

# Nuts & Volts

U.S. \$3.50  
CANADA \$4.50

Exploring Electronics And Technology For The Hobbyist And Professional

November 1998 Vol. 19 No. 11



## Mixed Control for the Masses



## FCC Proposes Ham Test Changes



## Flipping Out Over Flip-Flops



## Interfacing a Magnetic Stripe Reader



## The Ins and Outs of Optimizing Compilers





**BOTH SINGLE AND DUAL DRIVE  
MODELS AVAILABLE.**

**MULTIMEDIA PROCESSOR  
ACCELERATES DUPLICATION.**

**EXTERNAL SCSI-II PORT WORKS  
LIKE A STANDARD CD WRITER  
FOR CREATING CUSTOM DISKS.**



**TOTALLY SELF CONTAINED,  
NO CONNECTION TO A PC  
IS REQUIRED.**

**INTERNAL A/V HARD  
DRIVE STORES DISK IMAGES  
FOR MULTIPLE COPIES, AND  
CUSTOM AUDIO DISKS.**

**ADVANCED FORMAT  
DETECTION PRODUCES  
PERFECT DUPLICATES ON  
STANDARD CD-R MEDIA.**

# COPY ANY CD INSTANTLY. NO PC REQUIRED.

## **CD DUPE-IT!**

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

**BUY MANUFACTURER DIRECT: \$995  
408 330-5542**

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.



**CORPORATE SYSTEMS CENTER**  
3310 WOODWARD AVE., SANTA CLARA, CA 95054  
[WWW.CORPSYS.COM](http://WWW.CORPSYS.COM)

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.



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

## CyberEye Color Video Camera!



- High-quality (nice looking too!) composite color camera
- 1/4 inch CCD sensor w/auto white balance control
- Resolution: NTSC 542 x 492 (250,000 pixel)
- Manual focus knob/ring, 5mm to infinity
- Power: 5.0 VDC @ 180 mA. Supply from PC or keyboard power...no external adapter needed!

HSC#17263 \$69.00

## ATX Pentium Power!

- Support for Intel Pentium 90-200, 166-200 MMX CPU's
- Also supports Cxtx/IBM 6x86 P, PR 150 & 166 CPU's
- Also supports AMD K5, and, with special VRM, K6 CPU's
- 4 PCI slots, 4 ISA slots (one shared), 16-bit stereo sound
- 4 DIMM RAM sockets, parity or non-parity, ECC, EDO, FP
- On-board 2 x IDE, 2 x 16550 Serial ports, 1 parallel port
- New, 90-day warranty (CPU not included)



HSC# 80437 \$49.95

- ATX style Midtower case, fits above motherboard
  - "Netpower" logo on front, never used, 90-day warranty
- HSC# 17517 \$29.95

## Fujitsu 1 Gig. Drives

- Model #s M1606S, M2694E \$ M2932SA
- SCSI Interface - 3.5"
- Tested good and DOS formatted
- Used - w/90-day warranty!



HSC#17555 \$89.00

## Video-hacker Dream!

- Logitech Videoman Video-conference camera & interface
- These units were sold with Hewlett Packard S-700 workstations for videoconference capability
- We do not have technical data, software or manuals
- All we have is cameras with stand, and SCSI-II interface
- The camera is on a weighted stand that extends from 13" tall to over 20" tall, and has a stereo microphone
- Color camera is digital output only (not NTSC) as far as we can tell -- but who knows?
- Interface box has two SCSI-II ports on back, and a DC power input (we do not have the adapter), and on the front it has a mic. out jack, composite video out (BNC), and the connector for the camera cable.
- Note: HP and Logitech will provide no information on these



HSC#17503 \$39.95

## 2.0 GB IDE DRIVES

- JTS, Model #C2000-3AF
- 3882 Cyl. 16 Hd. 63 Sec.
- 6-1/8" L x 4.0" W x 5/8" H
- Each drive fully tested and DOS formatted
- HSC 90-day warranty

HSC#17561 \$65.00

## 1.3 GB IDE DRIVES

- Model #JTS1300-CHAMP
- 2526 Cyl. 16 Hd. 63 Sec.
- 6-1/8" L x 4.0" W x 5/8" H
- Each drive fully tested and DOS formatted
- HSC 90-day warranty

HSC#17560 \$55.00

## PC Power Supplies

- ATX-type perfect for use with case, motherboard at left!
- ATX supplies have 5V @ 25A as well as 3.3V @ 15A
- Our XTC312 comes with a 1-year warranty!



#17316 200 Watt Std PC \$17.50  
#XTC312 250 Watt ATX \$39.95

## HP ScanJet Special

- Wow! HP ScanJet 3P flat-bed greyscale scanners at \$49!
- Complete with stand, PC SCSI adapter, cables, Mac software (IBM drivers not included) at an unreal price!
- SCSI Interface, works with Mac or PC (Mac s/w incl.)
- 300dpi resolution (native mode), 1200dpi with dithering
- Information provided on where to download PC drivers
- Dealer display models & shelf stock returns (boxes may be opened, but scanners are unused)
- Scan rate of 10 seconds for letter-size page
- Factory RMA's from dealers, unused, 90-day warranty
- Hurry, the ones with document feeder are already gone, these won't last at this great price!



HSC#17392 \$49.00

## 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

## PCI-Bus 56K Modem!

- Lucent PCI-Bus 56K Modem at unheard-of price!
- Data, FAX, voice, full V.90 compatibility
- Voice from handset
- Windows 95/98 or NT only (Not Win 3.1 compatible)
- Uses latest Lucent chipset, comes with Lucent drivers
- New OEM pack, with Trio application software on CD
- Warranty



HSC#17532 \$39.95

## FM Tuner for your PC!

- Listen to FM radio while using your computer!
- Set up to 24 programmable stations
- Even works as an alarm clock (sorry, no snooze button!)
- Compatible with DOS/Windows/Win95/Win98
- ISA-bus card, receives from 87.5 to 108 MHz
- New OEM pack with antenna, audio cable, software, set-up guide -- works in combination with your sound card.
- 90-day warranty

HSC#17533 \$12.50

## Drive-bay Amp & Equalizer

- Made by NEC, fits into standard 5.25" drive bay
- 5-Band equalizer has 4 channels, 6 watts RMS/channel
- 25 watts RMS total power output
- Headphone jack on front panel
- Connects to drive power connector
- No special software or drivers req'd!
- Compatible with any sound card
- 90-day warranty



HSC#17534 \$19.95

## PCMCIA Sound Card!

- Media Vision PCMCIA Sound Card
- Great for Portables, Laptops with PCMCIA Slot
- External pod has joystick port, mic. input, line in & line out jacks, volume control.
- Install software, inst. included.
- Win 3.x, W95 compatible
- New in OEM pkg (no box), 90-day HSC warranty
- We had these before at \$39.95 and they went fast!



HSC#17036 \$29.95

## 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 TranXit 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

## USB Video Camera!

- Compaq "Proshare" color videoconferencing camera
- Made by Intel -- supported Win 95 plug & play device
- Universal Serial Bus (USB) interface
- Comes with USB cable, manuals



HSC#17539 \$59.00

## Cases!...Cases!...Cases!

- Mini-Tower, 3 - 5.25" and 4 - 3.5" bays
- One slot for 3.5" drive on front panel
- 15" H x 7" W x 16.5" D
- Takes standard mini-tower supply
- See our #17316 (this add)



HSC#17481 \$12.50

- Full-sized tower case, for AT or ATX!
- Comes w/AT-style power supply
- ATX cutouts on rear panel, just change to our #XTC312 ATX power supply!
- 24-1/4" H x 7.5" W x 16-3/4" D
- Brand new!, black in color



HSC# 17544 \$42.50

- AT-style Mid-tower
- Extra PIO and SIO slots on rear panel!
- 18.5" H x 6.5" W x 15.75" D
- Three 5.25" and two 3.5" front bays
- Brand new!, black in color



HSC# 17543 \$37.95

- ATX-style mid-tower cabinet
- Power supply included
- Three 5.25" and two 3.5" front bays
- 16.5" H x 8.25" W x 16.5" D
- Brand new!, 90-day warranty



HSC# 80459 \$59.50

- Full-size tower bargain at a great price!
- Five 5.25" and four 3.5" bays!
- Extra SIO & PIO connector cutouts!
- Great for backup server...etc
- Requires old-style larger power supply (ask for stock check...we might have it!)



HSC# 17504 \$15.00

## Ludicrous Laser Pointer!

- How can we do this!...we don't even know!...
- Small, handy laser pen keychain pointer.
- 5 mW, bright red laser with tight beam
- Brushed gold finish with spring-loaded clasp
- Brand new, with batteries and instructions
- 90-day warranty.



HSC#17383 \$12.50!

## 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
- New Price!



HSC#17160 \$39.95

## Workhorse Hard Drives!

- Seagate with SCSI interface full-height drives
- Good, Reliable drives for many applications
- Choose from 670 or 330 MB size
- With 90-day warranty!



HSC#17556 ST4766N \$35.00

HSC#17557 ST4385N \$29.00



## Visit HSC's Website!

- Pay us a virtual visit on the World Wide Web!
- Simply point your browser to <http://www.halted.com>
- Site is constantly being revised, please visit often!
- Check out the amazing "Gizmo of the Week" feature!

## HSC Catalog online!

- 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!



## JIMHANDY™ CW INTERFACE

**M**FJ's new JimHandy™ CW interface lets you use your two-meter or 440 MHz handheld to practice Morse code on-the-air! You can get your ham buddies together or even your entire club on-the-air.

Everybody can join in, including No Code Techs, Novices, TechPlus and anybody who wants to upgrade. You simply plug the JimHandy into your two-meter or 440 MHz handheld transmitter and plug in a straight key. Your CW is converted into audio tones that are sent to your mic jack and transmitted by your HT for everyone to copy.

The transmit/receive switch automatically keys your push-to-talk on your HT as soon as you start sending CW. It keeps it keyed until you've finished sending. Then it returns your HT to receive so you can copy. An adjustable T/R delay knob lets you send fast or slow CW.

The JimHandy is available for \$59.95.

## SIX-METER LOW-ANGLE DX VERTICAL ANTENNA

**M**FJ's omni-directional low-angle vertical radiator lets you work plenty of DX in all directions even with low power. It's super quiet — no static noise — and it's easy-to-put up. It fits anywhere!

It uses MFJ's exclusive GroundIsolated™ radial system to give you a much cleaner radiation pattern. You'll get more signals at desired low-angle radiation for easy DX. It eliminates common mode current paths and reduces undesirable feedline and supporting structure radiation. It also reduces conducted noise reaching the antenna over the outside of the feedline or the antenna support. MFJ's system ensures that the length of the feedline or support does not change the antenna's resonant frequency or SWR.

MFJ-1756 is quiet. A DC grounded radiator eliminates noise generated by static. It is easily cut for your favorite part of the six-meter band. A rugged adjustable air insulated matching stub lets you obtain a near perfect 1:1 SWR — a non-adjustable standard ground plane is much less than 50 ohms.

MFJ's large diameter radiator gives you wide bandwidth and a heavy duty ceramic insulator gives low RF loss. MFJ-1756 has fiberglass ground insulators, a 55 inch high-strength aluminum radiator and four 60 inch radials. It will mount on any 1 to 1-1/2 inch mast with a single U-bolt (included). Mast is not supplied.

The MFJ-1756 is available for \$69.95.

For more information, contact:

**MFJ ENTERPRISES, INC.**  
P.O. BOX 494, DEPT. NV  
MISSISSIPPI STATE, MS 39762  
601-323-5869 FAX: 601-323-6551  
E-MAIL: [mfj@mfjenterprises.com](mailto:mfj@mfjenterprises.com)  
WEB: <http://www.mfjenterprises.com>

Showcase your New Products here! Send all press releases or information/photos to: **Nuts & Volts Magazine**  
430 Princland Court, Corona, CA 91719  
or E-Mail to [newproducts@nutsvolts.com](mailto:newproducts@nutsvolts.com)



## DATA INTERFACE ADAPTERS

**U**se your personal computer to log data from global positioning systems, depth sounders, radar, and other marine navigational devices with these data interface adapters from B&B Electronics.

The plug-in connectors convert NMEA

(National Marine Electronics Assn.) standard data signals so they can communicate with any RS-232, RS-422, or RS-485 device such as a personal computer or printer.

Two adapter models are provided to suit either the older NMEA or the latest NMEA specs.

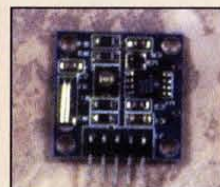
B&B Model 183COR converts the earlier NMEA0183 version 1.x data signal to EIA RS-232, RS-422, or RS-485 signals. Model 183V2C is for NMEA0183 version 2.x, the latest version of the NMEA specification. It converts one data signal in each direction between NMEA0183 and EIA RS-232.

Costs are \$99.95 for either of the NMEA converters.

For more information, contact:

**B&B ELECTRONICS MFG. CO.**  
707 DAYTON RD., DEPT. NV  
OTTAWA, IL 61350  
815-433-5100 FAX: 815-434-7094  
E-MAIL: [sales@bb-elec.com](mailto:sales@bb-elec.com)  
WEB: [www.bb-elec.com](http://www.bb-elec.com)

## CLOCK MODULE



**T**he Pocket Watch B contains a real-time clock, a calendar, and advanced timing features. The clock module keeps track of seconds, minutes, hours, days, months, and years. Adjustments for leap year are automatically performed. It is year 2000-compatible.

This real-time clock communicates via an easy-to-use, asynchronous, one to two wire, serial communications interface. Baud rates of 2.4K 4.8K, and 9.6K are supported with a user-friendly automatic baud detect system.

System timing functions can easily be implemented with any of the four advanced alarm types. There is a standard level alarm, a single shot alarm, and two alarms with variable output pulse duration and repetition rates.

The Pocket Watch B's small size and connection scheme allow the device to be inserted directly into circuit boards for production runs, or into breadboards for easy prototyping. Complete data sheets and application notes are available at [www.solutions-cubed.com](http://www.solutions-cubed.com)

The Pocket Watch B comes in a 1"x1" SIP module, and sells for \$24.95.

For more information, contact:

**SOLUTIONS CUBED**  
3029 ESPLANADE, STE. #F, DEPT. NV  
CHICO, CA 95973  
530-891-8045 FAX: 530-891-1643  
E-MAIL: [lon@solutions-cubed.com](mailto:lon@solutions-cubed.com)  
URL: [www.solutions-cubed.com](http://www.solutions-cubed.com)

## OSZIFOX HANDHELD STORAGE SCOPE



**I**n a pen-style housing, osziFOX is a handheld multifunctional 20 MHz storage scope that includes a small back-lit LCD readout with a performance that matches some benchtop units.

With sample rates from 50 nS to 1 mS, and auto, manual, or external triggering, AC and DC voltages or even frequencies can be measured easily, and simultaneously displayed on a PC screen.

Weighing only 70g, osziFOX's six-bit resolution is great for taking measurements in audio amplifiers, digital circuits, telephone installations, com-

munications debugging, and test or service departments.

Using the serial cable and Windows software supplied, signals recorded in the internal 128 byte memory can be stored on disk or printed on the PC's standard printer.

OsziFOX is available for \$129.00 each.

For more information, contact:

**SAELIG COMPANY LLC**  
1193 MOSELEY RD., DEPT. NV, VICTOR, NY 14564  
716-425-3753 FAX: 716-425-3835  
E-MAIL: [saelig@aol.com](mailto:saelig@aol.com) WEB: [www.saelig.com](http://www.saelig.com)

## PTZ ROBOTIC CAMERA

**A**ctivMedia's new Pioneer Pan-Tilt-Zoom (PTZ) system integrates a high-speed, wide-range pan-tilt sony camera with Pioneer PSOS software and Saphira software plug-in for intelligent camera control mounted, or easily added to any Pioneer robot.

Pioneer mobile robotic platforms offer sturdy, well-tested, affordable bases for research, prototyping, education, and applications indoors and out.

Teleoperate the camera remotely from a PC or let it roam on its own under Pioneer's Saphira or other software. Monitor images in real-time or process video with framegrabber and video transmitter-receiver pair.

Key features include: fully integrated with

PSOS and Saphira software plug-in for easy operation; pre-mounted on any new Pioneer model or easily installed on existing Pioneers; 12x optical zoom for wide range of applications; high-speed auto-focus lens for responsiveness; quick 200-degree pan moves up to 80 degrees per second; plugs into Pioneer RS232C serial port; and NTSC or PAL.

For more information, contact:

**ACTIVMEDIA, INC.**  
182 HANCOCK RD., DEPT. NV  
PETERBOROUGH, NH 03458  
603-924-9100 FAX: 603-924-2184  
1-800-639-9481  
E-MAIL: [jdietsch@activmedia.com](mailto:jdietsch@activmedia.com)  
WEB: <http://www.activmedia.com/robots>



# Tech America

When You're Serious About  
Electronics... We Deliver!

## Commercial 2-Way Radios at an Unheard-of Price!

# HALF PRICE!

# 79<sup>95</sup>

Reg  
159.95

**uniden**<sup>®</sup>  
*Quality Goes the Distance*

### Models SPH21DT and SPU21KT

One-Channel VHF/UHF Handheld Transceivers—  
For On-the-Go People Who Need to Stay in Touch

- Incredible value—Ni-Cd battery and AC charger included in this low price!
- Rugged construction suits business and worksite use—**Built to Last!**
- Equipped with channel-monitoring button and 16 frequencies (set DIP switch to one channel)
- Optional CTCSS (private channel) board for extra privacy (sold separately)

Great for small-business owners to stay in touch with workers or serve customers more efficiently. A full 2W output delivers clear communication over ranges of several miles, depending on location. Advanced phase-locked loop circuitry stabilizes frequency for highly dependable business or recreational use. Plus, they offer 20 times the power of conventional family radios. Where privacy is required, add optional CTCSS boards to two radios and ensure a noise-free, private connection. The rechargeable battery will last eight hours (based on 90% standby time). (Includes: antenna, rechargeable Ni-Cd battery, belt clip and AC adapter/wall charger. Mfr. Warranty: one-year parts and labor. Size: 5.31×2.5×1.25" (HWD). Weight: 11.5 oz.)

940-0098 Model SPH21DT VHF ..... Reg 159.95 **Sale ea 79.95**

940-0099 Model SPU21KT UHF ..... Reg 159.95 **Sale ea 79.95**

### Save on Accessories

940-0126 CTCSS Plug-In Board ..... Reg 42.00 **Sale ea 34.95**

940-0124 Speaker/Microphone ..... Reg 43.00 **Sale ea 34.95**

940-0118 Extra Rechargeable Battery ..... Reg 32.00 **Sale ea 24.95**

FCC License Required: You must have a valid FCC Business Radio Service license before you can start enjoying the many benefits these transceivers provide. There is no test, but the FCC does require a nominal fee. Transmitting without a license can result in fines and/or confiscation of equipment.

2-Watt, VHF/UHF  
with Shock-Resistant  
ABS Molded Case

Tough Enough  
for Business,  
Great for  
Recreational  
Uses!

Actual Size



## Order Today! Call Toll-Free 1-800-877-0072

You Must Supply Special Code **28011** Receive These Super Deals!

## Order on the Web Site at [www.techam.com](http://www.techam.com)

TechAmerica makes no warranties of any kind, express or implied, including any warranty of merchantability or fitness for a particular purpose with regard to the merchandise. See page 399 of our catalog for our return policy and other terms and conditions of your order. ©1998 Delaware TechAmerica, Inc. All rights reserved. TechAmerica cannot be liable for pictorial or typographical inaccuracies. All product specifications, which include dimensions, are subject to change without notice. Prices shown are cash prices in U.S. dollars and are subject to change without notice. Shipping and handling fees are extra.



# Contents

## ARTICLES

### FCC PROPOSES HAM TEST CHANGES *Gordon West*..... 8

Several aspects of current ham testing requirements may be undergoing drastic changes. Get your feedback in to the FCC and ARRL by December 1st.

### INTERFACING A MAGNETIC STRIPE

#### READER *Gerald Roylance*..... 20

Cards with magnetic stripes are everywhere. Learn how the stripes are utilized, and how to interface your own magnetic stripe reader.

### THE INS AND OUTS OF OPTIMIZING

#### COMPILERS *Jeff Stefan*..... 38

Want to write better code? Consider understanding compiler optimizations.

### RESISTANCE IS FUTILE! *E. Z. Camp*..... 44

### SECURITY ELECTRONICS SYSTEMS AND

#### CIRCUITS — PART 10 *Ray Marston*..... 76

A variety of add-on automobile security circuits are described in this final episode of the series.

### THE COMPUTER-CONTROLLED WORLD *Ryan Sheldon*..... 92

Mixed control for the masses. See how a simple control system using four devices can be utilized for a heating and cooling system.



*Gordon West WB6NOA says  
"Write the FCC with your comments about the proposed rule changes for ham testing today!"*

*The comment period closes on  
December 1st!!*

Check out  
Santa's Special  
on page 96!!



## COLUMNS

### AMATEUR ROBOTICS NOTEBOOK *Robert Nansel*..... 0

Due to time constraints, there will not be a robotics column this month, but it will return in December.

### ELECTRONICS Q & A *TJ Byers*..... 28

### OPEN CHANNEL *Joseph J. Carr K4IPV*..... 87

Flipping out over flip-flops, digital circuit power supplies, and RF exposure to hams.

### RESOURCE BIN *Don Lancaster*..... 83

New secrets of military surplus (part 2).

### STAMP APPLICATIONS *Jon Williams*..... 12

Timing is everything — taking a look at Interrupts, plus a serial follow-up.

## DEPARTMENTS

ADVERTISER'S INDEX.....	68
CLASSIFIED AD INFO.....	68
DEALER DIRECTORY.....	36
EVENTS CALENDAR.....	47
NEW PRODUCT NEWS.....	4
NEWS BYTES.....	25
NV ADMART.....	56-57
READER FEEDBACK.....	17
TECH FORUM.....	42

## CLASSIFIED AD INDEX

10. Ham Gear for Sale.....	48	125. Microcontrollers.....	63
20. Ham Gear Wanted.....	48	130. Antique Electronics.....	63
30. CB/Scanners.....	48	135. Aviation Electronics.....	64
40. Music & Accessories.....	49	140. Publications.....	64
50. Computer Hardware.....	49	145. Robotics.....	64
60. Computer Software.....	51	150. Plans/Kits/Schematics.....	64
70. Computer Equip. Wanted.....	52	155. Manuals/Schematics Wanted.....	65
80. Test Equipment.....	52	160. Misc. Electronics For Sale.....	65
85. Security.....	55	170. Misc. Electronics Wanted.....	67
90. Satellite Equipment.....	58	175. BBS & Online Services.....	70
95. Military Surplus Electronics.....	58	180. Education.....	70
100. Audio/Video/Laser.....	58	190. Business Opportunities.....	70
110. Cable TV.....	59	200. Repairs/Services.....	71
115. Telephone/Fax.....	61		
120. Components.....	61		

Nuts & Volts Magazine is published monthly for \$19.00 per year by T&L Publications, Inc., 430 Princeland Court, Corona, CA. POSTMASTER: Send address changes to Nuts & Volts Magazine, 430 Princeland Court, Corona, CA 91719.



*You Win  
with Nuts & Volts!*

Subscribe today and be  
automatically entered in our new  
MONTHLY PRIZE DRAWING!!!

See page 35 for details!!

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.



Published Monthly By  
**T & L Publications, Inc.**  
 430 Princland Court  
 Corona, CA 91719  
 (909) 371-8497  
 FAX (909) 371-3052

**E-Mail**  
 editor@nutsvolts.com  
**URL**  
 http://www.nutsvolts.com

**Subscription**  
**Order ONLY Line**  
**1-800-783-4624**

**Publisher**  
 Jack Lemieux N6ZTD  
**Editor**  
 Larry Lemieux KD6UWV

**Managing Editor**  
 Robin Nelson KD6UWS

**On-The-Road Exhibit**  
**Coordinator**  
 Audrey Lemieux N6VXW

**Subscriptions**  
 Abby Madain

**Classified Ads**  
 Natalie Sigafus

Copyright 1998  
 by **T & L Publications, Inc.**  
 All Rights Reserved

All advertising is subject to publisher's approval. We are not responsible for mistakes, misprints or typographical errors. Nuts & Volts Magazine assumes no responsibility for the availability or condition of advertised items or for the honesty of the advertiser. The publisher makes no claims for the legality of any item advertised in Nuts & Volts. This is the sole responsibility of the advertiser. Advertisers and their agencies agree to indemnify and protect the publisher from any and all claims, action or expense arising from advertising placed in Nuts & Volts. Please send all subscription orders, correspondence, UPS, overnight mail and artwork to: 430 Princland Court, Corona, CA 91719.

The closing date for each issue is the 5th of the prior month, e.g., the closing date for the June issue is May 5th. Ad copy to be typeset by Nuts & Volts should be received one week prior to the closing date. Call or write for current advertising rates.

#### CHANGE OF ADDRESS

If you are moving, notify us AS SOON AS POSSIBLE so we can continue your subscription without interruption.

Your magazine **WILL NOT** automatically be forwarded to you by the post office, so it's important to submit your change of address directly to Nuts & Volts. We will not be able to replace missed issues of the magazine due to unreported address changes.

When you send in your new address, include a current mailing label from the magazine with your account number on it. If you do not have a mailing label, be sure to include your old address and the name(s) under which the subscription was submitted.

**DON'T MISS  
 A SINGLE  
 ISSUE!!**

**SUBSCRIBE  
 TODAY!!**

#### To Subscribe to NUTS & VOLTS

##### USA ONLY

\$19.00 — 1 Year    \$35.00 — 2 Years    \$51.00 — 3 Years

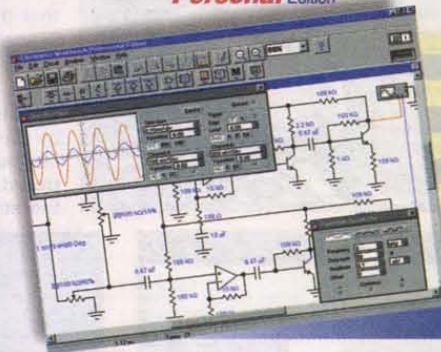
##### MAILED FIRST CLASS — FOREIGN ONLY

\$37.00 — Canada/Mexico    \$100.00 — Foreign/Air Mail  
 \$50.00 — Foreign/Surface

Send payment to the address below or call 1-800-783-4624  
 and use your Visa or MasterCard.  
**Nuts & Volts Magazine, 430 Princland Court, Corona, CA 91719**

**THE WORLD'S MOST POPULAR  
 DESIGN TOOL CHOSEN BY OVER  
 100,000 USERS!**

### Electronics Workbench<sup>®</sup> Personal Edition



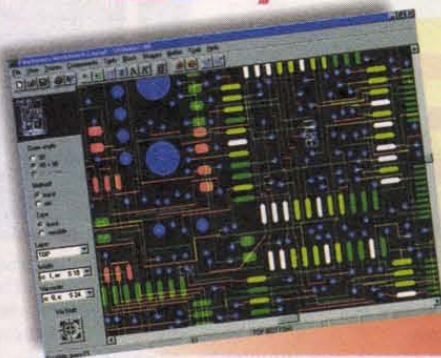
TRUE MIXED ANALOG/DIGITAL  
 FULLY INTERACTIVE SIMULATION  
 PRO SCHEMATIC EDITOR  
 8 VIRTUAL INSTRUMENTS  
 ON-SCREEN GRAPHS  
 OVER 4,000 MODELS  
 8 POWERFUL ANALYSES  
 FREE TECHNICAL SUPPORT

**\$299**

#### Full-featured schematic capture and SPICE circuit simulation!

The world's most popular circuit design tool that sets the standard for powerful, insightful SPICE simulation. Create professional looking schematics and then with the flick of a switch, display simulated waveforms live on a suite of virtual instruments. Includes 15 powerful analyses and a library of over 4,000 robust component models.

### Electronics Workbench<sup>®</sup> Layout Personal Edition



AUTOROUTING  
 REROUTE WHILE MOVE  
 32 ROUTING LAYERS  
 50" X 50" BOARD SIZE  
 OVER 3,500 LIBRARY SHAPES  
 EXTENSIVE OUTPUT  
 REAL TIME DESIGN RULE CHECK  
 DENSITY HISTOGRAMS  
 FREE TECHNICAL SUPPORT

**\$299**

#### Power-packed PCB layout with autorouting and real-time DRC!

EWB Layout is a powerful board layout package for producing high-quality, multi-layer printed circuit boards. Offering tight integration with our schematic capture program, EWB Layout is the best way to quickly produce well-designed boards.

**BUY BOTH AND SAVE! ~~\$598~~ \$548**

**CALL FOR INFORMATION  
 AND PRICING ON OUR  
 PROFESSIONAL EDITION.**

**800.263.5552**

**For a free demo, visit our website at [www.electronicworkbench.com](http://www.electronicworkbench.com)**

**30-DAY MONEY-BACK GUARANTEE**

**Fax: 416-977-1818**

**E-mail: [ewb@interactiv.com](mailto:ewb@interactiv.com)**





**A**mateur radio operators and EVERYONE interested in obtaining an amateur radio license are flooding the Federal Communications Commission (FCC) with comments about proposed rulemaking that could dramatically change ham test requirements. At the same time, amateur radio's largest non-profit steering organization — the American Radio Relay League (ARRL) founded in 1914 — proposes the retaining of the no-code VHF/UHF license, and dropping the Morse Code telegraphy examination in speed for General class from the present 13 wpm down to five wpm. And, until the Morse Code requirements on an international basis ultimately go away, No Code International also recommends dropping the Morse Code test speed for General class down to a simple five wpm exam.

"No Code International would like to see CW testing for all classes of amateur license to a five wpm speed," comments Fred Maia W5YI, Executive Director. "NCI does not at all oppose the USE of Morse Code in the amateur bands by those amateurs who choose to use it in that mode ... we just don't believe that Morse Code is an important enough factor in today's communications world that it should be a licensing criterion at any level beyond the absolute minimum required by international regulations," adds Maia. Ultimately, NCI stands for the complete elimination of Morse testing for all amateur licensing.

### THIS ONE IS FOR REAL

Every couple of years different organizations propose dropping code test speed requirements to the FCC. The ARRL will usually conduct a survey and normally reports back that this is an unpopular idea to change CW test speed requirements, and ultimately the FCC does nothing.

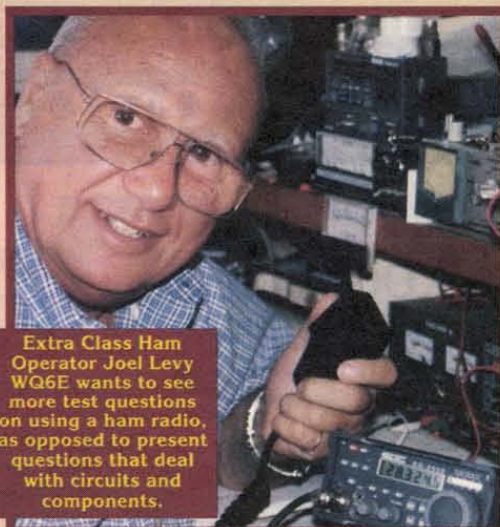
But this one is for real — the FCC has put the amateur radio service within its 1998 biennial Regulatory Review, and has officially released a Notice of Proposed Rulemaking Docket No. 98-143 to streamline the service and eliminate unnecessary and duplicative rules as they might effect ham testing. And this is not just an FCC Notice of Inquiry — this is the real thing — Notice of Proposed Rulemaking where the FCC has put the amateur radio service on "fast track" and could get new rules in place by the first

# FCC PROPOSES HAM TEST CHANGES

by Gordon West WB6NOA

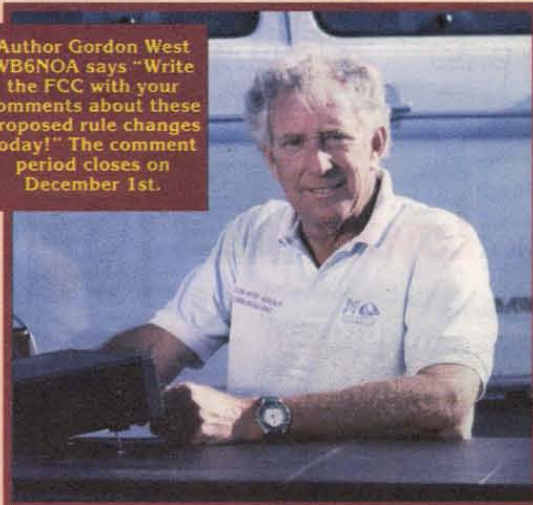
of next year.

The FCC proposes to modify the amateur



**Extra Class Ham Operator Joel Levy WQ6E wants to see more test questions on using a ham radio, as opposed to present questions that deal with circuits and components.**

**Author Gordon West WB6NOA says "Write the FCC with your comments about these proposed rule changes today!" The comment period closes on December 1st.**



**Extra Class Ham Operator Chip Margelli K7JA looks at the new ARRL proposals as a good way to bring more young hams into our hobby with practical tests.**



radio service rules as follows:

1. Reduce the number of license classes from six to four.
2. Provide greater opportunities to volunteer examiners (VEs) to participate in the examination process — in other words, make some changes to code and theory tests.
3. Eliminate Radio Amateur Civil Emergency Service (RACES) licenses because the emergency communications that are routinely transmitted by RACES stations can be transmitted by primary, club, or military recreational stations.
4. Finding out ways for improving the enforcement processes as they relate to amateur radio.

of privileges already earned by ham operators.

The ARRL also recommended renaming the classes of amateur radio license to classes A through D. Class D would be the present no-code Technician class license, and Class A would be the Extra class license. The slow-code five wpm General license would be Class C, and the Advanced class license would be Class B.

"We were surprised on how many negative comments we received regarding renaming the amateur licenses as ham Class A through D," comments ARRL President Ron Stafford W6ROD, at the recent ARRL Southwestern Division Convention. At the convention, most hams were quite upbeat with positive comments on the reduction of their General class code speed from 13 wpm down to five wpm



which would turn many entry-level hams into worldwide-band ham operators. Amateur operators already holding a five wpm certificate for Novice or Technician-plus would probably just take one or two more written exams to advance up to General class with no other code test required.

## WHAT THE FCC DIDN'T SAY

But most surprising to seasoned ham radio operators was the FCC saying absolutely NOTHING about a specific code speed change for General class or Extra class. Rather, the FCC indicated they will take their incoming comments from hams as a good way to finally announce any code test or written test changes.

And here are some of the points that the FCC raised to solicit comments from hams and non-hams on how the amateur tests would be structured in the future:

A. The present six classes of amateur license would be streamlined into four classes. The FCC was rather firm in indicating it will probably phase out the Novice license, as well as the five wpm Technician-plus class, leaving only the entry-level no-code Technician class. The present no-code Technician class is a popular one, and hams can get on the air above 50 MHz by simply completing two written exams. Under the new rules, just one written exam would probably be administered for Technician class.

To get to the worldwide General class license, all that would be necessary is a code test and one more additional written General class exam. In fact, under the ARRL proposal, the ONLY way a new ham could get on the worldwide bands would be to pass the five wpm, and ALSO pass the General written test. The restricted operation on Novice CW frequencies would go away, and also would the Technician-plus test for maybe coming up on a portion of the 10-meter phone band.

Under the ARRL proposal to the FCC rules, only five wpm and passing one more written test gives you EVERY worldwide General class band. And you won't be restricted just to one or two bands — with five wpm and the General theory test, you can operate on General class segments of EVERY worldwide band, plus unlimited access to all frequencies above 50 MHz.

Now don't panic if you are already a Tech-plus operator or a Novice operator, chances are you won't lose any present privileges. Good news for you — since you already have the five wpm satisfied, just a simple written examination and you could very well be turned into a grandfathered General class operator.

But the FCC does not go as far as the ARRL in saying dump the code speed. "We seek comments on all aspects of the Morse Code standards used in our examinations," writes the FCC in Point #24 of their NPRM. "Do the three

levels of five, 13, and 20 wpm remain relevant to today's communications practices? Should we continue to have three different levels, or should these be reduced to one or two — and, if so, what should be the required speed?" asks the FCC. They also indicate they are looking for comments on whether or not they would add elements to the written examination to insure a working knowledge of newer digital technology which, in part, is replacing the Morse Code.

The FCC also asks whether or not the code test of copying one minute out of five perfectly is appropriate. They ask whether or not the volunteer examiners could determine how to test for code speed. They suggest that volunteer examiners accredited by a volunteer examiner coordinator could take a greater role in the examination process, not necessarily restrained by specific FCC rules.

it down letter perfect. Give me a break!

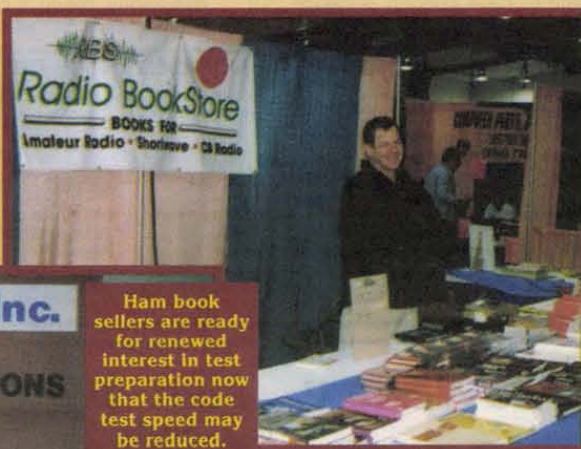
B. GREATER VOLUNTEER EXAMINER OPPORTUNITY. The FCC is suggesting that Advanced class operators be able to administer General class testing. The ARRL also recommends this, so we think that this will probably go through without any negative comments. The FCC and ARRL agree that ham operators who have passed a specific class test should be able to become certified through a participating volunteer exam coordinator and administer the same type of test that they have successfully passed.

But there IS some heated discussion about amateur operators who have been issued code test certificates of completion based on a handicap physician's statement. The discussion is about an alarming rate of handicap statements coming through without the FCC having the time and staff to actually verify the physician's report. Volunteer examiners are concerned that there is no verification of the physician's statement, and they ask how can these operators administer code tests if they aren't able to copy the code

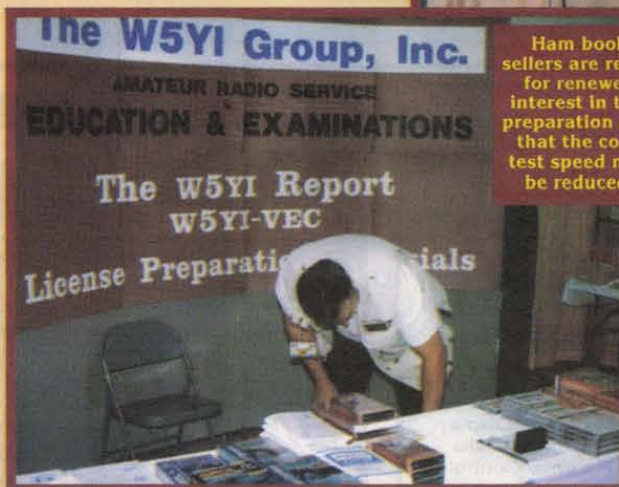


Worldwide ham activity will increase with the lowering of CW test scores — and small worldwide ham sets can be installed mobile almost anywhere!

At the recent Southwestern Division ARRL Convention, a 12-year-old Technician-plus ham recounted his story about being tested by a local VEC where he missed passing the General class exam by having a single letter error in one minute of



Ham book sellers are ready for renewed interest in test preparation now that the code test speed may be reduced.



perfect copy. He told me there were several places in his copy where he copied almost perfectly, but it didn't quite add up to the required 64 letters in a row. I am surprised that the volunteer examination team didn't take an overall look at the entire copy, and come up some sort of comprehensive test where this young lad would certainly pass. After all, he knew the content of the code at 13 wpm — he just didn't write

themselves? Again, the FCC is asking for public comments.

The scope of the volunteer examiner might also be expanded to allow that examiner to specifically tailor written and five wpm examinations to very young and very old candidates. Presently, the ARRL VEC allows examiners to take age into consideration when conducting code and written tests. Yet, the rules are clear that written questions and the four distractors may not be varied by the examination team. The FCC raises the point on whether or not volunteer examiners may take a more interpretive look on how a candidate is suited for passing or failing the test.

The FCC also suggests that new testing procedures could be imple-



mented — maybe submitting a log book for upgrades to insure they have worked so many contacts before they next go higher up the ham radio upgrade ladder. Or, for new students, maybe home study where a local "elmer" may help sign off certain requirements before the written and code test. The FCC suggests we all take a look at ham testing, and come up with more creative ways to make our ham service more attractive to beginners.

**C. RACES.** In the FCC NPRM, they are suggesting eliminating the specific RACES license. But, if you are a member of RACES, don't hit the panic button — they don't want to eliminate the RACES service, only the formality of having a special license for a RACES station. RACES operation would continue as normal.

**D. VIOLATION ENFORCEMENT.** The FCC is in agreement that prosecution of radio violators is next to minimum on the ham bands. This is because all of the FCC efforts are more directed to safety of life violations — such as catching the bad guys jamming aeronautical frequency 121.5, or coming up on a local paramedic channel and asking for 10 grams of cocaine to be delivered to a specific address. They are also busy tracking down police radio jammers, as well as the idiot using a marine VHF on Coast Guard Channel 16 and repeatedly calling "Mayday, Mayday, Mayday. I have run out of beer."

This means that CB radio and ham radio, including most routine land-mobile radio systems, go unmonitored. When they do get proof of a rule violator, they generally don't have the resources to start any enforcement action. The FCC asks what might be done to get them out of the loop, and to have enough evidence that might go directly into the court system. All you

attorneys, here is your time to help reshape ham radio enforcement. The FCC is asking how this might be done.

**F. WRITTEN TESTS.** The FCC asks hams to take a more active part in redesigning the written examination. Should we come up with more questions on digital techniques, replacing the high-speed code requirements with more written digital questions? And how should these questions be administered — fill-in-the-bank, multiple-choice, or essay? The FCC wants as much input from hams as possible.

**G.** The FCC will also dispose of other smaller petitions that have been hanging around their office for years. Maybe they'll find mine where I suggest lifting the old ham radio rule that says a marine single-sideband radio shall not be used as a ham radio. The new technology of marine SSB equipment makes marine sideband radios perfect for both purposes without any necessary modification that could injure their operation on distress frequencies. One radio for two purposes makes good sense to me!

## CONCLUSION

"Here at the FCC, we propose (1) to phase out the Novice class operator license and Technician operator license; (2) to authorize Advanced class operators to prepare and administer General class operator license exams; and (3) to sunset RACES station licenses by not issuing any license renewals.

We invite comments of the amateur community with respect to improving our enforcement processes as they relate to amateur radio. We also invite comments regarding the specific telegraphy speed requirements for the various license classes, and comments on ways to

streamline and improve the operator written examinations," comments the FCC.

## HERE'S HOW TO COMMENT

First, the date is right around the corner where your comments might go in the trash bin. Get your comments to the FCC BEFORE December of this year. Just days away.

The easiest way to file comments is through the FCC's electronic filing system (EFS). Comments filed through the EFS can be sent as an electronic file via the Internet to <http://www.fcc.gov/e-file/ecfs.html>. Only one copy of an electronic submission must be filed. You may also submit an electronic comment by Internet E-Mail. To get filing instructions for E-Mail comments, commentators should send an E-Mail to [ecfs@fcc.gov](mailto:ecfs@fcc.gov) and include the following words in the body of the message ... "Get form — your E-Mail address."

You can also file by paper, submitting one original and six copies of your comments. File to FCC, Commission Secretary Magalie Salas, FCC Building, 1919 "M" Street, N.W., Room 222, Washington, DC 20554.

You can also choose to file on diskette. Diskettes should be submitted to N.J. DePont, Public Safety & Private Wireless Division, Wireless Telecommunications Bureau, Room 8332, 2025 "M" Street, N.W., Washington, DC 20554. Word Perfect 5.1 for Windows or compatible software, please.

You should also send your comments to the ARRL. They will ultimately see them, and may offer a reply to your comments. But if you work closely with the ARRL now, you can help strengthen your agreement on what each of you will ultimately say. You can file your thoughts with [www.arrl.org](http://www.arrl.org).

You can also look at the NRPM on the ARRL web page at <http://www.arrl.org>. You can also download it from the FCC at [www.fcc.gov](http://www.fcc.gov) and follow the instructions to receive WT Docket 98-143.

Whether you are a ham radio operator or not, WRITE THE FCC WITH YOUR COMMENTS! Get your thoughts down on paper or on computer, and get them into the FCC today.

I will look forward to reading your comments soon. NV

### REQUIREMENTS FOR AMATEUR LICENSES UNDER THE ARRL PROPOSAL

License Class Class D	Written Exam Operational and technical questions relevant to VHF/UHF	Morse Exam None	Level of Difficulty Same as present Technician
Upgrade from D to C	Operational and technical questions relevant to HF	5 words per minute	Same as upgrading from present Tech Plus to General
Upgrade from C to B	Similar to present Element 4A (Advanced)	12 words per minute	Same as upgrading to present Advanced, plus Morse exam
Upgrade from B to A	More advanced technical questions	None	Same as upgrading from Advanced to Extra

**ViewStar**



NEW!

## Converter Sale !!

Best Quality,  
Reliability &  
Performance  
DOC, FCC, UL,  
Approved with  
1 Yr. Warranty

### Including Such Features And More:

- ◆ Double PLL Synthesized 550 Mhz Tuner
- ◆ On Screen Display
- ◆ Closed Caption Decoder
- ◆ Unlimited favorite Channel Recalls
- ◆ Full Text Fields
- ◆ Rapid Channel Scanning
- ◆ Parental Control
- ◆ Remote Control Included

85 Channel Converter

W/ Volume Control

W/ Closed Caption Decoder

(With Text & On Screen Display)

1-9 10-49 50+

56 53 51

69 66 63

98 90 85

(Freight included)

Call 1-888-603-4439

## ATTENTION CABLE VIEWERS

CABLE VIEWERS... get back to your **BASIC** Cable Needs

Call 1-800-577-8775

For information regarding all of your **BASIC** cable needs.

5 GOOD REASONS TO BUY OUR FAR SUPERIOR PRODUCT

- ◆ PRICE
- ◆ EFFICIENT SALES AND SERVICE
- ◆ WE SPECIALIZE IN 5, 10 LOT PRICING
- ◆ ALL FUNCTIONS (COMPATIBLE WITH ALL MAJOR BRANDS)

◆ **ANY SIZE** ORDER FILLED WITH SAME DAY SHIPPING

We handle NEW equipment ONLY — Don't trust last years OBSOLETE and UNSOLD stock!  
COMPETITIVE PRICING — DEALERS WELCOME



**BASIC  
ELECTRICAL  
SUPPLY &  
WAREHOUSING  
CORPORATION**

It is not the intent of E.E.S.W. to defraud any pay television operator and we will not assist any company or individual in doing the same.  
\*Refer to sales personnel for specifications.

P.O. BOX 8180 • BARTLETT, IL 60103-8180 • 847-584-2099





# Pacific Test Equipment



**PACIFIC**  
TEST EQUIPMENT

## BLOWOUT SALE

	<b>HP 8657A Synthesized Signal Generator</b> 0.1 - 1040 MHz with 10 Hz Resolution, +12 to -143.5 dBm 50W Reverse power protection, internal AM/FM Modulation Note: RF Connectors on rear panel (opt. 002)	Retail \$9,995 Regular \$5,900 <b>Sale \$2,375</b>
	<b>HP 8656B Synthesized Signal Generator</b> 0.1 - 990 MHz with 10 Hz Resolution, +13 to -127 dBm 25W Reverse power protection, internal AM/FM Modulation Note: RF Connectors on rear panel (opt. 002)	Retail \$7,900 Regular \$4,250 <b>Sale \$1,875</b>
	<b>HP 8656A Synthesized Signal Generator</b>	<b>Sale \$1,050</b>
	<b>HP 5334B Universal Counter</b> 0 to 100MHz, 9 digit per second resolution, rise/fall time, pulse-width, ac/dc voltage measurement. Frequency, period, ratio and time interval. Front and rear inputs in parallel. HP-IB	Retail \$2,305 Regular \$1,000 <b>Sale \$195</b>
	<b>HP 3457A Digital Multimeter</b> 3-1/2 to 6-1/2 Digit with extended resolution to 7-1/2 digits. dcV, acV, dcI, acI, Ohms, frequency and period. 1350 readings/sec. at 3-1/2 digits. HP-IB	Retail \$3,260 Regular \$2,495 <b>Sale \$1,380</b>
	<b>Tektronix 2445A 150MHz Oscilloscope</b> Auto-setup, 4 channel, 1M and 50 Ohm input impedance, dual time base, CRT readout with cursors. 2mV sensitivity.	Regular \$3,200 <b>Sale \$1,895</b>

Above items come with a 90 Day warranty, standard accessories, and FREE UPS Ground shipping within the continental U.S.

We accept VISA, MC and prepayment in advance. Sorry no C.O.D.'s. Quantities are limited to stock on-hand. 20% restocking fee on returns.

### We Buy Late Model Test and Measurement Equipment by HP, Tektronix, Fluke, R&S, Wavetek, Anritsu, and others.

(408) 441-7341 or fax (408) 441-8049

We also carry Brand New Iwatsu/LeCroy - Topward - LG Precision

<b>Iwatsu/LeCroy</b> <b>LA314/SS-7840</b> 400 MHz, 4 Channel Cursor, High-Speed Auto Setup, TV Trigger <b>\$7,200</b>	<b>Topward</b> Single Output Model Meter Output Price 3603D Digital 60V/3A \$495 Triple Output Model Meter Output Price 6603D Digital 60V/3A X 2 \$875 5V/5A Fixed Others Available - Call	<b>LG Precision</b> <b>OS-5100RB</b> 100 MHz, 4 Channel Cursor, Auto Setup CRT Readout <b>\$1,595</b>
--	--	--



**PACIFIC**  
TEST EQUIPMENT

**Pacific Test Equipment Corp.**

1450 Koll Cir. #111 • San Jose, CA 95112

(408) 441-7341 • Fax (408) 441-8049

For a free catalogue

or inquires on other equipment call

(408) 441-7341 M-F 9-6 (PST)

Ask for Erwin Talavera

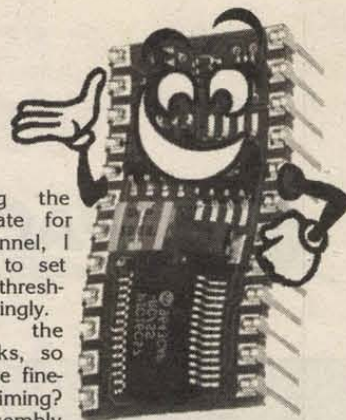
Write in 140 on Reader Service Card.

Nuts & Volts Magazine/November 1998 **11**



# STAMP APPLICATIONS

by Jon Williams



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

### Timing Is Everything

*One of the regular pokes taken at the Stamp is its lack of interrupts. A fair complaint perhaps, but not all micros have them and quite a few products are built with micros that don't. With a little bit of programming discipline – and a helpful second Stamp – we can write code that emulates a software interrupt.*

I recently converted a PIC-based (16F84) project to the BS2. The trickiest part of the conversion was the way I monitored the four sensor (switch) inputs. In the PIC, I have a software interrupt that causes the inputs to be scanned several times per second. With no interrupts in the BS2, I had to use a different method.

It's simple, but not necessarily easy. The main code loop has to be fine-tuned so that no matter what path it takes, its execution time is always the same. Geez, how do we do that? The truth is that the process can be very tricky, especially with complex code (so we'll keep our demo simple). I believe the easiest way to write such a program is by creating a state machine. PBASIC makes this very easy with the BRANCH command.

Let's say we want to monitor a couple of inputs and, if each is active beyond some threshold, we take an action. This doesn't sound like a big request, does it? So how would you pull it off? The way that I chose to do it was by monitoring

the inputs at a regular interval. If the input is active, a counter is incremented; otherwise, it's cleared. If the counter exceeds a given threshold, then some action is taken. The upside of this technique is that the inputs are debounced by the process.

Listing 1 is a very simple demo using a Stamp II and the Parallax BASIC Stamp Activity Board (BSAC). Two switches (on pins 8 and 9) are monitored. If either of the inputs is held long enough, a corresponding LED is lit (in addition to the input LED). If both are lit at once, they are flashed.

Take a look at the code. What you should notice is that the subroutine **ChkSw** is always run through each execution of the loop. By trimming the loop timing so that it's constant, we're able to write our processing code based on predictable behavior. In this case, each run through the loop is about 100 milliseconds. So, to alarm on a two-second input, the input would have to be active for 20 iterations through the loop ( $20 \times 100 \text{ ms} = 2 \text{ seconds}$ ).

You might be wondering why I chose to use a loop in **ChkSw** with only two inputs. The reason is that it makes the code very easy to expand, even if it does make it a little tricky to time. There are a couple of PAUSE commands inserted in this code to make the timing as even as possible, regardless of the state of the inputs.

Another thing that I did was use a nibble-sized variable for the alarm state. This technique will give you the ability to have differing alarm levels. As an example, a BS2-based product I developed (and upon which this demo is based) has a secondary threshold for each channel. By

monitoring the alarm state for each channel, I was able to set the alarm threshold accordingly.

Okay, the code works, so how do we fine-tune the timing? Some assembly language programmers actually go through the arduous process of counting machine cycles. Thankfully, we don't have to do that. What we're going to do is use a spare pin on our project to talk to another Stamp. The second Stamp will measure our code and display the timing on a Scott Edwards serial LCD.

Listing 2 is a program that performs the measurement. The code measures a high pulse on pin 15. Since the resolution of PULSIN is two microseconds, dividing by 500 gives us milliseconds – a timing unit that's a little easier to deal with. Keep in mind that this program is designed to measure short events. Due to the constraints of PULSIN, the maximum duration that can be measured is 131 milliseconds.

Once you've connected the timing Stamp to your project, you'll need to isolate the section under test. With the section isolated, place the line HIGH x at the beginning of the section and LOW x at the end of the section (x is the pin number). So long as the fragment is within the limits of PULSIN, the time will be displayed on the LCD.

In the demo, **ChkSw** takes about nine milliseconds to run. I added a couple of pads (PAUSE statements) to keep things as even as possible, regardless of the inputs. With that done, each state routine is checked and padded so that they're equal. With the state processes equal, the last thing to do is pad the main loop to achieve

' Listing 1  
' Nuts & Volts: Stamp Applications, November 1998

' -----[ Title ]-----

' File..... STATE.BS2  
' Purpose... State machine framework  
' Author.... Jon Williams  
' E-mail.... jonwms@aol.com  
' WWW..... http://members.aol.com/jonwms  
' Started... 03 OCT 98  
' Updated... 04 OCT 98

' -----[ Program Description ]-----

' This program demonstrates the general operation of a state machine. Its purpose is to monitor and debounce several inputs with near real-time precision (emulating a software interrupt-based process).

' Run the program on a Parallax BSAC

' -----[ Revision History ]-----

' -----[ I/O Definitions ]-----

SW0\_ VAR In8 ' switch inputs  
SW1\_ VAR In9  
LED0\_ VAR Out10 ' LED outputs  
LED1\_ VAR Out11

' -----[ Constants ]-----

On CON 0 ' active low output  
Off CON 1

' -----[ Variables ]-----

state VAR Byte  
tics VAR Byte(2)  
alarm VAR Byte(2)  
swMax VAR Byte(2)  
x VAR Byte  
test VAR Byte

' -----[ EEPROM Data ]-----

' -----[ Initialization ]-----

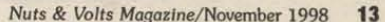
Init: DirC = %1100  
 state = 0  
  
 LED0\_ = Off ' start with LEDs off  
 LED1\_ = Off  
  
 tics(0) = 0 ' clear the input counters  
 tics(1) = 0  
  
 alarm(0) = Off ' alarms clear  
 alarm(1) = Off  
  
 swMax(0) = 20 ' alarm on 20 "tics" (2-sec)  
 swMax(1) = 50 ' alarm on 50 "tics" (5 sec)

' -----[ Main Code ]-----

Main: ' HIGH 0 ' start of timing pulse  
 GOSUB ChkSw ' check the inputs  
  
 ' process the current state  
 BRANCH state,[Proc0,Proc1,Proc2]  
 GOTO Main

Listing 1







# STAMP APPLICATIONS

parameters from the Stamp. It also gave me a chance to work with polling versus interrupt reception in VB (we talked about that in the StampNet 1 project).

Let's look at the Stamp side first. Set-up parameters are stored in the first 64 bytes of the Stamp's EEPROM (note that for this demo program the data is completely arbitrary). After this data block is a three-byte revision code that will not be overwritten. Its purpose is to identify the code and features of the attached controller.

The first thing the program does is check to see if the PC is connected. This is accomplished by looking at the state of the receive line. Take a look at Figure 1. As you've seen in many Stamp projects, R1 limits the current into the Stamp from the RS-232 connection. The purpose of R2 is to pull the line high (1) when nothing is connected. As soon as you connect a PC, this line will go low (0). In my production project, I look to see if a PC is connected and jump the code that allows set-up parameters to be changed. Even if you don't need to detect a PC, it's good practice to tie the input line to Vcc or ground. This will prevent noise from causing a false start bit on a floating input and corrupting your serial input.

Back to the demo. Once we see the PC, we wait on a start byte (\$FF) and a command. It's a good idea to use the timeout parameter so that your program doesn't hang up if something goes wrong. In this case, we simply loop back to the beginning and look for the PC again. After the start byte and command arrive, the command is converted to a cleaner format with LOOKDOWN, and the program BRANCHes to the code that's appropriate for the command received.

The first possible command is the general query. This causes the Stamp to return the embedded revision code. Once again, the code takes advantage of PBASIC's symbolic constants. Notice the loop control line:

```
FOR addr = RevCode TO (RevCode + 2)
```

The loop reads and sends the revision code bytes to the PC. The nice part about this is that I can move the revision code to any portion of the EE and not change the processing code. Since this is my last opportunity to preach (more later),

I encourage you to write programs that are easy to read and maintain. Enough said.

Processing the upload command is identical; it just sends more information to the PC.

The trickiest part of the program is downloading new parameters. Once the download command is received, we wait for 64 bytes to be sent from the PC. In order to keep things synchronized and in order, the PC actually sends a start byte (for framing), and the address and data to be written to the address. After reception, the Stamp writes the data to EE, reads it back, then sends the address and data back to the PC for confirmation. By reading back the just-written data, we're able to detect transmission and EE errors. As we'll see in just a minute, the PC will only tolerate a few errors before giving up.

Okay, let's look at the PC code for downloading (Listing 4). Here's a basic description before we get to the specifics:

## SOURCES

For more information on the BASIC Stamp, contact:

### Parallax, Inc.

3805 Atherton Road, #102  
Rocklin, CA 95765  
phone (916) 624-8333  
http://www.parallaxinc.com

### Jan Axelson

#### Lakeview Research

2209 Winnebago St.  
Madison, WI 53704  
Phone: (608) 241-5824  
Fax: (608) 241-5848  
jan@lvr.com

### Scott Edwards Electronics, Inc.

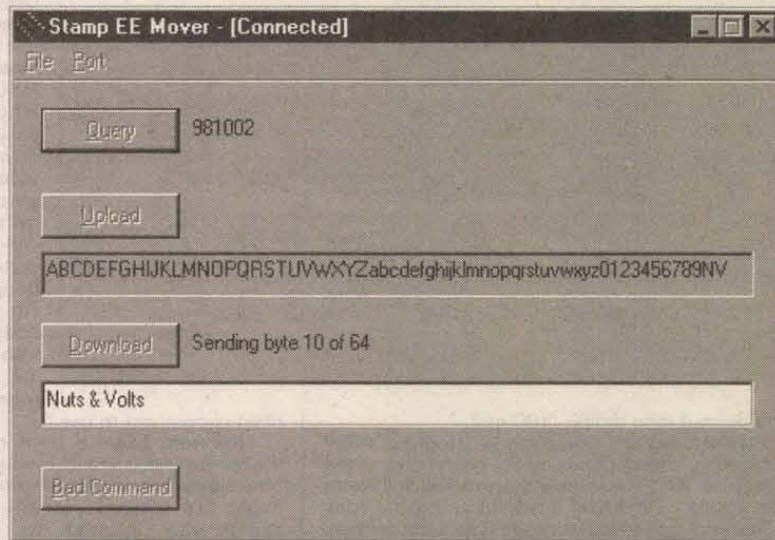
2700 E. Fry Blvd. Suite A4  
Sierra Vista, AZ 85635  
phone 520-459-4802  
fax 520-459-0623  
www.seetron.com  
info@seetron.com

### Jon Williams

3718 Valley View Lane #3040  
Irving, TX 75062  
(903) 509-1691

jonwms@aol.com  
http://members.aol.com/jonwms  
ftp://members.aol.com/jonwms/stamps

After sending the download command, the code will loop through 64 iterations. If there is no data



Listing 2  
Nuts & Volts: Stamp Applications, November 1998

```

-----[ Title ]-----
Program... SPDIEST.BS2
Purpose... Speed monitor for code sections
Author.... Jon Williams
E-mail.... jonwms@aol.com
WWW..... http://members.aol.com/jonwms
Started... 23 SEP 1998
Updated... 23 SEP 1998

-----[ Program Description ]-----
This program is designed to test code fragments for execution speed. The
speed is measured in milliseconds in order to allow PAUSE commands into
the code for speed tuning.

The program monitors a high-going pulse on Pin 15 and displays the
result (in milliseconds) on a SEETRON LCD. To use, connect a spare pin
on your project to pin 15. At the beginning of your test section, insert
HIGH x (where x is your output pin). At the end of the section place
LOW x to stop the timing.

-----[ Revision History ]-----

-----[ I/O Definitions ]-----
LCDpin CON 0          ' SEETRON LCD serial line
PInput CON 15         ' PULSIN pin

-----[ Constants ]-----

```

```

N2400 CON $418D
Inst CON 254
ClrLCD CON 1
CrstHm CON 2

```

2400b baud, inverted  
backpack LCD instruction byte  
clear the LCD  
move to line 1, col 1

```

-----[ Variables ]-----
pTime VAR Word
msTm1 VAR Word
msTm2 VAR Word

```

pulse width (2 us units)  
ms - whole portion  
ms - fractional portion

```

-----[ EEPROM Data ]-----

```

```

-----[ Initialization ]-----

```

```

Init: PAUSE 1000          ' let LCD initialize

SEROUT LCDpin,N2400,[Inst,ClrLCD,"Ready..."]
PAUSE 200

```

```

-----[ Main ]-----

```

```

Main: PULSIN PInput, 1, pTime
msTm1 = pTime / 500
msTm2 = pTime / 5 // 100
SEROUT LCDpin,N2400,[Inst,CrstHm,DEC msTm1,".",DEC2 msTm2," ms"]

GOTO Main

```

```

-----[ Subroutines ]-----

```



# STAMP APPLICATIONS

for the loop iteration, a zero is downloaded. After sending the start, address and data byte, the PC waits for the address and data to come back. If the address and data do not come back correctly, another attempt is made. If five attempts are made to the same address and the data still comes back bad, the process is aborted. Whew!

There's a lot going on.

The first thing we do is prevent a premature program shutdown so that the Stamp's EE doesn't get trashed and cause problems. This is done by disabling the buttons and menus and setting a flag called "downloading." This flag is checked in the Query(Unload event in case the operator

clicks the form's close [x] button.

With the process safe from user-interruption, the command is sent and the program waits for 200 milliseconds for the Stamp to get ready. This is a case where the Stamp SERIN timeout for the downloaded data needs to be longer than 200 milliseconds.

```

' Listing 3
' Nuts & Volts: Stamp Applications, November 1998

' -----[ Title ]-----
'
' File..... EEMOVER.BS2
' Purpose... Stamp to PC Communications Experiments
' Author.... Jon Williams
' E-mail.... jonwms@aol.com
' Started... 30 SEP 98
' Updated... 2 OCT 98

' -----[ Program Description ]-----
'
' This program awaits a PC command and processes it accordingly: send the
' revision code, upload the EE-stored parameters or allow the download of
' a new (64 byte) parameters block.

' For convenience, this project was built on a Parallax BSAC. A SEETRON
' 4x40 LCD module was used in debugging.

' -----[ Revision History ]-----
'
' 2 OCT 98 : Finally figured it all out and everything works!

' -----[ I/O Definitions ]-----
'
TXpin  CON    0          ' serial output to PC
RXpin  CON    1          ' serial input from PC
LCDpin CON    15         ' debugging pin (SEETRON LCD)
PCMPin CON    16         ' uses BS2 programming port

PCcon  VAR    .In1       ' pc connected?
LEDrx  VAR    Out8       ' receive LED
LEDtx  VAR    Out9       ' transmit LED

' -----[ Constants ]-----
'
N9600  CON    84          ' non inverted (through driver)
T9600  CON    $4054       ' inverted (direct)

Off     CON    1          ' active low
On      CON    0

Yes     CON    0
No      CON    1

Start  CON    $FF        ' start byte
CmdQr  CON    $A7        ' query - return date code
CmdUp  CON    $A0        ' upload ee
CmdDn  CON    $A1        ' download new ee

' -----[ Variables ]-----
'
cmd     VAR    Byte       ' command byte
addr    VAR    Byte
dByte  VAR    Byte
tries  VAR    Byte

' -----[ EEPROM Data ]-----
'
Setup1 DATA  "ABCDEFGHJKLMNPQRSTUVWXYZ"
Setup2 DATA  "abcdefghijklmnopqrstuvwxyz"
Setup3 DATA  "0123456789"
Setup4 DATA  "NV"

RevCode DATA  98,10,02      ' embedded revision code

' -----[ Initialization ]-----
'
Init:  DirA = %0001
       DirC = %0011

' -----[ Main Code ]-----
'
Main:  LEDtx = Off          ' clear the TX/RX LEDs
       LEDrx = Off

       ' look for PC
       IF PCcon = Yes THEN M1          ' look for low on input line
       SEROUT LCDpin,T9600,[12,"PC is not connected"]
       PAUSE 250
       GOTO Main

M1:    SEROUT LCDpin,T9600,[12,"Connected. Waiting..."]
       SERIN  RXpin,T9600,5000,Main,[WAIT (Start), cmd]

       LEDrx = On              ' show transmission received
       PAUSE 50
       LEDrx = Off

       LOOKDOWN cmd,[CmdQr,CmdUp,CmdDn],cmd          ' decode command byte
       BRANCH cmd,[CQry,CUpId,CdNld]                  ' branch to processing
       GOTO CBad

CQry:  SEROUT LCDpin,T9600,[12, "Query "]
       GOSUB RCode
       PAUSE 1000
       GOTO Main

CUpId: SEROUT LCDpin,T9600,[12, "Upload"]
       GOSUB UpLoad
       PAUSE 1000
       GOTO Main

CdNld: SEROUT LCDpin,T9600,[12, "Download"]
       GOSUB DnLoad
       PAUSE 1000
       GOTO Main

CBad:  SEROUT LCDpin,T9600,[12, "Invalid Command"]
       PAUSE 1000
       GOTO Main

' -----[ Subroutines ]-----
'
RCode: ' send revision code to PC
       LEDtx = On
       FOR addr = RevCode TO (RevCode + 2)
         READ addr, dByte
         SEROUT TXpin,T9600,[dByte]
       NEXT
       LEDtx = Off
       RETURN

UpLoad: LEDtx = On
       FOR addr = 0 TO 63
         READ addr, dByte
         SEROUT TXpin,T9600,[dByte]
       NEXT
       LEDtx = Off
       RETURN

DnLoad: ' download new set-up data
       LEDrx = On
       SERIN  RXpin,T9600,2000,DLx,[WAIT (Start),addr,dByte]
       LEDrx = Off

       ' show the transmission
       SEROUT LCDpin,T9600,[1,"Writing... ", DEC2 addr, "->",DEC3 dByte]
       SEROUT LCDpin,T9600,[1," (",dByte, ") "]

       ' copy to ee
       WRITE addr,dByte          ' write to ee
       READ addr,dByte           ' read it back

       ' return address and data
       LEDtx = On
       SEROUT TXpin,T9600,[addr,dByte]
       LEDtx = Off

       IF addr < 63 THEN DnLoad    ' do 64 bytes
       DLx: RETURN

```



# STAMP APPLICATIONS

Listing 4  
Nuts & Volts: Stamp Applications, November 1998

```
Private Sub cmdDnload_Click()
    Dim addr As Byte
    Dim tries As Byte
    Dim temp As String
    Dim x As Byte
    Dim response

    Call EnableButtons(False)
    mnuFile.Enabled = False
    mnuPort.Enabled = False
    Screen.MousePointer = vbHourglass
    downloading = True

    ' send download command
    Call SendHeader(CmdDn)
    Call Delay(200)

    ' download the ee data
    addr = 1
    Do
        lblByteCount.Caption = "Sending byte" & Str(addr) & " of 64"
        tries = 0
        Do
            ' get a byte
            temp = Mid$(txtDnload.Text, addr, 1)
            ' if empty, program the location with 0
            If (temp = "") Then temp = Chr$(0)
            ' build the buffer (adjusted address + byte)
            txBuf = Chr$(addr - 1) & temp
            ' send start byte and buffer
```

```
MSComm1.Output = Chr$(Start) & txBuf

    ' wait for two-byte response
    Do
        DoEvents
        x = MSComm1.InBufferCount
        Loop Until (x = 2)
        rxBuf = MSComm1.Input

        ' increment tries counter
        tries = tries + 1
        Loop Until (tries = 5) Or (rxBuf = txBuf)

        ' exit if bad chip
        If (tries = 5) And (rxBuf <> txBuf) Then
            response = MsgBox("Error: Cell " & Str(addr), vbOKOnly)
            addr = 65
        End If

        addr = addr + 1
        Call Delay(150)
        Loop While (addr <= 64)

        lblByteCount.Caption = ""
        Call EnableButtons(True)
        mnuFile.Enabled = True
        mnuPort.Enabled = True
        Screen.MousePointer = vbDefault
        downloading = False
    End Sub
```

A Do-Loop construct is used for the overall download structure. The control variable `addr` is initialized to 1 before starting the loop and checked for exceeding 64. This structure makes it easy to break out of the Do-Loop by setting the control value to greater than 64.

The first part of the loop core gets a piece of data to send. In this case, we're grabbing a character from a text input field. If you are dealing with non-string data, remember to convert the byte to a string with the `Chr$()` function. In this program, a null string (the input is less than 64 characters) is converted to 0. I used this because some of the elements in my Stamp production are zero-terminated strings. With the character in hand, the start byte, and address and data are sent. As I stated earlier, I decided to send the start byte through each iteration to

keep everything in sync.

After the transmission, we wait for two bytes to come back from the Stamp. Notice the use of the `DoEvents` function in the reception loop. This is really important, especially if something goes wrong on the Stamp end. `DoEvents` allows Windows to do other things while processing the loop.

The received input is checked against the data sent. If it's the same, we move on to the next address. If it's not, we'll try the same address again. If the same address fails five times, the loop is terminated and the user is notified.

It all looks pretty easy now that it works, but it was a bear in the process. Good luck with your PC/Stamp projects. They really are a lot of fun when everything is working right.

## Farewell, Friends

As those of you that monitor the Stamp list know, this article will be my final *regular* Stamp Applications column for *Nuts & Volts*. I stress "regular" because I am not walking away from Stamping and I really do enjoy writing about my projects. It's just that time is scarce for me right now. With a full-time engineering job and a budding career as an actor (and all the craziness that goes along with that ...), I honestly don't have the time to write a full column each month. I will submit articles as time permits — including the conclusion of StampNet. I promise.

I really do want to thank Larry Lemieux and his staff at *Nuts & Volts* for allowing me to write the column this past year and for giving me complete freedom to write about what I

chose. Of course, I have to thank my buddy Scott Edwards for trusting me with his creation, for his support, his encouragement, and for his friendship. And I certainly couldn't have done what I've done without the support of Ken Gracey and the good folks at Parallax. Thank you, Parallax, for everything.

Finally, I must thank my dearest friend, Kim Jaech. Who's Kim? Kim is the miracle worker that translates my techno-gibberish into intelligible English. And all along you folks thought I was a pretty good writer, didn't you? Well, not without Kim. Everything that I've ever had published has passed through her capable hands and so long as I have my way, everything I ever write in the future will too. Thanks, Kim. I love you.

For those of you in the Metroplex, perhaps I'll see you at a DPRG meeting or at Tanner's on one of my Saturday afternoon parts runs. For those that I've met via E-Mail, snail mail, or the telephone, thanks for your kind words and valuable suggestions for the column. I sincerely appreciate your comments and your input. May God bless each of you always.

Happy Stamping. I'll see you in the movies! **NV**

## PIC'n Books

LEARN ABOUT PIC16/17 MICROCONTROLLERS

### EASY PIC'n Beginner

- Programming techniques
- Instruction set
- Addressing modes
- Bit manipulation
- Subroutines
- Sequencing
- Lookup tables
- Interrupts
- Using a text editor - source code
- Using an assembler
- Timing and counting
- Interfacing - I/O conversion
- Lots of examples

\$29.95

### PIC'n Up The Pace Intermediate

- Serial communication
- PIC16 to peripheral chips
- PIC16 to PIC16
- Serial EEPROMS
- LCD interface
- Scanning keypads
- D/A conversion
- Sensors - analog voltage output
- A/D conversion
- Math routines
- Decimal interface
- PIC16F84 EEPROM data memory
- Lots of circuits and code

\$34.95

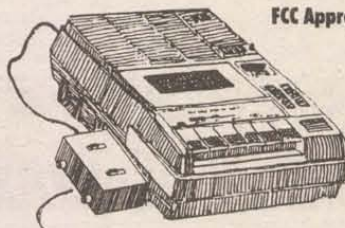
+ \$4 s/h in US for one book, \$5 both books  
VISA, MC, AMEX, MO, Check  
CA residents please add 7.25% CA sales tax  
PIC is a trademark of Microchip Technology Inc.

**SQUARE 1 ELECTRONICS**

P.O. Box 501, Kelseyville, CA 95451  
Voice (707) 279-8881 FAX (707) 279-8883  
<http://www.sq-1.com>  
E-Mail [sqone@pacific.net](mailto:sqone@pacific.net)

## TELEPHONE LISTENING DEVICE WITH 12 HR. RECORDER

FCC Approved



Record telephone conversations in your office or home. Starts automatically when phone is answered, records both sides of phone conversation. Recorder stops when phone is hung up. \$99.95 + \$7 shipping. For telephone listening device separately \$19.95 + \$2 ship.

For comprehensive 50 page catalog of Micro Video, VHF transmitters, Surveillance, and Counter-surveillance and much more! Send \$3.00

Call 407-725-1000

**USI CORP**

P.O. Box N2052 Melbourne, FL 32902

COD'S OK

Write in 60 on Reader Service Card.



# reader FeedBack

Dear Nuts & Volts:

I enjoyed the reference article by Gordon West (Apr. '98, "Copper Foil Grounding for RF.")

As an avid boater and an old-time electronics, I am usually well read on RF things written for boaters. I have never seen copper foil grounding mentioned in the sailing literature that I have read. Perhaps I have missed it, but if such an article has never been printed, I am certain it would be well received by sailors.

I used to work on an underwater missile that had a wooden nose cone. Yes, it was made of spruce plywood, and it had a one foot wide copper foil strip that ran from its tip down to a wide contact that connected to the aluminum body of the rocket.

The explanation was that it carried static charges away from the metal nose tip fitting. This puzzled me as I never thought that static charges had much difficulty going wherever they pleased, and that a simple piece of wire would have done the job. As usual, I find that there is always more to learn.

Jess Talley  
via Internet

Dear Nuts & Volts:

In the Sept. '98 issue, Mr. H. Halney requests actual examples of Y2K problems. He seems to have overlooked an actual problem included in his letter.

He states "some clock chips only tell you what the year is modulo 4, that is, will February have 28 days or 29?"

Those chips are an actual Y2K problem. They will tell you that the last year of the 20th Century is a Leap Year, which it is not! The next Leap Year is 2004.

Emil Rossdeutsch  
New York, NY

Dear Nuts & Volts:

In your Sept. '98 issue, pages 25 and 26, in answer to #89814 about charging a 72-volt battery system, Fernando Garcia said, "I don't think you would die from a 72-volt shock."

Although 72 volts is less dangerous than higher voltages, I have read documented reports of people being killed by 40 volts, and I have received a good jolt myself from 24 volts by getting across it with wet fingers.

As a result, I would consider any electrical circuit with 24 or more volts between any conductor and ground — or between any two conductors — to be potentially dangerous.

Personal contact with such energized conductors must

always be prevented. I even encountered a high power audio amplifier (200W into 8 ohms) with a warning on the rear panel stating that the voltage at the speaker terminals (40V @ 5A when going full blast) is "hazardous to human life."

Michael Kiley  
Crestwood, IL

Dear TJ Byers:

The answer to the well-depth question (Aug. '98 Q & A) may provide a workable solution, but a pressure transducer would be a better choice. Mount the sensor near the pump and use its output to drive a meter or an LED bar graph as a depth indicator. You could use the voltage or current output from the sensor with a set of comparators to trigger events when the water goes down to limits that you preset. The pressure under about 35 feet of water is +1 atmosphere, so a 0-1 atmosphere absolute pressure gauge that can work submerged in water would nicely meet the needs of "Stano." Getting the transducer down the well pipe might take a bit of doing, but a piece of PVC pipe (larger inside diameter than the outside diameter of the water pipe) sawed in half lengthwise and clamped together around the water line would easily slide down to the pump. Using the pipe as a guide would also keep the sensor out of the muck at the bottom of the well.

Jon Titus  
Test & Measurement World Magazine  
Newton, MA

Response:

This approach will work, but at a higher price. The problem isn't the cost of the pressure sensor, which you can buy from **Omega Engineering** (1-800-826-6342; <http://www.omega.com>) and **EG&G IC Sensors** (1-800-767-1888; <http://www.egginc.com/btn/webmate/egg/page/egg/index>) for about \$15.00, but the additional support electronics. These are piezoresistive pressure sensors, suitable for PC board mounting, that come in a TO-5 package. They are available in full-scale ranges from 5.0 to 100 PSI (pounds per square inch). All models are operated from a constant-current excitation supply of 1.5 mA. The problem is the low voltage output from the sensor, which is a mere 5.5 mV per PSI for Omega's PX71-030AV sensor needed for a 35-foot well, as shown in the chart below.

Omega Engineering Pressure Sensor Products  
Pressure Range Sensitivity @ 1.5mA excitation Without Fitting With Fitting

0 to 5.0 PSI	20 mV per PSI	PX71-005AV	PX72-005AV
0 to 15 PSI	9.5 mV per PSI	PX71-015AV	PX72-015AV
0 to 30 PSI	5.5 mV per PSI	PX71-030AV	PX72-030AV
0 to 60 PSI	3.0 mV per PSI	PX71-060AV	PX72-060AV
0 to 100 PSI	2.0 mV per PSI	PX71-100AV	PX72-100AV

Subtracting for the earth's 14.7 PSI barometric pressure, this translates into about 2.3 mV per foot — or just 82 mV from full to empty. Given the harsh electrical environment at the well site, a signal this weak has to be amplified and filtered before it can be processed. The total cost is going to be more than the \$10.00 thermistor version. But as you point out, it's a reliable depth gauge that'll survive the ravages of time.

TJ Byers  
Q & A Editor

## Identify and Control with RFID

Transponders, Antennas, Reader/Decoders

for access control, personnel identification, animal feeding, pet id, race timing, ticketing, inventory control, eas, pallet control, vehicle tolling, garment management, plant routing, equipment locator, ...

Development kit  
US\$ 139.00

## Radio Frequency Identification

Since 1991

INTERSOFT

1840 Lockmill Rd, Estill Springs TN 37330, USA

Ph 931-967-8643 Fx 931-967-5069 [www.cafes.net/intersoft](http://www.cafes.net/intersoft)

Write in 71 on Reader Service Card.

## JFETS

ULTRA LOW NOISE  
LS843 - 3nV/Hz typ

TIGHT MATCHING  
LS843 - 1 mV max

- ♦ N & P Channel
- ♦ Duals & Singles
- ♦ Custom Screening
- ♦ Die, SMT, Thru-Hole
- ♦ No Order Minimum
- ♦ COD's Accepted

Second Source for Domestic  
& Foreign JFETs & Bipolars

Full Service U.S. Manufacturer  
of Specialty Linear Products

## LINEAR SYSTEMS

4042 Clipper Court  
Fremont, CA 94538  
510-490-9160/510-353-0261 (Fax)  
E-mail: 3623671@MCI.MAIL.COM

## Look Ma, No BASIC Stamp\*

PicBasic Compiler - \$99.95

Put BASIC Stamp I programs right into a PIC microcontroller - no BS1 module necessary! The programs run faster and can be longer. You also get more variables and extra instructions. For mid-range PIC12C67x, 16C55x, 6xx, 7xx, 8x, 9xx.

PicBasic Pro Compiler - \$249.95

PicBasic Pro is BASIC Stamp II compatible, and like the standard compiler above, eliminates the need for a BS2 module. Pro adds built-in LCD support, interrupts in BASIC, arrays, program size to 8K, real I/O. Then, Else and I/O to any PIC pin. For mid-range PIC12C67x, 16C55x, 6xx, 7xx, 8x, 9xx.

\*BASIC Stamp is a trademark of Parallax Inc.

EPIC Plus PIC Programmer - \$59.95

Programs PIC12C50x, 67x, 16C55x, 6xx, 7xx, 8x, 9xx. Optional ZIF adapters for DIP, SOIC, MQFP, PLCC. Runs off two 9-volt batteries or optional AC adapter. Includes programming software and assembler.

PICProto  
Prototyping Boards

Get it wired quicker! High-quality blank prototyping boards for PICmicros. Holds 5V reg, caps, osc, DB9-25, large proto area. \$8.95 - \$17.95

microEngineering Labs, Inc.

Box 7532 Colorado Springs CO 80933  
(719) 520-5323 (719) 520-1867 fax

<http://www.melabs.com>

email: [info@melabs.com](mailto:info@melabs.com)

Write in 72 on Reader Service Card. 17



# COMPUTER CIRCULATION CENTER, Inc.

dba: Alltech Electronics

2618 Temple Heights Drive.

Oceanside, CA 92056

Phone Order Hours 9AM - 5:30PM Mon-Fri

Phone Orders

760/724-2404

\$25 -Min. Order -

9350 Clairemont Mesa, San Diego - 619/573-0411

1401 El Camino Real. Oceanside - 760/721-0093

1300 E. Edinger. Santa Ana - 714/543-5011

2018 W. Lomita BLVD. Lomita - 310/539-2260

We buy surplus & excess computer inventory as well as scrap electronics related inventory.

## Mitsubishi DJ-1000 Digital Camera

### Pocket Size

Holds up to 15 images  
320 x 240 or 504 x 378  
PCMCIA Required for image  
downloading.  
Windows 3.1/95 Compatible  
See the web for more details



\$95

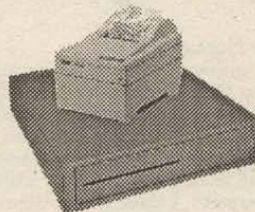
Be sure to check  
our Web Site for  
more information  
on these and other  
products!

www.allelec.com

## Fujitsu Cash Drawer

With Metal Till. Triggers  
from any 24VDC source.  
RJ45 connector.

\$79.00



Fujitsu Cash Drawer, Metal Till, 9" Monochrome  
VGA Monitor, & Star SP200 Parallel Printer \$299.00

## NEC Mini 486



Need a Linux Box?

\$29.00

Mini footprint  
3.5" x 11.5 x 13  
486 SX 25 CPU  
4MB On board  
2 ISA Slots  
IDE, FD, 2  
COM, 1 LPT &  
512K VGA  
UPGRADABLE  
to DX2/66



\$9.95

USR Sportster 14.4

Pulls from  
working sys-  
tems. **Non PnP**  
Version. Works  
with any\* OS.  
**No Plug n Pray**  
**Hassle!**

## Intergraph 4MB PCI Intense 3D 100

\$35.00

Rendition  
V1000e



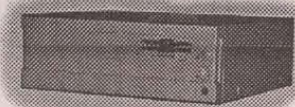
3D Accelerated  
Video Card for  
Windows 95/NT  
See Web for  
more details

## Epson Reciept Printer



\$89.00

EPSON  
TM300PD  
Parallel  
Interface  
With drawer  
trigger



\$39.00

Slimline Case  
8MB RAM  
1.44 Floppy  
DX266 Add \$10

486 DX33 Barebones

## 10" Open Frame NEW Color SVGA!

Up to 1024 x  
768 pixels  
110V AC  
operation.  
CD-1035EM

\$159.00



Refurb:  
\$119.00



\$79.00

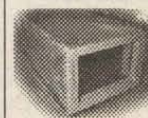
9" Mono NEW VGA

Great for servers,  
small places, POS  
systems..  
Low profile case  
with swivel stand

## External SCSI Cases \$29.00 & Up



5.25" Closed HH \$29.  
5.25" Open HH \$35.  
5.25" Open FH \$45.  
3.5" Open for Zip,  
Syquest, etc .... \$29.  
3.5" Lunchbox \$19.  
All cases have two 50  
pin centronics  
connectors.



## Mac ADB Trackpad

\$9.95

Powerbook like  
trackpad.  
ALPS Glidepoint  
21/8" x 11/2"  
ADB Cable.  
Works with any  
ADB Mac.



## FLOPPY & ZIP SCSI DRIVES

3.5" NEW 720K .....\$5.00  
3.5" NEW 1.44MB .....\$16.00  
SCSI Zip Drive External  
Refurb .....\$89.00

## PC KEYBOARD / MOUSE

AT 101 Keyboard .....\$9.95  
9 Pin Serial Mouse .....\$6.95

Black External  
28.8  
Modem/Fax  
with Mac Cable.  
No Software  
Included.

\$29.00

Originally from:  
"Pippin @world"



Motorola Macintosh  
ModemSURFr 28.8



Metal Box  
'Cube' case  
Security Monitor  
with front  
mount controls.  
Black cabinet.  
75Ω input

\$39.00

9" B&W Security Monitor

## CPUs

486SX 25/33 .....\$3.00 .....\$5.00  
486SX2-66 .....\$8.00  
486DX25/33 .....\$5.00 .....\$8.00  
486DX2-50/2-66 .....\$18.00 .....\$29.00  
486DX4-100 .....\$49.00  
Pentium 75/90 .....\$39.00 .....\$49.00  
Pentium 100 / 133 .....\$65.00 .....\$75.00  
Pentium 166 .....\$99.00

Upgrade  
Your  
System



## EPROMs

2716 /2732 .....75¢  
2764 /27128 .....\$1.50  
27256 /27512 .....\$2.00  
1 Meg .....\$2.50  
2 Meg .....\$3.50

## RAM Chips

4Meg x 9-80 .....\$13.00  
1x32-70 .....\$9.00  
2x32-70 .....\$19.00  
4x32-70 .....\$35.00  
1 meg x9-10 .....\$2.00  
1 meg x9-80 .....\$3.00  
1 meg x9-70 .....\$4.00

## IDE Hard Drives

420 Meg .....\$59.00  
320 Meg .....\$49.00  
270 Meg .....\$40.00  
120 Meg .....\$35.00  
80 Meg .....\$25.00  
40 Meg .....\$15.00



## PC Oldies but Goodies

EGA/CGA Card -or- ISA Super I/O .....\$14.95  
2 Meg AT Memory Card -or- Parallel/Mono Card .....\$9.00  
Floppy Controller -or- Serial / Parallel Card .....\$6.95  
VLB 1 Meg VGA Card -or- 386 Motherboard w/2 Meg .....\$19.95  
16 Bit (ISA) VGA w/256/512/1 Meg .....\$9.00 / \$12.00 / \$14.95  
VLB Super I/O .....\$12.95  
8 Bit VGA Card -or- XT Motherboard w/640K .....\$9.95

See Our Website for  
industrial surplus.

Drawer Slides • Casters  
Motors • Plastic Sheets  
..and more!

## CD ROM & Sound Cards

4x IDE Internal .....\$29.00  
8x IDE Internal .....\$39.00  
24x IDE Internal .....\$59.00  
4x SCSI Internal .....\$39.00  
4x SCSI External .....\$69.00  
Ensoniq SoundScape w/on board CPU .....\$49.00  
Universal Audio Cable (CD ROM to Soundcard) .....\$4.95

HTTP://WWW.ALLELEC.COM

VISIT OUR WEB PAGE DAILY FOR SPECIALS & MORE INFO. ON THESE ITEMS



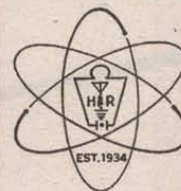
Excellence  
since  
1934

**H&R**  
COMPANY

# HERBACH AND RADEMAN

Products for Science and Industry  
**THIS MONTH**

OUR CATALOG IS LIMITED ONLY BY YOUR IMAGINATION ...



## Tri-Layer Solar Panel

3.0 WATTS Rated 40 Volts DC Open Circuit  
Size 12 x 12 x 1/8"

Amorphous silicon resin, glass encapsulated. Operating voltage 24VDC at 100mA in bright sunlight with short circuit current of 200mA. Supplied with connector clips. Use for battery charging and other solar panel applications, or experiments. New. Wt. 3 lbs.

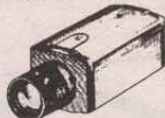
TM98SED3180 ----- \$24.95

## PRICED RIGHT !!!

### Monochrome 1/3" CCD CAMERA

Internal electronically controlled micro chip sensor compensates for all light changes, eliminates need for auto-iris lens.

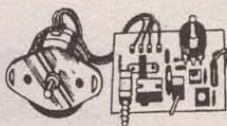
- ✓ Resolution over 380 lines
- ✓ Electronic Shutter with automatic adjustment
- ✓ Automatic light compensation
- ✓ Sensitivity 0.3 lux
- ✓ Supply Voltage 12 VDC (Supplied with 115VAC power module)
- ✓ No lag ✓ No burn-in ✓ Accepts all C and CS lenses
- ✓ Size 3-3/4" x 1-3/4" x 2", standard 1/4-20 mounting, Shpg Wt, 1 lb.



G3-054 ----- (LESS LENS) \$109.95

### SOLID STATE STEPPER MOTOR CONTROLLER KIT For 6 thru 30 VDC OPERATION

Kit contains all necessary components to construct this versatile device. CONTROLLER WILL OPERATE 4 PHASE STEP PER MOTORS WITH CURRENT RATINGS UP TO 1.25 AMPS PER PHASE CONTINUOUS. Controls allow selection of DIRECTION, SINGLE STEP OR HOLD, in addition to HALF-STEP, FULL-STEP AND WAVE DRIVE STEPPING SEQUENCE. Speed control ranges from 1 PULSE PER SECOND TO BEYOND 1500 PULSES PER SECOND. LED's indicate PHASE SEQUENCE. Kit will operate from Battery or Power supply. Kit will operate unipolar motors rated for 6 VDC to 30 VDC, with 5, 6, or 8 leads. Includes a 12V 7.5° motor for demo. Shpg Wt, 2 lbs.



TM93KIT2421 ----- \$24.50

Kits cannot be returned or exchanged if they have been soldered  
When properly assembled, kits work as specified.



### SWITCHING POWER SUPPLY

+5 VDC 4.5 AMPS, +12 VDC 1.2 AMPS, 9 VAC 0.55 AMPS  
Input 105-130 VAC, 60 Hz, 70 Watts max.

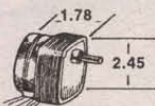
IDEAL FOR MOTOR CONTROL BOARDS. Features IEC 3 blade AC input, international style on-off rocker switch, LED on-off indicator, internal fusing and +5 VDC adjustment. Size: 3"H x 6-3/8"W x 8-1/4"L. UL Listed. New. Shpg, 2.5 lbs. ea.

TM97PWS3080 ----- \$4.95 ea. ----- 10 or more \$3.95 ea.

### HER is a distributor for hurst Motors

#### GEARED STEPPING MOTORS - SERIES SAS

Input 8 Watts, Winding resistance 36 Ohms.  
Wt. each, 2 lbs.



Reduction	Step Angle (degrees)	Output Speed 200 p/s (rpm)	Torque 200 p/s (oz-in)**	H&R NO.	PRICE EACH
600	0.0125	0.42	200*	H2-100	\$67.40
300	0.0250	0.83	200*	H2-101	\$67.40
75	0.100	3.33	200*	H2-102	\$63.70
30	0.250	8.33	97	H2-104	\$55.40
15	0.500	16.67	52	H2-105	\$55.40
10	0.75	25.00	35	H2-106	\$49.10
2	3.75	125.00	7	H2-107	\$53.40

\*Maximum gear train loading.

\*\*Torque measured at nominal voltage with L/R drive.

### 3-1/2" DIGITAL MULTIMETER POCKET TYPE

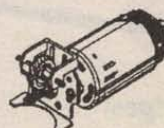
Display: 3.5 digit LCD, 0.5" high with polarity, 5 DC voltage ranges 200mV, 2000mV, 20V, 200V and 1000V. Five DC current ranges 200  $\mu$ A, 2000  $\mu$ A, 20mA, 200mA and 10A. Overload protection. Two AC voltage ranges 200V and 750V. Five resistance ranges 200 $\Omega$ , 2000 $\Omega$ , 20K $\Omega$ , 200K $\Omega$  and 2000K $\Omega$ . Diode and transistor test capability. 0.25% basic accuracy with probes. Size: 2-3/4" W x 1" H x 5" L. New. Shpg wt 1 lb.



TM97TLE2992 ----- \$13.95

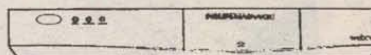
### REVERSIBLE DC GEARHEAD Worm Gear Drive Motor 12 - 120 VDC or 120 VAC

CCL Motor #DE-25L ... Motor can also operate as 120 VAC with attached bridge rectifier. 120 RPM no load @ 12 VDC. Worm drive is 1/2" long, turning 25-1 plastic gear (approx. 0.750" dia.) There are two 0.420" cams at 180° concentric from the shaft on either side of the plastic gear. Motor is 2.800"L x 1.410" dia. Overall length of assembly is 3.700". New. Shpg wt 1 lb.



TM98MTR3220 ----- \$4.95 ea. ----- 10 or more \$4.50 ea.

### Philips Magnavox Internet Unit - WEB TV



Connect to the World Wide Web  
using your TV and your Phone Lines

#### Features:

- \* One button internet access
- \* Surf the NET using hand held remote
- \* Easy hook-up with TV and telephone lines
- \* E-mail with 5 individual mail boxes with message waiting light
- \* Parental control for child safety
- \* Line share eliminates need for second line
- \* 33.6 KBPS internal modem
- \* Expansion ports for future accessories
- \* Cables and connectors included

Philips #MAT960A1 ... Unit size: 11-1/8" x 2" x 8-1/4". New. Shpg Wt. 3lbs.  
TM98COM3214 ----- \$99.95

### TURBO KING Radio Controlled Car Kit

Build your own remote controlled car from the ground up, no soldering required. You will learn all about gears, motors, RF Frequency, and more from the detailed assembly and training manuals. Seven remote functions. Included with the kits are - an assembly manual, training manual, self test, remote controller, flashing top light, and pre-assembled PC board. Fun for ages 10 + up. Four AA and one 9V batteries are required, not supplied. New. Shpg Wt, 2 lbs.



E6-AK870 ----- \$24.95

### TOROID TRANSFORMER 19 VAC 2 Amps and 7.5 VAC 1.5 Amps

Toroid open frame type, input 115 Vac 60Hz. Secondary can be wired series to add up to 26.5 VAC or series buck to 11.5 VAC at the current ratings. Wire leads for connections include ground wire. Wiring instructions on the body of unit. Base size 2-3/4"L x 3"W with 2 holes and 2 notches for easy mounting. O/A Size: 3-1/4"L x 2-3/4"W x 2"H. New. Wt, 2 Lbs.



TM98XFR3088 ----- \$3.95

VISA

MasterCard

Discover

ORDER TOLL FREE 24 HRS at 1-800-848-8001  
or fax us at 609-802-0465

To receive our 100+ page CATALOG call 609-802-0422  
or e-mail us at sales@herbach.com

\$25.00 minimum; additional shipping and handling charges apply  
Prices subject to change

**H&R**  
COMPANY

16 Roland Ave. Mt. Laurel NJ 08054  
INTERNET <http://www.herbach.com>



# Interfacing a Magnetic Stripe Reader

## Magnetic Stripes

Cards with magnetic stripes on the back are everywhere. Credit cards, ATM cards, student ID cards, and even driver's licenses have them. If you go to a trade show, they will give you an ID with a magnetic stripe. Even my grocery card has a magnetic stripe. You cannot get away from this technology.

You can read a card's magnetic stripe by wiring a magnetic stripe reader (MSR) to your computer's parallel port and running a simple program. Figure 1 shows my reader with the LPT port adapter — the only additional requirement is a five-volt supply to power the reader.

My interest in magnetic stripes was peaked by some recent events. During my last trip to the DMV, the clerk typed in all the info on my driver's license instead of swiping the card or just entering my license number — and he made mistakes! Then I was at a tradeshow where the organizers made a tidy profit renting MSR readers and printers to the exhibitors. I've also been curious about the information on the card — if you haven't noticed, many store credit card transactions now print your name on receipt. Does the store get that information from the card or from the credit card company's computer?

All this came to a head when I picked up a magnetic stripe reader for a few dollars at a local surplus store. A little poking around and a search of "magstripe" on the Web turned

up a lot of information.

Some of the information in this article comes from <http://www.com/~tommy/files/magcard1.txt> and <http://www.ee.washington.edu/eeca/text/cardreader.txt>. If you want to try reading

a card with iron fillings and cellophane tape, look at <http://b63334.student.cwru.edu/projects/card/card.htm>.

## What's on the Back of the Card

The card geometry is 3.375

inches by 2.118 inches. The magnetic stripe on the back may have up to three tracks (ISO 3554), appropriately called Track 1, Track 2, and Track 3. Each track is 0.110 inches wide, and all data is recorded serially. The tracks are recorded at different densities and have different formats.

- Track 1 is recorded at 210 bits per inch (BPI). The track contains information in seven-bit characters, and each character has six information bits plus one parity bit. Each track can hold 79 alphanumeric characters.

- Track 2 is recorded at 75 BPI and five bits per character. Each character has four information bits and one parity bit. The track holds 40 digits.

- Track 3 is recorded at 210 BPI and five bits per character. The track holds 107 digits.

Some cards have additional tracks, and some cards use different formats. The California driver's license, for example, records Track 1 at six bits per character (no parity) to squeeze more data on the track.

The magnetic card specifications are also covered in ANSI Standard X4.16 from American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018. Other relevant standards are ISO 7810-1985, ISO 7811-2, and ISO 7811-6.

## The Plan

Reading the magnetic stripe involves several tasks.

Figure 1

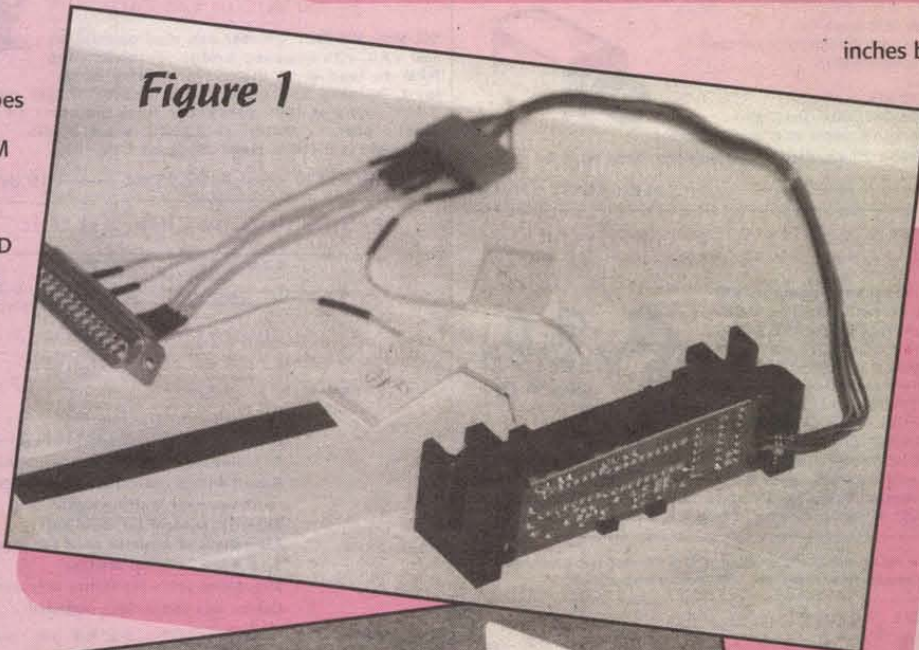


Figure 2





Signal	MSR pin	Color	LPT DB25 pin	Port Bit	Position	Description
+5 Volts	10	Red	NC	NA		Power
RCP2_L	6	Blue	13	0x10		Track 2 Clock
RDP2_L	5	Green	15	0x08		Track 2 Data
RCPI_L	4	Yellow	10	0x40		Track 1 Clock
RDP1_L	3	Orange	12	0x20		Track 1 Data
CLS_L	2	Brown	11	0x80		Card Present
GND	1	Black	18, 19, 20, 21, 22, 23, 24, 25	NA		Power and Signal Ground

Table 1. Magnetic Stripe Interface

1. Connecting the MSR to the computer.
2. Capturing the MSR bit stream into the computer.
3. Extracting the track characters from the bit stream.
4. Testing the track for errors and possibly correcting them.
5. Interpreting the information on the track.

The first task physically connects the reader to the computer, and the other tasks are performed in software by the C program MAG-CARD listed here in the article.

## Connecting the MSR to the Computer

My magnetic stripe reader is

a Neuron Corp, Model MCR-133-2R-2020, Serial 2110249. Its interface signals and pinouts are given in Table 1. All signals are active low. Other MSRs will have similar signals, but their pinouts will vary.

I picked up my reader at a surplus store, and you might do the same. If not, Digi-Key

Start sentinel	1 character
Format code = 'B'	1 character
Primary account number	Up to 19 characters following ANSI X4.13
Separator '^'	1 character
Last Name/First Initial	e.g., "Public/John Q"
Separator '^'	1 character
Expiration date or separator	4 (YYMM) or 1 characters
Other data	Variable
End sentinel	1 character
LRC	1 character

Table 2: Track 1 Format Code B

(<http://www.digikey.com>) sells some Panasonic magnetic card readers. A reader that only reads Track 2 (ISO2) sells for \$30.00, and one that reads both Track 1 and Track 2 (ISO1/ISO2) sells for \$70.00. I haven't tried them, but they should be similar.

Wiring the MSR to the parallel port is easy because there are

```

/* Mode: C - */
// Read a Credit Card Magnetic Stripe
// Copyright Gerald Roylance 1998. All rights reserved.

#include <stdlib.h>
#include <stdio.h>
#include <assert.h>
#include <ctype.h>
#include <conio.h>

// for inp() and kbhit()

#define LPTOUT 0x378
// port 0 (bidirectional data)
// port 1 (pins are input only)
// pin 15 = 0x08 IRDP2
// pin 13 = 0x10 IRCP2
// pin 12 = 0x20 IRDP1
// pin 10 = 0x40 IRCP1
// pin 11 = 0x80 ICLS
#define Active(b) ((b)&0x80)

// Define the bit test masks for a track
struct MTrack
{
    unsigned char bClock;
    unsigned char bData;
};

struct MTrack mTrack1 = {0x40, 0x20};
struct MTrack mTrack2 = {0x10, 0x08};

// Define the codes used on each track
struct MCode
{
    unsigned int cBits;
    unsigned int fParity;
    unsigned char bSentinel;
    unsigned char bTerminal;
};

struct MCode mc7Bit = {7, 1, 0x45, 0x1F}; // Industry Standard
// Track 1
struct MCode mc6Bit = {6, 0, 0x05, 0x1F}; // California Drivers
// License
struct MCode mc5Bit = {5, 1, 0x0B, 0x1F}; // Industry Standard
// Track 2

// Capture raw signal data at the LPT input port

// returns
// < 0 if there is a problem capturing the data
// 0 if user types a key
// # of bytes of data
int CaptureRaw(int cbRaw, unsigned char *abRaw)
{
    // I/O Port values
    int portOut = LPTOUT;
    int portIn = portOut+1;
    int portInt = portOut+2;
    unsigned char b;
    unsigned char bLast;
    int cb = 0;

    // timeout counter ... don't hang the machine forever
    long dwDelay = 0;
    long dwDelayLimit = 10000000L;

    // make sure the arguments are reasonable
    assert(cbRaw > 256 && abRaw != NULL);

    // Initialize the LPT port
    // put the open collector drivers on I/O port in a reasonable state
    // we don't need to do this ...
    outp(portInt, 0x00);
    // no interrupts
    outp(portInt, 0x00);

    // -CLS should be high
    assert(!Active(inp(portIn)));

    // wait for -CLS to go active
    while (1)
    {
        // read the port
        b = inp(portIn);
        // test if active
        if (Active(b))
            break;

        // if the user types a character, give up
        if (kbhit())
        {
            (void)getchar();
            return 0;
        }

        // remember this byte
        bLast = b;
        // record the first active data byte
        abRaw[cb++] = b;

        // capture data while -CLS is active
        while (1)
        {
            b = inp(portIn);
            // record if I/O data byte changed
            if (b != bLast)
            {
                // remember b for next data change
                bLast = b;

                // record the new data
                abRaw[cb++] = b;

                // bail out if we run out of buffer
                if (cb >= cbRaw)
                {
                    // Raw buffer full!
                    return -1;
                }

                // reset the failsafe counter
                dwDelay = 0;

                // quit when the select line goes inactive
                if (!Active(b))
                    break;

                // failsafe counter ...
                if (dwDelay++ > dwDelayLimit)
                {
                    // *** Failsafe counter expired!
                    return -2;
                }
            }
        }

        return cb;
    }

    // Turn array of port raw data values into a track byte string

    // returns # of bytes in Track > 2 if successful
    int ExtractTrack(struct MTrack *pmTrack, struct MCode *pmcCode,
        int cbRaw, unsigned char *abRaw,
        int cbTrack, unsigned char *abTrack)
    {
        // the number of bits in a character
        unsigned int cBits = pmcCode->cBits;
        unsigned char bWeight = (1 << (cBits-1));
        unsigned char bSentinel = pmcCode->bSentinel;
        unsigned char bTerminal = pmcCode->bTerminal;
        // specify the Clock and Data bits of the interface byte
        unsigned char bClock = pmTrack->bClock;
        unsigned char bData = pmTrack->bData;
        // initialize the state machine
        unsigned char bLast = abRaw[0];
        unsigned char bShift = 0;
        int iStripe = -1;
        int iBit = 0;
        int iRaw;

        // data is LSB first
        for (iRaw = 0; iRaw < cbRaw; iRaw++)
        {
            unsigned char b = abRaw[iRaw];

            // Look for Falling Clock Edge
            if (((bLast&bClock)!=0) && ((b&bClock)==0))
            {
                // there is a clock edge.
                // Determine the bit (reader signal is active low)
                unsigned char bit = ((b&bData)?0:bWeight);

                // shift the register and or in the new bit
                bShift = (bShift>>1) | bit;
                iBit++;

                // process the new bit
                if (iStripe < 0)
                {
                    // iByte < 0 means we have not seen a start sentinel yet.
                    // Check if this bit now reveals the sentinel.
                    if (bShift == bSentinel)
                    {
                        // fprintf(stderr, "Start Sentinel found\n");
                        // start recording characters ...
                        iStripe = 0;
                        abTrack[iStripe++] = bShift;
                        iBit = 0;
                    }
                }
                else
                {
                    // we've seen a start sentinel, so mark off each cBits into a
                    byte
                    if (iBit == cBits)
                    {
                        // we've picked up a new byte
                        abTrack[iStripe++] = bShift;
                        iBit = 0;

                        // if the byte before this one was the end sentinel,
                        // then this byte is the LCC and we are done with the string
                        if (iStripe >= 2 && abTrack[iStripe-2] == bTerminal)
                        {
                            // fprintf(stderr, "End Sentinel found\n");
                            return iStripe;

                            // will we run out of room?
                            if (iStripe >= cbTrack)
                                break;
                        }
                    }
                }
            }

            // end of look for falling edge

            // remember this byte for the next iteration
            bLast = b;
        }

        // we did not find an end sentinel or ran out of room
        return -1;
    }

    // Convert the Stripe Bytes to a character string
    void DumpRaw(int cb, unsigned char *abRaw)
    {
        FILE *file = fopen("magcard.txt", "wt");
        if (file == NULL)
        {
            perror("DumpRaw");
        }
        else
        {
            int i;
            for (i = 0; i < cb; i++)

```



only a few wires. The essential task is making an adapter cable from the MSR's connector to the LPT port connector. Each pin on the MSR is wired to a male DB25 connector that plugs into the LPT port. The pins are called out in Table 1. Connect all the LPT ground leads together, and make some provision for powering the MSR.

If your reader doesn't have Track 1 or Track 2, then you can leave its clock and data pins open. You must supply a connection for CLS\_L for the software to recognize a card.

When a card is swiped, CLS\_L

goes low (becomes active) and then the clock lines continue to toggle at a reasonably constant rate. Initially both data lines are held high (logic zero), but after a short time, they start changing back and forth. The data should be clocked on the high to low transition of its clock line — the software given handles that.

## Getting the Data into the Computer

The connection to the LPT port allows the computer to sample the instantaneous signal values from the MSR. For the con-

nection to be useful, the computer must sample the port often enough to notice all the clock changes before a data line changes. The procedure CaptureRaw reads the port data and records every change. The port data only needs to be saved when the CLS line is active (i.e., when a card is being swiped), so the routine waits for CLS\_L to go active, and then records all the data until CLS\_L becomes inactive.

To get an idea of how often we must look at the port, an MSR can read cards that are swiped at 4 to 60

inches per second. For Track 1, that implies bit rates of 840 to 12,600 bits per second. In order to catch all the clock changes, it should sample at least four times the data rate — about 50,000 samples per second or every 20 microseconds for a fast swipe.

Start Sentinel	1 character
Format code = 'D'	1 character
Name	58 characters
Address	29 characters
City	13 characters
End sentinel	1 character
LRC	1 character

**Table 3: Track 1 for California Driver's License**

```

    unsigned char b = abRaw[i];
    fprintf(file, "%02x %d%d%d%d%d%d%d\n",
        b,
        (b>>7)&1, (b>>6)&1, (b>>5)&1, (b>>4)&1,
        (b>>3)&1, (b>>2)&1, (b>>1)&1, (b)&1);
}
fclose(file);
}

int fOddParity(unsigned char bByte)
{
    register unsigned char b = bByte;

    b ^= (b>>4);
    b ^= (b>>2);
    b ^= (b>>1);

    return (b&0x01);
}

char cYYY(unsigned int cBits, unsigned int cx)
{
    if (cBits == 4 || cBits == 5)
    {
        return '0' + (cx&0x0F);
    }
    else if (cBits == 6 || cBits == 7)
    {
        // characters are six bit + parity ...
        return '1' + (cx&0x3F);
    }
    else
    {
        // *** unknown code!
        assert(0);
        return ' ';
    }
}

void PrintTrack(struct MCode *pmcCode, int cbLength, unsigned char
*abTrack)
{
    int i;
    int cBits = pmcCode->cBits;

    for (i = 0; i < cbLength; i++)
    {
        fprintf(stderr, "%c", cYYY(cBits, abTrack[i]));
    }
    fprintf(stderr, "\n");
}

void PrintTrackParity(int cbLength, unsigned char *abTrack)
{
    int i;

    for (i = 0; i < cbLength; i++)
    {
        fprintf(stderr, "%c", (fOddParity(abTrack[i]))? 'X': ' ');
    }
    fprintf(stderr, "\n");
}

char *szStripeToChar(int cbTrack, unsigned char *abTrack, char
*acStripe)
{
    int i;

    for (i = 0; i < cbTrack; i++)
    {
        acStripe[i] = cYYY(7, abTrack[i]);
    }
    // *** should guarantee for the null byte ...
    acStripe[cbTrack] = '\0';

    return acStripe;
}

// Process one Track

```

```

// return length of track
int ProcessTrack(struct MTrack *pmtTrack, struct MCode *pmcCode,
    int cb, unsigned char *abRaw,
    int cbTrack, unsigned char *abTrack)
{
    int iReturn = -1;

    // we got stuff ...
    int cbLength = ExtractTrack(pmtTrack, pmcCode, cb, abRaw, cbTrack,
    abTrack);

    assert(cYYY(7, 0x45) == '%');
    assert(cYYY(7, 0x3E) == '^');
    assert(cYYY(7, 0x5F) == '?');

    // if cbLength <= 2, then we did not find the sentinels!
    if (cbLength <= 2)
    {
        fprintf(stderr, "... no sentinels found\n");
    }
    else
    {
        // Print the raw data
        fprintf(stderr, "Track Raw length %d bytes\n", cbLength);
        PrintTrack(pmcCode, cbLength, abTrack);

        // Do error detection
        unsigned char bLCC = 0;
        int cBits = pmcCode->cBits;
        int fParity = pmcCode->fParity;
        unsigned char bMaskP = (0xFFU >> (8-cBits));
        unsigned char bMaskD = (fParity)? (bMaskP>>1) : bMaskP;
        int cErrors = 0;
        int iError = 0;

        // calculate # of parity errors and LCC
        for (i = 0; i < cbLength; i++)
        {
            bLCC ^= abTrack[i];
            if (fOddParity(abTrack[i]))
            {
                cErrors++;
                iError = i;
            }
        }

        // do we have a parity error
        if (fParity && cErrors != 0)
        {
            PrintTrackParity(cbLength, abTrack);
            fprintf(stderr, "Parity Errors: cErrors = %d, LCC = %02x\n",
            cErrors, bLCC);
            if (cErrors == 1)
            {
                fprintf(stderr, "Correcting single error:\n");
                abTrack[iError] ^= bLCC;
                PrintTrack(pmcCode, cbLength, abTrack);
                // but say we failed anyway
                iReturn = -1;
            }
            else if ((bMaskD & bLCC) != 0)
            {
                fprintf(stderr, "LCC Error: LCC = %02x\n", bLCC);
            }
            else
            {
                // no errors found!
                iReturn = cbLength;
            }
        }
    }
    return iReturn;
}

// Read and Print a Card

unsigned char abRaw[16384];
int cbRaw = sizeof(abRaw);

int MagReadAndPrint(void)

```

```

{
    int iReturn = 1;

    fprintf(stderr, "Swipe Card — or press a key to quit\n");

    // capture the data and the number of samples
    int cb = CaptureRaw(cbRaw, abRaw);

    fprintf(stderr, "Capture data return %d bytes\n", cb);

    assert(cb <= cbRaw);
    if (cb < 0)
    {
        fprintf(stderr, "— Problem capturing the data: error = %d\n", cb);
    }
    else if (cb == 0)
    {
        // user quit
        iReturn = 0;
    }
    else
    {
        unsigned char abTrack[256];
        int cbTrack = sizeof(abTrack);

        // dump port data to a file
        // DumpRaw(cb, abRaw);

        fprintf(stderr, "TRACK1 — 7bit\n");
        if (ProcessTrack(&mtTrack1, &mc7Bit, cb, abRaw, cbTrack,
        abTrack) < 3)
        {
            int cbDriver;

            // if 7 bit failed, try 6 bit ...
            fprintf(stderr, "TRACK1 — 6bit\n");
            cbDriver = ProcessTrack(&mtTrack1, &mc6Bit, cb, abRaw,
            cbTrack, abTrack);
            if (cbDriver > 2 && cYYY(6, abTrack[1]) == 'D')
            {
                int i;
                int cName = 58;
                int cAddress = 29;
                int cCity = 13;
                int iName = 2;
                int iAddress = iName + cName;
                int iCity = iAddress + cAddress;
                int iEnd = iCity + cCity;

                fprintf(stderr, "California Driver's License\n");
                for (i=iName; i < min(cbDriver, iAddress); i++)
                {
                    fprintf(stderr, "%c", cYYY(6, abTrack[i]));
                }
                fprintf(stderr, "\n");
                for (i=iAddress; i < min(cbDriver, iCity); i++)
                {
                    fprintf(stderr, "%c", cYYY(6, abTrack[i]));
                }
                fprintf(stderr, "\n");
                for (i=iCity; i < min(cbDriver, iEnd); i++)
                {
                    fprintf(stderr, "%c", cYYY(6, abTrack[i]));
                }
                fprintf(stderr, "\n");

                fprintf(stderr, "TRACK2 — 5bit\n");
                ProcessTrack(&mtTrack2, &mc5Bit, cb, abRaw, cbTrack, abTrack);
            }
        }

        return iReturn;
    }
}

// Main

int main(void)
{
    assert(fOddParity(1) && fOddParity(0x71));

    // read and print card until the user hits a character ...
    while (MagReadAndPrint())
    {
    }

    return 0;
}

```



Unfortunately, Windows cannot perform such high sample rates, so the program must run in MS/DOS mode. Windows runs in protected mode and installs a virtual device driver (VxD) for the LPT I/O ports. That VxD traps all I/O instructions to the LPT port and then emulates the I/O. Instead of one simple I/O instruction, the computer will execute hundreds of instructions and perform some task switches. Furthermore, Windows may switch to another application and cause large gaps in the sampling.

Instead of fighting Windows or building more exotic hardware, we can run the code in real mode under MS/DOS. The real-time clock will still interrupt the sampling routine, but its effect is minor. To run the program, put Windows into MS/DOS mode by executing Start | Shut Down, and then select "Restart the computer in MS/DOS Mode." Then run MAGCARD.EXE from the MS/DOS command line.

## Grouping the Bits into Characters

The procedure CaptureRaw saves the instantaneous values at the data port. The procedure ExtractTrack examines the raw port data for clock transitions, determines the bit value, and assembles the bits into characters. To get the information from two tracks, we call ExtractTrack twice — once for each track.

The basic format of each track is a preamble, a start sentinel character, an arbitrary number of data characters, the end sentinel character, and a longitudinal check character (LCC). The data come from the card in bit serial fashion with the LSB first. A special bit pattern — called the start sentinel — marks the end of the preamble and the start of the data. Succeeding bits are grouped into appropriately-sized characters for the track. Another special character — the end sentinel — marks the end of the data and tells us the next character is the LCC.

## Testing for Errors

If ExtractTrack finds the sentinels, then the track data will be stored in the array abTrack. Now we need to test that information for errors. In the standard formats, each character has a parity bit, so each character is tested for proper (odd) parity. Any bad parity indicates the track was misread.

All track formats have a longitudinal check character (LCC). When the track was recorded, the LCC was chosen so that a bitwise XOR of all the characters in the track will produce zero. After

Start Sentinel	1 character
Primary account number	Up to 19 characters
Separator	1 character
Country code (3 characters)	Only if primary account number starts with 59 ... USA is 840
Expiration Date or separator	4 characters YYMM or 1 character
Other data ...	
End Sentinel	1 character
LRC	1 character

Table 4: Track 2 Format

A	Issuer is BCD unless
0	Government, issuer is BCDE
1	UATP
2	Airlines
3	Travel and Entertainment
4	Bank, issuer is BCDEF
5	Bank
	if B is 1, 2, or 3, then issuer is 1, 2, or 3 digits
	if B is 0, 4, 5, 6, 7, 8, then issuer is BCDEF
6	Retail (Restricted), issuer is BCDE
7	Petroleum
8	<future>
9	National Card

reading a track, if XORing all of the characters does not produce zero, then there was a read error. The LCC is an even parity check bit across all the track characters. If either the parity test or the LCC test fails, then there is a problem with the data. We must either reread the track or correct the data.

The parity and LCC checks are redundant: either test will detect a single bit that went bad. We don't need both tests to detect a single bit error — one test would be enough. With the two tests, we can actually correct a single bit error. We may not want to do this because it lowers our reliability (we may mistakenly "correct" a detected error to the wrong value), but it will improve our ability to read some cards.

If only one character has bad parity, then we can reconstruct the character using the LCC. The bad parity tells us which character has the error, and the LCC tells us which data bits in that character are bad.

For example, assume bit 3 of the 10th character should be a zero, but is misread as a one. The 10th character (as read) now has an extra one bit, so the 10th character's parity is even. That tells us there is a problem with character 10. When we bitwise XOR all the characters in the track, we don't get zero.

The erroneous bit 3 of the 10th character causes bit 3 of the XOR to be nonzero. Putting the two pieces of information together, we know that bit 3 of character 10 is wrong; complementing that bit should fix the data.

Well, maybe not. Although the parity and LCC scheme can fix single bit errors, multiple errors may confuse it. If there were two errors in one character, then the LCC comes out wrong

but all the parity calculations are right. We know there's an error, but we don't know which character. Even worse, there may be two errors in one character and one error in a second character.

The parity calculation indicates only the second character, and the correction algorithm mistakenly believes fixing only the second character will fix the track.

Consequently, it may be better not to correct errors and instead to ask the operator to swipe the card again or key the information in by hand. In technical terms, the Hamming distance of the parity and LCC code is 4. That means we can detect all single, double, and triple bit errors, but will miss some four bit errors.

If we use correction, then we can correct all single bit errors and detect double bit errors — but we will turn some triple bit errors into four bit errors. If we don't correct, then we are much more certain that the data we do read is correct.

## Interpreting the Data

After the track has been read without errors (or corrected), then we can decode the information in the track. There are several conventions for encoding the data in a track. Track 1 is a high-density track with up to 79 alphanumeric characters. The first character of the track tells us how to decode the remaining data. Track 2 is a low-density track with more rigid encoding.

### Track 1 Format

Track 1 encodes alphanumeric information. The first character following the start sentinel describes the remainder of the track. Usually the first character will be an 'A' (signifying that the following format depends on the card issuer) or a 'B' (signifying a standard layout for the initial data fields).

Of course, seeing format code 'A' doesn't help you unless you know what the card is. Seeing format code 'B' means you can figure out some things about the card.

In the next sections, we cover

the character code used by Track 1 and format code 'B.'

### Track 1 Character Code

The code is six bits (64 possible characters). The code can be converted to ASCII by adding 0x20 (a space) to the six-bit code, but many of the possible characters are reserved or prohibited. Space, 'A'-'Z', '0'-'9', '#', '\$', '(', ')', '-', '.', and '/' are legitimate characters. The start sentinel is 0x45 ('%'), the end sentinel is 0x1F ('?'), and the separator is 0x3E ('^') and have special purposes.

### Track 1 Format Code B

If the character following the start sentinel is a 'B,' then the remainder of the track has an account number, name, and expiration date. The 'B' format code is used by most credit and ATM cards, and is shown in Table 2.

The data following the account number is sometimes dependent upon the account number. If the account number starts with "59," then a country code follows the account number separator. More information can be found in ANSI X4.16.

### Track 1 for the California Driver's License

The California driver's license has an unusual format (Table 3). In order to pack more data into the track, they forgo parity and record the data at six bits per character. The format code is a 'D' instead of a 'B.'

### Track 2 Format

Track 2 is the low-density, numbers-only track that can hold up to 40 characters. The track usually contains an account number, an expiration date, and some additional information.

### Track 2 Character Code

The Track 2 character code is four bits plus parity, so the track can hold only hexadecimal digits. The hex digits can be converted to ASCII by adding the code for '0.'

The characters 0-9 are used for data, and three characters are designated the start sentinel (B or ':'), the end sentinel (F or '?'), and the separator character (D or '='). The remaining three characters are for hardware control (A or '<' and E or '>') or are reserved (C or '<').

### Track 2 Format

Table 4 describes the Track 2 format. The data following the expiration date is determined by the card issuer.



# ACQUISITION SALE

## AST GLOBAL ELECTRONICS ACQUIRES COMPLETE INVENTORY FROM CADISCO ELECTRONICS OF BALTIMORE

### DON'T MISS THIS SALE!

- Over 5,000 pieces of test and laboratory equipment priced to sell.
- Huge assortment of surplus parts available.
- Most equipment priced from \$25-\$250.
- Partial listing of equipment posted on our web site [www.astglobal.com](http://www.astglobal.com)

SALE WILL BE HELD DECEMBER 4, 5, 6

FOR THREE DAYS ONLY AT  
**CADISCO ELECTRONICS**

514 Ensor Street, Baltimore, Maryland



QUESTIONS?? CALL TOLL FREE AT

**1-888-216-7159**

```
// Credit Card Checksum Algorithm
// ANSI X4.13-1983
#include <assert.h>
#include <string.h>
#include <ctype.h>

#define digit_weight(x) (assert(isdigit(x)),
(x - '0'))

// Calculate the value of the check digit ...
int iCCheckCalc(char *szAcct, int n)
{
    int s = 0;
    int i;

    assert(n > 0);

    for (i = n-2; i >= 0; i--)
        // weights alternate 1,2,1,2,... and
        // the check digit (i=n-1) has weight 1

    int a = ((n-1)&0x1) ? 2 : 1;
    int x = a * digit_weight(szAcct[i]);

    s = s + (x%10) + (x/10);
}

// calculate the additive inverse modulo
10
return (10 - (s%10)) % 10;

// Return nonzero if checksum is OK
int fCChecksum(char *szAcct)
{
    int n = strlen(szAcct);
    int c = digit_weight(szAcct[n-1]);
    int s = iCCheckCalc(szAcct, n);

    return c == s;
}
```

### California Drivers License Track 2

Although Track 1 of the California driver's license uses the unusual six-bit character format, Track 2 is conventional. Driver's licenses have expiration dates just like credit cards, so Track 2 dutifully records that information.

The driver's license number is encoded as an account number. Amusingly, the state of California is apparently a retail establishment because its account number string starts with a 6 (see the section on account numbers below). The encoding appears to be

6 + 006460 + <class> +  
<driver's license number> +  
<check digit>

where a class C license is coded as 3. The variable information following the expiration date is the driver's birth date encoded as YYMMDD.

### Account Numbers

ANSI X4.13-1983 describes the format of account numbers.

#### Account Number Format

The table below tells how to decode an account number. If the digits of the account number are ABCDEFGH ..., then use the first digit (A) to decode the remaining digits.

#### Credit Card Checksum

Account numbers also have a checksum algorithm. Retailers and banks want to make sure they got the account number correct, so they include a check digit.

Not only does the checksum algorithm detect a bad digit, but it also detects the common error of swapping two neighboring digits (i.e., turning "37" into "73"). The routine fCChecksum will test the checksum. **NV**



**HO! HO! HO!**

Just in time for the holidays ...

Check out our special

gift subscription offer on page 96.



#### SUPER BLACKLIGHT

Super power blacklight glows a deep purple and brilliantly lights blacklight posters, invisible ultraviolet inks, some currencies, certain minerals, etc. Unit is complete with a sophisticated circuit board and was designed for use by a cosmetic company for use in detecting skin problems. High quality completely assembled unit is about 7" L x 3" W x 2 1/4" D. It uses a 12VDC 500ma adapter (included) and its circuitry allows the unit to be turned on for one minute then it resets after another minute. The circuitry could possibly be modified for continuous on, however, we don't have any info. on how to do this or if it is even possible. We will tell you that the output of this is very bright and covers all of the longwave spectrum. Brand new in manufacturer box. Very unique and worth many, many times our price.

G9589 \$6.95 ea. **SALE** Expires 12-31-98

#### OUR TINIEST MOTOR

Tiny super efficient motor is great for making tiny solar powered robots. These are brand new motors made for the "vibrator" function in pagers. The body is only 9/16" long x 1/4" dia. Attached to the shaft is a "D" shaped weight, which can be removed. Make a robot that you can power from a hearing aid battery, a solar cell, etc. Many circuits for robots exist on the internet that use this type of motor and typically these motors sell for \$10.00 or more, when available.

G9599 \$5.95 ea. 2 for \$10.95 100 for \$500.00 **SALE** Expires 12-31-98

#### ELECTROMAGNETIC FIELD (EMF) DETECTOR

This is a complete EMF detector utilizing 3 SMD ICs and 10 bright LEDs that indicate relative strength of EMF energy. Operates on one 9V battery (not included). As soon as you press the on/off button, the unit runs a "self-test" by lighting all 10 LEDs then it resets itself and indicates the relative EMF strength by the quantity and color of LEDs that light. Size of unit is about 3 5/16" x 2 3/8". These are brand new and prime, but without the outer plastic case. Full scale is 1 milligauss. We have no data or schematics, but all you need to do is connect a 9V battery and you're in business.

G8317 \$3.98 ea. **SALE** Expires 12-31-98



#### ISD1100X 10 SECOND VOICE RECORDER MODULE

These are brand new small size voice recorder/playback Chip-on-Board modules. They only require the addition of 2 pushbutton switches, a speaker, an electret microphone and an electrolytic capacitor to provide a high quality voice recorder that can retain a message for 100 years even without power. Requires 4.5V to 5.5VDC for operation and can be used with any 2 lead electret microphone. These are brand new and come with all data/hookup info. Size of module is only 1 1/2" x 1 1/16". Module only—you supply microphone, speaker, capacitor, and switches

G9827 \$6.98 ea. **NEW** Complete set of additional components (2 switches, 1 speaker, 1 tiny microphone and 1 capacitor).  
G9828 \$2.00 ea.

#### RED 10MM BLINKING LED

Here's the perfect attention attracting item that is hard not to notice! Just connect this bright red mammoth LED to a 9V battery and you have a flashing red light that will attract everyone's attention. Perfect for alarms, model applications, alerts, etc. Brand new, made by Kingbright. Has diffused red lens. Flash rate on 9VDC is about 2 times per second.

G9812 99¢ ea. 10 for \$8.00

#### MALLORY MODEL MSO320 SONALERT II™

These make great alerts, alarms, attention getters, etc. Simply connect any voltage from 3VDC up to a maximum of 20VDC and these small Sonalerts™ will blast out a 3.4KHz tone at 75dB/2FT (at 12VDC). Maximum current is 3-16ma. Size only 23mm dia x 9mm high. Has solder pins on 15mm centers. Brand new!

G9808 99¢ ea. 10 for \$9.00 100 for \$75.00 1000 for \$650.00

#### BRIGHT BLUE T1 LED

Prime bright blue LED type 264V8D features a light blue diffused lens. Brand new!

G9831 69¢ ea. 100 for \$59.00

#### HIGH OUTPUT SOLAR CELL

Silicon solar cell with an output of 1/2 volt and 60ma. Will drive the pager motor directly! Triangle shape about 1 1/2" on 2 sides and a 1 1/8" base.

G9267 \$1.99 ea. 10 for \$18.00



WE ALSO OFFER OVER 150 DIFFERENT ELECTRONIC KITS.

**ELECTRONIC  
GOLDMINE**  
PO Box 5408  
Scottsdale, AZ 85261

<http://www.goldmine-elec.com>

NOTE: All items subject to prior sale. All prices expire 12-31-98

For Phone Orders Call: 800-445-0697  
or Fax Your Orders to: (602) 661-8259  
For a Free Catalog Call: (602) 451-7454  
Foreign catalog request: send \$5.00

Minimum Order: \$10 (plus min. \$5 Shipping and Handling). We accept MasterCard, Visa and personal checks, however, we cannot accept personal checks on orders outside the U.S. Minimum Foreign Order Amount: \$50 (plus a minimum \$10 S&H)

#### 12VDC OPERATED 15KV NEGATIVE ION GENERATOR

Compact negative ion generator clears air of impurities and provides a fountain of fresh air. Negative ions are produced during a thunderstorm and these are the same type that this 2 1/4" x 1 5/8" x 7/8" module produces. Operates from 12VDC (can even operate from a 9V battery at slightly reduced output). Simple to use, just connect 12VDC to the red and black power input leads and a tremendous quantity of negative ions will be emitted by the needle assembly shown. These are brand new factory fresh prime units perfect for homes, cars, offices, etc.

G9695 \$12.95 ea. 2 for \$25.00



**Unique!**



# News Bytes

## 1999 Trinity College Fire-Fighting Home Robot Contest

over \$4,000.00 in prizes

The Trinity College Fire-Fighting Home Robot Contest will be held on the Trinity College campus in Hartford, CT on Sunday, April 18, 1999.

This is the largest, public, true Robotics competition held in the US that is open to entrants of any age, ability, or experience from anywhere in the world.

Last April, we had a great contest. People came from all over the US, Canada, and Europe to compete, participate, watch, learn, and enjoy. This April, the contest will be even better.

The goal of the 1999 contest is the same - to build a Robot that can find and extinguish a fire in a house. The challenge is to build a computerized (not radio-controlled) Robotic device that can move through a model of a single floor of a house, detect fire (a lit candle), and then extinguish it. Robots that accomplish this task in the shortest time win.

Other events scheduled on the contest weekend include Robotics seminars and exposition.

This weekend-long international event will culminate months of work and effort by Robotists of all ages. Last year's contest drew interest from peo-

ple in all 50 states and 14 countries. Participants ranged from college professors and engineers to elementary school students and they came from as far as Switzerland and Argentina.

The 1999 rules are very much like last year's rules, but some slight changes have been made to make the contest more realistic, more fun, and more like the real world. There will be two divisions again this year. A Junior division for those in High School and younger and a Senior division for everyone else. There will be a cash prize of \$1,000.00 awarded to the top winner in each division with additional prizes to other winners in those divisions.

Trinity College is also helping to set up regional contests around North America. Check the Home Page to see if there is a site near you.

Video tapes of the 1998 contest are available for \$25.00 each (includes shipping). Copies of the updated 1999 rules are available for \$3.00. Send cash, check, or money order payable to: **Trinity College, Jake Mendelssohn, 190 Mohegan Dr., West Hartford, CT 06117.** E-Mail: [JMENDEL141@AOL.COM](mailto:JMENDEL141@AOL.COM). Or download the information from the contest Home Page at <http://www.trincoll.edu/~robot>.

## 5 Axis Robotic Arm Kit \$195.00 Plus S&H

**We make it easy!**



**You can build this Robotic Arm!** Impressive, fast, accurate, and repeatable motion. Any computer capable of sending 2400 or 9600 baud serial data can control the arm, even a Basic Stamp. This arm makes a great foundation for AI and motion control experiments. Position the arm in an X, Y, Z, grid with a joystick or keyboard using the new RoboMotion for Windows. The kit includes the hardware, structural components, Hitex servos, pre-assembled SSC servo controller, DOS and Windows software, and an illustrated assembly manual. Camouflage paint not included.

**We have many more cool robots, check out our web page or ask for our free catalog!**

3 Axis Version \$155.00 • Mobile Version \$250.00 • Mobile Robots Book \$48.00

Lynxmotion, Inc.  
104 Partridge Road  
Pekin, IL 61554-1403 USA  
<http://www.lynxmotion.com>

Tel: 309-382-1816  
Fax: 309-382-1254  
[sales@lynxmotion.com](mailto:sales@lynxmotion.com)  
[tech@lynxmotion.com](mailto:tech@lynxmotion.com)

Write In 128 on Reader Service Card.

## 0% FINANCING for 2 Months

2 Easy Payments  
**\$29!**  
97 Edition

2 Easy Payments  
**\$29!**  
back issue. Perfect for Service & Experimenter

2 Easy Payments  
**\$195**  
Publisher

2 Easy Payments  
**\$45**  
Publisher

2 Easy Payments  
**\$235**  
Publisher

2 Easy Payments of  
**\$75!!**

2 Easy Payments Any Product

Complete Catalogs of ALL Major Component Manufacturers

2 payments <b>\$29</b>	97 EEM CD	2 payments <b>\$75</b>	97 ICM CD
2 payments <b>\$44</b>	98 EEM CD	2 payments <b>\$65</b>	97 for Moderate Design 97 ICM Books
2 payments <b>\$59</b>	96 ICM CD	2 payments <b>\$99</b>	98 ICM CD
2 payments <b>\$52</b>	96 ICM Books	2 payments <b>\$93</b>	98 for Advanced Design 98 ICM Books

Save Time with "REFeree"

#1 Choice of Service Centers

**CROSS REFERENCE & SPEC**

Quarter Million Transistors, ICs & Diodes

A Specialist in "Hard to Cross House Numbers"

Easy, Powerful & Fast.

The Most Comprehensive Software Sold.

A selection yields Device Specifications & 75 to 250 Potential Replacements!

Replacement Numbers are Totally Global including Domestic, Asian, European, House Branded, as well as ECG, NTE, SK & GE. Displays Case Drawings, Lead Configuration & Pin-outs for many Devices. Coverage of Replacement Numbers is Very Impressive. 7 Disk Set (17 Meg decompressed) For DOS, Win3.1 & 95 Latest Version 7.11 Includes Many Helpful Conversion Utilities, Tables & Formulas.

Includes: 4 HUGE Consumer Electronics Industry Directories

1- Consumer Electronics Parts Sources (Service) 2- Consumer Electronics Manufacturers 3- The Entire Computer Industry 4- Semiconductor Manufacturers

Perfect for Service, Engineering and Purchasing.

Shop the way the Pro's do, Use Their Tools!

These are the books that find the "Gold". For many years they've been used by the Sharpest Purchasing Agents. Look under every rock...they're impossible to find at ANY price, let alone a great deal like this: Find: Distributors, Manufacturers and Service providers for Products, Services or ANY Component Parts imaginable from USA & Canada. Sources for Everything from Gears to Semiconductors to Foreign Assembly Services.

2 payments  
**\$15**  
Only available with another item

**Parts Sources Library**  
Best Kept Secrets  
All 6 pcs  
Huge

WOW 2 easy payments  
**\$239!**  
0% Financing!  
Instant Credit!

the Perfect Gift  
Only a few left:

2 Payments  
**\$239** NEC 486 DX2-50  
12m - 340m - 9.5" active - W95 - PCMIA

2 Payments  
**\$282** Compac 486 DX4-100  
16m - 710m - 10.4" ds - W95 - PCMIA

may differ from illustration

All Cards & COD We don't sell semiconductors / NO catalog FAX 516-826-7776

Netcom 800-733-3733 ext 6300 516-826-1808 10-9 EST 7Days

Write In 129 on Reader Service Card.

Nuts & Volts Magazine/November 1998 25



# WESTERN TEST SYSTEMS

# WE BUY AND SELL

Inquiries 303-438-9662 • Fax 303-438-9685

Orders only 800-538-1493

530 Compton St., Unit #C, Broomfield, Colorado 80020

## OSCILLOSCOPES & ACCESSORIES

### TO 100 MHz

TEK 7A22 1 MHz High CMRR Differential Amplifier	\$250.00
TEK 7B53A 100 MHz Dual Time Base	\$175.00
TEK SC502 15 MHz Dual Trace Oscilloscope, TM500 series	\$375.00

### ABOVE 100 MHz

TEK 2465 300 MHz 4-channel Oscilloscope	\$2,500.00
TEK 7104 1 GHz Oscilloscope, with 7A29, 7A29-04, 7B10, 7B15	\$4,500.00
TEK 7844 400 MHz Dual Beam Oscilloscope frame	\$600.00
TEK 7844 400 MHz Dual Beam Oscilloscope with 7A24, 7A26, 7B80, 7B85	\$1,000.00
TEK 7904A 500 MHz System, with 7A24, 7A26, 7B80, 7B85	\$1,250.00
TEK 7A13 105 MHz Differential Comparator	\$225.00
TEK 7A19 600 MHz Single Trace Amplifier	\$150.00
TEK 7A24 400 MHz Dual Trace Amplifier	\$300.00
TEK 7A26 200 MHz Dual Trace Amplifier	\$175.00
TEK 7A42 4-Channel Logic Triggered Vertical Amplifier	\$500.00
TEK 7B15 1 GHz Delaying Time Base	\$450.00
TEK 7B80 400 MHz Delaying Time Base	\$175.00
TEK 7B85 400 MHz Delaying Time Base	\$175.00
TEK 7B92A 500 MHz Dual Time Base	\$275.00

### STORAGE

TEK 7833 100 MHz Storage Oscilloscope frame	\$600.00
TEK 7833 100 MHz Storage Oscilloscope with (2) 7A26, (1) 7B92A	\$900.00

### PROBES

HP 1122A Probe Power Supply	\$150.00
TEK 1101 Accessory Power Supply, for FET probes	\$250.00
TEK PG604 100 MHz Differential Probe	\$750.00
TEK P601 900 MHz 1X/10X/100X FET Probe	\$450.00
TEK P6202A 500 MHz 10X FET Probe	\$300.00
TEK P6203 1 GHz 10X Active Probe, for 11000 series	\$375.00
TEK P6701-opt.02 O/E Converter, 450-1050 nm/0.1 mW, DC-700 MHz, ST conn.	\$375.00

### CALIBRATION

TEK SG503 Level Generator, 250 kHz-250 MHz, TM500 series	\$600.00
--	----------

## WAVEFORM GENERATORS

### FUNCTION

HP 3310A 5 MHz Function Generator	\$250.00
HP 3310B 5 MHz Function Generator, monochrome & var. phase trigger	\$325.00
HP 3312A 13 MHz Function Generator	\$650.00
HP 3325A 21 MHz Synthesized Function Generator, HP1B	\$1,650.00
HP 3325A-002 21 MHz Function Generator, high voltage output option	\$1,750.00
HP 8165A-002.003 Prog. Signal Source, 1 mHz-50 MHz, log sweep, rear out	\$2,000.00
HP 8904A-002.004 Multifunction Synthesizer, DC-600 kHz, HP1B	\$2,500.00
TEK AWG5102 Arb. Waveform Gen., 20 MS/s, 12 bits, 50ppm synthesis <1MHz	\$900.00
TEK AWG5105-opt.02 Arbitrary Waveform Generator, dual channel option	\$1,250.00
TEK DD501 Digital Delay & Burst Gen., for function & pulse gen's	\$275.00
TEK FG501 1 MHz Function Generator, TM500 series	\$225.00
TEK FG502 11 MHz Function Generator	\$300.00
TEK FG503 3 MHz Function Generator, TM500 series	\$250.00
TEK RG501 Ramp Generator, TM500 series	\$225.00
WAVETEK 180 2 MHz Sweep/Function Generator	\$200.00
WAVETEK 185 5 MHz Lin/Log Sweep/Function Generator	\$300.00
WAVETEK 288 20 MHz Synthesized Function Generator, GPIB	\$750.00

### PULSE

BERKELEY NUCLEONICS 7085B Digital Delay Generator, 0-100 mS, 1 nS res., 5 Hz-5 MHz	\$750.00
HP 214B-001 10 MHz Pulse Generator, 50 V/50 ohms, counted burst opt	\$1,750.00
HP 8007B 10 MHz Pulse Generator	\$650.00
HP 8012B 50 MHz Pulse Generator, variable transition time	\$600.00
HP 8015A 50 MHz Dual Output Pulse Generator	\$750.00
HP 8080A/81A/83A/84A 300 MHz Word Generator	\$800.00
HP 8080A/91A/92A/93A 1 GHz Single Channel Pulse Generator	\$950.00
HP 8111A 20 MHz Pulse / Function Generator	\$1,500.00
HP 8115A 50 MHz Dual Channel Pulse Generator, HP1B	\$3,500.00
TEK PG502 250 MHz Pulse Generator, 1 nS, TM500 series	\$600.00
TEK PG505 100 kHz Pulse Generator, 80 V peak, TM500 series	\$275.00
TEK PG508 50 MHz Pulse Generator, TM500 series	\$500.00
WAVETEK 802 50 MHz Pulse Generator	\$300.00

## VOLTAGE & CURRENT

### VOLTMETERS

FLUKE 845AR High Impedance Voltmeter / Null Detector	\$500.00
HP 3456A 6-1/2 Digit Voltmeter	\$750.00
HP 3478A 5-1/2 digit Voltmeter, HP1B	\$700.00
KEITHLEY 155 Null Detector	\$200.00
Microvoltmeter, 1 uV-1000 V f.s.	
KEITHLEY 181 6-1/2 digit Nanovoltmeter, 10 nV sensitivity, GPIB	\$900.00
SOLARTRON 7081 8-1/2 digit Voltmeter	\$3,900.00

TEK DM501A 4-1/2 digit Multimeter, TM500 series plug-in	\$225.00
---	----------

### CALIBRATION

FLUKE 510A AC Reference Standard, 10 VRMS, 0-10 mA	\$450.00
FLUKE 515A Portable Calibrator, DC/AC/Ohms, line & battery power	\$900.00
FLUKE 5220A Transconductance Amplifier, DC-5 kHz, 0-20 A	\$3,000.00
FLUKE 720A 7-decade Kelvin-Variety Voltage Divider	\$1,250.00
FLUKE 731B DC Reference Standard	\$400.00
FLUKE 732A DC Voltage Standard	\$2,000.00
HOLT 11 AC Thermal Converter Set, 0.5-1200 V, 20 Hz-30 MHz	\$2,000.00
VALHALLA 2703 AC Volt Std., 0-120V/10 Hz-100 kHz; 120-1200V/10 Hz-1 kHz	\$2,250.00

### VOLTAGE SOURCES

HP 6115A Precision Dual Range Power Supply, 50V 0.8A / 100V 0.4A	\$850.00
KEITHLEY 228 Programmable Voltage/Current Source	\$2,500.00

### CURRENT METERS & SOURCES

HP 4140B Picoammeter / DC Voltage Source, without test fixture	\$2,000.00
HP 6177C DC Current Source, to 50V, 500mA	\$500.00
HP 6181C DC Current Source, to 100 V, 250 mA	\$500.00
HP 6186C DC Current Source, to 300V, 100mA	\$750.00
KEITHLEY 220 Programmable Current Source, 0.5 pA-101 mA, 1-105 V lim	\$2,000.00
KEITHLEY 225 Current Source, 0.1 uA-100 mA, 10-100 V compliance	\$500.00
KEITHLEY 227 Current Source, 1 uA-1 A, 0-50 V compliance	\$800.00
KEITHLEY 261 Picoampere Source	\$375.00
KEITHLEY 642 Electrometer	\$1,500.00
TEK A6303 Current Probe, DC-15 MHz, 100 A max. for use with AM503	\$1,000.00
TEK AM503/A6302/TM501 AC/DC Current Probe System	
TEK CT5-opt.02 High Current Transformer for P6021/A6302, to 1000A	\$300.00

## IMPEDANCE & COMPONENT TEST

### L.C.R.

BOONTON 62AD 1 MHz Inductance Meter, 2-2000 uH	\$550.00
BOONTON 72BD 1 MHz Capacitance Meter, 3-1/2 digit display	\$650.00
HP 4262A-101 3-1/2 digit LCR Meter, 120 Hz/1 kHz/10 kHz test, HP1B	\$2,250.00
HP 4275A-001 5-1/2 digit LCR Meter, 10 kHz-10 MHz, 0-35 V int. bias	\$5,000.00

### STANDARDS

E.S.I. DB62-11K 6-Decade Resistor, 0-11,111.10 Ohms, 0.01 Ohm res.	\$300.00
E.S.I. SR1010 Resistance Transfer Standards, 1 Ohm-100 K/step	\$550.00
E.S.I. SR1050-1M Resistance Transfer Standard, 1 Megohm/step	\$2,000.00
GR 1404-A 1000 pF Reference Standard Capacitor	\$700.00
GR 1406 Standard Air Capacitors, GR900 connector, 0.1% acc.	\$375.00
GR 1412-BC Decade Capacitor, 50 pF - 1.11115 uF	\$350.00
GR 1432-U 4-Decade Resistor, 0-111.10 Ohms, 0.01 Ohm resolution	\$125.00
GR 1433-J 4-Decade Resistor, 0-11,110 Ohms, 0.1 Ohm resolution	\$250.00
GR 1433-K 4-Decade Resistor, 0-11,110 Ohms, 0.1 Ohm resolution	\$250.00
GR 1433-L 4-Decade Resistor, 0-11,100 Ohms, 10 Ohms resolution	\$250.00
GR 1433-N 5-Decade Resistor, 0-11,111 Ohms, 0.1 Ohm resolution	\$300.00
GR 1433-U 4-Decade Resistor, 0-111.0 Ohms, 0.01 Ohm resolution	\$250.00
GR 1433-X 6-Decade Resistor, 0-111,111.0 Ohms, 0.1 Ohm res.	\$350.00
GR 1482-series Standard Inductors	\$275.00
HP 16380A Standard Air Capacitor Set, 1/10/100/1000 pF	\$1,500.00
VALHALLA 2724A Programmable Resistance Standard, 0-11 Gigaohms, GPIB	\$1,675.00

### HI & LO RESISTANCE

HP 4328A Milliohmeter	\$1,300.00
HP 4329A High Resistance Meter	\$1,200.00

### CURVE TRACERS

TEK 577D1/177 Storage Curve Tracer, with standard test fixture	\$2,250.00
TEK 577D2/177 Curve Tracer, with standard test fixture	\$1,850.00

### T.D.R.

TEK 1502-opt.04 Time Domain Reflectometer, 0-2,000 feet, chart recorder	\$1,400.00
TEK 1503-opt.04 Time Domain Reflectometer, 0-50,000 feet, chart recorder	\$1,400.00

## POWER SUPPLIES

### SINGLE OUTPUT

HP 6002A-001 0-60 V/0-10 A/200 Watts max. Autoringing Power Supply	\$750.00
HP 6200B Dual Range Power Supply, 0-20 V 0-1.5 A/0-40 V 0-750 mA CV/CC	\$200.00
HP 6201B 0-20 V 0-1.5 A CV/CC Power Supply	\$175.00
HP 6207B 0-160 V 0-200 mA CV/CC Power Supply	\$300.00
HP 6256B 0-10 V 0-20 A CV/CC Power Supply	\$300.00
HP 6260B-027 0-10 V 0-100 A CV/CC Power Supply, 208 VAC line	\$675.00

HP 6261B-027 0-20 V 0-50 A CV/CC Power Supply, 208 VAC line	\$675.00
HP 6263B 0-20 V 0-10 A CV/CC Power Supply	\$400.00
HP 6266B 0-40 V 0-5 A CV/CC Power Supply	\$400.00
HP 6269B-028 0-40 V 0-50 A CV/CC Power Supply, 230 VAC line	\$950.00
HP 6271B 0-80 V 0-3 A CV/CC Power Supply	\$400.00
HP 6274B 0-80 V 0-1.5 A CV/CC Power Supply	\$900.00
HP 6281A 0-7.5 V 0-5 CV/CC Power Supply	\$175.00
HP 6284A 0-20 V 0-3 A CV/CC Power Supply	\$225.00
HP 6299A 0-100 V 0-750 mA CV/CC Power Supply	\$225.00
HP 6384A 4.0-5.5 V at 8 A CV/CL Power Supply	\$125.00
HP 6434B 0-40 V 0-25 A CV/CC Power Supply	\$800.00
HP 6443B 0-120 V 0-2.5 A CV/CC Power Supply	\$450.00
KEPCO ABC-1500M 0-1500 V 10 mA CV/CL Power Supply	\$125.00
KEPCO ATE 36-30M 0-36 V 0-30 A CV/CC Power Supply	\$900.00
KEPCO ATE 36-8M 0-36 V 0-8 A CV/CC Power Supply	\$375.00
SORENSEN DCR 20-25B 0-20 V 0-25 A CV/CC Power Supply	\$550.00
SORENSEN DCR 600-0.75B 0-600 V 0-750 mA CV/CC Power Supply	\$600.00
SORENSEN SRL 20-12 0-20 V 0-12 A CV/CC Power Supply	\$400.00
SORENSEN SRL 60-0.60 V 0-8 A CV/CC Power Supply	\$600.00
TEK PS501-1 Power Supply, 0-20 V, 2 mV res., 400 mA, TM500 series	\$175.00

### MULTIPLE OUTPUT

HP 6227B Dual 0-25 V 0-2 A CV/CC Power Supply	\$600.00
HP 6228B Dual 0-50 V 0-1 A CV/CC Power Supply	\$600.00
HP 6253A Dual 0-20 V 0-3 A CV/CC Power Supply	\$500.00
HP 6255A Dual 0-40 V 0-1.5 A CV/CC Power Supply	\$500.00
TEK PS5010 Programmable Triple Power Supply, TM5000 series	\$750.00
TEK PS5042A Dual Power Supply, TM500 series	\$200.00

### MISCELLANEOUS

ACME PS2L-500 Programmable Load, 0-75 V / 0-75 A / 500 Watts max.	\$400.00
ELGAR 1751B/461 AC Power Source, 0-135 VAC, 1750 Watts, fixed freq. osc.	\$2,000.00
HP 59501B HP1B Isolated DAC/Power Supply Programmer	\$175.00
HP 59502A Bipolar Power Supply/Amplifier, +/- 20 V 2 A	\$800.00
KEPCO BOP 20-20M Bipolar Op Amp Power Supply, to 20 V 20 A	\$675.00
KEPCO BOP 50-2M Bipolar Op Amp Power Supply, to 50 V 2 A	\$400.00
TRANSISTOR DEVICES DAL-50-15-100 Programmable Load, 0-50 V, 0-15 A, 100 Watts max.	\$200.00

## TIME & FREQUENCY

### UNIVERSAL COUNTERS

HP 5315A 100 MHz/100 nS Universal Counter	\$450.00
HP 5315A-002.003 100 MHz/100 nS Univ. Counter, battery power, 1 GHz C-ch	\$650.00
HP 5315B 100 MHz/100 nS Universal Counter	\$500.00
HP 5316A 100 MHz/100 nS Universal Counter, HP1B	\$800.00
HP 5316A-001.003 100 MHz/100 nS Univ. Counter, HP1B, TCXO, 1 GHz C-ch	\$750.00
HP 5316B 100 MHz/100 nS Universal Counter, HP1B	\$1,000.00
HP 5334A 100 MHz Universal Counter, HP1B	\$750.00
HP 5334A-010.030.050 100 MHz Univ. Counter; OCXO, DVM, 1.3 GHz C-ch, rear in	\$1,000.00
HP 5334B-010.060 100 MHz Universal Counter, HP1B, OCXO	\$750.00
HP 5335A 200 MHz Universal / Statistical Counter	\$1,200.00
PHILIPS PM6654/120 120 MHz/100 nS Universal Counter, 1.3 GHz C-ch, TCXO	\$600.00
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

### 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	\$4,000.00
HP 5340A 18 GHz Frequency Counter	\$1,000.00
HP 5342A 18 GHz Frequency Counter	\$2,000.00
HP 5342A-001 18 GHz Frequency Counter, OCXO reference	\$2,200.00
HP 5342A-001.011 18 GHz Frequency Counter, OCXO reference & HP1B	\$2,400.00
HP 5342A-003 18 GHz Freq. Counter, +22 dBm, 20 dBm dynamic range	\$2,000.00
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
HP 5384A 225 MHz Frequency Counter, HP1B	\$500.00
HP 5385A 1 GHz Frequency Counter, HP1B	\$750.00
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
HP 5087A-1.1 0.1x6 12x4 Dist. Amp. eight 5 MHz outputs, four 10 MHz outputs	\$1,500.00
HP 5087A-opt.033 Distribution Amplifier, 12 outputs at 10 MHz	\$1,750.00

## AUDIO & BASEBAND

### SPECTRUM ANALYSIS

HP 3586C Selective Level Meter, 50 Hz-32.5 MHz, 50 & 75 ohms	\$1,500.00
--	------------





TEK 7L5L3/7603 Spectrum Analyzer, 20 Hz-5 MHz, 10 Hz min. res., w/frame \$1,500.00

### DISTORTION ANALYZERS

HP 339A Distortion Analyzer, built-in low distortion osc. \$1,250.00  
HP 8903A-001 Audio Analyzer, 20 Hz-100 kHz; rear panel input \$2,000.00  
HP 8903B-001, 013, 051 Audio Analyzer, 20 Hz-100 kHz; C-message, CCITT \$2,500.00  
TEK DA4084 Programmable Distortion Analyzer \$1,000.00

### RMS VOLTMETERS

FLUKE 8920A True RMS Voltmeter, 180 uV-700 V, 10 Hz-20 MHz \$450.00  
FLUKE 8922A True RMS Voltmeter, 180 uV-700 V, 2 Hz-11 MHz \$450.00  
HP 209A Sine/Square Wave Generator, 4 Hz-2 MHz, 5 VRMS max. \$225.00

### OSCILLATORS

HP 3336C Synthesizer/Level Generator, 10 Hz-21 MHz \$1,400.00  
TEK SG5010 Programmable Oscillator, 10 Hz-163.8 kHz \$2,750.00  
TEK SG502 Sine/Square Osc., 5 Hz-500 kHz, 70 dB step atten., TM500 \$200.00

### MISCELLANEOUS

HP 3575A-003 Phase-Gain Meter, 1 Hz-13 MHz, dual display option \$850.00  
HP 4437A Step Attenuator, 0-119.9 dB, DC-1 MHz, 600 ohms unbal. \$175.00  
HP 461A Amplifier, 20/40 dB, 1 kHz-150 MHz, 0.5 V/50 Ohms \$125.00  
KROHN-HITE 3103 High/Low Pass Filter, 10 Hz-3 MHz, 24 dB/octave \$400.00  
KROHN-HITE 3342R Dual HP/LP Filter, 0.001 Hz-99.9 kHz, 48 dB/octave \$1,100.00  
KROHN-HITE 3750 LP/HP/BP/BR Filter, 0.02 Hz-20 kHz, 6/12/18/24 dB/oct. \$700.00  
KROHN-HITE DCA-10R 10 Watt Amplifier, 20 dB gain, DC-1 MHz, 600-1000 Ohms \$450.00  
ROCKLAND 852 Dual Highpass/Lowpass Filter, 0.1 Hz-111 kHz \$1,000.00  
TEK AF501 Tunable Bandpass Filter / Amplifier, 3 Hz-35 kHz \$300.00  
TEK AM502 Differential Amplifier, 0.1 Hz-1 MHz, TM500 series \$475.00

## RF & MICROWAVE

### SPECTRUM ANALYZERS

HP 11517A/19A/20A Mixer Set, 18.0-40 GHz, for HP 8555A/8569A \$600.00  
HP 11970A WR28 Harmonic Mixer, 26.5-40 GHz \$1,100.00  
HP 11970K WR42 Harmonic Mixer, 18.0-26.5 GHz \$1,100.00  
HP 11970U WR22 Harmonic Mixer, 33-50 GHz \$1,400.00  
HP 11970U WR19 Harmonic Mixer, 40-60 GHz \$1,400.00  
HP 8444A-05 Tracking Generator, 0.5-1500 MHz, for 855A, 856B, etc. \$1,250.00  
HP 8445B Preselector, 1.8-18.0 GHz, for HP 8555A \$650.00  
HP 8565A-100 Spectrum Analyzer, 10 MHz-22 GHz, 100 Hz min. res. \$4,500.00  
HP 8566B Spectrum An., 100 Hz-22 GHz, HP calibration certificate \$37,500.00  
HP 8569B Spectrum Analyzer, 10 MHz-22 GHz, 100 Hz min. res. \$7,500.00  
TEK 7L14-038/7603 Spectrum Analyzer, 1 kHz-2.5 GHz, 30 Hz min. res. bw. \$2,500.00  
TEK TR503 Tracking Generator, 0.1-1800 MHz, for 492/4/5/6 \$850.00  
TEK WM782V WR15 Harmonic Mixer, 50-75 GHz \$1,500.00

### NETWORK ANALYZERS

HP 85021C Directional Bridge, 0.01-18 GHz, 33 dB dir. for 8756/87 \$1,000.00  
HP 8756A Scalar Network Analyzer \$2,500.00

### SIGNAL GENERATORS

FLUKE 6060A Synthesized Signal Gen., 0.1-1050 MHz, 10 Hz res., GPIB \$2,750.00  
FLUKE 6060A/AN Synthesized Signal Gen., 10 kHz-520 MHz, 10 Hz res., GPIB \$1,750.00  
FLUKE 6062A Synthesized Signal Gen., 0.1-2100 MHz, 10 Hz res., GPIB \$5,000.00  
GIGATRONICS 600/10-18 Synthesized Source, 10-18 GHz, 1 kHz res., GPIB \$3,000.00  
GIGATRONICS 875/50 Levelled Multiplier, x4, 50.0-75.0 GHz output, -3 dBm \$2,500.00  
GIGATRONICS 875/86 Levelled Multiplier, 26.5-40.8 & 50.0-75.0 GHz outputs \$3,750.00  
GIGATRONICS 900/2-8 Synthesized Signal/Sweep Gen., 2-8 GHz, 1 kHz res., GPIB \$3,000.00  
HP 11720A Pulse Modulator, 2-18 GHz, 80 dB on/off ratio \$750.00  
HP 85100V Frequency Mult., 10-15 GHz in / 50-75 GHz out >0 dBm \$3,750.00  
HP 8640B-001, 002 Signal Gen., 0.5-1024 MHz, AM, FM, var. audio osc. \$1,750.00  
HP 8656A Synthesized Signal Gen., 0.1-990 MHz, 100 Hz res., HP1B \$2,500.00  
HP 8657A-002 Signal Generator, 0.1-1040 MHz, 10 Hz res., HP1B \$3,250.00  
HP 8660C/8660B-002 Synth. Sig. Gen., 1-1300 MHz, FM / Phase mod., w/86635A \$3,250.00  
HP 8660C/8660B-002 Synth. Sig. Gen., 1-2600 MHz, FM / Phase Mod., w/86635A \$4,500.00  
HP 8663B Signal Generator, 2.3-6.5 GHz, AM, WBFM, Pulse \$3,500.00  
HP 8664B Signal Generator, 5.4-12.5 GHz, AM, WBFM, Pulse \$3,500.00

### SWEEP GENERATORS

HP 8350A/83545A-002 Sweep Oscillator, 5.9-12.4 GHz, 70 dB step attenuator \$4,000.00  
HP 8350B/83592B-002 Sweep Generator, 10 MHz-20 GHz, 70 dB step attenuator \$14,500.00  
HP 83545A RF Plug-in, 5.9-12.4 GHz, +17 dBm levelled \$1,750.00  
HP 8601A Generator/Sweeper, 0.1-110 MHz, +20 dBm levelled \$400.00

HP 8620C Sweep Oscillator Frame \$550.00  
HP 8622B-002 RF Plug-in, 10-2400 MHz, +13 dBm levelled, 70 dB atten. \$1,500.00

HP 86230B RF Plug-in, 1.8-4.2 GHz, +10 dBm unlevelled \$500.00  
HP 86235A-001, 002 RF Plug-in, 1.7-4.3 GHz, +14 dBm levelled, 70 dB atten. \$600.00  
HP 86240C RF Plug-in, 3.8-8.6 GHz, +16 dBm levelled \$700.00  
HP 86241A-001 RF Plug-in, 3.2-6.5 GHz, +8 dBm levelled \$300.00  
HP 86242D-004, 008 RF Plug-in, 5.9-9.0 GHz, +10 dBm levelled \$300.00  
HP 86250D RF Plug-in, 8.0-12.4 GHz, +10 dBm levelled \$500.00  
HP 86260A RF Plug-in, 12.0-18.0 GHz, +10 dBm unlevelled \$500.00  
HP 86260A-H04 RF Plug-in, 10.0-15.0 GHz, +10 dBm unlevelled \$500.00  
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 962 Sweep Generator, 1.0-4.0 GHz, markers, +12 dBm univ. \$1,500.00  
WILTRON 6619A Sweep Generator, 2-8 GHz, +10 dBm levelled \$1,500.00

### POWER METERS

ANRITSU MA72B Power Sensor, -20 to +20 dBm, 0.01-18 GHz \$300.00  
ANRITSU MP-81B/ML-83A Power Meter, 75-110 GHz (WR10), -20 to +20 dBm \$2,500.00  
BIRD 4410A/4410-1 Wattmeter, with 200-535 kHz 10 W-10 kW element \$350.00  
BOONTON 4200-01A, 03/8-4A x2 Dual Channel Microwattmeter, w/(2) 1 MHz-7 GHz sensors \$1,500.00  
BOONTON 42B/41-4B Analog Power Meter, with 1 MHz-12 GHz sensor \$375.00  
BOONTON 42B/41-4E Analog Power Meter, with 1 MHz-18 GHz sensor \$500.00  
GENERAL MICROWAVE 476/4240A Power Meter & Sensor, 0.01-18 GHz, -35 to +10 dBm \$300.00  
HP 435A/8481A Power Meter, 10 MHz-18 GHz, -30 to +20 dBm \$900.00  
HP 435A/8482B Power Meter, 1-4200 MHz, -10 to +34 dBm \$950.00  
HP 435B/8482B Power Meter, 0.1 to +43 dBm, 100 kHz-4.2 GHz \$1,800.00  
HP 8477A Power Meter Calibrator, for HP 432 series \$500.00  
HP K486A WR42 Thermistor Mount, 18.0-26.5 GHz, for 432 series \$350.00  
HP Q8486A Power Sensor, 33.0-50.0 GHz, WR22, for 435B/87/8 \$1,500.00  
HP R486A WR28 Thermistor Mount, 18.0-26.5 GHz, for 432 series \$350.00

### RF MILLIVOLTMETERS

BOONTON 92B-opt.05 RF Millivoltmeter, 10 kHz-1.2 GHz, 0.1 mV scale \$500.00  
RACAL 9303 TRMS Level Meter, 10 kHz-2 GHz, -77 to +23 dBm, GPIB \$875.00

### AMPLIFIERS, MISCELLANEOUS

AMPLIFIER RESEARCH 1W1000 Amplifier, 30 dB gain, 1-1000 MHz, 1 Watt output \$650.00  
BOONTON 824D-opt.01A Modulation Meter, AM, FM, 10-1200 MHz, GPIB \$900.00  
HP 11715A AM/FM Test Source \$1,600.00  
HP 415E SWR Meter \$300.00  
HP 4658A Amplifier, 20/40 dB, 5 Hz-1 MHz, 1/2 Watt/50 Ohms \$125.00  
HP 8447A Amplifier, 20 dB, 0.1-400 MHz, 5 dB NF, +6 dBm output \$375.00  
HP 8447E Amplifier, 22 dB, 0.1-1300 MHz, +13 dBm output \$750.00  
HP 8447F Preamplifier / Power Amplifier, 0.1-1300 MHz \$1,200.00  
HP 8901A Modulation Analyzer, 10 kHz-1300 MHz \$2,000.00  
HP 8901B-1-2-3 Modulation An., 0.15-1300 MHz, rear input, CCXO, ext. LO \$4,000.00  
HP 8970A Noise Figure Meter \$5,000.00  
HUGHES 1177H02F000 TWT Amplifier, 4.0-8.0 GHz, 10 Watts output \$1,500.00  
MICROWAVE SEMI-CORP. MC5112 Noise Source, 25.5 dB ENR, 1.0-12.4 GHz, (N/m), +28 VDC \$275.00  
ROHDE & SCHWARTZ ESH2 Test Receiver, 9 kHz-30 MHz \$5,000.00

## COAXIAL & WAVEGUIDE

AMERICAN NUCLEONICS AM-432 Cavity Backed Spiral Antenna, LHC, 2-18 GHz, TNC(f) "NEW" \$95.00  
FXR/MICROLAB S3-02N Triple Stub Tuner, 200-1000 MHz, 100 Watts max., N(m/f) \$125.00  
GR 874-LTL Constant Impedance Trombone Line, 0-44 cm, DC-2 GHz \$400.00  
GR 900-Q GR900 14mm Interseries Adapters \$125.00  
HP 11590A-001 Bias Network, 1.0-18 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, 100-2000 MHz, APC7 test port \$450.00  
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 Attenuator, 0-11 dB, DC-4 GHz, SMA \$350.00  
HP 8495G-002 Programmable Step Attenuator, 0-70 dB, DC-4 GHz, SMA \$300.00  
HP 8495H-002 Programmable Step Attenuator, 0-70 dB, DC-18 GHz, SMA \$400.00  
HP 8497K-004 Programmable Step Attenuator, 0-90 dB, DC-26.5 GHz \$750.00  
HP K422A WR42 Flat Broadband Detector, 18.0-26.5 GHz \$350.00  
HP K532A WR42 Frequency Meter, 18.0-26.5 GHz \$450.00  
HP K870A WR42 Slide Screw Tuner, 18.0-26.5 GHz \$275.00  
HP K914B WR42 Moving Load, 18.0-26.5 GHz \$350.00  
HP Q752D WR22 Directional Coupler, 20 dB, 33-50 GHz \$650.00  
HP R375A WR28 Variable Attenuator, 0-20 dB, 26.5-40 GHz \$375.00

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 R814B 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 Isolator, 25 dB, 26.5-40 GHz \$450.00  
HUGHES 4512H-1000 WR22 Frequency Meter, 33-50 GHz \$900.00  
HUGHES 45732H-1200 WR22 Level Set Attenuator, 0-25 dB, 33-50 GHz \$250.00  
HUGHES 45772H-1100 WR22 Thermistor Mount, -20 to +10 dBm, 33-50 GHz \$400.00  
HUGHES 45775H-1100 WR12 Thermistor Mount, -20 to +10 dBm, 60-90 GHz \$800.00  
HUGHES 47316H-1111 WR10 Tuneable Detector, 75-110 GHz, positive polarity \$600.00  
HUGHES 47323H-1211 WR19 Flat Broadband Detector, negative, 40-60 GHz \$650.00  
HUGHES 47974H-1000 WR15 SPST PIN Switch, 250 MHz speed, 60-62 GHz response \$375.00  
KAY 442D Step Attenuator, 0-101 dB, 75 ohms, BNC \$100.00  
KRYTAR 1818 Directional Coupler, 16 dB, 2-18 GHz, SMA(f) \$200.00  
M/A-COM 3-19-300/10 WR19 Directional Coupler, 10 dB, 40-60 GHz \$450.00  
MIDWEST MICROWAVE 3537 DC Block, 0.1-12.4 GHz, SMA(m/f) "NEW" \$40.00  
MINI-CIRCUITS ZFDC-20-4 Directional Coupler, 19.5 dB, 1-1000 MHz, SMA(f) \$25.00  
MINI-CIRCUITS ZHL-4-2 Amplifier, 30 dB gain, 0.7-4.2 GHz, +28 dBm, 15V, SMA(f) \$400.00  
NARDA 25171 Level Set Attenuator, 0-17 dB, 2-8 GHz, SMA(f) \$100.00  
NARDA 26298 20 dB Attenuator, 150 Watts, DC-1 GHz, N(f/f) \$200.00  
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 Load, 200 Watts, 2.0-12.4 GHz, N(m) \$400.00  
NARDA 369BNF High Power Termination, 175 Watts, 0.7-18 GHz, N(f) \$325.00  
NARDA 3753B Coaxial Phase Shifter, 0-55 deg./GHz, 3.5-12.4 GHz \$1,250.00  
NARDA 4000-SERIES SMA Miniature Directional Couplers \$75.00  
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 765-10 10 dB Attenuator, 50 Watts, DC-5 GHz, N(m/f) \$135.00  
NARDA 766-10 10 dB Attenuator, 20 Watts, DC-4 GHz, N(m/f) \$100.00  
NARDA 792FV Variable Attenuator, 0-20 dB, 2.0-12.4 GHz \$375.00  
NARDA 794FM Direct Reading Variable Attenuator, 0-40 dB, 4-8 GHz \$375.00  
OMNI-SPECTRUM 2143 WR42 Crystal Detector, 1-18 GHz, negative polarity, SMA(m/f) \$50.00  
PAMTECH KYG1014 WR42 Junction Circulator, 18.0-26.5 GHz \$250.00  
SONOMA ENG. S-4901 WR15 Junction Isolator, 57-59 GHz, 30 dB isolation \$125.00  
SONOMA ENG. S-4906 WR15 Junction Isolator, 60-62 GHz, 30 dB isolation \$125.00  
SONOMA ENG. S-4907 WR15 Junction Isolator, 62-64 GHz, 30 dB isolation \$125.00  
SONOMA SCIENTIFIC 2143 WR42 Circulator, 20 dB, 20.6-24.8 GHz \$75.00  
SPACEK LABS DQ-1 WR22 Flat Broadband Detector, 33-50 GHz \$400.00  
SPACEK LABS K-2X Frequency Doubler, 9.0-13.25 GHz in / 18.0-26.5 GHz out \$350.00  
SPACEK LABS KA-3X Frequency Tripler, 8.83-13.33 GHz in / 26.5-40.0 GHz out \$350.00  
TRG B528 WR22 Direct Reading Phase Shifter, 0-360 deg., 33-50 GHz \$1,250.00  
TRG V551 WR15 Frequency Meter, 50-75 GHz \$600.00  
TRG W551 WR10 Frequency Meter, 50-75 GHz \$750.00  
WAVELINE 100080 WR28 Terminated Crossguide Coupler, 30 dB \$200.00  
WEINSCHEL 1515 Power Divider, 2-Way, DC-18 GHz, SMA(m/f) \$125.00  
WEINSCHEL DS109 Double Stub Tuner, 1-13 GHz, N(m/f) \$150.00  
WEINSCHEL DS109L Double Stub Tuner, 0.2-2.0 GHz, N(m/f) \$150.00

## COMMUNICATIONS

HP 59401A HP1B Bus Analyzer \$700.00  
TEK 1410R NTSC Gen., w/SPG2 sync. generator, TSG7 color bars \$800.00  
TEK 1411R PAL Test Gen., w/SPG12 sync. generator, TSG11 color bars, TSG13 linearity \$750.00  
TEK 1411R PAL Test Gen., w/SPG12, TSG11, TSG13, TSG15, TSG16 \$1,000.00  
TEK 1411R PAL Test Gen., w/SPG12, TSG11, TSG12, TSG13, TSG15, TSG16 \$1,100.00  
TEK 1411R-opt.04 PAL Test Gen., w/SPG12, TSG11, TSG13, TSG15, TSG16 \$1,400.00  
TEK 1420 NTSC Vectorscope \$600.00  
TEK 147A NTSC Test Signal Generator, with noise test signal \$800.00  
TEK 148 PAL Insertion Test Signal Generator \$700.00  
TEK 520A NTSC Vectorscope \$750.00  
TEK 521A PAL Vectorscope \$750.00  
P.A.R. 5206-95, 98 Two-Phase Lock-in Amp., 2 Hz-100 kHz, GPIB \$1,500.00  
P.A.R. 5209 Lock-in Amp., 0.5 Hz-120 kHz, 130 dB dynamic reserve \$2,500.00  
TEK TM5006 5000-series 6-slot Programmable Power Module \$600.00  
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



# 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:

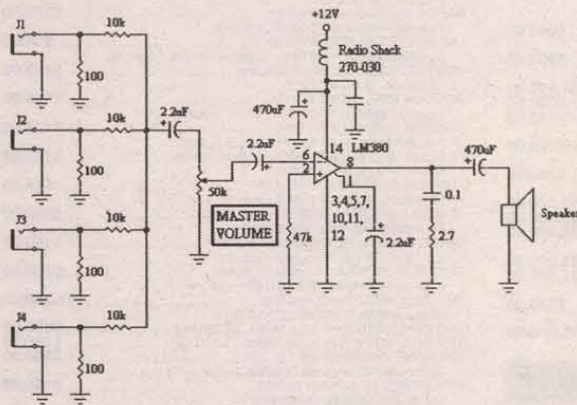
One man's trash is another man's treasure: two types of metal detectors. Transistor basics for want-to-be engineers. Maxim's new family of tunable low-pass filters and an audio mixer. Two Q & A answer updates (space-age stepper motor controller and well-depth gauge), and hard disk hardware fixes.

### Mix And Match Audio

**Q.** I have a simple problem for which I hope you can give me a simple solution. Between scanners, ham radios, and broadcast band, I have more than a couple receivers in my truck. Is there a simple circuit that would combine the audio outputs together via the external speaker (earphone) jack on each rig and run them through one quality speaker? I don't want the output of one rig to feed back into another and cause damage.

John Chaput  
via Internet

**A.** Yes, there's a simple solution called an audio mixer. This circuit is used extensively in the recording industry to combine different sound sources — basically, the way the two channels of a stereo recording are created by combining sounds from 16 or more separate sources. Here's a four-input mixer.

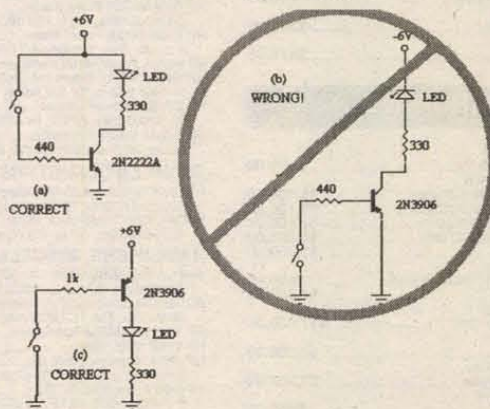


The outputs of your receivers plug into jacks J1 through J4 — the order isn't important, and you don't have to fill all four (two or three work the same). The 100-ohm resistor simulates the load of an

earphone, and the 10K resistor prevents the output from feeding back into the other inputs (receivers). The combined inputs now go to an LM380 power amplifier, which gives you enough sound to be heard over the noise of your truck. Make sure to use the Radio Shack hash filter shown, otherwise you'll get more engine noise than you will radio. To use the mixer, turn the Master Volume up full, plug the receiver into the desired jack, and adjust its volume control for the desired loudness. Turn off that receiver and proceed to the next, then the next, etc. After that, use the Master Volume to adjust the sound level. While only four inputs are shown, you can add as many as you wish — well, up to a point. After about a dozen, you may want to consider an intermediate amplifier (an op amp between the 10K resistors and Master Volume control) to make up for the losses. If you want to have some fun, turn on two receivers at the same time and use their respective volume controls to fade from one source to the other, just like the sound engineers do.

### Transistor Basics

**Q.** I know this may be very basic for most of your readers, but I'm trying to do some simple tests with transistors before assembling a more complex design and I cannot get the PNP transistors (2N3906) to work. Here are the two test circuits — (a) and (b).



Closing the switch in circuit (a) turns on the LED; when I do the same in circuit (b) it doesn't work. What am I doing wrong?

Gregory M. Kiyoi  
via Internet

**A.** Well you've done a lot of things right. For example, you reversed both the LED diode and the polarity of the power supply. That's smart. Your

mistake is that you don't have a current path through the base of the transistor. Basically, a transistor is two back-to-back diodes with the base as common. For a transistor to work, you need to have current flowing from the base to the emitter. This current causes current to flow from the collector to the emitter; the amount of current flow is determined by the gain (hfe) of the transistor. If the transistor has an hfe of 100, 1 mA through the base-emitter will produce a flow of 100 mA through the collector-emitter. In circuit (b), there is no current path through the base-emitter. Since you're mixing NPN and PNP transistors in a more complex circuit, the correct way to handle the situation

### SOLUTIONS TO YOUR CABLING NEEDS

Cat.5 -- Enhanced Cat.5 -- USB -- IEEE1284 / 488 / 1394  
Firewire -- High-End Monitor -- Manual & Auto Switches  
Apple -- Custom Ribbon Cables -- Premise Wiring -- more!  
HUGE SELECTION OF SCSI CABLES & ADAPTERS

### USB Hubs & Printer Cables Are Here!

4-port hub, dual power...\$60.00  
USB to Parallel printer cable...\$52.00

No minimum order, same day shipping on most orders, A+ and CET technician available to answer your questions.



Northwest Cable & Connector Co.  
[www.nwcable.com](http://www.nwcable.com)

Phone: (360) 754-3606 Fax: (360) 754-0825

### Miniature Transmitters and Receivers

	<input type="checkbox"/> 2 Button - 3 Channel Remote Control Transmitter				
	<input type="checkbox"/> 59,049 Changeable Security Codes - 10 Trinary Bits				
	<input type="checkbox"/> Operates at 318mhz	<input type="checkbox"/> 12 Volt Battery Incl.			
	<input type="checkbox"/> Size - 1.25" x 2"	<input type="checkbox"/> 1 Inch Keyring			
			Qty	1	5
RF300T	150' Range 2 Button Transmitter			24.95	16.95
RF300TXT	300' Range 2 Button Transmitter			29.95	20.95
	<input type="checkbox"/> 3 Channel Remote Control Receiver				
	<input type="checkbox"/> Input : 8-12vdc regulated or 11-24vdc unregulated				
	<input type="checkbox"/> Latched or Momentary Digital Outputs (x: L or M)				
	<input type="checkbox"/> PCB Board Size - 1.25" x 3.75"				
RF300Rx	3 Channel Receiver			24.95	16.95
RF300RKx	3 Channel Receiver Kit			19.95	12.95

Visitect Inc. 510-651-1425

P.O. Box 14156 Fremont CA 94539 Fax 510-651-8454 Accept Visa, M/C, COD's

Write in 29 on Reader Service Card.



is to invert the 2N3906 transistor (c) so that you can run off a single-polarity power source. In this configuration, current will flow from the emitter (+6V) through the base via the 1K resistor when the switch is closed. This causes the LED to glow. Good luck with your project!

## Hard Disk Fixes

**Q.** My 2GB (nearly full) hard disk went from being fully operational to being "not detected" by the computer's BIOS. A spare hard disk works just fine in the computer. Because the BIOS doesn't recognize the drive, I'm thinking that the failure is with the drive's electronics and not a mechanical crash. Some questions: Is my assumption likely to be correct? Are there any fuses on a typical drive? Can the drive be repaired or the data retrieved? If so, can you provide a repair/restoration vendor's contact or name two?

**Derek Neely  
via Internet**

**A.** Been there many times, most recently a couple of weeks ago. Yes, you have a hard disk problem. There are many reasons why a hard disk fails. Let me list them in the order of failure rate.

- 1) The disk gets "stickism" where the bearing freezes or the read/write head "glues" itself to the platter, preventing the disk from rotating. If you don't hear the drive rev up when power is applied, it may be stuck. To fix it, hold the drive horizontally in your hand and give it a quick twist. This often frees the stick and gets the disk up and running, but not for long. Remove the data immediately. Some data may be lost, but probably nothing important.
- 2) Heat and vibration inside the PC cabinet has caused the solder joints on the controller board, mounted directly under the drive itself, to loosen and lose electrical contact. This most frequently happens with the milk-white power connector. VERY carefully apply soldering iron heat to these four pads on the controller board. Also push down — don't remove — any socketed ICs on the controller board to reseal them.
- 3) The controller board has died. Unfortunately, there are no fuses to replace. However, this problem is fixable if you can find a used drive of the same make, model, and relatively-close serial number. Simply remove the board from the used drive and drop it into your drive. The controller board is coupled to the drive via a couple of flexi-

ble printed circuit cables. These are fragile, as are the connectors that attaches them, so be careful. I've repaired several drives this way.

4) The drive is dead and you've exhausted all the hardware options. If the drive contains valuable data it's probably worth having a professional retrieve them for you. Expect to pay about \$500.00. You'll find a list of data recovery services at <http://www.bintinternet.com/~gfd/links.htm>. Although I've never used a data recovery service, the following two companies sound like they know what they're doing: ECO Data Recovery (1-800-339-3412; <http://www.eco-datarecov.com/index.html>) and Data Recovery Labs (416-510-6990; <http://www.datarec.com/index5.html>).

## Well-Depth Gauge Revisited

**Q.** In a previous column (Aug. '98), you published a schematic of a well-depth alarm using thermistors. I thought of using this circuit for a cistern, but how would you get the thermistors down the well and be watertight too? Phone wire?

**Stephanie Drake  
via Internet**

**A.** Yes, I'd use phone wire — but not the kind you buy from Radio Shack. Instead, contact your local phone company and ask for a hank of direct burial cable. It has about six twisted pairs and is encased in silicon-filled rubber. However, the last time I asked for a "slice" of this cable (I needed about 36 feet) they gave me a full spool, so be careful what you ask for. You may get more than you want! If you can corner a repair tech, he/she will probably have some remnants on hand. My local phone company hands this stuff out for free, but others may charge. Alternatives? Of course. Coax, ribbon, and just about any wire that's designed to work in wind, rain, sleet, and snow — you know, the kind you see on power poles and the outside of a building. What's more important is the thermistor splices, which could compromise the integrity of the sensor. I suggest covering the splices with RTV (silicon) then covering that with shrink wrap after it's cured, as illustrated below. Whatever you do, don't insulate the thermistor. It's already waterproof and trying to further protect it will only hinder its performance. Just make sure the leads are covered.

## HACKING THE INTERNET

The latest tricks and methods being used on the Net to pirate software (warez) and the newest hacking websites. Includes examples, countermeasures, password defeats, UNIX, Sprintnet, brute force techs, lots of tips. **More! \$29.**

### INTERNET TRACKING & TRACING

Scammers, spammers, stalkers, infectors, and others hide behind the Internet's anonymity to commit serious offenses. Learn from master hackers best methods to track & trace IDs and origins, and to protect your own privacy. **More! \$29.**

### INTERNET CONS & SCAMS

Internet cons, scams and related frauds now rake in \$2+ billion annually! Most are done anonymously with impunity. Details how they're done, how to ID them, how to protect yourself. **More! \$25.**

### THE COOKIE TERMINATOR

When online, many websites track your every move! Browser cookie, history and cache files contain personal data readily accessible to Internet predators, scammers, spammers and snoops. Your financial, medical, political, habits, lifestyle, future plans data is exposed to the world! Step-by-step how to remove and stop cookies from destroying your privacy. **\$25.**

**Any 2 for \$49, 3 for \$64, all 4 for \$79!**

### PBX HACKING

PBX hacking losses are at \$5-\$10 billion annually! Details how PBXs are hacked, countermeasures. Author interview in Forbes! **\$24.**

**TOP SECRET**

## CONSUMERTRONICS

2430 Juan Tabo, NE, #259, ABQ, NM 87112  
P.O. Box 23097 ABQ, NM 87192  
Fax: 505-292-4078 (all hours, orders only) Voice: 505-237-2073 (10-6 M-F)

Full Catalog: [www.tsc-global.com/consumer.html](http://www.tsc-global.com/consumer.html) Adventure: [www.tsc-global.com](http://www.tsc-global.com)

Established in 1971. Featured on CBS "60 Minutes," Forbes, New York Times. Add \$5 total S/H (US, Canada). Postal MO is fastest! VISA, MC OK. No CODs. Take 10% OFF all Orders over \$100, and Take \$2.00 OFF all New Orders over \$20 placed by Mail or Fax. Catalog \$1 w/order, \$3 w/o.

Sold for legal educational purposes only. See Catalog for LIMITED WARRANTY, SPECIAL PROJECTS and all other applicable policies.

## CELLPHONE MODIF. GUIDE

How cellphones operate and are modified. Vulnerabilities to hack attack and countermeasures. Cloning details for NAMS, ESNs, etc, control data formats, computing encoded MINs, ESNs, SIDNs, Op Sys, PROMs, forcing ACK, test mode and resets, cable diagrams, scanning, tracking, scanner restorations, freq allocations, roaming, step-by-step to keypad-reprogram 100+ popular cell phones. One FREE database search. **More! \$49.**

### PAGER (BEEPER) MANUAL

How Pagers work, different types and uses, freqs, advantages over and uses with cellphones, and tips and tricks. How Pagers are hacked/countermeasures. And plans for a Personal Pocket Paging System (xmitter and receiver). **More! \$29.**

**Both for only \$69!**

## PHREAKING CALLER ID & ANI

How they work and dozens of ways of defeating Caller ID, ANI, \*69, \*57, Call Blocking, \*67 etc. Describes ESS, SS7, CNA, CAMA, DNR, Diverters, Centrex - **more! \$25.**

## HACKING FAX MACHINES

Details all known methods of hacking Faxes, countermeasures. Includes computer fax modems, crimes, interceptions, fax servers, fax-on-demand, protocols, parameters, compression, encryption, fax surveillance-type mods. **More! \$29.**

## VOICE MAIL HACKING

VMSs are hacked to penetrate PBXs to make outgoing calls, get free VMB usage, secretly read/change/delete messages, or damage the VMS (or its PBX) itself. Step-by-step on how it's done, countermeasures. **\$29.**

## STOPPING POWER METERS

**As reported on "60 MINUTES"!** New 6th Edition! Plans for devices that can slow down (even stop) watt-hour meters - while loads draw full power! Devices plug into one outlet and normal loads into other outlets. Describes meter creep, overload droop, pole meters, etc. **\$29.**

### SPM THE VIDEO

Now it's easier to learn about KW-HR Power Meters than ever before! This educational video shows you how they work and their anatomy. Demonstrates SPMEM device and external magnetic methods used to slow and stop meters! Hosted by a top expert in the field. From the novice to the pro, an excellent source of info on these exciting devices! Great in combo with our SPM related manuals! **\$29.**

### THE I.G. MANUAL

External magnetic ways (applied to meter) to slow down and stop power meters while drawing full loads. Plans **\$25.**

### KW-HR METERS

How watt-hour meters work, calibration, error modes (many), ANSI Standards, etc. Demand and Polyphase Meters. Experimental results to slow and stop meters by others. **\$25.**

**Any 2 for \$49, 3 for \$64, all 4 for \$79!**

## COMPUTER PHREAKING

Describes in detail how computers penetrate each other, and how VIRUSES, TROJAN HORSES, WORMS are implemented. Dozens of computer crime and abuse methods and countermeasures. Includes disk filled with hacker text files and utilities, and the legendary FLUSHOT+ protection system. Internet advice, password defeats, glossary - much more! Manual + PC Disk! **\$39.**

### THE HACKER FILES

3 HD PC disks filled with choice raw, colorful and highly informative hacker, phreaker text files covering many topics! **\$39.**

**Both for only \$69!**

## BEYOND VAN ECK PHREAKING

Plans for remote eavesdropping of TV video signals. Range up to 1 KM. Describes how van Eck systems work, and are also used in surveillance of computer systems. **\$29.** The van Eck Demo Tape is **\$29.** Both for only **\$49!**

## MANY MORE TITLES!

Beyond Phone Color Boxes - **\$29**

Hacking Answer. Machines - **\$19**

Casino Hacking - **\$25**

Automatic Teller Machines - **\$39**

Credit Card Scams - **\$29**

Cons & Scams - **\$29**

Social Engineering - **\$29**

Polygraph Defeats - **\$25**

By an Order of the Magnitude - **\$49**

Ultimate Success Manual - **\$19**

Stealth Technology - **\$19**

Secret & Survival Radio - **\$19**

High Voltage Devices - **\$29**

Mind Control - **\$29**

Under Attack! - **\$29**

Radionics Manual - **\$29**

Heal Thyself - **\$19**

Secrets of Solderless BBs - **\$24**

Secret & Alternate IDs - **\$15**

Cryptanalysis Techniques - **\$29**

Government Land Grab - **\$15**

Rocket's Red Glare - **\$29**

Survival Guns & Ammo - **\$19**

## THE DIRTY-2 DOZEN!

24+ Hot Hack/Phreak Disks!

See CATALOG!

## SPECIAL PROJECTS

We will design & build just about anything electronic! Hardware

done as SPECIAL PROJECTS

only. See Catalog for details

and SP Application Form, else:

[www.tsc-global.com/spaf-spp.html](http://www.tsc-global.com/spaf-spp.html)

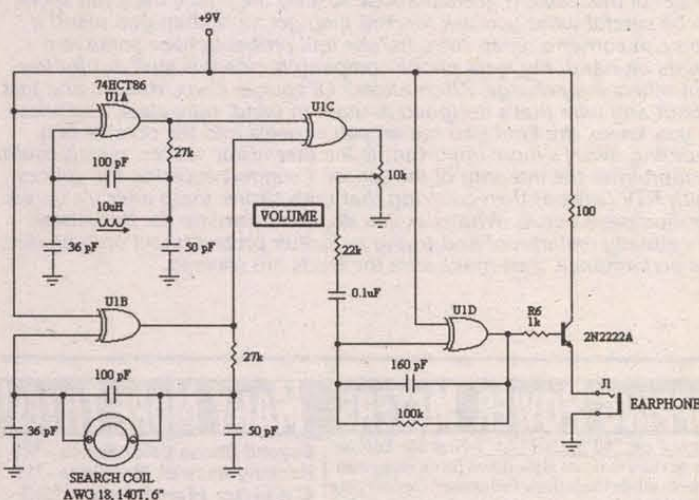


## Let The Treasure Hunt Begin

**Q.** I'm trying to find plans for a transmit/receive type metal locator. I understand the concept and the principles of the system, but that's a long way from actually building one. I was referred to a book by Charles Rakes on building metal locators but haven't been to find it.

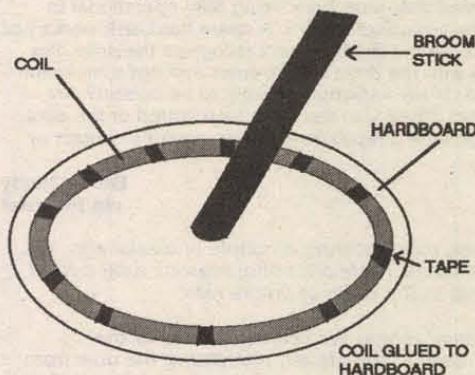
### Karl Klein via Internet

**A.** Like all technologies, today's metal detector doesn't look anything like the ones Mr. Rakes describes in his 1986 book (which is long out of print). Back in those days, the BFO (beat frequency oscillator) detector was all the rage. Today, it's pulse induction and VLF (very low frequency), with magnetometers playing a small part. Here's how they compare. Pulse induction is the least sensitive and the least expensive. It can't discriminate between gold or tin — but it's great at finding beer cans and watches. Magnetometers, often called flux gates or gradiometers, are mainly sensitive to iron objects. The unique thing about VLF metal detectors is that they can tell the difference between a gold coin and a bottle cap — well, most of the time. Unfortunately, it's not an easy trick because it requires a microprocessor. Radio Shack sells an entry-level VLF metal detector (63-3005) for just \$49.99, but the serious units run about \$400.00. While I don't have the space to show you how to build a VLF metal detector, you can have fun with this medium low-frequency BFO metal detector:



This metal detector uses four exclusive-OR gates, two of which (U1A and U1B) are wired as twin oscillators. The search coil is the inductance element of one oscillator (U1B). One oscillator is tuned to 161 KHz and the other is tuned to 160 KHz. U1C serves as a mixer, which outputs difference and sum frequencies of 1 KHz and 321 KHz, the latter of which is filtered out by the 10 kHz filter at U1D. When the loop coil is brought near metal, the metal changes the inductance of the

inductor which changes the oscillator's frequency and the pitch of the audio. While not as sensitive as a VLF, the sensitivity is enough to detect a coin buried under a foot of sand. The coil is 140 turns of scramble-wound 18-gauge enamelled wire on a six-inch, round form that you make by pounding eight 6-penny nails into a board (a kitchen pot works, too). The coil is then taped and glued to a piece of hardboard or plywood. An old broom stick serves as a handle.



*To use the detector, tune the variable inductor until you hear a tone in the headphones – then have fun!*

## Gradiometer Sees Through Rock

**Q.** As a treasure hunter for many years, I've used a wide variety of metal detectors, including a long boom proton differential magnetometer, dual-loop deep range metal detectors by White, and the more common coin detectors by Fisher and others. Now that I'm fully retired, I need to hold down the cost of owning such gadgetry, plus I'd enjoy building or modifying my own. The objects I search for are made of old iron, weighing between 20 and 200 pounds, and are buried at depths ranging between 5 to 20 feet in mud or rock-filled pits. Given these parameters, relatively minor anomalies in the earth's magnetic field is probably the only way to find them. Do you know anything about the sensitivity of the FGM-3 flux gate sensors or have any other circuit recommendations for sensitive differential detectors that balance out the earth's field?

**WO Enderle W7IZR**  
**via Internet**

**A. Honeywell (612-954-2093; [http://www.ssec.honeywell.com/products/magsensor\\_index.html#a](http://www.ssec.honeywell.com/products/magsensor_index.html#a))** claims to have the most sensitive magnetic field detectors for low-cost commercial applications, and are well-suited for your need. Honeywell's magnetic sensing elements are Anisotropic magnetoresistors (AMR) made of nickel-ferrite (NiFe) thin films deposited on silicon to form a balanced Wheatstone bridge, where the resistance of the four resistors is the same. This material has the unique property of changing resistance when a magnetic field is applied perpendicular to the current flow in the AMR material. In the Wheatstone configuration, the magnetic field causes one pair of resistors to decrease in value and the opposing pair to increase in resistance. The result is a differential output voltage with a sensitivity of just 27 microgauss ( $\mu\text{G}$ ). The output is linear over a range of -2G to +2G. (By comparison, the earth's magnetic field is 300 milligauss (mG)). Because of the fine resolution and wide range, these sensors are used in compasses, traffic detection, navigation systems – and gradiometers. Here are two simple designs using the HMC1001 one-

# Weeder Technologies

Add \$4  
ship/hand

**FREE**  
**CATALOG!**

Visa  
MasterCard

# Pro-Kit

PO Box 2426, Ft. Walton Beach, FL 32549

850-863-5723

## Stackable RS-232 Kits

**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 pins. Turn on/off relays. Sense switch translations, button presses, 4x4 matrix decoding using auto-debounce and repeat. **\$32**

**Analogue Input** - 8 input pins, 12-bit plus sign self-calibrating ADC. Returns results in 1mV steps from 0 to 4095. Software programmable alarm trip-points for each input. DIP switch addressable; stack up to 16 modules on same port for 128 single-ended or 64 differential inputs. **\$48**

**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: "/1231 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**

## 50 MHz Freq Counter

Reads frequency from 1Hz to 50MHz and displays up to 7 digits on a 16 character LCD. Auto-range feature provides floating decimal point and automatic placement of suffix (Hz, KHz, or MHz). Microcontroller based provides for very small parts count. **\$48**

## DTMF Decoder/Logger

Keep track of all numbers dialed or entered from any phone on your line. Decodes all touch-tones and displays them on a 16 character LCD. Holds the last 240 digits in a non-volatile memory which can be scrolled through. Connect directly to radio receiver's speaker terminals for off-air decoding of repeater codes, or numbers dialed on a radio program. **\$55**

## IR Remote Control Receiver

Learns and responds to the data patterns emitted by standard infrared remote controls used by TVs, VCRs, Stereos, etc. Lets you control all your electronic projects with your TV remote. 7 individual output pins can be assigned to any button on your remote, and can be configured for either "toggle" or "momentary" action. **\$32**

## Telephone Call Restrictors

Two modes of operation; either prevent receiving or placing telephone calls (or call prefixes) which have been entered into memory, or prevent those calls (or call prefixes) which have "not" been entered into memory. Use touch-tone input to program.

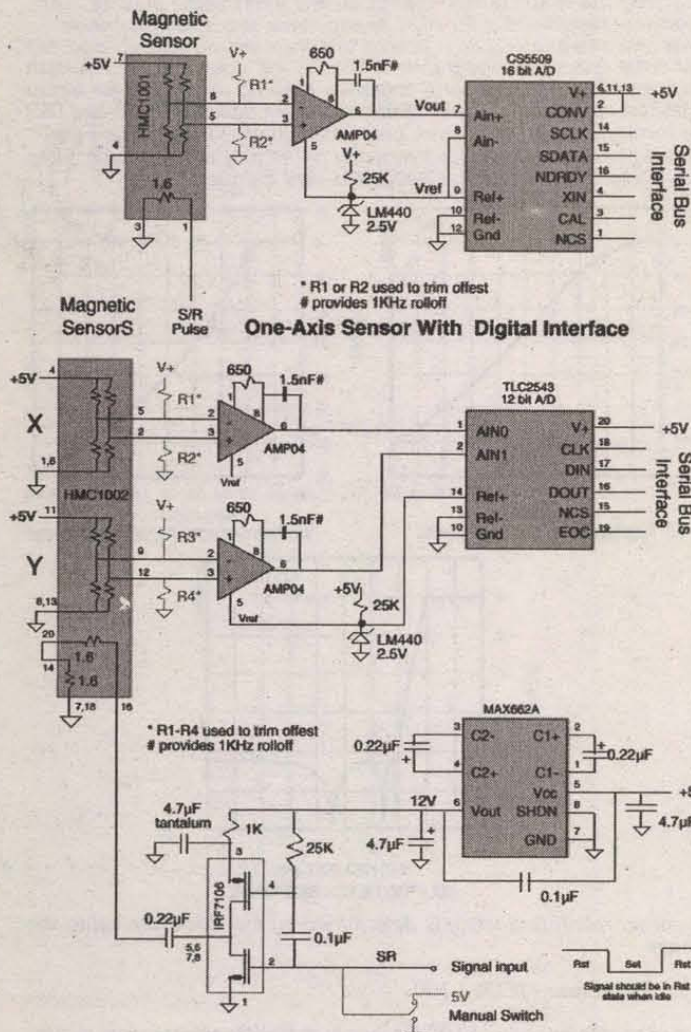
Block out selected outgoing calls. Bypass at any time using your password. **\$35**

Block out selected incoming calls. Calls identified using Caller ID data. **\$46**

ABC ELECTRONICS 315 7TH AVE N. MPLS. MN. 55401			
(612)332-2378 FAX (612)332-8481 E-MAIL: SURP1@VISI.COM			
WE BUY TEST EQUIPMENT AND COMPONENTS.			
VISIT US ON THE WEB AT WWW.ABCTEST.COM			
HP 8901A MODULATION ANALYZER	\$2100.	TEK 2465A 350MHZ 4CH OSCILLOSCOPE	\$3500.00
HP 8165A 50MHZ PROG. SIGNAL SOURCE	\$1700.00	TEK TDS320 100MHZ DIGITAL O-SCOPE	\$1700.00
HP 436A RF POWER METER NO CABLE OR SENSOR	\$700.00	TEK 465 100MHZ OSCILLOSCOPE	\$400.00
HP 8559A/853A 01-21GHZ SPECTRUM ANALYZER	\$3500.00	TEK 475 200MHZ OSCILLOSCOPE	\$500.00
HP 1740A 100MHZ OSCILLOSCOPE	\$250.00	TEK 496P 1KHZ-1.8GHZ SPEC. ANALYZER	\$4000.00
HP 8350B SWEEP OSCILLATOR MAINFRAME	\$2900.00	TEK 576 CURVE TRACER	\$2500.00
HP E3617A 0-60VDC IAMP DIG. READOUT	\$275.00	TEK C505001 PROG-O-SCOPE CAL GEN.	\$2000.00
HP 3325A SYNTHESIZER/FUNCTION GENERATOR	\$1100.00	TEK PS8010 POWER SUPPLY	\$450.00
HP 3325A OPT.01 HIGH STABILITY TIME BASE	\$1350.00	TEK 7L12 SPECTRUM ANALYZER	\$1350.00
HP 6034A 0-60V 10A DIG. DISPLAY	\$900.00	TEK 485 350MHZ OSCILLOSCOPE	\$65.00
HP 5355A 200MHZ COUNTER	\$800.00	TEK 454 100M502 OSCILLOSCOPE	\$300.00
HP 3488A SWITCH-CONTROLLER	\$550.00	TEK TMS006 POWER FRAME	\$250.00
HP 2864A QUARTZ THERMOMETER	\$300.00	TEK 11A32 400MHZ 2CH AMPLIFIER	\$750.00
HP 4109B PICO-AMP METER, DC VOLTAGE SOURCE	\$3500.00	TEK 11A34 300MHZ 4CH AMPLIFIER	\$900.00
HP 54201A 350MHZ DIG. OSCILLOSCOPE	\$1500.00	TEK 11A52 755MHZ 2CH AMPLIFIER	\$400.00
HP 8011A PULSE GENERATOR	\$250.00	TEK 11A71 .GHZ 1CH AMPLIFIER	\$300.00
HP 3455A DMM	\$250.00	TEK 11302A 500MHZ PROG. O-SCOPE FRAME	\$750.00
HP 3497A DATA ACQUISITION/CONTROL UNIT	\$600.00	TEK 11401 500MHZ PROG. O-SCOPE FRAME	\$750.00
HP 86790A RF PLUG IN 2-18GHZ	\$1200.00	TEK 11402 1GHZ DIG. PROG. O-SCOPE FRAME	\$1000.00
HP 86603A RF PLUG IN 1MHZ-2.6GHZ	\$1700.00	TEK TMS06 POWER FRAME	\$100.00
HP 86601A RF PLUG IN .01MHZ-110MHZ	\$400.00	TEK 7104 1GHZ OSCILLOSCOPE FRAME	\$1250.00
HP 86632C AM-FM MODULATION PLUG IN	\$750.00	TEK AM503 CURRENT PROBE AMPLIFIER	\$35.00
HP 1631D LOGIC ANALYZER	\$300.00	TEK 7B92A TIME BASE	\$125.00
HP 8640B OPT.02 1GHZ AM/FM SIGNAL GEN.	\$1400.00	TEK 7S12 SAMPLING PLUG IN	\$350.00



axis detector and HMC1002 two-axis detector.



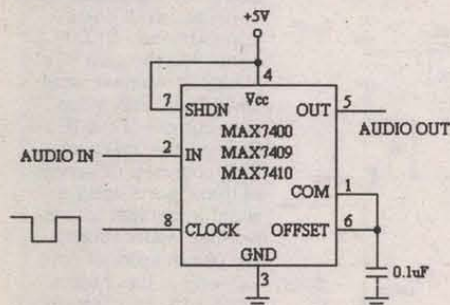
## Two-Axis Sensor With Set/Reset Circuit and Digital Interface

You can buy the HMC1001 and HMC1002 from Newark Electronics (1-800-639-2759; <http://www.newark.com>) for \$18.00 and \$31.00, respectively. For a complete schematic of a gradiometer, download document AN204 from the Honeywell Web site.

## Tunable Low-Pass Filters

**Q.** I've made a home-grown infrared gas analyzer using two DACs (digital-to-analog converter) on an instrumentation card. The DAC signals are carried through a 20-foot cable with other signals and DC power to a terminal strip for connection. What I need is a filter to smooth out the stairsteps of the outputs. The required response is DC to 10 Hz, and the sampling rate is 50 Hz. Currently, I'm using a simple two-pole Sallen-Key Bessel filter with unity gain — and less than stunning performance. Would you suggest cascading two of these filters and if so how should I distribute the cut-off frequencies?

Steve Roberts  
via Internet



**A.** This is a very timely question because Maxim Integrated Products (408-737-7600; <http://www.maxim-ic.com>) just announced a family of switched-capacitor filter ICs specifically designed for ADC anti-aliasing and DAC postfiltering. The MAX7409 is a fifth-order,

low-pass, Bessel, switched-capacitor filter; the MAX7410 is a fifth-order, low-pass, Butterworth, switched-capacitor filter; and the MAX7400 is an eighth-order, low-pass, Elliptic, switched-capacitor filter.

Source Code:810NV

Sale Ends: 12/15/98

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

## COVERT SURVEILLANCE: Protect Your Assets

MC-985 \$350	CL-985 \$350	SD-985 \$295	VL-985 \$350	EX-985 \$295
				EMERGENCY LIGHT CAMERA
				EL-985 \$325

## All "985" Series Color Cameras Feature:

- Sensor: 1/3" Sharp® Color CCD
- Resolution: Over 380 TV lines
- Sensitivity: Super Low, 2 Lux
- Built-In Backlight Compensation
- Lens: 3.7 mm Pinhole
- Viewing Angle: 92 FOV
- Video Output: Female RCA
- Power: 5V DC (included)

## CLOSEOUT

## Color Camera Kit:

- 1/2" Sony Color CCD
- 400 TV line Res.
- 2 lux Sensitivity
- Backlight Compensation
- 4 mm Standard Lens
- Wall Mounting Kit
- 5V Power Transformer

SONY-1002 \$175

## Counter Surveillance: Protect Your Privacy

## Protect Yourself From:

- Telephone Taps
- Room Transmitters
- Body Wires

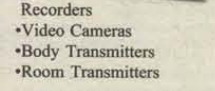


Built-In White Noise Generator

AI-5500 \$380

## Detects Concealed:

- Tape Recorders
- Video Cameras
- Body Transmitters
- Room Transmitters



LED and Vibration Alert

TRVD-900 \$450

Your Payment Options: Credit Card, Cashier's Check, or Money Order

## AMERICAN INNOVATIONS, Inc.

119 ROCKLAND CENTER ~ Suite 315 NANUET, NY 10954

Voice: (1) 914-735-6127 Fax: (1) 914-735-3560

Write In 31 on Reader Service Card.

## ◆ New HP Ilex COLOR Scanners

\$100.00



## ◆ USED HP DUPLEX LASER PRINTERS \$375.00



Hewlett Packard IIID - MIO Port to NetWork - 300 DPI - Can Print Double or Single Sided - Dual Letter Trays - Prints Letter or Legal Size - 3 Meg of Ram (expandable) Uses 95A Cartridges Lease Returns, All were well Maintained Under Service Contract, No Hassle 30 Day Warranty

## ◆ 4 meg AGP Video Cards - Diamond Stealth 3D 4000

\$50.00



## ◆ Slick Looking Computer Cases



AT Towers, (not ATX)

Full (260w/ps) (11 bays) \$35.00

Mid Size (230w/ps) (7 bays) \$22.00

Mini-tower (230w/ps) (6 bays) \$17.00

## Microwave Goodies and Gadgets

## ◆ Brand New Wavetek 907AF Frequency Generators

Range is 7-12.4 Ghz \$1000.00

We have SMA Attenuators - Stepper Motors

The List Grows Daily!! Check the Web Site for More Low Prices

## ELECTRO MAVIN

800-421-2442 or FAX 310-632-3557

E-MAIL [john@mavin.com](mailto:john@mavin.com)WEB ADDRESS <http://www.mavin.com/mavin.html>



# SURPLUS TEST EQUIPMENT

## HEWLETT PACKARD

11713A, Attenuator/Switch Driver	\$800
11729B, Carrier Noise Test Set	\$4500
11975A, Amplifier, 2-8GHz	\$2000
16500A, Logic Analysis System w/16510A/16520A	
16521A/16531A	\$6000
1652B, Logic Analyzer w/Oscilloscope	\$4000
3310A, Function Generator	\$250
3312A, Function Generator, 1Hz-13MHz	\$700
3325A, Synthesizer/Function Generator	\$1000
3325A/01/02, Synthesizer/Function Generator	\$1500
3335A, Frequency Synthesizer, 200Hz-81MHz	
w/Opt. 01	\$5500
334A, Distortion Analyzer	\$250
339A, Distortion Analyzer	\$1200
3456A, Digital Multimeter, 6.5 Digits	\$800
3478A, Digital Multimeter	\$700
3488A, Switch Control	\$600
3551A, Transmission Test Set	\$950
3562A, Dynamic Signal Analyzer	\$7000
35677A, S-Parameter Test Set	\$2700
3575A, Phase Gain Meter 1Hz-13MHz	\$1000
3581C, Selective Voltmeter	\$800
3585A, Spectrum Analyzer, 20Hz-40.1MHz	\$6000
3586B, Selective Level Meter	\$750
4192A, LF Impedance Analyzer w/16097A Kit	\$12,000
4193A, Vector Impedance Meter	\$7500
4342A, Q-Meter	\$1800
435B, Power Meter	\$500
436A, Power Meter w/Opt. 022	\$1200
4935A, Transmission Impairment Test Set	
w/Opt. 001	\$1500
5314A/01/02, Universal Counter	\$225
5316B, Universal Counter	\$1000
5328B, Universal Counter	\$1000
5334A, 100MHz Universal Frequency Counter	\$1000
5334B, Universal Counter	\$1000
5335A, Frequency Counter, Opt. 10/20	\$850
5340A, Frequency Counter, 10Hz-18GHz	\$800
5340A, Frequency Counter w/Opt. 01/02/011	\$1350
5342A, Microwave Frequency Counter,	
10Hz-18GHz	\$1100
5355A, Frequency Converter	\$1000
5386A, Frequency Counter, 10Hz-3GHz	\$2350
54100A, Digitizing Oscilloscope	\$2500
54110D, 1GHz Color Digitizing Oscilloscope	\$2500
54120A, Digitizing Oscilloscope Mainframe	\$5750
54121A, Four Channel Test Set	\$6500
54201D, Digitizing Oscilloscope	\$2650
8011A, Pulse Generator	\$400
8011A, Pulse Generator w/Opt. 001	\$500
8012B, Pulse Generator	\$750
8013B, Pulse Generator	\$750
8116A, 50MHz Pulse/Function Generator, Opt. 001	\$4500
8165A/002, Programmable Signal Source w/AM	\$2200
8347A, RF Amplifier, 100kHz-3GHz	\$3000
8350A, Sweep Oscillator Mainframe	\$1350
8350B, Sweep Oscillator Mainframe	\$2350
8352A, Sweeper Plug-in, 0.1-2.4GHz, w/Opt. 02	\$4500
83540A, RF Plug-in, 2-8.4GHz	\$2000
83540A/002, RF Plug-in, 2-8.4GHz	\$2500
83545A, Oscillator Plug-in, 5.9-12.4GHz	\$1750
83570A, Sweep Oscillator Plug-in, 18-26.5GHz	\$3250
8411A/018, Frequency Converter, 11 to 18GHz	\$500
8494H, Programmable Attenuator (unused)	\$800
8495H, Programmable Attenuator (unused)	\$600
8501A, Storage Normalizer	\$1000
8511A, Harmonic Frequency Counter	\$7000
853A/8558B, Spectrum Analyzer,	
100kHz-1500MHz	\$3850
853A/8559A, Spectrum Analyzer, 10MHz-21GHz	\$4750
8554B, RF Spectrum Analyzer Plug-in,	
500kHz-1250MHz	\$800
8559A, Spectrum Analyzer Plug-in, 0.1-21GHz	\$2650
8568A/B, Spectrum Analyzer, 100Hz-22GHz	\$25,000
8568A/B, Spectrum Analyzer, 100Hz-1500MHz	\$11,000
8569B, Spectrum Analyzer, 10MHz-22GHz	\$7000
86290B, Sweeper Oscillator Plug-in, 2-18.6GHz	\$1100
8640A, Signal Generator, 0.5-512MHz	\$700
8640B, Signal Generator, Opt. 002, 5-1024MHz	\$2100
8640B, Signal Generator, Opt. 1, 2	\$2200
8654A, Signal Generator, 10-520MHz	\$450
8656A, Signal Generator, 100kHz-990MHz	\$2000
8660D, Synthesized Signal Generator	\$7000
8672A, Synth. Signal Gen., 2.0-18.0GHz	\$7000
8748B, S-Parameter Test Set, 5-12.4GHz	\$700
8748A, S-Parameter Test Set w/Opt. 026	\$1350
8753A, Network Analyzer w/85046 Test Set	\$13,500
8757A, Scalar Network Analyzer,	
10MHz-60GHz	\$4500
8901B, Modulation Analyzer	\$4000
8903B/001, Audio Analyzer	\$2500
8904A, Multifunction Synthesizer w/Opt. 002	\$2500
8970A, Noise Figure Meter	\$5000

## TEKTRONIX

1502, TDR Cable Tester w/Opt. 04 Recorder	\$1700
---	--------

1503, TDR Cable Tester w/Opt. 04 Recorder	\$1550
2236, 100MHz Oscilloscope	
w/Counter/Timer/DMM	\$1550
2247A, 100MHz Oscilloscope w/Counter/Timer	
Voltmeter	\$2500
2337, 100MHz Oscilloscope w/DMM	\$1650
2430A, 150MHz Digital Oscilloscope	\$2850
2432A, 300MHz Digital Storage Oscilloscope	\$3000
2445, Four Channel 150MHz Oscilloscope	\$1500
2465, Four Channel 300MHz Oscilloscope	\$2500
2465B, Four Channel 400MHz Oscilloscope	\$5500
466, 100MHz Storage Oscilloscope w/DMM4	\$800
475, 200MHz Oscilloscope	\$650
475A, 250MHz Oscilloscope	\$800
485, Oscilloscope, 350MHz	\$900
576, Curve Tracer	\$2750
577/D2, Curve Tracer, Non-storage w/177 Fixture	\$1750
7A42, Four Channel Amplifier Plug-in	\$650
7D20, Programmable Digitizer	\$400
7L5/L3, Spectrum Analyzer, 20Hz-5MHz,	
w/Opt. 025 Tracking Generator	\$1850
7L12, Spectrum Analyzer, 100kHz-1.8GHz	\$1500
7L13, Spectrum Analyzer, 1kHz-1.8GHz	\$1800
7L18, Spectrum Analyzer Plug-in, 1.5-18GHz	
Capable of 60GHz with Mixers	\$2500
7S12, TDR/Sampler	\$450
AA5001, Programmable Distortion Analyzer	\$1700
AFG5101, Arbitrary Function Generator	\$1500
CG5001, Programmable Calibration Generator	\$4000
CSA907R, Error Detector, 1-700MHz	\$6500
PG506, Calibration Generator Plug-in	\$600
R2246, 4 Channel Oscilloscope, 150MHz	\$1650
SG5010, Programmable Oscillator	\$3000
SG504, Leveled Sinewave Generator	\$2200
TM5003, Three Slot Power Mainframe	\$450

VISIT OUR WEBPAGE AT  
[WWW.RSSURPLUS.COM](http://WWW.RSSURPLUS.COM)

TM5006, Six Slot Power Mainframe	\$550
TR503, Tracking Generator for 492/4/5/6	\$850

## MISCELLANEOUS

Acme Elect. PS21000, Electronic Load	\$850
California Inst. 4500L/M3, AC Power Source	\$4500
California Inst. 4503L, AC Power Source	\$4500
Eaton 2052B, Amplifier, 100-512MHz	\$800
EIP 545A, Microwave Frequency Counter	\$800
EIP 548A, Frequency Counter, 10Hz-26.5GHz	\$2000
EIP 548B, Frequency Counter, 10Hz-26.5GHz	\$3250
EIP 578, Source Locking Frequency Counter	\$2500
ENI 1140LA, Power Amplifier, 9kHz-250kHz	\$3500
ENI 310L, RF Amplifier, 50dB, 250kHz-110MHz	\$2000
ENI 325LA, Power Amplifier, 250kHz-150MHz	
25 Watts	\$1850
ENI 503L, RF Amplifier, 40dB, 2-510MHz	\$800
ENI 5100L, RF Amplifier, 100 Watt, 1.5-400MHz	\$8000
Fluke 5100B/03/05, Multifunction Calibrator	\$3000
Fluke 5101B/03, Calibrator	\$3000
Fluke 5200A, AC Voltage Calibrator	\$2000
Fluke 5440B, Direct Voltage Calibrator	\$3000
Fluke 732A, DC Standard	\$1850
Fluke 752A, Reference Divider	\$2500
Fluke 8520A, Digital Multimeter	\$700
Gigatronix 910, Frequency Synthesizer,	
0.05-26GHz	\$9500
Kikusui PAD16-10L, Power Supply, 16V, 10A	\$300
Kikusui PLZ700W, Electronic Load	\$850
Krohn-Hite 3202/R3202, Tunable Filter/	
Rack Version	\$500/\$350
Marconi 2019A, Signal Gen., 80kHz-1040MHz	\$2750
Philips 6652C, Prog. High Res. Counter/Timer	
8 Digit, 120MHz	\$1300
Sorensen DCR300-33T, DC Power Supply	
300V/33A	\$2750
Sorensen DCS40-25, DC Power Supply, 40V/25A	\$750
Trans. Devices DLR400 15 3500A, Dynamic Load	\$1500
Trans. Devices DLP 50-60-1000A, Electronic Load	\$800
Trans. Devices DLVP 130-110-1000	
Electronic Load	\$950
Trans. Devices DLVP 50-120-1000	
Electronic Load	\$1000
Valhalla 2703, AC Voltage Standard	\$2350
Varian VZL6942G5JM, Amplifier, 1-2GHz,	
100 Watt	\$8000
Wandell Goltzman SMP19, Level Meter,	
50Hz-25MHz	\$2000
Wavetek 178, Automatic Synthesizer	\$1850
Wavetek 23/01, 12MHz Synthesized Signal	
Generator	\$1000
Wavetek 3000, Signal Generator, 1-520MHz	\$900
Wavetek 3000-200, Signal Generator	\$900
Wavetek 3001, Signal Generator, 1-520MHz	\$1000
Wavetek 801, Pulse Generator, 5Hz-50MHz	\$800

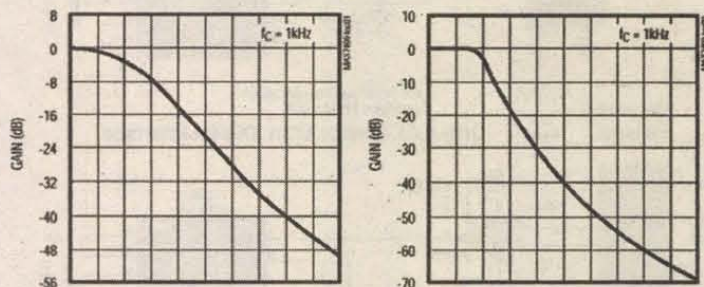
## R & S Surplus

1050 E. CYPRESS STREET, COVINA, CA 91724

(626) 967-0846 • FAX (626) 967-1999

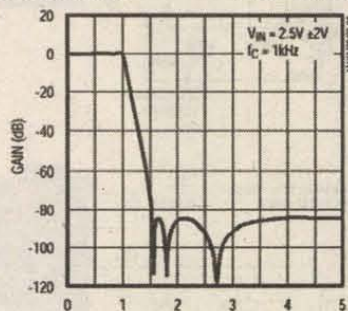
## Electronics Q & A

Low-pass Bessel filters delay all frequency components equally, preserving the shape of step inputs. Bessel filters settle quickly — an important characteristic for ADC applications that use multiplexed inputs. An anti-aliasing filter placed between the multiplexer and ADC must settle quickly as the inputs are switched. Low-pass Butterworth filters provide a flat passband response, making them ideal for instrumentation applications that require minimum deviation from the DC gain throughout the passband. Low-pass Elliptic filters provide the steepest possible rolloff with frequency of the four most popular filter types (Bessel, Butterworth, Chebyshev, and Elliptic).



BESSEL FILTER RESPONSE

BUTTERWORTH FILTER RESPONSE



ELLIPTIC FILTER RESPONSE

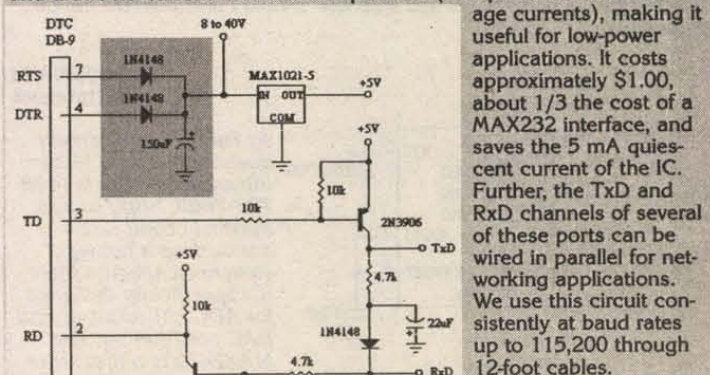
The corner rolloff frequency is determined by the clock rate using the formula

$$\text{clock rate} = f_{\text{CLK}} / 100$$

For a corner frequency of 100 Hz, apply a 10-KHz squarewave to pin 8. When using the filter for anti-aliasing or DAC postfiltering, you have to synchronize the DAC and filter clocks. If the clocks aren't synchro-

## Reader's Tip

Several simple RS-232 interfaces built around bipolar transistors have appeared in *NEV* articles, but most have shortcomings. The following circuit is small, simple, inexpensive, compatible with the RS-232 standard, and works in full-duplex operation, something most simplified interfaces can't do. The circuit is based on the one used for the BASIC Stamp II microprocessor. The modification is the addition of diode D1 and capacitor C1 to the Parallax circuit. When RxD is active, C1 charges to -12 volts and holds it during positive transitions, which effectively isolates the TxD and RxD lines and allows full-duplex operation. Q1 is the receive inverter, and Q2 the transmit inverter. TxD and RxD go to the host TD and RD go to the local CPU. The circuit "steals" its power from the host serial port, and draws no current when not in operation (except for transistor leak-



age currents), making it useful for low-power applications. It costs approximately \$1.00, about 1/3 the cost of a MAX232 interface, and saves the 5 mA quiescent current of the IC. Further, the TxD and RxD channels of several of these ports can be wired in parallel for networking applications. We use this circuit consistently at baud rates up to 115,200 through 12-foot cables.

Dan Michaels  
Oricom Technologies  
[oricom@sni.net](mailto:oricom@sni.net)



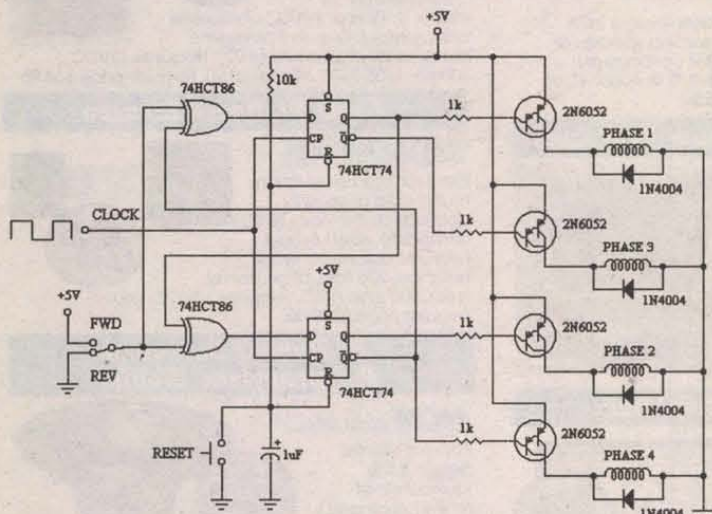
nized, beat frequencies will alias into the passband. I can't find the ICs at any of the local watering holes yet, but you can order the part directly from Maxim at 408-737-7600, extension 3468. However, I'm sure their regular distributors, like Digi-Key (1-800-344-4539; <http://www.digikey.com>), will have them in stock anytime soon. They cost about \$3.00.

### Space-age Stepper Motor Controller Update

**Q.** In the Feb. '98 issue, you published a schematic of a "Space-Age Stepper Motor Controller." In a later issue, you published a correction reversing the TIP120 transistors. I have tried this circuit and cannot get it to work. Can you explain the logic for this circuit? I'm having trouble understanding how bipolar current flow can be achieved with fewer than eight transistors.

**J. D. Mather**  
Johnson City, TN

**A.** Actually, there were two mistakes in that schematic, which I copied from a supposed "NASA" source in my sleep and didn't check for errors. Here's the same circuit from EDN's "Ideas For Design" submitted by a JPL engineer that I know works — I tried it!



How does it work? Sit tight and buckle up because this will be fast. Different magnetic polarity sequences are needed to drive a stepper motor. For forward motion, Phase 1 leads Phase 2 by 90 degrees; for reverse motion, Phase 2 leads Phase 1 by 90 degrees — just the opposite. Using XOR gates and flip-flops, it's easy enough to make this happen because flipping the switch flips the phase shift from lead to lag — just what's needed. As always, the speed of the motor is proportional to the clock pulse; the higher the clock speed, the faster the motor spins.

## Some bright ideas for the new year



Coming up in 1999, Nuts & Volts will be adding some exciting new features to their web site!

Keep on the look-out for the following:

- ☆ An interactive chat room
- ☆ An extensive article search engine
- ☆ A special Subscribers-Only section

# The Filter Company

## Positive Notch Filters

Internet: [www.gofilters.com](http://www.gofilters.com)

**Large STOCK on all Available Channels**

**2 thru 30\*, 95 thru 99**

**0,1,57,58,59,60,61,A1,A2,A3,A4,A5**

**ORDER BY SINGLE CHANNELS**

**We Specialize in Large Quantities on every Channel**

**Prices as low as \$6.00ea**

**NOBODY BEATS OUR PRICES**

**Monday - Friday (8am to 5pm) Central Time**  
**QUALITY METAL CYLINDER TYPE NON-TUNABLE**  
**ABSOLUTELY NO DRIFTING PROBLEMS**

### Standard Positive Filters

**1pc-\$16.00    5pcs-\$14.00    10pcs-\$12.00**  
**25pcs-\$10.00    50pcs-\$8.00**

\*Standard Positive Filters, Channels 26-30 add \$3.00 more each.

### Positive "G and S" Series Filters

**1pc-\$30.00    5pcs-\$28.00    10pcs-\$25.00**

Tom G. - FL Excellent Service, fast and quick. The only bad thing about this company is they don't sell Cable Boxes. We hope someday they will.....

David P. - CA We called around for help on filters and nobody had any answers except one, call the "THE FILTER COMPANY" we did and had an answer in a matter of seconds.....

John B. - IL Our company buys in the 100 quantities and needs a large selection of different channels. "The Filter Company" was the only one who was able to supply.....

PHONE ORDERS:

**1-800-235-8080**

Visa, Mastercard and Discover  
(UPS COD for established customers)

Anyone implying theft of Cable Service will be denied assistance  
We do not sell Data Blockers, Bullets or FM Traps !!!!

A "TFC" Company



**Give our 800 line a howl for the best service in the Country.....!!!!**



# We've Got It!

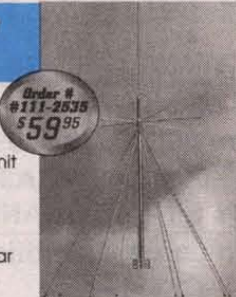
## MCM Electronics®

Prices effective  
November 1 through  
December 11, 1998.

**MCM is the leading supplier to the consumer electronics service industry. Additionally, hobbyists, educators and even manufacturers have looked to MCM for all of their component needs. Call today for your free catalog!**

### Discone Style Antenna

Perfect for scanner or Amateur Radio use. Continuous Receive From 25-1300MHz. Transmit on 6M, 2M, 70CM, 33CM and 23CM. Maximum Power Capacity 200W. "N" Type Connector. Overall Length 67" Regular Price \$69.95



Order #  
#111-2635  
\$59.95

### ATC Lead Wire Fuse

This unique product incorporates a 6' length of wire, attached to one side of a standard ATC type automotive fuse. This greatly eases installation of low to medium current devices, such as car stereos, radar detectors or cellular phones. Replace the existing fuse, with an MCM Lead Wire Fuse of the same value. Five per package.



YOUR CHOICE  
\$2.29

Order #	Amperage	Order #	Amperage
60-3855	5	60-3875	20
60-3860	7.5	60-3880	25
60-3865	10	60-3885	30
60-3870	15		

### Nickel-Metal Hydride Cells

Get NiMH performance in a standard "AA" or "AAA" cell. Performance is 50% over that of Ni-Cad batteries of the same size. Sold individually.

AS LOW AS  
\$2.99



Order #	Size	(1-9)	(10-49)	(50-up)
29-2615	"AA"	\$3.59	\$3.29	\$2.99
29-2620	"AAA"	4.19	3.89	3.59

### DMM W/Logic Function

**TENMA®**

3 1/2 digit DMM measures AC/DC voltage from 200mV-600V, resistance to 2000Mohm, capacitance to 20µF, transistor h<sub>FE</sub> gain and audible continuity test. Requires 9V battery (#290-080) not included. Dimensions: 2 1/2" (W) x 5 1/2" (H) x 1 1/2" (D). Regular price \$65.95.

Order #  
#72-4025  
\$39.95



### Digital Solder Station

**TENMA®**

Digital LED display shows operating temperature and setpoint. Rotary control allows temperature setting from 340-875° F. Closed loop temperature control provides accurate, stable control. Regular price \$119.00

Order #  
#21-1590  
\$65.00



### Subwoofer Amplifier Module



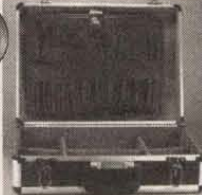
110W amp board handles speaker level or RCA inputs and may be installed in existing speaker or subwoofer enclosures. •60-160Hz continuously variable 12dB crossover •110W RMS @ 4ohm •Cut out 10" x 7" •Regular price \$185.00

Order #  
#80-4465  
\$159.00

### Heavy Duty Aluminum Tool Case

Includes two tool pallets and adjustable compartments. Measures 19" x 14" x 6", ideal for hand tools and small test equipment. Rugged aluminum case is finished in black. Regular price \$51.50.

Order #  
#21-3460  
\$34.95



### 50 Watt PA Amplifier



Order #  
#80-190  
\$69.00

Perfect for auditoriums, churches and office buildings. Inputs include two 1/2" microphone, ceramic phono and aux. Special fader allows phono/aux mixing. Outputs include 4, 8 and 16ohm, plus 70V and 100V line. Requires 117VAC/12VDC. Measures: 13" x 4 1/2" x 10 1/2". Regular price \$201.00

### Solderless Breadboard

Perfect for circuit designing, prototyping and educational purposes. Usable for high frequency, high speed and low noise circuits. 1260 terminal strip tie points, 100 distribution strip tie points, two binding post connections. Dimensions: 4" x 8 1/2" x 1 1/2". Regular price \$20.59

Order #  
#72-348  
\$12.50



### 85 Channel Cable Converter

Includes last channel recall, channel memory, switched AC outlet and sleep timer. Remote requires two "AA" batteries (MCM #290-070). Regular price \$61.75.

Order #  
#33-2065  
\$49.95



To take advantage of special pricing on the items listed, please provide this code: **NVM21**

### Current Meters

YOUR CHOICE  
\$14.50



Inexpensive ammeters are ideal for any DC current measuring application including charging systems. Induction type sensing only requires cable to be placed in slot frame on the rear of meter case, no electrical connections or leads to hook up. Regular price \$19.95.

Order #	Current range
72-7051	-100-0-100 Amp
72-7043	-30-0-30 Amp

### Micro PC Board Camera

**DEFENDER SECURITY**

B/W CCD camera measures only 1 1/4" x 1 1/4" x 1". Provides NTSC composite video output. Built-in 3.6mm lens provides viewing angle of 92°. Requires 12VDC, 300mA. (#58-3330 AC adaptor). Regular price \$64.95

Order #  
#82-2950  
\$49.00



### Color PC Board Camera

**DEFENDER SECURITY**

Ideal for any observation, multimedia or security application. Provides NTSC composite video output. Features automatic white balance, 330 lines of horizontal resolution and AGC. Requires 12VDC, 240mA. Regular price \$199.00.

Order #  
#82-3015  
\$149.00



### 8" Rubber Surround Polypropylene Woofer

**MCM AUDIO SOURCE**

Popular woofer design is the foundation of many home and auto speaker systems. 70W/100W RMS/peak capacity, frequency response 30Hz-3.5KHz. 8ohm. Other sizes available. Regular price \$13.50

Order #  
#55-1190  
\$9.95



### Telephone Relay Modules

Pre-assembled circuit boards provide 5A relay output from phone line depending upon specific needs. •#28-4842 engages the output relay when the phone rings, ideal for external ringers •#28-4845 engages the output relay whenever the phone line becomes active. It also incorporates a mic level output, making it useful for use as a telephone recording control. Requires 12VDC, 50mA. Board dimensions 2 3/4" x 1 6/8" x 1 1/2".

AS LOW AS  
\$11.95



Order #	Description	Reg.	Sale
28-4845	Recording control	\$15.95	\$11.95
28-4842	Ring control relay	17.95	13.50

**FREE  
Catalog**

**Same Day Shipping!**

In stock orders received by 5:00 p.m. (YOUR TIME), are shipped the same day.



**MCM ELECTRONICS®**  
650 CONGRESS PARK DR.  
CENTERVILLE, OH 45459  
A PREMIER FARNELL Company

[www.mcmelectronics.com](http://www.mcmelectronics.com)  
SOURCE CODE: NVM21



# You Win with Nuts & Volts

Subscribe today and be  
automatically entered in our new  
**MONTHLY PRIZE DRAWING!!!**

## OCTOBER PRIZE

### BASIC Stamp II Professional Package

A custom-built package consisting  
of the following parts:

- (1) BASIC Stamp II Starter Kit  
(includes BS2-IC module, carrier  
board, cable, etc.)
- (1) Parallax Epoch chronometer

**WINNER TO BE ANNOUNCED  
IN NEXT MONTH'S ISSUE!!**

- AppKit
- (1) LTC1298 A/D AppKit
- (1) Standard Servo

Provided compliments of  
**PARALLAX, Inc.**



A  
\$350 Value

## NOVEMBER PRIZE

### HARD DRIVE DUPE-IT! PRO from CORPORATE SYSTEMS CENTER

Pro model loaded with IDE and SCSI  
interfaces, translator, drive mechanic,  
and drive diagnostic test software  
with printer port.

A  
\$995 Value

**To Subscribe –**  
Just fill in and mail the  
enclosed subscription card or  
call our toll free orderline at  
(800) 783-4624 with a  
Visa or MasterCard.

## ATTENTION CURRENT NUTS & VOLTS SUBSCRIBERS:

If you have a current, paid subscription to Nuts & Volts, you  
are automatically entered each month in our drawing!!

We now offer  
a three-year  
subscription  
for only \$51.00!!  
(USA delivery only)

If you do not wish to order a subscription,  
but would like to be entered in our drawing,  
simply **send or E-Mail** your name, address,  
and telephone number, to NUTS & VOLTS,  
430 Princeland Court, Corona, CA 91719,  
drawing@nutsvolts.com. No phone entries  
accepted. All orders/entries must be  
received by October 31st to be included in the  
October drawing. November entries  
must be received by November 30th.

Check us out on the web!  
<http://www.nutsvolts.com>

## Modern computing and standard surge suppressors... a recipe for disaster.

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.

## INTRODUCING BRICK WALL SURGE FILTERS... The World's Best Surge Suppressor

Initially engineered for critical, non-fail industrial applications, this patented device protects indefinitely and sets a new standard for every measure of surge suppressor and powerline filtering performance.

A Brick Wall 1) Utilizes NO MOV'S or Any Other Sacrificial Components (a two pound inductor and nine capacitors are the heart of the unit) 2) Has No Joule Rating or Surge Current Limitations 3) HAS BEEN TESTED AND CERTIFIED BY UL TO THE MOST DEMANDING CLASSIFICATION OF A NEW GOVERNMENT SPECIFICATION; CLASS I, GRADE A. Which Means: UL PUT ONE THOUSAND 3000A, 6000V SURGES (this is the largest surge an interior environment can experience) THROUGH A UNIT (at 60 second intervals) AND DOCUMENTED NO FAILURE OR PERFORMANCE DEGRADATION OF ANY KIND WHATSOEVER.

### i.e.: A Brick Wall Will Not Fail.

We know of no cord connected, MOV based surge protection device that has, or can pass this test.

A Brick Wall possesses UL's lowest Suppressed Voltage Rating (let-through voltage) of 330V. This is the lowest rating they will grant. In that test of one thousand 6000V, 3000A surges, UL NEVER SAW THE LET-THROUGH VOLTAGE EXCEED 290V. YOU CANNOT DO BETTER THAN THIS FOR A POINT-OF-USE SURGE PROTECTION DEVICE. Once again, we know of no other surge protection device that could come close to this performance level.

A Brick Wall is a current activated Series Mode device. Since it is not wired in parallel, nor voltage activated, it does not have to wait for the capacitors of the power supply to charge before it becomes effective. YOUR EQUIPMENT IS PROTECTED INSTANTANEOUSLY (and indefinitely).

These devices were engineered utilizing a current limiting/surge filtering technology. THEY DO NOT DIVERT ANY SURGE CURRENT TO THE GROUND WIRE. They Will Not Cause Your Computer System To LOCK-UP CRASH OR MISOPERATE as a consequence of surge diversion. Your current surge "suppressor" will.

### Powerline Filtering

In addition to all this, Brick Wall Surge FILTERS are the best AC powerline filters you can buy (that we have been able to find anyway). Industrial machinery, copiers, coffee makers, laser printers, fluorescent lights, refrigerators, etc., all cause powerline noise that can cause your computer to misoperate. A Brick Wall Surge Filter will make powerline noise related problems disappear.

## You Can't Buy a Better Surge Protection/Powerline Filtering Device... Anywhere.

## SO... HOW IMPORTANT IS YOUR SYSTEM?



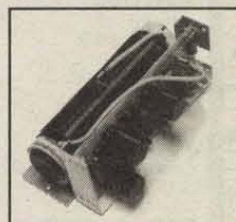
**BRICK WALL DIV.,  
PRICE WHEELER CORP.**  
**1-800-528-0313**

Fax: 1-800-528-6623 E-Mail: [info@brickwall.com](mailto:info@brickwall.com)

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

Visa - MC - AMEX

ASK ABOUT OUR NEW IN-LINE UPS/SERVER PROTECTOR



Available in Modular Form





# DEALER DIRECTORY

The dealers listed below carry the latest issue of Nuts & Volts, for your convenience.

## ALABAMA

**Little Professor Book Center**  
2717 S. 18th St.  
Birmingham 35209  
**RT Systems**  
**Amateur Radio Supply**  
8207 Stephanie Dr.  
Huntsville 35802

## ARIZONA

**Batteries, Batteries**  
3415 W. Glendale Ave. #4  
Phoenix 85051  
1829 E. Southern Ave.  
Tempe 85282  
6245 E. Bell Rd.  
Scottsdale 85254  
**Elliott Electronic Supply**  
1251 S. Tyndall Ave.  
Tucson 85713  
**The Electronic Thrift Store**  
12329 N.W. Grand Ave. #F  
El Mirage 85375  
**Tower Records**  
3 E. 9th St.  
Tempe 85281

## AUSTRALIA

**DonTronics**  
P.O. Box 595  
29 Ellesmere Cres.  
Tullamarine 3043  
www.dontronics.com

## CALIFORNIA

**Abletronics**  
9155 Archibald Ave. Unit E  
Cucamonga 91730  
**Advanced Computer Products, Inc.**  
1310 "B" E. Edinger Ave.  
Santa Ana 92705  
**All Electronics**  
905 S. Vermont Ave.  
Los Angeles 90006  
14928 Oxnard St.  
Van Nuys 91411  
**Allen's To Go**  
13461 Hwy. 88  
Lockeford 95237  
**Alltronics**  
2300-D Zanker Rd.  
San Jose 95131  
**Brand Newsstand**  
234-1/2 N. Brand Blvd.  
Glendale 91203  
**Centerfold International**  
716 N. Fairfax Ave.  
Los Angeles 90046  
**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  
**Panorama Electronics**  
8737 Van Nuys Blvd.  
Panorama City 91402  
**Sandy's Electronics Supply, Inc.**  
20655 Soledad Cyn. Rd. #15  
Santa Clarita 91351  
**Sav-On Electronics**  
13225 Harbor Blvd.  
Garden Grove 92643  
**The Red Barn**  
Hwy. 299  
Bleiber 96009  
**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  
1205 W. Covina Pkwy.  
West Covina 91790  
**Video Electronics**  
3829 University Ave.  
San Diego 92105  
**CANADA**  
**Corn-West Radio Systems Ltd.**  
48 E. 69th Ave.  
Vancouver, BC V5X 4K6

**Muir Communications Ltd.**  
3214 Douglas St.  
Victoria, BC V8Z 3K6

## COLORADO

**TH Electronics**  
216 Commerce Dr., Unit 2  
Ft. Collins 80524  
**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  
**Electronic Service Products**  
437 Washington Ave.  
North Haven 06473  
**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  
**Al's News**  
8219 S.W. 124th St.  
Miami 33156  
**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 Lohus Blossom Ln.  
Ocean View 96737  
**Tower Records**  
4211 Wai'alea 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 61708  
2301 N. Clark St. #200  
Chicago 60614  
1209 E. Golf Rd.  
Schaumburg 60173

## INDIANA

**Harbourtown 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

## 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

**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-Com**  
707 22nd St.  
Union City 07087  
**JR Tech Systems**  
1309 Hwy. 71  
Belmar 07719

## NEW MEXICO

**Newsland Bookstore**  
2112 Central S.E.  
Albuquerque 87106

## NEW YORK

**All Phase Video Security, Inc.**  
70 Cain Dr.  
Brentwood 11717  
**Goldcrest Electronics**  
480 St. Paul St.  
Rochester 14605  
**Ham Central**  
3 Neptune Rd.  
Poughkeepsie 12601  
**Hirsch Sales Corporation**  
219 California Dr.  
Williamsville 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 Jackson Rd. Store #58  
Toledo 43613  
**Hosfelt Electronics, Inc.**  
2700 Sunset Blvd.  
Steubenville 43952  
**Keyways, Inc.**  
611 S. Main St.  
Miami 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 S.W. Nimbus Ave. Bldg. 8  
Beaverton 97005  
960 Conger  
Eugene 97402  
1545 N. Commercial N.E.  
Salem 97303  
**Powell's Technical Bookstore**  
33 N.W. Park  
Portland 97209  
**Taylor News & Books**  
133 W. Main, Ste. 102  
Oklahoma City 73102  
**Tower Books**  
1307 N.E. 102nd Ave.  
Portland 97220  
**PENNSYLVANIA**  
**Genes Books, Inc.**  
King of Prussia Plaza  
King of Prussia 19406  
**Lehman Scientific**  
2997-F Cape Horn Rd.  
Red Lion 17356  
**Montco 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**  
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. N.E.  
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 N.E. 8th St.  
Bellevue 98004  
20 Mercer St.  
Seattle 98109  
**WISCONSIN**  
**Amateur Electronic Supply, Inc.**  
5710 W. Good Hope Rd.  
Milwaukee 53223  
**Greenfield News & Hobby**  
6815 W. Layton Ave.  
Greenfield 53220  
**Cudahy News & Hobby Ctr.**  
4758 Packard Ave.  
Cudahy 53110



**CALL TOLL FREE**  
(800) 292-7711 orders only  
Se Habla Español

# C&S SALES

EXCELLENCE IN SERVICE

CALL OR WRITE FOR OUR  
NEW FREE 64 PAGE  
CATALOG!  
(800) 445-3201

## REPAIR SYSTEM SOLDERING AND DESOLDERING Model SL-916

**\$425.00**

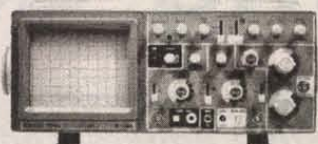
Top-of-the-line repair system will handle desoldering. Temperature controlled soldering from 300°F to 790°F (150°C to 420°C), desoldering temperature range 410°F to 900°F (210°C to 480°C). The system is based on principle of vacuum absorption of the solder from the PC board.

SL-928 - Desoldering System with Digital Display also available. **\$325.00**



## Elenco Scopes

Free Dust Cover and Probes



S-1325	25MHz	\$325
S-1330	25MHz Delayed Sweep	\$439
S-1340	40MHz	\$475
S-1345	40MHz Delayed Sweep	\$569
S-1360	60MHz Delayed Sweep	\$749
S-1390	100MHz Delayed Sweep	\$895

### DIGITAL SCOPE SUPER SPECIALS

DS-203	20MHz/10Ms/s Analog/Digital	\$695
DS-303	40MHz/20Ms/s Analog/Digital	\$895
DS-603	60MHz/20Ms/s Analog/Digital	\$995

## Four Functions In One Model MX-9300



**\$459.95**

### Features:

- One instrument with four test and measuring systems:
- 1.3GHz Frequency Counter
- 2MHz Sweep Function Generator
- Digital Multimeter
- Digital Triple Power Supply - 0-30V @ 3A, 15V @ 1A, 5V @ 2A

## NEW Tektronix DMMs

- 40,000 count
- High Accuracy
- Tektronix quality
- 3yr warranty

DMM 912	<del>\$149</del>	\$179
DMM 914	<del>\$249</del>	\$229
DMM 916	<del>\$265</del>	\$275



## 20MHz Sweep / Function Generator with Frequency Counter Model 4040

- 0.2Hz to 20MHz
- AM & FM modulation
- Burst Operation
- External Frequency counter to 30MHz
- Linear and Log sweep



10MHz Model 4017	\$309
5MHz Model 4011	\$239
	<b>\$399</b>

## Fluke Scopemeters



123...NEW...	\$950
92B	\$1445
96B	\$1695
97	\$1695
99B	\$2095
105B...NEW...	\$2495

ALL FLUKE  
PRODUCTS  
ON SALE

## Technician Tool Kit Model TK-1500

28 tools plus a DMM contained in a large flexible tool case with a handle ideal for everyone on the go.



**\$49.95**

Fluke Multimeters	
Model 2611	\$195
Model 7011	\$85
Model 7311	\$115
Model 7511	\$139
Model 7711	\$154
Model 7911	\$175
Model 12	\$84
Model 83	\$235
Model 85	\$269
Model 8711	\$299
Model 863E	\$475
Model 867BE	\$650

B&K Precision Multimeters	
Model 389	\$109
Model 390	\$127
Model 391	\$143
Model 5360	\$195
Model 5380	\$265
Model 388A	\$99
Model 2707	\$75
Model 2860A	\$79
Model 5370	\$219
Model 5390	\$295

## NEW DIGITAL LCR METER Model LCR-1810

- Capacitance .1pF to 20MF
- Inductance 1μH to 20H
- Resistance .01Ω to 2000MΩ
- Temperature -20°C to 75°C
- DC Volts 0 - 20V
- Frequency up to 15MHz
- Diode/Audible Continuity Test
- Signal Output Function
- 3 1/2 Digit Display

**\$99.95**



## B&K High Current DC Power Supply

- Variable 3-14 VDC
- Thermal Protection
- Current Limiting

Model 1686 12A	\$159
Model 1686 25A	\$239

B & K 13.8V Fixed DC Power Supplies  
Model 1680 6A \$39  
Model 1682 15A \$75



## Quad Power Supply Model XP-4

4 Fully Regulated DC Power Supplies in One Unit  
4 DC voltages: 3 fixed - +5V @ 1A, -5V @ 250mA, +12V @ 500A • 1 Variable 0-12V @ 500mA



**\$29.95**

## Digital Multimeter Model M-1740 \$39.95

Free Holster

11 functions including freq to 20MHz, cap to 20μF.  
2 Year Warranty



## Family Radio Model FRS-14 by Standard

- 1 Mile Range
- 1/2 Watt Output, 14 Channels
- LCD Channel & Code Display
- 35 Selectable Channel Codes
- Back-Lit Display
- No License Required!

**\$129.95 each or 2 for \$250.00**



## Handheld Universal Counter

### Features:

- 10-Digit LCD Display.
- 250MHz Direct Count.
- 16 Segment & RF Signal Strength Bargraph.
- NiCad Battery Included.



Model F-2800  
1MHz - 2.8GHz

**\$99**

## B&K Spectrum Analyzers



500MHz Series

BK2615A	\$1250
BK2620A	\$1675

- 150KHz to 500MHz
- Dynamic Range 80dB (113dB with attenuation)
- +20dBm maximum input
- 12.5 and 400KHz resolution bandwidth
- 150KHz/hour stability
- Built-in tracking generator (Model 2620A)

1.05GHz Series

BK2625A	\$1925
BK2630A	\$2595

- 150KHz to 1,050MHz
- Dynamic Range 80dB (113dB with attenuation)
- AM & FM demod included
- 20 and 400KHz resolution bandwidth
- 150KHz/hour stability
- Built-in tracking generator (Model 2630A)

## Simm Module Tester B&K Precision Model 898

- Tests 72 and 30 pin SIMMs to 36 bits.
- Stands alone and portable. No other equipment required.
- Automatically identifies width, depth and speed of SIMMs.
- 10 built-in tests identify most memory defects Pre-heat cycle prior to tests.



**\$625**

## Model XP-581

4 Fully Regulated DC Power Supplies in One Unit  
4 DC voltages: 3 fixed - +5V @ 3A, +12V @ 1A, -12V @ 1A  
1 Variable - 2.5 - 20V @ 2A



**\$89.95**

## Portable Semiconductor Tester B&K Precision Model 510

- In or out-of-order circuit tests for transistor, FETs, SCRs and darlington.



**\$199**

## Satellite Finder Model SF-01

- Aligns Satellite Dishes
- Range 950-2050MHz
- Compact Size
- Self Power Check



**\$39.95**

## Dual-Display LCR Meter w/ Stat Functions B&K Model 878 \$219.95

Auto/manual range  
Many features  
with Q factor  
High Accuracy



## Digital Audio Generator SG-9300

**\$175**



- 10Hz - 1MHz
- Low Distortion
- Sine/Square waves
- Built-in 150MHz Frequency Counter

Guaranteed Lowest Prices

# C&S SALES, INC.

UPS SHIPPING: 48 STATES 5%  
OTHERS CALL FOR DETAILS  
IL Residents add 8.25% Sales Tax

150 W. CARPENTER AVENUE  
WHEELING, IL 60090  
FAX: (847) 541-9904 (847) 541-0710  
[http://www.elenco.com/cs\\_sales/](http://www.elenco.com/cs_sales/)



15 DAY MONEY BACK GUARANTEE

FULL FACTORY WARRANTY

PRICE IS SUBJECT TO CHANGE WITHOUT NOTICE



# The Ins and Outs of Optimizing Compilers

by Jeff Stefan

If you're not writing computer programs in hand-coded assembly, chances are you're using a compiler. If you're using a compiler, chances are the compiler is performing optimizations on your code, possibly unbeknownst to you. Compilers are where text touches silicon; your abstract source code becomes a concrete program that runs on an actual machine. Being aware of compiler optimization techniques can save you a measured amount of frustration, especially when debugging your code.

## Fundamental Compiler Technology

Compilers are usually broken up into two parts: a front end and back end. The front end takes care of scanning and parsing the source code, and the back end takes care of generating and optimizing code. Figure 1 illustrates the basic components of a compiler.

As the source code enters the compiler, the front end reads the characters in the input stream and separates them into tokens, as shown in Figure 2. This is the part of the compilation process that's called lexical analysis. Tokens are symbols that cannot be reduced any further. Tokens are not restricted to single characters. For example, if you have a variable named `MyVar` in your source program, `MyVar` cannot be reduced any further, therefore, `MyVar` is a token. In some compiler literature, tokens are occasionally called atoms.

As the tokens are scanned, their type is determined and the token and its type are placed in a data construct called a symbol table. The symbol table is a convenient storage device that allows other components to access expressions, variables, and types. Symbol tables are usually implemented as linked lists.

The next component in the compiler's front end is the parser. The parser does essentially two things. First, it determines whether the input represents a legal construct of the language. Second, it puts the input expression into an intermediate form that makes it easier for the code generator to process. The parser tries to match the sequence of tokens to a set of rules called productions. The set of productions that make up the rules for a language is called a grammar.

If you look in Appendix A, Section A13 of Kernighan and Ritchie's book *The C Programming Language*, the grammar for C is listed. Productions or grammar rules are usually expressed in Backus-Normal Form, or BNF. BNF

## Want to write better code?

Consider understanding compiler optimizations.

was invented and used to express the grammar for the first implementation of FORTRAN. BNF is an adaptation of the way linguists express natural language. John Backus is credited for creating FORTRAN and for first developing BNF, so BNF is named after him. BNF is a convenient way to express a programming language's grammar and has stood the test of time. An example of a

code can be generated for this expression, and the resulting computation can be stored in the variable `i`.

Here's the derivation:

First, we can consider `j + k * z` to be an expression `<Expr>`. From the grammar rules, `<Expr>` can be rewritten as `<Expr> ::= <Expr> * <ID>`. Since `<ID>` can be rewritten as a letter or a digit, this derivation resolves to `<Expr> * z`. Next we need to figure out `j + k` into the derivation. We do this by rewriting `<Expr> * z` with `<Expr> + <ID> * z`. We can substitute the token `k` for `<ID>`, resulting in `<Expr> + k * z`. Lastly, we can rewrite `<Expr>` as `<ID>`, yielding `<ID> + k * z`. We can substitute the token `j` for `<ID>`, resulting in `j + k * z`. Since we were able to match the expression to the grammar rules, the input expression is indeed legal and can be correctly compiled. Figure 4 shows the complete derivation sequence.

## Code Generation

After parsing is complete, the grammar rules are matched, and the symbol tables filled, code generation can begin. Code generation may take the form of assembly language, or the compiler may skip assembly code generation and directly produce code for the target machine. This is called native code generation. Most C compilers for embedded systems produce assembly code, which is then optimized before any object code is produced.

## Low-Tech Optimization

There's a lot you can do before your source code is ever compiled. Careful programming can make the compiler's job easier. By using a few hand-optimization techniques, your code will run tighter and faster when it's compiled. Hand optimization is a low-tech approach, but it pays off. For

example, look at the following C code fragment:

```
for (i = 0; i < 10; i++)
{
    x = 10;
    y = i + x;
}
```

Simply removing the assignment `x = 10` rad-

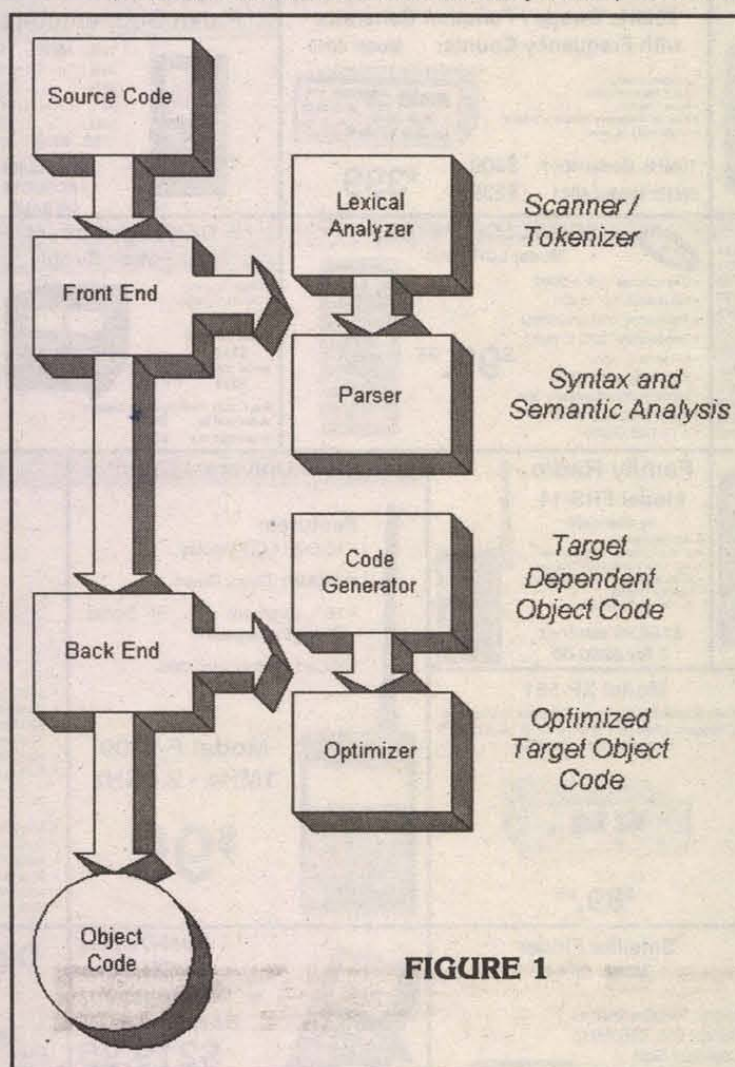


FIGURE 1

grammar for simple arithmetic expressions is shown in Figure 3.

Suppose the parser encounters the input expression `i = j + k * z`. In order to determine if this is indeed a legal expression, the parser needs to match it to the grammar rules given in Figure 3. Is `i = j + k * z` a legal expression? First, the parser must determine whether `j + k * z` can be derived from the grammar rules. If it can, then



ically increases the efficiency of this code fragment. This type of source level optimization is fairly obvious, and even beginning programmers recognize this. More subtle methods include using pointers instead of using array indices as the following example illustrates:

```
/*
 * Non-pointer method of access buffer elements
 * using an index variable
 */
printf("\nBuffer access using index variable\n");
for(i = 0; i < 10; i++)
    printf("%c", Buffer[i]);
```

Performance of this code is increased by using a pointer:

```
/*
 * Set pointer to start of Buffer and print values
 */
printf("\nBuffer access using pointer\n");
ptr = Buffer;
while(*ptr)
    printf("%c", *ptr++);
printf("\n");
```

These are simple optimizations that a careful programmer can accomplish on his or her own.

## Profiling

Another useful procedure is to profile a program without any compiler optimizations turned on. Profilers are important, but sometimes little used tools. Profilers — or performance analyzers — find run-time bottlenecks in your program while it executes. You compile and link your program, then execute it under the profiler's control. When the program terminates, the profiler generates program performance statistics.

You can discover where your program spends most of its time, how many times certain routines were called, how much CPU time was consumed, and how many interrupts occurred, among other things. Profilers are extremely powerful tools that are sometimes bundled for free with some compilers.

## Common Optimization Techniques

A compiler doesn't necessarily produce object code or an executable program exactly the way your program intended it to. All a compiler is expected to do is to reproduce the way the program was intended to behave.

From a compiler's perspective, as long as the program produced works the same way as your program text intended, what happens algorithmically within the program doesn't matter. This is surprising, but true. Knowing that the optimized program a compiler produces may not be exactly what you programmed is a good thing to bear in mind when you're debugging your code.

Some of the compiler optimization methods have strange sounding names that, on the surface, don't seem to make a lot of sense, such as loop induction, peephole optimization, or constant folding. It's worth the time to understand optimization terminology so you can make informed decisions about what optimizations to allow when compiling your code.

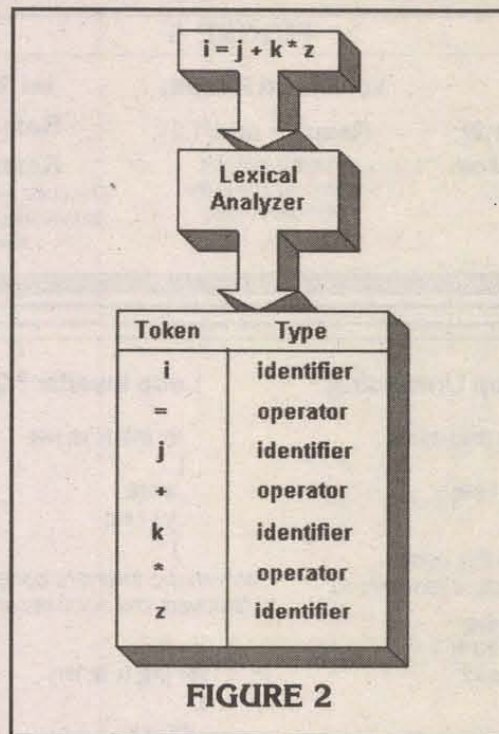


FIGURE 2

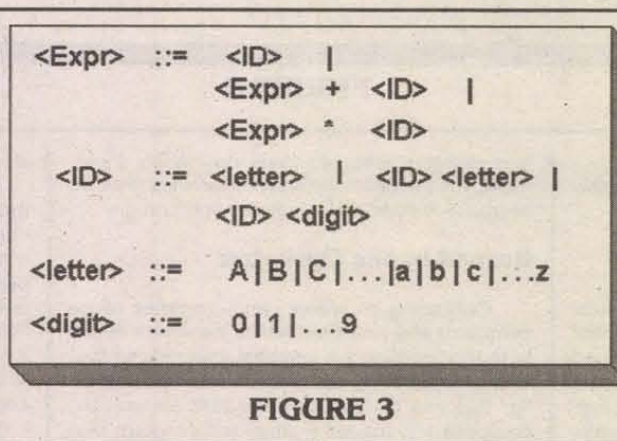


FIGURE 3

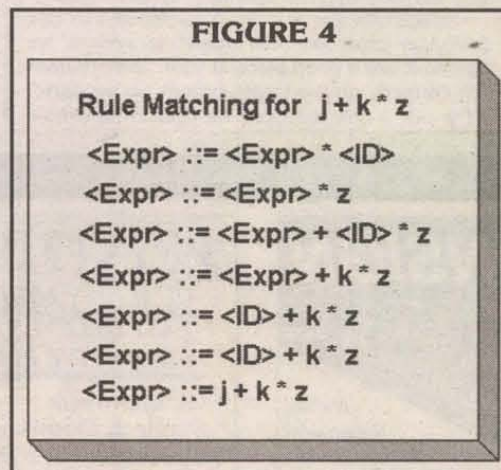


FIGURE 4

## Register Allocation

Register allocation is probably the simplest and most ubiquitous of all optimizations. When a variable is accessed, the compiler first looks if it

can use a CPU register to store the variable instead of storing it in external memory. This is a speed-oriented optimization, since no memory address bus cycles are used. Register allocation must be done in the back end of the compiler during code generation, since the front end of the compiler does not know how many registers the target machine contains.

## Dead Code Elimination

If a value is computed but never used, it's dead code. An optimizing compiler will recognize this and eliminate it in the code generation phase. This can be distracting if code stubs are placed in a program to be filled in later. For example, if you have the following lines in your program:

```
int Result;
Result = add(1,2);
```

and your program never used the variable Result again, the code may be completely optimized out of your program. If this was a program stub that you were going to build upon later, you'd be in trouble. A way to place stubs into the code without having them optimized out and without turning off compiler optimizations is to add the following assignment immediately after the call to add(1,2):

```
Result = Result;
```

This uses the variable Result without really doing anything. This simple trick costs nothing and allows the stub to avoid the optimizer's axe. You could also declare Result as volatile. Declaring a variable as volatile forces the compiler to use the variable under all circumstances, since the keyword volatile suppresses any compiler optimizations. Be careful using the keyword volatile, since all of the variables of this type will never be optimized. See Figure 5 for a simple side-by-side comparison of this code.

## Loops

Loops are obvious candidates for optimization. Most programs spend most of their CPU cycles within loops. Here are some common loop optimizations.

### Loop Unwinding

Loop unwinding is a classic example of the code-size, code-speed tradeoff. When loop unwinding occurs, the loop is decomposed into linear code. The linear code is copied the number of times the code iterates. This produces more code, but it runs faster. An example of loop unwinding is shown in Figure 6.

### Loop-Invariant Code

If code exists in a loop that doesn't change, then there is no reason for the code to be executed over and over again within the loop. It wastes CPU and bus cycles, which wastes time. Optimizing compilers that are sensitive to loop-invariance recognize this type of code and extract it from the loop. The loop-invariant code is placed above the loop, yielding more efficient code. We saw this example before, in the Low-



Tech Optimization section. An example of loop-invariant code elimination is shown in Figure 6.

## Loop induction

Pointers are more efficient than indexes, and addition is more efficient than multiplication. With loop induction optimization, the compiler attempts to replace array index multiplications with pointer additions, again yielding more efficient code. We saw a simple form of this in the Low-Tech Optimization section where we substituted pointers for array indexes in the for loop code example.

## Constant Folding

This is a somewhat strange name for performing calculations at compile-time instead of run-time. When a compiler encounters expressions that can be evaluated at compile time, the compiler does the actual calculation and then stores the result. For example, a code fragment such as:

```
#define MAX_TEMPERATURE 100
y = 25;
x + y + 2 * MAX_TEMPERATURE;
```

is optimized to  $x + 225$  by the compiler by utilizing constant folding.

## Peephole Optimization

The last technique we'll examine is peephole optimization. This is also sometimes called linear optimization. Peephole optimization is common throughout almost all compilers, since it is one of the easier techniques to implement. A peephole optimizer scans through the code examining only a small fragment at a time, like it's examining the code through a little peephole (hence the name).

The peephole optimizer then tries to improve the current fragment, possibly reducing redundant instructions or placing memory references

into registers. After it's done optimizing a segment, the peephole optimizer examines another segment of code and continues optimizing.

## Burned by the Optimizer

Optimizing compilers can sometimes cause confusion and cost time, which translates directly to money. Here's a personal experience I had with an optimizing compiler for a 32 bit processor that was used in an embedded system. We compiled and loaded a small test program that was supplied with the operating system code.

Since this was our first experience with this particular processor and operating system, we figured it was a good place to start. The program ran correctly on the target system, so we decided to add a new function. We declared a simple

elapsed.

We decided to call the development environment vendor, thinking that we had encountered a bug in the compiler or debugger. After talking to a couple of support engineers, we finally happened upon one who had previously encountered a similar problem. His response was "Welcome to the world of optimizing compilers!" It turned out that our result value was never used in the program, so via dead code elimination, the compiler decided to optimize out the code.

The moral of this story is, however valuable compiler optimizations may be, TURN THEM OFF when you are initially developing code for a new system using new tools. Incrementally turn on optimizations as your code development progresses. If you don't, you may get burned when you're debugging. **NV**

FIGURE 5

<b>int Result;</b> <b>Result = add(1,2);</b> <i>This code is optimized out by the compiler</i>	<b>volatile int Result;</b> <b>Result = add(1,2);</b> <i>Result is NEVER optimized due to the keyword volatile</i>	<b>int Result;</b> <b>Result = add(1,2);</b> <b>Result = Result;</b> <i>This code is not optimized out due to the simple benign assignment Result = Result;</i>
--	--	--

integer function that added two numbers together:

```
int add( int x, int y);
```

The actual call to the function in the body of the code was:

```
Result = add(1,2);
```

It was hard to

think of a simpler function to start experimenting with. We compiled, linked, downloaded, and ran the code through the debugger on the target system. The debugger stepped right over the function call as if it didn't exist in the code! We checked the code, recompiled, downloaded, and ran again with the same result.

Everything appeared to be completely legal. We tried it on a PC with another compiler, and the line containing the function call was executed. We returned to the target environment, recompiled, and ran again. The debugger still stubbornly refused to execute the function call.

To add to our confusion, we could set a breakpoint within the function body, but could not set a breakpoint at the function invocation. Meanwhile, several hours had

## Loop Unwinding

```
for (i=0; i<3; i++)
{
    x = x+i;
}
```

When this code unwinds, it resolves to:

```
x = x+0;
x = x+1;
x = x+2;
```

## Loop Invariant Code

```
for (i=0; i<10; i++)
{
    x=10;
    y=i+x;
}
```

When the invariant code is removed, the code resolves to:

```
x = 10;
for (i=0; i<10; i++)
{
    y=i+x;
}
```

FIGURE 6

## BUY • SELL • CONSIGN

### WANTED

- Electronic Test Equipment
- Electronics Inventory
- Scientific Equipment
- Mfg. Shop Equip.
- Data/Telco
- Memory

# DEXIS

9749 Hamilton Road  
Eden Prairie, MN 55344

We Sell  
Nationally!

Call our Fax-On-

Demand System, or our

Internet site for current availability.

Visit our 25,000 sq. ft. show room warehouse  
M-F 9 to 6; Sat 9 to 5

PHONE: (612) 944-7670

INTERNET: WWW.GO2DEXIS.COM

FAX: (612) 942-9712 • FAX-ON-DEMAND: 1-800-547-4636 X 300

## PRINTED CIRCUIT BOARDS

### QUALITY PRODUCT

### FAST DELIVERY

### COMPETITIVE PRICING

- \* UL approved
- \* Single & Double sided
- \* Multilayers to 8 layer
- \* SMOBC
- \* LPI mask
- \* Through hole or SMT
- \* Nickel & Gold Plating
- \* Routing or scoring
- \* Electrical Testing
- \* Artwork or CAD data
- \* Fast quotes

PROTOTYPE THROUGH  
PRODUCTION

# PULSAR, INC

9901 W. Pacific Ave.  
Franklin Park, IL 60131  
Phone 847.233.0012  
Fax 847.233.0013  
Modem 847.233.0014

www.pulsar-inc.com



THINK  
CHRISTMAS!

### TWINKLING HOLIDAY ORNAMENT KIT

Ornament is 3" tall, small enough to hang on your Christmas tree or around your neck at a holiday party. Either way, it's guaranteed to attract attention.

97K006

\$18.00 each



### "Semiuniversal" RCA 39-BUTTON REMOTE CONTROL

This versatile unit works on several products and brands. Just press desired function button and enter the 3-digit code provided. Requires four AAA batteries. Unused.

97V010

\$9.95 each

GIFT IDEAL!

### ECOHEAT™ HEAT GUN

An economical, lightweight, multi-use heat gun with two heat settings (500° and 1000°F). Has 3-position slide switch, built-in hand guard, 3-wire grounded cord, thermoplastic case. UL listed, 120VAC.

EC-100

\$32.95 each



### 13.8VDC, 15A REGULATED POWER SUPPLY

Input: 120VAC, 60Hz. Output: 13.8VDC, 15A fully regulated, 17A surge. With short circuit protection and fuse.

98E017

\$79.95 each



### 3.5" DISK DRIVE POWER CABLE

Adapt your PC power supply to run a 3.5" drive.

94W009

99¢ each

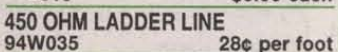


### DESOLDERING PUMP

High suction power, ideal for PC board repairs. Light-weight, one-hand operation.

98Z013

\$5.99 each



### 450 OHM LADDER LINE

94W035

28¢ per foot



### RARE EARTH MAGNET

Two magnets inside a metal frame that separates easily. Each magnet is approx. 200 Gauss. Size approx. 1.5" x 0.75"

98N009

\$4.00 each



### CAN MOTOR

1-7/16" x 2-3/8", with 1/8" x 5/16" shaft. 18V @ 250 mA.

98M006

\$3.95 each



GREAT  
GIFT!

### COLOR DESKTOP CAMERA

Great for videoconferencing, security systems and many other uses. Operates on 12VDC @ 0.2A through supplied adapter. NTSC output through RCA jack. Fixed focus. Door slides over lens for protection. Toshiba #1K-M27A.

98V012

\$129.95 each



### MINI Thunder Blaster III

100,000 Volts! A short blast of one-quarter second duration will stop an attack, causing minor muscle contractions, and have a

repelling effect. A moderate-length blast of one to four seconds can cause an attacker to fall to the ground and result in mental confusion. It may make an assailant unwilling to continue an attack, but he will be able to get up almost immediately. A full charge of five seconds can immobilize an attacker, cause disorientation, loss of balance, falling to the ground and leave him weak and dazed for some minutes afterward.

98Z015

\$39.95 each

### "SOLAR BABY"

Open circuit: 18.5VDC. Peak power: 15VDC. Current at peak power: 333mA. Operating voltage: 13.5VDC. Sturdy aluminum frame on fiberglass-backed panel measures slightly less than 11" square. Wires included for easy hookup. Tristar Distributors #HSP-5.

98E024

\$58.00 each



### GENUINE 14X JEWELER'S LOUPE

High-quality glass Hastings Triplet flat field loupe made in the USA by Bausch & Lomb. If you're in the field searching part numbers on components or serial numbers on equipment, this little gem could pay for itself the first time you use it.

98Z012

\$16.00 each



### 14-DAY PROGRAMMABLE TIMER

Originally used to control a satellite receiver through its IR port. Time on/off for eight distinct events. Modify it for your needs or dismantle it for its parts. Programmable with a 2732 EPROM in a removable "personality" module, the unit may be modified to control any IR device through its IR port. Contains Z80 CPU, clock display and associated parts. Operates from 9VDC 500 mA wall transformer which is included.

92V014

\$9.95 each



### LAPTOP/PALMTOP COMPUTER CARRY CASE

High-density, impact-absorbing close-cell EVA foam on all exterior walls and 2mm PVC inner belt for extra protection. ABS fabricated handle and bottom has 200 pounds holding strength. Reinforced water-repellent and stain-resistant polyurethane coating. Smooth, self-healing nylon zippers plus anodized strap loop attached to metal plate base. Movable velcro partitions. Ergonomically-designed shoulder strap with nonslip backing and extra padding for user comfort. Easy-to-lock/detach quick hook system. Size 17" x 11" x 3".

15-7056

\$20.00 each



### LONGWAVE ULTRAVIOLET LAMP

This pocket-sized longwave ultraviolet light may be used for detecting invisible inks, minerals in rocks, etc. It's the size of a pocket pager and even has a belt clip to keep it handy. Runs on two "AA" batteries (not included). 3.25" W x 1.75" H x 1" D.

95L007

\$7.95 each

### "INVISIBLE INK" PENS

For use with UV lamp 95L007 (above).

• FINE POINT

96U002

\$2.99 each

• BROAD POINT

96L006

\$4.99 each

### PHONE FM TRANSMITTER KIT

This small but powerful circuit attaches to a phone line and transmits the conversation into the FM band. It uses the phone line itself as an antenna. No battery is required since power is drawn from the phone line. Easily adjusted to transmit outside the commercial FM band for greater security. Sold only as a testing device.

Kit 16

\$12.99 each



### CHECK OUR WEB SITE FOR HARD DRIVE INVENTORY



### 6 METER FSK RECEIVER

Crystal controlled on 50.675 receive frequency. Superhet with 10.7MHz IF. Three ICs and one transistor. Not a kit! New, with schematics and spec sheet for major components.

92A067

\$9.95 each

### BOOM MIKE

Electret Condenser Type  
This versatile microphone may be wired for handy-talkie, sound card, telephone, base station, aircraft radio, CB radio, motorcycle intercom, etc. An earphone or miniature speaker may be installed in either or both muffs. The microphone unit can be easily removed and installed on another headset or helmet.

92A001

\$4.95 each



Special  
Sale!

### EPROM SPECIAL!

All 50¢ Each

2764 • 27128 • 27256

27C256 • 27512 • 27C512

Min. Order 10 of a Type

Socket Pulls - Subject to Stock on Hand  
Offer Expires 12-31-98



GIFT IDEAL!

### BROW MOUNTED BINOCULAR MAGNIFIER

Wear this handy magnifier with its velcro strap. One size fits all so it's always comfortable. Magnifier assembly tilts up out of the way when not needed. Fixed lens gives 1.8X magnification for most close-up activity. For a closer look a second binocular lens tilts down from inside visor. For turbopeep mode, swivel the loupe in front of the right eye. Combinations are 1.8X, 2.3X, 3.7X and 4.8X.

MP242

\$23.95 each



### ANIMAL SOUNDS PIANO KIT

Synthesized piano sound plus seven animal sounds. Demo mode plays popular songs. Requires two AA batteries. Auto power-off. All parts included. Easy to assemble with easy step-by-step instructions.

96K003

\$29.00 each



### PELTIER JUNCTION

1-3/16" sq. x 1/16" copper plate soldered to opposite side of module that is soldered to 2" x 3" x 1/2" heatsink. Nominal Voltage: 12V @ 0.72A. Use to cool Pentium CPUs or devise your own applications. Units may be paralleled for increased capacity. Voltage is reversible and this device can be used to either heat or cool.

98U001

\$19.95 each

### POCKET REFERENCE

480 pages of tables, maps, formulas, constants and conversions that fit in your shirt pocket (3.2" x 5.4" x 0.6"). The greatest pocket reference of all time!

92U010

\$9.95 each



# ALLTRONICS

2300-D Zanker Road - San Jose, CA 95131-1114

World Wide Web: <http://www.alltronics.com>

(408) 943-9773 - Fax (408) 943-9776

THINK  
CHRISTMAS!

Send \$2.00 For Our Latest Catalog!  
\$4.00 Foreign. Refundable on First Order.



Store Hours: 9-6 M-F & 10-3 Sat. - Pacific  
Visa, M/C, AmEx Accepted.

All Sales Final.

California Residents Add Sales Tax.

Shipping Additional on All Orders.

Prices Good 60 Days from Date of Publication

011098



# 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)

How can I interface and set the switches of a HP PaintJet printer to work with a IBM-compatible PC? I do not have a manual. The printer appears to be a RS232 serial port. The printer does a self-test okay. There are two DIP switches to be set.

**11981** **Cliff Canyonville, OR**

I recently bought a used computer.

The sound does not work and before it boots up, it gives me the following message: "!!Warning!! The Primary Wave Device does not appear at I/O address 534. The sound card will not be fully functional without this device. Check the hardware settings, and then check the hardware configuration panel associated with this program. The "Waveport" parameter must match port address selected by the hardware jumpers. Press any button to continue."

After this, my Windows95 runs just fine although with no sound.

**11982** **John Rehm via Internet**

How do underground wire locators work? Do you have a simple circuit for building such a device?

**11983** **Richard Haendel via Internet**

I have prepared a cassette tape for teaching purposes. Is there any way to prevent the duplication of this tape by others?

I need an electronic piece to go with the tape to prevent direct and easy duplication.

**11984** **via Internet**

I have several new surplus 3UP1 CRTs that have been in my junk box for over 20 years. I cannot bring myself to toss them out, especially since I just completed a homebrew spectrum analyzer and one of them would be a great fit for it. They are a natural to dress up any new PIC project, too!

My difficulty is not the 2 KV of HV required for the anode or focus electrodes since the new laser kit power supplies will adapt neatly there. I need help on part selection/design for the deflection circuits. I want to

be able to drive the CRT with a 0 to 5V output from a DAC.

The only specs for the 3UP1 show that I will need about -300 to +300V drive into a 20 pF load. By driving it with DAC output from a PIC, I could even generate simple text if it had about 3 MHz of bandwidth. For the spectrum analyzer, I only need 50 KHz or so, of bandwidth.

Is there a simple way to create a deflection circuit for this project (perhaps with an op-amp and MOSFET)?

**11985** **Ron L. Sparks Katy, TX**

I have a RadioShack multimeter, a Micronta 22-168, which includes the capacity to communicate via the serial port. It works fine with the supplied software, but I have been unable to access it with the suggested (GV Basic) basic code. Here's the QB version of the code to read the data in the multimeter once:

```
OPEN "COM1:
1200,N,7,2,RS,CS,DS,CD" FOR RANDOM AS #2
AS$ = "D"
PRINT #2, AS$
IN$ = INPUT$(14, #2)
PRINT IN$
CLOSE #2
```

The program does not get past the IN\$ line. IN\$ is always empty if I print it from outside the program. Does anyone have Quick Basic code which will access this meter?

**11986** **Grant Fair Ontario, Canada**

I am able to buy a surplus generator that puts out 400 Hz. Can you help me with a way to convert it to 60 Hz? Articles or projects?

**11987** **Gary Stiffler via Internet**

I have a Tystar VGA monitor I am running on my older 486 PC. When I run America Online, it tells me I don't have 256 colors selected as AOL requires to run properly. I tried to change the VGA drivers in Windows Setup, but all it did was cause the monitor to be completely out of sync. I have two questions:

1. How does one know how many colors a given monitor will support, assuming you have no docu-

mentation?

2. Which VGA driver should I use for this application?

**11988** **Lonnie W. Sutton Dugway, UT**

I tried to modify the SA8500-321, cut a jumper W310, and install a .01 uF disk cap, and the resistor connect to pin 21 in IC305.

The problem is, it only works for a short time and turns the screen black. If the channel is changed, it will work again, but for a short time. Maybe I am doing something wrong.

**11989** **Alfredo Gonzalez Presidio, TX**

I replaced a HP C1599A SCSI DAT tape drive after it failed. But after checking out the failed drive, all the motors run and the tape tries to stat against the VCR type heads. The tape lowers itself twice then the yellow LED comes on blinking silently and failing. Can someone point me to a repair path?

**119810** **George Clute Mercer Island, WA**

I'm looking for a simple circuit to detect randomly inverting video. Ideally, the circuit would light an LED when this happens.

**119811** **Anonymous**

## ANSWERS

### ANSWER TO #89810 - AUG. 1998

Make sure you are disabling the touchpad in the laptop's BIOS, not just removing it from Windows. Also, your touchpad probably uses DOS drivers, because you are using Win 3.1. Make sure any mousy looking lines in AUTOEXEC.BAT and CONFIG.SYS are "rem"ed out (type REM in front of the offending line, i.e., REM C:\DOS\TOUCHPAD.COM) instead of C:\DOS\TOUCHPAD.COM). This temporarily disables the drivers.

You will then have to add lines pertaining to your mouse drivers (MOUSE.COM) if the automatic setup doesn't do it (i.e., add C:\MOUSE\MOUSE.COM, if you copied your drivers to C:\MOUSE\).

Then reboot and see if your mouse works. If it doesn't, poke around for any other touchpad dri-

## 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.

vers. Also, try running your mouse as COM2.

To do this, you will have to add a command line switch to the MOUSE.COM line in AUTOEXEC.BAT. At the DOS prompt, switch to the directory containing your new mouse drivers and type MOUSE /? [ENTER].

This will tell you about the options available. One last thing to try is to disable all power saving related to the serial ports. You will have to do that through your laptop's BIOS, too.

**Evan Weaver Hockessin, DE**



## ANSWER TO #109811 - OCT. 1998

The LM3914, LM3915, and LM3916 are designed to do just

that. They require a minimum of parts to operate and most come with diagrams on how to hook them up as

either a VU meter or a power meter.

Two or more of these units can be cascaded together to drive 20 or more LEDs, LCDs, or vacuum fluorescent displays. A single pin changes the mode of operation from a "moving dot" to the "bar graph" mode.

The LM3914 senses an analog voltage and divides into 10 segments which drive 10 separate outputs. These outputs are regulated and fully programmable which means that you can program it for low-power usage, as well as high-power amps.

The LM3915 is a logarithmic version of the LM3914 with a 3 dB interval between segments.

The LM3916 has all of the same features as the LM3914 and LM3915, but is designed specifically for use as a "VU" meter.

Several cross reference numbers are:

National Semiconductor part # LM3914

ECG part #1508

NTE part #1508

National Semiconductor part # LM3915

ECG part #1509

NTE part #1509

National Semiconductor part # LM3916

NTE part #1549

Chris Bieber, CA

## ANSWER TO #109815 - OCT. 1998

Do not use port I/O to control your soundcard — use the waveln driver.

Windows puts a lot of overhead on I/O port instructions, and soundcards require double-buffered DMA transfers and other sophisticated device programming methods.

Application software should talk to the hardware through the system device drivers.

There are many benefits. Not only do you avoid fiddling with low-level programming, but your program will also work with soundcards that are not SoundBlaster compatible.

The proper driver is the waveln multimedia device. I know how to access it in C, but not VB. You should be able to find the details about PCMWAVEFORMAT and the equivalents of wavelnOpen, wavelnPrepareHeader, MM\_WIM\_DATA, and friends.

There are also calls to control the mixer settings, but I recommend working on the decoding algorithm before tackling the soundcard and mixer programming.

The quick fix is to use the Sound Recorder [Start | Accessories | Multimedia Sound Recorder] to record a .WAV file with your weather satellite image, and writing a VB program to process the .WAV file.

Using the soundcard directly implies processing the image on the fly, and it may take a while before your program can do it on the fly. Using a .WAV file will give you consistent data and let you focus on the algorithms without worrying about processing speed.

Record the image in mono at 8 KHz with 8 or 16 bit samples. The .WAV file has some header information and then the data. The eight-bit samples are offset 128 numbers and the 16-bit samples are two's complement.

Several people have used soundcards to process weather satellite information. The August '97 GST has an article about a freeware satellite decoder, but I don't know if it does

Continued on page 74

## ANSWER TO #7984 - JULY 1998

A "Roger Beep" or End of Transmission (EOT) beep circuit is fairly easy and inexpensive to build as the schematic diagram shows.

The circuit can be assembled on a small section of perfboard using point-to-point wiring and installed inside most any transceiver.

The circuit is designed around an LM1458 dual op-amp IC, but any similar IC such as the LM358, etc., will also work. The circuit operates as follows:

When push button switch S2 (microphone PTT switch) is pressed, the relay coil is energized which causes the transceiver to transmit. When the microphone PTT button is released, the transceiver remains in transmit for approximately .27 seconds during which time, the beep tone is transmitted.

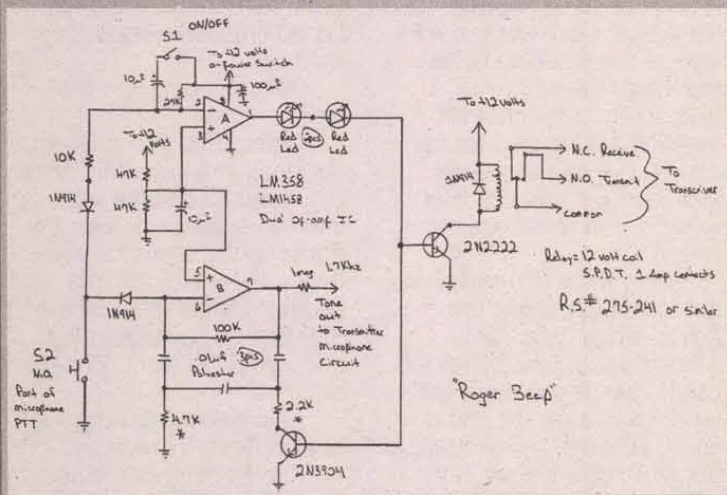
After the .27 second delay time has passed, the relay coil is de-energized which places the transceiver back into receive.

When switch S1 (normally a mini toggle, etc.) is open, the EOT beep tone is not transmitted. The frequency of the beep tone (currently 1700 Hz) can be changed somewhat by altering the component values of either one or both of the resistors marked with "\*".

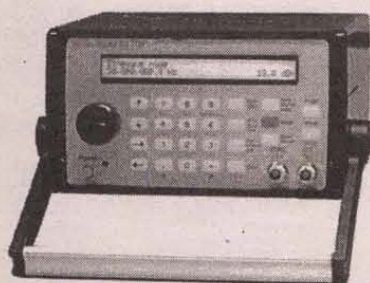
Increasing their values will lower the frequency while decreasing their values will raise the frequency.

A different value resistor may need to be substituted in place of the one megohm output resistor at pin 7 of the IC in order to avoid over-modulating the transmitter. Increasing the resistance value will lower the modulation level.

Brian Piller  
Baxter Springs, KS



## Any waveform you want!



Telulex Inc. model SG-100A

**\$995**

Quantity 1

Money back guarantee

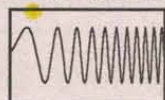
**Telulex Inc.**

### ● Synthesized Signal Generator

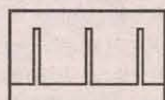
Clean sinewaves DC-20 MHz with .001% accuracy!  
.1 Hz steps. DC Offset. RS232 remote control.

### ● Arbitrary Waveform Generator

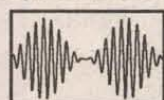
40 Megasamples/Second. 32,768 points. 12 bit DAC



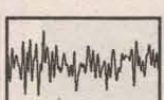
DC to 20 MHz linear and log sweeps



Pulse Generator



Int/Ext AM, SSB, Dualtone Gen.



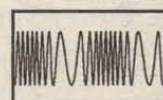
Noise

### ● Function Generator

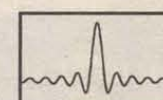
Ramps, Triangles, Exponentials, Noise & more.  
0 to 2 MHz in 1 Hz steps. Continuous or Triggered.

### ● Pulse Generator

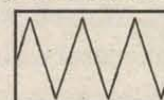
Digital waveforms with adjustable duty cycle



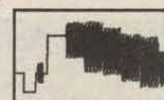
Int/Ext FM, PM, BPSK, Burst



Arbitrary Waveforms



Ramps, Triangles, Exponentials



Unlimited Possibilities!

2455 Old Middlefield Way S  
Mountain View, CA 94043

Tel (650) 938-0240

Fax (650) 938-0241

<http://www.Telulex.com>

Email: [sales@Telulex.com](mailto:sales@Telulex.com)



## NEW! Graphics LCD Module with Serial Interface



The new G12864 makes it easy to display text and graphics on a 128-by-64-pixel LCD. It interfaces with a computer through a 2400 or 9600-baud RS-232 serial hookup.

### Text Features

The G12864 works like a serial-receive terminal. It displays text in a 4-line by 16-character format. Text is displayed in a large 8- by 16-pixel font, which can be edited to include custom symbols.

### Graphics Features

The display lets you plot points, draw lines, and display full-screen graphics using easy instructions. Its flash memory stores the text font plus 14 screens. You can create fonts and graphics on your PC, then download them to the G12864 using the included software.

### Convenience Features

A power supply and DB9 serial-port connector are built in. Connect the display to the (included) AC adapter; plug the (included) serial cable into your PC or other computer, and you're ready to go. Current draw ranges from 15mA (typical, backlight off) to 100mA (max, backlight on). For complete specifications, see our web site: [www.seetron.com](http://www.seetron.com).

Display, with starter pack: \$199      Display alone (OEM qty 1): \$179

Scott Edwards Electronics • PO Box 160 • Sierra Vista • AZ • 85636-0160  
ph: 520-459-4802 • fax: 520-459-0623 • e-mail: [info@seetron.com](mailto:info@seetron.com)  
Internet: [www.seetron.com](http://www.seetron.com)

Write in 185 on Reader Service Card.

**Metric**  
Equipment Sales, Inc.

**800-432-3424**  
Fax: 510-264-0886  
[www.metricsales.com](http://www.metricsales.com)

**RENT • BUY • SELL**  
Yes, we will buy your surplus equipment!

**Scopes, Meters, Analyzers, Power Supplies, Signal Generators, Counters, Recorders and more**

Hewlett-Packard, Tektronix, Fluke, Dranetz, TTC, Anritsu, Wavetek, Keithley, and more

**Test & Measurement Instruments**

**Over 7000 Models • 6-Month Warranty  
Save 30-90% • 5-Day Free Trial**

## Resistance is Futile!

by E. Z. Camp

Looking for a new career? I've got a great one, if you don't mind when or IF you eat or sleep! The money's good, you get to travel, and you meet lots of interesting people. In your spare time, you're parked in front of a computer screen, when you're not on the phone doing your investigations.

Me, I'm a technical writer. Free-lance to be specific. Yep, it's a 24/7 work week, but I love it! You wouldn't believe the things I've seen and places I've visited, not to mention getting paid for my efforts. I've met extremely intelligent people, beautiful women, and some real nut cases!

Every once in a while, you get to verbally abuse the Editor, when "editorial license" is stretched. This job can be fun, if you don't get fired! Like I said, the pay is good, although never on time, but that's how it goes in the publishing business.

Fringe benefits? You bet! Some of the technical stuff you pick up is like money in the bank. The sharp tech writer can develop some ideas legally from this material, and really cash in.

You've got to be super careful here, as you don't want to get black-listed for piracy. Your job could disappear overnight!

This job can get dull and boring, but within a couple of days you're on something new — just like the weather, it's always changing. Sometimes, it even gets risky, or should I say, downright dangerous? Take for instance, the Metalloid Affair ...

The phone was buzzing at me again, damn! Getting really tough to concentrate on editing.

"Hello?"

"Skip? It's Fred. You busy?"

"Always, Fred! What's up with you?"

"I'm working on a new project farmed out to me from DIGI-LOG and I ran out of acrylic spray — got any?"

"Yeah, I think I've got about half a can left. DIGI-LOG, huh? That's the outfit I'm editing data sheets for right now."

"Oh, anything interesting?"

"Sure looks like it! Seems our dead-and-gone Ms. Anna Log developed some very interesting linear circuits. I'm doing up the specs for what they call the 741 op-amp, and another gadget they call the 555 timer. They expect big sales! And I think they might be right."

"You've been getting a lot of work from them lately."

"No kidding! Ever since that article I did for them before they pulled out of digital manufacturing and changed their name. How'd you hook up with them?"

"They saw a letter I sent into a hobbyist electronic magazine a while back. I was looking for information on temperature coefficients of certain metal and non-metal alloys."

"I guess they saw something they liked?"

"Sure did. They contacted me as soon as the mag hit the newsstands! Wanted some independent research conducted on attempting to come up with a zero-tempco metal alloy. They offered me a juicy contract, and I took it!"

"Good for you! Well, I'm



ready for a little break. How about if I bring you over the acrylic spray and we rap for a bit?"

"Great! Bring those specs you're working on - I want to see them."

"Right! See you in 15!"

Fred's a scrawny little guy with those rough, good looks that women can't seem to resist. He's got himself a centerfold wife, and both of them have those upper-stratosphere type IQs. His 'workshop' is something to behold, money being no object.

"Hi, Fred! Where's the wife?"

"Out nailing down another software contract. I'm free for the afternoon. How's yours?"

"Great! She's really getting heavy into this anti-fraud stuff now that New Jersey has the highest auto insurance rates on the planet. There seems to be an abundance of 'dirty' doctors and patients in the area."

"Tell me about it! Hand me that acrylic spray, huh?"

He began to gingerly spray a coat of the crystal clear plastic onto a beautifully labeled aluminum panel. "Has she had any luck yet nailing any dirty lawyers?"

Walking over to open a window for ventilation, I replied, "No luck yet. They're pretty well protected. Looks like lots of cash changing hands up top. Boy, that spray stinks!"

"Yeah, but not as bad as those lawyers!"

"Agreed, but not all of them are dirty. We still need them, like it or not. What's that panel for?"

"Oh, I had a little accident with the chart recorder DIGI-LOG loaned me for this job. I kind of destroyed their front panel, so I made a new one," offered Fred.

Fred is always having 'little accidents.' For such a sharp guy, it always amazes me how he does it! "How many coats are you putting on there? I'm getting a buzz!"

Fred grumbled, "Relax Skip, I'm done. Want to see

the test rig?"

"Sure, is this it?" I replied, pointing to his bench.

On the bench was a neatly made fixture holding a shiny, metallic rod about the size of a lead pencil. Several sets of wires led off to the chart recorder.

A pair of triple-ought cables almost a 1/2" in diameter were connected to the jig and hung off the bench. These went down to the floor and tied in to three series-connected graphite rods about the size of flashlights. The cables disappeared through a wall grommet.

Fred saw my puzzled look, "Those are my homemade variable resistors - see the sliders on the rods? I needed some kind of current limiting on this set-up. I'm using my door stop for the power supply."

Said 'door stop' is a huge, 75-pound transformer rated at five volts at 1 KVA. That's a 200-amp supply, folks! I asked sarcastically, "Think you've got enough current, Fred?"

A straight-faced Fred: "Just about enough, maybe! I've been running conductivity tests on different alloys supplied to my specs from another outfit. Their standard sample size is 1/4" by 5", so I needed something hefty to get a measurement."

I asked, "So you said DIGI-LOG wants you to investigate alloys for zero-tempco; what's the point?"

Fred laughed. "The zero-tempco they're interested in is not dimensionally related, but electrically related. They apparently have a use for conductors that exhibit no conductivity change over wide temperature variations. This was not my original intent, but if they wanted to pay me, why not bag two birds with one stone?"

"So what are you looking for?"

Fred explained, "My original theory was that it should be possible to form an alloy from two or more metals or non-metals that would have

very high and constant conductivity at any temperature. By combining a metal, whose conductivity decreases as temperature increases, I hoped to get something that worked."

"Bloody hell, you say! Did you do it?"

He looked upset. "Yeah, I fulfilled their contract. Would you believe I found two workable alloys?"

I was intrigued to say the least, "How'd you do it?"

Fred pondered. "Did you know that aluminum is NOT a metal? Not many people do. It's a metalloid; its conductivity varies directly with temperature, as opposed to real metals. This was the key to my experiments, as aluminum already has a high conductivity, like gold and silver and copper. The trick was to alloy one or more real metals with aluminum in the right proportions. Two of the dozen alloys I dreamed up show the zero-tempco effect, and I've still got three more to test."

"So, why the long face?"

"I'm still not seeing what I expected to see!"

"Let's see how your rig works, okay Fred?"

He brightened up. "Sure! This thing's really pretty simple, just set up for high power. I apply power to the sample rod from the door stop through the variable resistors using those monster cables, starting out at about 10 amps and ending up at 50-100 amps. At those currents, the sample 'self-heats' which saves me using a separate heater."

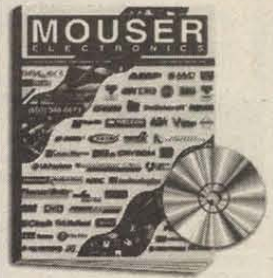
"And you print out the run on the chart recorder?"

"Right! The three upper recorder pens trace out the sample temperature, current through the sample, and the voltage drop across it. The fourth pen gives the calculated resistance of the sample. What you want to see is a flat line on that trace."

I was impressed. "Nice chart recorder they loaned you."

"Yeah, I was lucky I was able to fix it! Want to watch a

## ELECTRONIC COMPONENTS



Visit our web site!  
[www.mouser.com](http://www.mouser.com)

Catalog is available on the internet, CD-ROM, or in paper!

- Over 72,500 Products
- More than 145 Suppliers
- Same Day Shipping
- No Minimum Order

**800-992-9943**

817-483-6828 Fax: 817-483-6899  
[catalog@mouser.com](mailto:catalog@mouser.com)

**MOUSER**  
ELECTRONICS  
958 North Main St., Mansfield, TX 76063

Write in 187 on Reader Service Card.

### Learn MICROCONTROLLERS EMBEDDED SYSTEMS and PROGRAMMING...

with the AES learning system/  
embedded control system.  
Extensive manuals guide  
you through your  
development project.  
All programming  
and hardware details  
explained. Complete schematics.  
Learn to program the LCD, keypad  
digital, analog, and serial I/O. for  
your applications.



**THREE MODELS AVAILABLE.**  
Choose from an Intel 8051,  
Intel 8088, or Motorola 68HC11  
based system.  
All models come with:

- 32K Byte ROM, 32K Byte RAM • 2 by 16 Liquid Crystal Display • 4 by 5 Keypad • Digital, Analog, and Serial I/O • Interrupts, timers, chip-selects • 26 pin expansion connector • Built-in Logic Probe • Power Supply (can also be battery operated) • Powerful ROM MONITOR to help you program • Connects to your PC for programming or data logging (cable included) • Assembly, BASIC, and C programming (varies with model) • Program disks with Cross Assembler and many, well documented, program examples • User's Manuals: cover all details (over 500 pages) • Completely assembled and ready to use • Source code for all drivers and MONITOR • Optional Text Book

Everything you need. From \$279

Money Back Guarantee

Call for Free Info Pack, or see

WEB at <http://www.aesmicro.com>

714-550-8094, FAX 714-550-9941

**Call 1-800-730-3232**

**AES**  
Advanced Educational Systems

AES 575 ANTON BLVD., SUITE 300, COSTA MESA, CA 92626, USA





## REFILL INKS FOR INKJET PRINTERS

Refill your old cartridge and save. All refill kits come with instructions and needed materials for refilling inkjet cartridges. Success guaranteed. Available for the following:

**CANON BC-01, BC-02** CANON BJ10e, APPLE STYLEWRITER, BJ-200 Single Black Refill \$8.00; Triple Refill \$19.00. **CANON BJC-600** (BC-201) Single Black or Single Colors (3 refills) \$8.00. **CANON BJ-130/300/330 & IBM Exec Jet** (Cart #BJL-481 & BJL-642) Black - 3-bottle kit \$22.00. **CANON BJC-210/240** (BC-05 Cart) 3-color kit (3 refills each color for BC-05) \$24.00. **CANON BJC-4000** and Apple Stylewriter 2400 Black 3-bottle kit (3 refills BC-21 black, 30 refills BC-11 black, 10 refills BC-10) \$19.00. **CANON BJC-4000/BJC70** and Apple Stylewriter 2400 Tri-color kit - 6 refills each color for BC-21 or 15 refills each color for BC-11 \$24.00. **CANON BJC-800/820/880** 3-bottle kit (for BJL-643B) \$19.00. **CANON BJC-800/820/880** 3-bottle tri-color kit (Cart #BJL-643CMY) \$24.00. **EPSON STYLUS COLOR PRINTER** - (Cart S020034) Single Triple black \$19.00; Tri-color kit (Cart S020036) 2 refills each color \$24.00. **EPSON STYLUS COLOR II** - (S020047) Triple Black \$19.00 (S020049) Tri-color (2 refills each color) \$24.00. **EPSON STYLUS COLOR 400, 500, & 600** (S020093) Triple black (7 refills total) \$19.00; **EPSON STYLUS COLOR 200, 500** (S020097) Tri-color 3 refills each color \$24.00. **EPSON STYLUS COLOR 400, 600, 800, 1520** Tri-color (S020089) 3 refills each color \$24.00. **EPSON STYLUS 800/1000** (S020025) 3-refill kit, black, \$19.00. **HP DESKJET 500/550/560** (51608A, 51633A, 51626A) Black single refills \$8.00. **HP DESKJET 500/550/560**, Black 3-bottle kit \$19.00. **HP DESKJET 500C/550C/560C** - Tri-color kit (5 refills each color) \$24.00. **HP DESKJET 1200C, DESIGNJET 650** (Cart #HP 51640B) Black Three pack (3 refills) \$19.00. **HP DESKJET 1200C/1600C, DESIGNJET 650** (Cart #HP 51640 C.M.Y.) Tri-color kit (one refill each color) \$24.00. **HP DESKJET 600/660** (HP 51629A) Black three pack \$19.00. **HP DESKJET 600C/660C**, (HP 51649A) Tri-color (5 refills each color) \$24.00. **HP DESKJET 855C/1600C** (HP 51645A) Black three pack \$19.00. **HP DESKJET 855C** (HP 51641A) Tri-color kit (2 refills each color) \$24.00. **HP DESKJET 720, 722, 890, OFFICE JET 1170 & 1175** (C1823A) Tri-color kit (2 refills each color) \$24.00. **HP PAINTJET and PAINTJET XL** (51606A) Black 3-bottle kit \$19.00. **HP PAINTJET and PAINTJET XL** (51606C) Tri-color kit \$24.00. **HP PAINTJET XL300** (C1645A & C1656A) Black 3-refill kit \$19.00. **HP PAINTJET XL300** Tri-color kit (1 refill each color) HP 51639C.M.Y. \$24.00. **HP THINKJET, QUIETJET, KODAK DICONIX 150** (51604A or 92261A) black 5 refills \$9.00. **IBM/Lexmark/Execjet/4076** (1380620) black 3-refill kit \$19.00. **IBM/Lexmark Execjet IIC, WinWriter 150 C** (Cart #1380619) 4 refills each color \$24.00. **SNAP AND FILL SYSTEM** - Permits refilling HP 51626A (black for HP 500-series) and HP 51629A (black for HP 600-series) cartridges without making a hole in the cartridge. Consists of special cartridge holder, syringe, plastic tubing, and directions. **STARTER KIT** - with ink for 3 refills \$28.00. **EXTRA INK FOR SNAP & FILL SYSTEM** (black only) 4-oz. bottle \$18.00; 8-oz. bottle \$34.00. Specify whether for HP 51626A or HP 51629A.

## HARD-TO-GET PRINTER RIBBONS

Gorilla Banana, Commodore 1525 \$8.00; Adam Coleco \$12.00; TI-850/855 \$6.00; Centronics 700 Zip Pack \$5.00; C. Itoh Prowriter Jr., Riteman C+/F+ \$6.00; Riteman Inforunner \$8.00; Commodore MPS-801 \$5.00; MPS-803 \$7.00; Decwriter LA30/36 \$4.00; Apple Scribe \$4.00; Mannisman Tally Spirit 80, Commodore 1526 \$5.00; Epson JX-80 4-Color \$14.00; Printronix P-1013 \$11.00; Star SJ144 color 3-pack \$29.00.

ALSO HEAT & TRANSFER RIBBONS AND PAPER FOR PRINTING T-SHIRTS.

Over 300 different ribbons in stock. All ribbons new, not re-inked. Fully guaranteed.

Order directly or send SASE for complete list.

Add \$4.00 per order shipping. California residents add 7.75% sales tax. On ribbon orders over \$50.00 deduct 10% discount.

## H.T. ORR Computer Supplies

249 Juanita Way, Placentia, CA 92870-2216

714-528-9822 • 800-377-2023 • FAX 714-993-6216

<http://www.extremeplay.com/occomp/orr.htm>

Write in 188 on Reader Service Card.



**HO! HO! HO!**

Just in time for the holidays ...

Check out our special

gift subscription offer on page 96.

## WE'LL MEET OR BEAT ANY COMPETITOR'S PRICE!

ALL PRODUCTS  
1 Year Warranty



**BRAND NEW**

**Wavemaster 99 Channel**

• Sleep Timer • Std./HRC Switch • Parental Control

AS LOW AS \$45<sup>00</sup> COMPLETE

CHECK US OUT!



Formerly JES, Inc.

**BEST PRICES!**

**FAST SERVICE**

**SAME DAY SHIPPING**



**Panasonic I45 & I75's**

WE STOCK  
EVERY MODEL USED.

CALL NOW FOR

**WHOLESALE PRICING**

**TOLL FREE: 800-322-9690**



**FAX: 516-246-5634**

run or two or three?" He was already in the middle of sample #10's first run.

I checked my watch, "Can't, gotta get on home and toss a couple of Cornish hens in the oven before the wife gets home."

"Come to think of it, I'm getting hungry myself. Well, I've got time for another run - I'll let you know how it goes."

"Okay, take it easy. I'll give you a call tomorrow." I beat a hasty retreat out to my car.

And then, all of a sudden WHAM!!!

I woke up with my face flat on his concrete sidewalk, with people milling all around me, and a meat wagon up on the curb! Lying next to me was the plastic spray can lid.

Said I, "What the hell?" and finally managed to sit up. "Are you okay?" asked the ambulance driver.

"I think I'm in one piece, but my ears are ringing."

Right then Fred came staggering out what used to be his front door, one arm dangling uselessly, obviously broken. In his other, he was clutching a piece of chart recorder paper and waving it at me with a big grin! "I did it!"

"You certainly did," I said, looking at his demolished house front, "but what the heck did you do?"

"Look at all of these flat lines!" he said, pushing the recorder paper in my face, "Notice anything unusual? I pushed the current from 10 amps to 200 amps: ambient temperature, flat line! Zero voltage drop, flat line! Zero resistance, flat line! What's that tell you?"

I was starting to hurt. "You blew up your house, and your Old Lady's gonna be a little miffed?"

Fred was unperturbed, "I'll buy her a few more! Come on, read the chart, will you?"

I finally got it: "A room temperature superconductor! You're now fabulously wealthy - so THAT was your original theory! What about DIGI-LOG? Don't they own it?"

Now Fred was miffed! "Don't you remember, I already fulfilled their contract! They're getting two working alloys. This one's all mine. Although, they'll probably charge me for a new chart recorder; theirs didn't survive the blast."

"And I'm going to write your story up for a mere 10 times my usual fee! What caused the explosion anyway, Fred?"

"Oh, I had a little accident - dropped the acrylic spray can right on the resistor assembly. Which promptly vaporized when a slider shorted and put full current right through that big steel bench - shrapnel was flying all over the place. Pretty much missed everything except my wing."

Well, they loaded us into the meat-wagon, assuring us that our injuries weren't anything life-threatening. I finally had a chance to reflect, "You know, Fred, I never did like those ceramic superconductors."

"Me neither, Skip. They don't bend." Go Figure!!! NV



# Events CALENDAR

NOVEMBER 1998

## NOVEMBER 1

**CA - LIVERMORE** - Hamfest. Livermore ARK, Cliff Kibbe KF6EII, 209-835-6715. E-Mail: larkswap@hotmail.com  
**IA - DES MOINES** - Hamfest. Tikva Tracers ARC, Randall Lees NOLMS, 515-279-4241. E-Mail: rclees@raccoon.com  
**IL - MACOMB** - Hamfest. National Guard Armory, 8am-1pm. VE Exams. Talk-in: 147.060/147.660, 444.300/449.300. Lamoine Emergency ARC, Don Johnson KA9SQB, 309-833-4626. E-Mail: Don Johnson@ccmail.wiu.edu  
**NY - FARMINGVILLE** - Hamfest. Radio Central ARC, JoAnn Colletti N2IME, 516-399-1877. E-Mail: w02n@ll.net  
**OH - MASSILLON** - Hamfest. Stark County Fairgrounds, 305 Wertz Ave. N.W. Talk-in: 147.18+ repeater. MARC, Don Wade W8DEA, 330-497-7232; Terry Russ, 330-837-3091 before 10pm. E-Mail: MARC.HAMCLUB@JUNO.COM

## NOVEMBER 7

**CA - SANTEE** - ARC of El Cajon Ham, Computer & Electronic Swapmeet. Santee Drive-in. 619-561-0052  
**FL - MIAMI** - Hamfest. Flamingo Net/University of Miami ARC, Walt Dixon W4DWN, 305-895-0398  
**FL - SORRENTO** - Hamfest. Lake ARA, Chuck Crittendon KA4EXM, 352-669-2075  
**KY - HAZARD** - Swapfest. Hazard High School, south end of Rt. 15, Hazard Bypass. 8am-2pm. VEC Exams. Talk-in: 146.07/67. KY Mountains ARC, John Farler K4AVX, 606-436-5354. E-Mail: jfarler@mis.net Web: http://www.geo.cities.com/SiliconValley/2564/hf.html  
**NH - LONDONDERRY** - Ham Radio Flea Market. Lions Club, Mammoth Rd. (Rt. 128). 8am-1pm. The Interstate Repeater Society ARC, Paul Gifford, 603-432-1538. E-Mail: k1llx@juno.com  
**NM - SOCORRO** - Hamfest. SARA, TARA, & City of Socorro, Al Braun AC5BX, 505-835-3456 days or 505-835-1061 eves. E-Mail: AC5BX@juno.com Web: http://www.ees.nmt.edu/sara/  
**OK - ENID** - Hamfest. Garfield County Fairgrounds, Hoover Bldg., Oxford & 4th Sts. 8am-5pm. VE Exams. Talk-in: 147.15+ 444.400+. Tom Worth N5LWT, 580-233-8473. E-Mail: N5LWT@HOTMAIL.COM. Fred Selfridge N5QJX, 580-242-3551. E-Mail: FREDNREL@IONET.NET  
**SC - MYRTLE BEACH** - Beachfest '98. Myrtle Beach High School, 38th Ave. N. VE Exams. Talk-in: 147.12. GSARC, Jim Wood KF4CJE, 843-238-0800. E-Mail: kf4cje@juno.com Web: www.w4gs.org, http://www.qsl.net/kf4hav/hamfest.htm  
**TX - AZLE** - Hamfest. Tri-County ARC, David Johnson KB5YLQ, 817-922-1081 days, 817-444-2369 eves. E-Mail: kb5ylg@gte.net Web: http://www.qsl.net/tcarc-ntxl  
**WI - WAUKESHA** - Hamfest. Milwaukee Repeater Club, Mike KB9PHA, 414-258-4435. Web: http://execpc.com/~mrc/friendlyfest.htm

## NOVEMBER 7-8

**GA - LAWRENCEVILLE** - Hamfest. Gwinnett County Fairgrounds. Sat: 9am-5pm, Sun: 9am-3pm. VE Exams. Talk-in: 145.45, PL 107.2 if necessary. Alford Memorial RC, Randy Bassett KR4NQ, 770-410-3989. E-Mail:

The Events Calendar is a free service for publicizing electronic events such as amateur radio hamfests, flea markets, etc. If your organization is sponsoring an event and would like a free listing, contact us at least 60 days in advance. 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.

All listing information should be sent to:

**Nuts & Volts Magazine  
Events Calendar**  
430 Princland Court  
Corona, CA 91719  
Phone 909-371-8497  
Fax 909-371-3052  
E-mail events@nutsvolts.com

Hamfest@totr.radio.org

**TX - ODESSA** - Hamfest. Ector County Coliseum, Exhibit Bldg. D., 42nd & Andrews Hwy. Sat: 8am-5pm, Sun: 9am-1pm. VE Exams. Talk-in: 145.470. West TX ARC, Robert Jordan N5RKN, 915-335-7980. E-Mail: n5rkn@apex2000.net Web: http://www.apex2000.net/personal/wd5cwj/main2.htm

## NOVEMBER 8

**WI - KAUKAUNA** - Hamfest. Starlite Club, Corners of Hwy. 55 & CR JJ. VE Exams. Talk-in: 146.52 simplex. Fox Cities ARC, Chad Pennings N9PRC, 920-993-0485. Web: http://www.w9l.ampr.org

## NOVEMBER 14

**AL - MONTGOMERY** - Hamfest & Computer Show. Garrett Coliseum, S. AL State Fairgrounds. 9am-3pm. Phil 334-272-7980 after 5pm CST. E-Mail: wb4ozn@worldnet.att.net  
**CA - FONTANA** - Inland Empire ARC Amateur Radio & Electronics Swapmeet. A B Miller High School. Bill 909-822-4138 eves  
**FL - PORT ST. LUCIE** - Hamfest. St. Andrew Lutheran Church, 295 N. Prima Vista Blvd. 8am-2pm. Talk-in: 146.955. Port St. Lucie ARA, Roy J. Cox KT4PA, 561-340-4319. Paul Harrison KI4MG, 561-878-2475. E-Mail: julian@ecqal.net Web: www.geocities.com/CapeCanaveral/Hangar/4533  
**FL - TITUSVILLE** - Hamfest. Titusville ARC, Bud Hughes K4CWG, 407-267-3450. E-Mail: bud@expedient.com  
**LA - WEST MONROE** - Hamfest. Twin City Ham Club, Mark Ketchell N5MYH, 318-323-6621. E-Mail: TCHC@iAmerica.net  
**LA - WEST MONROE** - Hamfest. Twin City Ham Club, Mark Ketchell N5MYH, 318-323-6621. E-Mail: TCHC@iAmerica.net  
**LA - WEST MONROE** - Hamfest. Twin City Ham Club, Mark Ketchell N5MYH, 318-323-6621. E-Mail: TCHC@iAmerica.net  
**LA - WEST MONROE** - Hamfest. Twin City Ham Club, Mark Ketchell N5MYH, 318-323-6621. E-Mail: TCHC@iAmerica.net

## NOVEMBER 14-15

**IN - FT. WAYNE** - Hamfest & Computer Expo. Allen County War Memorial Coliseum-Expo Center. Sat: 9am-4pm, Sun: 9am-3pm. VE Exams. Talk-in: 146.88(-). Doug Jones N9NNT, 219-484-3317. E-Mail: djones2233@aol.com Web: http://www.pipeline.com/~dagagnon/

## NOVEMBER 15

**MA - PLYMOUTH** - Hamfest. Mayflower ARC, Jack Kenely K1BFJ, 508-830-3452. http://members.aol.com/wa1vkd/flyer.htm  
**NC - BENSON** - Jarsfest. American Legion Complex, Hwy. 301, N. 8am-4pm. Talk-in: 147.270 + 600. VE Exams. Johnston ARS, Paul Dunn KD4BJD, 919-894-3100. Web: http://www.jars.net

## NOVEMBER 18

**FL - ST. PETERSBURG** - Hamfest. Pelican Chapter #128 QCWA, Jay Strom K9BSL, 813-822-9107

## NOVEMBER 20-21

**MS - OCEAN SPRINGS** - Hamfest/Swapfest. Latimer Community Center, N. of I-10, Exit 50. Fri: 5-9pm, Sat: 8am-2pm. Talk-in: 145.110 N5OS (-600). West Jackson County ARC, Phil Hunsberger W9NZ, 228-872-1499; Harry McLemore KD4AK, 228-872-0732

## NOVEMBER 21

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

**IL - LITCHFIELD** - Hamfest. Central IL/St. Louis Area ATV Club, Scott Millick K9SM, 217-532-3837

## NOVEMBER 21-22

**FL - TAMPA** - Suncoast Amateur Radio & Computer Convention. State Fairgrounds, Expo Hall. Ed Pellenz N4HRN, 813-685-7115 or 813-272-7021 xt. 3320. E-Mail: epellenz@cftnet.com Web: http://www.fgcarc.org

## NOVEMBER 22

**IL - WHEATON** - Radio Fest, Electronics Flea Market. DuPage County Fairgrounds, Manchester Rd. GMRs of Illinois, Inc., 815-756-3933 or 630-393-3937  
**NY - POUGHKEEPSIE** - Hamfest. Mt. Beacon ARC, Ken Akasofu KL7JQC, 914-485-9617

## NOVEMBER 28

**IN - EVANSVILLE** - Winter Hamfest. Vanderburgh County Fairgrounds, Exposition Center. 8am-2pm. 145.150-Evansville, 146.925-E 443.925+ Vincennes. EARS, Neil WB9VPG 812-479-5741.

Continued on page 72

## COMPUTER SHOWS

**AGI Shows**, 317-299-8827. E-Mail: info@agishows.com http://www.agishows.com

**Blue Star Productions** 810-788-1901 http://www.supercomputersale.com

**Computers And You**, 734-283-1754. www.a1-supercomputersales.com

**Computer Central Shows** 847-412-1900 & 1-888-296-6066. E-Mail: compcent@megsnet.net www.computercentralshows.com

**Five Star Productions** 810-890-0988 E-Mail: jeff@fivestar www.fivestarsystems.com

**Georgia Mountain Productions** 706-388-4827. E-Mail: gamtntpro@blrg.tds.net georgiamountain.com

**Gibraltar Trade Center, Inc.** 734-287-2000. Taylor, MI.  
**Gibraltar Trade Center, Inc.** 810-465-6440. Mt. Clemens, MI.

**MarketPro, Inc.**, 201-825-2229 http://www.marketpro.com

**MarketPro, Inc.**, 301-984-0880. E-Mail: md@marketpro.com http://marketpro.com

**Northern Computer Shows** 978-744-8440. E-Mail: inquiries@ncshows.com Web: ncshows.com

**Peter Trapp Computer Shows**, 603-272-5008. Web: www.petertrapp.com

## \$\$\$ We Can Save You Money \$\$\$

Computers	PCB Manufacturing	PCB Assembly Services	Full Line Of Electronic Components
Custom Built PC's at the Lowest Prices  Computer Accessories	Single & Double Sided	Board Stuffing Wave Soldering Acquisition of Parts	IC's Semiconductors Capacitors Resistors Sockets Relays Transistors & More
Call <b>Chaffin Electronics</b> Toll Free at (800) 442-2330			
<b>WE WANT YOUR BUSINESS!!! BIG OR SMALL</b>			
Phone (800) 442 2330	Fax (740) 354-9462	Email ccinc@zoomnet.net	Internet www.chaffinelectronics.com

Write in 67 on Reader Service Card.

## RF Science & Technology

P.O. Box 606, 21 Market St. N., Smiths Falls, Ont., K7A 4T6 Canada  
 phone: (613) 283-5195 fax: (613) 283-0637

### Superior Electronics at Affordable Prices

 <b>Frequency</b> MIC-1026 \$129 MIC-10026 \$99	 <b>Multimeters</b> TES-2610 \$124 TES-2300 \$139	 <b>Active Antenna</b> M-20 \$66.95	 <b>Torches</b> \$25 to \$35 Prices subject to change without notice see our on-line catalogue for details and ordering instructions
---	--	--	---

**SAVE MONEY NOW!!!** Order On-line with our secure server  
 http://www.falls.igs.net/~rftech rftech@falls.igs.net  
 our complete catalogue is on-line, with many new items being added soon

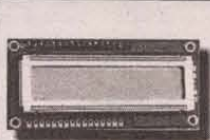


# LOWEST COST LCD'S ON EARTH



## VIDEO LCD

4 Inch Video NTSC \$150  
Sharp P/N 4LU4E  
Composite NTSC & RGB Input  
12:00 OR 6:00 Viewing Angle  
Integrated Backlight & Inverter  
Extended Temp: -10 to +60 C  
Brightness: 260 nits  
Power Consumption: 4.3 Watts  
Contrast: 50 to 1



## CHARACTER LCD

OPTREX DMF-5005SN-EW  
240 x 64 Graphic EL Backlit STN \$30  
OPTREX DMF-5005N  
240 x 64 Graphic Reflective STN \$30  
SANYO DM2023-7G1  
2 x 20 Character Reflective STN \$8  
SHARP LM20A21  
2 x 20 Character Reflective STN \$8  
VIKAY 2035TNDL NOTW-D  
2 X 16 Character LED Backlit STN \$8



## LCD MONITOR

10.4" DSTN or 12.1" TFT  
Analog SVGA Input  
Autosync  
Auto Sizeing  
Automatic Expansion of VGA  
images to SVGA (On 12.1")  
Very Aggressive Pricing  
Starting under \$500!



## TOUCH MONITOR

EarthVue 10.4  
10.4" VGA TFT  
Analog VGA Input  
105 Nit Brightness  
RS-232 Touch Screen Option  
Only 9.9" W x 7.7" H x 1.5" D  
Ideal For Factory Automation  
Fully Articulating Ball Mount  
Only \$1095 With Touch



## LCD DISPLAYS

6.3" Mono STN \$60  
9.4" Mono Reflective \$60  
8.4" TFT \$250  
9.4" DSTN \$150  
10.4" TFT \$350  
10.4" DSTN \$240

NoteBook Screens  
340 Models in Stock  
Obsolete Screens Stocked  
Hard To Find LCD? Call!



## CONTROLLERS

ISA  
PCI  
PC/104  
NTSC  
Analog VGA  
Complete LCD Kits with LCD,  
Controller & Cable Starting  
under \$200



**EARTH**

Computer Technologies

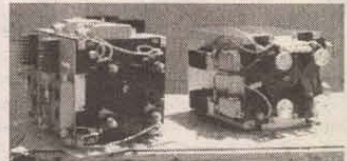
"The World Leader In LCD Recycling"

Ph: (949) 361-2333 Fax: (949) 361-2121  
<http://www.flat-panel.com>

Write In 32 on Reader Service Card.

## HAM GEAR FOR SALE

**WANTED: ROCKWELL**-Collins HF-80 equipment, 851S-1, 237B-3 log periodic, Collins literature. Jim Stitzinger 805-259-2011, 805-259-3830 (fax), bfl-jfs@smartlink.net



**CELLWAVE 4** channel cavity, ferrite transmitter combiners. 870MHz combiners will tune down to 860MHz. Cellwave model no. 505980. Dimensions: 13x18x13 inches. Weight: 50 lbs. \$475. Cellwave power monitor ZRB101 with DSG-2 sensor \$275. Test Equipment, 1412 S. Central Park Ave. #D, Anaheim, CA 92802. 714-778-5151. Fax 714-778-0312.

**THE SMART BATTERY CHARGER** for lead acid or gel cell batteries. Can be left connected to the battery INDEFINITELY, will not overcharge! Standard kit is 12V @ 1 amp. This kit is 100% complete. For the kit order #150-KIT at \$59.95. For an assembled and tested unit, order #150-ASY at \$79.95. CA residents add 7.75% sales tax. Add \$6.50 per unit shipping. MC/VISA accepted. A&A Engineering, 2521 W. La Palma #K, Anaheim, CA 92801. 714-952-2114, FAX 714-952-3280.

**MILITARY COMPONENTS** wanted. Capacitors, resistors, diodes, transistors, semiconductors, ICs. Electronic Material Industries, 818-769-1002, FAX: 818-769-1084.

**LML RADIO 2** meter mobile amp by Motorola 60 watt \$30; Motorola Mostar VHF 16 ch. prg. 45W \$30; MT500 50MHz \$35; Syntor VHF 45W prg. UHF repeater 15W programmable 256 channels \$120. Free catalog 909-873-1319. Fax on demand 24 hr. 909-820-1885. Web catalog: <http://members.aol.com/hrh6/LMLinc> Write 424 E. Shamrock, Rialto, CA 92376.

**HAM EQUIPMENT** repair or overhaul Collins, Drake, Swan, Astro, Yaesu, Kenwood, etc. 20 years experience with former Slep Electronics Co. Same excellent service, same reasonable rates, satisfaction guaranteed. Brooks Electronics, 828-349-3503. E-Mail: [rwbrooks@dnet.net](mailto:rwbrooks@dnet.net)

**MOTOROLA GP-68 VHF** (136-174MHz) or UHF (430-470MHz) commercial handhelds 20 ch., DTMF keypad, PL/DPL, rapid 3 hours desktop charger 1200mAh battery, user programmable only \$295 ea. Order on the web: <http://www.nsradio.com> E-Mail: [info@nsradio.com](mailto:info@nsradio.com) Tel 253-946-2426 Fax 253-946-8311. NSI Communications, Inc.

**SPECTRUM ANALYZERS**, test equipment. Closing R&D/manufacturing company. Must sell lots of equipment. Call 1-800-869-7827 or visit [www.starcom.com](http://www.starcom.com)

**NEW PRODUCTS FROM S & S: UPGRADE YOUR OLD RIGS! Digital dial** (counter) has 10Hz resolution HF, 100Hz VHF and frequency range 50KHz to 230MHz; kit \$99.95; assembled \$149.95. **NEW Digital VFO** with 1Hz resolution to 54MHz; kit \$169.95; assembled \$219.95. S&H \$7 (Continental US). **GUARANTEED TO WORK.** For info send **SASE.** Call/write to order: S & S Engineering, 14102 Brown Rd., Smithsburg, MD 21783. 301-416-0661, E-Mail: [N3SAD@aol.com](mailto:N3SAD@aol.com) or see <http://www.xmetric.com/sseng>

## HAM GEAR WANTED

**MILITARY COMPONENTS** wanted. Capacitors, resistors, diodes, transistors, semiconductors, ICs. Electronic Material Industries, 818-769-1002, FAX: 818-769-1084.

## CB - SCANNERS

**SALES, SERVICE:** CB equipment, radios, modifications, power mice, echo-reverb boxes, kits, meters, filters, antennas, noise toys, mounts, hard-to-find items. Partial list \$1, complete list \$4. D&R Electronics, 10 Park St., Thomaston, CT 06787. 860-283-9492.

**RED BOOK CB MODIFICATION.** Audio, modulation, PLL/VCO, sliders, \$25. Ken's 2825 Lake, Kalamazoo, MI 49001. 616-345-4609. [www.kenselectronic.com](http://www.kenselectronic.com)

**BLACK BOOK CB LINEARS.** Theory, 60 schematics. \$25. KEN's, 2825 Lake, Kalamazoo, MI 49001 616-345-4609. [www.kenselectronics.com](http://www.kenselectronics.com)

**ORANGE BOOK SCANNER REPAIR.** 500 models, modifications, \$25. KEN's, 2825 Lake, Kalamazoo, MI 49001 616-345-4609. [www.kenselectronics.com](http://www.kenselectronics.com)

**SCANNING USA:** monthly magazine 100% scanning. All the news and product reviews from the writers you trust. Get more from your scanner. Subscriptions \$24.95, samples \$3. Call 1-800-651-0922 your Visa or MasterCard, or write 2054 Hawthorne, Joliet, IL 60435

**"CB MODIFICATION SECRETS,"** new 200-page guide by author of "CB Radio Hacker's Guide." More easy AM/SSB CB upgrades & enhancements: Cobra, Realistic, Uniden, President, etc. Freq. expansion, VFO, clarifier unlock, VOX, Roger Beep, anti-theft device, receive preamp, more. Only \$21.95, plus \$5 S/H (\$7 to Canada). CRB Research, Box 56, Commack, NY 11725. NYS res. add \$2.22 tax. Visa/MC orders call: 516-543-9169.

**CB RADIO EQUIPMENT:** Selling all kinds of equipment! For details E-Mail: [rushead1@juno.com](mailto:rushead1@juno.com)

# AMAZING PRODUCTS! INFORMATION

## ATTENTION!! RAILGUN EXPERIMENTERS

**HIGH ENERGY PULSER** EXPERIMENTERS AND RESEARCHERS  
RAIL GUN, COIL GUN, EXPLODING WATER, ANTIGRAVITY, MASS  
WARPING, LEVITATION, PLASMA PROPULSION, LATTICE SHAPING, EMP etc.

- Lossless Energy Charging
- Programmable Voltage to 2 KV and Energy Control to 3 KJ
- Triggered Spark Switch [IKJ]
- Universal 12 VDC or 115 VAC
- 7.5 X 7.5 X 7" Light weight

HEP3 Plans High Energy Pulser/Ignitor.....\$15.00  
HEP3K Kit/ Plans (With 500 Joules Energy Storage).....\$49.50  
HEP30 Assembled (With 500 Joules Energy Storage).....\$449.50  
All Individual Parts and Subassemblies Available

## JACOBS LADDER

Observe a pyrotechnical display of "traveling" fiery plasma. Starts off as 1/2" arc and expands to over 3" before evaporating into space. This is an excellent attention getting display as well as a winning science project! With arc control.

JACK1 Plans.....\$8.00  
JACK1K Kit/ Plans.....\$129.50  
JACK10 Ready to Use.....\$249.50

12KVG20 Pwr Supply Only.....\$99.50  
12KVG20K Kit of Pwr Supply.....\$79.50

## 3Mi FM VOICE TRANSMITTER

Safety Protocol Allows Listening to Children or Invalids in Hazardous Areas, Pools, Ponds etc. Great Security Intrusion Alert! Uses FM Table Top Radio.

FMV1K Kit/Plans.....\$39.50

## ATTENTION!

### ANTI GRAVITY,

We Can Supply Low Cost HIGH VOLTAGE Current Producing Generators from 50 to 500 KV. Contact Factory For Details or Call 603 673 6493

## MICRO MINI MITE

### TESLA COIL

LIGHTS UP A 4 FT. FLUORESCENT TUBE WITHOUT CONTACT!!  
YET ONLY 3" TALL!  
Super Magic Trick  
Low Cost Science Project  
12 VDC/115 VAC Operation  
MTC1K Kit/Plans.....\$19.50  
MTC10 Ready to Use.....\$34.50

## BURNING LASER RAY GUN

BLASTS THRU THE HARDEST OF METALS!

All Parts Available  
LAGUN2 Plans.....\$20.00

## BURNING CO2 BENCH LASER

HOTTER THAN MOST TORCHES!

All Parts Available  
LC7 Plans.....\$20.00

## PHASOR BLAST WAVE PISTOL

130 db of Directional Sonic Shock Waves Energy Handheld and Battery Operated

PPPI Plans.....\$8.00  
PPPIK Kit/Plans.....\$49.50  
PPPI Ready to Use.....\$79.50

## HOVERBOARD PLANS

Kit Soon to be Available

28 Pages of "how to" build a magnetic force field capable of containing a column of ionized air up to several psi. Proven theory may require additional experiment

HOVER Plans.....\$25.00

## ELECTRONIC HYPNOSIS

### AND MIND CONTROL

Generates Highly Effective Audible and Visual Stimuli With Bio-Feedback That Can Induce Hypnotic as Well as ALPHA Relaxed States of the Mind. Place Subjects "Under" Your Control. Enhances Hidden PSYCHIC Ability in Many People!

MIND Plans.....\$15.00  
MIND2K Kit and Plans.....\$49.50  
MIND20 Assembled.....\$89.50

## TELEPHONE TAPING SYSTEM

Tapes Phone Conversation 20 Mega Input 21 Check Level

TAP30X Ready to Use.....\$84.50  
BEEP10 Beeper Alert.....\$29.95

## TRANSISTORIZED TESLA COIL

Turns A LIGHT BULB INTO A SPECTACULAR PLASMA DISPLAY

Transmits Wireless Energy Noiseless Operation Pyrotechnic Effect  
12 VDC/5 Amps or Battery 115 VAC Optional Converter Adjustable Frequency Control For Effect

TCL5 Plans.....\$8.00  
TCL5K Kit/Plans.....\$59.50  
TCL50 Ready to Use.....\$109.50  
12DC/7 12VDC/7Amps.....\$39.50

1 800 221 1705 ORDERS ONLY! FAX 1 603 672 5406 INFO 9-5pm 1 603 673 4730 FREE CATALOG ON REQUEST  
Pay by MC, VISA, Cash, Chk, MO, COD. Please Add \$5.00 S&H plus \$5.00 if COD. Overseas Please Contact for PROFORMA



# LASERS & ACCESSORIES

## HELIUM NEON LASERS

- ☒ Complete Systems
- ☒ Plasma Tubes
- ☒ Power Supplies

## ACCESSORIES

- ☒ Optics
- ☒ Electro-Optics
- ☒ IR Viewers
- ☒ Books & More



**MEREDITH**  
**INSTRUMENTS**

Phone: 602-934-9387 • Fax: 602-934-9482

## DIODE LASERS

- ☒ Visible / IR
- ☒ Complete Modules
- ☒ Collimating Optics
- ☒ Drive Circuits

## FREE CATALOG

WEB SITE:

www.  
mi-lasers.com

Write in 34 on Reader Service Card.

**240+ CHANNEL CB/HAM/COMMER-**  
**CIAL** radios: AM/FM/SSB/CW  
export/domestic: RCI, Motorola, Uniden,  
Cobra, Alinco, Kenwood. Mics, antennas,  
linears, meters, books, night scopes, and  
tons more stuff! Catalog \$3. MAXTECH,  
Box 8086, New York, NY 10150. 718-  
547-8244.



**ULTIMATE MODIFICATION BIBLE.**  
Mind boggling is the only way to describe  
this 220 page book. Modification of CBs,  
channels, power, sliders, talk back and  
more. 10 meter radios, HAM RADIO,  
scanners, toys, meters, and more. Only  
\$29.95 + \$3.25 shipping. Phone orders  
1-800-256-9895 (MC-Disc-Visa) No  
CODs.

**CB MODIFICATIONS! Frequencies,**  
**books, kits, high-performance acces-**  
**sories, plans, repairs, amplifiers, 10-**  
**meter conversions. The best since**  
**1976! Catalog \$3. CBCI, Box 1898NV,**  
**Monterey, CA 93942.**

**SUPERSTAR, GALAXY, Mirage,**  
Uniden, Cobra, microphones, power  
supplies, scanners hard-to-find products,  
picture price sheets. \$1 to cover postage  
(REFUNDABLE). Galaxy, Box 1202,  
Akron, OH 44309. Over 10 yrs. in busi-  
ness.

**KONNEX DISTRIBUTING.** Call 1-888-  
777-7874, PO Box 451372, Los Angeles,  
CA 90045. CBs, antennas, meters, transis-  
tors. Best prices. Credit card accept-  
able.

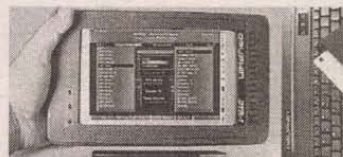
## MUSIC & ACCESSORIES

**MODULAR ANALOG SYNTHESIZER**  
**KITS.** Build your own studio-quality  
music synthesizer. Complete with all  
parts, double-sided PCB, front panel and  
solder. Includes 20+ page  
instruction/tutorial manual, full schemat-  
ics. New kits added every month!  
Synthesis Technology. Phone/fax 817-  
498-3782. More information on our web-  
site: [www.synthtech.com](http://www.synthtech.com) E-Mail:  
[synth1@airmail.net](mailto:synth1@airmail.net)

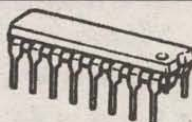
## COMPUTER HARDWARE

**NEC 386SL** 25MHz color notebook com-  
puters 4MB RAM 120 HD \$100. John  
973-591-0523.

**CRTs CHEAP.** Buy direct from the  
manufacturer. Save money. Mfg. all CRT  
types since 1950. **3 year warranty.** Reg-  
Res 19" tubes \$75; 25" \$100; hi-res 13"  
tubes from \$80. We specialize in **hi-res-**  
**olution** video/computer CRTs. T.M.C.  
215-226-0749/215-223-0388.



**THE SMALLEST AND COOLEST,**  
**FULL IBM PC EVER MADE!** Yours for  
\$649! Cost was \$4,000. People are  
amazed when they see it! Extremely well  
made. Weighs only 2 pounds! Measures  
9"x5.5"x1.37"! Take it wherever you go!  
Runs any application for DOS or  
Windows 3.1. Windows for pen comput-  
ing has animated icons & sound annota-  
tion with a cool female personality. Only a  
few available, so don't wait a single day.  
Built-in handwriting recognition and on-  
screen or external keyboard. Electronic  
pen acts as a mouse and doesn't need to  
touch the glass screen to move the cur-  
sor! 486/25 with 4 meg RAM and 80  
megabyte capacity. Razor sharp 6" mono  
screen 640x480/1 meg VGA touch  
screen, built-in speaker,  
parallel/serial/ext. monitor, outputs.  
Includes: electronic pen, battery, glove  
leather case, AC supply, compact exten-  
sion keyboard is the same size as the  
computer. Small external half inch high  
1.4 floppy. Books and software. Netcom  
1-800-733-3733 ext. 6300.



**WANTED: EXCESS ELECTRONIC**  
**INVENTORIES, ICs, MEMORY,**  
**EPROMs, PALs, LEDs, CIRCUIT**  
**BOARDS, DIODES, AND TRANSIS-**  
**TORS. CALL ACTIVE MICRO, 562-494-**  
**4851 OR FAX 562-494-4913.**

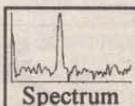
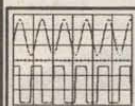
**COLOR LASER PRINTERS:** Hewlett  
Packard Color Laserjet (3100A)  
\$1,490; QMS Colorscript 210 (post-  
script) \$995; QMS Colorscript 230  
(postscript) \$1,395; QMS Magicolor  
CS1000 (11x17") \$1,695; Tektronix  
Phaser (4693PX) \$595; Tektronix  
Phaser 200i (postscript) \$895;  
Tektronix Phaser III PXI (11x17")  
\$995; Tektronix Phaser 300i (11x17")  
\$1,695. Accept VISA, MasterCard,  
AMEX. 60 day warranty. Call MAPLE  
DATA: 908-964-7070. E-Mail:  
[Maplesales@aol.com](mailto:Maplesales@aol.com)

**4 MB, 72 Pin SIMMs \$4 ea.** Pikul &  
Associates, 314-937-0335.

# Digital Storage Oscilloscopes

From \$189?

ATC modules connect to your PC printer port and  
transform it into a full-function DSO, spectrum analyzer,  
logger, & DVM. Units DC to 25MHz



Captured  
Waveforms  
Pico Tech  
ADC-200 in  
Windows

O-Scope II  
in DOS

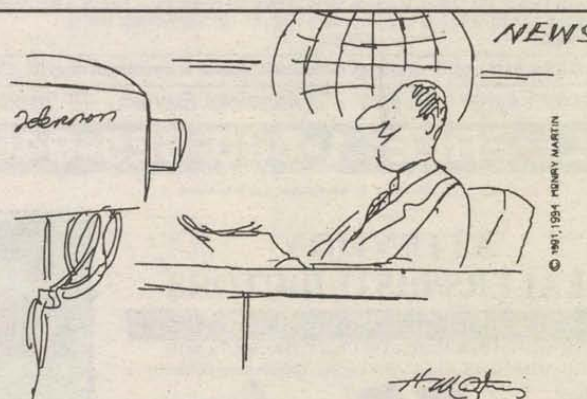


ATC proudly announces the addition of Pico  
Technology Ltd. products to our product line.  
Pico is based in Britain and offers a variety of  
data logging and virtual instrument modules.

O-Scope 1p (ST 50KHz).....\$189  
O-Scope II (DT 500KHz).....\$349  
ADC-100 (DT 12bit 50KHz)..... \$449  
ADC-200/20 (DT 10MHz)....  
ADC-200/50 (DT 25MHz)....  
Loggers 1-22 ch. (8-16 bit) from \$99  
Shipping UPS \$7.50 grnd, \$11.50 (2 day)

**CALL**

**800-980-9806**  
**Allison Technology Corporation**  
2006 Finney Valley Rd., Rosenberg, TX 77471  
Fax: 281-239-8006 Technical: 281-239-8500  
E-Mail: [atc@accesscomm.net](mailto:atc@accesscomm.net)  
<http://www.atcweb.com>



"More on the declaration of World Peace later,  
now for some really important news..."

## CYBER-TEST NOW HAS HEWLETT PACKARD LASER PRINTER PARTS AVAILABLE!

The news is true! Cyber-Test now can provide a complete line of affordably priced  
Hewlett Packard parts. We also offer laser printer parts for other popular brands  
like Okidata, Panasonic and Brother. Call today for details and availability.



**THE PARTS PLACE**

**800-881-3344**  
**www.cyber-testinc.com**

448 Commerce Way - Bldg. 100  
Longwood, Florida 32750  
Fax: 407-260-0922



# WE BUY & SELL!

**C and H**

**50 YEARS IN BUSINESS**  
**SALES COMPANY**

2176 E. Colorado Blvd.  
Pasadena, CA 91107

Take advantage of our special purchase on TEST EQUIPMENT

## HIGH PRECISION DIGITAL MULTIMETER

FLUKE, Model 8810A. LED readout. 5-1/2 digit auto-ranging multimeter. Has ohms converter and true rms options. Accuracy AC volts 0.1% to 0.5%, AC rms 0.2% to 0.4%, DC volts 0.01%, ohms 0.02% to 0.2%. Max input voltage 1000 VDC or peak AC. Input impedance to 1 to 1000 meg ohms depending on range. Power input voltage 115 VAC 50/60 Hz. Has built-in carrying handle that can be used as a tilting base. Dimensions: 9-1/4" wide x 14-1/2" deep (including carrying handle) x 3-1/4" high.

Stock #TE9805

\$295.00



## MILLIOHMETER

HEWLETT PACKARD, Model 4328A. Designed to measure very low resistances. Measurement range 1m ohm to 100 ohms. Resolution 20 u ohms. Analog meter readout. Ideal for measuring contact resistance of switches or relays. This unit is also useful for measuring the resistivity of semiconductor devices. (Requires special 4 terminal probes which are not supplied, but probably are available from Hewlett Packard.) Power input: 115-230 VAC 48-66 Hz, 5 VA max. Dimensions: 5-1/8" wide x 11-1/2" deep x 6-1/2" high.

Stock #TE9812

\$200.00



## 3-1/2 DIGIT DIGITAL MULTIMETER

FLUKE, Model 8000A. LED readout. Classic digital multimeter. Ideal companion to our Stock #TE9800 counter. Measures AC/DC volts/milliamperes plus ohms. Input range 0-200 mV to 1200 volts, 0-200 uA to 2000 mA, 0 to 2000 K ohms. Portable unit with carrying handle which also can be used as a tilt stand. Input impedance 10 meg ohms. Max. input voltage 1200 VDC or rms. Accuracy DC volts 0.1% of input +1 digit. AC volts 0.5% of input +2 digits 45 Hz to 10 KHz. Input power 115 VAC 50 to 400 Hz 5 watts. Dimen.: 8-1/2" wide x 12" deep (including carrying handle) x 2-1/2" high.

Stock #TE9801

\$75.00



## 200,000 COUNT DIGITAL MULTIMETER, FLUKE, Model 8800A. LED readout.

6-digit, auto-ranging multimeter. Basic accuracy  $\pm 0.05\%$ . 15 ranges DC volts:  $\pm 200$  mv to  $\pm 1200$  in 5 ranges accuracy  $\pm 0.08\%$  or better. AC volts: 2 VAC to 1200 VAC in 4 ranges. Accuracy  $\pm 1\%$  or better depending on frequency and range. Resistance 200 ohm to 20 meg ohms in 6 ranges. Accuracy  $\pm 0.2\%$  or better. Input impedance: 1000 meg ohms or more on DC ranges, 2 meg ohms on AC ranges. Has complete overload protection and isolated inputs. Power input 110/230 VAC 50/60 Hz 8 watts. Built-in carrying handle that also acts as a tilt-up base. Dimensions: 3-1/2" high x 9" wide x 12-1/2" deep.

Stock #TE9815

\$100.00



**3600 RPM DC MOTOR WITH OPTICAL ENCODER** PACIFIC SCIENTIFIC, #4VM82-004-4. 30 volts nom. input voltage. Permanent magnet, reversible servo motor. Has Hewlett Packard optical encoder. Ball bearings. No load speed at 30 VDC input is 4600 rpm. No load current 0.75 amp at 60 oz-in load rpm is 3600, current is approx. 6.6 amps. Torque constant is 9.1 oz-in per amp. Rotor inertia 0.0007 oz-in-sec<sup>2</sup>. Terminal resistance 0.89 ohm. Optical encoder is similar to "HEDS 6000" series. Encoder has 1024 counts per revolution, two channel quadrature output. Outputs are TTL compatible. Encoder requires 5 VDC input at less than 50 mA input current. Dual shafts: front shaft is 3/8" dia x 3/4" long. This shaft is tapped on the end 8X32 tpi. Rear shaft is 1/4" dia x 7/16" long. This shaft has dual flats that measure approx 3/16" across. Motor has four 8X32 tpi tapped mounting holes on front. A 3-3/16" dia. centering pilot is also provided on the front face. Dimensions: 4" dia. x 5-1/2" long (excluding shafts.)

Stock #DCME9850

\$79.50



Call us first if you have surplus inventories of electronic, optical, or mechanical items for disposal

☒ Master Charge ☒ Visa ☒ American Express ☒ Discover

**TOLL FREE: 1-800-325-9465**

Write in 35 on Reader Service Card.

## ATTENTION DEALERS/DISTRIBUTORS

BUY DIRECT FROM THE MANUFACTURER

THESE AND OTHER VIDEO SECURITY PRODUCTS NOW AVAILABLE!!!! (DEALERS/DIST. ONLY) Minimum Order.

	Qty 5	Qty 10	Qty 20	Qty 50+
CCD Cameras				
B&W Board	\$57	\$52	\$47	Call!
B&W Board/sound	\$62	\$57	\$52	Call!
B&W Mini	\$65	\$60	\$55	Call!
Color - Mini	\$150	\$142	\$135	Call!

\*B&W CCDs use Sansone Chips. Color CCDs use Sony.

Guardian Eye



## CCD Camera Hidden Inside a "Magnavox" Clock

	Qty 5	Qty 10	Qty 20	Qty 50+
CCD Clock				
B&W Wired	\$144	\$129	\$114	Call!
B&W Wireless	\$289	\$264	\$248	Call!
Color Wired	\$234	\$218	\$199	Call!
Color Wireless	\$387	\$362	\$345	Call!

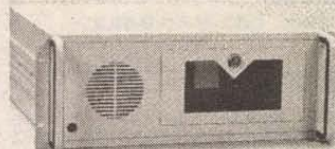
Wireless use 2.4GHz standard transmitters and receivers.

**Call ATN Today for the Best Prices and Quality Security Products.**

American Technologies Network Corp.  
20 S. Linden Ave. #1B  
S. San Francisco, CA 94080  
www.atncorp.com  
1(800)910-2862  
1(650)875-0130  
fax: 1(650)875-0129  
sales@atncorp.com

Write in 36 on Reader Service Card.

**PENTIUM MOTHERBOARDS, VIA** chipset, 1MB, AGP, 100MHz operation, 3 ISA/3 PCI, \$99. **CPUs:** Celeron 128K 300/333 @ \$169/209. Pentium II: 300/333/350/400/450 @ \$239/259/319/499/699; **IBM/Cyrix** 233/266/300/333 @ \$66/78/99/179; **AMD K6 MMX** 233/266/300/300 @ \$99/109/129; K6-3D 266/300/333/350 @ \$99/139/159/239. **36X CD-ROM**, audio button \$49, 32/64MB SDRAM 10ns DIMM \$46/98, 64/128MB PC-100 DIMM \$101/199. S3 Trio 3D 4MB AGP video card \$34. Call for current pricing, other parts and illustrated catalog, faxback catalog pages, 1-year warranty or better. tech-specialties, Inc., 5703 Heffernan, Houston, TX 77087-4113, 1-800-864-5391 for orders and tech support, fax: 713-307-0314, Internet: www.ts.nu

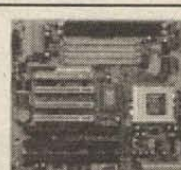


**19" RACKMOUNT PC chassis:** Heavy duty, 4U, for standard 7 slots ATX motherboard. Optional 8, 12, 14 slots back panels available. Four (three hidden) 3.5"/two 5.25" drive bays, 4.625" front panel fan, power supply not included, \$189 with this ad! Monitor chassis \$269, keyboard chassis \$139. 8255-8253 I/O card with prototyping area \$69, 12-bit ADDA card \$89. **Computronics Technology**, 972-242-8087.

**SYSTEMS, PERIPHERALS. UPS.** Closing R&D/manufacturing company. Must sell lots of equipment. Call for list 1-800-869-7827 or visit www.starcom.com for list

**BUILD YOUR own IBM COMPUTER** from available parts with the help of an easy 79 minute video tape. This award winning VHS shows you how to save money or start a small business by assembling any compatible 386 to Pentium MMX computer in a step-by-step, easy-to-follow procedure. It's easy when you know how! Order your tape today, while supplies last, only \$29 (reg \$59.95) plus \$2.95 P&H. Send check to: **EVP, PO Box 2201, Northlake, IL 60164-0201** or call 1-800-754-5096 now!

**NEW "All-In-One" 486 mainboard** with Intel DX2 66MHz CPU (with heatsink and fan) 128K cache 1Meg Video (Video 7) and IDE I/O (and all the cables) for \$60. (Also available without CPU for \$40). Fits in a standard PC case. 16 30 pin SIMM sockets. Call Under The Wire Electronics (UTWE) 626-930-1121 (10am-5pm Pacific Time) or fax 626-930-1123. UTWE, 235 E. Colorado Blvd. #211, Pasadena, CA 91101. E-Mail: sales@utwe.com



**233MHz MMX CPU w/fan & TX-Pro II motherboard**, 512K cache, PCI 64 bit 4 meg. video w/AGP, 3D 32 voice sound, PCI Ultra DMA IDE, 4 72 pin EDO/FP & 2 168 pin DIMM/SDIMM memory sockets, AMI BIOS, 2 serial, 1 parallel, 2 USB, PS/2, infrared ports, ATX or normal power connectors, 2 year warranty, combo deal only \$169. 300MHz CPU upgrade \$59, ATX form card, (2 USB, PS/2, IF port connectors), \$15. **Order toll free 1-877-728-3927** or web: www.saveware.com (Complete line of computer products!)

**LOOKING FOR cheap clone PC parts that actually work?** Call UTWE for CD-ROMs, hard drives, disk controllers, video cards, mainboards CPUs, etc. For example, **NEW Clone-o-matic mainboard** with 4 PCI, 3 ISA, 256K cache, I/O built on board with 200MHz AMD \$110, 2 meg PCI S3 video board \$28. Remember, today we have, tomorrow we don't! For all the latest deal sheets E-Mail: dealsheets@utwe.com Call 626-930-1121 (10am-5pm Pacific) or fax 626-930-1123. E-Mail: sales@utwe.com



**233MHz SYSTEM with 4.3 gigabyte fast UDMA hard drive**, 32X CD-ROM, 1.44 floppy, 32 megabytes of fast 10ns SDIMM memory, PCI 64 bit 4 meg. video w/AGP, 3D 32 voice sound, 160 watt speakers, WIN95 keyboard, Internet scroll mouse. 2 year parts and labor warranty. Only \$459! 300MHz CPU upgrades \$59, ATX form card (2 USB, PS/2, IF port connectors) \$15, 32 megs memory upgrade \$39, monitors 14" \$139, 15" \$159, 56K, modem/fax/voice/speakerphone \$49. **Order toll free 877-728-3927** or web www.saveware.com (Complete line of computer products!)

**UTWE KNOWS what YOU want on the web!** Pictures of the private parts collection of UTWE (yea, and cheap prices). See all those SCSI cases, the mainboards, the network cards, the disk drive controllers, video cards, network hubs, cables (you did realize I meant computer parts right?), keyboards, drives, sound cards, and some other new and used oddball stuff by stopping by www.utwe.com If you just want text deal sheets sent to you then E-Mail: deal sheets@utwe.com And of course, we still have a voice phone 626-930-1121 (10am-5pm PST) and fax 626-930-1123. E-Mail: sales@utwe.com

**DEC EQUIPMENT WANTED!!!** We are buying DEC systems, boards, terminals, drives and peripherals. Also Scientific Micro Systems (SMS), DSD, Datability, Dilog, other DEC compatibles, and Computer Output Microfilm (COM) units. Please call for a quote or fax us your equipment list. We buy, sell, and trade. **KEYWAYS, INC.**, 937-847-2300 OR fax 937-847-2350.

## PRINTED CIRCUIT BOARDS

Since 1969

**Prototype to Production**  
**Quick • Quality • Service • Price**

- Single Sided
- Double Sided
- Multi-Layer
- Surface Mount
- Punch Press Capability
- LPI

**QUICK TURN AROUND**  
**COMPLETE IN-HOUSE CAPABILITY**

## CIRCUIT ETCHING TECHNIQUES

Since 1969

700 Lee Street  
Elk Grove Village  
Illinois 60007  
Phone: 847-228-1722  
Fax: 847-228-1816  
Modern: 847-228-6549  
Toll Free: 888-657-3827

Please call Jim, Barb, or Babu for more information and/or quote.

Write in 37 on Reader Service Card.

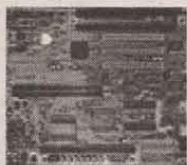


<http://www.pccables.com> PC CABLES and PARTS. 100s of hard-to-find new cables and parts, free technical information, low prices, fast online ordering & browsing.



**MONITORS R US®, COLOR \$54 & UP**, used, low mileage, refurbished, run in 5 hrs. & calibrated. Excellent image, 90 day warranty. Satisfaction guaranteed. (1) **14" VGA .28DP, analog controls \$54.95 ea.** Your choice Phillips-Magnavox, Teco, Hyundai, CTX & Unisys brands. (2) **14" VGA .26DP digital controls \$74.95 ea.** Maker Zenith Data Systems. (3) **ERGO MONITOR ARM SET, NEW IN FACTORY SEALED CARTON NOW \$59 ea.**, includes MA-2 arm, CM desktop clamp and monitor tray. (4) **NEC-AST VERSA, Laptop Docking Station Series 2, \$59 each.** New in factory sealed carton. (5) **MICRO FERRUPS MODEL ME-3.1 KVA, MAKE OFFER.** Shipping weight about 200 lbs. **NOTE:** all prices each, FOB Las Vegas. UPS shipping weight 14" monitors 30 lbs., monitor arm set 36 lbs. & docking station 28 lbs. Mail orders: **LESS BUSTERS ELECTRONICS, 2039 CIVIC CENTER DRIVE #176, N. LAS VEGAS, NV 89030, 702-642-0325. WEB [www.lessbusters.com](http://www.lessbusters.com)**

**START YOUR OWN TECHNICAL VENTURE!** Don Lancaster's newly updated **INCREDIBLE SECRET MONEY MACHINE II** tells how. We now have autographed copies of the Guru's underground classic for \$18.50. Synergetics Press, Box 809-K, Thatcher, AZ 85552. 520-428-4073. VISA/MC.



**266MHz PENTIUM II Celeron CPU w/fan & Intel 1440LX/EX AGP chipset motherboard, 512K cache, PCI video w/AGP & 8 megabytes EDO memory onboard, 3D 32 voice sound, PCI ultra DMA IDE, 2 72 pin EDO/FP & 2 168 pin DIMM/SDIMM memory sockets, AMI BIOS, 2 serial, 1 parallel, 2 USB, PS/2, infrared ports, ATX or normal power connectors, 2 year warranty, combo deal only \$249. 300MHz CPU upgrade \$49, ATX form card (2 USB, PS/2, IF port connectors) \$15. Order TOLL FREE 877-728-3927 or WEB [www.saveware.com](http://www.saveware.com) (Complete line of computer products!)**

**WANTED: HOUSTON** Instrument DMP62 plotter logic board, HP 9872A plotter manual, Watanabe WX4637 plotter manual. Takarada 815-654-3956.

# TIMELESS PRODUCTS

The Best Prices and Service • In Business over 15 years!

Phone 218-346-6660 Fax 218-346-6664

## CABLE TV CONVERTERS

WILL NOT DECODE

**New! "TP 125 V"**  
**128 Channel Converter with Volume**

**Special Prices for  
TP1550PC  
Call for Details**

**Panasonic still available!**

- REFURBISHED CONVERTERS ALSO AVAILABLE •
- QUALITY REPAIR DEPARTMENT FOR ALL YOUR TUNER REPAIRS •
- REMOTES AVAILABLE FOR MOST CABLE BOXES •

DEALERS ONLY • GREAT QUANTITY PRICES • NO DECODER SALES

Write in 39 on Reader Service Card.

**USED IBM PS/2E, TYPE 9533, 486 SLC50** (size of "Yellow Pages") ideal for word processing, Internet, E-Mail and **hobbyists**. Will run DOS 6.22, Win 3.1 and Win 95. XGA video w/256 colors. Serial and parallel ports and video on motherboard. 3.5" floppy. One 16-bit ISA slot. Standard notebook type hard drive, not proprietary. Mini keyboard w/finger mouse like a notebook included. Pricing with 8 meg mem. & 120 meg. HD \$70; 16 meg mem. & 120 meg. HD \$80; 16 meg mem. & 335 HD \$115; HP Deskjet \$80; HP Deskjet 500 \$90. (Plus S&H) E-Mail: [fcs0998@aol.com](mailto:fcs0998@aol.com) or call toll free 1-877-945-4523.

**WE CARRY** a variety of cables, switch boxes, accessories, and adapters to connect PCs, printers, Mac's, networks, telecommunications, and audio/video equipment. We offer: custom cables, free catalogs, and same day shipping on most orders. Visit our website at [www.rogerssystems.com](http://www.rogerssystems.com) or call 1-800-366-0579.

**HARD DRIVE liquidation 85 Megabytes \$15.** Internet mouse \$6.95, SVGA Monitors \$145, Flatbed Scanners \$75, 56K Modems 45, 386SX40 \$25, 1.2/1.44 Floppy \$20, Adaptec SCSI controllers \$45, memory 1.25/megabyte. 714-778-0450.

**EVERYTHING NEW** w/warranty! P300MHz MMX \$195, 1.28 gigabyte \$65. 15"/17" SVGA monitors \$145/235. Pentium Class systems from \$450. Also multimedia kits, hard drives, scanners, printers, SCSI adapters \$25. Memory, cases, etc. Call for monthly specials. CCI 714-778-0450. E-Mail: [cci@net999.com](mailto:cci@net999.com)

**SONY/AMIGA/MAC/IND. MULTISCANS 15" 0.26 DP 15.7-37KHz TTL/Analog, sync on green, & 150 Blem 15" SVSA's \$85.** Expert Sony repair. Refurbished. Pikul & Assoc., 101 Glenfield Dr., Festus, MO 63028. 314-937-0335.

**MONITOR ADAPTERS.** Convert OEM. (incl. PGA) 31.5KHz & above monitors with BNC connectors to PC use. Model VA10 VGA to RGB+ Sync \$45. Model VA11 VGA to R G/Sync B \$55. VA12 VGA to PGA (DB9) \$45. Pikul & Assoc., 101 Glenfield Dr., Festus, MO 63028. 314-937-0335.

**POWERBOOK DUO 280C 32/330/14.4 \$520; DuoDock II \$135; DuoDock \$115; Powerbook 280C 24/330 \$475; Duo 16 meg memory \$75; 8 meg \$50; AC adapter 500 series misc. \$50; POWER-MAC 6100/66 24/500 \$325. 650-842-3268.**

**P233 MHz Multimedia systems**, fully loaded, liquidation price \$495. 300MHz \$500. Laser printers \$275. Color Inkjets \$95. Notebooks \$350. Closeout prices on Software. Call 714-778-0450.

## COMPUTER SOFTWARE

**FREE IBM DISK CATALOG** of quality Shareware and CD-ROMs. **MOM 'N' POP'S SOFTWARE <ASP>**, PO Box 15003-N, Springhill, FL 34609-0111. 352-688-9108. [momnpop@gate.net](mailto:momnpop@gate.net)

**LINUX & FREEBSD & LINUX & FREEBSD** Linux and FreeBSD distributions on CD-ROM for as low as \$1.99. See our full range of Linux products and books at **incredible prices**. Use our secured shopping cart system at [www.cheapbytes.com](http://www.cheapbytes.com) Visa and MasterCard gladly accepted. E-Mail: [sales@cheapbytes.com](mailto:sales@cheapbytes.com) fax: 209-367-8518. CheapBytes, PO Box 2714, Lodi, CA 95241.

**MAKE \$\$\$** giving away our software! Business kit \$10 (refundable). RASCOM, 860 E. Carson St. #118-89, Carson, CA 90745.

## Remote I/O Control

### Model HCON-1

The perfect solution for  
Home Automation  
Temperature Monitor/Control  
Remote Relay Control  
Remote Equipment Control

Only \$119.00 plus shipping

### J-Works, Inc

12328 Gladstone St., Unit 4  
Sylmar, CA 91342  
(818) 361-0787 Voice (818) 270-2413 Fax

RS-485 Full Duplex Communication  
Up to 32 Devices Per Channel  
Simple ACSII Command Set  
1 to 20 Switch Input  
20 Relay/LED Output 35ma  
Quadrature Encoder Inputs  
1-Wire Temperature Inputs  
Dallas DS1820/21 Support  
Input Power 8-15VDC  
Small Size 1.9 X 2.8 Inches

Visit our Web site at  
<http://www.j-works.com>  
E-mail [sales@j-works.com](mailto:sales@j-works.com)

## CABLE TV BOXES MULTISYSTEM

1. Replacement for all systems.
2. No makes and models required.
3. Built-in copy guard, sleep timer.
4. Volume and remote control, P.G.

**1-800-807-6543**

30 day money back guarantee and 6 month warranty

Write in 38 on Reader Service Card.

Nuts & Volts Magazine/November 1998 51



**MOD CHIPS for Sony PlayStation.** Now your backups will work. Only \$9.95 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)

**CAM & MOTION SW/HW:** Z-trace, PCB toolpath. Plotcam motion control, step drivers. [cmheater@juno.com](mailto:cmheater@juno.com) MSG/FAX 407-452-7197, 407-459-2729. [www.megabits.net/ddt](http://www.megabits.net/ddt)

**LIQUIDATION WINDOWS 95/98,** Office97, WindowsNT, 1,000 games, 10 CDs \$25, DOS \$25, Lotus SmartSuite \$10, WordPerfect Suite \$35. Antivirus \$5. Call 714-778-0450.

**MICROSOFT OFFICE 97 CDs \$65.** Valid serial number sealed full OEM version! While they last WOW! COMPARE Academic \$249. Retail \$530. Cashier's cheque or M/O. Document Control, 103 South Court, Cleveland, MS 39530. 601-843-0152 docctrl@tecinfo.com

**MICROSOFT OFFICE 97 PROFESSIONAL EDITION, \$79.** That's right, \$79. Includes Word 97, Excel 97, Access 97, PowerPoint 97, and Outlook 97. Brand new, unopened, and shrink-wrapped. Easy fulfillment. No manuals. Visa/MC accepted. Call Gulf Professional Services toll-free 1-888-208-9797, or order online at [www.gulfpro.com](http://www.gulfpro.com) E-Mail: [sales@gulfpro.com](mailto:sales@gulfpro.com)

## COMPUTER EQUIPMENT WANTED

**WANTED: FOR** historical museum, pre-1980 microcomputers, magazines, and sales literature. Floyd, VA 24091-0341 (540-763-3311/540-382-2935).

**HP CALCULATORS** wanted: models 10, 70, calculator watch, others for private collection. Cash paid. Bob Morrow, 765-855-2348, [rkmmorrow@aol.com](mailto:rkmmorrow@aol.com)

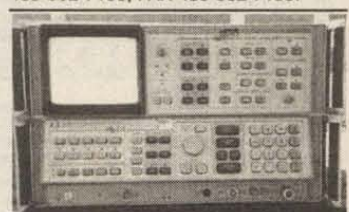
**QFA-500 TAPE** backup system wanted. Need interface board and tape unit. Please call 1-800-240-4637.

**WANTED: TERMINALS + PRINTERS:** DEC, Wyse, IBM, ADDS, Okidata, Data South, Epson, C.I.TOH, etc. Call for quote on any surplus computer equipment. Call Jeremy, 603-673-8077.

**DEC EQUIPMENT WANTED!!!** We are buying DEC systems, boards, terminals, drives and peripherals. Also Scientific Micro Systems (SMS), DSD, Datability, Dialog, other DEC compatibles, and Computer Output Microfilm (COM) units. Please call for a quote or fax us your equipment list. We buy, sell, and trade. **KEYWAYS, INC.,** 937-847-2300 OR fax 937-847-2350.

## TEST EQUIPMENT

**EQUIPMENT MANUALS** we have 1000's of service and operators manuals for all types of test and measurement equipment from 1950 to present. All test equipment manufacturers are represented. Call, write, or fax your want list. Please include mfg.'s manual P/N unit serial numbers if known. **Manuals Plus,** Box 549, TAD #601, Tooele, UT 84074. 435-882-7188, FAX 435-882-7195.



**HP 8568A spectrum analyzer & 85662A display.** Frequency range: 100Hz to 1.5GHz, good working condition, \$7,500. Tel: 714-778-5151 Fax: 714-778-0312.

**ENI MRI 2000 2KW linear pulse** amp 15-65MHz, unused, \$1,600; National Bureau of Standards, variable rejection filters for the following frequencies: 220-440KHz, 1.75-3.5MHz, 55-110KHz, 27.5-55KHz, 110-220KHz, 440-880KHz, \$200 ea.; GR 1606A, RF bridge, \$400; RF communications 805, RF amp 50KHz-80MHz, 47dB, 7W PO, \$450; Tektronix 2235 100MHz scope, \$600; HP 1727A, 275MHz storage scope, \$650; HP 1712A, 200MHz scope, \$500; Tek TM504, \$150; DM 501A, \$200; FG503 3MHz function gen., \$200; PS503A, \$150; HP 3406A, RF voltmeter, \$400; Boonton 42B, RF voltmeter, \$250; HP 3490A, 5.5 digit DVM, \$300. A-Comm Electronics 303-341-2283.

**WE BUY electrical power systems test equipment.** This includes the following manufacturers: **Multi-Amp** (now AVO Multi-Amp), **Biddle** (now AVO Biddle), **Megger** (now AVO Megger), **Associated Research, AEMC, EIL, Programma** or any other test equipment used for testing high voltage equipment and components. The test equipment that we are looking for is used for testing high voltage transformers, circuit breakers, cables, and protective relays. FAX 972-564-9139 or phone 1-800-261-9139 for quote. **Phase 3 Power Test Equipment.**



**TEK 577/D2/177 curve tracer** \$750 in good condition. **Tek 2201 digital storage/analog oscilloscope**, new in a box \$450. **TEK PS 283** triple output power supply, new in a box \$375. 10 day money back guarantee. For more great deals on test equipment please call 650-244-9438 or visit our web site: <http://www.equipetek.com>



# ACE COMPUTERS

(877) ACE-COMP

Our 15th Year

(847) 952-6901 FAX

1425 East Algonquin Road

Arlington Hts, IL 60005

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

**Home Office Pro**

- Intel Pentium® II Processor w/512K Cache
- 64 Megs SDRAM
- 6.5GB Ultra ATA Hard Drive
- 32X Speed CD-ROM Drive/1.44M FDD
- US Robotics 56KB V.90 Fax/Modem
- Matrox Productiva G100 AGP with 8M
- Goldstar 17" Monitor - 0.26 Dot Pitch
- Sound Blaster 64 AWE with Subwoofer
- Microsoft Ergonomic Style Mouse/104 KB
- Mini-Tower or Desktop Case w/6 Bays
- Win 95/98 or Windows NT 4.0 (Add \$99 for Windows NT)
- Microsoft Office 97 Included!
- 3 Year Complete Warranty Included

PENTIUM® II 266 - \$1649 • PENTIUM® II 350 - \$1949  
PENTIUM® II 300 - \$1699 • PENTIUM® II 400 - \$2149  
PENTIUM® II 333 - \$1799 • PENTIUM® II 450 - \$2349  
Business/Personal lease as low as \$61/Mo, 36 Months

**Discovery Station**

- Intel Pentium® II Processor w/512K Cache
- 32 Megs SDRAM Memory
- 4.3 GB UDMA Hard Drive
- 32X Speed CD-ROM Drive
- 1.44M Floppy
- USR 56K - V.90 Fax/Modem
- Diamond Stealth 3D-4000 AGP w/4M RAM
- 17" Monitor - 0.28 Dot Pitch
- Creative® PCI WaveTable Sound with Speakers
- Microsoft Intellimouse Mouse/104 Kb
- Mini-Tower or Desktop Case w/6 Bays
- Windows 95/98 or Windows NT 4.0 (Add \$99 for Windows NT)
- 3 Year Complete Warranty Included

PENTIUM® II 266-\$1249 • PENTIUM® II 350 - \$1549  
PENTIUM® II 300-\$1299 • PENTIUM® II 400 - \$1749  
PENTIUM® II 333-\$1399 • PENTIUM® II 450 - \$1949  
Business/Personal lease as low as \$47/Mo, 36 Months

**Network Equipment**

**Network Interface Cards**

- Microdyne NE2000 - ISA Coax/AUI Network Card \$ 9.99
- Microdyne Home Gaming Kit (2 Cards, Coax Cable) \$ 24.99
- Microdyne NE2500 - ISA Twisted Pair Network Card \$ 19.99
- Microdyne NE2500 - ISA Combo Network Card \$ 29.99
- 3Com Etherlink III - ISA Combo Network Card \$ 59.99
- Microdyne NE2500 - ISA Combo 5 Pack \$ 69.99
- Microdyne NE5500 - PCI Twisted Pair Network Card \$ 19.99
- Microdyne NE5500 - PCI Twisted Pair 5 Pack \$ 99.99
- SMC Etherpower - Twisted Pair Ethernet Card \$ 39.99
- SMC Etherpower - PCI Combo Ethernet Card \$ 49.99
- Microdyne NE5500 - PCI Combo Network Card \$ 29.99
- Microdyne NE5500 - PCI Combo 5 Pack \$ 99.99
- 3COM Etherlink XL - PCI Combo Ethernet Card \$ 59.99
- SMC Etherpower II - 10/100 PCI Ethernet Card \$ 59.99
- 3COM Etherlink XL - 10/100 PCI Ethernet Card \$ 59.99
- Intel Etherexpress Pro - 10/100 PCI Ethernet Card \$ 59.99
- Intel Etherexpress Pro - 10/100 PCI 5 Pack \$ 329.99

**Network Concentrators (Hubs)**

- Asante 5 Port FriendlyHub \$ 39
- Bay Netgear 8 Port/16 Port Hub \$ 79/\$119
- SMC EtherEZ Hub 8 Port Desktop/16 Port Rackmount \$ 139/\$379
- 3Com OfficeConnect 8 Port Hub \$ 149
- 3Com Superstack 12 Port Rackmountable Hub \$ 329

Call about Network Equipment Not Listed!

**SVGA Monitors**

**VISIONMASTER**

- Iiyama Visionmaster 350 - 15" 0.28 Dot Pitch, Digital, 1280 x 1024 \$239
- Iiyama Visionmaster 8617E 0.26 Dot, 1600 x 1280 Digital \$429
- Iiyama Visionmaster 9017E 0.25 AG-PC Editor's Choice 9/97 \$489
- Iiyama Visionmaster 450 - 19" Monitor - 0.26 Pitch - PC World Best Buy \$699
- Iiyama Visionmaster 8721 - 21" Monitor, 1800 x 1440 Resolution \$999
- Iiyama Visionmaster 9221E 21" Diamondtron, 1800 x 1440 Resolution \$999
- Iiyama Visionmaster Profile 36 CM LCD Monitor - Incredible Screen \$999

Megapix 14" Non-Interlaced 0.28 Dot Pitch \$119  
Megapix 15" Non-Interlaced 0.28 Dot Pitch \$149  
Sony Multiscan 1551 Trinitron, Digital \$289  
KDS VS-717 Non-Interlaced 0.28 Dot Pitch, 1280 x 1024 \$239  
Megapix 17" Non-Interlaced, 0.28 Dot Pitch, 1280 x 1024 \$279  
Goldstar 17" Non-Interlaced, 0.26 Dot Pitch, 1600 x 1280 \$329  
KDS VS-917 Non-Interlaced 0.26 Dot Pitch, 1600 x 1280 \$399  
Panasonic S70, 0.27 Pitch, 3 Year warranty-1 Year onsite! \$329  
NEC Multisync XV17+ 0.25 Dot Pitch, ChromaClear, Digital \$499  
KCS 20" SVGA (18.8" Viewable) 0.28 Dot Pitch, Excellent \$499  
NEC Multisync P1150, 0.28 Dot Pitch \$1499  
Sony SP0300 SFT, 0.25 AG, Trinitron Tube \$1699  
Viewsonic 21-810 \$999

**Memory/Microprocessors**

**30 Pin SIMM Modules**

- 4M x9 SIMM \$19
- 72 Pin SIMM Modules \$12/\$12/\$25
- 4M NonParity/EDO/Parity \$12/\$12/\$25
- 8M NonParity/EDO/Parity \$14/\$13/\$24
- 16M NonParity/EDO/Parity \$29/\$23/\$39
- 32M NonParity/EDO/Parity \$49/\$39/\$59
- 64M EDO/Parity \$99/\$149

**168 Pin DIMM Modules**

- 16M SDRAM 10 ns \$25
- 32M SDRAM 10 ns/PC100 \$39 / \$59
- 64M SDRAM 10 ns/PC100 \$79 / \$129
- 128M SDRAM 10 ns/PC100 \$159 / \$219

**Microprocessor Chips**

- Pentium® II 450/400 Mhz \$599/\$429
- Pentium® II 350/333 Mhz \$329/\$279
- Pentium® II 300/266 Mhz \$239/\$199
- Celeron® 333/300A - 128K Cache \$199/\$159
- Celeron® 300/266 - OK Cache \$99/\$89
- Pentium® 233 MMX/200 MMX \$139/\$119
- Pentium® 200 Mhz/166 MMX \$139/\$99
- Pentium® 166 Mhz/133Mhz \$85/\$75
- AMD K6 - 300/266 MMX \$99/\$89
- Pentium® II Pro/Pentium® Fans \$123/\$158

**Enhanced IDE & SCSI2 Hard Drives**

**Enhanced IDE and Ultra DMA Drives**

- 2.14 Gig Seagate, 12 ms access \$119.99
- 2.14 Gig Western Digital, 10 ms access \$119.99
- 2.14 Gig Quantum Fireball Ultra DMA, 9 ms \$129.99
- 2.55 Gig Maxtor Diamondmax, 9 ms access \$139.99
- 3.2 Gig Western Digital, 11 ms access \$129.99
- 3.2 Gig Seagate Medalist Ultra DMA, 10 ms \$129.99
- 4.3 Gig Western Digital, 10 ms access \$139.99
- 4.3 Gig Seagate Ultra DMA, 12 ms \$139.99
- 5.0 Gig Micropolis Mustang, 9 ms access \$149.99
- 5.1 Gig Quantum Fireball, Ultra DMA, 9 ms \$159.99
- 5.1 Gig Western Digital, 10 ms Ultra DMA \$159.99
- 6.4 Gig Quantum Fireball, Ultra DMA, 9 ms \$189.99
- 6.4 Gig Seagate Medalist, Ultra DMA, 11 ms \$179.99
- 6.4 Gig Western Digital, 10 ms Ultra DMA \$179.99
- 6.5 Gig Seagate Medalist Pro, 7200 RPM, 9 ms \$219.99
- 8.4 Gig Quantum Fireball, Ultra DMA, 9 ms \$219.99
- 8.6 Gig Seagate Medalist, Ultra DMA, 9 ms \$199.99
- 9.1 Gig Seagate Medalist Pro, 7200 RPM \$269.99
- 11.5 Gig Maxtor Diamondmax, 9 ms \$289.99
- 16.8 Gig IBM Ultrastar, 8 ms \$439.99

**SCSI2 Drives**

- 2.1 GB Quantum Fireball Ultra SCSI, 9 ms \$ 199.99
- 2.1 GB Quantum Atlas Ultra Wide, 9 ms \$ 199.99
- 4.5 GB Quantum Viking Ultra Wide SCSI2, 8 ms \$ 249.99
- 4.5 GB Seagate Barracuda Ultra/Ultra Wide, 7.9 ms \$469/\$479
- 8.7 GB Micropolis Tomahawk Ultra SCSI2, 8 ms \$399.99
- 9.1 GB Micropolis Tomahawk UW SCSI2 \$439.99
- 9.1 Gig Seagate Barracuda Ultra2 Wide 7.9 ms \$ 599.99
- 9.1 Gig IBM Deskstar Ultra Wide 7 ms \$ 599.99
- 9.1 Gig Quantum Atlas Ultra Wide, 9 ms \$ 599.99
- 9.1 Gig Seagate Cheetah Ultra/Ultra Wide \$949/\$999
- 18.2 Gig Seagate Cheetah Ultra/Ultra Wide \$1899.99

**Motherboards for Pentium® Processors**

**BCM 575 AT/550 ATX-430TX, P75-233PCI w/512K, DIMM** \$79

**Tyan Tomcat, Single/Dual CPU, w/8 SIMMs, 512K** \$99/\$119

**Syan Turbo-2 AT/ATX, Intel 430TX w/6 SIMM/2 DIMM 512K** \$79

**SuperMicro P55MMS98-Intel 430TX, 512K** \$79

**ASUS TX97T/K97E, AT-430TX, P75-233 PCI w/512K** \$99

**Motherboards for the Pentium® Pro Processor**

**BCM 600 - 150-200 MHz, Intel 440FX Chipset, PCI/ISA** \$179

**Supermicro AT or ATX 150-200, Intel 440FX, PCI/ISA** \$149

**Tyan Titan Pro - Single/Dual processor PCI/ISA, AT or ATX \$129/\$249**

**Intel PR440FX - Dual Pro, UW SCSI, 10/100 LAN, Audio, ATX** \$429

**Motherboards for the Pentium® II Processor**

**BCM 632 - Intel 440LX Chipset, PCI/ISA/AGP/DIMMs, ATX** \$109

**BCM QS440BX - Intel 440LX Chipset, PCI/ISA/AGP/DIMMs, ATX** \$129

**Intel AL440LX - Intel 440LX, PCI/ISA/AGP/DIMMs, Audio, ATX** \$129

**Intel SE440BX - Intel 440BX, PCI/ISA/AGP/DIMMs, Audio, ATX** \$159

**Intel N440BX - Intel Server Board, PCI/SCSI/LAN/DIMMs/Dual** \$529

**Abit BH-6 - Intel 440BX, PCI/ISA/AGP/DIMMs, ATX** \$129

**Abit LX-6 - Intel 440LX, PCI/ISA/AGP/DIMMs, ATX** \$129

**Asus P2L97/P2L97S - Intel 440LX, PCI/ISA/AGP, ATX, SCSI \$129/\$199**

**Supermicro P6SLS/DLS-440LX, Single/Dual P2.2940UW SCSI \$219/\$299**

**Supermicro P6SBS/DBS-440BX, Single/Dual P2.3940UW SCSI \$229/\$349**

**Soltek SL618-440LX, PCI/AGP/ISA-AT FORM, SIMM/DIMM!! \$109**

**Soltek SL67AC / SL67A - 440BX - With/Without SCSI2 \$229 / \$129**

**Tyan 1830 - 440BX, 4 ISA/4 PCI 1 AGP, AT Form Factor \$159**

**Tyan Tiger Dual - 440LX, Dual Processor, 3 Year Warranty \$169**

**CD-ROM/Modems/Sound**

**CD-ROM Drives**

- Mitsumi EIDE 4X, 145 ms \$34.99
- Toshiba EIDE 32X, 85 ms \$69.99
- Toshiba 32X SCSI2, 80 ms \$99.99
- Plextor 32X SCSI2, 80 ms \$179.99
- Mitsumi 2X/8X CD-Writer \$249.99
- HP CD-ReWriter EIDE/Ext Parallel Teac 4X/12X CD-Writer SCSI2 \$389.99
- Plextor 4X/12X CD-Writer SCSI2 \$429.99
- Creative Labs DVD2 Encore Kit \$199.99
- (Plus \$30 Rebate 'til 12/98!!!) \$169.99

**Modems**

- 56K X2 Compatible with Voice \$69
- USR Sportster 56K Int/Ext \$89/\$129
- Diamond Supra 56K V.90 Int/Ext \$79 / \$109

**Sound Cards**

- Ensoniq PCI 3D Sound Card \$49.99
- Diamond Monster Sound MX80 \$89.99
- Creative Sound Blaster 16 PNP \$39.99
- Creative Sound Blaster 64 Value \$49.99
- Creative Sound Blaster 128 PCI \$59.99
- Creative Sound Blaster Live! \$169.99

**SVGA Cards and Accelerators**

- Trident PCI with 2M DRAM / AGP with 4M \$29 / \$49
- Diamond Stealth 3D, 2M/4M DRAM PCI \$39 / \$59
- ATI Video Xpression 2M PCI \$49
- Diamond Monitor 3D II-8M/12M 3Dfx Voodoo2 Chipset \$179 / \$229
- Matrox Mystique 220 PCI with 4M RAM \$89
- Matrox Millennium II PCI 4M/8M VRAM \$129 / \$179
- Matrox Millennium II Rainbow Runner/TV Tuner \$169 / \$189
- ATI Xpert @ Work/Xpert @ Play AGP 4M (8M + \$50) \$79 / \$99
- Diamond Viper 330 Pro AGP with 4M RAM \$89
- ATI All in Wonder Pro PCI/AGP 4M/8M \$179 / \$249

**ACE COMPUTERS 1-877-ACE-COMP**

Delivering Power and Performance for Less Since 1983 [www.acecomputers.com](http://www.acecomputers.com)



# Professional

# 10 HOUR RECORDER

Factory Direct

"BUILT LIKE A BATTLESHIP"

• Heavy duty commercial recorder - NOT improvised from consumer models

• 12, 14, and 16 hour models also available

• BUILT-IN voice activation (add \$30)

• Applications information included

• Dimensions: 11.5 x 7.0 x 2.75"

SPECIAL  
Nuts & Volts  
Price..

\$159

COD's OK. Sorry, no credit cards. Free catalog USA only; other countries \$5. Price includes UPS to 48 States on Pre-Paid Orders

Viking International

150 Executive Park Blvd. #4600 San Francisco, CA 94134

Phone: (415) 468-2066 • Fax: (415) 468-2067 • Web: www.vikingintl.com

Write in 40 on Reader Service Card.

**FEITEK PROVIDES** repair, calibration and traceable certifications of test equipment. Free estimates. We buy, sell and trade all makes of test equipment. Visa and MasterCard accepted. Check out our inventory and specials at [WWW.FEITEK.COM](http://WWW.FEITEK.COM) 2752 Walton Road, St. Louis, MO 63114, 314-423-1770.

**KENTRONIX TEST EQUIPMENT SPECIALS.** Check our WEB site at <http://www.kentronix.com> for monthly specials. We are also looking to buy test equipment, coaxial and waveguide components, manuals, etc. Contact Brian at 732-681-3229 or FAX 732-681-3312. E-Mail: [brian@kentronix.com](mailto:brian@kentronix.com)

**SCOPE SALE:** 475A DM44 \$650. 465 \$225; 7904 frame w/7A24, 7A26, 7B85, 7B92A, \$450; Philips PM3217, \$200; Kikusui 50MHz 4 channel 5042, \$150; Tek 466, \$275; 7A13, \$100 LED; 7A18, \$45; 7A19, \$100; 7A26, \$60; 7B53A, \$60; 7B80/7B85, \$75 ea.; 7B92A, \$125; 7D15, \$175; DC504, \$175; PG-508, \$250; PS 5101 \$150; S-1 \$50; S-2 sampling head \$150; S-52 \$200; S-6 \$250; SC-502 Scope \$200. 707-745-4804.

**TEST EQUIPMENT for sale:** HP 83557A millimeter wave 50-75GHz as new boxed \$6,000; HP 83558A 75-110GHz \$6,000; HP 8508A with 85081A \$3,900; EIP 931 microwave sweeper .01-18GHz \$3,900; Fluke 3384B DSO 100MHz NEW \$3,000 and much more. **WE BUY TEST EQUIPMENT, FAX** your list to: HTB Elektronik; ATTN: "Tom" FAX 01149 4706 7049 or E-Mail: [tom@br emerhaven-net.de](mailto:tom@br emerhaven-net.de)

**NEW HEWLETT-PACKARD 141T CRTS \$195 EACH.** We have quantities available. These are double boxed, unopened with late 80's date code, guaranteed. Fits all Kentronix. 732-681-3229 or FAX 732-681-3312. Mailing: Kentronix, PO Box 2444, Farmingdale, NJ 07727 or E-Mail: [brian@kentronix.com](mailto:brian@kentronix.com)

**WANTED: WESTERN** electric test equipment. Tube-type only please. Freq. measurement sets, oscillators, amplifiers, coils, transformers, parts, tubes. Free offer, Great Wireless Museum 1-800-653-6427.

**AFFORDABLE HP** power sensor repair! Most 8481As repaired for \$235 or less. We also handle 478As and many others. Call or fax for more information. Willamette RF, Inc., 541-754-7226, FAX 541-753-4629.

**TEST EQUIPMENT** repair or overhaul Tektronix, HP, Wavetek, Bontoon, etc. 20 years experience with former Slep Electronics Co., same excellent service same reasonable rates, satisfaction guaranteed. Brooks Electronics 828-349-3503. E-Mail: [rwb@brooks.dnet.net](mailto:rwb@brooks.dnet.net)

**MICRODYNE 1100, 1200, 1400 series** receivers all bands, FM and PM demods, SDU, IF filters. Aydin, Schlumberger, monitor systems bit syncs. 805-934-2058.

**WANTED: WESTERN** electric test equipment. Tube-type only please. Freq. measuring sets, oscillators, amplifiers, parts, tubes, etc. 1-800-251-5454.

**BRUEL & KJAER BUY, SELL, BEST PRICES.** EXCALIBUR ENGINEERING, 3198-C AIRPORT LOOP DRIVE, COSTA MESA, CA 92626. 714-540-0169, FAX 714-540-5417.

**CAPANALYZER 88** finds bad caps in-circuit with 100% accuracy. Checks both ESR and DCR, auto-discharge feature. Money back guarantee. [www.eds-inc.com](http://www.eds-inc.com) 561-487-6103.

**LEAKSEEKER 82A** tracks a shorted or leaky component to the EXACT location on the PCB. Range: zero to 150 ohms. Money back guarantee. [www.eds-inc.com](http://www.eds-inc.com) 561-487-6103.

**WANTED: ELECTRONIC** estates. Ham, broadcasting, military, test, public address, tubes, transformers, telex equipment. The bigger the pile, the more worthwhile. We fly anywhere. Sumner McDanel 1-800-251-5454.

**BEST PRICES** on guaranteed test equipment. Oscilloscopes, Tektronix 305, 454, 475, SC 504, 2225, 2246, & others. Huntron Tracker 2000, Fluke, HP and other fine used test equipment. Check us out at: [www.lonemtn.com](http://www.lonemtn.com)

**SPECTRUM ANALYZER** in a probe. \$249. View thru your inexpensive scope. [WWW.spectrumprobe.com](http://WWW.spectrumprobe.com)

**WANTED: RADIO** service monitors, IFR, Motorola, HP, Marconi, also late model HP equipment. 716-763-9104 or Fax 716-763-0371. <http://www.amtronix.com>

**LOWEST PRICES!** Check out Metric's "Current Specials" at <http://www.metric-sales.com> Great deals on top quality refurbished test equipment. Call 1-800-432-3424 for a free catalog.

**SUCH A DEAL!** Check out Metric's "Current Specials" at <http://www.metric-sales.com> Great deals on top quality reconditioned test equipment. Call 1-800-432-3424 for a free catalog.

**WANTED! ELECTRONIC** test equipment. We pay top dollar for used scopes, generators, analyzers from HP, Tektronix, and others. Call Charles at Metric for immediate quotation. 1-800-432-3424 Fax: 510-264-0886.

**WANTED! ELECTRONIC** test equipment. We pay top dollar for used scopes, generators, analyzers from HP, Tektronix, and others. Call Charles at Metric for immediate quotation. 1-800-432-3424 Fax: 510-264-0886.

**WANTED! ELECTRONIC** test equipment. We pay top dollar for used scopes, generators, analyzers from HP, Tektronix, and others. Call Charles at Metric for immediate quotation. 1-800-432-3424 Fax: 510-264-0886.

# AST GLOBAL ELECTRONICS

24529 STATE HWY. 408, CAMBRIDGE SPRINGS, PA 16403  
VOICE 814-398-8080 • 1-888-216-7159 • FAX 814-398-1176

VIEW COMPLETE LISTING AT:  
<http://www.astglobal.com>

IF WE DON'T CARRY IT ... WE'LL FIND IT  
QUICKLY ... AT REASONABLE PRICES.

B&K 3020, Sweep/Function Generator, 2MHz (Sine, Square, Triangle).....	\$175	HP 6294A, Power Supply, 0-60V @ 1A (metered).....	\$275
Dransetz 626, Universal Disturbance Analyzer, Frame only w/Power Supply & Communication Plug-in.....	\$375	HP 8011A, Pulse Generator, 1Hz-20MHz.....	\$175
EIP 545, Microwave Counter 18GHz.....	\$650	HP 8013B, Pulse Generator, 1Hz-50MHz.....	\$275
ESI DP1311, Variable Resistor, 100K max 1K/Step.....	\$100	HP 8015A, Pulse Generator, 1Hz-50MHz 30V.....	\$425
ESI R7225, Decade Voltage Divider.....	\$375	HP 8091A, Rate Generator (1GHz) w/8092A Delay Generator (1GHz) w/8093A Output Amp w/5401A & 15400A.....	\$2,000
Fluke 332B, DC Voltage Standard.....	\$475	HP 8165A, Programmable Sig Source, 1mHz-50MHz.....	\$950
Fluke 335A, DC Voltage Standard.....	\$375	HP 8180A, Data Generator.....	\$425
Fluke 382A, Voltage/Current Calibrator.....	\$525	HP 8410B, Network Analyzer Mainframe.....	\$275
Fluke 540B, Transfer Standard w/454-2 Voltage Plug-in.....	\$825	HP 8414A, Polar Display.....	\$225
Fluke 721A, Lead Compensator.....	\$275	HP 8443A, Tracking Generator, 1KHz-110MHz.....	\$325
Fluke 760A, Meter Calibrator.....	\$450	HP 8444A, Tracking Generator for 141T System, 5-1300MHz.....	\$750
Fluke 845AB, Null Detector/Micro Voltmeter 1uV-1000VDC.....	\$375	HP 8445B, Auto Preselector, 1.8-18GHz.....	\$550
Fluke 845AR, Null Detector/Micro Voltmeter 1uV-1000VDC.....	\$375	HP 8553B, RF Plug-in (for 140 Series Mainframes), 1KHz-110MHz.....	\$425
Fluke 893A, AC/DC Differential Voltmeter 0 to 100 Volts, AC/DC, 0.1%DC, 0.5%AC, 1uV Resolution.....	\$100	HP 8553L, RF Plug-in (for 140 Mainframes), use with 8552A, 1KHz-110MHz.....	\$125
Fluke 3330B, Constant Current/Voltage Calibrator.....	\$475	HP 8601A, Sweeper Generator, 1-110MHz.....	\$425
Fluke 5100B, Multifunction Calibrator, Opt. 0305.....	\$3,250	HP 8614A, Signal Generator, 800-2400MHz, AM/FM Levell.....	\$475
Fluke 5100B, Multifunction Calibrator.....	\$2,700	HP 8616A, Signal Generator UHF, 1.8-4.5GHz, +10-120dB, AM/FM.....	\$475
Fluke 5200A, Programmable AC Calibrator.....	\$1,250	HP 8624D, RF Plug-in, 5.9-20GHz.....	\$350
Fluke 5215A, Precision Power Amp.....	\$950	HP 8640B, Signal Generator, 5-1050MHz, Opt. 002001 or 003, \$1,800.....	\$950
Fluke 6011A, Synthesized Signal Generator, 10Hz-11MHz (7-dig).....	\$550	HP 8640B, Signal Generator, 5-512MHz, Opt. 001 or 003.....	\$950
Fluke 6060B, Synthesized Signal Generator 10KHz-1050MHz.....	\$1,800	HP 8743A, Reflection Test Set, 2-12.4GHz.....	\$475
Fluke 6070A, Synthesized RF Signal Generator 200KHz-520MHz.....	\$1,500	HP 8901A, Modulation Analyzer.....	\$1,000
Fluke 8000A, DMM 5 1/2 Digit.....	\$75	HP 8903A, D/A Converter.....	\$175
Fluke 8050A, DMM 4 1/2 Digit w/Battery Pack.....	\$145	HP 89501A, HP-IB Isolated D/A Converter.....	\$125
Fluke 8050A, DMM 4 1/2 Digit w/Battery Pack.....	\$145	Huntron Tracker 2000, w/140 Switcher (nize).....	\$1,000
<b>TURN IDLE TEST EQUIPMENT - INTO CASH - CALL OR FAX FOR QUOTATION</b>			
Fluke 6520A, DMM 5 1/2 Digit.....	\$325	Kepco ATES-5M, Power Supply, 50V @ 5A.....	\$650
Fluke 8000A, DMM 4 1/2 Digit w/Battery Pack.....	\$175	Kepco BVP100-4M, Bi-Polar Power Supply, 0-100V @ 4A (metered).....	\$275
Fluke 9100A, DMM 5 1/2 Digit.....	\$175	Kepco JOE 36-15MVPT, Power Supply, 0-36 @ 15A (metered).....	\$650
Fluke 9100A, Micro System Troubleshooter.....	\$375	Kepco JOE 36-3MVPT, Power Supply, 0-36 @ 3A (metered).....	\$175
Fluke 930, Scopemeter (unused).....	\$950	Krohn-Hite 3302R, Dual Channel Tunable Filter, 20Hz-2MHz, High Pass, Low Pass Band Reject.....	\$275
Gold K105-0, Logic Analyzer w/4 Probe Pads.....	\$500	Polarad SPNH, Signal Generator, 20Hz-20KHz.....	\$450
HP 141T, Spectrum Analyzer Mainframe.....	\$4,000	Polarad SPNL, Signal Generator, 1Hz-600KHz.....	\$350
HP 141T, Spectrum Analyzer w/8552A/8553B, 1KHz-110MHz.....	\$1,200	Racal Dana 8303, True RMS RF Level Meter.....	\$550
HP 141T, Spectrum Analyzer w/8552B/8553A, 20Hz-300KHz.....	\$1,100	Rockland 1023F, Dual HiLo Filter.....	\$150
HP 141T, Spectrum Analyzer w/8552B/8554A, 1KHz-1.2GHz.....	\$1,700	Rockland 1023F, Dual HiLo Filter.....	\$150
HP 141T, Spectrum Analyzer w/8552B/8555A, 10MHz-18GHz.....	\$1,900	Sencore S081, Scope (100MHz) w/Probe, Dual Trace.....	\$250
HP 1807B, Scope Mainframe.....	\$250	Sencore SC81, Scope (100MHz) w/Probe, Dual Trace.....	\$500
HP 204B, Oscillator, 5Hz-1.2MHz, 5V RMS.....	\$100	Sencore SC8100, Wavemeter Analyzer (like new).....	\$1,900
HP 204C, Oscillator, 5Hz-1.2MHz, 5V RMS.....	\$125	Sorenson TVAG, TV Video Analyzer.....	\$1,100
HP 214A, Pulse Generator, 0.8V-100V.....	\$200	Sorenson DCR-90-5A, Power Supply, 80V @ 5A (metered).....	\$475
HP 334A, Distortion Analyzer.....	\$275	SRL 112B, PLOPRF Synthesizer.....	\$125
HP 350D, Attenuator.....	\$75	Tek DC503, Plug-in Counter Unit, 100MHz.....	\$175
HP 400E, AC Voltmeter, 10Hz-10MHz.....	\$150	Tek DMS01A, Plug-in DMM, 4 1/2 Digit.....	\$150
HP 400F, RMS Voltmeter, 20Hz-4MHz, 100uV-300V.....	\$175	Tek DMS02, Plug-in DMM, 4 1/2 Digit.....	\$150
HP 400B, AC Voltmeter Battery Operated, 5Hz-2MHz, 1mV-300V.....	\$100	Tek FG501, Plug-in Function Generator, 0.01Hz-1MHz.....	\$175
HP 415E, SWR Meter.....	\$100	Tek FG504, Plug-in Function Generator, 0.01Hz-40MHz.....	\$450
HP 427A, Multi-function Meter, DC & Resistance (10Hz-1MHz).....	\$100	Tek PG501, Plug-in Pulse Generator, 5Hz-50MHz.....	\$175
HP 432A, Power Meter w/Cable/Battery, 0.1-18GHz Sensor.....	\$350	Tek PS501-1, Plug-in Power Supply.....	\$150
HP 432A, Power Meter w/Cable/Sensor.....	\$150	Tek PS503A, Plug-in Power Supply Triple.....	\$175
HP 435A, Power Meter w/Sensor/Cable.....	\$175	Tek OG-502, Plug-in Optical Impulse Generator (unused).....	\$950
HP 651B, Test Oscillator, 10Hz-10MHz.....	\$150	Tek T922, Scope (15MHz), Dual Trace, nice.....	\$175
HP 652B, Test Oscillator, 10Hz-10MHz.....	\$150	Tek T923, Scope (15MHz), Dual Trace.....	\$125
HP 654A, Oscillator, 10Hz-10MHz, 90dB Attenuator.....	\$225	Tek T924, Scope (15MHz), Dual Trace.....	\$150
HP 16300, Logic Analyzer w/Probe.....	\$550	Tek T925, Scope (15MHz), Dual Trace.....	\$150
HP 1980B, Scope Measurement System w/1965A Gated Universal Trigger (like new).....	\$550	Tek T926, Scope (15MHz), Dual Trace.....	\$150
HP 3121A, Function Generator, 1Hz-15MHz.....	\$490	Tek T927, Scope (15MHz), Dual Trace.....	\$150
HP 3265A, Programmable Frequency Synthesizer 1Hz-50MHz.....	\$1,100	Tek T928, Scope (15MHz), Dual Trace.....	\$150
HP 3300B, Automatic Synthesizer, 20Hz-15MHz.....	\$325	Tek T929, Scope (15MHz), Dual Trace.....	\$150
HP 4000A, True RMS Voltmeter, 10Hz-10MHz, 1mV-300V.....	\$175	Tek T930, Scope (15MHz), Dual Trace.....	\$150
HP 4003C, True RMS Meter, AC/DC 100Hz, 1mV-300V.....	\$275	Tek T931, Plug-in Digital Delay.....	\$125
HP 4006A, RF Voltmeter, 50uV-3V, 1.2GHz.....	\$250	Tek T932, Plug-in Digital Delay.....	\$125
HP 4455A, DMM 5 1/2 Digit.....	\$250	Tek T933, Plug-in Digital Delay.....	\$125
HP 4456A, DMM 6 1/2 Digit.....	\$325	Tek T934, Plug-in Digital Delay.....	\$125
HP 4466A, DMM 4 1/2 Digit, AC/Battery, 5 Function.....	\$225	Tek T935, Plug-in Digital Delay.....	\$125
HP 3575A, Digital Phase Gain Meter.....	\$650	Tek T936, Plug-in Digital Delay.....	\$125
HP 3580A, Spectrum Analyzer, 5Hz-50KHz, LED Readout.....	\$850	Tek T937, Plug-in Digital Delay.....	\$125
HP 3581A, Wave Analyzer, 15Hz-50KHz.....	\$425	Tek T938, Plug-in Digital Delay.....	\$125
HP 3770A, Amplitude/Delay Distortion Analyzer.....	\$625	Tek T939, Plug-in Digital Delay.....	\$125
HP 3781B, Pattern Generator.....	\$300	Tek T940, Plug-in Digital Delay.....	\$125
HP 432A, LCR Meter.....	\$450	Tek T941, Plug-in Digital Delay.....	\$125
HP 5316A, Counter, 100MHz, HP/IB.....	\$475	Tek T942, Plug-in Digital Delay.....	\$125
HP 5328A, Counter, 100MHz w/DMM Opt. 021.....	\$250	Tek T943, Plug-in Digital Delay.....	\$125
HP 5328A, Counter, 500MHz.....	\$350	Tek T944, Plug-in Digital Delay.....	\$125
HP 5334A, Counter, 100MHz, Opt. 010 Oven.....	\$600	Tek T945, Plug-in Digital Delay.....	\$125
HP 5340A, Counter, 18GHz (nize).....	\$700	Tek T946, Plug-in Digital Delay.....	\$125
HP 5345, Counter, 500MHz.....	\$450	Tek T947, Plug-in Digital Delay.....	\$125
HP 5345A, Counter, 500MHz, HP/IB.....	\$650	Tek T948, Plug-in Digital Delay.....	\$125
HP 6067A, VHF Switch, Supply 20V @ 3A, 20-40V @ 1A (metered).....	\$175	Tek T949, Plug-in Digital Delay.....	\$125
HP 6112A, Power Supply, 40V @ 5A (metered).....	\$175	Tek T950, Plug-in Digital Delay.....	\$125
HP 6116A, Power Supply, 0-100V @ 200mA (metered).....	\$125	Tek T951, Plug-in Digital Delay.....	\$125
HP 6202B, Power Supply, 40V @ 75A (metered).....	\$175	Tek T952, Plug-in Digital Delay.....	\$125
HP 6203B, Power Supply, 7.5V @ 3A (metered).....	\$175	Tek T953, Plug-in Digital Delay.....	\$125
HP 6205B, Power Supply (dual), 0-40V @ 3A, 0-20V @ 6A (metered).....	\$225	Tek T954, Plug-in Digital Delay.....	\$125
HP 6206B, Power Supply, 0-60V @ 1A (metered).....	\$250	Tek T955, Plug-in Digital Delay.....	\$125
HP 6253A, Power Supply (dual), 0-25V @ 3A (metered).....	\$225	Tek T956, Plug-in Digital Delay.....	\$125
HP 6265B, Power Supply, 10V @ 10A (metered).....	\$400	Tek T957, Plug-in Digital Delay.....	\$125
HP 6265B, Power Supply, 40V @ 3A (metered).....	\$250	Tek T958, Plug-in Digital Delay.....	\$125
HP 6266A, Power Supply, 40V @ 6A (metered).....	\$250	Tek T959, Plug-in Digital Delay.....	\$125
HP 6269A, Power Supply, 0-40V @ 1.5A (metered).....	\$225	Tek T960, Plug-in Digital Delay.....	\$125
<b>• 60-DAY WARRANTY • 10-DAY RIGHT OF RETURN • SATISFACTION GUARANTEED</b>			



• 60-DAY WARRANTY  
• 10-DAY RIGHT OF RETURN  
• SATISFACTION GUARANTEED



**POOR MAN'S** Spectrum Analyzer/Monitor Receiver Kit. 2 to 1,700 MHz. Basic kit only \$78. Now available with switched resolution filters, tracking generator and direct digital frequency readout. Works with ANY scope or IBM compatible computer. Send stamped envelope for details. Science Workshop, Box 310B, Bethpage, NY 11714. <http://www.science-workshop.com>

**CUSHMAN CE3** \$175; Heathkit frequency counter SM2420 0-512MHz \$29; Tek 191 sig-gen \$100; Tek 465 & DM 40 \$125. Call for list. 909-873-1319.

**NEW WEB SITE** [WWW.Psitech-Plus.com](http://WWW.Psitech-Plus.com) Purchase and sell test measurement equipment.

**DIGITAL, ANALOG, & RF** test equipment. Closing R&D/manufacturing company. Must sell lots of equipment. Call 1-800-869-7827 or visit [www.starcom.com](http://www.starcom.com) for list.

**TEKTRONIX RACK Mount 496P Spectrum Analyzer** \$4,350. 510-226-7783.

**HP 1722B 275 MHz oscilloscope**, excellent condition with manual \$450, 650-842-3268.

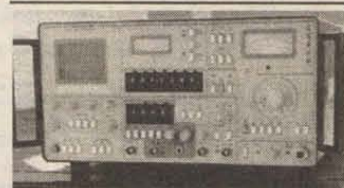
**NEW: POCKET TESTBENCH**, tiny, portable, RS-232 instrument. Scope, logic, spectrum, counter, generator modes. Oricom Technologies, 303-444-9776 ([www.sni.net/~oricom](http://www.sni.net/~oricom)).

**DEC EQUIPMENT WANTED!!!** We are buying DEC systems, boards, terminals, drives and peripherals. Also Scientific Micro Systems (SMS), DSD, Datability, Dialog, other DEC compatibles, and Computer Output Microfilm (COM) units. Please call for a quote or fax us your equipment list. We buy, sell, and trade. **KEYWAYS, INC.**, 937-847-2300 OR fax 937-847-2350.

**EQUIPMENT SALE:** HP 59501A D/A power supply \$50; HP 1630G logic analyzer, with all pods \$450; Anritsu 645A, both the sending & receiving unit for \$250; Leader LPS-151 DC tracking supply \$200. 707-745-4804, fax 707-747-5277.

**FACTORY BOXED** new 30 HSM 2GHz high-speed module \$450; Psitech Plus, 707-745-4804, fax 707-747-5277. [WWW.Psitech-Plus.com](http://WWW.Psitech-Plus.com)

**TEST EQUIPMENT** for sale/wanted: RF, Microwave, video and fiber optic. Cable TV, Broadcast TV, satellite and related industries. Wavetek, Tektronix, Hewlett Packard and other manufacturers. Spectrum analyzers, signal level meters, sweep systems, TDRs, OTDRs, and much more. PTL Test Equipment, Inc. Phone 561-747-3647 FAX 561-575-4635.



**CT SYSTEM, Inc. service monitor:** model 3000B, \$800, good working condition. Frequency range 400KHz to 1GHz, RF output 0.03UV to 316MV, receive sensitivity 2UV, RF sweep generator, tone generator/decoder, FM marker at 600Hz and 5KHz, internal wattmeter, internal distortion analyzer, oscilloscope. Tel: 714-778-5151 Fax: 714-778-0312.

**LOWEST PRICES!** HP 7585B drafting plotter \$1,000; HP 7596A Draft Master II plotter \$1,000; HP 7475A, 7550A plotters with HPIB \$500 each. All items come with manuals and 10 day right of return. **WALL SURPLUS**, phone/fax 732-681-2032.

**LOWEST PRICES!** HP 3551A transmission test set \$500; HP 5316A universal counter \$400; HP 141T display mainframe \$300; HP 5005B signature multimeter \$300; HP 5345A electric counter with channel C plug-in, option 011 and 012 \$500; HP 8750A storage normalizer \$300; HP 5004A signature analyzer \$200; HP 5150A thermal printer w/opt 002 \$200. All items come with a manual and 10 day right of return. **WALL SURPLUS**, phone/fax 732-681-2032 anytime.

**HP 3497A** data acquisition/control unit with voltmeter, current source, 20 channel multiplexer, D/A converter, manuals, \$450. (2) for \$850. **HP 6940B** multiprogrammer with 59500A interface, timer, scanner, and A/D cards, manuals, \$225. **Fluke 1722A** instrument controller, \$200. **Tektronix 528A** waveform monitor, 1420 vectorscope, rack mount, \$500. Kent, 515-232-7528.

**TEKTRONIX OSCILLOSCOPES:** 475 200MHz with opt 93 \$325; 466 storage 100MHz \$325; 464 storage with DM44 \$325; 454 scope \$250; 434 storage \$250; **7623A** with 7A14, 7A18, 7B53A plug-ins \$275; 7613 with 7A18 + 7B53A plug-ins \$200; **7603, 7613, 7623A** mainframes \$125. Each with manuals and 10 day right of return. **WALL SURPLUS**, phone/fax 732-681-2032.

**HP 8620C** sweep oscillator opt 011 with 862 42A RF plug-in \$500; **HP 8444A** tracking generator \$350; **Tek 7912** AD programmable digitizer \$400; **Tek 7C11N** curve tracer \$250; **Tek SC 502** 15MHz scope \$250. Each with manual and 10 day right of return. **WALL SURPLUS**, phone/fax 732-681-2032 anytime.

**RUBIDIUM STANDARDS:** Efratom, EG&G, \$425 (voltage control added free!). Graphtec WR7200 chart recorder, 12 sensitivities 6 speeds, 8 pounds, 5 rolls paper, \$295; cesium, quartz standards/repairs. Voltage controllable quartz modules, Austron 2100R automatic Loran-C receiver, \$500; Austron 2110 disciplined quartz standard, \$500. Both \$925. Corby Dawson 805-736-0288.

**RACAL 1992** nanosecond counter w/1.3GHz C-channel and high-stability timebase. Late model, excellent, w/manual, \$495. 732-445-4915.

**TEST EQUIPMENT** for sale: <http://www.A-COMM.COM>

## Tired of Expensive Inkjet Cartridges ? Save 90% on Inkjet Inks !

Printer	# of Refills		Cost/Refill		Kit Price	
	Black	Color	Black	Color	Black	Color
HP 500 Series, 400, Officejet 300, 350, Fax	7	14	4.71	2.85	32.95	39.95
HP 600 Series, Officejet 500, 570, 600	7	14	4.71	3.21	32.95	44.95
HP 800 Series, 1000C, 1150C, Copier 120, 210	6	10	6.67	4.00	39.95	39.95
HP 720C, 722C, 890C, 1120C	6	10	6.67	4.50	39.95	44.95
Canon BJ-10, 200, 210, 240, 250 Apple SWriter 1200, 1500	14	20	2.15	2.00	29.95	39.95
Canon BJC-4000 Series, C2500, C3000, C3500, C5000	60	60	0.50	0.67	29.95	39.95
Apple StyleWriter 2400, 2500						
Canon BJC-600, 610, 620 Apple SWriter Pro	20	13	1.50	3.07	29.95	39.95
Epson Stylus Color, Color Pro, Pro XL	12	12	2.50	3.33	29.95	39.95
Epson Stylus Color II, IIs	15	15	2.00	2.66	29.95	39.95
Epson Stylus Color 500, 200	20	17	1.50	2.35	29.95	39.95
Epson Stylus Color 400, 600, 800, 850, Photo	20	17	1.50	2.65	29.95	44.95
Lexmark JP 1000, 1020, 1100, ExecJet II, IIC, Medley 4C	10	17	3.00	2.35	29.95	39.95
Lexmark JetPrinter 5700, 5000, 7000, 7200	10	17	4.00	2.35	39.95	39.95
Xerox Home Center 450C, XJ6C Inkjet	22	12	1.36	3.33	29.95	39.95

## SAVE 30 - 50% on New Compatible Cartridges!

Printer	BLACK	COLOR
	CARTRIDGE	CARTRIDGE
Canon BJC-4000 Series, C2500, C3000, C3500, C5000	\$5.50	\$12.95
Apple StyleWriter 2400, 2500	\$5.50	\$12.95
Canon BJC-600, 610, 620 Apple StyleWriter Pro	\$4.95 (9cc)	\$4.95 @ (9cc)
Hi-Capacity Canon BJC-600, 610, 620	\$5.95 (15cc)	\$5.95 @ (12cc)
Canon BJC-70, BJC-80	\$9.95 (3-pak)	\$14.95 (3-pak)
Epson Stylus Color, Color Pro, Pro XL	\$12.00	\$19.00
Epson Stylus Color II, IIs	\$14.00	\$19.00
Epson Stylus Color 500, 200	\$14.00	\$19.00
Epson Stylus Color 400, 600, 800, 850, 1520, Photo	\$14.00	\$19.00

- **BULK Inks, Refill Accessories**
- **Glossy card stock & Coated Paper**
- **School & Government PO's Welcome**
- **2 - 3 Day Shipping**

**Quality Inks for:**  
HP • Epson • Lexmark  
Canon • Apple • DEC

**Inkjet**  
Southwest



**Call or see us online!**

Monday - Friday  
7:30 - 4:30 PST 10:30 - 7:30 EST

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

(602) 668-7334 Fax

**1-800-447-3469**

(602) 668-0959







## A/D CONVERTERS with SERIAL OUTPUT

Tiny (1.75"x1.41") fully assembled and tested printed circuit board includes two 8-bit A/D converters and one digital input. Up to 16 units addressable (DIP switch setting) totalling 32 converters on a single serial port. Output is ASCII encoded bit count (0 to 255) at 2400 BPS via RJ-11 interface. Fully programmed PIC16C71 installed in IC socket. Sample software in BASIC included. Requires 8-28Vdc At 1-2mA.  
\*\$49.95\* Optional  
DC adapter \$19.95.  
Add \$5.00 shipping.



Tele: 847-891-2584  
Fax: 847-891-2587  
www.glentech-rf.com

## SURPLUS SALE

1,000,000 WALL  
TRANSFORMERS



3VDC/100MA .... CX099 .... \$0.75  
6VDC/100MA .... CS039 .... \$1.45  
9VDC/100MA .... CR314 .... \$1.45  
12VDC/200MA .... CS033 .... \$0.99  
13.5VAC/400MA... CR574 .... \$1.29  
24VDC/500MA .... CR174 .... \$3.40

Min 1000/type -- Call for other types

## SURPLUS TRADERS

PO Box 276,  
Albany, VT 05440  
Tel: (01) 514-739-9328  
Fax: (01) 514-345-8303  
http://www.73.com/vt

FREE CATALOG!

## PROGRAMMERS OVER 50 MODELS

ADVANTECH EETools NEEDNAME DATA I/O ICE TECHNOLOGY HILO  
SYSTEM GENERAL CHROMA MODULAR CIRCUIT TECHNOLOGY XELTEK



PROMAX EMP-20 MEGAMAX MEGAMAX SIMM/SP TESTER EMUPA  
CALL ADVANTECH LABTOOL 599 EETools SIMMAX  
629 ICE TECH MICROV 795 CHROMA SIMM/SP  
650 EETools ALLMAX 359 MOD-MCT-EMUPAR  
409 EETools MEGAMAX 279 MOD-MCT-EMUPAR  
509 EETools MEGAMAX 49 EPROM 1G TO 512K  
369 XELTEK SUPERPRO II 69 EPROM 1G TO 1MEG  
409 XELTEK SUPERPRO II 99 EPROM 4G TO 1MEG  
249 XELTEK SUPERPRO II 199 EPROM 16G TO 1MEG  
165 XELTEK ROMMASTER II 89 EPROM 1G TO 8MEG  
479 MOD-MCT-EMUPA 129 EPROM 4G TO 8MEG  
739 SIAG ORBIT-32 250 EPROM 8G TO 8MEG



## General Device Instruments

Sales 916-393-1655 Fax 916-392-4949  
Web www.generaldevice.com E-Mail icdevice@best.com

## BATTERY — YUASA



Sealed Lead-Acid/Gel-Cell  
12V: 7AH \$19, 2.3/4AH \$16  
18AH \$39, 1.2AH \$13  
6V: 4AH \$9, 10AH \$13

Quantity Discounts Available  
Call for other models

## Aventrade

4518 Temple City Blvd.  
Temple City, CA 91780  
Tel: 626-286-0118 Fax 626-287-9618  
E-Mail: aventrade@aol.com

## Serial Problems???

Use your PC compatible desktop or laptop computer to debug serial communications problems with Serial, our test tool for serial communications.

Serial works with the standard data rates and asynchronous serial formats commonly found in modern office and industrial environments. Suitable for development, service work, and end-user problem diagnosis.

- Easy to Use
- Menu and Windows
- Highly Configurable
- Contextual Help
- Autobaud Detect
- Time Stamping
- Custom font editor for EGA/VGA Screens
- Saves Configurations
- Extensive Manual
- Block transmit ability
- CRC/LRC generation

Serial, with manual ..... \$99.95  
Cable for full duplex monitoring ..... \$49.95

For Orders and Inquiries Call: 1-800-980-9806

Allison Technology Corporation  
2006 Finney Valley Rd., Rosenberg, TX 77471  
281-239-8500 • 281-239-8006 FAX

## GET IT UP BEFORE WINTER!

MARCONI ANTENNA 700W 50 Ω  
THE BEST "LITTLE" LOW BAND ANTENNA

EASY TO  
INSTALL.  
— 160M —  
130' OVERALL  
\$53.95 PP  
— 80M —  
67' OVERALL  
\$46.95 PP

THE OCR, AN OPTICALLY COUPLED  
REGEN. IS AN EXCEPTIONAL REGEN  
RECEIVER KIT. EASY TO ASSEMBLE.  
(SEE QST JUNE 98) \$91.95 PP

## SEND FOR FREE CATALOG:

- SMART BATTERY CONTROLLER KITS
- CODE PRACTICE OSCILLATOR... \$23.45 PP
- CURTIS KEYS KIT ..... \$46.95 PP

1-800 JADE PRO (523-3776)  
www.jadeprod.com/  
email: jadepr@jadeprod.com

JADE PRODUCTS INC. E. HAMPSTEAD NH 03826-0388

## PCB's in Minutes from LaserPrint!\*

8 1/2" x 11" Sheets  
\* Or Photocopier  
Use household  
iron to apply.



## PnP BLUE or PnP WET

For High Precision Professional PCB Layouts

1. LaserPrint
2. Iron-On
3. Peel-Off
4. Etch

Adds an Extra Layer of Resist for Super Fine Lines on Std. Clad Bds  
Transfers Laser Printer or Copier Toner as Resist to Std. Clad Bds

205h\$30/405h\$50/1005h\$100 Blue/Wet (No Mix)  
Sample Print 5 Shits Blue + 5 Shits Wet \$50  
VISA/MC/PC/CHMO \$4.50h - 2nd Day Mail

Techniks Inc. P.O. Box 463 Ringoes NJ 08551  
(908)788-8249

100% Money Back Guarantee-Dealer Inquiries Invited

## Convert RS-232 to RS-485 or TTL/CMOS for Only \$49.00

Communicate up to 1000 feet, at up to 1 MEGA-BPS, full or half duplex, up to 32 units on one serial link, with 31 jumper options for flexible configuration, LED indicators.

## COMMUNICATIONS CONVERTER

- FULL SCHEMATIC AND DOCUMENTATION
- FULL FAMILY OF MODULAR DESIGNS
- RS-485/RS-422 REMOTE I/O MODULE KITS
- NETWORK SOFTWARE AND SOURCE CODE
- AUTOMATIC OR RTS UNITS AVAILABLE
- RJ-11/12 CONNECTORS OR TERMINAL STRIP
- TURN YOUR PC INTO A DISTRIBUTED DATA ACQUISITION AND CONTROL SYSTEM

## R.E. SMITH

(513) 874-4796  
4311 TYLERSVILLE RD. ■ HAMILTON, OHIO 45011  
www.rs485.com

## TV 85 PJ & TV 86 CABLE CONVERTERS VOLUME & NON-VOLUME CONTROL

SALES/SERVICE  
VOICE 1-800-473-0506  
FAX 1-800-488-0525

## FOSS WAREHOUSE DISTRIBUTORS

285 Schenck St.  
N. Tonawanda, NY 14120  
www.foss.com

PCBs  
PER SQIN  
\$100.00 SETUP  
WE SPECIALIZE IN SINGLE SIDED, 1 OZ, PC75

PCB  
LAYOUT  
PER COMPONENT PIN \$100.00 MINIMUM

ENGINEERING  
DIAGRAMS  
PER COMPONENT PIN \$100.00 MINIMUM

V&V MACH. & EQUIP., INC. (HOUSTON, TX OFFICE)  
PH (281) 397-8101 FAX (281) 397-6220  
MARKETING TECH, S.A. (MEXICO/PLANT)  
PH 011 (525) 361-3351 FAX 011 (525) 361-5996

## Peltier Junction

While They Last!  
1 3/16" x 1 3/16" cooling area  
Quantity Pricing Available



WITH HEATSINK AND LEADS  
\$10 EACH  
OR THREE FOR \$25

SHREVE SYSTEMS  
318-424-9777  
Ask for Jake  
HTTP://WWW.SHREVEYSTEMS.COM

## RGB Color Composite Displays ON SALE!



\*refreshed with 90-day warranty  
ONLY \$79!!  
Excellent for studio, lab or surveillance applications  
640x480 resolution, RCA-style connectors

Returns subject to a 15% restocking fee. Prices are subject to change without notice.  
WE ACCEPT VISA, MASTERCARD, AMEX, DISCOVER

Telecom Hardware/Software Developers  
STOP using your phone lines to test and demonstrate your telecom devices. Our affordable telephone line simulators offer authentic USA dial tone, busy signals, ringing, and exceptional speech quality.

RING-IT! TELCO SIMULATOR  
• Single Line (two RJ-11 Jacks)  
• LED Display  
• DTMF Operation  
• Automatic Ring-up Mode  
• \$325 (\$149 kit available)

PARTY-LINE TELCO SIMULATOR  
• Six Extensions  
• Caller-ID (Name/No)  
• Distinctive Ringing  
• \$425 (\$199.95 kit avail)

Digital Products  
COMPANY

134 Windstar Circle  
Folsom, CA 95630 USA  
Tel: 916-985-7219  
Fax: 916-985-8460

http://www.digitalproductsco.com

## ADAPT-11 & ADAPT-12 Low-cost modules for HC11 & HC12 plug into solderless breadboards

- Evaluate your idea instantly!
- Breadboard it, for quick hardware changes
- Program it in-circuit, for quick software changes
- Debug your application—no the basics!

ADAPT-11 Modules feature three 8-bit I/O ports, SPI, SCI, eight 8-bit analog input channels, hardware timers/counters, & interrupts. All Starter Packages include PC serial download cable, documentation, & disk of utilities & examples. Bundle ImageCraft C for Windows (ICC11) with any Starter Package for an additional US\$120 + \$5 S&H.

HC11 Starter Package Configurations:  
AD11-SP 2K EE256 bytes RAM US\$ 74.95 + \$5 S&H  
AD11C75-SP 8K EE512 bytes RAM US\$ 87.00 + \$5 S&H  
AD11C75DX-SP 8K EE32K bytes RAM US\$120.00 + \$5 S&H  
AD11-SP4K ADAPT-11 w/ 32K EE32K RAM memory expansion card & dual slot adapter (2 I/O ports total) US\$123.00 + \$5 S&H

ADAPT-12 features 68HC12A4, 4K EE, 1K RAM, 85 I/O lines, eight high speed 8-bit analog inputs, memory expansion connector, RS232 & RS485, convenient firmware loader, plus support for all BDM pods. All this on a compact 2.25" x 3.25" board. Starter Package (AD12-SP) US\$99 + \$5 S&H. Add US\$125 for ICC12WN. AVAILABLE SOON! ADAPT-912 features 68HC12B32 (32K Flash, 768 EE, 1K RAM, 56 I/O lines, 8 chn. analog), RS232 and RS485. All this and more on a compact 2.25" x 3.25" board! Starter Package (AD12-SP) US\$99 + \$5 S&H. Add US\$125 for ICC12WN.

TECHNOLOGICAL ARTS  
voice/fax: (416) 963-8996  
www.interlog.com/techart

## HIGH PERFORMANCE ULTRA-MINIATURE PINHOLE LENS CAMERA W/ CASE

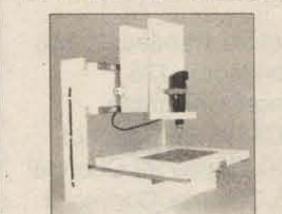
The "NEW" MiniCam1 (in a durable, metal case) is the smallest pinhole camera in the industry! Its actually smaller than the board cameras

currently on the market. Comes w/ mounting bracket & power supply for easy installation • High resolution—more than 420 lines, 0.1 lux • Ultra miniature—lightweight & measures only 29mm x 29mm x 12mm. • Pinhole lens offers sharp image w/ heightened sensitivity • Can be easily mounted behind a 1/8" hole for any custom/covert applications. ONLY...\$79.00

Surveillance Catalog \$5.00

SPY OUTLET  
2468 Niagara Falls Blvd • Tonawanda NY 14150  
(716) 695-8660 Fax 695-7380 www.spyoutlet.com

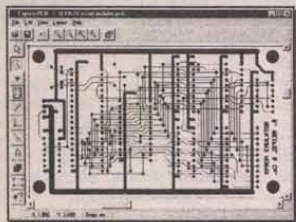
## 3-Axis Machine



Full function 3-axis machine kit based on Parallax's BASIC Stamp 2.  
• 3 Stepper motor drive with 4 thou resolution  
• Approx 12"x12"x18" when assembled  
• Kits from \$299  
• Includes PCB Drilling software and Stamp code  
Miford Instruments - England  
Tel: 011-44-1977-683665 Fax: 1977-681 465  
www.mifordinstruments.co.uk



## PC Board Layout Software



www.expresspcb.com

## ATTENTION DEALERS

### WHOLESALE ONLY!

• ANY CABLE MFRG CONVERTERS & ACC

• BEST PRICING & SERVICE

• SHOP US NOW

PANASONIC • NOVA, ETC.

800-777-7731

## ATOMIC TIME FOR ANY COMPUTER

WWVB based time code receiver and real time clock with RS232 interface

### FEATURES

Sensitive receiver  
Direct UTC readout in ASCII  
Y2K compatible calendar  
0.1 second accuracy  
RS232 powered  
Low cost

### APPLICATIONS

Remote data acquisition  
Embedded systems  
Automatic sequencers  
Tamperproof time stamping

**ULTRALINK**

702 782 9758 www.ulio.com

## EPS EPROMS AS LOW AS 25¢

27C256	27C040	27C1024	87C51
27C512	27C400	28F010	8751
2732A	27C4096	28F020	8755
27C32	574000	28F040	88705
27C128	574200	8749H	2564
27C64	27C402	8748H	2516
2716	27C020	8741	
2708	27C210	8742	
27C512-90	27C010	8744	

**PROCESSOR**  
8255  
8254  
80C31

**STATIC RAM**  
62256 & 6264 & 6116  
GAL16V8 & GAL22V10  
PIC16C54 & PIC16C56

**MEMORY**  
8255  
8254  
80C31

## SPECIAL 2764

TEL: (818) 774-9444 • FAX: (818) 774-0822  
WE BUY EXCESS INVENTORY

FREE SAMPLE COPY!

## ANTIQUE RADIO CLASSIFIED

Antique Radio's Leading Monthly Magazine

Articles - Classifieds - Ads for Parts & Services. Also: Ham Equip. - Books - Telegraph - 40's, 50's & 60's Radios - Early TV - Auction Reports & more...

1-Year: \$39.49 (\$57.95 by 1st Class)  
6-Month Trial - \$19.95. Foreign - Write.

A.R.C., P.O. Box 802-G23  
Carlisle, MA 01741

Call: 978-371-0512 • Fax: 978-371-7129

Web: www.antiqueradio.com

## EQUIPMENT FOR SALE

### ELECTRONIC TEST

Tektronix .....EXT 330  
Hewlett-Packard .....EXT 331  
Other Manufacturers .....EXT 332  
MEASURE & INSPECT .....EXT 333  
VIDEO PRODUCTS .....EXT 370  
SCIENTIFIC & LAB .....EXT 335  
LASERS .....EXT 340  
POWER SUPPLIES .....EXT 334  
COBWEB CORNER .....EXT 380  
MFG

COMPLETE INDEX .....EXT 300

To obtain information via FAX: A) Have your fax number ready. B) Dial 1-800-547-4636. C) Request above Extension Numbers.

**DEXIS CORPORATION**  
(612) 944-7670 FAX (612) 942-9712  
9749 HAMILTON ROAD  
EDEN PRARIE, MN 55344

## CUT MANUFACTURING COST!

CUSTOM METAL BOXES  
WE ACCEPT SMALL ORDERS TOO

SHEET METAL

20 GAUGE

SILK SCREEN

PRINTED

WITH YOUR CO. NAME

ALSO PCB, SMT, PROTOTYPES, ASSEMBLY, PLASTIC MOLDS, INJECTION MOLDING.

USA Office: V&V Mach. & Equipment, Inc.  
Ph: (281) 397-8101, Fax: (281) 397-6220.  
Mexico Plant: Marketing Tech.  
Ph: 011 (525) 361-3351, Fax: 011 (525) 361-5996.

## Get PIC'n!

Everything you need to get started with the exciting PIC microcontrollers today!

PIC-n-GO Package includes:

ITU PIC-1+ Programmer



• Programs ALL PIC16C55/62/70/80/9x, PIC16F8x, and PIC12C devices!  
• 5 pin expansion header for In-System Programming and adapters  
• Power Supply, Cable, Software, Manuals and Example Programs  
Options: 18 pin ZIF - add \$15  
4028 pin ZIF adapter - \$39

PLUS: a PIC16F84-10/P  
Electrically-Erasable  
Microcontroller

Only \$75! Kit only \$45

Order Toll Free! (888) 4-TU-TEC

ITU Technologies  
3704 Chevrolet Ave. Ste. 3, Cincinnati, OH 45211  
Phone: (513) 661-7523 Fax: (513) 661-7534  
E-mail: sales@itutech.com

## ASSEMBLY & ENGINEERING

Producible designs since 1970

Contract Engineering  
Embedded Microprocessors  
PCB Layout and Packaging Design  
Analog including RF to 1 GHz  
Instrumentation  
A/D and D/A

Contract Assembly  
High-Speed Fuji Surface Mount  
Through hole  
Turn-key or Kit  
Run sizes one through thousands  
Test and burn-in available

Bilocon Corp.  
800-736-5927  
425-353-2276  
www.bilocon.com

ST241A  
Stereo microscope  
\$240.00  
New - 1 year warranty



650/367-8320  
Fax - 365-5845  
3580 Haven Avenue  
Redwood City, CA 94063-4603  
Email: jllittle@netwizards.net

## CONTROL • MEASURE • INPUT

### MODEL 40-\$109

• RS-232 interface  
• 28 lines digital I/O  
• Eight analog inputs  
• PWM output  
• Three stepper ports



### MODEL 100-\$279

• 12-bit 100KHz A/D • Four analog outputs  
• Three timer counters • 24 digital I/O



**PRAIRIE DIGITAL, INC.**  
920 SEVENTEENTH ST., INDUSTRIAL PARK  
PRAIRIE DU SAC, WI 53178  
TEL: (608) 643-8599 • FAX: (608) 643-6754

CALLER ID PHONE  
w/ELECTRONIC ORGANIZER!  
w/1500 NUMBER  
SPEED DIALER AND  
MUCH MORE!!



\$49.95 + S&H, MC/VISA  
TURNER TECHNOLOGIES  
800-600-1952

## SURVEILLANCE FREE CATALOG



Color Cameras Starting at \$149 IR Flashlights Starting at \$35 Night Vision Starting at \$169

FULL ONLINE CATALOG  
www.mscelectronics.com

MSC Electronics  
PO BOX 461 Jessup, MD 20794  
(301) 497-1600  
FAX (301) 497-1925

## 1 MB cache, AMD 300

System featuring: 10/12/98  
Enlight Mini Tower, VIA chipset, 100MHz operation, 2 USB ports, 64 MB PC-100 compatible memory, 6.4 GB IBM UDMA-33 drive, 32X CD-Rom with audio button, 4 MB AGP video card, S3-Trio3D chipset, 1.44 floppy, V.90/X2 PCI faxmodem, 3D sound card, full-size speaker set, 15" digital monitor, Windows 98 on CD .....\$993

tech-specialties, Inc.

(800)864-5391, fax: (713)307-0314  
email: sales@ts.nu, web: www.ts.nu

Detailed Quote on other configurations (PII 300/450, single/dual CPU or low cost, 233 MHz/32 \$570 w. monitor) by email, fax or phone. Ask for Free Shipping and Catalog!

## TEST EQUIPMENT

HP  
8620C Sweep Oscillator .....\$200  
8503A S-Parameter .....\$125  
8505A Network Analyzer  
500KHz-1.3GHz .....\$900  
8558B Spectrum Analyzer  
0.1-1500MHz .....\$800  
7912P .....\$350

GOULD  
4030 Digital Storage Oscilloscope ...\$250  
TEK  
5110 Oscilloscope w/No-Tech 5200 ..\$75  
OF152 Fiber Optic TDR,  
1300NM Multimode .....\$750

PLUG-INS  
7A18 ...\$25 7B70 ...\$25  
7B92A ...\$25 7A19 ...\$25  
7A26 ...\$25

7D01 Logic Analyzer .....\$100

PLUS BAR CODE EQUIPMENT, PHONES, CALLER IDS, PC EQUIPMENT, and MUCH, MUCH MORE • FREE CATALOG  
T.T.I. • 616-475-8531 • 616-475-8534 fax  
CALL TODAY

## GPS Units

Trimble Placer 400  
6 Channel w/3" diam. Antenna  
\$59.95

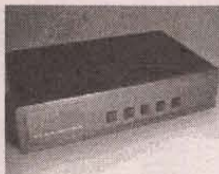
Trimble Placer 300  
6 Channel w/Wedge Antenna  
\$99.95

Survey Software / Antennas  
Call for a List or Fax to 713-522-6309

## Communications Surplus

713-526-8000 or 877-878-6GPS  
lshaefer@flash.net





**FACTORY SALE! QVS 104:** 4 BNC/RCA 12 pixels, 256 scale. 8.5" (W) x 2" (H) x 5.5" (L). \$169 @ 5 pcs., \$149 @ 10 pcs. Also available: 8-1 video auto-switcher, \$65 @ 5 pcs., \$58 @ 10 pcs. Distributors welcome. Matco, Inc., 1-800-440-0299 Fax: 630-350-9546. E-Mail: sales@matco.com



**PROGRAMMABLE DIGITAL KEYPAD.** Assembled. 1 to 8 digit code user programmable. Relay time adjustable. Keypad separate from control box for tamper protection. \$27.95 + \$5 shipping. Amazon Electronics. Tel 1-888-549-3749. Lots of other products. <http://www.electronics123.com>



**NANNY CAMS** starting at \$149! Color, B&W, wired or 2.4GHz wireless. Audio available! Quantity discounts. Visa, MasterCard. Over 200 surveillance products. Free catalog 301-497-1600. [www.mscelectronics.com](http://www.mscelectronics.com)

**Closing Date**  
For Next Issue — November 5th

# Quality Reconditioned TEST EQUIPMENT

## Advantest R3271 \$19,000.00

Spectrum Analyzer, 100 Hz 26.5 GHz excellent spectral purity, 10 Hz to 3 MHz resolution bw, built in frequency counter with 1 Hz resolution.

## Anritsu MG 3670B \$17,500.00

Signal Generator, 300 kHz to 2.25 GHz, -143 to +13 dBm (resolution 0.1 dB). Digital modulation signal generator equipped with high quadrature modulator. Has MG0303B burst function.

## Anritsu MG 3671B \$19,500.00

Digital Modulation Signal Generator, 300 kHz to 2.7 GHz, -143 to +13 dBm (resolution 0.1 dB). Provides a stable and precise output as well as spectral purity up to a max output of +13 dBm, even with modulation.

## Hewlett-Packard 8657A \$3,900.00

Signal Generator, 100 kHz to 1040 MHz, 10 Hz resolution, output power +13 to -143.5 dBm into 50Ω. Option 002, RF connectors on rear panel.

## Hewlett-Packard 3561A \$8,250.00

Dynamic Signal Analyzer, 000125 Hz to 100 kHz, +27 to -120 dBV, 80 dB dynamic range, to 640 μHz resolution bw.  
3561A Opt 001 \$8,750.00.  
(extended non-volatile memory)

## Hewlett-Packard 8566B \$39,500.00

Spectrum Analyzer, 100 Hz to 325 GHz with external mixers (not provided), amplitude range of -134 to +30 dBm.

## Hewlett-Packard 5342A Special \$1,350.00

Microwave Frequency Counter, 500 MHz to 18.0 GHz, wide FM tolerance, 11 digit led display, sensitivity to -25 dBm. Opt 001, high stability time base; 011, HP-1B.

## Hewlett-Packard 3562A \$10,700.00

Dynamic Signal Analyzer, 64 μHz to 100 kHz, spectrum, network and transient analysis, 150 dB dynamic range, high accuracy.

## Hewlett-Packard 3563A \$14,000.00

Control Systems Analyzer, provides measurement of analog and digital signals. Network, spectrum, waveform and transient applications. 64 μHz to 100 kHz, 80 dB dynamic range, analog and digital input, high accuracy (+/-0.15 dB).

## Hewlett-Packard 8671A \$4,250.00

Microwave Frequency Synthesizer, 2.0 to 6.2 GHz, +8 dBm min. output power.

## EIP 545 Special \$750.00

Microwave Frequency Counter, 10 Hz to 18 GHz frequency range (3 bands), 12 digit LED display, time base: 10 MHz, aging rate <3x10<sup>-7</sup>/month, 50Ω input.

## EIP 545A Special \$895.00

Microwave Frequency Counter, 10 MHz to 18 GHz frequency range (3 bands), 12 digit LED display, time base: 10 MHz, aging rate <3x10<sup>-7</sup>/month, 50Ω input.

## Wavetek 3520 \$3,250.00

Signal Generator, 1 to 2800 MHz, -137 to +10 dBm, frequency resolution is 100 Hz to 1040 MHz and 200 Hz to 2800 MHz. GPIB, 32 front panel stored settings.

## Tektronix 2465A \$3,950.00

350 MHz Oscilloscope, 4 channel, 1 ns risetime, 2 mV/div vertical sensitivity at 350 MHz, auto setup, save and recall setups, on-screen trigger-level readout, volts and time cursors with on-screen readout. Has Opt. 05, TV/Video waveform measurement; 11, rear panel probe power.

## Tektronix 11402 Special \$2,950.00

Digitizing Oscilloscope, 1 GHz bw, monochrome, 8 channel acquisition, advanced waveform processing. Accepts 3 11000-Series plug-ins.

## Tektronix 11403 Special \$3,950.00

Digitizing Oscilloscope, 1 GHz bw, color, 8 channel acquisition, dual independent time bases, advanced waveform processing. Accepts 3 11000-Series plug-ins.

## Tektronix 2213A Special \$600.00

60 MHz Oscilloscope, 2mV sensitivity, 5 nS/div sweep speed, advanced trigger system. Includes 2 probes.

## Tektronix 2220 Special \$895.00

60 MHz Oscilloscope, digitizing rates 20 MS/s at 5 uS/div and faster to 20 samples/s at 5 s/div, digital storage/non-storage, single timebase, 4 k record length.

## Tektronix 2430A Special \$3,750.00

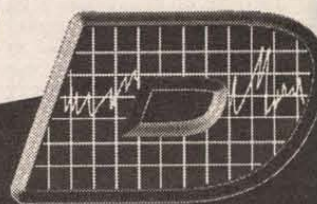
150 MHz Digital Oscilloscope, 100 MS/s digitizing rate, simultaneous acquisition on 2 channels, envelope mode with 2 ns glitch capture. Has Opt. 05, TV/Video waveform measurement; 11, probe power.

## Tektronix 466 Special \$575.00

100 MHz Storage Oscilloscope, dual trace, 5 mV/div, stored writing speed of 3000 div/μs variable persistence. Includes 2 probes.

## Tektronix 465 Special \$550.00

100 MHz Oscilloscope, dual trace, 5 mV/div sensitivity, 5 nS/div sweep rate. Includes 2 probes.



**DANBAR  
SALES COMPANY**

**WANTED  
USED TEST  
EQUIPMENT**

(602) 483-6202  
Fax (602) 483-6403  
14455 North 79th Street, Unit #C • Scottsdale, Arizona 85260

**ALWAYS-IN-TOUCH** sends Caller ID & duration of inbound and outbound calls instantly to pager, \$99. 1-800-240-4637 or [www.callerid.com](http://www.callerid.com)

## SATELLITE EQUIPMENT

**USED SATELLITE EQUIPMENT.** You name it, we have it. LNAs, downconverters, drives, receivers. Working condition guaranteed. Call 765-385-2305.

**FREE SATELLITE TV CATALOG.** Tech books, installation videos, analysis software 1-800-843-2425 or [www.baylin.com](http://www.baylin.com)

**SATELLITE EQUIPMENT** available: Receivers \$25 and up; 20-25 LNB \$30; C-KU feed horns \$65. Call 757-599-4408.

**L BAND** quadrifilar T/R antenna, 55 dB LNA, 20 watt HPA, works great for remote GPS. Info at [afstar.com](http://afstar.com)

**MILITARY TRANSISTORS & DIODES & INTEGRATED CIRCUITS WANTED.** ELECTRONIC MATERIAL INDUSTRIES 818-769-1002, FAX 818-769-1084.



**FREE BIG** dish catalog. Low prices! Systems, upgrades, parts, and "4DTV." Skyvision, 1010 Frontier Dr., Fergus Falls, MN 56537. [www.skyvision.com](http://www.skyvision.com) Call 1-800-543-3025.

**KU UPLINK.** 5.6 meter antenna, modulators, upconverters, TWT HPAs, exciter, test equipment, 26KVA generator. Closing company. Must sell lots of equipment. Call 1-800-869-7827 or visit [www.starcom.com](http://www.starcom.com) for list.

**DSS TEST CARD** information. Call toll free, 1-888-416-7296.



**BEST PRICING** on 18" satellite TV systems for home and RV. DSS, DISH Network programming, multi-room viewing options, accessories. [www.skyvision.com](http://www.skyvision.com) Call 1-800-543-3025.

**SATELLITE RADIO BOOK AND GUIDE.** New book covers all Audio Services, SCPC, Subcarriers, FM Squared, Facsimile, Press Services, Weather Services. Simple how-to-learn instructions. \$16.95 plus \$3 Priority Mail. UNIVERSAL ELECTRONICS, 4555 GROVES ROAD, #12, COLUMBUS, OH 43232. 614-866-4605.

**FREE SATELLITE TV INSTALLATION TOOLS AND EQUIPMENT CATALOGUE:** for complete installation. Consumers, dealers, distributors and technicians welcome. 1-800-646-8665 or [www.natropolis.com](http://www.natropolis.com) or fax 651-641-1898. Natropolis, Int'l, PO Box 14115, St. Paul, MN 55114.

## MILITARY SURPLUS ELECTRONICS

**MILLIONS \$\$\$** in "scrap gold" from old computers and electronics junk. Message: 603-645-4776 or [www.tiac.net/users/quicksand/goldtek.htm](http://www.tiac.net/users/quicksand/goldtek.htm)



## AUDIO — VIDEO — LASERS

**PROJECTION LAMP Blowout!** 50% below retail! BSK/BSW/BRX \$5, BVE \$26, CAL/CXP \$19, CAR \$13, CBA \$31, CTT/DAX \$26, CXR \$22, DCA \$26, DDB/DDW \$26, DDD \$25, DJT \$14, DHT \$27, EUL \$16, ELH \$12, EJA \$12, EHL \$15, BHC/DYS/DYV \$11, FAL \$19, DFT \$27, FCS \$7. Free shipping on prepaid orders over \$50. Call Tom 609-222-0636, Fax 609-222-0638.

**START YOUR OWN TECHNICAL VENTURE!** Don Lancaster's newly updated **INCREDIBLE SECRET MONEY MACHINE II** tells how. We now have autographed copies of the Guru's underground classic for \$18.50. Synergetics Press, Box 809-K, Thatcher, AZ 85552. 520-428-4073. VISA/MC.

**MOD CHIPS for Sony PlayStation.** Now your backups will work. Only \$9.95 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)



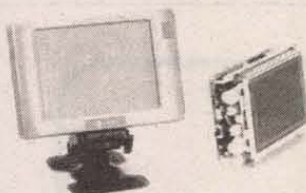
**ANTIQUE VIDEO TRANSFER SERVICE:** transfer of any 2" quadruplex video tapes. Quad TV spots, features, medical, corporate, military, government, and university tape libraries TRANSFERRED TO VHS. Affordable. Phone/fax 415-821-7500. If no answer call 415-821-3359 or pager 415-245-8700.

**CREATE 3-D video images with the Visual Eyes Video system.** Phone or fax 918-479-6451 or write to Sync-A-Link, PO Box 4, Locust Grove, OK 74352.

**BROADCAST VIDEO equipment wanted:** all types, new or old. Please call, Jon with info. 1-800-539-2859.

**SONY/TEK-RTD 710** real time digitizer, \$2,000. Great for video engineering. Call Roger @ GS&E, 716-338-7001. VISA/MC.

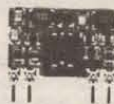
**WANTED: PRO video equipment,** VCRs, switchers, cameras, etc. Advanced Media 702-874-1911.



**TFT COLOR LCD monitor:** 12VDC power, NTSC video input. Display for car, boat, navigation, instrument, security. 4" panel \$199. 5.6" monitor \$499. TV tuner and 6.4" display, remote control, audio/video switching \$699. Also whole line of CCD CAMERA, SECURITY products. Rearview black/white camera and 4" display set for RV, truck, bus safety \$339. 1-800-266-5706 PCT. Website: [mobil-e-tech.com](http://mobil-e-tech.com)

**ELECTROVOICE MICROPHONES!** Quality used mics for recording, broadcast, and PA applications. Omnidirectional: EV635 \$45, D056 \$39, Shure 561 \$29, Cardioid: RE11 \$125, RE15 \$95, RE16 \$89-\$125, RE18, \$159, DL42 shotgun \$219. Free shipping on prepaid order over \$50. Call Tom 609-222-0636, Fax 309-222-0638.

## RF Data Modules



### AM TRANSMITTER

- Small size: 17.78 x 11.43mm
- CMOS/TTL input
- No adjustable components
- Low Current. 4mA typical
- 418MHz or 433.92MHz OOK
- Simple to integrate - simply add antenna, data and power
- Range up to 250ft.
- Wide supply range, 2-14Vdc
- SAW controlled - stability
- Also available in DIL package

AM-RT5 ..... \$12.10



### AM RECEIVER

- Compact size: 38.1 x 13.7mm
- On-board data recovery. CMOS
- Low current. 2.4mA typical
- 2kHz data rate. CMOS/TTL output
- 5Vdc operation
- On 418MHz or 433.92MHz (4xx)
- No adjustable components
- Patented Laser Trimmed component
- High stability
- Sensitivity: -105dBm
- Available also in 0.8mA version

AM-HRR3-4xx ..... \$10.95

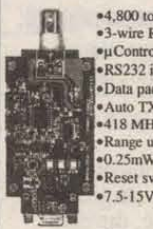


### FM TRANSCIVER

- Only 23 x 33 x 11mm
- Up to 40k bps data rate
- 19200 baud with ASCII
- Up to 500ft. range
- 5v operation
- 0.25mW into 50
- 418 or 433MHz FM
- Fast 1ms enable
- Direct interface to 5V CMOS
- Auto TX/RX changeover

BIM-4xx-F ..... \$87.36

### RS232 TRANSCIVER MODULES



- 4,800 to 38,400 bps half duplex
- 3-wire RS232 interface
- Controller with user EEPROM
- RS232 interface protected to  $\pm 15kV$
- Data packetizing performed by user
- Auto TX/RX changeover
- 418 MHz and 433MHz versions
- Range up to 500ft. (0.25mW ver.)
- 0.25mW & 10mW versions
- Reset switch and status LED's
- 7.5-15V dc via DB9 connector, 20mA

BIM-4xx-RS232 .... \$139.30



Transceiver..... RTcom-4xx..... \$247.90  
Transmitter..... RTcomTx-4xx..... \$ 87.15  
Receiver..... RTcomRx-4xx..... \$105.52



**ABACOM**  
TECHNOLOGIES



Tel: (416)236-3858  
Fax: (416)236-8866  
[www.abacom-tech.com](http://www.abacom-tech.com)  
[abacomtech@compuserve.com](mailto:abacomtech@compuserve.com)

## MICRO VIDEO CAMERAS

### MB-750U & MB750P

Video Cameras  
your Choice  
**\$89.95**

- 1.25" sq.
- .1 LUX
- 420 TV Line

The Best, Smallest, Micro Cameras on the Market Today!  
Call and Compare! We Match or Beat All Prices!

### NIGHT VISION



Night Vision Scope w/ Illuminator  
Fun to use, Low cost.  
3.6 x 85mm f1.6  
MI-PR100 - \$399.95

### WIRELESS VIDEO CAMERAS

Compatible with  
AC or Battery

Transmits  
Over  
1000 ft.



GFT-1001 \$189.95  
Gives any camera the  
ability to be Wireless.  
Transmits Over 1000 ft.



Wireless 4-Channel B/W &  
COLOR Cameras Available!  
Plug and Play Readiness



Wireless Observation System's  
GFS-1001 (900MHz) - \$499.95  
GFS-1001c (900MHz) - \$599.95  
(1.2 GHz system available)

**1-800-752-3571**

Visit Polaroid Ind. Web Site at:  
<http://www.polaroidusa.com>

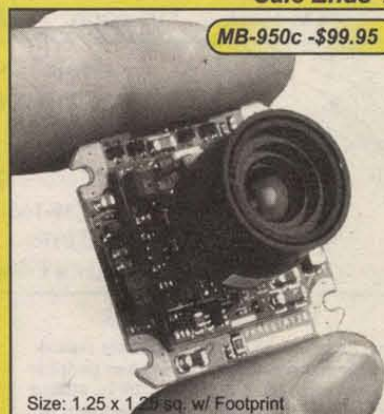
**Polaris Industries** 470 Armour Drive NE • Atlanta GA 30324 • Tech Info: 404-872-0722 • FAX 404-872-1038

Write in 45 on Reader Service Card.

## Panasonic Color Camera Sale

**MB-950c Panasonic Camera Sale \$99.95 was \$299.95**  
Sale Ends 12/31/98

**MB-950c - \$99.95**



Size: 1.25 x 1.25 sq. w/ Footprint

### Micro Color MB-950C: \$99.95

- Wide Voltage Range, 5-14 Volts!
- Small Footprint!
- Self contained ultra small package design for various applications.
- MCM PCB design for minimizing the size and improve durability.

### Specifications: MB-950c Color Camera

Pick-up device ..... 1/4" Interline transfer  
Effective Pixels ..... 512 (H) x 496 (V)  
Scanning System ..... 2:1 Interlace  
525 lines - 60 fields  
Frame per second ..... 30 frames  
Synchronization ..... Internal  
Video output ..... VBS, 1vpp 75 Ohms  
Horizontal Res. .... More than 330 lines  
Min. Required Illumination 40 LUX @ F2.8  
AGC ..... On fixed  
White Balance ..... ATW fixed  
Operating Temperature ..... 32°F to 104°F  
Ambient conditions ..... Indoors.

## AFFORDABLE LIPSTICK CAMERAS

**NOW**  
**\$99.95**  
**EACH**



Length: 1.9"  
Diameter: .91"

LP-850i



Length: 1.37"  
Diameter: .87"

LP-850p

These cameras are supplied with a PCM-1 Video/Power cable. The RCA female connection is for standard video connection to a Monitor or VCR. Video signal - 75 ohms at 1 volt peak to peak NTSC. The power is supplied to the camera by a 2.1mm barrel connector, 12 VDC center positive.



**FREE LASER CATALOG.** Helium-Neon, Argon, ruby, visible laser diode modules, lightshows, holography, laser pointers. Lowest prices. Midwest Laser Products, PO Box 262, Frankfort, IL 60423. 815-464-0085 [www.midwest-laser.com](http://www.midwest-laser.com)

## CABLE TV

**DEALERS:** NEW VM8000 cable converter. Sharp tuner, 800MHz. 125 channels. Call for lot pricing. NTS 1-888-355-6687.

**UNMODIFIED ST 1000 and ST 4000,** \$20 ea. Bill 419-385-3100.

**UNMODIFIED JERROLD-212** converter \$50. 97.5, 106.5, 108.5, AB filters \$12 ea. All PIC 16C series, 68HC series wholesale only! Good price 1-888-561-4796 8am-5pm CST. E-Mail: KOGEN-ELECTRONICS@JUNO.COM

**125 CHANNEL** Digital Pro converter with audio & video \$82 each. Panasonic TZ-PC175DG2-7 converter with volume control \$135 each. The best converters you can buy! Please call 1-888-561-4796.

**GENUINE UNMODIFIED JERROLD DPBB7312 FOR SALE 10 LOT MIN.** CALL 708-715-6118.



**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.

**ADEAL4U WHOLESALERS BIG SAVINGS \$\$\$ BEST QUALITY - NO CHEAP CLONES** 888-387-1248 [www.adeal4u.com](http://www.adeal4u.com)

**NEW! CABLE** converter electronic service equipment and supplies for most cable converter boxes. Highest service, lowest prices. Call Ken Enry Electronics. 24 hr. order and information hot line 516-389-3536.

**CABLE TV.** Panasonic TZPC 175DG2, brand new, \$80 w/volume, 1 year warranty, minimum 10 pcs. any qty., plus all major brands available. Lowest price new/field pulls. E-Mail: OCALA@BELL SOUTH.NET phone: 1-800-929-1549 fax: 305-220-9396

**PICS, GALS READ** if you've lost your masters. Programming service available. Call for info. Network Sales, 616-683-0500.

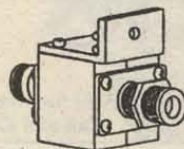
**WANTED: GENUINE RAW UNMODIFIED CABLE TV CONVERTERS, TOP CASH PAID.** CALL 708-715-6118.



**ISOLATION BUFFER AMPLIFIER.** Specially manufactured unit. (1) Blocks connected devices oscillator signals from being received or reflected on the incoming coax cable line. (2) Blocks-Protects connected devices against APPLIED LFAC-DC-surge voltages that may occur on or applied to its incoming coax cable line. Frequency response 40-900MHz, low noise, gain variable 0-36dB, switchable FM-AM trap, 117VAC operation. Includes 6ft coax cable \$22.95 PP set, 2 sets \$39.95 PP. (3) 1-4 set **TV-CABLE SPLITTER, DSS DIPLEXER**, low loss, top quality, with 3ft coax cable, 3 ea. terminating resistors. \$5.95 PP a set with isolation amplifier order. **PAYMENT: M/O ONLY. LESS BUSTERS ELECTRONICS**, 2039 Civic Center Drive #176, N. Las Vegas, NV 89030. 702-642-0325. **WEB: www.lessbusters.com**

**WANTED PIONEER 6110, 6310 CONVERTERS, RAW, TOP CASH, LOTS 5 OR MORE.** 702-642-0325.

**PIONEER 6110, 6310s, READY TO GO, SATISFACTION GUARANTEED, SORRY NO NEVADA SALES, LESS BUSTERS ELECTRONICS**, 702-642-0325, **WEB: WWW.lessbuster.com**



**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 \$16! (3/\$33)!** Use SUPER ZAPPERS if you have COX, TCI, WARNER in: CA, TX, FL, NY, PA, MI. **DESCRAMBLER PLANS (4=\$5, 20=\$15) 130+ DESCRAMBLER SOURCES (\$5).** **FREE SHIPPING. OPEN 24 HOURS!** 352-429-5496. **BRINKER ENGINEERING LABS, USA.**

**PLANS: DESCRAMBLE CABLE FOR UNDER \$12. PLUS TWO FREE BONUSES.** TOLL FREE 1-888-588-3715.

**FREE CABLE DESCRAMBLER PLANS!** For details write: Sierra Publishing, 909 E. Yorba Linda Blvd., Suite H-181, Dept. NVI, Placentia, CA 92870.

# Roger's Systems Specialist

**Best Prices!**



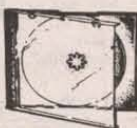
**Best Service!**

## 20' Audio Cable

Stereo extension cables, for speakers and headphones 3.5mm, gold plated male to female, shielded, 20 ft.

#AC-560.....\$4.50 each

## CD Jewel Case

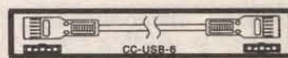


Replacement for original case. durable plastic.

#TM-CD-1....3/\$1.00

## USB Cable

Male to male "A" to "A", shielded, 6 ft.



#CC-USB-6.....\$5.00 each

## Microphone

Stick-on monitor or clip on shirt, 6 ft. cord, condenser mic.



#TM-MIC-2.....\$1.00 each

## Mouse Pad

Sponge rubber backing to prevent sliding, many colors available, call for details.



#TM-PAD.....\$1.00 each

## USB Ports

USB(2) to 10 pin motherboard w/ bracket



#TM-USB-9.....\$7.00 each

**7' Category 5 crossover network cable for computer to computer connection.**



TE-068-L5X

Retail Price.....\$9.00

Roger's Price.....\$1.00



Headphone with microphone, for net meetings, and voice dictation.



TM-165-MONO

Retail Price.....\$30.00

Roger's Price.....\$3.50



## CD-ROM Drive

Made by Delta  
24X  
EIDE  
w/ cables  
Internal

**\$39.00**

## Computer Toolkit

Ideal for standard user maintenance repairs and general servicing of computers peripherals, includes: 14 in. nut driver, 1/8 in. slotted screwdriver, 3/16 in. slotted screwdriver, IC extractor for 8.40 pin ICs assembly tweezers, heat sink clamp, tri claw parts holder, spare parts tube: diameter 3/4 in., length 6 in. durable black vinyl padded case with individuals straps for all tools listed above.



#TM-TK1  
\$10.00 each

**Amplified computer speaker cubes w/subwoofer. Black.**  
With power supply and speaker wire.

**GREAT SOUND!**

TM-172-SUB

Retail Price.....\$69.00

Roger's Price.....\$39.00

Local 805-295-5577 [www.rogerssystems.com](http://www.rogerssystems.com) FAX 805-295-8777



\$10.00 minimum order required • Add \$4.50 shipping for pre-paid orders

California residents add 8.25% tax • eMail [sales@rogerssystems.com](mailto:sales@rogerssystems.com)

Call for quantity discounts • No out of state checks accepted • Most orders shipped same day!

24895 Avenue Rockefeller, Valencia, CA 91355





**CABLE CONVERTERS**, remotes, etc., free flyer. Jake 1-800-879-9657.

**AS-IS** converters Oak Sigma, \$20; Zenith, \$7; genuine unmodified DPV5, \$10. Call John 419-243-7856.

**CALL ALLEN** for all your cable needs or computer software. Programming service available. For info call 909-941-4858 or visit us at our web on site <http://members.aol.com/ALENCABLE>

**LOW COST** plain converters: Pioneer BC 4135, Hamlin CR-6000, DRZ-3, they're all 450MHz, 70 channel comes with new remote, 1 year warranty for only \$15 each. Panasonic: TZPC-170, 450MHz with volume, \$25 each; TV-86, \$25. Minimum 10-lot. Call 405-634-1535.

**CABLE STOP**, one stop for all your cable needs. What do you get for your money? Quality parts at a low price, 800 tech support, a company that will be there when you need them. 1-800-562-8442 12pm-7:30pm EST

**CABLE PARTS!** Computer parts. Call for great prices or visit us on the Web: [HTTP://WWW.CB-Electronics.com](http://WWW.CB-Electronics.com) or call 1-800-436-8630.

**CBTV REPAIR.** We specialize in all converters, including Zenith. Give us a call: 405-634-1535.

**ONE STOP** shop. We carry a full line of CBTV equipment for all your cable needs. Also a wide variety of converter parts and accessories. Call for free catalog: 405-631-5153, FAX: 405-631-4788.

**CABLE CONVERTOR** repair and upgrades most models, warranty. Call 972-304-4119.

**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.

**CABLE CONVERTERS:** unmodified, Jerrold, Scientific Atlanta, Zenith, Pioneer, Tocom, Panasonic, quality units at great dealer prices. Call now for specials 702-270-4351.

**ZENITH 73 ch.** unmodified ST1622 complete as-is \$35 each; refurbished \$75. Also Pioneer 6110 field pull working \$90. Also Zenith ST-1000 complete as-is \$8. Also Zenith 16xx 99 ch. refurbished \$95. Limited quantities Call M-F 9-4 Gregg 702-270-4341 or pager 1-800-478-0334.

**ATTENTION: YOU'VE** tried the rest, now go with the best. **UNICORN ELECTRONICS** where our valued customers **ALWAYS** come first. **CABLE CONVERTERS AND ACCESSORIES.** We will beat all competitors prices **GUARANTEED.** All units in **STOCK FOR IMMEDIATE SHIPMENT.** Free batteries and coax cable. **FREE** bullet protection with every unit purchased. **FREE** shipping with a \$500 purchase or more. **NO COD** charges. **ALL** products come with a 1 year warranty and a 30 day money back guarantee. Please give us a call **TOLL FREE** 1-888-738-8181 9am to 6:30pm EST. **VISA, M/CARD, DISCOVER, COD.** **UNICORN** Electronics does not advocate unauthorized use or theft of cable services.

**MOD CHIPS** for Sony PlayStation. Now your backups will work. Only \$9.95 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)

**JERROLD UNMODIFIED CONVERTERS** for sale. Call for best prices. **NO DESCRAMBLER SALES.** CALL BRLD ELECTRONICS 1-800-322-6316.

**WANTED: TEKNIKA** 6510 cable converter boxes/parts. 415-221-5940.

**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.

**UNMODIFIED, POWER-UP,** Pioneer BA: 6110, \$75; 5135 \$45; 5125 \$25; Jerrold DP5, channel 2: \$19, DPBB 7312, \$95; S/A 8590-757 (11 button) \$95. Minimum 10-lot. 405-631-5153.

**PANASONIC CATV converter**, unmodified (Plain Jane) model TZ-PC 1203N, TZ-PC 1103N and others **priced very low 407-676-2530.**

**PANASONIC CATV converter**, unmodified (Plain Jane) model TZ-PC 1203N, TZ-PC 1103N and others **priced very low 407-676-2530.**

## TELEPHONE/FAX

**BEEPER, TWO-WAY** radio repairs, modifications, duplications, all models, test equipment. Call TJ 718-341-1849, Fax 718-978-4616.

**BLUE BOOK PHONE REPAIR.** 1000 models answering machines, cordless, \$25. KEN's, 2825 Lake, Kalamazoo, MI 49001 616-345-4609. [www.kenselecronics.com](http://www.kenselecronics.com)

**TELEPHONE CATALOG** of Panasonic, SWBell, VTEC and more, including alarm systems, parts, and all phone accessories. Send \$2 to HES Electronics, POB 183, Brick, NJ 08723. Mention this ad and get a \$10 certificate! Visit [www.heselectronics.com](http://www.heselectronics.com)

**NEW: MEMORECS** system, the most important feature your answering machine is missing. Oricom Technologies, 303-444-9776. [www.sni.net/~oricom](http://www.sni.net/~oricom)

**PHONE SYSTEMS WANTED!!!** We buy AT&T MERLIN, SYSTEM 25/75/85 and other AT&T phone systems. Please call for a quote or fax us your equipment list. **KEYWAYS, INC.,** 937-847-2300 or FAX 937-847-2350.

# WHOLESALE TO THE PUBLIC!

THE INDUSTRIES

LEADING DISTRIBUTOR OF

CABLE ELECTRONICS IS NOW OPEN TO THE PUBLIC

- ◆ WE WILL BEAT ALL COMPETITOR'S PRICING
- ◆ 30 DAY MONEY BACK GUARANTEE
- ◆ ALL NEW LIFETIME WARRANTY
- ◆ STATE OF THE ART EQUIPMENT

(CALL FOR DETAILS)

# A WHOLE NEW DIMENSION

IN CABLE ELECTRONICS

# 1.800.474.2343

QUALIFIED PROFESSIONAL SALES & SERVICE REPRESENTATIVES ARE WAITING FOR YOUR CALL.

NO NEW YORK SALES, ANYONE IMPLYING THEFT OF SERVICE WILL BE DENIED OF ALL SALES ASSISTANCE

## ALFA ELECTRONICS

HIGH QUALITY TEST EQUIPMENT

Visit [www.alfaelectronics.com](http://www.alfaelectronics.com) for complete info

Call 1-800-526-2532 for Order and Free Catalog

DMM	LCR/COUNTER	FLUKE	SPECIALTY
DMM-898 (\$179.00): true rms, AC/DC (V.A.), $\Omega$ , bar graph, freq, capac, dBm, logic, diode	CAP-15 (\$49.95): 3 1/2 digit, 0.1pF, 20mF, 9 Ranges, 0.1pF resolution, zero adjustment.	12B \$ 94.95	• AC Current Probe \$34.95
DMM-23T (\$99.95): 4 1/2 digit, true rms, high resol. (10 $\mu$ V, 10mA, 10m $\Omega$ ), hFE, diode, contin.	LCR-24 (\$119.95): 0.1 $\mu$ H-200H, 0.1pF-2000pF, 0.01 $\Omega$ -20M $\Omega$ , diode test. New Model.	70-III \$ 99.00	• DC/AC Current Probe \$79.95
DMM-20 (\$74.95): AC/DC (V.A.), $\Omega$ , hFE, diode, capac, induct, $\Omega$ , hFE, diode, duty cycle	LCR-131D (\$219.95): autorange, 0.1 $\mu$ H-10kH, 0.1pF-10mF, 1m $\Omega$ -10M $\Omega$ , Q Factor, serial/parallel, 120Hz/1kHz testing mode.	73-III \$125.00	• Mini AC Clamp \$59.95
DMM-122 (\$59.95): DC/AC(V.A.), $\Omega$ , hFE, diode, capacitance, freq, logic, continuity	FC-1200 (\$129.95): 1.25GHz Handheld, 8 digits display, 10ppm accuracy, sensitivity 5mV (130-350MHz), 30mV (440MHz)	75-III \$155.00	• AC Clamp w/temp \$89.95
DMM-123 (\$44.95): DMM + capacitance, DC/AC(V.A.), $\Omega$ , hFE, diode, continuity		77-III \$173.00	• DC/AC Clamp \$109.95
DMM-10 (\$19.95): 3 1/2 digit, DC/AC V, $\Omega$ , hFE, diode, signal output (+3V, 0.5Vsq, 50% duty)		79-III \$195.00	• Thermometer \$69.95-\$89.95

Single Output DC Power Supplies	Triple Output	AUDIO/RF/FUNCT. GEN.
• Constant current, constant voltage mode	• Independence or Tracking operation	RF Generator • SG-4160 (\$124.95) 100kHz-150MHz sinewaves in 8 ranges
• Short Circuit and overload protected	• Parallel to double current output (PS-8102 & PS-8103 only)	• SG-4162AD (\$229.95) with 6 digit counter
Analog Meters Display	Triple Output (Analog display)	Audio Generator • AG-2601 (\$14.95) 10Hz-1MHz, 0.8Vpp sine, 0-10Vpp squarewave
PS-303 (\$159.00) 30V/3A	PS-8200 (\$179.95) 30V/3A	• AG-2603AD (\$229.95) with 6 digit counter
PS-305 (\$219.95) 30V/5A	PS-8201 (\$239.95) 30V/5A	Function Generator • FG-2100A (\$154.95)
PS-8112 (\$309.95) 60V/5A	PS-8300 (\$199.95) 30V/3A	0.2Hz-2MHz, 5mV-20Vpp
PS-1610 (\$289.00) 16V/10A	PS-8301 (\$259.95) 30V/5A	• FG-2103 (\$329.95) Sweep 0.5Hz-5MHz
PS-8107 (\$399.95) 30V/10A		

20 MHz Scope	Cursor Readout	Triple Output	Single Output	Programmable	FUNCTION GENERATOR	BENCHTOP DMM
• OS-620 \$324.95	• OS-626G \$599.95	• 2 variable out 0-30V/0.3A	• Const voltage, current mod	• Auto serial/parallel (PPT ser)	FG-8020G (\$209.95)	DM-8834 (\$179.95) 3 1/2 digit
• Most economical scope	• Readouts a Cursor meas	• One fixed 5V/3A output	• Voltage regulation <0.01%	• Auto track (PPT series)	• 0.02Hz-2MHz w/counter	• AC/DC (V.A.), $\Omega$ , diode
• Dual CH/X-Y operation	• Dual CH / Delay sweep	• Auto track, serial, parallel	• Current regulation <0.2%	• IEEE-488.2 and SCPI compatible command set	• Sine/Sqr/Tri/pulse/Ramp	DM-8048 (\$339.95) 3 1/2 digit
• 1 mV/div sensitivity	• Built-in delay line	• Const. vol, current mode	PS-1830 (\$198.95) 18V/3A	PS-1860C (\$149.95) 18V/6A	FG-8020C (\$209.95)	• ACV to 50kHz, true rms
• 2-axis input, CH1 output	• ALT trigger, Hold-Off	• 4 analog or 2 digital display	PS-1850 (\$214.95) 18V/5A	PS-1830D (\$214.95) 18V/3A	• 0.02Hz-2MHz w/counter	DM-8055G (\$889.95) 5 1/2 digit
• TV syn, ALT trigger	• Z-axis input, CH1 output	PC-3030 (\$499.95)	PS-1830D (\$214.95) 18V/3A	PS-1850D (\$244.95) 18V/5A	• 0.05Hz-5MHz w/counter	• 0.006% accuracy, GPIB
• 2 probes (x1, x10)	• 2 probes (x1, x10)	PC-3030D (\$549.95) digital		PPT-3615 (\$361.50) 36V/15A	• INT/EXT AM/FM mod	• dBm, auto, R.E.L., min/max

**ALFA ELECTRONICS**  
P.O. BOX 8089  
PRINCETON, NJ 08543-8089

TEL: (800) 526-2532 / (609) 897-1135  
FAX: 609-897-0206  
E-mail: [sales@alfaelectronics.com](mailto:sales@alfaelectronics.com)

Call / Write / Fax / Email for FREE CATALOG  
Visa, MC, AMEX, COD, PO Accepted. OEM Welcome.  
1 Year Warranty (2 Years for GW/Instek)





**P.S. Technology**

Tel: (800) 637-9936 Fax: (800) 878-7083



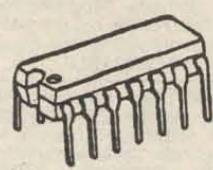
PLUG IN

- ◆ IC's & Semiconductors
- ◆ Telephone & Cellular Accessories
- ◆ Amplifiers & Audio Equipment
- ◆ 35mm Cameras
- ◆ Universal Remote Controls
- ◆ Batteries (all brands)

- ◆ Computer Products
- ◆ Recordable CD's & Tapes (top brands)
- ◆ Indoor TV Antennas
- ◆ Security Systems
- ◆ CB Radios
- ◆ Fuses & Switches



SOLDER ROLL



**AMAZING! 15¢ ALL ICs.** CD4001B, CD4011B, CD4013B, CD4017B, CD4028B, CD4050B, CD4066B, CD4069B, LM324, LM339, LM358, LM393, LM555, LM741, MC1488, MC1489, 74LS174, 74LS244, 74LS245, 74LS374. Brand new parts. 100pcs./package. Add \$6 freight. Gateway Products Corporation, PO Box 936397, Margate, FL 33093, 954-974-6864. Fax 954-974-6818. VISA/MC, no CODs.

**AMAZING! 10¢ ALL SCHOTTKY DIODES:** 1N5820, 1N5821. 100pcs./package. Brand new parts. Add \$6 freight. Gateway Products Corporation, PO Box 936397, Margate, FL 33093, 954-974-6864. Fax 954-974-6818. VISA/MC, no CODs.

**MILLIONS \$\$\$ in "scrap gold" from old computers and electronics junk.** Message: 603-645-4776 or www.tiac.net/users/quicksand/goldtek.htm

**SMT COMPONENTS** and complete SMT manufacturing system. Closing R&D/manufacturing company. Must sell lots of equipment. Call 1-800-869-7827 or visit www.starcom.com for list.

Write in 48 on Reader Service Card.

## SUMMER SPECIALS

### MOTHERBOARDS WITH CPU:

K6 233 Mhz MMX w/ CPU	\$159
K6 266 Mhz MMX w/ CPU	\$169
K6 300 Mhz MMX w/ CPU	\$189
K6-2 300 Mhz MMX w/ CPU	\$239
K6-2 333 Mhz MMX w/ CPU	\$279
K6-2 350 Mhz MMX w/ CPU	\$369
Pentium II 266 MMX w/ CPU	\$319
Pentium II 300 MMX w/ CPU	\$379
Pentium II 333 MMX w/ CPU	\$399
Pentium II 350 MMX w/ CPU	\$469
Pentium II 400 MMX w/ CPU	\$646
Pentium II 450 MMX w/ CPU	\$895

### 32MB MEM

**\$39.95**

### 24X CD ROM..\$39

32/36ROM..\$49/55

### Orders & Price

Tel: (800) 899 6430

Fax: (209) 549 8576

### 24X Bundle

**\$69**

32X Speed CD  
16 Bit Sound Card  
with Wavetable.  
Amplified Speakers 80W

Buy with  
confidence  
Risk Free  
30 Days  
Money Back

For ALL kinds of Drives, Sound Cards  
Speakers and CD Titles: \$Call

### FLOPPY DRIVES

1.44 Mitsumi.....	\$18
1.44 Teac.....	\$21

### MONITORS

14" 28 108 N-I, Low Radiation.....	\$125
15" 28 1024x768 N-I, Low Rad.....	\$135
17" 28 1280x1024 N-I, Low Rad.....	\$239

### KEYBOARDS

104 Keyboard.....	\$10.95
Keytronic.....	\$23
Focus 2000.....	\$Call

### VGA CARDS

SVGA 1MB ISA.....	\$32
PCI 1MB/2MB/4MB.....	\$25/\$5/\$9
PCI OR AGP 4MB, TV OUT, OPTI.....	\$35
PCI OR AGP VGA 8MB.....	\$39
MATROX, ATI, DIAMOND.....	\$CALL
SVGA CARDS WITH VRAM.....	\$CALL
ANY OTHER VGA CARDS.....	\$CALL

### CONTROLLER CARDS

IO 2S, 1P & 1G.....	\$12
---------------------	------

### MODEM/ FAX MODEM

33.6K Voice Modem/ Fax Modem.....	\$37
56K Voice Modem/ Fax Modem V90.....	\$45
US ROBOTIC 56K Modem..... V90.....	\$99
ISDN.....	\$CALL

### CASES WITH POWER SUPPLIES

DESKTOP CASE PREMIUM.....	\$35
MED TOWER CASE PREMIUM.....	\$35
FULL TOWER CASE PREMIUM.....	\$75
ATX MED TOWER CASE PREMI.....	\$59

### HARD DRIVES SPECIALS

2.1GB..\$119	3.5GB..\$119	4.3GB..\$129
6.4GB..\$159	8.4GB..\$199	11GB..\$CALL

### IBM 6X86 300 MMX

Motherboard  
CPU, VGA & SOUND  
**\$175**

### Siml Memory LOW \$\$\$

Will beat any price  
Resellers  
Dealers  
Welcome

### AMD K6 300 MMX

Motherboard  
CPU, VGA & SOUND  
**\$199**

All Systems carry  
3 years Parts &  
5 years Labour  
Warranty.  
Lifetime Tech  
Support

CREDIT CARDS OK  
VISA  
MasterCard  
\*Govt. P.O. \* C.C.O.P.  
us out  
No Minimum Charge No Hidden Charge.  
Prices subject to change without notice.  
15% Restocking fee for Non Defective Items.  
Orders of \$950 or more, ground shipping free,  
except for Cases, Monitors, Keyboards and F.Drives.

**EVERYDAY LOW PRICES**

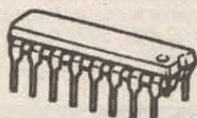
**www.bisme.com**

**BISME COMPUTERS OUTLET** 906 N Carpenter Rd. Suite A, Modesto, CA 95351

**ALWAYS-IN-Touch** sends Caller ID & duration of inbound and outbound calls instantly to pager, \$99. 1-800-240-4637 or www.callerid.com

**WWW.CALLERID.COM** is a good place to find cool multi-line in/outbound call recording devices.

### COMPONENTS



**WANTED: EXCESS ELECTRONIC INVENTORIES, ICs, MEMORY, EPROMs, PALs, LEDs, CIRCUIT BOARDS, DIODES, AND TRANSISTORS. CALL ACTIVE MICRO, 562-494-4851 OR FAX 562-494-4913.**



**FACTORY SALE! CNL100, CNP101:** 1/3" CCD, 430 line horiz., 12V/100mA, lens and pin hole types, lens 3.6mm/F2.0, 1.27" (W) x 1.27" (L) x 1" (H). \$43 @ 5 pcs., \$38 @ 10 pcs. Distributors welcome. Matco, Inc., 1-800-440-0299 Fax: 630-350-9546. E-Mail: sales@mat-co.com

## WHOLESALE CABLE

### COMPLETE LINE OF CABLE PRODUCTS

- ☑ Quality merchandise by brand name manufacturers
- ☑ Satisfaction guaranteed
- ☑ Free gift on first order
- ☑ Technical support
- ☑ 2 year warranty on new converters
- ☑ COD shipping & overnight shipping by request
- ☑ Experience where it counts
- ☑ Volume pricing

**PLAIN CONVERTERS:** ZENITH, OAK, PANASONIC, PIONEER, EAGLE, HAMLIN, STARGATE, PLUS MORE.

**REMOTE CONTROLS:** ALL MAJOR BRANDS, INCLUDING 2-4 FUNCTION UNIVERSAL REMOTES

**WHOLESALE CABLE** M-F 11am-6pm EST (800) 909-4333 (718) 262-0900 • FAX (718) 657-4015 • (718) 297-9221

No NY sales. Federal and local laws provide criminal and civil penalties for unauthorized use. Check with your cable providers for permission to use equipment. Must be paying for all services you receive. Order by model number only. Some equipment refurbished as new.

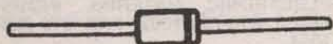
Tell us the  
best price you  
were offered,  
where you got  
it from, and  
let us try to  
beat it.



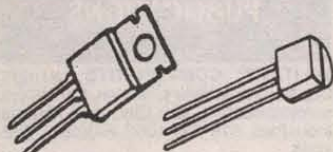




**AMAZING! 4MHz CRYSTAL FOR 30¢.** Brand new. 100pcs./package. Add \$6 freight. Gateway Products Corporation, PO Box 936397, Margate, FL 33093, 954-974-6864. Fax 954-974-6818. VISA/MC, no CODs.



**AMAZING! 10¢ ALL SCHOTTKY DIODES:** 1N5820, 1N5821. 100pcs./package. Brand new parts. Add \$6 freight. Gateway Products Corporation, PO Box 936397, Margate, FL 33093, 954-974-6864. Fax 954-974-6818. VISA/MC, no CODs.



**AMAZING! 10¢ ALL REGULATOR.** All TO92 package: 78L05, 79L05, 78L12, TO220 package for 20¢: LM317T, 7808, 7812, 7815, 7818, 7908, 7912, 7915. Brand new parts. 100pcs./package. Add \$6 freight. Gateway Products Corporation, PO Box 936397, Margate, FL 33093, 954-974-6864. Fax 954-974-6818. VISA/MC, no CODs.

**COMPONENTS:** 74LS00B1 5¢, 74LS164P 5¢, 74LS165AN 5¢. BOURNES 500 OHM 20T pot 15¢. All parts are unused in tubes, quantity orders welcome send check or money order to LLOYD'S, 27315 Jefferson Ave., Ste. J-17, Temecula, CA 92590. \$3 for postage and handling.

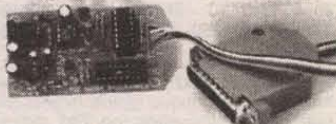
**OLD ICs & TRANSISTORS WANTED:** HIGHEST PRICES PAID please FAX your list with part number, quantity & condition of any semiconductors to Rick @ ESI, 5363 Broadway Ave., Cleveland, OH 44127. 216-441-8500 FAX 216-441-8503. Since 1946! www.electronicssurplus.com

**IC PULLOUTS,** other components, sold cheap. Buying unused connectors, especially coaxial and "round plugs." www.ncci.net/millermetal

## MICROCONTROLLERS

**16C5X/8051 COMPILER:** Generates assembly code listing from a BASIC like programming language for 16C5X or 8051 microprocessor that can then be used by your assembler. For Windows 95 and 98 systems. Includes manual, specify which processor. \$49.95 + S&H. Cyltek Systems, 310A Breesport, San Antonio, TX 78063.

**PICBOT AUTOMATION** controller. Single PCB with extensive I/O and sensory for home & office automation, robotics, and light industrial applications. Includes 20MHz 8-bit RISC MCU, up to 512K SRAM & FLASH, dual H-bridge motor drivers, dual serial COM ports, stereo digital audio, 14 Darlington drivers, 6 high-current drivers, 8 LED drivers, IR remote sensor, and user prototype area with 10 PIC I/O (A/D) lines and SMT pads. Includes an object-oriented stack-based interpreter that runs applications from any text file on a PC. Runs off any DC power source from +6V to +24V, and connects directly to PC COM port for easy programming and configuration. Single PCB solution for mobile robot projects. Prices from \$199 quantity 1. Webco Technology, 408-690-9660. www.webco.com



**PIC 16C/F84 Development Programmer** kit. Attaches to parallel printer port. 9V battery powered. 16F84 included. \$23.95 + \$5 shipping. Amazon Electronics. Tel 1-888-549-3749. Lots of other products. http://www.electronics123.com

Subscribe to Nuts & Volts!  
Call 1-800-783-4624

**P-BRAIN** microcontroller. A very compact 68HC11 module that is ready to go with EEPROM and RAM, about 1 inch square and 1oz. in weight. http://members.aol.com/fuboco E-Mail: fuboco@juno.com Tel: 561-575-1487. Future-Bot Components.

## ANTIQUE ELECTRONICS

**WESTERN ELECTRIC WANTED:** 1920's-1960's. Amplifiers, mixers, pre-amps, speakers, tubes, etc. FREE OFFER 1-800-251-5454.

**CRYSTAL SETS.** Parts, plans, books, kits. Largest source in the world. Catalog \$2. MIDCO, PO Box 222288, Hollywood, FL 33022.

**WANTED: FOR** historical museum, pre-1980 microcomputers, magazines, and sales literature. Floyd, VA 24091-0341 (540-763-3311/540-382-2935).

**WESTERN ELECTRIC** audio equipment wanted. 1926-1960s amplifiers, speakers, pre-amps, tube, transformers, etc. 1-800-old-mics 1-800-653-6427 Great Wireless Museum.

**WESTERN ELECTRIC WANTED:** 1927-1960S. Amplifiers, speakers, tubes, etc. Free offer. 1-800-251-5454.

## RAINBOW KITS

### ACTIVE ANTENNA

Freq. 1MHz to 100MHz



ACA-1  
ACA-C Optional Cabinet available  
PCB size: 4.2" x 4.6"  
Size: 1.5"H x 5"W x 5.3"D  
KIT \$44.95  
\$14.95

- Replace a 60' long wire antenna with this small unit.
- Use it on short-wave, HF and VHF.
- Great for scanners, ham receivers, or general coverage receivers.
- Gain control

### INTERNET PHONE

### PHONE HOOK UP to INTERNET

- Use your telephone to talk on the internet instead of that little microphone and speakers that are attached to your computer.



INP-1  
INP-C Optional Cabinet available  
PCB size: 4.5" x 4.1"  
Size: 1.5"H x 5"W x 5.3"D  
KIT \$44.95  
\$12.95

- Gives you better clarity, even gives you privacy.
- With a cordless phone you have the freedom to walk around the room while on the internet.
- Uses any standard type phone.

### Amateur Radio "PERFECT CODE" Keyer

Measure the DOTS and DASHES perfectly every time.



Add this CW Keyer to your existing rig or use it as a code practice oscillator.

APC-1  
APC-C Optional Cabinet available  
PCB size 2.25" x 2.75"  
Size: 1.5"H x 5"W x 5.3"D  
KIT \$39.95  
\$14.95

- INEXPENSIVE CW Keyer great for the beginner or the old timer alike.
- Speed and Volume control.
- Built in paddles.

### TV NOTCH FILTERS FOR CHANNELS 2 thru 22 ONLY



Our TV filters eliminate unwanted TV channels or interference that alters both sound and video with a beep beep beep. Works on cable channels (2 thru 22) only.

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



This Manual contains schematics, parts lists & P.C. board layouts for many of the Rainbow Kits. Use your own parts to construct our kits.

KIT BOOK  
\$14.95



### 2 STATION INTERCOM

Great for kids room to the kitchen, put one out to your garage.

- Communicate up to 500' between units
- 2 intercom stations supplied in INT-2 kit
- Power requirements: 2 - 9v batteries
- 30' of hookup wire supplied

INT-2  
INT-2C Optional (2 cabinets)

PCB size 1" x 1.75"  
Size: 1.6"H x 2.5"W x 3"D

KIT \$29.95  
\$24.95



CALL FOR OUR COMPLETE CATALOG

### WATER ALARM

When the liquid level reaches the sensor it automatically turns the pump on or off. The Water Alarm supplies you with 100 mA of output that activates a relay (that you supply). This relay can turn on a sump pump, or in applications where you are filling an area with liquid it turns off the pump.



WA-2  
Size 1.4" x 2"

KIT \$17.95

### SKILL MASTER



Fun for the whole family!  
6 skill levels

- Tests your eye hand coordination.
- The more LEDs you light up, the better your skill.
- Push the button when its green and you advance up the skill level, push it when its red and you loose a step.
- Comes with 6 different game overlays
- Operating voltage 9v DC. Case Included

SLG-1  
Size: 2.3" x 4.8"  
KIT \$29.95

### 10 MINUTE COUNT DOWN GAME TIMER



- 10 Minute Timer
- 3 - seven segment LED displays.
- Counts down by seconds.
- In the last minute it sounds a short beep every 10 seconds.
- The last 10 seconds sound a beep every second.
- One long beep will sound when time is up.
- This kit is a good example of how a microprocessor works.

GT-10 PCB: 2.3" x 4.8" KIT \$49.95  
GT-C Cabinet size: 1.6"H x 2.5"W x 5"D \$12.95

### NIGHT CRICKET

Sneak this little NIGHT CRICKET into someone's bedroom, when night falls the fun begins. The lights go out and the cricket starts chirping, turn the lights on to find the varmint and the chirping stops. Small enough to hide most anywhere.

NC-1 PCB size: 2.75" x 1.2" KIT \$14.95

We will accept  
telephone orders for  
Visa or Mastercard

SHIPPING COSTS:	U.S.A.	CANADA P.R. & MEXICO	80
\$1.00 - \$50.00	ADD \$5.50	\$7.00	
\$50.01 - \$100.00	ADD \$6.50	\$7.00	
\$100.01 - \$150.00	ADD \$7.50	\$9.00	
\$150.01 - UP	ADD \$8.50	\$10.00	

Electronic Rainbow Ind., Inc.  
6227 Coffman Rd. Indianapolis, IN 46268  
CALL 317-291-7262 FAX 317-291-7269  
INTERNET: www.rainbowkits.com





**P-BRAIN** microcontroller. A very compact 68HC11 module that is ready to go with EEPROM and RAM, about 1 inch square and 1oz. in weight. <http://members.aol.com/fuboco> E-Mail: [fuboco@juno.com](mailto:fuboco@juno.com) Tel: 561-575-1487. Future-Bot Components.

## ANTIQUE ELECTRONICS

**WESTERN ELECTRIC WANTED:** 1920's-1960's. Amplifiers, mixers, pre-amps, speakers, tubes, etc. **FREE OFFER** 1-800-251-5454.

**CRYSTAL SETS.** Parts, plans, books, kits. Largest source in the world. Catalog \$2. MIDCO, PO Box 222288, Hollywood, FL 33022.

**WANTED:** FOR historical museum, pre-1980 microcomputers, magazines, and sales literature. Floyd, VA 24091-0341 (540-763-3311/540-382-2935).

**WESTERN ELECTRIC** audio equipment wanted. 1926-1960s amplifiers, speakers, pre-amps, tube, transformers, etc. 1-800-old-mics 1-800-653-6427 Great Wireless Museum.

**WESTERN ELECTRIC WANTED:** 1927-1960S. Amplifiers, speakers, tubes, etc. Free offer. 1-800-251-5454.

**MILITARY TRANSISTORS & DIODES & INTEGRATED CIRCUITS WANTED.** **ELECTRONIC MATERIAL INDUSTRIES** 818-769-1002, FAX 818-769-1084.

**ANTIQUE RADIO CLASSIFIED.** Free sample copy! Antique radio's largest-circulation monthly magazine. Old radios, TVs, ham equip., 40s & 50s radios, telegraph, books & more. Ads & articles. Free 20-word ad monthly. Subscribe today. Six-month trial: \$19.95. Yearly rates: \$39.49 (\$57.95 by 1st Class). Foreign: write. ARC, PO Box 802-G23A, Carlisle, MA 01741. Phone: 978-371-0512; Fax: 978-371-7129; Web: [www.antiqueradio.com](http://www.antiqueradio.com)

**RADIO TUBES** and phono. needles. 870-347-2281.

## AVIATION ELECTRONICS

**SYNCHRO RESOLVER** test sets, system analyzers, test equipment. [www.lonemtn.com](http://www.lonemtn.com)

**MILITARY TRANSISTORS & DIODES & INTEGRATED CIRCUITS WANTED.** **ELECTRONIC MATERIAL INDUSTRIES** 818-769-1002, FAX 818-769-1084.

**BUY, SELL, trade,** avionics equipment, Collins, King, Sperry: test equipment, IFR, Litton LTN series INUs. 941-625-3222 P. 941-625-0494 F. E-Mail: [avonics@afcon.net](mailto:avonics@afcon.net)

## PUBLICATIONS

**MILITARY COMPONENTS** wanted. Capacitors, resistors, diodes, transistors, semiconductors, ICs. Electronic Material Industries, 818-769-1002, FAX: 818-769-1084.

**START YOUR OWN TECHNICAL VENTURE!** Don Lancaster's newly updated **INCREDIBLE SECRET MONEY MACHINE II** tells how. We now have autographed copies of the Guru's underground classic for \$18.50. Synergetics Press, Box 809-K, Thatcher, AZ 85552. 520-428-4073. [VISA/MC](mailto:VISA/MC).

**THE CASE AGAINST PATENTS.** Don Lancaster's tested and proven alternatives that work in the real world. \$28.50. Synergetics Press, 3860 West First Street, Box 809, Thatcher, AZ 85552. 520-428-4073. [synergetics@tinaja.com](mailto:synergetics@tinaja.com) [VISA/MC](mailto:VISA/MC).

**ELECTRONIC EAVESDROPPING EQUIPMENT DESIGN** by Winston Arrington. This revised edition contains 117 schematics and text of our production equipment. 29 crystal transmitters, 35 room, 32 telephone, 15 subcarrier, countermeasures and much more. Request a free detailed explanation sheet of contents. **PRICE:** \$65 + S&H \$6. **SHEFFIELD ELECTRONICS CO.,** PO Box 377940-E, Chicago, IL 60637-7940. Tel: 773-324-2196. <http://www.adnetmk.com/sheffield>

**NEW SURVIVAL COMMUNICATIONS BOOK.** How to build complete home communications systems. Covers all needs: shortwave radio, amateur radio, citizens band, scanners, federal, weather, alternate news, satellite radio, equipment sources. How to build and use alternate emergency power sources, solar, generators, backup batteries. 200 pages. \$24 Fast delivery Priority Mail. MC or Visa. Call Universal Electronics 1-800-241-8171.

## ROBOTICS

**H-BRIDGE MOTOR** controllers, 12VDC, 35A average, 50A peak PWM out. Forward, reverse, ramp-up and ramp-down on acceleration/deceleration. Current foldback when hot, reverse polarity protected, conformal coated, regenerative braking, compact, approx. 3.75"x5.5". \$25 + S&H. 717-735-5053. <http://members.tripod.com/~divelec>

**AWESOME ROBOTS,** robots kits, micro-controllers, R/C servos, IR sensors. Great prices! <http://www.mrrobot.com> 804-272-5752, 1-888-Mr-Robot.

**Closing Date**  
For Next Issue - November 5th

# ALL ELECTRONICS CORPORATION

QUALITY PARTS

FAST SHIPPING

DISCOUNT PRICING

CALL, WRITE, FAX  
or E-MAIL For A  
Free 96 Page  
CATALOG.  
Outside the U.S.A.  
send \$3.00 postage.

### 9 Volt Style Nickel-Cadmium Rechargeable Battery

Sanyo "Rechargacell"™ # N-6PT  
7.2 v 120 mAh battery  
for 9 Volt applications.

**\$2.00** each  
CAT# NCB-91  
10 for \$30.00

### "Hi-8" Video Cassette

SONY HI-8 Top quality, metal particle 120 minute video cassettes. Used for a short time, then bulk-erased. Each cassette has its own plastic storage box.



**\$3.00** each  
CAT # VCU-8  
10 for \$28.00 • 100 for \$250.00

### 3 Volt 35 mAh Lithium Coin Cell

Sony CR1220  
3 Volt, 35 mAh. 0.48" (12 mm) diameter x 0.08" (2 mm) thick. Fresh, 1997 date code. Large quantity available.

**CAT # LBAT-19**  
**2 for \$1.00**

100 for \$35.00 • 1000 for \$200.00

Surface mount holders available for coin cells.

### Resettable Circuit Protector 0.65 - 1.3 Amp

Raychem "Polyswitch" # RXE-065-S1 General purpose circuit protectors for power supplies, alarm systems, speakers, motors etc. Unlike traditional fuses, they automatically reset when fault condition is cleared. Can be paralleled for higher ratings. Current: 0.65 Amps. Trip Current: 1.3 Amps. Max Voltage: 60 Volts. 0.33" diameter. UL, CSA listed.

**CAT # RXE-065**  
**3 for \$1.00**  
100 for \$20.00 • 500 for \$85.00  
1000 for \$150.00

### Mini-Right Angle Gearhead Motor with Control Circuit

Omron # R2DG-41 These unusual little motors have built-in control circuits that allow them to be used in a continuous or a pulsed mode. In continuous mode the final drive gear turns at 22-45 RPM (3-6 Vdc). In the pulsed mode the final drive gear turns one revolution each time the controller is momentarily pulsed. The motor assembly is 1.75" x 1.25" x 0.5" overall. The nylon final gear is 0.62 diameter and has a little nipple slightly off-center to which a small push-rod could be attached. Motors are in good condition, removed from equipment. Hook-up instructions included.



**CAT # DCM-110**  
**\$7.50** each

### 7' Modular Phone Cord With Ferrite Bead

Standard RJ-11 (4 pin) telephone cord with ferrite bead to reduce RFI interference. Bead is detachable if you want to use it in another application.

**\$1.25** each  
CAT # MT-260FB  
10 for \$10.00  
100 for \$85.00

### Piezoelectric Element

1.32 DIAMETER X 0.16"

AVX/Kyocera # KBT-33RB-2CN

Metal encased piezoelectric acoustic generator. High durability. Small, thin shape. Designed for telephone use. Inside the metal case is a 1.28" diameter piezo element with 5.5" leads attached. If you're looking for a plain element with leads, the case can be pried apart fairly easily. **CAT# PE-39**

**2 for \$1.00**  
100 for \$40.00  
1000 for \$250.00  
(25¢ each)

### Projection TV Lens

Mitsubishi # 490P15706

Originally for use in a three-gun TV projection system. High-impact plastic lens housing and support bracket. 5.35" diameter x 2.92" long at maximum focal length. Lens can be disassembled to yield five elements including a 3.1" dia. glass concave / convex lens, a 2.93" diameter glass convex-convex lens and three plastic correction elements.



**\$7.50** each  
CAT # LNS-10  
12 for \$72.00

### S-VHS Tape (Used)

Super VHS tape users! Save a bundle on name-brand S-VHS, T-120 tapes. These tapes were used for a brief period, then bulk erased. The record-protect tabs have been broken out, so you will have to cover the notch with a piece of tape, but they work great and cost a fraction of the "new" price. Try some, you'll be back for more.

**CAT #S-VHS**  
**\$3.00** each  
10 for \$28.00 • 100 for \$250.00

### Great Price! "EAR BUD" STEREO EARPHONES

Miniature "in-ear" earphones for use with most portable CD, radio and tape players. Gold-plated 3.5 mm stereo phone plug. 32 ohm impedance.

Large Quantity Available

**CAT #HP-6**  
**85¢** each  
10 for \$7.50  
100 for \$50.00



ORDER TOLL FREE

**1-800-826-5432**

MAIL ORDERS TO:  
**ALL ELECTRONICS CORP.**  
P.O. BOX 567  
VAN NUYS, CA 91408-0567

FAX (818) 781-2653 • INFO (818) 904-0524  
INTERNET <http://www.allcorp.com/>  
E-MAIL [allcorp@allcorp.com](mailto:allcorp@allcorp.com)

NO MINIMUM ORDER • All Orders Can Be Charged to Visa, Mastercard, American Express or Discover • Checks and Money Orders Accepted by Mail • Orders Delivered in the State of California must include California State Sales Tax • NO C.O.D. • Shipping and Handling \$5.00 for the 48 Continental United States • ALL OTHERS including Alaska, Hawaii, P.R. and Canada Must Pay Full Shipping • Quantities Limited • Prices Subject to change without notice.

**MANUFACTURERS - We Purchase EXCESS INVENTORIES... Call, Write, E-MAIL or Fax YOUR LIST.**



**PICBOT AUTOMATION** controller. Single PCB with extensive I/O and sensory for home & office automation, robotics, and light industrial applications. Includes 20MHz 8-bit RISC MCU, up to 512K SRAM & FLASH, dual H-bridge motor drivers, dual serial COM ports, stereo digital audio, 14 Darlington drivers, 6 high-current drivers, 8 LED drivers, IR remote sensor, and user prototype area with 10 PIC I/O (A/D) lines and SMT pads. Includes an object-oriented stack-based interpreter that runs applications from any text file on a PC. Runs off any DC power source from +6V to +24V, and connects directly to PC COM port for easy programming and configuration. **Single PCB solution for mobile robot projects.** Prices from \$199 quantity 1. Webco Technology, 408-690-9660. [www.webco.com](http://www.webco.com)

## PLANS — KITS — SCHEMATICS

**HOBBY CATALOG:** Broadcasting and microbroadcasting transmitters, amplifiers, antennas. **Start your own radio station books.** Audio, TV, ham, CB, surveillance, science projects, and more. **PAN-COM International**, Box 130-V, Paradise, CA 95967. [www.panaxis.com](http://www.panaxis.com)

**PROTOBOARDS FOR** rapid project construction, PIC monitor, pocket testbench chips/kits. Oricom Technologies, 303-444-9776. [www.sni.net/~oricom](http://www.sni.net/~oricom)

**ELECTRONIC KITS,** projects and supplies for prototyping, designing or hobby. Call 1-888-GO-4-KITS for catalogs or send \$3 to Quality Kits, 49 McMichael St., Kingston, ON, K7M 1M8. <http://www.qkits.com>



**BROADCAST FARTHER!** 75-110MHz amplifier connects to stereo transmitters. Produces 2-15 watts. Requires 50-150mW drive. Complete plans with part source and antenna information only \$14 + \$2 S&H. **Progressive Concepts**, PO Box 586, Streamwood, IL 60107. 630-736-9822.

**SURVEILLANCE TRANSMITTER SCHEMATICS!** FM band-2 telephone and 3 room transmitters constructed using Radio Shack parts with their numbers given. One telephone and two room transmitters are tunable from 65 to 305MHz, and constructed with listed supply house parts. PC board patterns presented. **PRICE:** \$25 + S&H \$2. For immediate shipment, pay with money order. **SHEFFIELD ELECTRONICS CO.**, PO Box 377940-E, Chicago, IL 60637-7940. Tel: 773-324-2196. <http://www.adnetmk.com/sheffield>



**TERRIFIC TIMEPIECES!** LED binary clock. LED digital clocks, other kits! Free catalog! WPC, 805-339-0702. [www.west.net/~wpc](http://www.west.net/~wpc)

**MOD CHIPS for Sony PlayStation.** Now your backups will work. Only \$9.95 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)

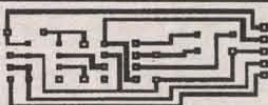
**TEST EQUIPMENT** kits. If you liked Heathkit, you will love Technology Systems, 4 Prospect Pl., Torrington, CT 06790.

**MILITARY COMPONENTS** wanted. Capacitors, resistors, diodes, transistors, semiconductors, ICs. Electronic Material Industries, 818-769-1002, FAX: 818-769-1084.

**BUILD THE MENDOCINO MOTOR.** This fascinating device is a solar powered, magnetically levitated motor. It will delight and amaze you and your friends. The 27 page plans book includes a list of parts suppliers. The motor uses readily available parts. Plans are \$15 plus \$2.50 S&H. Write to: St. Elmo's Fire, PO Box 141, Stow, MA 01775. E-Mail: [tcv@genrad.com](mailto:tcv@genrad.com)

**200+ ELECTRONICS PROJECTS.** Build for pleasure or make 100% (or more) profits reselling printed plans. \$1 (refundable) for catalog & dealer info. MATCO-A5, PO Box 509, ROSEVILLE, MI 48066-0509.

**AWESOME KITS:** voice changers, levitators, lasers, gas sensors, and more! Catalog \$1. **LNS Technologies**, PO Box 67243, Scotts Valley, CA 95067. [www.ccnet.com/~lnstech](http://www.ccnet.com/~lnstech)



**CIRCUIT BOARDS.** Single sided. No minimum. No set-up fees. No hidden costs. No per hole charge, up to 1,000 holes per panel. Complete price list available. Circuit Design, PO Box 5415, Central Point, OR 97502, 541-664-7904. Phone or Fax. The Worldwide Circuit Design Network, <http://www.circuitdesign.net>



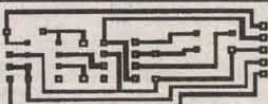
**CIRCUIT BOARDS.** Totally new! Low cost, precision-made PC boards from your Gerber/NC Drill files. Single and double sided. Full details at <http://www.pcbmilling.com> E-Mail: [feedback@pcbmill.com](mailto:feedback@pcbmill.com) FAX: 703-818-0071.

**HEATHKIT COMPANY** is selling photocopies of most Heathkit manuals. Only authorized source for copyright manuals. Phone: 616-925-5899, 8-4 ET.

**MATCH BOOK sized FM wireless mic kit,** surface mount, color enclosure included. Details: [www.Nmart.com](http://www.Nmart.com) or send \$9.50 check/M/O plus \$0.50 S&H to Anders Corp., 104 Gray St., Paterson, NJ 07501. Satisfaction guaranteed.

**18" COLOR LCD monitor kit.** Our exciting kit comes complete with an 18" DSTN LCD panel, an enclosure, all the cables, and instructions on how to assemble. Comparable to other monitors priced well over \$2,000. Available in black or beige. Kit only \$995. Digitron, 150K Mason Cir., Concord, CA 94520. 1-888-676-9971 x264.

**FORTY YEARS** in electronics and fourteen as reverse engineers, has produced 3,000+ schematic diagrams herded into 21 catalogs for sale to technicians trying to earn extra yenom repairing weird tronic, or those just curious how things work. Send 4 stamps for list of catalogs and hurl inducing propaganda. **Bomarc Services**, Box 1113, Casper, WY 82602. [ROLLO@TRIB.COM](mailto:ROLLO@TRIB.COM)



**ENGINEERS-ELECTRONIC** designers world wide advertising free! On the world wide circuit design network. Go to <http://www.circuitdesign.net> for details.

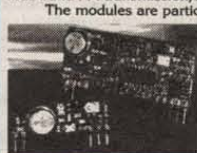
# Go Wireless With Our Modules

## SILRX/TXM

SILRX — \$26.00 ea.  
TXM — \$15.50 ea.

The TXM and SILRX modules are a transmitter and receiver pair which can achieve a one-way radio data link-up to a distance of 200m over open ground.

Both units are supplied in space-saving single in-line packages and offer SAW controlled, wide band FM transmission/reception.



The modules are particularly suited to battery-powered, portable applications where low power and small size are critical design criteria.

## TX2/RX2

TX2 — \$19.50 ea.  
RX2 — \$38.50 ea.

The TX2 and RX2 radio transmitter and receiver pair enable the simple implementation of a data link at up to 40kb/s at distances up to 75m in-building and 300m open ground. Both modules combine full screening with extensive internal filtering to ensure EMC compliance by minimizing spurious radiations and susceptibilities. The TX2 and RX2 modules will suit one-to-one and multinode wireless links in applications including car and building security, EPOS and inventory tracking, remote industrial process monitoring, and computer networking.

Because of their small size and low power requirements, both modules are ideal for use in portable, battery-powered applications such as hand-held terminals.



## RPC

RPC — \$99.00 ea.

The RPC module is an intelligent transceiver which enables a radio network link to be simply implemented between a number of digital devices. The module combines an RF circuit with processor-intensive low-level packet formatting and recovery functionality, requiring only a simple antenna and 5V supply to operate with a microcontroller or a PC.



**Lowest Priced!**

## BiM

BiM — \$69.00 ea.

The BiM module integrates a low-power UHF FM transmitter and matching superhet receiver together with data recovery and TX/RX change over circuits to provide a low-cost solution to implementing a bi-directional short-range radio data link.



## Lemos International Co., Inc.

65 Southbridge Street, Auburn, MA 01501  
Phone (508) 798-5004 ♦ Fax (508) 798-4782  
[www.lemosint.com](http://www.lemosint.com) ♦ [lemosint@ma.ultranet.com](mailto:lemosint@ma.ultranet.com)  
All products available in either 418 or 433 MHz

Write in 52 on Reader Service Card.

## Turn Your Multimedia PC into a Powerful Real-Time Audio Spectrum Analyzer

### Features

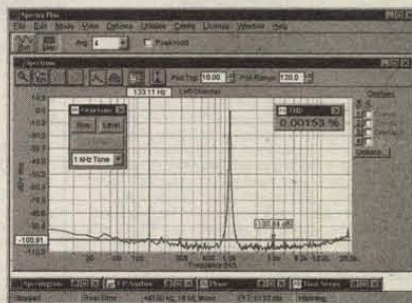
- 20 kHz real-time bandwidth
- Fast 32 bit executable
- Dual channel analysis
- High Resolution FFT
- Octave Analysis
- Distortion measurements
- Signal Generation
- Triggering, Decimation
- Transfer Functions, Coherence
- Time Series, Spectrum Phase, and 3-D Surface plots
- Real-Time Recording and Post-Processing modes

### Applications

- Distortion Analysis
- Frequency Response Testing
- Acoustic Research

### System Requirements

- 486 CPU or greater
- 8 MB RAM minimum
- Win. 95, NT, or Win. 3.1 + Win.32s
- Mouse and Math coprocessor



**Priced from \$495**

(U.S. sales only — not for export/resale)

**DOWNLOAD FREE**

**30 DAY TRIAL!**

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

**PHS** Pioneer Hill Software  
24460 Mason Rd.  
Poulsbo, WA 98370  
a subsidiary of Sound Technology, Inc.



**Spectra Plus**  
FFT Spectral Analysis System

Sales: (360) 697-3472

Fax: (360) 697-7717

e-mail: [pioneer@telebyte.com](mailto:pioneer@telebyte.com)

Write in 53 on Reader Service Card.

Nuts & Volts Magazine/November 1998

65



**CASH FOR** your test equipment manuals in good condition for most Tektronix, HP, Fluke, and other test equipment. E-Mail your list and best price to: [manuals@lonemtn.com](mailto:manuals@lonemtn.com)

**WANTED SERVICE** manual or copy for  
Radio Shack DUOFONE 16. 518-664-  
7215.

**FREE FLYER** on cable TV, phones, credit cards info, schematics, project boards, other misc. items. Bill 1-800-879-9657.

**HIGH QUALITY TOOLS AND STAINLESS STEEL HARDWARE.** European and American screwdrivers, nut-drivers, pliers, hex- keys, balldrivers, and more! Wiha, Bondhus, and Knipex. Stainless cap screws, machine screws, nuts, washers, U-bolts, and eyes. Free catalog. Robert Mink Import-Export, Box 6437V, Fair Haven, NJ 07704. Telephone or fax: 732-756-9388. E-Mail: w2tv@csi.com



CAMAC), PMTs, optics, high vacuum, and high voltage components and equipment. Guaranteed quality at reasonable cost. OE Technologies, Box 703, La Madera, NM 87539. Ph: 505-583-2482, Fax: 505-583-9190, E-Mail: [oetech@newmexico.com](mailto:oetech@newmexico.com) <http://www.oetech.com>

**CALL FOR a free electronics catalog**  
or visit our web site at [www.bgmicro.com/](http://www.bgmicro.com/) **B.G. Micro**, PO Box 280298,  
Dallas, TX 75228. Order line **1-800-276-2206**

**INVENTORY LIQUIDATION:** DEC, Modicon, Siemens-TI, Sixnet, GE, AB, Delta TAU, Sorensen DC60A P/S, Huntron (circuit analyzer), A6ium (logic analyzer), misc: (\$1 a lb) components, connector, pins, ICs, indicator lamps, pots, relay, switches, LEDs, caps, transistors, fans, blowers, power supplies, 19 in. VGA monitors. Call Chip at IAS 410-584-7800 Fax: 410-584-7805.

**NEW WEB SITE** [WWW.Psitech-Plus.com](http://WWW.Psitech-Plus.com) Purchase and sell test measurement equipment.

**2 NEW** Energizer "N" batteries, surplus catalog. Send \$1, EDS, PO Box 502, Columbus, NE 68601.

**HIGHEND SURPLUS 203-744-4101. OK INDUSTRIES DEMO BLOWOUT.** If it is not listed just give us a call, chances are we have it! **SOLDER STATIONS:** total rework, forced convection, hot air. MTR5000 (retail \$4,595) sell \$2,350; MTR4000 (retail \$3,995) sell \$1,750; MTR3000 (retail \$2,495) sell \$1,250; BTR2000 (retail \$1,595) sell \$775; FCR2000 (retail \$1,850) sell \$950; BTR1000 (retail \$825) sell \$400; SMT1160 (retail \$1,000) sell \$450; SA2000 (retail \$395) sell \$185; SA1000 (retail \$295) sell \$150; SA500 (retail \$225) sell \$75. **PUR-AIR:** Fume extractors. EP101 (retail \$1,895) sell \$475; EP051 (retail \$595) sell \$225. **JEM:** Batch ovens JEM310 (retail \$7,995) sell \$3,600; JEM210 (retail \$4,995) sell \$2,200. **PICK & PLACE:** Chip placers, vacuum pencils, fluid dispensers. SMT8001 (retail \$4,000) sell \$1,750; SMT880 (retail \$2,200) sell \$950; FD1000 (retail \$395) sell \$175; VP1000 (retail \$395) sell \$175. **BOARD ETCHER:** SSP-75A (retail \$995) sell \$400. **ALWAYS BUYING: VIDEO, RADIO, PHONE SYSTEMS, COMPUTERS, STEREO, AND BROADCAST EQUIPMENT.**

**SMT MANUFACTURING** equipment. components, digital, analog, & RF test equipment. 26 KVA generator. Closing R&D/manufacturing company. Must sell lots of equipment. Call 1-800-869-7827 or visit [www.starcom.com](http://www.starcom.com) for list.

Transmits color or B&W with fantastic quality - almost like a direct wired connection to any TV tuned to cable channel 59. Crystal controlled for no frequency drift with performance that equals law enforcement models that cost hundreds more! Basic 20 mW model transmits up to 300' while the high power 100 mW unit goes up to 1/4 mile. Audio units include sound using a sensitive built-in mike that will hear a whisper 15 feet away! Units run on 9 volts and hook-up to most any CCD camera. Any of our cameras have been tested to mate perfectly with our Cubes and work great. Fully assembled - just hook-up power and you're on the air.

C-2000, Basic Video Transmitter Cube.....	\$89.95
C-3000, Basic Video and Audio Transmitter Cube.....	\$149.95
C-2001, High Power Video Transmitter Cube.....	\$179.95
C-3001, High Power Video and Audio Transmitter Cube.....	\$229.95

A truly professional frequency synthesized FM Stereo transmitter station in one easy to use, handsome cabinet. Most radio stations require

a whole equipment rack to hold all the features we've packed into the FM-100. Set frequency easily with the Up/Down key buttons and the big LED digital display. Plus there's input low pass filtering that gives great sound no matter what the source (no more squeals or swishing sounds from cheap CD player inputs)! Peak limiters for maximum 'punch' in your audio - without over modulation. LED bargraph meters for easy setting of audio levels and a built-in mixer with mike and line level inputs. Churches, drive-ins, schools and colleges find the FM-100 to be the answer to their transmitting needs, you will too. No one offers all these features at this price! Kit includes cabinet, whip antenna and 120 VAC supply.

We also offer a high power export version of the FM-100 that's fully assembled with one watt of RF power, for miles of program coverage. The export version can only be shipped outside the USA, or within the US if accompanied by a signed statement that the unit will be exported.

FM-100, Professional FM Stereo Transmitter Kit.....	\$299.95
FM-100WT, Fully Wired High Power FM Transmitter.....	\$429.95

Ramsey AM radio transmitters operate in the standard AM broadcast band and are easily set to any clear channel in your area. Our AM-25, 'pro' version, fully synthesized transmitter features easy frequency setting DIP switches for stable, no-drift frequency control, while being jumper settable for higher power output when regulations allow. The entry-level AM-1 uses a tunable transistor circuit for frequency setting, and is also available with a FCC license (if required, expected range is up to 1/4 mi! depending upon antenna and conditions). Transmitters accept standard line-level inputs from tape decks, CD players or mixers, and run on 12 volts DC. The Pro AM-25 comes complete with AC power adapter, matching case and set bottom loaded wire antenna. Our AM-1 comes with a matching case and knob set for a finished, professional look.

AM-25, Professional AM Transmitter Kit.....	\$129.95
AM-1, Entry level AM Radio Transmitter Kit.....	\$29.95
CAM, Matching Case Set for AM-1.....	\$14.95

If you're looking for a good quality CCD board camera, stop right here! Our cameras use top quality Japanese "Class A" CCD arrays with over 1,440 lines of resolution, not the off-spec arrays that are found on many other cameras. You see, the Japanese suppliers grade the CCDs at manufacture and some manufacturers end up with the off-grade chips due to either cost constraints or lack of buying 'clout.' Also, a new strain of CMOS single chip cameras are entering the market, those units have about 1/2 the resolution and draw over twice the current that these cameras do - don't be fooled! Our cameras have nice clean fields and excellent contrast, they can be used in bright light or in low light if you want to see in the dark, the black & white models are super IR (Infrared) sensitive. Our IR-1 Illuminator kit is invisible to the human eye, but lights the scene like a flashlight at night! Color cameras has Auto White Balance, Auto Gain, Back Light Compensation and DSPI. Available with Wide-angle (80°) or super slim Pin-hole style lens. They run on 9 VDC and produce standard 1 volt p-p video. Add one of our transmitter units for wireless transmission to any TV set, or add our 1/8" Interface board for audio sound and sync easy direct wire hook-up connection to any Video monitor, VCR or TV with video/audio input jacks. Cameras fully assembled, incl. video non-wired connector.

CCDWA-2, B&W CCD Camera, wide-angle lens.....	\$99.95
CCDPH-2, B&W CCD Camera, slim fit pin-hole len.....	\$99.95
CCDPH-2, Color CCD Camera, wide-angle lens.....	\$149.95
IR-1, IR Illuminator Kit for B&W cameras.....	\$24.95
IB-1, Interface Board Kit.....	\$24.95

quality is excellent, connect to the line output of any CD player, tape deck or mike mixer and you're on-the-air. Foreign buyers will appreciate the high power output capability of the FM-25; many Caribbean folk use a single FM-25 to cover the whole island! New, improved, clean and hum-free runs on either 12 VDC or 120 VAC. Kit comes complete with case set, whip antenna, 120 VAC power adapter - easy one evening assembly.

**FM-25, Synthesized FM Stereo Transmitter Kit.....\$129.95**

A lower cost alternative to our high performance transmitters. Offers great value, tunable over the 88-108 MHz FM broadcast band, plenty of power and our manual goes into great detail outlining aspects of antennas, transmitting range and the FCC rules and regulations. Connects to any cassette deck, CD player or mixer and you're on-the-air, you'll be amazed at the exceptional audio quality! Runs on internal 9V battery or external power from 5 to 15 VDC. Add our matching case and whip antenna set for a nice finished look.

FM-10A, Tunable FM Stereo Transmitter Kit.....	\$34.95
CFM, Matching Case and Antenna Set.....	\$14.95
AC12-5, 12 Volt DC Wall Plug Adapter.....	\$9.95

Add some serious muscle to your signal, boost power up to 1 watt over a frequency range of 100 KHz to over 1000 MHz! Use as a lab amp for signal generators, plus many foreign users employ the LPA-1 to boost the power of their FM Stereo transmitters, providing radio service through an entire town. Runs on 12 VDC. For a neat, professionally finished look, add the optional matching case set.

LPA-1, Power Booster Amplifier Kit.....	\$39.95
CLPA, Matching Case Set for LPA-1 Kit.....	\$14.95
LPA-1WT, Fully Wired LPA-1 with Case.....	\$99.95

Search for buried treasure at the beach, backyard or park. This professional quality kit can detect metal at a depth of up to 6 inches. Easy to use, just listen for the change in tone as you 'sweep' the unit across the surface - the larger the tone changes, the larger the object.

Has built-in speaker or earphone connection, runs on standard 9 volt battery. Complete kit includes handsome case, rugged PVC handle assembly that 'breaks down' for easy transportation and shielded Faraday search coil. Easy one evening assembly. This nifty kit will literally pay for itself! That guy in the picture looks like he found something - what do you think it is - gold, silver, Rogaine, Viagra? You'll have fun with this kit.

TF-1, Treasure Finder Kit.....\$39.95

aluminum. 10 x 25 power with fully coated optics. Includes lens cleaner cloth, neck lanyard and nice carry case. For extra demanding use in bright sun, choose the EX module with ruby coated Objective lens. First quality at a close-out price! We've seen the exact same units with the "Bushnell" name on them being sold for \$30 more!

BNO-1, Binoculars and case.....	\$24.95
BNO-1EX, Ruby Coated Lens Binoculars and case.....	\$29.95

Decode all that gibberish! This is the popular descrambler / scrambler that you've read about in all the Scanner and Electronic magazines. Speech inversion technology is used, which is compatible with most cordless phones and many police department systems,

hook it up to your scanner speaker terminals and you're in business. Easily configured for any use: mike, line level and speaker output inputs are provided. Also communicate in total privacy over telephone or radio, full duplex operation - scramble and unscramble at the same time. Easy to build, all complex circuitry contained in new custom ASIC chip for clear, clean audio. Runs on 9 to 15VDC. Our matching case set adds a professional look to your kit.


SS-70A, Speech Descrambler/Scrambler Kit.....	\$39.95
CSS, Custom Matching Case and Knob Set.....	\$14.95
SS-70AWT, Fully Wired SS-70A with Case.....	\$79.95
AC12-5 12 Volt DC Wall Plug Adapter.....	\$9.95

See our complete catalog and order  
on-line with our secure server at:  
**[www.ramsevelectronics.com](http://www.ramsevelectronics.com)**

**RAMSEY ELECTRONICS, INC.**  
793 Canning Parkway Victor, NY 14564

**Order Toll-free: 800-446-2295**  
Sorry, no tech info, order status at this number

**Call Factory direct: 716-924-4560**  
**Fax: 716-924-4555**



**ORDERING INFO:** Satisfaction Guaranteed. Examine for 10 days, if not pleased, return in original form for refund. Add \$6.95 for shipping, handling and insurance. Orders under \$20, add \$3.00. NY residents add 7% sales tax. Sorry, no CODs. Foreign orders, add 20% for surface mail or use credit card and specify shipping method.



**\$\$\$ATTENTION\$\$\$** Modem coupling transformer for sale mfg. Midcom: P/N 671-8000. 15k in stock for immediate shipping. Limited offer, call 732-294-1944 ask for Alex @ Global. Data sheet available.



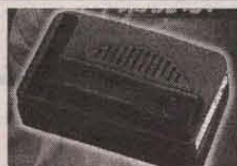
**SOLAR-POWERED FAN HAT.** Baseball type hat with solar powered fan. Great for sports fans, golfers, etc. Available in red or blue. \$19 plus \$2.00 shipping. CA residents add 7.75% sales tax. Visa/MC/Disc/Amex OK. H.T. Orr Computer Supplies, 249 Juanita Way, Placentia, CA 92670. 714-528-9822, 1-800-377-2023, FAX 714-993-6216.

<http://www.pccables.com> PC CABLES and PARTS. 100s of hard-to-find new cables and parts, Free technical information, low prices, fast online ordering & browsing.

**L BAND** quadrifilar T/R antenna, 55 dB LNA, 20 watt HPA, works great for remote GPS. Info at [afstar.com](http://afstar.com).

**FOR SALE:** (E)EPROM, PIC, 874x, 8751, PAL, GAL, PLD, DC motor, stepper, LCD and many other new and used electronics components. Call 425-489-9042, E-Mail: [esreng@jps.net](mailto:esreng@jps.net)

**ALPINE XL-15 electronic air cleaners** (four to sell) the best air cleaner in its class. Ozonator/RF ionizer combination **closeout sale** \$325 each, 650-842-3268.



**Z64 GAME recorder:** self-contained computer with 32meg RAM, ZIP. Plug into N64 station. Unlimited game storage, saving \$375. N64 is a Nintendo trademark. 1-800-266-5706 PCT. Website: [mobil-e-tech.com](http://mobil-e-tech.com)

## MISCELLANEOUS ELECTRONICS WANTED

**MILITARY TRANSISTORS & DIODES & INTEGRATED CIRCUITS WANTED.** ELECTRONIC MATERIAL INDUSTRIES 818-769-1002, FAX 818-769-1084.

**TESTERS WANTED:** Immediate offers made for Ultrasonic, Magnetic Particle, Eddy Current, X-Ray and Borescopes, 24hrs. Leave detailed message with make/model. 1-800-530-3371.

**WANTED: ELECTRON** tubes, ICs, semi-conductors. Summit, PO Box 1850, Linden, NJ 07036. Call 1-800-526-4052.

**WE BUY** your electronic excess inventories. ICs, caps, transistors, LED, connectors, PCBs, computers and related products. Call Tom Freeman 714-558-8813, fax 714-558-1603.

**WANTED: TUBE** HiFi/commercial amps, preamps, corner/horn speakers. Altec, Marantz, McIntosh, Western Electric, etc. 405-737-3312 fax 405-737-3355.

**ELECTRON TUBES,** transistors-RF aircraft radar & comm. Sold or bought. ARS Electronics, 7110 De Celis Pl., Van Nuys, CA 91406. 1-800-422-4250, fax 818-997-6158.

**WESTERN ELECTRIC** audio equipment wanted. 1927-1960's. Amplifiers, "pre-amps," speakers, transformers, tubes, etc. 1-800-251-5454.

## Got A Battery Problem?

Get the **Ultimate Battery Monitor**

Fits 2" hole!



# E-Meter™

Perfect for...

- ...Emergency vehicles.
- ...Power hungry mobiles.
- ...Back up power systems.
- ...Cell/repeater monitoring.

**"Batteries don't die, they're murdered"**

Proven in thousands of marine, military, RV, and industrial applications, the **E-Meter** gives you the battery information you need to build and run reliable DC systems. A multi-color bar graph shows battery status at a glance. Big LED's display **volts, amps, amp-hours, time or percent of capacity remaining, and kilowatt-hours.** Tracks historical information including battery charge efficiency, number of discharge cycles, deepest and average depth of discharge. Optional RS232, temperature sensor, and low battery/genrun contact. Models up to 500V @1000A. 12-24V @ ≤ 500 A units are priced under \$250 w/ sensor!

Call ext. 12 with any application or OEM questions!

## Cruising Equipment

5245 Shilshole Ave. NW, Seattle, WA 98107  
(206) 782-8100 Fax: (206) 782-4336  
See us on the web: <http://cruisingequip.com>

## TONER CARTRIDGE RECHARGE

& Laser Printer Supplies

CALL NOW FOR YOUR FREE CATALOG #13!



Instruction Manual  
Free with starter kit

Video Training Tapes  
choose from our library

Catalog #13  
100 pages  
**FREE!**

Marketing Flyers  
with customized pricing

Printer/Copier/Fax  
Cross Reference  
58 pgs-Free with any order

■ Black, Color & MICR Toner  
■ Tools and Accessories  
■ Technical Support

■ Cartridge Parts  
■ Video Training Tapes  
■ OPC Drums and Belts

■ InkJet Refill Supplies  
■ Graphic Black Toner Kits  
■ MICR Toner Kits

Visit our website at

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

for all the free tech documents, Sales Specials and the latest industry news!



Chenesko Products Inc.  
2221 Fifth Ave., Suite 4,  
Berkshire, NY 11779  
Fax: 516-467-3223  
E-Mail: [chenesko@aol.com](mailto:chenesko@aol.com)  
<http://www.chenesko.com>

**800-221-3516**

Write in 56 on Reader Service Card.

**WANT USED** or surplus DC motor controls or adjustable frequency AC drives, 1/2 HP and up. DC motors fractional to 3 HP. C. Woodruff, 5507 55th Ave. S., Seattle, WA 98118. Voice/Fax 206-723-8487.

**WANTED: TUBES,** radios, transmitters, receivers, gyros, bearings, connectors, relays, lamps, synchros. Hyness Company, 709B Delair Road, Cranbury, NJ 08512-4212. Phone: 609-395-1116, FAX 609-395-1117.

**WESTERN ELECTRIC** audio equipment wanted. 1926-1960s amplifiers, speakers, pre-amps, tube, transformers, etc. 1-800-old-mics 1-800-653-6427 Great Wireless Museum.

**DEC EQUIPMENT WANTED!!!** We are buying DEC systems, boards, terminals, drives and peripherals. Also Scientific Micro Systems (SMS), DSD, Datability, Dialog, other DEC compatibles, and Computer Output Microfilm (COM) units. Please call for a quote or fax us your equipment list. We buy, sell, and trade. **KEYWAYS, INC.,** 937-847-2300 OR fax 937-847-2350.

**OLD ICs & TRANSISTORS WANTED:** HIGHEST PRICES PAID please FAX your list with part number, quantity & condition of any semiconductors to Rick @ ESI, 5363 Broadway Ave., Cleveland, OH 44127. 216-441-8500 FAX 216-441-8503. Since 1946! [www.electronicsturplus.com](http://www.electronicsturplus.com)

## FOR THE BEST PRICES ON PROFESSIONAL TOOLS, CALL ELECTRO-TOOL



**platt** - Case - Deluxe Polypropylene. Chemical Resistant. Tools by CooperTools and others. 800T Case, complete with tools ... **\$419.95**  
800T Case Only ... **\$121.80**

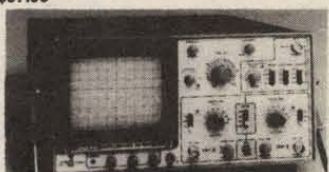


**platt** - Case - Cordura Exterior. Two exterior pockets & one literature pocket. 660ZT Case, complete with tools ... **\$223.00**  
660ZT Case Only ... **\$59.45**  
Optional Sperry meter #DM6510 as shown ... **\$65.00**



**Weller WCC100-** Electronically controlled station, temperature adjustable from 350°F-850°F. Zero voltage circuit-safe for sensitive components, 40 Watt pencil ... **\$97.90**

**OptiVISOR** - Superior magnification, Optical Glass Prismatic lenses (not plastic). Select any one of (6) magnifications ... **\$24.00**



**GoldStar** - 20 MHz Dual Trace Oscilloscope OS-9020A-Large 6" rectangular, high sensitivity: 1mV/div., high accuracy: ±3%, stable, low-drift design, 8 divisions of displayed dynamic range and accurate, distortion-free waveform measurements ... **\$372.00**

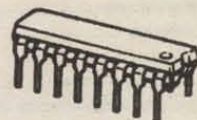
## Electro Tool, Inc.



9103 Gillman, Livonia, MI 48150  
Customer Service: (734) 422-1221  
ORDERS ONLY: 1 (800) 772-3455  
FAX: (734) 422-3432



**"Tools American Made."**



**WANTED: EXCESS ELECTRONIC INVENTORIES,** ICs, MEMORY, EPROMs, PALs, LEDs, CIRCUIT BOARDS, DIODES, AND TRANSISTORS. CALL ACTIVE MICRO, 562-494-4851 OR FAX 562-494-4913.

**WESTERN ELECTRIC WANTED:** 1920's-1960's. Amplifiers, mixers, pre-amps, speakers, tubes, etc. FREE OFFER 1-800-251-5454.



# HOW TO PLACE A CLASSIFIED AD

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.

## WORDS IN BOLD AND/OR ALL CAPS

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.

## PHOTOS, DRAWINGS, AND BOXES

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, or **\$8.00** for halftone of photographs. To **BOX** your ad, include an additional **\$50.00** for copy-only ads, or **\$75.00** for ads with art or photos.

## FAXING IN AD COPY

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.

## DEADLINE

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.

## IMPORTANT INFORMATION

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.

*Choose a category for your ad from the classifications listed below.*

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
30. CB/Scanners	90. Satellite Equipment	130. Antique Electronics	170. Misc. Electronics Wanted
40. Music & Accessories	95. Military Surplus Electronics	135. Aviation Electronics	175. BBS & Online Services
50. Computer Hardware	100. Audio/Video/Lasers	140. Publications	180. Education
60. Computer Software	110. Cable TV	145. Robotics	190. Business Opportunities
70. Computer Equipment Wanted	115. Telephone/Fax	150. Plans/Kits/Schematics	200. Repairs/Service

## ADVERTISER'S INDEX

Abacom Technologies .....	59	Corporate Systems Center .....	2, 99	J-Works, Inc. ....	51	R.E. Smith .....	56
ABC Electronics .....	30	Cruising Equipment .....	67	KDE Electronics Corp. ....	55	RF Science & Technology .....	47
Ace Computers .....	52	Cunard Associates .....	78	Kimtronix .....	70	Roger's Systems Specialist .....	60, 86
ACP Super Store .....	70	Cyber-Test Incorporated .....	49	La Paz Electronics Int'l. ....	79	Sam's Electronics .....	55
Advanced Educational Systems .....	45	Danbar Sales Company .....	58	Lemos International Co., Inc. ....	65	Scott Edwards Electronics .....	44
Alfa Electronics .....	61	Dexis .....	40, 57	Linear Systems .....	17	Seabird Technical .....	57
All Electronics Corporation .....	64	Digital Products Co. ....	56	Lynxmotion, Inc. ....	25	Shreve Systems .....	56
Allison Technology Corporation .....	49, 56	Dimension .....	61	M2L Electronics .....	90	Skycraft Parts & Surplus, Inc. ....	79
Alltech Electronics .....	18	Earth Computer Technologies .....	48	MCM Electronics .....	34	Spy Outlet .....	56
Alltronics .....	41	E.H. Yost & Co. ....	81	Meredith Instruments .....	49	Square 1 Electronics .....	16
All TV, Inc. ....	80	ELECTRO MAVIN .....	31	Metric Equipment Sales, Inc. ....	44	Surplus Traders .....	56
American Innovations, Inc. ....	31	Electro Tool, Inc. ....	67	microEngineering Labs .....	17	Synergetics .....	83
American Technologies Network Corp. ....	50	Electronic Design Specialists, Inc. ....	55	Micromint .....	77	Tech America .....	5
AM Research, Inc. ....	77	Electronic Goldmine .....	24	Milford Instruments-England .....	56	Techniks, Inc. ....	56
ANA Instruments .....	73	Electronic Rainbow Ind., Inc. ....	63	Modern Electronics .....	78	Technological Arts .....	56
Andromeda Research .....	13	EMAC, Inc. ....	76	Motron Electronics .....	74	tech-specialties, Inc. ....	57
Antique Radio Classified .....	57	EPS .....	57	Mouser Electronics .....	45	Telulex, Inc. ....	43
AST Global Electronics .....	24, 53	Equipment Management Technology .....	90	Mr. NiCd .....	81	The Filter Company .....	33, 82
Aventrade .....	56	ExpressPCB .....	56	MSC Electronics .....	57	The RF Connection .....	87
Basic Electrical Supply		Foss Warehouse Distributors .....	56	Netcom .....	25	Timeless Products .....	51
& Warehousing Corporation .....	10	Gateway Electronics, Inc. ....	71	Northwest Cable & Connector Co. ....	28	T.T.I. ....	57
Baylin Publications .....	81	General Device Instruments .....	56	Optoelectronics .....	98	Turner Technologies .....	57
Bell Electronics .....	13	Glentech, Inc. ....	56	Pacific Test Equipment Corp. ....	11	Ultra Link .....	57
Bilcocon Corp. ....	57	Halted Specialties Co. ....	3	Parallax, Inc. ....	Back Cover	Unicorn Electronics .....	73
Bisme Computers Outlet .....	62	Herbach and Rademan .....	19	PARAMAX, INC. ....	85	USI Corp. ....	16
Brick Wall Div., Price Wheeler Corp. ....	35	H.T. Orr Computer Supplies .....	46	PCW, Inc. ....	76	Utopia Tools .....	88
C & S Sales, Inc. ....	37, 72	IndustroLogic .....	88	Phelps Instruments .....	74	V&V Mach. & Equipment, Inc. ....	56, 57
C and H Sales Company .....	50	Information Unlimited .....	48	Pioneer Hill Software .....	65	VersaTech Electronics .....	87
Capital Electronics, Inc. ....	80, 89	Infjet Southwest .....	54	Polaris Industries .....	59	Viewstar .....	10
Chaffin Electronics .....	47	Interactive Image Technologies, Ltd. ....	7	Prairie Digital, Inc. ....	57	Viking International .....	53
Cheneko Products, Inc. ....	67	Intersoft .....	70	P.S. Technology .....	62	Visitect, Inc. ....	28
Circuit Etching Technics .....	50	Intronics, Inc. ....	17	Pulsar, Inc. ....	40	Weeder Technologies .....	30
Communications Surplus .....	57	ITU Technologies .....	57	R & S Surplus .....	32	Western Test Systems .....	26-27
Comtrad Industries .....	97	Jade Products, Inc. ....	56	Ramsey Electronics, Inc. ....	66	Wholesale Cable .....	62
Consumertronics .....	29	James' Electronic Services, Ltd. ....	46	Resources Un-Ltd. ....	75		



## AMATEUR RADIO & TV

Abacom Technologies	59
Alltronics	41
Communications Surplus	57
Gateway Electronics, Inc.	71
Intersoft	17
Jade Products, Inc.	56
Lemos International Co., Inc.	65
Ramsey Electronics, Inc.	66
RF Science & Technology	47
Tech America	5
The RF Connection	87

## BATTERIES/CHARGERS

Aventrade	56
Cruising Equipment	67
Cunard Associates	78
E.H. Yost & Co.	81
Jade Products, Inc.	56
Mr. NiCd	81

## BUSINESS OPPORTUNITIES

Cheneko Products, Inc.	67
------------------------	----

## BUYING ELECTRONIC SURPLUS

ABC Electronics	30
Alltech Electronics	18
C and H Sales Company	50
Dexis	40, 57
Earth Computer Technologies	48
EPS	57
Equipment Management Technology	90
Metric Equipment Sales, Inc.	44
Roger's Systems Specialist	60, 86
Skycraft Parts & Surplus, Inc.	79

## CABLE TV

All TV, Inc.	80
Basic Electrical Supply & Warehousing Corporation	10
Dimension	61
Foss Warehouse Distributors	56
James' Electronic Services, Ltd.	46
KDE Electronics Corp.	55
Kimtronix	70
Modern Electronics	78
PCW, Inc.	76
Sam's Electronics	55
The Filter Company	33, 82
Timeless Products	51
Viewstar	10
Wholesale Cable	62

## CB/SCANNERS

USI Corp.	16
-----------	----

## CCD CAMERAS/VIDEO

American Innovations, Inc.	31
American Technologies Network Corp.	50
Herbach & Rademan	19
MSC Electronics	57
Polaris Industries	59
Ramsey Electronics, Inc.	66
Resources Un-Ltd.	75
Seabird Technical	57
Spy Outlet	56
USI Corp.	16

## COMPONENTS

Ace Computers	52
Circuit Etching Technics	50
Communications Surplus	57
Electronic Goldmine	24
EPS	57
La Paz Electronics Int'l.	79
Linear Systems	17
Pulsar, Inc.	40
Skycraft Parts & Surplus, Inc.	79
Unicorn Electronics	73
Visitec, Inc.	28

## COMPUTER

Hardware	
Ace Computers	52
ACP Super Store	70
Allison Technology Corp.	49, 56
Alltech Electronics	18
AM Research, Inc.	77
Bism Computer Outlet	62
Brick Wall Div., Price Wheeler Corp.	35
Chaffin Electronics	47
Consumertronics	29

Corporate Systems Center	2, 99
Earth Computer Technologies	48
ELECTRO MAVIN	31
General Device Instruments	56
Halted Specialties Co.	3
La Paz Electronics Int'l.	79
MCM Electronics	34
Northwest Cable & Connector Co.	28
Roger's Systems Specialist	60, 86
Shreve Systems	56
Techniks, Inc.	56
tech-specialties, Inc.	57
Ultra Link	57

## Software

AM Research, Inc.	77
Bism Computer Outlet	62
Comtrad Industries	97
Interactive Image Technologies, Ltd.	7
Pioneer Hill Software	65
Ultra Link	57

## Microcontrollers / I/O Boards

Abacom Technologies	59
Advanced Educational Systems	45
AM Research, Inc.	77
Bism Computer Outlet	62
EMAC, Inc.	76
IndustroLogic	88
Intersoft	17
ITU Technologies	57
La Paz Electronics Int'l.	79
Micromint	77
Motron Electronics	74
Parallax, Inc.	Back Cover
PARAMAX, INC.	85
Prairie Digital, Inc.	57
R.E. Smith	56
Scott Edwards Electronics	44
Square 1 Electronics	16
Technological Arts	56
VersaTech Electronics	87

## Printers/Printer Supplies

Cheneko Products, Inc.	67
H.T. Orr Computer Supplies	46
Inkjet Southwest	54

## DESIGN/ENGINEERING SERVICES

ExpressPCB	56
Pulsar, Inc.	40
V&V Mach. & Equipment, Inc.	56, 57

## EDUCATION

Advanced Educational Systems	45
EMAC, Inc.	76

## EVENTS/SHOWS

ACP Super Store	70
AST Global Electronics	24

## KITS

Alltronics	41
C & S Sales, Inc.	37, 72
Digital Products, Inc.	56
Earth Computer Technologies	48
Electronic Goldmine	24
Electronic Rainbow Ind., Inc.	63
EMAC, Inc.	76
Gateway Electronics, Inc.	71
Information Unlimited	48
Inkjet Southwest	54
Jade Products, Inc.	56
Ramsey Electronics, Inc.	66
Scott Edwards Electronics	44
USI Corp.	16
Weeder Technologies	30

## LASERS

Information Unlimited	48
Meredith Instruments	49
Resources Un-Ltd.	75
Unicorn Electronics	73

## MISC./SURPLUS

All Electronics Corporation	64
Alltech Electronics	18
C and H Sales Company	50
Chaffin Electronics	47
Communications Surplus	57
Consumertronics	29
Cyber-Test Incorporated	49
Electronic Goldmine	24
Electronic Rainbow Ind., Inc.	63
EPS	57
Equipment Management Technology	90
Gateway Electronics, Inc.	71

**FIND**  
what you need ...  
**FAST**  
BY PRODUCT  
OR  
CATEGORY

Halted Specialties Co.	3
P.S. Technology	62
Resources Un-Ltd.	75
Shreve Systems	56
Skycraft Parts & Surplus, Inc.	79
Surplus Traders	56
Unicorn Electronics	73
Viking International	53
Visitec, Inc.	28
Weeder Technologies	30

## PROGRAMMERS

Andromeda Research	13
General Device Instruments	56
Intronics, Inc.	70
M2L Electronics	90
microEngineering Labs	17

## PUBLICATIONS

Antique Radio Classified	57
Consumertronics	29
Mouser Electronics	45
Netcom	25
Square 1 Electronics	16
Synergetics	83

## ROBOTICS

Abacom Technologies	59
Lemos International Co., Inc.	65
Lynxmotion, Inc.	25
PARAMAX, INC.	85
Millford Instruments-England	56

## SATELLITE

Baylin Publications	81
---------------------	----

## SECURITY

American Innovations, Inc.	31
American Technologies Network Corp.	50
Information Unlimited	48
Intersoft	17
Lemos International Co., Inc.	65
MSC Electronics	57
Polaris Industries	59
USI Corp.	16
Visitec, Inc.	28

## SOLAR EQUIPMENT

Cruising Equipment	67
Herbach & Rademan	19

## STEPPER MOTORS

Alltronics	41
Herbach & Rademan	19
PARAMAX, INC.	85

## TELEPHONE

Bilocon Corp.	57
Digital Products, Inc.	56
Telulex, Inc.	43
Turner Technologies, Inc.	57
Weeder Technologies	30

## TEST EQUIPMENT

ABC Electronics	30
Alfa Electronics	61
Allison Technology Corp.	49, 56
ANA Instruments	73
AST Global Electronics	53
Bell Electronics	13
C & S Sales, Inc.	37, 72
C and H Sales Company	50
Cruising Equipment	67
Danbar Sales Company	58
Dexis	40, 57
Digital Products, Inc.	56
Electronic Design Specialists	55
Equipment Management Technology	90
Electro Tool, Inc.	67
Glentech	56
Intronics, Inc.	70
J-Works, Inc.	51
Metric Equipment Sales, Inc.	44
MCM Electronics	34
Optoelectronics	98
Pacific Test Equipment Corp.	11
Phelps Instruments	74
Pioneer Hill Software	65
R & S Surplus	32
RF Science & Technology	47
Seabird Technical	57
Telulex, Inc.	43
T.T.I.	57
Western Test Systems	26-27

## TOOLS

C & S Sales, Inc.	37, 72
Electro Tool, Inc.	67
RF Science & Technology	47
The RF Connection	87
Utopia Tools	88

## WIRE/CABLE & CONNECTORS

Northwest Cable & Connector Co.	28
Roger's Systems Specialist	60, 86
The RF Connection	87



# ATTENTION DEALERS

BUY DIRECT FROM THE WHOLESALE

GET THE BEST PRICES AND SERVICE

ALL UNITS ARE IN STOCK FOR IMMEDIATE SHIPMENT

## CABLE CONVERTERS AND ACCESSORIES

### CALL FOR PRICING ON ITEMS NOT LISTED

	QTY 5	QTY 10	QTY 25	QTY 50	QTY 100
--	----------	-----------	-----------	-----------	------------

#### NEW CONVERTERS

CENTURY CT-3000	\$64	\$60	\$55	\$50	CALL
COMMERCIAL-11	\$75	\$70	\$65	\$62	CALL
VIEWSTAR-550 MHZ	\$50	\$45	\$42	\$38	CALL
DIGITECH-550 MHZ	\$55	\$49	\$48	\$46	CALL

#### EXPLORER CONVERTERS

EXP-6600	\$250	\$225	\$200	\$175	CALL
----------	-------	-------	-------	-------	------

#### PANASONIC CONVERTERS

PAN-175/VOL	\$165	\$155	\$145	\$135	CALL
-------------	-------	-------	-------	-------	------

WE WILL MEET OR BEAT ANY ADVERTISED PRICE

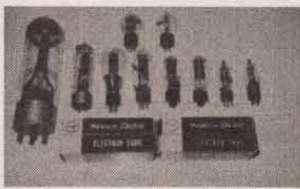
## 1-800-800-0766

### KIMTRONIX

30 day money back guarantee. All shipping and handling at customers expense. Anyone implying theft of cable service will be denied sale. NO FLORIDA SALES. WE WILL MEET OR BEAT ALL COMPETITOR'S PRICES IN THIS MAGAZINE

Write In 57 on Reader Service Card.

**WANTED: ELECTRONIC** estates. Ham, broadcasting, military, test, public address, tubes, transformers, telex equipment. The bigger the pile, the more worthwhile. We fly anywhere. Sumner McDaniel 1-800-251-5454.



**HIGHEST PRICES** paid for Western Electric tubes, new and used. Call Don Singerhouse/Singerhouse Sound. Toll free 1-888-715-tube.

**WANTED: AVIONICS** test equipment, IFR, 600A, 401L, others, Collins, King, Sperry, North Atlantic, Litton INUs LTN series, rate and tilt tables, air data test sets, 941-625-3222 P, 941-625-0494 F, E-Mail: avionics@afcon.net

**WANTED: BALANCING** machines & vibration analyzing equipment manufactured by the following: Spectral Dynamics, Hofmann, Bentley Nevada, Schenck, IRD Mechanalysis, Gishott. Contact Mike Park at E.T. Balancing, 12823 Athens Way, Los Angeles, CA 90061. 310-538-9738, FAX: 310-538-8273.

**RADAR/MICROWAVE** equip: Aviation, marine, fire control. Like TPS 21, APS 10, 42 APG 30. Parts, TM's, etc. Radar, Box 10215, Pittsburgh, PA 15232.

**NERDY PROFESSOR** seeks equipment for restoration/display. Will pay fair price and shipping. Please E-Mail kovacs@cis.stanford.edu or fax 650-424-8931 if you have for sale: HP 9100A or B, 9810A, 9815A, 9820A, 9830A, HP 55, 65 or 67 or other early HP calculators, HP 01 calculator watch, HP quartz thermometer probes, HP 200A audio oscillator (tilt-to-open lid), HP 521 frequency counter, HP 970A handheld multimeter, Tek 511 oscilloscope.

## BBS & ONLINE SERVICES

**VISIT DON Lancaster's GURU'S LAIR** website at <http://www.tinaja.com> PICs, pseudoscience, PostScript, patents, Tinaja quests, flutterwumpers, book-on-demand, magic sinewaves, money machines, Navicubes, tramways, wavelets, and Webmastering. Online reprints, consultants net, forums, annotated hot links, surplus bargains, great heaping bunches more.

**MOD CHIPS** for Sony PlayStation. Now your backups will work. Only \$9.95 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)

## EDUCATION

**START YOUR OWN TECHNICAL VENTURE!** Don Lancaster's newly updated **INCREDIBLE SECRET MONEY MACHINE II** tells how. We now have autographed copies of the Guru's underground classic for \$18.50. Synergetics Press, Box 809-K, Thatcher, AZ 85552. 520-428-4073. VISA/MC.

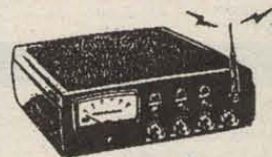
**DON LANCASTER'S ACTIVE FILTER COOKBOOK** is back in print. Autographed copies of the seven-teenth(!) classic printing \$28.50. **SYNERGETICS PRESS**, Box 809-N, Thatcher, AZ 85552. 520-428-4073. Visa/MC.

**GRAND UNIFIED THEORY MADE EASY.** 110 page book explains a new theory linking gravity, electronics & magnetism. Explores universe mysteries, goes beyond relativity & quantum theory. \$9.95. To order: send check or M/O to American Science Innovations, PO Box 155, Clarington, OH 43915.

**WANTED: SOMEONE** to teach me PIC and/or single board computers. I have some knowledge, but need more! I have a project that needs stepper motor controls, among other things. Would like to find someone in the central NJ area if possible. E-MAIL: GARYBAL@AOL.COM

## BUSINESS OPPORTUNITIES

**MILLIONS \$\$\$** in "scrap gold" from old computers and electronics junk. Message: 603-645-4776 or [www.tiac.net/users/quiksand/goldtek.htm](http://www.tiac.net/users/quiksand/goldtek.htm)

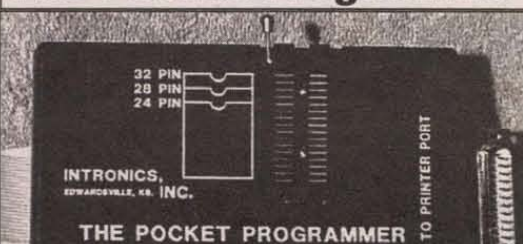


**COUNTER SURVEILLANCE=\$250 HRI** Electronic eavesdropping is unbelievably widespread! Are you sure you're safe? Learn how others (without prior experience) earn \$250 HR in the fascinating field of COUNTER-SURVEILLANCE! For FREE catalog call: 1-800-732-5000.

**MILITARY COMPONENTS** wanted. Capacitors, resistors, diodes, transistors, semiconductors, ICs. Electronic Material Industries, 818-769-1002, FAX: 818-769-1084.

**THE CASE AGAINST PATENTS.** Thoroughly tested and proven alternatives that work in the real world, \$28.50. **SYNERGETICS PRESS**, Box 809-N, Thatcher, AZ 85552. 520-428-4073. Visa/MC.

## The Pocket Programmer



The portable programmer that uses the printer port of your PC instead of an internal card. Easy to use software that programs E(E)prom, Flash & Dallas Ram. 27(C)/28(C)/28F/ 29F/29CXXX & 25XX series from 16K to 8 Megabit with a 32 pin socket. Adapters available for Pic, MCU's 874X, 875X, 40-Pin X 16 & Serial Eprom's, PLCC, 5-Gang, 82/74 Prom's and Eprom Emulator to 32K X 8. Only \$129.95

Same Name, Address & Phone Number for 16 Years... Now isn't that Amazing?

**Intronics, Inc.**

Box 13723 / 612 Newton St.

Edwardsville, KS 66113

Tel. (913) 422-2094

Add \$5.00 COD

Add \$4.00 Shipping

Fax (913) 441-1623 Visa / Master Charge / Amex

## ACP's 88th GIANT COMPUTER SWAP★MEET

Orange County's Original! All Day Sunday 8am-2pm Nov 29th

FREE Admission & Parking Shop 100's of Sellers

in ACP's Giant Parking Lot !!!

Advanced Computer Products, Inc.

## ACP SUPER★STORE

Since 1976

1310 E. Edinger Santa Ana, CA 714-558-8813



**START YOUR OWN TECHNICAL VENTURE!** Don Lancaster's newly updated **INCREDIBLE SECRET MONEY MACHINE II** tells how. We now have autographed copies of the Guru's underground classic for \$18.50. Synergetics Press, Box 809-K, Thatcher, AZ 85552. 520-428-4073. VISA/MC.

## REPAIRS — SERVICES

**PC BOARDS REPAIRED.** Prices start at \$5. Minimum 5 of one type. Network Sales, 616-683-0500.

**ENGINEERING CONSULTING.** Product development from conceptual to manufacturing stages. Digital, analog, and RF expertise. Microcontroller designs for HC05xx, HC11xx, and PIC families. Software design for IBM PC. XILINX and Altera FPGA design. In-house schematic capture and PWB. Hicks Electronic Design, PO Box 7366, Loveland, CO 80537-0366. Toll Free 1-888-849-6792 E-Mail: [steve@hickseng.com](mailto:steve@hickseng.com) website: [www.hickseng.com](http://www.hickseng.com)

**PICS, GALS READ** if you've lost your masters. Programming service available. Call for info. Network Sales, 616-683-0500.

**(E)EPROM PROGRAMMING** done quickly and economically. One day turn around typical. Simple copy \$3 per device. Also prototyping, design, and consulting services available. Call or send SASE to: **Luzer Electronics, 4023 North Bayberry, Wichita, KS 67226. 316-687-2127, FAX 316-687-3103.**

**PINBALL MACHINES!** Books, Magazines, Manuals, Diagrams, Supplies, Parts. \$2 catalog, Marco Specialties, 5290-N Platt Springs Rd., Lexington, SC 29073-9252. 803-957-5500. FAX 803-957-6974. E-Mail: [tilt@ix.netcom.com](mailto:tilt@ix.netcom.com) <http://pinballmachine.com>

**SERVICE REPAIR TIPS for FREE! PROFESSIONAL BOARD LEVEL & COMPONENT LEVEL REPAIRS for TVs, VCRs, projection TVs, CAMCORDERs, CD players, audio and other repairs on computer disk. ADD your repairs. PRINT out repairs. BACKUP & save your repairs. Want to share your repair tips? If you do, we'll send you FREE updates! Ask about our TIP EXCHANGE policy. For IBM compatible computers with a hard drive. Get your FREE Stage 1 SERVICE TIPS Now! FREE CALL. CALL NOW 1-800-215-5081.**

*Try a classified ad in Nuts & Volts. Details on page 68.*

## Some bright ideas for the new year



Coming up in 1999, *Nuts & Volts* will be adding some exciting new features to their web site!

Keep on the look-out for the following:

- ☆ An interactive chat room
- ☆ An extensive article search engine
- ☆ A special Subscribers-Only section

So ...

**Keep your eyes on the web ...**



## order toll-free 1-800-669-5810

### AMAZING MINI MICRO FM RADIO! \$7.50

Much lighter than a heavy jam box with really good sound! This tiny radio (1.5"x1.06"x0.38") has a seek button, reset control, and an on/off switch. Personal listening has never sounded better! Ideal for ballgames, studyhall, and workouts. Battery and nugget style earphones included.



### TWISTER TWISTER \$4.95

Originally designed for promotional displays, this unit features a 7.5" twisted clear plastic rod, a 3V motor, and an attached cardboard 5-3/4" sleeve battery holder (will hold 2 D-cell batteries, not included.) The motor measures 2" x 1-3/4" dia with a 5/8" long, 1/8" dia. shaft, has mounting tabs and rotates at about 40 rpm. You can use it as an attention getter, mounting a small sign on top of the lucite rod, or come up with your own creative use. GREAT for long term use, because the current draw is so small!

### Full Spectrum White LED \$4.95

Very bright 5mm (T1-3/4) white LED. Water clear lens. Operates on 3.6v.



### Brilliant 450nm Blue LED \$4.95

5mm (T1-3/4) blue LED - the brightest we've seen. Operates on 3.6v.



### GIANT ARROW KIT \$23.95

It flashes, it chases, it lights up in pretty colors! This giant arrow features 81 yellow and green LEDs, an on/off switch, and a potentiometer to adjust the speed of the arrow action. Comes complete with these and all other parts, a clearly marked circuit board, and an assembly instruction sheet with schematic diagram and troubleshooting tips. Operates on 12VDC, so you can run it on your car battery, a wall pack, or any other appropriate power source you select.



### Controlling The World With Your PC...

Here's a useful book that tells you how to connect your personal computer to the real world and make it do useful work like controlling stepping motors, monitoring fluid levels, or switching appliances on and off. No PC modification necessary for these projects either - every circuit in this book connects directly to the parallel printer port of your PC! Also included are a circuit diagram and listings for control software written in Pascal, C, and BASIC. AND (this is the good part) the accompanying disk contains full source code in all languages plus compiled (.EXE) files - (that means no typing ... yeah!) Whether you want to generate audio tones and speech, drive high power loads and DC relays, or convert DTMF tones to binary values, this book is a great source for information, projects, and ideas. There are also 9 appendices (that's plural for appendix - that hunk of helpful info that didn't fit into any one chapter of the book!) They cover such topics as expanding the parallel port for 24 bit I/O, bidirectional printer port use, and using your PC's game port for input. Controlling The World With Your PC is \$35.00

### PHOTON II MICROLIGHT

The popular photon microlight has been improved. These super-bright (better than 8 candellas!) LED lights are visible over a mile away. The LED is secured in a tough ABS case and offers a squeeze button for quick use, and a constant on slide switch for prolonged lighting needs. The lithium batteries last a very long time (10 year shelf life!) and are included. The light won't burn out because it is an LED! Specify your choice of five incredible bright colors. Great for home or office use, popular with fire and rescue professionals, pyrotechnicians, stage performers, and dimly lit restaurant patrons. PHOTON II microlights include a keyring and come in ruby red (\$13.50), amber yellow (\$13.50), sapphire blue (\$17.50), diamond white (\$17.50), and emerald green (\$17.50). Includes two replaceable 2016 lithium batteries.



### RF LINEAR POWER BOOSTER AMPLIFIER KIT \$39.95

A quick and simple boost for signal generators, transmitters, and other low power devices, this kit can boost power up to 1 watt over a frequency range of 100 KHz to over 1000 MHz. Operates on 12 to 15 vdc @ 250 mA, via a 2.1mm male power jack. 38 db gain at 10 MHz, 10db at 1000 MHz. Optional case \$14.95

THE FINE PRINT: PRICES SUBJECT TO CHANGE WITHOUT NOTICE \* GATEWAY IS NOT RESPONSIBLE FOR PRINTING ERRORS \* MASTERCARD, VISA AND DISCOVER ACCEPTED \* YES, WE'LL TAKE YOUR CHECK - SORRY, NO C.O.D.s \* \$10 MERCHANDISE MINIMUM ON MAIL ORDERS \* SUPPLY OF SOME ITEMS IS LIMITED \* PRICES DO NOT INCLUDE SHIPPING \* UPS GROUND SHIPPING/ HANDLING WITHIN THE CONTINENTAL U.S. (ITEMS REQUIRING ADDITIONAL AMOUNTS ARE NOTED)...\$4.25\* FOR THE FIRST ITEM, \$0.50 FOR EACH ADDITIONAL ITEM. RESTOCKING CHARGE MAY BE ASSESSED ON RETURNED ITEMS. IF YOU TRY TO FAIL, AND SUCCEED,



WHAT HAVE YOU DONE?

for other neat stuff surf the internet  
[www.gatewayex.com](http://www.gatewayex.com)

**gateway**  
ELECTRONICS, INC.

8123 PAGE BLVD.  
ST. LOUIS, MO 63130  
(314)427-6116

9222 CHESAPEAKE DR.  
SAN DIEGO, CA 92123  
(619)279-6802

2525 FEDERAL BLVD.  
DENVER, CO 80211  
(303)458-5444

MAIL ORDERS CALL  
TOLL-FREE  
1-800-669-5810

FAX ORDERS (314)427-3147

### VIRTUAL REALITY COLOR VIDEO HEADSET WITH AUDIO AND MOTION SENSOR \$65.00



**Watch late night TV without disturbing anyone!** This video viewing system can be connected to your vcr and you can watch (and hear) your program on the headset! Of course, it is not like the picture on that 12 foot big screen at the local sports pub, but you can watch in your jammies and see who the guests are on your favorite late night talk show! *Play your favorite video games arcade style!*

Designed for use with many Super NES and Sega Genesis games, the headset has both audio and motion sensing capabilities. Generally speaking, this is ideal for racing, flight, and tank simulators with a first person or rear view perspective, and games with an eye level perspective. System features volume control, sensitivity control, brightness control, tint control, as well as a reset button and mode switches to select your application. Composite video headset system includes headset, tracking tube (for motion sensing), AC adapter, Super NES cable assembly and Sega Genesis cable assembly. A pinout is also included for TV/VCR viewing.

### Virtual Reality Vest \$39.50

Whether you are shooting the enemy in your favorite computer game, jamming to the rhythm of the latest punk rock sensation, or watching Jason carve up yet another nice neighbor, you will add a whole new dimension to the experience with this vest. Feel the action in your favorite video game, experience "body base" from your stereo, or add a new jolt to the violent machine gun and car crash video craze. This backpack style vest produces vibrations and sound in conjunction with loud or base tones from the audio source. Originally designed for Super Nintendo, Sega Genesis I & II, as well as others, the units also include instructions and connectors for portable music players, computer sound cards, TV and VCR units, and table top stereo receivers and CD players. AC powered, the unit includes vest, power amplifier, mini cord, game adapter, mini stereo adapter, and wall transformer...Oh, and all the trademark names used in this ad are the property of their respective owners! Mail order customers please add an additional \$4.00 per unit to shipping charges for this item.



E-Mail: EARSHAM@aol.com  
Web: http://members.aol.com/earsham/

## NOVEMBER 29

**CA - SANTA ANA** - Swapmeet. ACP parking lot. Mary Russo 714-558-8813  
**NY - PATCHOGUE** - Hamfest, Mid Island ARC, Mike Grant N2OX, 516-736-9126.  
E-Mail: globalcm@erols.com Web: http://members.aol.com/midisarc/98fest.html

## DECEMBER 1998

### DECEMBER 5

**AL - DOTHAN** - Hamfest, Wiregrass ARC, Cheryl Tucker KD4BWE, 334-677-7485  
**CA - SANTEE** - ARC of El Cajon Ham, Computer & Electronic Swapmeet. Santee Drive-in. 619-561-0052  
**GA - CLAXTON** - Hamfest, Veterans Community Center, Hwy. 280 W. VE Exams. Talk-in: 147.075+. Claxton ARC Emergency Service, Mr. Ellie Waters WB4CJB, 912-653-4939. E-Mail: ellie@premierweb.net. Wes Kennedy KU4SR, 912-739-2047, E-Mail: ku4sr@mcid2000.com  
**LA - MINDEN** - Christmas Hamfest, Civic Center, 520 Broadway. 8:30am-3pm. VEC Exams. MARA repeater 147.300+. MARA, Inc., Dusty Collins KB5WFE, 318-371-0636.

E-Mail: dustyc@prysm.net  
Web: http://www.norwesla.com/mara.htm  
**MN - GOLDEN VALLEY** - Hamfest, Courage Handi-Ham System, Nancy Meydell, 612-520-0512  
**NC - GREENSBORO** - Hamfest, Coliseum Special Events Center. 9am-3pm. 76 Group, 336-851-1676. http://www.sabwc.com/gsohamfest

### DECEMBER 6

**CA - LIVERMORE** - Hamfest, Livermore ARC, Cliff Kibbe KF6EII, 209-835-6715.  
E-Mail: larkswap@hotmail.com

### DECEMBER 12

**CA - FONTANA** - Inland Empire ARC Amateur Radio & Electronics Swapmeet. A B Miller High

School. Bill 909-822-4138 eves  
**FL - LAKE CITY** - Hamfest & Computer Show. Columbia County Fairgrounds, SR 247, Gateway to FL #4. Columbia ARS, Joe Aymond WD4EOJ, 904-935-2405 6-10pm. E-Mail: wd4eoj@isgroup.net or Colin Boutwell WA5RKR, 904-755-7960. E-Mail: wa5rkr@isgroup.net  
**SC - UNION** - Hamfest, Union County ARC, Roger Gregory KI4RG, 864-427-1462.  
E-Mail: rgregory@carol.net

### DECEMBER 19

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

## JANUARY 1999

### JANUARY 2

**TN - MORRISTOWN** - Hamfest & Computer Show. Talley Ward Recreation Bldg. Talk-in: 147.303+ & 53.030. Lakeway ARC, Perry Hensley N4PH, 423-828-4848 E-Mail: n4ph@juno.com. Kemp Lawson KF4AGB, 423-587-3320. E-Mail: kemplawson@aol.com.  
Web: www.usit.net/mfawbush/larc.html

### JANUARY 9

**SC - GREENWOOD** - Hamfest & Computer Show. Greenwood Civic Center, 1610 Hwy. 72 E. 9am-5pm. FCC exams. Talk-in: 147.165+ (open) alternate: 146.52 simplex. Greenwood ARS, Frank Kolar WA9FWO, 864-229-5639.  
Web: http://www.w4gwd.org  
**WI - WAUKESHA** - Hamfest. Waukesha County Expo Center Forum. 8am-2pm. West Allis RAC, Phil Gural W9NAW, 414-425-3649

### JANUARY 9-10

**FL - FT. MYERS** - Hamfest. Sat: 9am-3pm, Sun: 9am-2pm. Talk-in: 146.880. Ft. Meyers ARC, Colleen Sammons KQ4TR, 941-936-1431.  
E-Mail: csammons@juno.com

### JANUARY 10

**IN - SOUTH BEND** - Hamfest. Michiana Valley Hamfest Assn., Bob Denniston KA9WNR, 219-291-0252

### JANUARY 16

**FL - LANTANA** - Flea Market. Next to Pizza Hut, 6170 S. Congress Ave. 7am-12pm. Talk-in: 146.67. The Major Armstrong FM Assn., Jeff Beals WA4AW, 561-586-5120. Al West W4SDC, 561-641-8244

**LA - HAMMOND** - Hamfest. Southeast Louisiana ARC, Jack Stang N5XVJ, 504-542-7605.  
E-Mail: jstang@t55.com

**MI - FLINT** - Hamfest. AR & Youth, Clay KF8UI, 810-233-7889. E-Mail: clay@lavbbs.com

**MO - ST. JOSEPH** - Hamfest. Ramada Inn, I-29 @ Frederick Ave. 8am-3pm. Talk-in: 146.85 and 444.925. Missouri Valley ARC & Ray Clay ARC, John Winkler W8OVR, 816-424-6484. Gaylen Pearson, E-Mail: WBOW@IBM.Net

### JANUARY 17

**MI - HAZEL PARK** - Hamfest. Hazel Park High School, 23400 Hughes St. 8am-2pm. Talk-in: 146.64 (-). Hazel Park ARC, Tom Austin N8TMQ, Tom Krausnick WC9F, HPARC, POB 368, Hazel Park, MI 48030.  
**NY - YONKERS** - Flea Market. Lincoln High School, Kneeland Ave. 9am-3pm. VE Exams. Talk-in: 440.425 PL 156.7, 223.760 PL 67.0, 146.910, 443.350 PL 156.7. Metro 70cm Network, Otto Supliski WB2SLQ, 914-969-1053

### JANUARY 23

**NC - WINSTON-SALEM** - FirstFest. Dixie Classic Fairgrounds, Home & Garden Bldg. Forsyth ARC, Inc., 336-723-7388. E-Mail: n4loz@ibm.net  
Web: http://www.rdc.com/~kq4lo/farc.htm  
Web: http://members.xoom.com/w4nc/

### JANUARY 24

**OH - DOVER** - Hamfest. Tusco ARC, Howard Blind KD8KF, 330-364-5258

### JANUARY 29-30

**MS - JACKSON** - Hamfest. Jackson ARC, Ron Brown AB5WF, 601-956-1448 or 601-982-0101.  
E-Mail: ab5wf@juno.com  
Web: http://www.jxnarc.org

### JANUARY 30

**AL - GREENVILLE** - Hamfest. Butler & Pike County RACES, Jerry McCullough KE4ERO, 334-382-7644. E-Mail: w4mpq@alaweb.com

### JANUARY 31

**MD - ODENTON** - Hamfest. Maryland Mobiles ARC, Bill Ziegler KA6TYY, 410-987-2384.  
E-Mail: ka6tyy@juno.com

## FEBRUARY 1999

### 24 Hr. Shipping

To Order Call 1-800-292-7711 Fax: (847) 541-9904

## Quality Kits for Hobbyist and Students

All Kits include PCB, all parts, and detailed assembly manuals.

### XK-700 Digital / Analog Trainer

Elenco's newest advanced designed Digital / Analog Trainer is specially designed for school projects. It is built on a single PC board for maximum reliability. It includes 5 built-in power supplies, a function generator with continuously sine, triangular and square wave forms. 1560 tie point breadboard area. Tools and meter shown optional. (Mounted in a professional tool case made of reinforced metal).

**XK-700**  
Assembled and Tested  
**\$189.95**

**XK-700-SEMI KIT**  
w/ Fully Assembled PC Board  
**\$174.95**

**XK-700K - Kit**  
**\$159.95**



Made in the USA

### Hobbyist Tool Kit

**TK-1000**  
All the tools you'll need to build these kits. 25 tools contained in a heavy-duty carrying case.

**\$39.95**



### SOLDERLESS KITS

NEW

#### TALKING CLOCK KIT

**\$14.95 AK-220**



- Dual analog/digital
- Rooster crows every hour.
- Easy-to-build
- No Soldering Required

#### 35mm Camera Kit

**AK-540 \$14.95**

Learn all about Photography

No Soldering Required



#### ELECTRONIC KEYBOARD KIT

**AK-900**

**\$24.95**

- 37 mini-size keys
- 8 tempo rhythms
- 4 custom drums



#### REMOTE CONTROL CAR KIT

**AK-870**

- 7 functions
- Remote control included

**\$24.95**

No Soldering Required



Call for a  
**FREE**  
64 page  
catalog!  
(800) 445-3201

### Stereo Cassette Player Kit

**\$14.95 AK-200**

- Transparent Case
- Belt Clip
- High Resolution
- Includes Head-phones



### M-1005K

Digital Multimeter Kit

Low cost. 3 1/2 digit LCD. 18 ranges, transistor test, diode test, overload protection and pocket-size.

**\$19.95**



### AM/FM-108K

AM/FM Radio Kit and Training Course 14 Transistors and 5 Diodes

**\$29.95**

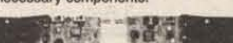


AM Radio Kit and Training Course 7 Transistors and 1 Diode **\$19.95**

### FO-30K

Fiber Optics Technology with Training Course **\$24.95**

Learn the basics of fiber optics data communications while you build this exciting kit. Comes complete with all necessary components.



### Telephone Kit

**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.



**\$15.95**

### AR-2N6K

2 meter / 6 meter Amateur Radio Kit



**\$34.95**

### 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.

**\$14.95**

### Elenco XP-720K Power Supply Kit

- 3 fully regulated stackable DC supplies.
- +1.5VDC to 15VDC @ 1A
- -1.5VDC to 15VDC @ 1A
- +5VDC @ 3A
- Plus 2 AC supplies: 6.3VAC @ 1A 12.6VAC @ 1A

**\$54.95**



### Sound Activated Switch

**Model K-35**

Clap and the light comes on, clap again and it goes off.



### Telephone Bug

**Model K-35**

Size of a dime, yet transmits both sides of a phone conversation to any FM radio. No battery needed.



**\$7.95**

### Strobe Light Kit

**Model AK-520**

You will have fun building this kit and learn how strobe lights work. Complete with all parts and case.



**\$54.95**

### Motion Detector Kit

**Model AK-510**

Simple and fun to build. Compact, portable, and adds safety to your home or office. Requires one (1) 9V battery.



**\$14.95**

### Guaranteed Lowest Prices

UPS SHIPPING: 48 STATES 5%  
OTHERS CALL FOR DETAILS  
IL Residents add 8.25% Sales Tax

### C&S SALES, INC.

150 W. CARPENTER AVENUE  
WHEELING, IL 60090  
FAX: (847) 541-9904 • (847) 541-0710  
http://www.elenco.com/cs\_sales



### 15 DAY MONEY BACK GUARANTEE

FULL FACTORY WARRANTY

PRICES SUBJECT TO CHANGE WITHOUT NOTICE



# Events CALENDAR

## FEBRUARY 6

**SC - NORTH CHARLESTON** - Hamfest.  
Charleston ARS, Jenny Myers WA4NGV, 843-747-2324. E-Mail: BRYCEMYERS@AOL.COM

## FEBRUARY 6-7

**FL - MIAMI** - Tropical Hambooree. Fair Expo Center, S.W. 112th Ave. & Coral Way. VE Exams. Talk-in: 146.925, 146.76, 444.525. Dade Radio Club of Miami, Evelyn Gauzens. 305-642-4139. E-Mail: edg@elink.net. 305-226-5346. E-Mail: wd4sf@bellsouth.net. Web: www.hambooree.org

## FEBRUARY 7

**OH - LORAIN** - Hamfest. Northern Ohio ARS, Mike Willemijn WBEL, 440-324-4574

## FEBRUARY 12-13-14

**FL - ORLANDO** - Hamfest. Northern FL Section Conv., Tim Starr AE4NJ, 407-850-9258. E-Mail: AE4NJ@aol.com  
Web: http://www.oarc.org/hamcat.html

## FEBRUARY 13

**NY - WESTFIELD** - Hamfest. Westfield Exempt Volunteer Fireman's Assn., 75 Bourne St. 8am-3pm. Talk-in: 145.350 (-). Chautauque County RAS, Eric Kroon N2PCQ, 716-595-3220. E-Mail: ekroon@netsync.net

## FEBRUARY 20

**FL - BROOKSVILLE** - Hamfest. Spring Hill VFW Post 10209, Spring Hill Dr. between US 41 & Mariner Blvd. Talk-in: 146.715. Hernandez County ARA, Ralph Wilson AF4FC, 352-754-9653. Jim Angello KE4SZP, 352-688-5214. E-Mail: jangello@fiber-net.com

Web: www.fiber-net.com/pub/hcara/index.htm

**MN - BLAINE** - Hamfest. Robbinsdale ARC, Jerry Dorf N0FWG, 612-537-1722. E-Mail: jerryd@skypoint.com

## FEBRUARY 21

**NC - ELKIN** - Hamfest. Briarpatch & Foothills ARCs, Jimmy Holbrook KB4GKI, 336-957-3820. E-Mail: kb4gki@aol.com Web: http://members.aol.com/kb4ghi/kb4gki.html

## FEBRUARY 27

**KY - CAVE CITY** - Hamfest. Mammoth Cave ARC, 502-651-2363. E-Mail: lburnett@glasgowky.com Web: http://www.scrctc.blue.net/mcsrc

## FEBRUARY 27-28

**OH - CINCINNATI** - Convention. Great Lakes Div. Conv., William Tittle KA8LYA, 513-661-1861. E-Mail: gldivconvention@juno.com

## FEBRUARY 28

**NY - MELVILLE** - Hamfest. Radio Central ARC, JoAnn Colletti N2IME, 516-399-1877. E-Mail: wo2n@li.net

**OH - CIRCLEVILLE** - Hamfest. Teays ARC, Roy Ulko KG8EK, 740-477-8310. E-Mail: royulko@scioto.net

**OH - CUYAHOGA FALLS** - Hamfest. Cuyahoga Falls ARC, Carl Hervol N8JLQ, 330-497-7047. E-Mail: carlh@pop.nex.com

## MARCH 1999

### MARCH 5-6-7

**NE - NORFOLK** - State Convention. Fred Wiebelhaus NOVXL, 402-379-1929. E-Mail: dfwiebel@suffia.net Web: http://members.aol.com/davidn0xbn/evarc.html

### MARCH 6-7

**FL - NEW PORT RICHEY** - Hamfest. Gulf Coast ARC, Rick Brown KF4GX, 813-842-2127. E-Mail: richar@gte.net

### MARCH 7

**NY - LINDENHURST** - Hamfest. Great South Bay ARC & Suffolk County RC, 516-422-9594. E-Mail: ka2d@li.net Web: http://www.gsbarc.org

**WI - WAUKESHA** - Swapfest. Waukesha County Expo Center. 8am-2pm. VE Exams. Talk-in: 146.82 PL 127.3. SEWFARS, John Brecher N9NWN, 414-835-7035

### MARCH 13

**MO - KANSAS CITY** - Hamfest. Ararat AR Shrine Club, Steve Dowdy WJ0I, 816-941-3392. E-Mail: sdowdy@qnl.com

**WA - PUYALLUP** - Hamfest. Mike & Key ARC, Michael Dinkelman N7WA, 253-631-3756 or 425-867-4797. E-Mail: mwink@eskimom.com

### MARCH 13-14

**NC - CHARLOTTE** - Hamfest & Computerfair. Charlotte Merchandise Mart, 2500 E. Independence Blvd. Mecklenburg ARS, Tim Slay WO4G, 704-382-3234 (W) or 704-948-6283 (H). E-Mail: wo4g@w4bfb.org

Web: http://www.w4bfb.org/hamfest.html

### MARCH 14

**OH - CONNEAUT** - Hamfest. Conneaut ARC,

Jack Martilla KA8TUJ, 440-593-3353

## MARCH 20

**FL - STUART** - Hamfest. Martin County ARA, David Millard KE4AMW, 561-288-7100

## MARCH 20-21

**TX - MIDLAND** - Hamfest. Midland ARC, Beverly Harwood KC5BNT, 915-686-1841. E-Mail: shamrock@apex2000.net Web: http://www.bxnet/edge/midswap.htm

## MARCH 21

**NC - KINSTON** - Down East Hamfest. Lenoir County Fairgrounds, Hwy. 11 S. 8am-3pm. Doug Burt W4OFO, 252-524-5724

**OH - MAJUMEE** - Hamfest. Toledo Mobile Radio Assn., Brenda Krukowski KB8IUP, 419-243-3836. Web: http://www.tmrhamradio.org

## MARCH 27-28

**MD - TIMONIU** - Maryland State Convention. Sharon Dobson N3QQC, 410-HAM-FEST (Box 3772), 1-800-HAM-FEST (Box 3772). E-Mail: n3qqc@amsat.org Web: http://www.gbhc.org

## APRIL 1999

### APRIL 10

**NC - MORGANTON** - Hamfest & Computer Fair. Burke County Fairgrounds, Hwy. 181N (Exit 100 Eastbound, Exit 105 Westbound I-40), 8am-5pm. Talk-in: 147.15 (K4VLY repeater). Catawba Valley, Tom Taylor, 704-433-6205. E-Mail: kc4qpr@vistar.net

### APRIL 11

**NC - RALEIGH** - RARSFest. State Fairgrounds. Raleigh ARS, Wilbur Goss WD4RDT, 919-266-9883

### APRIL 18

**CT - HARTFORD** - 1999 Trinity College Fire-Fighting Home Robot Contest. Trinity College campus. Jake Mendelsohn, 190 Mohegan Dr., West Hartford, CT 06117. E-Mail: JMENDEL141@AOL.COM Web: http://www.trincoll.edu/~robot

## MAY 1999

### MAY 2

**NY - YONKERS** - Flea Market. Lincoln High School, Kneeland Ave. 9am-3pm. VE Exams. Talk-in: 440.425 PL 156.7, 223.760 PL 67.0, 146.910, 443.350 PL 156.7. Metro 70cm Network, Otto Supliski WB2SLQ, 914-969-1053

## SEPTEMBER 1999

### SEPTEMBER 26

**NY - YONKERS** - Flea Market. Lincoln High School, Kneeland Ave. 9am-3pm. VE Exams. Talk-in: 440.425 PL 156.7, 223.760 PL 67.0, 146.910, 443.350 PL 156.7. Metro 70cm Network, Otto Supliski WB2SLQ, 914-969-1053

**We are looking for  
New Distributors for  
Nuts & Volts Magazine.**

If you would be interested in  
selling Nuts & Volts in your  
store or on your newsstand,  
we have a great deal for you!

For complete information, ask  
for our New Distributor flyer.

**Nuts & Volts Magazine**  
430 Princeland Court  
Corona, CA 91719  
phone 909-371-8497  
fax 909-371-3052  
E-Mail  
distributors@nutsvolts.com

Celebrating our 16th Year Of Service !!

### COLLIMATING LENS

This economical collimating lens assembly consists of a black anodized aluminum barrel that acts as a heat sink, and a glass lens with a focal point of 7.5mm. Designed to fit standard 9mm laser diodes. Simply place diode in the lens assembly, adjust beam to desired focus, then set with adhesive.

STOCK	1-7	10-21	25+
LSLENS Lens Assembly	24.99	23.74	21.37

### DIODE/TRANSISTOR TESTER KIT

This dynamic tester allows checking of transistors & diodes in circuit. Identifies NPN or PNP transistors. Checks all types, small or large power. Identifies anode or cathode of diodes.

STOCK	1-7	10-21	25+
DT100K	24.99	23.74	21.37

### ANTI-STATIC FOAM CLEANER

A thick, foaming cleaner for use in static sensitive applications. Safe for plastics and fiberglass. Use on computer cases and all office equipment. Also cleans soft fabrics. 5 oz. aerosol can.

STOCK	1-7	10-21	25+
SB1102	1.99	1.89	1.70

### EPROMS

STOCK	1-24	25-99	100+
2716	2.99	2.84	2.56
2732	4.49	4.27	3.84
2732A-20	5.39	5.12	4.61
2764-20	5.39	5.12	4.61
2764-25	4.49	4.27	3.84
2764A-20	3.49	3.32	2.99
2764A-25	2.99	2.84	2.56
27C54-15	2.99	2.84	2.56
27256-15	4.79	4.55	4.10
27C256-15	2.99	2.84	2.56
27512-25	3.09	2.94	2.65
27C512-25	2.99	2.84	2.56
27C10-15	3.79	3.60	3.24
27C020-15	4.49	4.27	3.84
27C040-12	6.29	5.98	5.38
27C080-12	12.99	12.34	11.11

### 7400 SERIES I.C.'s

STOCK	1-24	25-99	100+
7400	.29	.28	.25
7402	.19	.18	.16
7404	.29	.28	.25
7406	.27	.26	.23
7407	.33	.31	.28
7408	.33	.31	.28
7410	.19	.18	.16
7411	.55	.52	.47
7414	.27	.26	.23
7420	.24	.23	.21
7432	.33	.31	.28
7447	.89	.85	.77
7473	.79	.75	.68
7474	.33	.31	.28

### FM MICROPHONE KIT

Transmit your voice on any FM radio. Range up to 1000'. Case included.

STOCK	1-7	10-21	25+
K30	11.99	11.39	10.25

### What Do We Have ?

- I.C.'s
- Capacitors
- Oxidation
- Connectors
- Crystals
- Trimpots
- Diodes
- Kits
- Tools
- Vias
- Laser Diodes
- LED's
- Visas
- Transistors
- Resistors
- And more!

### GADGETEER'S GOLDINE

This exciting collection of electronic projects features experiments ranging from magnetic levitation and lasers to high-tech surveillance and digital communications.

• By Gordon McComb

STOCK	1-7	10-21	25+
TB3360	21.99	20.89	18.80

- Order Line — (800) 824-3432 • International — (724) 495-1230 • Fax Orders — (724) 495-7882
- Technical Support — (724) 495-1231 • No Minimum Order — (Orders under \$20 subject to \$5 charge) • UPS 3 day, Blue, Red, & Fed. Ex. Shipping Available (Call for charges) • PA Res. Add 7 %
- Sales Tax • Open Mon-Fri 9:00 AM - 5:00 PM (EST) • Corporate Accounts / Quantity Discounts Available • We accept M/C, VISA, Discover & American Express with no surcharge • Call For FREE Catalog (\$2.00 Outside U.S.)
- We Carry A Complete Line Of Electronic Components • Email - [unielec@aol.com](mailto:unielec@aol.com)

Unicorn Electronics

1142 State Route 18

Aliquippa, PA 15001

FREE SHIPPING!!

on pre-paid orders

Write in 69 on Reader Service Card.

# ANA Instruments

Phone: 1-800-944-0495

Fax: (540) 775-9638

E-Mail: [anainstr@crosslink.net](mailto:anainstr@crosslink.net)

## Specials

HP 141T CRTs, New in Box.....	\$195.00
HP 8657A Signal Generator.....	\$4,500.00
100 KHz-1040 MHz	
HP 8640B Signal Generator.....	\$2,100.00
Opt. 001, 002, 003	
Gigatronics 600 .01-8 GHz.....	\$2,400.00
HP 86222A .01-2.4 GHz.....	\$1,100.00
HP 8903B Audio Analyzer.....	\$2,700.00
HP 8901B Modulation Analyzer.....	\$3,700.00
HP 8902A Measuring Receiver.....	\$17,500.00
HP 436A Power Meter w/Cable.....	\$1,400.00
Tek 492 Opt 1,2,3 Spec. Analyzer ..	\$6,200.00
Sanders 5440C Noise Figure Meter... (new)	\$400.00

## Wanted

**RF & Microwave Test and Measurement  
Equipment & Components**

**Electronic Test Equipment Bought and Sold**  
Visa and MasterCard Accepted



# ELECTRONIC TEST EQUIPMENT BOUGHT & SOLD

90 DAY WARRANTY PARTS & LABOR • 10 DAY RIGHT OF RETURN, OPEN ACCOUNTS

Altech 360D11, Frequency Syn. 0.1-2GHz	\$800	HP 86241A, RF Plug-in, 3.2-6.5GHz	\$400
Altech Type 32, Precision Attenuator, 0-100dB	\$300	HP 86260A, RF Plug-in, 12.4-18GHz	\$400
Argosystems AS210, Frequency Calibration System	\$2,000	HP 86290A, RF Plug-in, 2-18GHz	\$1,200
Bird 4381, RF Power Analyzer, Opt. 832	\$200	HP 86290B, RF Plug-in, 2-18GHz	\$1,400
Boonton 102B, Signal Generator, 45-520MHz	\$500	HP 8656B, Signal Generator, 1-990MHz, AM/FM	\$3,000
Boonton 518-A4, Q Standard	\$250	HP 8660C, Freq Syn w/86603A & 86635A, 2.6GHz	\$2,500
Boonton 82AD, Modulation Meter	\$950	HP 8697A, RF Plug-in, 26.5-40GHz	\$250
Boonton 92BD, Digital RF Millivolt Meter	\$250	HP 8743A, Reflection Transmission Test Set	\$200
Boonton 4200WE, Power Meter, 18GHz	\$800	HP 8743A/018, Reflection Transmission Test Set, 18GHz	\$300
Boonton 4220S1013, Power Meter, 18GHz	\$900	HP 8748A/H26, S-Parameter Test Set, 4-2600MHz	\$2,000
Boonton 4300, Power Meter w/2-51013 Detectors, Calibrated	\$2,500	HP 8750A, Storage Normalizer, Includes Cable	\$250
Bruehl & Kjaer 1612, Bandpass Filter	\$250	HP 8754A/H26, Network Analyzer, 4-2600MHz	\$4,000
Calif. Inst. 101T, AC Power Source	\$400	HP 8755C, Network Analyzer Plug-in	\$250
Data Precision 6000/611, Waveform Analyzer	\$350	HP 8757A/001, Network Analyzer, Opt. 001	\$4,000
Datron 1062, Digital Multimeter	\$350	HP 8901A/02/03/010, Modulation Analyzer	\$1,800
DR Thiedig MILLI-TO2, Ohmmeter, 1 Milliohm-2 Terraohm	\$400	Keithley 192, Programmable DMM, 6.5 Digits, HP/IB	\$600
Eaton 380K11, Frequency Synthesizer, 1-2000MHz	\$2,000	Keithley 614, Electrometer	\$700
EIP 371, Source Locking Microwave Counter, 18GHz	\$1,000	Krohn-Hite 3202, Filter, LP, HP, BP, Unused	\$350
ESI 250DE, LCR Bridge	\$200	Leeds & North 1091, Capacitor Decade, .001uF-TuF	\$150
ESI 296, Auto LCR Meter	\$800	Marconi 6960, Power Meter with 6920 Sensor	\$800
Fluke 3330B, DC Voltage, Current Calibrator	\$200	Narda 5882, High Directivity Bridge, 2-18GHz	\$300
Fluke 335A, DC Voltage Standard, 0-1100VDC	\$400	Narda 5292 Directional Coupler, 1-18GHz	\$200
Fluke 515A, Portable Calibrator	\$800	PMI 1018B, Peak Power Meter	\$350
Fluke 5200A, Programmable AC Standard, HP/IB	\$1,000	Polarad 1105 E-L, Sig. Gen., 1020A Mod., 8-24GHz	\$300
Fluke 6010A, Frequency Synthesizer, 10Hz-11MHz	\$500	Polarad 1207, Signal Source 3.8-8.2GHz	\$200
Fluke 6080A/AN Frequency Syn., 5-1024MHz	\$5,000	Racal Dana 1515, Delay Pulse Generator	\$500
Fluke 731B, DC Transfer Standard	\$150	Racal Dana 1992, Frequency Counter, High Stab.	\$500
Fluke 8922A, True RMS Voltmeter	\$250	Racal Dana 9082P, Signal Gen. 1.5-520MHz	\$600
Fluke 9010A, Micro-System Troubleshooter Opt. 001	\$200	Racal Dana 9303, True RMS RF Level Meter	\$500
Fluke AS5, Thermal Converter	\$200	Racal Dana 9515, Universal Counter, HP/IB, Opt. 41	\$200
General Microwave 478A, Peak Power Meter	\$700	Rohde & Schwarz SPN, Audio Generator	\$300
General Radio 1433G, Decade Resistor	\$350	Sandus 5440C, Noise Figure Mtr., 10kHz-40GHz	\$400
General Radio 1433G, Decade Resistor, 1.111111M	\$300	Sencore TF30, Super Cricket Transistor Tester	\$200
General Radio 1538-P4, High Intensity Flash Capacitor	\$50	Tek 1241A, Logic Analyzer, with Accessories	\$650
General Radio 1633-A, Incremental Inductance Bridge	\$500	Tek 1410, Sync Generator SPQ2, Color Bars TSG7	\$650
Gigatronics 60010-18, Signal Generator, 10-18GHz	\$1,000	Tek 1420, NTSC Vectorscope	\$500
Guideline 9154C, Precision Volt Standard Cell	\$300	Tek 1470, NTSC Color Sync & Test Sig. Generator	\$500
Guideline 9577, Precision DMM, 7.5 Digits	\$300	Tek 1502, TDR, Opt. 4, Chart Recorder	\$1,000
Hitachi V-212, Scope, 20MHz, Dual Trace	\$200	Tek 150301/05, TDR, Scale in Meters	\$1,200
HP 1124A, 100MHz Active Divider Probe, Unused	\$100	Tek 178, Linear IC Test Fixture, For 577	\$300
HP 11500A, Bias Network	\$250	Tek 2336, Scope, 100MHz, Dual Trace	\$800
HP 11604A, Universal Extension	\$100	Tek 2432, Scope, Digital, 300MHz, 4 Channel	\$3,000
HP 11605A, Flexible Arm	\$200	Tek 2445B, Scope, 200MHz Cursors	\$2,500
HP 11638A, Calibration Kit, Type N	\$200	Tek 2445B/012, Scope, 150MHz, 4 Trace, HP/IB	\$3,000
HP 11664A/01, Detectors, 0.1-18GHz	\$200	Tek 2465, Scope, 300MHz, 4 Channel	\$2,000
HP 11665B, Modulator	\$250	Tek 305DMM, Scope, 10MHz, Dual Trace, DMM, battery	\$800
HP 11712A, Service Kit for 8670 Series Inst.	\$500	Tek 464, Scope, 100MHz Dual Trace, Storage	\$400
HP 11869A, Adaptor for Plug-In 8350A/B	\$350	Tek 465, Scope, 100MHz Dual Trace	\$400
HP 15453A, Pod Set for 8170A	\$200	Tek 465M, Scope, 100MHz Dual Trace	\$400
HP 1630G, Logic Analyzer, 65 Ch. 100MHz	\$600	Tek 492/02, Spectrum Analyzer	\$4,000
HP 16500A, Mainframe, 16510A, 16530A, 16531A, 16520A, 16521A	\$3,000	Tek 496P, Programmable Spectrum Analyzer	\$4,000
HP 16510B, Logic Analyzer Card, 16500A System	\$500	Tek 5003, Power Module	\$300
HP 16530A/16531A, Digital Scope Card, 16500A System	\$500	Tek 5A13N, Differential Comparator	\$250
HP 1742A, Scope, 100MHz, Dual Trace, w/DMM	\$400	Tek 5A20N, Differential Amp	\$100
HP 214B, Pulse Generator	\$1,000	Tek 604, XY Monitor	\$100
HP 3312A, Function Generator, 1-13MHz, Sweep	\$400	Tek 7C71N, Curve Tracer	\$200
HP 3325A, Function Generator	\$1,200	Tek 7D20, Programmable Digitizer P	\$600
HP 3325A/01/02, Function Gen. Opt. 01/02	\$2,000	Tek AM502, Differential Amp	\$100
HP 3400A, RMS Voltmeter, 10Hz-10MHz	\$200	Tek DC503, Universal Counter Timer TM500	\$150
HP 3455A, Digital Multimeter	\$300	Tek DC504, Counter/Timer TM500	\$100
HP 3456A, Digital Voltmeter, 6.5 Digits	\$500	Tek DM502A, Autoranging DMM	\$150
HP 346A, Noise Source, 10MHz-18GHz	\$500	Tek FG502, Function Generator, 1Hz-11MHz	\$250
HP 3468A, Multimeter, 6.5 Digits	\$400	Tek FG504, Function Generator, .001Hz-40MHz	\$500
HP 3580A, Spectrum Analyzer, Opt. 02	\$800	Tek MRS01, XY Monitor Scope	\$200
HP 4140B, Picoammeter, DC Source	\$2,000	Tek P6046, Differential Probe	\$300
HP 4270A, Automatic Capacitance Bridge	\$200	Tek PG508, Pulse Generator, 50MHz	\$300
HP 436A/022, Power Meter, HP/IB	\$900	Tek PS503A, Dual Power Supply	\$150
HP 438A, Power Meter w/2 8481A Sensors	\$3,500	Tek SC502, Scope, 15MHz, Dual Trace	\$250
HP 5004A, Signature Analyzer	\$100	Tek SC503, Scope, 10MHz Storage	\$400
HP 5005B, Signature Multimeter	\$350	Tek SC504, Scope, 80MHz Dual Trace	\$500
HP 5006A, Signature Analyzer	\$500	Tek SG502, Sig. Gen. 5Hz-50KHz TM500 Sys.	\$200
HP 5182A, Waveform Recorder, Generator	\$200	Tek TG501, Time Mark Generator	\$400
HP 5316A, Universal Counter	\$250	Tek TM503, Mainframe 3 Slot, TM500	\$100
HP 5328A/021/040, Frequency Counter, DMM	\$250	Tecscan SSG2000, Freq. Syn., 100kHz-2GHz, AM, FM	\$1,800
HP 5334A/020, Universal Counter w/DVM	\$800	Valhalla 2000, Auto Digital Watt-Ammeter	\$200
HP 5335A/010, Frequency Counter	\$1,000	Vu-Dat 5110, Semiconductor Tester, In/out Circuit	\$150
HP 5335A/030, Frequency Counter, 130MHz	\$1,000	Wavelek 1084, Signal Gen. Sweeper, 3.5-4.5GHz	\$300
HP 5340A, Frequency Counter, 18GHz	\$200	Wavelek 185, Sweep Function Gen., .0001-5MHz	\$400
HP 54100D, Digital Scope, 1GHz	\$2,000	Wavelek 1910, XY Monitor, Dual Trace	\$450
HP 54200A, Digital Storage Scope, Dual Trace, 200MG/S	\$1,000	Wavelek 452, Filter, Dual Hi/Low, 1Hz-10KHz	\$400
HP 6112A, Power Supply, 0-40V, 0.5A	\$200	Wavelek 7530A, FFT Spectrum Analyzer 0-100KHz	\$500
HP 8015A, Pulse Generator, 1Hz-50MHz, 30V	\$500	Wavelek 907, Signal Generator, 7-11GHz	\$600
HP 8165A, Programmable Signal Source, .0001-50MHz	\$1,500	Wavelek 955, Micro Source, 7.5-12.4GHz, AM, FM, Sweep	\$1,000
HP 8350A/86290B, Sweep Oscillator, 2-18GHz	\$4,000	Wiltron 560A, Network Analyzer	\$800
HP 8350B, Sweep Oscillator Mainframe	\$3,000	Wiltron 560-97A50, SWR Autotester, 0.1-18GHz	\$500
HP 8410C/8412B, Network Analyzer w/8411A/Opt. 18, 18GHz	\$800	Wiltron 610D, Sweeper Mainframe	\$250
HP 8411A, Frequency Converters	\$250	Wiltron 610D/6237D, Sweep Generator, 2-18GHz	\$800
HP 8414A, Polar Display	\$300	Wiltron 6213D, RF Plug-in, 10MHz-4.2GHz	\$400
HP 8445B, Spectrum Anz., Automatic Pre-Selector	\$300	Wiltron 6219D, RF Plug-in, 2-8GHz	\$200
HP 8553B, Spectrum Anz., RF Plug-in, 1KC-110MHz	\$200	Wiltron 6223D, RF Plug-in, 4-12.4GHz	\$250
HP 8554B/8552B, Spectrum Analyzer 141T, 1.2GHz	\$1,500	Wiltron 6229D, RF Plug-in, 7.9-18.5GHz	\$300
HP 8557A/180TR, Spectrum Analyzer, 0.1-350MHz	\$1,000	Wiltron 6277F5, VSWR Bridge, 10-1000MHz	\$150
HP 8558A/182T, Spectrum Analyzer, 0.1-21GHz	\$2,500	Wiltron 6647A-20/02/03, Programmable Sweep Generator	\$4,000
HP 8559A/853A, Spectrum Analyzer, Digital, 0.1-21GHz	\$4,000	Wiltron 6NF50, Autotester, 1-1500MHz, for 640	\$100
HP 8565A, Spectrum Analyzer, 0.1-22GHz	\$3,500	Wiltron 7B50, Detector, 1-1500MHz, for 640	\$100
HP 8566A, Spectrum Analyzer, as new	\$20,000		
HP 86222B/H69, RF Plug-in, 0.1-4GHz	\$1,000		

## INVENTORY CLEARANCE SALE

SAVINGS UP TO 50%

### PHelps INSTRUMENTS

2631 Hillside Ave., Norco, CA 91760  
909-279-7347 • FAX 909-279-7347

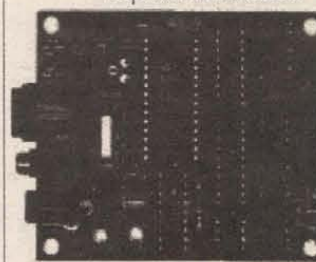


## Motron

310 Garfield St Suite 4  
PO Box 2748  
Eugene, Oregon 97402

DTMF Remote Controller  
Only \$99.00 Plus S/H

<http://www.motron.com>



VISA, MasterCard, AMERICAN EXPRESS, Discover.  
S/H: \$8 USA; \$11 Canada; \$16 Foreign.

The Auto-Kal<sup>®</sup> AK-16 DTMF Controller Board features 16 relay driver outputs and DTMF to X-10 house control capability! Control the relay driver outputs, X-10 modules, or both with your radio keypad! X-10 operation requires the PL-513 Power Line Interface (\$20). The AK-16 mates readily with our RB-8/10 (\$99) or RB-16/10 (\$149) relay boards. The 0-12 digit security code is user programmable using your DTMF keypad. Additional features include re-programmable CW ID, CW response, and several modes of operation including Pan-Tilt Camera Control. The AK-16 is a fully assembled and tested printed circuit board.

Se Habla Español. Pida Por Don Moser.

Price and Specifications are subject to change without notice

Info: (541) 687-2118 Orders: (800) 338-9058 Fax: (541) 687-2492

## TECH FORUM

Continued from page 44

HFFAX reception. A good pointer is <http://ourworld.compuserve.com/homepages/HFFAX/toc6.htm>.

G. L. Roylance  
via Internet

### ANSWER TO #109814 - OCT. 1998

How you decompress your hard drive is entirely based upon which compression mechanism/program was used to compress it. There are many out there, such as Stackcr, SuperStor, Doublespace, Drivespace, DriveMax, etc., and they each have different decompression methods.

Kurt Richter  
via Internet

### ANSWER TO #10984 - OCT. 1998

You requested a way to input/output data between two computers using the serial ports. I was somewhat confused by what exactly you wanted to do, but for simple commands, DOS has just what you asked for.

I think the CTTY command is available in DOS 5.0 and lower, but can be used with any version after it is added to the SETVER list (type HELP SETVER, and HELP CTTY at the DOS prompt for more info).

CTTY basically re-directs keyboard input and screen output to a serial port, or other device as directed. See below for more information.

To output commands from the second computer serial port to the first, just use the echo command with the re-director. The following is an old DOS trick for testing modems, but can be modified for your use.

This is a quick way to test a modem to see if you have interrupt or software conflicts. Boot DOS using F5 (loads nothing).

At the DOS prompt ENTER: (the following assumes the modem is on COM 2).

echo ATDT > com2 (you should hear dial tone).

echo ATH > com2 (should make the modem hang up).

NOTE: On some Pentium sys-

tems with the on-board serial ports, you may have to issue the first command twice (the first time will just wake up the port).

All you should need for an interconnection cable is a three-wire cable, ground, transmit, and receive with the last two crossed.

DB25 DB25 or on a DB9  
RED TO 2 — 2 3 TD  
GREEN RD 3 — 3 2 RD  
BLACK GRD 7 — 7 5 GRD

And from PC Mag info: The CTTY command. Purpose: Replaces the standard input and output (keyboard and screen or CON) with a different I/O device. Used rarely.

Syntax: CTTY device. Remarks: You must be sure that the specified device is both an input and output device. Use CTTY CON to reset for normal operations.

Example: CTTY AUX. All screen messages will be sent to the AUX device (the first serial port) and all keyboard input will come from that device.

You mentioned something about building a circuit to do something that would let you use two keyboards in parallel via the serial port. It would seem to me that you could do that with some simple C programming much easier.

Randy Boettjer  
Oakview, CA

### ANSWER TO #10982 - OCT. 1998

Blocking the unknowns with your Caller ID box is a very bad idea. You will block out all operator-assisted calls such as collect calls, possibly any calls from 911 (if such ever occurs), any calls from some cell-phone companies, any international calls, and possibly any call from a region of the US that doesn't support Caller ID.

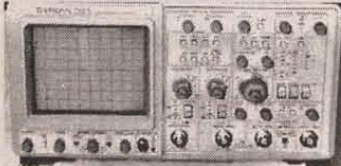
There are probably other occasions as well. Unknown callers are a known backdoor to the Caller ID system, and this backdoor is there for

Continued on page 85



# MOVE IT! MOVE IT! MOVE IT!

## TEKTRONIX 2465, 4 Channel, 300MHz, O'Scope on screen ALPHANUMERIC READOUT of waveform stats.



One of the most popular & powerful scopes available at a reasonable cost. Features: 500ps/Div sweep, 2mV/Div vertical sensitivity, 1Mohm / 50-ohm input, 500MHz trigger bandwidth, four channels. On-screen waveform cursors provide vert. & horiz. scale factors, trigger level, voltage, time, freq., phase, ratio values and mode indication. Complete with 2 new probes, pouch, cover and manual. Mint condition. Calibration and 90 day warranty. **\$2295.00**

## ROTARY TABLE with PRECISE .002" RESOLUTION



Hard to find rotary motion base. This 13lb. unit includes a 9.25" diameter anodized aluminum platter with a toothed outside diameter. A toothed belt surrounds the O.D. and is driven by a 1/2" diam. toothed pulley attached to the output of a Bayside 5:1 ratio, right angle drive, powered by a Siosyn, M061-LF-504, 1.25V, 3.8A, 200 step per rev., 60 oz/in. stepper motor. By our estimate this should equate to about an 18500:1 final drive ratio! or about 0.0195 deg. per full step! Overall size is: 14.5"W x 17"L x 4.75"H Construction is of anodized aluminum with a cast structural resin outer chassis. Removed from precision optical device. **\$229ea. 2 for \$399.**



## LENGTHY LINEAR SLIDE, CAN GIVE YOU A LIFT as WELL!

Four different lengths available, all with similar construction. All units based on a heavy duty 1.5" wide, stainless steel, dual rails. Drive is via a toothed belt, powered by a SLO-SYN M061-LF-504, 1.25V @3.8A stepper motor with 200 steps per rev and 60 oz. in. hold. The "Medium unit" shown right, also includes a precise Z axis drive, providing 3.5 inches of precise travel by virtue of its 4:1 ratio toothed belt drive. Powered is by another M061-LF-504 stepper. The remaining three lengths have no Z drive. All units incorporate a superior quality, recirculating ball bearing slide with 3" x 3" x 1/2" thick mounting plate. "Z" unit size: 7"H x 2.5"W x 5.75"D Very limited quantity. Also the "short" slide is mounted on a 1/4" thick anodized alum. plate. All have been carefully removed for precision optical equipment. The dimensions and travels are listed below:

Model	Travel	Rail L"	Weight	Overall Size	Price
Ex Long:	46"	49"	12lbs.	51"L x 5"W x 3.5"H	\$149ea. or \$269 for pair
Long:	30"	33"	9lbs.	39"L x 5"W x 3.5"H	\$129ea. or \$229 for pair
Med w/Z:	20"	23"	12lbs.	24"L x 2"W x 4.6"H	\$139ea. or \$249 for pair
Short:	11.5"	16"	7lbs.	16"L x 4"W x 6.5"H	\$69ea. or \$119 for pair

## PRICE BUSTER, DSP, COLOR CAMERA,

Brand New, model GM550, Size: 1.6" x 1.6" x 1.5", 1/3" CCD with SONY CCD & DSP technology. 4mm, f/8 glass lens, 80° FOV. Resolution >350 lines, sensitivity, 0.3lux, AWB, AGC & auto electronic shutter 1/60 to 1/10,000 sec. Pwr. 12VDC @160ma. NTSC out. Budget color surveillance. **Reg. \$269, SPECIAL GM550-STD.....\$149ea. GM550-PH.....\$149ea.**

## CHECK THIS! ULTRA MINI and WEATHERPROOF

Our "LIPSTICK" camera sets new standards. Sleek black anodized, aluminum, housing is O-Ring sealed & RAINPROOF. Adjustable tilting mount included. Specs: 1/3" CCD, 380 Lines resolution, 0.3 lux sensitivity, AGC, Auto Shutter. Operates on 9 to 12VDC @100mA, 3.7mm, 90° FOV lens. A real glass lens. NTSC video out. 1/2 once! SENSITIVE to IR. Ultra small size only: 23mm diam. X 50mm long. With 36° leads. **GM-200KSTD...\$119 pwr. adapter...\$4.95**

## "EMBEDDABLE", PINHOLE LENS, "BULLET CAM" it's INCREDIBLE!

So tiny you can install it right into a door with merely an 0.9" diameter hole. Sleek black anodized, extruded aluminum housing. Similar construction as the lipstick camera above only smaller! 1/3" CCD, 410 Lines Res., 0.3 lux sens., AGC, Auto Shutter. Power from 9 to 16VDC @100mA, 250k PIXELS, 90° FOV Pinhole lens. A real glass lens. Std. NTSC video out. 1/2 once! SENSITIVE to IR. Size only 23mm diam. x 35mm long. With 36° leads. Think of the places you could put this little jewel. **GM-200KPH lens...\$129**

Please fax us your list of unique surplus material.

## TWO MINI C-MOUNT CAMERAS, The super sensitive, GM410 or the general purpose GM412, The GM-412 specs. B&W,



size 1.5"sq. X 2.4"L, 250,000 Pixels, 380 Lines Resolution, Sensitivity 0.3 Lux, The GM410 specs: size only 1.5" SQ. X 1.6"L, >270,000 Pixels, 410 Lines Res., Sens. 0.05 LUX., Both cameras are 1/3" CCD with AGC & Electronic shutter. 12V @110mA power. NTSC out. IR SENSITIVE, BNC video out, Both use std. DC pwr. jack. Aluminum housings with dual threaded top and bottom mounting. True performance not hype! These cameras will outperform ANY camera in this magazine. Multi-lens options are available to exploit their superior performance. **GM412, less lens...\$119, GM410, less lens...\$169**

## C-MOUNT LENS OPTIONS to ENHANCE YOUR IMAGE:

Fast Lenses for Low Light or General Purpose Normal Light

16mm, f1.6, 15° FOV.....\$39	4mm, 80° FOV.....\$24
8mm, f1.3, 40° FOV.....\$49	8mm, 40° FOV.....\$24
4mm, f1.4, 78° FOV.....\$49	12mm, 28° FOV.....\$24

## PRICE BUSTER, DSP, COLOR, MINI C-MOUNT, CAMERA,



Brand New, model GM859, Size only: 2" x 2" x 2.5"L, Latest 1/4" CCD technology. Res. 350 lines, sens. <3lux, auto white balance, AGC, Auto iris connector. 9-12VDC @150ma power. BNC video out. Switchable gain. Superior cast aluminum housing with top and bottom mounting. Perfect for general surveillance. Less lens. Lens options listed below. **Reg. \$299 Save \$100, GM859.....\$199**

## SUPER! UNDERWATER (60 ft.) "LIPSTICK" CAMERA with INTEGRAL INFRA-RED ILLUMINATOR!



Sleek black anodized, BRASS, housing is O-Ring sealed & WATERPROOF. Adjustable mount included. Specs: 1/3" CCD, 400 Lines resolution, 0.05 lux sensitivity, AGC, Auto Shutter. Operates on 12VDC @225mA, 3.6mm, 92° FOV lens. A real glass lens. NTSC video out. Superior construction. SENSITIVE to IR. Ultra small size only: 1.25" diam. X 2" long. With 60 ft. cable. Great for general outdoor use also. **REG. \$299, GM-300KIR.....\$219**

## SONY, COLOR CONFERENCE CAMERA, 450Line, 8X, NTSC & Y/C OUT,

Serial Control of Pan, Tilt, Zoom, Auto Iris and Auto Focus too! Like having your own R2D2. Intended for use in fortune 500 board rooms. The video performance is stunning. Superior to almost anything we have seen. Camera and lens is an integral assembly. Excellent Condition. Rugged black ABS enclosure. 8 pin mini-DIN & Std. SVHS jack. Size: 8"D x 6.5"H. Sorry, we have no data on using the serial port. The units self test on power up and the video is active. Reg price over \$4K **SPECIAL PRICE...\$289ea.**



## Brand New, Video Motion Sensor. Model VM10.

Attach to any standard video signal and you've got an electronic "watchman" diligently watching the entire scene. Or any adjustable sized area within the scene. Such as a doorway or even a drawer or cabinet. A state of the art security aid. The unit will close a contact when it senses a change. Use it to turn on a VCR or call the house. Auto or manual reset. Compact, ac powered. Adjustable sensitivity. Video loop through jack. **NEW VM-10.....\$189.**



## COMPACT 3mW ARGON LASER. Super brilliant turquoise beam.

Looks as bright as a 20mW HeNe! New, Uniphase 2202-3 with pwr. supply. The 488nm, TEM00 mode is something to see! The power is in the wavelength. This highly visible beam operates where the eye is most sensitive. Very impressive for it's size. Head only 2.5" diam. and 13" long. Plug and play operation. Standard 110VAC operation. Compact power supply and fan cooled head. Less than 1/4 the price of a new one. Photo not available at press time. Looks like a scaled down version of the 2213 below. **Reg. \$3000 Our price.....\$695ea.**

## POWERFUL 75mW ARGON LASER. Uniphase 2213-75, w/2113 pwr. supply.

The 488nm, TEM00 mode is something to see! Power for a "serious" display. Excellent plug and play condition. Power supply can be controlled remotely with optional interfaces. Standard 220VAC operation. Compact used power supply and Brand new fan cooled head. Less than 1/3 the price of a new one. **Reg. \$5800, Special...\$1795 Remote...\$175, Remote w/LCD disp...\$595**



## OPTICAL X-Y DISPLACEMENT MEASUREMENT ANALOGIC 7000C, provides resolution to 0.005% of lens displacement.

Full scale 0.225" range. Comprised of PMT based optical camera and control unit. Capable of measuring displacement, motion and elongation. Measurement is non contact thus eliminating any change in the target dynamics. Operation is achieved by locking onto a target area which has a contrasting property. LIKE NEW condition. Includes heavy duty wheeled transit case for system. Analog outputs for waveform analysis and direct digital display. **WAS 50K+ NOW.....\$895**

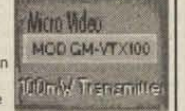


## WORLD'S SMALLEST

... 100mW ...

## VIDEO TRANSMITTER,

Incredibly only 0.98" x 0.8" x 0.037" in size. Transmits crystal controlled hi-res. images with 100mW output! The transmitter you've been waiting for. Shown actual size. Much smaller than the 9V battery which powers it. Draws only 35mA! Factory tuned ready to receive on cable channel 59. Will work with color or B&W cameras. UHF Bow tie antenna with balun and 3' F cable for TV included. Perfect with our GM1000A cameras. Both will fit in a cigarette pack...with the battery! The best deal anywhere. **TVX-100...\$199. with GM1000A-PH CAM...\$279.**



## YOU CAN NEVER BE TOO THIN or TOO POWERFUL.

Unique Thinline Energy Cell from Portable Energy Products. Their model PLA02V50. A super thin, high performance, patented technology, sealed lead acid battery. Each cell provides 2V@5AH. Their size is an amazing 3.1" x 5.3" x 0.3" thick! They can be mounted in any orientation. Can line the bottom of a briefcase or be covertly worn on the body. 30% higher energy density than conventional lead acid batteries. **Price 6 cells for \$15 or 24 for \$49**



# RESOURCES UN-LTD.

300 BEDFORD STREET, MANCHESTER, NH 03101

VISA, MC, AMEX, DISCOVER, COD. ORDER: 800-810-4070 TECH. 603-668-2499 ORDER FAX: 603-644-7825 E-MAIL unlt4u@tiac.net

Write in 144 on Reader Service Card.

Nuts & Volts Magazine/November 1998 75



# SECURITY ELECTRONICS SYSTEMS AND CIRCUITS

## — Part 10

by Ray Marston

Ray Marston describes a variety of add-on automobile security circuits in this final episode of the series.

### INTRODUCTION

All previous episodes of this series have dealt with security circuits that are designed for use in domestic, commercial, or industrial applications. By contrast, this concluding episode deals exclusively with fairly simple 'add-on' security circuits designed for use in automobiles fitted with normal 12V negative-ground electrical systems.

Modern automobiles virtually bristle with various 'security' devices and gadgets that are designed to enhance the vehicle's safety, reliability, mechanical efficiency, and immunity to theft.

If you own a reasonably modern (post 1994) automobile, it is probably already so well-equipped with good security devices that you will not need to add any more. If, on the other hand, your vehicle dates back beyond 1989, you may be able to gain by fitting one or more of the simple circuits that are described in this article, or by using one or more of the various commercial 'add-on' vehicle security units that are widely available.

The circuits described here include simple engine immobiliz-

ers and anti-theft alarms, ice-hazard, low-fuel-level, and 'lights-are-on' alarms, a headlight time-delay switch, and a timed auto-turn-off rear-screen heater controller.

### VEHICLE IMMOBILIZER CIRCUITS

Most immobilizers work by disabling the vehicle's engine, thus minimizing a thief's chances of starting or driving the automobile. The simplest and most effective way to immobilize a vehicle fitted with a normal petrol (gasoline) engine is to physically remove its ignition system's rotor-arm.

This task (which was compulsory in the UK during WW2) only takes half a minute to perform, and is recommended whenever a vehicle is left parked in a public area for more than a few days, but is too inconvenient a practice for every-day use.

Instead, simple and convenient immobilizers can take the form of a secret switch (or remotely-controlled relay contacts) wired into some vital electrical part of the vehicle's engine; Figures 1 to 4 show some basic circuits of this type.

Figures 1 and 2 show how immobilizers can be wired into the engine's ignition system.

In Figure 1(a), switch S1 is wired across the engine's contact-breaker (CB) points; when S1 is open, the ignition operates normally, but when it is closed, the CB points are shorted out and the engine is unable to operate. This simple circuit gives excellent protection, particularly if the wiring is carefully concealed at the CB end, but S1 must be able to handle the coil's high operating current when it is closed, and be able to withstand the CB point's typical 600V peak-to-peak 'ringing' voltages when the engine is operating normally.

The improved immobilizer circuit of Figure 1(b) does not suffer from the above snags. Here, an inexpensive and easily available 18V transient suppressor diode (D1) — which acts like a pair of back-to-back zen-

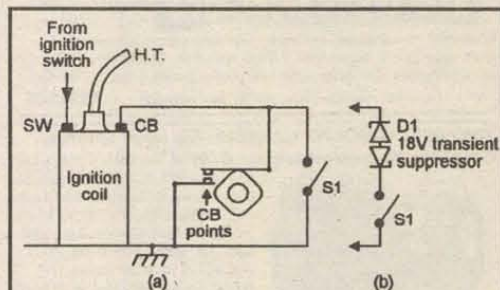


Figure 1. Contact-breaker immobilizer, operates when switch is closed.

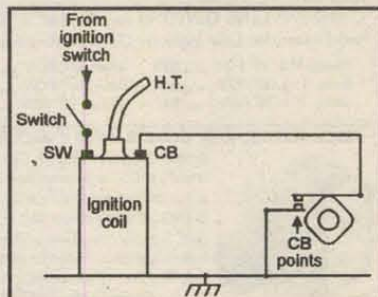


Figure 2. Ignition immobilizer, operates when switch is open.

the ignition systems vital 'ringing' voltages when an attempt is made to start the engine. This circuit gives superb anti-theft protection.

In Figure 2, the immobilizer switch is wired in series with the vehicle's ignition switch, so that the engine operates only when the switch is closed. The protection offered by this widely-used type of circuit is not quite as good as that of Figure 1, since a moderately skilled thief can easily bypass the immobilizer and ignition switches by simply hooking a wire from the battery to the SW terminal of the ignition coil.

Figure 3 shows how a heavy-duty immobilizer switch can be wired into the vehicle's electric starter system, so that the starter only operates if this switch is closed. This system gives better protection than that of Figure 2, but is not as good as Figure 1 because the starter solenoid can be operated manually on many old vehicles, and also because the starter and immobilizer switches can be bypassed by a single length of wire.

Finally, Figure 4 shows how

## World Passing You By?

Are you interested in Microprocessors & Embedded Control Systems? If not you should be! Look around, just about everything these days has an embedded microprocessor in it. TVs, cars, radios, traffic lights & even toys have embedded computers controlling their actions. The Primer Trainer is the tool that can not only teach you how these devices operate but give you the opportunity to program these types of systems yourself. Examples & exercises in the Self Instruction manual take you from writing simple programs to controlling motors. Start out in Machine language, then move on to Assembler, & then continue on with optional C, Basic, or Forth Compilers. So don't be left behind; this is information you need to know!

### Examples Include:

- Measuring Temperature
- Using a Photocell to Detect Light Levels
- Making a Waveform Generator
- Constructing a Capacitance Meter
- Motor Speed Control Using Back EMF
- Interfacing and Controlling Stepper Motors
- Scanning Keypads and Writing to LCD/LED Displays
- Bus Interfacing an 8255 PPI
- Using the Primer as an EPROM Programmer
- DTMF Autodialer & Remote Controller (New!)

The PRIMER is only \$119.95 in kit form. The PRIMER Assembled & Tested is \$169.95. This trainer can be used stand alone via the keypad and display or connected to a PC with the optional upgrade (\$49.95). The Upgrade includes: an RS232 serial port & cable, 32K of battery backed RAM, & Assembler/Terminal software. Please add \$5.00 for shipping within the U.S. Picture shown with upgrade option and optional heavy-duty keypad (\$29.95) installed. Satisfaction guaranteed.

**EMAC, inc.**  
11 EMAC WAY, CARBONDALE, IL 62901  
618-529-4525 Fax 457-0110 BBS 529-5708  
World Wide Web: <http://www.emacinc.com>

1985 - 1998  
OVER  
12  
YEARS  
OF SERVICE

## Cable Converters

NEW

※860E, 135 channel converter with remote, ch-3 output, AFT/MFT(auto fine tuning & manual fine tuning), parental lock, HRC/STD and sleep timer

NEW

※860V, 135 channel volume control converter, with remote, ch-3/4 output, AFT/MFT, parental lock, HRC/STD and sleep timer

※550E, 85 channel converter with remote unit, ch-3 output, AFT(auto fine tuning), parental lock, HRC/STD, sleep timer

※Refurbished 85 channel plain converter with remote, ch-3 output, auto fine tuning, HRC/STD and sleep timer ----- from \$25

Call or Fax us for free brochures and price list

PCW CO/(310)515-5085, (310)538-3636(Fax)



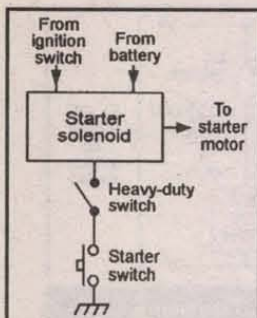


Figure 3. Starter-motor immobilizer, operates when switch is open.

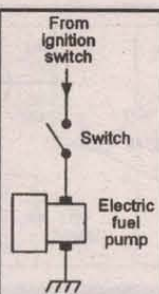


Figure 4. Fuel-pump immobilizer, operates when switch is open.

an immobilizer switch can be wired in series with the electric fuel pump on suitable vehicles, so that the pump only operates when this switch is closed. Note that this system lets a thief start the engine and drive for a short distance on the carburetor's residual fuel, which is quickly used up.

A weakness of the Figure 1 to 4 circuits is that they must all be turned on and off manually, and thus only give protection if the owner remembers to turn them on. By contrast, Figure 5 shows an immobilizer that turns on automatically when an attempt is made to start the engine, but can be turned off by briefly operating a hidden push-button switch. A small 'reminder' LED turns on when the engine is disabled by the immobilizer. This circuit thus gives a high level of protection, since it does not depend on the memory of its owner, and operates as follows.

The coil of 12V relay RLA is shunted by series-connected R1 and an LED, which illuminates when RLA is on, and this combination is wired in series with 1000µF capacitor C1, which is shunted by series-connected n.o. relay contacts RLA/1 and n.c. push-button switch S1. This RLA-C1 combination is wired between the ignition coil's SW terminal and ground, and the relay's RLA/2 n.o. contacts are wired across the vehicle's CB points (using a Figure 1b connection).

Normally, C1 is fully discharged; consequently, when the ignition switch is first closed a surge of current flows through RLA coil via C1, and the relay turns on and the LED illuminates. As the relay goes on, contacts RLA/1 close and lock the relay on via S1, and contacts RLA/2 close and short out the vehicle's CB points, thus immobilizing the engine. The relay stays on until S1 is briefly opened, at which point the relay unlatches and C1 charges up rapidly via the relay coil, and the relay and LED then turn off. As the relay turns off, it removes the short from the vehicle's CB points, and the engine is

able to operate in the normal way.

## ANTI-THEFT ALARM CIRCUITS

Vehicle anti-theft alarms come in a variety of basic types, and the most reliable of these are the types that are switched on/off externally (rather than internally) and are activated via simple door-controlled microswitches or via a battery-voltage sensing circuit.

In modern vehicles, the external on/off control function is usually obtained via an IR remote-control system, but on older vehicles, it can be obtained cheaply and simply via a prominent key-switch (or a concealed toggle switch) fitted to the outside of the vehicle. Figures 6 to 8 show practical alarm systems of these types that are designed for use in older vehicles; each of these circuits can also act as an immobilizer and, if required, operates the vehicle's horn and lights and immobilizes the engine under the 'alarm' condition.

In the Figure 6 and 7 circuits, microswitches that are built into the vehicle are used (when the alarm system is enabled) to trip a pair of self-latching relays when any of the car doors, hood, or trunk are opened; these relays immobilize the engine and operate the horn and headlights either directly or via additional timing circuitry.

Two suitable front-door

microswitches are built into most vehicles as standard fittings and are used to operate the courtesy or dome lights; additional dome-light-operating microswitches — which are readily available from

key switch. When the key switch is closed, current flows through both relays via D1 if any of the door switches close, or flows through them via D2 if any of the auxiliary switches close. In either

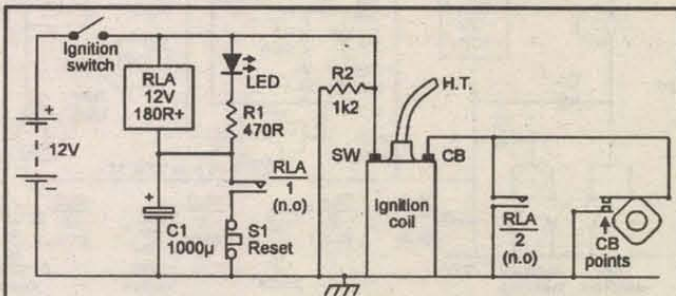


Figure 5. Self-activating immobilizer circuit.

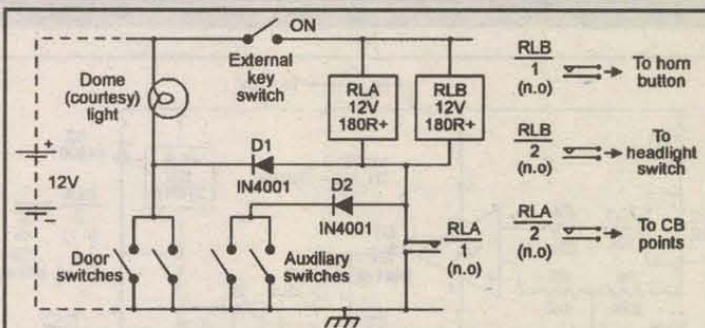


Figure 6. Basic microswitch-activated anti-theft alarm/immobilizer.

specialist 'vehicle security' retailers — can easily be fitted to the rear doors. Similar microswitches can be used as 'auxiliary' switches to protect the hood and trunk (bonnet and boot).

The operation of the Figure 6 circuit is very simple. The alarm is enabled by closing the external

case, both relays turn on.

As RLA goes on, contacts RLA/1 close and lock both relays on, and contacts RLA/2 close and short out the vehicle's CB points (using a Figure 1b connection), thus immobilizing the vehicle. Simultaneously, contacts RLB/1 close and switch on the car horn

## BIG POWER LOW COST



Dominoes are rugged, miniature encapsulated controllers that combine lots of analog and digital I/O with a fast control-oriented floating-point BASIC to provide a one-stop computation and control solution for cost-sensitive control tasks. Used stand alone or connected via RS-232/RS-485, Dominoes are true plug-and-go control.

### Domino 1 features:

- Full floating-point ROMed BASIC
- 32-KB SRAM and 32-KB EEPROM
- 12 bits of parallel I/O
- 2 PWM outputs
- I<sup>2</sup>C bus
- 2-channel 12-bit ADC
- Serial port: 19.2-kbps RS-232A, RS-422, or RS-485
- +5 V @ 15 mA

### Domino 2 has:

- everything in Domino 1 plus
- 16 more bits of high-current parallel I/O
- Hardware clock/calendar
- Wide-range power operation
- Hardware PWM output

**\$99 to \$139**

Visit our Web site for complete datasheets

**www.micromint.com**

To Order Call: **1-800-635-3355**

4 Park St., Vernon, CT 06066  
(860) 871-6170

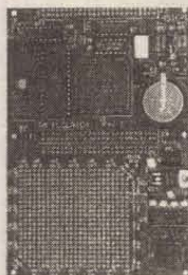


Write in 102 on Reader Service Card.

## MORE POWER!

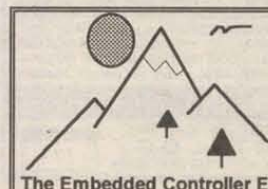
**68HC11, 80C51 & 80C166**

AM Research supports over 30 of the most popular Embedded controllers with both **hardware** and **software**.



- ✓ More Microcontrollers
- ✓ Faster Hardware.
- ✓ Faster Software.
- ✓ More Productive.
- ✓ More Tools & Utilities.
- ✓ IIC Peripherals.
- ✓ Single Chip Capable.
- ✓ Outstanding Support.
- ✓ Custom designs.

Call or email for a free full line brochure



Orders (800) 949-8051  
Info (916) 652-7472  
fax (916) 652-6642  
www.amresearch.com

**AM Research, Inc.**  
PO Box 43  
The Embedded Controller Experts Loomis, CA 95650

Write in 70 on Reader Service Card.

November 1998 **77**



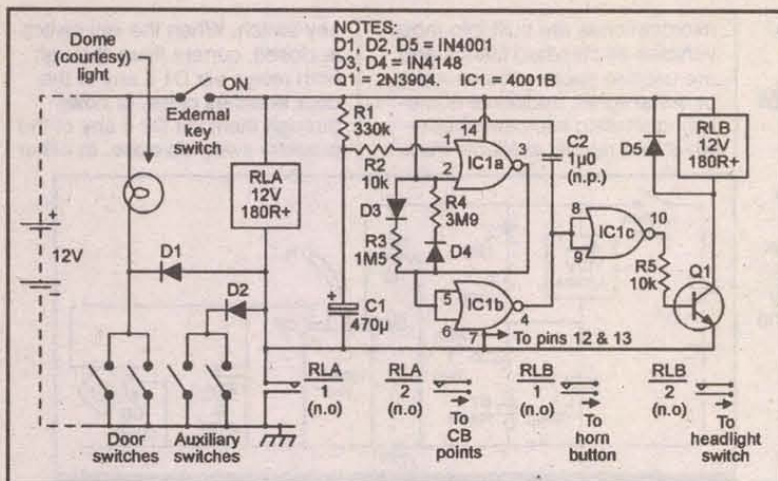


Figure 7. Improved anti-theft alarm/immobilizer has pulsed and time-controlled outputs.

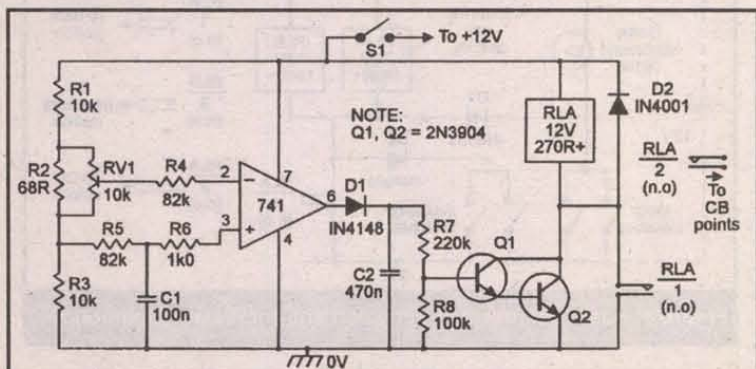


Figure 8. Basic voltage-sensing alarm circuit.

(or a siren unit), giving an audible indication of the intrusion, and contacts RLB/2 close and switch on the headlights (or activate a headlight flasher unit), giving a visual identification of the violated

vehicle. The horn and light (etc.) remain on until the key-switch is opened.

Obvious weaknesses of the simple Figure 6 circuit are that, if it is activated and is not switched

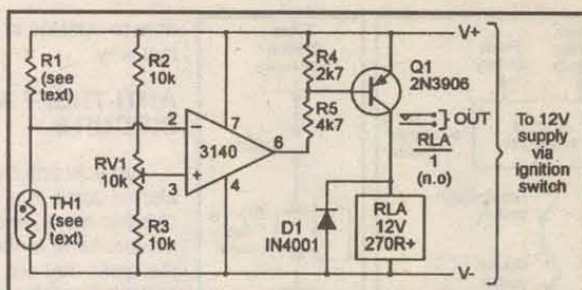


Figure 9. Relay-output ice-hazard alarm.

off manually within a reasonable space of time (typically 15 minutes), it will probably break local noise-control regulations, will probably damage the horn, and will eventually flatten the vehicle's battery. Figure 7 shows a way of modifying the Figure 6 circuit so that the horn and lights turn off automatically after about four minutes, but the immobilizer stays active until turned off via the key switch, thus eliminating all of the above problems.

In Figure 7, RLA turns on and self-latches in the same way as in the Figure 6 circuit, but as contacts RLA/1 close, they connect the full battery voltage across the RLB-driving timer-gated asymmetrical pulse generator formed from a 4001B CMOS IC and Q1. This generator is activated for about four minutes, via R1-C1, whenever RLA is turned on by a 'break-in' detector, and repeatedly pulses RLB (and thus the vehicle's lights and horn) on and off, for unequal periods, for the duration of this four-minute period.

During this 'pulsing' period, the 'off' time of RLB is controlled by C2-D3-R3 and approximates 1.5 seconds, and the 'on'-time is controlled by C2-D4-R4 and approximates four seconds, and the vehicle's horn thus generates a distinctive and easily recognized warning signal. Note that C2 is a non-polarized (n.p.) capacitor.

Finally, to complete this look at anti-theft alarm circuits, Figure 8 shows the practical circuit of a simple voltage-sensing type of alarm unit that can be used in place of the basic RLA-driving network used in the Figure 6 and 7 designs. Circuit operation relies on the fact that (when the vehicle's engine is not operating) a small but sharp drop occurs in the vehicle's battery voltage whenever a courtesy light is automatically turned on by the opening of a front door, or when the ignition is switched on. This sudden drop in voltage is detected and made to operate RLA. The system has the advantage that its 'alarm' signals are derived directly from the vehicle's battery, rather than via various microswitches, but it is not quite as reliable as a conventional microswitch-activated alarm system.

The operation of the Figure 8 circuit — which is connected across the vehicle's battery via S1 — is fairly simple. Here, potential divider R1-R2-R3 is wired across the circuit's supply lines, and the output of this divider is fed, via RV1-R4, to the inverting (pin 2) input terminal of the 741 op-amp, which is wired in the open-loop mode, but is taken to the non-inverting (pin 3) input via a simple (R5-C1-R6) time-delay 'memory' network. A small offset voltage can be applied between the two input terminals via RV1.

Suppose then that the RV1 offset control is adjusted so that the pin 2 voltage is fractionally higher than that of pin 3 under normal 'steady voltage' conditions and, that under this condition, the output of the op-amp is driven to negative saturation. Now if a small but abrupt fall occurs in the supply voltage, this fall is transferred immediately to pin 2 of the op-amp, but does not immediately reach pin 3 because of the time-delay or memory action of C1.

## PRIMECELL

IF YOU NEED NEW BATTERIES FOR YOUR ELECTRONIC EQUIPMENT  
DON'T PITCH EM! SEND THEM FOR REBUILDING! - SAVE \$\$

CUNARD ASSOCIATES, R.D. 6 Box 104, Bedford, PA 15522

- WE INSTALL NEW NI-CAD OR NI-MH BATTERIES INTO YOUR ORIGINAL CASE.
- WE IMPROVE CAPACITY TO BETTER THAN ORIGINAL.
- WE FIX WHAT CAN'T BE FOUND, (OR AFFORDED)
- WE PROVIDE QUICK SERVICE / EXTENDED LIFE FOR OLDER EQUIPMENT
- WE OFFER FREE QUOTES. / FREE RETURN IF QUOTE IS REFUSED.
- WE PROPERLY DISPOSE OF YOUR OLD CELLS BY RECYCLING.
- WE GIVE YOU A 12 MONTH WARRANTY.
- WE WILL BE HERE WHEN YOU NEED US / 12 YEARS IN BUSINESS.
- WE SAVE YOU \*\*\*\* MONEY \*\*\*\* \$\$\$

• NO JOB IS TOO LARGE OR TOO SMALL. WE OFFER VOLUME DISCOUNTS  
TO LAW ENFORCEMENT / COMPANIES / FIRE DEPARTMENTS / UNIVERSITIES

GENERAL ELECTRIC	UNIDEN	BENDIX KING
MPD/PLS - MPR/MPS/MPX	APH56 APX500 \$ 21.95	KR105/LAA125 \$ 34.95
19A704850P(1200mAh) \$ 34.95	APX650 1050 \$ 29.95	
19A704850P(1800mAh) \$ 39.95	1000 1100 1200 \$ 34.95	
PL190429763(777)G1/3 \$ 37.95	BP100/200/205 \$ 14.95	
	205 inc to 1350 \$ 22.95	
MAXON 5A-1155 1160 \$ 39.95		
TAD 1450 1510 1520 \$ 21.95		
MOTOROLA	ICOM	CORDLESS DRILLS
P200 HT600 MT1000	BP2/BP3/BP22 \$ 18.95	Any brand 7.2V \$ 18.95
NTN 4585 4824 5414 \$ 37.95	BP5/BP23/24 \$ 24.95	Any brand 9.6V \$ 29.95
NTN 5447 5521 5545 \$ 37.95	BP7/CMT/BP8 \$ 34.95	Any brand 12.0V \$ 32.95
		Any brand 14.4V \$ 37.95
MIDLAND	YAESU	SURVEYING EQUIP.
70-B10 B16 B19 B21 \$ 39.95	FNB 3 4 12 14 16 \$ 32.95	COMPUTERS - PHONES
70-B32 70-B36 \$ 39.95	FNB19 21 26 27 38 \$ 32.95	Send battery for quote.
	FNB 17 25 35 \$ 23.95	

FOR INFORMATION ABOUT YOUR REQUIREMENTS ..... CONTACT US:  
PHONE OR FAX: (814) 623-7000 E-MAIL TO: PRIMECELL@AOL.COM  
SEND YOUR PACKS FOR FREE QUOTATION VIA UPS, RPS OR US MAIL  
DOWNLOAD OUR CATALOG, WEB SITE: <http://users.aol.com/PrimeCell>

### BATTERY REBUILD SERVICE

MANY OTHERS AVAILABLE - WRITE OR CALL  
**FREE CATALOG**  
ADD \$4.50 SHIPPING & HANDLING PER ORDER

## WHOLESALE CABLE BOXES

### CONVERTERS · FILTERS

Call Us To  
Satisfy All Of Your Cable  
Equipment Needs!

## WE CARRY ALL THE MAJOR BRAND NAMES!

30 DAY MONEY BACK  
GUARANTEE!  
1 YEAR WARRANTY

Call Now and Take Advantage!!!

## MODERN ELECTRONICS

### 1-800-906-6664

2609 S. 156TH CIRCLE • OMAHA, NE 68130  
VISIT OUR WEB SITE: <http://www.modernelectronics.com>  
E-MAIL: [modern@modernelectronics.com](mailto:modern@modernelectronics.com)



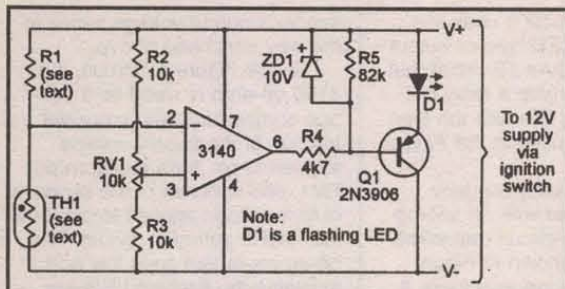


Figure 10. Ice-hazard alarm with flashing LED output.

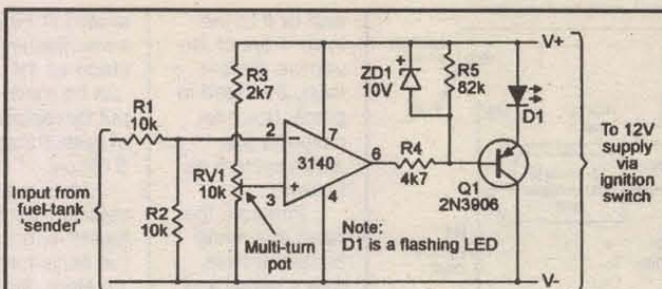


Figure 12. Low fuel level alarm.

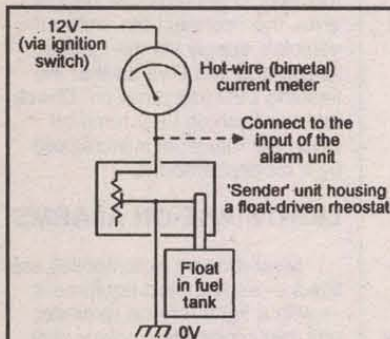


Figure 11. Basic circuit of a typical fuel level gauge.

Consequently, pin 2 briefly goes negative relative to pin 3, and as it does so, the output of the op-amp is driven briefly to positive saturation, thus giving a positive output pulse. This pulse is used to charge C2 via D1, and C2 drives Q1-Q2 and relay RLA on via R7. As RLA goes on, contacts RLA/1 close and self-latch the relay, and contacts RLA/2 close and immobilize the vehicle via its CB points.

Note that this circuit responds only to sudden drops in voltage, and is not influenced by stable absolute values of battery voltage.

The Figure 8 circuit can be used directly in place of the RLA network in the Figure 6 or 7 circuits. When installing the circuit in a vehicle, RV1 must be carefully adjusted so that the alarm turns on reliably when the courtesy (dome) light goes on, without being excessively sensitive to the small shifts that occur in the battery voltage due to its chemical action.

To find the correct setting of RV1, temporarily disable self-latching contacts RLA/1, and temporarily replace the courtesy lamp with one having roughly half its normal current rating.

Now adjust RV1 just past the point where RLA fails to activate when the lamp goes on, and then turn RV1 back a fraction, so that RLA is just activated by the courtesy light. Now refit the original courtesy light, and recheck the action. If reliable action is obtained, re-enable the RLA/1 contacts.

## INSTALLING ANTI-THEFT ALARMS

The anti-theft alarms described in the last section are all designed to be turned on and off via an externally mounted switch, which may take the form of a carefully hidden toggle switch or a prominently mounted key-switch. In either case, the switch must be mounted so that neither it or its wiring is vulnerable to damage by weather, dirt, or potential car thieves.

Once the alarm's external on/off switch has been fitted, the next installation job is to fit suitable microswitches to activate the system. Two suitable switches are already fitted to most vehicles, and are used to operate the dome or courtesy light. Additional switches must be fitted to the rear doors, and must also be fitted to the trunk and hood if full anti-theft protection is to be obtained.

Note that if your vehicle is fitted with a voltage-sensing type of

alarm system, these microswitches must be used to switch a normal filament lamp; the higher the load current used, the more reliable will be the operation of the alarm circuit; the microswitches can all be wired in parallel and used to drive a single load. When installation is complete, give your system a complete functional check, taking care not to annoy your neighbors in the process.

## ICE-HAZARD ALARMS

Ice-hazard alarms activate when the vehicle's ignition is turned on and the air temperature several inches above the road surface is at or below the 0°C freezing point of water. The alarms thus indicate a risk of meeting ice under actual driving conditions. Two useful ice-hazard alarms are shown in this section, and can easily be fitted to most automobiles. Both units use a low-cost n.t.c. thermistor — mounted outside of the vehicle, near its front and several inches above the road surface — as a thermal sensor that gives a good

indication of the actual road temperature.

The first circuit, shown in Figure 9, connects to the vehicle's 12V supply via its ignition switch, and turns-on relay RLA under the 'ice-hazard' condition; the RLA/1 contacts can be used to activate any desired type of

external alarm device. In this circuit, the 3140 op-amp is used as a voltage comparator, in which a presettable reference voltage is applied to its pin 3 input via RV1, a temperature-sensitive variable voltage is applied to pin 2 from the R1-TH1 potential divider, and the action is such that the pin 6 output of the op-amp switches low and activates Q1 and RLA if the variable voltage exceeds the reference voltage.

In practice, the output voltage of the R1-TH1 divider rises as the TH1 temperature falls, and — if the circuit is correctly set up — trips relay RLA at a TH1 temperature of precisely 0°C.

This circuit's thermistor can be any n.t.c. disc or bead type that has a resistance in the range 1K5 to 5K0 at 25°C (the normally-specified 'nominal resistance value' temperature of most thermistors). Typically, the TH1 resistance at 0°C is about treble the 25°C value and, in this circuit, the R1 value should roughly equal TH1's '0°C' value; thus, if TH1 has a nominal 25°C value of 1K5, R1 needs a value of about 4K5.

## COMPUTER PARTS

www.lapazusa.com

### MEMORY UPGRADES

1Mx9-70 SIMM.....	\$10
4Mx9-70 SIMM.....	\$19
1Mx32/36-70 72-pin SIMM (4MB).....	\$19/15
2Mx32/36-70 72-pin SIMM (8MB).....	\$18/25
4Mx32/36-70 72-pin SIMM (16MB).....	\$24/29
8Mx32/36-60 72-pin SIMM (32MB).....	\$45/55
64M(8x8) EDO/PC100 DIMM.....	\$75/93

### VIDEO

1MB KIT(2-256x16)2CAS SOJ/ZIP.....	\$18/35
1MB KIT(2-256x16) 2WE SOJ/ZIP.....	\$19/35

### CARD

64Kx1-15ns 22-DIP.....	\$5.50
32Kx8-25/20/15ns 28-DIP.....	\$32/22.50
64Kx8-15ns 32-DIP.....	\$6
128Kx8-15/20ns 32-DIP narrow.....	\$12 & up
128Kx8-15/20/25ns 32-DIP wide.....	\$15 & up

### CPU

INTEL 486DX2-66 (5v) CPU.....	\$30
INTEL 486DX4-100 (5v) CPU KIT.....	\$69
INTEL PENTIUM 83MHz OVERDRIVE.....	\$85
INTEL PENTIUM 133/166 CPU.....	\$66/79

### MISC.

486 M/B 100MHz, 256K, 16MB.....	\$95.00
PENTIUM M/B 133MHz, 512K, 32MB.....	\$195.00
* 1-year warranty on these kits	
MMX ADAPTOR allows your MB to accept MMX CPU's.....	\$30.00

AMD 486DX4-100+5v ADAPTOR+CPU FAN  
This kit will allow you to upgrade your old MB to a faster CPU  
\$65.00

LBA CARD upgrade your hard drive beyond 540MB  
without the expense of upgrading your present BIOS  
\$29.95

## PACKARD BELL

FROM 386/486 TO PENTIUM MOTHERBOARDS

PRICES SUBJECT TO CHANGE WITHOUT NOTICE -- TERMS: COD(CASH),  
VISA/MC -- MINIMUM ORDER \$20 -- SHIPPING & HANDLING: \$7 MIN.  
ORDER LINE: (800) 586-4199

## LA PAZ ELECTRONICS INT'L

P.O. BOX 261095, San Diego CA 92196  
TEL (619) 586-7610 FAX (619) 586-1482  
e-mail: lapazusa@pobox.com

When Visiting Disney World And Sea World.  
Come To The World Of Electronic Surplus!

## SKYCRAFT

PARTS & SURPLUS, INC.  
ORLANDO, FLORIDA

Located At The Intersection Of I-4  
And Fairbanks Avenue.

A Self-Service Retail Outlet Featuring Commercial  
And Government Electronic Surplus Including:

- ★ WIRE
- ★ SWITCHES
- ★ RESISTORS
- ★ TRANSISTORS
- ★ TRANSFORMERS
- ★ TEST EQUIPMENT
- ★ NI-CAD BATTERIES

- ★ COAX
- ★ RELAYS
- ★ HARDWARE
- ★ CAPACITORS
- ★ PANEL METERS
- ★ CIRCUIT BOARDS
- ★ INTEGRATED CIRCUITS

### HOURS:

Monday - Friday 8:30-6:00  
Saturday 8:30-5:00

★★★★★★★★★  
We Buy Surplus  
Electronic Parts —  
FAX your list.

FAX 407/647-4831  
PH 407/628-5634  
P.O. BOX 536186  
ORLANDO, FLA. 32853-6186

SKYCRAFT PARTS  
2245 W. Fairbanks Ave.  
To Order Call 407-628-5634



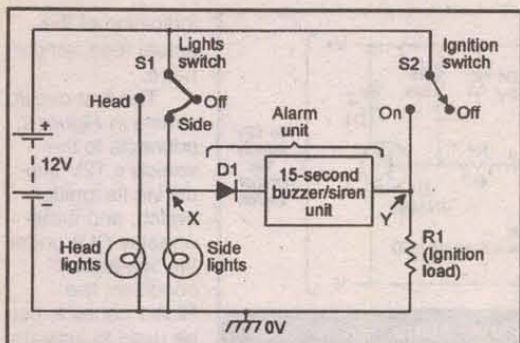


Figure 13. Basic Type-1 'lights-are-on' alarm circuit.

Note, however, that the precise R1 value is not critical, since balance-control RV1 can compensate for errors in the range -50% to +100% in the R1 value. The actual methods of mounting TH1 and setting RV1 are described later in this section.

In most practical ice-hazard alarm applications, the hazard condition may continue intermittently during several hours of driving, and it is thus best to use a flashing-LED type of 'hazard alarm' indicator, rather than a continuously-active audible-warning type. Figure 10 shows the Figure 9 circuit modified to give a flashing-LED alarm output directly, rather than via a relay. In this case, Q1 is wired as an emitter-follower, and drives on D1 — a low-cost flashing LED device — when the op-amp output switches low. Note that R4-ZD1 and Q1's base-emitter volt-drop limit D1's maximum applied voltage to a safe value of 9.4 volts.

When building either of these ice-hazard alarms, note that thermistor TH1 must be mounted in a small 'head' that is fixed to the lower front of the vehicle and connected to the main alarm-unit via twin flex. To make the head, solder the thermistor to a small tag-board and solder its leads to the twin flex. Coat the whole assembly with waterproof varnish, so that moisture will not affect its apparent resistance, then mount it in a small plastic or metal box

and fix it to the lower front of the vehicle. Before fixing the head in place, however, calibrate the alarm system as follows.

Immerse the head in a small container filled with a water and ice mixture. Use a thermometer to measure the temperature of the mixture, and add

shown in Figure 12, it uses the same flashing-LED type of output stage as the Figure 10 circuit, but can be made to give a relay output by replacing this with the type of output stage used in the Figure 9 circuit.

Most reasonably-modern vehicles are fitted with an analog fuel-level gauge circuit that takes the basic form shown in Figure 11. Here, the gauge is actually a hot-wire (bimetal) current meter that is wired in series with a 'sender' unit that is mounted in the fuel tank and consists of a float-driven rheostat that presents

a high resistance (and a low current meter reading) when the tank is empty, and a low resistance (and a high current meter reading) when the tank is full. Note that the output voltage of the sender rises as the fuel level falls, and a low fuel level alarm can thus take the basic form of a simple

sender's output voltage varies in the way described above.

In the Figure 12 circuit, the 3140 op-amp is wired as a voltage comparator, with a pre-set fraction of the supply voltage applied to pin 3 via multiturn pot RV1, and with half of the sender's output voltage applied to pin 2 via the R1-R2 potential divider. The op-amp's output goes low and activates the flashing LED (via Q1) when the pin 2 voltage rises above the pre-set pin 3 value. To set up the circuit, wait until the fuel falls to the required 'danger' level, then connect the unit to the vehicle's supply via the ignition switch and trim RV1 so that the flashing LED just turns on. Check that the flashing LED turns off when the fuel level is increased by a modest amount.

## LIGHTS-ARE-ON ALARMS

Most modern automobiles are fitted — as standard equipment — with a lights-are-on reminder unit that emits a low-power audible alarm signal that warns the driver — as he/she opens the driver's door — if the car lights have been left on.

'Lights-are-on' alarm units of this basic type are easy to build and are fairly easy to add to most older types of vehicle, and come in two basic types. Type-1 is for use in very old vehicles that are not fitted with a courtesy light that is switched automatically via a conventional door-activated

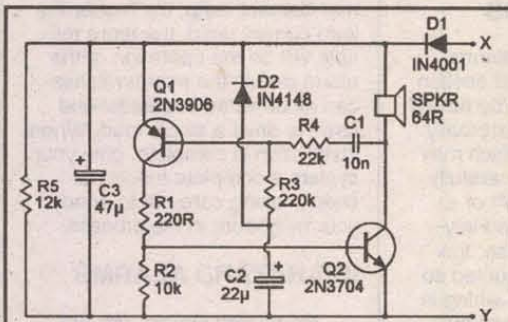


Figure 14. Practical Type-1 'lights-are-on' alarm unit.

ice until a steady reading of 0°C is obtained. Now adjust RV1 so that the alarm (RLA or the flashing LED) just turns on; raise the temperature slightly, and check that the alarm turns off again. If satisfactory, the head and the alarm system can now be fixed to the vehicle.

## A LOW FUEL LEVEL ALARM

One of the most annoying things that can happen to a car driver is to run out of fuel after having failed to notice the advance-warnings shown on the vehicle's fuel gauge. This event can easily be avoided by fitting the vehicle with a simple circuit that monitors the fuel gauge and activates a flashing-LED alarm under potential 'danger' conditions. A circuit of this type is

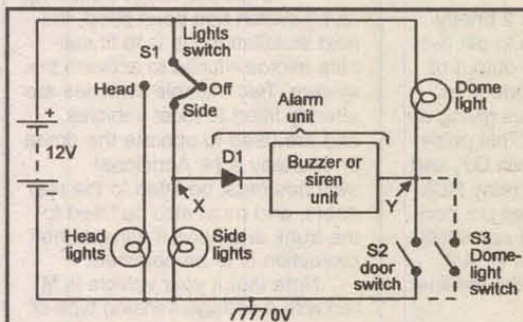


Figure 15. Basic Type-2 'lights-are-on' alarm circuit.

over-voltage alarm. A suitable 'flashing-LED' alarm circuit is shown in Figure 12.

Before starting to build the Figure 12 circuit, check that you can gain easy access to the tank-mounted sender unit or the rear of the fuel gauge, and that the

microswitch, and Type-2 is for use in vehicles that are fitted with such a courtesy light system.

Figure 13 illustrates the basic operating principles of a Type-1 lights-are-on alarm circuit. Here, the actual alarm consists of a low-power 15-second buzzer or siren

## PARTS - PARTS - PARTS

65.8 Mhz Saw Filters	100 pcs. - \$2.40	300 pcs. - \$2.00	600 pcs. - \$1.75
16 & 18 Pin IC Sockets	500 pcs. - \$0.09	1,000 pcs. - \$0.07	5,000 pcs. - \$0.05
18VAC, 300mA, Wall Transformers (Perfect for Stereo Units)	50 pcs. - \$3.00	100 pcs. - \$2.50	250 pcs. - \$2.00
4 Mhz Resonators, 3 pins	100 pcs. - \$4.45	500 pcs. - \$4.40	1,000 pcs. - \$3.35
4 & 8 Mhz Crystals, 2 pins	100 pcs. - \$5.55	500 pcs. - \$5.50	1,000 pcs. - \$4.44
24 Mhz Crystals, 2 pins	100 pcs. - \$2.10	250 pcs. - \$1.95	500 pcs. - \$1.85
Micro-Chip Pic-16C54RC	100 pcs. - \$2.30	250 pcs. - \$2.25	500 pcs. - \$2.15
Micro-Chip Pic-16C56RC	100 pcs. - \$2.00	500 pcs. - \$1.75	1,000 pcs. - \$1.68
TDA-8340 I.C.	100 pcs. - \$3.48	500 pcs. - \$2.75	1,000 pcs. - \$2.45
TSA-6060 I.C.			

Call for Larger Quantity Quotes

Phone: (515) 847-3888  
Fax: (515) 847-3889  
BBS: (515) 847-3890



303 Sherman Street  
Ackley, Iowa 50601

E-Mail: sales@capital-elec.com  
Web: http://www.capital-elec.com



**ALL.TV.INC.**  
"Our Name Says It All"

Call Us for ALL Your Cable Needs  
Large Inventory of Major Brands  
We will beat ALL competitor's prices

Also serving Puerto Rico  
In Stock 85 Channel HRC ST — VIEWSTAR  
In Stock 125 Channel HRC ST Volume  
In Stock Panasonic TZ-PC175DG2

E-Mail — alltv@icanect.net

Same Day Shipping

**TOLL FREE 1-800-510-1924**



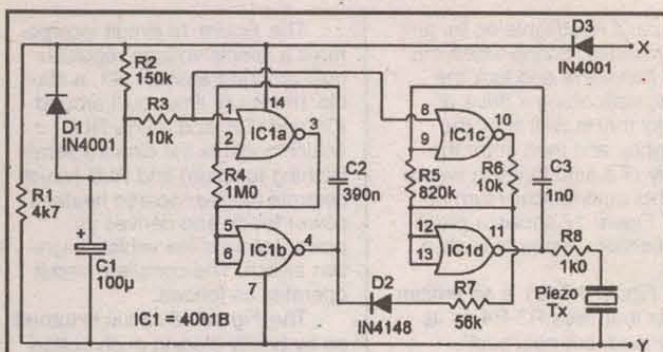


Figure 16. Practical warble-tone Type-2 'lights-are-on' alarm unit.

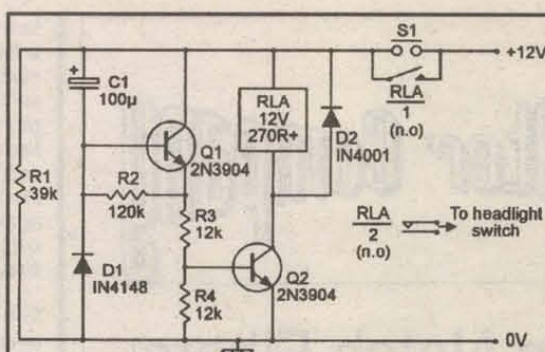


Figure 17. A headlight time-delay switch circuit.

unit that has its supply lines wired in series with diode D1 so that current can only flow through the unit (and thus activate the buzzer/siren) when point-X is many-volts positive to point-Y. And, in the diagram, this situation only occurs when 'lights' switch S1 is in the ON (Side or Head) position and 'ignition' switch S2 is turned OFF. Thus, if the lights are left on, the alarm unit sounds-off as soon as the ignition is switched off, but mutes automatically after 15 seconds.

Figure 14 shows a simple but practical version of a Type-1 'lights-are-on' alarm unit. Here, Q1-Q2 are wired as a modified complementary astable multivibrator that has its power supplied via D1 and uses a 64R low-power speaker as the collector load of Q2, which is a 2N3704 type and has a peak collector current rating of 800mA.

The astable's action is such that it generates a loud and fairly high alarm tone when power is initially applied, but the volume and frequency then decay steadily down to zero over a period of about 15 seconds. The decay time is controlled by R3-C2, and the initial frequency is controlled

by R3-R4 and C1. To use the unit, simply connect its 'X' and 'Y' points in the way shown in Figure 13.

Figure 15 illustrates the basic operating principles of the Type-2 lights-are-on alarm. It is similar to the Type-1 system, except that the alarm unit is wired between 'lights' switch S1 and dome-light-activating door-switch S2, so that the alarm only sounds if the lights are on when the driver's door is open.

The above Type-2 system is used on most modern vehicles, in which the dome light uses separate circuits for its 'courtesy' and

'reading' lights. A snag with most older vehicles is that they use a single light-bulb to perform both of these functions, with the 'reading' switch wired in parallel with S2, as shown by S3 in Figure 15 and, as a consequence, the alarm can be activated by either of these switches.

The easiest way around this snag is to use an auto-turn-off alarm unit that, like the Type-1 unit, only sounds for a dozen or so seconds when activated. The alarm unit can thus take the simple 'monotone' form shown in Figure 14, or can take the more attractive 'warble-tone' form

charges up via R2 and after a delay of about 15 seconds (determined by R2-C1) gates both astables off, silencing the piezo Tx.

When the unit's power connections are removed, C1 rapidly (in a second or so) discharges via D1-R1, and the unit is then ready to repeat its operating sequence when power is connected again.

## A HEADLIGHT TIME-DELAY SWITCH

Headlight time-delay switches are simple add-on units that, when activated by a push switch,

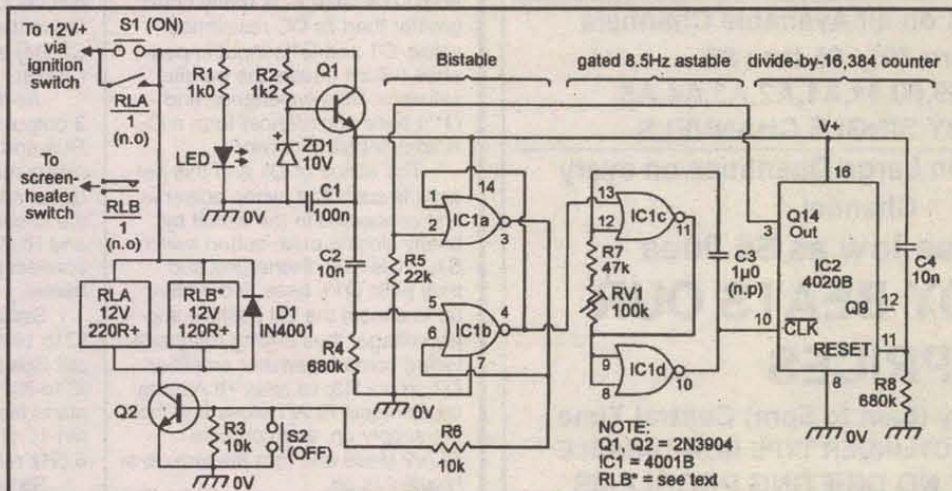


Figure 18. A rear-screen heater timer circuit.

## DIGITAL SATELLITE TV REVOLUTION!

### KNOWLEDGE is POWER!

- A clear explanation of all aspects of digital satellite TV
- Communication fundamentals and standards
- Digital compression, MPEG-2, DVB, error correction
- Uplink, satellite and receive system operation
- Internet operation and satellite delivery of data
- Installing fixed and tracking dishes
- Retrofitting older systems and mobile systems
- Conventional and IF distribution systems
- Troubleshooting and repair ... and much more ...

CALL 800-483-2423

TO ORDER - Send \$50 plus \$4 s/h to:  
Baylin Publications, 1905 Mariposa, Boulder, CO 80302  
MASTER, VISA & AMEX / COD orders accepted

Telephone: 303-449-4551

FAX: 303-939-8720

E-Mail: fbaylin@baylin.com

FREE CATALOG - Satellite TV books, videos and software



486 pages, 8-1/2" x 11"

JUST  
PUBLISHED!

Mr. NiCd

## NOVEMBER SUPER SPECIALS!

THE BEST BATTERIES  
IN AMERICA!

Packs & Charger for YAESU FT-50R / 40R / 10R:

FNB-40xh (Sim-NMH) 7.2v 650mAh \$41.95

FNB-47xh (NMH) 7.2v 1800mAh \$49.95

FNB-41xh (Sim-NMH) 9.6v 1000mAh \$49.95

For YAESU FT-51R / 41R / 11R:

FNB-38 pack (5W) 9.6v 700mAh \$39.95

For YAESU FT-530 / 416 / 816 / 76 / 26:

FNB-26 pack (NMH) 7.2v 1500mAh \$32.95

FNB-27s (5w NMH) 12.0v 1000mAh \$45.95

For YAESU FT-411 / 470 / 73 / 33 / 23:

FNB-11 pack (5w) 12.0v 600mAh \$24.95

FBA-10 6-Cell AA case \$14.95

Packs for ALINCO DJ-580 / 582 / 180 radios:

EBP-20ns pack 7.2v 1500mAh \$29.95

EBP-22nh pk (5w) 12.0v 1000mAh \$36.95

EDH-11 6-Cell AA case \$14.95

For ICOM IC-21A / T22-42A / W31-32A / T7A:

BP-180xh pk (NMH) 7.2v 1000mAh \$39.95

BP-173 pack (5w) 9.6v 700mAh \$49.95

For ICOM IC-W21A / 2G-XAT / V21AT (Black or Gray):

BP-132s (5w NMH) 12.0v 1500mAh \$49.95

For ICOM IC-2SAT / W2A / 3SAT / 4SAT etc:

BP-83 pack 7.2v 600mAh \$23.95

For ICOM IC-2AT etc & Radio Shack HTX-202 / 404:

BP-8h pack 8.4v 1400mAh \$32.95

BP-202s pack (HTX-202) 7.2v 1400mAh \$29.95

For KENWOOD TH-79A / 42A / 22A:

PB-32xh pack (NMH) 6.0v 1000mAh \$29.95

PB-34xh pack (5w NMH) 9.6v 1000mAh \$39.95

For KENWOOD TH-78 / 48 / 28 / 27:

PB-13 (original size) 7.2v 700mAh \$26.95

For KENWOOD TH-77, 75, 55, 46, 45, 26, 25:

PB-6x (NMH wiring plug) 7.2v 1200mAh \$34.95

Mail, phone, & Fax orders welcome! Pay with

Mastercard / VISA / DISCOVER / American Express

Call 608-831-3443 / Fax 608-831-1082

Mr. NiCd - E. H. Yost & Company

2211-D Parview Road, Middleton, WI 53562

CALL OR WRITE FOR OUR FREE CATALOG!

Cellular / Laptop / Videocam / Commercial & Aviation packs too!

E-mail: ehyst@midplains.net



# The Filter Company

## Positive Notch Filters

Internet: [www.gofilters.com](http://www.gofilters.com)

Large STOCK on all Available Channels

2 thru 30\*, 95 thru 99

0,1,57,58,59,60,61,A1,A2,A3,A4,A5

ORDER BY SINGLE CHANNELS

We Specialize in Large Quantities on every Channel

Prices as low as \$6.00ea

## NOBODY BEATS OUR PRICES

Monday - Friday (8am to 5pm) Central Time

QUALITY METAL CYLINDER TYPE NON-TUNABLE

ABSOLUTELY NO DRIFTING PROBLEMS

### Standard Positive Filters

1pc-\$16.00 5pcs-\$14.00 10pcs-\$12.00

25pcs-\$10.00 50pcs-\$8.00

\*Standard Positive Filters, Channels 26-30 add \$3.00 more each.

### Positive "G and S" Series Filters

1pc-\$30.00 5pcs-\$28.00 10pcs-\$25.00

Tom G. - FL Excellent Service, fast and quick. The only bad thing about this company is they don't sell Cable Boxes. We hope someday they will.....

David P. - CA We called around for help on filters and nobody had any answers except one, call the "THE FILTER COMPANY" we did and had an answer in a matter of seconds.....

John B. - IL Our company buys in the 100 quantities and needs a large selection of different channels. "The Filter Company" was the only one who was able to supply.....

PHONE ORDERS:

## 1-800-235-8080

Visa, Mastercard and Discover  
(UPS COD for established customers)

Anyone implying theft of Cable  
Service will be denied assistance  
We do not sell Data Blockers,  
Bullets or FM Traps !!!!

A "TFC" Company



Give our 800 line a howl for the best service in the Country.....!!!!

turn a car's headlights on for just a few minutes, during which the owner can leave and lock the vehicle, walk along a drive or pathway that is well lit by the headlights, and then enter the security of a safe building before the lights automatically turn off again. Figure 17 shows a practical transistor version of such a circuit.

In Figure 17, Q1 is an emitter follower that uses R3-R4 as its emitter load, but has 'bootstrapped' resistor R2 wired between its base and emitter, so that R2's impedance — as seen from Q1's base — is many times greater than its DC resistance value. C1 and Q1's input impedance (which equals the parallel values of R2's impedance and Q1's base impedance) form a C-R time-constant network.

The action of Q1 and this network is such that, when power is first connected to the circuit by briefly closing push-button switch S1, C1 is fully discharged and thus pulls Q1's base and emitter up to almost the full positive supply voltage, thus driving relay-activating common-emitter amplifier Q2 on via R3; as relay RLA turns on, contacts RLA/1 close and lock the supply on, and contacts RLA/2 close and turn the vehicle's headlights on.

As soon as power is connected to the circuit, C1 starts to charge up via the very high parallel impedances of R2 and Q2's base, and Q2's emitter voltage (and the current fed into Q2's base via R3) starts to decay exponentially until, after a delay of about two minutes, these values fall so low that RLA turns off, thus breaking the supply connection as RLA/1 opens and turning off the headlights as RLA/2 opens. C1 discharges rapidly via R1-D1 when the circuit's power connection is broken.

### A REAR-SCREEN HEATER TIMER

Automobile rear-screen heaters draw typical operating currents of about 15 amps and thus place a heavy strain on the vehicle's electrical generating system. If the heater is inadvertently left on for long periods, this strain can greatly reduce the generator's reliability and working life.

Consequently, most modern automobiles are fitted with push-button operated rear-screen heater controllers that turn the heater off automatically after an operating period of about 16 minutes. Reliability-enhancing units of this basic type can easily be added to older vehicles and, to conclude this series, Figure 18 shows a practical add-on circuit of this type.

The Figure 18 circuit incorporates a simple voltage regulator built around transistor Q1, a stable 16-minute timer built around IC1 and IC2, and relays RLA (which controls the circuit's semi-latching function) and RLB (which controls the rear-screen heater's power feed), and derives its power feed via the vehicle's ignition switch. The complete circuit operates as follows.

The Figure 18 circuit is turned on by briefly closing push button switch S1. As S1 closes, the LED illuminates, a stable 9.4V supply is applied to the IC1-IC2 timer circuit via Q1, and 'reset' pulses are fed to the IC1a-IC1b bistable (via C2-R4) and the IC2 counter (via C4-R8).

As the bistable resets, its pin 3 output flips high and turns on RLA and RLB via Q2; as the relays turn on, the RLA/1 contacts close, shunting S1 and locking-on the circuit's supply connection, and RLB/1 contacts close and connect power to the rear-screen heater.

Simultaneously, as the IC1a-IC1b bistable resets, its pin 4 output flips low and turns on the IC1c-IC1d gated astable, which starts feeding clock pulses into pin 10 of the IC2 counter at an 8.5Hz rate.

Sixteen minutes later, in the arrival of the astable's 8192nd clock pulse, the pin 3 output of IC2 flips high and changes the state of the IC1a-IC1b bistable, which simultaneously gates off the astable and removes Q2's base drive, thus turning off both relays; as RLA turns off, it removes the timer's supply connection, and as RLB turns off, it removes power from the rear-screen heater.

Thus, when the vehicle's ignition is turned on, the Figure 18 circuit connects power to the rear-screen heater as soon as S1 is closed, but removes it again automatically after 16 minutes. If desired, the timing period can be ended prematurely by briefly closing S2, thus turning off both relays.

The circuit's timing period can, if you wish, be set to exactly 16 minutes by temporarily connecting an LED and 2K7 series resistor between pins 12 and 8 (0V) of IC2 and trimming RV1 so that the LED operates with precise 30-second on and off periods.

When building this circuit, note that RLA's contacts have to pass maximum currents of less than 200mA, and RLA can thus be almost any general-purpose relay, but that RLB's contacts have to pass the full operating current of the rear-screen heater (typically 15A), and RLB must thus be a dedicated heavy-duty 'automobile' relay. **NV**



# RESOURCE BIN

number eighty two

## New secrets of military surplus (Part 2).

**O**ur usual reminder here that the *Resource Bin* is now 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.

### Uh, Where Were We?

Last month, we started to look into superb new opportunities in military surplus electronics. We saw that your key website is [www.drms.com](http://www.drms.com) and that you can now bid online and pay with VISA. We also looked at the types of sales, condition codes, and the typical prices you might expect. More details at [www.tinaja.com/resbn01.html](http://www.tinaja.com/resbn01.html).

Continuing ...

### Winners and Losers

How could you find out who paid how much for what? Those national sales and their RCP sale results are detailed on their main website. They even show you how much the losers bid, the number of bidders, the cost percentage, and their spread between high and low bids for any item. It is rare for there to be more than four or so bidders. Except for a few obviously popular items.

Local sealed bid sale results are not yet on the web. Although they were promised someday. You can get these on an item-by-item basis with a phone call, by viewing printouts on the base, or by paying \$5.00 for their printed and mailed listings.

Do note that there are two sets of national web listings. The *bid abstracts* is "raw data" that gives you a full list of all the bidders for any item, along with the total percentage return. The *bid results* gives you only their actual winners. Along with items that were withdrawn, unbid, or rejected.

Their abstracts and results are not necessarily on line at the

same time. So you just might have to save certain abstracts of interest. Files more than two weeks old get dropped.

How much to bid? Chances are that six cents on the dollar will more than get your gem for you. Unless it's very popular and in mint condition. But I prefer to bid much lower and wait till it comes around again. Unlike most regular auctions, the sale never ends. If you hit every time, you are paying

### NEXT MONTH: Don looks at some exciting new integrated circuits.

way too much.

There's a near infinite supply of this stuff. Round and round.

### The "Never be Underbid" Ploy

There's at least one company with an unusual surplus bidding strategy. They always seem to make absolutely certain they are the *lowest* bidder on any item. Every time. As a matter of professional pride, they'll make sure they are *never* underbid.

Naturally, they are also the lowest bid on items that nobody else bid on. Otherwise known as the winner. As you might suspect, their hit rate ends up kinda low. I estimate it at a few percent overall. But they still seem to get great heaping mountains of stuff. Just by bidding on nearly everything that does not eat.

The results would seem rather akin to the "send your wife to the top name on the list" chain letter. Where sheer quantity takes precedence over quality. But a few absolute gems are virtually certain.

For this low bid ploy to work, you will have to continuously run around the country in a large truck. You also must have a very definite storage and disposal plan.

Plus a good feel for what you can get away with.

The feds often require minimum bids (typically \$5.00 or

\$10.00) on the local auctions. So do be sure to ask. Other minimums (such as \$2,400.00 for a RRboxcar) are carefully spelled out. As far as I know, rejecting a high token bid on a local sale is very rare.

But on national sales, the feds do reserve their right to throw out any bids that "unfairly take advantage" of either themselves or other bidders. The criteria for an "insufficient price" rejection seems sorta bizarre.

Apparently, the cost percentage, the number of *other* token bidders, former item bids, and how bad it makes the rest of the sale look all get taken into account. There is some evidence that anything under 25 cents per thousand dollars acquisition cost of high value items usually gets rejected outright. But \$2.00 per thousand awards on lower demand items seem routinely accepted.

Accepted low price bids seem less generous on obvious values such as machine tools or aircraft parts.

On the other hand, I have seen the feds reject bids which were 10 times higher what a sane individual would spend for core memory or paper tape punches. Old electronics often has a *negative* value. The rejected bids are shown on the bid result pages. The message here is that *token bids* work. So long as your items are either not much in demand, hard to get to, need heavy rework, or are obscurely described. And so long as the market remains erratic rather than efficient. The trap to watch out for is hitting on only one token bid at a site that is a long or inconvenient trip away.

Needless to say, the feds do not take lightly to "no show" bids. They get even more upset if you stiff them on a VISA card. And if you don't pick up your stuff by "pumpkin time," you can lose all rights to it.

Even if paid for.

Normal pickup interval is 10 days. They tend to get very upset if you try for even a slight extension.

### The Bidding Process

A useful surplus strategy might be based on buying for a penny on the dollar, selling for a dime, and trying to make a nine percent profit in the process. But note that there is a total glut in the electronic test equipment market. Lean and mean is your *only* ploy that works. So, your best bet is to buy surplus to build up a dream lab. Or for other personal uses.

It is best to take your time

### new from DON LANCASTER

#### ACTIVE FILTER COOKBOOK

The sixteenth (!) printing of Don's bible on analog op-amp lowpass, bandpass, and highpass active filters. De-mythified instant designs. \$28.50

#### CMOS AND TTL COOKBOOKS

Millions of copies in print worldwide. THE two books for digital integrated circuit fundamentals. About as hands-on as you can get. \$28.50 each.

#### RESEARCH INFOPACKS

Don's instant cash-and-carry flat rate consulting service. Ask any reasonable technical question for a detailed analysis and complete report. See [www.tinaja.com/info01](http://www.tinaja.com/info01) for specifics. \$75.00

#### INCREDIBLE SECRET MONEY MACHINE II

Updated 2nd edition of Don's classic on setting up your own technical or craft venture. \$18.50

#### LANCASTER CLASSICS LIBRARY

Don's best early stuff at a bargain price. Includes the CMOS Cookbook, The TTL Cookbook, Active Filter Cookbook, PostScript video, Case Against Patents, Incredible Secret Money Machine II, and Hardware Hacker II reprints. \$119.50

#### LOTS OF OTHER GOODIES

Tech Musings V or VI .....	\$24.50
Ask the Guru I or II or III .....	\$24.50
Hardware Hacker II, III or IV .....	\$24.50
Micro Cookbook .....	\$19.50
PostScript Beginner Stuff .....	\$29.50
PostScript Show and Tell .....	\$29.50
Intro to PostScript Video .....	\$29.50
PostScript Reference II .....	\$34.50
PostScript Tutorial/Cookbook .....	\$22.50
PostScript by Example .....	\$32.50
Understanding PS Programming .....	\$29.50
PostScript: A Visual Approach .....	\$22.50
PostScript Program Design .....	\$24.50
Thinking in PostScript .....	\$22.50
LaserWriter Reference .....	\$19.50
Type 1 Font Format .....	\$16.50
Acrobat Reference .....	\$24.50
Whole works (all PostScript) .....	\$380.00
Technical Insider Secrets .....	FREE

#### BOOK-ON-DEMAND PUB KIT

Ongoing details on Book-on-demand publishing, a new method of producing books only when and as ordered. Reprints, sources, samples. \$39.50

#### THE CASE AGAINST PATENTS

For most individuals, patents are virtually certain to result in a net loss of sanity, energy, time, and money. This reprint set shows you Don's tested and proven real-world alternatives. \$8.50

#### BLATANT OPPORTUNIST I

The reprints from all Don's Midnight Engineering columns. Includes a broad range of real world, proven coverage on small scale technical startup ventures. Stuff you can use right now. \$24.50

#### RESOURCE BIN I

A complete collection of all Don's Nuts & Volts columns to date, including a new index and his master names and numbers list. \$24.50

#### FREE SAMPLES

Check Don's Guru's Lair at <http://www.tinaja.com> for interactive catalogs and online samples of Don's unique products. Searchable reprints and reference resources, too. Tech help, hot links to cool sites, consultants. email: [don@tinaja.com](mailto:don@tinaja.com)

FREE US VOICE HELPLINE VISA/MC

#### SYNERGETICS

Box 809-NV  
Thatcher, AZ 85552  
(520) 428-4073

about the process. I grab the dynamic listing as soon as it comes up and throw it in a time-ordered box. I then try to find out what each item is along with its acquisition cost. The official catalog is finally added, and bid prices are then worried over for one week before the actual bid. I do try to bid a day or two before the deadline. Note that their fax machines tend to jam up near the bid closing time.

Most of the bidding can be done online. Simply use mouse clicks and follow the instructions.



# RESOURCE BIN

## MIL SURPLUS DRMO OFFICE LISTINGS (PART 1)

<b>DRMO Lakehurst</b> NAWC-AD NAES Lakehurst Bldg 75 Lakehurst NJ 08733 Phone: 732-323-2691 Fax: 732-323-7374	<b>DRMO Montgomery (*)</b> 560 North Drive Bldg 900 Maxwell AFB 36114 Phone: 334-416-4194 Fax: 334-416-3700	<b>DRMO Portsmouth</b> Portsmouth Naval Shipyard Bldg 136 Box 2028 Portsmouth NH 0304 Phone: 207-438-5154	<b>DRMO Savannah Annex</b> Bldg 423 Savannah Army Depot Savannah IL 61074 Phone: 815-273-8330 Fax: 815-273-8331	<b>DRMO Texarkana</b> Bldg 473 Red River Army Depot Texarkana, TX 75507 Phone: 903-334-4297 Fax: 903-334-4232
<b>DRMO LeJeune</b> 906 Louis Road Camp LeJeune NC 28547 Phone: 910-451-3477 Fax: 910-451-3306	<b>DRMO Mountain Home</b> Box 4068 1220 Desert Home Mtn home AFB ID 83648 Phone: 208-828-2306 Fax: 208-828-4176	<b>DRMO Pensacola (*)</b> 260 Warehouse Rd Suite A Pensacola FL 32508 Phone: 850-452-2351 Fax: 850-452-2821	<b>DRMO Scott</b> Warehouse 1 Section 2 C. M. Price Support Center Granite City, IL 62040 Phone: 618-452-4584 Fax: 618-452-4463	<b>DRMO Tobyhanna</b> Tobyhanna Army Depot 11 Hap Arnold Blvd. Tobyhanna, PA 18466 Phone: 717-895-7455 Fax: 717-895-7454
<b>DRMO Letterkenny</b> Letterkenny Army Depot Bldg 2260 Chambersburg Pa 17201 Phone: 717-267-5548 Fax: 717-267-5538	<b>DRMO McClellan AFB</b> 4522 Parker Ave Bldg 700A McClellan AFB CA 95652 Phone: 916-643-3830 Fax: 916-643-0416	<b>DRMO Philadelphia (*)</b> Bldg 26-C 2800 South 20th Street Philadelphia PA 19101 Phone: 215-737-3720 Fax: 215-737-7017	<b>DRMO Selfridge</b> Bldg 590 Selfridge Angb MI 48045 Phone: 810-307-4233 Fax: 810-307-4304	<b>DRMO Travis (*)</b> 291 Hickman Bldg 724 Travis AFB CA 94535 Phone: 707-424-4443 Fax: 707-424-4447
<b>DRMO Lewis</b> Box 338500 Bldg 9670 Logistics Center Fl Lewis WA 98433 Phone: 253-967-4890 Fax: 253-967-2049	<b>DRMO McConnell (*)</b> 53568 Muldane Road Bldg 139 McConnell AFB KS 67221 Phone: 316-652-4094 Fax: 316-652-4101	<b>DRMO Richmond</b> Warehouse 3 9000 Jefferson Davis Hwy Richmond VA 23297 Phone: 804-279-4325 Fax: 804-279-5588	<b>DRMO Sheppard (*)</b> 1302 Motorpool Bldg 2136, Dr Stop 37 Sheppard AFB TX 76311 Phone: 817-676-4934 Fax: 817-676-4932	<b>DRMO Tucson</b> 7030 E Irvington Rd Davis-Monthan AFB Tucson AZ 85707 Phone: 520-228-8817 Fax: 520-228-8101
<b>DRMO Little Rock (*)</b> 1575 N Lachmund Drive Little Rock AFB AR 72099 Phone: 501-988-3363 Fax: 501-988-6205	<b>DRMO Nellis</b> 5506 Blytheville Driv Nellis AFB NV 89191 Phone: 702-652-2004 Fax: 702-652-4239	<b>DRMO Riley</b> Box 2490 Bldg 1950 Fort Riley KS 66552 Phone: 913-239-5318 Fax: 785-239-8138	<b>DRMO Sierra Annex</b> Sierra Army Depot Herkong CA 96113 Phone: 530-827-4546 Fax: 530-827-4752	<b>DRMO 29 Palms Annex (*)</b> MCAGCC Bldg 2085 Rifle Range Rd 29 Palms CA 92278 Phone: 619-830-6643 Fax: 619-830-6776
<b>DRMO Luke (*)</b> 7011 N El Mirage Road Glendale AZ 85307 Phone: 602-856-7144 Fax: 602-856-7146	<b>DRMO Norfolk</b> 7829 Seventh Steel Norfolk VA 23511 Phone: 804-444-5144 Fax: 804-444-4171	<b>DRMO Rock Island</b> Rock Island Arsenal Bldg 154 Rock Island IL 61299 Phone: 309-782-1617	<b>DRMO Sill (*)</b> Bldg 3323 Naylor Road Fort Sill OK 73503 Phone: 580-442-4703 Fax: 580-248-7410	<b>DRMO Vandenberg</b> Bldg 1205 Utah St Vandenberg AFB CA 93437 Phone: 805-734-8232 Fax: 805-734-8232
<b>DRMO March</b> 14575 Arnold Bldg 7047 March AFB CA 92518 Phone: 909-855-7101 Fax: 909-855-7101	<b>DRMO Offutt</b> 405 Gemini Blvd Offutt AFB NE 68113 Phone: 402-294-3934 Fax: 402-294-2698	<b>DRMO Romulus Annex</b> Seneca Army Depot Romulus NY 14541 Phone: 607-869-1236	<b>DRMO Sparta</b> Bldg 2184 Ft McCoy Sparta WI 54656 Phone: 608-388-3718 Fax: 608-388-2948	<b>DRMO Warner Robins</b> 1200 Macon St Robins AFB GA 31098 Phone: 912-926-3437 Fax: 912-926-1983
<b>DRMO McAlester (*)</b> US Army Ammunition Plant Bldg 645 1 C Tree Road McAlester OK 74501 Phone: 918-420-6248 Fax: 918-420-6069	<b>DRMO Oklahoma City</b> 6150 Air Depot Blvd #15 Tinker AFB OK 73145 Phone: 405-739-7885 Fax: 405-739-7072	<b>DRMO Roosevelt Roads</b> USNSRR Bldg 1973 Sorrental Dr Ceiba PR 00735 Phone: 809-865-4903 Fax: 787-865-3406	<b>DRMO St Juliens Creek</b> Bldg 1400 Magazine ST Portsmouth VA 23709 Phone: 804-396-0136 Fax: 804-396-0449	<b>DRMO Whiteman</b> Box 6010 640 2nd St Whiteman AFB MO 65305 Phone: 660-687-5595 Fax: 660-687-5598
<b>DRMO Meade</b> Box 388 77 Rock Avenue FT Meade MD 20755 Phone: 301-677-6366 Fax: 301-677-3567	<b>DRMO Panama</b> Unit 0940 Bldg 745 Olin Avenue Corozal Panama Phone: 011-507-85-4754	<b>DRMO Rucker (*)</b> Bldg 1215 Nighthawk St Ft Rucker AL 36362 Phone: 334-255-9111 Fax: 334-255-3451	<b>DRMO Stewart</b> Bldg 1152 Ft Stewart GA 31313 Phone: 912-767-8893 Fax: 912-767-1121	<b>DRMO Williamsburg (*)</b> FISC Cheatham Annex 108 Sanda Ave Bldg 16 Williamsburg VA 23187 Phone: 757-887-7264 Fax: 757-887-7289
<b>DRMO Mechanicsburg</b> Navy SPCC Bldg 206 5450 Carlisle Pike Mechanicsburg PA 17055 Phone: 717-605-2267 Fax: 717-605-3940	<b>DRMO Patrick</b> Bldg 1391 Marina Road Patrick AFB FL 32925 Phone: 407-494-6434	<b>DRMO San Antonio</b> 500 Tayman St Bldg 3050 E Kelly Kelly AFB TX 78241 Phone: 210-925-6167 Fax: 210-925-1106	<b>DRMO Stockton</b> Bldg 1002 Rough & Ready Island Stockton CA 95203 Phone: 209-944-0268 Fax: 209-944-0205	<b>DRMO Wright-Patterson</b> 5490 Pearson Rd Wright-Pat AFB OH 45433 Phone: 513-257-4203 Fax: 513-257-7974
<b>DRMO Minot</b> 401 Bomber Blvd Minot AFB ND 58705 Phone: 701-723-6119 Fax: 701-723-3269	<b>DRMO Port Hueneme</b> 779 Stethem Road Bldg 513 Port Hueneme CA 93043 Phone: 805-982-5636 Fax: 805-982-4312	<b>DRMO San Diego</b> Box 337 OLF Building 193, Ream Field Imperial Beach, CA 91932 Phone: 619-437-9446 Fax: 619-437-9435	<b>DRMO Tampa (*)</b> 5110 N Boundary Blvd Mac Dill AFB FL 33621 Phone: 813-828-2671 Fax: 813-828-4689	<b>DRMO Yuma Annex (*)</b> Box 99135 Bldg 321 Marionette and Smith YUMA AZ 85369 Phone: 520-341-2177 Fax: 520-341-2020

(\*) Scheduled to close in the next few months.

If an end-user certificate will be needed (this is fairly rare), then it is best sent via fax at the time your bid is accepted.

Winners only are usually notified with a phone call, followed by fax and mail. Payment is easiest with VISA over the fax. At DRMO, VISA, certified checks, or exact cash. Any personal checks above \$25.00 are not allowed.

Payment must, of course, precede any pickup.

### Getting the Goods

Getting on a military base can be somewhat of a hassle. But the process usually will go something like this: Somewhere near the main gate will be a visitor contact area. You'll go there and show them your driver's licence, registration, the rental contract (if any), and proof-of-insurance. They'll

issue you a day pass.

Patience and extreme politeness are essential. So is a reasonable demeanor. Those "mad bomber," "dirty hippy," or "flamingly accessorized" looks don't seem to set all that well. It is also very important to pay *extreme* attention to all details. Every time.

Access ease depends upon the base. Huachuca opts for the full drill. D-M Tucson just waves you through. And Luke's DRMO is outside the gate.

The DRMO will often be a fenced area in an obscure corner of the base. Be certain to listen to all directions. Otherwise, you may get run over by a tank. You should park outside the DRMO office and then make contact with them. They then should tell you exactly where to go for pickup.

Banker's hours seem the DRMO norm. Weekdays only with

most sites closed by 2 p.m..

The feds will help you load to your *open conveyance only*. Whatever they can safely do with a forklift. *No other loading help is normally provided.*

If you have someone else pick up your stuff for you, you are supposed to prefile an authorized shipper form to the DRMO ahead of time. But so far, I've gotten away with the loader having a carefully detailed printout of an authorization E-Mail, or faxing a suitable sheet of paper.

Remember, it is their gig. They can make up any rules they like.

### \$24.00 Jeeps?

One of the most persistent urban lore myths of all time is the \$24.00 Jeep. Surprisingly, it turns out that these WW II derelicts

have (and extremely rarely continue) to be sold. The only little kicker is that these are not street legal. So they always are carefully cut in half before each sale.

These make great bookends if you have a big enough library.

It does turn out that at least one Yuppy direct mail reseller has newly been buying these up and dropping usable parts into new frames and then upgrading them to street legal. The final cost is high enough, though, that you would really want to have one of these real bad. You can find a much better Jeep in a local shop.

The feds have a big time recycling program on Humvees, so these are virtually *never* sold surplus.

Once.

Lots of street legal trucks and other military vehicles do get sold surplus. Many of these tend to be badly worn or have other serious problems. For some obscure reason, a lot of these ride like an army truck. Very careful inspection is the key. Be especially wary of that word "residue." Also if an "approximate quantity one" ever shows up in the description. Bidding tends to end up rather competitive on these, and they often may go for way more than they are really worth.

### Free Surplus?

Most of the stuff on the sales is also available *free*. If you are a part of a military, government, state, or local agency. Your local city government could, say, request camping gear for sponsored Boy Scout use. Or athletic items for the city park. Or an Indian res can (and recently did) get a horse. Or a struggling volunteer fire group could try and score used turnout gear, tankers, and even crash trucks.

These uses take precedence over public sales. Full details appear on the "insider" half of the fed's mil surplus website. Needless to say, if you try to personally profit from any such scam, they will stake you to an anhill. And leave you there till the next meeting of the steering committee.

Your secret is to scan the fed's raw inventory property search to find the stuff *before* they get locked into any specific public sale. There are a lot of bureaucratic hassles involved.

### For More Help

Your usual starting point here is at <http://www.drms.com>. Everything you need is theoretic-



# TECH FORUM

cally on this site. Note the ".com." Not ".gov" or ".mi." but it does take some digging and practice to get to all the really useful stuff.

One thing you might consider is to find an *agent*. A relative or friend or whoever who just happens to live across the street from a remote DRMO office. Having them preview, pick up, triage, and stash the stuff can greatly simplify the process.

Conversely, when you are properly positioned and want to be an agent (for a reasonable fee or part of the stash), give me a call or E-Mail me at [don@tinaja.com](mailto:don@tinaja.com). I particularly could use Barstow and Edwards help.

My resource sidebars here give you the address, phone, and fax number for most of the DRMO offices. Those with an asterisk are on a hit list and have received serious death threats.

You can get your own online copies at [www.tinaja.com/resbn01.html](http://www.tinaja.com/resbn01.html). Lots of samples of gotten goodies at [www.tinaja.com/bargte01.html](http://www.tinaja.com/bargte01.html). The best stuff here includes Tek 2213 scopes, giant HP pen plotters, great AC motors, complete and like-new printed circuit plate thru labs, lots of Tek, HP, and Fluke premium gear, and (yup — you guessed it) a humongous 50 KW load bank. The latter FOB Thatcher.

I'll be happy to answer mil surplus questions as per our helpline. And more structured help is found at my [www.tinaja.com/info01.html](http://www.tinaja.com/info01.html).

## This Month's Contest

For our contest this month, just tell me your mil surplus story. Preferably as a tragedy or farce.

There should be a largish pile of my new *Incredible Secret Money Machine III* going to the dozen or so better entries, plus an all-expense-paid (FOB Thatcher, AZ) *tinaja quest* for two that will go to the very best of all.

To be fair to everyone, all entries must get written and submitted via snail mail. Send all your written entries to me here at Synergetics, rather than to Nuts & Volts editorial.

Let's hear from you. NV

Microcomputer pioneer and guru Don Lancaster is the author of 35 books and countless tech articles.

Don is the webmaster of his Guru's Lair found at <http://www.tinajacoml/tinaja>. You can reach Don at Synergetics, Box 809, Thatcher, AZ 85552. Or send any messages to [don@tinaja.com](mailto:don@tinaja.com).

Continued from page 74

these and other emergency occasions. Don't deadbolt the emergency escape.

Kurt Richter  
via Internet

## ANSWER TO #10989 - OCT. 1998

Innotech Systems, Inc. makes a broad line of remote control ICs. Their IC4001 is a universal transmitter that can control up to four devices.

Their IC1001 IR is a remote control receiver IC. Data sheets for these and other similar devices are available in .PDF format and their web page is <http://www.innotechsystems.com/shrtfrm.htm>.

Tom Tillander  
Bay village, OH

## ANSWER TO #9981 - SEPT. 1998

Use very thin copper foil, backed with adhesive (aluminum oxidizes too soon) or conductive paint on the inside of the case, greatest leakage remaining is around the ports and keyboard.

Fashion a metallic cover for any unused I/O port, and be sure all current external connectors mate metal to metal, and maintain electrical continuity on all shield components.

The keyboard is tricky if not already shielded by OEM. Each laptop design requires some ingenuity to prevent shorting your system board against the EMI shielding. Always remember if your plug-in items are using fully shielded cables.

Rick Kajander  
via Internet

## ANSWER TO #9982 - SEPT. 1998

The SAFE 250 is probably a 24-volt operation. Typically, the UPS is higher voltage for higher output for the same reason autos went from six volts in the pre-1960s to 12 volts.

By having a higher source volt-

## ANSWER TO #109812 - OCT. 1998

The easiest way to accomplish the switching that you require is to use a single diode as a switch.

You place the power supply parallel with the battery pack and place a diode on the battery positive lead so that the battery feeds the computer through this diode.

When the wall power runs the computer, it has a slightly higher voltage than the battery pack which means the battery won't flow through the diode to the computer until the

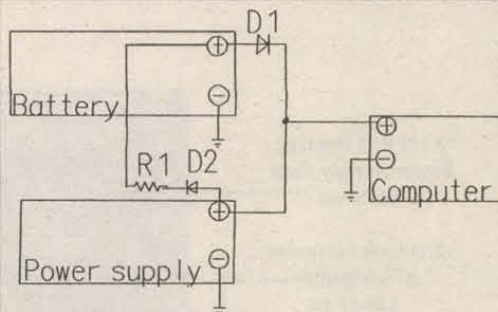
wall power fails.

When the wall power fails, the diode will switch into conduction within a few microseconds, or nanoseconds, and will power the computer from the battery without the characteristic surge that most relays cause.

You can still add a trickle charger to the back side of the battery pack using a small diode (4001) and resistor combination to regulate the current flow to the battery from either a separate transformer or from the original power supply that runs the computer.

There will be a voltage drop across the battery feed diode, so choose a diode that has the lowest possible drop. Choose one with the lowest recover time and correct amperage also.

Chris  
Bieber, CA



age, the current is lowered. The key to the voltage of operation aside from some of the frequencies may vary due to lower voltage, is the transformer used to transform the chopped 24 volts up to a 110-volt squarewave output.

The turns ratio of the transformer is typically 5:1, to give a 5 times increase in the input voltage. Using 12 volts to get the 110-volt squarewave will require a transformer with a turns ratio of 10:1. So, if your SAFE 250 is a 24 volt input, then it will not operate from 12 volts without a major transformer modification.

There are several UPSs that are 12-volt operated. Some of the smaller Triplite are ones I have worked

with. If yours happens to be one designed for 12-volt operation, then the only thing you have to do is get it to switch into UPS Mode, and normally this is accomplished by removing the 110-volt input supply. However, they will not usually switch into the backup mode without first having the 110-volt source then disconnecting.

You can look in the unit and find the switching relay — and manually operate — or supply voltage to the coil to operate it. You can also wire a mechanical switch across the contacts. The configuration can vary from one to another. Could be single pole or double pole as needed.

Ed Pruitt  
Keller, TX

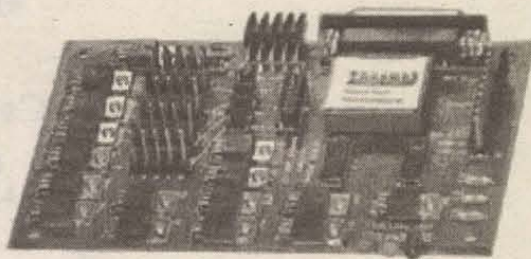
## ADDRESSABLE STEPPER MOTOR CONTROLLER

Part Number: JWP1X-1A

**\$199.95**

The PARAMAX stepper motor controller is a PC parallel port based addressable controller capable of simultaneous operation of 4 uni-polar stepper motors ranging in voltages from 5 to 12 volts at up to 2 amps per phase. The PARAMAX stepper motor controller includes 8 digital inputs with a data throughput rate of 500k bytes per second. Using the unique PARAMAX addressing method, up to 256 controllers can simultaneously function from a single parallel port. The programming package includes libraries that allow you to create applications both under Windows and DOS. Included libraries are: C++, Pascal, Delphi, Basic and utilities for DOS and Windows.

Also available at:  
**FORD ELECTRONICS, INC**  
(714) 521-8080



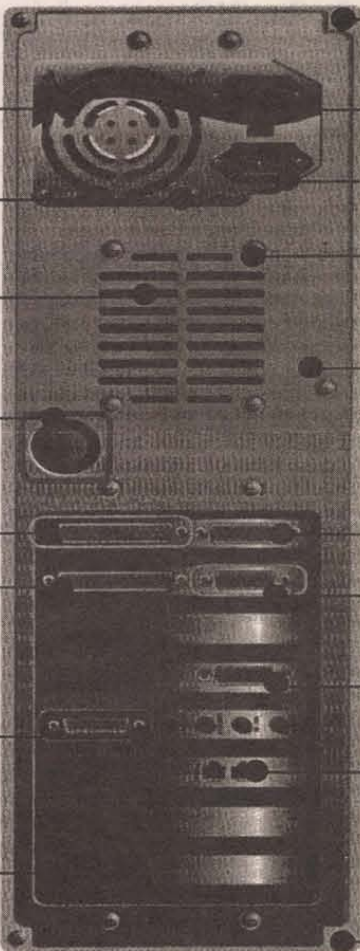
**PARAMAX INC.**  
(800) 473-8080

Come and visit us on the internet at:  
[www.paramax.net](http://www.paramax.net)



If its on your computer  
you can find it at Roger's...

For Less!



Knurled Brass  
Thumbscrews for Cases  
\$.25 ea.

6' Monitor Power Cords  
\$2.00 ea.

6' Computer Power Cords  
\$2.00 ea.

Fan Mounting Screws  
10/\$1.00

AT Medium Tower  
Case, 7 bays  
\$51.30

I/O Serial Parallel  
Cards- Hi-Speed Serial  
Multi-IRQ, 16-bit  
\$8.50

DB9 Serial Ports to  
Motherboard  
\$1.50

AGP 4MB SGRAM 3D  
64 bit Video Card  
\$34.00

Voice Fax Modem  
56k V.90 PCI  
\$54.00

Phillips Head Case  
Screws and Other  
Common Computer  
Screws  
\$2.00/bag

3 1/8 Ball Bearing  
Power Supply Fans  
\$3.00 ea.

230 watt computer  
power supply  
\$20.50 ea.

3 1/8" Ball Bearing  
Case Fan  
\$7.00 ea.

5-pin AT to PS/2  
keyboard adapters  
\$1.75 ea.

DB Nut Male Stud w/  
Washers, and nuts  
\$1.00/bag

DB25 Parallel Ports  
to Motherboard  
\$1.50

Full Duplex 3-D ISA  
Sound Cards  
\$12.00 ea.

Blank Slot Bracket  
\$.25 ea.

Call for a FREE catalog!

**Roger's Systems Specialist**



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



# Open Channel

## Flipping Out Over Flip-Flops

by Joseph J. Carr

Digital logic functions can be made from combinations of AND, OR, and NOT gates. Even the NAND and NOR functions are only variants of NOT-OR and NOT-AND configurations.

One of the problems with gates is that they are transient circuits; that is, they are incapable of storing information even for a short period of time. Flip-flops, on the other hand, are circuits that can store single-bits of information. Many forms of solid-state computer memory devices are little more than arrays of flip-flops

organized in a manner that allows storage of digital words in a computer.

Most flip-flops are bistable devices, i.e., they have two stable output states. The flip-flop is not particularly concerned which state is in existence at any given time. Being bistable, it is happy in either state. If the output is labeled Q, we find that either Q = HIGH or Q = LOW is an acceptable state, and will be stable. Some flip-flops are equipped with two complementary outputs, labeled Q and NOT-Q (or bar-Q).

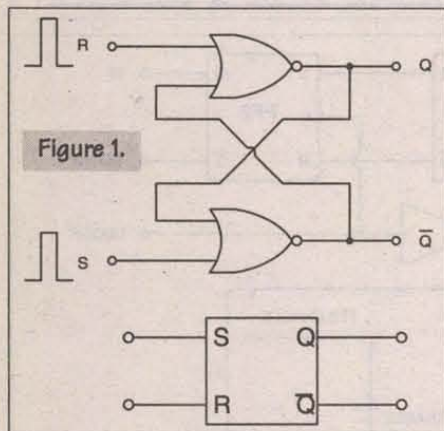


Figure 1.

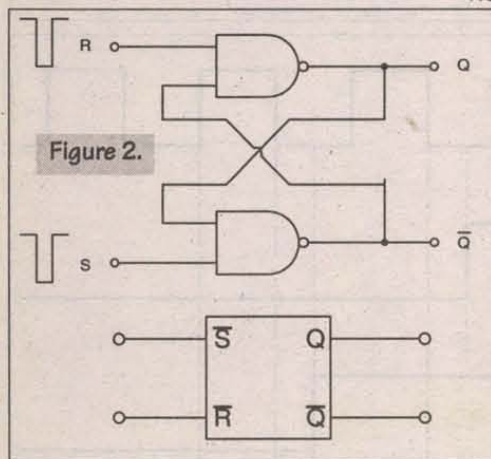


Figure 2.

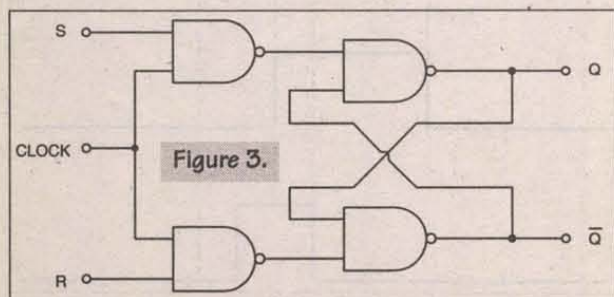


Figure 3.

### R-S Flip-Flops

One of the simplest flip-flops is the reset-set (R-S) flip-flop. These circuits can be made from either NAND or NOR gates, although the performance attributes are different for the two different forms. The NOR-logic configuration and the associated symbol is shown in Figure 1. Note that the circuit has two outputs: Q and NOT-Q. This is an example of a complementary output flip-flop. These outputs always have the opposite state. If Q = HIGH, then NOT-Q = LOW, and vice versa.

In the NOR-logic R-S flip-flop, the output changes state when an appropriate input is momentarily brought HIGH from its resting LOW position. Only a brief pulse at the input is needed to effect the change. The rules of operation of the NOR-logic R-S flip-flop are summarized below:

1. When both S and R inputs are LOW, no change occurs in the output.
2. If both S and R are

brought HIGH, this is a

disallowed state. This input condition should be avoided.

3. Bringing the S input momentarily HIGH will set the output, i.e., makes Q = HIGH and NOT-Q = LOW.

4. Bringing the R input momentarily HIGH resets the flip-flop, i.e., makes Q = LOW and NOT-Q = HIGH.

The basic NOR gate R-S flip-flop can be constructed from either TTL, CMOS, or other logic family NOR gate arrays.

The NAND-logic R-S flip-flop uses inverted logic, i.e., the output state changes are caused by bringing the appropriate input LOW. An example of a NAND-logic R-S flip-flop and its symbol are shown in Figure 2.

Because the inputs are active-LOW, this circuit is sometimes called a NOT-RS flip-flop. In this text, however, it is more convenient to simply refer to both NAND-logic and NOR-logic circuits as simply R-S flip-flops. The NAND/NOR distinction is made in the text, where necessary, or by the schematic.

The output conditions of the NAND-logic R-S flip-flop are shown below.

1. If the S and R inputs are simultaneously LOW, then a disallowed state exists. This state must be avoided.

2. If both S and R inputs are made simultaneously HIGH, then no change in the inputs will occur.

3. If the S input is momentarily brought LOW, while the R input remains HIGH, then Q = HIGH and the NOT-Q = LOW. The flip-flop is in the "set" state.

4. If the R input is momentarily brought LOW, while the S input remains HIGH, then the flip-flop is reset, i.e., Q = LOW and NOT-Q = HIGH.

The R-S flip-flop is used frequently in applications where a pulse applied to the S or R input sets a condition, and then a subsequent pulse is used to reset the circuit to its initial condition.

### Clocked R-S Flip-Flops

The operation of the two previous R-S flip-flops — the NAND-logic and NOR-logic — was unconditional. The output state changed immediately when an appropriate input pulse was received. This is called asynchronous operation.

The clocked R-S flip-flop in Figure 3 is able to operate synchronously; i.e., the output will change state only when the input pulse coincides with a clock pulse. This behavior is obtained by adding a pair of NAND gates to the NAND-logic R-S flip-flop circuit.

The commonly used schematic diagram circuit symbol for the clocked R-S flip-flop is shown in

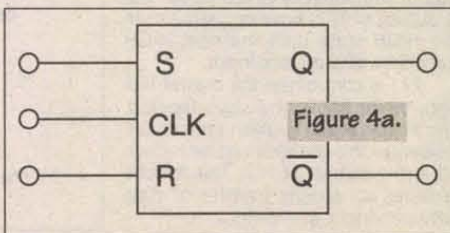


Figure 4a.

**RF** The RF Connection  
213 North Frederick Ave.  
Suite 111N  
Gaithersburg, MD USA  
20877

<http://www.therfc.com/>

Complete Selection of MIL-Spec Coax, RF Connectors and Relays

UG-21B/U N Male for RG-213/214.....\$5.00  
UG-21D/U N Male for RG-213/214.....\$3.25

N Connectors for 9913/Flexi4XL/9096

UG-21B/9913.....\$6.00 Pins Only.....\$1.50  
UG-21D/9913.....\$4.00 Extra Gasket......75

Amphenol 83-1SP-1050 PL-259.....\$0.90  
UG-176/U Reducer RG-59/8X .25 or 5/1.00  
UG-175/U Reducer RG-58/58A .25 or 5/1.00  
Silver Teflon PL-259/Gold Pin.....\$1.00 or 10/\$9.00

MIL-Spec Coax Available (Teflon, PVC IIA)

New Product: Belden 9913F. 9913 with High Density PE Foam dielectric, stranded center cond. and Duobond III Jacket.....80/ft or \$76.00/100ft

Also New: 9092, RG8X with Type II Jacket  
Intro Price.....\$23.00/100ft

Call for Specials of the Month

Full Line of Audio Connectors for Icom, Kenwood, and Yaesu

8 Pin Mike Female.....\$2.50  
8 Pin Mike Male Panel.....\$2.50  
13 Pin DIN for Kenwood.....\$2.75  
8 Pin DIN for Icom.....\$1.00  
8 Pin DIN for Kenwood.....\$1.50

Prices Do Not Include Shipping

Orders 800/783-2666  
Info 301/840-5477  
FAX 301/869-3680

Write in 62 on Reader Service Card.

## Tiny FBasic Computer



(Shown 85% Actual Size - 40 pin DIP)

The TICkit 62 module is like a Parallax Basic Stamp® II, but has 4 times the program space installed (expandable to 64K). It also has 4 times the variable space (96 bytes), and uses a modern structured language similar to BASIC only more powerful.

- Only tool you need is a PC
- Inexpensive \$45/module, \$16/IC
- Development Kit only \$45
- Huge library of I/O function
- Structured FBasic Language
- Easy to learn and use
- Powerful enough for large projects

ASK ABOUT OUR STAMP COMPATIBLE PERIPHERAL COMPONENTS

**VersaTech**  
Electronics

PHONE: (303) 828-9156, FAX: (303) 828-9316  
e-mail: [versatech@csn.net](mailto:versatech@csn.net)  
Web: [www.csn.net/versatech](http://www.csn.net/versatech)  
11170 Flatiron Drive, Lafayette, CO 80026

Basic Stamp is a registered trademark of Parallax, Inc.



## NEW PRODUCTS from **IndustroLogic™**



**SMD-12 Stored  
Message Display**  
\$179

Display messages with switch closures or serial port. Twelve 32 character scrollable msgs, 8 character .56" green LED display, enter messages via internal keypad or serial port. 5.75"W x 2.75"H x 6"D. 20 oz. Stud mounted steel case incl.



**SIO-1000 RS-232  
Data Acquisition  
Interface Board**  
\$179

8 digital in, 8 digital out, dual 12 bit analog inputs & outputs, 10KHZ counter in, frequency out. WIN/DOS software, cable, ABS enclosure, power supply. 4.25" x 6.5" x 1.5" high. 12 oz.

Industrologic, Inc.  
3201 Highgate Lane  
St. Charles, MO 63301

**(314) 707-8818**  
9AM-5PM Central

Visit our web site to download  
complete product documentation:

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

Write in 63 on Reader Service Card.

## ELECTRONIC TOOLS ETC.

TWEEZERS, FORCEPS, SCISSORS

\*PROBES (DENTAL PICKS)

\*DREMEL TOOLS, ROTARY  
TOOL EQUIPMENT

\*OPTICAL AIDS (MAGNIFIERS)

\*SCREWDRIVERS, TIPS, BITS

\*PLIERS, ALL SHAPES, SIZES

\*NEW, HARD TO FIND  
TOOLS EVERYDAY

TOLL FREE: 1-888-UTOPIA-2

SAVE  
\$  
HERE!

**UTOPIA  
TOOLS**

CALL OR WRITE  
3899 BARNARD DR.  
APT. #619  
OCEANSIDE CA  
92058

CALL:

(760) 439-6682

FAX:

(760) 439-6682

CALL NOW FOR FREE CATALOG

## Open Channel

Figure 4A, while the timing diagram is in Figure 4B. The clock circuit produces a chain of squarewaves at the CLK input (also called "C" in some cases). Note that the Q output does not change state immediately when the S input pulse goes HIGH. The output waits until the clock input is also HIGH. Similarly, the output is not reset until the clock pulse and R input pulses are coincident. Because of this feature, the literature for some scientific instruments calls the clocked R-S flip-flop a coincidence detector.

### Master-Slave Flip-Flops

It is often difficult, or impossible, to transfer data through a circuit in an orderly manner. We often get into high-speed digital analogies of the old-fashioned "relay race" problem. Recall that type of problem in circuits where two electromechanical relay switches are supposed to close simultaneously. If one relay is a little sluggish, or the other is a little snappier than the other (or both!), then there is a brief instant where one is open and the other is still closed, or vice versa. This condition often produces unpredictable or even disastrous results. The same action exists in digital circuits where the culprit is differences in device propagation time, i.e., the time required for a pulse to travel through the circuit to effect an output change.

Note that two clocked R-S flip-flops and an inverter can be used to synchronize data transfer. The circuit, which is shown in Figure 5, is called a master-slave flip-flop, also sometimes called the RST flip-flop.

In Figure 5, the inputs to FF1 are the inputs to the circuit as a whole, i.e., the inputs to the master-slave FF. The outputs of the master-slave FF are the outputs of flip-flop FF2. Also, the clock affects FF2 directly, but must be inverted before being applied to FF1. Both flip-flops only go active when their respective clock inputs are HIGH.

A timing diagram for this circuit is shown in Figure 6. Recall from above that FF1 is enabled when the overall clock pulse is LOW, and FF2 is enabled when it is HIGH (because of the inverter action).

When the pulse is applied to the S input, nothing happens at Q1 (the Q output of FF1) until the clock pulse drops LOW again. At that time, Q1 snaps HIGH, thereby making the S input of FF2 HIGH also. But at this time the clock pulse is LOW, so no change occurs at the FF2 output terminal. When the next clock pulse arrives, however, the FF2 clock input goes HIGH (Q1 and S2 are still HIGH), so the Q output of FF2 goes HIGH.

Similarly, the reset pulse arrives when the clock is LOW, so the Q1 output immediately drops LOW. The Q output of FF2, however, remains in the HIGH state until the next HIGH transition of the clock input.

FF1 is considered the master flip-flop, while FF2 is the slave flip-flop. The action at FF1 is given time to settle before the changes can be reflected in the output of FF2. This feature provides an orderly transfer of data between input and output.

### Type-D Flip-Flops

A Type-D flip-flop is a modified RST flip-flop that has only one input (labeled D for "data"). See Figure 7. The type-D flip-flop will transfer data (HIGH or LOW) from the D input to the Q output only when the clock terminal is HIGH. The following rules govern the behavior of the type-D flip-flop.

1. When the clock input goes HIGH, the data (HIGH or LOW state) present on the D input is transferred to the Q output.

2. If the clock input remains HIGH, then the Q output will follow changes in the data at the D input.

3. If the clock input

remains LOW, then the Q output will retain the last data that was present on the D input at the instant the clock dropped LOW.

Because of the behavior presented in the above rules, the type-D flip-flop is sometimes called a data latch, or simply latch. The circuit symbol for the type-D flip-flop is shown in

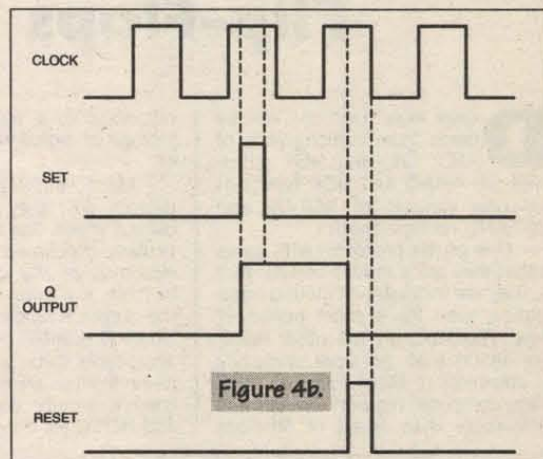


Figure 4b.

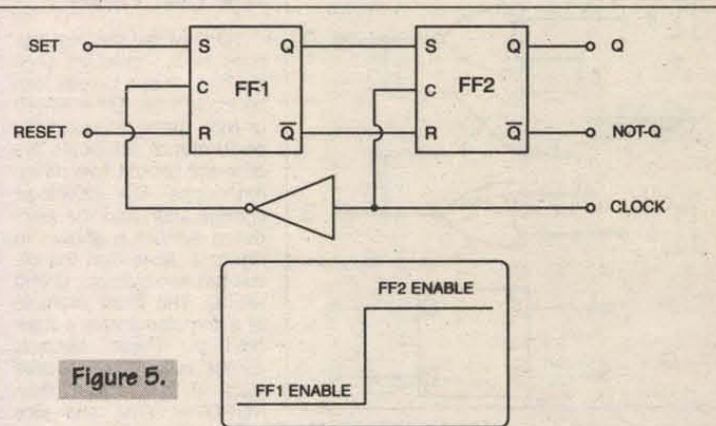


Figure 5.

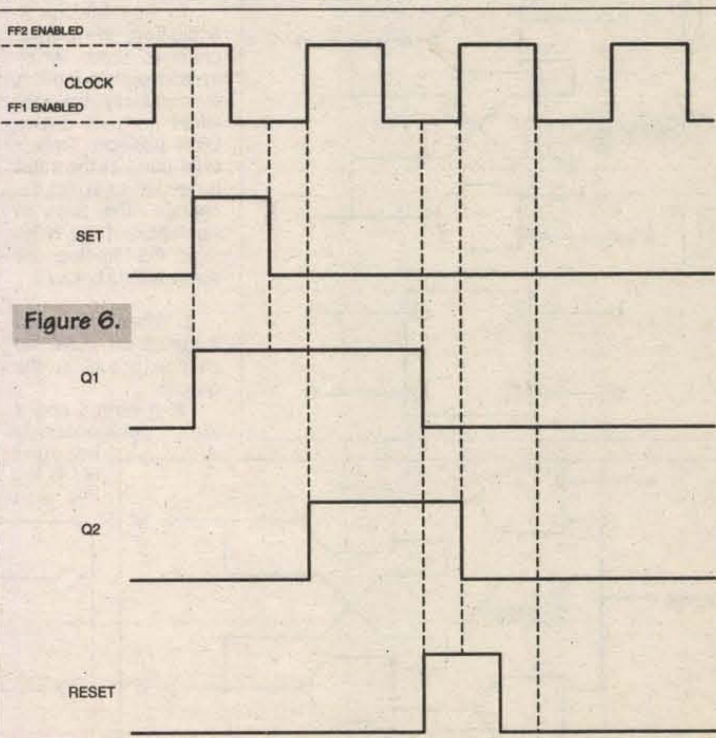


Figure 6.



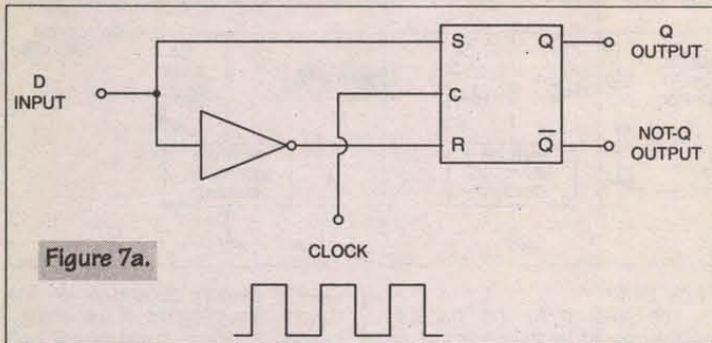


Figure 7a.

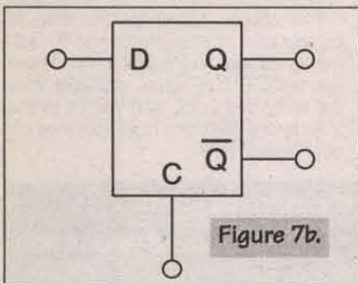


Figure 7b.

Figure 7B.

We can see these rules more graphically in Figures 8A through 8C. Consider first Figure 8A. Recall that the data on the D input will be transferred to the Q output only when the clock terminal is HIGH. At time T0 in Figure 8A, the clock goes HIGH, and the D input is LOW, so the Q output is also LOW.

At time T1, the D input goes

HIGH, but cannot affect the Q output because the clock is LOW. The clock goes HIGH at T2, so the output will also go HIGH. The output pulse exists only for the interval T2-T3 because the HIGH condition on the D input only coincides with that interval.

At time T5, both the D and clock inputs go HIGH, but note that the D line remains HIGH even after the block pulse disappears. By the third rule, then, the output must remain HIGH after the clock pulse passes.

Another situation is described by Figure 8B. In this case, the clock line goes HIGH and remains HIGH. The Q output, therefore, is in an unlatched condition, so will follow the data applied to the D input. Because the D input data is a squarewave, the output will also be a squarewave.

Still another condition is shown in Figure 8C. Again the D input data is a squarewave or pulse train, but

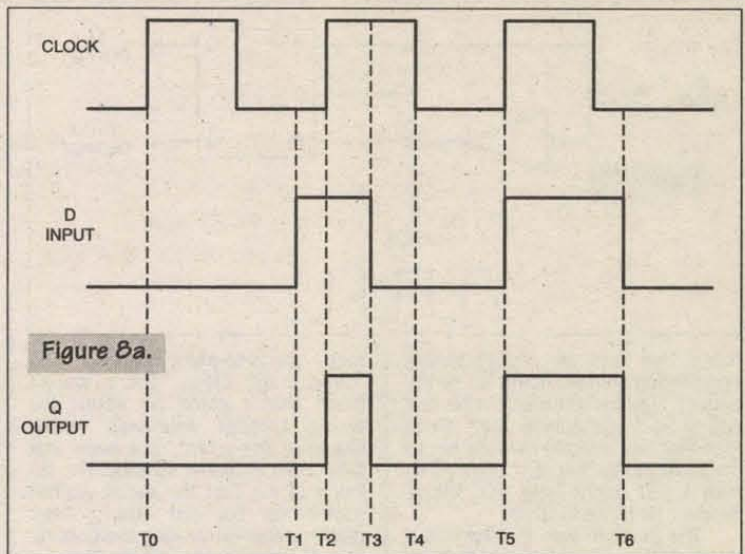


Figure 8a.

the block is not permanently HIGH in this example. At time T1, both the clock and the D input are HIGH, so the Q output is also HIGH. At time T2, the clock drops LOW, but since D is HIGH at that instant, the output will remain in the HIGH condition. Note that the D input can change at will, without affecting the output, as long as the clock input remains LOW. But at the time T5, the clock goes HIGH, and since the D line is LOW, the output goes LOW also. At time T6, however, the D line goes HIGH, while the clock is still HIGH, so the

output goes HIGH.

## Digital Circuit Power Supplies

When I was in grad school, I worked for the university as an electronics technician repairing medical equipment (which paid three times what a graduate teaching assistant made!). One day, there was a knock on my workshop door, and a fellow was standing there with a rat's nest wired homebrew digital project in his



- PRODUCT ENGINEERING
- FIRMWARE DEVELOPMENT

- MICRO CONTROLLER & EPROM HARDWARE & SOFTWARE DEVELOPMENT

"QUALITY IS OUR CAPITAL CONCERN."

## Complete On Site Electrical Engineering Lab

- REVERSE ENGINEERING
- RF CIRCUIT DESIGN & MANUFACTURING

From Auto-Routing to CNC Routing to Electronic Assemblies...  
**Capital Electronics** is Your Best Route For Printed Circuit Boards.

### DESIGN/LAYOUT

- CAD LAYOUT SERVICES
- COMPATIBLE WITH ALMOST ALL CAD SYSTEMS
- FROM SCHEMATICS OR SAMPLE PCB's
- PHOTOPLOTTING SERVICES
- 28,800 BAUDE MODEM

### PRINTED CIRCUIT BOARDS

- SINGLE & DOUBLE SIDED
- MULTI-LAYER & FLEXIBLE PCB'S
- FROM QUICK TURN PROTOTYPES TO SCHEDULED PRODUCTION RUNS
- FINE LINES, SMT
- ELECTRICAL TESTING
- PRECIOUS METAL PLATING

### ASSEMBLY SERVICES

- FAST TURN BOARD STUFFING
- WIRE HARNESSSES
- WAVE SOLDERING
- ACQUISITION OF PARTS
- FINAL TESTING
- TURNKEY SERVICES
- CUSTOM ENCLOSURES

**For Quick & Competitive Pricing or More Information, Please Call Us Today!**

303 Sherman Street • Ackley, Iowa 50601  
**(515) 847-3888**

Fax (515) 847-3889 • Modem (515) 847-3890



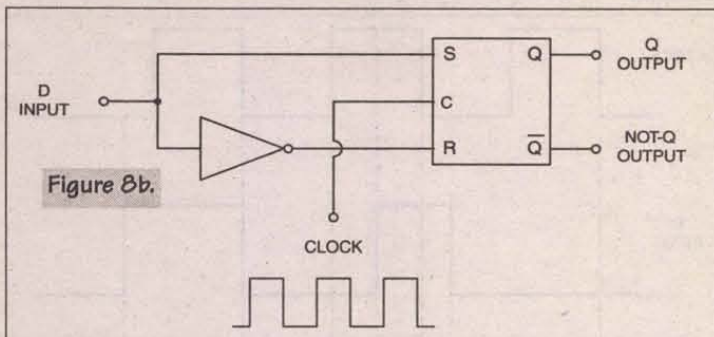
### Internet Access:

For Automated Info Response:  
INFO@capital-elec.com

E-Mail: Quote@capital-elec.com

Web Access: <http://www.capital-elec.com>

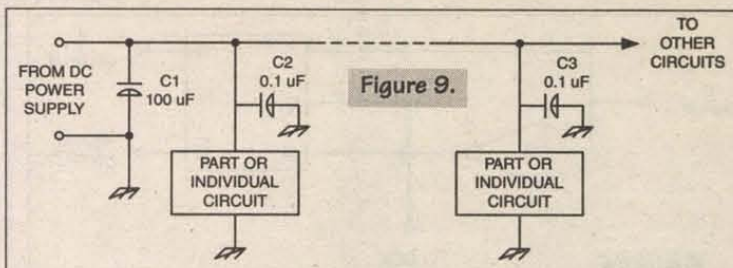
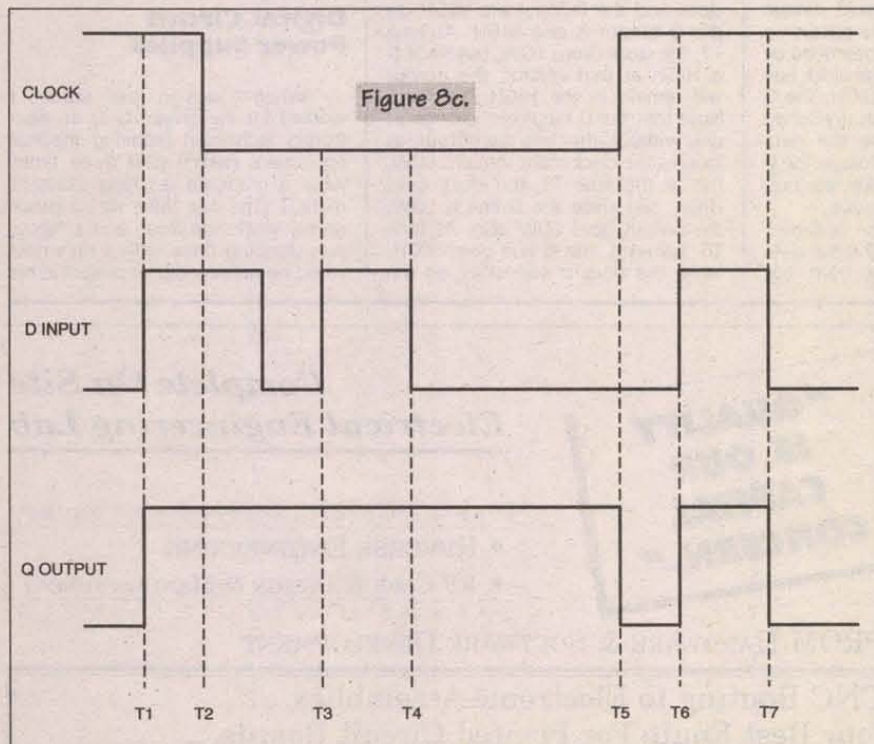




hands. He was an undergraduate engineering student doing his senior project. "Doctor Frabitz (not his real name) said you'd help me." Since Prof. Frabitz basically held the key to my professional future, I allowed as how I just might help this fellow. Besides, he looked forlorn.

The problem was that he had a relatively large digital project built on perf-board with an odd combination of wire-wrap (poorly done), solder-

tack, point-to-point wiring, and "dead bug" chips. There wasn't much that I could do about the wiring (proper wire-wrap wiring would've been best, but even that falls down at higher speeds). The fellow told me that the circuit worked sometimes, but not others. After painstakingly eliminating the possibility of loose solder connections, I noticed that there were a lot of TTL devices on the card and NOT ONE



#### CAPACITOR!

The solution to the student's problem would be to re-wire the circuit properly, and then use an adequate number of bypass capacitors in the DC power supply circuitry. Figure 9 shows the usual approach. At the point where the DC power supply is connected to the board, a high value electrolytic capacitor is used. Different textbooks recommend values anywhere from 100  $\mu$ F to 1,000  $\mu$ F for the capacitor (C1 in Figure 9).

The point of using the capacitor is to form a local current reservoir to handle instantaneous needs, so I tend to use values in the lower end of the range (the correct

value is partially dependent on the current requirements of the circuit). In addition, there should be a 0.1  $\mu$ F capacitor at each device or other active circuit. This capacitor should be as close as possible to the V+ terminal on the individual chip. There are small 0.1  $\mu$ F units available that are quite compact, and will fit in the standard 0.100-inch hole spacings on perf-board. **NV**

#### Connections ...

I can be reached by snail mail at P.O. Box 1099, Falls Church, VA 22041, or via E-Mail at [CARRJJ@AOL.COM](mailto:CARRJJ@AOL.COM).

#### Reading List: RF Exposure to Hams (A Balanced Approach)

There are some new regulations from the FCC regarding RF radiation exposure from ham rigs. Some hams must file paperwork with the FCC. In addition, if you live near any radio transmitting antenna, you will want to be aware of the problems so that you can guard against affecting your own health.

There is a lot of baseless talk about this subject. Both sides are about equally shrill and equally baseless. The problem is not as severe as the pro side would have you believe, but it's also not a "no problem" situation either. If you are concerned with this potential problem, and how the problem can be cured, then I recommend that you obtain a copy of a new book published by ARRL.

The ARRL has been active in this issue for quite a long time, and has — what I believe — is a common sense approach that wisely walks a middle ground (the science is too soft to be certain about either extreme). It is called *RF Exposure and You* (ISBN 0-87259-662-1) by Ed Hare (W1RFI).

Hare breaks the subject down in a way that ordinary people can understand. The price is \$15.00, which is certainly cheap for that size book (especially one that contains information that may help you retain your health). It is available from ham radio stores, or direct from ARRL at <http://www.arrl.org>. I also found it listed at Amazon Books, so check out <http://www.amazon.com>.

**Equipment Management Technology**  
From Acquisition to Disposition

**BUY \* RENT \* SELL**  
Quality  
Test and Measurement Equipment

We inventory HP, Tektronix, Fluke, Anritsu, Wiltron, Iwatsu, Wavetek, GenRad and many other manufacturers. Our product lines include RF & microwave, oscilloscopes, generators, supplies, communications, voltage and frequency standards. Call us now for a quote!

Tel: 650-631-1700 \* Fax: 650-631-1200 \* email: [sales@emt1.com](mailto:sales@emt1.com)

#### EZ-EP DEVICE PROGRAMMER - \$169.95

Check Web!! -- [www.m2l.com](http://www.m2l.com)

**Fast** - Programs 27C010 in 23 seconds

**Portable** - Connects to PC Parallel Port

**Versatile** - Programs 2716-080 plus EE and flash (28, 29) to 32 pins

**Inexpensive** - Best for less than \$200

• Correct implementation of manufacturer specified algorithms for fast, reliable programming.

• Easy to use menu based software has binary editor, read, verify, copy, etc. Free updates via bbs or web.

• Full over current detection on all device power supplies protects against bad chips and reverse insertion.

• Broad support for additional devices using adapters listed below.

#### Available Adapters

EP-PIC (16C5x, 81, 82x, 71, 84)	\$49.95
EP-PIC84 (16C62-5, 72-4)	\$39.95
EP-PIC12 (12C50x)	\$39.95
EP-PIC17 (17C4x)	\$49.95
EP-51 (8751, C51)	\$39.95
EP-11E (89HC11 E/A)	\$59.95
EP-11D (89HC11D)	\$39.95
EP-16 (16B1 EPROMs)	\$49.95
EP-28 (286E02, 3, 4, 6, 7, 8)	\$39.95
EP-SE2 (93x, 24x, 25x, 85x)	\$39.95
EP-750 (87C750, 1, 2)	\$59.95
EP-PEEL (IC722x10, 18x)	\$59.95
EP-1051 (89C1051, 2051)	\$39.95
EP-PLCC (PLCC EPROMs)	\$49.95
EP-SOIC (SOIC EPROMs)	\$49.95
EP-TSOP (TSOP EPROMs)	\$59.95

Many Other Adapters Available

#### M<sup>2</sup>L Electronics

970/259-0555  
Fax: 970/259-0777  
361 S Camino Del Rio #119  
Durango, CO 81301  
CO orders please add 7% sales tax  
<http://www.m2l.com>





# New Product News

Continued from page 4

## AUDIO NOISE REDUCTION SYSTEM

The model NRS1500 noise reduction system assumes that a signal below a predetermined amplitude is noise. It also senses and attenuates noise by measuring the frequency content of the audio signal and then filters noise that occurs above the highest signal frequency. Combining both of these techniques can achieve 25 dB noise reduction by using "single-ended" operation which eliminates the need for the encode decode process.

The NRS1500 circuitry combines a dynamic filter and downward expander to provide a high level of effectiveness without sonic artifacts normally associated with noise reduction systems.

The user switchable volume compression is useful for fast automatic leveling. It attenuates large amplitude signals, such that signals above the adaptive threshold are scaled by 0.2 dB/dB, while the signals below the externally set threshold remain essentially unchanged. Instead of attempting to attenuate all large amplitude signals, the selectable volume leveling circuit attenuates the audio signal when the overall signal amplitude has increased for a considerable amount of time (less than one second).

The NRS1500 is an ideal choice for broad-

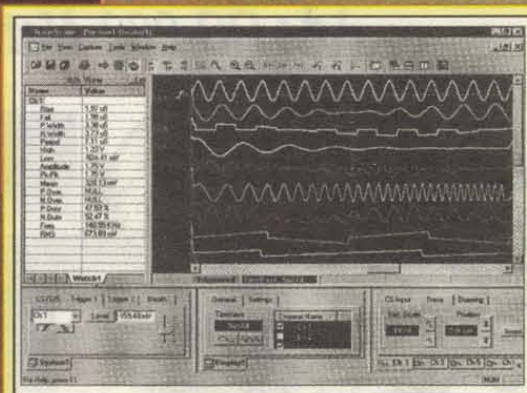


cast studios, commercial recording studios, radio amateurs, and other consumer and professional audio applications while preserving full signal fidelity and transparency.

The NRS1500 is priced at \$189.00.

For more information, contact:

**C & S ELECTRONICS**  
P.O. BOX 2142, DEPT. NV  
NORWALK, CT 06852-2142  
203-866-3208 FAX: 203-854-5036  
E-MAIL: CANDSELECT@worldnet.att.net



## GAGESCOPE FOR WINDOWS

GageScope for Windows supports up to 32-channel oscilloscope systems and gives the user complete control of the CompuScope card.

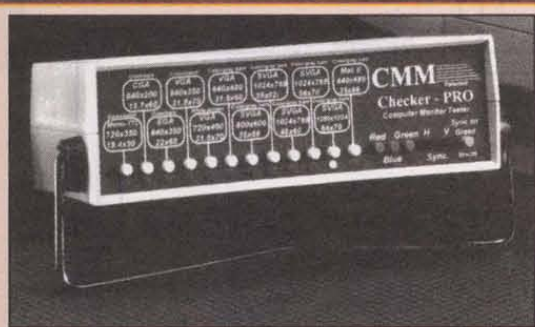
The stand-alone software includes waveform cursors, multiple windows with different timebases, the ability to save and load signals, compatibility with SIG files used with our CompuGen arbitrary waveform generator, and more.

With the optional waveform parameters plug-in, users can automatically calculate rise time, fall time, pulse width, frequency, and many other signal characteristics.

With the optional FFT signal plug-in, users can perform spectral analysis with up to one million point FFTs.

For more information, contact:

**GAGE APPLIED SCIENCES, INC.**  
1233 SHELburne RD., STE. 400, DEPT. NV  
SOUTH BURLINGTON, VT 05403  
1-800-567-GAGE FAX: 1-800-780-8411  
WEB: [www.gage-applied.com](http://www.gage-applied.com)



## CHECKER PRO

Computer & Monitor Maint., Inc. announces the Checker Pro.

The Checker Pro is an AC or battery-operated computer color monitor pattern generator. With sweep rates to 64 KHz, various patterns, and gray scale, you can check out almost any monitor.

The Checker pro fills a need in both the field service and shop maintenance areas. By connecting the Checker Pro to the monitor, problems can be isolated. No more swapping video cards or monitors, or even opening the computer for diagnosis. Also, by using the Checker Pro, you no longer need to tie up a computer systems to test or burn in a monitor: with its support of mono, CGA, EGA, MAC, VGA modes from 31.5 KHz to 64 KHz you can easily test and evaluate almost any monitor.

On the bench, the Checker Pro allows a great deal of flexibility. The technician can quickly switch modes using the push buttons, add sync on green, turn off any of the colors, and turn off either horizontal or vertical sync. The Checker Pro provides various test patterns for VGA monitors. Its unique color bar/eight-step gray scale pattern allows color balance and tracking to be quickly evaluated and/or adjusted.

The suggested retail price is \$499.95 US.

For more information, contact:

**COMPUTER & MONITOR MAINT., INC.**  
6649-N1 PEACHTREE IND. BLVD., DEPT. NV  
NORCROSS, GA 30092  
770-662-5633 1-800-466-4411  
<http://www.computermonitor.com>

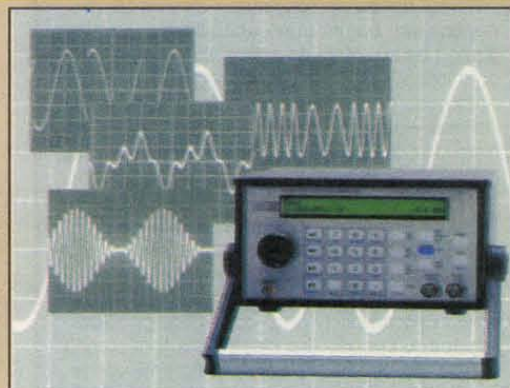
## SMARTARB FUNCTION GENERATOR

The BNC Model 625A SmartARB provides function, arbitrary waveform, and pulse generation capabilities. Modes include not only the standard sine, square, ramp, triangle, and random waveforms but, also AM, FM, PM, SSB, FSK, BPSK signal modulation, DTMF generate, DTMF detect, voltage and power measurement, data, and word generation.

Additionally, BNC's ARB offers true phase shifting without skipped points.

For more information, contact:

**BERKELEY NUCLEONICS CORP.**  
3060 KERNER BLVD. #2, DEPT. NV, SAN RAFAEL, CA 94901  
415-453-9955 FAX: 415-453-9956 1-800-234-7858  
WEB: [www.berkeleynucleonics.com/smartarb/smartarb.htm](http://www.berkeleynucleonics.com/smartarb/smartarb.htm)



## ENHANCED DACQ-25 PRODUCT LINE

Base2 Computer Corp. announces the availability of the newly redesigned DACQ-25 acquisition module and version 2.0 of its DataMaster analysis software package.

The new DACQ-25 can now be directly connected to many commonly used sensors which previously required custom interface circuitry. The latest release of DataMaster software offers a fully user configurable interface for displaying and printing data analysis results, perfect for building your own application or experiment.

DACQ-25 data acquisition module functions include: eight analog inputs (four differential) with 10 or 12-bit resolution; four input ranges 1 to 4A, -2 to 2V, 0 to 200 mV, -100 to 100 mV; eight CMOS digital inputs and eight CMOS digital outputs.

Sampling rates are fully adjustable from

over 10,000 samples a second down to one sample every 30 seconds.

The device normally draws power from the computer's parallel port, thereby eliminating external power connections.

An external power connector is provided giving the option for increased digital output drive for powering external sensor circuitry.

Operation with three-volt laptop systems is assured due to the internal DC/DC power supply. All analog and digital inputs are protected against over/under voltage.

For more information, contact:

**BASE2 COMPUTER CORP.**  
P.O. BOX 950, DEPT. NV  
PASADENA, CA 91102  
818-730-8024  
E-MAIL: [base2@pacbell.net](mailto:base2@pacbell.net)  
WEB: [www.loop.com/~base2](http://www.loop.com/~base2)



# Mixed Control

by Ryan Sheldon, National Control Devices (404) 244-2432 <http://members.aol.com/ncdcat>

## for the Masses

In the past couple of months, I have discussed Graphic LCDs and how they can be controlled from a Visual Basic application. This month, I want to go back a little further and tie together some of my earlier articles to demonstrate a powerful computer control system.

This month's control system is based on technologies outlined in previous months of "The Computer Controlled World." This article demonstrates how heating and cooling systems can be controlled using the serial port of your desktop computer.

The hardware may seem overkill for the application, but its true capabilities are only limited by software. In effect, increasing the sophistication of the software greatly enhances the capabilities of the hardware. As many users have already discovered, the hardware is relatively universal and is ideally suited for both complicated and simple control applications.

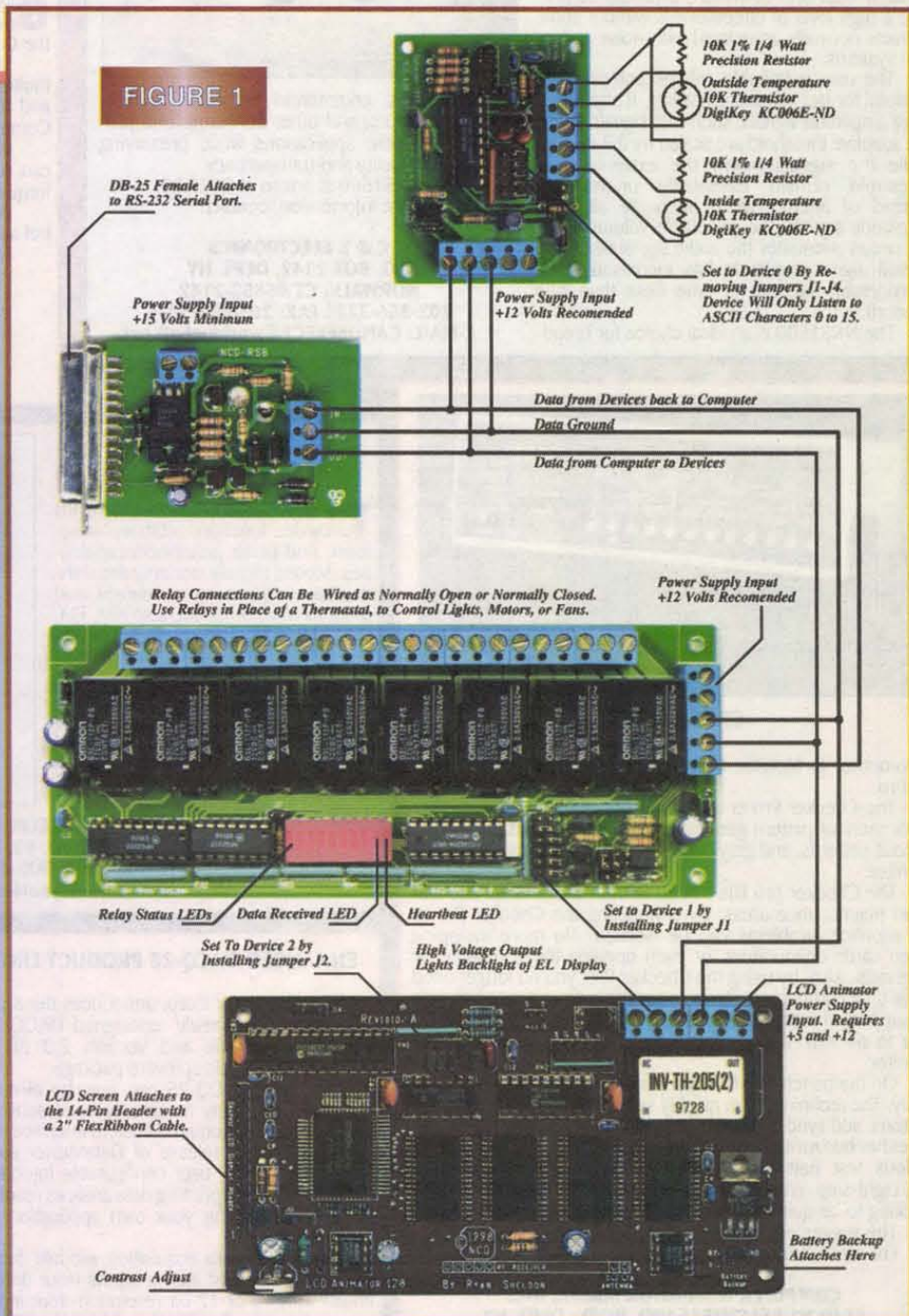
The technologies illustrated are designed to be networkable components of a larger control system such as a desktop PC. A networkable control system such as this offers upgradability and modularity by allowing you to choose the electronics that closely match the needs of your specific application.

Later in this article, I will discuss software issues that make the whole system work. I think you will be surprised at how little software is actually involved. But for now, I want to talk about the networking and its role in our thermostat on steroids.

### Rules for RS-232 Networking

If you have been reading my articles, you know that you can attach up to 16 RS-232 networkable devices on a single RS-232 serial port in any combination. Controlling these devices is very easy if you know the following rules:

- 1) Your serial port can send or receive ASCII characters 0 to 255.
- 2) Each device attached to a single RS-232 serial port listens to a range of 16 ASCII characters:
  - a) A device set to address 0 listens to





- ASCII characters 0 to 15.  
 b) A device set to address 1 listens to ASCII characters 16 to 31.  
 c) A device set to address 2 listens to ASCII characters 32 to 47.  
 d) A device set to address 15 listens to

ASCII characters 240 to 255.

- 3) The device number is always set in hardware using a set of four jumpers.  
 4) The device number is always set in software using a number from 0 to 15.

You can mix and match A/D converters, relay drivers, graphic and character LCD displays, as well as input scanners, output modules, and all the other things discussed in previous articles ... all on a single serial port. Just remember that each device should be set to a different device number and each device number is referred to in software as a number from 0 to 15.

## The Project

This month, I want to highlight a simple control system using four devices. The first device is a serial booster used for communicating RS-232 data to and from multiple devices. The second device is an AD8 analog-to-digital converter used for reading analog data such as light and temperature levels into the computer. The third device is an R85 relay driver, which is used as a general-purpose software controlled bank of eight switches. And the final device is the LCD Animator 128, used to display status information of the entire system in a remote location.

## System Wiring

Wiring the system is relatively simple. Attach the DB-25 connector of the serial booster to your RS-232 serial port. Once attached, you will have three terminals used to communicate data to and from all devices. Their function is self-explanatory: Ground, Output, and Input ... pretty simple. Just wire the output of the RSB to the RS-232 input of all three devices. Wire the input of the RSB to the output of the R85 and the AD8 controllers. The LCD Animator 128 does not send data back to the computer, so only two wires are required for complete operation. Please see Figure 1 for a detailed wiring diagram.

## System Jumpering

Setting up the jumpers is very simple. All devices should be set to receive data at 19200 baud. The AD8 should

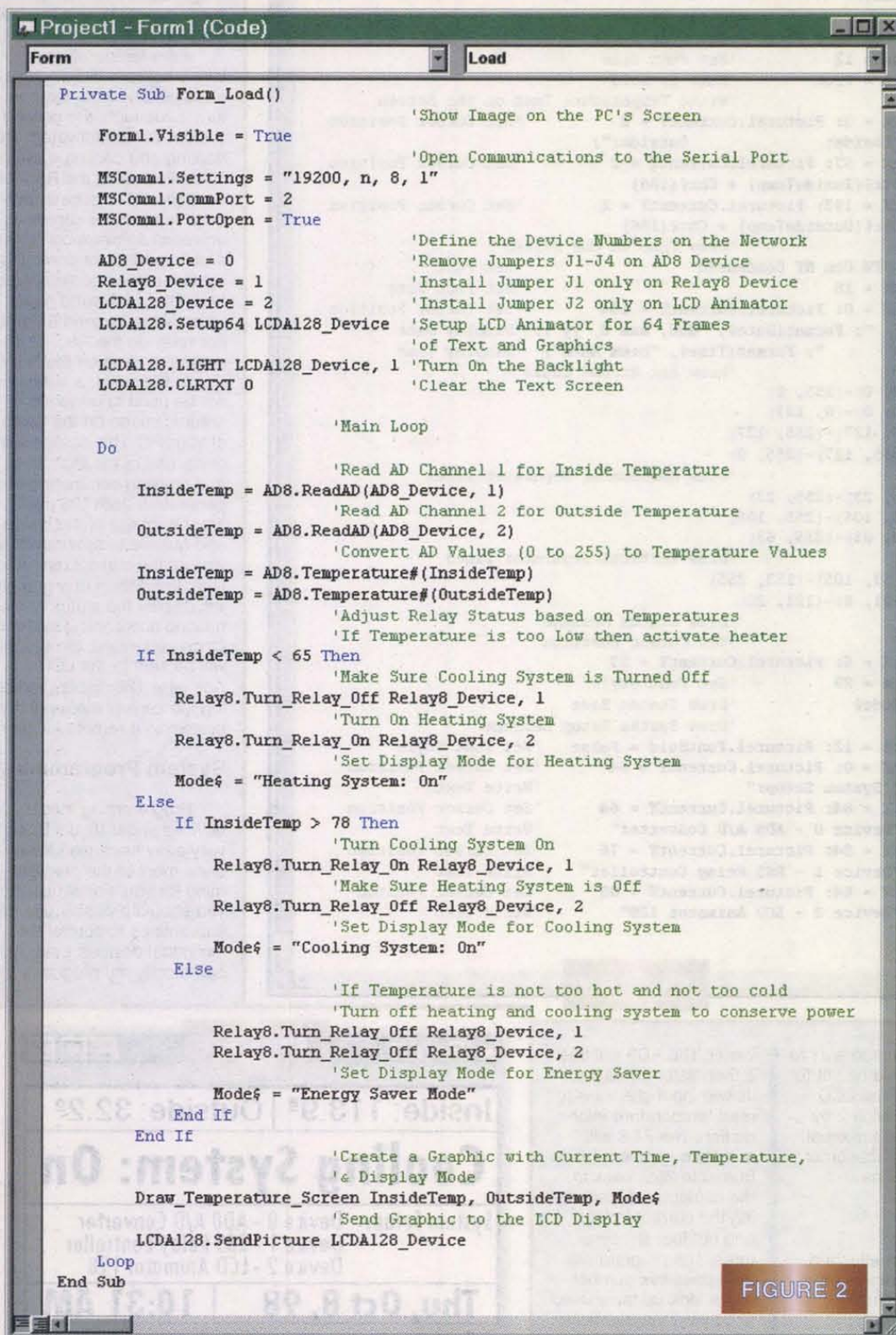


FIGURE 2



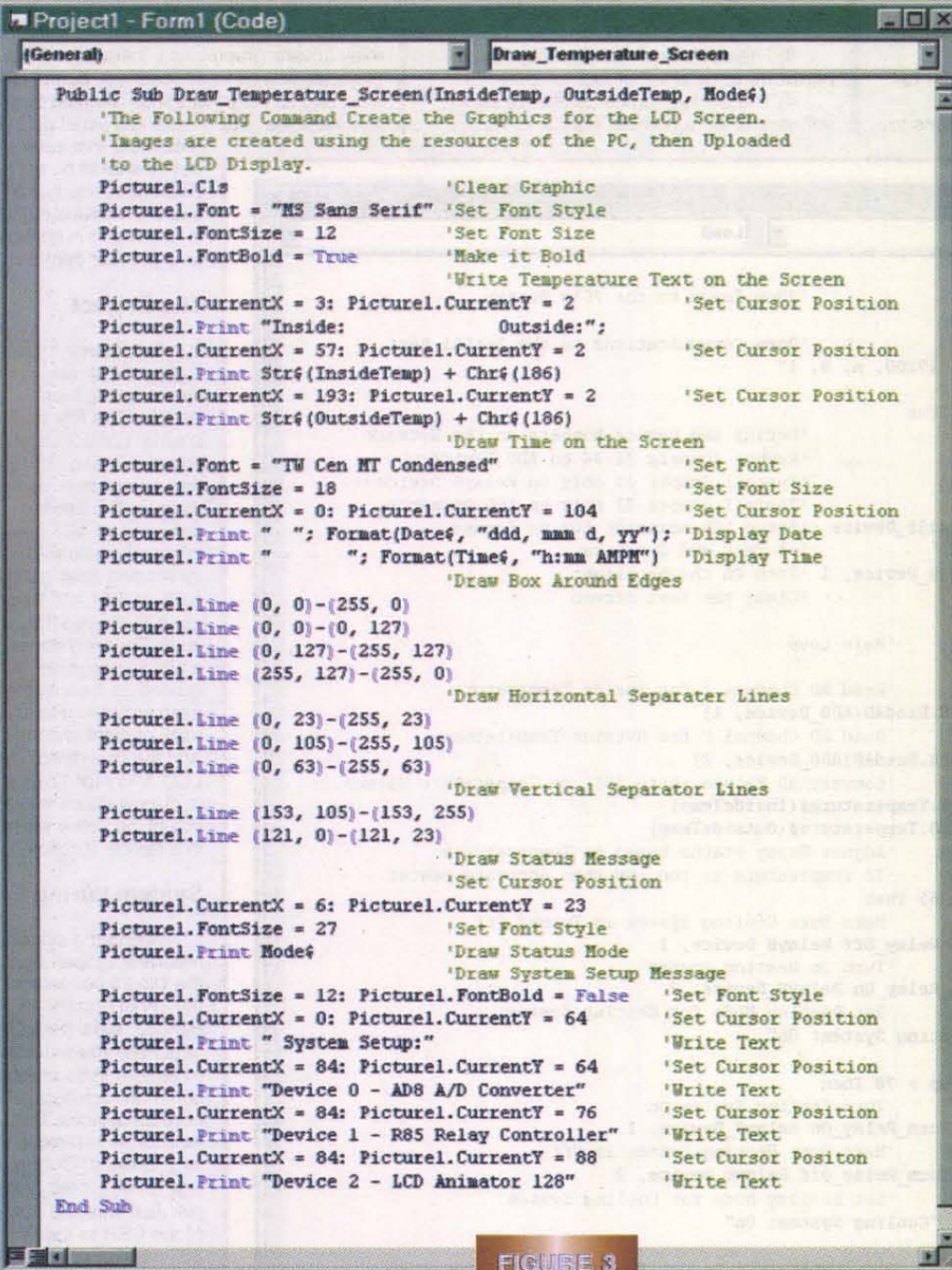


FIGURE 3

be set to device 0 by removing jumpers J1 to J4. The R85 relay controller should be set to device 1 by installing jumper J1. The LCD Animator 128 should be set to device 2 by installing jumper J2. See the user's manual of each device for an explicit explanation of jumpers and other hardware options.

### Theory of Operation

Once the hardware has been attached to your computer, you will use simple commands to communicate to and from the attached devices. The demonstration program will read the inside and outside temperature using the AD8 analog-to-digital con-

verter. The AD8 will use a thermistor on each of its two input channels to read temperature information. The AD8 will send two numbers (each from 0 to 255) back to the computer representing the current indoor and outdoor temperatures. The program will then pass this number into a look-up table used to convert the numbers 0 to 255 into actual temperatures.

The program will then evaluate the current temperature and determine if the heating or cooling system needs to be turned on. If the current temperature is within an acceptable temperature range, both the heating and cooling systems will be deactivated.

If the temperature is too low, a heater will be activated. Similarly, if the temperature is too high, the cooling system will be activated. The heating and cooling system is controlled using the R85 relay controller. This general-purpose relay driver serves as a universal software-controlled switch, perfect for controlling lights, heaters, coolers, fans, and other real-world hardware. Never exceed 5 amps per relay on the R85, or 10 amps per relay on the R810.

At this point, a subroutine will be used to generate a graphic image on the screen of your PC. This screen will make use of the PC's fonts and drawing commands to generate a 256x128 pixel graphic image of the inside and outside temperatures, as well as the current date and time. In addition, the graphic will display the status of the heating and cooling system. Once generated, the graphic will be sent to the LCD Animator 128 display, indicating the current status of the system to a remote location.

### System Programming

Programming these devices under Visual Basic is very easy because I have done most of the programming for you. For simplicity, you should probably use my subroutines to control the individual devices. Later, you can modify my programs for

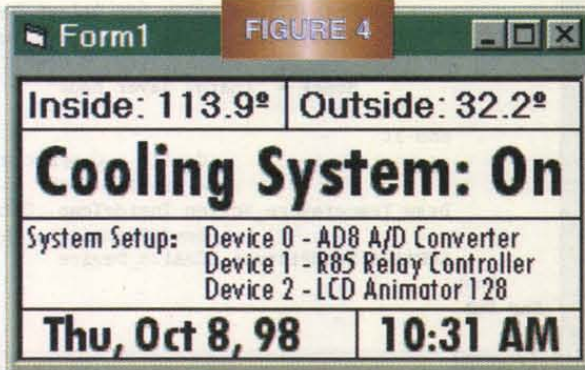


FIGURE 4



FIGURE 6



FIGURE 5



your specific application. If this sounds a little intimidating, let me reassure you that using these devices only requires a few lines of code. So follow along, and I will explain what I have done that makes these devices so easy to control.

I have been working hard to create a series of modules that allow you to do just about anything with a single line of code. Once modules are loaded into your program, you can easily access my subroutines for controlling each individual device.

For example, three devices will be outlined in this article. So, three modules will be used to control each of the three devices. I have named each of these three control modules to identify the product name of each device.

For example, if you wanted to talk to the relay driver, you would use the Relay8 module. To turn on a relay, you would use the command:

```
Relay8.Turn_Relay_On Device, Relay
```

Device is a number from 0 to 15. Since the relay will be configured in this article as device 1, you could use the following command:

```
Relay8.Turn_Relay_On 1, Relay
```

More appropriately, we have defined the constant "Relay\_Device = 1" so to control the relay driver, you should use the following statement (just to maintain good programming practice):

```
Relay8.Turn_Relay_On Relay_Device, Relay
```

Relay is a number from 1 to 8 identifying which relay should be activated.

Table 1 shows some other example calls to my subroutines, just so you can more easily read what I am doing in the programming

FIGURE 7



example in Figure 2.

If you don't want to use constants, you can directly send the device number to control each device as shown in Table 2.

Figure 2 illustrates the main program used to read temperature data, control the relays, and the graphic LCD display. The main program starts by opening COM2 at 19.2K baud. Next, device numbers are assigned in software to each of the three attached devices. The AD8 is set to 0, the R85 is set to 1, and the LCD Animator is set

```
Print AD8.ReadAD AD8_Device, 1
Print AD8.ReadAD AD8_Device, 2
Relay8.Turn_Relay_On Relay_Device, 1
Relay8.Turn_Relay_Off Relay_Device, 7
LCDA128.Light LCDA128_Device, 1
LCDA128.Light LCDA128_Device, 0
```

```
Print AD8.ReadAD 0, 1
Print AD8.ReadAD 0, 2
Relay8.Turn_Relay_On 1, 1
Relay8.Turn_Relay_Off 1, 7
LCDA128.Light 2, 1
LCDA128.Light 2, 0
```

```
'Print A/D Value of Channel 1 on AD8, Device 0
'Print A/D Value of Channel 2 on AD8, Device 0
'Turn on Relay 1 on Relay 8 controller, Device 1
'Turn off Relay 7 on Relay 8 controller, Device 1
'Turn on Backlight of LCD Animator 128, Device 2
'Turn off Backlight of LCD Animator 128, Device 2
```

to device 2.

The LCD Animator is initialized by calling the Setup64 subroutine within the LCDA128 module. Once initialized, the backlight is turned on and the text layer of the LCD is cleared.

The entire program repeats in an endless cycle within the Do/Loop statements. The cycle begins by reading the inside temperature, then the outside temperature. The Inside/OutsideTemp variables now hold an A/D value from 0 to 255. The AD8.Temperature# function converts this number to an actual temperature value.

The temperature is then evaluated. If the inside temperature is less than 65 degrees, a heater is activated by turning on relay 2. The cooling system is turned off at the same time by turning off relay 1.

If the temperature is greater than 78 degrees, the cooling system is turned on by activating relay 1. The heater is turned off by turning off relay 2.

If the temperature is within 65 to 78 degrees, both the heating and cooling systems are deactivated. The Mode\$ variable stores the current status of the heating/cooling system in user-readable text. The current Mode will be later displayed on the LCD displays.

Next, the program calls the Draw\_Temperature\_Screen subroutine. This subroutine takes advantage

TABLE 1

```
'Print A/D Value of Channel 1 on AD8
'Print A/D Value of Channel 2 on AD8
'Turn on Relay 1 on Relay 8 controller
'Turn on Backlight of LCD Animator 128
'Turn off Backlight of LCD Animator 128
```

TABLE 2



of Visual Basic's powerful graphics and text capabilities to generate a 256x128 graphic that holds the current time, date, temperature, and heating/cooling status. Figure 3 illustrates the commands used to generate this screen. Figure 4 shows the graphics on the screen of the PC. Once the graphics are generated, the command  
**LCD A128.SendPicture LCD A128\_Device**  
 sends the status information to the LCD Animator 128.

Figure 5 illustrates an example image uploaded to the LCD Animator when the temperature falls too low.

Figure 6 illustrates an example image uploaded to the LCD Animator when the temperature is within an acceptable range.

Figure 7 illustrates an example image uploaded to the LCD Animator when the temperature raises too high.

As you can see, programming these devices is really very simple and the applications are unlimited. Some people are using the R85 relay controller for controlling lights, gates, alarms, and even opening and closing windows. The AD8 is used to read data into the computer such as light and temperature levels. In many cases, people often use mul-

tiples AD8s to read multiple signals into the computer from several locations. The RSB serial booster allows you to attach up to 16 devices to a single serial port at baud rates up to 38.4K over a distance of 800+ feet.

### Expandability

You can attach other devices to this network as well. You could add more AD8 A/D converters, LCD Animators, and relay drivers. You could also add new devices to this network such as audio/video switchers, stepper motor controllers, servo motor controllers, and DC motor controllers. Each device needs its own device number in software from 0 to 15, and a corresponding device number set using jumpers J1-J4 on each individual device.

I hope you have enjoyed this month's

Computer Controlled World. Please feel free to call or write with your questions or comments. All Visual Basic source code is available directly from me, just send me an E-Mail at [ncdryan@aol.com](mailto:ncdryan@aol.com) and I will return your mail with source code attached. NV

### Boards and Chips Available

Contact Ryan Sheldon  
**National Control Devices**

Phone: (404) 244-2432

Fax: (417) 646-8302

E-Mail: [NCDRyan@aol.com](mailto:NCDRyan@aol.com)

<http://members.aol.com/ncdcat/>

**The LCD Animator 128 is available exclusively to Nuts & Volts readers for just \$199.00 if you mention this article when ordering.**

## THE COMPUTER CONTROLLED WORLD

## GIFT SUBSCRIPTIONS HALF PRICE!!

**That's right!**

**Buy or renew your own subscription to *Nuts & Volts* at the regular price, and order a second subscription to give to a friend or family member and pay half the regular rate!!**

**Along with your subscription order, include the name and address of the person to receive the gift subscription, and we'll send them a special holiday card announcing their gift.**

***Offer applies to any length, PREPAID USA-delivered subscriptions only!!***

**NUTS & VOLTS MAGAZINE**  
 430 Princeland Court, Corona, CA 91719  
 909-371-8497 • 909-371-3052 FAX  
 Subscription Order ONLY Line 1-800-783-4624  
 E-Mail: [subscribe@nutsvolts.com](mailto:subscribe@nutsvolts.com)

### \* SANTA SPECIAL \*



**Offer expires January 1, 1999.**



# Bring a drained battery back to life without opening your hood

The remarkable Auto Starter® *eliminates the need for dangerous jumper cables* and can provide independent power for a variety of uses.

by Chris Murdock

Imagine this...after a long flight home, you arrive at the airport parking lot, get in your car and turn the key. Nothing happens, not even a click. Guess what? Your car battery's drained. It's cold, dark and you're alone. Do you flag down a stranger and hope he has jumper cables? Do you walk back to the airport, phone a tow truck and wait? No...you simply reach into your glove box and take out your Auto Starter®. You plug it into your car's cigarette lighter and, in a matter of minutes, you're on your way.

**A good start.** These days, cars have complex electrical systems which support many accessories. Many of these features operate even if your car isn't running, which increases the risk that someday you'll find your car's battery drained...no horn, no lights, not even a click from the solenoid. Before Auto Starter, you either had to call a tow truck or try to get a jump from another vehicle. Tow trucks are slow to arrive and very expensive. Jumper cables, even heavy-duty ones, are dangerous and involve getting under the hood. Plus, there has to be another car around to provide the jump. Battery acid can burn your skin and ruin your clothes. If the cables are not connected correctly they can damage your car's expensive electrical system or, even worse, cause an explosion. With Auto Starter, you don't need a jump—you don't even have to

open the hood. You simply plug the unit into the cigarette lighter, wait a few minutes and you're on your way. Leave the unit plugged in for 30-120 minutes while driving and it recharges automatically.

The five-amp sealed alkaline battery operates under extreme temperatures, from sub-zero to 120 degrees. Less than eight inches long; it stores easily in your glove box. Once it's charged, Auto Starter will retain the power to start your car for five years. It is the easiest, most convenient protection you can own.

## Portable power.

Auto Starter has many other uses. It's an independent 12V DC power supply that can operate TVs, radios, cellular phones and laptops. Almost any appliance that runs off of an adapter can operate independently with Auto Starter, so it's perfect for picnics, camping, boating and more.

Auto Starter also makes it easier to work on your car. Plug it in before you change the car battery, and you won't have to reprogram your car's clock, radio or alarm system. You can even use it as an emergency alternator to run your car's engine for up to one hour. You wouldn't think of driving around without a spare tire—why not have a spare battery and alternator that fits right in your glove box?



**The Auto Starter eliminates the need for another car to give you a jump, and gives you a portable 12-volt DC power supply!**

- **No getting out of your car**
- **No opening the hood**
- **No jumper cables**
- **No tow trucks**
- **No flagging down strangers**
- **Portable power...anywhere**



Auto Starter can power TVs, radios, cellular phones, laptops...you name it! Perfect for boating, camping, vacations...anywhere you need portable power.

**Try it risk-free.** Considering the cost of a tow, Auto Starter will pay for itself the first time you have a problem. This remarkable product is backed by a one year manufacturer's limited warranty and Comtrad's exclusive risk-free home trial. If you are not fully satisfied for any reason, return it within 30 days for a full refund, "No Questions Asked."

**Auto Starter®.....\$49.95 \$6 S&H**  
**Buy two or more.....\$39.95 each**  
 Please mention promotional code 2948-14437.

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

**800-992-2966**



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

Virginia residents only—please include 4.5% sales tax.

**comtrad industries**  
 2820 Waterford Lake Dr., Suite 102  
 Midlothian, Virginia 23113



# Opto Hits The Spot



## SCOUT

- 10MHz - 1.4GHz
- Stores 400 frequencies in memory
- Reaction Tune the ICOM R7000, R7100, R8500, R9000, R10, AOR 8000, AOR 8200, and Opto R11
- 10 digit LCD with signal strength bar-graph
- Vibrator and beeper alert mode

**\$349** **SAVE \$100**

DB32 Antenna Sold Separately (\$29)



## R11

- 30MHz - 2GHz wide band receiver (Cellular Blocked)
- Built-in speaker for instant audio demodulation
- LED frequency range indication display
- Reaction Tune with Scout
- Capture 5 watt UHF signal from 500 feet
- 1000 frequency lockout

**\$299**

TA100S Antenna Included



## XPLOER

- 30MHz - 2GHz (Cellular Blocked)
- Two line LCD frequency display
- Decode CTCSS, DCS, and DTMF
- 500 memories
- 1000 frequency lockout
- Built-in PC interface
- Capture 5 watt UHF signal from 800 feet

**\$799** **SAVE \$100**

TA100S Antenna Included

## In The Spotlight



## OPTOCOM

- High speed triple conversion GRE receiver
- Track Motorola 400, 500, 800, and 900MHz systems
- Decode CTCSS, DCS, LTR, DTMF, and Motorola talk group IDs
- Scan trunked and conventional frequencies simultaneously
- Reaction Tune with Scout Frequency Recorder
- Software Controlled volume & squelch for remote control operation

- Store & Scan, download up to 28 different frequencies or one talk group ID for scanning without computer control
- Supplied with the all new Trakkstar software
- Trunk Track LTR systems
- Scans conventional frequencies from 25-250, 760-823.995, 849.005-868.995, 894.005-1300MHz (Cellular frequencies blocked)

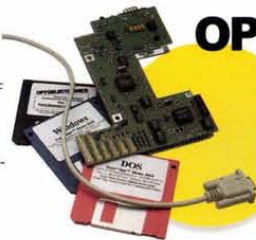
## OPTOTRAKKER



- Decodes CTCSS, DCS, LTR, Motorola Type I and II, and DTMF
- Scan multiple trunked systems at the same time under computer control
- All trunked frequency bands supported, including 400MHz, 500MHz, 800MHz and 900MHz
- Built-in Data Slicer Circuit
- Pass through technology requires only one com port

**\$299** **Includes Software**

Receivers supported under computer control: Icom R7000, R7100, R8500, R9000 and R10, AOR AR8000, AR3000A, AR5000, and Pro 2005/6 with OS456/OSLite, Pro 2035/42 with OS535



## OPTOSCAN

- Computer control scanning interface board for the popular RadioShack Pro 2005/6 (OSLite) and Pro 2035/42(OS535).
- Decode CTCSS, DCS, and DTMF with OS535 only
- Supported by popular third party software

**\$175** **SAVE \$24**  
OS456Lite: \$99

## Special Prices are for a Limited Time Only!!



## COUNTERS

Handheld frequency counters, all incorporating patented Digital Filter and Digital Auto Capture. All counters come with initial accuracy of +/- 1ppm. High impedance amplifiers standard on M1 and 3000APlus. Call for additional features on all three counters.

**CUB \$149**  
**M1 \$199**  
**3000A+ \$299**

**SAVE \$50 on the M1 & 3000A+**

Antennas Sold Separately



## TECHTOYZ

Micro Test equipment in pager style cases featuring a 2000 character DTMF decoder, a Frequency Counter with three memory hold, and an RF Detector with settable threshold alarm.

**Micro Counter \$99**  
**Micro DTMF \$99**  
**Micro RF Detector \$149**

TMC100 Antenna Sold Separately (\$9)

**FACTORY DIRECT ORDER LINE 800-327-5912**

**OPTOELECTRONICS®**

5821 N.E. 14th Avenue • Ft. Lauderdale, FL • 33334

Telephone: (954)•771•2050 Fax: (954)•771•2052 EMail: sales@optoelectronics.com

Prices and Specifications are subject to change without notice or obligation

The OptoCom has not been approved by the Federal Communications Commission. This device may not be sold or offered for sale until the approval of FCC has been obtained. Contact Optoelectronics for information on availability. Optoelectronics, ScanStar, Motorola, EF Johnson LTR and Microsoft Windows are all registered trademarks. Scout, 3000A+, R11, Xplorer, MicroCounter, M1, Cub are covered by U.S. Patent No. 5,471,402.



**FIVE INDIVIDUAL  
CONTROLLERS  
FOR FULL PERFORMANCE.**

**HIGH PERFORMANCE  
INTEL EMBEDDED  
RISC PROCESSOR.**

**COPIES EVERYTHING:  
PARTITIONS, O/S,  
PROGRAMS - THE WORKS!**



**SURFACE ANALYZER FOR  
PERFECT COPIES.**

**COMPLETE SYSTEM - NO  
PC CONNECTION REQUIRED.**

# COPY HARD DRIVES INSTANTLY!

"THE FASTEST WAY WE'VE FOUND TO MASS PRODUCE SYSTEMS." ANDY HSU, GENESIS TECHNOLOGY

**BUY MANUFACTURER DIRECT: \$895  
408 330-5543**

## FOUR DRIVE DUPLICATOR

Copy entire hard drives with ease. Drive duplicators are an essential tool for dealers and system builders. Why spend hours installing and formatting drives when you can clone four at once? This high speed, stand-alone IDE copier is easy to use and totally self-contained.

Set up any IDE or Ultra-DMA drive with all your original software. Connect blank drives and press "copy". You'll completely duplicate

four drives faster and more accurately than you can copy just one on a PC!

Notebook and desktop drives are supported. Five separate ports let you copy drives at full speed without changing jumpers. Other copiers slow down with two or more drives attached. This true parallel transfer duplicator runs at full speed regardless of the number of drives attached. The built-in surface

verification scans drives for perfect data integrity.

Call now and get the duplicator chosen and approved by Computer Sciences, IBM, and Maxtor.



**CORPORATE SYSTEMS CENTER**  
3310 WOODWARD AVE., SANTA CLARA, CA 95054  
[WWW.CORPSYS.COM](http://WWW.CORPSYS.COM)

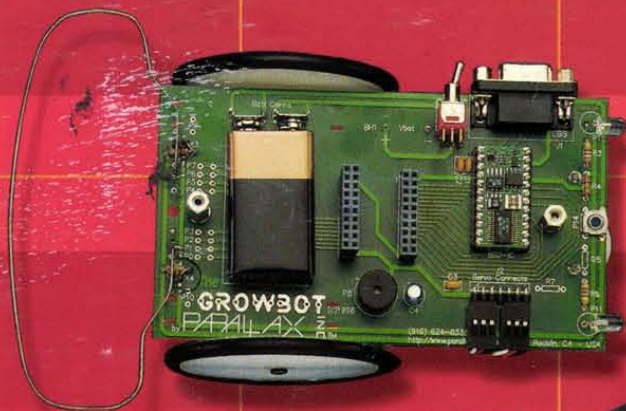
This product is sold and intended for legitimate in-house duplication purposes only.  
Copyright laws must be observed.



# Meet the GROWBOT™

#29100

Save \$30! Order your GrowBot by 12/20/98!



**Easy-to-build kit.** The GrowBot is a robotic kit designed around the Parallax BS2-IC module. GrowBot's standard I/O devices include a bumper, photo-resistor light sensors, a piezo speaker, LED lights, and servo drivetrain. GrowBot requires two hours to build using a soldering iron, needle-nose pliers, a small phillips screwdriver and a hobby knife. BS2-IC module, software and documentation included.

## BASIC Stamp® expandability.

The BS2-IC controls the GrowBot by executing up to 500 lines of PBASIC code from its non-volatile EEPROM. PULSOUT and FREQOUT commands control the servos and speaker, and IN detects closure of the bumper switch.

The BS2-IC module has 16 I/Os available for GrowBot control, and each is brought to the AppModule header in the middle of the GrowBot.

## AppModules include:

Breadboard Prototype area with wire jumpers (#29114 - \$29)

Through-hole Prototype area for point-to-point solder or wire wrapping (#29110 - \$19)

See <http://www.parallaxinc.com> for details on new AppMods including the mobile digital recording studio, LED display terminal, and IR proximity sensor.



## Christmas Special!

\$149 introductory price (+ shipping)  
through December 20, 1998 (regular \$179).

**Assembly instructions.** Assembly instructions are picture-oriented and descriptive, making it an ideal project for parent-child combinations for age 12 and above.

**December 25th Christmas Day Technical Support:** Christmas Day technical support 7 a.m. to 4 p.m. PST at (916) 624-8333.

Happy Holidays from:

**PARALLAX** 

Call toll free 888 512 1024 to order.  
More info? Visit our website  
<http://www.parallaxinc.com>

BS2-IC Stamp and Parallax are registered trademarks of Parallax, Inc.

Write in 195 on Reader Service Card.

NUTS & VOLTS MAGAZINE  
430 PRINCELAND COURT  
CORONA, CA 91719

CHANGE SERVICE REQUESTED

43

BULK RATE  
U.S. POSTAGE  
**PAID**  
PERMIT No. 359  
LONG BEACH CA