0.1/1.0/5.0 MHz	\$750.00
HP 105B Quartz Oscillator, 0.1/1.0/5.0 MHz, battery power	\$1,500.00





# 90 DAY WARRANTY PARTS AND LABOR • 10 DAY INSPECTION TEST EQUIPMENT WANTED CALL OR FAX LIST • OPEN ACCOUNTS



HP 5087A-opt.033 Distribution Amplifier; .....\$1,750.00  
12 outputs at 10 MHz

## AUDIO & BASEBAND

### SPECTRUM ANALYZERS

HP 3586C Selective Level Meter, .....\$1,500.00  
50 Hz-32.5 MHz, 50 & 75 ohms  
HP 8556A/8552B/141T Spectrum Analyzer, .....\$1,500.00  
20 Hz-300 kHz, 10 Hz min. res. bw.  
TEK 7L5/L7/603 Spectrum Analyzer, .....\$1,500.00  
20 Hz-5 MHz, 10 Hz min. res., w/frame

### DISTORTION ANALYZERS

HP 339A Distortion Analyzer, built-in low distortion osc. ....\$1,500.00  
HP 8903A-001 Audio Analyzer, .....\$2,600.00  
20 Hz-100 kHz; rear panel input  
HP 8903B-001, 013, 051 Audio Analyzer, .....\$3,750.00  
20 Hz-100 kHz; C-message, CCITT  
TEK DA4084 Programmable Distortion Analyzer .....\$1,000.00

### RMS VOLTMETERS

FLUKE 8920A True RMS Voltmeter, .....\$500.00  
180 uV-700 V, 10 Hz-20 MHz  
FLUKE 8922A True RMS Voltmeter, .....\$500.00  
180 uV-700 V, 2 Hz-11 MHz

### OSCILLATORS

HP 204C Oscillator, 5 Hz-1.2 MHz, 5 VRMS .....\$150.00  
HP 209A Sine/Square Wave Generator, .....\$225.00  
4 Hz-2 MHz, 5 VRMS max.  
TEK SG502 Sine/Square Osc., .....\$200.00  
5 Hz-500 kHz, 70 dB step atten., TM500

### MISCELLANEOUS

HP 3575A-001 Phase-Gain Meter, .....\$850.00  
1 Hz-13 MHz, dual display option  
HP 4437A Step Attenuator, 0-119.9 dB, .....\$175.00  
DC-1 MHz, 600 ohms unbal.  
HP 461A Amplifier, 20/40 dB, .....\$125.00  
1 kHz-150 MHz, 0.5 V/50 Ohms  
KROHN-HITE 3103 High/Low Pass Filter, .....\$400.00  
10 Hz-3 kHz, 24 dB/octave  
KROHN-HITE 3202R Dual HP/LP/BP/BR Filter, .....\$500.00  
20 Hz-2 MHz, 24 dB/octave  
KROHN-HITE 3342R Dual HP/LP Filter, .....\$1,100.00  
0.001 Hz-99.9 kHz, 48 dB/octave  
KROHN-HITE 3750 LP/HP/BP/BR Filter, .....\$700.00  
0.02 Hz-20 kHz, 6/12/18/24 dB/oct.  
ROCKLAND 852 Dual Highpass/ .....\$1,000.00  
Lowpass Filter, 0.1 Hz-111 kHz  
TEK AF501 Tunable Bandpass Filter / .....\$300.00  
Amplifier, 3 Hz-35 kHz  
TEK AM502 Differential Amplifier, .....\$475.00  
0.1 Hz-1 MHz, TM500 series

## RF & MICROWAVE

### SPECTRUM ANALYZERS

HP 11517A/19A/20A Mixer Set, .....\$600.00  
18.0-40.0 GHz, for HP 8555A/8569A  
HP 11970A WR28 Harmonic Mixer, 26.5-40 GHz .....\$1,100.00  
HP 11970Q WR28 Harmonic Mixer, 33-50 GHz .....\$1,400.00  
HP 8444A-059 Tracking Generator, .....\$1,250.00  
0.5-1500 MHz, for 8554, 8568, etc.  
HP 8445B Prescaler, 1.8-18.0 GHz, for HP 8555A .....\$650.00  
HP 8555A-100 Spectrum Analyzer, .....\$4,500.00  
10 MHz-22 GHz, 100 Hz min. res.  
HP 8568B Spectrum An., .....\$37,500.00  
100 Hz-22 GHz, HP calibration certificate  
HP 8569B Spectrum Analyzer, .....\$8,500.00  
10 MHz-22 GHz, 100 Hz min. res. bw.  
TEK TR503 Tracking Generator, .....\$1,375.00  
0.1-1800 MHz, for 492/4/5/6  
TEK VM782V WR15 Harmonic Mixer, 50-75 GHz .....\$2,000.00

### NETWORK ANALYZERS

HP 3577A/3567A/35678A Network .....\$12,500.00  
Analyzer, 5 Hz-200 MHz, w/S-Parameter & Cal Kit

### SIGNAL GENERATORS

FLUKE 6060A Synthesized Signal Gen., .....\$2,750.00  
0.1-1050 MHz, 10 Hz res., GPIB  
FLUKE 6060A/AN Synthesized Signal Gen., .....\$2,000.00  
10 kHz-520 MHz, 10 Hz res., GPIB  
FLUKE 6070A Synthesized Signal .....\$2,000.00  
Generator, 0.2-520 MHz, 1 Hz res.  
GIGATRONICS 600/10-18 Synthesized Source, .....\$3,000.00  
10-18 GHz, 1 kHz res., GPIB  
GIGATRONICS 840-01 Freq. Doubler, .....\$2,000.00  
26.5-40 GHz (WR28) out, 13-20 GHz in  
GIGATRONICS 875/50 Levelled Multiplier, x4, .....\$3,500.00  
50.0-75.0 GHz output, -3 dBm  
GIGATRONICS 875/86 Levelled Multiplier, .....\$5,000.00  
26.5-40.0 & 50.0-75.0 GHz outputs  
GIGATRONICS 910/12-18, opt. 14, 16 .....\$3,500.00  
Synthesized Source/Sweeper, 12-18 GHz, 1 Hz res., COXO  
HP 11720A Pulse Modulator, 2-18 GHz, 80 dB on/off ratio .....\$750.00  
HP 85100V Frequency Mult., .....\$4,250.00  
10-15 GHz in / 50-75 GHz out > 0 dBm  
HP 8640B-001, 002 Signal Gen., .....\$1,750.00  
0.5-1024 MHz, AM, FM, var. audio osc.  
HP 8660C/86602B-002 Synth. Sig. Gen., .....\$3,250.00  
1-1300 MHz, FM / Phase mod. w/86635A  
HP 8660C/86603A/86633B Synthesizer, .....\$3,750.00  
1-2600 MHz, AM, FM

### SWEEP GENERATORS

HP 8350B/83562B-002 Sweep Generator, .....\$18,500.00  
10 MHz-20 GHz, 70 dB step attenuator  
HP 8350B/83562C-004 Sweep Oscillator, .....\$17,500.00  
10 MHz-20 GHz, +10 dBm levelled  
HP 8601A General Sweep, .....\$400.00  
0.1-110 MHz, +20 dBm levelled  
HP 8620C Sweep Oscillator Frame .....\$550.00  
HP 8620C-011 Sweep Oscillator Frame, HP/B programmable .....\$675.00

HP 86222B-002 RF Plug-in, .....\$1,750.00  
10-2400 MHz, +13 dBm levelled, 70 dB atten.  
HP 86230B RF Plug-in, 1.8-4.2 GHz, +10 dBm unlevelled .....\$675.00  
HP 86235A-001, 002 RF Plug-in, .....\$1,000.00  
1.7-4.3 GHz, +14 dBm levelled, 70 dB atten.  
HP 86240C RF Plug-in, 3.6-8.6 GHz, +16 dBm levelled .....\$1,000.00  
HP 86241A-001 RF Plug-in, 3.2-6.5 GHz, +8 dBm levelled .....\$500.00  
HP 86242D-004, 008 RF Plug-in, .....\$500.00  
5.9-9.0 GHz, +10 dBm levelled  
HP 86250D RF Plug-in, 8.0-12.4 GHz, +10 dBm levelled .....\$675.00  
HP 86260A RF Plug-in, 12.0-18.0 GHz, +10 dBm unlevelled .....\$800.00  
HP 86260A-H04 RF Plug-in, .....\$800.00  
10.0-15.0 GHz, +10 dBm unlevelled  
HP 86290A RF Plug-in, 2.0-18.0 GHz, +7 dBm levelled .....\$1,750.00  
HP 86290B RF Plug-in, 2.0-18.6 GHz, +10 dBm levelled .....\$2,000.00  
WAVETEK 862 Sweep Generator, .....\$1,500.00  
10-4.0 GHz, markers, +12 dBm unlvld.  
WILTRON 6617A-40 Sweep Generator, .....\$3,000.00  
10 MHz-8 GHz, +16 dBm levelled

### POWER METERS

ANRITSU MA72B Power Sensor, .....\$300.00  
-20 to +20 dBm, 0.01-18 GHz  
ANRITSU MP-81B/ML-83A Power Meter, .....\$2,500.00  
75-110 GHz (WR10), -20 to +20 dBm  
BOONTON 4200-01A, 03/8-4A x2 .....\$1,500.00  
Dual Channel Microwattmeter, w/(2) 1 MHz-7 GHz sensors  
BOONTON 42B41-4B Analog Power .....\$375.00  
Meter, with 1 MHz-12 GHz sensor  
BOONTON 42B41-4E Analog Power .....\$500.00  
Meter, with 1 MHz-18 GHz sensor  
GENERAL MICROWAVE 476/4240A Power .....\$300.00  
Meter & Sensor, 0.01-18 GHz, -35 to +10 dBm  
HP 435A/8481A Power Meter, .....\$900.00  
10 MHz-18 GHz, -30 to +20 dBm  
HP 435A/8482H Power Meter, .....\$950.00  
0.1-4200 MHz, -10 to +34 dBm  
HP 435B-001/8482H Power Meter, .....\$1,200.00  
HP 8477A Power Meter Calibrator, for HP 432 series .....\$500.00  
HP 8486A Power Sensor, .....\$1,500.00  
33.0-50.0 GHz, WR22, for 435/6/7/8  
HP 8486A WR28 Thermistor Mount, .....\$350.00  
26.5-40 GHz, for 432 series

### RF MILLIVOLTMETERS

BOONTON 92B RF Millivoltmeter, .....\$500.00  
10 kHz-1.2 GHz, 50 Ohm dB & mV scale  
BOONTON 92BD 3-1/2 digit RF .....\$600.00  
Millivoltmeter, 10 kHz-1.2 GHz  
BOONTON 92B-opt.05 RF Millivoltmeter, .....\$500.00  
10 kHz-1.2 GHz, 75 Ohm dB & mV scale  
RACAL 9303 TRMS Level Meter, .....\$875.00  
10 kHz-2 GHz, -77 to +23 dBm, GPIB

### AMPLIFIERS, MISCELLANEOUS

BOONTON 82AD-opt.01A Modulation Meter, .....\$900.00  
AM, FM, 10-1200 MHz, GPIB  
HP 11715A AM/FM Test Source .....\$1,600.00  
HP 415E SWR Meter .....\$300.00  
HP 465A Amplifier, 20/40 dB, .....\$125.00  
5 Hz-1 MHz, 1/2 Watt/50 Ohms  
HP 8447A-001 Dual Amplifier, 0.1-400 MHz .....\$450.00  
HP 8447E Amplifier, 22 dB, 0.1-1300 MHz, +13 dBm output .....\$750.00  
HP 8901A Modulation Analyzer, 150 kHz-1300 MHz .....\$3,000.00  
HP 8901B-1, 2, 3 Modulation An., .....\$4,500.00  
0.15-1300 MHz, rear input, COXO, ext. LO  
HP 8970A Noise Figure Meter .....\$6,000.00  
HUGHES 1177H01F000 TWT Amplifier, .....\$1,500.00  
2.0-4.0 GHz, 10 Watts output  
HUGHES 1177H02F000 TWT Amplifier, .....\$1,500.00  
4.0-8.0 GHz, 10 Watts output  
HUGHES 1277H02F000 TWT Amplifier, .....\$2,500.00  
4.0-8.0 GHz, 20 Watts output  
HUGHES 8020H02F000 TWT Amplifier, .....\$2,750.00  
4.0-8.0 GHz, 20 Watts output  
MICROWAVE SEMI-CORP. MC5112 Noise .....\$275.00  
Source, 25 dB ENR, 0.1-12.4 GHz, N(m), +28 VDC  
ROHDE & SCHWARTZ ESHZ Test .....\$6,000.00  
Receiver, 9 kHz-30 MHz

## COAXIAL & WAVEGUIDE

AMERICAN NUCLEONICS AM-432 .....\$95.00  
Cavity Backed Spiral Antenna, LHC, 2-18 GHz, TNC(f) "NEW"  
BIRD 8329-310 30 dB Attenuator, .....\$650.00  
2000 Watts, DC-1 GHz, LC(f)/N(f)  
FXR/MICROLAB S3-02N Triple Stub Tuner, .....\$125.00  
200-1000 MHz, 100 Watts max., N(m/f)  
GR 874-LTL Constant Impedance .....\$400.00  
Trombone Line, 0-44 cm, DC-2 GHz  
GR 900-Q GR900 14mm Interseries Adapters .....\$125.00  
HP 11590A-001 Bias Network, 1.0-18.0 GHz, APC7 .....\$450.00  
HP 11612A Bias Network, 45 MHz-26.5 GHz, APC3.5 .....\$550.00  
HP 11691D Directional Coupler, 22 dB, 2-18 GHz .....\$450.00  
HP 774D Dual Directional Coupler, 20 dB, 215-450 MHz .....\$275.00  
HP 777D Dual Directional Coupler, 20 dB, 1.9-4.1 GHz .....\$275.00  
HP 778D-011 Dual Dir. Coupler, 20 dB, .....\$450.00  
100-2000 MHz, APC7 test port  
HP 8470B Crystal Detector, 10 MHz-18 GHz, neg. pol., APC7 .....\$250.00  
HP 8472A Crystal Detector, 10 MHz-18 GHz, neg. pol., SMA .....\$150.00  
HP 8494G-002 Programmable Step .....\$350.00  
Attenuator, 0-11 dB, DC-4 GHz, SMA  
HP 8495G-002 Programmable Step .....\$300.00  
Attenuator, 0-70 dB, DC-4 GHz, SMA  
HP 8495H-002 Programmable Step .....\$400.00  
Attenuator, 0-70 dB, DC-18 GHz, SMA  
HP 8497K-004 Programmable Step .....\$750.00  
Attenuator, 0-90 dB, DC-26.5 GHz  
HP K422A WF42 Flat Broadband Detector, 18.0-26.5 GHz .....\$350.00  
HP K532A WF42 Frequency Meter, 18.0-26.5 GHz .....\$450.00  
HP K870A WF42 Slide Screw Tuner, 18.0-26.5 GHz .....\$275.00  
HP K914B WF42 Moving Load, 18.0-26.5 GHz .....\$350.00  
HP Q752D WF42 Directional Coupler, 20 dB, 33-50 GHz .....\$650.00  
HP R375A WR28 Variable Attenuator, 0-20 dB, 26.5-40 GHz .....\$375.00  
HP R422A WR28 Flat Broadband Detector, 26.5-40 GHz .....\$400.00

HP R532A WR28 Frequency Meter, 26.5-40 GHz .....\$500.00  
HP R752A WR28 Directional Coupler, 3 dB, 26.5-40 GHz .....\$450.00  
HP R914B WR28 Moving Load, 26.5-40 GHz .....\$300.00  
HP V365A WR15 Isolator, 25 dB, 50-75 GHz .....\$900.00  
HP V752D WR15 Directional Coupler, 20 dB, 50-75 GHz .....\$650.00  
HP X870A WR90 Slide Screw Tuner .....\$150.00  
HUGHES 45111H-2000 WR28 z .....\$450.00  
Isolator, 25 dB, 26.5-40 GHz  
HUGHES 45712H-1000 WR22 .....\$900.00  
Frequency Meter, 33-50 GHz  
HUGHES 45721H-2000 WR28 Precision .....\$1,200.00  
Rotary Vane Atten., 0-50 dB, 26.5-40 GHz  
HUGHES 45732H-1200 WR22 Level .....\$250.00  
Set Attenuator, 0-25 dB, 33-50 GHz  
HUGHES 47316H-1111 WR10 Tuneable .....\$600.00  
Detector, 75-110 GHz, positive polarity  
HUGHES 47323H-1211 WR19 Flat .....\$650.00  
Broadband Detector, negative, 40-60 GHz  
HUGHES 47974H-1000 WR15 SPST .....\$375.00  
PIN Switch, 250 MHz speed, 60-62 GHz response  
KAY 442D Step Attenuator, 0-101 dB, 75 ohms, BNC .....\$100.00  
KRYTAR 1818 Directional Coupler, .....\$200.00  
16 dB, 2-18 GHz, SMA(f)  
M/A-COM 31-39-30/10 WR19 .....\$450.00  
Directional Coupler, 10 dB, 40-60 GHz  
MIDWEST MICROWAVE 3537 .....\$40.00  
DC Block, 0.1-12.4 GHz, SMA(m/f) "NEW"  
MINI-CIRCUITS ZFDC-20-4 .....\$25.00  
Directional Coupler, 19.5 dB, 1-1000 MHz, SMA(f)  
NARDA 25171 Level Set Attenuator, .....\$100.00  
0-17 dB, 2-8 GHz, SMA(f)  
NARDA 26298 20 dB Attenuator, .....\$200.00  
150 Watts, DC-1 GHz, N(f)  
NARDA 3000-SERIES Directional Couplers .....\$150.00  
NARDA 3024 Bi-Directional Coupler, 20 dB, 4-8 GHz .....\$300.00  
NARDA 3090-SERIES Precision High Directivity Couplers .....\$225.00  
NARDA 368NM Coaxial High Power .....\$400.00  
Load, 500 Watts, 2.0-12.4 GHz, N(m)  
NARDA 369BNF High Power Termination, .....\$325.00  
175 Watts, 0.7-18 GHz, N(f)  
NARDA 3753B Coaxial Phase Shifter, .....\$1,250.00  
0-55 deg/GHz, 3.5-12.4 GHz  
NARDA 4000-SERIES SMA Miniature Directional Couplers .....\$75.00  
NARDA 4203-6 Directional Coupler, 6 dB, 2-18 GHz, SMA(f/w) .....\$225.00  
NARDA 4245-10 Directional Coupler, 10 dB, 4-12 GHz, SMA(f) .....\$100.00  
NARDA 4799 Level Set Attenuator, 0-15 dB, 4-18 GHz, SMA(f) .....\$135.00  
NARDA 5070-SERIES Precision Reflectometer Couplers .....\$300.00  
NARDA 765-20 dB Attenuator, 50 Watts, DC-5 GHz, N(m/f) .....\$135.00  
NARDA 766-10 dB Attenuator, 20 Watts, DC-4 GHz, N(m/f) .....\$100.00  
NARDA 792F Variable Attenuator, 0-20 dB, 2.0-12.4 GHz .....\$375.00  
NARDA 794FM Direct Reading .....\$375.00  
Variable Attenuator, 0-40 dB, 4-8 GHz  
OMNI-SPECTRA 2085-6010-00 Crystal .....\$50.00  
Detector, 1-18 GHz, negative polarity, SMA(m/f)  
PAMTECH KYG1014 WR42 .....\$250.00  
Junction Circulator, 18.0-26.5 GHz  
SONOMA ENG. S-4901 WR15 .....\$125.00  
Junction Isolator, 57-59 GHz, 30 dB isolation  
SONOMA ENG. S-4906 WR15 .....\$125.00  
Junction Isolator, 60-62 GHz, 30 dB isolation  
SONOMA ENG. S-4907 WR15 .....\$125.00  
Junction Isolator, 62-64 GHz, 30 dB isolation  
SONOMA SCIENTIFIC 21A3 WR42 .....\$75.00  
Circulator, 20 dB, 20.6-24.8 GHz  
SPACEK LABS DQ-1 WR22 Flat .....\$400.00  
Broadband Detector, 33-50 GHz  
SPACEK LABS K-2X Frequency Doubler, .....\$350.00  
9.0-13.25 GHz in / 18.0-26.5 GHz out  
SPACEK LABS KA-3X Frequency Tripler, out .....\$350.00  
8.83-13.33 GHz in / 26.5-40.0 GHz  
TRG B528 WR22 Direct Reading Phase .....\$1,250.00  
Shifter, 0-360 deg, 33-50 GHz  
TRG V551 WR15 Frequency Meter, 50-75 GHz .....\$600.00  
TRG W551 WR10 Frequency Meter, 75-110 GHz .....\$750.00  
WAVELINE 100-180 WR28 .....\$200.00  
Terminated Crossguide Coupler, 30 dB  
WEINSCHEL 1515 Power Divider .....\$125.00  
2-Way, DC-18 GHz, SMA(m/f)  
WEINSCHEL DS109 Double Stub Tuner, 1-13 GHz, N(m/f) .....\$150.00  
WEINSCHEL DS109L Double Stub .....\$150.00  
Tuner, 0.2-2.0 GHz, N(m/f)

## COMMUNICATIONS

HP 59401A HP/B Bus Analyzer .....\$700.00  
TEK 1410R NTSC Gen., w/SPG2 sync. .....\$800.00  
generator, TSG7 color bars  
TEK 1411R PAL Gen., w/SPG12 sync; .....\$750.00  
TSG11 color bars; TSG13 linearity  
TEK 1411R PAL Test Gen., .....\$1,000.00  
w/SPG12, TSG11, TSG13, TSG15, TSG16  
TEK 1411R PAL Test Gen., .....\$1,100.00  
w/SPG12, TSG11, TSG12, TSG13, TSG15, TSG16  
TEK 1411R-opt.04 PAL Test Gen., w/ .....\$1,400.00  
SPG12, TSG11, TSG13, TSG15, TSG16  
TEK 1420 NTSC Vectorscope .....\$600.00  
TEK 147A NTSC Test Signal Generator, .....\$800.00  
with noise test signal  
TEK 148 PAL Insertion Test Signal Generator .....\$700.00  
TEK 1750 NTSC Waveform / Vector Monitor .....\$2,250.00  
TEK 520A NTSC Vectorscope .....\$750.00  
TEK 521A PAL Vectorscope .....\$750.00

## MISCELLANEOUS

P.A.R. 5101 Lock-in Amplifier, 5 Hz-100 kHz .....\$650.00  
P.A.R. 5206-95, 98 Two-Phase .....\$1,500.00  
Lock-in Amp., 2 Hz-100 kHz, GPIB  
P.A.R. 5209 Lock-in Amp., 0.5 Hz-120 kHz, .....\$2,500.00  
130 dB dynamic reserve  
TEK TM5006 5000-series 6-slot Programmable .....\$600.00  
Power Module  
TEK TM504 500-series 4-slot Power Module .....\$175.00  
TEK TM506 500-series 6-slot Power Module .....\$250.00  
TEK TM515 500-series 5-slot Traveller Power Module .....\$275.00



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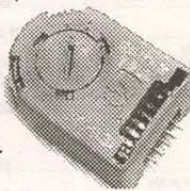
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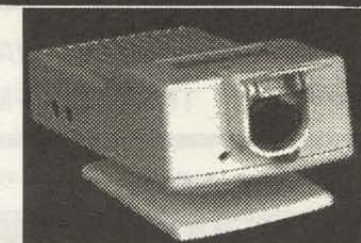
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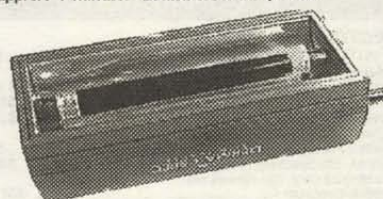
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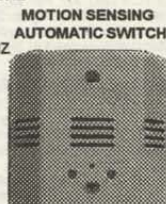
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# STAMP APPLICATIONS

by Jon Williams



## Putting the Spotlight on BASIC Stamp Projects, Hints, and Tips

### Remote Control Stamping

*Microcontroller networking is not new — I'm just a little late to the party. Honestly, I've been wanting to control one (or more) Stamps from my PC for a long time. Inspired by Ryan Sheldon's terrific articles on PC-based RS-232 control, I decided to stop thinking about networking Stamps and start doing it. The cool thing about using the BASIC Stamp is that we can design our network nodes to do anything we need or desire; we are not restricted to off-the-shelf components.*

*What I'm going to present this month is the front-end of a project that I generically call StampNet. And I really should correct my last statement. This isn't a singular project as much as a series of software, firmware, and hardware building blocks designed to guide and inspire you to build your own Stamp-based network projects. Sound good? Okay then, let's dig in.*

### The Big Picture

Since we're not going to squeeze all of this into one installment, let's take a look at the big picture. The overall concept is divided into three major elements: the "master" control software, a communication module, and "slave" (remote) nodes. Of course, there is software in all three elements, and hardware at the communication module and slave nodes.

Like Ryan, we're going to create our master control software using Visual Basic. Our slave nodes will be custom-built around the BASIC Stamp. As I've already pointed out, we're not going to connect the master software directly to the slave nodes; there will be an intermediary that I call the communication module or "master node." The purpose of the master node is two-fold: it buffers communication between the fast PC and the relatively slow Stamp-based slave nodes, and it gives us the opportunity to handle local I/O and other network-type (X-10) control.

### The Master Node

Based on the last sentence, you've probably guessed that we're going to use a BS2 for the master node. Why? Several reasons, actually. Using the BS2 gives us the opportunity to do local I/O, X-10 control and connects directly to the PC through a serial cable. All this for about the same price as an RS-232 to RS-485 adapter. And, unlike a standard adapter, we can modify the BS2's behavior to suit our particular needs.

### Stage 1

This month, we'll work with the heart of our communications network by building a small demo program. The purpose of this program —

PCTOBS2 — is to establish a serial link between the PC and the master node. With the link established, we'll be able to pass information back and forth.

Since I didn't want to fuss with hardware at this point, my temporary master node is the BASIC Stamp Activity Board (BSAB). If you don't have one, download the documentation (PDF format) from Parallax for the I/O schematics. The demo master node program uses the four LEDs, the POT input, and the analog (PWM) output circuitry. It's all very straightforward stuff. You can easily construct the circuit on a solderless breadboard.

For convenience sake, the master node communicates with the PC through the programming port (defined as pin 16 in PBASIC). You can change this if you like, but with the pin's built-in level shifters, it's really the easiest route to take. If you do build your own hardware, be sure to put a 0.1 uF capacitor inline with the ATN pin on the Stamp. The capacitor blocks the steady state of the PC's DTR output and allows the "attention" pulse generated by the BS2 programming software. The capacitor is already installed in the BSAB and I've updated my BS2 carrier boards with the same arrangement. I recommend that you do the same. Alternately, you can install an in-line switch, but you'll have to remember to close it for programming and to open it when running your VB program(s).

### Visual Programming

Since Ryan Sheldon has done such an excellent job explaining the construction of a Visual Basic program, I'm not going to cover all the gory details. I will cover those things that I consider good practice or that will bite you when you're not looking (ask me how I know they'll bite ...). If you skipped Ryan's articles in the March and April '98 issues, please go back and read them now.

The most important thing to keep in mind is that Visual Basic is an event-driven language, unlike PBASIC, which is essentially linear in nature. Okay, what do we mean by "event-driven?" In the simplest terms, nothing happens in an event-driven program until something (an event) happens! Sounds a bit like the chicken and the egg, doesn't it? It's really not that bad.

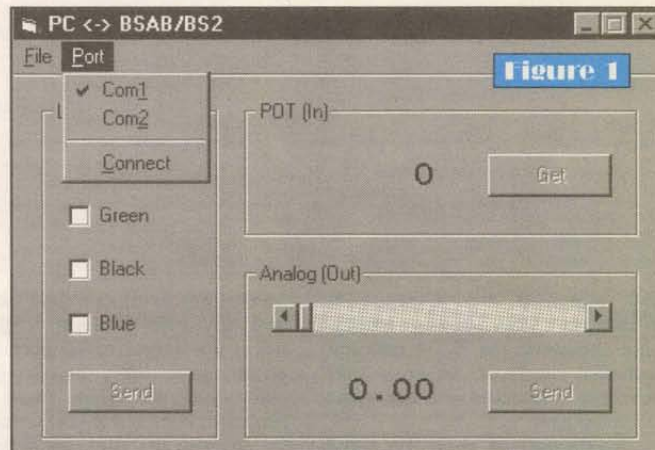
Events are generated in myriad ways: the program starts, a button is clicked, a character is received from the serial port, etc. As VB programmers, it is our job to write the handlers (subroutines) for the events that affect us. Since most of it is very sim-

ple coding, I'm not going to analyze the entire VB program; I'm just going to cover the serial communications stuff necessary to talk with the Stamp.

### Getting Connected

Figure 1 shows our VB program just after start-up with the Port menu selected. In my opinion, it's good practice to allow your program to open and close the serial port when needed. The purpose of the Port menu, therefore, is to allow the user to select which port to use and then to connect when ready. Listing 1 is the code for the subroutine that handles the connection.

In operation, the "Connect" menu item changes to "Disconnect" when a successful connection is made. I could have used a separate menu item, but this just seemed nicer and more intuitive. As you can see, the code checks the menu caption to determine the current connec-



```
Private Sub mnuPortConnect_Click()  
    If mnuPortConnect.Caption = "&Connect" Then  
        ' connect  
        ' trap comm port error  
        On Error GoTo NoConnect  
        MSCmm1.PortOpen = True  
        ' connected - remove error trapping  
        On Error GoTo 0  
        frmMain.Caption = "PC <-> BSAB/BS2 (Connected)"  
        ' update Port menu  
        mnuPortConnect.Caption = "&Disconnect"  
        ' disable comm port selection while connected  
        mnuPortCom1.Enabled = False  
        mnuPortCom2.Enabled = False  
        SetButtons (True)  
    Else  
        ' disconnect  
        MSCmm1.PortOpen = False  
        frmMain.Caption = "PC <-> BSAB/BS2"  
        mnuPortConnect.Caption = "&Connect"  
        mnuPortCom1.Enabled = True  
        mnuPortCom2.Enabled = True  
        SetButtons (False)  
    End If  
Exit Sub  
  
NoConnect:  
    ' display port connection problem  
    lblTransmit.Caption = "Error: Could not connect"  
    On Error GoTo 0  
End Sub
```

Listing 1



# STAMP APPLICATIONS

Listing 3  
Nuts & Volts: Stamp Applications, July 1998

```

'-----[ Title ]-----
' File..... PCTOBS2.BS2
' Purpose... PC To BSAB/BS2 Demo
' Author.... Jon Williams
' E-mail.... jonwms@aol.com
' WWW..... http://members.aol.com/jonwms
' Started... 31 MAY 1998
' Updated... 31 MAY 1998

'-----[ Program Description ]-----
' This program receives a command+data message from a corresponding PC
' program. The PC message is structured thusly:
'
' $55, address, message, data
'
' The Stamp will respond with:
'
' $55, address, high_byte, low_byte, CR
'
' Note: Not all messages will return data, but the Stamp will always send
' four elements to the PC. All bytes are returned in hex format, followed
' by a carriage return that serves as an end-of-packet marker.
'
' BASIC Stamp Activity Board jumper settings:
'
' X2: Pos 2
' X6: In

'-----[ Revision History ]-----
'
' 31 MAY 98 : Rev 1

'-----[ Constants ]-----
'
Baud96 CON 84 ' serial baud rate (to PC)
SIOPin CON 16 ' use programming port
' - couple ATN with capacitor
PotPin CON 7 ' pot input on BSAB
AnPin CON 12 ' analog (PWM) pin on BSAB

'-----[ Variables ]-----
'
addr VAR Byte ' node address
msg VAR Byte ' message

```

```

pcData VAR Byte
sData VAR Word
sDHigh VAR sData.HighByte
sDLow VAR sData.LowByte

```

```

' data byte
' return data

```

Listing 3

```

'-----[ EEPROM Data ]-----
'
'-----[ Initialization ]-----
'
Init: OUTC = %1111 ' clear LEDs
      DIRC = %1111 ' make LED pins outputs

'-----[ Main Code ]-----
'
Main: ' wait for message from PC
      SERIN SIOPin, Baud96, [WAIT ($55), addr, msg, pcData]

      ' ignore message not addressed to this node
      IF addr <> 1 THEN Main

      ' jump to process called by msg
      ' 0 is not a valid message
      BRANCH msg, [Main, DoLEds, GetPot, AnOut]

      GOTO Main

'-----[ Subroutines ]-----
'
DoLEds: ' invert bits for active low outputs on BSAB
        OutC = pcData ^ %0F
        ' clear response data
        sData = $00
        GOTO Rspnd

GetPot: ' read pot and return value to PC
        HIGH PotPin
        PAUSE 5
        RCTIME PotPin, 1, sData
        GOTO Rspnd

AnOut: ' output the analog value
        PWM AnPin, pcData, 500
        ' clear response data
        sData = $00
        GOTO Rspnd

Rspnd: ' output to PC
        SEROUT SIOPin, Baud96, [hex2 $55, hex2 addr, hex4 sData, 13]
        GOTO Main

```

tion state. If the caption is "&Connect" (the leading ampersand underlines the "C" to define a keyboard shortcut), we know that we're not connected and can open the serial port.

It attempts to open the serial port, I should say. Remember that, in our multi-tasking environment,

several programs could be running and any one of them might be using our target serial port. It's a good idea to notify the user (especially yourself) when there is a problem. Notice that just before we try to open the port, we define an error trap. What this line (On Error GoTo NoConnect) does is force the

program to branch to the label "NoConnect" if there is an error. Since we've defined the error trap just before attempting to open the serial port, it's pretty safe to assume that any error would have been caused by that attempt.

display an error message and then turn off the error trapping. This prevents other errors from bringing us back to the "NoConnect" label. Pretty simple and very useful. This

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Advanced programmers may want to check the actual error code before proceeding.

For the moment, let's assume that the port was in use. Since our program can't open the selected port, an error is generated and the program branches to "NoConnect."

You can see that, in this section, we

```

Private Sub MSCComm1_OnComm()
Dim temp As String
Dim i As Integer

```

Listing 4

```

If MSCComm1.CommEvent = comEvReceive Then
' get a character from the buffer
temp = StrConv(MSCComm1.Input, vbUnicode)
' if CR, then process the data
If temp = Chr(13) Then
' look for header
i = InStr(1, buffer, "55")
' remove *trash* preceeding header
If i > 0 Then
buffer = Mid$(buffer, i)
End If
If Len(buffer) = 8 Then
' go process the input
lblReceive.Caption = "RX: " & buffer
ProcessInput (LastMsg)
Else
lblReceive.Caption = "RX: Bad
Packet"
End If
' clear the buffer
buffer = ""
Else
' add character to buffer
buffer = buffer & temp
End If
Else
' process other events here
End If
End Sub

```



# STAMP APPLICATIONS

Properties - MSComm1

MSComm1 MSComm

Alphabetic Categorized **Figure 2**

(About)	...
(Custom)	
(Name)	MSComm1
CommPort	1
DTREnable	False
EOFFEnable	False
Handshaking	0 - comNone
InBufferSize	128
Index	
InputLen	1
InputMode	1 - comInputModeBinary
Left	2160
NullDiscard	False
OutBufferSize	128
ParityReplace	?
RThreshold	1
RTSEnable	False
Settings	9600,n,8,1
SThreshold	0
Tag	
Top	2520

we change our Port menu item to "Disconnect" and disable the port selection items. This is done for safety. We don't want the user changing serial port properties while the port is in use. The last step in the connection process is to enable our transmit buttons (labeled "Send" and "Get" on the form). Since this happens in several places in the program, I created a custom subroutine called "SetButtons()" to do the work in one place.

Disconnecting is just a matter of undoing everything that we just did. Notice the "Exit Sub" in the line just after the connect/disconnect section. This is important. It forces the subroutine to end so that the error trapping code is not executed under normal conditions.

## Talking To The Stamp

Let's move on. Now that we're connected, we have access to the transmit buttons. There is one transmit button for each of the respective areas of the program: setting the state of the LEDs, reading the POT, and outputting an analog voltage. When we click one of

these buttons, a message — and sometimes data — is sent to the Stamp for processing. If the message was a request for information (like the POT reading), the Stamp will return data for us to process and display.

Since I'm a simple guy at heart, I like to keep things simple. Along that theme, I decided on fixed-length messages between the Stamp and the PC. Sending messages from the PC is done with a subroutine called "SendMsg." Receiving information from the Stamp happens in the background (automatically, based on the arrival of characters at the serial port) in the less cleverly named "MSComm1\_OnComm." I'll explain the name and its operation in a minute. First things first. Let's send a message to the Stamp.

Take a look at Listing 2, the code for sending a message to the Stamp. As I already pointed out, our message will have a fixed length; in this case, four bytes, a header (\$55), the node address, the message and a data byte that might be needed for the particular message. The header gives the Stamp something to look for before reading in the rest of the message. This helps keep things in sync. The address byte specifies the target node for this message. We will use 1 as the address for the master node. Next comes the command and data (i.e., LED status). Now that we know what it does, let's see how it's done.

The first thing we do before actually sending the message is to disable our transmit buttons. In practice, you'll probably never notice this as it takes less than five milliseconds to transmit four bytes at 9600 baud. I think it's good practice, however, just in case something goes wrong. We don't want to stuff any more messages into a transmit queue that's not functioning properly.

Since the MSComm object deals with strings, a string (msgQueue) is built from our message bytes. To aid in the development, I created a hex version of this string (prefixed with "TX:") and put it on the form. As it turns out, I never had any trouble sending information to the Stamp. With the message string built and displayed, we send it to the Stamp by copying it to the output buffer of the MSComm object.

After placing the message in the buffer, the program waits for it to be sent by monitoring the number of bytes left in the output buffer. The "DoEvents" keyword embedded in this Do-Loop is very important as it lets the program handle other events while in the loop. If you left this out, and the transmission

is particularly important if you plan to distribute your programs.

Okay, now let's go the other way. When the port is opened, we turn off the error trapping and then tell the user we've made a successful connection by changing the caption of our form (you can see this in Figure 2). Since we're connected,

```
Public Sub SendMsg(addr As Byte, msg As Byte, data As Byte)
    Dim msgQueue As String * 4
    Dim msgData As String
    Dim x As Byte
    Dim temp As Byte

    ' disable buttons while sending message)
    SetButtons (False)

    ' build message string
    msgQueue = Chr$(55) & Chr$(addr) & Chr$(msg) & Chr$(data)

    ' display transmit message (in hex)
    msgData = "TX: "
    For x = 1 To 4
        temp = Asc(Mid$(msgQueue, x, 1))
        msgData = msgData & HexStr(temp)
    Next
    lblTransmit.Caption = msgData

    ' send message to Stamp
    MSComm1.Output = msgQueue
    ' wait until output buffer is empty
    Do
        DoEvents
    Loop Until MSComm1.OutBufferCount = 0
    ' clear the input buffer
    MSComm1.InBufferCount = 0
    ' save the message number
    lastMsg = msg

    ' re-enable buttons
    SetButtons (True)
End Sub
```

## Listing 2

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# STAMP APPLICATIONS

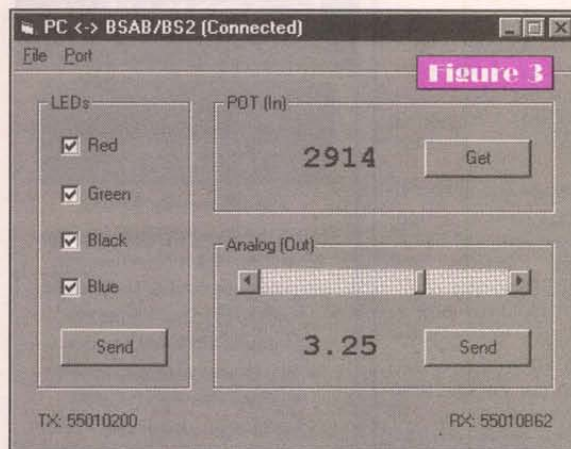


Figure 3

got hung up, you could end up having to terminate your program forcefully.

With the output buffer empty — meaning our message has been sent — we clear the input buffer of any garbage and wait for a message to come back. We also save the message number we sent (for later processing of any returned data) and re-enable the transmit buttons.

## Listening To The PC

The PC code wasn't too tough, was it? Now let's look at the BASIC Stamp end of things — that's even easier. Listing 3 is the BS2 program that processes the messages from the PC. Of course, we'll add to it in the future, but you can plainly see that the structure is set up for easy adaptation.

There's really nothing to it. We wait for a message that begins with \$55, then store the address, message number, and data. Since this demo doesn't deal with slave nodes, it throws away any messages not destined for the master node. Next month, we'll update this code to pass the message on to the target slave.

You may remember we talked about the BRANCH command a couple of months ago. This program demonstrates a very typical use of BRANCH. Now, I know that the astute — and that's all of you — will observe that this may be just a little too convenient since we're only using three messages and the numbering is contiguous (1, 2, and 3). Later, when we get a little more sophisticated and add messages, it may not be convenient to number them in this fashion. No problem. We can use LOOKDOWN to sort things out for the BRANCH command.

The subroutines are trivial, so I'm not going to discuss them except to say that each is responsible for setting the value of sData that will be returned to the PC. The last line of each subroutine is a

GOTO that routes the program to the response code. Like at the PC, we start the message with \$55, send our address, the return data, and finish up with a carriage return. The carriage return lets the PC program know that the message is

complete. This works well since the message is sent back as a string in hex format.

The last thing we need to do to complete this phase of our project is to receive the message at the PC and process the data. Unlike the Stamp, the PC does not sit and wait for the response; it goes happily about its business until characters show up at the serial port.

## Listening For The Stamp

Remember just a few minutes ago we talked about event-driven programming? Well, here it is. I commented earlier that an event can be generated upon the arrival of a character at the serial port. We're going to take advantage of this behavior to deal with the data as it shows up. You may be wondering why I chose event-driven code over polling (waiting for the data). I did this because the same code can be used in projects where the PC asks for data and in projects where a Stamp just freewheels information into the PC as it pleases. We will not be freewheeling in a multi-stamp network, but you may want to build a Stamp-based data collector, for example, that sends data to the PC without being prompted. This is where event-driven programming can be very useful.

Just a quick note on set-up. Figure 2 shows the settings I used for the various MScmm properties. Notice that the property RThreshold (receive threshold) is set to one. This forces a "receive" event to be generated each time a character shows up. You'll need to set this as the default value of zero (no event).

"OnComm" is a generalized handler that is called when any event is generated by the MScmm object. Listing 4 is the code for this subroutine. Since we only care about receiving characters at the moment, the first thing the subroutine does is check for that event (comEvReceive). If it is a receive

event, we grab the character from the input buffer. If the character was a carriage return, we know that the message is complete and we can process it. If the character was anything else, we add it to our holding string and wait for another character. And remember, all this happens while the program is doing other things.

The first step in checking the message is to look for our header (\$55) at the beginning of the buffer. Theoretically, it should always occupy the first two characters of the received string, but I found when writing the program that this wasn't always the case. For reasons that I still don't understand, junk seemed to precede the message from time to time. The Mid\$ function takes care of removing any junk characters that may have found their way into the front end of our message.

If the "cleaned" message contains the correct number of characters, we put it on screen and call the subroutine "ProcessInput" to display the returned data.

Figure 3 shows the program after a successful transaction with the Stamp. Notice that the transmitted message was "55010200." Broken down, we see our header (\$55), the node number (01), the "Get POT" command (02), and a data byte of \$00. You can see that the Stamp returned "55010B62." This string tells us that the message came from node 01 and the data passed back was \$0B62. Since the transmitted command was "Get POT," the data is converted to a decimal (2914) and displayed on the form.

If the message is not eight characters in length, we assume that it's bad and display "RX: Bad Packet" on the form. Here's another one of those voodoo programming things. I wrote this error handling code because I was getting bad messages about 25% of the time. That's a problem. And when I modified my Stamp program to deal with single-character commands and hooked it up to a terminal program, I got no such junk. I was so frustrated that I started saying words we can't print here and I even resorted to asking my goldfish for advice! He was no help, so I'm going to buy a new one as soon as I can get to the pet store (just kidding, I like my goldfish — even if he doesn't know duff about computer programming!).

Okay, here's the truth. In a moment of desperation, I did a search on the term "mscmm" using Windows Explorer and found a demo program buried deep in my hard drive. Low and behold, it was a terminal program written in VB. When I ran it, no junk! What I noticed was something very inter-

## SOURCES

For more information on the BASIC Stamp, contact:

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Internet:

<http://members.aol.com/jonwms>  
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esting in the MScmm settings: the input mode was set to binary (versus text mode that I had been using).

I tried it. It worked. No more junk. Hooray! Why did it work? Beats the tar out of me. If one of you VB gurus will explain it to me, I'll share it with everyone else.

The code works, so play with it — as is — as a starting point before getting adventurous, particularly with the MScmm object properties. While it may not seem like much, we've actually got quite a lot of power with the code we have in hand. The PC has just become a display device for the Stamp. This leads to all kinds of possibilities with graphics, long-term data storage, sharing with other programs; the sky is really the limit.

## What's Next?

Next time, we'll create programs that listen to a free-wheeling stamp, send X-10 commands, and send messages to remote Stamp nodes. For reference, you should probably go back and read the June 1997 installment of this column (written by Scott Edwards) on RS-485 networking with Stamps. As always, you can get the code from my FTP directory (<ftp://members.aol.com/jonwms/stamps>). This project is saved as STAMPNET1.ZIP.

Have fun. I'll see you next time! NV



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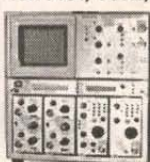
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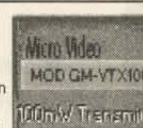
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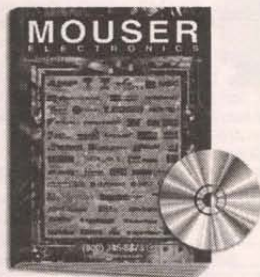
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by Joseph J. Carr

# Open Channel

## Electromagnetic Interference (EMI)

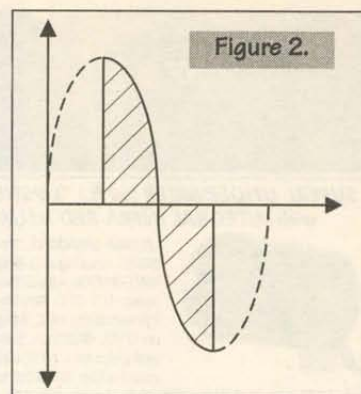


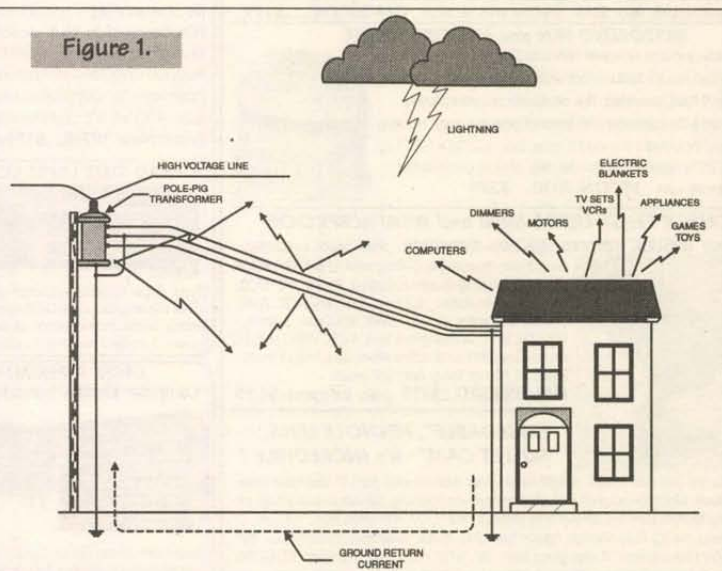
Figure 2.

The world is a really hostile place for electronic devices. Whether you use radio receiving and/or transmitting equipment, consumer electronics equipment, or electronic instrumentation, it is likely that you will experience electromagnetic interference (EMI) at some point. The stuff is all over the place!

Figure 1 shows some of the many, many sources of EMI in the normal residential or business building (industrial plants will have even more). A number of these sources have one thing in common: electrical arcing or sparking. Lightning, even when it is far enough away to be out of sight, can produce huge amounts of EMI. The lightning bolt may be either cloud-to-cloud or cloud-to-ground, and consists of about 250,000 amperes of current oscillating back and forth. Any arc produces a large number of harmonics. Indeed, selecting these harmonics was how the old spark gap transmitters (circa Titanic era) worked. Lightning will produce significant harmonic energy well into the high frequency (HF) region of the radio spectrum.

Lightning also produces high voltage transients on the AC power lines. It does not require a direct hit for lightning to produce these transients. Any electrical current in motion relative to a conductor will induce an electromotive force (EMF) into the conductor. When a lightning bolt flashes anywhere nearby, or overhead, an EMF will be produced. When electronics were all analog these transients did not usually disrupt electronic circuits unless they were strong enough to create damage (many a silicon power supply rectifier has succumbed to lightning transients on the line). Digital circuits, on the other hand, can be severely disrupted by lightning transients.

The AC power lines are also a source of problems. The standard power system used in North America distributes power via high voltage lines operated against ground (see Figure 1). There may be several step-down transformers between your building and the power company generating station. There will be at least one transformer close by your building. It will either be buried or on a pole, as in Figure 1. The secondary of the transformer is center-tapped, with the center-tap grounded. The two ends of the transformer form a 240-volt service, while each end and ground form 120-volt services. All three lines are brought into the building.



Several forms of interference are associated with the AC power lines. First, of course, is the fact that there are significant 60 Hz electrical and magnetic fields surrounding the wires from the pole and the wiring inside the building. You can hear this noise when you touch a finger to the audio input of an amplifier hooked to a loudspeaker.

Another source of noise from the AC power lines is arcing. Loose connections are a source of noise problems and, like other forms of arcing, will produce harmonic energy a long way above 60 Hz. The power company will repair loose connections on power lines, but you must use an electrician to repair connections inside the building.

A number of appliances in the house will also produce noise. Anything with an electrical motor (air conditioner, refrigerator, furnace, heat pump, etc.) can produce arcing. The problem is at the brushes inside the motor. Like all other forms of arcing, the motor will interfere with circuits and devices operating well into the HF spectrum.

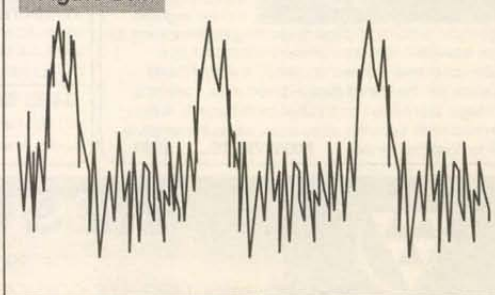
One class of device that can cause real havoc are those devices that operate using a silicon controlled rectifier or triac device. Examples include light dimmers, train speed controls, electric blanket controls, and so forth. These devices operate to control

power by using only a portion of the AC sine wave cycle. In Figure 2, the shaded portion is the power actually applied to the load. The difference between high and lower power settings of the control is the percentage of the AC sine wave that is applied (as indicated by the shaded portion). Because the waveforms have a sharp cut-off and cut-on characteristic when power is stopped and started over the course of a cycle, harmonic energy is produced. Sometimes lots of it.

Television sets and video cassette recorders (VCRs) are significant sources of EMI. There are three basic sources of EMI: vertical deflection circuits, horizontal deflection circuits, and the color circuits. The two deflection circuits use non-sine waveforms. The vertical operates at 59.94 Hz, while the horizontal operates at 15,734 Hz. The harmonics of both can cause problems with receivers and other devices, especially the horizontal deflection.

The color circuits of television

Figure 3a.





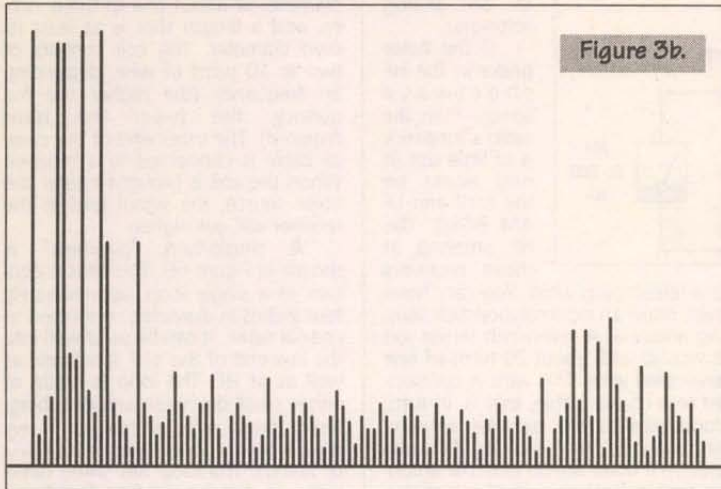


Figure 3b.

sets use a phase reference at about 3.58 MHz. The EMI from the color phase circuits is especially strong from VCRs in the record mode. In my neighborhood, I can use my ham radio receiver to determine whether or not there is a popular movie on TV. The cacophony from the 3.58 MHz signals from all those VCRs tears up the 80-meter ham band.

Figures 3A and 3B show the time series and spectrum plots of about six seconds' worth of signal recorded at my home. I used a 10-turn, six-inch diameter loop of wire connected to the shielded cable that goes to the microphone input jack on a cassette recorder. The site was near my computer desk, so EMI from both the receiver and the monitor was recorded. The recorded signal was then processed in Spectra Plus software to produce the time and frequency series shown in Figures 3A and 3B.

Especially notice the spectrum in Figure 3B. This is a spectrum plot, so shows lines representing frequencies, while the height of the line represents the strength of the signal. There is a huge concentration of energy around 60 Hz (left side of graph), with significant spikes at numerous frequencies out past 3,800 Hz. Because of the raucous noise on my Drake R-8A receiver, especially when it is tuned to the AM broadcast band, I suspect that significant harmonics at least go into the medium wave segment of the

spectrum.

### Tools for Finding EMI Sources

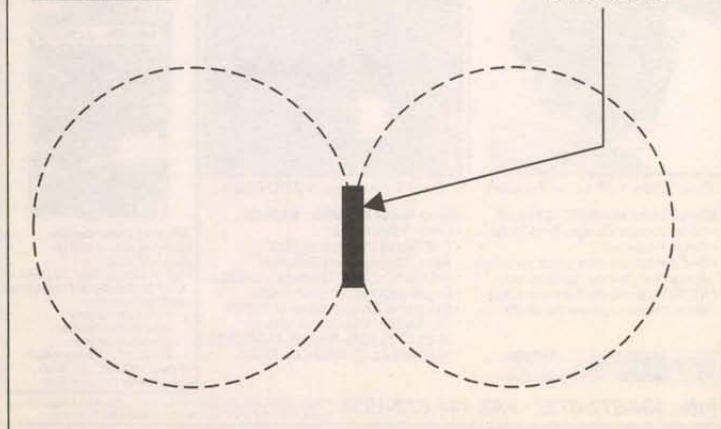
Rule 1: The correct tool for finding RF sources is anything that will permit you to unambiguously determine where the radiation is coming from. We will take a look at several low-cost possibilities.

If you are looking for a source that is out in the neighborhood somewhere, such as a loose power line or a malfunctioning electrical system in another building, then an ordinary solid-state portable AM BCB radio receiver may do the trick. Open the radio and locate the loopstick antenna. If you rotate the radio through an arc where the loopstick is first broadside to the arriving signal, and then perpendicular to the signal, you will notice a tremendous reduction in signal. Ferrite loopsticks are extremely sensitive to direction of arrival, with a sharp null occurring off the ends.

By noting the direction in which the null occurs (Figure 4), you find the line of direction to/from the signal source. It is not unambiguous, however. To find the actual direction, from the two possibilities that are 180 degrees opposed, move along the line and note in which direction the signal increases. Except in a very few cases where reflections occur, the signal will become stronger as you move towards the source.

Figure 4.

LOOPSTICK



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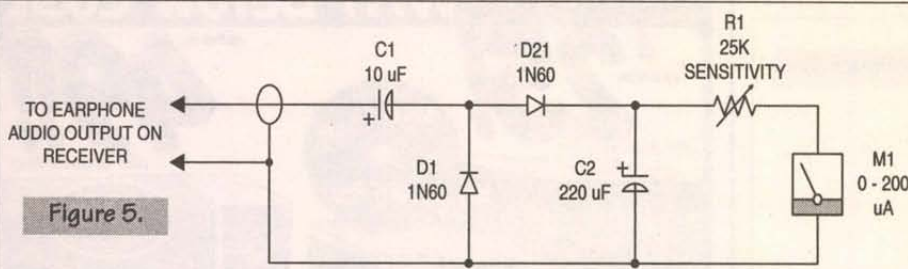


Figure 5.

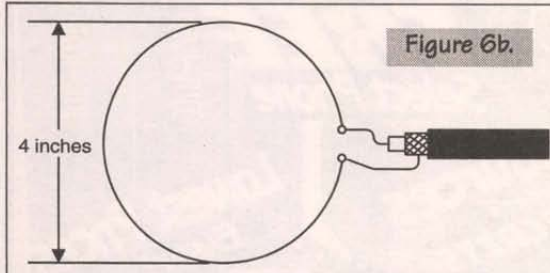


Figure 6b.

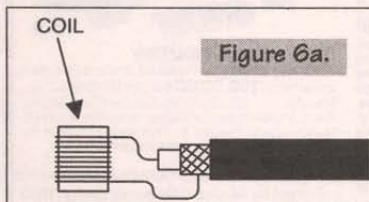


Figure 6a.

The standard mediumwave and shortwave loop antenna used by a lot of radio enthusiasts is also useful for finding RF emitting sources. A square loop of 10 to 24 inches to the

side is relatively easy to construct, and forms a very directional antenna. These antennas are commonly used in radio direction finding. Such loop antennas offer a null when pointed broadside to the signal direction, and a peak when orthogonal to the signal direction.

A portable radio with an S-meter will work wonders in this respect. An ad-hoc signal strength meter ("S-meter") can be formed using the circuit in Figure 5. This circuit plugs into the earphone jack of the receiver. The received audio is rectified by D1/D2 (a voltage doubler), and then applied to a DC current meter. Because resistor R1 (sensitivity control) is in series with M1, it operates

as an analog voltmeter. If the noise peaks in the HF shortwave bands, then the radio's loopstick is of little use (it only works on the MW and LF AM BCBs). The HF antenna in those receivers is a telescoping whip. You can, however, make an external loopstick sensing antenna. A seven-inch ferrite rod is wound with about 20 turns of fine enameled wire. This wire is connected to a coaxial cable, that is, in turn, connected to the external antenna terminals of the receiver (if such exists). If there are no external antenna terminals, then a small coil of several turns wrapped around the telescoping antenna will couple signal to the radio. It's a good idea to keep the antenna at minimum height in order to minimize pick-up from sources other than the loopstick. More sensitivity can be had if a resonant loopstick is available, but those also restrict the frequency band.

Two coil sensors are shown in Figure 6. The sensor in Figure 6A is a solenoid-wound inductor connected to a length of coaxial cable. The coil has a

diameter of about one to three inches, and a length that is at least its own diameter. The coil consists of two to 10 turns of wire, depending on frequency (the higher the frequency, the fewer the turns required). The other end of the coaxial cable is connected to a receiver. When the coil is brought nearer the noise source, the signal level in the receiver will get higher.

A single-turn "gimmick" is shown in Figure 6B. This sensor consists of a single loop, approximately four inches in diameter, connected to coaxial cable. It can be used well into the low end of the VHF spectrum, as well as at HF. The loop is made of either small diameter copper tubing, heavy brass wire or rod, or heavy gauge solid copper wire (#10 AWG or lower). The loop has some directivity, so can be used to ferret out extremely localized sources.

A fault with the single-turn loop is that it is somewhat sensitive to magnetic fields, although not so much as some of the other forms. Figures 7A and 7B show dual-loop

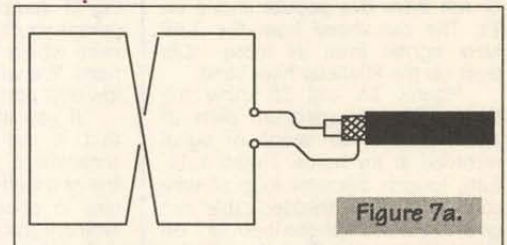


Figure 7a.

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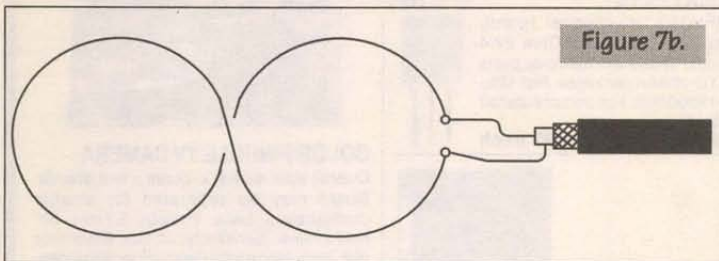


Figure 7b.

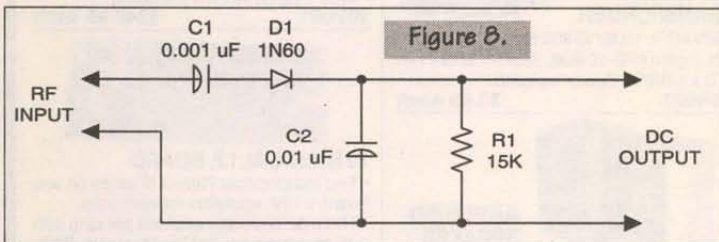


Figure 8.

sensors that are less sensitive to magnetic field pick-up. In Figure 7A, the loops of the sensor are rectangular and crossed in the center. The feed-line (coaxial cable) is connected to a break in one of the two coils.

The version shown in Figure 7B is circular. One version that I built was made of #8 AWG solid copper wire formed around a tin can. Getting the coils about the right size and reasonably circular is relatively easy given a proper former. The exact size of the coils in Figures 7A and 7B is not terribly important. The coil should not be too large, however, or it will be less local and may become a bit ambiguous in locating some sources.

#### RF Detectors

The RF output of the sensor coils can be routed to a receiver, and for low-level signals may well have to be so treated. For higher power sources, however, an RF detector probe is used. Figures 8 and 9 show two forms of suitable RF detector probe.

The RF detector in Figure 8 is passive, i.e., it has no amplification. It can be used around transmitters and other RF power sources. The input from the sensor is applied to C1 — a small value capacitor — and then is rectified by the 1N60 diode. The 1N60 is an old germanium type diode, and is used in preference to silicon diodes because it has a lower junction potential (so is more sensitive). The junction potential of Ge devices is 0.2 to 0.3 volts, and for silicon it is 0.6 to 0.7 volts. The pulsating DC from the rectifier is filtered by

capacitor C2. Resistor R1 forms a load for the diode and is not optional.

An amplifier version of the RF detector circuit is shown in Figure 9. In this version, the same RF detector circuit is used, but it is preceded by a 15 to 20 dB gain amplifier. In this particular circuit, the amplifier is a Mini-Circuits MAR-1 device. It produces gain from near-DC to about 1,000 MHz. Other devices in the same series will work to 2,000 MHz, and in the related ERA-x series up to 8,000 MHz. Clearly, any of these devices are well suited to the needs of most readers. The cost of the MAR-1 device is very low (in the USA it is about \$3.00 in unit quantities).

In future columns, we will take a deeper look at EMI, and discuss methods for solving EMI problems. **NV**

#### For Further Reading

ARRL Radio Frequency Interference: How To Find It and Fix It. American Radio Relay League, 225 Main Street, Newington, CT 06111. You can order via the web site: <http://www.arrl.org>.

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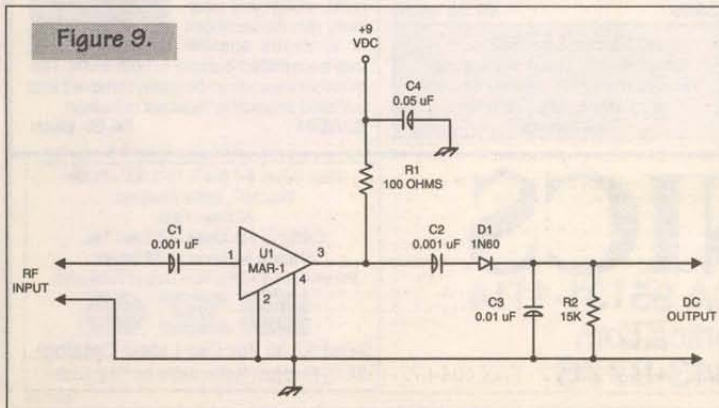


Figure 9.

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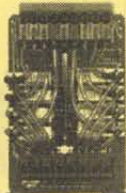
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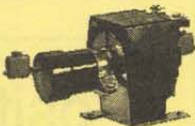
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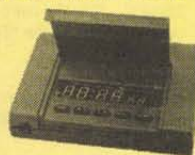


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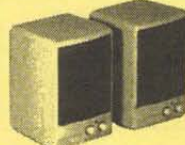
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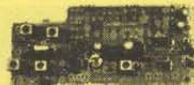
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# AMATEUR ROBOTICS

# NOTEBOOK

by Robert Nansel

Last month, I showed how to build most of the mechanics of Breadbot. The only mechanical detail left is making the "bow tie" front bumper. This month, we also wire, program, and stand back in amazement as Breadbot performs pirouettes on the tabletop.

## Bow Tie Bumper

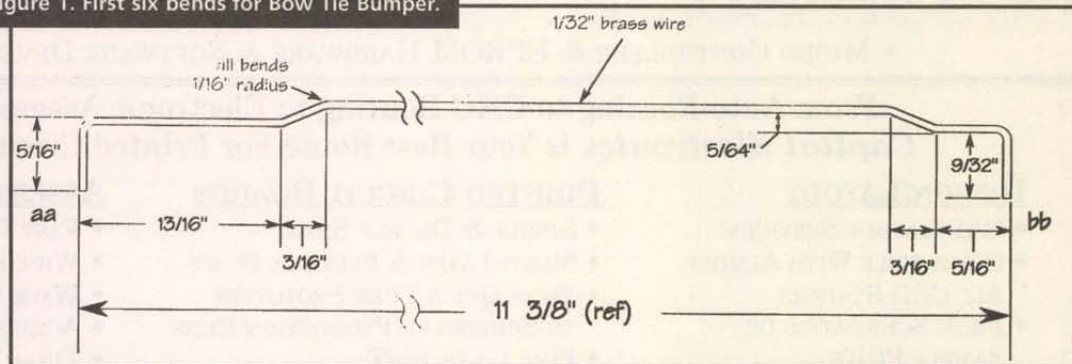
Using needle-nose pliers, bend the ends of a 12" length of 1/32" brass wire as shown in Figure 1. Next, mark the wire 3-11/16" from each end. Make 5/8" radius bends at each mark using a 3/4" dowel as a form. Wrap the brass wire through an arc of 180 degrees centered on the marks. Once released, the wire will spring back to an angle of about 74 degrees (Figure 2a).

The straight sections need no further bending; the springiness of the wire allows the bumper to assume the bow tie shape when you cross the ends aa and bb, and plug them into the breadboard (Figure 2b).

## About the BASIC Stamp 1

I chose the Parallax BASIC Stamp for this project because it's not too

Figure 1. First six bends for Bow Tie Bumper.



expensive and it's really easy to work with. Jon Williams does a great job explaining how to use BASIC Stamps in his Stamp Applications column in this magazine, so I won't go into too much detail in this column about the ins and outs of programming Stamps; there's tons of information out there on the web and in this magazine. The Parallax site alone has megabytes of software, example code, and documentation.

The bare facts then: the BS1-IC is a 14-pin, single-inline package with surface-mount ICs (for particulars on what each of the 14 pins do see Figure 3). It's about 1.4" long by .4" tall (not counting the pins), and only 1/8" thick. It has eight general-purpose

I/O lines and 256 bytes of program space (about 100 PBASIC instructions).

So, okay, 256 bytes is not much program memory, and variable memory is even tighter — just 14 bytes. If you want to use subroutines you really only have 12 bytes. The BS1-IC is no speed rocket, either. It loafs along on a 4 MHz clock and executes, on average, about 2,000 lines of PBASIC code a second. If you want to run faster, or you want more memory, you'll need to get a BASIC Stamp 2, which has twice the speed, twice the I/O, and six times the memory. It also costs \$15.00 more. The BS1-IC has enough power — just barely — to run Breadbot, so that's what I'll stick

with for now.

All you need to get started with the BS1-IC is a PC and a programming cable. You can get a programming cable from Parallax in their BASIC Stamp 1 starter kit, which also includes a BS1-IC, the software, manuals, and a carrier board for \$99.00.

Or you can make your own cable as shown in Figure 4 for less than \$2.00 with parts from Radio Shack, and download all the software and manuals you need directly from the Parallax website for free. The only thing you don't get this way is the carrier board, and you don't need that anyway, because Breadbot itself is the carrier board. I went the cheap route. If you do also, you'll need Adobe's Acrobat Reader to read and print the manuals from Parallax since they come in pdf format.

## Wiring Breadbot

If you use pre-stripped and bent jumper wires, Breadbot can be wired up in less than an hour. The schematic in Figure 5 shows why: not counting jumper wires and connectors, Breadbot has a total of just 10 electrical components.

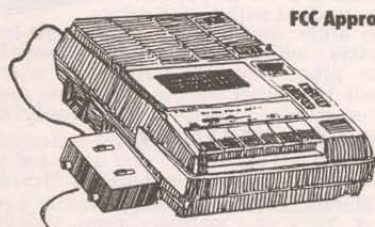
For the sake of beginners, I'll present the wiring of Breadbot in stages with test procedures at each stage to ensure success. Those of you with more experience reading schematics and building circuits with solderless protoboards may want to skip the next section and get directly to testing.

On the left of the schematic are the three bumper contact switches with their associated pull-up resistors, and most of the wiring work is done there (Figure 6).

But first, begin by tying the two power distribution busses together with two 2" jumpers across the fourth and fifth rows of tie-points at the back of Breadbot (top of Figure 8); the blue stripes mark the Vss (ground) distribution strips, and the

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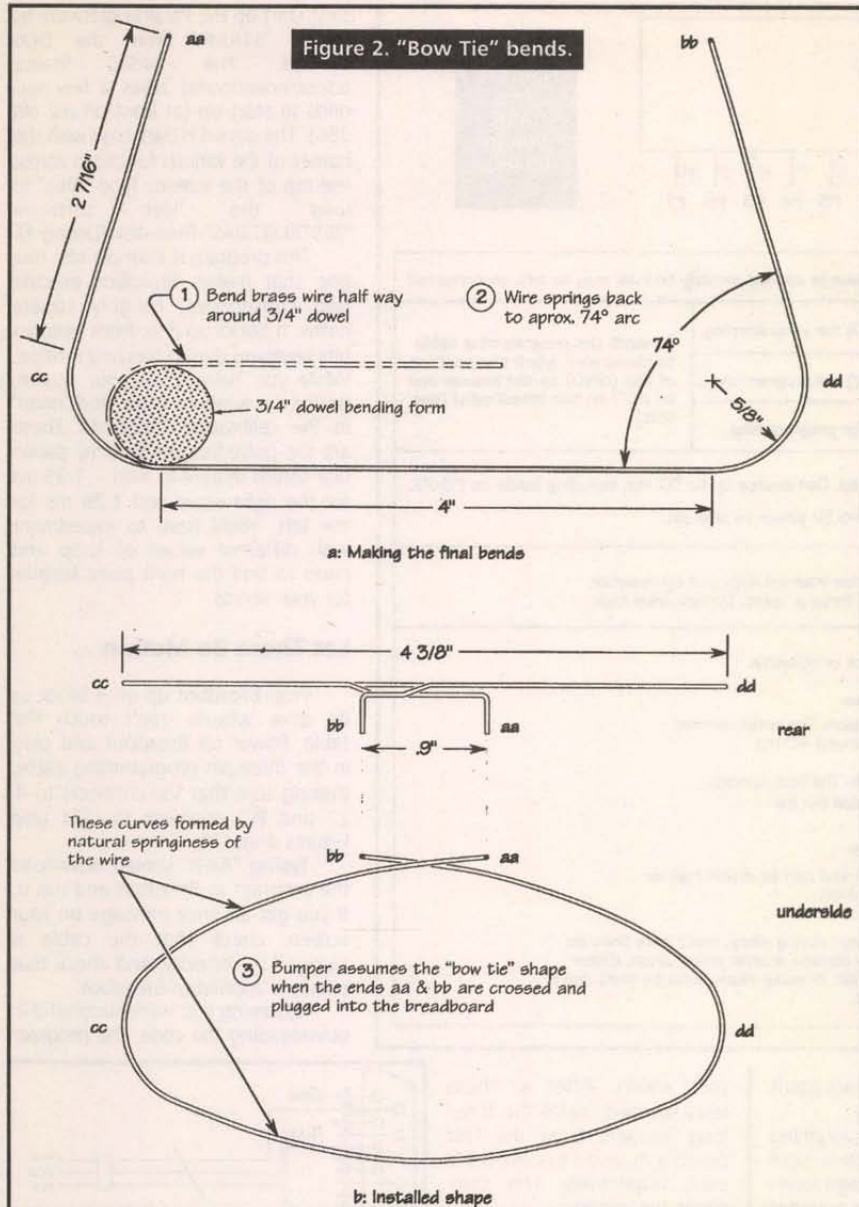
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Figure 2. "Bow Tie" bends.



red stripes mark the Vdd (+6V) strips. It's painfully easy to forget power

and ground connections, so continue down the length of the breadboard

for several months.

Originally, I had two separate

and make all the ground connections in a batch; following Figure 6, put jumpers to ground at a-22, j-25, j-30, and j-59. Next do the Vdd connections at j-24, a-25, and j-29.

Cut or snap to length two three-pin and two four-pin strip-line headers from the 36-pin header called for in last month's parts list. You'll be left with a 22-pin header that can be used for connectors in future projects (such as the programming cable and more Breadbots ...). Plug the solder-plated pins of the headers into the locations shown in Figure 6, leaving the gold-plated pins facing up. Install the 1 Kohm pull-up resistors at c-51 through c-53.

Now for the rest of the wires. The only tricky jumper is the one that connects the second pull-up resistor to i-62. I used one of the long green jumpers from my jumper-wire kit (Radio Shack #276-173); I cut and bent the jumper so it would lie down in the groove that runs down the center of the breadboard. I'm a great believer in using standard prefabricated jumpers when I work with solderless breadboards, but this single custom jumper greatly simplified the wiring arrangement I had used

jumpers that had to be routed over the tops of the plug-ends of the whiskers and bow-tie bumper; it was ugly and awkward because those jumpers had to be removed each time I wanted to adjust anything (as can be seen from last month's photos). Now, no jumpers overlap the whisker or bow-tie bumper wires at all, so all the wiring can be done before you install those components.

The right whisker plugs in at j-57 and f-59, and the left whisker plugs in at a-57 and e-59; adjust both whiskers so they are centered between the last two pins of their respective headers. For the bow-tie bumper, plug end aa into b-61 and end bb into i-61, with the wire threaded between the two front pins of the four-pin headers (Figure 8). The wires should rest against the front-most pins of the headers on row 63. When pressure is applied to the bumper wire, it should be free to flex and to pivot around aa and bb, and it should make contact with at least one of the row 62 pins.

### Testing the Whiskers

With a multimeter or logic probe, test the whiskers and the front bumper for proper operation as follows: Insert the batteries in the holder and plug the power leads into the power distribution busses (black wire to blue strip, red to red strip). Check that the voltage between the whiskers and the positive bus is six volts. Next, measure the voltage at pull-up resistor test point tp-a. With no pressure applied to the left whisker, the voltage should be near six volts. Measure again while pressing the whisker back; it should now measure near zero volts. If either of these tests fail, check your wiring against Figure 7. Repeat these tests at test points tp-b and tp-c for the front bumper and right whisker, respectively (Figure 8).

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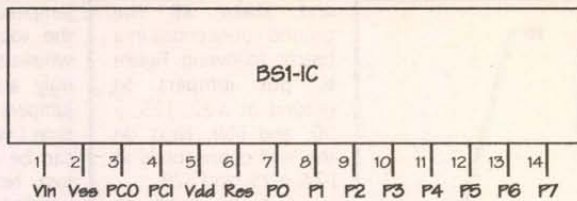


Figure 3.  
The  
BASIC  
Stamp  
BS1-IC.

tory, start up the Parallax software by typing "STAMP" from the DOS prompt. The BASIC Stamp editor/downloader takes a few seconds to start up (at least on my old 386). The screen is dark blue with the names of the various functions across the top of the screen. Type "Alt-L" to load the test software "TESTROBT.BAS" from disk (Listing 1).

This program is a simple test routine that makes Breadbot execute two consecutive, roughly square paths. It backs up if its front bumper hits anything during forward motion. While you have it on your screen, notice the symbols "lstop" and "rstop" in the calibration constants. These are the pulse lengths that my particular servos require to stop — 1.35 ms for the right servo and 1.29 ms for the left. You'll have to experiment with different values of lstop and rstop to find the right pulse lengths for your servos.

### Let There Be Motion ...

Prop Breadbot up on a block so its drive wheels don't touch the table. Power up Breadbot and plug in the three-pin programming cable, making sure that Vss connects to d-22 and PCI connects to d-24 (see Figures 4 and 7).

Typing "Alt-R" should download the program to Breadbot and run it. If you get an error message on your screen, check that the cable is plugged in correctly, and check that power is applied to Breadbot.

Assuming you were successful in downloading the code, the program

### Breadbot Gets Smart ... Sort of

Before you install the BASIC Stamp, check for the presence of 6V at a-25 and ground at a-22. Pull the +6V lead out, then install the Stamp with pin 1 at b-21 and pin 14 at b-34; the surface-mount components should face away from the centerline of the robot; if they don't, you've got

the Stamp plugged in backwards (don't laugh, I've done this).

Once you're satisfied everything is right, plug the red battery wire back in and check the voltage levels at a-25 and a-22. If these voltages change drastically from your earlier measurement or, if any of the chips on the BASIC Stamp get hot, remove power immediately and re-check

your wiring. After all these tests succeed, install the three long jumpers from the test points a, b, and c to c-30, d-31, e-32, respectively. This completes the wiring.

### Fire Up the PC

In the BASIC Stamp direc-

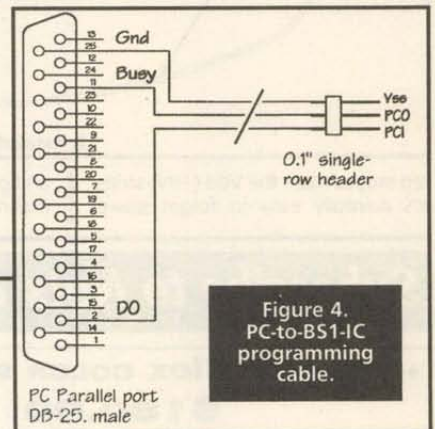


Figure 4.  
PC-to-BS1-IC  
programming  
cable.

is now waiting for you to press Breadbot's whiskers or bumper to start the programmed motion. You can unplug the programming cable from Breadbot now, if you like.

On a smooth surface, Breadbot will drive forward about six inches, turn left 90 degrees, go forward six inches, turn left again, etc., until it has come back to its starting place and orientation. Then it will repeat this process, except turning right each time. How close Breadbot comes to returning to its initial orientation and position is a matter of how well your servos are calibrated.

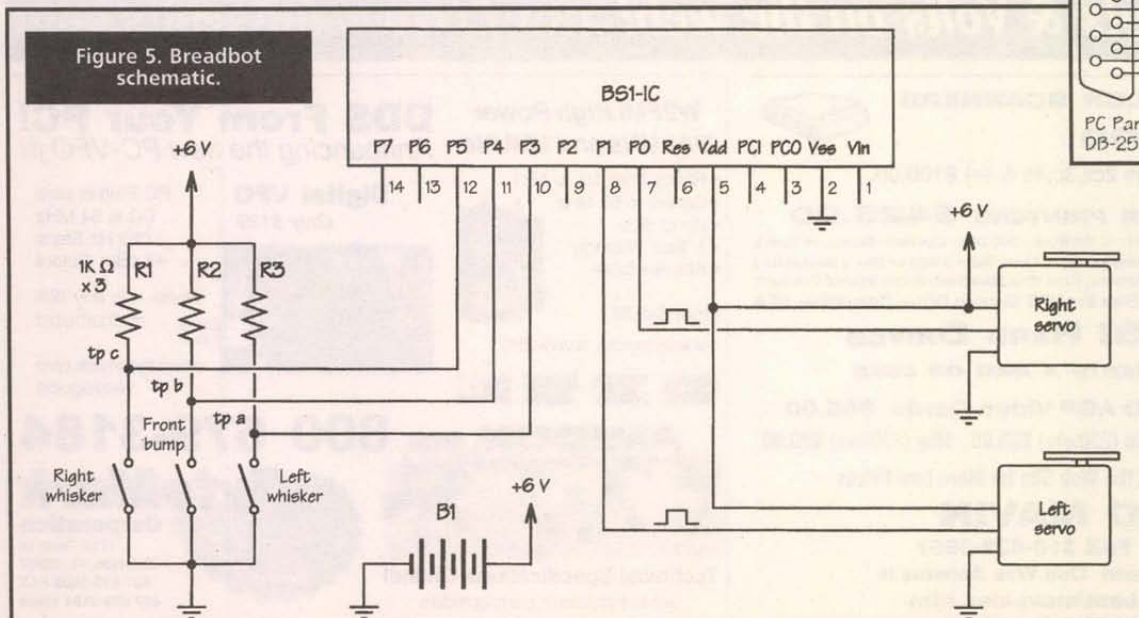
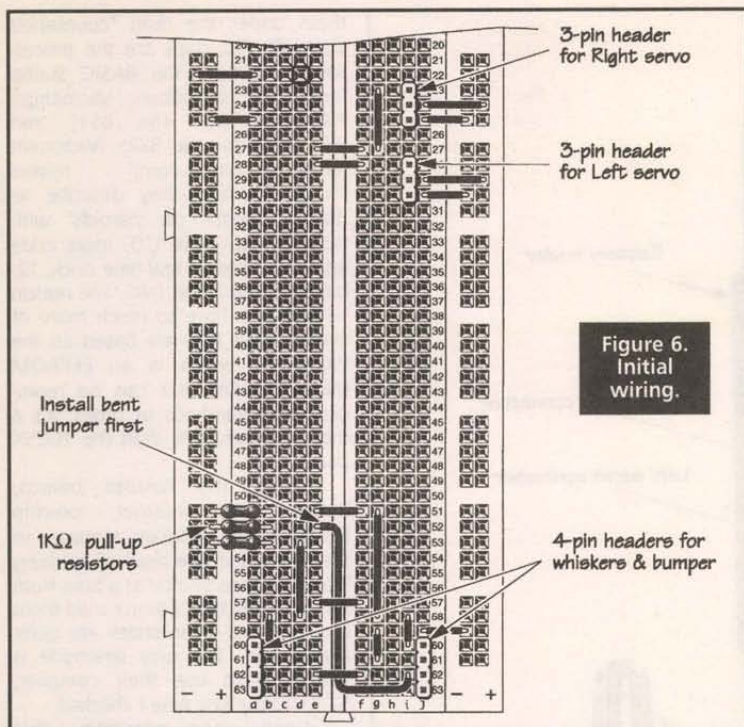


Figure 5. Breadbot  
schematic.





And the weather, irregularities in the tires and the driving surface, how accurately you managed to mount the servos ... in other words, don't expect Breadbot to be a precision machine.

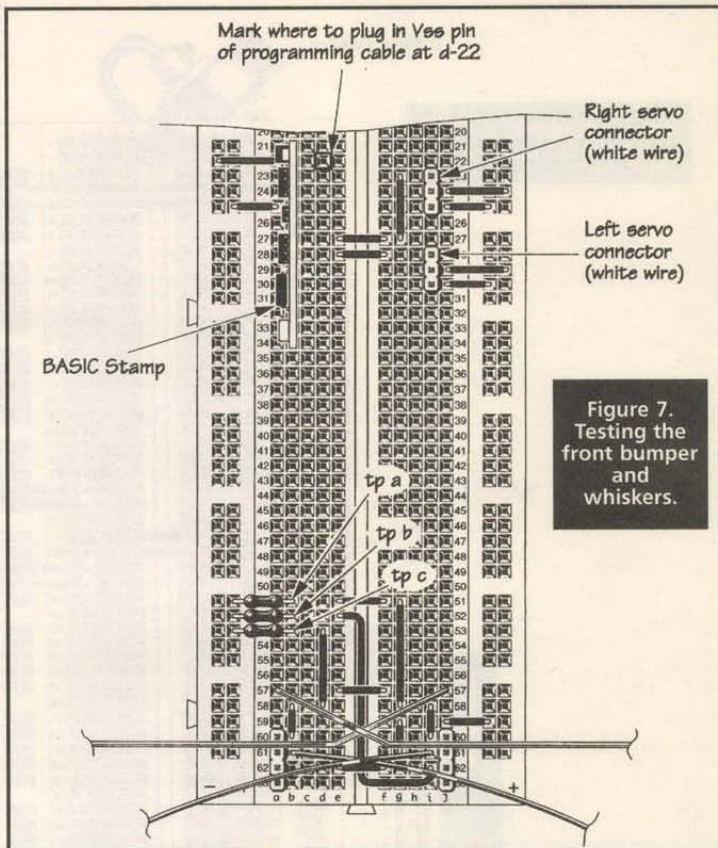
## Troubleshooting

If Breadbot goes backwards caster-first on the first motion segment, you may have the servo cables reversed. The right wheel should turn clockwise four separate times, while

the left wheel should alternately turn counter-clockwise and clockwise.

If one of the servos turns but the other doesn't, try disconnecting the functioning servo and connecting the other servo to the functioning servo's connector to see if that will make it work. If it does, then you probably have a problem with the wiring for the other header connector on the breadboard.

If you have an oscilloscope, check for the presence of pulses at f-27 and f-28. You can also use a logic



probe. If you don't detect pulses, check the pins on the Stamp. If there are still no pulses, check if the Stamp is getting power and ground.

Once you've eliminated all other possibilities, you may decide you have a bad Stamp. But before you throw it away, try re-reading the Parallax documentation and checking your wiring a

third time. It's possible to fry Stamps, but they are pretty hardy. Always suspect that you've made a wiring or programming error first.

## 101 Bytes of Fun

That's it. From here, you can modify the test program any way you

### \* Outputs

SYMBOL left = 1 'p1 = left servo  
SYMBOL right = 0 'p0 = right servo

### \* Inputs

SYMBOL fbumper = pin4 'p4 = front bumper  
SYMBOL lwhisker = pin3 'p3 = left whisker  
SYMBOL rwhisker = pin5 'p5 = right whisker

SYMBOL bump = 0 'Bumper & whiskers active low  
SYMBOL CCW = 0 'Counterclockwise  
SYMBOL CW = 1 'Clockwise  
SYMBOL fwd = 0 'Forward  
SYMBOL rvs = 1 'Reverse  
SYMBOL pauseval = 50 ' ~500 microsecond delay

\* Calibration constants. Must be individually determined for each servo

SYMBOL rmax = 185 'Max pulse widths (clockwise rotation)  
SYMBOL lmax = 179 'Min pulse widths (counterclockwise rotation)  
SYMBOL rmin = 85 'Servo stop pulse widths  
SYMBOL lmin = 79  
SYMBOL rstop = 135  
SYMBOL lstop = 129

SYMBOL r\_drive\_speed = 11 'Drive speeds  
SYMBOL l\_drive\_speed = 13  
SYMBOL r\_steer\_speed = 10 'Steering speeds  
SYMBOL l\_steer\_speed = 10

### \* Byte variables

SYMBOL l\_spd = b2  
SYMBOL r\_spd = b3  
SYMBOL drive\_distance = b7  
SYMBOL steer\_angle = b8  
SYMBOL delta = b9  
SYMBOL i = b10

### \* Bit variables

SYMBOL drive\_direction = bit8  
SYMBOL steer\_direction = bit9

\* Set up I/O bits 3, 4 and 5 as inputs, the rest as outputs

DIRS = %11000111 'only output bits 0 & 1 are connected  
'2, 6, & 7 are left as unconnected  
'outputs to save power & prevent  
'possible erratic operation

\* Initialize left & right speed vars

GOSUB allstop

wait\_bump:

IF lwhisker<>bump AND rwhisker<>bump AND

fbumper<>bump THEN wait\_bump

main:

drive\_direction = fwd

\* do a 6", left-hand square

drive\_distance = 27 '27 = approx 1 wheel rev  
steer\_direction = CCW  
steer\_angle = 13 '0.40 rev = approx 90 degree turn  
GOSUB square

\* now do a right-hand square

steer\_direction = CW  
GOSUB square  
GOTO wait\_bump  
END

allstop:

l\_spd = lstop  
r\_spd = rstop  
RETURN

\* Drive in a square pattern

square: FOR i = 1 to 4 'do 4 motion segments  
GOSUB drive  
pause 500  
GOSUB steer

pause 500

NEXT i  
RETURN

\* Straight line drive routine

drive: IF drive\_direction <> fwd THEN drive\_reverse

drive\_forward:

l\_spd = lstop + l\_drive\_speed  
r\_spd = rstop - r\_drive\_speed  
GOTO drive\_loop

drive\_reverse:

l\_spd = lstop - l\_drive\_speed  
r\_spd = rstop + r\_drive\_speed

drive\_loop:

FOR delta = 0 to drive\_distance  
pulsout left, l\_spd  
pulsout right, r\_spd  
pause pauseval  
IF fbumper = bump THEN drive\_reverse

NEXT delta  
RETURN

\* Turn in place routine

steer: IF steer\_direction <> CCW THEN steer\_CW

steer\_CCW:

l\_spd = lstop - l\_steer\_speed  
r\_spd = rstop - r\_steer\_speed  
GOTO steer\_loop

steer\_CW:

l\_spd = lstop + l\_steer\_speed  
r\_spd = rstop + r\_steer\_speed

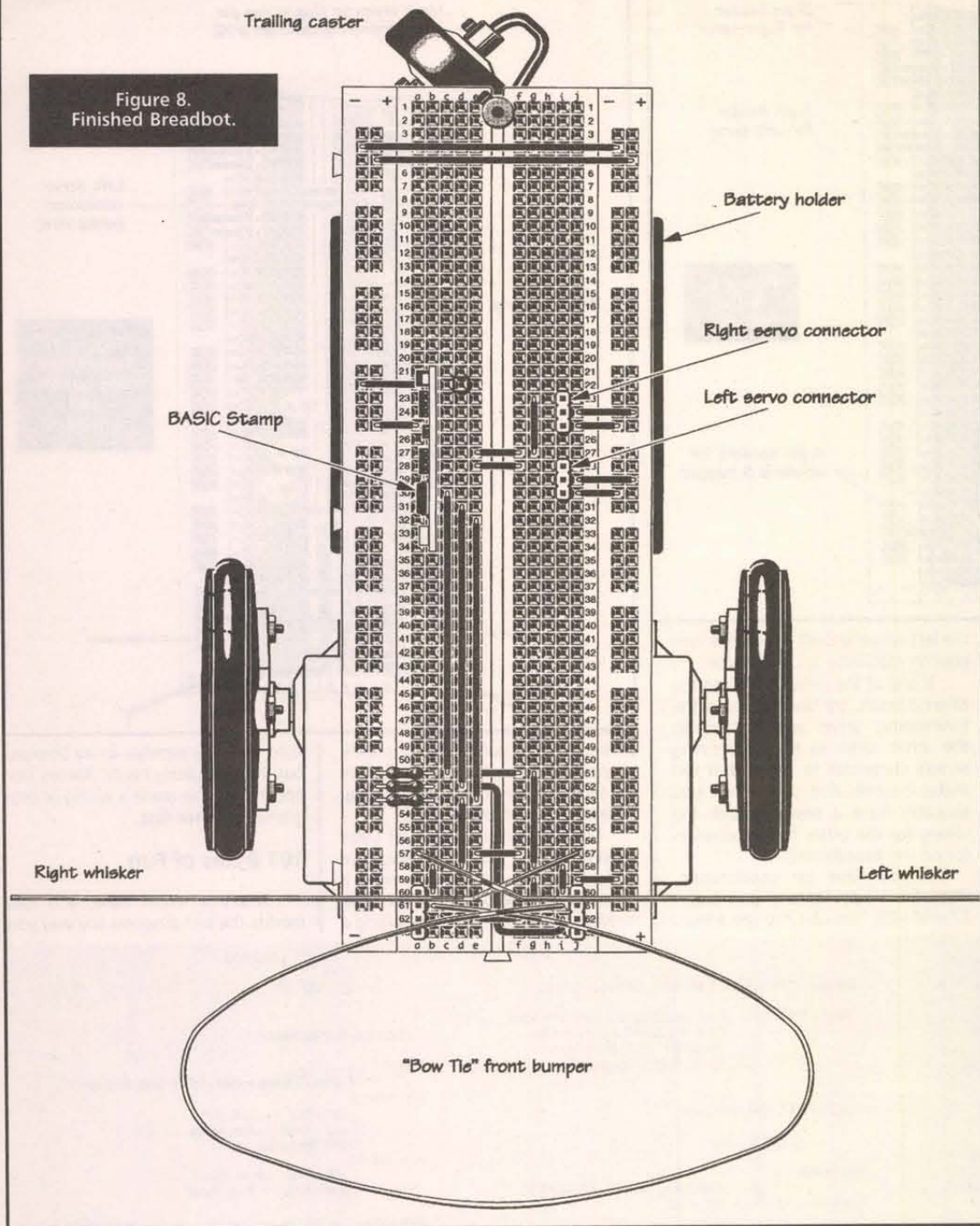
steer\_loop:

FOR delta = 1 to steer\_angle  
pulsout left, l\_spd  
pulsout right, r\_spd  
pause pauseval  
IF fbumper = bump THEN drive\_reverse

NEXT delta  
RETURN



Figure 8.  
Finished Breadbot.



like to make your Breadbot really strut its stuff. One area that could be tackled is making use of the whiskers

to sense obstacles. The program as it stands now uses the whiskers only as start switches. Also, though it does sense collisions with the bow-tie

bumper during straight-line forward motion, it doesn't do so while turning.

When adding to the program, keep in mind that memory space is very limited. The TESTROBT.BAS program takes up to 155 bytes out of 256, and it also uses half of the RAM variable space. I haven't put much effort into optimizing the program, so I'm sure a few bytes could be wrung out of it here and there. This is left as an exercise for the reader.

#### Alternatives to the BASIC Stamp

There are various clones of the BASIC Stamp (look for

them under the term "counterfeit stamps"). PIC chips are the processors that make the BASIC Stamp family go, specifically Microchip's PIC16C56 (for the BS1) and PIC16C57 (for the BS2). Micromint ([www.micromint.com](http://www.micromint.com)) makes "PicStics" which they describe as "BASIC Stamps on steroids" with more speed, more I/O, more code and data space, a real-time clock, 12-bit ADC, and 12-bit DAC. The reason why PicStics have so much more of everything is they are based on the PIC16F84, which is an EEPROM microcontroller that can be reprogrammed hundreds of times. It's a more powerful PIC than the 16C5X parts.

Unlike the Parallax boards, PicStics use internal, on-chip EEPROMs for program storage, so there isn't the overhead of fetching PBASIC tokens one bit at a time from a serial EEPROM. I haven't tried them out, yet, but their prices are quite competitive. The only downside is you have to use their compiler, \$149.00 the last time I checked.

Finally, one possibility that intrigues me is something called a "SIMMStick." You see, there's this group of small business people around the world who thought there should be simpler, cheaper single-board computers, people like Antti Lukats of Silicon Studio in Estonia ([www.anti@sistudio.com](http://www.anti@sistudio.com)), Don McKenzie of Dontronics in Australia ([www.dontronics.com](http://www.dontronics.com)), and Ben Wirz of Wirz Electronics in the USA ([www.wirz.com](http://www.wirz.com)), among others.

SIMMSticks are 1" by 3.5" boards based on the 30-pin SIMM form factor of older PC memory modules (Figure 9). They use through-hole components rather than surface-mount, so they are inherently easier for hackers to work with. Bare boards costing less than \$10.00 US are available for most PIC chips, the Zilog Z-8, and some Atmel microcontrollers.

You can make fully PBASIC-compatible boards from SIMMSticks, only these boards are expandable and customizable, and they will fit quite nicely on a Breadbot platform. You'll be hearing a lot more about these boards in the months ahead.

Next month, I'll talk more about SIMMSticks, as well as some ideas for more sensors for Breadbot.

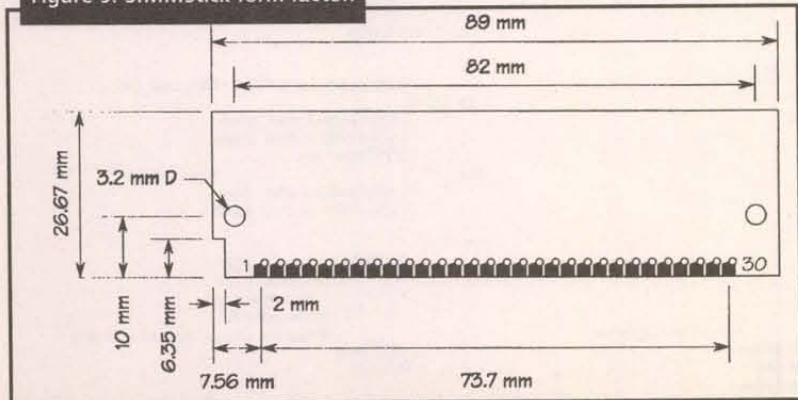
Until then, what are you waiting for? Get building robots! **NV**

If you have questions, comments, or ideas concerning amateur robotics, you can reach me at:

**Robert Nansel**  
69 S. Fremont Ave. #2  
Pittsburgh, PA 15202

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Figure 9. SIMMStick form factor.





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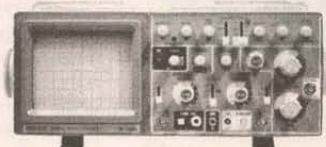
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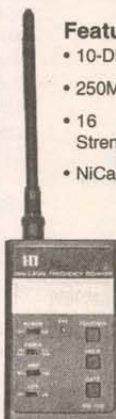
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**T**he Microchip family of PIC (Peripheral Interface Controller) microcontrollers is quickly becoming the preferred choice of designers and experimenters around the world. Microchip has continued to develop new parts at such a rapid pace that it can be difficult to keep up. If you're presently using a PIC in any of your designs you're probably familiar with at least some of the PICs available. If you're new to the PIC, the task of trying to figure out the differences in the family of parts can be difficult. My intent is to help guide you through by explaining the basic differences in the most common PIC microcontrollers.

## Overview

The PIC family breaks up into three main groups, which are:

- 12-bit instruction core (16C5X, 12C5XX)
- 14-bit instruction core (16C5XX, 16C62X, 16C6X, 16C7X, 16C8X, 16CF8X, 12C6XX, 16C9XX, 14C000)
- 16-bit instruction core (17CXX)

All three groups share the same core set of RISC instructions with additional instructions available on the 14- and 16-bit cores. This means that assembly code written for the 12-bit family can be easily upgraded to work on a 14- or 16-bit core part. This is one of the great advantages to the PIC.

tures with one major difference: they come in an eight-pin package. These parts are very unique and are the smallest micro available today.

Because of the eight-pin package constraint, creative solutions were required to allow for enough I/O to be useful. They have one input only pin and five I/O, Vdd (B+), and Vss (gnd) for a total of eight pins.

To achieve this, Microchip developed an onboard oscillator. It's not as accurate as a crystal, or even resonator, but it works great if timing is not critical (accuracy is about  $\pm 2.5\%$  over -40 to +85 C). This eliminates the need for any external oscillator parts although it can be used with a crystal or resonator at the cost of two I/O.

These parts also share the MCLR reset pin with the I/O, so if you need that function, you lose another I/O.

Microchip did add a form of interrupt. It's a wake-up, on state change interrupt. If the micro is in sleep mode, a change of state from low to high or high to low on any of four I/Os will wake up the processor. Not much different than a external reset on the MCLR pin, but it does allow simple switch hook-up to the micro.

## 14-bit Instruction Core

This group increases the number of instructions by two for a total of 35. Microchip actually added four instructions and replaced two with special function registers. Two math function commands and two return commands were added; one return command for the interrupts and one for the subroutine returns which can be nested deeper on the 14-bit core because the stack increases to eight levels. The two instructions replaced by a special function

# Understanding Microchip's Family of PIC Micros

by Chuck Hellebuyck

Microchip also decided to focus on making OTP (One Time Programmable) parts at affordable prices. This allows the experimenter, hobbyist, or professional designer to build affordable products without shelling out major dollars for windowed EPROM parts—or worse—custom silicon ROM parts.

All instructions (except branch and goto instructions) execute within one clock cycle (crystal freq./4) which makes it easy to check the execution timing.

## 12-bit Instruction Core

This is the original core produced and are the most cost-effective parts available from Microchip. They use only 33 instructions making it very easy to learn and remember all the instructions. Below are the group members.

### 16C5X

This is the group used in the BASIC Stamp Controllers that are popular with the many readers of *Nuts and Volts*. They are very useful parts and offer several variations. They come in three different packages: 18-pin, 28-pin (DIP or SOIC), or 20-pin package (SSOP). They offer two different amounts of I/O to meet your design requirements: 12 I/O or 20 I/O. Code space is available in three sizes: 0.5K, 1K, or 2K for your program (instructions are 12 bits wide).

This can be deceiving, though, because the mnemonic and operand are included in the same word so your program will probably use less code space than compared to a Motorola eight-bit micro.

Available RAM is 25 or 72 bytes (the 72 bytes are available in a banking arrangement only, which is somewhat annoying). One eight-bit timer is included with no interrupt on timer overflow. They all have one internal watch dog timer that runs on its own RC circuit, so it works during low power sleep mode.

All parts also share high I/O current capability of 20 mA source/25 mA sink which is incredibly useful for driving LEDs full bright or driving power transistors directly. They work over a large voltage range of 2.5-6.25 volts (it may be less if you choose the high-frequency crystal option). They will run at crystal speeds of 20 MHz which is an instruction time of 200 nanoseconds.

With the fact most instructions execute within one clock cycle, very fast routines can be accomplished. These parts are limited to a two-level stack which makes nested subroutines difficult, but not impossible because the program counter on all PICs can be written to.

The biggest difference between the 5X and the other PICs is the lack of interrupts. If you need an external interrupt then you have to move up to the 14-bit core parts.

Finally, these parts in sleep mode can draw as little as 1.0 uA which is very useful for battery applications.

### 12C5XX

These parts also use the 12-bit core and have many of the same 5X fea-

register are the TRIS (port direction) and OPTION (special function). The 14-bit core will work with the 12-bit core code, but these two instructions will have to change slightly.

### 16C55X

This is a recent addition to the 14-bit core group. The 16C55Xs are pin-for-pin compatible with their 5X, 12-bit core cousins with a major addition—interrupts. They also add one more I/O pin by sharing the T0CKI external clock pin (used for incrementing the eight-bit timer from an external source). The interrupts include the 12CXXX wake-up, on state change interrupt along with a real interrupt pin for capturing an event. Also included is a timer overflow interrupt for the eight-bit timer. All the interrupts jump to a single redirection register, so your main interrupt routine will have to bit test the interrupt flags within the INTCON register. Your program can mask any and all interrupts through the INTCON register, also. A final difference is the I/O characteristics increase to 25 mA sink and source.

### 16C62X

These parts are similar to the 55X group, but add two onboard comparators to the package.

The 62Xs have 13 I/O and 0.5K, 1K, or 2K of 14-bit wide code space.

They share all the features of the 14-bit core group including the interrupts. If you need comparators in your design, then these could reduce your overall parts count.

### 16C6X

These parts were of the original 14-bit core group. They consist of several parts with unique features. They start out with the 16C61 which isn't much different than the 16C556 part, but the rest of the 16C6X group is very different.

They add the following features to those parts mentioned above: 2K, 4K, or 8K of code space for your program; 22 or 33 I/O, synchronous serial port (shared with I/O); one or two Capture/Compare/PWM pins (shared with I/O); and three timers (two eight-bit, one 16-bit).

The 16-bit timer is great for accurate timing requirements. It can run from its own crystal separate from the main clock source. It will even run during sleep mode allowing time to increment while very little current is being consumed by the PIC. It has an overflow interrupt so you can wake up from sleep, process the timer information, and then sleep some more. The synchronous serial port can be used to communicate with serial devices. It operates in two modes: Serial Peripheral Interface (SPI) or Inter-Integrated Circuit (I2C). These are real powerful parts.

### 16C7X

These parts are identical to their 6X cousin with the addition of four, five, or



eight channels of eight-bit onboard analog-to-digital converter (A/D).

For example, if your design uses a 16C62 and you need to add A/D, then drop a 16C72 in its place. They are pin-for-pin compatible with each other. The A/D are shared with some of the port A and Port E I/O pins, so it's best to save these when doing a non-A/D design that may later need A/D.

### 16C67X

These are the latest parts available as I write this and I think are the most unique. They are eight-pin package versions of the 14-bit core group. They share the I/O the same way the 12CXXX eight-pin parts do to maintain one input only and five I/O. The amazing thing is that they also have two channels of A/D that operate the same as the 16C7X parts (shared with the I/O). Code that was written to work with the 16C7X A/D will work on the 16C67X parts. They also have all the 14-bit core interrupts. One eight-bit timer with timer overflow interrupt and built-in oscillator option. They offer 0.5K and 1K of code space. A lot of micro in a small package.

### 16C8X and 16F8X

If you're looking for a flash or EEPROM version of the PIC, this is the group. Originally, Microchip only offered EEPROM versions (16C8X), but have now released them in flash (16F8X).

They have all the features of the base 14-bit core group: interrupts, 13 I/O, one eight-bit timer, 0.5K or 1K of code space as EEPROM or flash, and 36 or 68 bytes of RAM.

Unique to these parts is the 64 bytes of EEPROM data memory. This data will stay even when power is removed, so it's great for storing calibration or variable data to be used when the program starts again.

### 16C9XX

This is a new addition to the 14-bit core group that shares many of the 16C63 and 16C73 features (three timers, interrupts, etc.). This group adds another feature — onboard Liquid Crystal Display (LCD) drive circuitry. It can drive up to 122 segments using four commons. The 16C924 also has five channels of A/D onboard making this a great part for measuring analog signals and then displaying the results on an LCD.

With the 16-bit timer, it could display time for possible datalog applications.

With the synchronous serial port, any kind of external data storage or PC interface is possible. These parts seem to have it all except onboard EEPROM for non-volatile memory storage.

### 14C000

This is a different numbering scheme and offers a different approach. It's a mixed signal processor. It has a slope type A/D rather than the sample and hold, and also has D/A capability. It shares the higher-end 14-bit core characteristics including the three timers and such. These are unique parts when compared to the rest of the PICs, but share the same code.

## 16-bit Instruction Core

This is the high-end group from Microchip. They offer up to 33 MHz clock speed for a 121 nanosecond instruction time. They have the same 35 instructions as the 14-bit core, plus 23 more instructions. The stack increases to 16 levels. 33 I/O is standard with two open-drain, high-voltage (12V), and high-current (60 mA) pins.

They add another 16-bit timer for four total timers.

These parts can also operate as a microprocessor rather than a microcontroller by accessing the program to be executed from external memory. These parts are numbered as 17CXX. If you understand these parts, then you probably didn't need to read everything I wrote above.

## Summary

I think you'll find a part to meet your next design requirements within the Microchip family. I started with the 16C54 and never left. I continue to be amazed at how fast Microchip is creating new components. They are working on expanding the flash group which seems to be the desire these days. Microchip also offers a fine selection of EEPROM including some unique parts there, also. Hopefully, I can cover those in another article.

My next goal is to explain the various options for programming these parts including the FREE simulator and assembler available from Microchip at [www.microchip.com](http://www.microchip.com). Along with that, I'd like to address the option of programming these parts using the BASIC language which is great for beginners.

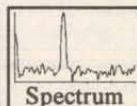
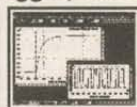
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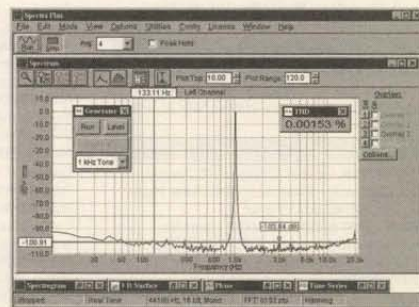
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# Events

# CALENDAR

**JULY 1998**

**JULY 3-4-5**

**MI - MT. CLEMENS** - Computer & Technology Show. Gibraltar Trade Center, 237 N. River Rd. 810-465-6440

**JULY 4**

**CA - SANTEE** - ARC of El Cajon Ham, Computer & Electronic Swapmeet. Santee Drive-in. 619-561-0052

**PA - ALLENTOWN** - Computer Show. Days Inn Conference Ctr. 10am-3pm. Peter Trapp Shows 603-272-5008. Web: [www.petertrapp.com](http://www.petertrapp.com)

**PA - DILLSBURG** - Harrisburg RAC Hamfest. Monaghan Fire Hall, 245 W. Siddonsburg Rd. Michael Kalbaugh N3HLK, 717-232-6087. fabinfo@fabral.com n3hjb@juno.com

**PA - LANCASTER** - Computer Show. Lancaster Host Resort. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**VA - HAMPTON** - Computer Show. Hampton Coliseum. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**JULY 4-5**

**FL - MELBOURNE** - Computer Show. Melbourne Auditorium. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**KY - LOUISVILLE** - Computer Show. Commonwealth Conv. Ctr. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**MD - TIMONUM** - Computer Show. MD State Fairgrounds. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**NY - WHITE PLAINS** - Computer Show. Westchester County Ctr. 9:30am-4pm. MarketPro 201-825-2229. Web: <http://www.marketpro.com>

**JULY 5**

**MI - GRAND RAPIDS** - Super Computer Sales. Crowne Plaza, 5700 28th St. S.E. 10am-4pm. Computers And You 734-283-1754. Web: [www.gatecom.com](http://www.gatecom.com)

**OH - LISBON** - Hamfest & Computer Show. Columbiana County Fairgrounds. 8am-3pm. Dick Sisley K3JKB, 330-385-1245

**PA - DICKSON CITY** - Computer Show. Genetti Manor. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**PA - LEHMAN** - Murgas ARC Hamfest. Luzerne Co. Fairgrounds, Rt. 118. Robert J. Michael WB3FAA, 717-288-3532

**PA - YORK** - Computer Show. Fairgrounds, Horticultural Hall. 10am-3pm. Peter Trapp Shows 603-272-5008. Web: [www.petertrapp.com](http://www.petertrapp.com)

**VA - NORFOLK** - Computer Show. Norfolk Scope. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**JULY 10-11-12**

**ND - DUNSEITH** - Int'l Hamfest. Int'l Peace Garden. Rt. 1 Box 116. Dave Snyder VE4XN, Canada 204-728-2463. Lynn Nelson W0CQ, USA 701-839-8200

**JULY 11**

**CA - FONTANA** - Inland Empire ARC Amateur Radio & Electronics Swapmeet. A B Miller High School. Bill 909-822-4138 eves

**CANADA - ONTARIO - MILTON** - Hamfest. Milton Fairgrounds. Lorne VASLOR, 905-336-2999. E-Mail: [ve3coj@bigwave.ca](mailto:ve3coj@bigwave.ca)

**IN - INDIANAPOLIS** - Central Division Convention. Rick Ogan N9LRR, 317-251-4407

**KY - TOMPKINSVILLE** - Hamfest. National Guard Armory, Hwy 163. J. Bunch 502-678-5784. E-Mail: [dwehch@glasgow-ky.com](mailto:dwehch@glasgow-ky.com)

**MI - PETOSKEY** - Swap & Shop. Emmet Co. Fairgrounds. 8am-1pm. Clark Rouse KA8TIL, 616-582-6455

**MO - KANSAS CITY** - PHD ARA Hamfest. Bob Roske WA0CLR, 816-436-0069. E-Mail: [wa0clr@juno.com](mailto:wa0clr@juno.com) Web: <http://www.tfs.net/~callman/phdara/phdara.htm>

**NC - SALISBURY** - NC Alligator Group Hamfest. Civic Center. 8am-1pm. Walter Bastow N4KVF, 704-279-3391. E-Mail: [alligator@juno.com](mailto:alligator@juno.com)

**NY - BUFFALO** - Computer Show. Hamburg Fairgrounds. 9:30am-4pm. MarketPro 201-825-2229. Web: <http://www.marketpro.com>

**NY - Poughkeepsie** - Computer Show. Mid-Hudson Civic Center. 9:30am-4pm. MarketPro 201-825-2229. Web: <http://www.marketpro.com>

**OH - NILES** - Computer Show. Eastwood Expo Center. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**OH - TOLEDO** - Computer Show. SeaGate Conv. Ctr. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**OK - ALTUS** - Altus Area ARA Hamfest. Ronald Hughes KB5UVC, 580-482-7994

The Events Calendar is a free service limited to electronic events such as computer shows, hamfests, flea markets, etc. If your organization is sponsoring an event and would like a free listing, contact us at least 60 days prior to the event. Include your flyer, estimated attendance, name of the person to contact, and phone number.

Complimentary issues are available upon request for distribution to your attendees. A street address for UPS is required.

While we strive for accuracy in our calendar, we can not be responsible for errors or cancellations. The information contained in this column is for the use of the readers of *Nuts & Volts* and may not be republished in any form without the written permission of T & L Publications, Inc.

**VA - ANNANDALE** - Computer Show. Northern VA Community College. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**WA - KENNEWICK** - Tri Cities ARC Hamfest. Dick N7WLD, 509-783-3479. E-Mail: [dick\\_goranson@kcc-computers.com](mailto:dick_goranson@kcc-computers.com)

**WI - OAK CREEK** - Swapfest. American Legion Post 434, 9327 S. Shepard Ave. 7am-2pm. 414-762-3235

**JULY 11-12**

**FL - FT. LAUDERDALE** - Computer Show. War Memorial Auditorium. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**FL - FT. MYERS** - Computer Show. Harborside Conv. Complex. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**GA - AUGUSTA** - Computer Show. Regency Mall. Georgia Mountain Productions 706-838-4827. E-Mail: [gamtpro@blg.tds.net](mailto:gamtpro@blg.tds.net)

**PA - KING OF PRUSSIA** - Computer Show. Valley Forge Convention Ctr. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**TN - NASHVILLE** - Computer Show. TN State Fairgrounds. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**JULY 12**

**IL - PEOTONE** - Kankakee ARS Hamfest. Don Keroac K9NR, 815-939-7548. E-Mail: [K9nr@juno.com](mailto:K9nr@juno.com) Web: <http://www.geocities.com/CapeCanaveral/Hangar/5711/>

**IN - FT. WAYNE** - Computer Show. Memorial Coliseum. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**MA - SWANSEA** - Computer Show. Venus DeMilo. Northern Computer Shows 978-744-8440. E-Mail: [inquiries@ncshows.com](mailto:inquiries@ncshows.com)

**MD - FREDERICK** - Computer Show. Frederick Fairgrounds. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**MI - FLINT** - Computer Show. Holiday Inn. Gateway Centre, US 23 @ Hill Rd. Exit. Five Star Productions 810-890-0988

**NJ - AUGUSTA** - Sussex Co. ARC Hamfest. Dan Carter N2ERH, 973-948-6999. E-Mail: [scarcnj@qsl.net](mailto:scarcnj@qsl.net) Web: <http://www.qsl.net/scarcnj/>

**NJ - PARSIPPANY** - Computer Show. Parsippany Hilton. 9:30am-4pm. MarketPro 201-825-2229. <http://www.marketpro.com>

**NY - ALEXANDER** - Genesee Radio Amateurs Hamfest. David Carlson KA2OQZ, 716-786-3622. E-Mail: [carlson@frontiernet.net](mailto:carlson@frontiernet.net) Web: <http://www.frontiernet.net/~wittman/wittman/GRAM>

**NY - ROCHESTER** - Computer Show. The Dome Ctr. 9:30am-4pm. MarketPro 201-825-2229. Web: <http://www.marketpro.com>

**OH - BOWLING GREEN** - Ham-A-Rama & Computer Show. Wood Co. Fairgrounds. 8am-1pm. 419-354-1811. E-Mail: [sjhudson@wcn.net](mailto:sjhudson@wcn.net)

**PA - ERIE** - Computer Show. Erie Civic Center. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**PA - KIMBERTON** - Valley Forge Hamfest. Kimberton Fire Company Fairgrounds. Bob Haase W3SA, 610-293-1919. E-Mail: [wb3joe@voicenet.com](mailto:wb3joe@voicenet.com)

**PA - PITTSBURGH** - North Hills ARC Hamfest. Northland Public Library, 300 Cumberland Rd., 8am-3pm. Bob Ferrey, Jr. N3DOK, 412-367-2393. E-Mail: [n3dok@pgh.net](mailto:n3dok@pgh.net) Web: <http://nharc.pgh.pa.us>

**JULY 17-18-19**

**MT - EAST GLACIER** - MT State Convention.

Gerry Leach VE6BVZ, 403-285-5547. E-Mail: [leachg@cadvision.com](mailto:leachg@cadvision.com)

**JULY 18**

**CA - ANGELS CAMP** - Flea Market. Utica Park. 7am-2pm. Stephen Barnett KD6CNU, 209-878-3829

**CA - SANTEE** - ARC of El Cajon Ham, Computer & Electronic Swapmeet. Santee Drive-in. 619-561-0052

**MD - OCEAN CITY** - Computer Show. Ocean City Conv. Ctr. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**NC - CARY** - Swapfest. Cary Community Ctr., 404 N. Academy. Cary ARC, PO Box 53, Cary, NC 27512

**NH - SEABROOK** - Computer Show. Greyhound Racetrack. Northern Computer Shows 978-744-8440. E-Mail: [inquiries@ncshows.com](mailto:inquiries@ncshows.com)

**OH - WELLINGTON** - Noarfest. Lorain County Fairgrounds, 8am-3pm. Clark Beckman N8PZD, 216-671-8795

**PA - SALEM TOWNSHIP** - Computer & Hamfest. Beach Haven Carnival Grounds. Charlie AD3L, 717-864-2571

**TX - TEXAS CITY** - Tidelands ARS Hamfest. Carl W. Steele Jr. WA5WVP, 409-948-0308

**JULY 18-19**

**FL - ORLANDO** - Computer Show. Central FL Fairgrounds. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**IN - INDIANAPOLIS** - Computer Show. IN State Fairgrounds. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**NJ - SECAUCUS** - Computer Show. Meadowlands Exposition Ctr. 9:30am-4pm. MarketPro 201-825-2229. Web: <http://www.marketpro.com>

**NY - STONY BROOK** - Computer Show. SUNY Stony Brook. 9:30am-4pm. MarketPro 201-825-2229. Web: <http://www.marketpro.com>

**OH - CLEVELAND** - Computer Show. Int'l Expo Center. Sat: 10am-6pm, Sun: 10am-4pm. Peter Trapp Shows 603-272-5008. Web: [www.petertrapp.com](http://www.petertrapp.com)

**OH - DAYTON** - Computer Show. Montgomery Co. Fairgrounds. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**PA - HARRISBURG** - Computer Show. Farm Show Complex. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**JULY 19**

**IL - SUGAR GROVE** - Fox River Radio League Hamfest. Waubesa Community College. James Von Olmhausen 630-897-3042. E-Mail: [n9uzc@amsat.org](mailto:n9uzc@amsat.org)

**MA - CAMBRIDGE** - Flea Market. Kendall Square area. MIT. Nick Altembernd KA1MQX, 617-253-3776. Web: <http://web.mit.edu/wlmmx/www/swapfest.html>

**MA - WORCESTER** - Computer Show. Worcester Centrum Center. Northern Computer Shows 978-744-8440. E-Mail: [inquiries@ncshows.com](mailto:inquiries@ncshows.com)

**MD - SALISBURY** - Computer Show. Wicomico Youth & Civic Ctr. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**MO - WASHINGTON** - Zero Beaters ARC Hamfest. Bernie E. Hillerman Park. 6am-2pm. Keith Wilson K0ZH, 314-629-2264. E-Mail: [n0mfd@amsat.org](mailto:n0mfd@amsat.org)

**NY - FARMINGVILLE** - Radio Central ARC Hamfest. Jo Ann Colletti N2IME, 516-399-1877. Web: <http://www.li.net/~n2mdq>

**OH - VAN WERT** - Hamfest. County Fairgrounds, US 127 S. 419-795-5763

**JULY 24-25**

**FL - MILTON** - Milton ARC Hamfest. Mark McAnally KE4QKN, 850-626-7686. E-Mail: [KE4QKN@AOL.COM](mailto:KE4QKN@AOL.COM)

**OK - OKLAHOMA CITY** - OK State Convention. Harold Miller KB1ZQ, 405-672-7735. E-Mail: [n11pn@swbell.net](mailto:n11pn@swbell.net)

**JULY 24-25-26**

**AZ - FLAGSTAFF** - AZ State Convention. Mark Kesauer N7KKQ, 602-440-2039. E-Mail: [rtackett@huntington.in.us](mailto:rtackett@huntington.in.us)

**MI - TAYLOR** - Computer & Technology Show. Gibraltar Trade Center, 15525 Racho Rd. 734-287-2000

**JULY 25**

**IN - HUNTINGTON** - Huntington Co. ARC Hamfest. Ray Tackett 219-786-0029. E-Mail: [rtackett@huntington.in.us](mailto:rtackett@huntington.in.us)

**NC - ASHEVILLE** - Hamfest. Haywood Co. Fairgrounds. 8am-4pm. Thomas Queen K4BNP, 828-258-2639. E-Mail: [k4bnp@aol.com](mailto:k4bnp@aol.com)

**OH - CINCINNATI** - OH-KY-IN ARS Hamfest. Diamond Oaks Career Dev. Campus, 6375 Harrison Ave. 7am-4pm. Dana Laurie WA8M, 513-761-7388. E-Mail: [rdl@one.net](mailto:rdl@one.net)

**VA - CHANTILLY** - Computer Show. Capital Expo Center. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**VA - RICHMOND** - Computer Show. The Showplace. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**JULY 25-26**

**FL - WEST PALM BEACH** - Computer Show. South FL Fairgrounds. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**NJ - SOMERSET** - Computer Show. Garden State Exhibit Ctr. 9:30am-4pm. MarketPro 201-825-2229. Web: <http://www.marketpro.com>

**OK - OKLAHOMA CITY** - Ham Holiday. OK State Fair Park (Hobbies, Arts & Crafts Bldg.) Sat: 5-8pm, Sun: 8am-5pm. Thomas Webb 405-732-7110. Web: [www.geocities.com/heartland/7332](http://www.geocities.com/heartland/7332). E-Mail: [n11pn@swbell.net](mailto:n11pn@swbell.net)

**PA - ALLENTOWN** - Computer Show. Allentown Fairgrounds. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**PA - MONROEVILLE** - Computer Show. Pittsburgh Expo Mart. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**TN - MEMPHIS** - Computer Show. Agriscient Int'l. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**JULY 26**

**CA - SANTA ANA** - Swapmeet. ACP parking lot. Mary Russo 714-558-8813

**IL - GLEN ELLYN** - Computer Show & Sale. College of DuPage, Main Area of Phys Ed Bldg. Corner of Park Blvd. & College Rd. 9:30am-3pm. Computer Central Shows 847-940-7547

**MD - NEW CARROLLTON** - Computer Show. Ramada Conference & Exhibition Ctr. 9:30am-4pm. MarketPro 301-984-0880. Web: [www.marketproshows.com](http://www.marketproshows.com)

**MD - TIMONUM** - Hamfest. York Rd. Bob Koblish N3HAT, 410-467-4634. E-Mail: [n3hat@erols.com](mailto:n3hat@erols.com) Web: <http://www.smart.net/~brats>

**ME - PORTLAND/WESTBROOK** - Computer Show. Verrillo's Convention Center. Northern Computer Shows 978-744-8440. E-Mail: [inquiries@ncshows.com](mailto:inquiries@ncshows.com)

**OH - PAULDING** - Hamfest. Park Lane Center, Fairgrounds Rd. Jerry KB8MAF, 419-399-4507. E-Mail: [JLRHOD@BRIGHT.NET](mailto:JLRHOD@BRIGHT.NET)

**VA - VIRGINIA BEACH** - Computer Show. VA



# Events CALENDAR

Beach Pavilion. 9:30am-4pm. MarketPro 301-984-0880. Web: www.marketproshows.com

## JULY 31-AUGUST 1

**TX - AUSTIN** - State Convention. Joe Makeever W5HS, 512-345-0800

## JULY 31-AUGUST 1-2

**MI - MT. CLEMENS** - Computer & Technology Show. Gibraltar Trade Center, 237 N. River Rd. 810-465-6440

## AUGUST 1998

### AUGUST 1

**CA - SANTEE** - ARC of El Cajon Ham, Computer & Electronic Swapmeet. Santee Drive-in. 619-561-0052

**IL - CARLINVILLE** - Hamfest & Computer Fair. Macoupin Co. Fairgrounds, Rt. 4. 7am-noon. Tim Jones, 217-627-2355

**KY - BOWLING GREEN** - KY Colonels ARC Hamfest. Leon Garrett K4CIT, 502-842-5307

**MO - SPRINGFIELD** - State Convention. Karen Thorpe NOTDW, 417-889-6775

**NC - HIGH POINT** - Hamfest. National Guard Armory, 8am-1pm. 336-887-3039. E-Mail: RAHam@infoave.net

**NY - WEEDSPORT** - Hamfest. Weedsport Speedway/Fairgrounds, Rt. 31. Joe Kahler WA2NGX, 315-364-5135

**OH - COLUMBUS** - Voice of Aladdin ARC Hamfest. Jim Morton KB8KJP, 614-846-7790

**OR - BASTON** - Coos Co. RC Hamfest. Brian Howard W7MLT, 541-572-5623

### AUGUST 1-2

**FL - JACKSONVILLE** - Hamfest & Computer Show. Prime Osborn Convention Ctr. Sat: 9am-5pm, Sun: 9am-3pm. 904-268-2302. Web: http://www.pobox.com/~w4ue/hamfest.html

**NY - WHITE PLAINS** - Computer Show. Westchester County Ctr. 9:30am-4pm. MarketPro 201-825-2229. Web: http://www.marketpro.com

**WA - SPOKANE** - Hamfest. University High School, 10212 E. 9th Ave. Sat: 9am-5pm, Sun: 8am-noon. JoAnn L. Gemmrig KA7SUZ, 509-928-1808

### AUGUST 2

**IL - PEOTONE** - Hamfest. Dave Brasel NF9N, 708-448-0580

**IN - ANGOLA** - Land of Lakes ARC Hamfest. Theresa J. Limestahl KB9NNR, 219-495-5403. E-Mail: tlimestahl@dmci.net

**NH - PORTSMOUTH** - Computer Show. Yoken's. Northern Computer Shows 978-744-8440. E-Mail: inquiries@ncshows.com

**OH - RANDOLPH** - ARC Hamfest. Portage County Fairgrounds, St. Rt. 44. 8am-4pm. Joanne Solak KJ30, 330-274-8240

**VA - BERRYVILLE** - Hamfest & Computer Show. Clarke Co. Ruritan Fairgrounds. Tom Martin KF4TXN, 540-539-4301.

E-Mail: hamfest@vvalley.com  
Web: http://www.vvalley.com/svarc.hamfest

### AUGUST 8

**CA - FONTANA** - Inland Empire ARC Amateur Radio & Electronics Swapmeet. A B Miller High School. Bill 909-822-4138 eves

**IL - QUINCY** - Western IL ARC Hamfest. Jim Funk N9JF, 217-336-4191.

E-Mail: jfunk@adams.net Web: http://scribers.midwest.net/bcrocket/swapfest.htm

**NY - BUFFALO** - Computer Show. Hamburg Fairgrounds. 9:30am-4pm. MarketPro 201-825-2229. Web: http://www.marketpro.com

**NY - Poughkeepsie** - Computer Show. Mid-Hudson Civic Center. 9:30am-4pm. MarketPro 201-825-2229. Web: http://www.marketpro.com

**PA - LEWISTOWN** - Hamfest. Decatur Township Fire Company grounds. 8am-1pm. Rich Yingling WB3COB 717-242-1882

**WI - HILBERT** - Ham Radio & Computerfest. Tommy's Village Lanes, Hwy. 57 North. 7:30am-2pm. Mike Ortleb KN9P, 920-853-7073

**WV - HUNTINGTON** - Tri-State ARA Hamfest. Bernard Mays WB8ZER, 304-743-5459.

E-Mail: wb8zer@juno.com

### AUGUST 9

**IA - AMANA** - Cedar Valley ARC Hamfest. Wayne Kolosik K10FE, 319-393-4224. E-Mail: k10fe@usa.net

**KY - FRANKFORT** - Hamfest. Western Hills High School. 8am-4pm. John R. Barnes KS4GL, 606-253-1178 eves. E-Mail: ks4gl@juno.com

**MI - JACKSON** - Hamfest & Computer Show. Jackson Community College. Terry K8SMC, 517-768-1770. E-Mail: k8smc@modempool.com

**NH - MANCHESTER** - Computer Show. Holiday Inn Expo Center. Northern Computer Shows 978-744-8440. E-Mail: inquiries@ncshows.com

**NJ - FAIRFIELD** - Computer Show. Fairfield

Radisson. 9:30am-4pm. MarketPro 201-825-2229. http://www.marketpro.com

**NY - ROCHESTER** - Computer Show. The Dome Ctr. 9:30am-4pm. MarketPro 201-825-2229. Web: http://www.marketpro.com

### AUGUST 14-15

**LA - NEW ORLEANS** - Int'l DX Convention. Don Boudreau W5FKX, 504-737-9733

### AUGUST 14-15-16

**CA - SAN DIEGO** - ARRL Southwestern Division Convention. Town & Country Hotel, Mission Ballroom. 500 Hotel Cir. N. Cybil Allbright 619-278-4284

### AUGUST 15

**CA - SANTEE** - ARC of El Cajon Ham, Computer & Electronic Swapmeet. Santee Drive-in. 619-561-0052

**GA - ALBANY** - Computer & Elect. Expo. Hasan Temple, 1822 Palmyra Rd. 9am-5pm. Sandy Rabb 912-888-9393. E-Mail: GODS@SURFSOUTH.COM

**KS - CHANUTE** - Chantane Area ARC Hamfest. Central Park Pavilion. 9am-1pm. Charlie Ward WD0AKU, 316-431-6402

**NH - SEABROOK** - Computer Show. Greyhound Racetrack. Northern Computer Shows 978-744-8440. E-Mail: inquiries@ncshows.com

### AUGUST 15-16

**AL - HUNTSVILLE** - Hamfest. Von Braun Civic Ctr. Sat: 9am-4:30pm, Sun: 9am-2:30pm. Art Davis WB4KKA, 256-883-0477

Web: www.hamfest.org  
**MN - WASECA** - Hamfest & Craftfair. Waseca Co. Fairgrounds. Lloyd L. Schlaak 507-465-8619.

E-Mail: n0vfv@smig.net  
**NY - STONY BROOK** - Computer Show. SUNY Stony Brook. 9:30am-4pm. MarketPro 201-825-2229. Web: http://www.marketpro.com

### AUGUST 16

**IN - LAFAYETTE** - Tippecanoe ARA Hamfest. James Canarecci WA9TGO, 765-474-6570

**KS - SALINA** - Central KS ARC Hamfest. Ron Tremblay WA0PSF, 785-827-8149. E-Mail: tremblay@midusa.net

**MA - CAMBRIDGE** - Flea Market. Kendall Square area. MIT. Nick Altemberd KA1MQX, 617-253-3776. Web: http://web.mit.edu/w1mqx/www/swapfest.html

**MA - TAUNTON** - Computer Show. Holiday Inn. Northern Computer Shows 978-744-8440. E-Mail: inquiries@ncshows.com

**MI - FLINT** - Computer Show. Holiday Inn, Gateway Centre, US 23 @ Hill Rd. Exit. Five Star Productions 810-890-0988

**OH - WARREN** - Hamfest. Trumbull Campus Kent State Univ., Rt. 45 (Mahoning Ave.) & Rts. 5/82 Bypass. Frank Fitzhugh KD8KJ, 330-652-0452. E-Mail: kd8kj@onecom.com

### AUGUST 21-22-23

**MI - TAYLOR** - Computer & Technology Show. Gibraltar Trade Center, 15525 Racho Rd. 734-287-2000

### AUGUST 22

**CANADA - MANITOBA - AUSTIN** - Hamfest.

Mani-toba Agricultural Museum. Dave Snyder VE4XN, 204-728-2463.

E-Mail: dsnyder@mb.sympatico.ca Web: http://www.mbnet.mb.ca/~donahue/austin.html

**IN - WARSAW** - Hamfest & Computer Show. Kosciusko County Fairgrounds, Bronson & Smith St. 8am-2pm. Loren Melton WB9OST, 219-858-9374 eves. after 6pm CDT

**NJ - BRIDGEWATER** - Hamfest. Somerset Co. 4H Ctr., Milltown Rd. 8am-1pm. Pat N2CQM, 732-873-3394. E-Mail: scars@qsl.net

Web: http://www.qsl.net/scars

### AUGUST 22-23

**NJ - SECAUCUS** - Computer Show. Meadowlands Exposition Ctr. 9:30am-4pm. MarketPro 201-825-2229.

Web: http://www.marketpro.com

### AUGUST 23

**IL - GLEN ELLYN** - Computer Show & Sale. College of DuPage. Main Arena of Phys Ed Bldg. Corner of Park Blvd. & College Rd. 9:30am-3pm. Computer Central Shows 847-940-7547

**MO - BLANCHETTE PARK** - Hamfest. 6:30am-2:30pm. Dirk Bremer KC0BZV, 314-750-3417. E-Mail: dirkb@myself.com

Web: www.qth.com/wb0hsl/  
**NH - NASHUA** - Computer Show. Sheraton Tara. Northern Computer Shows 978-744-8440.

E-Mail: inquiries@ncshows.com  
**NY - DEPEW** - Hamfest & Computer Show. Hearthstone Manor, 333 Dick Rd., 8am-3pm. Luke 716-634-4667. http://hamgate1.sunyerie.edu/~larc/greaterbuffalohamfest.html

**NY - YONKERS** - Hamfest & Computerfest. Yonkers Municipal Parking Garage, Main St. 9am-3pm. John Costa WB2AUL, 914-963-1021.

E-Mail: maytan@juno.com

### AUGUST 28-29-30

**MA - BOXBORO** - Convention. Boxborough Woods Hotel & Conference Ctr. Anthony Penta W1ABC, 978-887-8887. Web: http://www.ultra.net.com/~whd-inc/ham/boxboro/welcome.htm

**MI - MT. CLEMENS** - Computer & Technology Show. Gibraltar Trade Center, 237 N. River Rd. 810-465-6440

### AUGUST 29

**ME - LEWISTON** - Computer Show. Civic Center. Northern Computer Shows 978-744-8440. E-Mail: inquiries@ncshows.com

**NY - ALBANY** - Computer Show. Polish Community Center. 9:30am-4pm. MarketPro 201-825-2229. http://www.marketpro.com

### AUGUST 29-30

**CO - WOODLAND PARK** - Swapfest. Colorado Lions Camp, Don AADNW, 719-687-3692

**FL - SARASOTA** - Computer Show. Sarasota Municipal Auditorium. Frank Cox 941-954-0202

**GA - PEACHTREE** - Computer Show. Peachtree Showcase Exhibition Hall & Conv. Ctr., I-75 Exit 71. Georgia Mountain Productions 706-838-4827. E-Mail: gamtnp@blrg.tds.net

### AUGUST 30

**IA - DUBUQUE** - Hamfest, Radiofest & Computer

Expo. County Fairgrounds. 8am-2pm. Jerry Ehlers W0SAT, 319-583-1016.

E-Mail: kb0lclj@mwcl.net

Web: http://grarc.mwcl.net/

**IL - WOODSTOCK** - Hamfest & Computer Extravaganza. McHenry Co. Fairgrounds. 6am-3pm. Bob Grosse 708-944-0500.

E-Mail: N9KXG@quality-enterprises.com  
Web: http://quality-enterprises.com/TCRQ/

**IL - TILTON** - Vermilion Co. ARA Hamfest. IJAW, 579 Civic Center. Gary Denison KA9SKS, 217-759-7389. E-Mail: gdenison@danville.net

**NH - DURHAM** - Computer Show. Whittemore Center @ UNH. Northern Computer Shows 978-744-8440. E-Mail: inquiries@ncshows.com

**NJ - PARSIPPANY** - Computer Show. Parsippany Hilton. 9:30am-4pm. MarketPro 201-825-2229. http://www.marketpro.com

**NY - YONKERS** - Hamfest. Yonkers Raceway. 8am-2pm. Bill Hertwig N2QZB, 914-741-6606. Web: WWW.WECCA.ORG

**TN - CEDARS OF LEBANON** - Hamfest. Lee Hall NYAT, 615-849-9704. E-Mail: ny4t@qsl.net

## SEPTEMBER 1998

### SEPTEMBER 5

**CA - SANTEE** - ARC of El Cajon Ham, Computer & Electronic Swapmeet. Santee Drive-in. 619-561-0052

**KY - CAVE CITY** - Southern KY DX Assoc. Hamfest. Larry Brumett KN4IV, 502-651-2363. E-Mail: lbrumett@glasgow-ky.com

### SEPTEMBER 5-6

**NC - SHELBY** - Shelby ARC Hamfest. June Melvin WA4JNJ, 704-739-2583

### SEPTEMBER 11-12-13

**MI - TAYLOR** - Computer & Technology Show. Gibraltar Trade Center, 15525 Racho Rd. 734-287-2000

### SEPTEMBER 12

**CA - FONTANA** - Inland Empire ARC Amateur Radio & Electronics Swapmeet. A B Miller High School. Bill 909-822-4138 eves

**IL - ROLLING MEADOWS** - Convention & Banquet. Holiday Inn. Bill Smith W9VA, 847-945-1564. E-Mail: w9va@aol.com

Web: http://www.qth.com/w9dxc  
**IN - SPENCER** - Owen Co. ARA Hamfest. Kathryn Smith KB9INN, 812-829-2140

**MO - COLUMBIA** - Central MO Radio Assoc. Hamfest. Perry Ogletree N0NMC, 573-445-2662. E-Mail: cmra@qsl.net

Web: http://www.qsl.net/cmra  
**NY - BALLSTON SPA** - Hamfest. Saratoga Co. Fairgrounds. 7am-3pm. Darlene Lake N2XQG, E-Mail: lake@capital.net

**PA - ERIE** - RA of Erie Hamfest. Matthew Steger N3NTJ, 814-835-1566 or 814-864-3809

**WV - WHEELING** - Triple States RAC Hamfest. William Maxwell WD8JIA, 304-242-2509

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# RESOURCE BIN

number seventy eight

## Starting your own web page.

Our usual reminder here that the *Resource Bin* is a two-way column. You can get tech help, consultant referrals, and off-the-wall networking on nearly any electronic, *tinaja* questing, personal publishing, money machine, or computer topic by calling me at (520) 428-4073 weekdays 8-5 Mountain Standard Time.

### Getting Started On the Web

This month, I thought we'd once again go over the fundamentals of what the Internet is all about. And how you can get further involved.

Basically, the Internet is a bunch of computers that can talk to each other. Talking gets done 24 hours a day by way of an elaborate and a redundant high-speed world-wide network.

Each computer is treated as a peer, and can either provide or request info from any other via the interconnected web. There is purposely no center to the net, nor is anybody "in charge."

Because of the redundancy, the net automatically routes itself around any crowded or broken links. As well as gleefully patching itself around any and all attempts at censorship.

What can go across the net? Just about anything ...

**E-Mail** — Short for *electronic mail*. A way to quickly and cheaply send letters anywhere in the world. Normally, all these are kept short and to the point. But you can attach most anything in the way of a file, animation, a sound clip, or whatever. The darker side of E-Mail is known as *spamming*, which is sending out unsolicited or unwanted E-Mail to others. Usually lots of others. Because of its illegality, stupidity, and annoyance, spam does not work.

**Hypertext** — Hypertext is a method of sending a page of information. Often, this will be one scrollable computer screen worth of content. Such pages could typically be a mix of color text, graphics, and images. The pages can also offer instantly clickable links to other pages, to other Internet sites, to movies, sound bytes, or animation. The pages can usually be printed as

well. Hypertext pages have often been written in a rather simplistic language known as HTML. Short for *HyperText Markup Language*. But newer options such as Java, Adobe Acrobat PDF, and PGML are far superior.

**Search Engines** — These act as the "card catalogs" of the Internet and let you find out exactly where precisely what can be found. While [www.yahoo.com](http://www.yahoo.com) is the highest profile, my own favorite is [www.hotbot.com](http://www.hotbot.com). And [www.altavista.digital.com](http://www.altavista.digital.com) remains quite popular. There are hundreds of other search engines.

### NEXT MONTH: Don shows us how to locate unusual semiconductors and ICs.

One master engine listing is found at [www.wp.com/resch/search.html](http://www.wp.com/resch/search.html), while a useful snooping utility which gathers stuff together by inference appears at [www.inference.com](http://www.inference.com). Links to these are at [www.tinaja.com/webwb01.html](http://www.tinaja.com/webwb01.html).

**Directories** — Your best directories are nearly all free and fully web-based. Mags at [www.mediafinder.com](http://www.mediafinder.com). Books at [www.tinaja.com/amlink01.html](http://www.tinaja.com/amlink01.html), and the telephone numbers (even backwards ones) through [www.anywho.com:81](http://www.anywho.com:81), at [www.lookupusa.com](http://www.lookupusa.com) or any of a dozen competitors. People and their real and E-Mail addresses are findable through locales like [www.whowhere.com](http://www.whowhere.com). Maps are at [www.mapquest.com](http://www.mapquest.com) and similar services. Even that good old Thomas Registry is now online at, of all places, [www.thomasregister.com](http://www.thomasregister.com). This service is now free, but does require a password. Instant links to all of these are found at [www.tinaja.com/webwb01.html](http://www.tinaja.com/webwb01.html).

**Commerce** — We're just beginning to see online commerce taking off. But within a year, you'll use your VISA card as routinely online as you'd do normally. Early web pioneers here have been books, tickets, porno, and flowers. Online commerce eliminates middlemen and

makes all comparison shopping super easy. For low prices, wide selection, and faster availability. Which is certain to revolutionize how and where things get bought.

**Newsgroups and Newsletters** — A *Usenet* newsgroup is where individuals can post group messages on any special interest topic. You might visit to find everything there is to learn about, say, viscous couplings on 4WD blue 1987 VW Synchro diff locked vans. There are 10s of 1,000s of newsgroups. Sometimes these are included in your basic ISP rate; other times there is a minor surcharge for use. For samples see [www.dejanews.com](http://www.dejanews.com). Newsletters are targeted E-Mail sent to a subscription list. They tend to be moderated, more accurate, way more polite, and vastly more useful than newsgroups. These easily can overload you through their continuous barrage of messages.

**Porn** — A lot of the more popular sites on the Internet offer materials a few might consider offensive. These are often among the highest traffic and most profitable of all web ventures, so lots of other somebodies obviously do enthusiastically approve of all their content. Over the past century or two, it has been typical for any emerging new technology to go on through a "pornographic phase." This has sure been true for photography, movies, cable, and most especially VCRs. As a technology matures, porno recedes.

**Chat Lines** — This one is teeny bopper paradise. Chat lines work like E-Mail, except that they all are real time and interactive. The old party line. These enormous time wasters are especially popular on AOL. Just be sure who you are talking to is really who they appear to be. Remember that nobody knows you are a dog on the Internet. (Woof.) And don't be offended easily by flames (purposely hurled insults), trolls (intentionally outrageous points of view), or comments ranging from rude to way beyond obscene.

**... and just about everything else** — This week's *fad du jour* seems to be live Internet auctions. Since there's a lot of scam potential here (like buying your own product at list price), I personally don't expect this one to last too long. But they sure are popular right now. Especially for deep discount travel tickets. Live audio is now going great guns and is approaching CD quality. Many radio stations and short wave sites now offer live broadcasts. You now can make cheap phone calls over the net. Soon they should be totally hassle free as well. Video is still small and clunky, but I'd expect

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full VCR quality within the year at most. Live real-time video cams are everywhere, watching everything from coffee pots to kinky hamsters to Art Bell.

### Sneaking Up On It

It is *unthinkable* in this day and age not to gain at least some personal web access. For the net is where and how things are gonna happen.

There's different levels of Internet use access. The simplest is to borrow someone else's system.



# RESOURCE BIN

## SOME WEB SITE RESOURCES

<b>Adobe Acrobat</b> 1585 Charleston Rd Mountain View CA 94039 (800) 833-6687	<b>Inside the Internet</b> 9420 Bunsen Pkwy Louisville KY 40220 (502) 491-1900	<b>Internet Telephony</b> One Technical Plaza Norwalk CT 06854 (800) 243-6002	<b>NetworkWorld</b> 161 Worcester Rd Framingham MA 01701 (508) 875-6400	<b>Web Developer</b> 20 Ketchum St Westport CT 06880 (800) 556-9184
<b>Boardwatch Magazine</b> 8500 W Bowles Ave #210 Littleton CO 80123 (800) 933-6038	<b>Inter@ctive Week</b> One Park Ave New York NY 10016 (800) 825-4237	<b>Internet World</b> 20 Ketchum St Westport CT 06880 (800) 635-5537	<b>New Media</b> 901 Mariner's Bl #365 San Mateo CA 94404 (415) 573-5170	<b>Web Techniques</b> 411 Borel Ave San Mateo CA 94402 (800) 365-2210
<b>Computer Telephony</b> 12 W 21 St New York NY 10010 (212) 691-8215	<b>Interactive Developer</b> 209 Hamilton Ave Palo Alto CA 94301 (415) 833-7100	<b>Internic Registration</b> 505 Huntmar Park Dr Hemond VA 22070 (703) 742-4777	<b>Online Magazine</b> 462 Danbury Rd Wilton CT 06897 (800) 248-8466	<b>WebMaster</b> 1601 Civic Center #200 Santa Clara CA 95050 (800) 343-4935
<b>CTI</b> One Technology Plaza Norwalk CT 06854 (800) 243-6002	<b>InterActivity</b> 600 Harrison St San Francisco CA 94107 (415) 905-2200	<b>Kleper Report</b> 134 Caversham Woods Pittsford NY 14534 (716) 381-3428	<b>Synergetics</b> Box 809 Thatcher AZ 85552 (520) 428-4073	<b>WebServer Magazine</b> 320 Washington St Brookline MA 02146 (617) 739-7001
<b>Free-Loader Monthly</b> PO Box 6615 Warner Robins GA 31095 (912) 328-6589 FAX	<b>Internet Advisor</b> 5675 Ruffin Rd San Diego CA 92123 (800) 336-6060	<b>The Net</b> 150 N Hill Dr Brisbane CA 94005 (415) 468-4684	<b>Visual Developer</b> 14455 N Hayden Rd #220 Scottsdale AZ 85260 (602) 483-0192	<b>Wired</b> 520 3rd St 4rd Fl San Francisco CA 94107 (415) 276-5000
<b>IEEE Internet Computing</b> 10662 Los Vaqueros Cir Los Alamitos CA 90720 (714) 821-8380	<b>Internet Shopper</b> 20 Ketchum St Westport CT 06880 (800) 827-4812	<b>Network Computing</b> 600 Community Dr Manhasset NY 11030 (516) 562-5071	<b>Web Apps Magazine</b> 71 West 23rd St 3rd Fl New York NY 10010 (212) 246-7447	<b>Yahoo! Internet Life</b> 1 Park Ave New York NY 10016 (800) 825-4237

Most libraries and schools now offer free or cheap services as well. Intro Internet courses at a college can be a good deal. Especially if you treat them as a low-cost site rental.

Your next step up is to become a largely "read only" site. Here you can grab stuff at your convenience. With full E-Mail. But use no home page at all, or else provide a maintenance-free home page of limited content.

A *home page* is simply what is first seen when someone contacts your site over the net. Websites have one home page, but might stock thousands of other pages reached by appropriate clicking on the home page. Plus *hot links* to other pages from other hosts everywhere in the world.

Your next step up is providing your own home page, but keeping it short, interesting, and simple. Beyond that, you can eventually move up to a full blown site that attracts visitors and gives them really useful content.

It's usually a good idea to pick up a lot of Internet practice before you'll actually commit yourself to setting up your own web site.

### Finding an ISP

Normally, you do *not* get on to the web directly by yourself. This can be costly and requires an awful lot of round-the-clock equipment. Not to mention leased lines and zillions of hours per week of your support time. Instead, you'll hire an *Internet Service Provider*, or ISP instead. You have a choice here of national services such as your phone company or *America Online*. Or of using a local ISP.

My overwhelming preference is to go with a local ISP. Regardless of the route you choose, *make sure your access is a local call*. Or otherwise is toll-free without surcharges. This can be a bad gotcha in remote rural areas.

A local ISP may typically charge

you \$19.00 per month for basic Internet service. There might be extra charges for excess storage, bandwidth, higher baud rates, or for use hours beyond generous minimums. Special services such as secure online transactions, T1 lines, referral logs, wireless access, or excessive handholding may also cause you premium charges.

You can find ISPs online or else through the ads in local community newspapers and shoppers. I've got a listing at [www.tinaja.com/webwb01.html](http://www.tinaja.com/webwb01.html). Chances are you will want to change ISPs in a few months, so do *not* sign any long-term contracts.

Your minimum net access system should be Windows 95 compatible. It should have plenty of extra RAM and hard disk space. I do recommend a minimum of 32 megs of RAM and a two gig drive. Most web users stick with 33K modems. The faster modems still have problems and may not give you that much additional speed.

Special software called a *browser* is needed for Internet access. Two free choices are *Netscape* or else *Internet Explorer*. I very much prefer Netscape. I use their latest version 4.4 for my actual browser. But I still use good old *Netscape Gold 3* as my editor.

Getting started is simple enough. You find a local ISP and pay them for a month or two. They should give you some useful software and numbers to punch into all of your Netscape and networking preferences. Which gives you passwords, dial-up access, and a valid Internet address.

Every Internet site has its *address* that tells the other computers on the net how to access it. There will be two forms to this address. The *numeric* form might be 204.17.39.115, while the more humanly useful *name* form may be <http://www.yoursite.com>.

That *http://* is short for a *hyper-text transfer protocol* and states the

rules for sending bytes over the net. That *www* is simply the web. The *yoursite* is your actual site name. The *.com* trailer states you are a commercial venture.

The other older options are *.org* for organization or the *.net* for network, among others. There are several new naming conventions coming down, but these aren't yet fully in place.

Subpages are marked by a trailing slash, such as the <http://www.tinaja.com/barg01> leading you to my surplus bargain page. If there is no trailing slash, a filename of either *default.htm* is assumed on a Microsoft server or *index.html* on an Apache server.

Yes, you can have sub-subpages as deep as you want to. For instance, the online version of this column can be found as <http://www.tinaja.com/glib/resbn78.pdf>. But it's easier to just click on [www.tinaja.com/resbn01.html](http://www.tinaja.com/resbn01.html).

You have two choices for your *url* or *uniform resource locator*. You can get a free add-on or "sub lease" to your ISP's existing url. For instance, if the ISP is *xerxes.net*, your web address might be *xerxes.net/~you*. This route is instant and free, but has the major disadvantage that your address will have to change if you switch ISPs.

Instead, you might opt for the full Internet registration using your own unique and "portable" url. The charge is \$100.00 for the first two years, and \$50.00 per year after that.

Your ISP can do the registration for you. Otherwise, you do it yourself at [www.internic.net](http://www.internic.net). Their *whois* feature tells you if the name is taken. Besides letting you find out who owns other sites and how to reach them. The term *virtual host* means that all your traffic really goes through the ISP's *server*. A typical ISP might host dozens or even hundreds of accounts. To the web, they all look like separate urls. But these are all really one server.

You can decide how conspicu-

ous you'll want to make your relation to your ISP's host site. You can ask to be listed on their home page, or you can keep your involvement with any ISP totally invisible. The former gives you more local hits; the latter looks far more professional. Besides letting you move away at any time.

### Set Some Goals

The single most important step in setting up a web site is deciding what you want those pages to do for you. A very good starting point is to gather together all those tools you need for your own personal web access. If you let your site serve as your personal gateway to the net, chances are that others also will.

Plain old lists of links tend to be dull and dumpy. Especially those that are ripped off from another site. But fewer links carefully chosen and well annotated can be welcome.

If you are going to provide lots of links, do try to become *the* definitive gateway to some area of expertise.

And test *all* those links often.

The three most important features to offer on your web site are *content*, *content*, and *content*. Unique and well thought out *sole sourced* content that simply is not found elsewhere. This always was and still remains the key secret to a successful site.

It's very important to continuously update your site. Adding new stuff so visitors have a good reason to come back. The key rule here is *continuous small improvements*. Budget at least 20 hours per week for work on a site of medium complexity.

Do avoid all excessive glitz. Cutsey animation, fancy sound clips, frames, and humongous images only annoy and slow down your viewers. Besides getting old in a real big hurry.

Remember that a bored viewer or an impatient viewer is a gone viewer. It's far better to have somewhat of a "retro" look in a fast and elegant site than it is to overload it with the latest of useless "gee whiz" geegaws.

### Creating the Pages

Actually making your web pages is not that big a deal. The simplest and easiest way is to "borrow" the plans from sites you like and modify them using Netscape Gold. Just do be sure your editing is heavy enough that the final product bears no resemblance to the original. Then carefully look at your HTML code using an editor to make certain nothing is present but routine, stock, and fully legal code. Never use any image that is not clearly public domain or otherwise legal.

Just find a page you like and click on *edit*. This will download the



## RESOURCE BIN

code to your site for modification. No, you don't necessarily have to learn HTML. But the more HTML you do learn and the better you use it, the more easily you can resolve page problems and perform more unusual page tasks.

Tricks using *tables* are especially useful in formatting a page so it looks the way you want it to.

There's scads of "build your own home page" software packages out there. I personally do not use any of them. When I must use HTML, I rely on good old Netscape Gold to create the site pages, helped along by an occasional touch-up of my raw HTML code out of a text editor.

Otherwise, I will use the infinitely superior *Adobe Acrobat*. I send all my raw PostScript "gonzo" routines to *Acrobat Distiller*. This gives you total control of exactly what your end user will see. Fully searchable, expandable, and smoothed. In a wide variety of high-quality fonts and graphics of stunning quality. All byte served from a single and short file.

Using free readers that are widely available online.

### Promoting your Site

There are untold millions of web pages. How do you let others know about yours?

First and foremost, you'll want to go to the major search engines and hit on their *register url* buttons. Start with [www.hotbot.com](http://www.hotbot.com) and [www.altavista.digital.com](http://www.altavista.digital.com). Then you mine that long list at [www.wp.com/resch/search.html](http://www.wp.com/resch/search.html).

There are commercial services that — for a fee — list your site with dozens or hundreds of search engines. One site that also will do a free registration for you of the dozen biggest services is at [www.2com.com](http://www.2com.com).

A tutorial and promotion links are at [www.ep.com/faq/webanounce.html](http://www.ep.com/faq/webanounce.html).

Your second free promotion ploy is often overlooked. Be sure your *sig file* on your E-Mail has your home page and a mini-advertisement in it.

Many of the newsletters and mags in the sidebar do site reviews. Make sure they're all aware of your site. A simple "please review my site" will almost always work far better than many pages of hard sell.

It is important that all the major keywords for your site show up early on your home page. Or are otherwise included in your HTML code. Trying to trick any search engine into giving you an earlier listing is usually futile and often will have the exact opposite effect. Note that many search engines cannot find dynamic

pages.

### Printed Resources

Most of the better info about the web is, in fact, on the web. So, surfing should be your foremost route for resource tapping. There are bunches of mags and newsletters about web topics. I've gathered up a sampling of them for you in the sidebar.

There are literally tons of books on starting your up own web page. But some of them are appallingly bad. You can search for the better ones at <http://www.tinaja.com/amlink01.html>. To spot the more useful texts, pay careful attention to the user reviews.

### For More Help

Useful links to the search engines, newsgroups, directories, reference sites, registration, promotion, clip art, and other web-oriented utilities are found at [www.tinaja.com/webwb01.html](http://www.tinaja.com/webwb01.html). Free web-related insider tutorials are at [www.tinaja.com/weblib01.html](http://www.tinaja.com/weblib01.html).

Step-by-step info on getting online appeared back in RESBN56.PDF, while hints on web surfing and research are found in RESBN55.PDF, RESBN60.PDF, RESBN61.PDF, RESBN64.PD1, as

well as in RESBN71.PDF.

Lots of Acrobat help is found at [www.tinaja.com/acrob01.html](http://www.tinaja.com/acrob01.html). One good Acrobat newsgroup is *comp.text.pdf*. One of the many sources for free Acrobat readers is [www.adobe.com](http://www.adobe.com). Extensive free technical notes and development kits are also offered.

Finally, web page design help is found at [www.tinaja.com/info01.html](http://www.tinaja.com/info01.html).

Let's hear from you. **NV**

**M**icrocomputer pioneer and guru Don Lancaster is the author of 35 books and countless tech articles. Don maintains his no-charge US tech helpline found at (520) 428-4073, besides offering all of his own books, reprints, and consulting services. Don also offers a free catalog full of his unique products and resource secrets. The best calling times are 8-5 on weekdays, Mountain Standard Time.

Don is the webmaster of his Guru's Lair found at <http://www.tinaja.com/tinaja>. Full reprints and preprints of all Don's columns and ongoing tech support appear here. You can reach Don at Synergetics, Box 809, Thatcher, AZ 85552. Or send any messages to [don@tinaja.com](mailto:don@tinaja.com).

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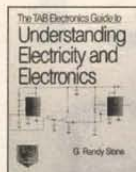
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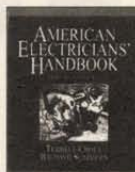
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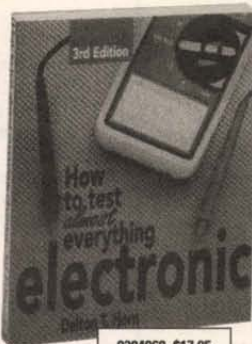
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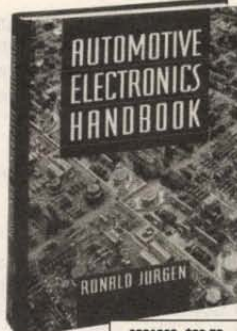
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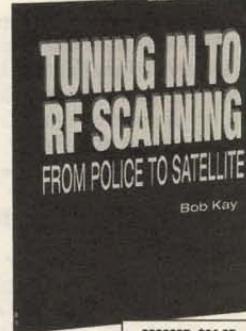
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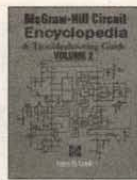
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# ELECTRONICS

## Q & A

With TJ Byers

In this column, I answer questions about all aspects of electronics, including computer hardware and software. This column doesn't replace the Tech Forum that you've grown to love and support. Instead, it will supplement it, so feel free to participate as always with your questions and answers. You can send your questions to me by E-Mail at [q&a@nutsvolts.com](mailto:q&a@nutsvolts.com), or by snail mail at Nuts & Volts Magazine, 430 Princeland Ct., Corona, CA 91719.

### What's Up:

What happens to your PC in the year 2000? Parallel printer port tester. This month's fun circuit is an IR model train detector. Then there are the usual fixes: a broken fax power supply, two broken scopes, and more on refueling toner cartridges. A great Reader's Tip on upgrading to Win 95 and a WinWord question. Finally, do you need an atomic clock?

### Refill, Refurbish, or Refuel?

**Q.** I own a Canon PC-7 copier that uses an A-30 cartridge, and I, too, would like to refill my own copier toner cartridges as you suggested in the Mar. '98 issue. When I called Global Computer Supplies for a refill kit, though, I struck out. They didn't seem to have a toner kit for my machine/cartridge. Would any of the many, many sizes and brands of toner refills sold at Staples or Office Max be okay to use? Can you suggest another source?

Ping Chun KH6ALN  
via Internet

**A.** I'm sorry, but I think you read my answer wrong. I <don't> encourage all readers to refill their toner cartridges. There's a lot more to recharging a toner cartridge than just adding new "ink." Many cartridges have internal parts that need to be replaced, too. And while the refurbishing kits contain these delicate components, the fix can be tricky. That's why most suppliers limit their sales to companies and not individuals. Yes, Global Computer Supplies (1-800-845-6225; <http://www.globalcomputer.com>) has refill kits for select cartridges, but certainly not all. So in answer to your question, the refills sold by Staples and Office Max won't work. These are toners for floor-model copy machines. I did a search for refurbishers for your particular A-30 cartridge and discovered a wide range of prices from \$50-\$120. Now that you're properly warned about the dangers, if you still want to do it yourself, I located a vendor (Morack, 708-598-0580; <http://www.mallbox.com/morack/cartridge.html>) who sells a A-30

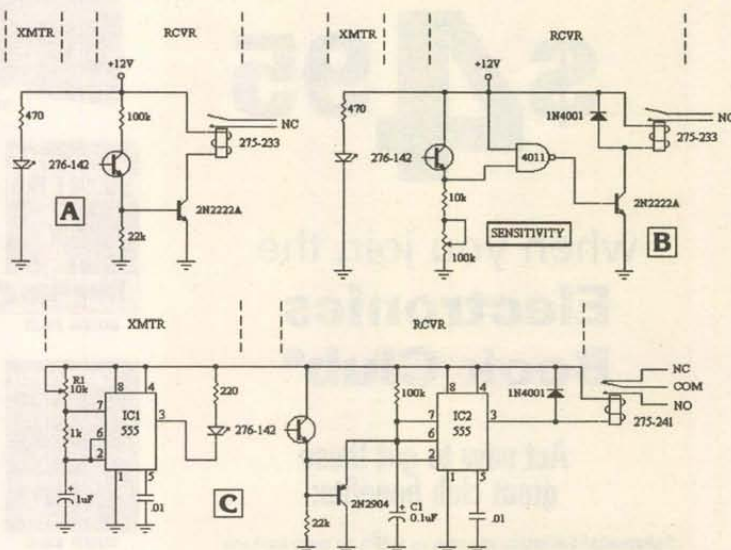
refill kit for \$19.95. Although I talked to a salesperson, I haven't seen it, so caveat emptor.

### Choo Choo Sensor

**Q.** In the model railroad hobby, detection of a train at a certain point is important. I need a simple and cheap IR detector that can operate a 12-volt relay over a distance of up to 8 inches when the train passes by. It doesn't have to latch, simply trigger when the IR is blocked.

Walter Bringsauf  
Towaco, NJ

**A.** That simple? Sure. You can find all the parts you need at your local Radio Shack. Because it's small scale RR, you'll want to use small emitters and detectors, like the Radio Shack 276-142. This is a matched pair that measures just 1/4-inch in diameter. When the phototransistor detects an IR source, it conducts; when the beam is broken, it stops conducting. The touchy part is the ambient light which can overwhelm the sensor, so I'm serving up a medley of circuits for you to choose from.



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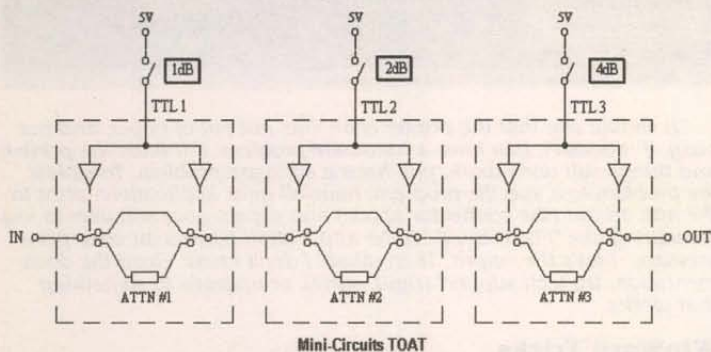
The simplest circuit is shown in drawing (a), which consists of a phototransistor in a Darlington configuration. When light strikes the IR sensor, it forward biases the 2N2222A transistor and activates the relay (a small reed relay that consumes only 11mA of current). When the IR beam is broken, the relay drops out and the relay contacts open. This is the most sensitive design and the smallest. Circuit (b) uses a 4011 NAND logic gate for the detector. When both inputs are high (i.e., when IR light is present), the output is low and 2N2222A is off. When the light beam is broken, the output goes low and the relay pulls in, closing the contacts. The circuit has the advantage that you can adjust the sensitivity and it draws virtually no current in the standby mode — plus there are three spare logic gates you can use for whatever you wish. The final circuit (c) is the most resistant to ambient light because it uses a modulated light source. IC1 is a simple 555 pulse generator driving the LED emitter (R1 adjusts the pulse rate). The heart of this circuit, though, is IC2, which is best described as a missing pulse detector. This circuit is sometimes used to detect relay chatter. The circuit is a one-shot monostable that's constantly triggered by the incoming IR pulses, which resets the multivibrator before C1 times out. If the beam is broken, pin 3 goes low until a new input pulse arrives. To calibrate the circuit, adjust R1 until the relay drops out (you may have to juggle the value of R1 to get the proper response). Have fun!

### Switched RF Attenuator

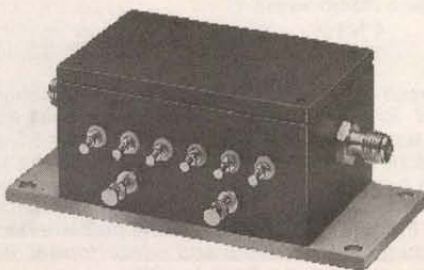
**Q.** I'm trying to find a switchable passive 75-ohm RF attenuator. This device existed many years ago and was intended to help CATV installers determine the attenuation required (CATV signals are always greater than the normal TV set can handle), after which a fixed attenuator could be inserted in the line. It was a small rectangular box that had a connector at each end and a row of toggle switches along one side. I believe the switches were arranged in a 1-2-4-8 decibel sequence so it could be switched in 1dB increments (there may have been a 16dB switch as well). If you know where such a device can be obtained, I'd greatly appreciate it.

**Michael George**  
via Internet

**A.** Step attenuators, as they're called, are available from **Pasternack Electronics (714-261-1920)** and **Pascall Ltd. (<http://www.pascall.co.uk/rpage2.htm#ManSw>)**. Some are portable, others are desktop size. Expect to pay \$200-\$500 for one. Most of today's step attenuators, though, are digitally controlled PIN diodes housed in an IC package (e.g., Mini-Circuits TOAT series) that you can buy for as little as \$60.00. They work on the same principle, but instead of a switch you apply a five-volt signal to "dial-in" the wanted attenuation. Of course, you don't have to use logic gates; switches can be used, too, as I've shown below.



These ICs can be cascaded in series to give you as much attenuation as needed. You can buy digital attenuator ICs from Mini-Circuits (1-800-654-7949; <http://www.minicircuits.com>) and M/A-Com (Allied Electronics, 1-800-433-5700; [www.allied.avnet.com](http://www.allied.avnet.com)). If you're uncomfortable with building RF circuits from scratch, Mini-Circuits also makes a cased step attenuator for a few bucks more (\$90.00) with BNC connectors on each end and the attenuation taps along the sides.



### Scope Manuals

**Q.** I bought two Tektronix analog oscilloscopes at a company auction. One of them, a 422 dual-trace portable, worked and the other one didn't. However, it seems my son turned on the 422 and left it on for a week or so before I caught it. Now it doesn't work either. I don't know whether it's a simple problem or if its little brain is fried. I'd like to get both fixed, or at least diagnose the problems. I talked to the people at Tektronix and they want \$290.00 just to open the thing up. I assume repairs are probably going to cost extra. Have you any suggestions as to a book or manual that I could use to explore the repair of these two instruments? Also, are you going to do an article in *N & V* on the repair of monitors? I thought that I read somewhere that you had one planned.

**Kim D. Port**  
via Internet

**A.** Let's take it one step at a time. First, the \$290.00 that Tektronix quoted is a flat fee, parts included. However, you can buy a refurbished 422 any day of the week for \$250.00, so it's not a good deal. **"Mr. Scope"** (Bob Garcia, 845 Fairfield Drive, Marietta, GA 30068-2619, 770-977-5701) is a retired Tektronix engineer who repairs scopes at remarkably good prices. His typical repair costs for a 60-MHz transistorized Tek scope with calibration is about \$125.00. Now if you think you can do it yourself, there are several places you can buy Tektronix manuals, all of which include a large troubleshooting section. Here are the best.

**Bob Lee**  
**R5-D3 Electronic Surplus**  
Portland, OR  
Tel: 503-774-6560

**Ed Matsuda**  
**Test Equipment Manuals**  
P.O. Box 390613  
San Diego, CA 92149  
Tel: 619-479-0225

**Deane E. Kidd W7TYR**  
27270 S.W. Ladd Hill Road  
Sherwood, OR 97140  
Tel: 503-625-7363

**Manuals Plus**  
P.O. Box 549  
TAD #601  
Tooele, UT 84074  
Tel: 801-882-7188

**Linda Perkins**  
**Manual Merchant**  
E-Mail: [linda\\_p@ix.netcom.com](mailto:linda_p@ix.netcom.com)

I've talked with many of these people over the years and they know their stuff. If they don't have what you want, they can direct you to someone who does (old Tek products have an almost cult following). Some prices are better than others (some manuals are originals; others are copies) so it pays to shop around. Finally, there's an excellent book, *"Oscilloscopes: Selecting and Restoring a Classic,"* by Stan Griffiths (E-Mail: [W7NI@teleport.com](mailto:W7NI@teleport.com)) that's a must for the serious hobbyist's book shelf. As to the article on monitor repair, we ran one in Nov. '97 written by Don Doerr. For now, I'm on hold.

### Needs A Fax Fix

**Q.** I have an Omnifax G77 fax machine with a crippled power supply. Most of the voltages can be confirmed with a DMM, but what appears to be the high-voltage portion is dead. The fuse is okay, so I must have an open circuit somewhere, but have been unable to successfully trace it. The high voltage to the switching circuit appears to be 167 volts. Can you offer any suggestions?

**Charlie Higginbotham**  
via Internet

**A.** Well, let's analyze the situation. You say MOST of the voltages are right, so I assume you have a solid +5V output. That tells us that the switching transistors are working, as is most of the power supply. This observation is reinforced by the fact that your line input voltage measures 167 volts. So the only thing left is that the rectifier diode(s) in the missing voltage are dead. Now, I don't know the specs of this particular power supply, but there may be a burned (open) resistor in that voltage line, too. Before I'd start tearing the power supply apart, though, I'd check for a cold solder joint on the fax board. Sometimes the voltage has a bridge from the top to bottom of the board, and a bad solder connection can easily cause the symptoms you describe — especially where the power supply plugs into the "motherboard." The first cure is to apply heat to the suspect solder joints, then plunge into the power supply if that doesn't fix the problem.

### WWVB

**Q.** In Germany, I recently purchased an inexpensive small plastic "alarm" clock with an interesting feature. Once a day it would tune to a frequency which broadcasts a time reference, and then reset its time according to the received time standard. When it couldn't receive, it just uses "dead-reckoning" until such time as it could successfully receive the time data. The manual says it can receive the time signal up to 1500 km or more (about 1,000 miles) from the transmitter. Moreover, it runs on two AA bat-



teries. **QUESTION:** Do we have these clocks and time reference here in the US? I think I've seen a similar product advertised for sale in this country, but it was quite expensive (\$100.00 or more; I paid a small fraction of that in Germany). If so, can you suggest any info on the frequencies involved, and data formatting?

**Steve Roberts  
via Internet**

**A.** What an interesting question! I wasn't aware of this time standard, but as it turns out it's a very-low frequency (VLF) signal (77.5 KHz) derived from the PTB (Physikalisch-Technische Bundesanstalt) atomic clocks. The DCF77 carrier is modulated by a pseudorandom binary sequence that's sent twice each second. The clock frequency of the binary sequence is 645.833 Hz. Quoting from the DCF77 standard, "The timecode is encoded in the sequence by inverting the sequence or not. Not inverted sequence corresponds to a 0 bit. The sequence is alleged to be generated by a nine-bit shift register which is coupled back on positions 5 and 9. The polynomial might be:  $x^9 + x^4 + 1$ ." I'll post the standard on our Web site (<http://www.nutsvolts.com>) under the name DCF77.TXT. The transmitter is located slightly southeast of Frankfurt, and has a power of just 50 KW, which means your alarm clock won't work on this continent.

The closest thing we have to this service is WWVB. Broadcast on 60 KHz from Ft. Collins, CO, this VLF signal contains imbedded clock signals similar — but not identical — to those of DCF77. My research shows that this service is in its infancy, but in time should evolve into something like DCF77. At the moment there are only a handful of WWVB products on the market, and they're not cheap. However, the US clock products you're thinking about get their timing from WWV or WWVH, two shortwave stations. WWV broadcasts on 2.5, 5.0, 10.0, 15.0, and 20.0 MHz from Ft. Collins, CO and WWVH broadcasts on 2.5, 5.0, 10.0, and 15.0 MHz from Kauai, HI. Both stations broadcast precise one-second time intervals and complete time information in coded form in UT1 and UTC (Universal Time) time scales. And, yes, you're right about the price. Most NIST (National Institute of Standards and Technology) clocks sell for about \$80.00. The WWVB clocks should sell for a lot less.

I know this is elaborating the point, but while I'm on the subject of time and date, let me point out a free NIST service, called Automated Computer Time Service (ACTS), that lets you set your computer clock to the exact nanosecond. Using ACTS requires only a modem and some simple software, like WINACTS (Windows) or PCTIME (DOS) provided by NIST. You can find both programs on our Web site. When a computer connects to ACTS by telephone, it receives an ASCII time code. The information in the time code is then used to set the computer's clock.

## Parallel Port Problems

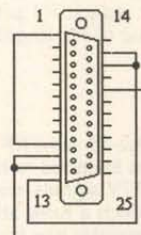
**Q.** In September, I purchased four 200 MHz Pentium computers. Over the months, three of them have stopped printing on the parallel printer port, which is odd because the computers were purchased from different vendors. I can print on the serial COM1 port, however, when the LPT1 port is selected, the printer problem message is returned. Is there a specific chip that handles the parallel printing chores that I can replace? I have done the usual diagnostic testing including changing printers, printing from my lap top, reloading the drivers, checking printer cables etc. I am operating from overseas. Calls to the vendors have not been successful, and at \$7.00 a minute is very expensive. I cannot ship the units back to the USA

for reasons also associated with costs and bureaucratic import/export red tape problems. Any help, or suggestions that you can provide will be greatly appreciated.

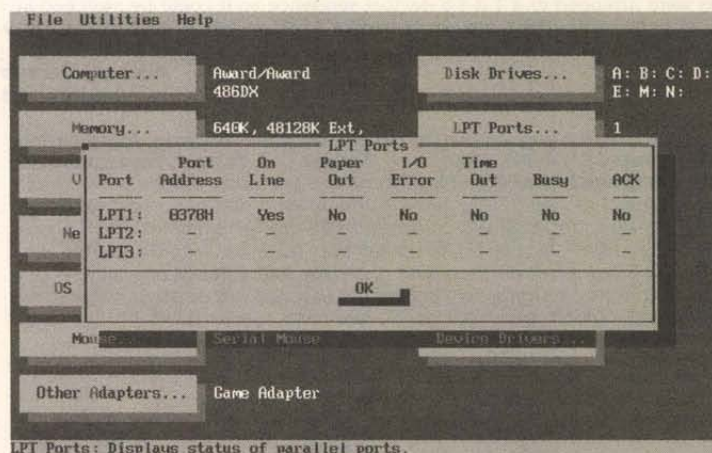
**Gordon White  
Cote D'Ivoire**

**A.** Think about it. You have four PCs with nothing in common. That is, they came from different vendors and the likelihood of them having an identical motherboard is slim. Even if they use the same printer I/O chip, what's the chance that three of the four would fail within months? So that narrows down the search to software — the common denominator. Now, I don't know how long you've been in your part of the world, but I can tell you there's a thriving bootleg software market in both Europe and Asia, and with you being on the west coast of Africa, your software probably comes from one of these sources. Mostly, the software bandits get around US patent laws by changing a couple of lines of code. It could be this code change that's causing your problem. Here's an easy way to check it out. Wire up a printer port test connector like the one shown below.

WIRING TABLE		
1	to	10
11	to	18
12	to	18
15	to	13
16	to	13



Plug this adapter into the printer port and type MSD (you can find a copy of MSD.EXE on our Web site) from the DOS prompt. If necessary, reboot your system from a DOS floppy and navigate to the DOS directory. The MSD utility surveys the system's hardware and its current status. Select the parallel port option and see if the PC recognizes a printer.



It should say that the printer is on-line, not out of paper, and not busy. If it doesn't, you have a hardware problem. If it finds the printer, and things still don't work, you have a software problem. To isolate the problem to a specific program, have all your applications print to the null printer (the connector above) and expect your software to say something like "File Printed." If the application returns an error print message, that's the culprit. Then what? I don't know. Read the documentation, try tech support (right, sure!), or upgrade to something that works.

## WinWord Tricks

**Q.** I've used Word for Windows 6.0 (WinWord 6.0) for many years and ran across something I can't correct. Yes, I'm an expert wordsmith, and know my way around this program. But last night I downloaded a WinWord page that sent me into a tailspin. All of the sudden my work space shrank to almost nothing. I had borders here, there and everywhere — hardly any working space — I'd guess about 1/4 my original screen! I went into View to correct it, but to no avail. I suspect a virus. Do you know which one it may be? Maybe a Macro virus?

**BigBoy  
via Internet**

**A.** No, you aren't infected. It's simply a formatting change caused by the download. To restore your previous format, look in the upper right corner of the screen sheet. If you're using Windows 95, you'll see three icons, an underline, a square, and an X. Click on the square, which now becomes two smaller squares and enlarges the work area. If you use Windows 3.1, the sizing icons are the up and down arrows. It's also possible that your attempts to fix the problem have created others, so pull down the View menu and select Normal. If you played with the Zoom setting, put it back to 100%.

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# SECURITY ELECTRONICS SYSTEMS AND CIRCUITS

## — Part 6

by Ray Marston

Ray Marston looks at anti-burglary and burglar alarm principles in this month's episode of the series.

The best known and most widely used type of electronic security unit is the 'burglar' alarm, which is designed to detect burglars attempting to break into protected premises, but lets authorized individuals roam freely within those premises, and to easily enter or leave their perimeter zones.

To be really effective, burglar alarms must be used in conjunction with various physical defenses/deterrents and with reliable locks, latches, and security windows, and their sensors and sirens must be located to give the best possible security to the individual premises that are being protected.

Note that the main goal of an anti-burglary security system is that of deterring potential burglars from even trying to break into the defended premises; the burglar alarm is simply a back-up to that system and is thus of value only if the main deterrent security system fails in its task.

To get the best value from any burglar alarm, the user must first learn the basic principles of anti-burglary protection, and must then use that knowledge to convert the basic burglar alarm into a device that gives a performance that is tailored to suit some specific security application.

This month's episode of the series gives a concise outline of these various principles; next month's episode will show a variety of practical build-it-yourself domestic-type burglar alarm and accessory circuits.

### ANTI-BURGLARY BASICS

#### THE BURGLAR

A burglar is a person who forcibly enters houses or other premises with the intention of theft. To be burglarized is a vile experience.

At best, the burglar may be a professional who will enter your home and steal many of your personal possessions, some of which will have a sentimental value far in excess of their insured monetary cost. The next day that same burglar will probably sell those precious goods for a trivial amount of money, and then go and rob someone else.

At worst, your burglar may be a demented amateur who enters your home with a heart full of hate, intent on stealing your cash and destroying or desecrating everything else. He will slash your furniture and clothes, urinate on your bedding, smear excrement and paint on your walls, and try to smash or burn everything else. This type of burglary is so repulsive that many victims never recover from the psychological damage caused by the experience.

Your vulnerability to burglary is greatly influenced by the location and nature of the premises in which you live or work,

and by the security precautions that you take to protect those premises.

In all advanced Western countries, annual burglary totals are proportional to national population figures and are typified by those of the UK, which has a total population of about 56,000,000.

In the UK, the annual total of burglaries in the 10 years up to 1997 averaged about 900,000, of which approximately 400,000 were domestic burglaries.

Of these domestic incidents, almost three-quarters involved actual physical forced entry, and more than a quarter were walk-in burglaries in which the intruder entered the premises via an unlocked door or window or — in a small number of cases — by using a carelessly hidden spare front door key.

For security purposes, all private premises can be regarded as defensible fortresses (houses or other buildings) that are surrounded by defensible outer border zones (private land, with outer fences and hedges, etc.).

No burglar can reach your private fortress without first passing through at least one of its outer border zones, which thus form your first and most important anti-burglary defense areas. If you use these areas sensibly, you will deter most burglars from even trying to break into your house.

Figure 1 and the next two major sections of text help illustrate some of the basic defense principles of these areas, specifically applied to medium-sized houses of the types found in many suburban areas.

#### FRONT OUTER BORDER DEFENSE ZONES

Most burglars make an unobtrusive visual study of a building by walking or driving casually past it to determine whether or not it seems an easy or a not-worth-the-risk target for burglary. Their main goal is to get into and out of the premises unobtrusively so, therefore, they like houses that have their front gardens enclosed by high shrubs or bushes, or are shrouded in darkness at night, or seem to be unoccupied, or have no obvious anti-burglary protection.

Most potential burglars can be scared off by taking simple precautions such as fitting the building with time switches that automatically operate house lights at various times, or by leaving a radio switched on when the house is empty, or by fitting a real or

Figure 2. Diagram showing various burglar deterrents used in the front outer border zone of a semi-detached house.

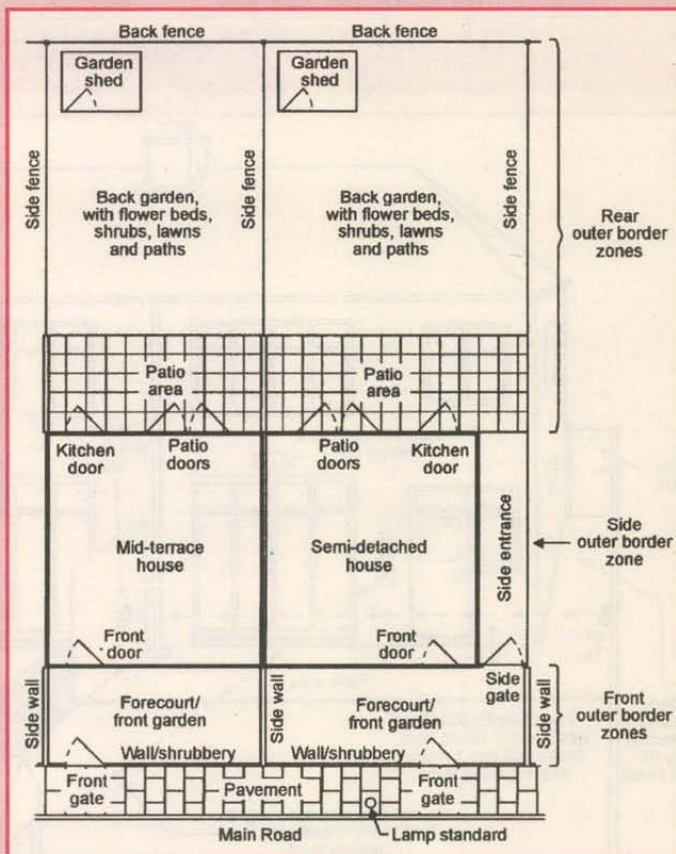
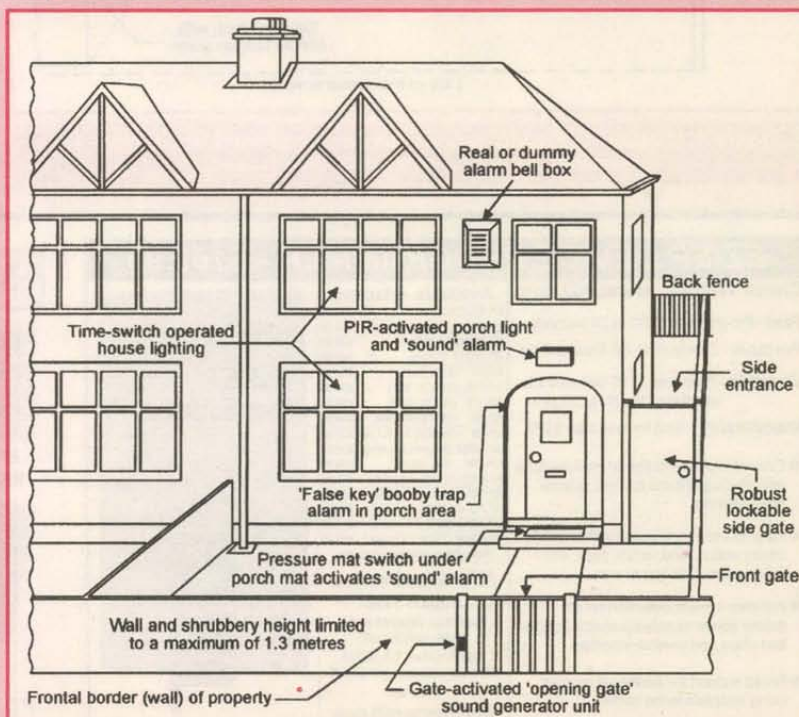


Figure 1. Diagram showing the outer border defense zones of typical UK-style mid-terrace and semi-detached houses (see text).





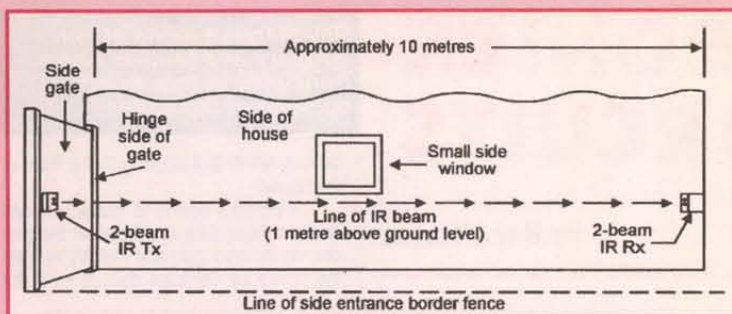


Figure 3. Diagram showing basic arrangement of an IR light-beam side entrance defense system.

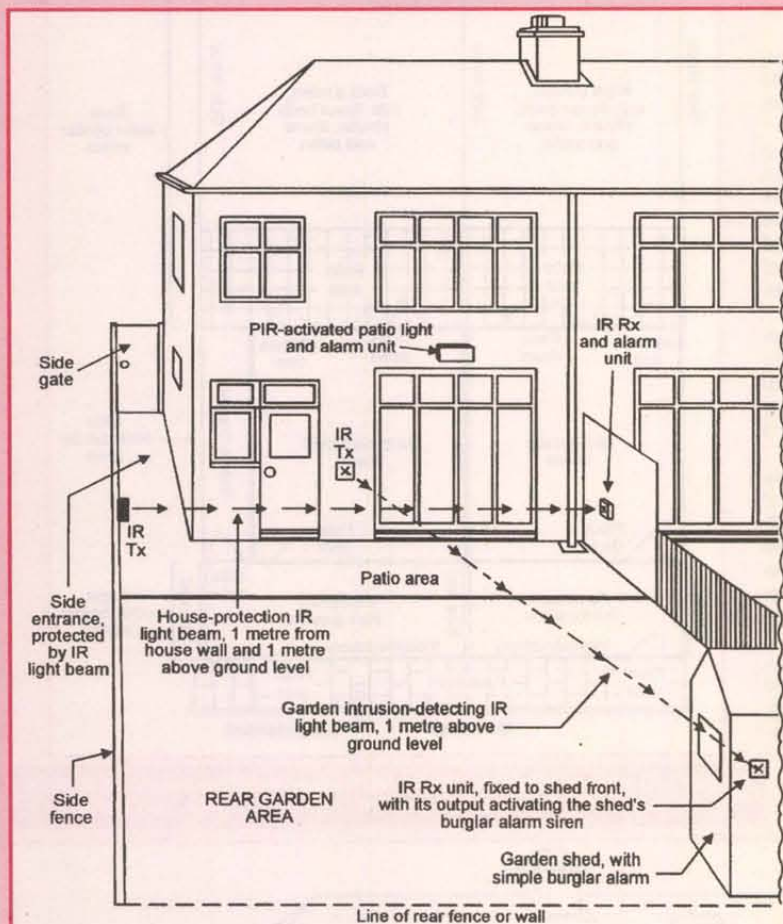


Figure 4. Diagram showing various burglar deterrents used in the rear border zone of a semi-detached house.

house has a side entrance — by forcing the side gate and then entering the house from the rear.

Burglars know that some people hide a spare front door key in or near the porch when they leave the house, and burglars often make a quick search for such a key. You can take advantage of this fact by making a simple 'false key' booby trap that activates a self-latching alarm if a dummy key or some other object is briefly moved.

Thus, basic rules for protecting the house against frontal attack are as follows, and are illustrated in Figures 2 and 3:

(1) Limit all front garden shrubbery to a maximum height of 1.3 meters.

(2) If your house front is poorly lit at night, fit it with an automatic PIR-activated porch lighting system.

(3) If your front gate is a self-closing type, fit it with a device that generates a distinctive sound as the gate is opened.

(4) If your front porch is not fitted with automatic PIR-activated lighting, place a hidden pressure mat switch in the porch and use it to activate a bell or other warning device when anyone treads on it.

(5) Deter burglars by fitting a real or dummy alarm bell box to the front of the house, by fitting the house with time-switch operated lighting, and by leaving a radio turned on when the house is unoccupied.

(6) Fit a simple 'false key' booby trap in the porch area.

(7) If you have a side entrance, fit it with a robust and lockable gate at its house-front end. Fit the side entrance with some type of intrusion-detecting alarm device that will activate if any unauthorized person enters the side entrance (even if they do so by climbing the gate), but will not be activated by cats, etc.

House side entrances have a typical length of about 10 meters and are best defended by a PIR alarm fitted with a 'corridor' type of lens, or by an IR dual 'light beam' alarm of the type described in Part 5 of this series. Figure 3 shows the basic arrangement of a suitable two-beam IR light beam alarm system.

In Figure 3, the IR dual-beam

transmitter (Tx) is fixed to the side gate — near its 'fence' edge — and is aimed diagonally along the length of the side entrance, at a height of about one meter, towards the IR receiver (Rx) unit, which is fixed to the house wall at the far end of the entrance. Thus, the beam's Tx to Rx contact will be broken if the gate is opened, or if any adult person moves along the side entrance when the gate is closed.

## REAR OUTER BORDER DEFENSE ZONES

Three-quarters of all house break-ins occur at the back of the home (where the burglar is least likely to be seen), usually via a window. To reach the house, the burglar must cross the garden and patio areas, and usually reaches these by climbing a back or side fence or via a side entrance; homes with rear access via a shared passage or driveway are very vulnerable to this type of break-in.

Once a burglar has entered one garden, he can easily gain access to adjacent houses by climbing over their side fences, sometimes breaking into several houses or their sheds or garages in a short space of time. Thus, basic rules for protecting homes against attack from the rear are as follows, and in some cases are illustrated in Figure 4:

(1) Burglars treat garden sheds and garages as valuable sources of tools and equipment for the break-in and for later sale, and often break into them before attacking the actual house. Thus, always fit your shed and garage with a simple battery-powered burglar alarm that activates a loud siren and a light strobe if not disabled (via a secret switch) within about 20 seconds of opening the shed/garage door.

(2) If you keep a ladder in the rear defense area, wire it to a simple 'loop' alarm, so that the alarm sounds if the ladder is forcibly moved.

(3) If your home has rear access via a passage or driveway, protect the top of your back fence/wall with barbed wire or in some other way.

(4) It is not practical to protect side fences against a burglar who wants to climb over them. Usually, however, the burglar is climbing them to reach the back of your house via the patio area, which can easily be protected via a PIR-activated flood-light/alarm unit or an IR light-beam alarm unit that is aimed along the back of the house a meter or so above

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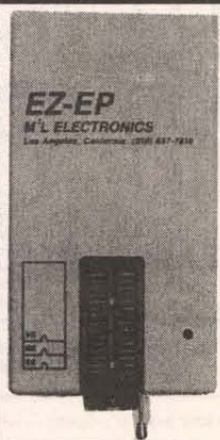
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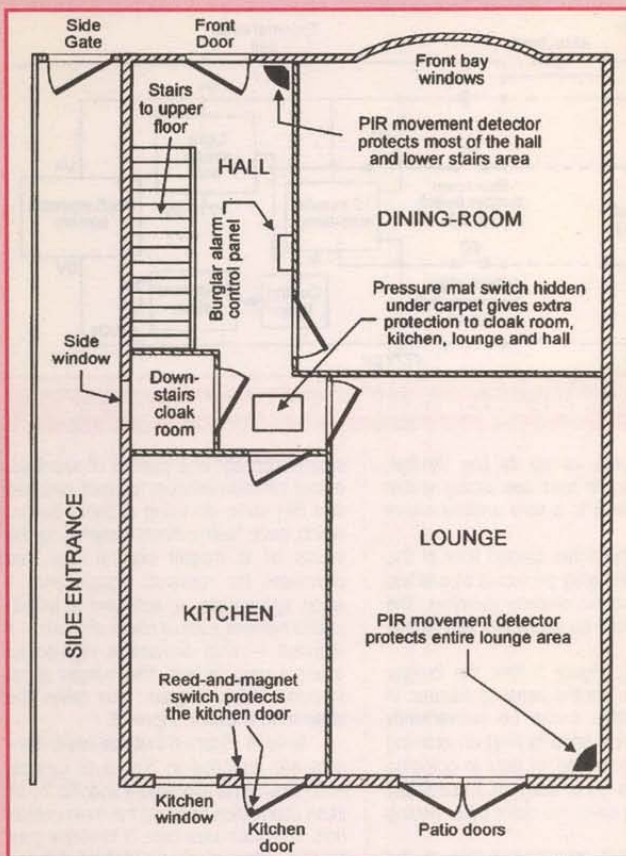


Figure 5. Ground floor plan of a semi-detached house, showing suitable positions for anti-burglary defenses.

ground level, as shown in Figure 4.

If an IR light-beam is used, it must be positioned so that its beam cannot be broken by carelessly placed patio furniture or by growing shrubbery.

(5) Sometimes the burglar may climb your garden fences to reach an adjacent property. You can detect this type of intrusion with an IR light-beam alarm unit that is aimed along the length of the garden, between the house and the garden shed (see Figure 4).

(6) If your house has a shared side entrance that leads to a pair of garages, mount a cheap dummy TV camera (with a built-in flashing LED that is powered from a remote battery) in a hard-to-reach position on the apex of the garages, aiming it along the entrance so that it is clearly visible from the street, as a burglar deterrent.

## FRONT-DOOR ROBBERS

The easiest way to get into someone's house is to simply knock on the front door and, when it opens, either barge or trick your way into the premises. Small-time crooks (including small children) often use the latter technique to carry out petty robberies, typically arriving as a pair and getting into the house on a flimsy pretext such as using your phone to make an emergency call, or asking for a glass of water, etc. One of the pair then keeps you busy with idle chit-chat while the other person searches the house for loose cash and trinkets. The basic rules for protecting yourself against this type of robbery are as follows:

(1) Fit your front door with a security chain, and never unhook it unless you are sure it is safe to do so.

(2) Buy a fixed or mobile self-latching panic-button alarm, and keep your finger on its button whenever you open the front door to a stranger.

(3) Never allow anyone (including children) into your house unless you are absolutely sure it is safe to do so.

(4) Never, under any circumstances, allow two or more strangers (particularly

innocent looking children) into your house at the same time.

(5) Never, ever, under any circumstances, leave a total stranger alone in any part of your house; if they have the impertinence to ask to be left alone (to make a 'private' telephone call), immediately order them to leave the house and then inform the local police.

## THE HOUSE

If the would-be burglar has suc-

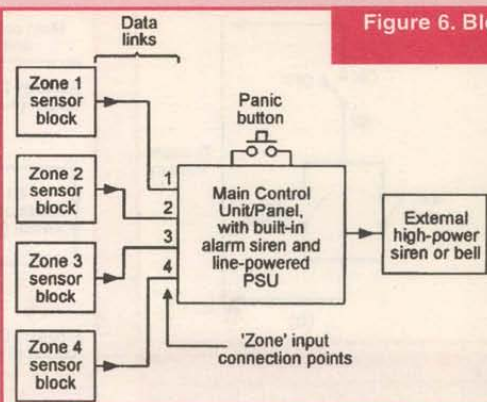


Figure 6. Block diagram of a basic burglar alarm system.

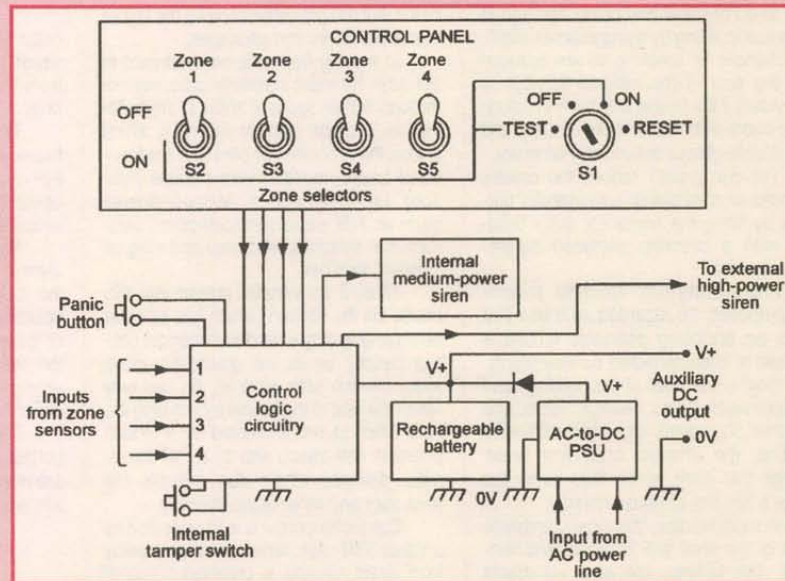


Figure 7. Typical basic form of a modern burglar alarm control unit and its control panel.

cessfully passed through your building's outer border defense zones, he will now

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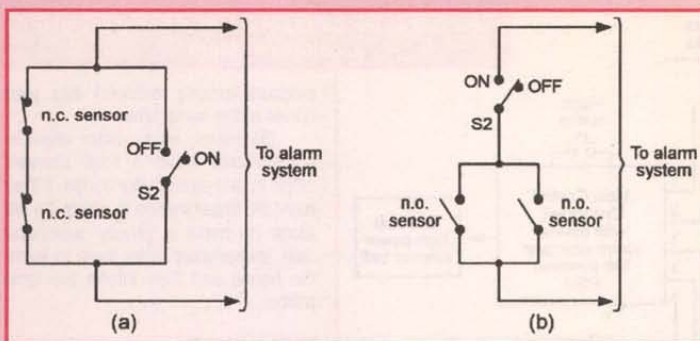


Figure 8. Method of enabling and disabling sensors switches via S2; (a) series-connected, n.c., (b) parallel-connected, n.o.

start to do physical and costly damage to the actual building by trying to break into it. His chances of breaking in are reduced (but the cost of the inflicted damage is increased) if the house is fitted with strong outer doors with robust locks/latches, and with double-glazed self-locking windows.

You can greatly reduce the crook's chances of committing a successful burglary by fitting the house (or other building) with a properly designed burglar alarm system.

Any building can, for crime prevention purposes, be regarded as a box that forms an enclosing perimeter around a number of interconnected compartments. This 'box' is the shell of the building, and contains walls, floors, ceilings, doors, and windows. To commit any crime within the building, the intruder must first break through this shell, which thus forms the owner's first line of house defense.

In most houses, the most vulnerable parts of the shell are its doors and windows, but ceilings are also vulnerable (often via a trap door and loft space) in some top-floor flats and apartments, and in many commercial buildings.

Once an intruder has entered the building, he can move from one room — or compartment — to the next only along

paths that are predetermined by the layout of internal doors and passages.

In moving from one compartment to the next, he must inevitably pass over or through certain spots or areas in the building, as is made clear in Figure 5, which shows the ground-floor plan of a medium-sized house, together with suitable positions for anti-burglary devices/sensors such as PIR movement detectors, pressure mat switches, and reed-and-magnet 'contact' switches.

Thus, if an intruder breaks into this house via the kitchen (which has its outer door protected by a reed-and-magnet contact switch), or via the downstairs cloak room (via the side window), he can only reach the rest of the house by entering the hall, which is well protected by a hidden pressure mat switch and by a PIR movement detector, which also protects the front door and most of the stairway.

The entire lounge is well protected by another PIR unit, which is aimed away from direct sunlight (a common cause of false alarms in PIR units), but will respond instantly if anyone enters the room via its main door or its patio doors.

The dining room is not individually protected, since it can only be accessed by its doorway (which is protected by the

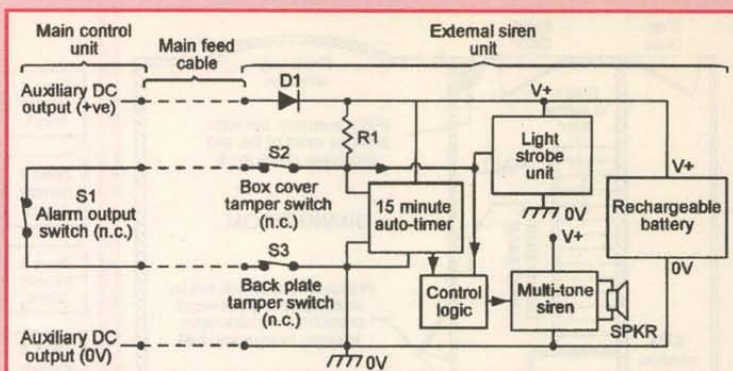


Figure 9. Block diagram of a high-quality external siren unit.

hall's PIR unit), or via its bay window, which (if the windows are clearly visible from the street) is a very unlikely attack point.

Thus, the entire ground floor of this house is adequately protected by just two PIR units and two detector switches. The upper floor can be protected with similar simplicity.

Note in Figure 5 that the burglar alarm's main control panel is situated in the hall, where it can be conveniently operated (via a security key) on entering or leaving the house, or prior to going up the stairs (to go to bed), or immediately after coming down the stairs (after getting out of bed).

The basic operating details of the burglar alarm system and its control panel are described in the next major section of this article.

## BURGLAR ALARM BASICS

### THE BURGLAR ALARM SYSTEM

Most modern domestic burglar alarm

systems consist of a number of switched-output intrusion sensors (contact switches and PIR units, etc.) and a 'panic' button, which have their outputs coupled to the inputs of a master control unit that processes the received signals and — when appropriate — activates a built-in medium-power audible alarm and can — if required — also activate a high-power external siren or bell. The burglar alarm system's block diagram thus takes the basic form shown in Figure 6.

Note in Figure 6 that the alarm sensors are arranged in blocks or groups, each of which is allocated a specific 'zone' input connection point on the main control unit. The basic idea here is to divide your property into a number of distinct defense zones, each of which can cover any desired area and can have its defenses enabled or disabled via the master control unit's control panel. Suppose that the house shown in Figures 1 to 5 is divided up into the following four defense zones:

Zone 1 = External defenses (shed, side-entrance, patio, and garden).

Zone 2 = Entire upper floor of the house.

Zone 3 = The ground floor, except the lounge and the hall pressure mat.

Zone 4 = The lounge and the hall pressure mat.

With this defense system, superb round-the-clock anti-burglary protection can be obtained by switching the zones in the following ways to suit the following circumstances:

When the house is empty, all four Zones should be enabled, thus giving total protection.

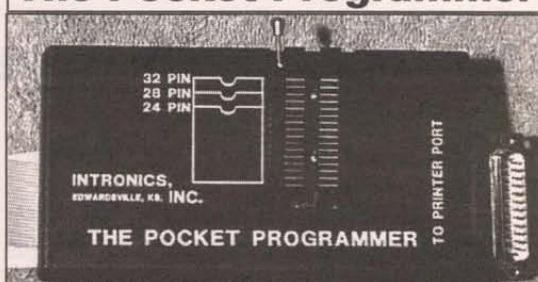
When the house is occupied during normal daylight hours, but the garden area is unused, only Zone 1 should be enabled. If only the garden and ground floor are in use, only Zone 2 should be enabled.

In the evening, if only the lounge is in use, Zones 1, 2, and 3 should all be enabled, thus protecting the occupier against the opportunist burglar who sneaks into the building while the family is watching TV in the evening. (Almost a quarter of all domestic burglaries occur when the house is occupied, with the occupiers either watching TV or asleep in bed.)

At night, when only the upper floor of the house is occupied, Zones 1, 3, and 4 should all be enabled.

Note that the 'panic' button is normally enabled even when all four Zones are disabled, thus giving the owner non-stop protection against thugs.

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## ENTRY/EXIT DELAY

In the basic type of system described above, the Zone 1, 2, and 4 defense circuitry sounds an alarm instantly if an intrusion is detected, but the Zone 3 defense circuitry (which defends the front door entry/exit and control panel areas) has built-in 'entry/exit' operating delays of about 45 seconds, thus giving the system's key-holder limited freedom to pass through the Zone 3 defense area (to enter or leave the house or to operate the control panel) without sounding the alarm.

This delay action is such that, when the owner enables Zone 3 via a key switch prior to leaving the house or going to bed, the Zone does not become active until the end of the 45 second 'exit delay' period; when the owner later passes through Zone 3 again to deactivate the alarm via the key switch, the Zone's sensors instantly detect the intrusion and activates a low-level 'warning' beeper, but only activates the main siren if the owner fails to reset the alarm (via the key switch) by the end of the 45 second 'entry' delay period.

Thus, the entry/exit delay facility gives the key holder reasonable freedom to move about the house without activating the main siren, but gives full protection against unwanted intruders who do not have a suitable key.

## THE MAIN CONTROL UNIT/PANEL

The main control unit is the effective 'heart' of the burglar alarm system, and can be managed via a control panel. In simple units, the panel enables the unit's main functions to be selected via a four-way master key switch (usually marked TEST, OFF, ON, and RESET).

Most modern control units take the basic form shown in Figure 7 and are powered from the domestic AC power lines via a built-in DC PSU that also provides an auxiliary DC power output.

The control unit should ideally also have a built-in rechargeable battery that is normally trickle-charged by the PSU, but takes over the PSU's main functions if the AC supply fails or is deliberately interrupted.

Modern control units usually have a built-in medium-power siren, plus a facility for activating a high-power external siren; ideally, the external siren should (to minimize the chances of generating publicly annoying false alarms) not activate until at

least 30 seconds after the built-in siren has activated, and must (to conform to local noise control regulations) turn off automatically after a maximum period of about 15 minutes. Most units also have a built-in 'tamper' switch that (except when the master key is set to the TEST or RESET positions) activates the built-in self-latching siren if the unit's case is opened.

The unit's control panel usually takes the basic form shown in Figure 7 but, in practice, often uses electronic keypad (rather than electro-mechanical) control switching.

In this diagram, key-operated switch S1 selects the unit's main functions, and toggle switches S2 to S5 allow individual defense zones to be enabled or disabled.

When S1 is set to the TEST position, the unit's tamper switch and the external alarm are disabled, and the internal alarm operates in the non-latching mode.

When S1 is set to the ON position, the system is fully active and the internal alarm operates in the self-latching mode.

When S1 is set to OFF, all four sensor zones are disabled, but the self-latching PANIC facility is fully active. If the alarm is activated in the self-latching mode, the alarm can only be turned off by first removing the cause of activation and then unlatching the alarm by moving S1 to the RESET position.

In traditional hard-wired alarm systems, the sensors that connect to the alarm's various 'zone' input points usually take the effective forms of contact switches, which can easily be enabled or disabled by the S2 to S5 toggle switches shown in Figure 7.

Figure 8 shows the connections for turning individual sections of the alarm sensor network on or off. Series-connected n.c. sensor networks can be enabled or disabled by wiring them in parallel with S2, as shown in Figure 8(a); the sensors are enabled when S2 is open, and are disabled when S2 is closed.

Parallel-connected n.o. sensor networks can be enabled and disabled by wiring them in series with S2, as shown in Figure 8(b); the sensors are enabled when S1 is closed, and are disabled when S1 is open.

## THE EXTERNAL SIREN/ALARM

The medium-power siren built into most modern control units usually drives an efficient piezo-electric output transduc-

er and operates at a fairly high audio frequency (typically 1.5KHz to 4KHz); this type of siren floods the house with sound, but such sound attenuates rapidly with distance.

Sirens designed for external use normally use an efficient horn-type loud-speaker as their output transducer and typically operate in the 800Hz to 1.2KHz audio range, which offers good long-distance acoustic coverage.

Both types of siren normally generate an attention-grabbing multi-tone (pulsed, warbled, or swept) sound, rather than a tiresome monotone sound.

External sirens are usually enclosed in a weather-proof bell-type alarm box that

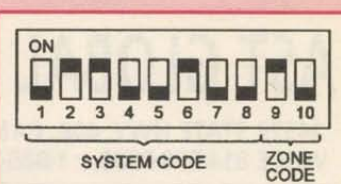


Figure 10. Block of 10 miniature switches built into each wireless sensor used in a low-cost wireless burglar alarm, to match the sensor's Tx 'system' and 'zone' coding to that used in the control unit's wireless Rx section.

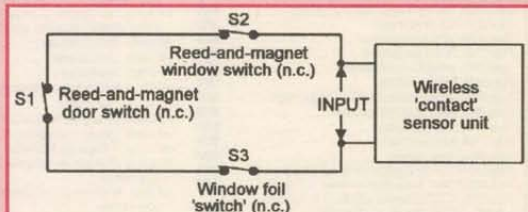


Figure 11. Example of three n.c. sensor switches loop-wired to the input of a single wireless 'contact' sensor unit.

is screwed to the house front. The box often incorporates a flashing alarm beacon that activates at the same time as the siren. Low-cost units of this type are usually powered via a multi-cored cable, from the auxiliary power output terminals of the main control unit, and can be disabled by simply severing the power cable, which must thus be protected by burying it in brickwork, etc.

High-quality external siren units, on the other hand, are self-powered and tamper-proof, and should (to conform to current design standards) meet the following basic design specifications:

- (1) The siren must be powered by an internal rechargeable battery that is automatically trickle charged in some way and has enough capacity to provide at least four hours of continuous alarm operation.
- (2) The unit must be designed so that the alarm is not triggered by a temporary failure in the trickle charging system, but will trigger if activated by the main control unit, or if the unit's main feed cable is cut.
- (3) The box must incorporate tamper switches that automatically activate the alarm if the box's cover is removed, or if the complete unit is forcibly removed from its fixing point (the wall).
- (4) The unit must incorporate a timing mechanism that automatically resets the siren (but not necessarily the beacon) after (typically) not more than 15 minutes of continuous operation.

Figure 9 shows the block diagram of a high-quality external siren unit that is powered by a built-in battery that is trickle charged via the control unit's auxiliary DC output terminals. This system is designed so that the control unit's 'alarm' output is connected to the siren unit's input via n.c. switch S1, which is loop-wired in series with the siren unit's two built-in n.c. tamper switches.

One of these (S2) is connected to the unit's box cover and opens if the cover is removed; the other (S3) is connected to the unit's back plate and opens if the unit is pulled away from the wall. Thus, the siren activates if S1 opens, or if the main feed cable is cut, or if the box cover is removed, or if the unit's back plate is torn from the wall.

If any of these conditions occur, the unit's built-in light strobe activates for the duration of the o.c. condition (or until the battery is exhausted), but the multi-tone siren (which is controlled by a 15-minute auto-timer and control logic) activates as soon as the o.c. condition occurs but resets again when the o.c. condition ends or — if the o.c. condition persists — after a maximum of 15 minutes.

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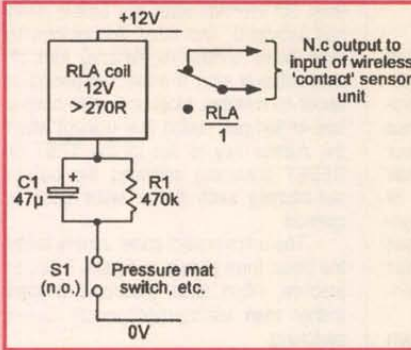


Figure 12. Simple adaptor circuit can be used to activate a wireless contact sensor unit via an n.o. switch such as a pressure mat type.

## WIRED VERSUS WIRELESS ALARM SYSTEMS

Modern commercial burglar alarm systems are usually microcontroller based, use a keypad type of control panel, and incorporate an event recorder that — if a break-in occurs — records the precise order in which the various defense zones are invaded. Such systems come in two basic types, being either 'wired' or 'wireless' systems.

In wired systems, all zone sensors (PIR movement detectors, contact switches, etc.) are cable wired to the main control unit which, in turn, is wired to the external siren unit. Such units are time consuming and (since they use lots of interconnection cable) messy to install.

In wireless systems, all major zone sensors incorporate a wireless Tx unit that communicates (via a coded 418MHz or 458MHz RF signal) with a matching wireless Rx unit that is built into the main control unit; the Tx unit signals to the Rx unit if an alarm, tamper, or low-battery condition occurs. Such systems are very easy and clean to install, but are considerably more expensive than normal wired systems.

All domestic wireless systems are provided with a key-fob style Tx unit that can be used to remotely set or unset the main alarm unit and to act as a 'panic' switch that can remotely activate the alarm siren at any time. Sensor units such as contact and PIR transmitters are battery powered (usually by a PP3 type battery) and — in approved designs — give at least six months of continuous operation per battery charge.

Such units are permanently active, can transmit pre-settable identification codes, have a built-in tamper switch that initiates a full alarm condition if the unit is illegally opened, have a low-voltage detector that warns of a failing battery condition, and incorporate sophisticated energy-saving circuitry that greatly extends battery life.

PIR units, for example, transmit a brief alarm signal as soon as an intrusion is detected, but then automatically go into a (typically) 60 second shut-down mode before becoming active again. This technique conserves power when a defended area is in normal 'zone off' use, but gives an instant intrusion warning if the zone is alarm-active.

Domestic-type wireless alarm systems vary greatly in price and performance. The cheaper systems usually provide a total of 256 possible identification

codes and only four sensor defense zones, to which the sensors can be individually matched by a built-in block of 10 miniature switches arranged as shown in Figure 10.

Here, switches 1 to 8 enable the sensor unit's eight-bit Tx 'system' code to be matched to that used by the system's RX unit (which can be pre-set by the owner), and switches 9 and 10 are used to allocate a two-bit 'zone' number to the sensor.

At the other end of the price scale, some systems offer 10- or 12-bit identification codes, and up to 16 defense zones (identified by a four-bit 'zone' code).

Note that, in wireless systems, the main control unit identifies individual sensors purely by their zone codes. Thus, if a sensor in (say) Zone 3 transmits a low-battery-voltage warning, the unit's control panel will display the fact. If only one sensor carries the Zone 3 code, the owner can quickly identify this particular unit and change its battery, but if several sensors carry the same code, the fault can only be traced by individually testing all of the Zone 3 sensor batteries.

Also note that wireless 'contact' sensors usually activate only when an n.c. input switch opens for a period of at least 200ms (this technique minimizing the chances of false alarming due to transient switching or signal pick-up); such sensors can be used with any desired number of n.c. sensor switches (reed-and-magnet switches, window foil, etc.) that are loop wired in the basic manner shown in Figure 11. They cannot be directly used with pressure mat switches, which are n.o. devices.

Figure 12 shows a simple relay-based adaptor circuit that can be used to activate a wireless contact sensor unit via a pressure mat switch or any other n.o. type of switch (or by any desired number of parallel-connected n.o. switches).

Here, 12V relay RLA has a coil resistance of at least 270R, and has one set of change-over (c.o.) contacts that have their n.c. pins wired to the input of the wireless sensor unit.

RLA's coil is wired in series with the 12V supply via mat switch S1 and the parallel C1-R1 combination. Normally, S1 is open, C1 is fully discharged, and the RLA/1 output contacts are closed.

If S1 now closes, a heavy pulse of current flows through RLA coil via C1 and S1, thus opening the RLA/1 output contact and activating the wireless contact sensor unit. If S1 remains closed, the RLA current rapidly decays to a very low value (determined by R1) and (after a few hundred milliseconds) the RLA/1 contacts re-open. When S1 opens again, C1 slowly discharges via R1 until — after a delay of a minute or so — the system can again be reactivated by closing S1. This circuit thus draws zero quiescent current, and draws only a few microamps of mean current if S1 is closed for long periods.

Next month's installment of the series will describe some wireless alarm system categories and various types of intrusion sensor, and will present a variety of hard-wired build-it-yourself burglar alarm circuits. **NV**







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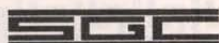


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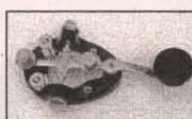
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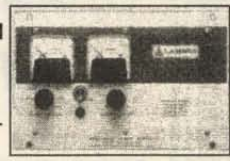


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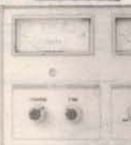


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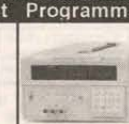
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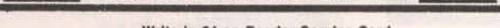
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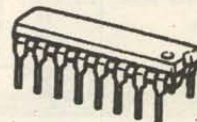
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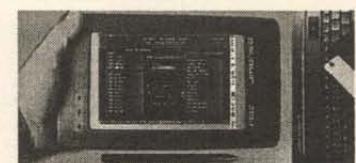


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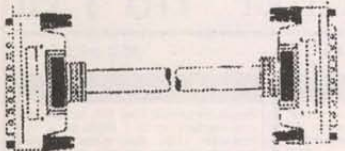
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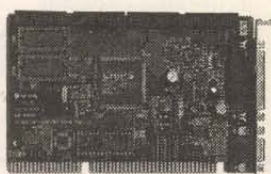
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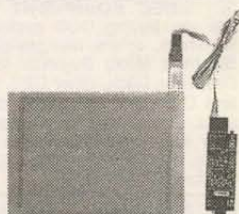
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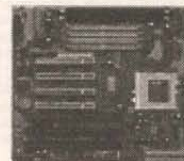
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Digital I/O - 12 I/O pins individually configurable for input or output. DIP switch addressable; stack up to 16 modules on same port for 192 I/O points. Turn on/off relays. Sense switch transitions, button presses, 4x4 matrix decoding using auto-debounce and repeat. **\$32**

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Home Automation (X-10) - Connects between a TW523 and your serial port. Receive/transmit all X-10 commands with your home-brewed programs. Full collision detection with auto re-transmission. **\$39**

Caller ID - Decodes the caller ID data and sends it to your serial port in a pre-formatted ascii character string. Example: \*12/31 08:45 850-863-5723 Weeder, Terry <CR>\*. Keep a log of all incoming calls. Block out unwanted callers to your BBS or other modem applications. **\$35**

Touch-Tone Input - Decodes DTMF tones and sends them to your serial port. Keep a log of all outgoing calls. Use with the Caller ID kit for a complete in/out logging system. Send commands to the Home Automation and/or Digital I/O kits using a remote telephone. **\$34**

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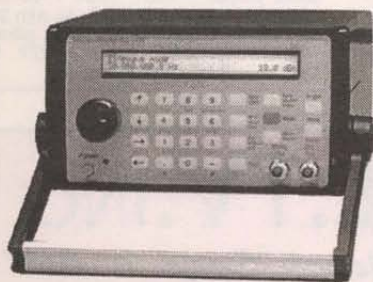
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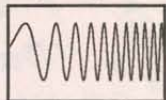
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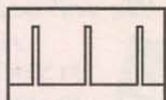
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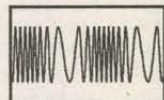
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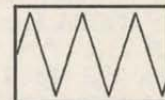
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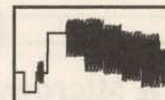
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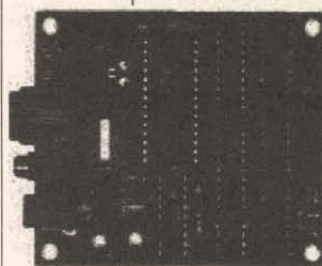
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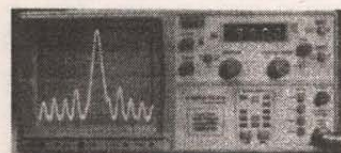
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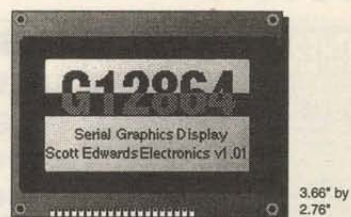
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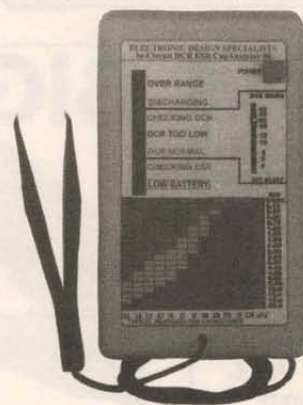
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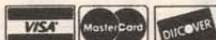
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Almost all surge protection devices use MOV's (metal oxide varistors) as their active element. MOV's are sacrificial/wear/limited life components. Surge suppressors based on this technology are doomed to failure. These surge "suppressors" also don't suppress a thing. They divert powerline surges equally to the ground and neutral wire. When you put current on the common ground wire of interconnected equipment some of that current will flow (through the inherent ground loops) to the data lines. This is a major cause of lock-ups and misoperations that plague today's computer environments. Another fact; all modern computers use switch mode power supplies. During surges the power supply capacitors must charge to the clamping level of the MOV before the MOV turns on. A recent study has shown that it takes a 3000A surge 15 microseconds (15,000 nanoseconds) to charge the typical capacitors of these power supplies to that level. The surge is virtually over before the MOV reacts. (See five things you probably don't know about your surge suppressor at [www.fivethings.com](http://www.fivethings.com).)

**THE POINT:** Standard surge suppressors allow too much current to hit the computer. Standard surge suppressors divert surge current to the ground wire and disrupt data transfer. Standard surge suppressors eventually fail without warning. Modern computers have logic voltage levels (the signals that transmit the data) and power supply voltages that are dramatically lower than that of their recent predecessors. Modern computers use integrated circuits with transistors of ever decreasing physical geometries. Modern computers are virtually always interconnected to other computers or peripheral equipment. The bottom line; *modern computers are much more sensitive and susceptible to powerline anomalies.*

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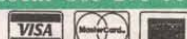
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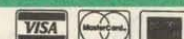
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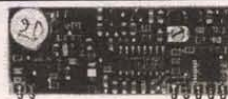
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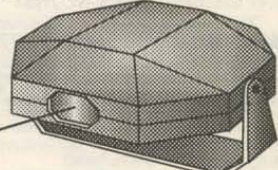
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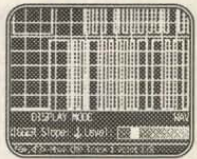
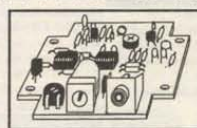
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NOTE: All TV Filter Kits are sold for educational purposes only. You must obtain permission from your local cable company before using these filters on your cable system.

DF-222 KIT \$14.95



**MOD CHIPS for Sony PlayStation.** Now your backups will work. Only \$14.95 ea. + \$3 shipping. Call 1-888-467-6150, all major credit cards accepted. Computers & components at wholesale prices. [www.cconusa.com](http://www.cconusa.com)

**SYNC-A-LINK UNIVERSAL VIDEO SYNC GENERATOR** restores all horizontal & vertical sync lines, DC level, compensates for inverted video, color phase, from standard or distorted analogue video-type formats. Comes complete with operations manual & 90-day warranty. \$160. 918-479-6451 or write to Sync-A-link Communications, PO Box 4, Locust Grove, OK 74352.

**UNIQUE VIDEO PRODUCTS:** Pattern generators with char. ID, color black, switchers, reference osc., distribution amps, video conversion, etc., kits also available. FREE catalog, GEKCO Labs, PO Box 642, Issaquah, WA 98027-6730, 425-392-0638, [www.gekco.com](http://www.gekco.com)

**BROADCAST VIDEO** equipment wanted: all types, new or old. Please call, Jon with info. 1-800-539-2859.

**1310NM InGaAsP DFB** long haul fiber-optic telecom lasers with optical isolator, integrated thermoelectric cooler and pig-tails, butterfly package, various manufacturers \$600. 207-493-3300.

**WANTED: TOP CASH/REWARD FOR YOUR DBX Sub-Sonic synthesizer!** Antique Video Transfer Service, 5001 Diamond Hts. Blvd., San Francisco, CA 94131-1621, 415-821-3359 fax 415-821-7500.

**SONY PLAYSTATION** mod chips allow you to play CDR backups & imports. \$50 ea. Quantity discounts. 1-800-663-8530.

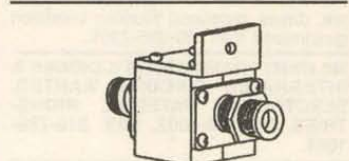
**HARD-TO-FIND tamperproof torx bits** (torx with hole). 7 piece set (T10-T40) for cable boxes, games, etc. \$8 set/2 for \$15. Postpaid, check/MO, John Hill, 5734 Vickie Dr., Winston-Salem, NC 27106. Fast turnaround!

**TFT COLOR LCD monitor:** 12VDC power, NTSC video input, built-in audio amplifier speakers. Display for car, boat, navigation, instrument, security. 4" panel 89,622 pixels \$199. 6.4" monitor with stand 224,640 pixels \$699. TV 2-60ch., cable 1-125ch. tuner and 6.4" display, remote control, FM modulation audio output \$799. Credit card accepted. Also whole line of CCD CAMERA, SECURITY products. E-Mail: [maxtron@earthlink.net](mailto:maxtron@earthlink.net) 1-800-266-5706 PCT.



**ANTIQUE VIDEO TRANSFER SERVICE** specializing in the transfer of any 2" quadruplex video tapes. Archive search and retrieval of: early to current quad TV spots, features, medical, corporate, military, government, and university tape libraries TRANSFERRED TO VHS. Fast, affordable, free estimate over the phone (general price quote). Phone/fax 415-821-7500. If no answer call 415-821-3359 or page 415-245-8700.

**CABLE TV**  
**JERROLD UNMODIFIED CONVERTERS FOR SALE.** CALL FOR BEST PRICES. NO DESCRAMBLER SALES. CALL BRLD ELECTRONICS 1-800-322-6316.



**EXPLOSIVE CABLE TV GRAB!** BRINKER ZAPPER/SNOOPER STOPPER combo module all in one! Buy wholesale factory-direct, no middleman. Let others get fined & zapped instead. 100% COMPATIBLE. Your order shipped NATIONWIDE immediately! LIFETIME GUARANTEE! VISA/MC/AMEX/COD/MO/CHECKS. ONLY \$10 (SPECIAL: 3/\$20 plus FREE DESCRAMBLER PLANS!). SUPER ZAPPER MODULES ONLY \$161 (3/\$33)! Use SUPER ZAPPERS if you have COX, TCI, WARNER in CA, TX, FL, NY, PA, MI. FREE SHIPPING. OPEN 24 HOURS! 352-429-5496 ext. 100. BRINKER ENGINEERING LABS, USA.

**DEALERS WANTED.** New product, new boxes. For all your other cable and accessory needs, please call 1-800-370-0801. All equipment carries a 1 yr. warranty and 30 day money back guarantee.

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**CATV REPAIR,** most models, great prices, warranty included. We sell equipment: Wavetek, model 1910-1405 oscilloscope 60MHz. Please call 619-563-6307, page 619-214-6148 or 619-999-5131.

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**PIONEER BA6110 Converters.** Unmodified. Excellent condition and guaranteed. \$79. Call 702-362-1010.

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All models: protection of short ckt, overload, reverse polarity, overvoltage; Constant Current & Voltage (CC/CV) fully adjustable. Regulation:  $\leq 0.1\%$  3mV (line)  $\leq 0.1\%$  3mV (load); ripple  $\leq 1$  mV.

#### SINGLE OUTPUT

PS-303 \$159.00, 30V/3A.  
PS-305 \$219.95, 30V/5A.  
PS-1610S \$289.00, 16V/10A.  
PS-2243 \$139.00, 12V/24V select, 3A.  
PS-2245 \$139.00, 12V/24V select, 5A.  
8107 \$399.95, 30V/10A.  
8110 \$289.95, 60V/3A.  
8112 \$399.95, 60V/5A.

Digital Voltmeter & Analog Ammeter  
8200 (\$201) \$179.95/\$239.95, 30V/3A (5A)  
Digital Display 8210/8300 \$199.95, 30V/3A.  
8211/8301 \$259.95, 30V/5A.

#### DUAL OUTPUTS

Independent Tracking  
Analog Display  
8108 \$549.95, 60V/3A.  
8109 \$699.95, 60V/5A.

PS-303D \$314.95, 30V/3A. PS-305D \$399.95, 30V/5A.

#### TRIPLE OUTPUTS, a fixed 5V/3A output, Indep. Tracking

Digital Display 8202 (\$203) \$499.95/\$549.95, 30V/3A (5A) x2.  
Analog Display 8102 (\$103) \$399.95/\$489.95, 30V/3A (5A) x2.  
With Parallel (30V/6A) and Series (60V/3A) Mode operation.

### NTSC/PAL TV COLOR BAR GEN.

CPG-1366A \$159.95, VHF NTSC;  
Freq: 45.75, 175.25, 187.25 MHz;  
RF Output: 10mV; Impedance: 75 $\Omega$ ;  
Video Output: BNC, 1V<sub>p-p</sub>;  
Power: 9VDC; 9V AC adapter (\$6).  
CPG-1367A \$159.95, VHF PAL.

### SWR/RF/mW POWER METER

310 \$89.95, 1.8-520MHz, RF  
Power: 0-4W/20W/200W 3 ranges;  
SWR Measurement: 1.0- $\infty$ , 4W min.  
Accuracy:  $\pm 1\%$ ; Insert Loss: 3dB  
In/Output Imp: 50 $\Omega$ ; SO-239 plug.  
320 \$89.95, 130-520MHz, Spec. 310.

330 \$119.95, 1.8-520MHz, Spec. see 310.

SWR-3P \$26.95 1.7-150MHz;  
RF Power: 0.5-10W, 0.5W-100W.

SWR-2P \$22.95, 1.7-30MHz; RF Power: 0.5-10W.

### mW RF Power Meter 340 \$219.00, 1.8-500MHz, RF

Power: 20mW/200mW/2W 3 ranges; Imped: 50 $\Omega$ ; Accuracy:  
 $\pm 10\%$  full scale. SWR  $\leq 1.15$ ; N-type connect; BNC type output

### FM STEREO MODULATOR

AG-2011A \$549.00  
RF SECTION:  
Carrier: 98MHz  $\pm 2$  MHz;  
Output: 10mV, 1mV & 0.1mV  
COMPOSITE SIGNALS:  
Pilot: 19KHz  $\pm 2$  Hz, 0.8Vrms  
INT. MODULATION: 400KHz;  
1KHz  $\pm 1\%$ , 1Vrms, distortion  $\leq 5\%$  L-R Separation:  $> 50$  dB.  
EXT. MODULATION: Freq: 50KHz-15KHz  
L-R Separation:  $> 45$  dB 100Hz-3KHz;  $> 35$  dB 50Hz-15KHz.

### WOW-FLUTTER METER

WF-3103A \$699.95 Freq. Range: 3KHz-10% JIS/CCIR;  
3.15KHz-10% DIN.  
Measure: 0.3/1/3/1% full scale.  
Accuracy:  $\pm 5\%$  of full scale.  
WF-3105A \$799.95 digital display  
Function: LIN/WOW/Flutter/WT.  
Freq Counter: 10Hz-9.99MHz.  
Indication: CCIR/DIN/JIS.

### TOOLKITS - ELECTRONIC/PC

9245 \$29.99 U.S. Patented, 45-pcs. Contents: IC insert/extractor with secures & bows, 3-prong part retriever, #0 Phillips screwdriver, 1/8" flat screwdriver, self-hold tweezers, metal tweezers, part tube, soldering iron, solder, crimping tool, long-nose plier, cutting plier, zipper vinyl case. Bits include: Phillips: #0/#1/#2/#3; Flat: 1/8"/3/16"/1/4"/9/32"; PZ1/PZ2; T8/T9/T10/T11/T12/T15/T17/T30/T40/T45; Hex: 5/64"/3/32"/1/8"/5/32"/3/16"; Sockets: 3/16" (5mm)/7/32" (5.5mm)/1/4" (6mm)/9/32" (7mm)/5/16" (8mm).  
\$223 \$34.99 23-pcs. Contents: IC insert/extractor with secures & bows, 3-prong part retriever, 3/16"/1/4" nutdriver, 3/16"/1/8" slotted screwdriver, #0/#1 Phillips, reversible T10/T15 bits, reversible #2 Phillips/4" slotted bits, tweezers, long-nose plier, outer, 6" adj. wrench, soldering iron, solder, crimping tool, zipper case.  
Various packages available. call/write/e-mail/fax for detail

### RF SIGNAL GENERATOR

SG-4160B \$124.95, 100K-150MHz  
up to 450MHz on 3rd harmonics in 6  
ranges; AM modulation; Accy:  $\pm 5\%$   
RF Output: 100mVrms to 35 MHz  
Modulation: Int. 1KHz (AM); Ext.  
50Hz-20KHz, at least 1V<sub>p-p</sub> input.  
Audio Output: 1KHz, 2V<sub>p-p</sub> min.  
SG-4162AD (w/ Freq. Counter) \$229.95, Spec. see SG-4160B.

COUNTER SECTION: 10Hz-150MHz, Max. Input:  $\leq 3$  V<sub>eff</sub>;  
Gate Time: 1, 1sec. Input Sensitivity: 35mV, 10Hz-200MHz;  
Input Impedance: 1M $\Omega$  (HF), 50 $\Omega$  (VHF). Display: 7-digit LEDs.

### AM/FM STD SIGNAL GEN.

SG-4118A \$179.00, Freq: 0.1-110MHz, Display: 6-digit LED;  
Resolution: 100Hz (0.1-34.999MHz); 1KHz (35MHz-110MHz).  
Accuracy:  $\pm 4$  (x10<sup>-1</sup> count); Output: -19dBu-99dBu, 1dB  
steps. Imped: 50 $\Omega$  VSWR 1.2; 100 preset frequency, store funct.

### AUDIO GENERATOR

AG-2601A \$124.95, 10Hz-1MHz in  
5 ranges; Output: sine wave 0-8V<sub>p-p</sub>,  
square 10V<sub>p-p</sub>. Output Imped: 600 $\Omega$ .  
Distortion:  $\leq 0.05\%$  500Hz-50KHz,  
 $\leq 0.5\%$  50KHz-500KHz.  
AG-2603AD \$229.95, with 6-digit,  
Int/Ext. Freq. Cntr, 10Hz-150MHz;  
Output Control: 0/20/-40dB & fine adjuster, spec. see AG-2601

### FUNCTION GENERATOR

FG-2100A \$169.95, 0.2Hz-2MHz in  
7 ranges; sine, square, triangle, pulse  
& Ramp; Output: 5mV<sub>p-p</sub>-20V<sub>p-p</sub>, 1%  
distortion. VCF: 0-10V/freq. to 1K-1  
FG-2102AD \$229.95 see FG-2100A;  
4-digit counter display; CMOS &  
TTL Output, 30ppm  $\pm 1$  cent accuracy  
FG-2020B \$159.00 0.5Hz-500KHz, Sine, Square, Triangle.  
FG-2103 \$329.95, Digital sweep generator, 0.5Hz-5MHz in 7  
ranges. Operating Mode: sweep, AM, gated burst, VCG.  
Freq. Counter: Int. 0.5Hz-5MHz; Ext. 5Hz-10MHz.  
FG-513 \$769.95, 13 MHz, Microprocessor embedded sweep;  
Freq. Counter & TCXO: 5Hz-100MHz, 6.5 digits,  $\pm 10$  dB attenuation;  
Sine/Square/Triangle/Pulse/Ramp/TTL & DC;  $\pm 0.1\%$   $\pm 1$ .

### AC MILLIVOLT METER

MV-3100A \$159.95 wide band 5Hz-  
1MHz; 3 scales, mV/dB/dBm; 300 $\mu$ V  
-100V in 12 ranges; 10 $\mu$ V resolution;  
70-40dB in 12 ranges, 0dB=1Vrms,  
0dBm=0.775V;  $\pm 3\%$  accuracy; Input  
impedance 10M $\Omega$ ; Noise  $\leq 2\%$ .  
MV-3201B \$369.95 2 ch.; simultaneous  
measurements; spec. see MV-3100

### OSCILLOSCOPES

OS-7305B \$249.00 DC-7MHz, 3"  
CRT, Horiz: 25V/div; 10Hz-100K  
Hz in 4 ranges; Vert: 10mV/div;  
Int./Ext. sync.; Input: 1M $\Omega$ /35pF.  
OS-7010A \$299.95 10MHz, 5" crt,  
Horiz: 2V/div; Vert: 10mV-10V/div;  
OS-6212G \$389.95 20MHz, 2 CH;  
Alt trig, trig. lock, hold off, TVsync.

8x10 div, 1mV/div, Horiz: 2 $\mu$ s-5 $\mu$ s/div; Vert: 1mV-5V/div.

OS-6532G \$699.95 50MHz, 2 CH/delay sweep, Alt trig, TV sync.  
OS-6101G \$499.95 100MHz, 4ch/8 traces, delay sweep, cursor  
readout. 2 years warranty for OS-622G, 653G, 6101 & 6102

### UHF ATTENUATORS

RT-8815U (50 $\Omega$ ) \$299.00 / RT-8817U (75 $\Omega$ ) \$299.00, 950MHz;  
81dB, 0.5W max.; Steps: 1/2/3/5/10/20/20/20, 8 switches.  
OS-6102G \$399.00 / OS-6103G (75 $\Omega$ ) \$399.00, 950MHz, 81dB,  
0.5W max.; Steps: 10dB/7.1dB/10dB, Electronic adjustment knob.

### MICROPROCESSOR TRAINER

BGC-8088 \$699.00, learn  
computer theory. Excellent  
for school & individual  
who want to learn about  
ROM, RAM, I/O ports,  
programming, & run a  
8088 Microprocessor. An  
easy to understand, step-  
by-step manual guides you  
to achieve your goal.  
56-key keyboard, LCD  
display, RS-232, UART...

### GRID DIP METER

DM-4061 \$89.95 1.5-250MHz,  
6 bands, 6 plug-in coils,  
2 transistor, and 1 diode.  
Modulation:  $\pm 2$  KHz Sine wave.  
Crystal Oscillator: 1-15MHz.  
Wave absorption meter. 9VDC battery.

### FREQUENCY COUNTER

FC-5250C \$119.95 10Hz-220MHz;  
HF: 10Hz-20MHz; VHF: 10-200MHz;  
Gate Time: 1, 1s; Max. Input: 10V<sub>p-p</sub>.  
Sensitivity: 35mV/10Hz-200MHz;  
Input Imped: HF: 1M $\Omega$ ; VHF: 50 $\Omega$ ;  
Display: 7-digit, 9V adapter (\$6).  
FC-5260A \$129.95 10Hz-600MHz;  
7-digit LEDs, 9V AC adapter (\$6).  
FC-5270 \$149.95 10Hz-1.2GHz;  
8-digit LEDs, 9V AC adapter (\$6).  
FC-5600B \$229.95 10Hz-600MHz;  
10-digit LEDs, 110/220VAC.  
FC-5700 \$299.95 10Hz-1.3GHz, 10-digit LEDs, Period measure

### SIGNAL TRACER/INJECTOR

SE-6100 \$134.95  
TRACER: Gain 60dB maximum.  
Attenuation: 0/20/40/60dB  
Input Imped: 100K $\Omega$ ; Meter: Vu 1mA  
Output Imped: 600 $\Omega$ ; Speaker: 8  $\Omega$ .  
INJECTOR:  $\pm 1$  KHz Square wave;  
Output Level: Variable 0-4.5V<sub>p-p</sub>, 9V battery or adaptor (\$6.00).

### LCR METERS

MIC-4070D \$179.95, L: 0.1p-200H, C: 0.1p-20mF, R: 1m $\Omega$ -  
20M $\Omega$ , 2Q range, Dissipation factor measurement, Zero adjust;  
Surface mount device (SMD) test probe: LT-06 \$21.95

### DIGITAL MULTIMETER

DMM-120 \$24.95, 3 1/2 dig.; 600VDC, 2ADC  
500VAC, 2M $\Omega$ , hFE/diode/continuity; 1.2%  
DMM-123+Cap. \$44.95, 3 1/2 digit; 600VDC,  
600VAC, 10ADC/AC, 2Q, 20pF, hFE &  
diode test, continuity beeper, 0.8% accuracy.  
DMM-124+Cap.+Temp.+Freq. \$69.95, 3 1/2,  
600VDC/500VAC, -58-752 $^{\circ}$ F, 2GQ, 20mF,  
200KHz, 3-phase/diode/continuity test; 1.2%  
DMM-125 \$54.95, Auto/Bargraph, 32M $\Omega$ ,  
600VDC/AC, 10ADC/AC, diode/continuity.  
MIC-35 \$59.95, 3 1/2 LCD, Autorange 20M $\Omega$   
1000VDC/750VAC, 20ADC/AC, data hold,  
diode/continuity test, fuse holder; 0.5% accy.  
MIC-39 \$129.95, Auto/Bargraph, True RMS, 3 1/2 LCD, 40M $\Omega$ ,  
40pF, 1000VDC/750VAC, 20ADC/AC, 600KHz freq. cnt; data  
hold, sleep mode, memory, read functions, holster; 0.3% accuracy.  
POCKET ANALOG MULTIMETER AMM-9810P \$14.95  
DCV: Range: 10/50/250/500V;  $\pm 4\%$ .  
ACV: Range: 50/250/500V;  $\pm 4\%$ .  
DCA: Range: 25mA, 250mA; Accuracy:  
 $\pm 4\%$  full scale; Protection: 0.5A/250V fuse.  
Resistance: Range: 500k $\Omega$  (x1k);  $\pm 5\%$ .  
hFE Test:  $\pm 4$  to  $\pm 56$  dB on ACV range.  
Accuracy:  $\pm 5\%$  of full scale.  
Battery Test: 1.5V and 9V.  
Max. Input: 500VDC/AC, or 250mADC.

### AUTO. CAPACITANCE METER

CM3300A \$139.00 10 ranges, 99.9pF - 99.9mF, fully automatic.  
Resolution: 0.1pF lowest, 0.1% full scale.  
Accuracy:  
0.5% of full scale  $\pm 1$  digit to 99.9 $\mu$ F,  
1% of full scale  $\pm 1$  digit to 99.9 $\mu$ F.  
Display: 3 digit LED.  
Unit: pF, nF,  $\mu$ F, mF, Overflow indicator.

### AUTO DISTORTION METER

DM-3104A \$799.95  
DISTORTION MEASURE  
Range: 0.01% to 30%,  
0.1/0.3/1/3/10/30% 6 ranges.  
Freq: 400Hz-10Hz, 1kHz  $\pm 10\%$  (HPF).  
Input: 3mV-100V; Ratio mea. 20dB.  
Auto. Freq. Switching Range:  
Fundamental Freq. = (fo)  $\pm 10\%$ .  
Fund. Rejection:  $> 80$  dB at (fo)  $\pm 5\%$ ;  $> 70$  dB at (fo)  $\pm 10\%$ .  
Harmonic Accuracy:  $\pm 0.5$  dB, 1.8/0.1-20KHz;  
LEVEL MEASURE Range: 0-100V; 0.3/1/3/10/30/100V;  
Freq Response:  $\pm 0.5$  dB/20-50KHz;  $\pm 1$  dB/20-100KHz.  
DM-3204 \$1,599.00 dual channels; Spec. see DM-3104A.



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**NOTCH FILTERS** 110, 108.5, 106.5, 97.5 75dB deep notch. \$19.95 ea., 1-5 qty. \$15.95 ea., 6-10 qty. \$11.95 ea., 11-20 qty. \$9.95 ea., 21 or more qty. Call 24 hr. order and information hot line 516-389-3536.

**UNMODIFIED CABLE CONVERTERS.** Zenith ST1600, ST1086, ST300, Panasonic 175, 145 vol. & non-vol. Regal RR-92 & RC 83, DP5, DP7, DRZ, 5503 VIP, SA 8580. Guaranteed low prices. Please call for more converters 405-631-1856.

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**ACTIVE INDUSTRIES** manufacturer of cable related products. 1-800-305-6878.

**LOOKING FOR** a good low cost plain converter like: Plo 4135 70 channel or brand new Centurion CF-3000 550MHz \$65. Also "raw" genuine unmodified units: Tocom 5503 VIP, \$45; DP5, \$55; DP7, channel 2, \$59; Zenith ST 1600, \$75. 405-634-1535.

**CLOSE OUT: ALL UNITS RAW AND UNMODIFIED:** Zenith ST1000, 1086, 1110, 5010 and ST6700s, Zenith ST1622, SA 8500, 8520, 8525, 8528, 8530 and 8540s. SA 8550, Jerrold DRZs. Prices based on orders of 200 or more. 1-800-380-9530.

**ATTN: CABLE** converter repairer. We stock-up most converter parts like: Tocom, Pioneer. Call for Zenith transistor saw filters, converter cases, lens and all other parts. Minimum order \$50. Call: 405-634-1535.

**ZENITH 73ch** unmodified ST1622 complete as-is \$50 each; refurbished \$90. 702-270-4341.

**NEW A,B switch** for Tocom \$9 each, video cassette storage cases: \$1 each, minimum order 50-lot. FM trap filter \$5. 405-634-1535.

**I WANT to buy any quantity in any condition:** CFT 2254, CFT 2024, CFT 2014, Jer BB7, DPV 7, Pioneer 5135, 6100, 6300, and SA 8590, 8600. Call 702-79C-TECH Mon-Fri 9-6.

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**CABLE CONVERTERS:** unmodified, Jerrold, Scientific Atlanta, Zenith, Pioneer, Tocom, Panasonic, quality units at great dealer prices. Call now for specials 702-270-4351.

**ZENITH ST-1000** complete as-is \$40, ST16XX 99 ch refurbished \$95. 702-270-4341.

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**Great Sounding! KOSS DIGITAL Stereo Headphones**

Koss MAC-5  
Made for the Ford Motor Company for use in Windstar and Aerostar Vans. These lightweight, adjustable headsets have great sound quality with great bass response for home or studio use. Supra-Aural foam ear cushions for hear-through sound and comfort. The 8' rubberized cords are terminated with 3.5 mm stereo phone plugs. Frequency response: 20-20,000 HZ.

**\$12.50 each** CAT #HP-5  
**10 for \$100.00**

**SPECIAL LOW PRICING Automotive Multi-Voltage Adaptor**

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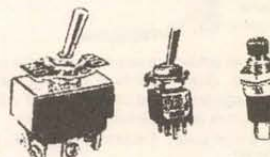
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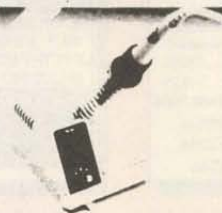
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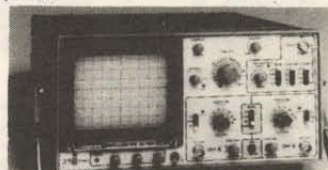


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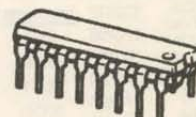
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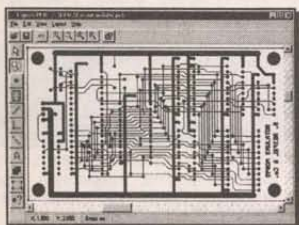
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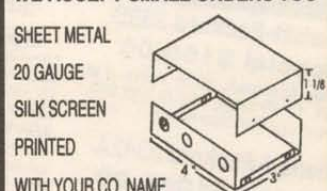
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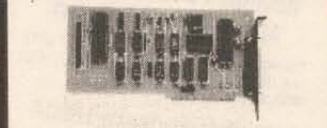
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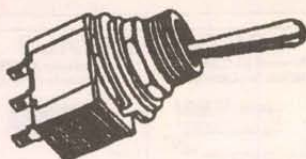
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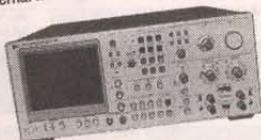
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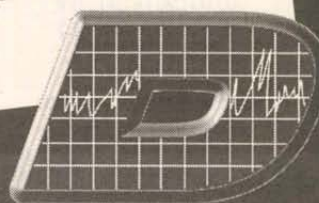
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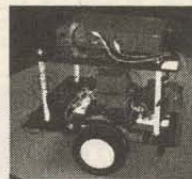
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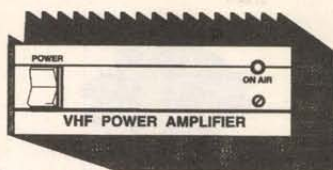
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## Tone-Grabber Touch Tone Decoder / Reader

Dialed phone numbers, repeater codes, control codes, anywhere touch-tones are used, your TG-1 will decode and store any number it hears. A simple hook-up to any radio speaker or phone line is all that is required, and since the TG-1 uses a central office quality decoder and microprocessor, it will decode digits at virtually any speed! A 256 digit non-volatile memory stores numbers for 100 years - even with the power turned off, and an 8 digit LED display allows you to scroll through anywhere in memory. To make it easy to pick out numbers and codes, a dash is inserted between any group or set of numbers that were decoded more than 2 seconds apart. The TG-1 runs from any 7 to 15 volt DC power source and is both voltage regulated and crystal controlled for the ultimate in stability. For stand-alone use add our matching case set for a clean, professionally finished project. We have a TG-1 connected up here at the Ramsey factory on the FM radio. It's fun to see the phone numbers that are dialed on the morning radio show! Although the TG-1 requires less than an evening to assemble (and is fun to build, too!), we offer the TG-1 fully wired and tested in matching case for a special price.

TG-1, Tone Grabber Kit \$99.95  
CTG, Matching Case Set for TG-1 Kit \$14.95  
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## The Cube World's Smallest TV Transmitter

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 or B&W up to 150' to any TV tuned to cable channel 59 with a solid 20 mW of power. Crystal controlled for no frequency drift with performance that equals law enforcement models that cost hundreds more! Deluxe model includes 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. Our cameras shown below have been tested to mate perfectly with The Cube and work great. Fully assembled.

C-2000 Video Transmitter Cube \$89.95  
C-3000 Video and Audio Transmitter Cube \$149.95

## CCD Camera Interface Board

Here's a nifty little kit that eases hook-up of your CCD camera module to any video monitor, VCR or video input TV set. The board provides a voltage regulated and filtered source to power the camera (CCD cameras require a stable source of power for best operation), sensitive electret condenser mike for great sound pick-up and RCA Phono jacks for both audio and video outputs. Runs on 11 - 20 VDC

IB-1 Interface Board Kit \$14.95

## CCD Video Cameras

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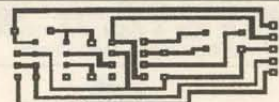
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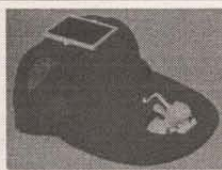
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  - Iiyama Visionmaster 8721, 21" Monitor, 1800 x 1440 Resolution \$1099
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### Pentium Processors

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- Tyan Tomcat - Single/Dual CPU, w/8 SIMMs, 512K \$149/\$159
- Tyan Turbo 2 AT/ATX, Intel 430TX w/6 SIMM/2 DIMM 512K \$139
- SuperMicro P55MMS98-Intel 430TX, 512K \$149
- ASUS TX97/TX97E, AT-430TX/P75-233 PCI w/512K \$149

### Motherboards for the Pentium Processor

- BCM 600 - 150-200 MHz, Intel 440FX Chipset, PCI/ISA \$199
- Supermicro, AT or ATX 150-200, Intel 440FX, PCI/ISA \$219
- Tyan Titan Pro - Single/Dual processor PCI/ISA, AT or ATX \$209/\$279
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### Motherboards for the Pentium II Processor

- BCM 632 - Intel 440LX Chipset, PCI/ISA/AGP/DIMMs, ATX \$129
- BCM 65440BX - Intel 440LX Chipset, PCI/ISA/AGP/DIMMs, ATX \$179
- Intel 4440LX - Intel 440LX, PCI/ISA/AGP/DIMMs, Audio, ATX \$159
- Intel SE440BX - Intel 440BX, PCI/ISA/AGP/DIMMs, Audio, ATX \$189
- Asus P2L97/P2L97S - Intel 440LX, PCI/ISA/AGP, ATX, SCSI \$179/\$229
- Supermicro P6SLS/DLS-440LX, Single/Dual P2.2940UW SCSI \$249/\$349
- Supermicro P6SBS/DBS-440BX, Single/Dual P2.3940UW SCSI \$349/\$449
- Soltek SL618-440LX, PCI/AGP/ISA-AT FORM, SIMM/DIMM \$179
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### Closeout boards for the Pentium Processor

- Tyan Tomcat III - Intel 430HX, Single or Dual Processor \$99/\$129
- Tyan Titan III/Titan VX - Intel 430HX/VX, 256K Cache \$79
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- 168 Pin DIMM Modules
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- 32M SDRAM 10 ns/PC100 \$39 / \$59
- 64M SDRAM 10 ns/PC100 \$79 / \$129
- 128M SDRAM 10 ns/PC100 \$159 / \$219
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- Pentium II 333/300 Mhz \$429/\$329
- Pentium II 266/233 Mhz \$209/\$179
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- Pentium Pro 180 Mhz/150 Mhz \$179/\$149
- Pentium 233 MMX/200 MMX \$109/\$89
- Pentium 200 Mhz/166 MMX \$139/\$89
- Pentium 166 Mhz/133Mhz \$85/\$75
- AMD K6 - 233/200 MMX \$99/\$79
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## CD-ROM/Modems/Sound

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- USR Sportster 56K Int/Ext \$119/\$149
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- Diamond Supra 56K V.90 Int/Ext \$79 / \$109

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- Diamond Monster Sound MX80 \$89.99
- Creative Sound Blaster 16 PNP \$39.99
- Creative Sound Blaster 64 Value \$69.99
- Creative Sound Blaster 64 Gold \$169.99

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- Diamond Stealth 3D, 2M/4M DRAM PCI \$59/\$79
- ATI Video Xpression 2M PCI \$49
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- ATI All in Wonder Pro PCI/AGP 4M/8M \$219/\$269

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# TECH FORUM

This is a READER TO READER Column. All questions AND answers will be provided by *Nuts & Volts* readers and are intended to promote the exchange of ideas and provide assistance for solving problems of a technical nature. All questions submitted are subject to editing and will be published on a space available basis if deemed suitable to the publisher. All answers are submitted by readers and **NO GUARANTEES WHATSOEVER** are made by the publisher. The implementation of any answer printed in this column may require varying degrees of technical experience and should only be attempted by qualified individuals. Always use common sense and good judgement!

## QUESTIONS

Send all material to **Nuts & Volts Magazine**, 430 Princeland Court, Corona, CA 91719, OR fax to (909) 371-3052, OR E-Mail to [forum@nutsvolts.com](mailto:forum@nutsvolts.com)

I have a Samsung microwave with a clock display. The clock is always 15 to 20 seconds ahead of time, no matter how assiduously I set it or how many seconds I try to retard it when I set it. I have to set the clock practically everyday.

Is the clock getting some sort of clock signal off the AC line?

**7981 Paul Mendelowitz  
Redwood City, CA**

I would like to add a circuit (hopefully a small compact unit) to an older model portable gas-driven generator that would keep the 115-volt output stable.

As it is now, the voltage output varies widely depending on the current drawn, such as is drawn by an electric handsaw.

**7982 Melvin S. Fisher  
Lebanon, PA**

I have a photocell electronic relay kit #KT-133-A sold by the long-gone Lafayette Electronics Mfg. Corp.

The instructions and schematic were apparently omitted. I'm unable to assemble without help from a good-hearted reader.

**7983 Albert Coppola  
Horseheads, NY**

I'm just getting into CB and wanted to know if someone has a schematic or plans for a "roger beep" for microphones available?

I hear a lot of people on the radio have one. At the end of transmission there is a beep about 1.8K tone burst.

**7984 Derek Rodgers  
Corpus Christi, TX**

How can I make a very simple continuous AM transmitter with about six components?

**7985 Jose Antonio Noda  
via Internet**

Some years ago [while Heathkit was still in business], I purchased one of their digital alarm clocks model GC-1107 in kit form. The clock has been operating excellently for quite a few years until two nights ago.

We had a power outage, a rare occurrence here, and apparently it affected the clock. All functions work perfectly, except it will no longer keep

time. It appears to have lost use of the 60 Hz input.

While all other parts, ICs, and other components are listed with their commercial equivalents, the primary integrated circuit (IC-1) has only Heathkit's house number [443-848] and the symbol of the manufacturer which appears to be something that resembles the mathematical "approximate" of two tildes, one above the other.

I am not sure which company that belongs to since I retired from CB radio repair some 10 years ago. I no longer have the resources to trace the maker or the commercial part number for IC-1.

The part is a 40-pin chip that drives a plasma-type display. Since the part is a plug-in device, I think if I could locate a commercial substitute for IC-1, I probably could put the clock back in service with a minimum amount of fuss.

I would appreciate hearing from anyone who might have data concerning this chip along with a commercial source.

**7986 Alfred Kohlberg, Jr.  
New Carrollton, MD**

I'd like to make a circuit that would control 50 LEDs which would be activated by a numbers pad.

If I want the LED in the number one position on, I would type 1 or 01 on the numerical pad and it would light that LED.

**7987 Salvatore Licata  
Brooklyn, NY**

I am restricted from using an outside antenna, so I was wondering about using two mobile whips mounted horizontally and joined at their feed points as sort of an indoor dipole.

My question is: how should they be connected? (A) To each other, and (b) to the transceiver (ICOM IC706)?

Ohms Law suggests that with the whips in parallel, the input impedance would be around 25 ohms. Connected in series, one whip might act as a ground plane for the other, but I can only guess what the input impedance would be.

I have an ICOM AT 180 antenna tuner which might help to provide a

match. I tried to sketch the possibilities as they occurred to me. Any suggestions would be most welcome. Of course, if the whole idea is ridiculous I'd like to know that too!

**7988 H. Neill  
Ontario, Canada**

I recently purchased a well-known brand RF signal generator that goes to 512 MHz. The vendor offers an external frequency doubler (to 1024 MHz), but I would like to construct my own.

I believe it involves microwave diodes and fullwave rectification, but I am not sure.

Can anyone tell me if I'm on the right track or better still, provide an actual circuit?

**7989 R. Chatfield  
Tucson, AZ**

I am interested in detecting 60 Hz power lines, especially buried ones.

The power lines may or may not be carrying current, although typically they will. Any circuit ideas or suggestions of products that achieve this, or websites that cover this topic are gratefully accepted.

**79810 Gus Calabrese  
Denver, CO**

I have been working on my first serious robot project and trying to decide what kind of sensors to use.

I picked the method of a sonar collision avoidance detector. I searched quite thoroughly in the robot books I own and the ones at the public library, and couldn't find a schematic or source. Some catalogs have them, but the units are too expensive.

Where can I find a schematic or a low-priced source?

**79811 Kirk Olson  
Eau Claire, WI**

I have succeeded in building a temperature controller that plugs directly into a PC's printer port. The program works perfectly when connected up to my desktop 386DX.

However, when connected to my Toshiba 500CS laptop, I can no longer read the bits coming from the PCR, the "printer command register" — the technique used on my 386,

## ANSWER INFO

- Include the question number that appears directly below the question you are responding to.
- Payment of \$25.00 will be sent if your answer is printed.
- In most cases, only one answer per question will be printed.
- Your name, city, state, and E-Mail address, (if submitted by E-Mail), will be printed in the magazine, unless you notify us otherwise with your submission.
- Due to space limitations, we can not reprint the original questions with the answer. The question number and the issue it appeared in are printed above the answer.
- Unanswered questions from a past issue may still be responded to.
- Comments regarding answers printed in this column may be printed in the Reader Feedback section if space allows.

## QUESTION INFO

### TO BE CONSIDERED FOR PUBLICATION

All questions should relate to one or more of the following:

- 1) Circuit Design
- 2) Electronic Theory
- 3) Problem Solving
- 4) Other Similar Topics

### INFORMATION/RESTRICTIONS

- No questions will be accepted that offer equipment for sale or equipment wanted to buy.
- Selected questions will be printed one time on a space available basis.
- Questions may be subject to editing.

### HELPFUL HINTS

- Be brief but include all pertinent information. If no one knows what you're asking, you won't get any response (and we probably won't print it either).
- Write legibly (or type). If we can't read it, we'll throw it away.
- Include your Name, Address and Phone Number. Only your name will be published with the question, but we may need to contact you.

out-porting 04 (in hex) doesn't seem to work on the Toshiba.

Does anybody have Toshiba-specific data on how I can send a software command so that my PCR will accept external inputs to the PC?

**79812 Thomas Raymond Ng  
via Internet**

## ANSWERS

### ANSWER TO #6981 - JUNE 1998

There are two different approaches to prevent a PIR-operated light from staying on forever after



## TECH FORUM

a momentary power interruption.

A couple of years ago, I purchased (for about \$15.00, I believe) a flood light unit at a local Lowe's home improvement center. It took a lot of searching and opening of boxes to read the detailed description of available units until I found one that operates just as you describe, except that at daybreak, the photocell turns off the light and returns the unit to automatic PIR actuation.

If you cannot wait for daylight until the light turns itself off, there is a more elegant and versatile solution based on line-carrier devices.

PIR-activated flood lights are available on special order from Radio Shack under the "Plug-n-Power" label, an alarm dealer, or from some home improvement centers as a device manufactured by X-10 and sold under various labels.

These do not use a power interrupt to turn on permanently and, therefore, will not latch on in case of a brief power failure.

To turn them on manually, you'll need to add a separate controller that can be plugged into any outlet in the house wiring to send signals over house wiring to the X-10 device.

The cost of the flood light unit is about \$50.00, depending on manufacturer, and the cost of the manual controller is under \$15.00.

Karl E. Katz  
York, PA

### ANSWER TO #6982 - JUNE 1998

The substitution of silicon devices for Germanium, depending on the circuit, may work. However, the GE devices are generally found in audio type amplifiers.

These devices have to be biased for either Class A or Class AB operation. The biasing of the device is based on the base emitter junction drop. So simply changing the devices will yield distortion due to the fact that the amplifier is no longer biased to Class A or AB operation.

Changes to the circuit will require determining what resistor actually provides the bias current for the transistor and adjusting the bias so the new device is in class A or AB mode. This will require a variable signal source and a scope connected to compare the input to output, and to adjust the bias components for linear amplification.

The best way is to put the input to the device on either the vertical or horizontal input and the output on the opposite input of the scope. As long as the levels are adjusted properly, the resultant display will be a 45-degree line on the scope if the line is straight and the input and output are linear. If it begins to curve or loop on either end, it is not linear. This can result from either too much drive to the device — driving it into saturation, or bias being set so it is not in Class A operation.

Somewhere, I have seen replacement Si devices to replace the GE that is supposedly able to handle the difference in the bias situation. I have never had occasion to use them. I either obtain the original device (kinda difficult sometimes) or scrap the device and opt for newer technology.

Ed Pruitt  
Keller, TX

### ANSWER TO #6983 - JUNE 1998

There is a wealth of information about the Theremin on the Internet. A brief search turned up the following resources:

Theremin schematics: <http://www.nashville.net/~theremin/TBuild.htm>

The Theremin Web Ring: <http://www.nashville.net/~theremin/webring.html>

A very simple Theremin schematic: <http://www.coolidge.org/Coolidge/tour/theremin.html>

A Theremin links page: <http://www.geocities.com/Vienna/4611/megalink.html>

Usenet Newsgroup: [alt.music.makers.theremin](mailto:alt.music.makers.theremin)

A musical instrument quality Theremin will have one antenna to control pitch and one to control volume. Hobby-type Theremins, such as the one at the Coolidge web site, have no ability to control the tone's volume.

Depending on your skill level and expectations, you can choose from several schematics and designs that are presented on the nashville.net TBuilding page.

Tim Godfrey  
via Internet

### ANSWER TO #6984 - JUNE 1998

We run into this problem often and it can be caused by three things: (A) Blown ports in the LCD driver chip (you're screwed!). (B) Broken traces between LCD panel and driver chip(s); this you can usually be eyeballed and repaired if you're very careful and delicate. (C) By far the most common cause is oxidized rubber contacts in the zebra strip between the board pads and LCD panel. If these things break contact and are in the air for any length of time, they oxidize and form a slick patina coating which is non-conducting.

The LCD panel should have a metal frame around it which is fastened to the circuit board with several tangs which go through said board and are twisted slightly to keep the frame in place. Untwist these tabs and remove the LCD panel and frame very, very carefully. The panel is thin, made of glass, and quite breakable! You should find one or more rectangular strips of what appears to be soft rubber around the perimeter of the panel.

Upon close examination of these

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strips, you will find that one or more of them are actually made up of alternate strips of clear and black rubber (thus the name "zebra strip"). These strips sit between the edge of the LCD panel and the gold plated contact pads of the circuit board and conduct data between these points. They have to make a good airtight seal to work properly, so they have to be clean and under a bit of pressure.

First, try cleaning both edges of the zebra strips with a Q-tip soaked in some sort of solvent such as rubbing alcohol, lacquer thinner, fingernail polish remover, etc. Clean the area of glass and the gold plated contacts on the board around the areas making contacts with these strips. Put the panel back on the board as it was and re-bend the metal tabs. The frame should be tight against the board in order to create pressure between the panel and contacts through the strips.

If this doesn't work, and it sometimes isn't quite enough, remove the panel again and this time lightly sand the zebra strips with a fine grit sandpaper, such as 400 or 600 and re-assemble. We have found this will cure almost all problems of this type, and get all your pixels back!

Warren Cook  
Bomarc Services  
Casper, WY

### ANSWER TO #6988 - JUNE 1998

You didn't specify what kind of

computer or what operating system you are running. I will make the most likely assumption that you are running Windows 95 on a Wintel box.

It sounds like you don't want your computer to use the Energy Star power-saving features of the monitor, so you can see the screen saver. If that is the case, here is how you disable the power savings:

In the Control Panel, double click on Display, and click on the Screen Saver tab. At the bottom of the tab there are two check-boxes for "Low Power Standby" and "shut off Monitor." Un-check them and click on OK, and then your monitor will stay active as long as the computer is running.

Tim Godfrey  
via Internet

### ANSWER TO #6985 - JUNE 1998

Your question can be best answered by those who manufacture the transformer. Here are a few manufacturers that can help you decide which transformer is best for your application:

Powertronics, 650-345-6800; Ulveco, Inc., 1-800-527-7042; Toroidal Corp. of Maryland, 1-800-274-5793; Advanced Component Industries 1-800-841-0994; MCI Transformer Corp., 516-587-0510; Pico Electronics, 1-800-228-9747, 1-800-431-1064.

Be professional and polite when you ask, and they will send you some





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Chris  
Bieber, CA

## ANSWER TO #6986 - JUNE 1998

The quartz crystal can be used as a resonant circuit in a modified Colpitts oscillator.

Basically, this can be one transistor with output (collector) connected back to the input (base) through the crystal. Add a few components for biasing and current limiting, and a capacitor as the output.

The idea of immersing the crystal

in water will probably not work. There is no way of separating the water from both sides of the crystal, so it becomes non-existent. The water would dampen the oscillations of the crystal, so if you could excite it, its frequency would likely be lower than expected.

There were in the early days of radio some crystal holders that basically consisted of metal contacts on each side and a compression device like a small spring, to hold pressure on the crystal. Current technology deposits a thin metal on the surface and contacts this metal through a small spring clip at the edge. I still see the old crystal holder at ham radio swapfests, usually in an old coffee can and marked \$10.00 each. The oldtimers would take the crystal out of the holder and adjust them by various means like polishing the surfaces, or rubbering them with a pencil eraser to get them to the desired frequency.

I also have a frequency standard I built some 20 years ago that uses TTL ICs and a crystal. The crystal says 10 MHz is connected in a couple of NOR gates of a chip, and the output is run to a 7490 decade counter, then the output of that goes to another 7490 decade counter. The resulting output is a squarewave on 10 MHz, and another one at 1 MHz (the first divide by 10), and 100 KHz (the second divide by 10), the third divide by 10 device can be used to get 10 KHz.

Originally, the circuit had a 3 MHz crystal and would give a 30 KHz squarewave output. A squarewave output will have harmonics up to 300 or 400 MHz.

Inputting this 30 KHz squarewave into an amateur two-meter receiver would give a Birdie every 30 KHz. So, receive crystals could be netted on the frequency since back in those days the two-meter channel spacing was 30 KHz. If your 3 MHz crystal was right, then the 30 KHz birdie fell on the exact frequency of the 30 KHz channel spacing.

As far as the doubler, tripler,

quadrupler, and so on, it is done everyday.

Build an amplifier with tuned circuits on input and output.

Input is tuned to the frequency of the crystal oscillator, and the output is tuned to 2x, 3x, 5x, or 7x the input. You will notice that 4x and 6x were left out. The frequency multiplier works better on odd multiples rather than even, so the third, fifth, and even seventh can usually be made to work. The fifth and seventh are a little tricky because the higher the multiple, the lower the resultant signal, so usually 2x and 3x are all that are used. If more multiplication is needed additional 2x or 3x circuits are cascaded.

Ed Pruitt  
Keller, TX

## ANSWER TO #69811 - JUNE 1998

The wave form analyzer is another type of oscilloscope with a more specific purpose in mind.

Several companies that advertise in *Nuts & Volts* deal in surplus equipment and possibly can supply you with the proper manual.

Failing this, I would ask for one of the competitors' manuals, such as HP or Tek, keeping in mind the general frequency or speed of your unit. Although they aren't exactly the same, they will give you more than enough information to learn how to operate, possibly calibrate, and generally learn the principles of the machine.

These companies also offer probes for sale and with any luck they might have one that both fits and works with your model.

Most manuals also describe the make-up of probes, necessary to operate with their unit, which allows the user to manufacture their own. One of these companies should be able to supply you with enough data to get started.

Western Test Systems, 303-438-9662; Tucker Electronics, 1-800-527-4642; R & S Surplus, 818-967-0846; Phelps Instruments, 909-279-7347, and Fair Radio Sales, 419-227-6573.

## ANSWERS TO #69810 - JUNE 1998

Wayne Truax failed to mention specs for the A/D converter he needs.

Does he need unipolar or bipolar? What acquisition speed does he need? What is he going to hook it up to? A computer?

I have some dandy designs that I would share with him.

Bill Marston  
billpc@erols.com

## ANSWERS TO #69810 - JUNE 1998

There are several ways to achieve cost-effective analog-to-digital conversion, especially for signals that fall within the -5 volt- to +5-volt range. The main difference is time vs. money.

The easiest solution is to just buy Advantech's PC-Multilab Card (P/N PCL711S). This has eight available A-to-D inputs. Each must be within the range of -5 volt to +5 volts. You just plug it into one of your PC's expansion ports, load the maker's DS-compatible drivers, and you're ready!

Cost: \$299.95, plus tax and shipping. It's available from Jameco Electronics, 1355 Shoreway Road, Belmont, CA 94002-4100. Voice 415-592-8097, Fax 415-592-2503.

Thomas Ng  
San Jose, CA

Chris  
Bieber, CA

## ANSWER TO #6987 - JUNE 1998

Hard drives for the Commodore 64 computer are currently made by Creative Micro Design, P.O. Box 646, East Longmeadow, MA 01028, phone 1-800-638-3263.

They have a catalog. These are SCSI drives from 40 megs to two gigs and additional SCSI drives can be connected to them for more capacity.

New old stock Lt. Kernal drives are available from Ron Fick, 12246 Monroe Pl., Denver, CO 80241. These are also SCSI drives and expandable, they are an older design

Continued on page 81

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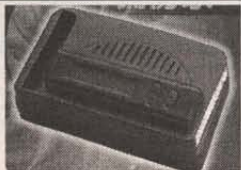
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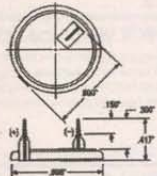


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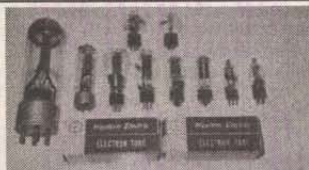
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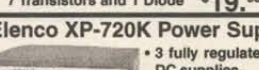


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AM/FM Radio Kit and Training Course 14 Transistors and 5 Diodes

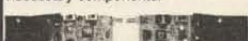
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Model AK-700

Build this high-tech see-thru plastic telephone. Learn theory on how telephones work and then proudly show off your work with the transparent phone case. Complete with all parts and manual. Neon lamps flash when the phone rings.



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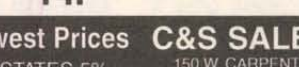
**AR-2N6K**  
2 meter / 6 meter Amateur Radio Kit



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**AK-300 Digital Roulette Kit**

This Digital Roulette Kit is just like the real thing. With a push of a button, the LEDs spin round and round. Where they stop is anybody's guess. It's unique design includes "pop out" chips of different values. Enjoy hours of fun with this game of chance. Requires one (1) 9V battery.



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All parts, all socket pulls must be cleaned & tested. \*Note: Speed selection available at additional charge and all parts subject to availability.

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27C64	\$0.65	27C1001	\$2.25
27128	\$0.65	27C1024	\$2.25
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New 2.88 Meg 3.5" floppy disk drive mfr. by Alps for IBM Thinkpads 755 Series computers. This drive replaces the 1.44 Meg drive by transferring it into the original mounting bracket (5 min.) and it will be auto-detected when the computer is started. Supports 720K/1.44Meg/2.88Meg standards.  
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Software included: Picture Publisher LE 3.1, (Imageing Software), Perceive Personal 2.1, (OCR Software)  
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## NEW TANDY SUPER VGA 1 MEG DRAM (16-Bit ISA Bus Type)

This board is your basic super VGA video board with 1 meg of DRAM type memory. (ISA BUS TYPE.) Core Logic Chip: WD90C31-25-00-02. Resolution/Color: 640x480/256c, 800x600/256c, 1024x768/256c, 1024x1024/16c. Note: Software drivers included with board. Windows 3.1, VESA, Autocad, etc.

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New Cyrix FastMath coprocessors for 80386DX16-33 systems. This FPU unit is used in place of Intel's 80387DX16-33 part. Originally priced at \$100.00, a steal \$10.95. Case: 68 pin grid array.

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These 16-bit PCMCIA ethernet adapters are tested demo units in excellent condition. Limited quantity available. Consists of card, cable, driver disk (WIN95 Plug & Play). Note: Sorry, manual not supplied.

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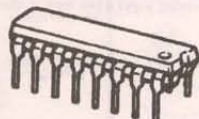
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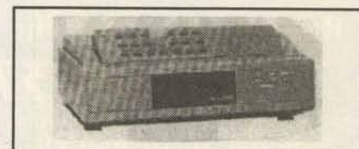
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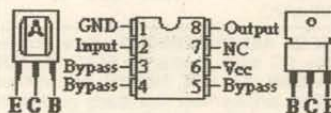


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## TECH FORUM

Continued from page 76

and a bit slower, but have some advantages for BBS or multiuser use.

Used hard drives: The Lt. Kernals are the most common, mostly 20 and 40 meg. Many BBSs ran on them.

Commodore D9060 and D9090 drives require a IEEE-488 (PET, HP1B, GPIB) converter board which are still available and other companies made similar drives. There were hard drives made especially for the Commodore 64 such as the Computer Specialties ST10C (10 meg) drive that I use which can plug into the serial bus or be used with a IEEE-488 adapter.

Frank Nally  
Louisville, KY

### ANSWER TO #69812 - JUNE 1998

If you put the keypad of your PC keyboard into Num Lock mode and then hold down the ALT key while you key in the number 65, then when you release the ALT key, the ROM BIOS enters the ASCII letter A into the keyboard buffer. If you're at the DOS prompt, for example, you will see the letter A echoed to your display. This "ALT-ann keypad trick" is provided by the ROM BIOS to enable entry into the keyboard buffer of any eight-bit value. Hold down ALT and enter 255 and you will have entered the binary value 11111111 or hex value 0xFF as they say in C.

When running GW-BASIC, the string "AUTO" that is echoed (and copied into your source program) when you hold ALT and press the A key on your keyboard, comes from an entirely different source. It "has to" come out of GW-BASIC itself.

In BASICA, a clone of GW-BASIC, I think, partial such strings are visible near the end of the executable file. Under BASICA almost every upper-

case letter has assigned to it a string that will be copied into the source buffer when invoked by holding down ALT and hitting that key.

The strings available are all relevant to BASIC and so you can bet that BASIC is where they are coming from. COMMAND.COM is not involved in either case.

If you cannot find the strings in the GW-BASIC executable, it is probably only because they are stored in some obscure form, such as each character having its high bit set, or some other interesting dodge.

The authors of these packages seem to have left behind a few obstacles for anyone attempting to reverse engineer or otherwise hack their handwork. But detailed documentation on the ALT-ann keypad

entry is available in the original IBM Tech Manual for the PC where they published the ROM BIOS assembly listing.

Jack Dennon  
via Internet

### ANSWER TO #69813 - JUNE 1998

The requirements you have placed on the design are going to make it unworkable for the following reasons:

You have a 62-volt transformer. By applying a fullwave bridge rectifier, the final DC voltage on the capacitors will be about 86 volts.

AC is RMS volts, the DC output will be peak voltage or 1.414 \* the AC input voltage.

There will be some ripple, so let's assume the average DC output will

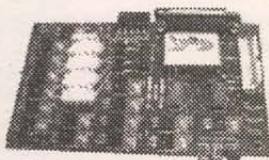
be 80 volts. The highest output you want is 30 volts, so removing the 30 volts from the 80 leaves 50 volts for the regulated voltage that has to be dropped across the pass transistors.

The 50 volts at 20 amps is a required power dissipation for the pass transistors of 1000 watts. At best, the rated power of 2n3055 transistors is less than 50 watts. Assuming a good heatsink. So to be able to dissipate 1000 watts, you would need at least 20 transistors and this is with the output at 30 volts. Take the output down to 5 volts and the dissipation will go up to 1500 watts.

It is workable by using a switching power supply to lower the dissipation of the transistors.

In switch mode, the transistor is

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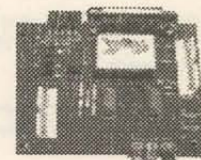
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**Del Amo Books & News**  
3758 Sepulveda Blvd.  
Torrance 90505

## Electro Mavin

2985 E. Harcourt St.  
Rancho Dominguez 90221  
**Ford Electronics**  
8431 Commonwealth Ave.  
Buena Park 90621

**Harding Way News**  
113 W. Harding Way  
Stockton 95204

**Harold's Newsstand**  
524 Geary St.  
San Francisco 94102

**HdB Electronics**  
2860 Spring St.  
Redwood City 94063

**Hi-Fi Doctor**  
1814 E. Ball Rd.  
Anaheim 92805

**HSC Electronic Supply**  
4837 Amber Ln.  
Sacramento 95841

3500 Ryder St.  
Santa Clara 95051

5681 Redwood Dr.  
Rohnert Park 94928

**JK Electronics**  
6395 Westminster Ave.  
Westminster 92683

**Laurel Park News**  
4346 Laurel Canyon Blvd.  
Studio City 91604

**Lion Electronic Labs**  
4948 E. Townsend Ave.  
Fresno 93727

## Netseller

7207 Arlington Ave. Ste. G  
Riverside 92503

**Op Amp Technical Books**  
1033 N. Sycamore Ave.  
Los Angeles 90038

**Pace Electronics**  
369 Hampshire Rd.  
Thousand Oaks 91361

**Panorama Electronics**  
8737 Van Nuys Blvd.  
Panorama City 91402

**Quality Time Computers**  
10331 De Soto Ave.  
Chatsworth 91311

**Sandy's Electronics Supply, Inc.**  
20655 Soledad Cyn. Rd. #15  
Santa Clara 91351

**Sav-On Electronics**  
13225 Harbor Blvd.  
Garden Grove 92643

**Short Circuits**  
36-660 Bankside Dr. #F  
Cathedral City 92234

**Springbok News**  
55 N. Baldwin Ave.  
Sierra Madre 91024

**Tower Books**  
211 Main St.  
Chico 95928

7840 Macy Plaza Dr.  
Citrus Heights 95610

1280 E. Willow Pass Rd.  
Concord 94520

630 San Antonio Rd.  
Mountain View 94040

1600 Broadway  
Sacramento 95818

5950 Florin Rd.  
Sacramento 95823

2538 Watt Ave.  
Sacramento 95812

2727 El Camino Real  
San Mateo 94403

**Tower Magazines/News**  
885 Riverside Pkwy.  
West Sacramento 95605

**Tower Records/Video**  
220 N. Beach Blvd.  
Anaheim 92801

2520 Durant  
Berkeley 94704

212 F St.  
Davis 95616

5703 Christie Ave.  
Emeryville 94608

5611 Blackstone  
Fresno 93710

2052 Redwood Hwy.  
Greenbrae 94904

6310 E. Pacific Coast Hwy.  
Long Beach 90803

2280 Market St.  
San Francisco 94114

3205 20th Ave.  
San Francisco 94132

2525 Jones St.  
San Francisco 94133

871 Blossom Hill Rd.  
San Jose 95123

14570 Ventura Blvd.  
Sherman Oaks 91403

1205 W. Covina Pkwy.  
West Covina 91790

**Valencia Newsstand**  
23164 W. Valencia Blvd.  
Valencia 91355

**Video Electronics**  
3829 University Ave.  
San Diego 92105

## CANADA

**Com-West Radio Systems Ltd.**  
48 E. 69th Ave.  
Vancouver, BC V5X 4K6

**Muir Communications Ltd.**  
3214 Douglas St.  
Victoria, BC V8Z 3K6

**Norlink Communications & Consulting**  
428 E. Victoria Ave.  
Thunder Bay, Ontario P7C 1A5

## COLOMBIA

**Roboli-K**  
Carrera 38 No. 10-60,  
Local 258, Bogota

## COLORADO

**Fistell's Micro Electronics**  
7023 E. Colfax Ave.  
Denver 80220

**International Tesla Society**  
2220 E. Bijou St.  
Colorado Springs 80909

**Tower Records/Video**  
2500 E. 1st Ave.  
Denver 80206

**Western Test Systems**  
530 Compton #C  
Broomfield 80020

## CONNECTICUT

**Archway News**  
64 Bank St.  
New Milford 06776

**DELAWARE**  
**Newark Newsstand**  
70 E. Main St.  
Newark 19711

## DISTRICT OF COLUMBIA

**Tower Records**  
2000 Pennsylvania Ave.  
Washington 20006

## FLORIDA

**Alfa Electronic Supply**  
1502 S. St. Rd. #7  
Hollywood 33023

**Bob's News & Books**  
1515 S. Andrew Ave.  
Fort Lauderdale 33316

**Clarks Out of Town News**  
303 S. Andrews Ave.  
Fort Lauderdale 33301

**Mike's Electronic Distributing Co.**  
1001 N.W. 52nd St.  
Fort Lauderdale 33309

**Skycraft Parts & Surplus, Inc.**  
2245 W. Fairbanks  
Winter Park 32789

**Sunny's At Sunset, Inc.**  
8260 Sunset Strip  
Sunrise 33322

## GEORGIA

**Tower Records**  
3400 Around Lenox Dr.  
Atlanta 30326

## HAWAII

**SolarWorks!**  
525 Lotus Blossom Ln.  
Ocean View 96737

**Tower Records**  
4211 Wai'ale'ale Ave.  
Honolulu 96816

611 Keeaumoku  
Honolulu 96814

## IDAHO

**The Current Source**  
5159 Glenwood  
Boise 83714

## ILLINOIS

**City Newsstand**  
4018 N. Cicero  
Chicago 60641

**Tower Records/Video/Books**  
383 W. Army Trail Rd.  
Bloomington 60108

2301 N. Clark St. #200  
Chicago 60614

1209 E. Golf Rd.  
Schaumburg 60173

## INDIANA

**Bobtown Sales**  
108 Park 32 W. Dr.  
Noblesville 46060

## KANSAS

**Hollywood At Home**  
9063 Metcalf Ave.  
Overland Park 66212

**Lloyd's Radio & Electronic, Inc.**  
220 W. Harry St.  
Wichita 67213

## LOUISIANA

**Lakeside News**  
3323 Severn Ave.  
Metairie 70002

**Tower Records**  
408 N. Peter St.  
New Orleans 70130

## MARYLAND

**Silicon Valley Electronics**  
2014-A Industrial Dr.  
Annapolis 21401

**Tower Records/Video**  
2566 Solomons Island Rd.  
Annapolis 21401

1601 Rockville Pike #210  
Rockville 20852

## MASSACHUSETTS

**Full Spectrum Communications**  
244 Essex St.  
Salem 01970

**Newsbreak, Inc.**  
579 G.A.R. Hwy. Rt. 6  
Swansea 02777

**Tower Records #172**  
360 Newbury St.  
Boston 02115

## MICHIGAN

**Family Electronics**  
111 E. Superior St.  
Alma 48801

**Little Professors Book Center**  
22174 Michigan Ave.  
Dearborn 48124

**MW Electronics**  
229 E. Michigan Ave.  
Paw Paw 49079

**Purchase Radio Supply, Inc.**  
327 E. Hoover Ave.  
Ann Arbor 48104

**Tower Records**  
1214 S. University Ave.  
Ann Arbor 48104

## MINNESOTA

**Radio City, Inc.**  
2633 County Road 1  
Mounds View 55112

## MISSOURI

**Accurate Instruments**  
11201 E. 24 Hwy.  
Independence 64054

**Electronics Exchange**  
8644 St. Charles Rock Rd.  
St. Louis 63114

## NEVADA

**Amateur Electronic Supply**  
1072 N. Rancho Dr.  
Las Vegas 89106

**Less Buster's Electronics**  
2930 N. Las Vegas Blvd.  
VSTG-22

North Las Vegas 89030

**Radio World**  
1656 Nevada Hwy.  
Boulder City 89005

**Tower Records/Video**  
4580 W. Sahara Ave.  
Las Vegas 89102

6450 S. Virginia  
Reno 89511

## NEW JERSEY

**Sys-Corn**  
707 22nd St.  
Union City 07087

**JR Tech Systems**  
1309 Hwy. 71  
Belmar 07719

## NEW YORK

**All Phase Video Security, Inc.**

70 Cain Dr.  
Brentwood 11717

**Global News, Inc.**  
22 8th Ave.  
New York, NY 10016

**Goldcrest Electronics**  
480 St. Paul St.  
Rochester 14605

**Ham Central**  
3 Neptune Rd.  
Poughkeepsie 12601

**Hirsch Sales Corporation**  
219 California Dr.  
Williamsport 14221

**Tower Records/Video**  
105 Old Country Rd.  
Carle Place 11514

350-370 Route 110  
Huntington 11746

1961 Broadway  
New York 10023

383 Lafayette St.  
New York 10003

## OHIO

**Compustuff**  
241 Great Oaks Trl.  
Wadsworth 44281

**Digital One**  
7603 Mentor Ave.  
Mentor 44060

**Footsteps**  
4925 Jackman Rd. Store #58  
Toledo 43613

**Hosfelt Electronics, Inc.**  
2700 Sunset Blvd.  
Steubenville 43952

**Keyways, Inc.**  
611 S. Main St.  
Miamiburg 45342

**Leo's Book Shop**  
330 N. Superior St.  
Toledo 43604

**Powermaxx, Inc.**  
1587 U.S. Route 68 N.  
Xenia 45385

## OKLAHOMA

**Steve's Books & Magazines**  
2612 S. Harvard  
Tulsa 74114

## OREGON

**News & Smokes**  
2295 W. Main St.  
Medford 97501

**News & Smokes #8**  
259-C Barnett Rd.  
Medford 97501

**Norvac Electronics**  
7940 SW Nimbus Ave. Bldg. 8  
Beaverton 97005

960 Conger  
Eugene 97402

1545 N. Commercial NE  
Salem 97303

**Powell's Technical Bookstore**  
33 NW Park  
Portland 97209

**Tower Books**  
1307 NE 102nd Ave.  
Portland 97220

## PENNSYLVANIA

**Business & Computer Bookstores**  
213 N. Easton Rd.  
Willow Grove 19090

**Genes Books, Inc.**  
King of Prussia Plaza  
King of Prussia 19406

**Lehman Scientific**  
2997-F Cape Horn Rd.  
Red Lion 17356

**Monico Electronics & Computers**  
2555 Industry Ln. Ste. D  
Norristown 19403

**Penn Electronics**  
2310 A Walnut St.  
Harrisburg 17103

**Surplus AI**  
RR 1 Box 337  
Hunlock Creek 18621

## Tower Books

425 South St.  
Philadelphia 19147

**Tower Records**  
340 W. Dekalb Pike  
King of Prussia 19406

## SOUTH CAROLINA

**555 Electronics**  
5646 Farrow Rd.  
Columbia 29203

## TENNESSEE

**Tower Books**  
204 W. End Ave.  
Nashville 37203

## TEXAS

**BDL News, Inc.**  
809 Pierce  
Houston 77002

**Electronic Parts Outlet**  
3753-B Fondren Rd.  
Houston 77063

**Mouser Electronics**  
958 N. Main St.  
Mansfield 76063

**Tanner Electronics**  
1301 W. Beltline #105  
Carrollton 75006

**Tower Records**  
2403 Guadalupe  
Austin 78705

## VIRGINIA

**Satellite Headquarters**  
7920 Timberlake Rd.  
Lynchburg 24502

**Tower Records/Video/Books**  
6200 Little River Tpk.  
Alexandria 22312

4110 W. Ox Rd. #12124  
Fairfax 22033

1601 Willow Lawn Dr.  
Richmond 23230

8389 E. Leesburg Pike  
Vienna 22182

## WASHINGTON

**A-B-C Communications, Inc.**  
17541 15th Ave. NE  
Seattle 98155

**Bohica Concepts**  
214 2nd St.  
Morton 98356

**Cody Books Ltd.**  
1125 Fir Ave.  
Blaine 98230

**Service Request**  
3304 W. Rowan Ave.  
Spokane 99205

**Supertronix**  
18650 68th Ave. S.  
Kent 98032

**Tower Books**  
10635 NE 8th St.  
Bellevue 98004

20 Mercer St.  
Seattle 98109

## WISCONSIN

**Amateur Electronic Supply, Inc.**  
5710 W. Good Hope Rd.  
Milwaukee 53223



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TYPE or PRINT your **ELECTRONICALLY RELATED** ad copy **CLEARLY** (not all caps) on a separate piece of paper. Spell out words when submitting handwritten copy. Calculate the number of words and multiply it by the appropriate rate (see RATE PER WORD section). Include any charges for bold and/or CAPPED words, any artwork costs that would be applicable, and/or costs for boxing your ad (explained below). Choose the appropriate classification for your ad(s) to appear in (see below). If no classification is indicated, it will be placed in Misc. Electronics or wherever we deem most suitable. **Enclose your name, address, phone number, and Nuts & Volts account number from your mailing label** (if available) for identification purposes. Include full payment — **CLASSIFIEDS RUN ON A PRE-PAID BASIS ONLY** — and mail your completed order to:

**NUTS & VOLTS MAGAZINE**, 430 Princeland Ct., Corona, CA 91719.

## RATE PER WORD

The ad rate for **current PAID subscribers** is **60¢** per word. All others pay **\$1.20** per word. There is a **\$9.00 minimum** charge per ad per insertion.

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Words to be set in **bold** or **CAPS** are each **10¢** extra PER WORD. **BOLD CAPS** are **20¢** extra per word. The first two words of each ad are bold capped at no charge. Indicate bold words by underlining. Words normally written in caps (e.g., IBM) and accepted abbreviations such as VAC or MHz are NOT charged as all cap words. Use a two-letter abbreviation for states.

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A photo or drawing may be run at the top of your classified ad for an additional **\$10.00** (1" depth max.) for camera-ready art. No wording is allowed in this area. Add a one-time charge of **\$5.00** to enlarge, reduce, or duplicate line art,

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You may fax in ad copy or changes before the closing date (5:00pm on the **5th**) at 909-371-3052 using MasterCard or Visa. Include credit card expiration date, the name that appears on the card, a daytime phone number, and your Nuts & Volts account number. Ads without credit card information will not be listed as received until payment is received in full. **WE DO NOT CALL OR FAX BACK VERIFICATION OR QUOTES OF FAXED-IN ADS.** For verification of faxed-in ads, please call 909-371-8497.

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Prepaid ads received by 5:00pm on the **closing date (5th of the month)** will appear in the following month's issue. Ads postmarked through the **5th**, but received after the closing date, will be placed in the next available issue. No cancellations or changes after the 5th. Cancellations and changes must be submitted in writing.

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All classified ads are running copy only. No special positioning, centering, dot leaders, extra space, etc. is allowed. All advertising in *Nuts & Volts* is limited to **electronically related items ONLY**. All ads are subject to approval by the publisher. We reserve the right to reject or edit any ad submitted. We do not take ad copy or changes over the phone. We do not bill for classified ads. Repeat ads or ads run in multiple classifications within the same issue are allowed. Paid subscribers may run ads at the **60¢** rate only through their subscription expiration date. **NO REFUNDS.** Credit only. No credit for typesetting errors will be issued unless you *clearly* print or type your ad copy.

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10. Ham Gear For Sale	80. Test Equipment	120. Components	155. Manuals/Schematics Wanted
20. Ham Gear Wanted	85. Security	125. Microcontrollers	160. Misc. Electronics For Sale
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50. Computer Hardware	100. Audio/Video/Lasers	140. Publications	180. Education
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featuring  
**Andy A. Node**

# THE WEEKEND WORKBENCH

"Fly me to the moon, let me soar among the stars ..." Oh, hi there. You caught me doing my Frank Sinatra impression over the radio. Over the radio, you ask? Yes, and it's really quite simple to do. This ordinary-looking microphone in my hand is really a miniature FM transmitter, which broadcasts my voice to my FM receiver. In fact, the microphone will talk through any FM receiver tuned to the same frequency as the mike, including car stereos, alarm clock radios, and Walkmans at distances up to 100 feet.

I got the idea from an educational electronic kit I saw advertised in this magazine — specifically the AmericaKit AK-710 FM Wireless Microphone from **Elenco Electronics** (1-800-

533-2441; <http://www.elenco.com>). While you can buy the kit from **C & S Sales** (1-800-292-7711; [http://www.elenco.com/cs\\_sales](http://www.elenco.com/cs_sales)) and many toy stores for \$15.95 or less, I thought it would be more fun if we did it ourselves, using parts you can buy from Radio Shack, **Digi-Key** (1-800-344-4539; <http://www.digikey.com>), and similar distributors.

## Construction

I obtained a schematic of the wireless microphone and permission to publish it from Elenco, the kit manufacturer. You can see it in

## Andy Builds A Wireless FM Microphone

You, too, can be a radio personality or rock singer with this cordless mike.

Figure 1.

I built the prototype of the FM mike on a small circuit board I bought from Radio Shack (276-148) — a dual mini board that I snapped in half for this project.

Although this is a simple circuit, placement of a few specific parts is critical because of the high frequencies involved (100 MHz). Specifically, I'm talking about Q2, C5, C6, C7, and L1. These parts form a tuned circuit which generates the FM signal, and they have to be located close together for the circuit to work properly. If the parts are too wide-

## HOW IT WORKS

There are many different methods for broadcasting information via radio waves. The two most popular are Amplitude Modulation (AM) and Frequency Modulation (FM). In amplitude modulation (Figure 5a), the voltage of the Radio Frequency (RF) wave, called a carrier, varies in accordance with the audio input signal. Let's say the carrier voltage is 10 volts with no audio input. If we were to modulate the carrier with a six-volt sine wave, which swings three volts positive and three volts negative, the output voltage will vary between seven volts and 13 volts. Increasing the audio input voltage to 10 volts results in a carrier voltage swing of five volts to 15 volts. The frequency of the input signal determines the shape of the carrier, and the amplitude of the input signal determines its voltage swing. The louder the audio, the greater the voltage swing.

With frequency modulation (Figure 5b), the carrier voltage remains constant and the audio input signal changes the frequency of the carrier, instead. The loudness of the audio determines how far the frequency is moved from the nominal carrier frequency. In a normal FM radio broadcast, the maximum the frequency can shift from the center frequency is  $\pm 150\text{KHz}$ . The louder the audio signal, the greater the frequency deviation. Let's say a 10-volt input signal causes the carrier frequency to change  $\pm 100\text{KHz}$ , then a one-volt input would produce a  $\pm 10\text{KHz}$  deviation. The number of times per second that the carrier deviates from the center frequency is equal to the frequency of the audio input.

Our wireless FM microphone uses four stages (Figure 6) to turn audio (voice) into frequency modulated RF. The first step — Block 1 — is the microphone. An electret sensor inside the microphone changes sound waves into electrical signals. Unlike dynamic microphones, which generate a voltage when struck by sound, an electret microphone changes resistance in response to sound waves, and needs a voltage source to operate. When voltage is supplied to the microphone via R1, current through the electret sensor increases and decreases according to the loudness of the sound.

This signal is input to the audio amplifier — transistor Q1 (Block 2) — which triples the microphone's voltage. In electronics parlance, the amplifier is said to have a gain of 3. The gain is determined by R2, R3, R6, and R7. Central to the operation of the wireless FM microphone is the RF oscillator — Block 3. Built around Q2, this stage provides the 88MHz to 108MHz carrier frequency that will be recognized by the FM receiver. Basically, an oscillator is an amplifier with positive feedback. Remember how we set the frequency of the transmitter to that of a dead spot on the FM receiver — by placing the microphone next to the speaker and listening for the squeal? This squeal happens when the output from the speaker is heard by the microphone and fed back to the receiver in a loop. This is positive feedback, where one signal reinforces the other. In the case of the squeal, the feedback is acoustically coupled. In Block 3, the feedback is electrically coupled.

The frequency of the oscillator is determined by a capacitor/inductor combination called a tuned circuit, or tank circuit. By changing the position of the iron core in L1, the inductance can be changed to tune the oscillator to a desired radio frequency. When sound strikes the microphone element, the amplified signal is placed on the base of Q2, which causes the capacitance of the tuned circuit to change and alter the frequency of the oscillator in step with the sound heard by the microphone. Presto, frequency modulation.

The final stage — Block 4 — is an RF amplifier. This stage amplifies the output from the oscillator in the same way the audio amplifier boosted the voltage from the microphone. The RF amplifier also acts as a buffer between the oscillator and the antenna. If the antennas were tied directly to the antenna without the buffer, stray capacitance picked up by the antenna (such as the capacitance of your hand or body) would produce large changes in the frequency of the oscillator — changes that the radio can't follow.

From there, the modulated RF signal goes to the antenna, which ideally should be tuned to a fraction of the wavelength. Given the confines of the cabinet and the use (and abuse) the microphone will experience, though, 12 inches is a good compromise.

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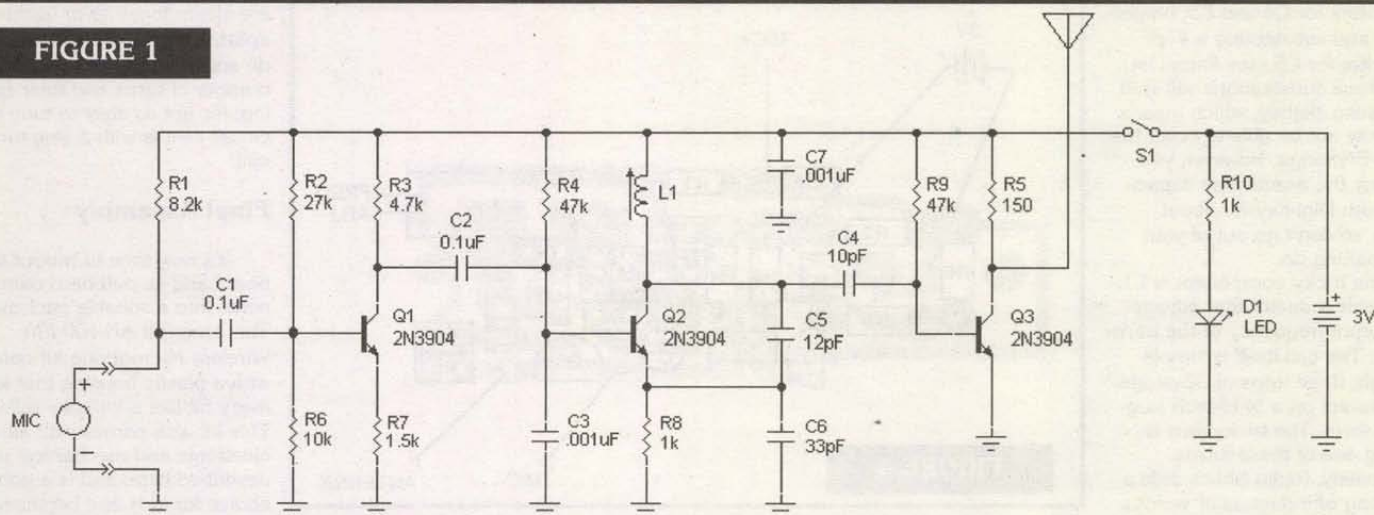
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FIGURE 1



ly separated, the circuit won't oscillate.

In case you don't know it, wires and component leads have two properties: resistance and inductance. At frequencies below 10 MHz, resistance is the main factor. As frequencies start pushing into the 100 MHz range, though, wire lengths as short as one inch can have enough inductance to squelch oscillation — or worse, cause unwanted oscillation.

In fact, wire length is a big problem in today's high-speed desktop computers. To avoid trouble, be sure to cluster the parts associated with Q2. Specifically, place C5 (12pF) directly across Q2, and cuddle Q3 as close to Q2 as possible. You can shorten the lead length of the resistors by standing them upright (Figure 2) rather than laying them flat.

Elenco has also graciously let us print the foil pattern of their printed circuit board (Figure 3). Thanks to this kind gesture, you don't have to wrestle with the problem of component place-

ment — they've been there and done that. The parts layout for this board is shown in Figure 4. Note that R5, R8, and R9 (those directly associated with Q2 and Q3) are mounted upright, whereas the other resistors lay flat against the board. In addition to making my own version of the wireless FM microphone — which took a full day — I populated and soldered up their board. It took me all of 30 minutes, and that included taking time out for coffee.

Whatever construction method you choose, pay attention to the orientation of the transistors and LED because they are polarity-sensitive. The microphone (MIC) uses an electret element, which is polarity-sensitive, too.

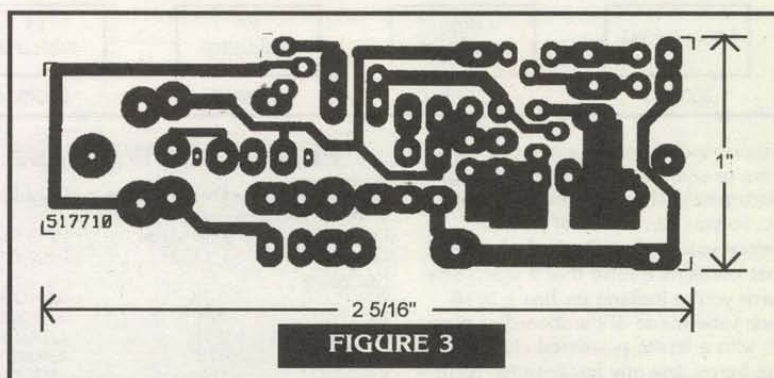
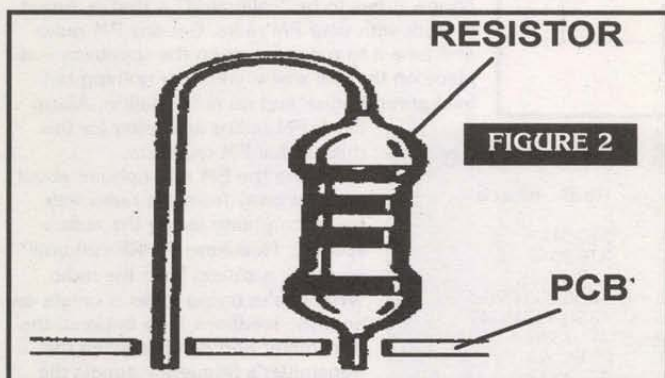
#### About The Parts

All resistors are 1/4 watt, and the capacitors are 50WVDC ceramic discs. Neither are polarity-sensitive, and are readily available from

any number of sources. Although Radio Shack doesn't stock three of the resistors (R1, R2, and R7) in their retail stores, you can order them through Radio Shack Unlimited (1-800-843-7422). However, you can buy an assortment of 500 1/4-watt carbon-film resistors (271-312) with these and many other "odd" values for just \$7.99 — a must for the serious hobbyist.

If you look at the circuit carefully, though, you'll spot that the three "missing" resistors are in the audio amplifier section (see "How It Works"), and their values aren't that critical. A few ohms here or there won't hurt if you know how to apply them. For example, you can change R1 to 4.7K, R2 to 22K, and R7 to 1K with no noticeable difference in performance.

Radio Shack doesn't sell the exact values for capacitors C4, C5, or C6, either. While these values are much more critical than the resistors mentioned above, you can come close enough to these values by paralleling two or three 4.7pF



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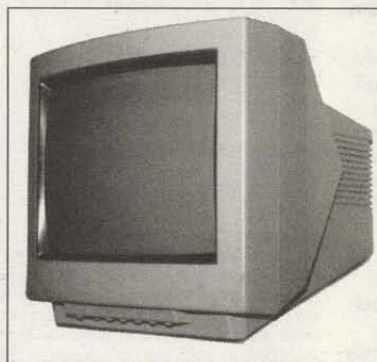


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capacitors for C4 and C5, respectively, and substituting a 47pF capacitor for C6 (see Parts List).

These substitutions will shift the tuning slightly, which means you may not be able to cover the entire FM range. However, you can buy the exact-value capacitors from Digi-Key for about \$2.00, so don't go out of your way making do.

The tricky component is L1, a variable inductor that adjusts the output frequency of the transmitter. The coil itself is simple enough: three turns of 22-gauge wire wound on a 5/16-inch slug-tuned form. The tricky part is finding one of these forms. Fortunately, Radio Shack sells a grab bag of inductors of various types — including adjustable tuning coils.

This assortment is a random selection of

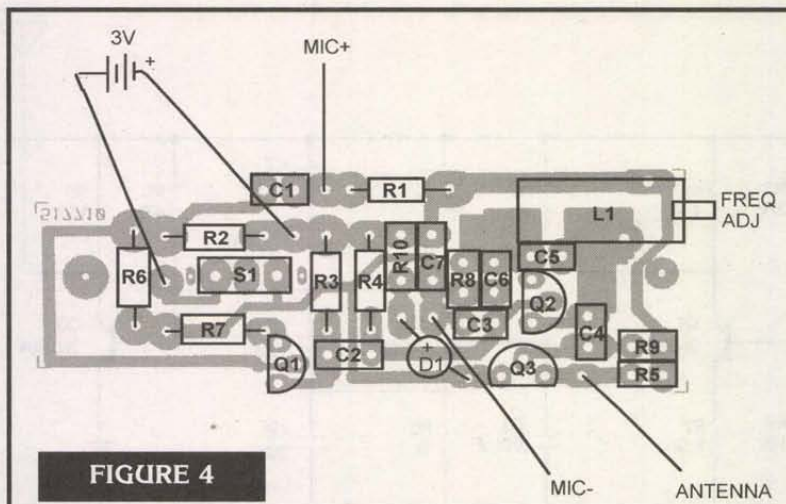


FIGURE 4

cation of fingernail polish will keep the coil from unraveling and sliding off the form. (Avoid getting polish on the ferrite slug or it'll be glued in place, too.) Finally, snip the leads to a convenient length and scrape the enamel off the ends so they will accept solder.

I've also experimented — with some success — with an open-air coil, one without a form or ferrite slug. To make this coil, wrap five or six turns of the 22-gauge magnet wire around a wooden pencil and carefully slide the coil off the pencil. This time, don't wind the coil tightly. Instead, space the windings out partly so that the finished coil looks like accordion bellows. You adjust the inductance of this coil by pushing and pulling on the coil so that the windings

hobbyists.

For the more ambitious hobbyist — those who want to build a wireless FM mike from scratch yet have it look professional — I've located a similar-looking dynamic microphone from Radio Shack (33-1067) for just \$5.99. It even has an on/off switch! Simply open the case and remove everything but the switch and put your parts inside. The LED is simply a power-on indicator and is optional.

If you don't need a professional look and simply want to play with the electronics, the project can be assembled in any plastic box big enough to hold everything. Just make sure the lid is plastic, not metal, or the transmitter will detune as you use it. The antenna is an integral part of the RF section and should be a 12-inch length of solid 22-gauge hook-up wire.

## Using The FM Microphone

Before you can use your wireless microphone, it has to be "calibrated" — that is, tuned to work with your FM radio. Get any FM radio and tune it to a dead spot on the spectrum — a place on the dial where you hear nothing but background noise and no radio station. Alarm clock FM radios are better for this than digital FM receivers.

Place the FM microphone about two feet away from the radio with the microphone facing the radio's speaker. Now tune the RF coil until you hear a squeal from the radio. What you're trying to do is create an acoustic feedback loop between the transmitter and receiver when the transmitter's frequency equals the receiver's. Now back away from the receiver until the squeal stops, and speak into the mike. You should hear your voice booming over the radio. Make no further adjustments to the transmitter.

To use your wireless microphone with other FM receivers, repeat the same procedure but, this time, tune the receiver to the transmitter. If the receiver is too far away to cause feedback, have a friend find your broadcast by twisting the radio knob until your voice comes through. The wireless mike has a range of 100 feet indoors and about 50 feet outdoors. To conserve batteries, turn the power switch off when not talking.

Now, if you'll excuse me, "Start spreading the news ..." NV

## AMPLITUDE MODULATION

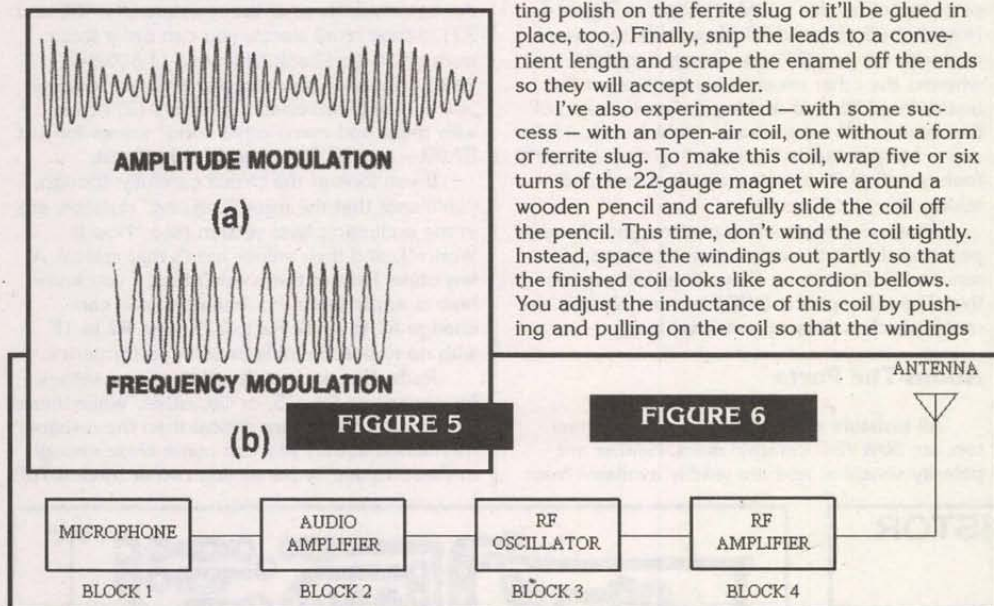
(a)

## FREQUENCY MODULATION

(b)

FIGURE 5

FIGURE 6



various inductors, so you'll probably have to search through several bags (fortunately, the bags are clear plastic, so you can see what's inside before you buy) until you find one that contains a form that'll work. The form you're looking for has a 5/16-inch tube made of cardboard or plastic with a ferrite powdered slug inside the barrel, but any ferrite-tuned form with a diameter about the size of a pencil will work.

If you can't find such a form, you can make one by wrapping a few turns of 3/4-inch-wide masking tape — sticky side out — around a wooden pencil. Dust the pencil first with a light coating of talc powder. Gingerly slide the tape tube off the pencil and paint it liberally inside and out with clear fingernail polish. This will harden the tape and give you a rigid form. You can salvage the ferrite slug from an old IF transformer (which you can find in the Radio Shack inductor assortment).

Once you have a suitable form, wind three turns of 22-gauge enamel-covered magnet wire near the slug end of the tube. Keep the turns tightly together, not spread apart. An appli-

## Parts List: Wireless FM Microphone

Reference	Description	Digi-Key	Radio Shack
<b>Semiconductors</b>			
D1	LED diode	LT1139-ND	276-041
Q1,Q2,Q3	2N3904	2N3904-ND	276-2016
<b>Resistors</b>			
R1	8.2K	8.2KQBK-ND	*RSU 11345055
R2	27K	27KQBK-ND	*RSU 11345147
R3	4.7K	4.7KQBK-ND	271-1330
R4,R9	47K	47KQBK-ND	271-1342
R5	150	150QBK-ND	271-1312
R6	10K	10KQBK-ND	271-1335
R7	1.5K	1.5KQBK-ND	*RSU 11344892
R8,R10	1K	1.0KQBK-ND	271-1321
<b>Capacitors</b>			
C1,C2	0.1uF	EF1104-ND	272-135
C3,C7	.001uF	1383PH-ND	272-126
C4	10pF	1301PH-ND	272-120 (2 in parallel)
C5	12pF	1302PH-ND	272-120 (3 in parallel)
C6	33pF	1307PH-ND	272-121 (47pF)
<b>Misc.</b>			
L1	see text	n/a	273-1601
MIC	Microphone	P9970-ND	270-090
S1	SPST switch	SW148-ND	
Battery holder	2 "AA" cells	BC22AAW-ND	270-408
Battery	"AA"		
Magnet wire	22-gauge	n/a	278-1345
Cabinet	see text	see text	33-1067

**Note:** The above \*RSUxxx resistors are special-order items from Radio Shack Unlimited (1-800-843-7422). However, Radio Shack's 1/4-watt carbon-film assortment pack (271-312) contain these values plus hundreds more, and is a good investment for the serious hobbyist. A complete kit of parts, including a swell plastic karaoke microphone case, can be purchased from many toy stores and electronic outlets under the brand name AmeriKit AK-710. To obtain a list of retailers in your part of town, call Elenco at 1-800-533-2441 or check out their Web site at <http://www.elenco.com>.



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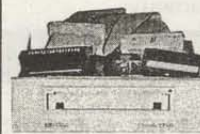
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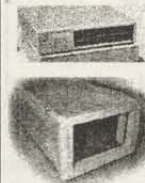


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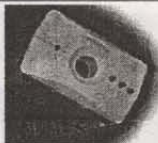
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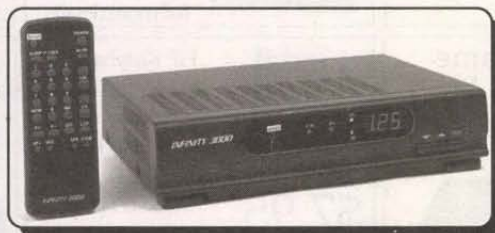
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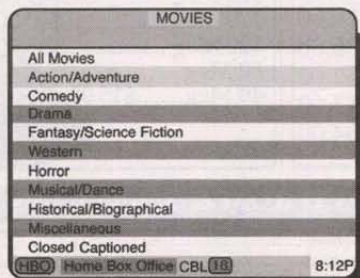
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# THE INDESTRUCTIBLE OUTBACKER HF WHIPS

by Gordon West

***This is not an "advetorial" on why you should buy the Australian Outbacker whip. In fact, I'll tell you right now that the six-foot Outbacker whip costing around \$300.00 performs no better, nor any worse, than a \$19.95 single-band ham stick.***

And, I'll also tell you there is nothing magic about how the whip antenna can work on any specific band from 1.8 MHz up to 156 MHz. But, I'll give you an idea on how they can accomplish multi-band capabilities on a single shaft, and I'll also "tune you in" on some tricks you can play to get increased performance by sticking on a longer stinger.

Whether you are into high-frequency ham radio, CB radio, marine long-range single side-band, or are a member of the Federal Emergency Management Association or Red Cross, I'll give you some inside evaluations on what this amazing indestructible whip with multi-band capabilities can — and maybe cannot

— do for YOU!

## BRIEF HISTORY

A young man named Don Arnold WD4FSY, regularly tours the world as a videographer and ambassador for the Baptist Church. Don was/is a very active ham radio operator on high frequency, and he would regularly bring his radio gear along on his journeys to stay in touch with other ministries throughout his travels. And, if ever there was a rig or antenna that Don could get his hands on, he would.

During one trip to Australia about 10 years ago, Don Arnold noticed all of the overland truckers towing "triples" were communicating on Australian high-frequency, land-mobile frequencies with a strange-looking, multi-band, brown whip produced by Terlin Aerials. When he asked the truckers about how these whips performed on medium- and high-frequency, land-mobile frequencies, they all indicated that the performance was superior to anything else that they had tried, and MOST important, these whips could take the punishment of overland abuse out on the OUTBACK.

Don made contact with Terlin Aerials, and Don and Terry developed a program to distribute these antennas in the United States.

And that's where I came in — Don brought the first whip over to my place, and we both agreed brown was a pretty ugly color, and there needed to be a slight re-design so the frequencies on the whip would tune specifically on worldwide ham band channels. And maybe bring in another type of whip, specifically tuned to marine band channels, too. And maybe bring in another style whip that would tune to federal emergency channels and military frequencies, too.

And this Don did, all in his spare time.

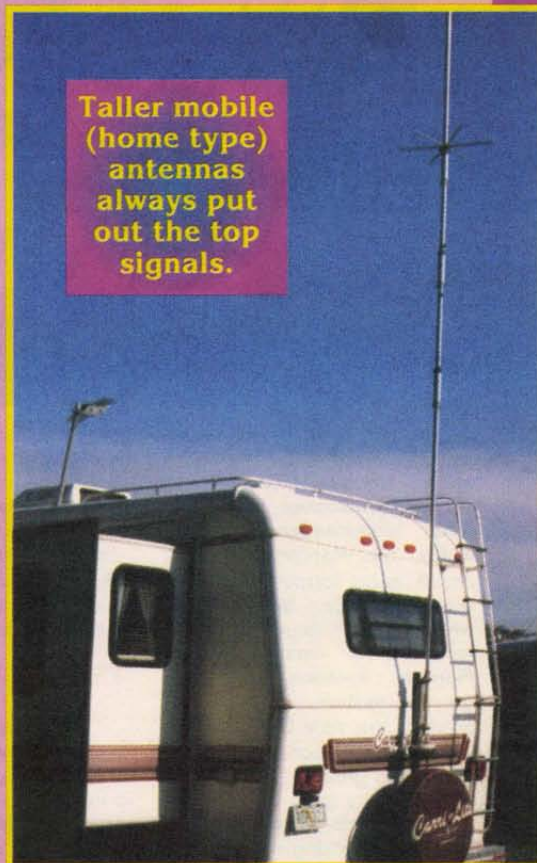
And since these antennas came from the Australian Outback, Don aptly named them "Outbackers." The brown color was changed to black, with a white version that immediately turned yellow for mariners. There was even a time when they came in colors, too.

And there were initial growing pains that everyone gets with a new product. First, there needed to be a conversion from the Australian big threads over to our more common 3/8 x 24 threads. Same thing with the massive spring — it needed the standard 3/8 x 24 thread arrangement, too. As I recall, the coaxial cable input needed a slight re-design to accept our regular type of PL-259.

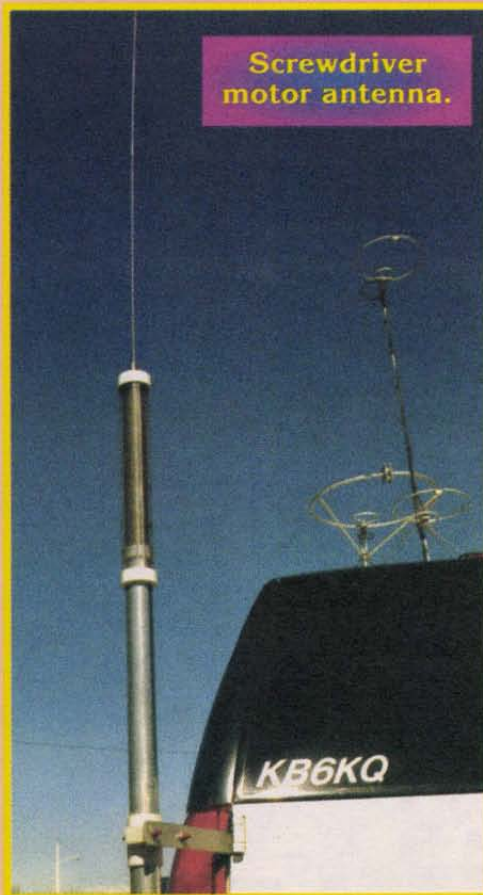
And then the springs needed to be replaced because they rusted badly. And then we needed more spare wander (not wonder) leads because hams would lose them when they operated on the lowest band and took the lead off completely.

And then everyone loved Outbackers. The

**Taller mobile (home type) antennas always put out the top signals.**



**Screwdriver motor antenna.**



popularity got to be such a big job for Arnold that he ultimately reached an agreement with Alpha Delta Communications, and Don Arnold and Don Tyrell reached an agreement where Alpha Delta Communications would then be the USA distributor. Management of the product line would be taken over by Jim Burns and his lovely wife, Shan.

## TECHNICALLY SPEAKING

So now you know where the Outbacker grew up. Now, let's take a look and see what makes this indestructible antenna tick.

Antenna basics for a resonant length of wire are developed around the halfwave dipole. The halfwave dipole is normally horizontal to the earth, and the feedpoint is right at the middle of the dipole. Each side of the dipole would be one-quarter wavelength long, and the end-to-end calculations are based on the formula  $468 \div \text{frequency in MHz} = \text{length in feet}$ .

The dipole is bidirectional. It radiates energy to the broad-side of the wire. Less energy comes off of the ends of the dipole.

The Marconi antenna is what most mobile whips are configured to. The Marconi antenna puts one-quarter wavelength of wire going straight up, and the other one-quarter wavelength of wire is made up of the ground system.

A simple Marconi antenna is a ground plane. The ground plane can be fed with coaxial cable without any matching by bending the ground one-quarter wavelength radials down to about a 45-degree angle. This achieves a feedpoint of





**Many single-band mobile whips cost less than \$20.00 each.**

approximately 50 ohms — a perfect match for your transceiver and coaxial cable feedline.

The Outbacker, plus most other high-frequency mobile whips, are Marconi antennas based on the formula  $234 \div \text{frequency in MHz} = \text{length of the whip}$ . But don't forget the necessary mirror image of the Marconi antenna necessary ground system. Without the ground, the very best Marconi won't transmit nor receive. You gotta have ground!

For unity gain, the Marconi antenna needs to be the following length sticking up from the ground system for the following bands:

10 meters ham	8 feet
15 meters ham	11 feet
16 MHz marine	14-1/2 feet
20 meters ham	16-1/2 feet
12 MHz marine	19-1/2 feet
8 MHz marine	29-1/4 feet
40 meters ham	32 feet
4 MHz marine	58-1/2 feet
75 meters ham	61-1/2 feet

As you can see by this table, once you drop below 21 MHz, the antenna becomes physically too long for mobile operation. To get around this, loading coils in the center of the antenna or helical loading at the top of the antenna effectively shorten the length necessary for the whip. And for high frequency, center-loading and top-loading are preferred against base-loading. Base-loading induces increased current losses, so this is why you won't find any base-loaded whips until you exceed 25 MHz.

Different manufacturers have developed their own unique way of offering radio operators single and multi-band capabilities from their whip antenna system. Antennas like the inexpensive Ham Stick are simply unscrewed during band changes, and a fistful of antennas will give you your choice of which band you plan to operate on. Hustler offers the same scheme, plus adaptor kits that could allow you to operate on up to four bands, all at once. Spyder antennas also feature multiple loading coils.

There are also motorized antennas where band changes are accomplished by remote con-

trolling a tap in the long center-loading coil. This is a very effective way to go, thanks to the large size of the loading coil. But it is an extremely big antenna to have on the end of your vehicle.

And then there is the well-known "Bug Catcher" that features capacitive hat top-loading, plus a massive coil for center-loading. But each time you change bands, you need to reconfigure the center-loading coil.

## THE OUTBACKER

What the Outbacker antenna does is to offer resonant band taps throughout the body of the helical loaded antenna to achieve the correct band for resonance. A length of wire, called the "wander lead," connects from a common point at the base of the antenna to the band tap for where you want to resonate the antenna. You wind the wire around the outside of the shaft to take up the slack.

For instance, if you plan to operate on the ham 15-meter band, the tap is near the top, so the wire winds around the shaft and plugs into the 15-meter port. If you plan to operate down on 40 meters, more inductance is necessary, so you drop down and plug into the 40-meter tap. But, you must also wrap the wander lead many times around the shaft to take up the slack.

And on the lowest band — either 80 meters or 160 meters — the wander lead comes off completely. Just remember where you put it because you'll need it for the higher bands.

The first concern everyone has is whether or not the tap points will ingress water. They won't. They are sealed. But will they corrode? Not really — about the only thing that happens is they get stuffed with mud, and you need to clean the tap point in order to make a good connection.

So what's actually taking place, electrically, with the wander lead tap points? Is it series resonance? Is it a parallel resonant trap? I go with series resonance myself because the tip whip always has plenty of voltage on the end. And this is good — the Outbacker utilizes all of the antenna for radiation, and the wander lead

simply bypasses the internal series loading coils to develop a good series resonant system. But there may be some additional schemes going on inside the whip when you make the connection point, and this part is not divulged by Terry over in Australia. When you hold a florescent tube up to the Outbacker, it many times will glow in areas that you might otherwise consider would be RF cold.

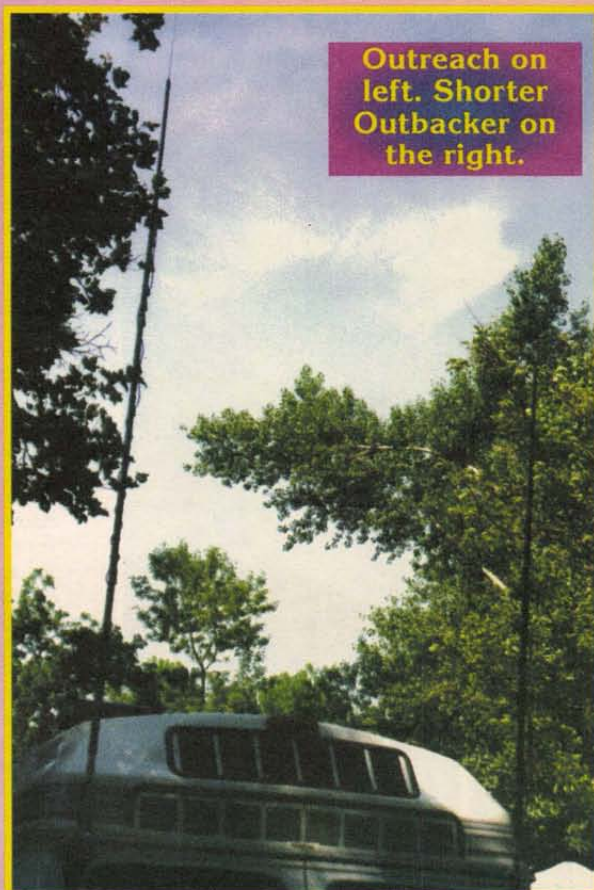
At resonance, there is maximum voltage on the tip whip. This can be seen by transmitting a steady carrier, and carefully brushing a lead pencil over the corona ball. It will generate quite a spark!

Down at the feedpoint, a good ground plane will generally yield 50-ohms impedance. This is just what you want for a direct coaxial cable feed. But, the antenna **MUST** be placed over some sort of a ground plane in order to achieve proper resonance and the right feedpoint impedance. The very best place to mount the antenna is on the trunk lid of an automobile. On campers and mobile homes, way up high using metal framework or a metal ladder as the ground counterpoise. The very worst place to mount the antenna is way down low where only the upper portion of the Outbacker is seen sticking above the trunk. Get the antenna up as high as possible, but always over some sort of a horizontal or semi-horizontal ground plane.

While the Outbacker has the same exact signal punch as a similar length antenna at a fraction of the cost, one single Outbacker can be said to operate on as many as 12 different radio bands without needing to buy another whip system. This actually makes the Outbacker less expensive than a handful of individual whips or loading coils. And for the marine frequencies, there are few manufacturers providing whips or loading coils for these frequency bands.

The taller the Outbacker, the greater the performance. Less loading.

Short Outbackers come with a four-foot



**Outreach on left. Shorter Outbacker on the right.**



black shaft with a three-foot stinger. You can order it just on worldwide high frequencies, or order it to also cover six meters and two meters. And they also have a high-power version of the short whip that can handle up to 500 watts when you drive it with an SGC POWER TALK amplifier.

Another version of the Outbacker comes with all ham frequencies and all marine bands for high-frequency operation. You get about 12 little tap points along the shaft for your favorite ham or marine band.

They also have an Outbacker for portable operation that breaks down into three two-foot sections that simply screw together. This is small enough to easily fit into a suitcase.

Then they have a stealth Outbacker that's only four feet long. You don't get as much signal output with only a four-foot whip, but nonetheless, it does work, and it can also include the ham radio six- and two-meter VHF bands, too. And they also have a tripod for backyard installations of any of the Outbacker whips.

## LONGER IS BETTER

But the REAL radio enthusiasts wanted more punch from their Outbackers, so they began to play some tricks. When operating on the 15-meter DX band, the trick is to plug into the 10-meter port. Then replace the relatively short whip stinger with a three-foot long whip stinger, and tune for precise resonance. The taller the whip, the better the signal on both transmit and receive.

So, finally Outbacker bowed to the requests of ham operators for a more powerful whip, so they came up with the OUTREACH. The Outreach has an eight-foot shaft that breaks into two sections. It also has an adjustable stainless steel whip that pulls out of the top shaft to about 36 inches. This 11-foot, high-frequency antenna can operate on 160 meters through 10 meters with up to 150-watt capabilities. They also have a high-power model that covers 160 meters through six meters, and handles up to 500 watts if you're running the SGC power amplifier.

During recent tests on our communications van, I compared the six-foot Outbacker to the 11-foot Outreach. Every station I talked with indicated increased signal strength from the longer Outreach. And on some bands, it was extremely noticeable for improved performance on receive. The Outreach uses a slightly different scheme of how the different band taps are placed on the black whip.

Traditionally, 160 meters is on the bottom with 10 meters on the top. With the Outreach, 10 meters is just above the middle with 17 meters on the top. This tells me there is probably both

series, as well as parallel, resonant circuits inside the black whip body. But no one in Australia will tell; and as long as I'm getting good signal reports and my transceiver is running cool, I'm happy knowing something correct is taking place inside the black shaft. I realize this is not the best way to analyze antenna circuits, but when it's proprietary, we'll just believe what we see on our S-meter and SWR analyzer.

## INDESTRUCTIBLE

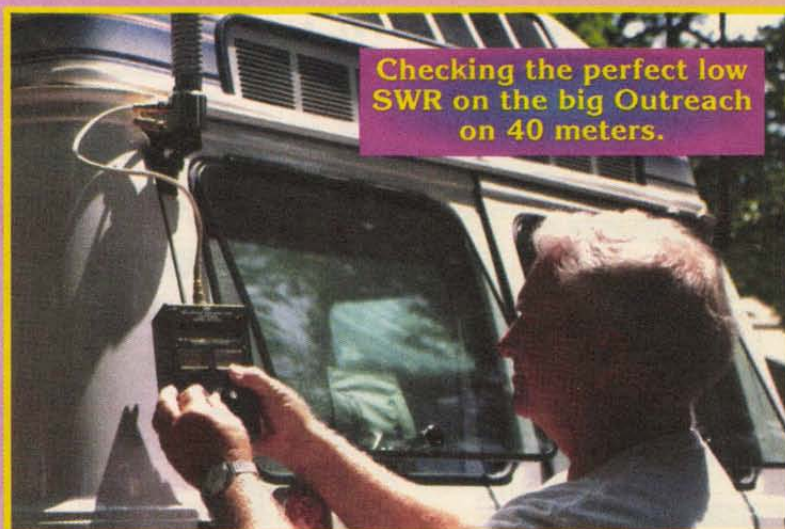
The best part of the Outbacker may be its capability to unscrew and break down into small sections, and resist breaking down where it's not supposed to due to a catastrophic encounter with a tree. I have yet to see a fractured Outbacker shaft. You can bend them, whack them, pound them, and completely submerge them in water, and the black shaft continues to stay intact. However, if you do submerge it in water, just be sure to pour out the water that may collect down the telescopic whip section.

And speaking of the telescopic whip, you WILL need to do some fine-tuning of the whip down on the ham 40-meter band, 75 meters, and 160 meters. On all of the other ham bands, setting the whip to the score mark allows for complete operation throughout the band.

On 40 meters, I set the whip to 7200, and I can operate at band edges with SWR not much higher than 1.7:1.

Down on 75 meters, I prefer the Outreach over the Outback because I have twice the band spread. I get about 60 KHz of usable resonance with the Outreach on 75 meters, and about 30 KHz of usable resonance with the regular Outbacker.

Down on 160 meters, we're talking about spot-on resonance with both antennas — maybe 15 KHz with the taller Outreach. But like any good 160-meter operator, you generally know where in the band you plan to yak. If you must really jump up and down the 160-meter band or



the 75-meter band, be prepared to exit the vehicle and do some tip-whip tuning. Or, if you have one of those HF mobile transceivers with a built-in tuner, now is the time to energize the tuner to fine-tune 75 meters and 160 meters.

So does this antenna outperform similar length single-band whips? Nope, sure doesn't. But I don't know of many 11-foot, single-band, HF whips, so the Outreach DOES outperform most single-band mobile whips — except for the mammoth Texas Bug Catcher which could be configured up to 15 feet in length.

But it comes close. And Outbacker is a lot lighter. And it looks better. And there's no messing around with a screwdriver to change little tiny coil tap settings. Just plug and play. My kind of an antenna for high-frequency operation.

Plus, all the folks at Outbacker are active hams and truly gentlemen. If you have special requirements, or problems with their installation, they'll work with you to help find an answer to get you back on the air.

For additional specification sheets on Outbacker antennas, plus the complete line of Alpha Delta Communications, Inc., antenna systems, write Alpha Delta, P.O. Box 620, Manchester, KY 40962, or phone 606-598-2029. Tell them Gordo sent you. NV

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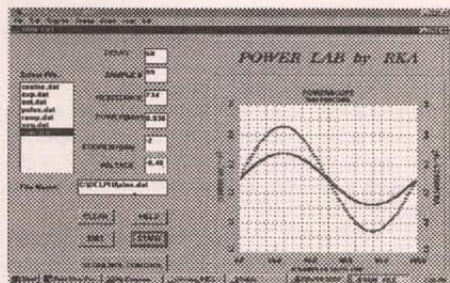
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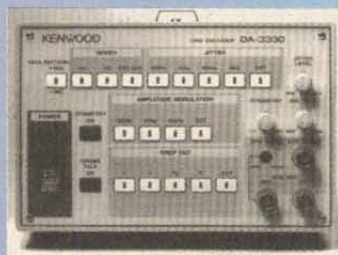
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# The Computer Controlled World: RS-232 Network Control Methods and Applications

## Opening Windows to the World — Part 2

by Ryan Sheldon, National Control Devices (404) 244-2432 <http://members.aol.com/ncdcat>

### Bridging the gap again ...

**M**y March '98 article, "Opening Windows to the World" went a long way toward showing users how to create a graphical user interface using Visual Basic 4 under Windows 95. I didn't expect to write this article again. However, I received numerous calls and E-Mail from Visual Basic 5 users who wanted to know where to get a copy of VB4, or just how to experiment with the directions in the article under VB5.

That's when I finally decided to upgrade to VB5. I do not claim to be an expert in any version of Visual Basic, but I have picked up enough of the language to control all of my custom electronics from this simple and powerful language. And what better way to take advantage of custom computer-controlled electronics than to provide a powerful user-created interface. After all, there is nothing like clicking a button on your desktop to make the

lights in a room turn on, or have a door open or close.

Let's face it, desktop computers are powerful and more widely used now than ever. It only makes sense to use them for whatever computer-control application you have in mind.

But often times, little information is available on the subject. And, if you do happen to find this information, beginners have little to no chance of understanding or applying this knowledge to completion of a complicated project.

So the idea in this

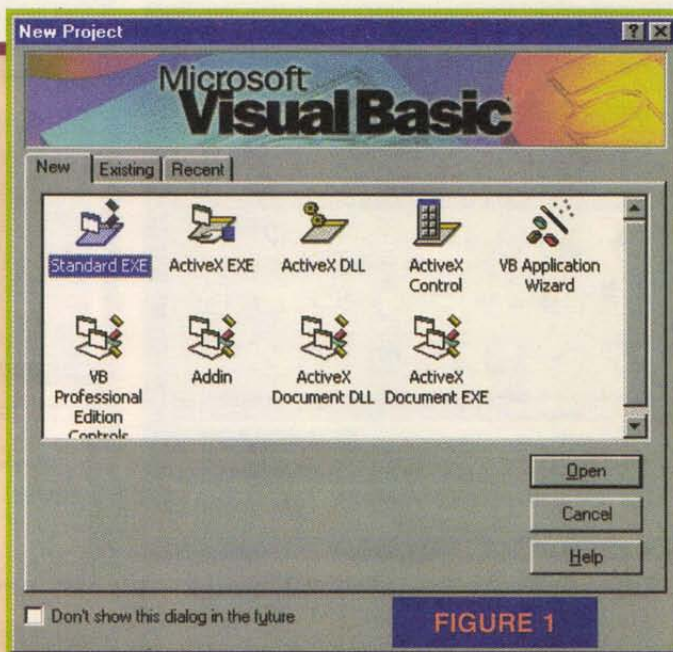


FIGURE 1

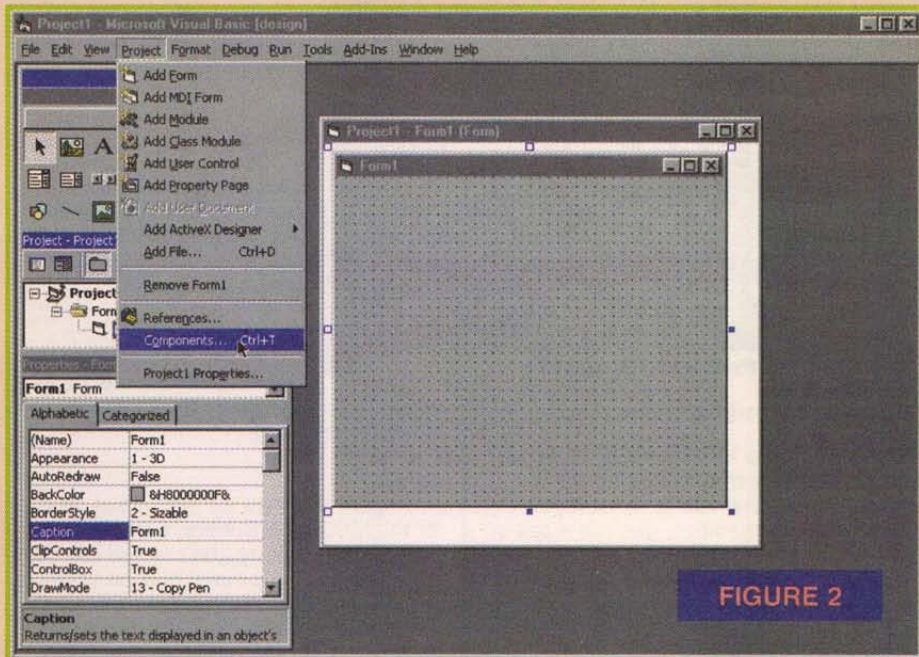


FIGURE 2

article is to again bridge the gap between Windows and the world, using the latest and greatest of the available technologies.

I think you'll find computer control from your desktop computer to be very easy. Especially since the steps for getting started are right here in front of you.

#### From VB4 to VB5

Occasionally, developers decide that it is in the best interest of the user to reorient menu items and even remove some useful options. Visual Basic 5 has a number of improvements making it a far more desirable language to work with. But, if you are familiar with version 4, version 5 may prove disorientating.

You can still open the serial port for RS-232 communications, but there are a few changes in how this is done. Visual Basic users will also notice a few differences in how programs are displayed, as well as a new type-as-you-go syntax reminder.

I still haven't found all the menu commands I so heavily relied on in version 4,



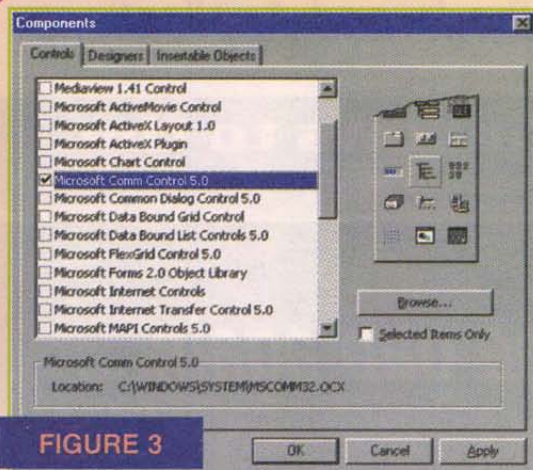


FIGURE 3



FIGURE 4

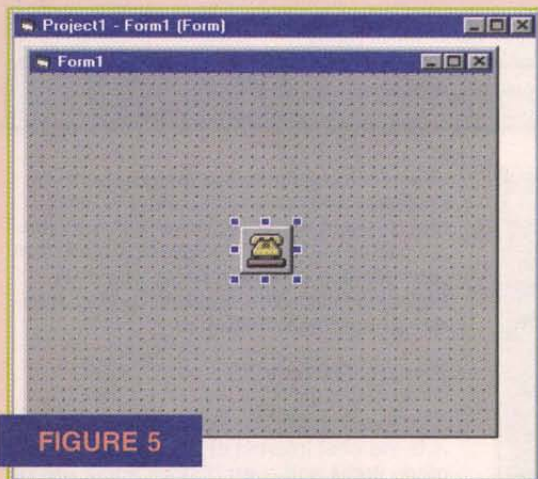


FIGURE 5

but the differences are so significantly better, that I don't mind having to relearn a few things. Visual Basic 5 offers automated typing of program instructions. As you type, a window of options will appear. You can simply hit the tab key to accept the automated command and continue typing.

The nice thing is, automated typing is completely optional. If you want to type in the whole command you may do so without interference. But I think with a little time and practice, most programmers will take advantage of this new feature.

## Software Requirements

You should be running Visual Basic 5 Professional or Enterprise Edition for the instructions in this article to work. If you have the standard edition, give me a call or send me an E-Mail and I'll tell you how to get started for free if you have access to the Internet (this way I know what my readers are using and a little about what projects they're working on).

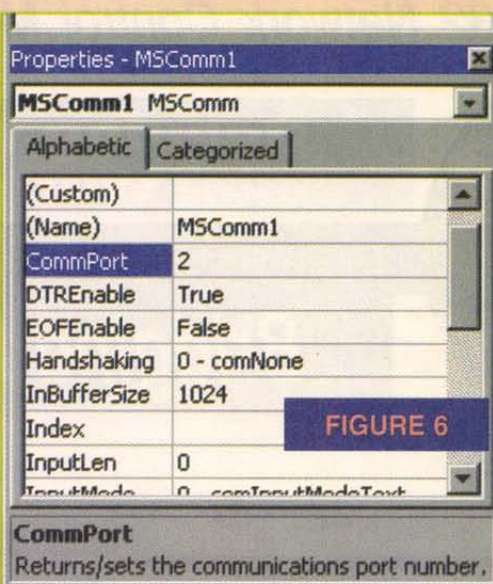


FIGURE 6

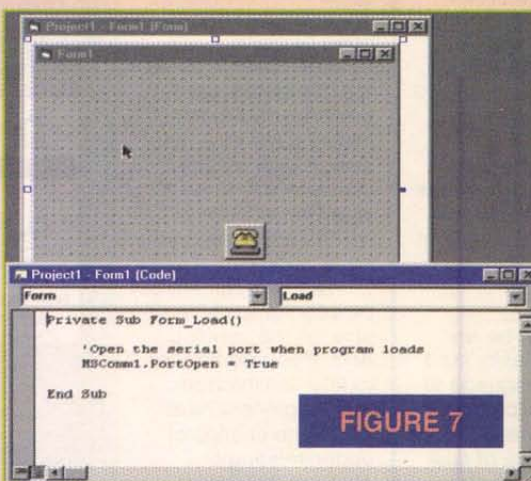


FIGURE 7

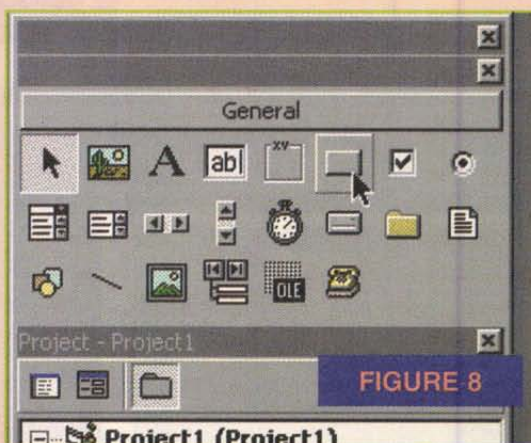


FIGURE 8

## Custom Hardware

Once again, I will be communicating to the world via the RS-232 port of the computer and I will use only two wires from the computer to do it.

This month's custom electronic circuit will show you how to control a simple serial-to-parallel converter. A serial-to-parallel converter takes serial data and converts it to eight output bits that can be used to control lights via relays, or other logic circuits.

Up to seven serial-to-parallel converters can share a single RS-232 serial port, providing a total of 56 output bits from a simple two-wire RS-232 connection. The hardware is simple and all parts are readily available for less than \$20.00 (great for the experimenter).

## Getting Started

Follow these simple steps to build your first computer-control application under Visual Basic 5 for Windows 95. I'll talk more about the hardware later, but let's start with the software since it will only take about 10 minutes.

### Step 1.

Start Visual Basic 5. You will see the screen shown in Figure 1. Select Open.

### Step 2.

Under the project menu, select components as shown in Figure 2.

### Step 3.

Put a check in the Microsoft Comm Control and Select OK as shown in Figure 3.

### Step 4.

A telephone icon will appear in your toolbox. Double-click the telephone icon to add RS-232 communications to your project as shown in Figure 4.

### Step 5.

Figure 5 shows RS-232 communications has been added to your program. Click one time on the telephone icon.

### Step 6.

Figure 6 shows the properties window for the MSComm Control. Select the CommPort property and change the number to an available serial port on your system. Many computers reserve Com 1 for the mouse, 2 for the modem. My system uses com 2 as the available serial port.



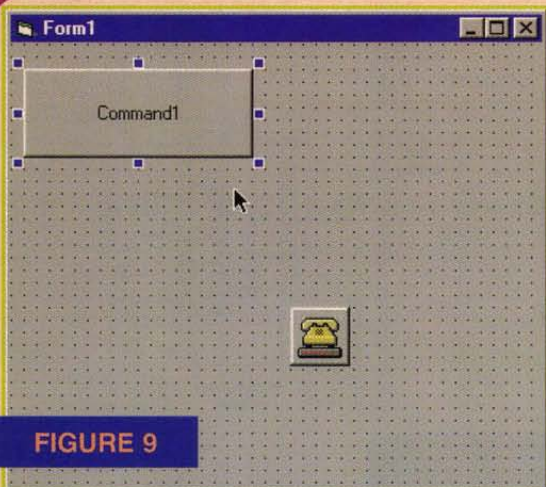


FIGURE 9

## Troubleshooting

Skip this section if your program started without producing any errors. Otherwise, you probably got a serial port related error (probably because it was unable to open the port). Try quitting any FAX software that may be running in the background.

In fact, it would be better to have VB5 as the only open application. You might check your bios set-up to see if the com port you selected in Step 6 matches the available com port.

## The Program

This program is just a simple

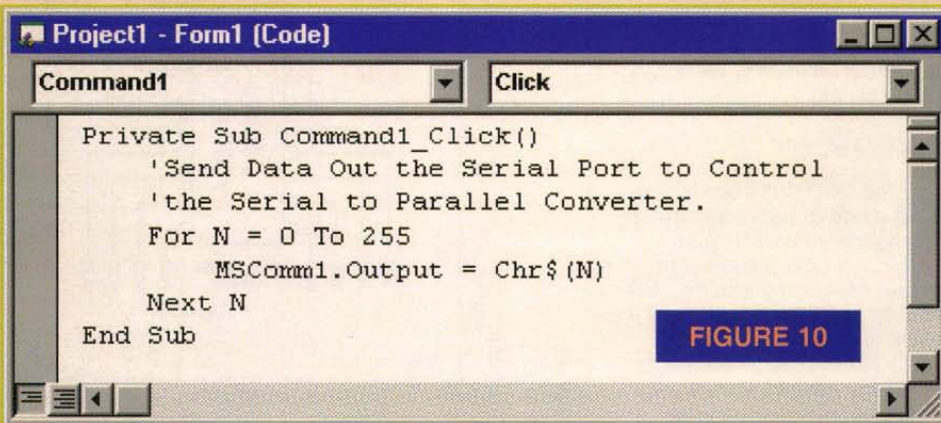


FIGURE 10

### Step 7.

Double-click on the project form as shown in Figure 7. This will open the Form\_Load subroutine. This subroutine is executed just as the program is started.

Type the command in this window as shown in Figure 7 to open the serial port for RS-232 communications as the program is started.

### Step 8.

Select the button tool in the toolbox as shown in Figure 8.

### Step 9.

Draw a button as shown in Figure 9.

### Step 10.

Double-click your newly created button and type the program shown in Figure 10 into the code window.

### Step 11.

Select "Start" under the "Run" pull-down menu to begin running your program.



FIGURE 11

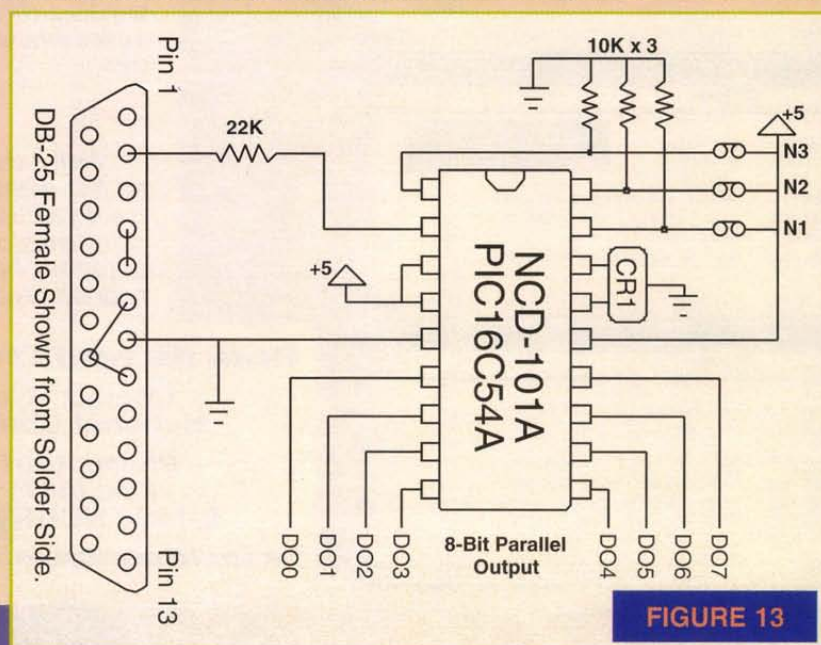


FIGURE 13

building block for sending data out the serial port of your computer. Every time you click the button created in step 9, the program created in step 10 executes. To simplify, every time you click the button, all 256 ASCII characters are sent out the serial port.

Keep in mind, only 256 ASCII characters can be sent and/or received by any RS-232 serial port. ASCII character 0 actually sends 00000000 out the serial port while ASCII 255 sends 11111111.

Figure 12 illustrates a short map of ASCII characters and their generated output. Take a close look at the ASCII characters being transmitted and the equivalent binary outputs, because this is what you're going to get from a serial-to-parallel converter when you send ASCII data. More on this subject later.

ASCII	Binary
0	00000000
1	00000001
2	00000010
3	00000011
4	00000100
5	00000101
16	00010000
32	00100000
33	00100001
34	00100010
64	01000000
128	10000000
192	11000000
255	11111111

FIGURE 12

## The Hardware

Figure 13 shows you how to create a simple serial-to-parallel converter, and how to hook it up to the RS-232 port of your computer. All parts in the diagram are readily available from National Control Devices (404-244-2432). CR1 is a ceramic resonator used to control baud rate. See the Figure 14 table for setting the baud rate.

## Raw Serial-to-Parallel Conversion Mode

N1, N2, and N3 control the name mode of the NCD-101. The diagram shows all name jumpers installed, configuring the NCD-101 as a raw serial-to-parallel converter. In this mode, only one NCD-101 may be driven from a single RS-232 serial port. Any data received is immediately converted to its binary equivalent (see



CR1	Baud Rate
4 MHz	9600 Baud
2 MHz	4800 Baud
1 MHz	2400 Baud
500 KHz	1200 Baud

FIGURE 14

Name	N1	N2	N3
0	0	0	0
1	1	0	0
2	0	1	0
3	1	1	0
4	0	0	1
5	1	0	1
6	0	1	1
7	1	1	1

0 = Jumper Removed  
1 = Jumper Installed

FIGURE 16

Figure 12 for a few ASCII- to-Binary conversions). Note that the words "binary output" and "parallel output" are synonymous in this application since sending an ASCII character of 0 is the equivalent of sending a binary of 00000000, which has a parallel output equivalent on D0-D7 as 00000000. Note that a 0 represents 0 volts on an output of the serial-to-parallel converter while a 1 represents +5 volts on an output.

### Named Serial-to-Parallel Conversion Modes

You can connect up to seven NCD-101s to the serial port of your computer using the naming mode. The naming mode requires a little more programming, but pro-

vides up to 56 logic level outputs with only a small handful of components.

See Figure 15 for a connection example of three NCD-101s to a single serial port. Take note of the name jumpers N1, N2, and N3. See Figure 16 to see how the names are defined.

### Programming in Name Mode

Figure 17 shows how to speak to each of the three NCD-101s connected to a single serial port. Each routine will count from 0 to 255 and put the binary representation on the outputs of each of the three NCD-101s.

Look carefully at each of the program examples to see how the name function is used ... pretty simple.

### Applications

The NCD-101s can be easily attached to relays for controlling lights or doors in your house. About two years ago, I began developing graphic LCD display controllers. I wrote all the initial drivers using a pair of NCD-101s in the name mode.

If you haven't seen it yet, check out our web page at <http://members.aol.com/ncdcat/>. I think you will quickly begin to see just how powerful these RS-232 network interface proces-

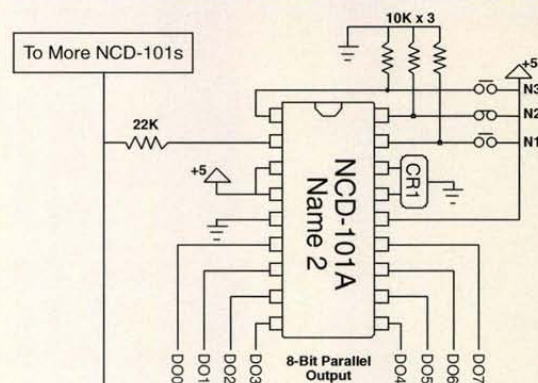
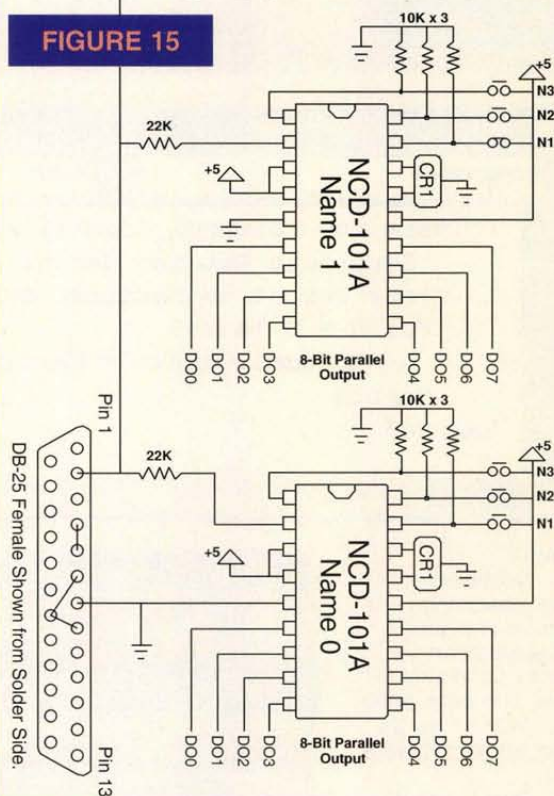


FIGURE 15



sors can be. They can be used for controlling character LCD displays, audio/video multiplexors, and a variety of other logic circuits.

### Closing

Well, I think that about covers it for this month. As usual, please call me if you have any questions or comments on this article. Call Ryan at (404) 244-2432 or E-Mail [ncdryan@aol.com](mailto:ncdryan@aol.com). NV

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Contact Ryan Sheldon  
National Control Devices

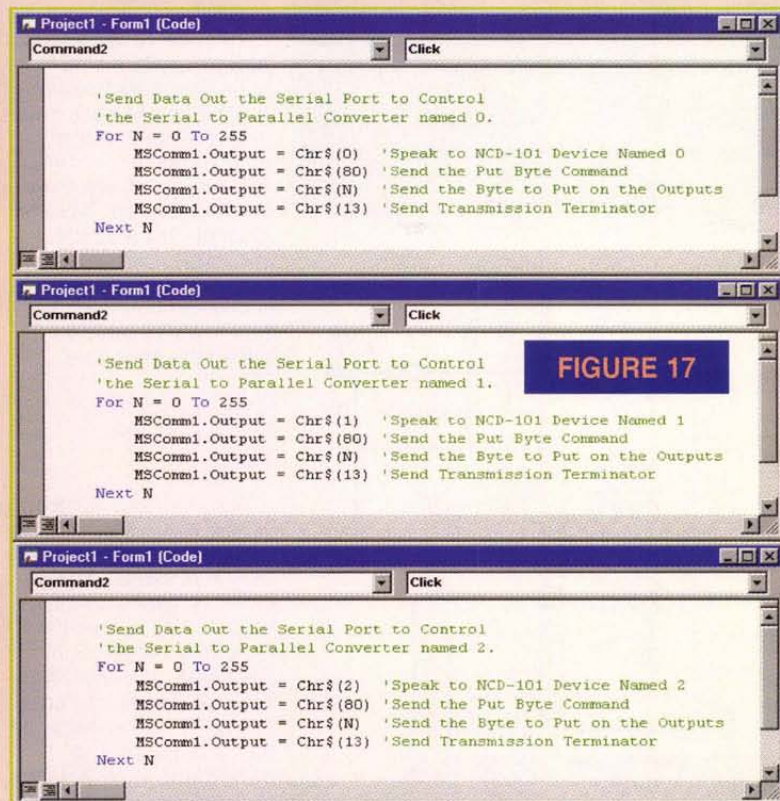
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FIGURE 17





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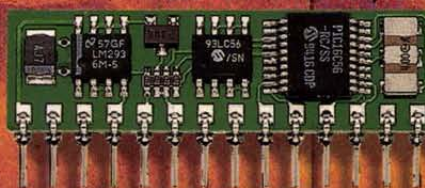
\*Antenna's sold separately for Scout, Cub, M1 and 3000APlus



# GETTING BACK TO BASICS

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BS1-IC Module - \$34  
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## BASIC Stamp I and BASIC Stamp Rev.D (as seen on page 4)

- 8 I/O lines
- 256 bytes EEPROM (program and data)
- 80 instructions max program length (average)
- 4 MHz oscillator
- 2,000 instructions/second
- 2400 baud serial I/O
- parallel PC interface
- PIC16C56 microcontroller
- small size  
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