

NUTS & VOLTS

M A G A Z I N E



U.S. \$3.50
CANADA \$4.50
VOL. 19 NO. 4
APRIL 1998

Exploring Electronics And Technology For The Hobbyist And Professional

Virtual Reality Illusions

Some Resources For The Hobbyist



04>

CLONE, FORMAT, REPAIR AND TEST ANY DISK DRIVE



STAND ALONE DRIVE DUPE-IT! CLONES ENTIRE DRIVES

Copy entire hard drives with ease. Why spend hours installing and formatting drives when you can do it instantly with Drive Dupe-It! Set up any SCSI or IDE drive with all your original software. Connect blank drives and press start. You'll copy entire drives instantly!

With our combo IDE/SCSI model, you can copy entire hard disk images from IDE to SCSI or vice-versa.

HOT NEW TECHNOLOGY REPAIRS DRIVES

Don't throw those used drives away! Breathe new life into old drives with Dupe-It! Pro. Reassign and eliminate bad SCSI blocks and IDE defects. Put the built-in drive repair system to work for you. Here's how it works: First, a precise analysis system scans the disk surfaces for errors. Defects are then mapped around and effectively "erased". The built-in error correcting system "trains" the drive to permanently avoid defective areas. Your data is stored only on safe areas of the disk. Capacity is reduced by an insignificant amount, and the drive works flawlessly once again.

Get the technology used by major repair shops and modern data recovery centers. Dupe-It! Pro repairs all disk defects caused by normal wear. Drives with excessive mechanical damage may not be repairable.

PRO MODEL INCLUDES FACTORY TEST SYSTEM

Choose the Dupe-It Pro, and you'll also have an entire factory drive test system for under \$1000. The Pro model gives you the ability to copy, reformat, repair, translate, and test any hard disk drive. Use the Pro to put any hard drive through its paces. A full factory final test and performance analysis is performed. Complete test and repair reports are sent to any standard printer.

STAND ALONE IDE DRIVE DUPE-IT

P/N IDI \$395.

COMBO IDE AND SCSI DUPE-IT WITH TRANSLATOR

P/N SDI2 \$795.

PRO MODEL LOADED WITH IDE AND SCSI INTERFACES, TRANSLATOR, DRIVE MECHANIC, AND DRIVE DIAGNOSTIC TEST SOFTWARE WITH PRINTER PORT
P/N SDIPRO \$995.



CORPORATE SYSTEMS CENTER

www.corpsys.com

ORDER FACTORY DIRECT:

408-743-8739

CD DUPE-IT! IS SOLD AND INTENDED FOR BACKUP AND IN-HOUSE DUPLICATION PURPOSES ONLY. COPYRIGHT LAWS MUST BE OBSERVED. CALL FOR RACK MOUNT AND MULTI-DRIVE COPIERS.

Write in 211 on Reader Service Card.



COPY ANY CD INSTANTLY!

CD DUPE-IT!

Instantly duplicate master CDs for software distribution. Make spare backup copies of your favorite software on rugged, permanent media. Produce custom discs quickly and economically. No mastering or multimedia experience is required.

ONE BUTTON OPERATION. NO PC NEEDED.

Insert your original disc and press "start". The multimedia processor quickly copies any CD to the internal A/V hard drive. Insert blank discs and make as many copies as you like. You'll produce identical, bit-for-bit duplicates. The system is totally self contained — no computer is needed. Just plug it in and press "start". You'll get perfect copies of any CD.

BUILD YOUR OWN CUSTOM AUDIO DISCS!

You can make your own custom audio discs without a PC! Insert your original CDs, select the tracks you want, and copy them. Then insert a blank CD-R, and you'll have a custom audio disc with just the songs you want.

With the included CD mastering software, CD Dupe-It will work overtime. Just attach a SCSI cable to your PC or Mac, and you're ready to design and create your own original CDs.

CD DUPE-IT! \$1095.
CASE OF 100 BLANK DISCS (Green/Gold) \$159.
CASE OF 100 BLANK DISCS (Gold/Gold) \$199.

HSC Electronic Supply

Serving
Silicon Valley
since 1964!

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

Sound Card Spectacular!

Four styles to choose from:

- Diamond Multimedia Multi-CD-ROM/Sound Card**
- Multi-interface for CD-ROM (Sony, Mitsumi, Pana., IDE)
- Full featured sound capability, 2MB Wavetable, 24 voice
- Short card, Soundblaster compatible
- Line-in, Line-out, Mic., Speaker & MIDI/Game jacks
- New OEM pack, instruction sheet, 90-day HSC warranty

HSC#171060 **\$14.95**

Media Vision ProAudio Spectrum Sound Card

- 16-bit audio, 44.1KHz stereo sound
- MPU 401 MIDI emulation, Soundblaster compatible
- Internal SCSI-2 CD-ROM port, microphone jack (mike not included), line-in, speaker jack, joystick port
- Includes driver disk, information sheet (no book)
- OEM package (no box), 90-day warranty

HSC#171059 **\$19.95**

Diamond Multimedia Wavetable Sound Card

- Multi-interface for CD-ROM (Sony, Mitsumi, Pana., IDE)
- Full featured sound capability, 2MB Wavetable, 24 voice
- Line-in, Line-out, Mic., Speaker & MIDI/Game jacks
- New OEM pack, instruction sheet, 90-day HSC warranty

HSC#171142 **\$24.95**

MediaVision Premium 3D Sound Card

- 16-bit audio, 44.1KHz digitized stereo sound
- MPU 401 MIDI, Soundblaster compat., SRS 3-D circuitry
- Internal SCSI-2 CD-ROM port, microphone jack (mike not included), line-in & speaker jacks, joystick port
- Includes driver disks, instruction sheet
- OEM package (no box), 90-day HSC warranty
- We had these and ran out...New stock at Lower Price!

HSC#171035 **\$29.95**

House that Equipment!

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

HSC# 171069 **\$99.00**

Absolute Last of the Red Hot Reno!

- Now at clearance price - Media Vision **Reno**:
- Consists of new external Reno CD-ROM drive, docking bay with SCSI2 port, AC Adapter, cable kit, travel pouch, headphones
- Late Model version Uses AC adaptor (included) or AA alkaline batteries (not included)
- Double-speed 180ms drive is lightning fast!
- Drive detaches from docking bay, use with headphones as a portable personal audio CD player
- Great for Mac or IBM (adaptor bracket included)
- Mac software included
- SCSI Controller & software required for IBM use
- Brand new, 90-day warranty!

Now - **\$59.00**

Available Separately:
A. Macintosh Powerbook SCSI Adapter (HDI-30 to 25-pin D connector) HSC#15704 **\$12.50** if purchased alone, or with purchase of Reno Kit, \$5.00

GPS Hacker Special!



- Fantastic opportunity for the techie who is interested in GPS (Global Positioning System) technology!
- These units were meant to be mounted in utility trucks to monitor and record their locations and times during trips
- Receiver is a Trimble Navigation "Placer GPS 400", which outputs location and time data through a serial port
- Outputs vehicle location in Trimble ASCII Interface protocol (TAIP)...check www.trimble.com for info.
- Requires no user intervention, can be programmed to send position reports at specified time or distance intervals based on epoch and frequency or distance.
- Outputs latitude, longitude, speed, time, direction
- Accuracy of position, 15 meters (non-differential)
- Acquisition time <30 seconds typ., 2 - 4 min. cold start
- Position update rate once per second to 9,999 second
- Unit is coupled to a single-board 80C186 computer that has several serial ports, 2MB SRAM, 2MB Flash RAM
- Piggyback tiny floppy controller board connects to a standard Teac 3.5" floppy drive
- Contained in a rugged, gasketed steel box 12" x 5.25" x 10"
- Hardware kit includes mounting hardware, power cable
- Small weatherproof antenna & 15' cable included
- Buy either the whole assembly, or just the component parts you are interested in!
- We do not have software or documentation at this time

HSC#171185 Complete GPS Assembly **\$129.00**

HSC#171186 GPS-400 Receiver & Ant. **\$69.00**

HSC#171191 80C186 Computer Board **\$29.00**

HSC#171187 Gasketed Chassis Box **\$19.50**

Super Sounding Speakers!

Tired of the cheesy sound coming from those give-away speakers in your multimedia kit? Try upgrading to these sonic wonders...you'll have to hear them to appreciate the difference these will make without blowing your budget!

GNT2500 2-way Bass-Reflex speakers

- 3.5" woofer, 1" piezo tweeter
- 15W built-in amplifiers, 80W peak, 5.4W RMS
- 40 - 20,000 Hz, built-in SRS 3-D stereo
- Measure approx. 3.75" x 6.125" x 9.25" tall
- AC adaptor, audio cables included
- On-off switch, 3-D switch, tone & volume controls
- Attractive off-white finish with grey grille-cloth

HSC#171670 **\$29.95**

GNT3000 3-way Bass-Reflex speakers

- 4" woofer, 2" midrange, 1" piezo tweeter
- 23W built-in amplifiers, 120W peak, 20W RMS
- 20 - 20,000 Hz, similar to GNT3500, but no SRS 3-D
- Measure approx. 6.25" x 6.5" x 9.75" tall
- AC adaptor, audio cables included
- On-off switch, bass, treble & volume controls
- Attractive off-white finish with grey grille-cloth

HSC#17085 **\$39.95**

X-Windows Terminal!

- Tiny Axil/Hyundai X11C smart terminal has big features!
- Connect to Ethernet (Coax or AUJ), SLIP, or both!
- Built-in 10Base2 transceiver, 10Base5 AUJ interface
- Uses a variety of protocols, TCP/IP, SLIP, TELNET, RARP, BOOTP, XDMCP, or PPP
- Comprehensive self-test and help menus for setup
- Requires 63.775KHz Horizontal, 67.9Hz Vertical (workstation-type) monitor, resolution is 1152 x 900
- RAM can be upgraded to 16MB (4MB SIMM included)
- New in box, includes 101-key keyboard, mouse, manual.
- Measures 11.5" x 11" x 2", keyboard is 18" x 7"



HSC#17213 **\$149.95**

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



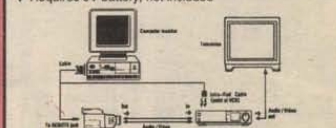
HSC#16483 PCMCIA Version **\$19.95**

HSC#16813 ISA-Bus Version **\$19.95**

Or a package deal...get both for **\$29.95**

PC Videotape Editor!

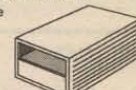
- Use your computer to edit your home videos!
- Delete footage, rearrange up to 99 scenes automatically!
- No expensive computer cards to install!
- Requires 386 or higher computer, Sony-type Control-L (LANC) source camcorder and a recording VCR with infra-red remote control with TV or video monitor.
- Unit consists of a cable to control the playback of your camcorder, and an infra-red transmitter to control VCR
- Plugs into parallel port of your computer - no disassembly of your computer required!
- Includes software (Win 3.1 compatible) cables and manual
- New in box - 90 day warranty
- Requires 9V battery, not included



HSC#17154 **\$29.95**

SCSI Drive Case Deal!

- Bargain case for 5.25" drives, brand new!
- 7" x 4.5" x 10.5" overall size
- 50-pin SCSI connectors
- SCSI ID switch
- 65W Power Supply
- Fan-cooled, uses standard IEC Power cord (not included)



HSC# 17130 5.25" SCSI Drive Case **\$39.95**

Function Generator Deal!

- Used Wavetek 182 Function Generator
- 2 Hz to 2 MHz, sine, square & sawtooth wave
- Triggered input, DC offset control
- No test bench should be without one!
- High quality name brand test equipment
- Used, tested good, 30-day warranty

HSC#93637 **\$179.95**

Media Vision PCMCIA Sound!

- Great for Portables, Laptops with PCMCIA Slot
- External pod has joystick port, mic. input, line in & line out jacks, volume control.
- Installation software, instructions included
- Windows 3.x, Windows 95 compatible
- New in OEM packaging (no box), 90-day HSC warranty
- We had these before at \$39.95 and they went fast!

HSC#17036 **\$29.95**

Spill-Resistant Keyboard!

- Keypad has shield to protect keyboard & electronics.
- 101-key keyboard has standard QWERTY layout
- Coiled cord with standard 5-pin DIN connector
- Brand new, 90-day warranty
- Similar to illustration



HSC#17088 **\$14.95**

Briefcase of Goodies!



- These handsome hardshell cases were used to carry a laptop-computer estimating system (laptop not included)
- They accept a Compaq LTE laptop, and provide a SCSI port to connect a CD-ROM drive with battery back-up!
- Large Nicad pack has 10 D-size Sanyo Cadnics cells.
- Built-in charger and battery monitoring circuitry
- Tiny piggy-back PC board is a SCSI interface
- Case measures 18" x 14" x 7", with several compartments
- SCSI II to CEN50 SCSI cable, many great parts inside!
- Buy either the whole assembly, or just the component parts you are interested in! Used, 30 day warranty

HSC#17180 Complete Laptop Case **\$49.95**

HSC#17182 Empty Hardshell Case **\$29.95**

HSC#17181 Nicad Pack, 12.5VDC, 5AH **\$17.50**

HSC#17179 SCSI II Cable, 1 ft. long **\$12.50**

Extra-long Cord Outlets!

- Don't daisy-chain those outlet strips to get power where you need it! (The fire department doesn't approve!)
- Multi-outlet SG/Waber outlet strips have extra-long cords
- UL Approved, metal housings, 15 Amp circuit breaker
- Brand new, two lengths to choose from!
- Hurry, these won't last long, especially the 50-footers!

HSC#17172 4-Outlet strip w/ 15' cord **\$9.95**

HSC#94148 3-Outlet strip w/ 50' cord **\$17.50**

Genuine Intel CPU's

- Just arrived...Intel 486 DX2-50
- 486 surface-mount chip on a PGA base.
- New, prime parts, not pulled! 90-day warranty

HSC#17176 **\$14.95**

Also just in...Intel 486 DX2-66

Standard ceramic PGA package

Good socket pulls, 90-day warranty

HSC#80420 **\$29.50**

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 on the World-Wide Web!
- Simply go to 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!

Terms: Some quantities limited; all items subject to prior sale. Minimum order: \$10.00 plus shipping. Orders under \$20.00 subject to \$2.00 handling fee, in addition to shipping. All orders shipped FOB Santa Clara, CA (this means you pay freight!), by UPS Surface (no P.O. Boxes) unless otherwise specified, in which case prevailing carrier rate plus \$5.00 handling fee applies. Prepaid orders that don't include shipping charges will be shipped freight COD. There is a \$4.75 UPS charge added to shipping charges for COD shipments. If you have questions about your order, please call Customer Service at (408) 732-1854 M-F 9AM to 6PM PST.

Halted
specialties co.

HSC
Electronic
Supply

Toll Free (Orders Only) 1-800-4 HALTED

Internet World Wide Web:

3500 Ryder St., Santa Clara, CA 95051

4837 Amber Ln., Sacramento, CA 95841

5681 Redwood Dr., Rohnert Park, CA 94928

(1-800-442-5833)

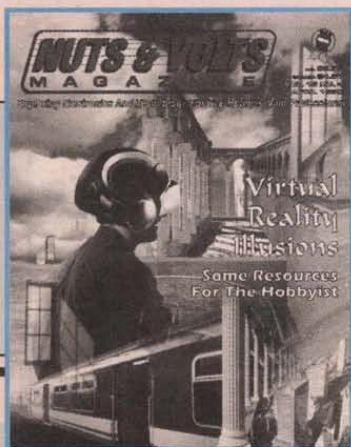
<http://www.halted.com>

(408) 732-1573

(916) 338-2545

(707) 585-7344

FAX your orders to: (408) 732-6428



Contents

ON THE COVER ...

Virtual Reality Illusions91

ARTICLES

COPPER FOIL GROUNDING FOR RADIO

FREQUENCIES Gordon West9

For a powerful marine and ham single-sideband transmission — and improved reception — good grounding techniques at the radio and automatic antenna tuner are extremely important.

PASSIVE INFRARED VARMINT CHASER Kenton Chun24

Try this humane way of deterring "unwelcome visitors."

FUZZY LOGIC Jeff Stefan40

This article explains how fuzzy logic works, and provides you with a simple program so you can experiment with fuzzy logic systems of your own.

CHARACTER LCD NETWORKABILITY Ryan Sheldon48

Control up to 16 character LCD displays of any size using only two wires from the RS-232 port of your computer.

BUILD QUICK HENRY TO MEASURE INDUCTANCE Fred Blechman59

Construct this simple adapter for use with your audio or RF signal generator to measure inductance values from one microhenry to over one henry.

SECURITY ELECTRONICS SYSTEMS AND

CIRCUITS — PART 3 Ray Marston77

Contact-operated security circuits are covered in the third installment of this ongoing series.

BUILD A "SUPER" ETCHING TANK Larry Ball98

Etch boards faster and conserve etchant with this innovative tank design.

COLUMNS

AMATEUR ROBOTICS Karl Lunt67

A "necessary" diversion from the Fire-Fighting robot — hacking the GameBoy, plus a very "timely" project.

OPEN CHANNEL Joseph J. Carr K4IPV33

What they didn't teach you ... if they ever even knew! Find out why theory and practicality don't always mix when it comes to electronics.

RESOURCE BIN Don Lancaster91

Shattering a few virtual reality illusions.

SOFTWARE WIZARDRY Harry Helms73

Webcasting: Learn how to implement it on your web site.

STAMP APPLICATIONS Jon Williams17

Getting back to the BS1.

DEPARTMENTS

ADVERTISER'S INDEX108

CLASSIFIED AD INFO108

DEALER DIRECTORY43

EVENTS CALENDAR44

NEW PRODUCT NEWS88

NV ADMART96-97

ELECTRONICS Q & A28

READER FEEDBACK6

TECH FORUM14

CLASSIFIED AD INDEX

10. Ham Gear for Sale.....5	125. Microcontrollers93
20. Ham Gear Wanted5	130. Antique Electronics66
30. CB/Scanners5	135. Aviation Electronics66
40. Music & Accessories7	140. Publications66
50. Computer Hardware7	145. Robotics72
60. Computer Software12	150. Plans/Kits/Schematics.....81
70. Computer Equip. Wanted16	155. Manuals/Schematics
80. Test Equipment.....16	Wanted83
85. Security.....36	160. Misc. Electronics For Sale.....83
90. Satellite Equipment.....37	170. Misc. Electronics Wanted.....86
95. Military Surplus Electronics...94	175. BBS & Online Services87
100. Audio/Video/Laser38	180. Education90
110. Cable TV45	190. Business Opportunities.....90
115. Telephone/Fax55	200. Repairs/Services93
120. Components.....55	

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.

Nuts & Volts Magazine is published monthly for \$19.00 per year by T&L Publications, Inc., 430 Princland Court, Corona, CA. Application to mail at 2nd class postage rates is pending at Corona and San Diego. POSTMASTER: Send address changes to Nuts & Volts Magazine, 430 Princland Court, Corona, CA 91719.

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), bfi-jfs@smartlink.net

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 Road, Smithsburg, MD 21783. 301-416-0661. E-Mail: N3SAD@aol.com or see <http://www.xmetric.com/sseng>



VACUUM TUBES, thousands in stock NOS, (new old stock) and high quality low mileage pre-owned tubes. All used tubes cleaned, tested, and boxed before shipment. LynTec 408-274-3559 <http://www.lyntec.com> Lynn@lyntec.com

MILITARY COMPONENTS wanted. Capacitors, resistors, diodes, transistors, semiconductors, ICs. Electronic Material Industries, 818-769-1002, FAX: 818-769-1084.

DIE CAST ENCLOSURES 4.7"x2.4"x1.6" with 2 BNC jacks installed. Great for homebrew projects, QRP, etc. Send SASE for more info and pictures to: ELLEN SALES, 13899 US 31, BEULAH, MI 49617.



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, including a custom-made, pre-punched, painted and lettered enclosure. 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.

MVP VHF \$25. Mitrec VHF \$25. Maxtrac UHF \$150. Power supplies & scanners & CB, free catalog. Call 909-873-1319 fax on demand 24 hrs. 909-820-1885. E-Mail: HPH6@aol.com & LML, 424 E. Shamrock, Rialto, CA 92376.

COLLINS 8040 automatic antenna tuner, 1.6-32MHz, 1KW, \$500; Collins URC-32, KWT-6 HF transceiver, with antenna tuner and wattmeter, \$1,500; A-COMM ELECTRONICS 303-290-8012, FAX 303-290-8133; SALES@A-COMM.COM

MMDS DOWNCONVERTERS Drake model 2880 \$58.95. 2.4GHz parabolic antennas \$89.95. For more information, send SASE to: Hudson Technologies, PO Box 552, Caldwell, ID 83606-0552.

HAM GEAR WANTED

MILITARY COMPONENTS wanted. Capacitors, resistors, diodes, transistors, semiconductors, ICs. Electronic Material Industries, 818-769-1002, FAX: 818-769-1084.

CB - SCANNERS

BLACK BOOK CB LINEARS. Repair notes, theory, specifications, 60 schematics. \$25. KEN's, 2825 Lake, Kalamazoo, MI 49001 616-345-4609.

CB MODIFICATIONS! Frequencies, books, kits, high-performance accessories, plans, repairs, amplifiers, 10-meter conversions. The best since 1976! Catalog \$3. CBCI, Box 31500NV, Phoenix, AZ 85046.

RED BOOK CB MODIFICATION. Audio, modulation, PLL/VCO, synthesis, crystals, sliders. \$25. Ken's 2825 Lake, Kalamazoo, MI 49001. 616-345-4609.

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.

ORANGE BOOK SCANNER REPAIR. Fix 500 models, modifications. \$25. KEN's, 2825 Lake, Kalamazoo, MI 49001 616-345-4609.

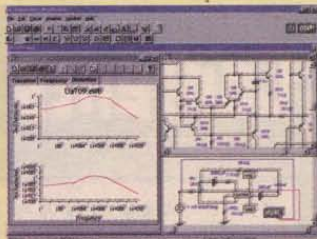
Better Designs - Faster With the Personal Design Solution

The Design Solution Includes: Electronics Workbench Personal Edition + EWB Layout

Electronics
Workbench
Personal Edition

Full-featured schematic capture and SPICE 3F circuit simulation!

The world's best selling circuit design software. With analog, digital and mixed A/D SPICE simulation, a full suite of analyses and over 4000 devices. Imports netlists. Seamlessly integrated with EWB Layout or exports to other popular PCB programs. Still the standard for power and ease of use. Still the same effective price.



\$299
Version 5

HIGH-END FEATURES

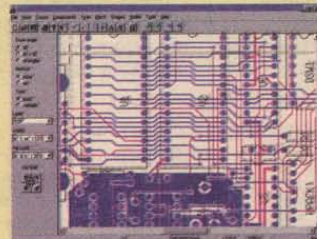
TRUE MIXED ANALOG/DIGITAL
FULLY INTERACTIVE SIMULATION
PRO SCHEMATIC EDITOR
HIERARCHICAL CIRCUITS
VIRTUAL INSTRUMENTS
ON-SCREEN GRAPHS
ANALOG AND DIGITAL MODELS
FREE TECHNICAL SUPPORT
DC OPERATING POINT
AC FREQUENCY
TRANSIENT
FOURIER
NOISE
DISTORTION

YES
YES
YES
YES
YES
YES
OVER 4,000
YES
YES
YES
YES
YES
YES
YES

Electronics
Workbench *Layout*
Personal Edition

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, you can incorporate board layout and design and quickly bring well-designed boards to production.



\$299
Version 5

POWER-PACKED FEATURES

AUTOROUTING
REROUTE WHILE MOVE
LAYERS
BOARD SIZE
LIBRARY SHAPES
BLIND AND BURIED VIAS
EXTENSIVE OUTPUT
SELECTIVE NET HIGHLIGHTING
USER DEFINED PADS
REAL TIME DESIGN RULE CHECK
DENSITY HISTOGRAMS
FREE TECHNICAL SUPPORT

YES
YES
32 ROUTING LAYERS
50" X 50"
OVER 3,500
YES
YES
YES
YES
YES
YES
YES

**30-DAY MONEY-BACK
GUARANTEE**

*Join over 85,000 customers
and find out why more circuit designers
buy Electronics Workbench than
any other circuit design tool.*

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

ELECTRONICS WORKBENCH Personal Edition \$299.00
EWB LAYOUT Personal Edition \$299.00

**BUY
BOTH
AND
SAVE**

PERSONAL DESIGN SOLUTION ~~\$598.00~~
\$548.00

CALL 800-263-5552

For a free demo, visit our website
at <http://www.interactiv.com>

INTERACTIVE IMAGE TECHNOLOGIES LTD., 908 Niagara Falls Boulevard,
#068, North Tonawanda, New York 14120-2060 / Telephone 416-977-5550.
TRADEMARKS ARE PROPERTY OF THEIR RESPECTIVE HOLDERS. OFFER IS IN U.S. DOLLARS AND VALID ONLY
IN THE UNITED STATES AND CANADA. ALL ORDERS SUBJECT TO \$15 SHIPPING AND HANDLING CHARGE.
Fax: 416-977-1818 E-mail: ewb@interactiv.com
CompuServe: 71333,3435 / BBS: 416-977-3540



reader FeedBack

Dear Nuts & Volts:

Regarding the Jan. '98 article on the mailbox indicator, Alltronics has a signal mail unit which works great once you get the bugs out. They sell it for \$14.95, with "no returns" which should be your tip-off.

I had to replace the "tune chip" with a piezo buzzer the first use, and the latch-up didn't work until I changed a 4001 chip. But it gives both an audible, as well as a visual LED signal, and has a reset button to reset it each time. I have a distance of over 150 feet from the transmitter in the mail box to the receiver inside the house.

Bob Jordan
via Internet

Dear Nuts & Volts:

Just wanted to say how much I enjoyed the article by John Montalbano in your November issue.

I built two of the interfaces and members in our scanner club also built them. Mine was installed in a 1000 channel scanner and works very well.

The other guys in the club have been looking for something like this for a while.

I do hope to see more articles of this type dealing with the scanner hobby. Keep up the good work.

Steve Hancock
via Internet

Dear Nuts & Volts:

The circuit description of the FM Transmitter by Fred Blechman is not entirely correct.

1. He says that "with the switch SW1 in the position shown ..." the current will flow through SW1. This is a moot point, but the current will probably tend to flow through the wire shunting the switch since the wire will most likely have less resistance than the switch contacts.

2. He says that "The positive voltage at the anode of D1 powers the rest of the circuitry." I don't think so. It is the voltage across the LED which powers the circuit. One could also say the voltage at the CATHODE of D1 (with respect to the anode of D4) powers the circuit.

3. He says "If, for whatever reason, the voltage at IN1 is NEGATIVE (with respect to IN2), the LED will not light." Actually, the LED will still light and the circuit should function normally. That is the beauty of using a bridge in such a circuit; the input polarity makes no difference.

4. Assuming the "OTHER" position of the switch is the position opposite to that shown in the schematic, putting the switch in that position has nothing to do with whether diodes D2 and D3 are activated. It is the input polarity which decides which pair of the four diodes D1-D4 are conducting. From the schematic, it appears that the OTHER position will disable the circuit altogether by

shorting out the bridge.

Thanks for a great magazine. I spend hours reading each issue as soon as it arrives and frequently refer to past issues for ideas.

John Smith
Plano, TX

Response:

1. He's right, but it doesn't matter. As a matter of fact, the switch, as we'll see, should not even be in the circuit!

2. He's merely more precise than my statement. The circuit will work without the LED, which is merely there to indicate the phone is off-hook and the unit is transmitting.

3. During the preparation of this article, the circuit board and schematic changed from the original. Switch SW1 was originally used to correct for reversed polarity at the phone line when only two input diodes were used. Now that a diode bridge is used at the input, this is no longer necessary.

4. The fact is, when the switch is placed in the position NOT shown on the schematic, it does, indeed, short out the phone line! Don't use the switch at all! Just leave it out of the circuit.

My thanks to John Smith for bringing this to my attention. Despite my errors in circuit description, the unit does work as described.

Fred Blechman
West Hills, CA

John Smith's Reply:

Did he actually confirm this? Note that the LED will act as a low voltage zener diode and maintain about 1.5 volts across his circuit independent of line variations. If the LED is removed, the voltage across the circuit is unpredictably set by the current through Q1 and by the line impedance.

In addition, I would expect large changes in frequency as a result of circuit voltage variations. It might be difficult to tune and keep on a particular frequency.

As for the rest, I believe the Nuts & Volts audience includes beginners, as well as seasoned electronics engineers. A beginner is depending on an accurate circuit description of operation to learn from the article whether or not he actually builds the circuit.

I sincerely do not intend to discourage Mr. Blechman. I admire his writing ability, as well as his technical capabilities and I commend him for submitting interesting articles.

John Smith
Plano, TX

Response:

John, you may have a good point regarding the use of the LED as a voltage stabilizer. I did not remove the LED to test the effect,

Continued on page 107

EPROM+ A DEVICE PROGRAMMER FOR BENCH AND FIELD

The Professionals' Choice!



FIRST GENERATION EPROMS (24 PIN) 2708, TMS2716*, 1702*

SECOND GENERATION EPROMS (24,28,32 PIN) 2516,32,64,68764/66

2716,32,64,128,256,512,1024,2048,4096,8192,16384,32768,65536,131072,262144,524288,1048576,2097152,4194304,8388608,16777216,33554432,67108864,134217728,268435456,536870912,1073741824,2147483648,4294967296,8589934592,17179869184,34359738368,68719476736,137438953472,274877906944,549755813888,1099511627776,2199023255552,4398046511104,8796093022208,17592186044416,35184372088832,70368744177664,140737488355328,281474976710656,562949953421312,1125899906842624,2251799813685248,4503599627370496,9007199254740992,18014398509481984,36028797018963968,72057594037927936,144115188075855872,288230376151711744,576460752303423488,1152921504606846976,2305843009213693952,4611686018427387904,9223372036854775808,18446744073709551616,36893488147419103232,73786976294838206464,147573952589676412928,295147905179352825856,590295810358705651712,1180591620717411303424,2361183241434822606848,4722366482869645213696,9444732965739290427392,18889465931478580854784,37778931862957161709568,75557863725914323419136,151115727451828646838272,302231454903657293676544,604462909807314587353088,1208925819614629174706176,2417851639229258349412352,4835703278458516698824704,9671406556917033397649408,19342813113834066784298816,38685626227668133568597632,77371252455336267137195264,154742504910672534274391296,309485009821345068548782592,618970019642690137097565184,1237940039285380274195130304,2475880078570760548390260608,4951760157141521097780521216,9903520314283042195561042432,1980704062856608439112204864,3961408125713216878224409728,7922816251426433756448819456,15845632502852867512897638912,31691265005705735025795277824,63382530011411470051590555648,126765060022822940103181111136,253530120045645880206362222272,507060240091291760412724444544,1014120480182583523525448889088,2028240960365167047050897778176,4056481920730334094101795556352,8112963841460668188203591112704,16225927682921336376407182225408,32451855365842672752814364450816,64903710731685345505628728901632,129807421463370691011257457802624,259614842926741382022514915605248,51922968585348276404502983121056,103845937170696552809005966242112,207691874341393105618011932484224,4153837486827862112360238649684448,8307674973655724224720477299368896,1661534994731144844844095559877792,3323069989462289689688191119755584,6646139978924579379376382239511168,13292279957849158758752764479022336,26584559915698317517505528958044672,53169119831396635035011057916089344,106338239662793270070022115832178688,212676479325586540140044231664357376,425352958651173080280088463328714752,850705917302346160560176926657429504,1701411834604692321120351353314859008,3402823669209384642240702706629718016,6805647338418769284481405413259436032,13611294676837538568962810826518716664,27222589353675077137925621653037433328,54445178707350154275851243306074866656,108890357414700308551702486612149733312,21778071482940061710340497322429946624,43556142965880123420680994644859893248,87112285931760246841361989289719786496,174224571863520493682723978479439572992,348449143727040987365447956958879145984,696898287454081974730895913917758291808,139379657490816394946179182783551656384,278759314981632789892358365567103312768,557518629963265579784716731134206625536,1115037259926531159569433462268413251072,2230074519853062319138866924536826502144,446014903970612463827773384907365300288,892029807941224927655546769814730600576,1784059615882449855311093539629461201152,3568119231764899710622187079258922402304,7136238463529799421244374158517844804608,14272476927059598842488748317035689609216,2854495385411919768497749663407137922304,57089907708238395369954993268142758444608,11417981541647679073990998653628550920928,22835963083295358147981997307257101841856,45671926166590716295963994614514203683712,91343852333181432591927989229028407367424,18268770466636286518385497845805681473488,3653754093327257303677099569161136689696,7307508186654514607354199138322273779392,14615016373309029214708398276644547558784,29230032746618058429416796553289095117568,58460065493236116858833593106578190235136,11692013098647223371766718621315638046272,23384026197294446743533437242631276092448,46768052394588893487066874485262552184896,9353610478917778697413374897052510436992,18707220957835557394826749794105020873984,37414441915671114789653499588210041747968,74828883831342229579306999176420083495936,14965776766268445915861399835284016699184,29931553532536891831722798670568033398368,59863107065073783663445597341136066796736,119726214130147567326891184682272133593504,23945242826029513465378236936454426718608,47890485652059026930756473872908853437216,95780971304118053861512947745817686474432,1915619426082361077230258954916353729488,3831238852164722154460517909832707458976,7662477704329444308921035819665414917952,15324955408658888617842071639330829835904,30649910817317777235684143278661659671808,61299821634635554471368286557323319343616,122599643269271108942736573114646638687232,245199286538542217885473146229293273774448,490398573077084435770946292458586547548896,98079714615416887154189258491717309593792,196159429228833774308378516983434619187584,392318858457667548616757033966869238375168,784637716915335097233514067933736776750336,1569275433830670194467028035867473553500672,313855086766134038893405607173494710700144,627710173532268077786811214346989421400288,125542034706453615557362242869397884200576,251084069412907231114724485738795768401152,502168138825814462229448915477591536822304,100433627765162892445889783095518306464384,200867255530325784891779566191036612928768,40173451106065156978355913238207322585536,80346902212130313956711826476414645171072,160693804424260627113423652952829290342144,321387608848521254226847305905658580684288,642775217697042508453694611811317167685568,128555043539408501690738922362263533537136,257110087078817003381477844724527067074272,514220174157634006762955689449054134148544,1028440348315268013525911119898108268297088,2056880696630536027051822239796216536594176,4113761393261072054103644479592433073188352,822752278652214410820728895918486614637664,164550455730442882164145779183697323275328,329100911460885764328291558367394646550656,658201822921771528656583116734789293101312,1316403645843543057313166233469578582202624,2632807291687086114626332466939157164405248,526561458337417222925266493387831432801056,1053122916674834445850532986775662865602112,2106245833349668891701065973551325731204224,4212491666699337783402131947102651462408448,842498333339867556680426389420530292481696,1684996666679735113360852778841060584963392,3369993333359470226721705557682121169927776,6739986666718940453443411115364242339855552,1347997333343788090688682223072848479711104,2695994666687576181377364446145696959422208,5391989333375152362754728892291393918844416,10783978666751304725509457784582787837688832,2156795733350260945101891556916557567537764,4313591466700521890203783113833115135075528,8627182933401043780407566227666230270151056,17254365866802087560815132455332460540302112,34508731733604175121630264910664921080604224,69017463467208350243260529821329842161208448,13803492693441670048652105964265964322440896,276069853868833400973042119285319286448817936,55213970773766680194608423857063857289763872,110427941547533360389216847714127114579537744,220855883095066720778433695428254229159075488,441711766190133441556867390856508458318150976,883423532380266883113734781713016916636301952,176684706476053376622746956342603383267260304,353369412952106753245493912685206766534520608,706738825904213506490987825370413533069041216,1413477651808427012981975650740827066138082432,2826955303616854025963951301481654132276164864,5653910607233708051927902602963308264552329728,11307821214467416103855805205926616529104659456,22615642428934832207711610411853233058209318912,45231284857869664415423220823706466116178377824,904625697157393288308464416474129322232356544,1809251394314786576616928932948258644464713088,3618502788629573153233857865896517288929426176,7237005577259146306467715731793034577858852352,1447401115451829261293543146358606915571764704,2894802230903658522587086292717213811433529408,5789604461807317045174172585434427662266898816,11579208923614634090348345170868553324533797632,2315841784722926818069669034173710669067595524,4631683569445853636139338068347421337815191048,9263367138891707272278676136694842675630382096,18526734277783414544557352273389685351260764192,37053468555566829089114704546779370702521388384,74106937111133658178229409093558741405042776768,148213874222267316356458818187117482801045533536,29642774844453463271291763637423496020209067072,59285549688906926542583527274846980400418134144,118571099377813853085167054549693860800836268288,237142198755627706170334109099387721601672537568,474284397511255412340668218198775443203345075136,948568795022510824681336436397550886406690150272,1897137590045021649362672872795101772813380300544,3794275180090043298725345745590203545626660601088,7588550360180086597450691491180407091253321202176,15177100720360173194901382982360814182566422404352,3035420144072034638980276596472162836513244808864,6070840288144069277976553192944325673026489617728,1214168057628813855595310639188865134605297933456,2428336115257627711190621278377730269210598866912,4856672230515255422381242556755460538421197733824,9713344461030510844762485113510921076842395467648,19426688922061021689524970227021842153684790935296,38853377844122043379049940454043684307369581870592,77706755688244086758099880908087368614739163741184,155413511376488173516199761816174737228478274882368,310827022752976347032399523632349474456956549764736,621654045505952694064799047264698948913911119529472,1243308091011905388129598094529397897827222390944,2486616182023810776259196189058795795654446781888,4973232364047621552518392

MIDWEST ELECTRONICS

124 12TH AVE. SOUTH, MINNEAPOLIS, MN 55415
PHONE: (612) 339-9533 FAX: (612) 305-0964

WWW.MIDWEST-ELECTRONICS.COM

WE'RE ALWAYS HAVING A SALE — COMPARE OUR PRICES

COMPUTERS

NEC MOBILEPRO 400 PALMTOP COMPUTER, WINDOWS CE, WORD, EXCEL, INTERNET, MUCH MORE, MSRP \$649 — OUR PRICE **\$199**
MULTIMEDIA KEYBOARDS — CONTROL YOUR CD-ROM, VOLUME, MUTE, INTERNET ACCESS, MODEM, AND SHORTCUTS ALL FROM YOUR KEYBOARD, PLUS ALL STANDARD WIN95 KEYS (104) INCLUDES DRIVERS — SUPER BUY AT **\$39**

BRAND NEW QUANTUM HARD DRIVES: 1.0GB - **\$119**, 1.2GB - **\$129**, 1.7GB - **\$139**, 2.1GB - **\$169**, 2.5GB - **\$179**, 4.3GB - **\$209**

CALL FOR CURRENT INFORMATION ON OUR MOTHERBOARD, CPU, AND MEMORY INVENTORY

NEW MONITORS

14" 1024X768 SVGA .28DP **\$189** 15" 1024X768 SVGA .28DP **\$249**
17" 1280X1024 SVGA .28DP **\$449**

USED MONITORS

14" 640X480 VGA STARTING AT **\$69** 14" 1024X768 SVGA STARTING AT **\$99**

VIDEO

2MB PCI VIDEO CARD **\$45**

MODEMS

33.6 INT. DATA/FAX
MODEM W/VOICE **\$49**

MULTIMEDIA

24X IDE CD-ROM **\$74**
16 BIT STEREO SOUND CARD **\$25**
56K FLEX MODEM FOR PENTIUM **\$65**

BRAND NEW ACER 101 KEYBOARDS **\$12** CLEAN USED PS/2 KEYBOARDS **\$5** NEW MINI-TOWER CASES W/250 WATT POWER SUPPLY **\$39** PS-2 MOUSE **\$15**
SERIAL MOUSE **\$10** 1.44 FLOPPY DISK DRIVE **\$22**

QUANTITY DISCOUNTS AVAILABLE ON ALL ITEMS

CALL US OR CHECK OUR WEB PAGE FOR GREAT DEALS ON NEW AND USED COMPUTERS, PARTS & ACCESSORIES

Write in 63 on Reader Service Card.

SECRET CB books, tune up manuals, service manuals, Sams photofacts + a whole lot more. Call for free catalog 1-800-536-0109.

KONNEX DISTRIBUTING. Call 1-888-777-7874. PO Box 451372, Los Angeles, CA 90045. CBs, antennas, meters, transistors, microphones, accessories. Best prices.

MUSIC & ACCESSORIES

COMPUTER HARDWARE

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.

TANDY/RADIO SHACK Model 1/3/4, 1000 Support. Monthly magazine, software, parts, repair. Computer News, POB 50127, Casper, WY 82605-0127. 307-265-6483.

Cables/Wire Harnesses Circuit Boards & Electro-Mechanical Assemblies

Quick turn around ♦ Prototype To Production ♦ Affordable pricing
♦ on-time delivery

Well Equipped Plant

Please Call for more information

PH: 847-616-0011 FX: 847-616-0015



Manu
Industries, inc
2645 American Lane
Elk Grove Village
IL 60007

Write in 141 on Reader Service Card.

WE BUY & SELL!

C and H

50 YEARS IN BUSINESS

SALES COMPANY

2176 E. Colorado Blvd.
Pasadena, CA 91107
FAX: (626) 796-4875

CALL OR WRITE FOR OUR FREE 128 PAGE CATALOG FILLED WITH GOODIES—ELECTRICAL, OPTICAL, MECHANICAL, AND MUCH MORE! ALSO, PLEASE VISIT OUR RETAIL STORE WHEN YOU'RE IN PASADENA.

Take advantage of our special purchase of TEST EQUIPMENT

ELECTRONIC COUNTER

HEWLETT PACKARD, Model 5328A. Universal counter. Usable to 100 MHz, 100 ns single shot resolution. Has frequency, period, period average, ratio, totalize, scale functions. A built-in digital voltmeter allows measurements of input voltages. Two input channels provide individual slope, polarity and level settings. Has 9 digit LED readout. Input power: 100-240 VAC 48-66 Hz 100 VA max. Dimensions: 17" wide x 17-1/4" deep x 3-1/2" high. Stock #TE9808 **\$250.00**



MULTIFUNCTION COUNTER

FLUKE, Model 1900A. Frequency range 5 Hz to 80 MHz. Period measurement 5 Hz to 1 MHz totalizing. Accumulates up to 999999 counts with overflow indicator. Input impedance 1 meg ohm less than 30 pF input capacitance. Display is a 6 digit LED readout. Time base 10.00 MHz. Has auto ranging in both period and frequency functions. Input sensitivity typ. 25 mV. Power requirement 115 or 230 VAC 50, 60 or 400 Hz 6.5 watts. Portable with carrying handle, which also can be used as a tilt stand. Dimensions: 8-1/2" wide x 12" deep (including handle) x 2-1/2" high. Stock #TE9800 **\$95.00**



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. 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**



AUTORANGING MULTIMETER

FLUKE, Model 8600A. LED readout. 4-1/2 digit resolution. 0.02% basic DC accuracy. Autoranging or manual operation. DC and AC voltage ranges to 1200 volts. AC and DC current measurement to 2 amps. Resistance to 20 meg ohms. Input resistance 2 meg ohms shunted by less than 100 pF. Power input 115 VAC 60 Hz 7 watts maximum. Has built-in carrying handle that also can be used as a tilt base. Dimensions: 8-1/2" wide x 12" deep (including handle) x 2-1/2" high. Stock #TE9804 **\$75.00**



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/millamps 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**



ALL TEST EQUIPMENT FUNCTIONALLY CHECKED, UNLESS DENOTED (CALIB.), WHICH IS CALIBRATED AND CERTIFIED TO MANUFACTURER'S SPECS AND ALL EQUIPMENT USED IN THE TEST IS DIRECTLY TRACEABLE TO THE NATIONAL BUREAU OF STANDARDS.

Call us first if you have surplus inventories of electronic, optical, or mechanical items for disposal.

Master Charge Visa American Express Discover

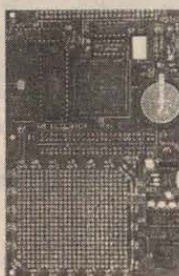
TOLL FREE: 1-800-325-9465

Write in 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



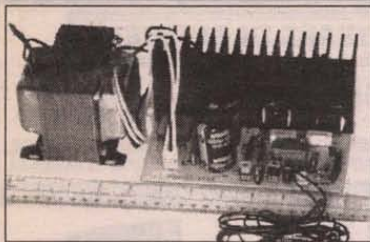
Orders (800) 949-8051
Info (916) 652-7472
fax (916) 652-6642
www.amresearch.com

AM Research, Inc.
PO Box 43
Loomis, CA 95650

Write in 180 on Reader Service Card.

April 1998 7

50W AUDIO AMP



Call Roger @
General Science & Engineering
716-338-7001

visit our web page
<http://www.axsnet.com/~genscien>

WITH
TRANSFORMER
70W into 4 Ohm

\$40.00 ea.
\$35.00 ea. 2 thru 9
\$40.00 ea. 10 or more

VISA OR MASTERCARD

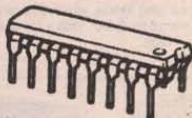
TANGO PCB SOFTWARE USERS. We use DOS version which won't drive our Cannon Bubblejet printer. Anyone out there have a driver that will work? Dan Marshall, 1-800-486-2288. 9am-6pm CST. Fax 512-453-2488.



19" RACKMOUNT PC chassis: Heavy duty, 4U, 8 slots expandable to 12, two (one hidden) 3.5"/two 5.25" drive bays, front panel fan, mini tower 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, both with software. **Computronics Technology**, 972-242-8087.

ROGER'S SYSTEMS SPECIALIST. SCSI fast wide cables, ten Base T cables and hubs, bi-directional 1284 I-EEE printer cables, micro-centronics type \$1.50. 9 ft. modem cable \$1 each. Pentium ball bearing fans \$2 ea. Hundreds of items. Call for catalog. Most orders shipped same day. Visit our web site www.rogerssystems.com 1-800-366-0579.

MACINTOSH SYSTEMS, repairs, parts and peripherals. Low prices on new, refurb, and used Macs and peripherals and all Mac parts. Repairs of whole units or repair or exchange of parts. Mac Shack 716-377-9230, FAX 716-377-9573. Visa/MC accepted. www.servtech.com/public/macshack



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.

BUILD YOUR own IBM™ computer from available parts with the help of an easy to view 79 min. video tape. This highly acclaimed VHS shows how to save you 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 this opportunity today, while supplies last, only \$29 (reg. \$59.95) plus \$2.95 P&H. Call 1-800-754-5096 or send check to: **EVP, PO BOX 2201, Northlake, IL 60164-0201** now!

Rave Review
Pop Comm
April '96

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"

FREE
AD-PAGE
SPECIAL EQUIPMENT
CATALOG!

SPECIAL
Nuts&Volts
Price..

\$159

COD's OK. Calif. residents add tax. Sorry, no credit cards. Free catalog USA only; other countries \$5.

...Includes UPS to 48 States

Viking International 150 Executive Park Blvd. #4600 San Francisco, CA 94134
Phone: (415) 468-2066 • Fax: (415) 468-2067 • Web: www.vikingintl.com "Since 1971"

Write in 179 on Reader Service Card.

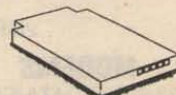
DEC EQUIPMENT WANTED!!! We are buying DEC systems, boards, terminals, drives and peripherals. Also Scientific Micro Systems (SMS), DSD, Datability, Dialog, other DEC compatibles, and Computer Output Microfilm (COM) units. Please call for a quote or fax us your equipment list. We buy, sell, and trade. **KEYWAYS, INC.**, 937-847-2300 OR fax 937-847-2350.

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-resolution video/computer CRTs. T.M.C. 215-226-0749/215-223-0388.

SONY/AMIGA/IND. MULTISCANS 15" 0.26 DP 15.7 (NTSC) thru 36KHz (1024x768). \$150. Blem SVGAs \$110. Others available. Expert Sony repair, parts available. 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.

NEW BAREBONES 200MMX computers in a mini-tower case with a 230W supply. 1.44MB floppy, 2.5MB SVGA and 16 bit 3D sound included. You provide the HD, monitor & kbd. Fully tested, \$300 + S&H. Used 486's also available. Disks N Data, PO Box 8428, Cherry Hill, NJ 08002. Jerry W2GIA 1-800-833-6893. E-Mail: dndcomp@ix.netcom.com "Since 1971"



ZENITH LAPTOP BATTERIES "NEW." Mastersport ZA-4-1 \$50. Supersport 2.5 amp-hour for ZWL 184 "NEW" \$30. Many other parts. Surplus Trading Corp., Benton Harbor, MI. 616-849-1800.

MONITOR REPAIR TECHNICIAN. Start up kit \$69.95 and up. Basic software \$25.95. Business, customers, where and how. USA, all foreign countries, ok. Internet: <http://crtpremiumtekk.cncoffice.com>

HEWLETT PACKARD Deskjet 500 printer (qty.), \$79. **HP Laserjet 3 Si** postscript, \$995. **HP 7550A** plotter (auto-feed, A to B size), \$99. **HP 7475A** plotter (8.5x11"), \$75. **Compaq** SVGA monitor, \$139. Accept Visa, MC, AMEX. Call Maple Data 908-964-7070.

Davilyn
CORP.

13406 Saticoy Street, North Hollywood, CA 91605

800-235-6222 818-787-3334 • F-818-787-4732 • [HTTP://WWW.Davilyn.com/Electronics](http://WWW.Davilyn.com/Electronics)

CALL FOR FREE CATALOG



TELEGRAPH KEYS

Unique item for military collectors. J37 telegraph key, new in original government package. \$49.95



JONES MODEL 1600-1 TACHOMETER

Instrument tachometer centrifugal mechanical tach measures RPM scale 0-500 RPM, coupling shaft 1/8" accessories, various size rubber tipped drive couplings, case new. Also Jones Model 1600-7 RPM scale 0-11,000 RPM w/accessories new. \$35/ea. or 2 for \$50

MORGAN DATA SYSTEMS MODEL 8609

Constant voltage or current power supply voltage range: 0 to 50 volts. Current range: 0 to 1.5A. Readout: 3 digit with 0.1 volt and 1mA current resolution. Regulation: linear; input voltage: 115V/220V. Adjustments: voltage and current has remote control adjustment capability. NEW. Price: \$195



THE BEST PRICE EVER
ON THIS INDUSTRY FAVORITE
\$1,095 + SHIPPING

HP 8640B SIGNAL GENERATOR OPT 003



CONDITION CODE "A"

Frequency: 500KHz to 512MHz. Indicates to 1024MHz. Requires external frequency doubler for 1024MHz (supplied with unit). Readout can be used as a frequency counter. Accuracy: 6.5 digits expandable to X10 and X100. Output: -145dBm to +19dBm (0.5 to 512MHz). Modulation: AM, FM, pulse, 400 and 1KHz, 1mV to 1V internal. Has input and output of modulation sources. PRICE: \$1,095

EXCEPTIONAL
CONDITION

QUANTITY LTD
ORDER TODAY
WARRANTY
100 DAYS

TEK MODEL 7603N



Oscilloscope: Mil Spec AN/USM-281C, 8x10 CM display, 100MHz response which accepts standard 7000 series plug-ins. Vertical Plug-in: 2 ea. 7A15 (AM-6565), frequency BW 75MHz, maximum sensitivity 5mV/DIV. Horizontal Plug-in: 1 ea. 7B53 (TD-1085), triggering to 100MHz, minimum, sweep time 50 NS/DIV, has delayed sweep capacity. Includes cover, probes, accessories. Price: \$395

ANURM-120 50 OHM THRU-LINE RF WATTMETER



Frequency range: 2MHz to 1000MHz. Power range: 10 watts to 1000 watts. USWR: 1.08 to 1. Uses three plug-in coupler elements (included). CU-753 2 to 30MHz 50 to 100 watts CU-754 25 to 250MHz 10 to 500 watts CU-755 200 to 1000MHz 10 to 500 watts. Connector: Type N. Case included. Size: 7"Wx6-5/8"Hx7-1/5"D. Weight: 6.5 lbs. Price: \$395



WATKINS JOHNSON VHF/UHF RECEIVER
TYPE WJ-8628-4
20-512 (1400) MHz

Plug-in module requires main frame (not supplied). Multimode bandwidth and detection. Can be set to auto scan tuning. Price: \$12,500.00

LAMBDA LK344A-FM POWER SUPPLY



Front panel voltage and current meters. Convection-cooled, no blower. Voltage adjustable from 0 to 60 VDC at a maximum current of 4A. Regulation 0.015% or 1mV. Line or load. Series/parallel operation. Remotely programmable by voltage or resistance. Less than 500uV RMS ripple. Constant current/constant current. NEW Price: \$395

by Gordon West

COPPER FOIL GROUNDING FOR RADIO FREQUENCIES

Hey, all you radio guys and girls, GOT GROUND? For a powerful marine and ham single-sideband transmission, and improved reception, good grounding techniques at the radio and at the automatic antenna tuner are extremely important. And for mariners planning on installing a differential GPS receiver for improved GPS positioning, GOOD GROUND is extremely important to improve the capabilities of your low-frequency DGPS system that feeds correction signals to your onboard GPS.

GOOD GROUNDING is also important to reduce the noise build-up interaction between various pieces of marine electronics aboard a boat. You may find that the inverter turned on that wipes out TV reception might be rendered almost noise-free by grounding the metal frame to a central ground plane aboard the boat. Same thing with automatic pilots and many voltage/ampereage monitoring systems — their built-in central processing units (CPUs) can generate tremendous radio frequency interference from their squawwaves, and this interference can be contained within the device by good grounding techniques.

THE ULTIMATE GROUND

You are floating on it: sea water — the ultimate ground. The conductivity of salt water is the closest thing we can get to a traditional copper-screen land ground. Did you ever wonder why big military and

one-quarter wavelength OR GREATER mirror image of the radiator. This mirror image ground system is sometimes called a COUNTERPOISE. Without a good COUNTERPOISE, a one-quarter wavelength antenna cannot develop the antenna current to force your signal off of the wire and out to the ionosphere.

Low-frequency, medium-frequency, and high-frequency antenna systems all rely on sea water as making up the other half of the radiating antenna system. Electrically, your insulated backstay or big white fiberglass high-frequency whip is tuner resonated to be one-quarter electrical wavelength long. The tuner then looks for the ground connection to develop the COUNTERPOISE as the other mirror-image one-quarter wavelength. The greater the ground counterpoise potential, the higher the antenna radio frequency current that may be developed at the output of the automatic antenna tuner.

"The effect of a perfectly conducting ground can be simulated under the antenna by installing a metal screen or mesh, such as chicken wire or hardware cloth, near or on the surface of soil ground," comments the American Radio Relay League in their *Ham Radio Antenna Book*.

"The screen should extend at least a half wavelength in every direction from the antenna ... the screen will reduce losses in the ground near the



Copper foil for radio grounds.

GETTING THERE IS THE BIG JOB

So how do you ground your marine and ham single-sideband transceiver to this water ground? And how do you ground the antenna coupler to the sea water ground? One big heavy ground cable should do the trick, right?

Wrong!

Despite the fact you grounded your radio and antenna coupler with massive four-gauge, stranded conductor, your brand new marine and ham single-sideband installation just isn't working right. Other mariners tell you your signal is garbled. The high seas marine operator indicates a very weak reception of your transmission, and on voice peaks your equipment goes into oscillation. Other boaters with SSB aboard all around you can talk regularly to the gang in Hawaii; and while you can hear them relatively well, they don't even know you are trying to transmit. Yet you have these huge four-gauge wires going from your antenna and tuner down to the world's biggest ground plate that's making sea water contact with a gold-plated connection.

What's worse, every time you transmit, all your bilge pumps click on, your autopilot goes whacko, your wind and speed equipment reads gale force conditions, and the propane stove automatic lighters begin to click with every syllable. And one of your guests indicates they will never use the head again when you're speaking over your marine SSB radio. Something about being in contact with the sea water and a burning sensation.

WHY WIRES WON'T WORK

You might have thought a big four-gauge wire off of your radio and tuner would be a great way to ground your long-range radio set-up to that massive underwater ground plate. You take out your fluke ohmmeter, and the combined run of 40 feet of #4-gauge wire registers only a fraction of a DC ohm resistance. With a maximum of two amperes of RF current from an antenna system from a 100-watt SSB transceiver, we definitely don't have a DC resis-

The brand new Yaesu ham radio FT-847 works better with a foil ground.



commercial AM radio stations always plant the base of their antennas in marshes or at the edge of ocean bays? This is because the necessary ground is already in place to make up the essential "missing quarter" of their antenna system.

THE MISSING GROUND?

Halfwave antenna principles are based on a one-quarter wavelength antenna radiator, and a

antenna ...". As you decrease these ground losses, you increase radiation resistance and the amount of current that leaps off your insulated backstay or big non-resonant whip, and takes that first long-range bounce off the ionosphere.

Luckily for us mariners, we don't need screen. Salt water is a wonderful conductor; and when you're sitting in the middle of it, you certainly exceed the half wavelength necessary for strong antenna currents in the backstay or whip.

tance problem, here, do we?

We don't, but we do.

Chances are you spotted the green #8 stranded wire that may be part of your BONDING system for corrosion control. This WIRE is more than adequate to handle the few hundred milliamps that might be flowing from a sacrificial zinc anode to the protected underwater metals. This WIRE might also provide a low resistance path to bleed off a static discharge as you're sailing through the water, or getting close to thunderstorm activity.

Wires do an interesting thing at radio frequencies, including the unpredictable alternating currents of lightning.

That big #4 ground wire you installed as part of your ship radio station ground system is making up a minimum of half of your halfwave automatically tuned Marconi antenna system. Current not only flows in the part of the antenna you never want to touch on transmit, but there may also be current that gets mighty warm as part of your wire ground system. This is because the current flowing along your wire conductor in your ground system is a moving electromagnetic field. That big ground wire that may go directly from your tuner down to the underwater ground plate may develop the characteristics of a COIL of wire — after all, that wire is in the form of a cylinder, if you think about it.

Coils at different radio frequencies develop a very special type of RESISTANCE where the phase angle of voltage and current within the electromagnetic field TRAP the RF currents from making it from the automatic tuner all the way down to that big copper ground plate. It's not the slight resistance of the big wire that TRAPS the energy, but rather the fact that wire is round, and behaves like a radio coil at certain frequencies. And because you're using many different frequencies on ham and marine, and because your automatic antenna tuner develops its own internal inductive and capacitive reactance to develop resonance in the antenna circuit, there is no telling what length of wire, what frequency, or what wavelength won't see the nearby water as the great ground potential that it is.

Sure, you could move your tuner and put it right down there next to the big ground plate, and this would solve the problem nicely. But now you have the added problem of RF being transmitted from the water line up, off of that single GTO-15 high voltage wire, getting into all of the other electronics onboard. Better leave the automatic antenna tuner right where it is, in the lazarette or hanging locker aft in a sailboat, or up near the antenna in the flying bridge of a power boat. Or in a home installation, the automatic antenna tuner is up at roof level, keeping all of the radio frequency energy safely away from the operator down below.

Copper foil offers negligible reactance at maritime and ham radio medium-frequency and high-frequency wavelengths. Copper foil takes your sea water ground and brings it right up to the base of the tuner with almost no DC I²R losses, and virtually no trapping of the signal caused by wire reactance.

Copper foil from the tuner to a good sea water ground eliminates the need for one-quarter wavelength radials run below decks, and may also eliminate the need for that 100 square feet of ground which was what we originally had to do in the old days where antenna tuning was done at the radio, rather than automatically in the automatic antenna coupler.

"The outside one square foot ground plate will

develop a terrific sea water ground potential if coupled to the automatic coupler using three-inch-wide copper foil," comments Jim Tindall of ICOM America. "But I always suggest that the more ground potential you can add to your marine and ham SSB system, the better," adds Tindall, indicating he might also ground to additional bonded underwater bronze through-hulls for additional sea water contact. It certainly wouldn't hurt.

In fact, the underwater bronze through-hulls that are part of your underwater bonding system make for great sea water pick-up points for your copper foil. Wire brush each bronze through-hull, wrap the foil around it and secure it with a stainless steel hose clamp, and then run the foil to other nearby bonded underwater bronze through-hulls. Since they are already bonded together with the corrosion control green wire, you are not changing your underwater galvanic balance.

During recent tests with three-inch-wide copper foil, I found that three or more bonded underwater bronze through-hulls gives me about the same performance as a dedicated underwater ground plate. Why bore a hole in the bottom of your boat for a



Shortwave reception improves with a foil ground.

ground plate if you don't have to? Got some bonded bronze through-hulls? Give them a try, first.

If you are swapping out wire for copper foil, get the wire out of circuit. Use the wire for something else — maybe re-doing that corrosion control bonding system to meet American Boat & Yacht Council (ABYC) recommendations. ALWAYS adhere to ABYC recommendations.

For power boats, your job is getting from the automatic tuner in the flying bridge down below to those underwater through-hulls. It's perfectly acceptable to squash the foil into an irregular slim mass, now and then, to squeeze through tight areas. Just try to keep as much surface area exposed on the foil as possible.

For home installations, your job is to get the copper foil over to the chicken wire that holds the plaster on the side of your home. Or maybe run the foil down through a rain water downspout, and start burying it in the soil.

For home installations, keep in mind that soil is a lousy ground, and doesn't have near the conductivity as sea water. You must run over 100 feet of three-inch-wide copper foil buried under the ground to achieve good soil contact. You may notice your signal will get better after a big rainstorm, too!

See, mariners, what a good deal we have by running our station floating in the world's best ground plane?

Marine radio manufacturers ICOM America and Shakespeare Antenna both commissioned one-hour-long individual audio cassettes ALL ABOUT MARINE SSB INSTALLATIONS, and ALL ABOUT MARINE VHF RADIO AND INSTALLATIONS. You can get these two audio cassettes directly from me for a \$20.00 bill by writing Radio School, 2414 College Drive, Costa Mesa, CA 92626. You can actually hear the difference between wire grounding and foil grounding systems.

The biggest provider of radio ground foil in bulk lengths of your choice is Metal & Cable Corporation, Twinsburg, OH; phone 330-425-8455, FAX 330-963-7246, or E-Mail David@metalcable.com. Besides their .0073-inch-thick x three-inch-wide pure copper foil, they also carry heavier .011-inch-thick x two-inch-wide copper strap with machine edges for safer handling. This is what I use for my home high-frequency radio installation where I don't need to fold it to sneak around tight corners as I would aboard a boat. This heavier strap is also a better way to convey nearby lightning surges directly to a good ground. I use this heavier copper foil off of my coaxial cable lead-in point on the side of my house directly down to a massive wet-soil ground system.

Aboard sailboats, I have seen this heavier foil added to the existing lightning wire ground system going from the base of the mast directly down to a keel bolt or underwater ground plate.

But if you should encounter a direct lightning strike, don't expect much of anything to work after the bolt other than your little handheld radio to call out for help. Lightning is unpredictable, and is a completely different subject than the need for a good radio frequency ground.

Finally, I suggest you also ground your stainless steel rails aft with the three-inch-wide copper foil. This will allow you a good sea water ground point for that new differential beacon receiver you're going to put back there for the reception of

low-frequency RDF-type GPS correction signals broadcast by the United States Coast Guard. Soon the US Coast Guard will have access to hundreds of land transmitting stations originally intended for the emergency broadcast service. Copper foil grounding techniques will allow you to pull in differential GPS correction signals all over the country — inland or out on the water. Since these signals are down below the AM broadcast band (200 KHz-500 KHz), good copper foil grounding techniques will dramatically improve your receiving capabilities.

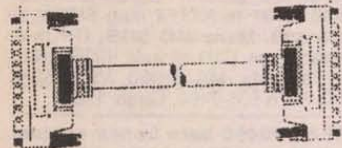
Also ground all of your other instruments aboard the boat — this will decrease the amount of noise coming out of those CPUs. For instruments, you can fold the three-inch foil in half, and this will suffice.

Got enough ground? That's easy to tell. Take that extra foil you ended up with, and toss one end into the sea water. Get someone to hold it near the antenna coupler. Make contact with a ham or marine shore station, and get an initial signal report. Now have your assistant touch the foil to the existing ground system, and see if your signal changes with this additional hunk of foil hanging in the sea water.

If the automatic tuner doesn't re-tune, and if the radio service says you sound the same, then you know that additional grounding is not necessary. See, I told you that just one or two good ground connections from your automatic coupler is all that is necessary if you use copper foil.

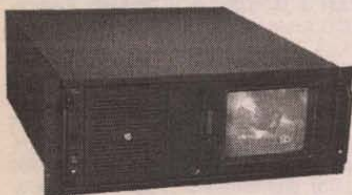
Copper foil — low reactance, good results. NV

PENTIUM MOTHERBOARDS, TX pro chipset, 1MB pipeline cache, performance under Win95 with 233 MX CPU beats Pentium II-300, 3 ISA/4 PCI, sound on board, 2-year warranty, \$85, CPUs: Pentium MMX: 166/200/233 @ \$119/139/229 IBM/Cyrix 200/233 MX \$99/159, AMD K6 MMX 166/200/233 @ \$119/159/189, 24X CD-ROM, audio button \$69, 72-pin SIMMs, 60ns EDO, 16MB \$35, 32MB \$74, S3 Virge DX 2MB video card \$39, 4MB GX \$54. Call for current pricing, other parts and illustrated catalog, faxback catalog pages, minimum 1-year warranty, 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



NORTHWEST CABLE and Connector Co. Your source for computer, network, and telecom cables, connectors, adapters, switchboxes, and related hardware. Examples: SCSI3 cable, HPDB68M/M, 6 foot, \$30; 7 foot UTP patch cable, \$3; RJ11 plugs, \$0.06; RJ45 plus, \$0.12. No minimum order, free shipping on orders over \$50. Deep discounts to wholesalers. Visa/MC/COD accepted. Call 360-754-3606, fax 360-754-0825, or visit www.olywa.net/lor elec/nccc

NEW "All-In-One" 486 mainboard with DX2-50 CPU (upgradeable) 128K cache 1Meg Video and IDE I/O (and all the cables) for \$55 (also available without CPU), fits in a standard PC case. 16 30 pin SIMM sockets. Win95, OS/2 and Win3.XX video support. Video chipset is Video 7. Uses 386, 486DLC, 486SX, 486DX and 486DX2 CPUs. Call for current price on 19 SIMMs. Call Under The Wire Electronics (UTWE) 626-930-1121 (10am-5pm PST) or fax 626-930-1123. UTWE 235 E. Colorado Blvd. #211, Pasadena, CA 91101. E-Mail: JohnUTWE@aol.com



RACKMOUNT PC CASES W/MONITOR: 2 models, 4U high, American-made, 7" mono VGA monitor built-in, AT/ATX, from \$499. DASH 1-800-844-7620, 913-681-3001.

PIC IN-CIRCUIT EMULATOR for PIC16Cxx from \$295. PIC programmer \$155; 80C552 (8051) development training system \$235; ROMY-16 EPROM emulator from \$195; 68HC11 development system \$210; Universal microprocessor simulator/debugger (including assembler and disassembler) \$100 each CPU. J&M Microtek, Inc., 83 Seaman Road, West Orange, NJ 07052, Tel 973-325-1892, Fax 973-736-4567, http://www.jm-micro.com

TRANSMIT YOUR brain waves through space to your robot or computer. Make them talk, type, and move. Book \$39.95. Hardware available. Rose, POB 7589, Chula Vista, CA 91912.

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!

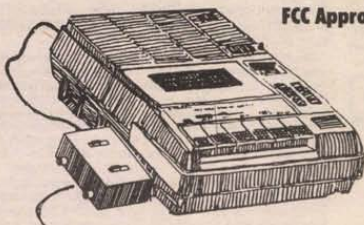
Cruising Equipment

5245 Shilshole Ave. NW, Seattle, WA 98107
(206) 782-8100 Fax: (206) 782-4336
See us on the web: <http://cruisingequip.com>

Write in 147 on Reader Service Card.

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 186 on Reader Service Card.

EVERYTHING NEW w/warranty! Motherboards w/CPU + 256K cache, P233 MHz MMX \$195, megabyte/gigabyte hard drives \$95. 15/17" SVGA monitors \$175/395. Pentium Class systems from \$450. Also multimedia kits, hard drives, scanners, printers, SCSI adapters \$25/45. Memory, cases, etc. Call for monthly specials. CCI 714-778-0450. E-Mail: cci@net999.com

TRS-80 MODELS 1, 3, 4, 100, pocket computer, COCO. #10 SASE, 55¢ stamp, for list to: TRS-80 AGAIN, 100D W. Falls St., Kings Mountain, NC 28086. E-Mail: petebum@aol.com

EXTERNAL SCSI cases with power supply for CD-ROM, tape, hard drive, etc. Includes 2 Centronics 50 pin connectors and internal cables, power LED, power cord, etc. Used, but in great condition, single device case \$29. 4 device case NEW/used \$90/\$50. Great deals on external SCSI cables too! Call Under The Wire Electronics (UTWE) 626-930-1121 (10am-5pm PST) or fax 626-930-1123. UTWE, 235 E. Colorado Blvd. #211, Pasadena, CA 91101. E-Mail: JohnUTWE@aol.com

UPS SLIMLINE, 400 VA sinewave, \$30 ea. qty 5. Pikul & Assoc. 314-937-0335.

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



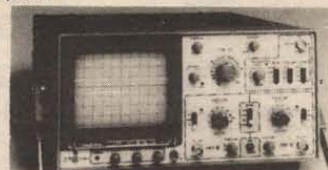
platt - Case - Cordura Exterior. Two exterior pockets & one literature pocket. 660ZT Case, complete with tools ... \$223.00
660ZT Case Only ... \$59.45
Optional Sperry meter #DM6510 as shown ... \$65.00



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 ... \$23.50



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 ... \$380.00

Electro Tool, Inc.



9103 Gillman, Livonia, MI 48150
Customer Service: (313) 422-1221
ORDERS ONLY: 1 (800) 772-3455
FAX: (313) 422-3432



"Tools American Made."

Write in 169 on Reader Service Card.



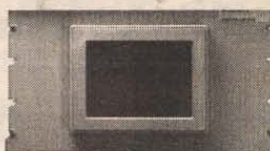
19" RACKMOUNT PC CASES: three 5-1/4" drive bays up front, PS included. AT-beige \$289, ATX-beige \$329, plus shipping and handling, on prepaid or COD orders. Black: add \$20. Ball-bearing slides available. Dash 1-800-844-7620, 913-681-3001.



INDUSTRIAL PCs: 11"x9"x4" and 15"x14"x6". Can be wall mounted, dust resistant, 12VDC, 24VDC, or 120/240VAC power, Pentium/K6 CPU AT or ATX. Dash 1-800-844-7620, 913-681-3001.

IBM P233 MHz multimedia systems, Gigabyte hard drives, liquidation price \$595. AT&T Pentiums \$650, 386 systems \$295. Laser printers \$275, color inkjets \$135, color notebooks \$650, closeout prices on software. Call 714-778-0450.

LOOKING FOR cheap clone PC parts that actually work? Call UTWE for CD-ROMs, hard drives, disk controllers, video cards, mainboards CPUs, etc. Large and small quantities OK. Call 626-930-1121 or fax 626-930-1123. E-Mail: JohnUTWE@aol.com



19" RACKMOUNT MONITORS: 9" mono SVGA \$249, 14" .28mm digital \$289 plus shipping, prepaid or COD. Black add \$25. Dash 1-800-844-7620, 913-681-3001.

486 COMPUTERS \$195, Pentiums \$295, FAX modems w/sound cards \$25, 386SX40 \$25, 1.2/1.44 floppy \$20, PCI SCSI \$45. 714-778-0450.

PC WATCHDOG protects against software bugs and power glitches, reboots PC if problems occur. Each multi-hit watchdog monitors up to 4 programs in multitasking environment. If you must be offline, 30 seconds is better than a weekend! Includes two 16 bit counters, 24 TTL I/O. Starting at \$70. Innovation West, 626-309-0885, lnovwest@aol.com http://members.aol.com/lnovwest/

COMPUTER CLOSETS: mini-tower BB Cannon 486DX2-66 or DX2-50 sys. 2-66 \$99, 2-50 \$89. 250 PCS. DEC Alpha mother bd. with CPU 166MHz \$99. DEC 486DX33/66PC work S. bare B. only \$69, \$250/5. Pentium MO BDs, ASUS SP97 to 233, 4 meg SVGA, & more \$99. Many MO BDS, CPUs & memory avail. Cat'l on web. BNFE, Rte. 1S, Peabody, MA 01960, V978-536-2000, F978-536-7400, Estab. 1964.

GREAT 80486 bare bones system deal! New 486DX2-50 (or 66) CPU, 128K cache, 1 Meg VGA by Video 7, 16 30 pin, SIMM sockets, IDE and floppy controller, 2 serial ports and 1 parallel port, desktop case with 235 watt supply all for \$80 (or \$95 for 66MHz). New cheap keyboards available too! Call UTWE @ 626-930-1121 10am-5pm PST or fax 626-930-1123. E-Mail: JohnUTWE@aol.com

AFFORDABLE CNC MACHINES! Also parts/drivers/software. Write: motivity, Attn. Pam, PO Box 428, Rocklin, CA 95677. Call 916-349-8757. www.motivityusa.com A great place to buy CNC.

COMPUTER SOFTWARE

MARKETING SOFTWARE outperform them all, get maximum returns. Want more information, call 1-800-228-1628 or connect to http://members.tripod.com/~GD_Enterprises/index.html GD Enterprises, PO Box 292705, Davie, FL 33329.

CAM & MOTION SOFTWARE: Z-trace, PCB toolpath, \$299. Plotcam motion, \$149. cmcheater@juno.com MSG/FAX 407-452-7197, 407-459-2729 <http://www.megabits.net/ddt>

LINUX! LINUX! LINUX! If you aren't purchasing your Linux products from us, you are paying too much! We offer the major distributions (Yggdrasil, Slackware, Red Hat, etc) at great prices! We also carry a full range of books. Contact us at www.cheapbytes.com and use our secured web server. E-Mail: sales@cheapbytes.com Fax: 209-367-8518. Cheap*Bytes, PO Box 2714, Lodi, CA 95241.

FREE HACKING/phreaking/troubleware diskette catalogue. Incredible subject matter. No commercial programming and NO SHAREWARE here! Peregrine Dynamics, 720 Portage Trail, Cuyahoga Falls, OH 44221.

IBM SHAREWARE, free catalog, \$1 disk, 35¢ specials, huge selection, 100% virus free. PMA, Box 2424, Scottsdale, AZ 85252. 602-496-6547. Specify disk size.

SONY PLAYSTATION mod chips allow you to play CDR backups & imports. \$50 ea. Quantity discounts. 1-800-663-8530.

Bearcat Intercepts Trunked Radio

COMMUNICATIONS ELECTRONICS INC.

Now...Monitor trunked radio broadcasts

Save big on radio scanners, weather stations, two-way transceivers and more from CEI during our 29th anniversary. To get your free fax-on-demand catalog dial 734-663-8888 from the telephone handset on your fax machine and follow the recorded voice prompts or visit CEI on the web at www.usascan.com. Get many free benefits such as extended warranty coverage on CEI merchandise when you use your Communications Electronics Platinum Plus Master Card issued by MBNA. No annual fee. Call 1-800-523-7666 anytime and mention offer Q3K1.

Weather Stations



The Weather Monitor II (7440) comes complete with an anemometer with 40 feet (12.2 m) of cable, external temperature sensor with 25 feet (7.6 m) of cable, junction box with 8 feet (2.4 m) of cable, AC-power adapter, detailed instruction booklet and one year limited factory warranty.

Now you can be your own weather reporter with the Davis Weather Monitor II. Our top-of-the-line weather station combines the most advanced weather monitoring technologies available into one incredible package. Glance at the display, and see wind direction and wind speed on the compass rose. Ideal for helping plan evacuation orders. Check the barometric trend arrow to see if the pressure is rising or falling. Push a button, and read indoor and outdoor temperature, wind chill, humidity and barometric pressure. Using the Weatherlink with Weather Talker option and your computer, you can issue your own spoken weather reports. Ideal for issuing your own spoken weather reports. Call 734-994-9000 now for live demonstration. Our system can even call you when preset alarm conditions are exceeded. Our package deal includes the new ultra high resolution 1/100 inch or 0.2 mm rain collector part #7852, and the external temperature/humidity sensor, part #7859. Save over \$175 when you order our package deal from CEI. Package deal is order #7440CS-W is \$419.95 plus \$18.00 shipping. If you have a personal computer, when you order the optional Weatherlink computer software for \$134.95, you'll have a powerful computerized weather station at a great price. For the IBM PC running Windows, order part #7862-A. Apple Mac Plus or higher including PowerBook, order part number 7866-A.

Davis Weather Monitor II 7440-A \$334.95
Davis Weather Wizard III 7425-A \$149.95
Davis Perception II indoor stand-alone weather monitor 7400-A \$124.95
Davis Weather Talker 7861-A - Call 734-994-9000 for demonstration \$334.95
Davis Solar Radiation shield 7714-A, helps protect temperature sensor \$54.95
Davis Remote Display Unit 7815-A \$84.95
Davis Rain Collector Heater - excellent for winter use 7720-A \$99.95
Davis Aluminum Rain Collector Shell 7704-A \$29.95
Davis Rain Collector II 0.01 inch resolution 7852-A \$59.95
Davis Rain Collector II 0.2 mm 7852MTC-A \$59.95
External Temperature/Humidity Sensor 7859-A \$99.95
Davis Weatherlink Software for IBM PC-Windows version 4.0 7862-A \$134.95
Davis Weatherlink Software for Apple-Version 3.0 7866-A \$134.95
Davis 4-Conductor 40' (12.2 m) extension cable 787040-A \$17.95
Davis 4-Conductor 40' (12.2 m) extension cable 787040-A \$21.95
Davis 4-Conductor 100' (30.5 m) junction box cable 7880100-A \$44.95
Davis Interface Cable Adapter Module 7760-A \$59.95
Davis Weather-resistant Terminal Box Shelter 7774-A \$34.95
Davis Electrostatic & RF Protected Junction Box 7740-A \$39.95
Davis Optically coupled Weatherlink Isolator Kit 774-A \$39.95
Davis Grounding Kit, helps protect your station - 7780-A \$19.95
Davis CatBoostTV Lighter Power Cord 7873-A \$9.95
2400 baud modem for Weatherlink-MEXT-A \$29.95
Davis aluminum Sensor Mounting Arm - 7702-A \$54.95

Radio Transceivers

NEW/RELM@MPV32-A Transceiver

Mfg. suggested list price \$515.00/Special \$299.95
Law enforcement and fire departments depend on the RELM MPV32 transceiver for direct two-way communications with their police or fire department, civil defense agency or amateur radio repeater. The MPV32 is our most popular programmable frequency agile five watt, 32 or optional 64 channel handheld transceiver that has built-in CTCSS, which may be programmed for any 39 standard EIA tones. Frequency range 136.000 to 174.000 MHz. The full function, DTMF compatible keypad also allows for DTMF Encode/Decode and programmable ANI. Weighing only 15.5 oz., it features dealer programmable synthesized frequencies either simplex or half duplex in 2.5 KHz increments. Other features include PC programming and cloning capabilities, scan list, priority channel, selectable scan delay, selectable 5 watt/1 watt power levels, liquid crystal display, time-out timer and much more. When you order the MPV32 from CEI, you'll get a complete package deal including antenna, 700 mA battery (add \$20.00 to substitute a 1000 mA battery), battery charger, belt clip and user operating instructions. Other useful accessories are available. A heavy duty leather carrying case with swivel belt loop part #LCMP is \$49.95; rapid charge battery charger, part #BCMP is \$69.95; speaker/microphone, part #SMMP is \$54.95; extra high capacity 1000 mA, ni-cad battery pack, part #BPMP1 is \$79.95; extra 700 mA, ni-cad battery pack, part #BPMP2 is \$59.95; cloning cable part #CCMP is \$34.95; PC programming kit, part #PCKIT030 is \$224.95. A UHF version with a frequency range of 450-480 MHz, part #MPU32 is \$349.95. Your RELM radio transceiver is ideal for many different applications since it is easy to field program with just a screwdriver and programming instructions. The technician programming instructions part #PIMPY is \$18.00. Call 1-800-USA-SCAN to order.

TrunkTracking Radios

Bearcat@235XLT-A TrunkTracker

Mfg. suggested list price \$429.95/CEI price \$269.95
300 Channels • 10 banks • Trunk Scan and Scan Lists
Trunk Lockout • Trunk Delay • Extra battery & charger
10 Priority Channels • Programmed Service Search
Size: 2-1/2" Wide x 1-3/4" Deep x 6" High
Frequency Coverage:
29,000-54,000 MHz., 108-174 MHz., 406-512 MHz., 806-823.995 MHz., 849.0125-868.995 MHz., 894.0125-956.000 MHz.
The Bearcat TrunkTracker BC235XLT, is the world's first scanner capable of tracking a selected radio transmission as it moves across a trunked radio system. Now it's easy to monitor fleets and subfleets in analog trunked radio systems. The BC235XLT can also work as a conventional scanner. This 300-channel, programmable handheld scanner provides scanner users with uninterrupted monitoring capabilities of Type I, II, and hybrid trunking systems. One of the biggest obstacles in the scanner industry has been the increasing use of trunking radio systems in business and public service agencies throughout the U.S. and Canada. This makes it nearly impossible to track a conversation as it moves within a trunk system from frequency to frequency. According to Ken Ascher, WB8LIT, Chairman & CEO of CEI, "The Bearcat 235XLT is a revolutionary breakthrough in scanner technology. Now it's easy to continuously monitor conversations even though the message is switching frequencies." The BC235XLT comes with AC adapter, CRX120 battery charger, two rechargeable long life ni-cad battery packs, belt clip, flexible rubber antenna, earphone, owner's manual and one year limited Uniden warranty. Not compatible with AGEIS, ASTRO, EDACS, ESAS and LTR systems. Call 1-800-USA-SCAN to order your scanner.

SW/CB/GMRS Radio

Have fun and use our CB, GMRS and commercial radios to keep in touch with friends. Visit our web site at www.usascan.com for more information or call 1-800-USA-SCAN to order.

Cobra 1480T-A SSB CB/SPECIAL \$139.95
Cobra 148FGT-A SSB CB with frequency counter \$179.95
Cobra 29WXST-A CB with sound tracking technology \$149.95
Cobra 2010GTW-A SSB CB Base (\$125.00 shipping) \$299.95
Cobra HH45W-A Handheld CB radio with weather \$89.95
Cobra FRS200-A Family Radio Service transceiver \$39.95
Maxon GMRS210-A GMRS transceiver/SPECIAL \$166.95
RELM RH256NB-A 25 watt VHF mobile transceiver \$284.95
Sangean ATS909-A portable shortwave receiver \$229.95

Radio Scanners

Monitor fire, police, weather, marine, medical, aircraft and other transmissions with your Bearcat scanner.

Bearcat 9000XLT-A base/mobile \$344.95
Bearcat 3000XLT-A handheld \$329.95
Bearcat 895XLT-A TrunkTracker base \$319.95
Bearcat 760XLT-A base/mobile \$179.95
Bearcat 230XLT-A handheld/SPECIAL \$194.95
Bearcat 235XLT-A TrunkTracker scanner \$269.95
Sportcat 150-A handheld with 800 MHz. \$144.95
Bearcat 80XLT-A handheld with 800 MHz. \$129.95
Bearcat BC712-A information mobile \$169.95
Bearcat BC77-A information mobile \$149.95
Reim MS200-A computer programmable \$219.95
Reim HS200-A handheld CTCSS/800 MHz. \$224.95

DISTRIBUTOR'S COUPON EXPIRES 7/31/98 #9804T7B

SAVE \$45 on 1 TrunkTracker

Save \$45 when you purchase your Bearcat 895XLT or BC235XLT scanner directly from Communications Electronics Inc. PO Box 1045, Ann Arbor MI 48106 USA. Telephone orders accepted. Call 1-800-USA-SCAN. Mention offer TT4. TERMS: Good only in USA & Canada. Only one coupon is redeemable per purchase and only on specified product.

Bearcat@895XLT-A Radio Scanner

Mfg. suggested list price \$729.95/Special \$319.95
300 Channels • 10 banks • Built-in CTCSS • S Meter
Size: 10-1/2" Wide x 7-1/2" Deep x 3-3/8" High
Frequency Coverage: 29,000-54,000 MHz., 108-174 MHz., 216,000-512,000 MHz., 806,000-823,995 MHz., 849,0125-868,995 MHz., 894,0125-956,000 MHz.

The Bearcat 895XLT is superb for intercepting trunked communications transmissions (see BC235XLT description) with features like TurboScan™ to search VHF channels at 100 steps per second. This base and mobile scanner is also ideal for intelligence professionals because it has a Signal Strength Meter, RS232C Port to allow computer control of your scanner via optional hardware and 30 trunking channel indicators to show you real-time trunking activity for an entire trunking system. Other features include Auto Store - Automatically stores all active frequencies within the specified bank(s). Auto Recording - This feature lets you record channel activity from the scanner onto a tape recorder. CTCSS Tone Board (Continuous Tone Control Squelch System) which allows the squelch to be broken during scanning only when a correct CTCSS tone is received. For maximum scanning enjoyment, order the following optional accessories: P5001 Cigarette lighter power cord for temporary operation from your vehicle's cigarette lighter \$14.95; P5002 DC power cord - enables permanent operation from your vehicle's fuse box \$14.95; MB001 Mobile mounting bracket \$14.95; EX711 External speaker with mounting bracket & 10 feet of cable with plug attached \$19.95. Comes with AC adapter, telescopic antenna, owner's manual and one year limited Uniden warranty.

Buy with confidence

It's easy to order from us. Mail orders to: Communications Electronics Inc., P.O. Box 1045, Ann Arbor, Michigan 48106 USA. Add \$18.00 per weather station or radio product for UPS ground shipping, handling and insurance to the continental USA unless otherwise stated. Add \$12.00 shipping for all accessories and publications. Add \$12.00 shipping per antenna. For Canada, Puerto Rico, Hawaii, Alaska, Guam, P.O. Box or APO/FPO delivery, shipping charges are two times continental US rates. Michigan residents add state sales tax. NO C.O.D.s. Satisfaction guaranteed or return item in unused condition in original packaging within 61 days for refund, less shipping charges. 10% surcharge for net 10 billing to qualified accounts. All sales are subject to availability, acceptance and verification. Prices, terms and specifications are subject to change without notice. We welcome your Discover, Visa, American Express, MasterCard, IMPAC or Eurocard. Call anytime 1-800-USA-SCAN or 800-872-7226 to order toll-free. Call 734-996-8888 if outside Canada or the USA. FAX anytime, dial 734-663-8888. Dealer and international inquiries invited. Order from Communications Electronics Inc. today and save.

Price schedule effective April 6, 1998. Add \$9.00/SHIPPING. ©1998 Communications Electronics Inc.

For credit card orders call 1-800-USA-SCAN

Communications Electronics Inc.
Emergency Operations Center
email: cei@usascan.com

www.usascan.com

PO Box 1045, Ann Arbor, Michigan 48106-1045 USA

For information call 734-996-8888 or FAX 734-663-8888

Top Quality Reconditioned Electronic Test Equipment

Hewlett-Packard • Tektronix • Fluke • Wiltron

BOUGHT & SOLD

Test Equipment Wanted

Looking for Test Equipment Manuals?
Contact: Manuals Plus (801)882-7188 • Fax (801)882-7195

Corporate Offices
P.O. Box 1762
San Mateo, CA 94401

Seattle, WA 206-251-6653
285 S.W. 41st St.
Renton, WA 98055

415-579-1711 • Fax 415-579-5777
<http://www.bellelect.com>



BELL

Electronics

Write in 218 on Reader Service Card.

LIQUIDATION WIN 95 companion, Wordperfect Suite, Printmaster Deluxe, 7 CDs retail value over \$1,000 sacrifice price \$53. 1,000 games, Encarta 10 CDs \$25, DOS \$25. Call 714-778-0450.

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. mompop@gate.net

PALM PILOT™ Users Group. Subscribe to our newsletter and download code via your E-Mail box. \$25 yearly dues. Your virtual membership form is at: rascom@msn.com

20,000 + TECHNICAL REPAIRS for TVs, VCRs, PROJECTION TVs, CAMCORDERS, AUDIO on disk. **COMPONENT/BOARD LEVEL REPAIRS.** Installs on your hard drive. Easy look-up by model/chassis number. ADD your own tech repairs. **PRINT** out repairs. **Special Sale** this month - only \$125. Send this ad with check or send \$5 for sample program with over 300 repairs. **HIGHER INTELLIGENCE SOFTWARE**, 60 FARMINGTON LANE, MELVILLE, NY 11747. 1-800-215-5081.

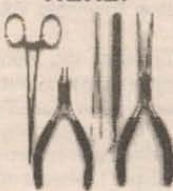
Closing Date
For Next Issue — April 6th

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. #519
OCEANSIDE CA
92056
CALL:
(760) 439-6682
FAX:
(760) 439-6682

CALL NOW FOR FREE CATALOG

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@MCMAIL.COM

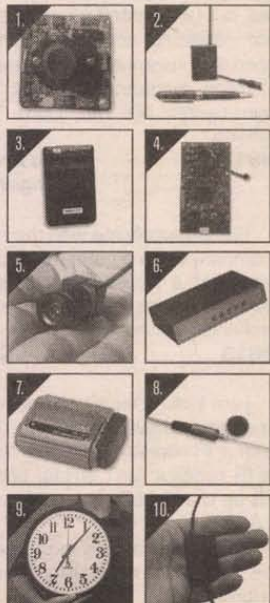
Write in 167 on Reader Service Card.

SUPERCIRCUITS

America's #1 Microvideo Source

VIDEO TOP 10

1. Microvideo Camera... 380 lines, 5 lux, Sharp chipset \$59.95
 2. Tiny Wireless Video Camera... 700' range, pinhole, \$299.95
 3. Covert Pager Video Cam... Sony chipset, 2 lux \$399.95
 4. Color Microvideo Camera... audio, 330 lines, 1.5 lux \$189.95
 5. World's Smallest Microvideo Camera 1 lux, .3 oz. \$99.95
 6. Micro Realtime Quad... puts 4 cameras on 1 screen \$199.95
 7. Sony EVO-220 Video Recorder... 8MM, tiny size \$899.95
 8. World's Smallest Video Transmitter... Please Call
 9. Wireless Video Clock Cam... FCC, 300 ft range \$399.95
 10. Microplate ATV Video Transmitter... Up to 700' \$199.95
- New Product!**



Buy your microvideo equipment where NASA, The Air Force, JPL, Lawrence Livermore Labs and the FBI does. Call us today.

For the best in high performance microvideo equipment, call the experts at Supercircuits. We've grown to be America's microvideo leader by consistently offering the best equipment at the lowest prices, with unbeatable service...compare our plug 'n play ease of use, warranties and return policies. Of course, Supercircuits microvideo is used by some of the biggest names in science, industry and national defense. But with prices starting at under \$60 for tiny high resolution video cameras, it is truly technology that is as affordable as it is amazing. Call us today, or send \$5.00 for our 64 page Microvideo Catalog, loaded with photos, specs and more. We promise you'll be amazed and pleased.

1-800-335-9777 ext NV
One Supercircuits Plaza, Leander, TX 78641
Visit us at www.supercircuits.com



Write in 62 on Reader Service Card.



UNDER \$149.95

With The Auto Remote® ... You have the ability to control any device from anywhere using any touch-tone phone

STANDARD EQUIPMENT FEATURES:

- Wide area data delivery, switching, and control.
- Uses existing paging infrastructure.
- 900 MHz frequencies/synthesized receiver.
- Serial data interface/RS232 option.
- Extended temperature range (-20°C to +70°C).
- Remote antenna options.
- Eight customer configurable open collector outputs.
- Six 350mA current sink or source.
- Two 1.75A current sink or source.
- Serial TTL interface.
- 512, 1200, and 2400 baud POCAG.

As Simple As Calling A Pager ...

The Auto Remote Control Module is a pager-like device that can be integrated into any electrical system to provide remote control capabilities. Toll-Free nationwide and local coverage is available by simply calling from any touch-tone phone.

Automotive Control: The Auto Remote allows car owners to remotely activate various functions of their vehicle from any touch-tone phone. Select from a menu of about eight functions, which includes starting or disabling the engine, disabling the vehicle upon a theft, locking or unlocking your doors, sounding the horn, and flashing the lights.

Environmental Control: The Auto Remote can be used in: schools, businesses, government facilities, and hotel environments to control lights, heating, and air-conditioning.

Text Messages: The Auto Remote can be used to send text messages to any display signs.

Theft Protection: The Auto Remote can be embedded within electronic or mechanical devices, rendering them inaccessible or unusable in the event of a theft.

Irrigation: The Auto Remote can be utilized to control irrigation systems. Cities can realize reduced water costs by utilizing our paging receivers to control water usage.

Gillian Technologies, Inc.
6278 N. Federal Hwy., Suite 178
Ft. Lauderdale, FL 33308
Phone (954) 493-9993
Toll Free (888) 493-9992
Fax (954) 946-0177 • www.autoremove.com

Write in 101 on Reader Service Card.

Nuts & Volts Magazine/April 1998 13

Questions & Answers

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

I have a Toshiba T4400SX laptop computer that has no video information, but the LCD display does light up. It works fine with another monitor.

The LCD has been replaced, but can someone identify the component that needs to be replaced without buying a board.

4981 Lee Amanns
Cincinnati, OH

I have a full hard disk backup which I cannot retrieve. It was backed up with Windows 95 back-up utility.

I was using Lantastic for DOS which caused Windows 95 to crash [the registry files were crosslinked].

I have since removed the offending software and re-installed Windows. However, I still can't access the back-up file. It is a 468 megabyte ".QIC" file on the hard drive.

The back-up utility says it is unable to retrieve anything from this file. I ran scandisk and it reported no errors. The only files lost were photos of our company's annual banquet, so I was told not to spend much time (and no \$) trying to retrieve them.

4982 David Eaton
via Internet

What are the pinout, impedance, and levels for an "S-VHS" connector?

I need to build a splitter, but haven't been able to find S-VHS specs.

4983 David Schoepf
Marianna, FL

I own a Radio Shack [Cat. #22-168] digital multimeter with a PC interface. I would like to buy a second if there existed a program/interface for plotting both the dependent and independent variable of choice. This could be time-based as present and plotted on the computer to be printed example speed of propeller vs. output voltage of a wind-generator, sunlight vs. water temperature [thermistor resistor, etc.].

4984 William Cherry
Beltsville, MD

I keep hearing the terms pull-up and pull-down resistors in conjunction with the I/O of the Parallax Stamp.

Could someone explain [in laymen's terms and diagrams] what these are, when and how they're used, and how their values are calculated?

4985 T. L. Curran
Danbury, CT

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

I would like to know how to get a VCR Plus+ working again. The main screen died and the numbers are very faint. I put in new batteries.

The company Gemstar won't repair it and I can't purchase a new one. They stopped making them, except with built-in encoders in VCRs.

4986 Hank Kurtz
Pittston Township, PA

I have a DTK Computer, Inc. 286 IBM clone. It has an open 40-pin socket for a math coprocessor. I got a 80287-XL coprocessor for it, but without any programming. What do I have to program to use this chip? I have not installed it as yet.

4987 Joseph W. Baldwin
Warren, MI

I need a circuit that will take an RF signal in the range of 4 MHz to 40 MHz with a level of about 0.8 volts and turn it into a clean 0 to 5 volt CMOS logic compatible squarewave.

A 50-50 duty cycle is highly desirable.

To keep loading of the RF source low, the circuit should have a high-input impedance and will need to be capacitor coupled. Basically, this is the input section of a frequency counter.

4988 Richard W. Floe
Kearney, NE

I have an amp that needs a schematic so it can be repaired. Does someone have a schematic to an Alpha Remote Mate amp? Or, where can I have it repaired?

4989 Grayle C. Hunley
Mechanicsville, VA

I just read your Jan. '98 issue. I need some help obtaining the circuit diagram or at least the pinout of the eight-pin plug for an RCA camera Model #TC 1110-4.

49910 John Erskine
Los Angeles, CA

I have a communications short-wave receiver that needs to be realigned. The radio is an old tube type.

Alignment of the IF stages are no problem. On the other hand, the RF/local oscillator coils have the tuning slugs sealed in place with a white substance. I thought it was paint. However, applying a small drop of paint remover

did not soften the substance. Coils are wound on 1/4" forms.

Any ideas how I can free the tuning slugs?

49811 James Brendage
Orangevale, CA

I recently completed construction of an LM1877 stereo amplifier as described by Ray Marston in his series on "Audio Power Amplifiers." Sounds great. I needed a stereo amplifier for my 31-inch TV set.

However, there is a problem with TV radiation introducing noise into the speakers. The closest speaker is four feet away.

Will a shield using aluminum foil fastened inside the speaker enclosure eliminate this interference?

There was some TV buzzing noise coming through the shielded input lines, but I eliminated it by placing 600-ohm resistors across the lines. An impedance mismatch, but it worked.

Your magazine is great for an experimenter like me. Don't change anything.

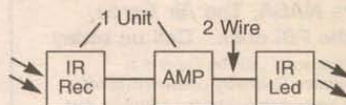
49812 James Brendage
Orangevale, CA

Please supply me with the name of a company or an amateur who can supply me with a 12-volt remote controlled switch similar to the security door lock mechanism for a car door.

49813 G. Lewis

I am looking for a schematic for an IR repeater. I have tried various ways to make a IR repeater, but the output of the IR receiver isn't strong enough to light up the IR LED. The output voltage is too low.

The IR repeater is of the hardware type. Below is a block diagram of what I'm looking for.



I have tried to use an op amp to boost the output signal so it will operate the IR LED. Still to no success.

49814 Ray Samples
Fayetteville, NC

I have a soundblaster sound card. The card came with a program called

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.

SB Talker that gave the computer programmed speech. How can I get programmed speech from my own programs written in GW-BASIC?

49815 M. Martin
Elmira, NY

I am a do-it-yourself audio nut, and I build my own crossovers, using air core inductors. But finding exactly the right value for an inductor can be difficult. I am wondering is there software available that will tell me how much wire to put on a core, if I give it core dimensions, wire size, required inductance,

TECH FORUM

etc., or any of the above in combination?

I have been looking all over the Internet, and have not been able to come up with anything.

49816 David Draper
via Internet

I need to add more memory to a TI-85. I think there is a box to do that, hooked to the link cables. I heard about it on the Internet. Also how do I take off edit lock on programs for the TI-85, also anything on hacking the TI-85 would help.

49817 Kyle Nonneman
Madison, WI

I have a BSR model EQ-3000 equalizer with a power supply problem. The address for BSR products in Newton, MA is out of date. I would like a current address and/or phone number for BSR products.

49818 Elmer Schmall
Tulsa, OK

I'm using a LM1458 op-amp and need the output to switch a TTL gate. The only problem is that the 'low' output from the op-amp is about 1.9 volts. It needs to be below .8V to interface with TTL logic.

Is there a simple way to drop the voltage down to an acceptable level?

49819 Kyle Gilpin
via Internet

I understand that my Motorola Star Tac cellular has the vibrating device inserted in the phone, but I would like to know how to activate this option on the Star Tac Cell-Phone

49820 via Internet

I have a robot platform-based on the Rug Warrior (Mobile Robots: Inspiration to Implementation, Jones/Flynn), which has a problem

with reverse direction and velocity control of the right motor.

The motor can be controlled for forward direction and velocity, but stops when commanded for reverse direction.

I suspect it's a software problem, but I'm stymied by the bit-level control of memory for motor operation.

The robot is programmed using the MIT freeware, Interactive C. The robot was not assembled from a kit, so help is scarce.

The Interactive C manual cites a "Rug Warrior Experts Group" for further assistance? If anyone has encountered and resolved the same problem, help would be appreciated.

49821 David Wing
Salem, NH

I have purchased five of Weeder's tech's kits. I feel somewhat limited using QBASIC as the program of choice. I have decided to change to Turbo C++.

I am still learning this new programming code. Can you tell me of any programs that you know of that run this code for the Weeder pro kit?

49822 J. F. Wagner
via Internet

ANSWERS

ANSWER TO #39811 - MAR. 1998

There are many claims on the market for rejuvenating Ni-Cad batteries and most of them either don't work, or simply contain \$1.00 worth of components.

One of the common failures with Ni-Cad batteries besides losing their precious gas (hydrogen) is sometimes referred to as "whiskers." This is caused by a growth inside the battery which shorts out the cells partially or wholly, and lowers the capacity of the

batteries output. Although this is not the only problem related to Ni-Cads, it is a common one.

A simple 100 to 500 uF capacitor charged up to around 100+ (150 max) volts DC, shunted into each individual cell one at a time through a toggle switch, disintegrates the whiskers by melting them while leaving the battery unaffected due to the short duration of the pulse.

You apply the power through a two pole, dual throw switch as a safety precaution against accidentally applying the full wall power directly into the cell.

I usually get a 50 to 75 percent return on very old surplus batteries that don't show signs of leakage or corrosion on their seal. (Positive lead) batteries that show signs of leakage rarely last more than a few months no matter what you do.

Chris
Bieber, CA

ANSWER TO #39810 - MAR. 1998

For your pocket alarm, I suggest a PIC controller, serial clock chip, and an alpha-numeric LCD display. Using a segment-type display creates a serious interconnect problem likely to require a large FPGA chip to handle. The more complex display should actually lower your system cost.

The PIC controller is available from Microchip. Versions programmable in BASIC are the BASIC Stamp (Parallax) and the FBASIC Ticket (VersaTech).

I recently have designed a system that includes all of your functions using the VersaTech device and I am willing to discuss my experience.

Mike Beaver
Los Altos, CA

ANSWER TO #3987 - MAR. 1998

RJ-11 and RJ-45 telephone connectors are wired such that the first pair is in the center of the connector

ANSWERS TO #29813 - FEB. 1998

A company called Tech America in Ft. Worth, TX, has an inductance meter kit (\$14.95) to be used with a DMM. Its part number is 990-0057. Tech America can be reached at 1-800-877-0072, and there is no minimum order.

Matt Brzescinski
Poway, CA

ANSWERS TO #29813 - FEB. 1998

Here are two catalog services for inexpensive inductance measuring kits that can be used with a digital multimeter:

1. Marlin P. Jones & Assoc., Inc., has a digital inductance meter kit stock #4519-RB that will measure inductors from 3 μ H to 7 mH. Their address is: P.O. Box 12685, Lake Park, FL 33403-0685 and phone 1-800-652-6733.

2. Gateway Electronics, Inc. has a capacitance/inductance meter kit that measures inductors from 10 μ H to 10 mH and capacitors from 2 pF to 2 μ F. Their address is: 8123 Page Blvd., St. Louis, MO 63130 and phone 1-800-669-5810.

John McMichael
Laramie, WY

and the following pairs work outward.

If you hold a plug with the locking tab down and the cable pointing away from you, pin 1 is on the right. For RJ-11 (six pins) R1 (ring) is pin 3, T1 is pin 4, R2 is pin 5, and T2 is pin 2. For RJ-45, the sequence is R4, T3, T2, R1, T1, R2, R3, T4.

Mike Beaver
Los Altos, CA

ANSWER TO #3983 - MAR. 1998

Your solar system controller sounds like a job for an LM324 quad op-amp.

Use a five-volt supply and thermistors for the temperature sensors.

Continued on page 106



SUPER STEREO AUDIO AMP

These were designed for multimedia computer systems and they contain a 20 watt stereo IC TDA 7350. We show you how to connect the inputs pads and outputs to use it as a very high quality 20 watt (10 watt per channel) stereo booster capable of driving any speakers (capable of handling that much power) to room filling volume from your portable radio, CD player, cassette player, etc. The output is amazing and the sound quality is unbelievable. These amplifier boards are brand new in manufacturer bags. Size of board 2 1/2" x 5". Operates on 12 VDC. We supply it with the hookups info needed to operate it, however we do not have the schematic or other data. Brand new Prime!

G9047 \$5.95

DUAL CHANNEL 900 MHZ TV CAMERA "AS IS"

These are miniature TV cameras designed to transmit to 900 MHz wireless monitors. Each has 2 switchable channels for operation on 2 different frequencies in the 900 MHz range. They were made to operate from 7 AA batteries (not included) or an AC adapter (not available). These are returns and may or may not work. They are sold "as is" and might even have a broken antenna or switch. No other specs or data available. Size: 2 3/4" x 1 7/8" x 5 3/4" and has a built in wide angle auto iris lens. Sold "as is" only - No returns.

G9325 \$39.95

HIGH QUALITY WIRELESS STEREO SPEAKER SYSTEM

Send any stereo audio from your stereo, TV, VCR, etc. through walls to these high quality stereo speakers. Each speaker uses 4 "C" batteries (not included). The small transmitter unit has an AC adapter (included). Complete system comes with 1 transmitter, adapter, and 2 black stereo speakers.

G8061 \$34.95

Additional pair of wireless speakers (white only).

G8062 \$10.00

WHITE 2 CHANNEL WIRELESS MONITOR "AS IS"

These are sophisticated 900 MHz 2 channel Black & White security monitors. They were designed to work with the G9325 camera. They are 5.5" monitors with auto switching, VCR switch, etc. They can operate from 10 "C" batteries (not included). These need to be repaired and are sold "as is" (no return) only.

G9263 \$35.00 - 2/\$60.00

3 FOR \$80.00

12" CCTV MONITOR "AS IS"

Black & white 4 channel automatic switching monitor with various deluxe features. These are "as is" and need to be repaired. Sorry no returns.

G9261 \$14.85

FIRST ALERT 120 VAC AUTOMATIC NIGHT LIGHT

Plugs into standard 120 VAC outlet and turns on automatically at night then off in the morning. Uses only 4 watts of electricity but provides a nice light for security. Buy several for use in bedrooms hallways, etc. Brand new!

G9333 \$2.00

SUPER BASS FOAM PAD HEADPHONES

Made for comfortable stereo music listening, these high quality headphones are perfect for replacement or new construction. Model KX-2 is black in color with a comfortable, adjustable metal headband and universal flex foam ear pads. Has 3.5 MM stereo plug and flexible cable. Brand new! Perfect for replacement or new construction.

G9315 \$2.95

VERY HIGH QUALITY ELECTRONIC TOOL SET

This is the nicest high quality tool set that we have ever come across. It was made to rigid specs for major retailers which in turn sold them for up to \$34.95. They consist of 4 insulated handle hand tools in a zipper carrying case. You get a sidecutter, and 3 various needle nose pliers which are handy for hundreds of applications. They were made in China but we assure you that these are not the low quality types that are typical of imported tools. These are some of the best tools you'll find. Each tool has a strong spring return and comfortable grip. Brand new in retail packaging!

G9268 \$15.95

ELECTRONIC GOLDMINE
PO Box 5408
Scottsdale, AZ 85261

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

NOTE: All items subject to prior sale

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: \$10.00 (plus \$5.00 Shipping and Handling). We accept MasterCard, Visa and personal checks, however, we cannot accept personal checks on orders outside the United States. Minimum Foreign Order Amount: \$50.00 (plus a minimum \$10.00 S&H)

CHARGER WITH "AA" SIZE NICADS

Small charger plugs directly into wall outlet and comes complete with 4 high quality SAFT "AA" Nicads. The charger is unique in that it can charge the 4 batteries at the standard charge rate or it can charge 2 at a time at a fast charge rate. Works with "AAA" size nicads also. Batteries can be recharged hundreds of times - perfect for those high drain toys that you bought the kids for Christmas! Features 2 red charging LED indicators. Size of charger 4 7/16" x 2 1/2" x 1 3/8". Remember you get the charger and a set of 4 AA nicads. Brand new in Box.

G9308 \$5.95

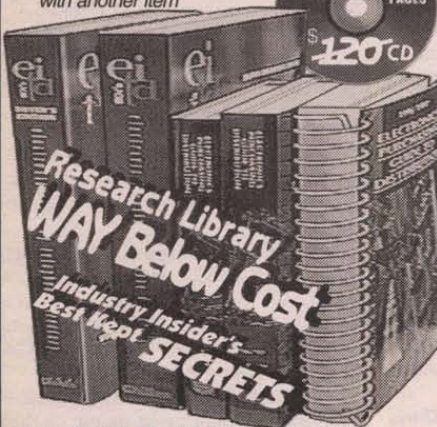
EXTRA "AA" NICADS G9300 69¢ EA

OR 4/\$2.50




LIQUIDATING WAY Below Distributor Cost

\$29!
From Publisher
All 6 Pcs
with another item



\$55!
From Publisher
with another item



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

In Seconds, Locate: Distributors, Manufacturers and Service providers for Products, Services or ANY Component Parts you can possibly imagine from USA & Canada! Contains sources for Everything from Semiconductors to Foreign Assembly Services. Scan by Product Description -or- Use the White Pages & locate ANY Company in the Electronics Industry. Use Advertisements in the Yellow Pages to locate Component Products. Consists of Chilton's EITD, Springs Technical's EPGD & American Business's CD with 10 Million + Listings. You'll get some real mileage out of this Library and Wonder how you ever did without it!

- \$29 ALL 6 Pcs Current Back Issues
- \$49 Above if Purchased Alone
- \$55 98 Single Edition EITD
- \$117 98 Triple Issue EPGD
- \$120 98 American Business CD

#1 Choice of Top Professionals

The Most Comprehensive IC Reference Ever Published.

Nothing Else like it in the World!

100,000 ICs of EVERY KIND from Every Manufacturer. Specifications, Selected Data Sheets, Every known Cross-reference, Alternate Sources, Manufacturer Profiles & Distributors. Perfect for Sales, Service, Engineering & Experimenters. If you're still squeezing an ICM from the 80's, Now's the time to upgrade while they're really affordable.

- \$55 3 Vol Back Issue of Current Production ICs Perfect for Service & Moderate Design Work
 - \$65 Above if Purchased Alone
 - \$195 \$135 97 Books, For Advanced Design Work
 - \$235 \$169 97 CD Rom
 - \$195 \$179 98 Books
 - \$235 \$199 98 CD Rom
- Other Editions may be available

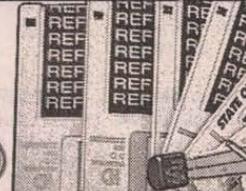
"REFEREE" Semiconductor & Directory Software

FREE
buy both REFEREE & ICM




Coffee/Tea Warmer works Great with any Mug

79!
with any other item



Cross-REFERENCE ALL types of Transistors, IC's & Diodes
Over 250,000 Devices Listed. A Specialist in "Hard to Cross House Numbers".
Extremely easy to use. The Most Comprehensive Cross-REFERENCE Software available. Any selection yields General Device Specifications and 75 to 250 Potential Replacements. Also Lists ECG, NTE, SK & GE subs, Plus, Case Drawings, Lead Configuration & Pin-outs for many Devices. Coverage of Replacement Numbers is Very Impressive.
REFEREE has become the Most Popular Software of its kind.
7 Disk Set with MODULAR Databases: Install them all (17 Meg.), or just a few.
Includes 4 HUGE Consumer Electronics Industry Directories
For Service, Engineering and Purchasing.
1- Consumer Electronics Parts Sources (Service) 2- Consumer Electronics Manufacturers
3- The Entire Computer Industry 4- Semiconductor Manufacturers


\$109
Adapter uses YOUR CD Drive on any Notebook Computer



\$179
With 16X CD ROM

\$269
Minimum Anywhere

88!
CD ONLY



\$115
from Publisher

Your CD Drive Slides Right In!
Uses Parallel Port & has Built in Printer Port
Desktop Unit, Built in Power Supply & Audio Output
Supports: DOS, Win 3.1 & 95
Use Your IDE CD ROM or Optional 16X CD ROM

All Cards & COD No. we don't sell semiconductors
Netcom 800-733-3733 ext 6300 516-826-1808 x 6300 9am-9pm EST 7days
Fax 516-826-7776

HP IIID DUPLEX LASER PRINTERS

MIO PORT TO NETWORK - CAN PRINT BOTH SIDES OF THE PAPER - DUAL TRAYS
USES STANDARD 95A CARTRIDGES - USED WELL MAINTAINED - 30 DAY WARRANTY



\$425.00 EA.

NEW!! HP IICX COLOR SCANNERS

\$185.00 EA.

DOCUMENT FEEDERS \$100.00 - TRANSPARENCY ADAPTERS - \$100.00

NEW!! SCSI HARD DRIVES

5 CENTS A MEG OR LESS

TO MUCH TO LIST!! CHECK OUT OUR WEB SITE OR CALL FOR MORE INFO
REMEMBER FOR GREAT DEALS CALL

ELECTRO MAVIN

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

E-MAIL john@mavin.com or visit our Web Page for more

great buys <http://www.cdc-online.com/mavsales.htm>

** shipping is ups from the Los Angeles area

COMPUTER SOFTWARE cont.

PLAYSTATION MOD chips play imports and CD-R backups. \$30-\$40 each. Quantity discounts, easy to install. 1-800-281-0551.

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

WANTED: TERMINALS + PRINTERS: DEC, Wyse, IBM, ADDS, Okidata, Data South, Epson, C.I.T.O.H., etc. Call for quote on any surplus computer equipment. Call Jeremy, 603-673-8077.

WANTED: 286/386/486 old computers, cards and parts, NEC, PB, Dell, AT&T, Compaq, etc., BNFE, F978-536-7400. WWW.BNFE.COM E-Mail.

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

FEITEK HAS the test equipment you want at reasonable prices. We buy, sell, and trade HP, Tek, GR, etc. Call or fax Monday thru Friday, 9 to 5, 314-423-1770, or write us at Box 3423, St. Louis, MO 63143.

FEITEK PROVIDES repair, calibration and certification on many makes of test equipment. We also have a large selection of used equipment. Send large SASE envelope for list. VISA and MasterCard accepted. Feitek Inc., 2752 Walton Road, St. Louis, MO 63114, 314-423-1770.

REMOTES Remote Control for Any Application

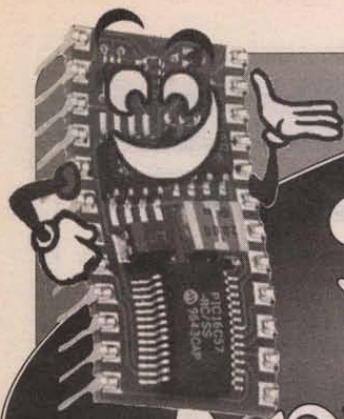
NEW NEW NEW NEW NEW

<p>3.5" x 2.75"</p>  <ul style="list-style-type: none"> 3 Channel Receiver Channel 1 - 5 amp Relay, N/O, N/C Channel 2 and 3 Digital Outputs Compatible with 2 Button or 4 Button Remote Code Hopping Receiver at 434 Mhz Compatible with All Garage Doors and Some Car Alarms <p>\$69⁹⁵</p>	<p>2.75" x 2.75"</p>  <ul style="list-style-type: none"> 6 Channel Receiver with Digital Outputs All Channels are Programmable for Momentary Latched, Latched with Condition 30-60-90 Sec. Timed Outputs Code Hopping Receiver at 434 Mhz Compatible with 2 Button or 4 Button Remote Compatible with Some Car Alarms <p>\$99⁹⁵</p>	<p>1.25" x 1.75"</p>  <ul style="list-style-type: none"> 2 Button - 3 Channel Remote Extra Long Range 434 Mhz with S.A.W. Resonator Push Both Buttons together for Channel 3 Compatible with Three and Six Channel Receivers. <p>\$29⁹⁵</p>	<p>1.25" x 1.75"</p>  <ul style="list-style-type: none"> 4 Button - 15 Channel Extra Long Range 434 Mhz S.A.W. Resonator Push Combination of Buttons together for Channel 5 through 15. E.g.: Push Button 1 and 2 together for Channel 5 Compatible with Three and Six Channel Receivers <p>\$39⁹⁵</p>
---	--	---	--

Street Smart Security • 1-800-908-4737

7147 University Avenue • La Mesa, CA 91941

Send, Fax or Call Order In - Use Credit Card or Check. Fax (619) 462-0652



Stamp Applications:

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

by Jon Williams

Having used it since the spring of 1994, I still turn to the BS1 as my default Stamp. Yes, the BS2 has more code space, more I/O pins, and extended features in PBASIC. I find, however, that the BS1 is suitable for most of my personal projects. It's only when I know I'll need the extra pins or code features that I use the BS2.

Getting Back To The BS1

Back in 1994, when there was no BS2 to turn to, BASIC Stamp had to resort to clever coding and I/O schemes to make projects work. The introduction of serial peripherals like Scott Edwards' Serial LCD Backpack® and Stamp Stretcher pulled a lot of us out of jams. This month, we're going to discuss some hardware and software techniques that just might help you out of a jam and squeeze your project back into the BS1.

Sharing Pins

From time to time, we'll run out of pins before we run out of code space. This is especially true with the BS1. With careful (read that again, I said, "careful") code writing and I/O hardware, we can share one or more pins. The trick is modifying the Dirs variable mid-stream. We don't normally do this, so we need to be cautious.

Take a look at the circuit in Figure 1. This circuit allows us to display the status of the I/O pin when it's an output, and to read it when it's configured as an input. Notice that this circuit is configured for negative logic. What this means is that a low output will light the LED, a high output will turn it off. Don't be alarmed by this; you can easily change positive logic (HIGH = On) to negative logic with the ^ (Exclusive OR) operator ($0 \wedge 1$ is 1).

Okay, let's use this circuit. Listing 1 is a very simple program that waits for you to push the button connected to Pin0, then flashes the LED five times. Notice that the Dirs variable is reset to configure the pin before each section. In case you're wondering, the purpose of the 470-ohm resistor is to protect the I/O pin in case you push the button when the pin is in an output condition. If you pressed the button when the Stamp had placed a HIGH (5 volts) on the pin, you'd have a short to ground. The resistor limits the current through this short to a safe level.

For another good example of pin sharing, refer to the Stamp Application Note #1, "LCD User-Interface Terminal." You can download this App Note from Parallax (see sources). By the way, the BASIC Stamp Activity Board that I mentioned last month comes with four of these LED/switch circuits.

Sizing Up Your Code

Within minutes of opening my first BS1, I had it up and running code. Within hours, I was writing useful programs. Within days, I ran into the dreaded "Error - EPROM Full" message from the Stamp compiler. "Yikes! What do I do now?" What I had to do was find code-saving techniques, but the pseudo-analog bar-graph display of the BS1 compiler didn't help much with my experiments; its resolution is much too coarse.

At the time, the BSAVE command wasn't really documented, but was made known through a small App Note that came with the BSLOAD utility. BSAVE writes a 256-byte binary file that is an image of the Stamp's EEPROM for your program. The EEPROM contains your code and user data and — more importantly — an address of the last EEPROM byte used by the program code. With this knowledge, I was able to write a program called STMPSIZE.EXE (for Stamp Size). What this program does is read CODE.OBJ (the file created by BSAVE) and displays the results with a

```
' Listing 1
' Nuts & Volts: Stamp Applications, April 1998

GetPin: Dirs = %00000000 ' all pins are inputs
IF Pin0 = 1 THEN GetPin ' wait for pin to go low

Blink: Dirs = %00000001 ' make pin 0 an output
FOR B0 = 1 TO 5
  PAUSE 500 ' LED on
  Pin0 = 0
  PAUSE 500 ' LED off
  Pin0 = 1
NEXT
GOTO GetPin ' do everything again
```

straightforward text output.

Using STMPSIZE is easy; just include the BSAVE command in your program and hit [Alt]+[R] (run). The nice thing about BSAVE is that the file is created before the compiler actually tries to download the program to the Stamp. This means that you don't need to connect your Stamp to do program analysis.

Let's look at a quick example. I found, through experimenting and using STMPSIZE, that I can gain a few precious bytes of code space by replac-

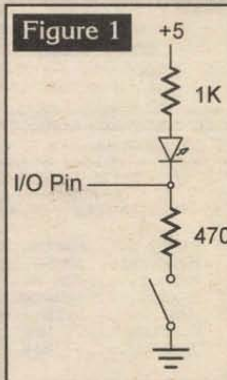


Figure 1

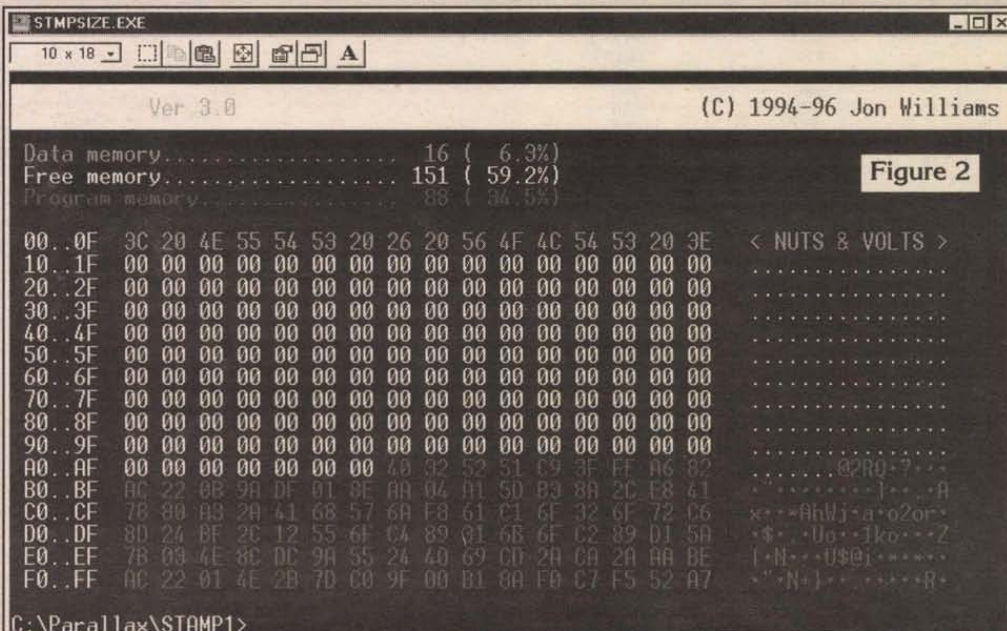


Figure 2

Stamp Applications:

ing a LOOKUP table with EEPROM statements and using READ to get the data. This is particularly useful if the data is used more than once and is not part of a subroutine.

Listing 2a is a small program that sends a message to a standard (not serial) LCD. Analysis with STMPsize shows us that the program uses 111 bytes. Now replace the output section with the code in Listing 2b and check it again. Now we've used 104 bytes (code plus data) — a savings of seven bytes. This may not sound like much but, believe me, it is! You can find STMPsize.ZIP in my FTP directory (see Sources). Figure 2 shows a screenshot of STMPsize with the modified code.

No Missed Inputs

Once you get comfortable with the Stamp, you'll probably want to start connecting it to external devices and circuits. The trouble starts when your external circuit does something when you're not expecting it. Your program may well be running some process that takes longer than your input is active. There are two things we can do, and I'm going to recommend them both.

The first thing we can do is stretch a short input, thus making our input pin active long enough to come around and see it. The type of circuit we need is called a one-shot or, for you extreme technocrats, a monostable multivibrator. What we have to do is design the output to be long enough for us to finish what we're doing so that it can see the input.

There are probably as many one-shot designs as there are people on the planet, so I'm going to use the ubiquitous 555 timer chip. They're tough, easy to use, and very easy to find. Take a look at the circuit in Figure 3, which is a 555-based adjustable one-shot. A low on Pin 2 of the 555 will cause the output (555 Pin 3) to go high for a period determined by R1 and C1 (multiply R1 by C1 to find the time).

You need to be careful not to make your 555 output pulse too long, otherwise you might miss another input. If you have an extra

Sources

For more information on the BASIC Stamp, contact:

Parallax, Inc.

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

1505 Grande Blvd., #1602
Tyler, TX 75703
(903) 509-1691
jonwms@aol.com

Internet: <http://members.aol.com/jonwms>
<ftp://members.aol.com/jonwms/stamps>

Stamp pin, you can fix this problem by connecting an output to Pin 4 of the 555. This pin is the Reset input. When taken low, it will reset the 555 output. I used this technique in a project with great success. If you don't connect Pin 4 of the 555 to the Stamp, connect it to +5 volts.

Okay, what about software? If you analyze most of your programs, you'll probably find that they're a collection of small modules that run over and over in a continuous loop. Let's say, for example, that we want to check an input, then do three

```
' Listing 2b
' Nuts & Volts: Stamp Applications, April 1998

' Replace sections of Listing 2a with this code

' -----[ EEPROM Data ]-----
'
'   EEPROM ("< NUTS & VOLTS >")

' -----[ Main Code ]-----
'
Start: FOR index = 0 TO 15
  READ index, char
  GOSUB LCDwr
NEXT
END
```

```
' Listing 2a
' Nuts & Volts: Stamp Applications, April 1998

' -----[ Title ]-----
'
File..... SSDEMO.BAS
Purpose... STMPsize Demo
Author.... Jon Williams
E-mail.... jonwms@aol.com
WWW..... http://members.aol.com/jonwms
Started... 07 MAR 1998
Updated... 07 MAR 1998

' -----[ Program Description ]-----
'
LCD Connections:
'
' LCD      (Function)      Stamp
' pin 1    Vss             Gnd
' pin 2    Vdd             +5
' pin 3    Vo              Gnd (or wiper of 10K pot)
' pin 4    RS              Pin 4
' pin 5    R/W             Gnd
' pin 6    E               Pin 5
' pin 7    DB0             Gnd
' pin 8    DB1             Gnd
' pin 9    DB2             Gnd
' pin 10   DB3             Gnd
' pin 11   DB4             Pin 0
' pin 12   DB5             Pin 1
' pin 13   DB6             Pin 2
' pin 14   DB7             Pin 4

' -----[ Revision History ]-----
'
' -----[ Constants ]-----
'
SYMBOL RS      = 4      ' Register Select (1 = char)
SYMBOL E       = 5      ' LCD enable pin (1 = enabled)

' LCD control characters
SYMBOL CclrLCD = $01    ' clear the LCD
SYMBOL CcrsrHm = $02    ' move cursor to home position
SYMBOL CcrsrLf = $10    ' move cursor left
SYMBOL CcrsrRt = $14    ' move cursor right
SYMBOL CdisPlf = $18    ' shift displayed chars left
SYMBOL CdisPrf = $1C    ' shift displayed chars right
SYMBOL CDDRam  = $80    ' Display Data RAM control

' -----[ Variables ]-----
'
SYMBOL char    = B1      ' character sent to LCD
```

```
SYMBOL index   = B2      ' loop counter

' -----[ EEPROM Data ]-----
'
' -----[ Initialization ]-----
Init:  Dirs = %00111111  ' set 0-5 as outputs
       Pins = %00000000  ' clear the pins

' Initialize the LCD (Hitachi HD44780 controller)
LCDini: PAUSE 500        ' let the LCD settle
        Pins = %0011     ' 8-bit mode
        PULSOUT E, 1
        PAUSE 5
        PULSOUT E, 1
        PULSOUT E, 1
        Pins = %0010     ' 4-bit mode
        PULSOUT E, 1
        char = %00001100 ' disp on, crsr off, blink off
        GOSUB LCDcmd
        char = %00000110 ' inc crsr, no disp shift
        GOSUB LCDcmd
        char = CclrLCD
        GOSUB LCDcmd

' -----[ Main Code ]-----
'
Start: FOR index = 0 TO 15
  LOOKUP index, ("< NUTS & VOLTS >"), char
  GOSUB LCDwr
NEXT
END

' -----[ Subroutines ]-----
'
LCDcmd: LOW RS          ' enter command mode
        ' then write the character
        '
        ' Write ASCII char to LCD
LCDwr:  Pins = Pins & %11010000 ' save 7, 6 and RS; clear bus
        Pins = char / 16 | Pins ' output high nibble
        PULSOUT E, 1           ' strobe the Enable line
        Pins = Pins & %11010000 ' output low nibble
        Pins = char & $0F | Pins
        PULSOUT E, 1           ' return to character mode
        HIGH RS
        RETURN
```


Stamp Applications:

Listing 3
Nuts & Volts: Stamp Applications, April 1998

```

-----[ Title ]-----
File..... BRANCH.BAS
Purpose... Demonstrates the use of BRANCH
Author.... Jon Williams
E-mail.... jonwms@aol.com
WWW..... http://members.aol.com/jonwms
Started... 07 MAR 98
Updated... 07 MAR 98

-----[ Program Description ]-----
This program demonstrates the use of BRANCH as a means of replacing
confusing IF-THENS and GOTOS in a dynamic program

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

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

-----[ Variables ]-----
SYMBOL state = B1

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

```

```

-----[ Initialization ]-----
Init: state = 0

-----[ Main Code ]-----
Main:  DEBUG "Checking the Input",CR ' check the input (sim)
      ' do other important things here

      BRANCH state,(ProcA, ProcB, ProcC) ' do the next process

ProcA:  DEBUG "In Process A",CR
      PAUSE 1000 ' simulate timing of process
      state = 1 ' point to next process
      Goto Main

ProcB:  DEBUG "In Process B",CR
      PAUSE 1000
      state = 2
      Goto Main

ProcC:  DEBUG "In Process C",CR
      PAUSE 1000
      state = 0
      Goto Main

END

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

```

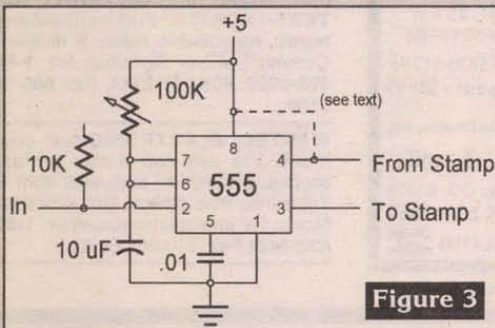


Figure 3

other things. Normally, our program flow would look something like this:

```

Look for the input
Do Process A
Do Process B
Do Process C
Do everything again

```

If we're worried about missing the input, we'll want to check it more often. Like this:

```

Look for the input
Do Process A
Look for the input
Do Process B
Look for the input
Do Process C
Do everything again

```

At first glance you might say, "Oh, that's easy, check the input in a subroutine." Sure, that's one way to do it, and it will work in most cases. There will be times, though, when you run out of GOSUBs (you overrun the GOSUB stack). We need another approach.

BRANCH is one of the most powerful — yet least-used — elements of PBASIC. What BRANCH does is direct the flow of your program based on the value of its control variable. Take a look at Listing 3. Notice that we start by checking our input (simulated with a DEBUG statement) then branch to the current process. At the conclusion of each process, the program loops back to the beginning.

Using BRANCH to control program flow is very powerful. The real power comes when you

allow each process to dynamically modify the control variable. Using this technique will cause your program to become very dynamic in its operation, without a confusing mess of IF-THENS and GOTOS.

A New Serial LCD

There's been a lot of "knock-off" serial LCDs since Scott Edwards first introduced them, but none very notable until now. By the time you read this, the ILM-216 should be available from Scott Edwards Electronics. I had a chance to work with a pre-production unit and I must say that I'm thrilled. Take a look at the specifications:

- Two lines of 16 characters
- LED backlighting
- Output for a piezo speaker

- Four switch inputs
- EEPROM storage of six custom characters
- EEPROM storage of two-line "splash" screen

Not bad, huh? A two-line LCD and four switch inputs for the price of a single I/O pin. The ability of the ILM-216 to store custom character maps and a splash screen means that we don't have to implement those features in code. This gives us more space for the meat of our program.

The ILM-216 comes with Scott's typically excellent documentation, so I'm not going to go into a lot of detail, except to say that its serial input and serial output lines can be tied together through a 1K resistor. Since the BS1 can send and receive serial data with the same pin, this configuration is a potential project saver. I'm working on a BS1 networking project that will use the ILM-216 for the node display. Look for details in a future article. **NV**

Beginner's Corner

The LED (light emitting diode) is probably the most common status indicator used in electronic circuits. Those of us with design experience rarely think about the details of incorporating them; those without experience (or who are new), should. LEDs are not like light bulbs. That is, you can't connect them directly between an I/O pin and ground (or +5) — they need to have a current-limiting resistor placed in the series to protect the LED and the Stamp. So how do we figure the correct size for that resistor? With Ohm's Law and a pocket calculator.

Without going into a lot of engineering, here are the basics: The current in a series circuit is the same through all components, and the total circuit voltage is divided among the components. In order to operate correctly, an LED needs a certain current (called forward current) at its specified forward voltage.

Let's say we have an LED with a forward voltage of two volts with a forward current of 10 milliamps. With a five-volt output from our Stamp, our resistor needs to handle three volts at 10 milliamps. Using the Ohm's Law formula $R = E/I$ (resistance equals volts divided by current), we end up with a calculated resistance of 300 ohms ($3 / 0.01$). Chances are that your corner electronics distributor (the guys who ALWAYS ask for your address) doesn't carry a 300-ohm resistor, but they do have them at 330 ohms. This will work fine. It's always safer to use a slightly larger resistor until you get the hang of circuit design.

Now, what we've just gone through only considers one pin. What if we want to light six LEDs? Will it work? Sorry, no. Well, not without problems. You see, the Stamp 1 can only source 40 milliamps of current. What this means is that the Stamp can only provide 40 mA when the outputs are high (+5). We can get a little more juice (up to 50 mA) from the Stamp by connecting the LEDs to +5 and activating them with a low output (like Figure 1). This is called sinking the current.

What we have to do is divide our available current by the number of outputs. Be careful here. Most general-purpose resistors have a 5% tolerance. This means that the resistance could be up to 5% lower than the marked value. Lower resistance means more current. You can either figure in the tolerance, or start your calculations without trying to use all the available current.

We'll be conservative and sink (active outputs are low) 40 mA of current. This gives us about 6.6 mA per LED, which means we'll need a resistor for each of 454 ohms. The closest standard value is 470 ohms, so that's what we'll use.

Scott Edwards Electronics

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.

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
Internet: www.seetron.com

Write
PIC
programs in
BASIC!

\$99⁹⁵

PicBasic Compiler

BASIC makes it easy for you to program the fast and powerful Microchip PIC microcontrollers.

- ❖ Expanded BASIC Stamp 1 compatible instruction set
- ❖ True compiler provides faster execution & longer programs than BASIC interpreters
- ❖ In-line assembler & Call support
- ❖ New Features! Peek & Poke, I2Cin & I2Cout
- ❖ Supports PIC16C6x, 7x & 8x
- ❖ Use with most PIC programmers

PicBasic Compiler Bundle - \$179.95

Includes: PicBasic Compiler, EPIC Programmer, AC Adapter, 25 Pin Cable, PICProto18 and PIC16F84

Also: PICProto Boards - \$8.95-\$17.95
EPIC Pocket PIC Programmer - \$59.95

*BASIC Stamp is a trademark of Parallax, Inc.

microEngineering Labs, Inc.

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

www.melabs.com

Write in 100 on Reader Service Card.

TEST EQUIPMENT cont.

WANTED: HI-voltage power supplies and hi-pot testers. Jennings JHP-70A, Von's C-1, hi-potronics, Spellman. Also looking for VDF 2.8pF Jennings capacitors and hi-voltage calibration resistors for units. Youngson's, Inc., 6701 Melrose Ave., Louisville, KY 40216. 502-448-6228.

NEW HEWLETT-PACKARD 141T CRTs. \$195 EACH. We have quantities available. These are double boxed unopened with late 80s date code, guaranteed. Fits all 141T spectrum analyzers. Contact Brian at Kentronix. 732-681-3229 or FAX 732-681-3312. Mailing: Kentronix, PO Box 2444, Farmingdale, NJ 07727 or E-Mail brian@kentronix.com

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

AM-FM SERVICE MONITORS bought & sold. IFR, Motorola, Wavetek, Marconi, Triplet, HP. **FOR QUOTE CALL TEST-TRONICS.** Full calibration & repair, reasonable rates. A division of Communications Signalling Inc. 1-888-423-2565, 805-251-2244, Fax 805-252-3100.

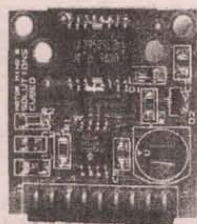
WANTED! ELECTRONIC test equipment. We pay top dollar for used scopes, generators, analyzers from HP, Tektronix, and others. Call Charles at Metric for immediate quotation. 1-800-432-3424 Fax: 510-264-0886.

Stamp users

Miniature Engineering Modules

Mini-Mods

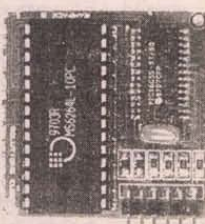
Serial Motor Controller. Control DC motors, fans, and Peltier junctions!



The Motor Mind B
only \$29.

1.2"x1.3" SIP module, up to 30V/2A DC motors, 254 speed steps, reverse, read tach(0-65,528Hz), auto-speed control, simple 1 or 2 pin serial communication.
(shown here without heat sink)

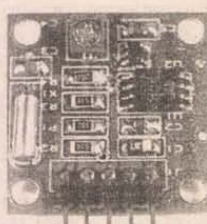
Serial RAM. Store all kinds of data with one i/o line!



The RAMPack B
only \$29.

1.6"x1.6" SIP module, 8K bytes of RAM, expandable to 32K, 1.2K-19.2K auto-baud detect, addressable Write, Byte Read, and Block Read commands, new buffer mode needs no addressing, 1, 2, or 4 pin serial communication.

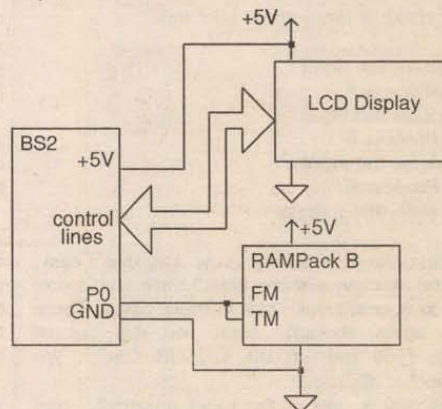
Serial Clock. Real time and your choice of 4 alarm types!



The Pocket Watch B
only \$24.

1.1"x1" SIP module, real time clock accurate to the second, year 2000 compatible, standard, single shot, short astable, and long astable alarm types, simple 1 or 2 pin serial communication.

Use the RAMPack B to store display messages and address pointers.



Store display data and addresses in RAM using only one i/o line and the RAMPack B

Solutions³

www.solutions-cubed.com
phone (530) 891-8045
fax (530) 891-1643

3029 F Esplanade
Chico, CA 95973

Place your order by phone, fax, mail, or via our web site. We accept Visa and Mastercard. Shipping and handling are extra. COD is extra. Ask about our consulting services! BASIC Stamp is a registered trademark of Parallax Inc.

WE'RE NOT FOOLING

MOTORIZED LINEAR SLIDE, with Z AXIS DRIVE

Heavy duty 3/8" diameter chromed steel rods provide up to 9 inches of linear travel. X drive is via a toothed belt powered by a SLO-SYN M061-LF-409, 1.25V@3.8A stepper motor with 200 steps per rev and 75 oz. in. hold. The Z axis is attached directly to the slide, provides 2 inches of travel and is powered by its own Rapidsyn 23E-6108BH 1.25V@3.8A stepper. 200 steps per rev and 60 oz. in. of hold. Very precise motion is possible due to the approx. 4:1 ratio toothed belt drive. Nice quality, suitable for gen'l use. Not recommended for ultra precise or high load applications. Removed from precision optical equipment. Overall size: 17" L x 6" H x 5.5" D. Complete assembly mounted on a rigid 1/4" thick base. Ltd. Qty.

"X and Z" DRIVE SYSTEM (as shown).....\$99.

CHECK THIS OUT! ULTRA MINI and WEATHERPROOF

Sold elsewhere in N&V for \$249! Our "LIPSTICK" camera

sets new standards. Sleek black anodized, aluminum, housing is O-Ring sealed and RAINPROOF. Adjustable filling mount included. Specs: 1/3" CCD, 380 Lines resolution, 0.3 Lux sensitivity, AGC, Auto Shutter. Operates on 9 to 16VDC @100mA, 3.7mm, 78° 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-200K-STD.....\$149 power 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. 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-200K-PH lens.....\$149 Pwr. module \$4.95**

NEW MODEL MICRO CAMERA, w/audio 1/3" CCD, 410 Lines

Res., 0.3 Lux sens., AGC, Auto Shutter. Power from 9 to 16VDC @100mA, 250K PIXELS. Std. model, 3.6mm, 92° FOV lens. Pinhole, 90° FOV. A real glass lens. Both focus from 10mm to infinity. Std. NTSC video out. 1/2 once! SENSITIVE to IR. Size Std: 1.25" sq. x 1" d. PH is 0.6" d. Both with 6" leads. **WARNING:** Don't confuse these models with LOW RESOLUTION, HIGH LUX C-MOS CAMERAS. C-MOUNT model now available. Only 0.9" d

GM-1000A-STANDARD..\$89 GM-1000A-STD/Audio.....\$109

GM-1000A-PINHOLE.....\$89 GM-1000A-PINHOLE/Audio.....\$109

GM-1000A-C-MOUNT.....\$89 GM-1000A-C-MOUNT/Audio.....\$109

C-Mount f2.0 Lenses	Micro Lenses for GM1000 series
4mm, 80°.....\$24	2.5mm, 150°.....\$22
8mm, 40°.....\$24	4.3mm, 78° f1.8.....\$22
12mm, 28°.....\$24	5mm, 70°PH.....\$22

WEATHER RESISTANT Camera Enclosure

Solid, extruded aircraft aluminum.

Strain reliefs for cables.

Size: 3.5" w x 3.7" h x 1.4" L

Our Price.....\$59ea.

with 110VHEATER.....\$79ea.

CO2, 60Watt CW, SEALED GLASS LASER HEADS

Integral Hard Sealed Mirrors, Factory Refurbished,

High quality water cooled heads, originally designed for a medical

application. Size: 44" L x 3.2" diam. Power requirement, 30KV

trigger with 15-20KV @ 7 to 20mA operating current. These are not

toys. Perfect for engraving, cutting and drilling many materials.

Always a sellout. Ltd qty.....50Watts \$995ea.

SEM-52, MILITARY, VHF, FM TRANCEIVER

Beautiful German made radio operates on up to six

pre-set, xtal controlled channels. We supply

47.8MHz & 55.5MHz. Radio is powered by six

standard "AA" cells. Controls include: OFF-ON

SQUELCH, (AUS-EIN-RSP), volume and channel

(KANAL) Accessories provided include: 2 battery

packs, 35" Ribbon antenna with flex base, Strap-

on "web" headset/mic and carry case.

Used in very good condition.

LTD. QTY.....\$139ea. or \$249 for pair

FRONT SURFACE MIRROR with

ADJUSTABLE MOUNT 19mm diam. mirror, attached to a sturdy adj. mount, integral riser & base machined from a single aluminum block. Dual allen adj. screws. Optical center 46mm high. Black anodized. Overall size: W50mm x 62mm H x D26mm. Removed from laser system. Ltd. qty.

OUR PRICE..\$39.00ea. 2 for \$69.00

VARI-DENSITY BEAM SPLITTER is MOTORIZED!

50mm diam. wheel, (dens. 0.2 -2+), mounted to 3VDC Canon gear-motor. Includes a 5mm photo-voltaic cell for feedback. Riser & base machined from a single block. Optical center 46mm high. Black anodized. Overall size: W63mm x H92mm x D69mm. Removed from equipment.

SPECIAL \$129ea.

"TECH SPEC" OPTICAL FLAT, Precision, Dual Surface, Zerodur, Edmund model, M43433, 6" d x 1" thick. Polished and certified to 1/10th wave. Ultra low expansion Schott Zerodur. Like new condition. Includes carry case and calib. certificate. Reg.....\$1200 Now.....\$395

CUBE BEAM SPLITTER, 13mm

Two precision right angle prisms, flat to two waves, Bonded and AR coated. Permanently mounted on alum. plate. Split approx: 88% thru, 6% split

\$15ea.

SUPER 10 CHANNEL, 720 HOUR TIME LAPSE VCR

Used, depot refurbished, GYR / HITACHI model 1440-10 at 1/3 of the regular price. More features than we have ever seen in one unit! On screen programming, time/date stamp, audio, fully programmable 10 channel auto video switch, power loss recovery and alarm inputs. Although not cosmetically perfect, they are in excellent working condition. Instant security system, just add cameras. ORDER # H1440-10..... \$799ea.

16 CHANNEL DIGITAL VIDEO MULTIPLEXER, allows real time, multi-camera recording to tape.

NEW! American Dynamics model 1484SL-16. allows recording of up to 16 cameras on one video tape. Video loss detection and pre-loss frame memory. Manual or auto camera selection. Bring your surveillance system up to commercial standards. Can be rack mounted. A quality unit. Very limited quantity available.

ORDER # 1484SL-16..... \$799ea.

NEW LASER DIODE MODULES, operate from 4.5 to 9VDC!

SPECIFICATIONS:

DC Power: 4.5 - 9V, @65mA

Power out: 4.5mw max

Range: 400-800 Meters

Glass Collimator

Size: 0.41" diam x 0.71"

Shown Actual Size

The best value for commercial, Subminiature, laser modules. Glass collimating lens provides 1.5mRad performance. (divergence comparable to HeNe lasers.) Wide input, internal surface mount, 4.5 to 9VDC power supply. Machined brass for excellent thermal characteristics.

650nm 5X Brighter...\$45

635nm 10X Brighter...\$69

***635F adj. focus...\$79**

Co-PILOT PRECISION ELECTRONIC COMPASS

Patented Magneto-Inductive sensor technology out performs ALL OTHER MAGNETIC SENSORS in it's class!

Two axis sensor calculates compass heading and cardinal points.

Built in compensation for external magnetic fields. Internal tilt compensation up to 20°.

The CO-PILOT is the most sophisticated auto compass available. +/- 5° accy, 1" res., backlit 2"x3" LCD display shows digital heading, cardinal points, moving compass rose as well as all menu choices. Magnetic or true north. Declination angle storage. Trail blazing memory. Automatic return reverses your route. One button bearing storage. Digital clock and up down timer. Adjustable electronic motion damping. Magnetic disturbance alarm. EL backlight. Auto shut off. Splash resistant. 200 hour battery life.

Co-PILOT Compass.....\$95ea.

MOUNTED, FRONT SURFACE MIRRORS, adjustable.

1.5" diam adj. mirror cell holds 14mm FSM. Mounts are easily removed from sturdy solid aluminum base. Four allen screws for adj. Single mirror base unit is: 5.25" H x 3" W x 1.6" D. Dual mirror base unit is: 4" W x 3" D x 2.75" H Perfect for home holography. Removed from system. Single \$15.95 Double Mnt.....\$19.95

NEW! 4 CHANNEL, VIDEO AUTO SWITCHER

Model GM34. Connect to any four standard video signals and they will be sequentially output to the dual rear panel BNC outputs. Front panel has user adjustable, variable dwell time from 1 to 15 sec per channel. Auto or manual switching with channel bypass. Compact only 8.6" W x 3.7" D x 1.75" H, ac powered. Video loop through jack. **NEW GM-34.....\$89ea.**

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 installation. Perfect with our GM1000A cameras. Both will fit in a cigarette pack.....with the battery!

TVX-100.....\$199. TVX-100 with GM-1000A-PH Camera.....\$288.

FREE ARGON LASER? 16mw Brilliant Tourquoise Blue, SPECTRA PHYSICS, 161B with POWER SUPPLY

Our low price is like paying for the power supply and getting the laser FREE! The 488nm, TEM00 mode is nearly 10X brighter than a 16mw HeNe! This is the laser you always wanted but couldn't afford. Perfect for that kick butt light show! All are in good, plug and play condition. Standard 115VAC operation. Integral fan cooling. We priced the whole system for less than others charge for the power supply alone. Why spend more? Always in demand. Limited Qty. **New Price.....\$5K+ OUR PRICE.....\$899**

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 hounds. Auto or manual reset. Compact, ac powered. Adjustable sensitivity. Video loop through jack. **NEW VM-10.....\$189.**

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, GM 410 has RCA video connector, GM-412 has a BNC. 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 SPECIAL.....\$129ea. GM410 less lens.....\$169ea.

Ultra Fast Lenses for Low Light or Gen'l Purp. for Normal Light

16mm, f1.6, 15° FOV.....\$39	4mm, 80° FOV.....\$24
8mm, f1.3, 30° FOV.....\$49	8mm, 40° FOV.....\$24
4mm, f1.4, 56° FOV.....\$49	12mm, 28° FOV.....\$24

Exclusive "LAB STYLE" LASERS, 650nm and 635nm,

Rugged, Dependable.

One year warranty.

Adjustable X and Y beam

position. Aircraft aluminum

housing. Internal battery and on-off switch included. Makes a super

pointer. 75d x 2.75" L. **SALE..... 650nm \$69, 635nm \$99**

ULTRA HIGH VACUUM TURBO PUMP

Leibold Heraeus Model Turbovac

150. Used with only 3600 hours on

the clock! Mint condition. Includes

Turbotronik NT150 controller and 6"

to 2" flange. Perfect for pumping

down gas lasers. One available.

Less than 1/2 price.....\$1995.

AIR BEARING SPINDLE from DOVER INSTRUMENTS

Super accurate air bearing spindle with servo controller. Similar to

534-RF-BDC/MFM. Face plate 4.8" d. Max. RPM 7200. Load

65lbs., axial stiffness: 1,500,000 lb/in., axial rotational

error <2 microinches, radial rotational error <2

microinches. Operates with 90PSI @ 1.3scfm. Rack mount

controller provides <0.01% speed

accuracy. Good condition. Removed

from precision lab instrument.

Dover price: >\$15K

ONE AVAILABLE.....\$1595

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 unltc4u@iac.net

Write in 89 on Reader Service Card.

Nuts & Volts Magazine/April 1998 21

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>

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.

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.

O'SCOPE SALE: Tek 485 350MHz \$625; Tek 475A 250MHz \$550; Tek 475 200MHz \$475; Tek 465B 100 MHz \$450; Tek 468/DM44 100MHz storage \$950; Tek 464 100MHz storage \$350; Tek 465 100MHz \$350; Tek 455 50MHz \$175; Tek 2213 60MHz \$395; Tek 2213A 60MHz \$450. All scopes in good working condition. ISA, PO Box 6955, Laguna Niguel, CA 92607. 714-488-0010, Fax: 714-488-0299, E-Mail: sklar@cerfnet.com

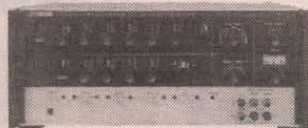
AFFORDABLE HP power sensor repair! Most 8481As repaired for \$235 or less. We also handle 478As and many others. Call or fax for more information. Willamette RF, Inc., 541-754-7226, FAX 541-753-4629.

EXCELLENT CONDITION TEST EQUIPMENT: HP 3488A switch/control mainframe \$850 (cards available); HP 37204A HP-IB extender \$235; HP 59306A relay actuator (6-SPDT) \$175; HP 59307A dual VHF switch (2-SP4T) \$175; HP 59401A HP-IB bus analyzer \$250; HP 8161A/020 100MHz HP-IB dual channel pulse generator \$3,000; HP 5334A 100MHz counter (rise/fall time, HP-IB, etc.) \$850; HP 5334A/030 as above with 1.3GHz channel C \$1,250; HP 5335A/020,040 200MHz counter (rise/fall time, statistics, HP-IB, etc.) \$1,200; Stanford Research SR 510 lock-in amplifier \$1,400; HP 339A distortion analyzer \$1,500; Tek 222A handheld battery-operated digital storage scope \$1,250 (many accessories available). HP 8502A/H26 transmission/reflection test set \$950; HP 8748A/H26 S-parameter test set \$1,550; Tek AM 503, A6302 current probe, amplifier \$850; Tek FG 504 40MHz function generator \$675. Excellent condition! All with warranty. Pepper Systems, 214-353-0257 (Fax 214-902-9511).

Quality Reconditioned TEST EQUIPMENT

Fluke 5200A

Programmable Voltage Calibrator, outputs from 100 μ V rms to 120 V rms at 50 mA current level.



Special \$1100.00

Fluke 5215A

Precision Power Amplifier, output voltages to 1100 Vrms, max output of 200 Watt, 10 Hz to 120 kHz.

Special \$1100.00

Fluke 5440A

Calibrator, 4 ppm, completely programmable, output from 0 to 1100 V dc, boost output and divider output from 0 to +2.2Vdc.

Special \$3500.00

Fluke 8012A

Digital Multimeter, 3.5 digits, seven functions, 0.1% basic accuracy, true-rms ac, from 45 Hz to 50 kHz, 10A range, 2 Ω and 20 Ω range.

\$175.00

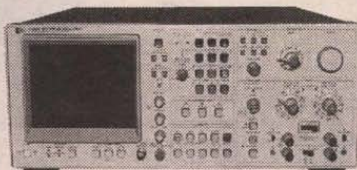
Hewlett-Packard 8657A Opt 002

Signal Generator, 100 kHz to 1040 MHz, 10 Hz resolution, output power +13 to -143.5 dBm into 50 Ω . Opt 002, RF connectors on rear panel.

Special \$3900.00

Hewlett-Packard 3582A

Spectrum Analyzer, .02 to 25.5 kHz, 0.02 Hz resolution, 70 dB dynamic range, transfer function, coherent function, phase spectrum, and frequency domain analysis, internal noise source, HP-IB.



Special \$1,995.00

EIP Microwave 548A Opt W-36

Microwave Frequency Counter, 10 Hz to 26.5 GHz, 12 digit LED display, sensitivity 25 mV rms (10 Hz to 100 MHz) -15dBm (22 to 26 GHz). Opt W-36 includes the following options and modifications: Opt. 05, oven stabilized time-base, opt. 06, extended frequency capability, opt. 08 GPIB, W-11, 50/60 to 400 Hz operation, EMI/RFI shielding.

\$3,900.00

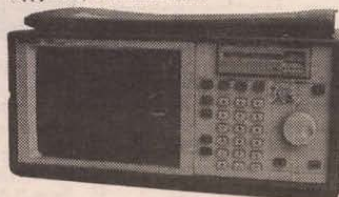
Hewlett-Packard 1650A

80 Channels of 25 MHz state or 100 MHz timing, trigger or pattern across 80 channels, built-in 3.5" floppy drive, with accessories.

\$1995.00

Hewlett-Packard 1650B

80 Channels of 35 MHz state or 100 MHz timing, trigger or pattern across 80 channels, built-in 3.5" floppy drive, with accessories.



\$2750.00

Hewlett-Packard 8901B

Modulation Analyzer, 150 kHz to 1300 MHz, measures AM and FM to 1% accuracy, measures RF frequency, measures power, low internal noise, completely automatic. Options available.

\$4,250.00

Hewlett-Packard 8903B

Audio Analyzer, 20 Hz to 100 kHz, combines the functionality of a low distortion audio source, frequency counter, high performance distortion analyzer, SINAD meter, and a ac/dc voltmeter.

Special \$3500.00

Hewlett-Packard 5350B

Microwave Frequency Counter, 500 MHz to 20 GHz, 11 digit display, 1 GHz tracking speed, measures frequency, period, period average, ratio, totalize, and time-interval. Sensitivity to -40 dBm.

\$4375.00

Hewlett-Packard 8640B

Signal Generator, 0.5 to 512 MHz, -149 to +19 dBm RF output, phase locking and counter.

\$1,250.00

Hewlett-Packard 8350A/83545A

Sweep Oscillator Mainframe with Sweep Oscillator plug-in. Plug-in capabilities; 5.9 to 12.4 GHz frequency range, 50 mW max leveled power, complete HP-IB programmability.

\$3,250.00

Hewlett-Packard 5335A

Universal Counter, 200 MHz, built-in automatic rise time, cycle, pulse width, slew rate and phase measurements. Automatic triggering.

Special \$750.00

Hewlett-Packard 8494B Attenuator

Manual, dc to 18.0 GHz, 0 to 11 dB in 1 dB steps.

\$450.00

Hewlett-Packard 8495B Attenuator

Manual, dc to 18 GHz, 0 to 70 dB in 10 dB steps.

\$450.00

Tektronix SG504

Signal Generator, provides a leveled output amplitude that is variable 245 to 1050 MHz in 2 bands. Amplitude range is 0.5 V to at least 4 V p-p.

Special \$2750.00

Tektronix 465B

100 MHz Oscilloscope, 5mV/div sensitivity, 2 ns sweep rate, delayed sweep, trigger view and beam finder. Includes 2 probes.

\$675.00

Tektronix 466

100 MHz Storage Oscilloscope, dual trace, 5 mV/div, stored writing speed of 3000 div/ μ s variable persistence. Includes 2 probes.

\$575.00

Tektronix 485

350 MHz Oscilloscope, dual trace, 5 mV/div sensitivity, 1 ns/div sweep rate, 3.0 div/ns writing speed, selectable input impedance. Includes 2 probes.

\$895.00



ELECTROMAGNETIC DETECTORS, including Trifield® broadband meter (analog) reads field strength of 10-1000 V/M at 100kHz-2.5GHz, also independently reads magnetic (3-axis) and electric fields, below 100kHz. (0.2-100 milli-Gauss, and .5-100 KV/M, at 60 Hz). Ideal general detection tool for both AC power and RF work \$170 postpaid. **Atmospheric ion counter** (digital) reads both polarities 10-2,000,000 ions/cc. (Atmosphere is typically 300-5000 positive and 200-3000 negative. Depends on weather, etc.) For the first time, under \$4,000 for a true ion counter! \$580 postpaid. **DC Gaussmeters** 4.5 digit Hall detector with versatile axial and transverse probe (.01-20,000 Gauss) \$210. **Earth magnetometer** (.01 milligauss-20 Gauss) \$365. All above have 1 year warranty and include 9-volt batteries. Made in USA by Alphalab Inc., 1280 South 300 West, Salt Lake City, UT 84101. Tel. 1-800-769-3754 or 801-487-9492. Free catalog. See www.trifield.com

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.



TEK 577/D2/177 curve tracer \$850 in good condition. **CUSHMAN CE-24A** selective level meter 1KHz-3.2MHz, -80 to 20dBm, .003uV sensitivity with 50 ohm input \$150. **TEK PS 283** tripple 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.odulo.com/corp/equiptek>

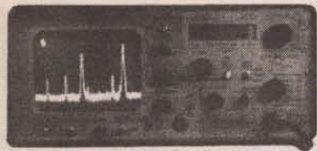
(602) 483-6202 • Fax (602) 483-6403

14455 North 79th Street, Unit #C • Scottsdale, Arizona 85260

WANTED: USED TEST EQUIPMENT

**DANBAR
SALES COMPANY**

TEK-SALE: New unused 69802B \$600, 6902A \$350; DA-4084 w/5003 distortion analyzer \$550. New factory boxed CFC 250 timer/counter \$95; 475 w/DM44 \$400; 7904 \$300; MI-5010 program. multifunction interface \$200; 7A13 \$135; 7A18 \$50; 7B15 \$175; 7B53A \$58; 7B80 \$70; 7B85 \$75; 7B92A \$125; 7D15 \$150; 7D20 \$250; 7F10 \$350; SI-5010 \$200; P6202A FET probe \$200; PG-508 \$225; SC-502 \$250. **New factory boxed PS283 \$325; 2511 \$400; SSMQK1 PLCC engineer's kit \$200.** All with 30 day warranty; call **Psitech Plus** 707-745-4804 request bi-monthly fax listings. Fax 707-747-5277, E-Mail: apeas@ix.netcom.com



ENGINEER TESTED: SPECTRUM ANALYZERS. Frequency counters, frequency standards, meters, scopes, generators, and more. **VISA, MASTER-CARD, AMEX.** More information: [HTTP://TECH-SERVICES.COM](http://TECH-SERVICES.COM) "Performance-tested." Calibrated. Warranted. Gary N6ZD.

EXCELLENT CONDITION TEST EQUIPMENT: HP 3325A synthesizer/function generator \$1,695; HP 5345A 500MHz counter \$400; with HP-IB \$675; HP 6012B autoranging 200W power supply \$2,400; HP 6237B triple output dual tracking power supply \$375; HP 7090A measuring plotter \$1,500; HP 7475A 6-pen plotter \$220; HP 83522A .01 to 2.4GHz RF plug-in \$4,900; HP 8411A/018 harmonic frequency converter \$475; HP 8743B/018 reflection/transmission test set \$875; HP 11713A attenuator/switch driver \$675; HP 11869A adapter (for 8350B) \$350; Tek 520A NTSC vectorscope \$650; Tek 466 (100MHz, storage) \$600; Tek 468, R468 (100MHz, digital storage) \$1,150, 900; Tek 475A (250MHz) \$650; Tek 475A/DM44 (250MHz, multimeter) \$725; Tek 7CT1N curve tracer plug-in \$325; Tek 7S14 1GHz sampler \$575; Tek PS 503A power supply plug-in \$175; Tek TR 503 tracking generator \$850; Wavetek 178 waveform synthesizer \$1,600. Excellent condition! All with warranty. Pepper Systems, 214-353-0257 (Fax 214-902-9511).

EXACT 124 function generator-dual out to 5MHz \$65; GR 1001A signal generator \$70; HP 651A 10MHz signal generator \$50; HP 8620A/86235A 1.7-4.3GHz sweep generator \$210; 86250A 8-12.4GHz plug-in \$150; HP 1900A 25MHz pulse generator \$75; Tek 464 100MHz storage scope \$400; Ralac 9913 200MHz counter \$55; Rockland FFT 512S FFT analyzer \$125; PMI 1038 network analyzer \$115; HP 3455A 6-1/2 digit voltmeter \$185; HP 410C voltmeter \$70; HP 432C power meter \$100; HP 3400A 10MHz RMS voltmeter \$80; Bendix ignition analyzer scope \$165; Doric DS500 K thermocouple readout \$25; HP 7132 chart recorder \$85; GR 1608A RLC bridge \$95; HP 3581 50kHz selective voltmeter \$110. 714-495-8649 evenings.

FED-LOG on CD-ROM. Have you wondered what all those numbers were on government sales catalogs? Now be able to identify all government stock numbers for price, mfg., part number, description. \$350 a set. Call TJ's Wholesale Surplus 904-897-6482. E-MAIL: TOMFORSHE@AOL.COM

WANTED: WILTRON 6400-6N50 or 6400-6NF50 SWR autotester and Wiltron 6400-71N50 detectors. Contact Jim Stevenson, telephone 609-888-2846, fax 609-888-2847, E-Mail: jl Stevenson@aol.com

TEKTRONIX EQUIPMENT: 7D20 programmable digitizer, \$400; 453 50MHz dual ch. scope, \$300; 7623A, 100MHz storage, \$350; 7704A 200MHz scope frame, \$350; P6042, current probe DC-50MHz, \$500; K212 scope cart, \$125; 200C scope cart, \$125; mobile 3 scope cart for 7000 series scopes, \$200; 7104, 7A29, 7A26, 7B53A, 7B15, 1GHz scope system, \$4,000; 604 XY display, \$300; A-comm Electronics 303-290-8012.

EQUIPMENT SALE: 435A \$150, 8 available. 214B pulse generator \$850; HP 3400A \$95; 8620C all scales w/86290A \$1,100; HP 3575A opt. 001 phase gain meter \$500, without option \$350; 36037A repeater \$75; 37203A HP-IB extender \$65; 59308 timing generator \$50; 59501A power supply programmer (as new) \$60; 5420A w/10920A digital signal analyzer \$200; HP late model 8170A logic pattern generator \$125; 8470A opt. 02 network analyzer \$250; 8742A reflection test set \$200. **Psitech Plus** 707-745-4804 request twice-monthly fax listings. Fax 707-747-5277. E-Mail: apeas@ix.netcom.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.

RE 204 AUDIO analyzer \$400. Call for others. **Psitech Plus** 707-745-4804 request twice-monthly fax listings. Fax 707-747-5277. E-Mail: apeas@ix.netcom.com

WANTED: LATE model TEST EQUIPMENT and test equipment MANUALS, HP, Tektronix, and others. Fax your for sale list to 410-750-1192 or mail to US Surplus, PO Box 37, Ellicott City, MD 21041, Attn: Ron Baublitz. Phone # 410-750-1083, E-Mail: ussurplu@clark.net

Roger's Systems Specialist

Order On-Line!

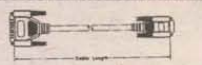
800-366-0579

"We Have Great Connections"
Computer - Communications

Call for a FREE catalog!

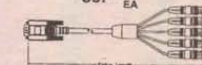
www.rogerssystems.com

MONITOR CABLES



6' HD15 TO DB13W3
MALE TO MALE
FOR SUN MONITORS

CC-VGA-DB13W3
\$39.00 EA



6' HD15 TO 5 BNC
MALE TO MALE
CC-VGA-5BNC
\$12.00 EA

Microphone

Stick-on monitor or clip on or stick on shirt 6 ft. cord; condenser mic.



#TM-MIC-2
\$2.00 each
100/.90 each

FLOPPY DISK FILE



HOLDS 100 DISCS
W/KEYLOCK
#TM-DSC-3
\$4.00 each

Magnetic Mount Antenna

Standard TNC connector, Portable, 12 in. tall, long cord

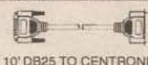
ONLY \$7.50 each

COLORFUL MOUSEPADS

MANY COLORS AND PATTERNS- DURABLE!

#TM-PAD \$1.00 each

PRINTER CABLES



10' DB25 TO CENTRONICS
MALE TO MALE
FOR HP, EPSON,
CANON AND OTHERS

CC-PR1-1284
\$9.00 EA

6' DB25 TO CENTRONICS
MALE TO MALE
FOR HP, EPSON,
CANON AND OTHERS

CC-PR6-1284
\$6.50 EA

1" CASE STICKERS

ASSORTED CASE STICKERS TO PLACE IN EMPTY SPACE ON FRONT OF COMPUTER CASE
\$1.00 EACH

CD Jewel Case

Replacement for original case



#TM-CD1
\$.40 each

Parallel Port

DB25 Female to 26 pin socket



#CN-702 \$.50 each
100/\$.40

DC-DC CONVERTER

CAR ADAPTER WITH MULTI-HEADS FOR RADAR DETECTORS, PHONES, CD PLAYERS, ETC.
TM-354.....\$8.00 EA

AUDIO ADAPTERS

S-VIDEO/ADB COUPLER F/F
AD-506.....\$2.00 EA
3.5MM COUPLER F/F-STEREO
AD-503
\$1.50 EA

ANDREA HEADPHONES W/MICROPHONE

-NOISE CANCELLING MICROPHONE-
-USE WITH LEFT OR RIGHT EAR-
#TM-165-MONO \$10.00 each

Multimedia

Slim-desktop microphone
TM-MIC-3 \$3.00 EA
20 +..... 2.50 EA

COMPUTER POWER SUPPLIES

230 WATT MINI SIZE-UL
PS-245.....\$20.50 EA
250 WATT MINI SIZE-UL
PS-247\$27.35 EA

CANNED AIR

12oz. CAN OF COMPRESSED AIR GREAT FOR CLEANING ELECTRONIC EQUIPMENT!
TM-AIR.....\$6.50 EA

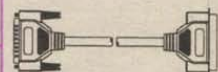


FANS

FOR COOLING PENTIUM II PROCESSORS -BALL BEARING W/SENSOR WIRE-
TM-FAN-PENT2
\$16.00 EA

HARD DISK DRIVE COOLER -IVORY COLOR, FITS IN 5 1/4" BAY-

TM-FAN-HDD
\$14.00 EA



Special I-EEE 1284 Printer Cable
10' Bi-Directional DB25 Male to Mini Centronic 36 A.K.A. type "A" - "C"
#CC-PR6-BIMIN
\$.89 each
100/.50 EACH

Local 805-295-5577

Remember, We Have Great Connections...For You!

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

Call for quantity discounts • No out of state checks accepted • Most orders shipped same day

24895 Avenue Rockefeller, Valencia, CA 91355





by Kenton Chun

PIR Varmint Chaser

Unless you live in a condo, you probably have had problems with varmints in your yard at one time or another. It may be stray cats or dogs, or even the occasional unwelcome solicitor! In addition to

rabies, varmints are known to carry and transmit infectious diseases and are a transport vector for blood sucking parasites and hitch hiker weeds.

Of course, it is unlawful and inhumane to resort to violent mea-

sures, and trapping and relocating varmints will not work in the long run because the varmint population is actually dependent upon the available food supply in the neighborhood.

Well-intentioned, but misguided

"feeders" will tend to support a permanent population of stray animals. Removing the varmints will only leave a vacancy for others to take their place.

No varmint likes to get wet. Survival depends on retaining body

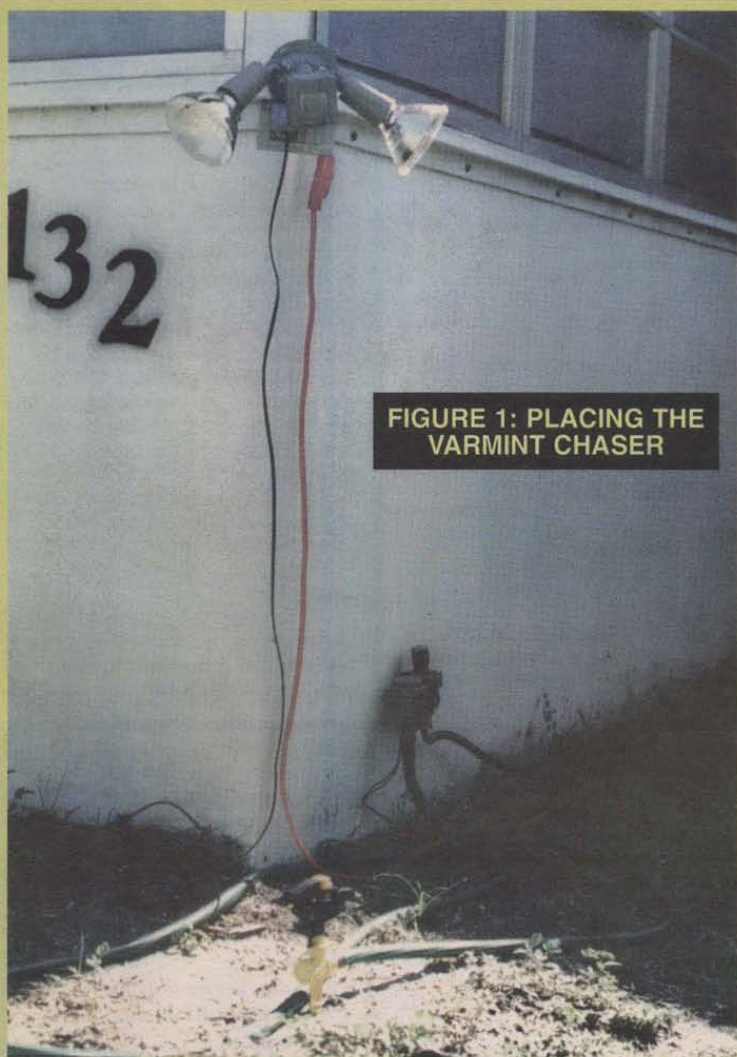


FIGURE 1: PLACING THE VARMINT CHASER

heat so dogs, cats, and other wild animals have an instinct to avoid being soaked.

This month's project will use a Passive Infrared (PIR) sensor to trigger open a solenoid valve which, in turn, is connected to a common yard sprinkler. When aimed at the area you wish to protect, varmints will steer clear!

The local chapter of the ASPCA confirms that this is an acceptable and humane method of deterring trespassing strays. Stray animals usually possess enough intelligence to realize when they are not welcome. The PIR varmint chaser will drive the point home without hurting them and may result in a greener lawn as well!

Passive Infrared (PIR) detectors have recently become cheap and plentiful. Advances in logic circuitry and infrared lensing systems have made them remarkably reliable and immune to false alarms. Most PIR sensor technology has been applied in automatic home lighting and commercial alarm systems.

These are sensing systems that sense the presence of a

warm-blooded entity and turn lights or alarms on in response. PIR detectors actually sense changes in far infrared, at frequencies associated with heat.

A typical PIR sensor consists of a comparator amplifier that is looking at the outputs of a reference voltage source and an infrared detector diode. After a settling period, the voltages are static and the detector is armed. When something warm like a raccoon, a person, or even a warm car hood passes in front of the detector, the voltage fluctuates.

A plastic Fresnel lens designed to focus the infrared on the detector will modulate the signal as the target moves. If the sensing circuitry decides this is a valid event, a relay is triggered into an "on" state.

Usually the relay is connected to lighting which turns on as the intruder is detected. In the case of potential

burglars, the lights coming on is usually enough of a deterrent to stop the advance. In the case of varmints, more convincing may be necessary.

Most varmints are nocturnal. They tend to patrol their perceived territorial boundaries (your yard) at night. This makes the PIR detector ideally suited for detecting and deterring nighttime prowlers.

Getting Started

The heart of the project is a commercially-available PIR lighting assembly. You can also use a PIR detector available from parts suppliers in this publication. Check the advertiser section for sources. PIR light assemblies can also be obtained from your local mega-hardware store. They come in various configurations, but the one we're looking for does not have to be an expensive model.

Higher cost models have light sensors built in so that they absolutely will not come on during the day. Bear this in mind if you want the unit to chase varmints all day, as well as all night.

Look for one that is rated for outdoor use — it should come complete with a weatherproof fixture and junction box suitable for use in damp locations.

You will also need an automatic sprinkler solenoid-operated valve. These normally closed valves are used to control branches of underground sprinkler systems. They typically come in one of two voltages, 24 VAC and 117 VAC models. If you decide to use the 24-VAC version, you will also need a

Wire the passive infrared detector according to the manufacturer's instructions. AC wiring conventions are different than DC conventions! In home AC circuits, the black wire is hot, the white wire is neutral, and the ground wire is green. Remember, "Black Is Dead."

In order to make the unit portable, I wired the PIR assembly to a standard grounded outlet box attached directly to the lamp assembly. If you are using correctly polarized plugs, the narrow plug slot is the hot one.

Make sure to cut the power at the breaker box before opening any junction boxes, or working on house circuitry. House current can be lethal. Do not cheat — connect all grounds.

It is suggested that you go ahead and wire in the outdoor lamp assemblies according to the manufacturer's instructions. The switched hot lead from the detector will be red (Figure 3). Wire the outlet to the red (switched hot) and white (neutral) wires.

You may decide not to use the lamps, but we have discovered that stray animals will begin to associate getting soaked with the light coming on and eventually will flee in response to only the light!

Wire the solenoid valve with five or 10 feet of 14-18 gauge outdoor wire, or extension, if you are using an outlet box. This will give you some latitude for locating the water supply away from the lamp assemblies. When the assembly is complete, it should look something like (Figure 2).

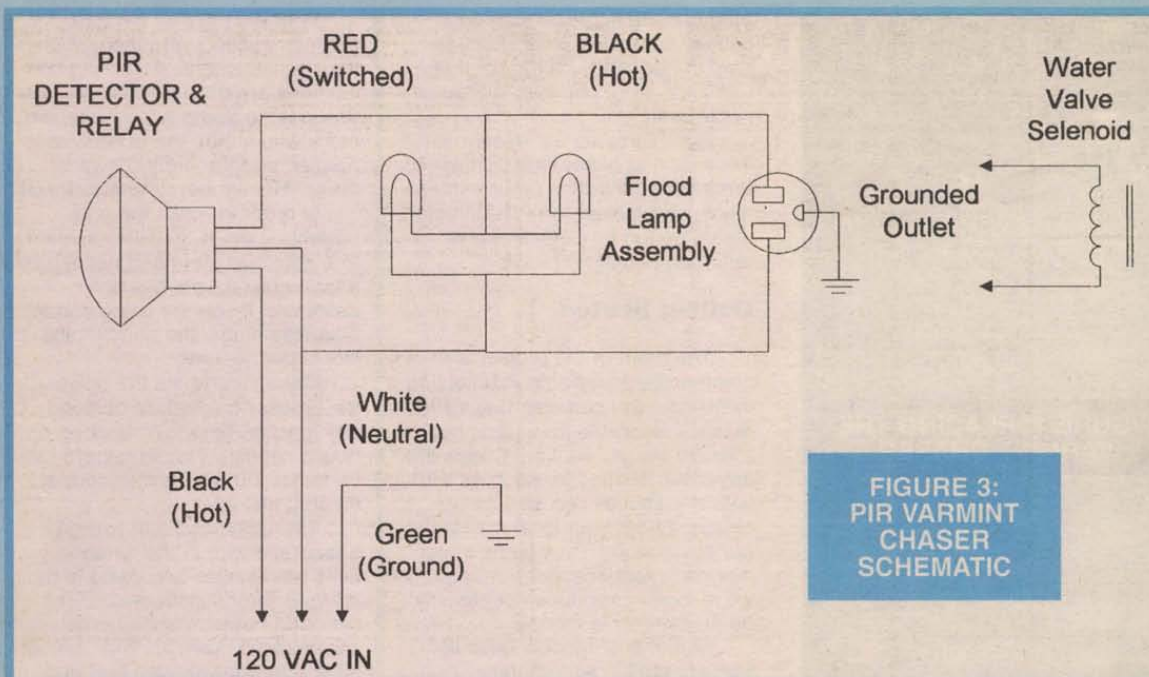
Mount the PIR assembly on a "C" clamp so that it can be



FIGURE 2: PIR AND WATER SOLENOID VALVE UNIT

24 VAC transformer or wall wart.

attached to any stable object in the



**FIGURE 3:
PIR VARMINT
CHASER
SCHEMATIC**

vicinity to be protected. The solenoid valve does not have to be attached to anything. Finally, using double-female washing machine supply hoses, connect the input of the solenoid valve to your hose bib, and the output to a garden sprinkler.

We have found that the most effective sprinklers are the spring-loaded impulse clapper type, or the whirling turbine type. These have quick start-up and are fairly noisy, which helps to startle the intruders.

It would be a good idea to power the project with a GFCI-protected outlet or branch circuit breaker since water is involved. If

you are using the 24-VAC version of the solenoid and have the transformer located well away from the PIR and water supply, the arrangement is pretty safe as it is.

Placing the Unit

Place the unit in an area that varmints are known to frequent. Study your varmints — they will usually enter and exit your property through a consistent path of least resistance. The best arrangement is pointing down a long pathway that is typically used by varmints to enter your yard.

Next, position the sprinkler 20

feet or so ahead of the PIR sensor. Impulse-type sprinklers usually have a stake attached so that they can be conveniently placed at different locations on the lawn. You will have to adjust the position of the stake and the pattern of the sprinkler to cover the area you wish to protect (Figure 1).

Finally, power up the PIR light assembly and turn on the water. The sprinkler may start up if the PIR model you have selected goes through an initialization cycle. Set the sensitivity so that the unit is not triggered by passing cars, or neighbors hanging out laundry.

Usually the duration can be set

to anything under one minute. It would take a fairly stubborn varmint to wait around any longer than that. Even if that is the case, the unit will catch them when they advance again.

Conclusion/Alternate Applications

The PIR Varmint chaser is a humane method of deterring strays from using your yard as their personal litter box. The yard will look a lot better as well. If you do not have a varmint problem, the project is easily adapted to trigger on a video camera for video surveillance, a scary music tape for trick-or-treating Halloween goblins, or even a camera for nighttime photography of wild animals. I have used the PIR varmint chaser for all of these purposes with great success.

Use your imagination to think up new uses for the PIR varmint chaser, and remember to have fun, whatever you do! NV

Parts List:

- PIR Sensor & Lamp Assembly (See Text)
- 120 VAC Solenoid Normally Closed Sprinkler Valve
- F-F Washing machine Supply Hose
- Impulse Sprinkler (See Text)
- 20' Outdoor Extension Cord
- C-Clamp
- Assorted crimp connectors, hardware as needed

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

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

TEST EQUIPMENT cont.

EQUIPMENT SALE: RE 204 audio analyzer \$400. Leader LPS-152 DC tracking supply \$200; LSW480-U80 Swemar gen. w/TV-VIF plug-in \$175; EIP 451/P1/P2/P5 auto microwave counter \$600, option P2 only \$450; Boonton 92SD \$125; Fluke 8000 DMM \$60; Philips PM-3217 o-scope \$200; Kikisui 5042 50 MHz 4 ch. o-scope \$200; NJE 0-20V, 0-1A bench supply \$50, 6 available. New unused PTS 160 test source and 320 test source \$175 each. Psitech Plus 707-745-4804, Fax 707-747-5277. E-Mail: apeas@ix.netcom.com

FLUKE 1722A instrument controller, \$275; 8520A 5-1/2 digit multimeter, HPIB, \$250; HP 3722A noise generator, \$125; 3462A DVM, \$75; 741A AC/DC differential voltmeter/DC standard, \$75; 5314A counter, \$60; General Radio 1925 multimeter, \$150; 1551B sound level meter, \$100; Nicolet UA-500A ubiquitous spectrum analyzer, \$125; Krohn Hite 3321 filter, \$80; Leeds & Northrup 7553 potentiometer, \$50; Data Precision 3500 DVM, \$50. The following \$25 each, non-working or untested: Gould K100D; HP 466A amplifier; Tek R564B; Krohn Hite 400-CR low frequency oscillator; General Radio 1219A. Kent, 515-232-7528.

2539 W. 237th Street, Bldg. F, Torrance, CA 90505
Order desk only: USA: (800) 872-8878 CA: (800) 223-9977
LA. & Technical Info: (310) 784-5488 Fax: (310) 784-7590
OEM INQUIRIES WELCOME

TIMELINE INC.

Over 11 years and 29,000 customers and still growing

Minimum Order: \$20.00. Minimum shipping and handling charge \$5.00. We accept
credit cards, MC, or VISA. No personal checks or C.O.D.s. CA residents add 8.25% sales
tax. We are not responsible for typographical errors. All merchandise subject to prior sale.
Phone orders welcome. Foreign orders require special handling. Prices subject to change
without notice. 20% restocking fee for returned orders.

LIQUID CRYSTAL DISPLAYS

240x64 dot LCD with built-in controller.

AND 4021ST-0E. Unit is EL back-lit. \$59.* or 2 for \$109.* or
OPTREX DMF5005 (non back-lit) \$49.* or 2 for \$89.*
20 character x 8 line 7/8L x 2 1/4H
The built-in controller allows you to do text and graphics.

Alphanumeric—parallel interface

16x1.....\$7.00	20x2.....\$10.00	32x2.....\$8.00
16x1 (lg. char.).....\$10.00	20x4.....\$15.00	40x1.....\$8.00
16x2.....\$7.00	20x4 (lg. char.).....\$10.00	40x2.....2 for \$20.00
16x2 (lg. char.).....\$10.00	24x2.....\$10.00	40x4.....\$20.00
16x4.....\$15.00	32x4.....\$10.00	4x2.....\$5.00

5V power required • Built-in C-MOS LCD driver & controller • Easy "microprocessor"
interface • 98 ASCII character generator • Certain models are backlit, call for more info.

Graphics and alphanumeric—serial interface

size	Mfr.	price	size	Mfr.	price
640x480 (backlit)	Epson	\$25.00	480x128	Hitachi	\$10.00
640x400 (backlit)	Panasonic	\$20.00	256x128	Epson	\$20.00
640x200	Toshiba	\$15.00	240x128 (backlit)	Optrex	\$20.00
480x128 (backlit)	ALPS	\$10.00	240x64	Epson	\$15.00
			160x128	Optrex	\$15.00

6" VGA LCD 640X480, Sanyo LMDK55-22 \$25.99

MONITORS

9" COLOR SVGA MONITOR \$249.00

Fully Enclosed - Tilt and swivel type.

MONITORS

Non-Enclosed TTL

Comes with pinout. 12V at 1.4 Amp input • Horizontal frequency 15KHz • Ability to do 40 and 80 columns.

5 inch Amber \$25.00 • 7 inch Amber \$25.00
9 inch Amber or Green \$25.00

5" COLOR MONITOR \$39.00

- Flat Facplate • 320 x 200 Dot Resolution • CGA & Hercules Compatible
- 12 VDC Operation • 15.75 KHz Horiz. Freq. • 60 Hz Vert. Sync. Freq.
- Open Frame Construction • Standard Interface Connector • Degaussing Coil included • Mfr. Samtron

2 for \$69

HACKER CORNER

Encased Spread Spectrum RF Modem \$199.99

The ProLink Radio Module is a small communication device which replaces cables between RS-232 devices with wireless RF (Radio Frequency) technology. Attaching a pair of ProLinks to any two devices with three wire asynchronous RS-232 ports allows wireless data transmission at rates up to 19.2 Kbaud (full duplex) over a range of 500 - 800 feet. Modules use 900 Mhz spread spectrum radio for communication which does not require an FCC site license. A variety of configuration information (radio channel, baud rate, serial port configuration, etc.) can be programmed into module's non-volatile memory by host PC to provide compatibility and avoid overlapping systems. Configuration changes are supported by menu driven, on-board software. Commonly used Terminal Emulation software and transfer protocols can be used for configuring modules and transferring data between computers. ProLinks require only 6-9 VDC (350 mA), RS-232 (9 pin sub - D) interface, and small (~4") whip antenna for operation. Unit size is 4.0" x 6.5" x 0.75". Installation schematics and application details available.

Encased Black & White Composite CCD Camera with Adapter

IR viewing to 1000 nm 7 1/2 L x 2 1/4 W x 1 1/4 H

Comes complete with CCD camera, mounting nut on bottom of casing.

12VDC power supply. Excellent low light capability, standard RCA NTSC video out. \$89.00

Great for: entryway security/remote monitoring, video conferencing/desktop video conferencing

2 for \$159.00

EMBEDDED 486 COMPUTER \$99.00

Complete enhanced Intel 486SX-33 based computer in ultra small (9-7/8L x 3-1/8H) case. Ideal for embedded operations or as a second computer. Features include: • One 16 bit ISA slot • 3 serial ports plus dedicated printer port • Parallel optical coupled adapter port • Built in IBM PC/AT keyboard port • On board VGA video and port • Uses standard SIMM up to 32 MB • BIOS is PC/AT compatible

Unit has a backup Ni-Cd battery system in case of power failure (5 min. backup time) and lockable front cover to prevent floppy drive access. Mounting / interface provisions for standard 3.5" laptop floppy and 2.5 inch hard drives. Comes with very comprehensive manual.

SONY Miniature Color LCD Display (LCX005BK) \$29.99

• 1.4 CM (0.55 inch) Diagonal Full Color Display • Built In Horizontal and Vertical Drivers • Delta Dot Pattern for High Picture Quality - 537 dots (H) x 222 dots (V) • Compatible with NTSC & PAL Format and Sync Inputs • 12 VDC Operation with -1 to +17 V RGB Signal and Driver Input Voltage • Excellent Display for Virtual Reality Projects, Viewfinders, and Miniature Test Equipment Displays • Pin Outs and Specification Included • Unit Requires Clock, Synchronization and Video

CELL SITE TRANSCEIVER \$49.00 2 for \$99.00

These transceivers were designed for operation in an AMPS (Advanced Mobile Phone Service) cell site. The 20 MHz bandwidth of the transceiver allows it to operate on all 666 channels allocated. The transmit channels are 870.030-889.980 MHz with the receive channels 45 MHz below those frequencies. A digital synthesizer is utilized to generate the selected frequency. Each unit contains two independent receivers to demodulate voice and data with a Receive Signal Strength Indicator (RSSI) circuit to select the one with the best signal strength. The transmitter provides a 1.5 watt modulated signal to drive an external power amplifier. Channel selection is accomplished with a 10 bit binary input via a connector on the back panel. Other interface requirements for operation are 26 VDC (unregulated) and an 18.980 MHz reference frequency for the digital synthesizer. The units contain independent boards for receiver, exciter, synthesizer, tunable front end, and interface assembly (which includes power supplies and voltage-controlled oscillator). Service manual, schematics and circuit descriptions included.

COLOR CCD CAMERA \$149.99

• 12 VDC • 1/3 inch CCD area image sensor • 514 (horizontal) x 491 (vertical) • 2:1 Interlaced • 15.734 KHz (horizontal), 59.94 Hz (vertical) • 330 horizontal and 350 vertical lines • 10 lx • 1V, NTSC signal format • Lens: 1/3-inch, fixed focus (F2.8 F5.6) • Dimensions: (W) 67 (2.63) x (H) 34 (1.45) x (D) 112.6 (4.43)

SELL: VALHALLA 2724A resistance standard calibrated \$850 and 2500 AC/DC current standard \$300 or both for \$1,000 and will include shipping (US only). Wanted Tektronix FG5010. 510-351-2047.

HP 5342A 18GHz microwave counter w/options 001 002 011, \$1,995. HP 339A distortion analyzer \$1,200. HP 33120A \$1,300. Check out www.test-equipment.net for more details. 732-445-4915.

ATLAS MISSILE E/F/H telemetry package flight certified. 2243.5MHz 10.6 watts PAM/FM/FM. 2 commutators, 20 VCOs. All tech data. 805-934-2058.

ASSOCIATED RESEARCH 5060AT high pot 0-6KV DC 5mA, \$500; HP 606B, signal generator, \$350; HP 606A, \$300; HP 3400A, \$250; HP 400E, \$250; HP 4815A, VECTOR Z METER, \$1,500; HP 4805 VECTOR GAIN METER, \$600; A-COMM ELECTRONICS 303-290-8012. Sales@A-comm.com

LARGE ASSORTMENT of used test equipment for sale. Request list or visit my website. Credit cards accepted. Jim Stevenson, phone: 609-888-2846, Fax: 609-888-2847. E-Mail: JLS@stevens@aol.com Website: http://www.stevensonlabs.com

SALE: TEK 465M 100MHz scope, good working condition, sale priced at \$195. ISA, PO Box 6955, Laguna Niguel, CA 92607. 714-488-0010, Fax: 714-488-0299, E-Mail: sklar@cerfnet.com

FLUKE 8810A, 4.5 dig DVM, \$250; Fluke 8000 DVM, \$80; Esterline Angus Speed Servo II, dual channel chart recorder, \$400; HP 7100B 2 ch. chart recorder, \$300; HP 7132A dual channel chart recorder, \$400; HP 7045B XY plotter, \$400; Leeds and Northrup 6 decade universal ratio set, \$500, GR 1608A Z bridge, \$400. A-comm Electronics 303-290-8012.

WANTED: TEKTRONIX type 212 oscilloscope. Allan Weiner, 207-985-7547.

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

AFFORDABLE LIPSTICK CAMERAS

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.

LP-850i - \$119.95
Length: 1.9" Diameter: .91"

LP-850p - \$129.95
Length: 1.37" Diameter: .87"

MICRO COLOR CAMERAS

MB-950c - \$299.95
Size: 1.25 x 1.25 sq. w/ Footprint
Micro Color MB-950C: \$299.95
• 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.

MB-960c - \$199.95
Size: 1.7 x 1.7 sq. x 2 PC Board
Micro Color MB-960C: \$199.95
• Lens: 3.6mm F#2
• Full Digital Process of BLC
• Auto Tracing White Balance
• 2H Mode of H.V. Aperture correction
• Digital process of color matrix
• Electronic Shutter up to 1/10,000
• Dip Switch Adjustment settings:
6)-BLC, 5)-Auto Shutter, 4)-AGC/On, 3)-Flickless, 2)-AWB/On, 1)-N/A

MB-1281 Color Camera
• Color module of 290,000 pixels 1/4" CCD
• 320 Horizontal Res. TV Lines
• DSP (Digital Signal Processing)
• Built-in Functions
• Auto Gain Control
• Auto White Balance
• Electronic Shutter
• Back Light Compensation
• Power - 12VDC @160mA
• Low Power Consumption



Wireless Observations System's
GFS-1001 (900MHz) - \$499.95
GFS-1001c (900MHz) - \$599.95
(1.2 Ghz system's available)

1-800-752-3571

Visit Polaris Ind. Web Site at:
<http://www.polarisusa.com>

Polaris Industries 470 Armour Drive NE • Atlanta GA 30324 • Tech Info: 404-872-0722 • FAX 404-872-1038

Prices, availability and specifications are subject to change without notice. Shipping and Handling are not included with price.

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 reach me online at QandA@nutsvolts.com, or by snail mail at Nuts & Volts Magazine, 430 Princeland Ct., Corona, CA 91719.

What's Up:

Dueling DSS receiver dilemma resolved, seeking obsolete replacement parts, and LM3914 basics. Windows 95 tips and tricks, selecting a video controller, and reader feedback on stepper-motor controllers.

Resistor Basics

Q. Kenton Chun's doorbell lamp ("Forever Doorbell," Feb. 1998) was a cute idea, but I wonder about the power dissipation in the dropping resistor; i.e., his 1/8 watt resistor at 600 ohms might not be up to the task for long. I once encountered an old, home-brew, control panel at work, which used 1/8 watt resistors to drop 12 volts DC for an LED. The LEDs had the right voltage across them, alright, but there was no light! A simple ohmmeter test showed that the LEDs had survived over the years, but the resistors had cooked and changed their value radically upward. As a result, the voltage was right, but the current was now below the point of a visible glow. Now the way I calculate it, 30 mA (per Mr. Chun's math) through 600 ohms works out to just over 1/2 watt. And considering the 99.999% duty cycle on the bell lamp, it looks like there could be some toast coming there, too. What do you think?

Jim Tolson
via Internet

A. Well, let's analyze the two designs. Let's assume that the LED drops 2.1 volts in the forward mode (some have a larger voltage drop, others have less — it depends on the color and construction). If the LED is powered from a 12-volt source, as in your example, then the 600-ohm resistor has to drop about 10 volts. Using Ohms Law, we discover that 10 volts through 600 ohms equals 16.6 mA ($I = E/R = 10/600$). Let's call it 17 mA. Power is current times voltage, or $P = EI$. So, in this case, the resistor needs to dissipate $0.017 \text{ mA} \times 10 \text{ volts}$, or 0.17 watts. The last time I looked, a 1/8-watt resistor equals 0.125 watts. This design clearly calls for a 1/4-watt resistor (0.25 watts), not the 1/8-watt resistors you uncovered. Bad engineering! Now, according to Kenton Chun's article, he worked from an 18-volt AC power source. Without going into a lot of detail about RMS and diode rectification, we can assume we have the equivalent of 9 volts DC. Running this formula through Ohms Law again, we get 7 volts across 600 ohms, or about 12 mA. Multiplying 12 mA by 7 volts nets a power dissipation of 0.084 watts — well within the design limits of any 1/8-watt resistor. The bottom line is that even though Mr. Chun's math was in error, the resistor will survive. Your home-brew friend missed the

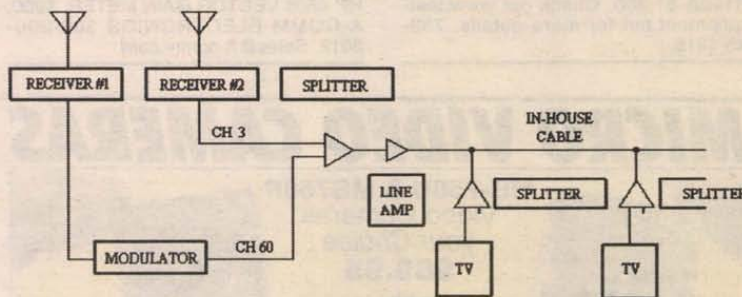
boat. My concern with the doorbell light is that the LED will survive the peak reverse voltage (most LEDs have a V_r of just 5 volts).

Agil Modulator Solves DSS Dilemma

Q. I have a Digital Satellite System (DSS) at home with two receivers: one (located in the family room) serves the family room and master bedroom, and the other (located in one of the kid's rooms) serves my two children's bedrooms. One receiver outputs on channel 3 and the other on channel 4. I want to tie the two cable "systems" together so that any television can watch what is on either receiver. Unfortunately, the receiver output channels are so close together that I get crosstalk (bleedover) when I connect them together. I've tried every trick in the book, but I can't keep the two receivers from interfering with each other. What I need is a circuit that will prevent this from happening. Any suggestions?

Robert R. Stapp
via Internet

A. I'm not surprised that you're having trouble with crosstalk using this strategy. The channel 3 modulator inside your DSS receiver lacks the expensive filtering of broadcast modulators; hence, the signal is "wider" than it should be and channel 3 will spill into nearby channels, including channels 2, 4, and 5. What you need is an "agil modulator" — sort of a video frequency converter. This device converts channel 3 (or channel 4) into channel 60 (439.250 MHz). Now you can mix the two DSS receivers without interference. You view Receiver #1 on channel 60 and Receiver #2 on channel 3. The diagram below shows you how to cable it together.



In this arrangement, the output of the modulator and Receiver #2 are mixed together in an ordinary cable splitter (Radio Shack 15-1141) that's been turned around so that the outputs are inputs and the input becomes the output. The mixed signals are then amplified using a standard line amplifier (Radio Shack 15-1112). The amplifier is necessary to make up for losses in the splitters and cable length, so don't skip it. Now you can use a single cable to provide service to every set in the house. Agil modulators are available from most DSS distributors, including Radio Shack, Satellite Warehouse (800-851-6534; <http://www.dbs-online.com/index>)

BUY • SELL • CONSIGN

WANTED

- Electronic Test Equipment
- Electronics Inventory
- Scientific Equipment
- Mfg. Shop Equip.
- Data/Telco
- Memory

9749 Hamilton Road
Eden Prairie, MN 55344

DEXIS

We Sell
Nationally!
Call our Fax-On-
Demand System, or our
Internet site for current availability.
Visit our 25,000 sq. ft. showroom 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

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. - \$.09@	1,000 pcs. - \$.07@	5,000 pcs. - \$.05@
18VAC, 300mA, Wall Transformers (Perfect for Stealth Units)	50 pcs. - \$3.00@	100 pcs. - \$2.50@	250 pcs. - \$2.00@
4 Mhz Resonators, 3 pins			
4 & 8 Mhz Crystals, 2 pins	100 pcs. - \$.45@	500 pcs. - \$.40@	1,000 pcs. - \$.35@
24 Mhz Crystals, 2 pins	100 pcs. - \$.55@	500 pcs. - \$.50@	1,000 pcs. - \$.44@
Micro-Chip Pic-16C54RC	100 pcs. - \$2.10@	250 pcs. - \$1.95@	500 pcs. - \$1.85@
Micro-Chip Pic-16C56RC	100 pcs. - \$2.30@	250 pcs. - \$2.25@	500 pcs. - \$2.15@
TDA-8340 I.C.	100 pcs. - \$2.00@	500 pcs. - \$1.75@	1,000 pcs. - \$1.68@
TSA-6060 I.C.	100 pcs. - \$3.48@	500 pcs. - \$2.75@	1,000 pcs. - \$2.45@

Call for Larger Quantity Quotes

Phone: (515) 847-3888

Fax: (515) 847-3889

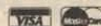
BBS: (515) 847-3890

CAPITAL
ELECTRONICS INC.

303 Sherman Street
Ackley, Iowa 50601

E-Mail: sales@capital-elec.com
Web: <http://www.capital-elec.com>

WE ACCEPT



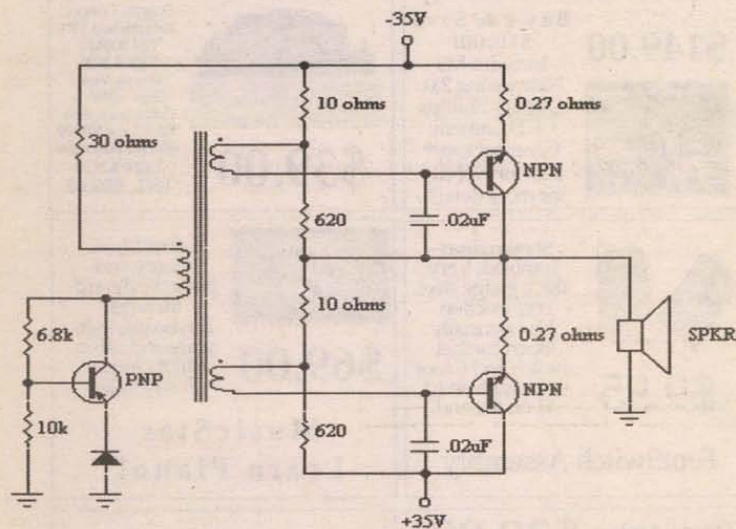
.html), and Star Link (405-745-9222; <http://www.starlink-dss.com>). The most popular modulators are ChannelPlus 3024 (\$250.00), MMOD70 (\$140.00), Sony MRD-D1, Triple Play (\$230.00). BTW, I bet you don't know that the channel 3 output of your DSS receiver is mono, not stereo! If you want stereo sound, you'll have to plug the audio output of the DSS receiver into a stereo amplifier.

Matched Transistor Pair Needed

Q. I have an old Sears Silvertone Musical Instrument Amp (Model 185.12010) that quit working. I traced the problem to a pair of output transistors that gave up the ghost. Unfortunately, Sears no longer supports or provides parts for this amplifier, and the problem is that these transistors have to be matched! Help!

K. Ramses
Coshocton, OH

A. Thanks for sending a copy of the schematic so that I can show other readers what to expect in similar circumstances. This is a very common design that came out in the late 60s when power ICs, like the LM1877, were but a dream. If you have an old stereo amplifier, you'll discover the same circuit.



The concept is a balanced positive-to-negative heavy current swing that relies on the perfect match of the two high-power transistors. Notice that each transistor is driven by a separate transformer winding. When properly matched for leakage and bias current, the connection junction of the two transistors rests at zero volts with zero signal input. Also notice that there's a small-value resistor (0.27 ohms) connected to the emitters of the two transistors. Often this is a fusible resistor that purposely blows out to prevent damage to the speaker when one of the transistors fails — so pay attention. The resistors may be dead, too. Now there's a good news and bad news part to this story. The good news: As for a suitable replacement, the NTE130MP, ECG 130MP, or their equivalent are perfect replacements and are sold by many local jobbers. The bad news: Expect to shell out about \$30.00 to \$50.00 for the matched pair, and don't expect them to be in current stock (probably a two-week wait).

Check Out The Specs

Q. I have a question that has puzzled me for sometime. When using an LM3914 in the dot mode, why does the first LED always seem to glow just a tad? That's the one that is connected to pin 1 of the LM3914 and is the "low end" of the display. In the bar mode this doesn't seem to happen

Mike Bryce
via Internet

A. First LED ... hmm? Actually, the answer is quite simple: It's the nature of the chip itself, as the data sheet below shows. Notice that the leakage current on pin 1 is considerably greater than the other outputs.

Acrobat Reader [lm3914.pdf]

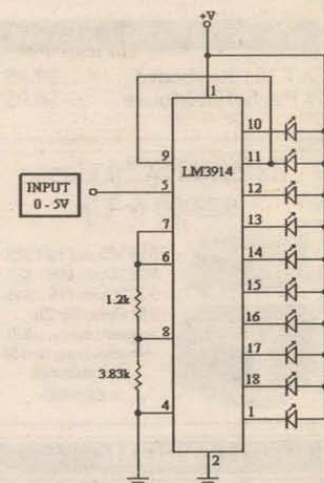
File Edit View Tools Window Help

Electrical Characteristics (Note 1) (Continued)					
Parameter	Conditions (Note 1)	Min	Typ	Max	Units
OUTPUT DRIVERS (Continued)					
Output Leakage	(Dot Mode) (Note 4)				
	Pins 10-18		0.1	10	μ A
	Pin 1	60	150	450	μ A
SUPPLY CURRENT					
Standby Supply Current	$V^+ = 5V, I_{REF} = 0.2 \text{ mA}$		2.4	4.2	mA
	$V^+ = 20V, I_{REF} = 1.0 \text{ mA}$		6.1	9.2	mA

Note 1: Unless otherwise stated, all specifications apply with the following conditions:
 $3 \text{ VDC} \leq V^+ \leq 20 \text{ VDC}$ $V_{REF} \text{ Vers } V_{LED} \leq 0V^+ - 1.5V$
 $3 \text{ VDC} \leq V_{LED} \leq V^+$ $0V \leq V_{REF} \leq V^+ - 1.5V$
 $-0.015V \leq V_{LED} \leq 12 \text{ VDC}$ $T_A = -25^\circ\text{C}$ $I_{REF} = 0.2 \text{ mA}$ $V_{LED} = 3.0V$, pin 9 connected to pin 5 (Bar Mode).
 For higher power dissipation, pulse testing is used.
 Note 2: Accuracy is measured referred to $\pm 10,000 \text{ VDC}$ at pin 6, with 0.600 VDC at pin 4. At lower full-scale voltages, buffer and comparator offset voltage may add significant error.
 Note 3: Pin 5 input current must be limited to $\leq 2 \text{ mA}$. The addition of a $30k$ resistor in series with pin 5 allows $\pm 100V$ signals without damage.
 Note 4: Bar mode results when pin 9 is within 20 mV of V^+ . Dot mode results when pin 9 is pulled at least 200 mV below V^+ or left open circuit. LED No. 10 (pin 10 output current) is disabled if pin 9 is pulled $0.5V$ or more below V_{LED} .
 Note 5: The maximum junction temperature of the LM3914 is 100°C . Devices must be derated for operation at elevated temperatures. Junction to ambient thermal resistance is 50°C/W for the molded DIP (N package).

Definition of Terms
 Accuracy: The difference between the observed threshold voltage and the ideal threshold voltage for each comparator. Specified and tested with $10V$ across the internal voltage divider on that resistor ratio matching error coefficient.
 LED Current Regulation: The change in output current over the specified range of LED supply voltage (V_{LED}) as measured at the current source outputs. As the forward voltage of an LED does not change significantly with a small

Start lm3914/22 Microsoft Word - DCL 30 Acrobat Reader [lm3914.pdf]



To reduce (not eliminate) the effect, National Semiconductor recommends that you return pin 9 (MODE) to pin 11 (LED 9) instead of letting it flap in the wind (open). Try this circuit and see if it works better.

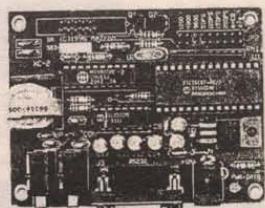
(Continued on page 102)

Motron

XC-2
DTMF To ASCII
Transceiver

<http://www.motron.com>

The New **Motron XC-2** is a versatile bi-directional DTMF to ASCII transceiver. DTMF digits are decoded from the audio line, converted to ASCII, and transmitted out through the serial port. ASCII data is received from the serial port, converted to DTMF digits and transmitted on the audio line. The **XC-2** uses the RS-232C serial communications protocol and includes a PTT output, which can be used to control a radio transmitter. The **XC-2** is user-configurable—select either 1200, 4800 or 9600 baud for the serial port and 5, 10, 15 or 20 cps DTMF transmission rate. Additional jumpers can be used to set DTMF '#' to generate an ASCII 'CR', and to control an open-collector output with DTMF 'a' (on) and 'b' (off). Audio connection options allow combined audio signals, or separate audio input and output via standard 3.5mm jacks. A standard DE-9S is used for serial communications. The **XC-2** is a fully assembled and tested printed circuit board, requires +8 to +17 VDC @ 200ma, and is only 2-1/2" x 3-1/2". OEM and Quantity discounts are available.



XC-2 Bi-Directional DTMF to ASCII Transceiver PCB \$99.00 Plus Shipping

We accept American Express & Visa & MasterCard & Discover/Novus

Orders: (800) 338-9058 Info: (541) 687-2118 Fax: (541) 687-2492

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 ...

www.baylin.com
or... call 800-483-2423

ORDER via Internet or Send \$60 plus \$4 s/h to:

Baylin Publications, 1905 Mariposa, Boulder, CO 80302
MASTER, VISA & AMEX /COD orders accepted

FREE CATALOG — Satellite TV books, videos and software



486 pages, 8-1/2" x 11"

JUST PUBLISHED!

Telephone: 303-449-4551
FAX: 303-939-8720

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.

Refurbished Computer Systems

AST 386 • 8MB • Refurb VGA
Monitor • 120 MB HD . \$120.00
486DX2/66 • 16 MB • 200 MB
New SVGA Monitor • \$299.00
Systems Include Keyboard and
1.44 MB Floppy
You supply software & go!



Starting at...
\$120!

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

www.allelec.com

HP Kittyhawk 1.3" IDE HD
Standard 2.5" 44 Pin Pinout
Fits *almost* anywhere!



20 MB 1.3" IDE.....\$7.95
Cable Adapter.....\$4.95

1/2 Actual Size

Quite Possibly the worlds smallest hard disk....

\$19.00



Standard RJ11.
Replaces tele-
phone handset.
Non-Amplified
No switch box.
Just connect
this instead of
the handset.

Plantronics Headset

10" Open Frame
Color SVGA!

Up to 1024 x
768 resolutin
110V AC
operation.
AC and VGA
cable
attached.
Ready to go!

\$119.00



Internet Camera
Video Conferencing

\$149.00



Buy 2 & Save
\$10.00!
Includes MS
Netmeeting 2.0.
Quality Phillips
CCD Camera.
Great package!
See our website
for more details.

TapeStor 800 & 3200



Seagate Connor
Refurbished TR1
TR1 800MB
TR3 3.2GB
Floppy Vers.
Only \$/W &
Cables included.
TR-1 Tape \$10.00
w/drive purchase
T3200 3.2GB
TR3...\$69.00

\$39.00



Great for projects!
About the size of a
red brick. With
built in fan.
+5 @ 10A, -5 @ 3A
+12@1.5A, -12@3A
Very nice P/S.

\$9.00

See Web for more
details.

Compact 80W DC P/S!

FLOPPY & ZIP SCSI DRIVES

3.5" NEW 720K\$5.00
3.5" NEW 1.44MB\$16.00
SCSI Zip Drive External
Refurb\$99.00

PC KEYBOARD / MOUSE

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



\$9.95

Shown disas-
sembled. Very
thick guage steel
construction.
Has normally
open contact
switch and 6 foot
wire with an RJ
11 on the end.

FootSwitch Assembly



Learn Music
theory and
piano keyboard.
Includes
Keyboard, soft-
ware and cable.
MIDI Output,
Ready to go!

\$69.00

**MusicStar
Learn Piano!**

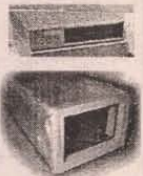
HP Printer P/S

\$29.00



4 Pin "L"
shaped connec-
tor, two styles,
one labeled
20VAC, other
10VAC
CenterTap.
Same output.

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.
All cases have two 50
pin centronics
connectors.

Original Apple
OEM Part.
1.5Amp output.
Needed for
Color & Type III
Batteries. Older
Duo's charge
batteries faster
with this one.

\$29.00



**Apple
PowerBook Duo P/S**



Epson Zip labeled.
+5V @ 1.5A.
VERY SMALL &
LIGHT WEIGHT
1.5" x 2.75"
Replace that big
bulky brick.

\$9.95

iomega ZipDrive P/S

CPUs

486SX 25/33\$3.00 ..\$5.00
486SX2-66\$8.00 ..\$8.00
486DX25/33\$5.00 ..\$8.00
486DX2-50/2-66 ...\$18.00 ..\$29.00
486DX4-100\$49.00 ..\$49.00
Pentium 75/90\$45.00 ..\$55.00
Pentium 100 / 133 ..\$65.00 ..\$75.00
Pentium 166\$99.00 ..\$99.00

Upgrade
Your
System



EPROMs

2716 /273275¢
2764 /27128\$1.50
27256 /27512 ...\$2.00
1Meg\$3.00
2 Meg\$4.00

RAM Chips

4Meg x 9-80\$15.00
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

2.5" 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
20 Meg.....\$9.00



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

Modems

External or Internal PC 2400\$9.95
Internal PC 9600\$12.95
Internal PC 14.4/Fax.....\$15.95
External 14.4.....\$19.00
External USR Sportster 28.8\$45.00
Hayes External 28.8 Accura (Mac/NEW)\$49.00
Powercomm 56KFlex External w/voice (PC).....\$95.00

CD ROM & Sound Cards

4x IDE Internal\$29.00
8x IDE Internal\$39.00
24x IDE Internal\$59.00
4x SCSI Internal.....\$49.00
4x SCSI External.....\$89.00
Ensoniq SoundScape w/on board CPU\$49.00
ExpertColor 16 bit SB Pro Compatible\$14.95
Universal Audio Cable (CD ROM to Soundcard)\$4.95

[HTTP://WWW.ALLELEC.COM](http://www.allelec.com)

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

TEST EQUIPMENT cont.

EFFRATOM FRK-L rubidium oscillators! 10MHz sinewave output, 0.5Vrms. Long term stability: $<1 \times 10^{-10}$ /month. Includes optional Mdl. EEK-10 heatsink and I/O connector. Used, with fresh NIST traceable calibration certificates, only \$500 ea. Full specifications and picture at our website. (Quantities available.) **Fluke 5101B opt. 005 multicalibrator**, DC/AC voltage and current plus resistance, \$2,400. ESI RS925 8 decade plus variable resistance standard, 0.01 Ω to 1.1M Ω , \$1,350. **General Radio 1863 megohmmeter**, 50K Ω to 20T Ω , \$550. **General Radio 1862C megohmmeter**, 500K Ω to 2T Ω , \$300. 60 day guarantee. **Lehman Scientific, 1-800-784-8680. Visa/MC. www.lehman-scientific.com**

TEKTRONIX TM500/TM5000 Plug-ins: SG503 250MHz leveled sinewave generator \$550. Many other plug-ins available. Metrowest Technologies, 508-478-7613, fax 508-634-3806.

HP 8558B/853A spectrum analyzer. 0.1-1500MHz w/digital storage display. Excellent condition, \$2,650. **Sencore SC61 waveform analyzer**, DC 60 MHz, oscilloscope plus digital readout of frequency, P-P volts, Delta volts, Delta time, etc. Comes with 2 brand new Sencore probes! Fully checked out and guaranteed, \$750. **EFFRATOM FRK-L rubidium oscillators!** 10MHz sinewave output, 0.5Vrms. Long term stability: $<1 \times 10^{-10}$ /month. Includes optional Mdl. EEK-10 heatsink and I/O connector. Used, with fresh NIST traceable calibration certificates, only \$500 ea. Full specifications and picture at our website. (Quantities available.) **Lehman Scientific, 1-800-784-8680. Visa/MC. www.lehmanscientific.com**

SELLING: HP 8150A optical source, mint, \$3,595. Also 8151A, 81511A, 81519A. **GenRad precision capacitance bridge**, 1615A, 1316, 1238 late style, super clean, \$2,795. **Tektronix 067-0599-00 curve tracer calibration fixture**, \$495. 172, 176, 178 fixtures, lowest prices. **J16 photometer w/J6523 1" probe** \$595. CT-5 \$395. EDC 1000VAC 6-dial precision voltage standard, \$895. **Wavetek 3002 520MHz \$395.** Keithley 225, 227, 705, lowest prices. **Weinschel VM-3 \$295. Free 12p. list laboratory test equipment.** Call Joseph Cohen, 200 Woodside, Winthrop, MA 02152, 617-846-8223.

SIGNAL GENERATOR HP 8640B opt. 1 & 3 \$850; HP 8640B/323 to 512 MHz \$325; HP 8616A 1800-4500MHz \$225; HP 8614A 800-1400MHz \$225. All equipment in good working condition. ISA, PO Box 6955, Laguna Niguel, CA 92607. 714-488-0010, Fax: 714-488-0299, E-Mail: sklar@cerfnet.com

AILTECH 7512-030, \$60; 7514-09-11, \$75; Automation Industries EM-3300, \$190; Bitronics 89890-6, \$30; Bird 6154, \$50; BECO 815-AF, \$70; Cohu 2700-10; Collins 980H-3/878L-1/878L-3, \$150; CVC GT-340A/GT-034, \$125; Dranetz 305C/102.7M0D15, \$60; Electro Impulse Lab DPM-3, \$40; Gen Precision Lab TS-783/UPM-35, \$60; Holtzer-Cabot ZM-14A/PSM-2, \$30; Honeywell chronotherm 3, \$30, 1883A-MPD, \$50; Intoximeters Inc Alco-sensor 3, \$15; North Atlantic 350, \$60, VM-202BRT-S132, \$50; Philips PM3251, \$175; Polard 1607E-FWTJ, \$75; Scientific Atlanta 1520, \$100; PI3-643, \$50; Spedcor Electric AN/USM-159A, \$60; UVP DE-4, \$40; Weston 61, \$50, 339 \$30, 433 \$30, 622 \$25, 901 \$25, 931 \$30. G&G 210-674-8771.

WANTED TEST EQUIPMENT AND SERVICE MONITORS. WE WILL TAKE YOUR EQUIPMENT IN ON CONSIGNMENT OR PAY TOP DOLLAR BY NEXT DAY FEDEX FOR GOOD NEW OR USED LATE MODEL EQUIPMENT. AMERITEC, BIRD, CUSHMAN, EIP, HP, IFR, MARCONI, MOTOROLA, NARDA, RYCOM, SMITH-MYERS, TEKTRONIX AND OTHERS. CALL 1-800-476-2526, FAX 228-868-0133 OR 601-868-0133. E-MAIL: alcomtest@worldnet.att.net FOR MORE INFO AND CHECK OUR WEB SITE AT http://home.att.net/~alcomtest FOR CURRENT SALE ITEMS.

WANTED: RADIO service monitors, IFR, Motorola, HP, Marconi, also late model HP equipment. 716-763-9104 or Fax 716-763-0371. <http://www.madbbbs.com/amtronix>

METROWEST TECHNOLOGIES: The home of friendly service. Call us just to chat about test equipment, we won't bite. 508-478-7613, fax 508-634-3806. Web page: www.metrowesttech.com

BRUEL & KJAER BUY, SELL, BEST PRICES. EXCALIBUR ENGINEERING, 3198-C AIRPORT LOOP DRIVE, COSTA MESA, CA 92626. 714-540-0169, FAX 714-540-5417.

WANTED: USED test and measurement equipment. We will pick up and pay on spot at time for pick up. Metrowest Technologies, 508-478-7613, fax 508-634-3806.

NETWORK ANALYZER HP 8505A, 8503A, 8501A complete RF network analyzer system calibrated excellent condition, \$3,500. ISA, PO Box 6955, Laguna Niguel, CA 92607. 714-488-0010, Fax: 714-488-0299, E-Mail: sklar@cerfnet.com

TEKTRONIX CURVE tracer: 577D2 with fixture \$750. Metrowest Technologies, 508-478-7613, fax 508-634-3806.

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.

TOOL KITS

Technicians Tool Kit TK-2000



\$42.95

Contains 25 tools

An electronic technician tool kit designed for the educational field. Heavy-duty deluxe Plano tool box comes with two cantilever trays having 18 component trays. Deep bottom storage area for bulky items. Quality array of tools meets most educational requirements.

Deluxe Tool Kit TK-3000



\$79.95

Contains 25 tools plus a special meter stand

A professional technician service tool kit in a metal reinforced tool case with heavy-duty handle and looks. A removable pallet handles most of the tools listed with more room for tools and parts in the lower half.

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

Stereo Cassette Player Kit AK-200

- Transparent Case
- Belt Clip
- High Resolution
- Includes Headphones



\$14.95

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

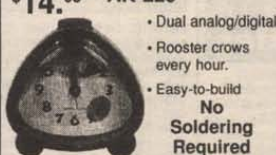


\$19.95

SOLDERLESS KITS

NEW

TALKING CLOCK KIT AK-220



\$14.95

- Dual analog/digital
- Rooster crows every hour.
- Easy-to-build
- No Soldering Required

35mm Camera Kit AK-540

Learn all about Photography



\$14.95

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



Telephone Kit Model AK-700

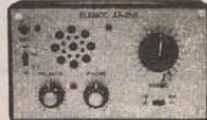
Build this high-tech see-thru plastic telephone. Learn theory on how telephones work and then proudly show off your work with the transparent phone case. Complete with all parts and manual. Neon lamps flash when the phone rings.



\$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

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.



Talking Clock Kit Model AK-210

- LCD time display
- One button instant time report
- Hourly time announcements
- 3 alarm sound choices: rooster crow, buzzer, cuckoo



\$14.95

Robotic Arm Model OWI-007

The Movit Robotic Arm is an educational kit that teaches the fundamentals of a basic robotic arm as well as your own motor skills.

\$59.95

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

Telephone Hold Button Model K-18

Put all incoming and outgoing calls on hold at the press of a button.



\$7.95

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

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

WANTED: CRT for HP 1980A/B scope HP P/N 5083-5652, Stoddart NM-22A RFI receiver, Tek 570 VT curve tracer, Sencore PA81 audio analyzer. Jeff Kyle 903-527-4196, 4268 FM 36 S., Caddo Mills, TX 75135.

TEKTRONIX PLUG-INS: Loads of them in stock. Metrowest Technologies, 508-478-7613, fax 508-634-3806.

METROWEST TECHNOLOGIES: Boston's Equipment Supersource. Call us for a quote on your next test equipment purchase. 508-478-7613, fax 508-634-3806. Web page: www.metrowesttech.com

LOWEST PRICES on Tek 7000 series oscilloscopes and plug-ins. Call or fax 732-681-2032.

HEWLETT PACKARD plotters: 7585B drafting plotter, \$1,500; 7596 Draftmaster II, \$1,500; 7550A w/HPIB \$500; 7475A w/HPIB, \$400. All with 30 day guarantee. Call or fax 732-681-2032.

TEK 1503 TDR cable tester, complete, \$1,000; Tek 7912AD programmable digitizer, \$500; Tek 475 oscilloscope w/opt 93, \$500; Tek 466 storage oscilloscope, \$400; Tek 464 storage oscilloscope w/DM44, \$500. Call or fax 732-681-2032.

ENGINEER TESTED: Frequency counters, frequency standards, meters, scopes, generators, etc. **VISA, MASTERCARD, AMEX.** More information: [HTTP://TECH-SERVICES.COM](http://TECH-SERVICES.COM) "Performance-tested." Calibrated. Warranted. New & used. Gary N6ZD.

TEKTRONIX LOGIC analyzers: Touchscreen with probes, \$450 and up. Metrowest Technologies, 508-478-7613, fax 508-634-3806.

FREQUENCY STANDARDS sales and service. Cesium, Rubidium and Quartz. Ask about our April specials! Corby Dawson 805-736-0288.

WE BUY electrical power systems test equipment. This includes the following manufacturers: **Multi-Amp** (now AVO Multi-Amp), **Biddle** or **James G. 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.**

NEW HEWLETT-PACKARD 141T CRTs. \$195 EACH. We have quantities available. These are double boxed, unopened with 1985 date code, guaranteed. Price is \$195 each plus shipping. Contact Brian at Kentronix. 732-681-3229 or FAX 732-681-3312. Mailing: PO Box 2444, Farmingdale, NJ 07727 or E-Mail brian@kentronix.com

HP 4815A Z-METER: Sandford Associates, **TOTAL Service Specialist.** Repairs warranted to HP/QA factory specs, former HP Tech/Supv. with expertise, parts, and tooling. Tel/Fax: 908-852-7989, E-Mail: GS_SA4815@compuserve.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.

WANTED: ELECTRONIC estates. Ham, broadcasting, military, test, public address, tubes, transformers, telec equipment. The bigger the pile, the more worthwhile. We fly anywhere. Sumner McDaniel 1-800-251-5454.

SPECTRUM ANALYZERS: HP 141T/8552B/8553B/8554B/8555A \$2,250; HP 3582A \$1,795. ISA, PO Box 6955, Laguna Niguel, CA 92607. 714-488-0010, Fax: 714-488-0299, E-Mail: sklar@cerfnet.com

HP 141T SPECTRUM ANALYZER, 100KHz to 110MHz, \$995. HP 5335A counter, \$600. 360-769-2761. Other items at WWW.OSCOPE.COM

HUNTRON: LIKE new at used prices. **HUNTRON** models: 5100's price \$5,000; RP388 price \$20,000; 640's price \$650; 700 price \$1,800; 410 price \$225; TM515 w/FG503, DC504, LA501, DM501 @ \$500. Tel: 1-800-879-2624 fax: 500-443-4948.

FLUKE 5200A/5205A AC calibrator, \$2,200; HP 436A/8481A power meter/sensor (unused), \$1,400. John 912-922-8244.

TEKTRONIX 496 spectrum analyzer, 1KHz-1.8GHz. Very clean. \$2,900 as is or \$4,500 guaranteed good working order. 912-953-6800 ext. 2497 or mercuro@aol.com

HP 6453A power supply, 200-240 VAC input, 0-15 VDC at 200 amps output, \$725. Precision, 505-988-5233. E-Mail: jbau@dsrt.com

MANUALS, HP, Tektronix, Fluke: Call or write with specific needs. April vintage manual special: Any Tektronix 500 series oscilloscope, \$20. Plug in manuals for same \$5 each when ordered with mainframe manual. Allen Fulmer, 2538 Sweetgum Way West, Clearwater, FL 33761, 813-796-3424.

Synthesized FM Stereo Transmitter

Microprocessor controlled for easy frequency programming using DIP switches, no drift, your signal is rock solid all the time - just like the commercial stations. Audio quality is excellent, connect to the line output of any CD player, tape deck or mixer and you're on-the-air. Foreign buyers will appreciate the high power output capability of the FM-25; many Caribbean folks 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

Tunable FM Stereo Transmitter

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, or optional 120 VAC adapter. 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

RF Power Booster Amplifier

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. Power required: 12 to 15 volts DC at 250mA, gain of 38dB at 10 MHz, 10 dB at 1000 MHz. 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

Micro FM Wireless Mike

World's smallest FM transmitter. Size of a sugar cube! Uses SMT (Surface Mount Technology) devices and mini electret condenser microphone, even the battery is included. We give you two complete sets of SMT parts to allow for any errors or mishaps-build it carefully and you've got extra SMT parts to build another! Audio quality and pick-up is unbelievable, transmission range up to 300 feet, tunable to anywhere in standard FM band 88 to 108 MHz. 7/8" w x 3/8" h x 3/4" h.

FM-5 Micro FM Wireless Mike Kit.....\$19.95

Crystal Controlled Wireless Mike

Super stable, drift free, not affected by temperature, metal or your body! Frequency is set by a crystal in the 2 meter Ham band of 146.535 MHz, easily picked up on any scanner radio or 2 meter rig. Changing the crystal to put frequency anywhere in the 140 to 160 MHz range-crystals cost only five or six dollars. Sensitive electret condenser mike picks up whispers anywhere in a room and transmit up to 1/4 mile. Powered by 3 volt Lithium or pair of watch batteries which are included. Uses the latest in SMT surface mount parts and we even include a few extras in case you sneeze and lose a part!

FM-6, Crystal Controlled FM Wireless Mike Kit.....\$39.95
FM-6WT Fully Wired FM-6.....\$69.95

RAMSEY Super Pro FM Stereo Radio Transmitter

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 freq 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-100.....\$429.95

AM Band Radio Transmitter

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 where regulations allow. The entry-level AM-1 uses a tunable transmit oscillator and runs the maximum 100 milliwatts of power. No FCC license is required, expected range is up to 1/4 mile depending upon antenna and conditions. Transmitters accept standard line-level inputs from tape decks, CD players or mike mixers, and run on 12 volts DC. The Pro AM-25 comes complete with AC power adapter, matching case set and bottom loaded wire antenna. Our entry-level AM-1 has an available 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

Tone-Grabber Touch Tone Decoder / Reader

Diald phone numbers, repeater codes, control codes, anywhere touch tones are used, your TG-1 will decode and store any number it hears. A simple hook-up to any radio speaker or phone line is all that is required, and since the TG-1 uses a central office quality decoder and microprocessor, it will decode digits at virtually any speed! A 256 digit non-volatile memory stores numbers for 100 years - even with the power turned off, and an 8 digit LED display allows you to scroll through anywhere in memory. To make it easy to pick out numbers and codes, a dash is inserted between any group or set of numbers that were decoded more than 2 seconds apart. The TG-1 runs from any 7 to 15 volt DC power source and is both voltage regulated and crystal controlled for the ultimate in stability. For stand-alone use add our matching case set for a clean, professionally finished project. We have a TG-1 connected up here at the Ramsey factory on the FM radio. It's fun to see the phone numbers that are dialed on the morning radio show! Although the TG-1 requires less than an evening to assemble (and is fun to build, too), we offer the TG-1 fully wired and tested in matching case for a special price.

TG-1, Tone Grabber Kit.....\$99.95
CTG, Matching Case Set for TG-1 Kit.....\$14.95
TG-1WT, Fully Wired Tone Grabber with Case.....\$149.95
AC12-5, 12 Volt DC Wall Plug Adapter.....\$9.95

The Cube World's Smallest TV Transmitter

Perfect video transmission from a transmitter you can hide under a quarter and only as thick as a stack of four pennies - that's a nickel in the picture! Transmits color or B&W up to 150' to any TV tuned to cable channel 59 with a solid 20 mW of power. Crystal controlled for no frequency drift with performance that equals law enforcement models that cost hundreds more! Deluxe model includes sound using a sensitive built-in mike that will hear a whisper 15 feet away! Units run on 9 volts and hook-up to most any CCD camera. Our cameras shown below have been tested to mate perfectly with The Cube and work great. Fully assembled.

C-2000 Video Transmitter Cube.....\$89.95
C-3000 Video and Audio Transmitter Cube.....\$149.95

CCD Camera Interface Board

Here's a nifty little kit that eases hook-up of your CCD camera module to any video monitor, VCR or video input TV set. The board provides a voltage regulated and filtered source to power the camera (CCD Cameras require a stable source of power for best operation), sensitive electret condenser mike for great sound pick-up and RCA Phone jacks for both audio and video outputs. Runs on 11 - 20 VDC

IB-1 Interface Board Kit.....\$14.95

CCD Video Cameras

If you're looking for a good quality CCD board camera, stop right here! Our cameras use top quality Japanese Class 'A' CCD arrays, 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'. These cameras have nice clean fields and excellent light sensitivity, you'll really see the difference, and if you want to see in the dark, these are super IR (Infrared) sensitive! Available with Wide-angle (80°) or super slim Pin-hole style lenses. Both 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 Interface board (below) for Audio sound pick-up and direct wire connection to any video monitor or TV video/audio input jacks. Fully assembled.

CCDWA-2 CCD Camera, wide-angle lens.....\$99.95
CCDPH-2 CCD Camera, slim fit pin-hole lens.....\$99.95
IR-1 IR Illuminator Kit.....\$24.95

Call for our Free Catalog!

RAMSEY ELECTRONICS, INC.
793 Canning Parkway
Victor, NY 14564

Order Toll-free: 1-800-446-2295
Sorry, no tech info or order status at this number

Technical Info, Order Status
Call Factory direct: (716) 924-4560
www.ramseyelectronics.com

ORDERING INFO: Satisfaction Guaranteed. Examine for 10 days, if not pleased, return in original form for refund. Add \$6.95 for shipping, handling and insurance. Orders under \$20, add \$3.00. NY residents add 7% sales tax. Sorry, no CODs. Foreign orders, add 20% for surface mail or use credit card and specify shipping method.

What They Didn't Teach You ... If They Ever Even Knew!

In the late 1970s, an electrical engineering professor in a major east coast university was teaching an undergraduate "electron devices" course (transistors, diodes, op-amps, etc.). He made the following statement: "The nice thing about electronic engineering, that's not true for the other fields, is that if it works on the blackboard it has to work on the bench." He meant it! And he also didn't quite get it when about one-third of the class burst into hysterical laughter. The rest of the class sat around quizzically wondering why the others were laughing their heads off.

Guess which of the two groups had some technician level experience prior to entering engineering school? The dudes that were laughing so hard had made their living either repairing products that should've worked because they worked on the blackboard, or debugging newly created circuits that didn't work on the bench the way they worked on the blackboard.

The Great Bob Pease, who proves that engineers can be both curmudgeonly and have a sense of humor, writing in one of his delightful "What's All This _____ Stuff, Anyhow?" articles, made the heretical suggestion that engineering schools only hire professors with years of engineering experience. I once told a friend of mine, who was an engineering professor, that most engineering school professors are not engineers because they had never practiced the profession except for "research." The doc who made the "... works on the blackboard" statement went through from high school to the Ph.D level to the professoriate without ever practicing the profession (senior projects, thesis, and dissertation projects are not quite the same thing).

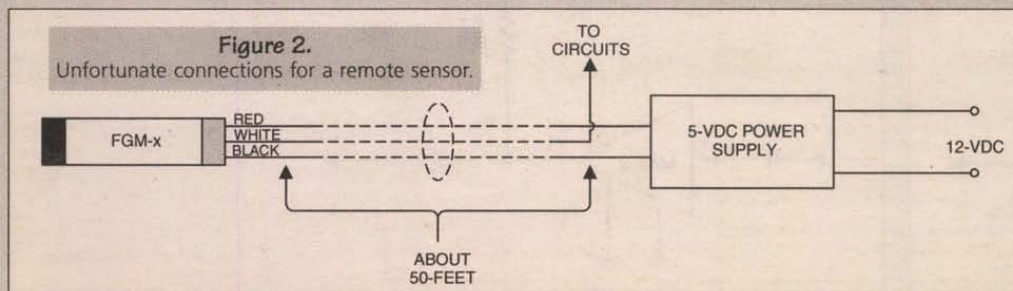
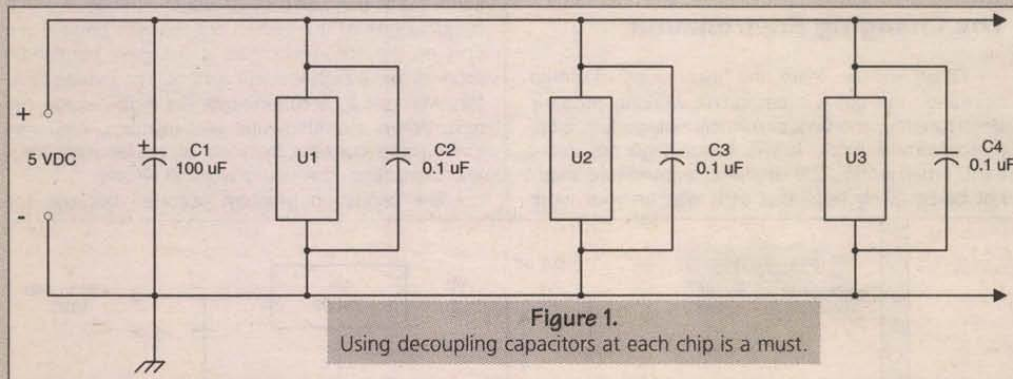
At one time, in many states, a person could not teach a profession unless they were licensed to prac-

tice it. The Professional Engineering (PE) license typically requires at least four years of "... progressively more responsible experience." That means that PE's who become professors have at least four years of experience. I recall one engineering school where nearly all of the EE professors had PE licenses. In another school, less than 100 miles away, so few professors had PE licenses that a senior (friend of mine) who needed to acquire the five signatures needed on the PE exam application, had to go outside the school to find them! They didn't even have enough PE's on the faculty to form a pick-up basketball game.

Among the things you are unlikely to learn in engineering school are the practical things that make a project successful. Many engineering professors see these as "trade school" topics, and leave them to the vo-techs. What they don't understand — never having practiced the profession — is that they are also what makes the project successful. Let's take a look at a few actual events.

The Case of the Student's Rat's Nest Project

When I was in engineering graduate school, I worked in the university's hospital repairing equipment (electronic repair techs made three times what a graduate teaching assistant earned!). One day, came a knock-knock-knock on my workshop door, and upon opening it, I found a genuine undergraduate engineering student. "Doctor Frabbits!" said you'd help me with my senior project." Since Doc Frabbits was my academic advisor, and therefore held the key to my entire professional future, I allowed as how I (' Not his real name!)



Open Channel

by Joseph J. Carr, CEF
K4IPV

might help the young fellow (sighhhh).

The chap came into the workshop carrying a box of goodies. He showed me a scrawled circuit on several pieces of green "engineering paper." I forget at this late date what the circuit did, but it contained a large number of the then-current TTL digital devices and some LED seven-segment numerical readouts. Then he brought out his circuit. Oh, my god, what next? That circuit was a rat's nest built on a chunk of wood. The TTL chips were soldered in "dead bug" style, and all interconnections were made with #26 or #28 enameled wire, with the ends more or less scraped to reveal the underlying copper. The circuit was clocked at about 4 MHz, if I recall correctly.

The fellow also failed to use any capacitors in the power supply distribution circuit. Take a look at Figure 1. Those TTL chips drew a lot more current than today's chips, so putting a 0.01 μ F to 0.1 μ F at each chip was essential (C2 through C4 in Figure 1). It's still important, but then it was critical. There should also be a capacitor at the point on the circuit board where the DC power supply lines connect (C1 in Figure 1). In some cases, where the power supply lines are long or there are a large number of devices on the PCB, then there should be additional capacitors on the DC power lines as well.

The Case of the Long Lines

My friend Erich Kern of Fat Quarters Software (who supply the FGM-x magnetic sensors) put me up to writing on this topic right after one of his sensor customers reported having a problem or two. The chap wanted to put an FGM-3 sensor about 50 feet from the DC power supply and signal processing circuits (Figure 2). He ran a set of wires between the two, and found erratic behavior. Eric told him to at least put a 10- μ F capacitor between the black and red DC power supply leads on the FGM-3 (which is what the spec sheet says to do!). He also recommended what I believe is the correct solution (Figure 3).

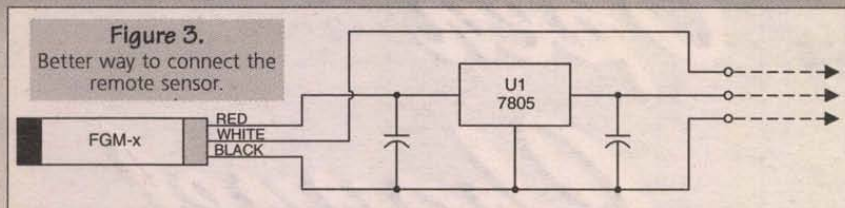
The +5 VDC voltage regulator and capacitor ought to be at the sensor end of the wire run, and the wire should be shielded. With sensitive instruments like a magnetic sensor, one might also want to consider a dual-regulated DC power supply.

The Case of the Burned-Out Pre-amp

Another practical problem came about from one of my articles in this magazine. I am a fan of the Mini-Circuits MAR-x monolithic microwave integrated circuits (MMIC). They are chips that operate from near-DC to either 1,000 MHz or 2,000 MHz, depending on the specific type number (which is what the "x" in "MAR-x" means). I typically use the MAR-1 and MAR-6 devices. One of the nice things about the MAR-x devices is that they have an inherent 50-ohms input and output impedances, so match well with other RF circuits and coaxial cable.

A fellow contacted me about the MAR-x pre-amplifier he had built for his VHF/UHF scanner receiver. That's a good application for the MAR-x. He

Open Channel



placed the amplifier right at the terminals of the antenna, up in the attic. The amplifier was used to overcome coax loss and to boost the signal received through the antenna. He complained bitterly that the MAR-x was a "no good product" because he had to replace the chip every three or four months. That didn't seem quite right to me because I've used MAR-x devices for years, not months, and never had a failure.

He sent me a schematic (Figure 4A) showing the MAR-x preamplifier connected to an unregulated DC power supply that was nominally rated 36 VDC, but actually varied between 30 VDC and 40 VDC depending on the load, the line voltage, and the phase of the moon (I suspect). He used the normal series limiting resistor (R1 in Figure 4A), making it 1,500 ohms. The idea is to drop the voltage to +5 VDC, while staying within the current rating. If the voltage stayed right at 36 VDC, the current drain through the MAR-x would be around 21 mA.

The particular MAR-x device he used nominally wanted to see 3.5 volts (V1 in Figure 4A), with the 5 volts he used being at the upper limit. When the voltage supply raised to 40 VDC, the value of V1 went higher than the rated voltage. I recommended that he place a low current 78L05 voltage regulator up in the attic in the same box with the MAR-x device (Figure 4B). He did so, and reported to me a year or so later that the problem went away. The device turned out to gain reliability when he operated it within specs.

A better solution would be to reduce the unregulated supply voltage to 9 to 12 volts, or so. Or one could use dual regulation by using a 78L09 or 78L12 at the lower end of the DC power supply wire, and a 78L05 at the MAR-x pre-amp in the attic.

Component Tolerances

One of the many reasons why circuits don't always work on the bench like they work on the blackboard is the little issue of component tolerances. When you buy transistors, you will find the beta gain listed with "min-typ-max" values. This means that the value will be between the minimum and maximum values and, if you are lucky, will be close to the "typical" value.

on the body. Suppose you have a resistor marked "1,000 ohms, 5%." The actual value can be $1,000\Omega \pm 5\%$, or 950Ω to $1,050\Omega$.

Figure 5 shows how such components might graph if you measure some critical component. The vertical axis shows the proportion of the total number at each value. We are assuming that the values form a normal distribution curve, although they may actually form some other curve. The minimum and maximum values are usually selected as either the $\pm 2\sigma$ or $\pm 3\sigma$ points, while the typical value will be the mean value. We tend to design circuits using the typical value, and sometimes don't take into consideration what the implications are of a particular component being closer to min or max values.

I've seen several different problems associated with the fact that actual component parameter values have a range. One such problem is the matter of tolerance build-up. In circuits that are reasonably robust, the effect of component variation will not be too terrible, especially if the variation is more or less randomly distributed. But every now and then, one will find a situation where all the values selected for some particular project pile up at one end of the range or the other. Some might be high, and some might be low, but if they combine to the values that make the circuit work poorly, then ... all bets are off.

Another problem was seen in a low-noise amplifier used in the UHF spectrum. The original circuit breadboarded by the engineer used a transistor that had a critical parameter close to the $+3\sigma$ point on its distribution curve. He optimized the circuit, and got it working real well. Unfortunately, the next one didn't work too terribly well. It seems that most of the transistors of that part number in the supply room box were closer to the mean point on the scale. The device he picked out happened to be atypical for the group.

The Changing Environment

Okay, so you learn the techniques of breadboarding, and get a super circuit working properly. Unfortunately, the final circuit will not work in a laboratory environment. It will, instead, go out into a hard, cruel world. The ambient temperature might not be so nicely regulated as it was on your work-

bench. Similarly with resistors: A resistor with a "five-percent tolerance" can have a value that is (five percent of the value written

bench.

I know some people who design avionics equipment. Do you have any idea how much the temperature changes from ground level to cruising altitude? Sitting at the Tucson International Airport, on a hot July day, the ambient temperature above the runway might be 130 degrees as the airplane lifts off. When it hits "altitude," the temperature might be -40 degrees.

In World War II, B-17 bomber waist gun crews knew not to touch the walls of their planes ungloved because their fingers would freeze in place (great place to have your trigger finger when a Luftwaffe Messerschmidt 109 was stitching a line of bullet holes in you).

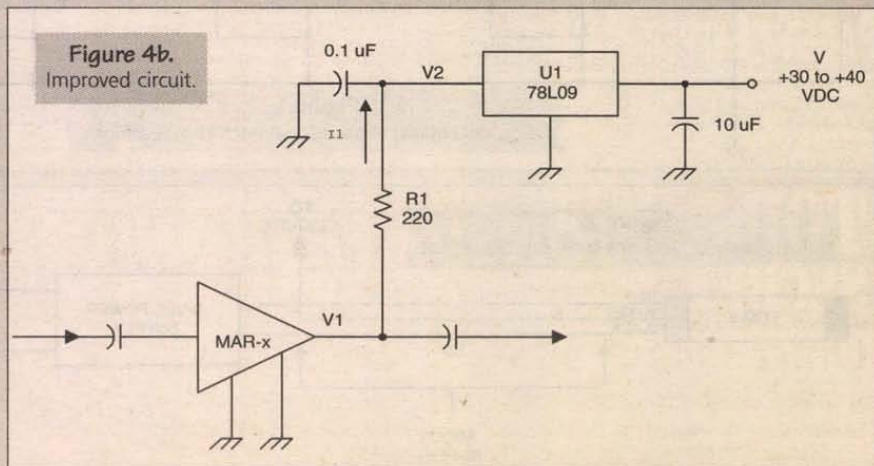
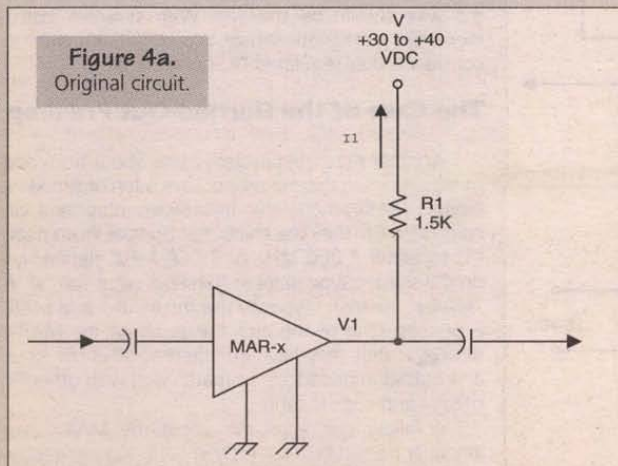
When you design circuits for them, you have to account for such variation. How do you handle such problems? One method is to create a closed environment that can be either heated or cooled as needed. That's probably the best solution.

One of the first times I ran into thermal problems in a big way was when car radios first became all-transistor (early 1960s). I was servicing car radios in those days (indeed, I feel positively old when I see models I worked on under warranty being listed as "classic cars!").

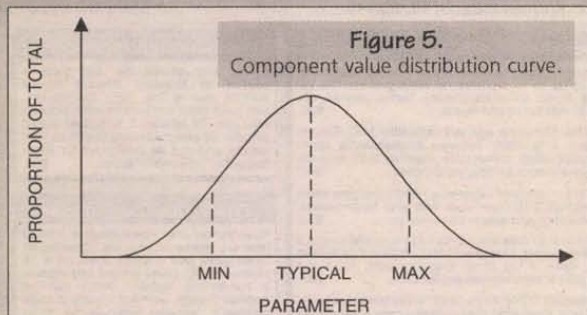
One major car radio maker had a real problem. Radios by the thousands were failing in an odd way. During the summer they would fail to work when the car first started, but would then pop on after a few miles. During the winter, however, they would also fail to work when the radio was first turned on. In other words, the radio failed when it was both hot and cold, so the engineers didn't initially think of a thermal problem. It turned out that they had a thermal problem on both ends of the temperature range. On hot days, either the vent or the air conditioner would cool the overheated radio off enough to make it work properly. On cold days, the heater would warm the radio up into the acceptable range. Changing the transistors from germanium to silicon units solved the problem.

Another odd problem popped up when a friend was servicing ancient scientific and medical instruments. One item had germanium transistors made in the early 1960s. When exactly the same part number was bought in the early 1990s, the circuit would either fail to bias correctly or would oscillate at a VHF frequency. Huh!?! It turned out that the original version of the transistors had a low-gain bandwidth product and a high-leakage current. The biasing resistors were set to accommodate the high-leakage current. When a modern unit was installed, with very low-leakage currents because of better metallurgy and fabrication, the values were all wrong.

The oscillation problem occurred because the



Open Channel



new transistor had a much higher gain-bandwidth product than the original unit. Stray inductances and capacitances in the circuit that didn't have any effect originally now caused oscillation. Previously, the low gain at the resonant frequency of the "strays" prevented oscillation. Sighhhh.

Some Ham Radio Examples

I once had a kit-built HF SSB transceiver (not a Heathkit) that had a terrible heat drift problem. A couple buddies had solved the problem on their units. It seems that the shielded box holding the variable frequency oscillator (VFO) was right next to a series of three vacuum tubes of the IF amplifier and detector. As those tubes threw off heat, it changed the thermal environment of the poorly designed VFO. One of the more popular solutions was to put a heat shield of insulating material between the VFO and IF strip. It sorta worked ... in fact, it worked quite well compared to the previous performance.

Another problem surfaced when a fellow from Central America contacted me through one of my ham radio columns. He was an American who worked in the jungle as a missionary or something. He had a certain factory-built HF SSB transceiver that had a terrible frequency drift as the rig heated up. On SSB rigs, that drift is particularly problematic. He was looking for a new VFO, thinking the old one was defective. I had heard of this problem before, and quickly found out that it was generic to the particular product. Another technical writer told me that the rig had been designed by a very famous HF designer, and was therefore very surprised at the problem.

When I contacted the fellow, he was really ticked! That rig had a drift of less than 50 ppm/hour when it left his lab, but cost cutting production people had made some — err — improvements. They changed the inductor's coil form from a costly synthetic material to ceramic, increasing its thermal coefficient of expansion. They also couldn't see why the designer specified Litz wire (which is hard to work) for the coil ... and replaced it with ordinary enameled wire. That also increased the thermal coefficient. They then took out the silvered mica DM-25 capacitors, polyethylene dielectric capacitors, and the disk ceramics with specified temperature coefficients, and replaced them with cheapo disk ceramics of uncertain parentage. The result: DRIFT! Fortunately, he still had one of the lab models in his possession, and graciously shipped it to the ham in Central America free of charge. Good work gone bad.

New Book

The most popular subjects I've written on in this and other magazines are radio astronomy, propagation studies, whistler and spheric hunting, VLF sudden ionospheric disturbance (SID) hunting, reception of Jupiter's natural radio signals, and so forth. I coined the term "radioscience observing" to cover all such activities. My new book of this title is now out. Howard W. Sams/PROMT Publishing has released *RadioScience Observing Volume 1* (ISBN 0-7906-1127-9, \$29.95). The book includes a CD-ROM software program that performs antenna dimension calculations, plus gives examples of natural radio sounds (not to mention some original music composed by my wife, Bonnie, that incorporates whistler and pulsar sounds). Call 1-800-428-7267, or order via Amazon Books on the Internet (<http://www.amazon.com>).

The environment imposes terrible burdens on the circuit designer. The temperatures can go up and down, vibration occurs (anyone remember the Heathkit VF-1 VFO ... it was vibration frequency modulated every time someone walked across the floor!), lumps, bumps, and bangs occur. And that's before we factor in component tolerances, stray inductances and capacitances, resistances in the connections, electrical noise, and a host of other problems. Yet they all have to be accounted for in the design ... and that's why the circuit doesn't always work on the bench like it works on the blackboard, professor. **NV**

Connections ...

I can be reached at P.O. Box 1099, Falls Church, VA 22041, or via E-Mail at carrij@aol.com

AUTOMATIC TELLER MACHINES

ATM crimes, abuses, vulnerabilities and defeats exposed! 100+ methods detailed, includes: Physical, Reg. E, cipher, PIN compromise, card counterfeiting, magnetic stripe, false front, TEMPEST, tapping, spoofing, inside job, vibration, pulse, high voltage - others, con jobs. Histories, law, security checklist, internal photos, figures. Much more! \$39.

CELLPHONE PHREAKING GUIDE

How cellphones operate and are modified. Vulnerabilities to hack attack and countermeasures. Details on programming NAMs, ESNs, etc (cloning), control data formats, computing encoded MINs, ESNs, SIDFs, operating systems, PROM programming, forcing ACK, test mode and resets, cable diagrams, scanning, tracking, scanner restorations, freq allocations, roaming. Step-by-steps to keypad-reprogram 100+ popular cellphones. 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.

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, CN/A, CAMA, DNR, Diverters, Centrex - more! \$19.

BEYOND VAN ECK PHREAKING

Eavesdropping on TV and computer video signals using an ordinary TV described in detail. Includes security industry reports. Range up to 1 KM. Plans include both the ours and the original Top Secret Van Eck designs! \$29.

HACKING THE INTERNET

The latest tricks and methods being used on the Net to pirate software (warez) and the newest hacking websites. Updated every two months. Includes examples, countermeasures, password defeats, UNIX, Sprintnet, brute force methods, lots of tips, and more! \$25.

COMPUTER PHREAKING

Describes in detail how computers penetrate each other, and how VIRUSES, TROJAN HORSES, WORMS, etc 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.

MANY MORE TITLES!

Hacking Fax Machines - \$29
PBX Hacking - \$19
Voice Mail Hacking - \$29
Beyond Phone Color Boxes - \$29
Hacking Answer. Machines - \$19
The Hacker Files - \$39
Internet Cons & Scams - \$19
Internet Tracking & Tracing - \$29
Hacking the Internet - \$25
Cookie Terminator - \$19
Beyond Van Eck Phreaking - \$29
Casino Hacking - \$25
Credit Card Scams - \$29
Cons & Scams - \$29
Polygraph Defeats - \$25
By an Order of the Magnitude - \$49
Ultimate Success Manual - \$19
Stealth Technology - \$19
Secret & Survival Radio - \$19
Secret & Alternate IDs - \$15
Rocket's Red Glare - \$29
High Voltage Devices - \$29
Mind Control - \$29
Under Attack! - \$29
Radionics Manual - \$29
Heal Thyself - \$19



SPECIAL PROJECTS

We will design & build just about anything! Ask for our free SP Application Form! Hardware now done as SPECIAL PROJECTS only

THE DIRTY-2 DOZEN!

24+ Disks. See CATALOG!
STOPPING POWER METERS
6TH EDITION
BY JOHN WILLIAMS AND BILLY GARD

As reported on "60 MINUTES"! All-new 6th Edition! Over 45 pages jam-packed with how devices can slow down (even stop) watt-hour meters - while loads draw full power! Device plugs into one outlet and normal loads into other outlets. Describes meter creep, overload droop, etc. Plans only! \$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.

All 3 (above), Only \$59! (Add \$20 for SPM Video)



MAIL \$3 FOR OUR LATEST CATALOG TO: (\$1 w/ Order)

CONSUMERTRONICS

2430 Juan Tabo, NE, #259, ABQ, NM 87112
P.O. Box 23097 ABQ, NM 87192

Order Today! 505-237-2073 (9-6, M-F)

Fax: 505-292-4078 (all hours, orders only) Web Adventure: www.tsc-global.com

Established in 1971. Featured on CBS "60 Minutes," Forbes, New York Times. Add \$5 total S/H (US, Canada). Sold for educational purposes only. Postal M.O. is fastest. VISA, MC OK. COD add \$7. See Catalog for LIMITED WARRANTY, SPECIAL PROJECTS and all other Policies

10% Off
Orders Over
\$100!!



\$29 SPM THE VIDEO!

Now its 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!

Only \$49 for SPM video + SPM manual!

AST GLOBAL ELECTRONICS

24529 STATE HWY. 408, CAMBRIDGE SPRINGS, PA 16403
VOICE 814-398-8080 • 1-888-216-7169 • 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.

Amber 3501A, Distortion & Noise Measuring System	\$275	HP 6253A, Power Supply (dual), 0-25V @ 3A (metered)	\$225
Associated Research 4045A, Hipot/Megometer, 0-5KV @ 3mA	\$250	HP 6260B, Power Supply, 10V @ 100A (metered)	\$400
Associated Research 5014A, DC Hipot, 0-3KVDC @ 2mA	\$250	HP 6265B, Power Supply, 40V @ 3A (metered)	\$250
Boston 4280, Microwave Meter w/ Cable/Sensor	\$150	HP 6266A, Power Supply, 40V @ 1A (metered)	\$250
Dranetz PA6001, Plug-in Line Analyzer	\$175	HP 6289A, Power Supply, 0-40 @ 6.5A (metered)	\$225
Dranetz PA6011, Plug-in Time Monitor	\$175	HP 8011A, Pulse Generator, 1Hz-20MHz	\$175
Dranetz PA6024A, Plug-in Harmonic Analyzer	\$275	HP 8013B, Pulse Generator, 1Hz-50MHz	\$275
Dranetz PA6024B, Plug-in Harmonic Analyzer	\$300	HP 8081A, Rate Generator (300MHz) w/8084A Word Generator (300MHz) w/8083A Output Amp (300MHz)	\$950
Dranetz 626, Universal Disturbance Analyzer, Frame only		HP 8091A, Rate Generator (1GHz) w/8092A Delay Generator (1GHz) w/8093A Output Amp w/15401A & 15400A	\$3,000
w/Power Supply & Communication Plug-in	\$375	HP 8157A, Optical Analyzer	\$375
ESI DP1311, Variable Resistor, 100K max 1K/Step	\$100	HP 8180A, Data Generator	\$425
ESI 2500E, RLC Bridge (nic)	\$150	HP 8182A, Data Analyzer	\$650
Fuke 332B, DC Voltage Standard	\$475	HP 8410B, Network Analyzer Mainframe	\$275
Fuke 335A, DC Voltage Standard	\$475	HP 8414A, Polar Display	\$225
Fuke 362A, Voltage/Current Calibrator	\$225	HP 8443A, Tracking Generator w/Cables, 1KHz-110MHz	\$475
Fuke 515A, Portable Calibrator	\$675	HP 8444A, Tracking Generator for 1411 System, 5-1300MHz	\$750
Fuke 540B, Transfer Standard w/AS-2 Voltage Plug-in	\$625	HP 8552A, IF Plug-in (for 140 Series Mainframes)	\$125
Fuke 720A, Kelvin Varley Voltage Divider	\$750	HP 8553B, RF Plug-in (for 140 Series Mainframes), 1KHz-110MHz	\$425
Fuke 721A, Load Compensator	\$275	HP 8553L, RF Plug-in (for 140 Mainframes), use with 8552A, 1KHz-110MHz	\$125
Fuke 750A, Reference Divider	\$475	HP 8601A, Sweeper Generator, 1-110MHz	\$425
Fuke 760A, Meter Calibrator	\$450	HP 8614A, Signal Generator, 800-2400MHz, AM/FM Levited	\$475
Fuke 845AB, Null Detector/Micro Voltmeter 1uV-1000VDC	\$375	HP 8616A, Signal Generator UHF, 1.8-4.5GHz, +10-12dB, AM/FM	\$475
Fuke 845AR, Null Differential Micro Voltmeter 1uV-1000VDC	\$375	HP 8640B, Signal Generator, 5-105MHz, Opt. 022001 or 003, \$1,800	
Fuke 860A, AC/DC Differential Voltmeter 0 to 1100 Volts, AC/DC, 0.1%DC, 0.5%AC, 1uV Resolution	\$100	HP 8656A, Synthesized Signal Generator, 100KHz-900MHz	\$1,650
Fuke 3308B, Constant Current/Voltage Calibrator	\$675	HP 8743A, Reflection Test Set, 2-12GHz	\$475
Fuke 5100B, Multifunction Calibrator, Opt. 03/05	\$3,250	HP 8901A, Modulation Analyzer	\$2,400
Fuke 5100B, Multifunction Calibrator	\$2,700	HP 59030A, D/A Converter	\$175
Fuke 5101B, Calibrator	\$3,450	HP 59501A, HP-IB Isolated D/A Converter	\$125
Fuke 5200A, Programmable AC Calibrator	\$1,250	Huntville 80-D, Micro Systems Troubleshooter	\$225
		Huntville 180P, Micro Systems Troubleshooter	\$350

TURN IDLE TEST EQUIPMENT INTO CASH - CALL OR FAX FOR QUOTATION

Fuke 5215A, Precision Power Amp	\$950	HP 8901A, Modulation Analyzer	\$2,400
Fuke 6011A, Synthesized Signal Generator, 10Hz-11MHz (7-digit)	\$875	HP 59030A, D/A Converter	\$175
Fuke 8000A, DMM 3-1/2 Digit	\$275	HP 59501A, HP-IB Isolated D/A Converter	\$125
Fuke 8050A, DMM 4-1/2 Digit w/Battery Pack	\$145	Huntville 80-D, Micro Systems Troubleshooter	\$225
Fuke 8050A, DMM 4-1/2 Digit w/Battery Pack	\$145	Huntville 180P, Micro Systems Troubleshooter	\$350
Fuke 8050A, DMM 4-1/2 Digit Opt. 02/05/07/08 (Chms Conv., Cur. Shunts, IEEE-488, Interface Iso. Ext. Trig.)	\$425	Kepec JOE 36-15MVP, Power Supply, 0-36 @ 15A (metered)	\$275
Fuke 8520A, DMM 4-1/2 Digit	\$125	Kepec JOE 36-3MVP, Power Supply, 0-36 @ 3A (metered)	\$175
Fuke 8600A, DMM 4-1/2 Digit w/Battery Pack	\$125	Kroh-Hite 3103R, Variable Bandpass Filter, 10Hz-1MHz	\$150
Fuke 8600A, DMM 4-1/2 Digit	\$175	Kroh-Hite 3202R, Dual Channel Tunable Filter, 20Hz-2MHz	\$275
Fuke 9005A, Logic Analyzer	\$275	High Pass, Low Pass Band Reject	\$275
Fuke 9010A, Logic Analyzer w/2-80 Pds	\$350	Kroh-Hite 3750, Filter	\$275
General Radio 1390-B, Random Noise Generator	\$150	Rockland 9303, True RMS RF Level Meter	\$550
General Radio 1346, Audio Frequency Micro Voltmeter	\$125	Rockland 1022F, Dual HiLo Filter	\$150
Guidline 9770B, Constant Current Source	\$125	Rockland 5100, Synthesizer, DC-2MHz, .001Hz Resolution	\$325
HP 1411T, Spectrum Analyzer Mainframe	\$475	Sencore SC61, Scope (100MHz) w/New Probes, Dual Trace	\$750
HP 1411T, Spectrum Analyzer w/8552B/8553B, 1KHz-110MHz	\$1,000	Sencore SC61, Scope (100MHz) w/Probes, Dual Trace	\$500
HP 1411T, Spectrum Analyzer w/8552B/8553B, 1KHz-110MHz	\$1,200	Sencore TVAS2, TV Video Analyzer	\$1,100
HP 1411T, Spectrum Analyzer w/8552B/8554B, 20Hz-300KHz	\$1,100	Sencore VC63, VCR Test Accessory	\$100
HP 1411T, Spectrum Analyzer w/8552B/8554B, 1KHz-12GHz	\$1,900	Sencore VG91, Universal Video Generator	\$1,200
HP 1807R, Scope Mainframe	\$250	Sorenson DCS-300-3.5, Power Supply, 0-300V @ 3.5A (non-metered)	\$375
HP 1821, Spectrum Analyzer Mainframe	\$550	SRL 112B, PLOPF Synthesizer	\$125
HP 214A, Pulse Generator, 0.0V-100V	\$250	SRL 262, Y Band Filter	\$100
HP 334A, Distortion Analyzer	\$275	Tek 4750DMM4, Scope (200MHz), Dual Trace w/DMM	\$375
HP 350D, Attenuator	\$75	Tek DC503, Plug-in Counter Universal, 100MHz	\$150
HP 400EL, AC Voltmeter, 10Hz-10MHz	\$150	Tek DM502A, Plug-in DMM, 4-1/2 Digit	\$150
HP 400FL, RMS Voltmeter, 20Hz-4MHz, 100uV-300V	\$175	Tek DM502, Plug-in Function Generator, .001Hz-1MHz	\$175
HP 403B, AC Voltmeter Battery Operated, 5Hz-2MHz, 1mV-300V	\$175	Tek FG504, Plug-in Function Generator, .001Hz-40MHz	\$450
HP 415E, SWR Meter	\$100	Tek FG501, Plug-in Pulse Generator, 5Hz-50MHz	\$175
HP 427A, Multi-function Meter (AC, DC & Resistance 10Hz-1MHz)	\$100	Tek PSS03A, Plug-in Power Supply Triple	\$125
HP 432A, Power Meter w/Cable/947B, 0.1-10GHz Sensor	\$250	Tek TMS03, Power Module, 3 Slot	\$175
HP 432A, Power Meter w/Cable/Sensor	\$250	Tek TMS04, Power Module, 4 Slot	\$150
HP 435A, Power Meter w/Sensor/Cable	\$175	Tek TMS06, Power Module, 6 Slot	\$200
HP 651B, Test Oscillator, 10Hz-10MHz	\$150	Tek OIG-502, Plug-in Optical Impulse Generator (unused)	\$1,500
HP 652B, Test Oscillator, 10Hz-10MHz	\$150	Tek PSS01-1, Plug-in Power Supply	\$150
HP 654A, Oscillator, 10Hz-10MHz, 90dB Attenuator	\$225	Tek 7A16A, Plug-in (225MHz), Single Trace Amp	\$100
HP 1808B, Scope Measurement System w/1965A		Tek 7A18, Plug-in (75MHz), Dual Trace Amp	\$75
Gated Universal Timer (like new)	\$550	Tek 7A19, Plug-in (600MHz), Single Trace Amp	\$150
HP 3312A, Function Generator, 1Hz-13MHz	\$490	Tek 7A26, Plug-in (200MHz), Dual Trace Amp	\$150
HP 3325A, Programmable Frequency Synthesizer 1Hz-32MHz	\$1,650	Tek 7850A, Plug-in (150MHz), Time Base	\$100
HP 3330B, Automatic Synthesizer, 20Hz-13MHz	\$325	Tek 7853A, Plug-in (100MHz), Dual Time Base	\$125
HP 3400A, True RMS Voltmeter, 10Hz-10MHz, 1mV-300V	\$200	Tek 7880, Plug-in (400MHz), Delayed Time Base	\$150
HP 3403C, True RMS Meter, AC/DC/0dB 100MHz	\$325	Tek 7892A, Plug-in (500MHz), Dual Time Base	\$200
HP 3406A, RF Voltmeter, 50V-3V, 1.2GHz	\$350	Tek 7D11, Plug-in Digital Delay	\$125
HP 3455A, DMM 5-1/2 Digit	\$250	Tek 7D13, Plug-in DMM 3-1/2 Digit	\$125
HP 3456A, DMM 6-1/2 Digit	\$325	Tek 7D15, Plug-in Counter/Timer, DC-225MHz	\$225
HP 3466A, DMM 4-1/2 Digit, AC/Battery, 5 Function	\$225	Tek 7G11, Plug-in Sampling Unit	\$175
HP 3551A, Transmission Test Set (Portable) Unused	\$750	Tek 134, Current Probe Amp	\$100
HP 3580A, Spectrum Analyzer, 5Hz-50KHz, LED Readout	\$850	Tek 465, Scope (100MHz), Dual Trace	\$425
HP 3581A, Wave Analyzer, 15Hz-50KHz	\$475	Tek 466, Scope (100MHz storage), Dual Trace	\$475
HP 3586C, Selective Voltmeter	\$450	Tek 475, Scope (200MHz), Dual Trace	\$425
HP 3762A, Data Generator, 30-150MHz	\$425	Tek 475A, Scope (250MHz), Dual Trace	\$625
HP 3770A, Amplitude/Delay Distribution Analyzer	\$425	Tek 485, Scope (300MHz), Dual Trace	\$850
HP 3779B, Primary MPX Analyzer	\$625	Tek 520A, NTSC Vectorscope	\$375
HP 3781B, Pattern Generator	\$300	Tek 2213, Scope (60MHz), Dual Trace	\$375
HP 4277A, LCZ Meter	\$2,400	Tek 2236, Scope (100MHz) w/Counter/Timer/DMM	\$800
HP 5314A, Counter/Timer, 100MHz (unused)	\$175	Tek 2445, Scope (150MHz), 4-Channel Cursor Readout	\$1,700
HP 5328A, Counter, 100MHz w/DMM/Opt 021	\$250	Tek 2465, Scope (300MHz), 4-Channel Cursor Readout	\$2,400
HP 5328A, Counter, 500MHz	\$350	Tek 7803, Scope Mainframe (100MHz)	\$300
HP 5345A, Counter, 500MHz, HP-IB	\$450	Tek 7704A, Scope Mainframe (250MHz)	\$325
HP 6104A, Precision Power Supply, 20V @ 3A, 20-40V @ 1A (metered)	\$175	Tek 7854, Scope (400MHz), Dual Beam w/Waveform Calculator	\$625
HP 6112A, Power Supply, 40V @ 5A (metered)	\$175	Tek 7904, Scope Mainframe (500MHz)	\$350
HP 6116A, Power Supply, 0-100V @ 200mA (metered)	\$125	Wavelet 145, Pulse/Function Generator, .0001-20MHz	\$350
HP 6202B, Power Supply, 40V @ 7.5A (metered)	\$175	Wavelet 185, Lin Log Sweep Generator, .0001Hz-5MHz	\$425
HP 6203B, Power Supply, 7.5V @ 3A (metered)	\$175	Wavelet 288, Synthesized Function Generator, 20Hz-20MHz (unused)	\$950
HP 6205B, Power Supply (dual), 0-40V @ 3A, 0-20V @ 8A (metered)	\$225	Wavelet 3000, Signal Generator, 1-520MHz	\$525
HP 6206B, Power Supply, 0-60V @ 1A (metered)	\$250	Wilcom T222C, Signaling Test Set (unused)	\$825
		Wilcom T105B, Rev. Level Test Set	\$600
		Wilcom 150A, Artificial Line T240	\$700

- 60-DAY WARRANTY
- 10-DAY RIGHT OF RETURN
- SATISFACTION GUARANTEED

Weeder Technologies 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 points. Turn on/off relays. Sense switch transitions, button presses, 4x4 matrix decoding using auto-debounce and repeat. \$32

Analog 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. \$49

Home Automation (X-10) - Connects between a TW523 and your serial port. Receive and transmit all X-10 commands with your home-brewed programs. Full collision detection and auto re-transmission. \$39

Caller ID - Decodes the caller ID data and sends it to your serial port in a pre-formatted ASCII character string. Example: *12/31 08:45 850-863-5723 Weeder, Terry <CR>. Keep a log of all incoming calls. Block out unwanted callers to your BBS or other modem applications. \$35

Touch-Tone Input - Decodes DTMF tones used to dial telephones 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 or Digital I/O kits using a remote telephone. \$34

50 MHz Frequency 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, only 2" x 3" big. \$46

IR Remote Control Receiver

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

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

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. 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

TEST EQUIPMENT cont.

WAVETEK 23 12MHz synthesizer/function generator w/option 001 GPIB \$750. Wavetek 275 12MHz arbitrary/function generator GPIB. Photos and more at www.test-equipment.net or call 732-445-4915.

TEKTRONIX TM500/TM5000: FG504 \$300. AM503 \$225. SC504 \$410. DM5010 \$410. Call 732-445-4915. Photos and more TM500 at www.test-equipment.net

WE BUY and sell test equipment. A-COMM ELECTRONICS 303-290-8012, 303-290-8133 FAX, CHECK OUR WEB SITE FOR LISTINGS OF TEST EQUIPMENT AND MICROWAVE COMPONENTS. <http://www.A-COMM.COM>

HP 7035B X-Y recorder \$50; HP 180A o'scope, \$100; HP 400D voltmeter, \$50; GR 1409Y standard cap 1.0uF ± .05%, \$50; 50 amp staco automatic voltage regulator .25% accuracy on output, new in box, \$200. All plus shipping. Phone John @ 304-525-8793.

WANTED: TEST equipment, TDR, HP 1815 with 1817, complete. Phone: John 705-324-3709. Fax: 705-324-5474.

SECURITY

MILITARY COMPONENTS wanted. Capacitors, resistors, diodes, transistors, semiconductors, ICs. Electronic Material Industries, 818-769-1002, FAX: 818-769-1084.

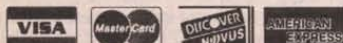
IS YOUR TELEPHONE BUGGED? Is your home bugged? Do you wonder why someone knows your every move? Free catalog. Security Counter Surveillance, 76 Boulevard, Hudson Falls, NY 12839.

ALARM CATALOG of Ademco, Moose, Napco, CCTV & more free. Voice or fax: 732-840-1390 or www.heselectronics.com Get the full 44 page version by sending \$2 to HES Electronics, POB 183, Brick, NJ 08723. Mention this ad and get a \$10 off certificate!

DUAL-PAGE quad switchers 8 camera inputs w/loop-out .3outputs. Allows you to view 4-cameras on a monitor simultaneously. Built-in video sequencer, plays back quad or full screen images, time & date stamp. Hi-res. Sold for \$700. Dir. now \$350 ea. color quads too. 781-933-0827. E-Mail: rickvids@msn.com

ABC ELECTRONICS 315 7TH AVE N. MPLS. MN. 55401 (612)332-2378 FAX (612)332-8481 E-MAILS: SRP1@VISI.COM WE BUY TEST EQUIPMENT AND COMPONENTS. VISIT US ON THE WEB AT WWW.ABCTEST.COM

TEK 7815 1 GHz DELAYING TIME BASE	\$250.00	TEK 2245 100 MHz 4 CHANNEL O-SCOPE	\$800.00
TEK 1470 NTSC GENERATOR	\$500.00	TEK 7A19 600 MHz SINGLE TRACE AMPLIFIER	\$150.00
TEK 7A26 200 MHz DUAL TRACE AMPLIFIER	\$75.00	TEK 7885 400 MHz DELAYING TIME BASE	\$125.00
TEK 7704 500 MHz MAIN FRAME	\$250.00	TEK 7811 SAMPLING PLUG IN	\$200.00
TEK 7812 GENERAL PURPOSE SAMPLER	\$350.00	FLUKE 95 SCOPE METER NO PROBES	\$600.00
TEK 453 50MHz OSCILLOSCOPE	\$200.00	TEK 146 NTSC GENERATOR	\$500.00
DRANETZ 626 DISTURBANCE ANALYZER	\$1500.00	HP 8182A 50 MHz PATTERN GENERATOR	\$800.00
GENRAD 1657 RLC BRIDGE	\$750.00	PHILLIPS PM3296 400 MHz OSCILLOSCOPE	\$1000.00
TEK 7200 PROGRAMMABLE DIGITIZER	\$500.00	EMI SCR 7.5-300 7.5V 300A POWER SUPPLY	\$500.00
TEK 465 100 MHz OSCILLOSCOPE	\$400.00	HP 8588B SPECTRUM ANALYZER	\$1500.00
TEK 465B 100 MHz OSCILLOSCOPE	\$450.00	WAVETEK 175 WAVE FORM GENERATOR	\$500.00
TEK 2335 100 MHz OSCILLOSCOPE	\$800.00	WAVETEK 157 PROG. WAVE FORM SYNTH.	\$250.00
TEK 2315 60 MHz OSCILLOSCOPE	\$350.00	RACAL DANA 1901 100 MHz COUNTER	\$200.00
TEK 496P 1KHz-1.8GHz SPECTRUM ANALYZER	\$5000.00	VALHALLA 27908 SIGNAL INTERFACE	\$150.00
BADLEY 132 SCOPE CALIBRATOR	\$700.00	GENRAD 1683 RLC BRIDGE	\$300.00
PHILLIPS PM3350A 60 MHz DIG STORAGE SCOPE	\$1000.00	HP 3455A MULTIMETER	\$300.00
HP 8601A 110 MHz SWEEP/SIGNAL GENERATOR	\$400.00	HQ 3456A MULTIMETER	\$450.00
FLUKE 3200A AC CALIBRATOR	\$1500.00	FLUKE 77 DMM "NEW"	\$120.00
HP 84100A 1GHz DIGITIZING OSCILLOSCOPE	\$3000.00	TEK TM504 4 SLOT POWER FRAME	\$125.00
HP 8170A LOGIC PATTERN GENERATOR	\$150.00	HP 4955A PROTOCOL ANALYZER	\$500.00
SYSTRON DONNER DSP 50	\$500.00	MAGTROL 4614 POLYPHASE POWER ANLZR	\$300.00
LEADER LSG21A 125 MHz SIGNAL GENERATOR	\$700.00	TEK CT-5 HIGH CURRENT TRANSFORMER	\$500.00
TEK TMS06 POWER MODULE	\$150.00	FLUKE 8502A 6.5 DIGIT DMM TRUE RMS	\$350.00
PHILLIPS PM5785 PULSE GENERATOR	\$750.00	FLUKE 1952 80 MHz COUNTER	\$200.00
WAVETEK CT235 AC/DC CURRENT PROBE	\$120.00	TEK 475 200MHz SCOPE	\$500.00



SATELLITE EQUIPMENT

DSS SURPLUS WANTED. Receivers, remotes, old & new access cards, antennas, feeds. Message/fax 561-483-8516. E-Mail: cable@flinet.com

SATELLITE EQUIPMENT available: Receivers \$25 and up; 20-25 LNB \$30; C-KU feed horns \$65. Call 757-599-4408.

GET SOUND for VCI and VCI Plus without codes. Free detail. Send SASE to: Nassirian, Box 382-V, Rio Linda, CA 95673.

DSS TEST CARD information. Call toll free, 1-888-416-7296.



FREE BIG dish catalog. Low prices! Systems, upgrades, parts, and "4DTV." Skyvision, 1010 Frontier Dr., Fergus Falls, MN 56537. www.skyvision.com Call 1-800-543-3025.

MILITARY TRANSISTORS & DIODES & INTEGRATED CIRCUITS WANTED. ELECTRONIC MATERIAL INDUSTRIES 818-769-1002, FAX 818-769-1084.

FREE SATELLITE TV CATALOG. Tech books, installation videos, analysis software 1-800-843-2425 or www.baylin.com

WHAT!!! YOU don't have TELECODE's NEW 1998 "HACKER CATALOG," yet! 125+ items. Call 520-726-2833. Surf online at: <http://www.hackerscatalog.com>



BEST PRICING on 18" satellite TV systems for home and RV. DSS, DISH Network programming, multi-room viewing options, accessories. www.skyvision.com Call 1-800-543-3025.

USED SATELLITE EQUIPMENT. You name it, we have it. LNAs, downconverters, drives, receivers. Working condition guaranteed. Call 765-385-2305.

TELECODE™

DSS BIBLE III emulator source code & plans, ASIC hacking, ECM theory & examples, updated history, dictionary of terms, FAQs, description and feature of all NEW cards, UN99 fixes, smartcard reader/writer schematics and lots more. 10 diskettes of software! No duplication from volume one to two. \$69.95 + \$5.50 P&H. **DSS BIBLES** Volume 2 on sale at \$59.95 + \$5.50 P&H, Volume 1 now \$39.95 + \$5.50 P&H 24 hour orderline: 520-726-2833 TELECODE, PO Box 6426-NV, Yuma, AZ 85366-6426. <http://www.hackerscatalog.com/dss3flyr.htm>

SEE WORLD SATELLITE, 1-800-435-2808. DISH NETWORK complete system ONLY \$189. FREE INSTALL KIT, FREE SHIPPING, 30 DAY MONEY BACK GUARANTEE.

Expedite Your Project Design and Testing.

Call for quick response and personal attention to your needs for:

Prototyping and Precision Crystal Production — special application frequency control crystals, to your specs, quickly.

Hybrid Clock and VCXO Oscillators made to your specs

— Clocks: 1-80 MHz, with high stability
— VCXOs: 1-40 MHz, with wide pullability

FOR AMATEUR BANDS • CB
MARINE VHF • SCANNERS
MICROPROCESSORS • PAGERS

Call Toll Free
1-800-JAN-XTAL
(526-9825)

FAX (941) 936-3750



Your reliable source
for frequency stability

JAN Crystals

Tiny FBasic Computer



(Shown 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
Web: <http://www.csn.net/versatech>
11170 Flatiron Drive, Lafayette, CO 80026

CAPITAL

ELECTRONICS INC.

- PRODUCT ENGINEERING
- FIRMWARE DEVELOPMENT

"QUALITY IS OUR CAPITAL CONCERN."

- MICRO CONTROLLER & EPROM HARDWARE & SOFTWARE DEVELOPMENT

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 PROTOYPES TO SCHEDULED PRODUCTION RUNS
- FINE LINES, SMT
- ELECTRICAL TESTING
- PRECIOUS METAL PLATING

ASSEMBLY SERVICES

- FAST TURN BOARD STUFFING
- WIRE HARNESES
- 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>

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.)

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

Web: www.brickwall.com

Visa - MC - AMEX

ASK ABOUT OUR NEW IN-LINE UPS/SERVER PROTECTOR



Available in Modular Form

Metric
Equipment Sales, Inc.

800-432-3424

Fax: 510-264-0886

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**

Write In 59 on Reader Service Card.

AUDIO — VIDEO — LASERS

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.

BROADCAST VIDEO equipment wanted: all types, new or old. Please call, Jon with info. 1-800-539-2859.

WANTED: PRO video equipment, VTRs, switchers, cameras, etc. Advanced Media 1-800-722-7468 ext. 2575.

WANTED PIONEER 5XXX-6XXXX SERIES CONVERTERS, RAW, LOTS 5 OR MORE, TOP CASH PAID. 702-642-0325.

13" COLOR COMPOSITE MONITOR, \$50 EA. 10 FOR \$400. FRONT CONTROLS- HUE, SATURATION, CONTRAST & BRIGHTNESS, USED, IN GREAT SHAPE. SHIPPING & HANDLING \$12 EA. CALL ROGER @ GS&E, 716-338-7001. VISA & MC.

6.4", 5.6" TFT LCD Monitor

Wide viewing angle, color LCD 960x234, bright CCFT backlight, 12V DC power, composite video input (NTSC)

\$582/5.4", \$725/6.4"

TFT LCD PANEL

4", 89, 622 Dots only

\$199

5.6", 168, 480 Dots \$537

6.4", 224, 640 Dots \$670

ACTIVE MATRIX



External Active GPS Antenna 1.575GHz

1.575GHz, 27dB Amp gain, 3 or 5V DC, 25mA, 1 watt. Magnetic mount, low profile BNC connector, 5 meter cable. Enhance reception for various GPS receivers.

\$56/1", \$79/2"



Broadband Active Antenna GPS-C1MA

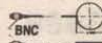
Designed to receive both USA and Russia satellite signal in one antenna 1.575 & 1.6 GHz **\$399**

VIDEO DISPLAY FOR CAR, BOAT, AIRPLANE, INSTRUMENT, NAVIGATION, SECURITY, TELEVISION, ETC., PLUG AND PLAY.

7"x5"x1" T.V. TUNER with remote control \$199

2.4GHz ANTENNAS for communication

Passive 1" and 2" models. Magnetic base, SMA connector, 80 cm, RG 174 cable **\$50**



N64 GAME RECORDER

Plug into N64 station, record 10 games into 1 100M ZIP media. No computer needed. Great for safe storage of your game and easy to carry while traveling. **\$375**

Model Z64 N64 is a trademark of Nintendo

12 Channel Antenna & GPS

Receiver Based on SIF chip set, 8 sec. hot start. Standard NMEA-0183 or SIF Binary, RS232 port interface, magnet base. Works with computer & mapping software. **\$276**

12 Channel SIF Module Low power, 0.1 sec re-acquisition. **GPS-910 \$240**



MAXTRON

SINCE 1975. MASTER, VISA ACCEPTED 626-350-5706/626-350-4965 FAX 11135 E. RUSH STREET, UNIT R, SOUTH EL MONTE, CA 91733

1-800-COOLSON (266-5706)

PACIFIC TIME DEALERS WELCOME

Write In 215 on Reader Service Card.

Fuzzy Logic

This article explains how fuzzy logic works and provides you with a simple program so you can experiment with fuzzy logic systems of your own.

The Beginnings

Western thought is fundamentally based on Aristotelian logic and the "Law of the Excluded Middle." Either something is true or false, on or off, while everything in the middle is ignored.

According to the classical Western view of the universe, things aren't partially on or off, or partially true or false. Formal logic is based on this outlook.

This same view worked its way into abstract mathematics, beginning with set theory as invented and explored in the late 1800s by the mathematician George Cantor.

Although there's no formal definition of a set, the concept of sets is familiar to most of us. A set is a collection of objects. The only required property of a set object is membership; either something's in the set or it's not. One set all by itself isn't worth much, so how do multiple sets interact?

They interact via three fundamental set operations: Union, Intersection, and Complementation. See Figure 1 for a listing of fundamental set operations.

The Aristotelian viewpoint has propagated like a virus from logic to set theory, and mutated with the evolution of Boolean algebra. The names for intersection, union, and complementation change from set theory, formal logic, and Boolean logic, but the meaning is the same.

See Figure 2 for a list illustrating the names for the same operations in each of the domains, including fuzzy sets (the Fuzzy Logic operations will be explained later).

Boolean logic turned out to be a nearly perfect tool to describe switching and logic circuits. The digital computer is basically an Aristotelian logic device, and inherently Western in concept.

All this translates to information loss when describing the real world to a computer. What about the truths that reside in the excluded middle? We know from our everyday experience that the universe does not present itself in clear-cut, black and white, yes or no configurations. Many things are somewhat true or somewhat false. The universe presents you with the option of choosing some degree of truth or falsehood. How do we reflect these choices within a computer program?

Another big problem is the subjective nature of words. How do you map words and phrases into numbers? Phrases like "a little" or "a lot" are hard to quantify. How do you represent the weight of words in a computer program?

The problem of quantifying middle truths did not escape the thoughts of some prominent logicians throughout recent history. The Polish philosopher and logician Jan Lukasiewicz described a logical system in 1920 that consisted of three values:

zero (false), one (true), and one-half (possible). Cornell professor Max Black described an early model of fuzzy sets in his 1937 paper entitled "Vagueness: An Exercise in Logical Analysis."

All of this work solidified in 1965 with the publication of Stanford Professor Lotfi Zadeh's paper entitled "Fuzzy Sets," in the June 1965 issue of the journal *Information and Control*. In an early pre-publication presentation of his paper, Zadeh was faced with severe criticism. This criticism dogged fuzzy logic for years, leading to a lack of research grants.

No one wanted to fund research for a risky, potential loser like fuzzy logic, and many claimed that fuzzy logic was just probability theory in disguise. If you can't get the money to study an emerging technology's properties and potential applications, then the new technology stalls and drifts to the unfunded, obscure backwaters of academia.

No one in the United States took fuzzy logic seriously, but things were different in Japan. Unburdened by the weight of Western Aristotelian Logic, the Japanese embraced fuzzy logic. Instead of arguing over the theoretical merits and faults of fuzzy logic, the Japanese produced fuzzy-based systems. Some of the Japanese fuzzy-based systems in production today are single button washing machines, subway and elevator controls, voice and handwriting recognition systems, and auto-focus cameras.

Basic Principles

There are three basic components to a fuzzy system: the fuzzifier, the rule base, and the de-fuzzifier, as shown in Figure 3.

Inputs enter the fuzzifier and are assigned a numerical value ranging from zero to one, depending on the input value's "degree of truth." Numbers themselves can be fuzzy. Say you're meeting someone for lunch at "around 12 o'clock." Fuzzy logic allows you to quantify vague situations like this.

We can assign truth values to "around 12 o'clock" as illustrated in Figure 4.

Truth values range from 0.0 to 1.0, with zero

indicating "completely false" and one indicating "completely true." This part corresponds exactly to Boolean logic.

The excluded middle area is assigned numerical values. As the time values on the X axis approach 12:00 p.m., the truth values on the Y axis approach one. After 12:00 p.m., the truth values on the Y axis decrease.

By assigning a degree of truth value to time, we know that 11:45 a.m. has a truth value of 0.5, which tells us that 11:45 a.m. is "somewhat true" in terms of being close to our lunch date. As a rough guide to the meaning associated with truth values, see Figure 5. Just remember that the meanings associ-

Fundamental Set Operations

- Union** - contains all of the objects in set A and set B
- Intersection** - contains only the objects that are in set A and set B
- Complement** - set of all objects not in a set

Fig. 1

Set Theory	Formal Logic	Boolean Logic	Fuzzy Logic
Intersection	Conjunction	AND	$\text{Min}(x,y)$
Union	Disjunction	OR	$\text{Max}(x,y)$
Complementation	Negation	NOT	$1.0 - x$

Fig. 2

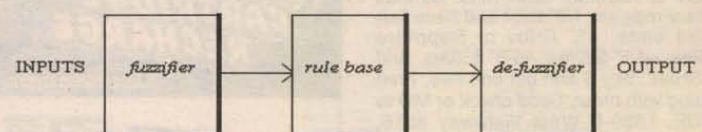


Fig. 3

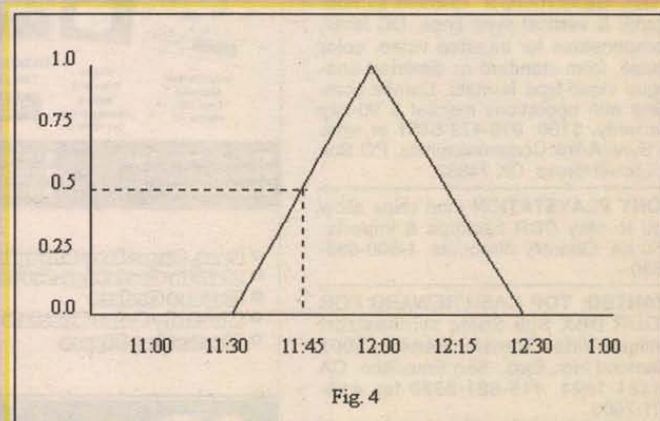


Fig. 4

ated to the truth values are arbitrary.

The linguistic meaning attached to the truth values are dependent on the system inputs you are

fuzzifying. If you're looking at temperature, and if you consider 90 degrees F to be hot, then you could assign a truth value of .83, which is close to "mostly true."

Lost in Space

Let's say we're controlling a spacecraft re-entry vehicle, and we need to monitor velocity and heat shield temperature. If the heat shield gets too hot, then we have to change our angle of attack or else burn up. If we go in at too steep an angle, then we'll miss our landing coordinates. If we go too in at too shallow an angle, we'll skip off the atmosphere like a flat stone on water and spin off into the black regions of space. We intend to build a fuzzy control module that will keep the spacecraft within nominal

limits.

The first thing we need to do is to assign degrees of truth values to the sensor input values, which are the temperature and re-entry angle of the spacecraft. These are called hedges. The graphs of these values are shown in Figure 6 and Figure 7. We have hedge values for both temperature and angle.

Once the input values are mapped to Y axis truth values, a rule base to manipulate the values must be established. We have eight rules in our system, which are listed in Figure 8.

These rules are of IF-THEN form, and are similar to rules found in expert systems, only they sound much more natural with the addition of the modifier "slightly." That's the beauty of Fuzzy Logic: we can use seemingly imprecise words like "slightly" or "somewhat," and assign them a precise numerical value.

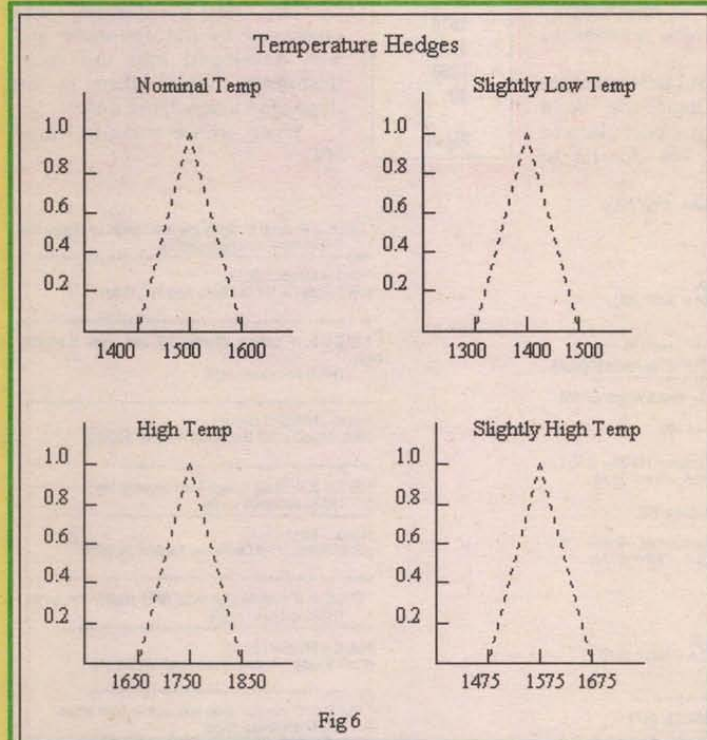


Fig 6

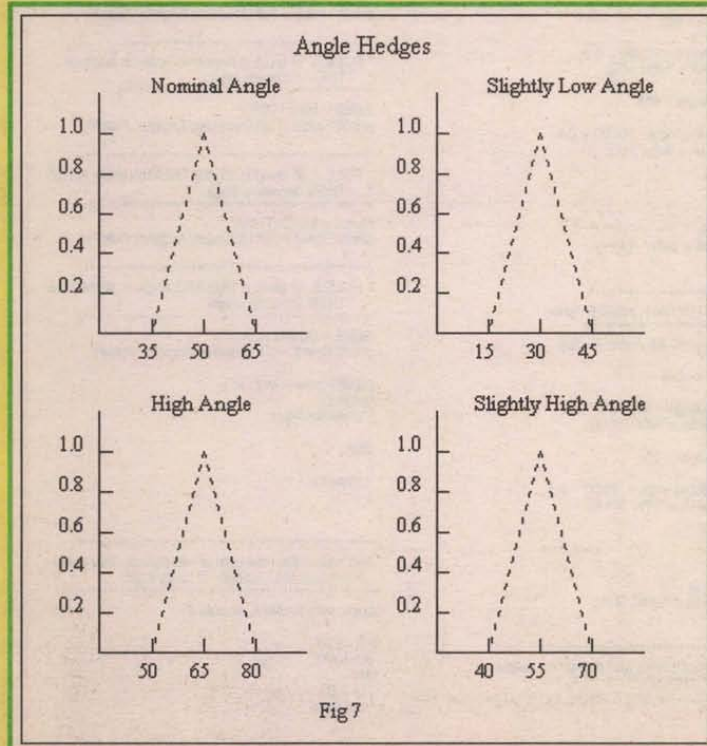


Fig 7

Determining a Range Function

We need two functions to fuzzify the incoming temperature and angle values. Here's one method: First, find the difference between the high and low value for the hedge. Looking at the Nominal Temp graph in Figure 6, the high value is 1600 and the low value is 1400. The difference is 200. We need a two-sided equation, since our hedge values rise on one side of the nominal value and fall on the other. The following is the pseudo-code instructions for the Nominal Temp graph:

Truth Value	Meaning
0.0	Completely false
0.2	Mostly false
0.4	Somewhat false
0.6	Somewhat true
0.8	Mostly true
1.0	Completely true

Fig. 5

```
IF Temp >= 1400 && Temp < 1600 THEN
  IF Temp <= 1500 THEN
    FuzzyTemp = (Temp - 1400)/200 + 0.5
  ELSE IF Temp > 1500 THEN
    FuzzyTemp = (Temp - 1600)/200 + 0.5
  ELSE
    FuzzyTemp = 0
```

If the temperature value is in the range we're looking for, and is less than or equal to the nominal temperature — 1500 — then subtract the lower limit from the temperature value and divide by the difference between the high and low values, which is 200. Add 0.5 to the result to scale it properly to the Y axis.

In order to get decreasing values for temperatures greater than the nominal value of 1500, subtract the temperature reading from the high value, and again divide by the range and add 0.5.

We need to take the absolute value of the result, since all we care about is the truth value and not its sign. This same method is used for all of the graphs for temperature and angle hedges. Again, this is just one of many ways to assign truth values. Assigning truth values is completely arbitrary, and the method used here makes sense for our system, but may not for another.

Coding the rule base is very easy. To AND two fuzzy numbers together, all we need to do is to find the smaller of the two numbers. Rule 1 is coded as:

```
Rule 1 = Min(SLT,SLA);
where SLT stands for Slightly Low Temp and SLA
stands for Slightly Low Angle. The Min function
itself is simple:
```

```
double Min(double A, double B)
{
  if (A <= B)
    return(A);
  else
    if (A > B)
      return(B);
}
```

We now have a rule base and our membership functions defined. What do we do with them? We read the inputs, run them through the fuzzification functions and the rules, then set an output to take some kind of action. In our case, we need to adjust the angle of the re-entry vehicle to avoid burning up. Here's where you, as the designer, must make some significant design choices.

You can de-fuzzify the outputs from the rule base and use the crisp value as a trigger for some control mechanism, or you can choose not to de-fuzzify the outputs.

In our example, the outputs from the rule base are printed and not de-fuzzified. In order to correct the angle of the re-entry vehicle in our system, take the highest numerical value produced by the rules and use that value as truth. A sample run for a temperature-angle pair is shown in Figure 9. The data

Rule Base

- RULE 1:** IF temp is slightly low AND angle is slightly low THEN increase angle.
- RULE 2:** IF temp is slightly high AND angle is slightly high THEN decrease angle
- RULE 3:** IF temp is high AND angle is high THEN decrease angle
- RULE 4:** IF temp is slightly high AND angle is slightly low THEN increase angle
- RULE 5:** IF temp is nominal AND angle is slightly high THEN decrease angle
- RULE 6:** IF temp is high AND angle is nominal THEN decrease angle
- RULE 7:** IF temp is slightly low AND angle is high THEN decrease angle
- RULE 8:** IF temp is high AND angle is slightly low THEN increase angle

Fig 8

file used with the program is called fval.dat and is listed in Figure 10.

Any data files you use for the program need to be in this format. The first value is the current temperature read from the sensors, and the second value is the re-entry angle. The program is named fuzz.exe, and the data file name in input from the command line. Just type: fuzz fval.dat to get the program to run.

In the trial run shown in Figure 9, the nominal angle (NA) value is 1.0, which is completely true. The temperature is high (HT) with a value of .95, so looking at the highest value in the rule base, it tells us via Rule 6 to decrease the re-entry

```

-----[READ INPUTS]-----
Temp = 1760.000000
Angle = 50.000000
-----[FUZZIFICATION]-----
NT = 0.000000
SLT = 0.000000
HT = 0.950000
SHT = 0.000000
NA = 1.000000
SLA = 0.000000
HA = 0.500000
SHA = 0.833333
-----[RULE BASE OUTPUT]-----
Rule1 = 0.000000 Increase Angle
Rule2 = 0.000000 Decrease Angle
Rule3 = 0.500000 Decrease Angle
Rule4 = 0.000000 Increase Angle
Rule5 = 0.000000 Decrease Angle
Rule6 = 0.950000 Decrease Angle
Rule7 = 0.000000 Decrease Angle
Rule8 = 0.000000 Increase Angle

```

Fig 9

angle. This is what we expect the rule base to tell us.

If you wanted just to look at one single value as the output of the rule base, then take all of the outputs and OR them together. In fuzzy logic, an OR operation means taking the maximum value of a set of numbers.

As usual, the code is yours to play with. I used Turbo C/C++ 3.0 for the example, but any C compiler should work equally as well. Adding an OR function to create a single output number from the set of rule outputs would be a nice addition to the code.

If you want to learn more about fuzzy logic, the World Wide Web is the best place to start. There are dozens of

fuzzy resources on the Web so you can easily expand your personal knowledge base if your interest is serious.

It's strange how history repeats itself. In 1937, the same year that Max Block's published his early paper on fuzzy sets, Howard Hughes approached the US Army about a new, lightning quick plane he recently designed and built, the H-1.

The H-1 was highly maneuverable and flew in excess of 330 MPH — faster than any American airplane built. Just like Zadeh's notion of fuzzy sets, Hughes's H-1 was rejected by the Americans. Guess what happened?

The H-1's design was embraced by the Japanese and was developed into the most destructive fighter plane in the Japanese arsenal, the Zero.

When are we going to learn?

NV

FVAL.DAT

```

1450
30
1325
60
1475
50
1650
24
1760
50
1650
35
1800
20

```

Fig 10

```

/*-----
* Filename: fuzz.c
* Description: Fuzzy Logic demo.
*
* (c) 1998 Jeff Stefan
*-----*/
#include <stdio.h>
#include <math.h>

double Min(double A, double B);
#define MAX_FILE_NAME 45

void main(int argc, char *argv[])
{
    FILE *fp;
    char Filename[MAX_FILE_NAME];
    int Result;
    double Temp, Angle;
    double NT, SLT, HT, SHT, NA, SLA, HA, SHA;
    double Rule1, Rule2, Rule3, Rule4, Rule5, Rule6, Rule7, Rule8;

    /* get filename from command line
    *-----*/
    if (argc < 2)
    {
        printf("Usage: fuzz filename\n");
        exit(0);
    }

    /* open file
    *-----*/
    strcpy(Filename, argv[1]);
    fp = fopen(Filename, "r");
    if (fp == NULL)
    {
        printf("Can't open file\n");
        exit(0);
    }

    /* init variables
    *-----*/
    NT = SLT = HT = SHT = 0.0;
    NA = SLA = HA = SHA = 0.0;

    /* read and process inputs
    *-----*/
    do
    {
        printf("-----[READ INPUTS]-----\n");
        Result = fscanf(fp, "%f", &Temp);
        if (Result == -1)
            break;
        printf("Temp = %f\n", Temp);
        fscanf(fp, "%f", &Angle);
        printf("Angle = %f\n", Angle);

        printf("-----[FUZZIFICATION]-----\n");

        /* NOMINAL TEMP (NT)
        *-----*/
        if (Temp >= 1400 && Temp <= 1600)
        {
            if (Temp <= 1500)
            {
                NT = (Temp - 1400)/200 + 0.5;
                printf("NT = %f\n", NT);
            }
            else if (Temp > 1500)
            {
                NT = fabs(Temp - 1600)/200 + 0.5;
                printf("NT = %f\n", NT);
            }
        }
        else
        {
            NT = 0.0;

```

```

        printf("NT = %f\n", NT);

        /* SLIGHTLY LOW TEMP (SLT)
        *-----*/
        if (Temp >= 1300 && Temp <= 1500)
        {
            if (Temp <= 1400)
            {
                SLT = (Temp - 1300)/200 + 0.5;
                printf("SLT = %f\n", SLT);
            }
            else if (Temp > 1400)
            {
                SLT = fabs(Temp - 1500)/200 + 0.5;
                printf("SLT = %f\n", SLT);
            }
        }
        else
        {
            SLT = 0.0;
            printf("SLT = %f\n", SLT);
        }

        /* HIGH TEMP (HT)
        *-----*/
        if (Temp >= 1650 && Temp <= 1850)
        {
            if (Temp <= 1750)
            {
                HT = (Temp - 1650)/200 + 0.5;
                printf("HT = %f\n", HT);
            }
            else if (Temp > 1750)
            {
                HT = fabs(Temp - 1850)/200 + 0.5;
                printf("HT = %f\n", HT);
            }
        }
        else
        {
            HT = 0.0;
            printf("HT = %f\n", HT);
        }

        /* SLIGHTLY HIGH TEMP (SHT)
        *-----*/
        if (Temp >= 1475 && Temp <= 1675)
        {
            if (Temp <= 1575)
            {
                SHT = (Temp - 1475)/200 + 0.5;
                printf("SHT = %f\n", SHT);
            }
            else if (Temp > 1575)
            {
                SHT = fabs(Temp - 1675)/200 + 0.5;
                printf("SHT = %f\n", SHT);
            }
        }
        else
        {
            SHT = 0.0;
            printf("SHT = %f\n", SHT);
        }

        /* NOMINAL ANGLE (NA)
        *-----*/
        if (Angle >= 35 && Angle <= 65)
        {
            if (Angle <= 50)
            {
                NA = (Angle - 35)/30 + 0.5;
                printf("NA = %f\n", NA);
            }
            else if (Angle > 50)
            {
                NA = fabs(Angle - 65)/30 + 0.5;

```

```

        printf("NA = %f\n", NA);

        else
        {
            NA = 0.0;
            printf("NA = %f\n", NA);
        }

        /* SLIGHTLY LOW ANGLE (SLA)
        *-----*/
        if (Angle >= 15 && Angle <= 45)
        {
            if (Angle <= 30)
            {
                SLA = (Angle - 15)/30 + 0.5;
                printf("SLA = %f\n", SLA);
            }
            else if (Angle > 30)
            {
                SLA = fabs(Angle - 45)/30 + 0.5;
                printf("SLA = %f\n", SLA);
            }
        }
        else
        {
            SLA = 0.0;
            printf("SLA = %f\n", SLA);
        }

        /* HIGH ANGLE (HA)
        *-----*/
        if (Angle >= 50 && Angle <= 80)
        {
            if (Angle <= 65)
            {
                HA = (Angle - 50)/30 + 0.5;
                printf("HA = %f\n", HA);
            }
            else if (Angle > 65)
            {
                HA = fabs(Angle - 80)/30 + 0.5;
                printf("HA = %f\n", HA);
            }
        }
        else
        {
            HA = 0.0;
            printf("HA = %f\n", HA);
        }

        /* SLIGHTLY HIGH ANGLE (SHA)
        *-----*/
        if (Angle >= 40 && Angle <= 70)
        {
            if (Angle <= 55)
            {
                SHA = (Angle - 40)/30 + 0.5;
                printf("SHA = %f\n", SHA);
            }
            else if (Angle > 55)
            {
                SHA = fabs(Angle - 70)/30 + 0.5;
                printf("SHA = %f\n", SHA);
            }
        }
        else
        {
            SHA = 0.0;
            printf("SHA = %f\n", SHA);
        }

        /* Run through rules and determine output
        *-----*/
        printf("-----[RULE BASE OUTPUT]-----\n");

```

```

/* RULE 1: IF temp is slightly low AND angle is slightly low
* THEN increase angle slightly.
*-----*/
Rule1 = Min(SLT, SLA);
printf("Rule1 = %f Increase Angle\n", Rule1);

/* RULE 2: IF temp is slightly high and angle is slightly
high
* THEN decrease angle.
*-----*/
Rule2 = Min(SHT, SHA);
printf("Rule2 = %f Decrease Angle\n", Rule2);

/* RULE 3: IF temp is high AND angle is high
* THEN decrease angle.
*-----*/
Rule3 = Min(HT, HA);
printf("Rule3 = %f Decrease Angle\n", Rule3);

/* RULE 4: IF slightly high temp AND slightly low angle
* THEN increase angle
*-----*/
Rule4 = Min(SHT, SLA);
printf("Rule4 = %f Increase Angle\n", Rule4);

/* RULE 5: IF normal temp and slightly high angle
* THEN decrease angle
*-----*/
Rule5 = Min(NT, SHA);
printf("Rule5 = %f Decrease Angle\n", Rule5);

/* RULE 6: IF temp is high AND angle is nominal
* THEN decrease angle.
*-----*/
Rule6 = Min(HT, NA);
printf("Rule6 = %f Decrease Angle\n", Rule6);

/* RULE 7: IF temp is slightly low AND angle is high
* THEN decrease angle.
*-----*/
Rule7 = Min(SLT, HA);
printf("Rule7 = %f Decrease Angle\n", Rule7);

/* RULE 8: IF temp is high AND angle is slightly low
* THEN increase angle.
*-----*/
Rule8 = Min(HT, SLA);
printf("Rule8 = %f Increase Angle\n", Rule8);

printf("Press a key...\n");
getchar();
while (!feof(fp));

if (fp)
{
    fclose(fp);
}

/* Min: return the minimum of two values. This is the
* traditional AND function in fuzzy logic.
*-----*/
double Min(double A, double B)
{
    if (A <= B)
        return(A);
    else
        return(B);
}

```




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
Tower Records
3 E. 9th St.
Tempe 85281

AUSTRALIA

DonTronics
P.O. Box 595
29 Elsmere Cres.
Tullamarine 3043

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
Digicity Net
4549 Quail Lakes Dr.
Stockton 95207
Electro Mavin
2985 E. Harcourt St.
Rancho Dominguez 90221
Ford Electronics
8431 Commonwealth Ave.
Buena Park 90621
Harding Way News
113 W. Harding Way
Stockton 95204
Harold's Newsstand
524 Geary St.
San Francisco 94102
HDB Electronics
2860 Spring St.
Redwood City 94063
Hi-Fi Doctor
1814 E. Ball Rd.
Anaheim 92805
HSC Electronic Supply
4837 Amber Ln.
Sacramento 95841
3500 Ryder St.
Santa Clara 95051
5681 Redwood Dr.
Rohnert Park 94928
JK Electronics
6395 Westminster Ave.
Westminster 92683
Laurel Park News
4346 Laurel Canyon Blvd.
Studio City 91604

Lion Electronic Labs
4948 E. Townsend Ave.
Fresno 93727
Netseller
7207 Arlington Ave., Ste. G
Riverside 92503
Op Amp Technical Books
1033 N. Sycamore Ave.
Los Angeles 90038
Pace Electronics
369 Hampshire Rd.
Thousand Oaks 91361
Panorama Electronics
8737 Van Nuys Blvd.
Panorama City 91402
Porter Ranch News Stand
18473 Devonshire St.
Northridge 91325
Sandy's Electronics Supply, Inc.
20655 Soledad Cyn. Rd., #15
Santa Clarita 91351
Sav-On Electronics
13225 Harbor Blvd.
Garden Grove 92643
Speakerworld Technology
2000 Warm Springs Ct., #6
Fremont 94539
Springbok News
55 N. Baldwin Ave.
Sierra Madre 91024
Tower Books
211 Main St.
Chico 95928
7840 Macy Plaza Dr.
Citrus Heights 95610
1280 E. Willow Pass Rd.
Concord 94520
630 San Antonio Rd.
Mountain View 94040
1600 Broadway
Sacramento 95818
5950 Florin Rd.
Sacramento 95823
2538 Watt Ave.
Sacramento 95812
2727 El Camino Real
San Mateo 94403
Tower Magazines/News
885 Riverside Pkwy.
West Sacramento 95605
Tower Records/Video
210 N. Beach Blvd.
Anaheim 92801
2520 Durant
Berkeley 94704
212 F St.
Davis 95616
5703 Christie Ave.
Emeryville 94608
5611 Blackstone
Fresno 93710
2052 Redwood Hwy.
Greenbrae 94904
6310 E. Pacific Coast Hwy.
Long Beach 90803
2280 Market St.
San Francisco 94114
3205 20th Ave.
San Francisco 94132
2525 Jones St.
San Francisco 94133
871 Blossom Hill Rd.
San Jose 95123
14570 Ventura Blvd.
Sherman Oaks 91403
1205 W. Covina Pkwy.
West Covina 91790
Valencia Newsstand
23164 W. Valencia Blvd.
Valencia 91355
Video Electronics
3829 University Ave.
San Diego 92105

Canada
Com-West Radio Systems Ltd.
48 E. 69th Ave.
Vancouver, BC V5X 4K6

Muir Communications Ltd.
3214 Douglas St.
Victoria, BC V8Z 3K6
Norlink Communications & Consulting
428 E. Victoria Ave.
Thunder Bay, Ontario P7C 1A5

COLORADO

Roboti-K
Carrera 38 No. 10-60,
Local 258, Bogota
COLORADO
Fistell's Micro Electronics
7023 E. Colfax Ave.
Denver 80220
International Tesla Society
2220 E. Bijou St.
Colorado Springs 80909
TH Electronics
216 Commerce Dr., Unit 2
Fort 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
Derric Electronics
1660 Whitney Ave.
Hamden 06517

DELAWARE
Newark Newsstand
70 E. Main St.
Newark 19711

DISTRICT OF COLUMBIA
Tower Records
2000 Pennsylvania Ave.
Washington 20006

FLORIDA
Alfa Electronic Supply
1502 S. St. Rd. #7
Hollywood 33023
Bob's News & Books
1515 S. Andrew Ave.
Fort Lauderdale 33316
Clarks Out of Town News
303 S. Andrews Ave.
Fort Lauderdale 33301
Mike's Electronic Distributing Co.
1001 N.W. 52nd St.
Fort Lauderdale 33309
Skycraft Parts & Surplus, Inc.
2245 W. Fairbanks
Winter Park 32789
Sunny's At Sunset, Inc.
8260 Sunset Strip
Sunrise 33322

GEORGIA
Tower Records
3400 Around Lenox Dr.
Atlanta 30326

HAWAII
SolarWorks!
525 Lotus Blossom Ln.
Ocean View 96737
Tower Records
4211 Waiiale Ave.
Honolulu 96816
611 Keeaumoku
Honolulu 96814

IDAH0
The Current Source
5159 Glenwood
Boise 83714

ILLINOIS
City Newsstand
4018 N. Cicero
Chicago 60641
Pick's Electronics
Lewis Park Mall
Carbondale 62901

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
Ladde News
3323 Severn Ave.
Metairie 70002
Tower Records
408 N. Peter St.
New Orleans 70130

MARYLAND
Silicon Valley Electronics
2014-A Industrial Dr.
Annapolis 21401
Tower Records/Video
2566 Solomons Island Rd.
Annapolis 21401
1601 Rockville Pike #210
Rockville 20852

MASSACHUSETTS
Full Spectrum Communications
244 Essex St.
Salem 01970
Newsbreak, Inc.
579 G.A.R. Hwy. Rt. 6
Swansea 02777
Tower Records #172
360 Newbury St.
Boston 02115

MICHIGAN
Family Electronics
111 E. Superior St.
Alma 48801
Little Professors Book Center
22174 Michigan Ave.
Dearborn 48124
MW Electronics
229 E. Michigan Ave.
Paw Paw 49079
Purchase Radio Supply, Inc.
327 E. Hoover Ave.
Ann Arbor 48104
Tower Records
1214 S. University Ave.
Ann Arbor 48104

MINNESOTA
Radio City, Inc.
2633 County Road 1
Mounds View 55112

MISSOURI
Accurate Instruments
11201 E. 24 Hwy.
Independence 64054
Bob's Electronics
123 S. Main St.
Piedmont 63957
Electronics Exchange
8644 St. Charles Rock Rd.
St. Louis 63114
Stewart & Associates
204 Sonderlin St.
O'Fallon 63366

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

NEW JERSEY
Sys-Com
707 22nd St.
Union City 07087
JR Tech Systems
1309 Hwy. 71
Belmar 07719

NEW YORK
All Phase Video Security, Inc.
70 Cain Dr.
Brentwood 11717
Global News, Inc.
22 8th Ave.
New York, NY 10016
Ham Central
3 Neptune Rd.
Poughkeepsie 12601
Hirsch Sales Corporation
219 California Dr.
Williamsville 14221
Hi-Tech Repair, Inc.
270 Neelytown Rd.
Montgomery 12549
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.
Miamisburg 45342
Leo's Book Shop
330 N. Superior St.
Toledo 43604
Magazines & More
26880 Brookpark Rd. Ext.
North Olmsted 44070
Powermaxx, Inc.
1587 U.S. Route 68 N.
Xenia 45385

OKLAHOMA
Steve's Books & Magazines
2612 S. Harvard
Tulsa 74114

OREGON
News & Smokes
2295 W. Main St.
Medford 97501
News & Smokes #8
259-C Barnett Rd.
Medford 97501
Norvac Electronics
7940 SW Nimbus Ave. Bldg. 8
Beaverton 97005
960 Conger
Eugene 97402
1545 N. Commercial NE
Salem 97303
Powell's Technical Bookstore
33 NW Park
Portland 97209
Tower Books
1307 NE 102nd Ave.
Portland 97220

PENNSYLVANIA
Business & Computer Bookstores
213 N. Easton Rd.
Willow Grove 19090
Lehman Scientific
2997-F Cape Horn Rd.
Red Lion 17356
Monica Electronics & Computers
2555 Industry Ln. Ste. D
Norristown 19403
Penn Electronics
2310 A Walnut St.
Harrisburg 17103
Surplus Al
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
Tanner Electronics
1301 W. Beltline #105
Carrollton 75006
The Communication Source
2713 Galleria Dr.
Arlington 76011
Tower Records
2403 Guadalupe
Austin 78705
VIRGINIA
Satellite Headquarters
7920 Timberlake Rd.
Lynchburg 24502
Tower Records/Video/Books
6200 Little River Tpk.
Alexandria 22312
4110 W. Ox Rd. #12124
Fairfax 22033
1601 Willow Lawn Dr.
Richmond 23230
8389 E. Leesburg Pike
Vienna 22182
WASHINGTON
A-B-C Communications, Inc.
17541 15th Ave. NE
Seattle 98155
Bohica Concepts
214 2nd St.
Morton 98356
Cody Books Ltd.
1122 Fir Ave.
Blaine 98230
Supertronix
18650 68th Ave. S.
Kent 98032
Tower Books
10635 NE 8th St.
Bellevue 98004
20 Mercer St.
Seattle 98109
WISCONSIN
Amateur Electronic Supply, Inc.
5710 W. Good Hope Rd.
Milwaukee 53223
News & Hobby Center
4758 Packard Ave.
Cudahy 53110

Events

CALENDAR

APRIL 1998

APRIL 3-4

AL - ALBERTVILLE - Hamfest. Albertville Recreation Center. Fri. 5-9pm, Sat. 8am-3pm. Buddy Smith KC4URL, 205-593-2516. E-Mail: kc4url@air-net.net

AR - SHERWOOD - Central AR Radio Emergency Net Hamfest. J. C. Smith N5RXXS, 501-568-7982
GA - ATLANTA - Southeastern VHF Conference. Sandy Donahue WA4QR, 404-875-9450. E-Mail: w4ru@arrl.org

APRIL 3-4-5

GA - AUGUSTA - Annual Worldwide Break. Radisson Hotel & Conference Ctr. Two 10th St. Sam Hacker 706-790-6213

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

APRIL 4

CA - ARMONA - Hams & Hackers Swap Meet. Hanford Fraternal Hall, 10th Ave. at Florida, Rick WB6VFZ, 209-945-2266

CA - SANTEE - ARC of El Cajon Ham, Computer & Electronic Swapmeet. Santee Drive-in. 619-561-0052
CO - BOULDER - Longmont ARC Hamfest. Jim Walker, E-Mail: walkerjim@usa.net

CT - WATERFORD - Ham Radio Auction. Waterford Senior Center on Rte. 85. Tony Griggs AA1JN, 860-859-0162. Web: www.ims.uconn.edu/~rason

FL - FT. LAUDERDALE - Computer Show. Holiday Inn West. 5100 N. St. Rd. 7. Narisaam Computer Show 770-663-0983

MI - LIVONIA - Super Computer Sales. Livonia Elks Lodge Hall, 31117 Plymouth Rd. 10am-3pm. Computers And You 734-283-1754

NC - MORGANTON - Catawba Valley Hamfest and Computer Fair. Burke Co. Fairgrounds Hwy. 181N. Thomas Taylor KC4QRP, 704-433-6205. E-Mail: kc4qrp@vistatech.net

NH - TWIN MOUNTAIN - Hamfest & Computer Fair. Twin Mountain Town Hall. 8am-3pm. Richard Force WB1ASL, 603-788-4428 bhbooks@together.net

OH - BEREIA - Computer Show. Cuyahoga Co. Fairgrounds. 10am-3pm. Peter Trapp Shows. 603-272-5008. www.petertrapp.com

PA - FREDERICKSBURG - Appalachian AR Group Hamfest. Paul Felty WB3HEC, 717-566-2606

VA - GOOCHLAND - SMART Fest. VA Co. Fairgrounds. 8am-3pm. Buddy Travis KA4NNN, 540-894-0406. E-Mail: btravis@msinc.com

WA - SPOKANE - Lilac City ARC Hamfest. St. Ann's Parish Hall, E. 2120 First Ave. 9am-5pm. 509-327-7196

WA - VANCOUVER - Clark Co. ARC Hamfest. Luther Brisky KC7KVL, 360-896-8909. E-Mail: lwayne@worldaccess.net Web: http://www.waia.org

APRIL 4-5

CA - VALLEJO - Computer Show. Solano Co. Frgrs. MarketPro 415-456-6730 Web: http://marketpro.com

FL - FT. LAUDERDALE - Computer Show. War Memorial Auditorium. 9:30am-4pm. MarketPro 301-984-0880

GA - KENNESAW - Computer Show. Outlet Mall, I-75 @ Exit 117. Georgia Mountain Productions 706-838-4827

MD - PIKESVILLE - Computer Show. Pikesville Armory. 9:30am-4pm. MarketPro 301-984-0880

OH - COLUMBUS - Computer Show. OH Expo Center. 9:30am-4pm. MarketPro 301-984-0880

PA - KING OF PRUSSIA - Computer Show. Valley Forge Conv. Ctr. 9:30am-4pm. MarketPro 301-984-0880

APRIL 5

CA - LIVERMORE - Swapmeet. Las Positas College. Noel Anklam 510-447-3857

CA - OXNARD - Computer Show. Community Ctr. MarketPro 415-456-6730 Web: http://marketpro.com

FL - PALM BEACH GARDENS - Computer Show. Palm Beach Gardens Marriott. 4000 RCA Blvd. Narisaam Computer Show 770-663-0983

IA - DELOIT - Denison Repeater Assn. Hamfest. John Amdor KD6MXL, 712-748-8162. E-Mail: johnmxl@netins.net Web: http://www.netins.net/showcase/johnmxl/deloit98.html

MA - TAUNTON - Computer Show. Holiday Inn. Northern Computer Shows 978-744-8440. E-Mail: tchc@iAmerica.net

MI - GRAND RAPIDS - Super Computer Sales. Crowne Plaza, 5700 28th St. S.E. 10am-4pm. Computers And You 734-283-1754

NC - RALEIGH - Hamfest. NC State ARRL Convention & Computer Fair. Jim Graham Bldg., State Fairgrounds. 8am-4pm. Wilbur Goss WD4RDT, 919-266-7883

NJ - TRENTON - Delaware Valley Radio Assn.

44 April 1998/Nuts & Volts Magazine

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

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

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

Hamfest. Tall Cedars of Lebanon picnic grove, Sawmill Rd. Darryl Foyth N2JVP, 609-882-2240. Web: www.slac.com/w2zq

OH - AKRON - Computer Show. Tadmor Shrine Temple. 10am-3pm. Peter Trapp Shows. 603-272-5008. www.petertrapp.com

VA - VIRGINIA BEACH - Computer Show. VA Beach Pavilion. 9:30am-4pm. MarketPro 301-984-0880

WI - MIDDLETON - Madison Area Repeater Assn. Swapfest. John Q. Hammons Trade Center. Jeremy Charles N9VHT, 608-245-8890 http://www.cs.wisc.edu/~jeremyc/mara/swapfest

APRIL 10-11

MS - TUPELO - Tupelo, Booneville and Union Co. ARCs Hamfest. Jack Ellis K15QV, 601-842-7255. Web: http://www.tupelofest.org

APRIL 11

AR - BENTONVILLE - Benton County Radio Operators. BCRO, P.O. Box 883, Pea Ridge, 72751

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

CA - SAN DIEGO - Computer Show. Scottish Rite Center. MarketPro 415-456-6730. Web: http://marketpro.com

CA - SANTA ROSA - Computer Show. Sonoma Co. Frgrs. MarketPro 415-456-6730. Web: http://marketpro.com

FL - JACKSONVILLE - Computer Show. Morocco Shrine Auditorium. 9:30am-4pm. MarketPro 301-984-0880

FL - MIAMI - HamSwapfest. U. of Miami Coral Gables Campus, Physics Parking Lot. 8am-12pm. Walt W4DWN 305-895-0398

MI - FLINT - Super Computer Sales. IMA Arena, 3501 Lapeer Rd. 10am-3pm. Computers And You 734-283-1754

OK - LAWTON - Lawton Ft. Sill ARC Hamfest. Bob Morford KA5YED, 580-355-6120. E-Mail: w5ks@nli.net

OR - PENDLETON - Hamfest & Computer Fair. Conv. Center. 8am-4pm. Denton WB7TDG, 541-276-8319. E-Mail: denton@oregontrail.net

PA - ALLENTOWN - Computer Show. Allentown Fairgrounds. 9:30am-4pm. MarketPro 301-984-0880

PA - HARRISBURG - Computer Show. Farm Show Complex. 9:30am-4pm. MarketPro 301-984-0880

PA - MONROEVILLE - Computer Show. Pittsburgh Expo Mart. 9:30am-4pm. MarketPro 301-984-0880

TN - CLINTON - Oak Ridge ARC Hamfest. Jim Whittlesey KC4RHW, E-Mail: kc4rhw@bellsouth.net

VA - CHANTILLY - Computer Show. Capital Expo Center. 9:30am-4pm. MarketPro 301-984-0880

APRIL 17-18-19

MI - TAYLOR - Computer & Technology Show. Gibraltar Trade Center, 15525 Racho Rd. 313-287-2000

APRIL 18

AZ - PHOENIX - ARC Hamfest. George Cooney KQ7C, 602-274-6212. E-Mail: georgie@aztec.asu.edu

CA - SACRAMENTO - River City ARC Hamfest. Roy Rudebaugh KD6LE, 916-427-6852. E-Mail: kd6le@juno.com

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

GA - WARNER ROBINS - Central Georgia ARC Hamfest. Dennis Ryckman KF4LTH, 912-956-1665

ME - AUGUSTA - Computer Show. Civic Center. Northern Computer Shows 978-744-8440. E-Mail: tchc@iAmerica.net

MI - DEARBORN - Super Computer Sales. Dearborn Civic Center, 15801 Michigan Ave. 10am-3pm. Computers And You 734-283-1754

MN - FERGUS FALLS - Lake Region ARC Hamfest. William Morgan AA0AX, 218-736-4448

MO - JOPLIN - ARC Hamfest. Andy Gabbert KA0TUD, 417-673-8371. E-Mail: agabbertka0tud@hotmail.com

PA - JOHNSTOWN - Computer Show. War Memorial Arena. 9:30am-4pm. MarketPro 301-984-0880

PA - LEBANON - Computer Show. Lebanon Valley Expo Center. 9:30am-4pm. MarketPro 301-984-0880

TN - DAYTON - Rhea County ARS Hamfest. Tom Mize 423-570-0840. Web: http://www.volstate.net/~ko4sy

TX - BELTON - Spring Fest. Bell County Expo Center. Mike Lefan WA5EQQ, 254-773-3590. E-Mail: hamexpo@vwm.com Web: http://www.tarc.org

APRIL 18-19

AL - BIRMINGHAM - Southeastern Div. Conv. Bill Levey WA4FAT, 205-97-0622. E-Mail: barc@bro.net Web: http://bro.net/barc

CA - SACRAMENTO - Computer Show. Cal Expo. MarketPro 415-456-6730 Web: http://marketpro.com

CT - HARTFORD - Trinity College Fire Fighting Home Robot Contest. 12pm-5pm. www.trincoll.edu/~robot JMEMDEL141@AOL.COM

FL - TAMPA - Computer Show. FL State Fairgrounds. 9:30am-4pm. MarketPro 301-984-0880

IL - ELGIN - CoCofest. Holiday Inn, Holiday Inn Indoor Recreation Ctr. Sat. 10am-5pm, Sun. 10am-3:30pm. Tony Podraza 847-428-3576. TONYPODRAZA@JUNO.COM

MD - GAITHERSBURG - Computer Show. Montgomery Co. Fairgrounds. 9:30am-4pm. MarketPro 301-984-0880

OH - CINCINNATI - Computer Show. Cincinnati Gardens. 9:30am-4pm. MarketPro 301-984-0880

TN - EAST RIDGE - Computer Show. Camp Jordan Arena. 9:30am-4pm. MarketPro 301-984-0880

VA - NORFOLK - Computer Show. Norfolk Scope. 9:30am-4pm. MarketPro 301-984-0880

APRIL 19

CA - LANCASTER - Computer Show. Antelope Valley Frgrs. MarketPro 415-456-6730. Web: http://marketpro.com

DE - NEWARK - Computer Show. University of Delaware. 9:30am-4pm. MarketPro 301-984-0880

IL - STICKNEY - Ham and computer show. Hawthorne Race Course, 3500 S. Cicero Ave. 8am-2pm. DARC, 7511 Walnut Ave., Woodridge, IL 60517-2818. http://homepage.interaccess.com/~geirh

MA - CAMBRIDGE - Flea Market. Kendall Square area. MIT. Nick Altemberd KA1MQX, 617-253-3776. Web: http://web.mit.edu/w1mx/www/swapfest.html

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

MI - MADISON HEIGHTS - Super Computer Sales. UFGCW Hall, 876 Horace Brown Dr. 10am-4pm. Computers And You 734-283-1754

MI - ST. JOSEPH - Blossomland AREA Hamfest. Duane Durlinger 616-982-0404. E-Mail: comdca@comdca.com Web: http://www.comdca.com/bara/

MN - SHAKOPEE - Hobby electronics show. Canterbury Park. 12pm-5pm. Helen WB0HOX, 612-361-6782

MO - CEDAR HILL - Jefferson County ARC Hamfest. Jim Autery KA0WXX, 314-296-3473

PA - STATE COLLEGE - Computer Show. Penn State Conference Ctr. Hotel. 9:30am-4pm. MarketPro 301-984-0880

APRIL 24-25

AR - LITTLE ROCK - Hamfest. The Expo Center, Interstate 30. Fri. 4pm-9pm, Sat. 8am-5pm. Jim Blackburn KB5IFV, 870-246-6734. E-Mail: 1rharm@usa.net Web: http://www.aristotle.net/~n5xay/lrh98.html

FL - GAINESVILLE - Hamfest & Computer Show. Alachua County Fairgrounds. Larry Walker WB4VAU,

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

APRIL 25

CA - FRESNO - Computer Show. Fresno Frgrs. MarketPro 415-456-6730 Web: http://marketpro.com

CA - SONOMA - Hamfest. Sonoma Valley Veteran's Memorial Bldg., 126 1st St. W. 8am-noon. Darrel WD6BOR, 707-996-4494

IA - DES MOINES - RAA Hamfest. Ron Hobbs NOXWI, 515-255-4020. E-Mail: rhobbs@aol.com

MD - NEW CARROLLTON - Computer Show. Ramada Conference & Exhibition Ctr. 9:30am-4pm. MarketPro 301-984-0880

MI - TAYLOR - Super Computer Sales. Democratic Club Hall, 23400 Wick Rd. 10am-3pm. Computers And You 734-283-1754

MN - ROCHESTER - ARC Hamfest. John Scott NOHZN, 507-285-6522. E-Mail: n0hzn@aol.com Web: http://members.aol.com/rarchams

NH - DURHAM - Computer Show. Whittemore Arena @ UNH. Northern Computer Shows 978-744-8440. E-Mail: tchc@iAmerica.net

NJ - HARMONY TOWNSHIP - Cherryville Repeater Assn. Hamfest. Marty Grozinski W2CQ, 908-788-2644, 908-788-4080

NM - ALBUQUERQUE - ARC & AR Caravan Club Hamfest. Chuck Opdyke KC5GA, 505-858-0306

NY - SYRACUSE - Liverpool ARC Hamfest. Robert Hamby W2WRH, 315-622-1068

OR - KLAMATH FALLS - Keno ARC Hamfest. Tom Hamilton WD6EAW, 541-883-2736. E-Mail: wjonesjr@cdsnet.net Web: http://home.cdsnet.net/~wjonesjr/kenoarc.htm

PA - BLOOMSBURG - Columbia-Montour ARC Hamfest & Computer Show. Bloomsburg Fairgrounds. Dave Schack WC3A, 717-752-6851. E-Mail: kev17815@epix.net Web: www.bafn.org/~cmarc/

PA - LANCASTER - Computer Show. Lancaster Host Resort. 9:30am-4pm. MarketPro 301-984-0880

RI - WEST GREENWICH - WA County & Fidelity ARC Hamfest. Everett Lovenbury N1VEZ, 401-539-1107. E-Mail: N1VEZ@juno.com

VA - RICHMOND - Computer Show. The Showplace. 9:30am-4pm. MarketPro 301-984-0880

APRIL 25-26

FL - ORLANDO - Computer Show. Central FL Fairgrounds. 9:30am-4pm. MarketPro 301-984-0880

IN - INDIANAPOLIS - Computer Show. IN State Fairgrounds. 9:30am-4pm. MarketPro 301-984-0880

OH - DAYTON - Computer Show. Montgomery Co. Fairgrounds. 9:30am-4pm. MarketPro 301-984-0880

TX - CHICOTA - Red River Valley ARC Hamfest. Don Honsinger KB5MUS, 903-732-3290. E-Mail: ka5bhy@webwide.net Web: http://pjic.parcis.cc.tx.us.80/org/arrvarc

APRIL 26

CA - SACRAMENTO - Computer Show. Scottish Rite Center. MarketPro 415-456-6730. Web: http://marketpro.com

DE - NEW CASTLE - State Conv. Nur Temple, Rte. 13 N. 9am-3pm. Hal Frantz KA3TWG, 302-793-1080. E-Mail: hfrantz@magpage.com Web: http://www.magpage.com/pennel

IL - ARTHUR - Moultrie ARK Hamfest. Moultrie Douglas County Fairgrounds. 8am-1pm. Ralph Zancha WC9V, 217-873-5287 or 217-543-2178

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

IL - KEWANEE - Area Amateur Radio Operators. Bill Anderson WB9TEW, 708-932-3023. E-Mail: bill@iwin.net

MA - WORCESTER - Computer Show. Centrum Centre. Northern Computer Shows 978-744-8440. E-Mail: tchc@iAmerica.net

Continued on page 95

You Are Invited to The "ORIGINAL"

TRENTON COMPUTER FESTIVAL

April 18-19th, 1998

at
Mercer County Community College

Saturday from 10am* to 6pm & Sunday from 10am* to 4pm

WWW.TCF.NET

*Flea market opens 1 hour earlier

400+ Indoor Exhibit Spaces

These commercial booths include National and local vendors and offer the best bargains in brand new hardware, software and accessories. You'll find many prices that are below what you can get from these same vendors at their stores or through the mail.

The Largest Personal Computer Outdoor Exhibit Area 1000+ Spaces!

Across of bargains in new and used computer hardware, software, accessories. Or come sell your own stuff. 1000+ outdoor spots (on asphalt) available - single spots specially priced to make the flea market affordable for anyone. Lots of buyers.

INTERNET/World Wide Web Cafe

You have access to a complete room set up with computers connected to the Internet/World Wide Web - available at NO charge!!! - FREE with your admission!!! Experts available for help.

NEW!!! CEU's for Seminars

New this year: for selected seminars you will be able to earn Continuing Education Units (CEUs)!!! These can be used to fulfill requirements for teachers, students and others -- at no extra cost!

100+ Seminars, Forums & Talks by Leading Experts

The computer industry's leading experts present programs on the latest business, technical and programming topics at all levels from beginner to advanced. Programs emphasize the latest on the INTERNET/World Wide Web, CD-ROM & Multimedia, as well as CAD, E-Mail, Graphics, Programming, Desktop Publishing, Hardware, Word Processing, Networking, Business Applications and much more! This educational opportunity is FREE with your admission! And you can earn CEUs for many of the seminars!

Saturday Evening Banquet

This sumptuous banquet is the highlight of the weekend. The festival's keynote speaker is also the featured speaker at the banquet and lots of door prizes are given out. You need to buy your ticket early because they are usually gone by noon on Saturday. You can purchase them at a booth in the student center.

Admission

General admission is only \$10 for 2 days, \$5 for Sunday-only. Students and Senior Citizens are only \$5 for 2 days. Children under 12 are Free on Sunday-only (if accompanied by an adult). Preschoolers are Free at all times.

For the latest information & directions call the TCF Information Line at: 215-957-4000, 24-hours.



HF TO GO

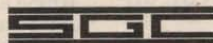
The World's Smallest Full-Featured HF-SSB Radio



The SG-2020 is the perfect choice for base, backpacks or business trips. • Weighing in at just 4.5 pounds, the SG-2020 features fully adjustable output power from 0 to 20 watts PEP. • Low current requirements in receive mode allow practical battery pack operation. • A bullet-proof front end provides third order intercept at better than +18dB, virtually eliminating adjacent channel interference. • Designed with the portable user in mind, it comes complete with built-in, fully adjustable mode 'B' lmbic keyer, VOGAD baseband speech processing and RF clipping. • All this plus legendary SGC quality and reliability at an incredibly low price.

SG-2020

For complete details on the SG-2020, see your SGC dealer, or check out our website.



1-800-259-7331
www.sgcworld.com

P.O. Box 3526 Bellevue, WA 98009 USA

Phone: (425) 746-6310 Fax: (425) 746-6384 Email: sgc@sgcworld.com

Write In 214 on Reader Service Card.

CABLE TV

CABLE TV SURPLUS WANTED: We buy & sell trunk stations, cable converter boxes, line extenders, passives, power supplies. Message/fax 561-483-8516. E-Mail: cable@flinet.com

NEW VIDEO cassette storage cases now available \$1.25 each, plus shipping and COD, 100 piece minimum order black grain finish with interior hubs, call Ken Ermy Electronics 24 hour order and information hot line 516-389-3536.

CLOSE OUT: ALL UNITS RAW AND UNMODIFIED: Zenith ST1000, 1086, 1110, 5010 and ST6700s. Zenith ST1622, SA 8500, 8520, 8525, 8528, 8530 and 8540s. SA 8550, Jerrold DRZs. Prices based on orders of 200 or more. 1-800-380-9530.

ATTN: CABLE CONVERTER RETAILERS. E-Mail or fax your monthly stock needs. All major brands available. Lowest prices. New/field pulls available. Bulk orders only. Message/Fax 561-483-8516. E-Mail: cable@flinet.com

ZENITH 73ch unmodified ST16XXS complete as-is \$60 each; refurbished \$90. 10 lot min 702-270-4341.

Network Service Tool Set

Popular installation and service tools for networks, modems and telephones. All hand tools are professional heavy duty type.

Use the compact tester on 10BASE-T (UTP & STP), thin Ethernet (BNC), 8-position Token Ring, AT&T 258A and EIA/TIA 568A/B. Automatically scans cables for continuity, wiring sequence and polarization. Tests STP cable ground. Testing installed cables is easy with Remote Terminator and gender changers (UTP and BNC). 9V battery included.

- Coax Stripping Tool, RG-58 & RG-59
- BNC Crimping Tool, RG-58 & RG-59
- Modular Cutting/Stripping/Crimping Tool (4, 6 & 8-Position)
- Multi-Network Cable Tester
- AC Receptacle Tester
- Cable Cutter

Order No. 55625 \$197.00



PC Service Tool Set

Contains all tools needed to troubleshoot & service IBM-compatible PCs. Set includes:

- AMI Diagnostic Software
- POST Card
- Logic Probe
- Digital Multi-Meter
- AC Receptacle Tester
- Serial Adapter
- Serial & Parallel Loopback Connectors
- DIP IC Puller
- PLCC IC Puller
- Grounding Wrist Strap
- Key Top Puller

Order No. 55000 \$198.00



PC Diagnostic Tool Set

- AMI Diagnostic Software
- POST Card

Order No. 55555 \$89.00

Network Installation Tool Set

- Network Tool Set 55625 without the Multi-Network Cable Tester.

Order No. 55600 \$99.00

Call for your FREE Catalog
Graymark®

P.O. Box 2015 Tustin, CA 92781
http://www.labvolt.com

CALL TODAY!
800-854-7393



Write In 58 on Reader Service Card.

Nuts & Volts Magazine/April 1998 45

ELECTRONIX EXPRESS

WELLER SOLDERING STATION - MODEL WLC 100

- Variable power control (5 to 40 watts)
- Replaceable heating element
- Quality light-weight pencil iron

\$3695



DUAL-TRACE OSCILLOSCOPE

W/HIGH RESOLUTION, BLUE CRT
INCLUDES PROBES, POWER CORD

2 YEAR WARRANTY

Goldstar 5020P

20MHZ

\$34900

Instek® FUNCTION GEN.

WITH INT/EXT

FREQ. COUNTER

MODEL 8016

\$21500

ALLIGATOR LEADS

SET OF 10

\$210

SWITCHES

8 POS DIP

60¢ ea.

Mini Toggle SPDT

50¢ ea.

ON-ON

SOLDERLESS BREADBOARD

830 tie points. MB102PLT model features 3 binding posts and aluminum backplate.

Part No. 1-9 10+

MB102 5.95 5.00

MB102PLT 8.95 8.00

HELPING

HAND

WITH

MAGNIFIER

#060836

\$350

MOTION DETECTOR

\$2 ea. - 10 For \$15

LM555 10 Min.

22¢ ea.

LM741 10 Min.

27¢ ea.

74LS00 10 Min.

18¢ ea.

7805 Regulator 10 Min.

30¢ ea.

2N3904 10 Min.

6¢ ea.

PN2222 10 Min.

6¢ ea.

Red LED T 1 1/4 10 Min.

6¢ ea.

Green LED T 1 1/4 10 Min.

7¢ ea.

Yellow LED T 1 1/4 10 Min.

8¢ ea.

Photo Cell 10 Min.

65¢ ea.

100K Pot., 1" Shaft PC ML 10 Min.

15¢ ea.

SOLDERING IRON 3-WIRE

HIGH PERFORMANCE

#060501

\$525

SOLDERING IRON STAND

W/SPONGE

#060842

\$350

1 LB. 60/40 Solder Roll .031"

\$595

DESOLDER PUMP W/TIP

#060820

\$350

15 TURN POT

69¢ ea.

Burns 3006P series.

All standard values available.

MAN72 C.A Red 0.3"

MAN74 C.C Red 0.3"

60¢ ea.

FREE CATALOG

MORE

Low-Priced

Items In Our

FREE

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

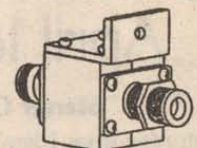
192-Page Catalog

192-Page Catalog

192-Page Catalog

192-Page Catalog

CABLE TV. ALL MAJOR NAME BRANDS. 30 DAY MONEY BACK, 1 YEAR WARRANTY, BEST PRICES. OPEN 8-9 MON-SAT. T & L SERVICES 1-888-823-6047.



EXPLOSIVE CABLE TV GRAB! BRINKER ZAPPER/SNOOPER STOP-PPER combo module all in one! Buy wholesale factory-direct, no middle-man. Let others get fined & zapped instead. Protect your cable box now! 100% COMPATIBLE. We supply over 80 advertisers weekly! Your order shipped fast, within hours! Why pay \$39 when you can buy direct! LIFE-TIME GUARANTEE! We accept VISA/MC/AMEX/COD/MO/CHECKS. ONLY \$10 (SPECIAL: 3/\$20 plus FREE DESCRAMBLER PLANS!). SUPER ZAPPER MODULES ONLY \$16! (3/\$33)! CABLE TV CONVERTER BOX SOURCES (125+) \$7, CATV LIGHTNING SUPPRESSOR \$8. FREE SHIPPING, ALWAYS! Call us anytime 1-888-430-7576 ext. 3135. BRINKER ENGINEERING LABS.

WE BUY raw unmodified cable converters, line gear and head-end equipment. Any quantity-most models. Call with your inventory. 1-800-380-9530.



CABLE MANUFACTURERS. Call Toggle Switch Supermarket, wholesale prices, free list. Fertik's, 5400 Ella, Philadelphia, PA 19120 Ph/Fax: 215-455-2121.

PICS, GALS READ if you've lost your masters. Programming service available. Call for info. Network Sales, 616-683-0500.

NEW! CABLE converter electronic service equipment and supplies for most cable converter boxes. Highest service, lowest prices. Call Ken Emy Electronics. 24 hr. order and information hot line 516-389-3536.

UNMODIFIED JERROLD Pioneer, SA and Panasonic Model 175 multivision. We carry all other cable products. Please call between 7-9 pm EST. 617-389-5155.

JERROLD UNMODIFIED CONVERTERS FOR SALE. CALL FOR BEST PRICES. NO DESCRAMBLER SALES. CALL BRLD ELECTRONICS 1-800-322-6316.

CABLE PARTS! Computer parts. Call for great prices or visit us on the Web: HTTP://WWW.CB-Electronics.com or call 1-800-436-8630.

CABLE CONVERTERS and supplies, shop no more, best prices and tech support. Extreme Electronics 1-888-609-4910.

CBTV REPAIR. We specialize in all converters, including Zenith. Give us a call: 405-634-1580.

LARGE QUANTITIES: RAW UNMODIFIED UNITS Pioneer 5000, 6000 series. Zenith 1600 series. SA-80s and up. Jerrold-DPV, CFTs. Tocom-O7S plus other models & manufactures. Call for Pricing. 1-800-380-9530.

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.

LOOKING FOR a good low cost plain converter, 60 channel manual fine tuning, only \$18 with remote. Regal 83 with volume 99 channel, Centurion CF 3000 99 channels. Also "Raw" units like: Tocom 5503 VIP, \$65 ea., DP5 \$55; Zenith ST 1600, \$75; DP7 \$69. All power up, clean and warranty. Let's us know you need need. 405-634-1535.

CATV REPAIR: most models, great prices, warranty included. Please call 573-363-0402.

CABLE CONVERTERS for catalog/orders call 1-800-671-8117. E-Mail: bluemoon@paonline.com mention Nuts/Volts for discount, 1 or 5 same low price. Drop/ship avail. w/warr., Visa/MC/COD.

Z-1600 TUNER & power supply repair. Call 573-363-0402.

RS-232 Networkable Control Electronics



NEW: RS-232 programmable 240x64 Graphic Display Module. Upload your BMP/GIF Image Files at 9600/19.2/38.4/115.2K Baud. Complete Support for 30x8 and 40x8 Text. Documentation and QBasic Software Gets You Running FAST!!! Counts as 2 Devices on the NCD RS-232 Network. Combine up to 8 GDSPs on a Single Serial Line. Many Pricing Options Starting at \$99. \$299 fully loaded.

Specializing In World Control From Your PC, Mac, or Amiga.



DC Motor Controller: 9-12 Volt. Operation for Motors Up to 4 Amps. Forward/Reverse 64 Speeds. With Infrared Receiver. NCD-M1 Kit \$89 Asm \$149



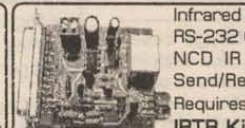
8-Relay Driver: includes 8 LED Status Lights. 12V Operation. Includes Infrared Receiver. With Omron Mechanical Relays. R85 (5A) Kit \$89 Asm \$139 R810 (10A) Kit \$109 Asm \$159



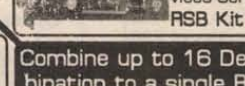
Audio/Video Switcher: 8 Inputs, 2 Outputs, Infrared Controllable. Routes Any Input to Any Output. 12-18 volt DC operation. For Line-Level Signal Switching. AVS8 Kit \$89 Asm \$139



Digital Tachometer: Dual 8-Bit A/D Requires \$12 RSB Booster. Dual 8-Bit Analog Inputs, 3 Programmable Outputs, Pulse Width Modulation, Period Measurement. Optoisolated and fully RS-232 Networkable. NCD-ADB Kit \$34, Asm \$49.



Infrared Transceiver for Remote RS-232 Communication with 16 NCD IR Controllable Devices. Send/Receive at 1200 Baud. Requires 12 volts DC. ITR Kit \$24 Asm \$39



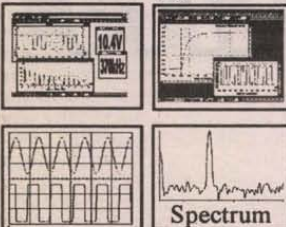
Serial Booster: Gives your RS-232 Port the Power It Needs to Drive 16 NCD Devices. Also Accepts O.C. RS-232 Generated by Devices Sending Data to Computer. RSB Kit \$12 Asm \$24

Combine up to 16 Devices in ANY Combination to a single RS-232 Serial Port. Includes Software in QBasic for PCs. Mac/Amiga Drivers Available soon. Include \$5 Shipping Visa/MC Accepted Orders and Inquiries: Contact Ryan Sheldon (404) 244-2432 FAX: (417) 648-8302 http://members.aol.com/nccat/index.html NCD, Box 384, Osceola, MO 64776

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 Ip (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)

800-980-9806
Allison Technology Corporation
8343 Carvel, Houston, TX 77036
Fax: 713-777-4746 Technical: 713-777-4041
BBS: 713-777-4753 email: atc@accesscomm.net
<http://www.atcweb.com>

Write in 173 on Reader Service Card.

SMARTCARD BIBLE. New (March 1998) book covering all aspects of smartcards: Hacking, operation, specifications, theory and more. With software and diagrams for smartcard reader/writer. \$39.95 plus \$5.50 P&H. 520-726-2833. TELECODE, PO Box 6426-NV, Yuma, AZ 85366-6426. <http://www.hackerscatalog.com/hackgold.htm>

CABLE TV converters and accessories for most cable boxes. Refurbished converters. Genuine unmodified S/A 8530/8550/8580/8570/8600. Jerrold DPV7, Zenith ST1600, Panasonic 175, Regal CR-83-3. We also repair private owned cable boxes for a low cost. For more info. Call 1-800-758-3169 (no FL sales).

CALL ALEN for all your cable needs or computer software, PICs, GALs read if you've lost your masters. Programming service available. For info call 909-941-4858 or E-Mail to alencable@aol.com or visit us at our web on site <http://members.aol.com/alencable>

TRIVISIONS CHEAP. The TRI 550 new basic 500MHz converters, with new remote \$38 plus shipping. Each in 100 lot. Call 706-398-2100.

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.

Miniature Transmitters and Receivers

Small, Attractive, High End Quality, 2 Channel Transmitter
59,049 Settable Codes, 150'-300' Range, 1-1/4"x2"x7/16", Assembled

	Qty	1	5	10
RF300T 150' Transmitter		24.95	19.95	15.95
RF300XT 300' Range Transmitter		29.95	24.95	19.95

Small, High End Quality, Receiver for the RF300 Transmitters
1-1/4"x3-3/4"x9/16", 8-24 vdc CMOS Input / Outputs, PCB

RF300R Receiver, assembled	24.95	20.95	16.95
RF300RK Receiver, Parts Kit	19.95	15.95	12.95

Small, Economical, Transmitter and Receiver Set
Set Code, 60' Range, 1-7/8"x2-3/8"x7/16" (T), 2"x2-3/4"x9/16" (R)
RF60 Transmitter and Receiver 24.95 19.95 14.95

Add \$4 shipping for first item + \$1 for each additional item. Ca. residents add 8.25% tax
Visa, Mastercard, Money Orders, Personal Checks and Cash C.O.D.s

Visitec Inc. (510) 651-1425 Fax (510) 651-8454
P.O. Box 14156 Fremont, CA. 94539

Write in 96 on Reader Service Card.

Quality Reconditioned Test Equipment 90 DAY WARRANTY & 10 DAY INSPECTION

HEWLETT PACKARD

10833A/B/C, HPBIB Cables, 1/2-4 meter	3 for \$50
11730D, Power Sensor Cable, 50 Ft (new)	\$75
1740A, 100 MHz Scope	\$375
1741A, 100 MHz Storage Scope	\$400
180TR, Rack Mount Display	\$200
1980B, Automatic O'Scope Measurement System	\$800
214B, 10 MHz Pulse Generator, 200W Pulse/50 ohms	\$1250
3310B, 5 MHz Function Generator	\$225
3311A, Function Generator, 1 Hz-1 MHz	\$175
3312A, Function Generator, 0.1 Hz-13 MHz	\$550
3325A, 21 MHz Synth Function Generator, HPBIB	\$1800
33320H, Prog Attn, DC-18GHz, 10dB range, 1dB steps	\$400
33322H, Prog Attn, DC-18GHz, 10dB range, 10dB steps	\$400
3400A, RMS Voltmeter, 10Hz-10MHz	\$150
3403C, Digital RMS Voltmeter, 2 Hz-100 MHz	\$300
3421A-201/44462A, Data Acquisition Control Unit, HPBIB	\$375
3455A, 6.5 digit Multimeter, HPBIB	\$350
3456A, 6.5 digit Multimeter, HPBIB	\$700
3465A, 4.5 digit Multimeter	\$175
3478A, 5.5 digit Multimeter, HPBIB	\$600
3488A, Switch/Control Unit	\$900
355C, Step Attenuator, DC-1 GHz, 1 dB steps	\$175
3575A, Gain/Phase Meter, 1 Hz-13 MHz	\$700
4274A, 5-1/2 digit LCR Meter, 100Hz-100KHz	\$3400
4275A-01, 5-1/2 digit LCR Meter, 10KHz-10MHz	\$4800
4328A-01, Milliohmeter w/ battery opt.	\$1100
432A/478A, Power Meter, 10 MHz-10 GHz	\$225
432A/8478B, Power Meter, 10 MHz-18 GHz	\$325
435A, Power Meter	\$200
436A, Power Meter w/ sensor cable	\$1100
4437A, Step Attenuator, DC-1 GHz, 600 ohm	\$175
44421A, 20 Chan Relay Multiplexer, used on 3497A	\$125
44428A, 16 Chan Actuator/Digital Output, used on 3497A	\$175
44470A, 10 Chan Relay Multiplexer, used on 3488A	\$175
44471A, 10 Chan Relay Multiplexer, used on 3488A	\$200
44474A, 16 Bit Data I/O Module, used on 3488A	\$200
44711A, 24 Chan FET Multiplexer, used on 3852A	\$300
491C, Amplifier, 2 GHz-4GHz, 1 Watt, 30dB Gain	\$675
4954A, Protocol Analyzer	\$1700
5300A w/5302A, 50 MHz Counter	\$100
5300A w/5303A, 500 MHz Counter	\$200
5314A, 100 MHz Counter	\$175
5316A, 100 MHz Counter, HPBIB	\$450
5316B, 100MHz Counter, HPBIB	\$750
5328A, 100 MHz Counter	\$175
5328A-021-030, 512 MHz Counter w/DVM	\$400
5334A, 100 MHz Counter, HPBIB	\$650
5334B, 100 MHz Counter, HPBIB	\$800
5335A-040, 200 MHz Counter, HPBIB	\$700
5335A-010-030, 1.3GHz Counter, Oven Osc, HPBIB	\$1200
536A, Frequency Meter, 0.96-4.2 GHz	\$100
5370B, Time Int Counter, 100 MHz, 100 ps accuracy	\$2250
54602A, 150MHz Four Channel O'Scope	\$1650
59306A, Relay Actuator	\$125
59313A, A/D Converter	\$100
59501B, Isolated DAC/Power Supply Programmer	\$125
6002A-01, Pwr Sup, 200 W, 0-50V@0-10A, GPBIB	\$675
6034L, Dig Autotuning Pwr Sup, 60W/10A/200W, HPBIB	\$850
6110A, (Har), Pwr Sup, 0-3KV@6mA (cables incl)	\$300
6112A, Precision Pwr Sup, 0-40V@0.5A	\$275
6181B, Constant Current Source, 100V, 250 mA	\$300
6200B (Har), Pwr Sup, 0-40V@0.75A or 0-20V@1.5A	\$150
6227B, Dual Pwr Sup, 0-25V@2A	\$475
6253A, Dual Pwr Sup, 0-20V@3A	\$350
6255A, Dual Pwr Sup, 0-40V@1.5A	\$400
6261B-026, Pwr Sup, 0-20V@50A	\$575
6267B, Pwr Sup, 0-40V@10A	\$475
6271B, Pwr Sup, 0-60V@3A	\$350
6284A, Pwr Sup, 0-20V@3A	\$175
6289A, Pwr Sup, 0-40V@1.5A	\$175
6291A, Pwr Sup, 0-40V@5A	\$550
6294A, Pwr Sup, 0-60V@1A	\$175
6515A, (Har), Pwr Sup, 0-1.6KV@5mA (cables incl)	\$275
6516A, High Voltage Pwr Sup, 0-3KV@5mA	\$375
6827A, Pwr Sup/Amplifier, +/-100V, +/-0.5A, 80dB gain, DC-15 KHz	\$500
8007B, Pulse Generator, 100 MHz	\$450
8084A, Word Generator Plug-In, 300 MHz	\$275
8444A-059, Tracking Generator, 0.5-1500 MHz	\$600
8445B-2-3, Tracking Prescaler, 1.8-18 GHz	\$400
8484A, Power Sensor, 10MHz-18GHz, -20dBm to -70dBm	\$200
8620C-011, Sweep Oscillator Mainframe, GPBIB	\$400
86250D, RF Plug-In, 8.0-12.4 GHz	\$375
86290B, RF Plug-In, 2.0-18.6 GHz	\$1400
8640B, Signal Generator, 0.5-512 MHz	\$1200
86602B, RF Plug-In, 1-1300 MHz	\$600
8660C/86631B/86602A, Synth Sig Gen, 1.3 GHz, HPBIB	\$1800
8901B-1-3, Modulation Analyzer, 150KHz-1300MHz	\$4000
9411B, Automatic Test Station Switch Cont, HPBIB	\$750
X486A, Thermistor Mount, 8.0-12.4 GHz	\$50
X752D, Directional Coupler, 20dB, 8.0-12.4 GHz	\$50

465, 100 MHz Dual Trace Oscilloscope	\$425
475, 200 MHz Dual Trace Oscilloscope	\$650
577D1/177, Storage Curve Tracer w/ std test fixture	\$1700
7104, 1 GHz O'Scope Mainframe	\$1700
7603-1, 100 MHz O'Scope w/ 7A26, 7B53A	\$300
7A13, 105 MHz Differential Comparator	\$150
7A18, 75 MHz Dual Trace Amplifier	\$50
7A22, 1 MHz High CMRR Differential Amplifier	\$200
7A24, 400MHz Dual Trace Amplifier	\$250
7A26, 200 MHz Dual Trace Amplifier	\$75
7B10, 1GHz Delayed Time Base	\$350
7B50A, 150 MHz Time Base	\$75
7B53A, 100 MHz Dual Time Base	\$75
7B70, 200 MHz Time Base	\$75
7B80, 400 MHz Delaying Time Base	\$100
7B85, 400 MHz Delta Delaying Time Base	\$100
7B92A, 500 MHz Dual Time Base	\$150
7CT1N, Curve Tracer Plug-In	\$300
7S14, 1 GHz Dual Trace Delayed Sweep Sampler	\$550
AM503, Current Probe Amplifier	\$350
DC5009, 135 MHz Universal Timer/Counter	\$375
DM501, 4.5 Digit Multimeter	\$150
FG502, 11MHz Function Generator	\$200
FG504, 40MHz Function Generator	\$500
P6015, 40kV, 1000X, 75MHz High Voltage Probe	\$250
P6460, Data Acquisition Probe (for 1240/1241 Analyzer)	\$200
P6602, Temperature Probe	\$125
PS5004, Precision Pwr Sup, 0-20V, GPBIB, 0.01% +/-2mV	\$600
PS5010, Prog Tripple Pwr Sup, TM5000 series	\$450
PS503A, Tripple Pwr Sup, (2) 0-20@1A, 5V@1A	\$150
S-3A, Sampling Head, DC-1 GHz	\$175
S-53, Trigger Recognizer Head (new)	\$250
SG503, Leveled Sinewave Generator	\$550
TG501, Time Mark Generator	\$400
TM5006, 6-slot Programmable Power Module	\$350
TSG170A, NTSC TV Generator	\$2800

MISCELLANEOUS

AEMC SL206, AC/DC Current Probe, 2A & 80A ranges	\$100
AEMC MD400, AC/DC Current Probe, 400A range	\$100
BECO 315A, Universal Impedance Bridge	\$200
Bird 10A, Plug-in Element for Bird 43, 10W@25-60 MHz	\$40
Bird 100A, Plug-in Element for Bird 43, 100W@25-60 MHz	\$40
Bird 43, Thru-line Wattmeter w/ Leather Case	\$175
Cal Inst 101T/850T, AC Power Source, 0-120 VAC, 45Hz-5KHz, 100 Watt	\$650
Cal Inst 101T/850T, AC Power Source, 0-600 VAC, 45Hz-3KHz, 100 Watt	\$800
Clarostat 240C, Power Decade Resistor	\$100
Dorn-Margolin ELT6, 1, Aircraft Locator Transmitter	\$150
Dranetz 606-3/101-103, Line Disturbance Analyzer	\$450
Ectron 760DLU, Differential Amplifier, DC-50KHz	\$300
EIP 548A-1-2-8-9, Microwave Counter, 10 Hz-26.5 GHz	\$2800
DAC out, GPBIB, rear input, power meter	\$2800
Fluke 5100B-03-05, Meter Calibrator	\$3400
Fluke 5200A, AC Voltage Calibrator	\$1250
Fluke 6010A, Synthesized Func Gen, 10Hz-11MHz, HPBIB	\$800
Fluke 8050A-01, 4-1/2 Digit Multimeter w/battery opt.	\$175
Fluke 8860, 5.5 Digit Multimeter	\$250
Fluke 8920A, Digital RMS Voltmeter, 10Hz-20 MHz	\$475
Fluke 8922A, Digital RMS Voltmeter, 2Hz-11 MHz	\$475
GenRad 1433B, 6-Decade Resistor, 0-1,111,110 ohms	\$450
GenRad 1454-A11 4-Decade Voltage Divider	\$100
Giga-Tronics 900/2-8, Synthesized Sweep/Sig. Gen, 2-8 GHz, opt 026 GPBIB	\$1150
Heise 711B, Digital Pressure Gauge, 0 to 30 PSI, 0.5%	\$475
JCSystems JCS20, Temperature Setpoint Programmer	\$200
Keithley 181, 6.5 Digit Nanovoltmeter, GPBIB	\$850
Keithley 485, Autorangeing Picoammeter	\$400
Keithley 614, Electrometer	\$700
Kepco BOP20-10M, Op Amp/Pwr Sup, +/-20V, +/-10A	\$500
Krohn-Hite 6620, Precision Phasemeter	\$550
Lambda LK350-FMOV, Pwr Sup, 0-20V@35A	\$300
Lambda LQ-532, Pwr Sup, 0-40V@5A, Dig Display	\$175
Laser Precision TD-9920, OTDR w/ case & manual	\$575
Narda 3293-2, Directional Coupler, 1-12.4 GHz (N type)	\$150
Narda 4203-16, Directional Coupler, 2-18 GHz (SMA)	\$100
Narda 8616, RF Radiation Monitor w/probes	\$450
Oram Power Supply, 270V@10A	\$900
Phoenix 5500-300-1, V3.5 Interface Plug-in	\$300
Phoenix 5500-624-1, T1 Interface Plug-in	\$350
PowerDesigns 2020B, Prec Pwr Sup, 0-20V@2A, 1mV res	\$150
PowerDesigns 6050C, Multirange Variable Pwr Sup, 0-6V@5A, 0-15V@3A, 0-30V@2A, 0-60V@1A	\$200
Simco SS-2X, Electrostatic Locator w/ probe	\$100
Sorensen Power Supply, 5V @ 200A	\$450
SysDon 101, 10 MHz Pulse Generator	\$75
Valhalla 4440, 4-1/2 Digit Voltmeter / Counter	\$125
Varian VZU6998H5, 12.4-18GHz TWT Amp, 60dB gain	\$2250
Wavetek 154, Prog Waveform Gen, .001Hz-10MHz	\$200
Wavetek 175, Arbitrary Waveform Generator, GPBIB	\$600
Wavetek 186 (rack), 5 MHz Phase Lock Generator	\$250
Wavetek 271-02, 12MHz Pulse/Func Gen, GPBIB	\$700

TEKTRONIX

1740, NTSC Waveform/Vector Monitor	\$1850
2236, 100MHz Dual Trace O'Scope w/ Counter & DMM	\$1150
2337, 100 MHz O'Scope	\$850
2465, 300MHz Four Channel Oscilloscope	\$2600

WANTED

Send us a list of your extra catalogs and manuals



TEST EQUIPMENT PLUS
(520) 575-6967, FAX (520) 575-6936
3331 W. Bright Terrace, Tucson, AZ 85741



Write in 57 on Reader Service Card.

Nuts & Volts Magazine/April 1998 47

The Computer Controlled World: RS-232 Network Control Methods and Application

CHARACTER LCD

by Ryan Sheldon, National Control Devices (404) 244-2432 <http://members.aol.com/ncdcat>

NETWORKABILITY

Character LCD displays have become an integral part of many projects for the hobbyist and professional engineer. RS-232 character display controllers are now commonplace in many applications. While most commercially available controllers are easy to use, few allow you to control more than a single display from a single serial port.

A few years ago, I came up with an inexpensive way to control up to 16 character LCD displays of any size using only two wires from the RS-232 port of my computer. For about \$15.00 per controller, this solution is by far the cheapest and most versatile.

The LCD display controllers in this article support modular RS-232 networking. Modular networking allows you to control up to 16 different devices in any combination from a single RS-232 serial port.

In the Dec. '97 issue, you learned how to build a simple relay controller that supports modular RS-232 networking ("RS-232 Relays"). In March '98, you learned how to read data into the computer using a modular input scanner ("Opening Windows to the World").

You can use a single serial port to control the relay driver you built in December, and the Input

Scanner you built in March to the LCD display controller you build this month.

Future articles will explain how to add graphic LCD display modules, video character overlays, video matrix switchers, and a variety of motor controllers to this network. So you can quickly see that modular networking is extremely powerful.

Using a modular programming structure enables complete control over a device with a single line of

programmer.

Figure 2. The example above shows a typical program containing two modules. The first module allows you to control character LCD displays while the second allows you to control graphic LCD displays. Modules contain their OWN set of subroutines. This greatly reduces programming clutter and simplifies future program maintenance.

Typical Program Structure

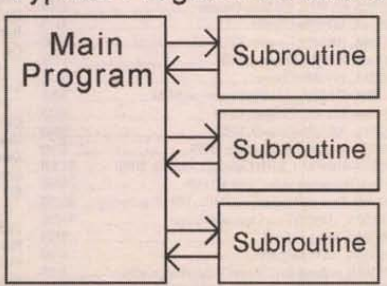


Figure 1. The example above shows a typical program structure where a main program is used to call subroutines. After the subroutine has executed, control is returned to the main program.

code, making the network easy to control for even an entry-level pro-

Modular Program Structure

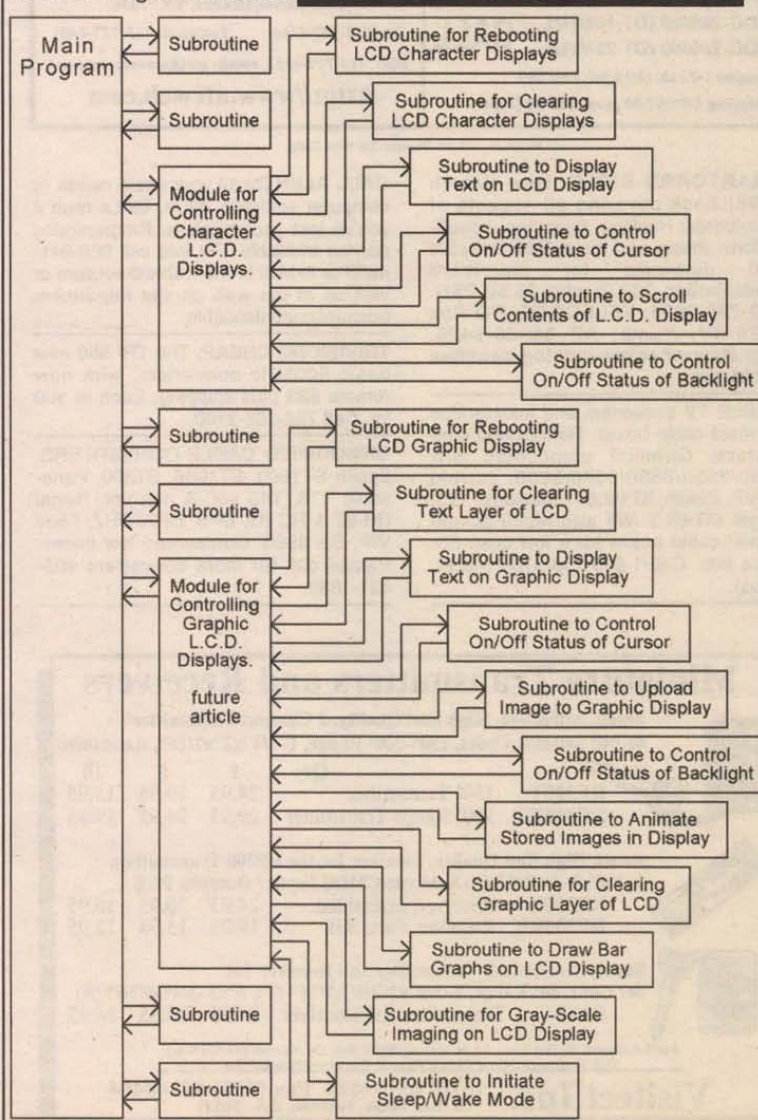
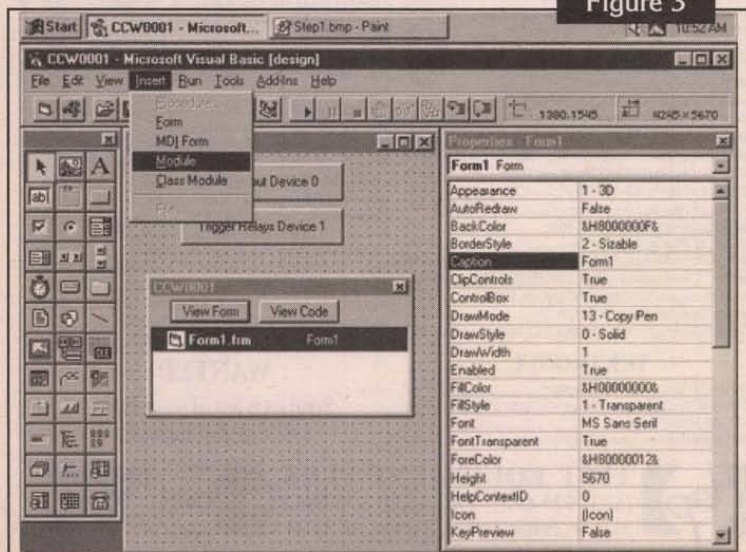


Figure 3



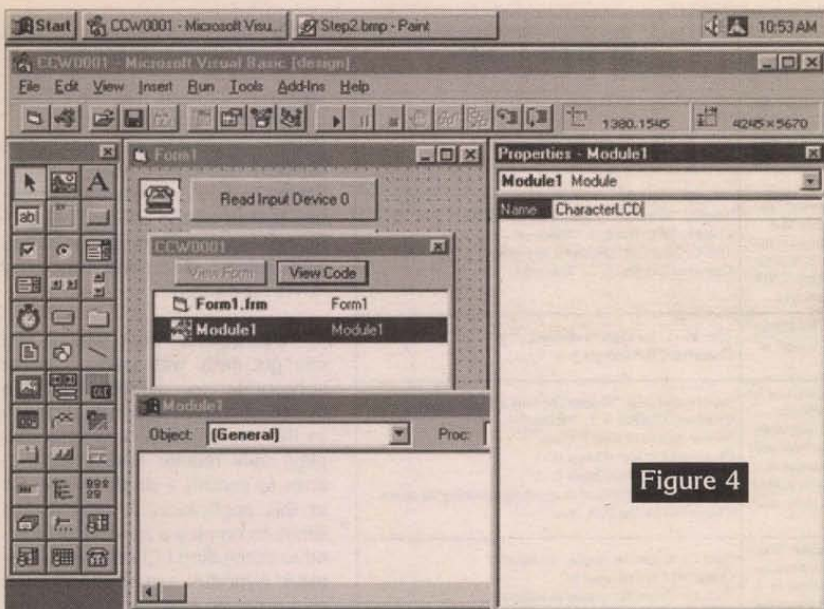


Figure 4

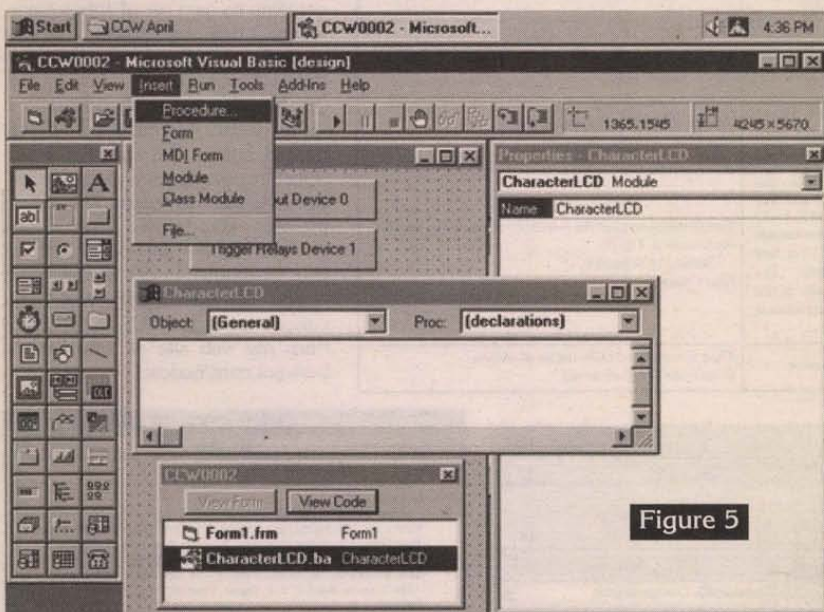


Figure 5

Possible Applications

Let's say for a moment that you wanted to build a computer-controlled security system for your house. The modular RS-232 network allows you to ask the input scanner if an intruder has been detected with a SINGLE line of code (a subroutine call). If an intruder was detected, you could use another line of code to activate a relay that sounds an alarm.

And now you can use a couple more lines of code to write a simple message on a display that tells your family that an intruder was detected. If you're like me, you might even add a line of code to the program to tell the relay driver to lock the intruder in a room.

All of these things are easily accomplished using RS-232 modular networking. Some of my readers are actively developing a security system very similar to the one described above. In addition, they are also using other components of this modular network to switch video and audio, turn on or off time-lapse video recorders, and make detailed log entries of traffic flow

throughout secure buildings.

Modular RS-232 networking is perhaps the most powerful type of network available for three simple reasons: 1) Users can choose the building blocks for their specific computer control application. 2) Modular hardware that supports this communications protocol is very inexpensive and is readily available at the board or chip level. 3) Modular networkability makes use of your existing RS-

Pin#	Name	I/O	Function
1	Vss	--	Ground
2	Vdd	-	+5 Vdc
3	Vic	-	Contrast Adjustment
4	RS	Input	Register Select 0 - Instruction 1 - Data
5	R/W	Input	Read/Write to Display 0 - Write to Display 1 - Read from Display (not used)
6	E	Input	Command/Data Strobe
7	DB0	I/O	Data Bit 0 (not used)
8	DB1	I/O	Data Bit 1 (not used)
9	DB2	I/O	Data Bit 2 (not used)
10	DB3	I/O	Data Bit 3 (not used)
11	DB4	I/O	Data Bit 4
12	DB5	I/O	Data Bit 5
13	DB6	I/O	Data Bit 6
14	DB7	I/O	Data Bit 7

Table 1

Figure 7

Module: CharacterLCD.BAS

```

Sub Test(Device, Lin, TTY)
    'Set the cursor on the user-selected
    'line of the display
    If Lin = 1 Then Line1 Device
    If Lin = 2 Then Line2 Device
    If Lin = 3 Then Line3 Device
    If Lin = 4 Then Line4 Device

    If TTY <> "" Then
        'Count from 1 to the length of characters
        'held in TTY
        For n = 1 To Len(TTY)
            'Convert String into ASCII code
            SEND = Asc(RMid(TTY, n, 1))
            'Split and Send ASCII value to the display
            'Part1
            WriteData Device, ((SEND And 240) / 16) + 16
            'Part 2
            WriteData Device, ((SEND And 15) / 16) + 16
        Next n
    End If
End Sub

```

Each subroutine in this module is responsible for controlling a specific function on an LCD character display. Up to 16 LCD character displays of various sizes can be attached to a single RS-232 serial port using only two wires.

This module has been used with character LCD displays of various sizes from 16x1 to 20x4 and should be compatible with any character display up to 40x4.

Provisions have been included in this module for software control of an EL or LED backlight.

In addition, this module is compatible with displays made by EPSON, Optrex, Hitachi, AND, and many other manufacturers.

```

Sub WriteData(Device, Dat)
    'Compute the Device Number
    Dev = Device * 16
    'Crop out first half of incoming Dat
    A = Dat And 15
    'Crop out second half of incoming Dat
    B = (Dat And 240) / 16
    'Transmit first half
    Foral.MSCom.Output = Chr(A + 0 + Dev)
    'Transmit second half with strobe (2)
    Foral.MSCom.Output = Chr(B + 2 + Dev)
    'Note: Display controlled in 4-bit mode
End Sub

```

```

Public Sub Backlight(Device, Status)
    'If Status = 0 then turn off backlight
    If Status = 0 Then
        'Turn Off Backlight
        WriteData Device, 0
        WriteData Device, 8
    Else
        'Otherwise, Turn On Backlight
        WriteData Device, 0
        WriteData Device, 4
    End If
End Sub

```

```

Public Sub MoveCursor(Device, Direction)
    'If Direction = -1 then Move Left
    If Direction = -1 Then
        'Move Cursor to the Left
        WriteData Device, 1
        WriteData Device, 1
    End If
    'If Direction = 1 then Move Right
    If Direction = 1 Then
        'Move Cursor to the Right
        WriteData Device, 1
        WriteData Device, 5
    End If
End Sub

```

```

Public Sub SetCursor(Device, Status)
    'If Status = 0 then Turn Off Cursor
    If Status = 0 Then
        'Send Command to Turn Off Cursor
        WriteData Device, 0
        WriteData Device, 12
    End If
    'If Status = 1 then
    If Status = 1 Then
        'Send Command to Turn On Cursor
        WriteData Device, 0
        WriteData Device, 13
    End If
    'If Status = 2 then
    If Status = 2 Then
        'Send Command to Turn On Understore
        WriteData Device, 0
        WriteData Device, 14
    End If
End Sub

```

```

Public Sub SetCursor(Device, Status)
    'If Status = 0 then Turn Off Cursor
    If Status = 0 Then
        'Send Command to Turn Off Cursor
        WriteData Device, 0
        WriteData Device, 12
    End If
    'If Status = 1 then
    If Status = 1 Then
        'Send Command to Turn On Understore
        WriteData Device, 0
        WriteData Device, 14
    End If
End Sub

```

```

Sub SetLine(Device, Lin)
    'Position Cursor on line 1
    If Lin = 1 Then
        WriteData Device, 14
        WriteData Device, 12
    End If
    'Position Cursor on line 2
    If Lin = 2 Then
        WriteData Device, 10
        WriteData Device, 12
    End If
    'Position Cursor on line 3
    If Lin = 3 Then
        WriteData Device, 6
        WriteData Device, 4
    End If
    'Position Cursor on line 4
    If Lin = 4 Then
        WriteData Device, 13
        WriteData Device, 4
    End If
End Sub

```

```

Sub RebootDisplay(Device)
    'Compute a Device Number
    Dev = Device * 16
    'Send Reboot Instructions 3 times to
    'ensure reboot
    For Count = 1 To 3
        'Reset Buffer
        Foral.MSCom.Output = Chr(Dev + 0)
        Foral.MSCom.Output = Chr(Dev + 0)
        'Send Init Codes
        WriteData Device, 0
        WriteData Device, 2
        WriteData Device, 0
        WriteData Device, 3
    Next Count
End Sub

```

```

Public Sub Scroll(Device, Direction)
    'If Direction Is -1 then Scroll Left
    If Direction = -1 Then
        'Scroll Contents of the Display Left
        WriteData Device, 1
        WriteData Device, 11
    End If
    'If Direction Is 1 then Scroll Right
    If Direction = 1 Then
        'Scroll Display Contents to the Right
        WriteData Device, 1
        WriteData Device, 12
    End If
End Sub

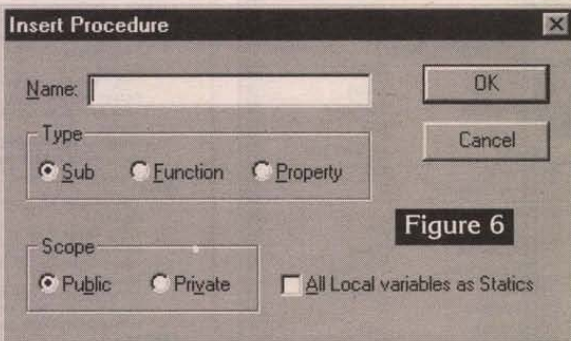
```

```

Sub ClearScreen(Device)
    'Send Commands to Clear the Screen
    WriteData Device, 0
    WriteData Device, 1
End Sub

```

Figure 6



232 serial port eliminating the need for expensive add-in cards.

Software

A modular RS-232 network requires the use of software that is just as modular as the hardware ... that is, software that holds control routines for your specific computer control application. The modular network makes use of subroutines and modules for all control functions.

I have already spent several hundred hours developing subroutines that work for the various devices. So my primary objective is to provide you with the information you require to use the subroutines I have already written. Again, I will focus on controlling these displays using Visual Basic 4 Professional under Windows 95. If you are not a VB programmer, you should find the code easily adaptable to your native language.

The subroutines I have already written are, what I call, control routines. Control routines serve as "ready-made" bridges between the programmer and a real-world control device. These bridges are perhaps the most powerful tool for the programmer because they completely eliminate the complexities of speaking to hardware. And for the non-programmer, control routines make the logical steps of computer control much easier to understand.

For our purposes here, a control routine tells external hardware what to do. It may tell a relay to turn on, read the status of an input, or display a line of text on this month's character LCD display. But keep in mind, these control routines were designed to eliminate programming. To simplify the programming aspect of this project, two types of control routines will be used: subroutines and modules.

Subroutines are the most common type of control routine. In last month's issue, we discussed the usage of subroutines. In summary, it was the responsibility of the subroutine to perform the actual data transmission to control an individual device. The

Subroutine Name	Description	Example Usage
WriteData	Sends data to the controller formatted for communication using the NCD RS-232 modular network protocol. WriteData is used for sending commands and data directly to the LCD display.	<i>Not For Use by User</i>
Text	Sends ASCII text directly to the display. The Device parameter may be any number from 0 to 15 defining which LCD display on the network is going to receive the text. LIN is the line of the display that will hold the text. TEXTS contains the string of text that is displayed.	'Display "Welcome" on Line 1 of Device 0 CharacterLCD.Text 0, 1, "Welcome" 'Display "Network" on Line 2 of Device 5 CharacterLCD.Text 5, 2, "Network"
Backlight	Controls the on/off status of the backlight. Device is a number from 0 to 15. 0 turns off the backlight while 1 turns it on.	'Turn on (1) backlight of device 3 CharacterLCD.Backlight 3, 1
MoveCursor	Moves the cursor left or right. This function is useful as a backupspace for editing purposes. Device is a number from 0 to 15 indicating which display will have the cursor relocated while Direction is a -1 for left movement or 1 for right movement. The cursor will be shifted 1 character in the direction indicated every time this subroutine is called.	'Incorrectly Spells "Welcme" on Line 1 of Device 0 CharacterLCD.Text 0, 1, "Welcme" 'Moves the cursor back 2 spaces CharacterLCD.MoveCursor 0, -1 'Display "ome". LINE=0 to avoid repositioning the cursor. CharacterLCD.Text 0, 0, "ome"
SetCursor	Sets the cursor type. Device is a number from 0 to 15 indicating which display will have the cursor setting changed. A status setting of 0 turns off the cursor, 1 turns it on, and 2 uses the underscore "_" character for the cursor.	'Turn Off Cursor for display at address 9 CharacterLCD.SetCursor 9,0 'Turn On Cursor for display at address 9 CharacterLCD.SetCursor 9,1
SetLine	Positions the cursor at the beginning of any of 4 lines of the display. Device is a number from 0 to 15 indicating which display will receive the SetLine command.	'Positions the cursor at Line 3 of a 20x4 display at address 0 CharacterLCD.SetLine 0, 3
RebootDisplay	Initializes the display for the first time. Device is a number from 0 to 15 that determines which display is to receive the reboot command.	'Reboots the LCD display at address 0 CharacterLCD.RebootDisplay 0
Scroll	Scrolls the contents of the display left or right. This function is useful for simple scrolling effects. Device is a number from 0 to 15 indicating which display will have the contents scrolled while Direction is a -1 for left movement or 1 for right movement. The display will be shifted 1 character in the direction indicated every time this subroutine is called.	'Scrolls the contents of the display 20 characters to the left. For Counter = 1 to 20 CharacterLCD.Scroll 0, -1 Next Counter
ClearScreen	Clears the display on the selected device.	'Clear the screen of LCD display at address 0 CharacterLCD.ClearScreen 0

Figure 8

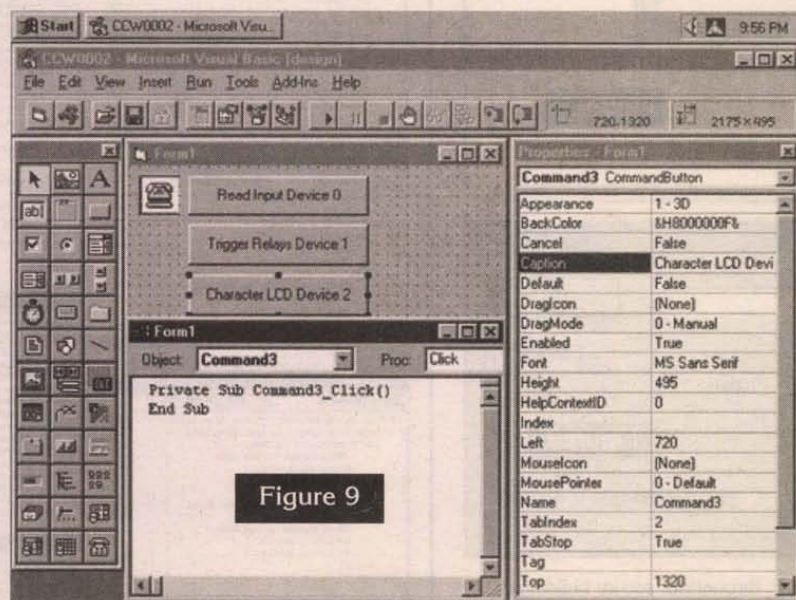
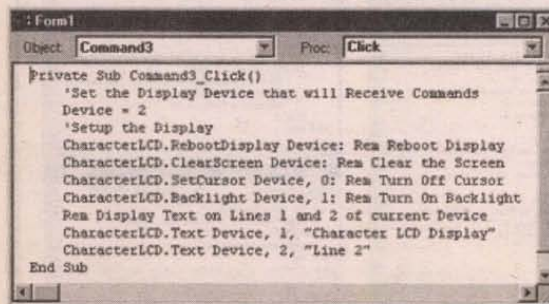


Figure 9



main program contained a set of buttons that could be clicked. When activated, the buttons would tell a subroutine to turn off a relay or maybe read an input. The actual lines of code within the subroutines do the work (and have already been written for you). This allows you to perform powerful hardware instruction calls with

Figure 10. The above program demonstrates how to speak to the CharacterLCD module and how to tell subroutines within the module to control the display.

a single line of code.

An example subroutine call:

Device = 0 : Rem Tells the subroutine which device to speak to.
Relay = 3 : Rem Tells the subroutine to speak to the third relay.
Status = 1 : Rem Tells the subroutine to turn on the selected relay.
Relay8 Device, Relay, Status : Rem Subroutine Call to control the relay driver hardware.

Subroutines work well if you can get away with using a single subroutine to control a single device. But some applications (such as this month's LCD character display) may require several subroutines to control a single device. So in this application, it only makes sense to employ a module dedicated to controlling LCD character displays. A module can best be defined as a program within a program that contains its own set of subroutines. Figure 2 demonstrates the role of a module in a typical computer-control application.

Modules are easily added to a Visual Basic 4 application. If you missed out on last month's article "Opening Windows to the World," you may want to read it. This article provides step-by-step instructions on how to use the serial port of your computer under Visual Basic 4. You can download the VB4 application source, "CCW0001.ZIP," from my web site at: <http://members.aol.com/necdcat/>.

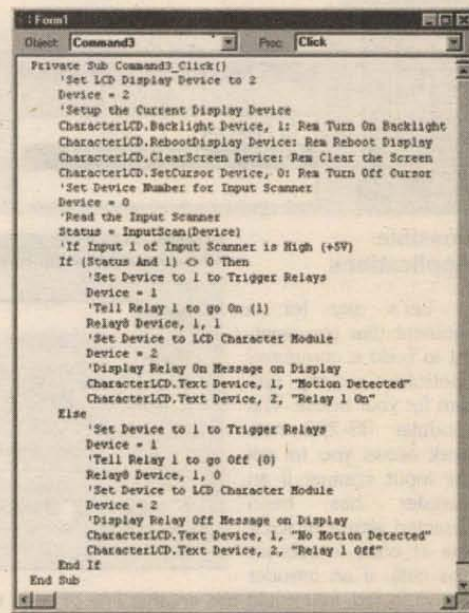


Figure 11. The above program demonstrates integration of three different devices attached to a single RS-232 serial port. Using the example code, you can easily ask the input scanner for a current status, and control a relay driver or a character LCD based on the received input.

CharacterLCD.BAS Module

We'll start by creating a module that works with

would tell an LCD display module set to address 3 to clear its screen. For example, to initialize and clear multiple LCD display, the following statements could be used:

```
CharacterLCD.RebootDisplay 0 :
  Rem Reboots the display at
  address 0
CharacterLCD.ClearScreen 0 : Rem
  Clears LCD display set to
  address 0
CharacterLCD.RebootDisplay 1 :
  Rem Reboots the display at
  address 1
CharacterLCD.ClearScreen 1 : Rem
  Clears LCD display set to
  address 1
CharacterLCD.RebootDisplay 2 :
  Rem Reboots the display at
  address 2
CharacterLCD.ClearScreen 2 : Rem
  Clears LCD display set to
  address 2
CharacterLCD.RebootDisplay 3 :
  Rem Reboots the display at
  address 3
CharacterLCD.ClearScreen 3 : Rem
  Clears LCD display set to
  address 3 etc. ...
```

The SetCursor subroutine is used to turn off the cursor adding aesthetic appeal to professional installations. But during development, you may want to leave it on.

The next subroutine — Backlight — is used to turn on the backlight of the selected LCD display. As you can see, using the CharacterLCD module is really very easy.

Displaying Text on the LCD

Writing text to the user-selected display requires little effort. All you have to do is tell the Text subroutine which display is to receive the text (device number), which line the text will be displayed on (line number), and which string of text to display.

The Text subroutine is far more powerful than you might think. For example, using a value of 0 for the "line" parameter writes text starting from wherever the cursor happens to be located. A value of 1 positions the cursor at the left-most side of line 1 and then begins writing text in a right-reading direction. Similarly, line values of 2, 3, or 4 home the cursor on the beginning of the selected line. Note that line values of 3 and 4 should only be used on a four-line display.

Sending an actual text message to the display is also very easy. If you are using a 20x4 display, your text message for line 1, 2, 3, or 4 should never exceed 20 characters. Similarly, if you are using a 40 character display, your text message should not exceed 40 characters. Extra characters will be truncated.

Project Integration

As promised, the LCD character display can share the serial port with a relay driver and the input

I would again like to encourage readers to contact me by phone at (404) 244-2432 or E-Mail me at ncdryan@aol.com with technical questions. If I'm not around, please leave a message. Your call will be returned. The NCD-LCDII interface processor is only available from National Control Devices, (404) 244-2432, <http://members.aol.com/ncdcat/>.

National Control Devices is owned by Ryan Sheldon, who actively supports the research and software developments for the Language Research Center, Georgia State University.

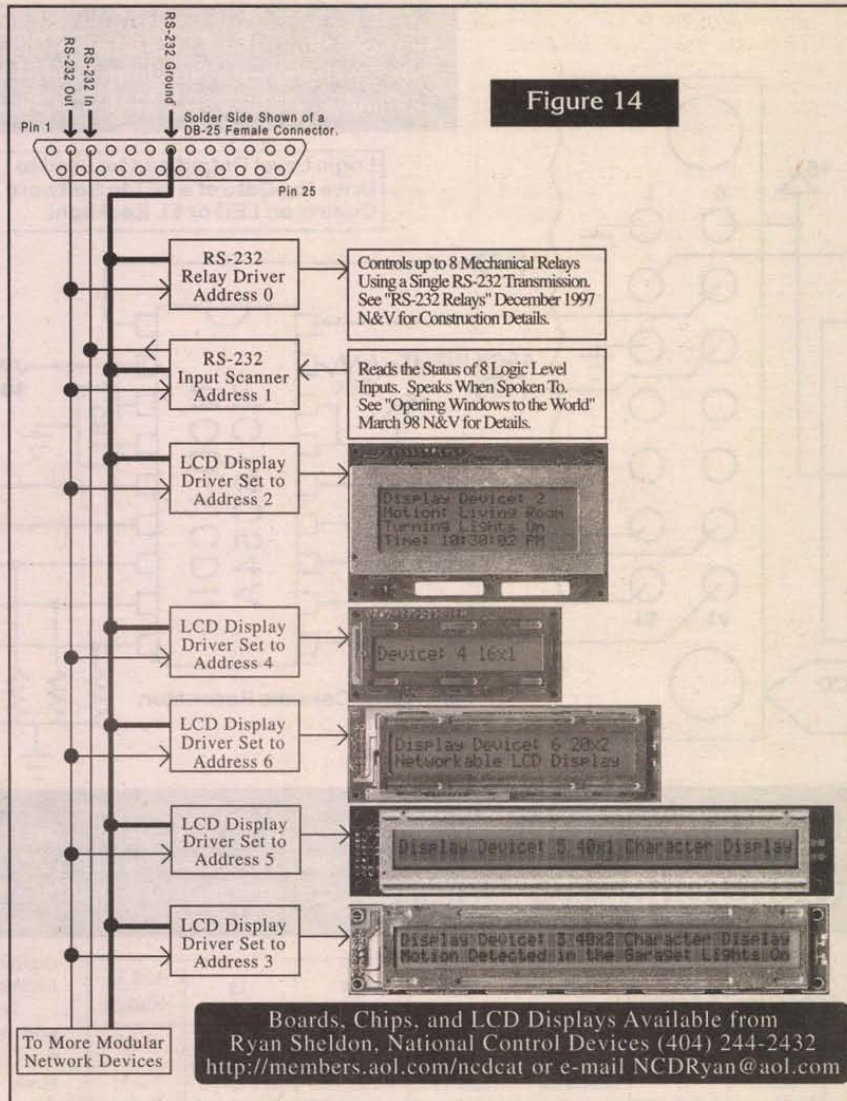


Figure 14

single 18-pin package provides addressing to 16 individual displays, two user-selected baud rates, back-light control, and universal compatibility with virtually all LCD character modules ever created. Because of its low cost and low parts count, the LCDII is ideally suited for integration in just about any project.

The Display

Character LCDs (unlike graphic LCDs) conform to a standard pinout. Whether you buy Epson, Optrex, or any other manufacturer, they will all have a 14-pin connection that is compatible with the NCD-LCDII display processor. Pin 1 is clearly marked (usually) on the LCD board. The pinout for all manufacturers is shown in Table 1.

LCDII Implementation

The LCDII processor does not make use of all logic lines going into the LCD display. For example, pin 5 is always tied low, meaning the LCDII will only write data to the LCD display. No read functions are required for this application so the read mode is never used. In addition, pins 7 to 10 are never used. The LCD display is controlled by the LCDII processor in four-bit mode. The LCDII must provide four data bits (on pins 11 to 14), and then a strobe pulse (pin 6). This must be done twice to write a single character to the display.

Hardware Networking

As you know by now, up to 16 modular networkable devices can be attached to a single RS-232 serial port. The NCD-LCDII implements this very simple networking system by making use of four jumpers. These jumpers define a range of ASCII characters that will be used for all instructions. For example, if you wanted to set a modular networkable device to address 0 (see Figure 13), you would remove jumpers J1-J4, and the device set to address 0 would only listen to ASCII characters 0 to 15. Similarly, if a device were set to address 6, you would need to remove jumpers J1 and J4 and install jumpers J2 and J3. The device set to address 6 would ONLY listen to ASCII characters 96 to 111. As illustrated in the table below, your computer (or microcontroller) can provide up to 256 ASCII characters, permitting up to 16 individual devices to listen to their own range of characters.

Networkable Interface

So far you've learned how to write the software and build the modular networkable hardware. Now all you have to do is attach the networkable devices of your choice to a single RS-232 serial port (in any combination of your choice). Figure 14 illustrates RS-232 connection of multiple modular networkable devices. Note that only three wires are required to support this network. This illustration demonstrates the power modular networkability offers the user.

Next time, I'm going to highlight inexpensive wireless communications methods. Watch for next article—"Naked Data"—and see how easy (and cheap) it is to control the world without wires ... all from your desktop PC using Visual Basic. NV

scanner you learned to build in previous articles. Figure 11 provides a self-explanatory integration of the relay driver, input scanner, and the CharacterLCD module in a real-world application. Read through the code just to get an idea of how easy it is to use subroutines and modules to control multiple devices.

The Hardware

As you can see in Figure 12, building the character LCD display controller is really very simple. The controller consists of little more than a PIC, a ceramic resonator (CR1), and a few resistors.

LCD displays require a negative voltage to position the crystals into view. This voltage is easily generated by using one-half of a MAX680. The 680 can generate up to -10 volts which is compatible with any size character LCD. The 10K potentiometer controls the LCD drive voltage level. Varying the LCD drive voltage level changes the contrast. The 47μF capacitors on the 680 serve as a chargepump and are critical for proper operation. Do not confuse the LCD drive voltage with the supply voltage. The supply voltage must provide +5 volts for the logic of the LCD display.

The LCDII Interface

Processor RS-232 data comes into the NCD-LCDII display processor on pin 2, gets decoded, and drives the logic, command, data, and strobe lines of the character LCD ... but ONLY if data is sent to the correct address as defined by jumpers J1-J4.

The LCDII is perhaps the easiest, most expandable, and cheap LCD display controller available. This

CABLE TV cont.

SCIENTIFIC ATLANTA™, unmodified, original 8570s field pulls \$75 ea., 10 lot min. Call 706-398-2100.

CABLE CONVERTERS original equipment with remote. Top condition. \$90 and \$130 with volume. Hurry! Limited quantities. Free shipping! COD only 412-833-0773.

CONVERTER REPAIR PARTS, CASES, TUNERS, REMOTE CONTROLS, AS LOW AS \$1 EACH. 407-676-2530. NO FLORIDA SALES.

ENGINEERING SERVICE. MEMORY DEVICES PROGRAMMED, AND MUCH MORE. 407-676-2530.

FOR SALE: Genuine unmodified Tocom 5503 VIP, SA 8600s; Panasonic volume control converters, Pioneer addressable from \$65; NSC 550MHz ch. 4 for \$25; new Zenith volume control 99 ch. from \$55; DPV-5 or DPV-7, Zenith 1600s series as-is from \$25 or guaranteed from \$65; SA 8600 remotes from \$3.50; Jerrold remotes model 400 & 450 from \$1.50. Prices negotiable based on quantities. Other brands available. Call Mon-Fri 11am-6pm EST. 1-800-909-4333, FAX: 718-657-4015.



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.

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.

TUNERS TOCOM 5503 tested \$4.75 ea., bargain, 10 lot min. Call 706-398-2100.

TOCOM UNMODIFIED 5503 CABLE CONVERTERS UNTOUCHED. \$6 EACH. 10 LOT MIN. CALL 706-398-2100.

FREE CABLE DESCRAMBLER PLANS! For details write: Sierra Publishing, 909 E. Yorba Linda Blvd., Suite H-181, Dept. NVB, Placentia, CA 92870.

WE PROGRAM 16Cs, 68HCs, 16V8, 22V10, 2764 EEPROMs for your electronic needs. 30 days money back guarantee. KCS 1-800-879-8820.

HACKERS GOLD CD-ROMs. Two volumes. The most complete underground collection of hackers files ever assembled. 550+ megabytes on each! Published: February 1998. Either CD-ROM \$34.95. Both \$49.95. 520-726-2833. **TELECODE**, PO Box 6426-NV, Yuma, AZ 85366-6426. <http://www.hackerscat.alog.com/hackgold.htm>

DESCRAMBLER PLANS, schematics, instructions, illustrations, PCB patterns, parts list, parts layout, easy-to-build, complete construction manual: **UNIVERSAL BASEBAND** plan \$20; **DIGITAL RF Jerrold** compatible plan \$20; **SUPER TRIMODE Jerrold** compatible plan \$20; **PIO3+ DIGITAL** pan plan \$35; **OAK SIGMA 3D** emulator station plan \$25. Money orders or cash only, catalog \$3 (free with order). Ponderosa Company, 7645 North Union Boulevard Suite 501, Colorado Springs, CO 80920.

WANTED: GENUINE RAW UNMODIFIED CABLE TV CONVERTERS. TOP CASH PAID. Call 1-800-538-CABLE.

VISIT OUR WEB SITE AT WWW.ALLCABLE.COM

CABLE TV CONVERTERS: LOWEST PRICES AROUND. 30 DAY MONEY BACK GUARANTEE. DEALERS WELCOME. 1-800-538-CABLE.

ZENITH ST-1000 complete as-is \$50, ST16XX 99 ch refurbished \$95. 702-270-4341.

TRIVISIONS CHEAP. The TRI 550 new basic 500MHz converters, with new remote \$38 plus shipping. Each in 100 lot. Call 706-398-2100.

CABLE BOX COVERS TOCOM 5503, good condition \$3.75 ea. 20 lot min. Call 706-398-2100.

SCIENTIFIC ATLANTA™, unmodified, original 8570s field pulls \$75 ea., 10 lot min. Call 706-398-2100.

PC BOARDS REPAIRED. Prices start at \$5. Minimum 25 of one type. Network Sales, 616-683-0500.

WANTED: RAW & unmodified cable converters. Please call 1-800-370-0801.

SONY PLAYSTATION mod chips allow you to play CDR backups & imports. \$50 ea. Quantity discounts. 1-800-663-8530.

EVERYTHING YOU need for **CABLE** and more. Parts & accessories. Best prices & quantity discount. **WE DON'T SELL BOXES.** 1-800-MODULE-0.

152800 110-160 Dec97-May98 CABLE CONVERTERS, remotes, etc., free flyer. Jake 1-800-879-9657.



ACE COMPUTERS Our 15th Year
Delivering Power and Performance for Less since 1983
(800) ACE-5936 www.acecomputers.com

Home Office Pro

- Intel 430TX Chipset w/512K Pipelined Burst Cache
- 32 Megs SDRAM
- 32X Speed CD-ROM Drive, Multimedia compatible
- 4.3 GB UDMA Hard Drive/1.44M Floppy Drive
- 56K X2 Fax/Modem with VoiceMail
- Diamond Stealth 3D ViRGE Video PCI 4M EDO
- 15" SVGA Monitor w/0.28 Dot Pitch
- 16 Bit Plug & Play Sound Card with Speakers
- Microsoft Ergonomic Style Mouse/104 Keyboard
- Mini-Tower Case w/250W UL Pwr/2 Fans
- Airmedia Wireless Internet Antenna
- Microsoft Win 95 or Windows NT 4.0 (Add \$99)

Add OfficeStar \$199 with System!

*P166MMX-\$1399 *P233MMX - \$1549
*AMD K6-200-\$1499 *P11-233MMX-\$1699
*P200MMX - \$1479 *P11-266MMX-\$1799
*AMD K6-233-\$1579 *P11-300MMX-\$1999

SVGA Monitors

- VISIONMASTER**
- Iiyama Visionmaster 350 - 15" 0.28 Dot Pitch, Digital, 1280 x 1024 \$289
 - Iiyama Visionmaster 8617E 0.28 Dot, 1600 x 1280, Digital \$549
 - Iiyama Visionmaster 9017E 0.25 AG - PC Editor's Choice 9/97 \$629
 - Iiyama Visionmaster 450 - 19" Monitor - 0.26 Pitch - Brand NEW!! \$829
 - Iiyama Visionmaster 8221E 21" Monitor, 1800 x 1440 Resolution \$1249
 - Iiyama Visionmaster 9221E 21" Diamondtron, 1800 x 1440 Resolution \$1299
 - Iiyama Visionmaster Profit 35 CM LCD Monitor, Incredible Screen \$1299
 - Megaplus 14" Non-Interlaced 0.28 Dot Pitch \$149
 - Megaplus 15" Non-Interlaced 0.28 Dot Pitch \$199
 - Sony Multiscan 15sf Trinitron, Digital \$329
 - Megaplus 17" Non-Interlaced, 0.28 Dot Pitch, 1280 x 1024 \$349
 - Goldstar 17" Non-Interlaced, 0.26 Dot Pitch, 1600 x 1280 \$399
 - Panasonic S70, 0.27 Pitch, 3 Year warranty-1 Year onsite! \$479
 - MAG Innovation DJ700 - 0.26 Dot Pitch, Digital, JAG Controls \$529
 - NEC Multisync XV17+ - 0.25 Dot Pitch, ClearaClear, Digital \$549
 - Sony Multiscan 17" - 0.28 Dot Pitch, Trinitron \$899
 - Viewsonic 17GA - 0.27 Dot Pitch, inboard speakers \$579
 - MAG Innovation MX-21F, 0.28 FST \$1299
 - NEC Multisync P1150, 0.28 Dot Pitch \$1799
 - Sony SPD300 SFT, 0.25 AG, Trinitron Tube \$1899
 - Viewsonic 21-810 \$1399

MOTHERBOARDS FOR

PENTIUM® PROCESSORS

- BCM 575 AT-430TX, P75-233PCI w/512K DIMM, MMX \$129
- BCM 550 ATX-430TX, P75-233PCI w/512K DIMM, MMX \$129
- Tyan Tomcat, Single/Dual CPU, w/8 SIMMs, 512K \$149/\$159
- Tyan Turbo-2 AT/ATX, Intel 430TX w/6 SIMM/2 DIMM 512K \$139
- SuperMicro P55MM98-Intel 430TX, 512K \$149
- Quicktek, P75-200 w/Adapteq 2940UW SCSI2, 512K Pipe. \$259
- ASUS TX971/TX97E, AT-430TX, P75-233 PCI w/512K \$149

MOTHERBOARDS FOR THE PENTIUM® PRO PROCESSOR

- BCM 600 - 150-200 Mhz, Intel 440FX Chipset, PCI/ISA \$199
- Supermicro AT or ATX 150-200, Intel 440FX, PCI/ISA \$219
- Tyan Titan Pro - Single/Dual processor PCI/ISA, AT or ATX \$209/\$279
- Intel PR440FX - Dual Pro, UW SCSI, 10/100 LAN, Audio, ATX \$449

MOTHERBOARDS FOR THE PENTIUM® II PROCESSOR

- BCM 632 - Intel 440LX Chipset, PCI/ISA/AGP/DIMMs, ATX \$179
- Intel AL440LX - Intel 440LX, PCI/ISA/AGP/DIMMs, Audio, ATX \$199
- Asus P2197 - Intel 440LX, PCI/ISA/AGP, ATX \$179
- Asus P2197S - Intel 440LX, PCI/ISA/AGP/UW SCSI, ATX \$249
- Supermicro P6LS-440LX, Single P2, PCI/AGP/DIMM/UW SCSI \$269
- Supermicro P6DLS-440LX, Dual P2, PCI/AGP/DIMM/UW SCSI \$399
- Supermicro P6SLA - Intel 440LX, PCI/AGP/ISA/DIMMs, ATX \$179
- Soltek SL61B-440LX, PCI/AGP/ISA-AT FORM, SIMM/DIMM \$179

CLOSEOUT BOARDS FOR THE PENTIUM® PROCESSOR

- Tyan Tomcat III - Intel 430HX, Single or Dual Processor \$99/\$129
- Tyan Titan III/Titan VX - Intel 430FX/IVX, 256K Cache \$79
- Iwili Triton with onboard Adapter, Wide SCSI2 \$149

SCSI Powerstation II

- Intel 440 LX Chipset w/2940UW SCSI Controller
- Intel Pentium II Processor with 512K Cache
- 32 Megs High Speed SDRAM (Exp. to 384Mb)
- 32X Speed CD-ROM Drive, Multimedia compatible
- 9.1GB Ultra Wide SCSI2 Drive, 7200 RPM
- 1.44M Floppy Drive
- 56K X2 Fax/Modem with VoiceMail
- AGP Video - 4M RAM Installed
- 17" Monitor 0.26 Dot Pitch (1600 x 1280 Res)
- Yamaha 3D Wavetable Sound w/Amplified Speakers
- Airmedia Wireless Internet Antenna
- Microsoft PS/2 Mouse/104 Keyboard
- MidTower ATX Case w/3 Fans
- Microsoft Win95 or Windows NT 4.0 (Add \$99)

P11-233MMX-\$2299
P11-266MMX-\$2399
P11-300MMX-\$2499
P11-333MMX-\$2599

Memory/Microprocessors

30 PIN SIMM MODULES

- 1M x 9 SIMM/SIPP \$8/\$10
- 4M x 9 SIMM \$23

72 PIN SIMM MODULES

- 4M NonParity/EDO/Parity \$12/\$12/\$25
- 8M NonParity/EDO/Parity \$20/\$20/\$39
- 16M NonParity/EDO/Parity \$29/\$29/\$49
- 32M NonParity/EDO/Parity \$62/\$59/\$99
- 64M EDO/Parity \$189/\$199

168 PIN DIMM MODULES

- 16M SDRAM 10 ns \$40
- 32M SDRAM 10 ns \$59
- 64M SDRAM 10 ns \$159
- 128M SDRAM 10 ns \$299

MICROPROCESSOR CHIPS

- Pentium® PII-333/300 Mhz \$599/\$499
- Pentium® PII-266/233 Mhz \$379/\$279
- Pentium® Pro 200 Mhz - 256K \$449
- Pentium® Pro 180 Mhz/150 Mhz \$199/\$149
- Pentium® 233 MMX/200 MMX \$199/\$129
- Pentium® 200 Mhz/166 MMX \$179/\$109
- Pentium® 166 Mhz/133 Mhz \$99/\$89
- Pentium® 120 Mhz/100 Mhz \$85/\$79
- AMD K6 - 233/200 MMX \$159/\$139
- Pentium® II/Pro/Pentium® Fans \$20/\$15/\$8

CD-ROM/Modems/Sound

CD ROM DRIVES

- Mitsumi EIDE 4X, 145 ms \$34.99
- Mitsumi EIDE 16X, 145 ms \$64.99
- Toshiba EIDE 32X, 85 ms \$79.99
- Panasonic SCSI2 8X, 145 ms \$79.99
- NEC SCSI2 16X, 105 ms \$99.99
- Toshiba 32X SCSI2, 80 ms \$129.99
- Plexstor 32X SCSI2, 80 ms \$239.99
- HP CD-Writer EIDE CD/RW \$399.99
- HP CD-Writer Parallel CD/RW \$489.99
- Plexstor 4X/12X CD-Writer SCSI2 \$489.99
- Creative Labs DVD2 Encore Kit \$299.99

MODEMS

- 56K X2 Compatible with Voice \$69.99
- USR Sportster 56K Int/Ext \$149/\$159
- USR 56K Voice Int/Ext \$159/\$179
- USR 56K Courier Int/Ext \$175/\$205
- (\$30 Rebate on USR 56K Modems!)

SOUND CARDS

- Diamond Monster Sound MX80 \$89.99
- Creative Sound Blaster 16 PNP \$49.99
- Creative Sound Blaster 64 Value \$79.99
- Creative Sound Blaster 64 Gold \$169.99

Network Equipment

NETWORK INTERFACE CARDS

- Microdyne NE2000 - ISA Coax/AUI Network Card \$14.99
- Microdyne Home Gaming Kit (2 Cards, Coax Cable) \$24.99
- Microdyne NE2500 - ISA Twisted Pair Network Card \$29.99
- Microdyne NE2500 - ISA Combo Network Card \$39.99
- 3Com Etherlink III - ISA Combo Network Card \$79.99
- Microdyne NE2500 - ISA Combo 5 Pack \$119.99
- Microdyne NE5500 - PCI Twisted Pair Network Card \$49.99
- Microdyne NE5500 - PCI Twisted Pair 5 Pack \$179.99
- SMC Etherpower - Twisted Pair Ethernet Card \$49.99
- 3COM Etherlink XL - PCI Twisted Pair Ethernet Card \$59.99
- SMC Etherpower - PCI Combo Ethernet Card \$69.99
- Microdyne NE5500 - PCI Combo Network Card \$69.99
- Microdyne NE5500 - PCI Combo 5 Pack \$249.99
- 3COM Etherlink XL - PCI Combo Ethernet Card \$89.99
- SMC Etherpower II - 10/100 PCI Ethernet Card \$69.99
- 3COM Etherlink XL - 10/100 PCI Ethernet Card \$79.99
- Intel Etherexpress Pro - 10/100 PCI Ethernet Card \$79.99
- Intel Etherexpress Pro - 10/100 PCI 5 Pack \$349.99

NETWORK CONCENTRATORS (HUBS)

- 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
- SMC Tigerstack 12 Port/24 Port Hubs with NMM \$479/\$899

CALL ABOUT NETWORK EQUIPMENT NOT LISTED!

Enhanced IDE & SCSI2 Hard Drives

ENHANCED IDE AND ULTRA DMA DRIVES

- 1.08 Gig Western Digital, 10 ms access \$109.99
- 1.75 Gig Seagate, 12.5 ms access \$124.99
- 2.14 Gig Seagate, 12 ms access \$129.99
- 2.14 Gig Western Digital, 10 ms access \$139.99
- 2.14 Gig Quantum Fireball Ultra DMA, 9 ms \$149.99
- 2.55 Gig Maxtor Diamondmax, 9 ms access \$159.99
- 3.1 Gig Western Digital, 11 ms access \$189.99
- 3.2 Gig Quantum Fireball Ultra DMA, 9 ms \$189.99
- 4.0 Gig Western Digital, 10 ms access \$199.99
- 4.3 Gig Seagate Ultra DMA, 12 ms \$199.99
- 4.3 Gig Quantum Fireball Ultra DMA, 9 ms \$219.99
- 5.0 Gig Micropolis Mustang, 9 ms access \$219.99
- 5.1 Gig Western Digital, 10 ms Ultra DMA \$219.99
- 6.4 Gig Quantum Fireball, Ultra DMA, 9 ms \$279.99
- 6.4 Gig Seagate Medalist Pro, Ultra DMA, 9 ms \$279.99
- 6.4 Gig Western Digital, 10 ms Ultra DMA \$279.99
- 8.4 Gig Quantum Fireball, Ultra DMA, 9 ms \$349.99

SCSI2 DRIVES

- 2.1 GB Quantum Fireball Ultra SCSI, 9 ms \$229.99
- 2.1 GB Quantum Atlas Ultra Wide, 9 ms \$249.99
- 3.2 GB Quantum Fireball Ultra SCSI, 9 ms \$269.99
- 4.3 GB Quantum Fireball Ultra SCSI, 9 ms \$299.99
- 4.5 GB Micropolis Tomahawk Ultra 8 ms \$349.99
- 4.5GB Seagate Hawk Ultra/Ultra Wide 7200RPM \$349/\$379
- 4.5 GB Seagate Barracuda Ultra/Ultra Wide, 7.9 ms \$529/\$579
- 6.4 GB Quantum Fireball Ultra SCSI, 9 ms \$389.99
- 8.7 GB Micropolis Tomahawk Ultra SCSI2, 8 ms \$469.99
- 9.1 GB Micropolis Tomahawk UW SCSI2 \$499.99
- 9.1 Gig Seagate Barracuda Ultra/Ultra Wide 7.9 ms \$729.99
- 9.1 Gig IBM Deskstar Ultra Wide 7 ms \$749.99
- 9.1 Gig Seagate Cheetah Ultra/Ultra Wide \$949/\$1029
- 9.2 Gig Seagate Elite Ultra/Ultra Wide \$2199.99

SVGA Cards and Accelerators

- Trident PCI with 2M DRAM / AGP with 4M \$39 /\$79
- Diamond Stealth 3D, 2M/4M DRAM PCI \$69/\$89
- ATI Video Xpression 2M PCI \$49
- Diamond Monitor 3D II - 30FX Voodoo Chipset Add-On \$249
- Matrox Mystique 220 PCI with 4M RAM \$119
- Matrox Millennium II PCI/AGP 4M/8M WRAM \$179/\$249
- Matrox Millennium II Rainbow Runner/TV Tuner \$199/\$399
- ATI Xpert @ Work/Xpert @ Play AGP 4M (BM + \$50)/\$179/\$199
- ATI Wonder Pro 330 Pro AGP with 4M RAM \$179
- ATI All in Wonder Pro PCI/AGP 4M/8M \$239/\$299

PLANS: DESCramBLE CABLE FOR UNDER \$12. PLUS TWO FREE BONUSSES. TOLL FREE 1-888-588-3715.

WANTED PIONEER 5XXX-6XXX SERIES CONVERTERS, RAW, LOTS 5 OR MORE, TOP CASH PAID. 702-642-0325.

B & M FOR your CABLE needs, we carry accessories and parts only for most makes and models. For information, please call 626-443-6510.

SIGMA ONE, 3D, 2000, and 2001 unmodified cable boxes avail. \$125+ 808-949-5410. No descrambler sales!

TELEPHONE/FAX

EXTENSION PHONE LOCKOUTS. Prevent trashed downloads and FAX blasting. Easily installed with screwdriver. 99 cents each plus \$6.50 per order. Docs included. **SYNERGETICS SURPLUS**, Box 809, Thatcher, AZ 85552. 520-428-4073. VISA/MC. synergetics@tinaja.com

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.

CALLER-ID PHONELINE simulator. Test/demonstrate telephone devices without phoneline! Six direct dial extensions, Caller-ID, distinctive ringing. Authentic dial tone, busy signals, 20Hz ringing. "Party-Line" kit includes PCB, all components, microprocessor, documentation, \$199.95. Custom enclosure \$32.95. Fully assembled \$425. Shipping \$8. Checks, credit cards. Digital Products Company, 134 Windstar Circle, Folsom, CA 95630. 916-985-7219, Fax 916-985-8460, E-Mail: digprod@aol.com Web site: www.digitalproductsco.com

WHAT!!! YOU don't have TELECODE's NEW 1998 "HACKER CATALOG," yet! 125+ items. Call 520-726-2833. Surf online at: <http://www.hackerscatalog.com>



MYSTERIES OF PROGRAMMING MOTOROLA CELLULAR PHONES! (CURRENT MODELS) IDEAL 120-PAGE TRAINING MANUAL for cell phone users & dealers. Contains extensive information-schematic diagrams, data port & cable hook-ups. Sorry no software. \$39.95 PP/PMO. **LESS BUSTERS ELECTRONICS**, 2039 CIVIC CENTER DR. #176, N. LAS VEGAS, NV 89030. Mail order only 702-642-0325.

TELEPHONE CATALOG of Panasonic, SWB, Intertel and more, including alarm systems, parts, and all phone accessories. Free catalog by voice or fax: 732-840-1390 or www.heselectronics.com Get the full 44 page version by sending \$2 to HES Electronics, POB 183, Brick, NJ 08723. Mention this ad and get a \$10 certificate!

BEEPER, TWO-WAY radio repairs, modifications, duplications, all models, test equipment. Call TJ 718-341-1849, Fax 718-978-4616.

CELLULAR PHONE EXTENSIONS. Two cellular phones on one number, no extra monthly charges. 601-843-1044. E-Mail: tm1044@intop.net

CELLULAR EXTENSIONS \$60 plus shipping. Motorola loader phones \$200. Loader phone kits \$100. Call Stuart at 228-831-8708 after 5:30 pm. CST or E-Mail ccomco@aol.com

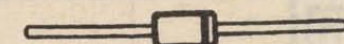
BLUE BOOK PHONE REPAIR. 1000 models answering machines, cordless, wired, \$25. KEN's, 2825 Lake, Kalamazoo, MI 49001 616-345-4609.

COMPONENTS

DON LANCASTER'S ACTIVE FILTER COOKBOOK is back in print. Auto-graphed copies of the seventeenth(!) classic printing \$28.50. **SYNERGETICS PRESS**, Box 809-N, Thatcher, AZ 85552. 520-428-4073. Visa/MC.

WANT TO Buy: ICs, military & aircraft relays, diodes, transistors, Cannon, TRW, Amp, Burndy, Deutsch, Bendix connectors, electronic test equipment & most components. **Hoffy Electronic Ent.**, 818-718-1165, FAX 818-341-5506.

VISIT OUR WEB SITE AT WWW.ALLCABLE.COM



AMAZING! 2¢ ALL DIODES: 1N4148, 1N4001, 1N4004, 1N4007 (1,000 pcs./package). Also in stock for 7¢: 1N5401, 1N5404, 1N5408 (200 pcs./package). Schottky diodes for 10¢: 1N5817, 1N5818, 1N5819 (200 pcs./package). Brand new parts. Add \$5 freight. Gateway Products Corporation, PO Box 936397, Margate, FL 33093, 954-974-6864, Fax: 954-974-6818. VISA/MC. Free Catalog.

AMAZING PRODUCTS!

ELECTRONIC & SCIENTIFIC DEVICES

NEW LASER WINDOW BOUNCE SCIENCE PROJECTS

Remarkable concept allows user to hear sounds within a premise over a beam of laser light reflected from a window or similar surface. Experimental device provides hours of interesting and educational use. Utilizes a visible red laser that simplifies alignment and discourages illegal use. Usable range will vary—expect about 20 to 50 meters. Optional lens will increase range 200 to 400 meters! Further range requires expensive optics. Requires a sturdy video tripod (not incl.). Caution-check local law in your state if planning to use for accessing oral communication. **REQUIRES OPTICAL ALIGNMENT**

LWB5 Plans.....\$20.00 LWB5K KIT/PLANS.....\$149.50
LWB50 Ready to Use With Selected Laser Pointer.....\$249.50
LWB70 Above With High Performance Laser Gun Sight, Long Range Extender Lens and Cushioned Headsets.....\$299.50

ULTRA BRIGHT LASERS

4 to 7x brighter 650-630 nm Radiation
 ALL METAL CONSTRUCTION
 1 YEAR WARRANTY

LAPN65 15mw equiv 2000 ft.....\$29.95
LAPN65F Focusable Above LAPN65.....\$39.95
LAPN63F Focusable/4000' Range.....\$69.95

FOCUSABLE LASER POINTERS

Complex Output Device Projects Visible Lines
 Coherent Line, and Geometric Shapes and Patterns
 Great Construction Aids or Special Lighting Effect
 Produce a Small Light Show

LAPN65PT 15 mw equiv 6670nm.....\$29.95

FANTASTIC VISUAL EFFECTS

Complex Output Device Projects Visible Lines
 Coherent Line, and Geometric Shapes and Patterns
 Great Construction Aids or Special Lighting Effect
 Produce a Small Light Show

LAPN65PT 15 mw equiv 6670nm.....\$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

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 feet. Proven theory may require additional experiment

HOVER Plans.....\$25.00

3 MI FM BROADCAST TELEPHONE TRANSMITTER

Tunable On FM Broadcast, Excellent Telephone Project. Only Transmits When Phone is Used
WPM7K Kit/Plans.....\$39.50
BEEP1K Beeper Alert Kit.....\$19.95

HIGH POWER STUNGUNS

STUN100 100KV StunGun.....\$29.50
STUN200 200KV StunGun.....\$49.50
STUN300 300KV StunGun.....\$69.50

JACOBS LADDER

Observe a pyrotechnical display of "traveling" fire 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 Minus Case.....\$129.50
JACK10 Ready to Use.....\$249.50

250KV TESLA COIL

10-14" of Explosive Bolts of Lightning
 Transmits Wireless Energy
 Strange and Bizarre pyrotechnical effects.
 Ion Motors Anti-Gravity
 Size 20" H x 8" W
 Weight - 25 Pounds
 115 Volts/2 Amps AC
 Labeled "Use Caution"

BTC3 Plans.....\$15.00
BTC3K Kit/Plans.....\$399.50
BTC30 Ready to Use.....\$499.50
BTC4 Plans 500KV 24 to 30".....\$20.00

HIGH CRIME AREA SECURITY

INFINITY+ TRANSMITTER
 ROOM MONITOR/LINE GRABBER/CONTROLLER
 MONITOR YOUR PREMISES
 Avoid intruders and break ins.
 ACCESS ON GOING CALLS
 Longhold (voicemail)
 CONTROL 8 APPLIANCES
 Remote control your home!
 EXTRA ADDED FEATURE!!!
 12 Call Mode from Play Phone

TELCN3 Plans.....\$10.00
TELCN3K Kit/Plans.....\$99.50
TELCN30 Ready to Use.....\$199.50

PHASOR BLAST WAVE PISTOL

130 db of Directional Sonic Shock Waves
 Handheld and Battery Operated
PPP1 Plans.....\$8.00
PPP1K Kit/Plans.....\$49.50
PPP10 Ready to Use.....\$79.50

ATTENTION! HIGH VOLTAGE EXPERIMENTERS

Battery Powered Mini Sized Modules for research in:
 HOVERCRAFT, ION GUNS
 FORCE FIELDS, SHOCKERS etc
MINIMAX4 4KV@10ma.....\$19.50

USES SCATTERED AND DIRECT REFLECTIONS

System setup shown using scattered reflection method

RECEIVER
 CYLINDRICAL ENCLOSURE
 BUILT IN VOICE FILTER
 ULTRA LOW NOISE DESIGN
 9 VOLT BATTERY
 WITH HEADPHONES

SELECTED FOR COHERENCE
 4mm Ø45mm visible red BATTERY OPERATED & has

LAGUN2 Plans.....\$20.00

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

KINETIC ELECTRIC GUN

PIONEER A FUTURISTIC WEAPON!
 500 Joules Energy Storage
 Constant Current Charging
 Triggered Spark Switch
 Ballistic Velocities
 Handheld Battery Operated
 Labeled & Dangerous product

EGUN1 Plans with Parts List.....\$20.00
All Parts are Individually Available

3MI FM BC TRANSMITTER

Safety Product 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

ION RAY GUN PROJECTS ENERGY

Star Wars Technology Demonstrates Weapons Potential!
IOG7K Kit/Plans.....\$99.50

ATTENTION! RAILGUN EXPERIMENTERS

HIGH ENERGY PULSER

RAIL GUN, COIL GUN, EXPLODING WATER, ANTIGRAVITY, MASS WARPING, LEVITATION, PLASMA PROPULSION, LANCE SHAPPING, 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 (Minus Energy Storage).....\$199.50
HEP30 Assembled (Minus Energy Storage).....\$299.50
HEPCAP 800 Joules Energy Storage.....\$199.50

WIRELESS LAB KITS

ALL PARTS TO BUILD 6 EXCITING TRANSMITTER PROJECTS

1 Super Sensitive Ultra Clear 1 Mile+ Voice Transmitter
 2 1 Mile+ Telephone Transmitter
 3 Line Powered Telephone Transmitter Never Needs Batteries!
 4 Tracking/Homing Beacon "Beeping" Transmitter
 5 Transmitter Rebroadcasts Video or Audio Outputs
 6 Short Range TV/FM Disrupter NEAT FRANK!! Discretion Advised

All 6 Above Kits Plus FREE Info Data Pack on "HELPER HINTS Building and Tuning" Wireless Devices
COMBOX Parts and Plans for above.....\$59.50
COMBOP Plans for all the above.....\$10.00

GRAVITY GENERATOR

Demonstrates a unique phenomena of electrical forces that produce the effect of "anti-gravity". You build and levitate a small mock space ship from simple materials. Excellent scientific demonstration of a fascinating method of levitation.

Levitate an Object!
GRA1 Plans and Book.....\$20.00
GRA1K Pwr Sup Kit/Plans.....\$99.50
GRA10 Assembled Pwr Sup.....\$149.50

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

Extended X4 Play
 Tapes Phone Conversation 20 Mins Input 21 Check Laws!
TAP30X Ready to Use.....\$84.50
BEEP10 Beeper Alert.....\$29.95

SHOCK FORCE FIELD/VEHICLE OBJECT ELECTROFUSER

Hard Shock, Stun, Wound, Electricity Objects. Great Payback for Those Who Suffer!
SHK1K Kit of Pwr Module.....\$19.50

CAUTION: MISHAPING IS ILLEGAL!

INFORMATION

UNLIMITED DEPT NV 1098
 BOX 716 AMHERST, N.H. 03031

24 Hr Toll FREE "Orders Only" Line 1-800-221-1705

Fax Your Order to 1-603-672-5406

9 to 5 pm EST Information Line 1-603-673-4730
 See Our Web Site at <http://www.amazing1.com>

We Accept MC, VISA, Cash, MO,

Checks. Please add \$5.00

Shipping. COD Orders Add Additional \$4.75.
 FREE CATALOG ON REQUEST!!

TONY TALLI'S ORIGINAL TELEVIEW DISTRIBUTORS

WHERE OUR VALUED CUSTOMERS' BUSINESS
IS HONESTLY APPRECIATED

**SERVING YOUR CABLE
NEEDS SINCE 1984**

1-800-847-3773

Not
affiliated
with NCCA.

Vega One **ORDERS ALSO ACCEPTED**

1-800-525-0428 P.M. SALES

Orders called in by 1:00 pm shipped same day. \$15 shipping.
NO NEVADA SALES • Hours: M-F 9-4 PST

FREE

1 YEAR
SUBSCRIPTION TO
NUTS & VOLTS
WITH \$500.00
MIN. ORDER

FREE Golf Hat with \$150 purchase.

FREE T-Shirt with \$500 purchase.

Call for this month's Nuts & Volts Specials

YES!
WE HAVE
COUPONS!

GIVE TELEVIEW TONY A CALL TODAY!
1-702-253-1852 • FAX 1-702-253-1854

P.O. BOX 71465 • LAS VEGAS, NV 89170-1465





*For all your cable needs
Call us first!*

**SIX-MONTH GUARANTEE
(30-DAY MONEY BACK)**

**Phone 630-616-8050
or
Fax 630-616-8094**

For orders only: 1-800-742-2567

HOURS: MON.-FRI. 8-6 CST • SAT. 10-2 CST

Greenleaf Electronics • P.O. Box 538 • Bensenville, IL 60106



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, \$8.00. **CANON BJC-600** (BC-201) Single Black or Single Colors (3 refills) \$8.00. **CANON BJ-130/300/330 & IBM Exec Jet** (Cart #BJ1-481 & BJ1-642) 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-20, 9 refills BCI-21 black, 30 refills BCI-11 black, 10 refills BCI-10) \$19.00. **CANON BJC-4000/BJC70** and Apple Stylewriter 2400 Tri-color kit - 6 refills each color for BCI-21 or 15 refills each color for BCI-11 \$24.00. **CANON BJC-800/820/880** 3-bottle kit (for BJ1-643B) \$19.00. **CANON BJC-800/820/880** 3-bottle tri-color kit (Cart #BJ1-643CMY) \$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 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

Gonilla 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 Infomunner \$8.00; Commodore MPS-801 \$5.00; MPS 803 \$5.00; 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.extremepay.com/occomp/orr.htm>

Write in 56 on Reader Service Card.

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

Write in 95 on Reader Service Card.

EZ-EP DEVICE PROGRAMMER - \$169.95

Check Web!! - www.m2l.com

Fast - Programs 27C010 in 23 seconds

Portable - Connects to PC Parallel Port

Versatile - Programs 2716-080 plus EE and flash (28F, 29C) to 32 pins

Inexpensive - Best for less than \$200

- Correct implementation of manufacturer algorithms for fast, reliable programming.
- Easy to use menu based software has binary editor, read, verify, copy, etc. Free updates via bbs or web.
- Full over current detection on all power supplies protects against bad chips and reverse insertion.
- Broad support for additional devices using adapters listed below.

Available Adapters

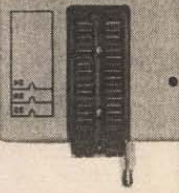
EP-PIC1 (16C5x, 61, 62x, 71, 84)	\$49.95
EP-PIC84 (16C62-5, 72-4)	\$39.95
EP-PIC12 (12C50x)	\$39.95
EP-PIC17 (17C4x)	\$49.95
EP-51 (8751, C51)	\$39.95
EP-11E (88HC11 EIA)	\$59.95
EP-110 (88HC711D3)	\$39.95
EP-16 (16B1 EPROMs)	\$49.95
EP-28 (28A02, 3, 4, 6, 7, 8)	\$39.95
EP-SE2 (83x, 24x, 25x, 85x)	\$39.95
EP-750 (87C750, 1, 2)	\$59.95
EP-PEEL (1CT22x10, 18x6)	\$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

M2L Electronics

310/837-7818
Fax/BBS: 310/841-6050
3526 Jasmine #4,
Los Angeles, CA 90034
CA orders please add 8.25% sales tax.
<http://www.m2l.com>

EZ-EP
M2L ELECTRONICS
Los Angeles, California (310) 837-7818



Write in 172 on Reader Service Card.

COMPONENTS cont.

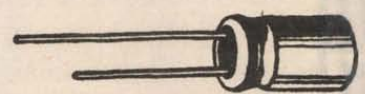
ELECTRONIC COMPONENTS and kits. Catalog \$1. Dan's Small Parts and Kits, Box 3634, Missoula, MT 59806. Web: <http://www.fix.net/dans.html>



AMAZING! 35¢ ALL TOGGLE SWITCHES. Brand new. Rated 6A/125V. Hardware included. 1/4" panel hole SPDT on-on, SPDT on-off-on, DPDT on-on, DPDT on-off-on. Minimum 100 pcs., no mixing. Add \$5 freight. Gateway Products Corporation, PO Box 936397, Margate, FL 33093, 954-974-6864, Fax: 954-974-6818, VISA/MC. Free catalog.

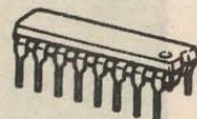
MILLIONS \$\$\$ in "scrap gold" from old computers and electronics junk. Message: 603-645-4776 or www.tiac.net/users/quiksand/goldtek.htm

RF TRANSISTORS, tubes, electrolytics. 2SC2879, 2SC2290, 2SC1969, 2SC2166, MRF454, 2SC1307, 2SC2029, 2SB754, 2SC2312, TA7222AP, 4CX250B, 572B, 12D6Q, 6JS6C, 3-500 graphite, trimmers, resistors. Westgate 1-800-213-4563.



AMAZING! 4¢ ALL ELECTROLYTICS: 1uF/50V, 2.2uF/50V, 3.3uF/50V, 4.7uF/50V, 10uF/25V, 22uF/25V, 33uF/25V, 47uF/25V. Also in stock: 100uF/25V 5¢, 220uF/25V 7¢, 330uF/25V 9¢, 470uF/25V 10¢. Brand new parts. Minimum 1,000 pcs. per package, no mixing. Add \$5 freight. Gateway Products Corporation, PO Box 936397, Margate, FL 33093, 954-974-6864, Fax: 954-974-6818. VISA/MC. Free Catalog.

MILITARY TRANSISTORS & DIODES & INTEGRATED CIRCUITS WANTED. ELECTRONIC MATERIAL INDUSTRIES 818-769-1002, FAX 818-769-1084.



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.

FLASH MEMORY AMD 29F010-120JI PLCC, \$2; Atmel 29C020-12 PLCC, \$3.25; AMD 29F040-90JI PLCC, \$4.50; 27C512-15 DIP, \$1.25; CCTV cameras starting at \$80; 10BASE-T Ethernet Xcvr, \$15. Pictures, information and more items available on web site: www.7shades.com/memory Scott at 310-325-8456.

RF FERRITE and iron powder cores. Free catalog. Palomar Engineers, PO Box 462222, Escondido, CA 92046, 760-747-3343. Palomar@compuserve.com

Closing Date
For Next Issue - April 6th

Honey, I
shrank the
COMPUTER!

PicStics are like BASIC Stamps® on steroids. They have more speed, more parallel I/O, more code and data space, and more neat features like a real-time clock, 12-bit ADC, and 12-bit DAC.

www.micromint.com



As low as \$29

Call for a catalog or visit our Web site today.

(800) 635-3355
(860) 871-6170

BASIC Stamp is a registered trademark of Parallax, Inc.

by
Fred
Blechman

Build Quick Henry to Measure Inductance



Build this simple adapter for use with your audio or RF signal generator and you can measure inductance values from 1 microhenry to over 1 henry. It uses an internal or external analog microammeter, or an oscilloscope, as a peak or null indicator.

Measuring the inductance of a choke, transformer, intermediate frequency (IF) can, toroid, open-air, or any other coil is a relatively clumsy process for the home experimenter or small repair shop. Unless equipped with an inductance bridge, the measurement of inductance is usually avoided because of the difficulty in making the measurement.

However using "Quick Henry" and two simple charts, anyone with an audio frequency (AF) generator can measure inductance quickly and easily from 1 millihenry (mH) to over 1 henry (H). With the use of a radio frequency (RF) generator, measurements can be made down to one microhenry (μH).

Figure 2: Resonant Frequency vs. Inductance (Audio Range)

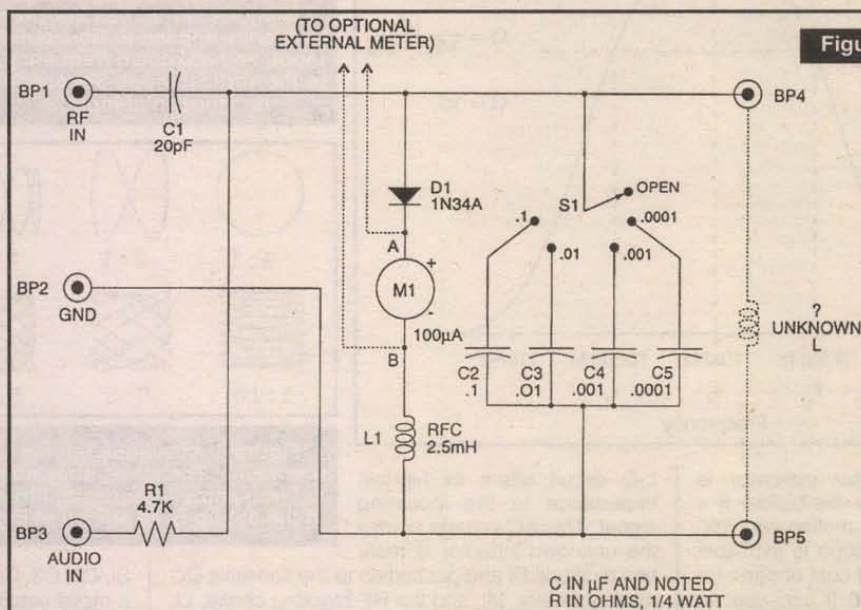
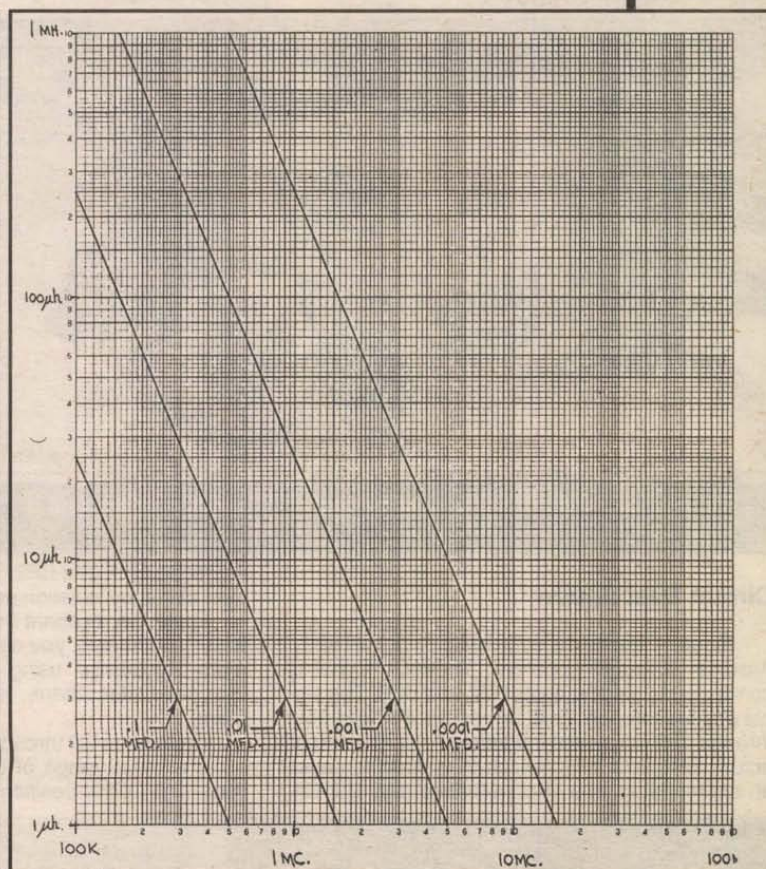
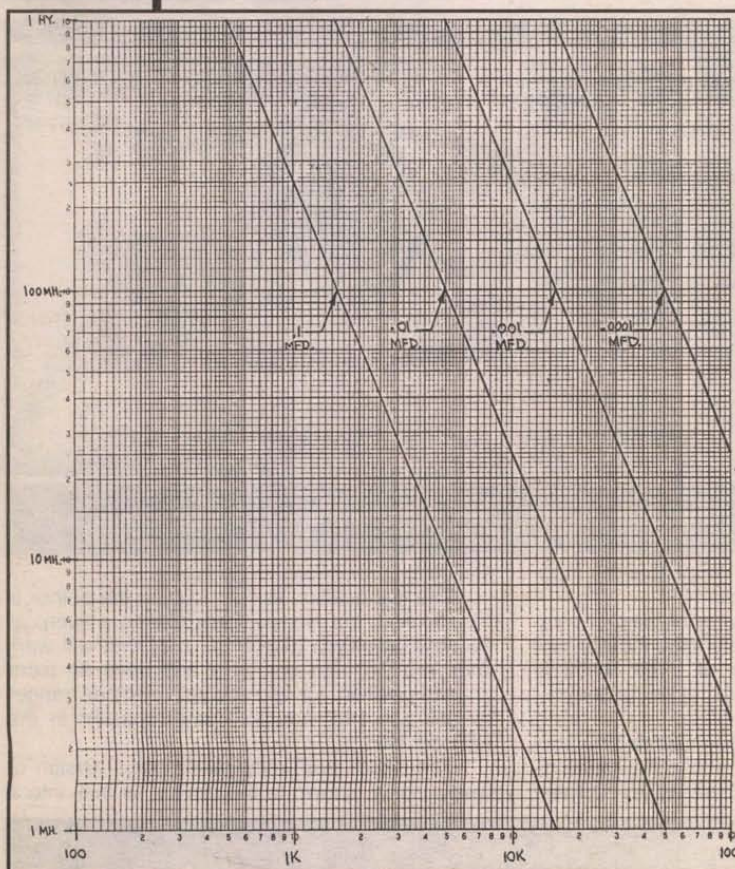


Figure 1: Quick Henry Schematic

Furthermore, using a calculator or simple BASIC computer program, measurements can be calculated beyond these ranges.

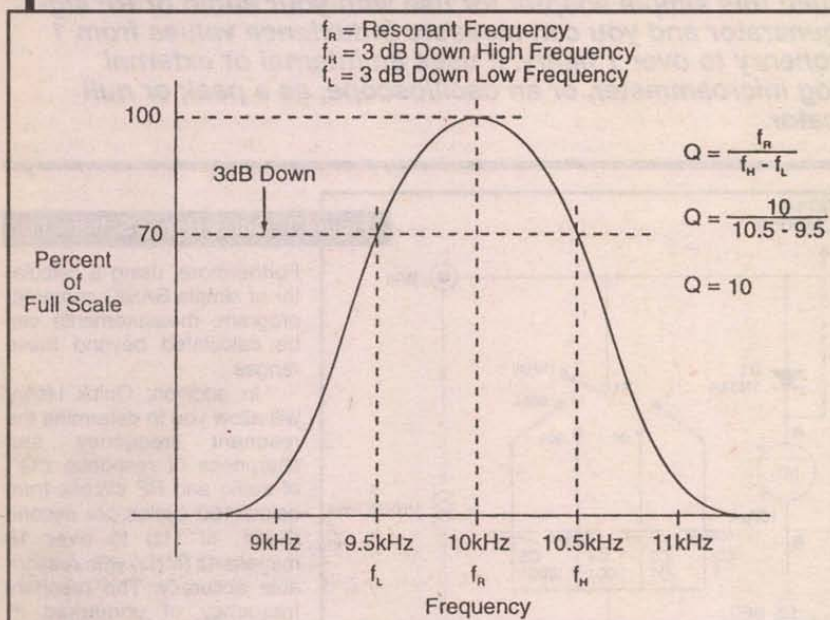
In addition, Quick Henry will allow you to determine the resonant frequency and sharpness of response ("Q") of audio and RF circuits from below 100 cycles per second (hertz, or Hz) to over 15 megahertz (MHz) with reasonable accuracy. The resonant frequency of unmarked IF transformers can be easily identified, and you can determine the inductance of

Figure 3: Resonant Frequency vs. Inductance (RF Range)



unmarked filter chokes, slug-tuned coils, RF chokes, etc. You can design, test, and trim air-wound coils and audio band pass circuits to your requirements.

Figure 4: Calculating Q with Quick Henry



Quick Henry's built-in meter indicator is optional, and may be omitted by the builder if a 10,000 ohms/volt or better DC multimeter, 100 microamp DC meter, or oscilloscope is available as an external indicator. The total cost of parts for Quick Henry is less than \$10.00 if you use an external indicator.

or C5), which is placed in parallel with the unknown inductor.

The audio input frequency is varied and, as the resonant frequency of the parallel combination of the unknown L and the selected C is approached, the voltage across BP4-BP5 increases sharply. At its resonant frequency, the parallel

sure external resonant circuits, or to "trim" an inductor with exactly the value of capacitance needed for resonance at a desired frequency.

Resistor R1 and capacitor C1 are used to prevent the signal generators from being loaded down by the L-C circuit, which has a very low impedance when not in resonance. Diode D1 must be a germanium diode, since it conducts with a much lower voltage loss than a more common silicon signal diode. RF choke L1 is needed to prevent the meter from acting as a short circuit to the L-C circuit at high-resonant frequencies.

Construction

The author's with-meter unit was built over 30 years ago with parts commonly available at that time. The exact enclosure and meter used then are no longer available, but are not critical. You may have an appropriate small metal or plastic cabinet and sensitive meter in your junk box, or can retrieve them from some other equipment you don't need.

In any case, construction of the unit requires no special techniques. Wiring is not critical, but don't make the leads longer than necessary, and place SI, C2, C3, C4, and C5 near BP4 and BP5. If using a metal cabinet, be sure that all binding posts are insulated from the box; there shouldn't be any

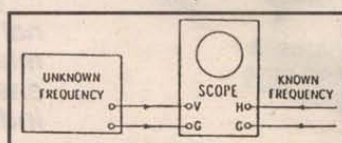


Figure 5: Typical oscilloscope Lissajous set-up has known frequency applied to horizontal input, and unknown frequency to the vertical input. Set scope for Horizontal Input.

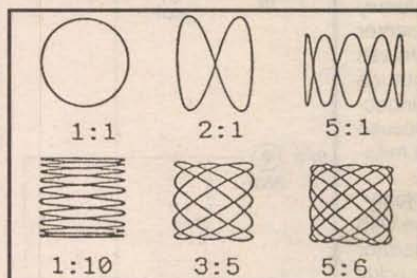
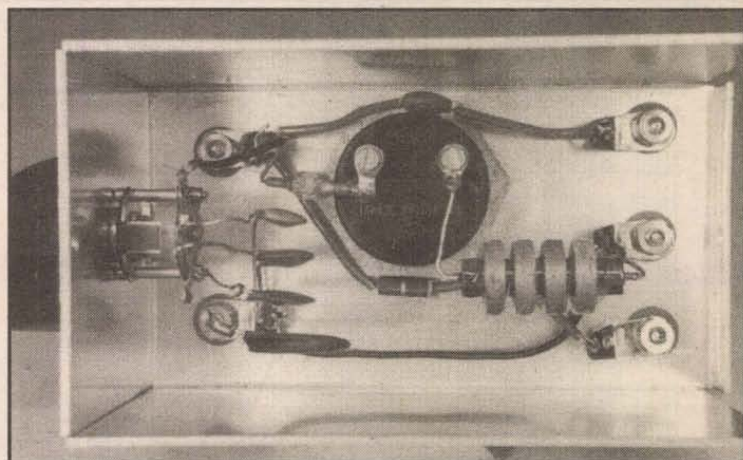


Figure 6: Lissajous figures using sinewaves. The ratios shown are vertical frequency to horizontal frequency if the set-up is as shown in Figure 5.

L-C circuit offers its highest impedance to the incoming signal. This AC voltage across the unknown inductor is rectified by diode D1 and passed on to the sensitive DC microammeter, MI, and the RF-blocking choke, LI. When using an RF generator, the signal is con-



The unknown inductor is connected to the "?" binding posts, and a parallel capacitor selected.



Quick Henry contains few parts, so it is very inexpensive to build.

Circuit Description

Figure 1 shows the schematic of Quick Henry. Assume an audio generator sinewave signal is connected to binding posts BP2 and BP3. The signal passes through isolation resistor R1 and then through the unknown inductance (L) connected across BP4 and BP5. Switch SI is used to select an appropriate value of capacitance (C2, C3, C4,

connected to BP1 and BP2, and coupled to the resonant circuit by isolation capacitor C1.

Once the resonant frequency of the L-C combination is known, you can determine the approximate inductance using one of three methods described later: charts, formula, or computer program.

Capacitors C2 through C5 — selected by SI — allow a broad range of L-C ratios and combinations. The OPEN position of SI allows you to mea-

electrical connections to the box.

The five-position switch used by the author is hard to find, but Radio Shack makes a two-pole six-position switch (see Parts List) that will work fine. You just use one pole and have an extra unused position. Or you can add another "range" by using a 1mF non-polarized capacitor in the sixth position.

The "black box" external-indicator version of Quick Henry, shown in the photos, is built into a

Fuji slide box, designed to hold 36 35mm slides (usually found at photo-finishing stores by just asking). Or look through your old slides and you'll probably find some in these or similar thin plastic boxes that make easily cut cabinets for small electronic projects like this one.

If you intend to use an available external multimeter to detect the resonant condition instead of building the meter into Quick Henry, an analog meter is much preferred to a digital meter. You can observe the analog needle move up scale to a maximum much more easily than interpreting an updating and constantly-changing digital display.

For an external indicator, bring out two wires and clip leads for connection to the external multi-

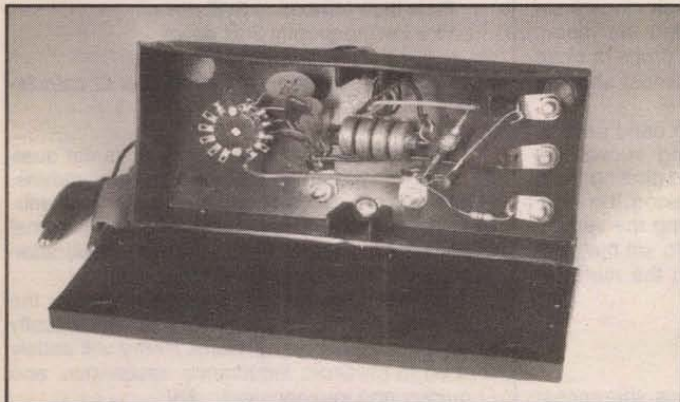
Operation

Most inductors with many turns of wire wound on a ferrite or iron core measure over 1 mH, and can be checked using an audio generator with Quick Henry. Typical air-wound coils are in the microhenry range, so use an RF generator. Never connect both generators to Quick Henry at the same time, as all sorts of spurious signals will result.

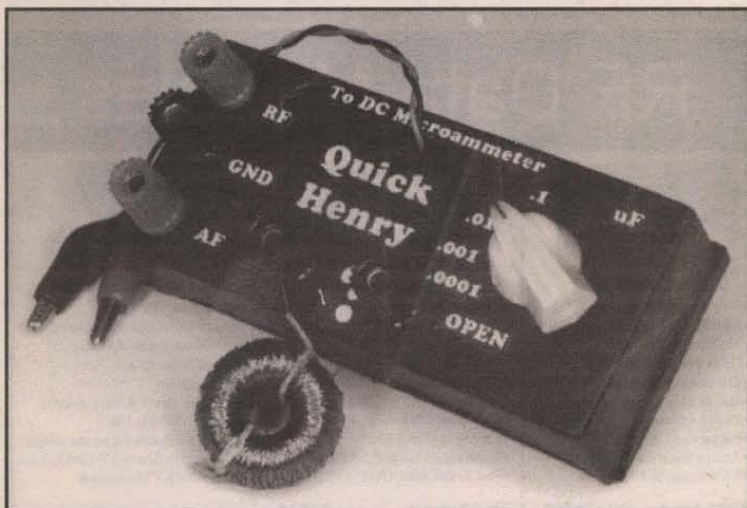
Connect the generator "ground" lead to BP2, and the "hot" lead to either BPI (RF) or BP3 (AF). If you are using the external indicator version of Quick Henry, connect the clip leads to the external DC meter or oscilloscope, observing polarity. For more accurate frequency readings than your sig-

(especially when using an RF generator and measuring in the low microhenry range), but these can be ignored. Look for a relatively high response as your proper indication of resonance.

If you don't find any significant response, try switching SI to the next higher value (.01), and sweep the frequencies again. When you do get a response, it will be quite definite, and might "pin" the meter (or scope display). Adjust the generator output for a comfortable peak reading. Most audio generators have enough output to deflect a sensitive meter well beyond full scale, and RF generators will give at least one-half scale under most conditions. The best accuracy will be obtained with the highest value of C that gives a sharp peak meter reading, so re-adjust the position of SI, if



The meter-less Quick Henry has few parts and can be built into a 35mm slide box for under \$10.00.



The unknown inductor is connected to the "?" binding posts and a parallel capacitor is selected with the switch.

meter. These points are marked on the schematic as A and B. Be sure to use red (positive) and black (negative) clips to indicate proper polarity for external connections.

When using an external multimeter to sense resonance instead of the built-in meter arrangement, the multimeter should be set on its lowest DC current or voltage range, observing proper polarity. When using an oscilloscope to sense the resonance voltage increase, set the sweep frequency to see many cycles, and the sensitivity to show the increased amplitude at resonance.

nal generator readout, you can connect a digital frequency counter directly across the signal generator leads, observing common grounds.

To start with, set SI to the ".001" position. Beginning at the low-frequency end of the signal generator, vary the frequency (changing generator frequency bands when necessary) until a clear meter upward deflection is observed. If using an oscilloscope, the amplitude of the display should increase to a peak.

Some minor spurious responses may be seen

```
10 REM * CALCULATE INDUCTANCE *
20 REM * F=RESONANT FREQUENCY WITH PARALLEL CAPACITOR *
30 REM * C=CAPACITOR IN PARALLEL WITH INDUCTOR *
40 REM * L=INDUCTANCE
100 INPUT"RESONANT FREQUENCY IN (1) KILOHERTZ OR (2) MEGAHERTZ";A
110 INPUT"ENTER RESONANT FREQUENCY";F
120 IF A=1 THEN F=F/1000
140 INPUT"ENTER CAPACITANCE IN MICROFARADS";C
200 L=1/(C*(6.28*F)^2)
205 IF A=1 THEN L=L/1000
210 PRINT"THE INDUCTANCE IS";L;
220 IF A=1 THEN PRINT"MILLIHENRIES";END
230 PRINT"MICROHENRIES"
```

LISTING 1: BASIC program to determine inductance when parallel capacitor and resonant frequency are known.

PARTS LIST

RI - 4.7K 1/4 watt resistor (Radio Shack #271-1330)
 C1 - 20 or 47 pF ceramic disc capacitor (Radio Shack #272-121)
 C2 - .1 uF metal-film capacitor (Radio Shack #272-1053)
 C3 - .01 uF metal film capacitor (Radio Shack #272-1051)
 C4 - .001 uF ceramic disc capacitor (Radio Shack #272-126)
 C5 - .0001 uF (100pF) ceramic disc capacitor (Radio Shack #272-123)
 DI - IN34A germanium diode (Radio Shack 276-1123)
 SI - Five-position switch (see text. Radio Shack #275-1386)
 LI - 2.5 mH RF choke (Ocean State Electronics #6302)
 BPI-BP5 - Insulated binding posts (Radio Shack #274-662)
 MI - 0-100 microampere meter (see text)
 Case - See text
 Selector Knob - To fit SI shaft (Radio Shack #274-424)

SOURCES

- Your junk box
- Your local Radio Shack store

• Ocean State Electronics

P.O. Box 1458
 Westerly, RI 02891
 Call 1-800-866-6626 for free 120-page catalog full of electronic parts.

necessary.

A broad peak, that is, one which is not too definite in relation to the varied frequency, is "low Q," and may be improved by using a higher value for C (setting SI to a higher value).

Once you have found the best setting for SI (and it really is much easier than it may sound), you can use Figure 2 to determine the inductance of the unknown coil if you're using an audio generator, or Figure 3 if you are using an RF genera-

tor. Enter the horizontal scale at the resonant frequency as read on the generator dial or frequency counter and move directly upward until you intersect the line representing the value of capacitance selected by SI. Then move straight to the left and read the value of the unknown inductance on the vertical scale.

Figures 2 and 3 have been plotted showing only the values of capacitance shown in Figure 1. If you desire to use any other values, either internally or connected to the binding posts externally, you can calculate the unknown inductance as follows:

$$L = \frac{1}{C(6.28F)^2}$$

L = inductance in microhenries (uH)
C = capacitance in microfarads (uF)
F = resonant frequency in megahertz (MHz)

When using this formula, be careful about your units; 1000 kilohertz is equal to 1 megahertz, and 1000 microhenries is equal to 1 millihenry. For example, a frequency of 10 kilohertz is .01 megahertz, and an inductance of 10,000 microhenries is 10 millihenries.

A third method to determine the inductance once the resonant frequency is known is to use the simple BASIC computer program shown in LISTING 1. This has worked without modification with

Radio Shack TRS-80 BASIC, IBM GWBASIC, QuickBASIC, and QBASIC.

For determining the resonant frequency of, say, an IF transformer, connect one of the windings (an ohmmeter will identify the windings by continuity) to BP4 and BP5, and set SI to OPEN. Using an RF generator, find the frequency that peaks the meter, and read this resonant frequency right off the generator dial. With SI in the OPEN position, a particular value of capacitor may be placed in parallel with an unknown inductor, and the resonant frequency determined in the same way.

Series resonant circuits can also be measured across BP4 and BP5 by noting a DIP in the meter reading rather than an increase. When not in resonance, the reactance of a series L-C circuit is high and the meter reading is high since most of the input signal is going through the meter. However, the series L-C reactance drops to close to zero at resonance, effectively almost shorting out the meter circuit.

You can actually plot the audio band pass of an R-C or L-C network by taking successive meter readings near resonance and plotting them on graph paper, with frequency along the horizontal axis, and meter reading along the vertical axis. In this case, it is convenient to set the generator output to read full scale on the meter at resonance.

Finding Q

To find the Q (relative bandpass sharpness)

of a resonant circuit, you need to determine the frequencies at which the meter reading is approximately 70% of the maximum value. These are the 3dB-down power settings.

Set the peak meter reading to full scale by adjusting the generator output. Now vary the input frequency on both sides of the resonant frequency to the points where the meter reads about .7 of full scale.

Note the frequencies where these meter readings occur and apply the following simple formula:

$$Q = Fr/(Fh-Fi)$$

Fr = resonant frequency
Fh = high frequency 3dB down
Fi = low frequency 3dB down

Figure 4 shows an example of a Q calculation.

The accuracy of Quick Henry does not qualify it as a laboratory standard by any means. Numerous errors are cumulative, such as distributed capacitance, stray inductance, the external capacitance of test leads, and the calibration accuracy of the signal generators used.

However, for the home experimenter or the small repair shop or lab, which do not usually need extreme accuracy, Quick Henry will satisfy a need to measure inductance, resonance, and Q quickly and inexpensively. NV

Turn Your Multimedia PC into a Powerful Real-Time Audio Spectrum Analyzer

Features

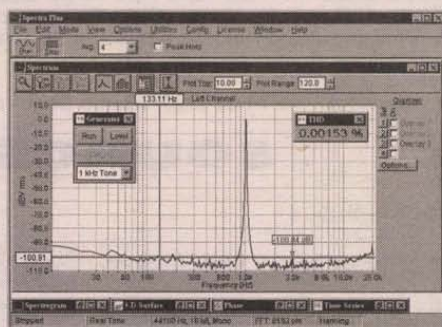
- 20 kHz real-time bandwidth
- Fast 32 bit executable
- Dual channel analysis
- High Resolution FFT
- Octave Analysis
- THD, THD+N, SNR measurements
- Signal Generation
- Digital Filtering
- Triggering, Decimation
- Transfer Functions, Coherence
- Dynamic Data Exchange (DDE)
- Time Series, Spectrum Phase, Spectrogram and 3-D Surface plots
- Real-Time Recording and Post-Processing modes

Applications

- Distortion Analysis
- Frequency Response Testing
- Vibration Measurements
- Acoustic Research

System Requirements

- 486 CPU or greater
- 8 MB RAM minimum
- Win. 95, NT, or Win. 3.1 + Win.32s
- Mouse and Math coprocessor
- 16 bit sound card



Priced from \$299

(U.S. sales only - not for export/resale)

Professional Quality Sound Cards Available...Call

DOWNLOAD FREE 30 DAY TRIAL!

www.telebyte.com/pioneer

PHS

Pioneer Hill Software
24460 Mason Rd. N.W.
Poulsbo, WA 98370

Spectra Plus 4.0
Affordable Signal Processing Software

Sales: (360) 697-3472

Fax: (360) 697-7717

e-mail: pioneer@telebyte.com

RF Data Modules



Transmitters

- Only 30 x 10 x 5mm
- ERP 0.25mW into 50
- 3V(F), 5V(F) or 6-12V(A)
- Up to 20k bps data transfer
- 418 or 433.9MHz FM
- Simple to integrate - simply add antenna, data, power
- Range up to 200m
- Analog or digital data i/p
- SAW controlled - stability

TXM-4xx-A..... \$24.50
TXM-4xx-F..... \$25.80



Receivers

- Only 21 x 47 x 5mm
- 13mA; 130uA on power save (100:1)
- Carrier detect o/p
- Simple to integrate
- Up to 20k bps
- 418 or 433.9MHz FM Superhet
- SAW controlled - stability
- Analog or digital o/p
- Wide supply range 4.5-9V (A/F ver.)
- Fast enable time <3ms

SILRX-4xx-A..... \$39.38
SILRX-4xx-F..... \$41.92



Transceivers

- Only 23 x 33 x 11mm
- Up to 40,000bps of balanced code
- 19200 baud with ASCII
- Up to 170m range.
- 5V operation
- 0.25mW into 1/4 wave antenna
- 418 or 433MHz FM
- Fast 1ms enable for power saving
- Direct interface to 5V CMOS logic
- Auto TX/RX changeover

BIM-4xx-F..... \$87.36

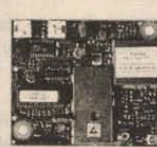
RS232 Transceivers



- 4,800 to 38,400 bps half duplex
- 3-wire RS232 interface
- Microcontroller with user EEPROM
- RS232 interface protected to ±15kV
- Auto TX/RX changeover
- 418 and 433MHz versions
- Range 120-200m
- 0.25mW, 1mW & 10mW versions
- Reset switch and status LED's
- 7.5-15V dc via DB9 connector 20mA

BIM-4xx-RS232 \$139.30

Synthesized Transceivers



- 64 channels, 25kHz width
- 464.075-464.850MHz
- Integral loop antenna
- External antenna option
- 5V operation
- Up to 2km range
- TTL logic level I/O
- 10kbps data rate
- <100uA in sleep mode
- 10mW RF o/p power

TXR-4xx-DTR100 \$313.50



ABACOM
TECHNOLOGIES

Free Catalog

Tel: (416) 236 3858
FaxBack: (416) 231 9681
Fax: (416) 236 8866

32 Blair Athol Crescent, Etobicoke, ON, M9A 1X5, Canada

MOTION DETECTOR KIT

Compact and portable. Adds safety to your home or office. Learn the basics of motion detector technology. Uses a pyroelectric infrared sensor. Simple and fun to build. Battery operated. Complete with all parts, PC board, case, schematic, and extensive training manual.

SS50K	Detector Kit	19.99	18.99	17.09
-------	--------------	-------	-------	-------

RS-232 MINI TESTER

Used to monitor the 7 most commonly used data lines to see if equipment has failed. 7 two color LEDs check status of TD, RD, RTS, CTS, DSR, CD & DTR.

MT100		9.99	9.49	8.54
-------	--	------	------	------

11 PIECE COMPUTER TOOL KIT

11 piece kit: 3/16" & 1/4" nut driver, 3 prong retriever, Tweezer, 3/16", 1/4", #1 & #2 Phillips reversible screw driver, T-10 & T-15 reversible screwdriver, 14-16 pin IC inserter, IC extractor, 1/8" flat screwdriver, #10 Phillips screwdriver, Black vinyl zippered Case

TK1100	Tool Kit	17.99	17.09	15.38
--------	----------	-------	-------	-------

DIGITAL MULTIMETER

• 3 1/2 digit LCD
• Low battery display
• Floating decimal point
• Frequency counter
• AC & DC curr. (600V)
• Transistor tester
• Resistance test
• Low ohm cont. beeper
• Reversed input jacks

reduces shock hazard
• Over range indicator (OL & -OL)
• Diode test function allows testing of semiconductor junctions
• Capacitance test sockets
• 3.5" W x 7.5" L x 1.4" D

MI700		49.99	47.49	42.74
-------	--	-------	-------	-------

LEAF SWITCH

• 4 amp
• N.O.

SB1059		.29	.28	.25
--------	--	-----	-----	-----

What Do We Have?

• I.C.'s
• Oscillators
• Crystals
• Diodes
• Tools
• Laser Diodes
• Vias
• Resistors

• Capacitors
• Connectors
• Trim pots
• Kits
• Vises
• LED's
• Transistors
• 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

TB3360		21.99	20.89	18.80
--------	--	-------	-------	-------

- Order Line — (800) 824-3432 • International — (412) 495-1230 • Fax Orders — (412) 495-7882
- Technical Support — (412) 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 with no surcharge • Call For FREE Catalog (\$2.00 Outside U.S.)
- We Carry A Complete Line Of Electronic Components • Email - unielec@aol.com

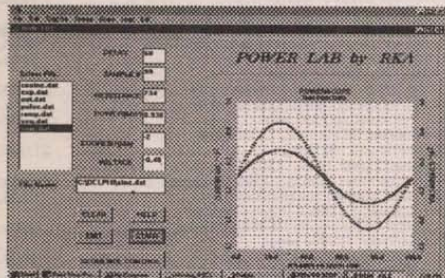
FREE SHIPPING!!
on pre-paid orders



Unicorn Electronics
1142 State Route 18
Aliquippa, PA 15001

Write in 205 on Reader Service Card.

PROGRAMMABLE POWER SUPPLY & DATA LOGGER



RKA SYSTEMS PRESENTS:

PROGRAMMABLE POWER SUPPLY
DATA LOGGER
WINDOWS ENVIRONMENT
EXCEL COMPATIBLE

- Programmable Power Supply (+/- 10 V, +/- 100mA)
- Virtual Digital Storage Scope(100 Samples Stored)
- Virtual Digital VOM (Volts, Current, Power, Resistance)

Applications:

- ♦ Lab Testing
- ♦ Voltage/Current Monitor

NOW ONLY
\$159.95

VISIT OUR WEB SITE AT:
<http://www.rkasys.com>



RKA Systems
484B Washington St. Unit #421
Monterey CA, 93940
Tel: 800 500 0449
E-Mail info@rkasys.com

Write in 165 on Reader Service Card.

SURPLUS TEST EQUIPMENT

HEWLETT PACKARD

11665B, Modulator (Unused)	\$350
11683A, Range Calibrator for HP Power Meters	\$550
11720A, Pulse Modulator, 2-18GHz	\$550
11729C, Carrier Noise Test Set w/Opt. 130	\$16,500
16510B, 80 Channel, 25MHz State & Timing Module	\$1000
1652B, Logic Analyzer w/Oscilloscope	\$4000
3311A, Function Generator, .01Hz-1MHz	\$225
3312A, Function Generator, .1Hz-13MHz	\$700
3314A, Function Generator, .001Hz-19.99MHz	\$2800
3325A, Synthesizer/Function Generator	\$1800
334A, Distortion Analyzer	\$250
338A, Distortion Analyzer	\$1200
3455A, Digital Voltmeter	\$400
3456A, Digital Multimeter, 6.5 Digits	\$800
3457A, Multimeter	\$3500
3478A, Digital Multimeter	\$700
3488A, Switch Control	\$1000
3551A, Transmission Test Set	\$950
3562A, Dynamic Signal Analyzer	\$9250
3562A, Dynamic Analyzer w/Opt. 063	\$11,500
35677A, S-Parameter Test Set	\$2700
3575A, Phase Gain Meter 1Hz-13MHz	\$1000
3581C, Selective Voltmeter	\$800
3582A, Spectrum Analyzer, .02Hz-25.5KHz	\$2500
3586B, Selective Level Meter	\$750
3586C, Selective Level Meter	\$800
3779D, Multiplexer Analyzer	\$2500
3852A, Data Acquisition/Control Unit	\$1800
4342A, Q-Meter	\$1800
435A, Power Meter	\$150
435B, Power Meter	\$500
436A, Power Meter w/Opt. 022	\$1200
4935A, Transmission Impairment Test Set w/Opt. 001	\$1500
5314A/0102, Universal Counter	\$225
5316B, Universal Counter	\$1000
5328B, Universal Counter	\$1000
5334A, 100MHz Universal Frequency Counter	\$1400
5334B, Universal Counter	\$1200
5335A, Frequency Counter, Opt. 10/20	\$1200
5340A, Frequency Counter, 10Hz-18GHz	\$800
5354A, Frequency Converter	\$800
5355A, Frequency Converter	\$1000
5356A, Converter Head	\$950
54100A, Digitizing Oscilloscope	\$3000
54201A, Digitizing Oscilloscope, 300MHz	\$2500
54201D, Digitizing Oscilloscope	\$2500
6002A, Opt. 01, Power Supply, HP-IB, 0-50V/0-10A	\$700
6012B, Autorange Power Supply, 0-60V, 0-50A	\$2750
6034A, DC Power Supply, 0-60V, 0-10A	\$1350
6186C, DC Power Source, 0-300V, 0.100 MA	\$850
6227B, Dual Power Supply, 0-25V/0-2A	\$600
6291A, DC Power Supply, 0-40V, 0-5A	\$650
6623A, Triple Output Power Supply	\$2800
7090A, Measuring Plotter	\$1200
8011A, Pulse Generator	\$400
8011A, Pulse Generator w/Opt. 001	\$500
8012B, Pulse Generator	\$750
8013B, Pulse Generator	\$750
8082A, Pulse Generator	\$1700
8165A/002, Programmable Signal Source w/AM	\$2200
8182A, Data Analyzer	\$1500
8350A, Sweep Oscillator Mainframe	\$2500
8350B, Sweep Oscillator Mainframe	\$3500
83522A, Oscillator Plug-in, .01-2.4GHz	\$4500
83540A, RF Plug-in, 2.0-8.4GHz	\$3000
83540A/002, RF Plug-in, 2-8.4GHz	\$3500
83545A, Oscillator Plug-in, 5.9-12.4GHz	\$2500
8411A/018, Frequency Converter, .11 to 18GHz	\$500
8502A, Transmission/Reflection Test Set	\$750
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, .01-21GHz	\$2650
8568A/B, Spectrum Analyzer, 100Hz-22GHz	\$35,000
(325GHz with mixers)	\$2100
8640B, Signal Generator, Opt. 002, .5-1024MHz	\$2200
8640B, Signal Generator, Opt. 1, 2	\$2200
8654A, Signal Generator, 10-520MHz	\$600
8656A, Signal Generator, 100KHz-900MHz	\$2500
8672A, Synth. Signal Gen., 2.0-18.0GHz	\$10,500
8673B, Synth. Signal Gen., 2.0-26.5GHz	\$18,000
8684A, Signal Generator, 5.4-12.5GHz	\$2350
8746B, S-Parameter Test Set, 5-12.4GHz	\$700
8748A, S-Parameter Test Set w/Opt. 026	\$2500
8754A/H26, Network Analyzer, w/8748A Opt. 026	\$6000
8756A, Scalar Network Analyzer	\$1500
8757A, Scalar Network Analyzer, 10MHz-60GHz	\$5000
8770A, Arbitrary Waveform Synthesizer	\$3000
8901B, Modulation Analyzer	\$5000
8903B/001, Audio Analyzer	\$3000
8904A, Multifunction Synthesizer w/Opt. 002	\$2500
8904A/001/003, Multifunction Synthesizer	\$2800
8970A, Noise Figure Meter	\$5000

2236, 100MHz Oscilloscope w/Counter/Timer/DMM	\$1550
2337, 100MHz Oscilloscope w/DMM	\$1650
2445, Four Channel 150MHz Oscilloscope	\$1800
466, 100MHz Storage Oscilloscope w/DM44	\$800
475, 200MHz Oscilloscope	\$650
475A, 250MHz Oscilloscope	\$800
485, Oscilloscope, 350MHz	\$900
494AP, Programmable Spectrum Analyzer, 10KHz-21GHz	\$16,000
520A, Vectorscope	\$400
7A42, Four Channel Amplifier Plug-in	\$650
7D20, Programmable Digitizer	\$400
7L12, Spectrum Analyzer, 100KHz-1.8GHz	\$1500
7L14, Spectrum Analyzer Plug-in, 1KHz-2.5GHz, Opt. 039	\$2200
7L18, Spectrum Analyzer Plug-in, 1.5-18GHz	\$2500
Capable of 60GHz with Mixers	\$4500
7S12, TDR/Sampler	\$1700
AA5001, Programmable Distortion Analyzer	\$1700
AM503, Current Probe Amplifier	\$400
CG5001, Programmable Calibration Generator	\$4000
CSA803, Sig. Analyzer w/(2) SD22 & (1) SD42	\$15,000
FS907, 2MHz Function Generator	\$975
R2246, 4 Channel Oscilloscope, 150MHz	\$1650
SG5010, Programmable Oscillator	\$3000
SG504, Leveled Sinewave Generator	\$2200
TM5003, Three Slot Power Mainframe	\$450
TM5006, Six Slot Power Mainframe	\$550
TR503, Tracking Generator for 4924/5/6	\$850

MISCELLANEOUS

Acme Elect. PS21000, Electronic Load	\$850
Bonton 102F, AM/FM Signal Generator, DC-1040MHz	\$1850
California Inst. 4500L/M3, AC Power Source	\$6000
Eaton 2052B, Amplifier, 100-512MHz	\$800
EIP 545A, Microwave Frequency Counter	\$1500
Fluke 5100B/03/05, Multifunction Calibrator	\$4000
Fluke 5100B/05, Multifunction Calibrator	\$3500
Fluke 5101B/03, Calibrator	\$4500
Fluke 5200A, AC Voltage Calibrator	\$2000
Fluke 5200A/5215A, AC Voltage Calibrator w/Power Amp	\$3850
Fluke 5440B, Precision DC Voltage Calibrator	\$4500
Fluke 6080B, Synthesized Signal Generator, .01-1050MHz	\$3500
Fluke 6160B, Synthesizer, Opt. 09	\$1000
Fluke 752A, Reference Divider	\$3000
Fluke 845AR, Voltmeter/Null Detector	\$350
Fluke 8520A, Digital Multimeter	\$700
Gen-Rad 1482B, Standard Inductor, 100UH	\$400
Gen-Rad 1482E, Standard Inductor, 1mH	\$350
Gen-Rad 1482L, Standard Inductor, 100mH	\$350
Gen-Rad 1482P, Standard Inductor, 1 Henry	\$400
Gen-Rad 1633A, Incremental Inductance Bridge	\$1700
Hughes 8001-H11, TWT Amplifier, 18-26.5GHz, 1 Watt	\$2500
Kikusui PAD16-10L, Power Supply, 16V, 10A	\$300
Kikusui PLZ700W, Electronic Load	\$850
Krohn-Hite 3202/R3202, Tunable Filter/Rack Version	\$500/\$350
Krohn-Hite 3342, Tunable Filter	\$1000
Marconi 2019A, Signal Gen., 80KHz-1040MHz	\$2750
Philips 5191, Prog. Synthesizer/Function Gen., 0.1MHz-2.147MHz	\$1750
Philips PM5715/11, 50MHz Pulse Generator (New)	\$1300
Philips 6652C, Prog. High Res. Counter/Timer, 8 Digit, 120MHz	\$1300
Stanford SR400, Photon Counter	\$1850
Trans Devices DLR400 15 3500A, Dynamic Load	\$1500
Valhalla 2703, AC Voltage Standard	\$2350
Wandell Goltzman SPM19, Level Meter, 50Hz-25MHz	\$2750
Wavetek 178, Automatic Synthesizer	\$1850
Wavetek 2002, Signal Generator, 1-2500MHz	\$1500
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
Wavetek 802, Pulse Generator, 5Hz-50MHz w/Delay	\$600
Wavetek 8541, Power Meter, 10MHz-40GHz (New)	\$1500
Wavetek 907A, Signal Generator, 7-12.4GHz	\$850

TEKTRONIX

1503, TDR Cable Tester w/Opt. 04 Recorder \$1550



R & S Surplus

1050 E. CYPRESS STREET, COVINA, CA 91724



(626) 967-0846 • FAX (626) 967-1999



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	\$300.00
TEK 7B53A 100 MHz Dual Time Base	\$175.00
TEK SC502 15 MHz Dual Trace Oscilloscope, TM500 series	\$375.00

ABOVE 100 MHz

TEK 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 7854 400 MHz Waveform Processing Oscilloscope frame	\$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 7B15 1 GHz Delaying Time Base	\$450.00
TEK 7B80 400 MHz Delayed Time Base	\$175.00
TEK 7B85 400 MHz Delta Delaying Time Base	\$175.00
TEK 7B92A 500 MHz Dual Time Base	\$275.00
TEK 7633 100 MHz Storage Oscilloscope frame	\$600.00

STORAGE

TEK 7633 100 MHz Storage Oscilloscope with (2) 7A26, (1) 7B92A	\$900.00
--	----------

PROBES

HP 1122A Probe Power Supply	\$200.00
TEK 1101 Accessory Power Supply, for FET probes	\$250.00
TEK P6201 900 MHz 1X/10X/100X FET Probe	\$450.00
TEK P6202A 500 MHz 10X FET Probe	\$300.00
TEK P6701-opt.02 O/E Converter, 450-1050 nm/0.1 mW; DC-700 MHz, ST conn.	\$675.00

CALIBRATION

TEK 067-0587-01 Signal Standardizer Calibration Fixture, 7000 series	\$300.00
TEK CG5001-opt.01/TM5006 Programmable Oscilloscope Calibrator, with power module	\$6,000.00
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, monocytle & var.phase trigger	\$325.00
HP 3312A 13 MHz Function Generator	\$750.00
TEK DD501 Digital Delay & Burst Gen., for function & pulse gen's	\$275.00
TEK FG501 1 MHz Function Generator, TM500 series	\$225.00
TEK FG503 3 MHz Function Generator, TM500 series	\$250.00
TEK RG501 Ramp Generator, TM500 series	\$225.00

PULSE

BERKELEY NUCLEONICS 7085B Digital Delay Generator, 0-100 mS, 1 nS res., 5 Hz-5 MHz	\$900.00
HP 214B-001 10 MHz Pulse Generator, 50 V/50 ohms, counted burst opt	\$1,750.00
HP 8005B 20 MHz Dual Output Pulse Generator	\$400.00
HP 8007B 10 MHz Pulse Generator	\$650.00
HP 8012B 50 MHz Pulse Generator, variable transition time	\$600.00
HP 8080A/81A/83A/84A 300 MHz Word Generator	\$800.00
HP 8080A/91A/92A/93A 1 GHz Single Channel Pulse Generator	\$950.00
TEK PG502 250 MHz Pulse Generator, Tr-1NS, TM500 series	\$600.00
TEK PG505 100 kHz Pulse Generator, 80 V peak, TM500 series	\$275.00

PROGRAMMABLE

HP 3325A 21 MHz Synthesized Function Generator, HPIB	\$1,650.00
HP 8165A-002.003 Prog. Signal Source, 1mHz-50 MHz, log sweep, rear out	\$2,000.00
TEK AWG5102 Arb. Waveform Gen., 20 MS/s, 12 bits, 500ppm synthesis <1MHz	\$1,400.00
TEK AWG5105-opt.02 Arbitrary Waveform Generator, dual channel option	\$1,900.00
WAVETEK 288 20 MHz Synthesized Function Generator, GPIB	\$1,000.00

VOLTAGE & CURRENT

VOLTMETERS

HP 3456A 6-1/2 Digit Voltmeter	\$750.00
HP 3468A 5-1/2 digit Multimeter	\$300.00
HP 3478A 5-1/2 digit Multimeter, HPIB	\$700.00
KEITHLEY 181 6-1/2 digit Nanovoltmeter, 10 nV sensitivity, GPIB	\$1,000.00
KEITHLEY 195A/1950 5-1/2 digit Multimeter, AC/Current option	\$500.00
SOLARTRON 7081 8-1/2 digit Voltmeter	\$3,900.00

CALIBRATION

FLUKE 5100B-03.05 Calibrator, wideband AC & GPIB options	\$4,500.00
FLUKE 510A AC Reference Standard, 10 VRMS, 0-10 mA	\$450.00

FLUKE 515A Portable Calibrator, DC/AC/Ohms, line & battery power	\$1,000.00
FLUKE 5220A Transconductance Amplifier, DC-5 kHz, 0-20 A	\$3,000.00
FLUKE 731B DC Reference Standard	\$400.00
FLUKE 732A DC Voltage Standard	\$2,000.00
FLUKE A55-series AC Thermal Converters	\$300.00
HOLT 11 AC Thermal Converter Set, 0.5-1200 V, 20 Hz-30 Hz	\$3,000.00
VALHALLA 2703 AC Volt.Std., 0-120V/10 Hz-100 kHz; 120-1200V/10 Hz-1 kHz	\$2,250.00

VOLTAGE SOURCES

HP 6114A Precision Dual Range Power Supply, 25V 2A / 40V 1A	\$850.00
HP 6115A Precision Dual Range Power Supply, 50V 0.8A / 100V 0.4A	\$875.00

CURRENT METERS & SOURCES

HP 4140B Picoammeter / DC Voltage Source	\$4,000.00
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 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 228 Programmable Voltage/Current Source	\$2,500.00
KEITHLEY 261 Picoampere Source	\$375.00
KEITHLEY 614 Electrometer	\$800.00
KEITHLEY 642 Electrometer	\$2,900.00
TEK AM503/A6302/TM501 AC/DC Current Probe System	\$1,000.00
TEK CT-5-opt.05 High Current Transformer for P6021/A6302, to 1000A	\$500.00
VALHALLA 2301 Programmable Single Phase Power Analyzer	\$1,250.00
VALHALLA 2575A AC/DC Wideband Current Shunt, 20 mA-100 A, DC-10 kHz	\$950.00

IMPEDANCE & COMPONENT TEST

L.C.R.

BOONTON 62AD 1 MHz Inductance Meter, 2-2000 uH	\$550.00
ESI 2160 LCR Bridge, 20 Hz-150 kHz, GPIB	\$2,000.00
HP 4262A-101 3-1/2 digit LCR Meter, 120 Hz/ 1 kHz/ 10 kHz test, HPIB	\$2,250.00
HP 4275A-001 5-1/2 digit LCR Meter, 10 kHz/10 MHz, 0-35 V int. bias	\$6,000.00

STANDARDS

E.S.I. DB62-11K 6-Decade Resistor, 0-11,111.0 Ohms, 0.01 Ohm res.	\$300.00
E.S.I. SR1010 Resistance Transfer Standards, 1 Ohm-100 K/step	\$700.00
E.S.I. SR1050-10M Resistance Transfer Standard, 10 Megohms/step	\$2,500.00
E.S.I. SR1050-1M Resistance Transfer Standard, 1 Megohm/step	\$2,000.00
E.S.I. SR1-set Set of eight Standard Resistors, 1 Ohm - 10 Megohms	\$900.00
GR 1404-A 1000 pF Reference Standard Capacitor	\$700.00
GR 1406 Standard Air Capacitors, GR900 connector, 0.1% acc.	\$375.00
GR 1409-F + L + T + Y Standard Capacitor Set; 0.001, 0.01, 0.1, and 1.0 uF	\$600.00
GR 1409-G/K/M/R/U/X Standard Capacitors: odd values half price	\$75.00
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, 0-1.110 Ohms, 1 Ohm resolution	\$350.00
GR 1433-N 5-Decade Resistor, 0-11,111 Ohms, 0.1 Ohm resolution	\$400.00
GR 1433-U 4-Decade Resistor, 0-111.0 Ohms, 0.01 Ohm resolution	\$350.00
GR 1433-X 6-Decade Resistor, 0-111,111.0 Ohms, 0.1 Ohm res.	\$450.00
GR 1482-series Standard Inductors	\$275.00
VALHALLA 2724A Programmable Resistance Standard, 0-11 Gigaohms, GPIB	\$1,675.00

HI & LO RESISTANCE

GR 1666 DC Resistance Bridge, 1 Micro-Ohm - 100 Kiloohms	\$600.00
HP 4328A Milliohmeter	\$1,300.00

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

POWER SUPPLIES

SINGLE OUTPUT

HP 6200B Dual Range Supply, 0-20 V 0-1.5 A 0-40 V 0-750 mA CVCC	\$200.00
HP 6201B 0-20 V 0-1.5 A CV/CC Power Supply	\$175.00
HP 6206B Dual Range 0-60 V 0.5 A / 0-30 V 1 A CV/CL Supply	\$200.00
HP 6207B 0-160 V 0-200 mA 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 6267B 0-40 V 0-10 A CV/CC Power Supply	\$550.00
HP 6269B-028 0-40 V 0-50 A CV/CC Power Supply; 230 VAC line	\$950.00

HP 6281A 0-7.5 V 0-5 A 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
KEPCO ATE 100-10M 0-100 V 0-10 A CV/CC Power Supply; 120 VAC 20 A line	\$900.00

KEPCO ATE 36-30M 0-36 V 0-30 A CV/CC Power Supply; 120 VAC 20 A line	\$900.00
KEPCO ATE 36-6M 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 300-1.5B 0-300 V 0-1.5 A CV/CC Power Supply	\$600.00
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	\$500.00
SORENSEN SRL 60-8 0-60 V 0-8 A CV/CC Power Supply	\$750.00
TEK PSS01-1 Power Supply, 0-20 V, 2 mV res., 400 mA, TM500 series	\$175.00

MULTIPLE OUTPUT

HP 6228B Dual 0-50 V 0-1 A CV/CC Power Supply	\$600.00
HP 6237B Triple Output Supply, +, -, 0-20 V 0.5 A, 0-18 V 1 A	\$550.00
HP 6253A Dual Output 0-20 V 0-3 A CV/CC Power Supply	\$550.00
TEK PSS010 Programmable Triple Power Supply, TM5000 series	\$750.00
TEK PSS03A 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 501C/400SD AC Power Source, 0-135 VAC, 500 VA, 20 Hz-10 kHz	\$1,200.00
HP 59501B HPIB Isolated DAC/Power Supply Programmer	\$175.00
TRANSISTOR DEVICES DAL-50-15-100 Programmable Load, 0-50 V, 0-15 A, 100 Watts max.	\$200.00
TRANSISTOR DEVICES DVL-50-300-3000 Programmable Load, 0-60 V/ 0-360 A/ 3000 Watts max.	\$1,200.00

TIME & FREQUENCY

UNIVERSAL COUNTERS

FLUKE 1910A-02.03 125 MHz/ 500 nS Universal Counter, TCXO reference	\$175.00
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, HPIB	\$600.00
HP 5316A-003.006 100 MHz/100 nS Counter, 1 GHz C-ch, offset/normalize	\$800.00
HP 5316B 100 MHz/ 100 nS Universal Counter, HPIB	\$1,000.00
HP 5316A 100 MHz Universal Counter, HPIB	\$850.00
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, HPIB, OCXO	\$1,000.00
HP 5335A 200 MHz Universal / Statistical Counter	\$1,200.00
RACAL-DANA 1992-04 100 MHz/1 nS Univ. Counter, 1.3 GHz C-channel, OCXO	\$750.00
TEK DC5004 Programmable 100 MHz/100nS Counter/Timer, TM5000 series	\$250.00
TEK DC5009 Programmable 135 MHz Univ. Counter/Timer, TM5000 series	\$500.00
TEK DC5010 350 MHz / 3.125 nS Universal Counter, TM5000 series	\$1,200.00
TEK DC503A 125 MHz/ 100 nS Universal Counter, TM500 series	\$275.00

FREQUENCY COUNTERS

EIP 575 18 GHz Source Locking Counter, GPIB	\$3,250.00
EIP 578-opt.02.05 26.5 GHz Source Locking Counter; power meas., OCXO	\$5,000.00
FLUKE 7220A 1.3 GHz Communications Counter	\$500.00
HP 5340A-011 18 GHz Frequency Counter, HPIB	\$1,250.00
HP 5342A 18 GHz Frequency Counter	\$2,400.00
HP 5342A-001 18 GHz Frequency Counter, OCXO reference	\$2,500.00
HP 5342A-003 18 GHz Freq. Counter, +22 dBm, -20 dBm dynamic range	\$2,400.00
HP 5342A-01.04.05 24 GHz Frequency Counter, OCXO, DAC	\$3,250.00
HP 5345A/5355A/5356B 26.5 GHz CW/Pulse Frequency Counter	\$4,000.00
TEK DP501 1.3 GHz Prescaler, divide by 16, TM500 series	\$225.00

STANDARDS

HP 105A Quartz Oscillator, 0.1/ 1.0/ 5.0 MHz	\$750.00
HP 105B Quartz Oscillator, 0.1/ 1.0/ 5.0 MHz, battery power	\$1,500.00
HP 5061A Cesium Beam Frequency Standard	\$8,500.00
HP 5087A-opt.033 Distribution Amplifier; 12 outputs at 10 MHz	\$1,750.00

AUDIO & BASEBAND

SPECTRUM ANALYSIS

HP 3566C Selective Level Meter, 50 Hz-32.5 MHz, 50 & 75 ohms	\$1,500.00
TEK 7L5L/7R603 Spectrum Analyzer, 20 Hz-5 MHz, 10 Hz min. res. w/frame	\$1,500.00



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



DISTORTION ANALYZERS

HP 333A Distortion Analyzer, 10 Hz-600 kHz	\$450.00
HP 339A Distortion Analyzer, built-in low distortion osc.	\$1,500.00
HP 8903A-001 Audio Analyzer, 20 Hz-100 kHz; rear panel input	\$2,600.00
HP 8903B-001, 013, 051 Audio Analyzer, 20 Hz-100 kHz; C-message, CCITT	\$3,750.00
TEK DA4084 Programmable Distortion Analyzer	\$1,000.00

RMS VOLTMETERS

FLUKE 8920A True RMS Voltmeter, 180 uV-700 V, 10 Hz-20 MHz	\$600.00
FLUKE 8922A True RMS Voltmeter, 180 uV-700 V, 2 Hz-11 MHz	\$600.00

OSCILLATORS

HP 204C Oscillator, 5 Hz-1.2 MHz, 5 VRMS	\$150.00
HP 204D Oscillator, 5 Hz-1.2 MHz, 5 VRMS, 60 dB step attenuator	\$200.00
HP 209A Sine/Square Wave Generator, 4 Hz-2 MHz, 5 VRMS max.	\$225.00
TEK SG502 Sine/Square Osc., 5 Hz-500 kHz, 70 dB step atten., TM500	\$200.00

MISCELLANEOUS

HP 3575A-001 Phase-Shift Meter, 1 Hz-13 MHz, dual display option	\$850.00
HP 4437A Step Attenuator, 0-119.9 dB, DC-1 MHz, 60 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	\$500.00
KROHN-HITE 3342R Dual HP/LP Filter, 0.001 Hz-90 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
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 11970A WR28 Harmonic Mixer, 26.5-40 GHz	\$1,100.00
HP 11970Q WR22 Harmonic Mixer, 33-50 GHz	\$1,400.00
HP 8444A-059 Tracking Generator, 0.5-1500 MHz, for 8554, 8568, etc.	\$1,250.00
HP 8445B Preselector, 1.8-18.0 GHz, for HP 8555A	\$650.00
HP 8553B/8552B/8443/141 Spectrum Analyzer, 0.1-110 MHz, with tracking generator	\$2,500.00
HP 8555A 100 Spectrum Analyzer, 10 MHz-22 GHz, 100 Hz min. res.	\$4,500.00
HP 8566B Spectrum Analyzer, 100 Hz-22 GHz, HP calibration certificate	\$37,500.00
HP 8569B Spectrum Analyzer, 10 MHz-22 GHz, 100 Hz min. res. bw.	\$8,500.00
TEK 119-0098-00 WR42 Single Ended Mixer, 18.0-26.5 GHz, for Tek 491	\$200.00
TEK 119-0099-00 WR28 Single Ended 491 Mixer, 26.5-40 GHz, for Tek	\$200.00
TEK TR502 Tracking Generator, 0.1-1800 MHz, for 713/714	\$1,250.00
TEK TR503 Tracking Generator, 0.1-1800 MHz, for 492/4/5/6	\$1,375.00
TEK WM490A WR28 Harmonic Mixer, 26.5-40 GHz	\$850.00
TEK WM490K WR42 Harmonic Mixer, 18.0-26.5 GHz	\$850.00
TEK WM782V WR15 Harmonic Mixer, 50-75 GHz	\$2,000.00

NETWORK ANALYZERS

HP 11665B Modulator, 0.15-18.0 GHz, N(m/f)	\$325.00
HP 11666A Reflectometer Bridge, 0.04-18.0 GHz, for HP 8755/6/7	\$1,100.00
WILTRON 560/3x 560-7550 Scalar Network Analyzer, w/(3) 0.01-18.5 GHz detectors	\$1,750.00

SIGNAL GENERATORS

FLUKE 8060A Synthesized Signal Gen., 0.1-1050 MHz, 10 Hz res., GPIB	\$2,750.00
FLUKE 8060A/AN Synthesized Signal Gen., 10 kHz-520 MHz, 10 Hz res., GPIB	\$2,000.00
FLUKE 8062A Signal Generator, 0.1-2100 MHz, 10 Hz resolution	\$5,500.00
FLUKE 8070A Synthesized Signal Generator, 0.2-520 MHz, 1 Hz res.	\$2,000.00
GIGATRONICS 605/10-18 Synthesized Source, 10-18 GHz, 1 kHz res., GPIB	\$3,000.00
GIGATRONICS 605/2-8 Synthesized Signal Gen., 2-8 GHz, 1 kHz res., GPIB	\$3,000.00
GIGATRONICS 840-01 Freq. Doubler, 26.5-40 GHz (WR28) out, 13-20 GHz in	\$2,000.00
GIGATRONICS 875/50 Levelled Multiplier, x4, 50.0-75.0 GHz output, -3 dBm	\$3,500.00
GIGATRONICS 875/86 Levelled Multiplier, 26.5-40.0 & 50.0-75.0 GHz outputs	\$5,000.00
GIGATRONICS 910/12-18, opt6, 14, 16 Synthesized Source/Sweeper, 12-18 GHz, 1 Hz res., OCXO	\$3,500.00
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	\$4,250.00
HP 8640B-001, 002 Signal Gen., 0.5-1024 MHz, AM, FM, var. audio osc.	\$2,200.00
HP 8654A Signal Generator, 10-520 MHz, calibrated AM & uncal. FM	\$550.00
HP 8660C/8660B-002 Synth. Sig. Gen., 1-1300 MHz, FM / Phase mod. w/86635A	\$3,250.00
HP 8660C/86603A/86633B Synthesizer, 1-2600 MHz, AM, FM	\$4,000.00

SWEEP GENERATORS

HP 8350B/83592C-004 Sweep Oscillator, 10 MHz-20 GHz, +10 dBm levelled	\$18,500.00
---	-------------

HP 8600A Digital Marker, for HP 8601A	\$400.00
HP 8601A Generator/Sweeper, 0.1-110 MHz, +20 dBm levelled	\$400.00
HP 8620C Sweep Oscillator Frame	\$550.00
HP 8620C-011 Sweep Oscillator Frame, HP1B programmable	\$675.00
HP 86222A RF Plug-in, 10-2400 MHz, +13 dBm levelled	\$1,250.00
HP 86222B-002 RF Plug-in, 10-2400 MHz, +13 dBm levelled, 70 dB atten.	\$1,750.00
HP 86230B RF Plug-in, 1.8-4.2 GHz, +10 dBm unlevelled	\$675.00
HP 86235A-001, 002 RF Plug-in, 1.7-4.3 GHz, +14 dBm levelled, 70 dB atten.	\$1,000.00
HP 86240C RF Plug-in, 3.6-8.6 GHz, +16 dBm levelled	\$1,000.00
HP 86241A-001 RF Plug-in, 3.2-6.5 GHz, +8 dBm levelled	\$500.00
HP 86242D-004, 008 RF Plug-in, 5.9-9.0 GHz, +10 dBm levelled	\$500.00
HP 86245A RF Plug-in, 5.9-12.4 GHz, +16 dBm levelled	\$1,100.00
HP 86250D RF Plug-in, 8.0-12.4 GHz, +10 dBm levelled	\$675.00
HP 86260A RF Plug-in, 12.0-18.0 GHz, +10 dBm unlevelled	\$800.00
HP 86260A-H04 RF Plug-in, 10.0-15.0 GHz, +10 dBm unlevelled	\$800.00
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 unlvld.	\$1,500.00

POWER METERS

ANRITSU MP-81B/ML-83A Power Meter, 75-110 GHz (WR10), -20 to +20 dBm	\$2,500.00
ANRITSU MP-82B/ML-83A Power Meter, 90-140 GHz (WR8) pin flange, -20, +20 dBm	\$3,250.00
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	\$400.00
HP 432A/8478B Power Meter, -25 to +10 dBm, 10 MHz-18 GHz	\$350.00
HP 435A/8481A Power Meter, 10 MHz-18 GHz, -30 to +20 dBm	\$900.00
HP 435A/8482H Power Meter, 0.1-4200 MHz, -10 to +34 dBm	\$950.00
HP 8477A Power Meter Calibrator, for HP 432 series	\$500.00
HP 8486A Power Sensor, 33.0-50.0 GHz, WR22, for 435/6/7/8	\$1,500.00
HP F486A WR28 Thermistor Mount, 26.5-40 GHz, for 432 series	\$350.00

RF MILLIVOLTMETERS

BOONTON 9200A-01 RF Millivoltmeter, 10 kHz-1.2 GHz, GPIB	\$900.00
RACAL 9303 TRIMS Level Meter, 10 kHz-2 GHz, -77 to +23 dBm, GPIB	\$875.00

AMPLIFIERS, MISCELLANEOUS

BOONTON 82AD-opt.01A Modulation Meter, AM, FM, 10-1200 MHz, GPIB	\$900.00
HP 465A Amplifier, 20/40 dB, 5 Hz-1 MHz, 1/2 Watt/50 Ohms	\$125.00
HP 8474A-001 Dual Amplifier, 0.1-400 MHz	\$450.00
HP 8474E Amplifier, 22 dB, 0.1-1300 MHz, +13 dBm output	\$750.00
HP 8901A Modulation Analyzer, 150 kHz-1300 MHz	\$3,000.00
HP 8901B-1, 2, 3 Modulation An., 0.15-1300 MHz, rear input, OCXO, ext. LO	\$4,500.00
HP 8970A Noise Figure Meter	\$6,000.00
HUGHES 1177H01 F000 TWT Amplifier, 2.0-4 GHz, 10 Watts output	\$1,500.00
HUGHES 1177H02 F000 TWT Amplifier, 4.0-8 GHz, 10 Watts output	\$1,500.00
HUGHES 1277H02 F000 TWT Amplifier, 4.0-8 GHz, 20 Watts output	\$2,500.00
HUGHES 8020H02 F000 TWT Amplifier, 4.0-8 GHz, 20 Watts output	\$2,750.00
M.P.D. LAB-1022A Amplifier, 34 dB, 1.0-2.0 GHz, 2 Watts	\$800.00
M.P.D. LAB-7114-3A Amplifier, 34 dB, 0.7-1.4 GHz, 3 Watts	\$800.00
MICROWAVE SEMI. CORP. MCS112 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	\$6,000.00

COAXIAL & WAVEGUIDE

AMERICAN NUCLEONICS AM-432 Cavity Backed Spiral Antenna, LHC, 2-18 GHz, TNC(f) "NEW"	\$95.00
BIRD 8329-310 30 dB Attenuator, 2000 Watts, DC-1 GHz, LC(f)/N(f)	\$650.00
FXRMICROLAB 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 Interference Adapters	\$125.00
HP 11590A-001 Bias Network, 1.0-18.0 GHz, APC7	\$450.00
HP 11612A Bias Network, 45 MHz-26.5 GHz, APC3.5	\$550.00
HP 11691D Directional Coupler, 22 dB, 2-18 GHz	\$450.00
HP 11692D Dual Directional Coupler, 22 dB, 2-18 GHz	\$800.00
HP 11904B APC2.4(f) x K(f) Adapter, DC-40 GHz	\$225.00
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 D11 Dual Dir. Coupler, 20 dB, 0.1-2.0 GHz, APC7/N(f)/f	\$450.00
HP 8470B Crystal Detector, 10 MHz-18 GHz, neg. pol., APC7	\$250.00
HP 8494G-002 Programmable Step Attenuator, 0-11 dB, DC-4 GHz, SMA	\$400.00
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 R422A WR28 Flat Broadband Detector, 26.5-40 GHz	\$400.00
HP R532A WR28 Frequency Meter, 26.5-40 GHz	\$500.00

HP R752A WR28 Directional Coupler, 3 dB, 26.5-40 GHz	\$450.00
HP R914B WR28 Moving Load, 26.5-40 GHz	\$300.00
HP V365A WR15 Isolator, 25 dB, 50-75 GHz	\$900.00
HP V752D WR15 Directional Coupler, 20 dB, 50-75 GHz	\$650.00
HP X870A WR90 Slide Screw Tuner	\$150.00
HUGHES 4511H-2000 WR28 Isolator, 25 dB, 26.5-40 GHz	\$450.00
HUGHES 45712H-1000 WR22 Frequency Meter, 33-50 GHz	\$900.00
HUGHES 45721H-2000 WR28 Precision Rotary Vane Attenuator, 0-50 dB, 26.5-40 GHz	\$1,200.00
HUGHES 45732H-1200 WR22 Level Set Attenuator, 0-25 dB, 33-50 GHz	\$250.00
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
INSULATED WIRE SPRR-175-78 Low Loss Coaxial Cable, 78 in., DC-18 GHz, SMA(m/ram)	\$45.00
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
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, 500 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 4203-6 Directional Coupler, 6 dB, 2-18 GHz, SMA(f)/f	\$225.00
NARDA 4245-10 Directional Coupler, 10 dB, 4-12 GHz, SMA(f)	\$100.00
NARDA 4799 Level Set Attenuator, 0-15 dB, 4-18 GHz, SMA(f)	\$135.00
NARDA 5070-SERIES Precision Reflectometer Couplers	\$300.00
NARDA 765-20 20 dB Attenuator, 50 Watts, DC-5 GHz, N(m/f)	\$135.00
NARDA 766-10 10 dB Attenuator, 20 Watts, DC-1 GHz, N(m/f)	\$100.00
NARDA 768-20 20 dB Attenuator, 20 Watts, DC-11 GHz, N(m/f)	\$125.00
NARDA 792FF 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-SPECTRA 2085-6010-00 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 21A3 WR42 Circulator, 20 dB, 2.0-26.4 GHz	\$125.00
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 GHz out	\$1,250.00
TRG B528 WR22 Direct Reading Phase Shifter, 0-360 deg., 33-50 GHz	\$1,500.00
TRG V551 WR15 Frequency Meter, 50-75 GHz	\$600.00
TRG W551 WR10 Frequency Meter, 75-110 GHz	\$750.00
WAVELINE 10080 WR28 Terminated Crossguide Coupler, 30 dB	\$250.00
WEINSCHEL 1515 Power Divider, 2-Way, DC-18 GHz, SMA(m/f/f)	\$125.00

COMMUNICATIONS

HP 4972A LAN Protocol Analyzer	\$1,500.00
HP 59401A HPIB Bus Analyzer	\$700.00
TEK 1410R NTSC Gen., w/SPG2 sync. generator, TSG7 color bars	\$800.00
TEK 1411R PAL 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. PAL Test Gen., w/SPG12, TSG11, TSG13, TSG15, TSG16	\$1,400.00
TEK 147A NTSC Test Signal Generator, with noise test signal	\$800.00
TEK 148 PAL Insertion Test Signal Generator	\$700.00
TEK 1750 NTSC Waveform / Vector Monitor	\$2,250.00
TEK 520A NTSC Vectorscope	\$750.00
TEK 521A PAL Vectorscope	\$750.00

MISCELLANEOUS

P.A.R. 5101 Lock-in Amplifier, 5 Hz-100 kHz	\$650.00
P.A.R. 5206-95, 98 Two-Phase 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 TMS006 5000-series 6-slot Programmable Power Module	\$600.00
TEK TMS04 500-series 4-slot Power Module	\$175.00
TEK TMS06 500-series 6-slot Power Module	\$250.00
TEK TMS15 500-series 5-slot Traveller Power Module	\$275.00

COMPONENTS cont.

MICROCHIP 16C56RC/P \$2.25 per 100, resonator 4.0MHz 3 pin, \$.40 per 100, \$.35 per 500, \$.29 per 1,000. 1-800-760-0555.

ANTIQUE ELECTRONICS

WANTED: FOR historical museum, pre-1980 microcomputers, magazines, and sales literature. Floyd, VA 24091-0341 (540-763-3311/540-382-2935).

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: \$38.95 (\$55.95 by 1st Class). Foreign: write: ARC, PO Box 802-G20, Carlisle, MA 01741. Phone: 508-371-0512; Fax: 508-371-7129; Web: www.ancient-radio.com

CRYSTAL SETS. Parts, plans, books, kits. Largest source in the world. Catalog \$2. MIDCO, PO Box 2288, Hollywood, FL 33022.

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.

WANTED: HH Scott model 296 dual channel laboratory amplifier w/w cabinet. Jeff Kyle 903-527-4196, 4268 FM 36 S., Caddo Mills, TX 75135.

WANTED: TOP CASH/REWARD FOR YOUR DBX Sub-Sonic synthesizer! Antique Video Transfer Service, 5001 Diamond Hts. Blvd., San Francisco, CA 94131-1621, 415-821-3359 fax 415-821-7500.

MILITARY TRANSISTORS & DIODES & INTEGRATED CIRCUITS WANTED. ELECTRONIC MATERIAL INDUSTRIES 818-769-1002, FAX 818-769-1084.

AVIATION ELECTRONICS

MILITARY TRANSISTORS & DIODES & INTEGRATED CIRCUITS WANTED. ELECTRONIC MATERIAL INDUSTRIES 818-769-1002, FAX 818-769-1084.

PUBLICATIONS

HACKERS AND EXPERIMENTERS BOOKS. Cable Hackers Bible Volumes 1 & 2, \$45.45 each; DSS Bible Volume 2, \$84.45 PPD; DSS Secrets 3-Volume set \$69.95 PPD; Scanner Hackers Bible Volume 1 & 2 \$35.45 each; Satellite Hackers Bible \$55.45; 8.6 Megabytes Hacker Software \$29.95; Black Box Bible \$35.45; Phone Phreakers Bible \$35.45; Phone Box Bible \$45.45; Superhackers Bible Volumes 1 & 2, \$35.45 each. Add \$2 insurance per order for. Many more plus videos! Ask for New 1998 catalog - free in USA, \$3 elsewhere. TELECODE 520-726-2833 <http://www.hackerscatalog.com>

SMARTCARD BIBLE. New (March 1998) book covering all aspects of smartcards: Hacking, operation, specifications, theory and more. With software and diagrams for smartcard reader/writer. \$39.95 plus \$5.50 P&H. 520-726-2833. TELECODE, PO Box 6426-NV, Yuma, AZ 85366-6426. <http://www.hackerscatalog.com/hackgold.htm>

TORMETS ELECTRONICS BENCH REFERENCE. New, first of its kind reference book. Covers power supply design, transistors, digital logic, op-amps, antenna design, coil winding, SMDs, drill sizes and much, much more. High quality, spiral bound. 105 pages. Send check for \$19.95 + \$2.50 postage and handling to: RMT Engineering, 6863 Buffham Rd., Seville, OH 44273.

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>

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.

FREE SAMPLE: "TRANSISTOR NETWORK," unique magazine for collectors of regular and novelty transistor radios. Articles, photos, and ads. Free 20 word ad monthly. Subscription: \$17 (US); \$28 (Canada); \$36 (Foreign). PO Box 43, Live Oak, FL 32064-0043. E-Mail: mon@suwanneevalley.net

RAINBOW KITS

Many of our kits are available completely built!

PIC RELAY CONTROLLER

This is a good companion for any kit that need additional amperage or a micro-controlled relay function.

Relay functions listed below are preset.

- ON / OFF toggle mode
- ON / RESET mode
- Fixed delay .5 second pulse stretch
- Fixed delay 10 second pulse stretch
- Variable time 1.5 to 14 sec.
- Variable time 11 to 24 sec.
- 3 Amp. total output
- Input and reset signal can be Active HI or LO
- Wall transformer included

Voltage requirements 7.5 to 15vDC Size: 1.75" x 2.7"

PRC-1 KIT \$24.95
PRC-C Case \$12.95

CALLER ID DEFEATER

The kit that brings back the privacy in phone calling. I know you can defeat CALLER ID if you dial *67, but how often do you remember to do that? This kit dials *67 automatically. Now nobody can identify you as the caller. Easily modified for Centrex telephone systems. We supply a DC wall transformer. PCB size: 2.75" x 2.25" Case Included

CID-1 BUILT \$69.95 KIT \$49.95



A Cricket, gets in your house and runs you crazy till you find it

Well this is no different, sneak this little NIGHT CRICKET into someone's bedroom, or cozy little nook, when night falls the fun begins. It's like a bad dream the lights go out and the cricket start chirping, turn the lights on to find the varmint and the chirping stops. It drives you nuts! Operates on a 9v battery. Small enough to hide most anywhere 2" x 3". You may want to get more than one. How many friends do you want to lose?

NC-1 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
\$9.95 with the purchase of any kit.

10 in 1 ULTIMATE LASER POINTER



The next generation of laser pointers is here! Project 10 different patterns from this unique new design without changing the lenses. This laser is so small it can be concealed in the palm of your hand. Keep people guessing where it is coming from! Dot has over 1,600 ft. range. Comes with Deluxe Key Chain. Powered by 3 LR44 batteries (included) Size: 1 7/8" dia x 5 1/16"

LAS-UFO BUILT \$29.95

LASER CHALLENGE

Great game for the Laser Pointer

Set your target across the room or pin it to your chest. You can set it anywhere up to 25 yards. Use the laser pointer to shoot the target and the alarm goes off. Fun for kids and adults, great for laser tag fun.

Power requirement: 9v battery PCB size: 1.5" x 1.2"

LAS-1 TARGET INCLUDED KIT \$14.95



Use this kit to control cooling fans. It senses heat and turns on a fan. The fan can be a ceiling fan or a fan in your computer, anything that needs cooled. Output is 100mA. Use the Relay kit RP-1 or the new Micro-controlled Relay PRC-1 kit for 3 amp. operation. Complete with temperature probe. Operating voltage: 7.5 to 18v DC Size: 1.5" x 1.2"

FC-1 KIT \$14.95



Listen through walls, hear conversations across the room. Add a parabolic reflector and hear blocks away. The BIG EAR can be hidden about anywhere. Makes an ultra sensitive intercom. Can be used as a 1.5W AMP. We supply a mini-electret mike in the kit. Power requirement 6 to 12v DC. SIZE: 1.75" x 1"

AA-1 BUILT \$29.95 KIT \$10.95

LASER LIGHT SHOW

Club Effect Lighting
Portable
Red Laser



12 preset built-in rotating patterns

Auto mode: Adjustable Music mode: Controlled by microphone On/off switch and auto/music switch
Includes 4 "AAA" batteries
3mW laser diode

LASHW-1 BUILT \$69.95

THE MIGHTY WIZARD

You can throw your old Ouija board away and come into the computer age. Use your inner feelings to control THE MIGHTY WIZARD. Touch your fingers to the pads and the 4 jumbo leds flash randomly till you release your fingers. One of the leds will stay lit. We supply 6 overlays, each a different game. Let your Bio-rhythm control your destiny. Fun to build and play for the whole family.

Power requirements 9v battery PCB size: 2" x 3"

Game size: 5.5" x 7.75"

MW-1 KIT \$18.95

RF ANALYZER



Want to know the code of your car alarm transmitter, your garage door opener or any other digitally transmitted RF signal? This kit will extract the code from the air through the antenna input, send the signal to the computer and display it on the screen. This is all done through the parallel port. Information can be stored to the hard drive for future reference. The RF Analyzer comes complete with Dos software. You can operate this kit from a 9v battery or from a wall transformer. We supply a wall transformer with your kit. Operating voltage 7.5 to 15v DC PCB size: 2.25" x 2.75"

RFA-1 KIT \$99.95
RFA-C Case \$12.95

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

Please add sufficient postage First lb \$5.50 Canada \$7.50 Additional LB. Add \$1.00 US FUNDS ONLY We will accept telephone orders for Visa or Mastercard

Electronic Rainbow Ind., Inc.
6227 Coffman Rd. Indianapolis, IN 46268

CALL 317-291-7262 FAX 317-291-7269
INTERNET: www.rainbowkits.com



by Karl Lunt

AMATEUR ROBOTICS

With the deadline for the Northwest Regionals of the Trinity College Home Fire-Fighting event less than two months away, I naturally devoted all of my precious robot time to ... hacking a GameBoy. I don't know what it is about these little gadgets that makes them so much fun to hack, but I have this vision of a GameBoy-guided robot and I've become slightly obsessed about making that happen. Note, however, that I did spend some time this month on a project somewhat related to the Fire-Fighting contest; more on that in a bit.

As you know from last month's column, the Nintendo GameBoy has a rabid circle of hackers and developers who have created some serious tools for writing and testing GameBoy applications. Besides an excellent C compiler, assembler, and linker, members of the GameBoy Developers Ring (GBDR) have created tools to help design game backgrounds, sprites, and music, and have even developed hardware for linking together up to four GBs for interactive play. One person, Jeff Frohwein, has even hooked a servo-based robotic hand to his GB; check out his web page for a picture or two of his machine.

The GB cartridges make perhaps an ideal module for moving code from place to place. They have no moving parts, a small package, and little power drain. These cartridges come in six different formats, based on the components inside. The most common variety contains read-only memory, in the form of a programmed ROM and, for really large games, a memory banking controller. You can spot this kind of cartridge by playing the game; turning off the GB forces you to restart the game completely. Since the cartridge contains no RAM, you cannot save the game's state and restore it for subsequent play.

One cartridge format in particular deserves close scrutiny by the robotics community. Cartridges such as *Metroid 2* and *The Legend of Zelda* contain 8K bytes of battery-backed RAM, a memory banking control chip, and a 32-pin ROM. Replacing this ROM with a flash EPROM creates a programmable cartridge capable of holding up to 512K bytes of code and data.

Using a cartridge like *Zelda* to control a robot requires you to jump several hurdles. First, you need to buy a cartridge with the proper innards. Stores such as FuncoLand (I love that name!) sell used GB cartridges at reasonable prices; current price for a *Zelda* cartridge is about \$15.00.

Second, you need to build a device that can read the original *Zelda* firmware and save it on a PC file, in case you ever want to restore your cartridge's data and play the game again. This same device must also be capable of writing new data into a properly modified GameBoy cartridge. Such devices, called GB reader/writers, are quite simple to build and make a neat weekend project.

Third, you need to buy a 4 MB flash EPROM such as the Advanced Micro Devices' AM29F040. These memory devices go for about \$20.00 each from Digi-Key (1-800-DIGIKEY), though you might be able to find them cheaper other places. Be sure you get a chip rated for 150 nsec operation or faster. This speed rating forms part of the dash number of the device. The suffix also contains a letter identifying the package type and a letter defining the temperature range. Thus, a PLCC part rated for 120 nsec in the commercial temperature range

carries a part number of AM29F040-120JC. This is the memory chip that you will install in your *Zelda* cartridge, after you first remove the existing ROM with its pre-burned *Zelda* code. Adding this memory chip is by far the most difficult part of the project; later in this article, I'll provide you with some tips and tools that should make the job easier.

Finally, you need software to drive your GB reader. I'm using a tool called ReadPlus, available at various sites on the Internet, for this purpose. ReadPlus can also write data to a GB cartridge that you have modified as described above.

Doing the hack

I spent several days researching the steps necessary to perform this GB cartridge hack. First off, I needed a 3.8 mm security bit, used to remove the tamper-proof screw that holds a GB cartridge together. I ordered this from MCM Electronics (1-800-543-4330) for \$3.49 (P/N 22-1145). At the same time, I ordered some Nintendo GameBoy connectors — the 32-pin devices that you plug a game cartridge into. These cost about \$3.00 each in quantities of five (P/N 83-2285).

Next up was the GB cartridge reader. There are at least five different systems in use for reading and writing modified GameBoy cartridges. Two of them

able on the printer port. Reading a byte of data thus requires two operations: one reads the lower four bits of a byte, and another operation reads the higher four bits. Finally, the 74hc00 creates the various gating and control signals needed to exchange data with the cartridge.

I decided to build my CARTIO hardware on a standard Radio Shack experimenter's board (276-158A), using wirewrap techniques. I thought about doing a printed circuit board (PCB), but I only need one and — if necessary — it's usually easier to rework a WW board than a PCB.

The first problem I hit involved the 32-pin GB connector. Naturally, it uses some weird metric, staggered pinout, which didn't fit in the 0.1-inch grid of the Radio Shack board. But such problems are trivial to any hacker with a Dremel tool. I marked a suitable rectangle on the experimenter's board outlining the area where I wanted the pins to fit, chucked a cutting wheel into the Dremel, donned my protective goggles, and went at it. With just a few minutes of careful work, I had cut the needed clearance for the GB connector pins.

ALWAYS wear eye protection whenever you use a Dremel or any other electrical cutting tool. The Dremel cutting bits turn at very high speeds and can shatter during use, flinging shards in all directions. I've already had one cutting disc snap on me, and the goggles probably saved at least one eye.

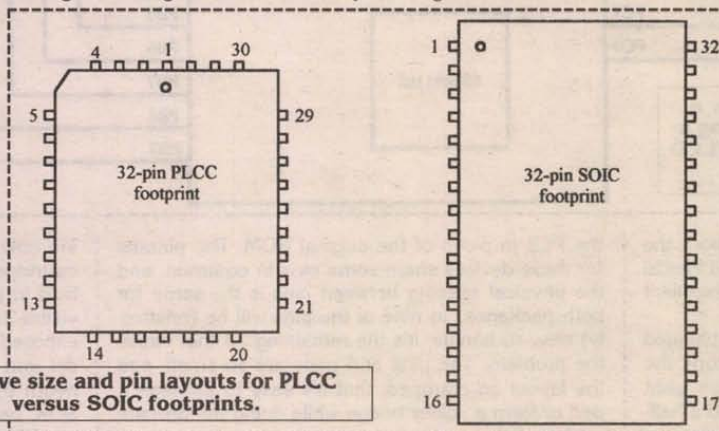
Next, I used the Dremel and a sanding disc to remove the alignment projections on the underside of the connector, near the mounting holes. This left a completely smooth surface, allowing me to mount the connector flat to the wirewrap board. Finally, I marked and drilled two 3/32nd-inch holes in the wirewrap board, ran a couple of 2-56 screws through the mounting holes in the GB connector, and bolted the connector to the board.

I collected the various WW sockets I would need for the project: four 20-pin, one 16-pin, and one 14-pin. I also needed a connector for hooking the board to the PC's printer port. After some

thought, I decided to install a 26-pin dual-row IDC male header on my wirewrap board, rather than use a DB-25 connector. I decided to leave the DB-25 on the end of a ribbon cable because I wanted some flexibility in how I mounted the board into a box. Wiring the DB-25 directly to the board would have cut down my construction options.

I also chose to leave off the small 7805 power supply shown in the schematic, instead using a two-pin male locking connector for external power. This lets me run the board from a bench supply, or from a small power supply that I might choose to put inside the final enclosure with the board. I did leave some extra room on the wirewrap board, should I change my mind and decide to add the 7805 circuitry later.

With all the parts in hand, I sat down and began the construction. I've always rather liked wirewrapping. For me, it is like knitting or painting is to other people; a way to occupy your hands, create something useful or valuable, and fill the hours. Even



require PC-internal cards, which I decided to avoid. The other three make use of the PC's printer port for transferring data. Of these three, I opted to use Pascal Felber's CARTIO system. The schematic is straightforward, using just six chips, and provides all the functionality I need. Refer to the accompanying schematic, which I've reworked from Pascal's original.

The GB cartridge expects to have a microcontroller driving the eight data lines and 16 address lines on the cartridge's connector. Creating these signals from a PC's printer port requires some latches and a multiplexer. As you can see in the schematic, the board uses three 74hc574 latches, controlled by a single 74hc138 data mux, to derive the address and data output lines from the eight printer data lines on the DB-25 connector. The data input lines require additional handling, as the line printer port only has four inputs. The two halves of a 74hc244 split the eight data lines into two four-bit nybbles, compatible with the four input lines avail-

1/8th inch of bare wire, then carefully tacking the wire directly to the finger of pad 31 on the connector. Use as little of the gold contact as you possibly can, and be careful not to create a solder bridge to nearby vias or pads. Finally, connect the remaining end of the 47K resistor to any trace on the board connected directly to Vdd. Be sure to use an ohmmeter to verify that the trace you want to use is actually connected directly to Vdd.

I have not included the artwork for my board in this article, because I had a layout error that needs fixing. I probably won't get around to fixing it, though, since I already have all the adapter boards I need. You should have enough information here to design your own adapter, if you like. Note that there isn't a lot of available room on the adapter board, and I had to use 8/8 design rules with 20 mil via holes to squeeze in all of the circuitry.

After I finished the wiring and cleaned up the residue from my Dremel work, I was ready to try programming my new GB cartridge. Using the -p option of ReadPlus, I was able to write my previously saved Zelda game into my flash cartridge. I then used ReadPlus' -a option to analyze the file in the cartridge; the analysis confirmed that the flash cartridge now contained the Zelda program, and that the cartridge's checksum was correct. I plugged the flash cartridge into a real GameBoy, turned it on, and spent a few minutes playing Zelda.

Though this hack involved some tedious work, I think the possibilities it opens up are worth the effort. I have a programmable cartridge capable of holding up to 512 KB of code, complete with a sophisticated banking scheme, all in a compact and rugged form factor. Although my tests involved GameBoy code, there is no reason why I couldn't

add a 32-pin GameBoy connector to an expanded 68hc11 board and use the GB cartridge as a memory device for the 'hc11. The GB cartridge only supports an eight-bit data bus, so using it for a larger processor — such as a 68332 — wouldn't be effective. Still, a lot of projects only need an eight-bit processor, and putting that code into a tiny GB cartridge makes sense.

The above discussion only skims the surface of this project, and I encourage you to tap into the GameBoy Developers' Ring on the Internet, and sift through the tons of valuable information on the GameBoy.

It's in the timing

I watched a lot of Olympics in February, all of it broadcast by the Canadian Broadcasting Corporation (CBC), which did an excellent job covering the event. Sports such as downhill skiing, speed skating, and bob-sleigh (as the Canadians call bobsledding) all require timing, and the results are usually displayed to the nearest hundredth of a second. As I watched these events, I thought about the various contests held by the Seattle Robotics Society, notably the upcoming Fire-Fighting contest.

For some reason, the actual timing of our events is always left to the last minute. Immediately before the contest starts, someone remembers that we need a timekeeper. A loud cry goes up for Frank Haymes, an SRS stalwart who carries a multi-function digital that can act as a stopwatch. Frank then gets pressed into service as a timer, since he owns the watch. Despite the fact that Frank always does a first-rate job as a timekeeper, I've always worried about the haphazard way we handle this important

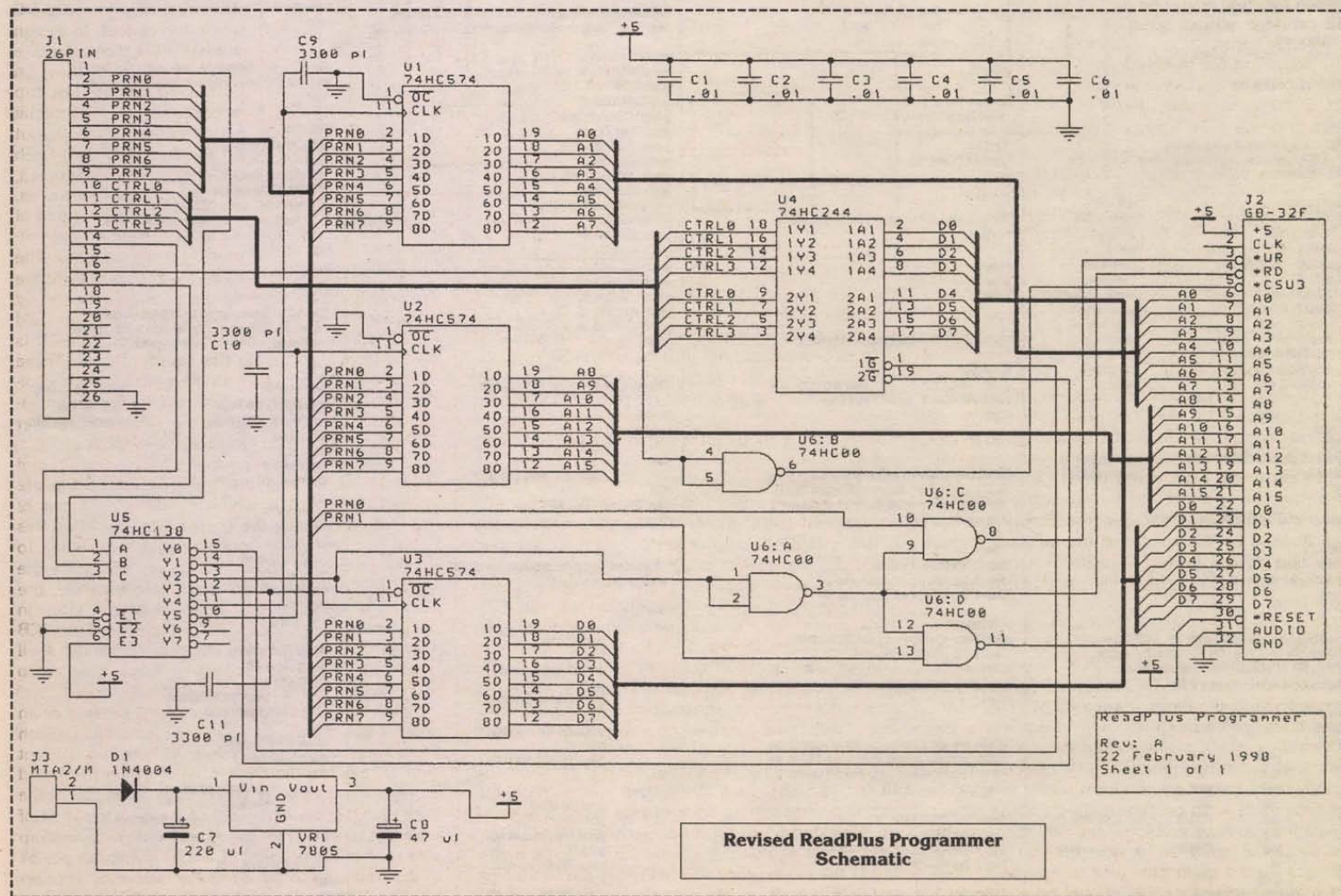
function. After all, Frank is only human, and one day he may have to miss a meeting due to some emergency or suchlike. Then what will we do for a stopwatch and a timekeeper?

So one evening, during the Olympics, I sat down and wired up a BOTBoard to act as a digital timer. The circuitry is ridiculously simple, little more than an LCD display and a couple of switches. Refer to the accompanying schematic.

I won't bore you with the details of driving an LCD using the 68hc11; I've covered that topic countless times in these pages already. I just used port lines PB2 through PB7 to create a four-bit latch and control lines for driving the display. PB2 acts as the register select, for choosing writes to either the data or command registers, while PB3 provides the E signal for latching data during transfers to the LCD. PB4 through PB7 serve as data lines D4 through D7 to the LCD.

The accompanying SBasic code shows how easy it is to make a 2x16 character LCD act as a stopwatch. This code maintains two four-word arrays — CLOCK0 and CLOCK1 — and displays the values in each on separate lines of the LCD. When the user presses the START button, hooked to PC0, the stopwatch code copies the time value in CLOCK0 to CLOCK1, then enables the 68hc11's timer TOC5 to begin counting at a rate of 100 counts per second. The interrupt service routine (ISR) for TOC5 uses each interrupt to increment the various elements of CLOCK0 to provide a clock timer with a maximum value of 24 hours.

While the clock is running, the code shows the value in CLOCK0 on the top line of the display and the value in CLOCK1 on the bottom. Though CLOCK0 is incrementing once each 1/100th of a



second, the display is updated less frequently, so you see a clock value that changes about four times a second. However, the real time value, kept in CLOCK0, is always accurate to 1/100th of a second. When the user presses the STOP button, tied to PC1, the code freezes CLOCK0 and updates the display one more time. Now the code sits in a loop, waiting for the user to press the START button again.

One element of this code shows a powerful feature of SBasic. I've used the ASMFUNC statement to override SBasic's normal _OUTCH function. Usually, SBasic uses a library version of _OUTCH to send a single character to the SCI. By overriding this function, I can use my own _OUTCH routine to send that character to the LCD. This means that all of the console output statements, such as PRINT, now send their output directly to the LCD.

Note that the code listed here has a small bug in it. The TOC5 interrupt — responsible for updating

the clock values — is active before the code copies the value of CLOCK0 to CLOCK1. Thus, occasionally the value that appears on the bottom line of the display will have bumped by one count from the value previously displayed on the top line. I'll leave the simple fix for this problem to those enterprising readers who want to try out this code.

I spent a couple of evenings wiring up the electronics and putting it in a Radio Shack project box. The design lends itself to timing many different types of events. If you drill holes and mount a pair of RCA phono jacks on the front panel, then wire jacks in parallel with both the START and STOP switches, you get a stopwatch that can use external switch closures to start and stop timing intervals. This can come in very handy for soapbox derby races or other fast events where the time crossing a finish line is important. You can also add code to support more than one clock array and change the behavior of the STOP button code, to build a stop-

watch timer that can track multiple legs of multiple racers.

This is one of those simple but useful projects that can mutate in many directions. Spend some time going over the code to get a feel for how the 68hc11 and SBasic work together to create a high-resolution timer. Then add your own ideas to turn this simple stopwatch into the right tool for your club's contests. Now, where did I put that Fire-Fighting contest robot? **NV**

As always, you can reach me at:

Karl Lunt

116 173rd St. S.W., Bothell, WA 98012

E-Mail: karllunt@seanet.com

Web: <http://www.seanet.com/~karllunt>

```
'stopwatch.bas event stopwatch for 68hc11 and 2-line LCD

include "regs11.lib"
asmfunc _outch 'replace _OUTCH
declare lcdtimer
declare wait
declare clock0(4) 'clock 0
declare clock1(4) 'clock 1
declare n
declare stopped

const DLY100s = 20000 'delay for 1/100th sec

'ISR to handle the 4.1 msec tic counter.
'This ISR decrements WAIT and LCDTIMER
'until either reaches 0, then rearms
'itself.

interrupt $ff0 'RTI
if wait <= 0
    wait = wait - 1
endif
if lcdtimer <= 0
    lcdtimer = lcdtimer - 1
endif
pokeb tllg2, %01000000
end

'ISR to count hundredths of a second.
'This ISR automatically updates the values
'in the clock0 array, then rearms itself.

interrupt $ffe0 'toc5 ISR
clock0(3) = clock0(3) + 1
if clock0(3) > 99
    clock0(3) = 0
    clock0(2) = clock0(2) + 1
    if clock0(2) > 59
        clock0(2) = 0
        clock0(1) = clock0(1) + 1
        if clock0(1) > 59
            clock0(1) = 0
            clock0(0) = clock0(0) + 1
            if clock0(0) > 23
                clock0(0) = 0
            endif
        endif
    endif
endif
end

pokeb tllg1, $08
end

'wait until LCDTIMER variable reaches 0

WaitLCD:
lcdtimer = pull()
do loop until lcdtimer = 0
return

'Assembly-language replacement for _OUTCH low-level
routine. This version of _OUTCH writes a character
to the LCD. All calls to PRINT and other SBasic
display routines will now write to the LCD.

asm
PORTB equ $1004
_outch
    pshb
    idab
    andb #07
    orab #07
    stab PORTB rs=1, e=0, msb=0
    orab #0f
    stab PORTB rs=1, e=1, msb=0
    tab
    andb #10
    orab #0c
```

```
    stab PORTB rs=1, e=1, data
    andb #14
    stab PORTB rs=1, e=0, data
    idab
    andb #07
    orab #07
    stab PORTB rs=1, e=0, msb=0
    orab #0f
    stab PORTB rs=1, e=1, msb=0
    tab
    lsb
    lsb
    lsb
    andb #10
    orab #0c
    stab PORTB rs=1, e=1, data
    andb #14
    stab PORTB rs=1, e=0, data
    ldd #100

    out1
    subd #1
    bne out1
    puls
    rts

endasm

' Move to start of second line on LCD

NewLine:
gosub LCDCmd, $c0
return

' Move to start of first line on LCD, do not clear
' display.

Home:
gosub LCDCmd, $80
return

' Clear LCD, then move to start of first line.

ClearLCD:
gosub LCDCmd, 1 'clear and home LCD
gosub WaitLCD, 2 'wait a bit
return

' LCDDataN sends the top four bits of a char to the
' LCD's data register. This routine toggles the RS
' and E lines as needed to time the transfer, using
' four writes to port B.

' Step 1: Set RS=1, E=0
' Step 2: Set RS=1, E=1
' Step 3: Set RS=1, E=1, data to bits 4-7
' Step 4: Set RS=1, E=0, data to bits 4-7

LCDDataN:
pokeb portb, (peekb(portb) and $07) or $07
pokeb portb, peekb(portb) or $0f
pokeb portb, peekb(portb) or ((pull()) and $10) or $0c
pokeb portb, peekb(portb) and $14
return

' LCDCmdN sends the top four bits of a char to the
' LCD's command register. This routine toggles the
' RS and E lines as needed to time the transfer,
' using four writes to port B.

' Step 1: Set RS=0, E=0
' Step 2: Set RS=0, E=1
' Step 3: Set RS=0, E=1, cmd to bits 4-7
' Step 4: Set RS=0, E=0, cmd to bits 4-7

LCDCmdN:
pokeb portb, peekb(portb) and $03
pokeb portb, peekb(portb) or $08
pokeb portb, peekb(portb) or ((pull()) and $10) or $08
pokeb portb, peekb(portb) and $10
return

' LCDCmd sends a byte to the LCD's command register,
' using two calls to LCDCmdN.

LCDCmd:
gosub LCDCmdN, pick(0) 'send the top nybble
place 0, lshft(pick(0)) 'move low nybble to
top
place 0, lshft(pick(0))
place 0, lshft(pick(0))
place 0, lshft(pick(0))
gosub LCDCmdN, pull() 'send the low nybble
return

' InitLCD sends a string of commands to the LCD following
' power-up. Timing between commands is done with WaitLCD.

InitLCD:
gosub WaitLCD, 10
gosub LCDCmdN, $30
gosub WaitLCD, 2
gosub LCDCmdN, $30
gosub WaitLCD, 2
gosub LCDCmdN, $30
gosub WaitLCD, 2
gosub LCDCmdN, $20
gosub WaitLCD, 10
gosub LCDCmd, $28
gosub WaitLCD, 10
gosub LCDCmd, 8
gosub WaitLCD, 10
gosub LCDCmd, 1
gosub WaitLCD, 10
gosub LCDCmd, 6
gosub WaitLCD, 10
gosub LCDCmd, 12
return

' Display a number as two decimal digits.

Print2d:
if pick(0) < 10
    outch '0'
else
    outch '0' + (pick(0) / 10)
endif
outch '0' + (pick(0) mod 10)
return

' Display time on top line or bottom line of LCD,
' depending on argument.

ShowTime:
if pick(0) = 0
    gosub Home
    print " "
    gosub Print2d, clock0(0)
    outch " "
    gosub Print2d, clock0(1)
    outch " "
    gosub Print2d, clock0(2)
    outch " "
    gosub Print2d, clock0(3)
endif
if pull() = 1
    gosub NewLine
    print " "
    gosub Print2d, clock1(0)
    outch " "
    gosub Print2d, clock1(1)
    outch " "
    gosub Print2d, clock1(2)
```

```
    outch " "
    gosub Print2d, clock1(3)

endif
return

' Wait for the user to press the Start switch. The
' logic includes a 40 msec debounce delay, using variable
' WAIT.

WaitForStart:
do
    waitwhile portc, $01 'wait until pc0 goes
low
    wait = 10
    do loop until wait = 0
loop while peekb(portc) and $01 = $01
pokeb tllg1, $08
pokeb tmsk1, $08
stopped = 0
return

' See if the user pressed the Stop switch. The logic
' includes a 40 msec debounce delay, using variable
' WAIT.

CheckForStop:
if peekb(portc) and $02 = 0
    wait = 10
    do loop until wait = 0
    if peekb(portc) and $02 = 0
        pokeb tmsk1, $00 'disable TOC5 interrupts
        stopped = -1 'show clock is stopped
    endif
endif
return

' The main program. Set up the interrupts, clear
' the two clock arrays, wait for the Start switch, update
' the displays, and wait for the Stop switch.

main:
pokeb ddr, $fc
pokeb tllg2, %01000000
pokeb tmsk2, %01000000
interrupts on
for n=0 to 3
    clock0(n) = 0
    clock1(n) = 0
next
gosub InitLCD
print " Stopwatch 1.0";
wait = 500
do loop until wait=0
gosub ClearLCD
print " Press START";
gosub NewLine
print " to begin";
do
    gosub WaitForStart
    gosub ClearLCD
    for n = 0 to 3
        clock1(n) = clock0(n)
        clock0(n) = 0
    next
    gosub ShowTime, 0
    gosub ShowTime, 1
    do
        gosub CheckForStop
        if wait = 0
            gosub ShowTime, 0
            wait = 60
        endif
    loop until stopped <= 0
loop
end
```


ANA Instruments

Phone: 1-800-944-0495

Fax: (540) 775-9638

E-Mail: 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

TEKTRONIX 465M SCOPE

AN/USM-425 militarized DC-100 MHz dual-trace oscilloscope with 8x10 CM display. Deflection 5 mv to 5 V/div in 10 calibrated steps, 1-2-5 sequence + vernier. Modes: TRIG View, 20 MHz BW, CH 1, ALT, Add, Chop, CH 2 or X-Y. Sweep 0.05 usec - 0.5 s/div in 22 steps + vernier; delay 0.05 us - 50 ms/div. Also X10 magnifier, adjustable handle, cover & manual coy. 100-132/200-264 VAC 48-440 Hz; 7x1.7x21.5, 32 lbs. USED-CHECKED, \$475.00



O-135 VDC 15 A Supply



PP-1459A BATTERY CHARGER, used to charge storage batteries; produces unregulated 0-135 VDC 15 amp output from 115/230 VAC 50-60 Hz 15 amp input. Has 2.5" dia meters 0-150 VDC and 0-20 amps DC, Coarse & Fine 12-step controls, plus 115/230 V input selector. Input - Output each have circuit breaker; with power cord. 12x11x12, 60 lbs sh. Used, \$49.50

LIFTING BODY BALLOON

Distress-orange inflatable "manta ray" shaped balloon measures about 8 feet nose-to-tail, wing-tip-to-wing-tip; 3 feet at thickest. Intended to be helium-filled to raise a wire antenna for air-sea rescue transmitter. Slight breeze lifts it much easier than round balloon even when air-filled. Nice experimental item; 3 lbs #SEB-42-ALV, unused, \$25



TETHER WIRE 306 FOOT SPOOL of vinyl-covered braided #22-size antenna wire intended for use with above kite or with balloon; usable as long wire antenna also. On spool; 3 lbs sh. #SEB-400X3, unused, \$12.95

Prices F.O.B. Lima, Ohio. VISA, MASTERCARD Accepted.

Allow for shipping charges. Write for latest Catalog.

Address Dept. NV • Phone 419/227-6573 • Fax 419/227-1313

E-Mail: fairadio@wcoil.com Home Page: <http://alpha.wcoil.com/~fairadio/>

FAIR RADIO SALES CO.

P.O. BOX 1105 • LIMA, OHIO • 45802

Write in 87 on Reader Service Card.

**K
D
E**

ELECTRONICS CORP.

ALL CABLE NEEDS SE HABLAN ESPAÑOL

**CONVERTERS
ALL BRANDS
WITH REMOTE**

**PARENTAL
LOCKOUT
AVAILABLE**

COMPETITIVE PRICING

TOLL FREE ORDER LINE:
1-800-361-4586

ALSO

HOOK-UP HELP LINE:
1-630-889-0281

NO ILLINOIS SALES

**HOURS: Mon. thru Fri. 9-6, Sat. 10-2
30-DAY MONEY BACK GUARANTEE
1 YEAR WARRANTY**

KDE ELECTRONICS CORP.
P.O. BOX 1494, ADDISON, IL 60101

COINTEGRATED



COINTEGRATED

Write in 126 on Reader Service Card.

Nuts & Volts Magazine/April 1998 71

TIMELESS PRODUCTS

The Best Prices and Service • In Business over 15 years!

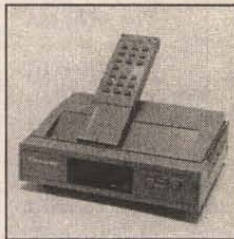
Phone 218-346-6660 Fax 218-346-6664

CABLE TV CONVERTERS

WILL NOT DECODE



TP1550PC



TZPC175D62

• LARGEST IN-STOCK DISTRIBUTOR OF TIMELESS AND PANASONIC CONVERTERS •

• REFURBISHED CONVERTERS ALSO AVAILABLE •

• QUALITY REPAIR DEPARTMENT FOR ALL YOUR TUNER REPAIRS •

• REMOTES AVAILABLE FOR MOST CABLE BOXES •

TZPC145362

TZPC1003

DEALERS ONLY • GREAT QUANTITY PRICES • NO DECODER SALES

Write in 171 on Reader Service Card.

PUBLICATIONS cont.

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 VISA/MC.

HOW TO CUT YOUR ELECTRIC BILL IN HALF - avoid high electric bills! You can reduce your bill by 50% using proven methods. Call LORD/WYATT COMMUNICATIONS for details 718-789-7329 press ext. 20.

MILITARY COMPONENTS wanted. Capacitors, resistors, diodes, transistors, semiconductors, ICs. Electronic Material Industries, 818-769-1002, FAX: 818-769-1084.

WANTED: NAVY rate training manuals: Torpedoman, Mineman, Radarman, Sonarman, Fire Control Technician, Gunnersmate Missile, Aviation & Army Equivalents. Box 10215, Pittsburgh, PA 15232.

WHAT!!! YOU don't have TELECODE's NEW 1998 "HACKER CATALOG," yet! 125+ items. Call 520-726-2833. Surf online at: <http://www.hackerscatalog.com>

HACKERS GOLD CD-ROMs. Two volumes. The most complete underground collection of hackers files ever assembled. 550+ megabytes on each! Published: February 1998. Either CD-ROM \$34.95. Both \$49.95. 520-726-2833. TELECODE, PO Box 6426-NV, Yuma, AZ 85366-6426. <http://www.hackerscatalog.com/hackgold.htm>

MAGAZINE SUBSCRIPTIONS DISCOUNTED up to 60%! CQ, 73, Popular Communications! Computer titles! Over 600 family, business, sports titles! Free list (stamp appreciated). Ed Howell, Dept. NV, Box 73, Folly Beach, SC 29439-0073.

Looking for a great value? Subscriptions to *Nuts & Volts* are only \$19 for a full year.

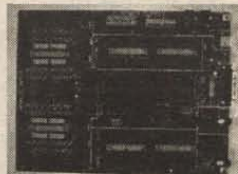
Call Toll Free and use your Visa or MasterCard to order! 1-800-783-4624

Or check out our web site and take advantage of our special subscription offer.

<http://www.nutsvolts.com>

ROBOTICS

ROBOTS WANTED: dead or alive, whole or parts. HeathKit (HERO JR, HERO 1, HERO 2000, or Arm Trainer), and robots (Topo, BOB, FRED, Andromed, RB5X, Gemini, Hubot, Newton SynPet, Omnibots, Rhino, Marvin, Servitron, ITSABOX, Cyber I, MAXX STEELE, etc. Also looking for robot options, books, and literature. Will pay cash. Please E-Mail: rdoerr@bizserve.com Call 810-777-1313 or write to: Robert Doerr, 26308 Cubberness, St. Clair Shores, MI 48081.



I/O CONTROLLER kit 64 12-bit analog inputs, 128 digital inputs/outputs, DTMF, IR from \$79. <http://www.takecontrol.com> 706-782-9848.



HEXAPOD ROBOT, walks forward, reverse turns left and right. Comes with everything to build your own robot. Includes a counterfeit Basic Stamp with example code. \$150 complete. Add \$7.50 S&H USA. IL residents add 6.25%. VISA, MasterCard. Tel: 309-382-1816 Fax: 309-382-1254 Web: www.lynxmotion.com Free catalog with more robots



ROBOTIC ARM, 5 axis arm, including gripper. Control with any serial port. Very accurate and repeatable. Comes with everything to build your own robot. Includes a MiniSSC2 servo controller with software. \$195 complete. Add \$7.50 S&H USA. IL residents add 6.25%. VISA, MasterCard, Tel: 309-382-1816 Fax: 309-382-1254 Web: www.lynxmotion.com Free catalog with more robots.



MICROMOUSE ROBOT, can be used for line tracking, mazes, etc. Everything you need to build your own robot. Includes a Counterfeit Basic Stamp with example code. \$95 complete. Add \$7.50 S&H USA. IL residents add 6.25%. VISA, MasterCard, Tel: 309-382-1816 Fax: 309-382-1254 Web: www.lynxmotion.com Free catalog with more robots.

Sell Nuts & Volts in your store! Contact us for complete details. phone 909-371-8497 fax 909-371-3052 E-Mail distributors@nutsvolts.com

ATTENTION DEALERS: WHOLESALE ONLY!

EXCLUSIVE:



NEW!

Wavemaster 99 Channel

• Sleep Timer • Std./HRC Switch • Parental Control

10+ 20+ 50+
\$57 52 45



Formerly JES, Inc.

BEST PRICES!

FAST SERVICE

SAME DAY SHIPPING



	5+	10+	20+
Panasonic 145	\$72	65	60
Refurb. Panasonic 145	57	55	52
Panasonic 100	52	49	--
Panasonic 175	---	CALL!	---
Starcomm DQN (99 ch; Refurb.)	49	45	39

TOLL FREE: 800-322-9690



FAX: 516-246-5634

Software Wizardry

By Harry Helms

Webcasting

There is a seemingly unlimited amount of information available on the World Wide Web. And that means it's tough keeping up-to-date with new material and changes to your favorite Web sites. You can bookmark your favorite sites in your Web browser, but you still have to "manually" check each of those sites occasionally for new material and changes. If a site contains several pages, finding the page(s) where the new or altered material appears can take a lot of time and effort ... so much so that it's often not worth the effort to try to keep up with such changes.

On the other "end" of the Web, developers would like some way to cut through the clutter on the Web and alert earlier visitors when new material is available on a site. The motivation is more than kindness on the part of Web developers; advertisers would pay premium prices for space on pages that are sure to reach earlier visitors.

The dream for many Web developers has been to create a system that alerts Web site visitors when new or updated content is available or — better yet — automatically deliver such pages to visitors who want to receive them. This has become known as push technology, or webcasting. Several different push technologies have been developed, but now we are at the point where webcasting is becoming simple enough to implement on almost any Web site. This means you no longer have to rely upon visitors to re-visit your site for new content; you can instead "mail" them new content and pages as you develop them.

This has a lot of potential for Web users and developers. This month, we'll take a look at how to implement webcasting on your Web site.

Early Efforts

The potential of webcasting was recognized soon after the Web became popular. Two popular methods were developed by PointCast and BackWeb.

The PointCast system requires users to download and install the PointCast software on their PC. Users fill out registration forms with PointCast or PointCast-equipped Web sites to indicate what type of information the user wants to receive. When updated information is made available by PointCast or participating Web sites, it is downloaded to the user's PC "in the background." This means the material is automatically downloaded even while the PC is visiting another Web site. The downloaded material is displayed as a screen saver whenever the PC is not being used for a task.

BackWeb works in a similar fashion, but it indicates when new content has been received by placing a small icon on the user's monitor display. Users click on the icon to display the new material.

While useful, technologies like PointCast and BackWeb have some obvious limitations. You have to install new software on your PC. You are limited to the sites supporting these technologies. And you don't have control over how the updated material is delivered or displayed.

PointCast, BackWeb, and similar push technologies are "plug-ins" for popular Web browsers like Netscape and Internet Explorer. It was natural that Netscape and Microsoft would add push technologies to upgrades of their browsers. And that's just what they did.

Netscape's Netcaster

Netscape incorporated a push technology called Netcaster in the latest version of their Communicator

browser released in late 1997. Netcaster was designed to take advantage of the huge advantage Netscape enjoyed in browser usage prior to 1997.

The default Web site for Netscape's browsers is, not surprisingly, www.netscape.com. This meant that Netscape's Web site was the most visited spot on the Web until 1997. Netcaster was intended to work with Netscape's Web site, and deliver updated material to visitors who used Netcaster-enabled Netscape browsers.

Netcaster is a pure Java application, meaning it can work in recent versions of the Netscape and Microsoft browsers. "Channels" on the Netscape site use Java, JavaScript, and HTML, and are delivered to users through Netscape.

Netcaster was intended as a way to sell "channel space" on Netscape's Web site, not as a general-purpose Web push technology. Netscape managed to conclude deals with several leading media companies — such as Disney — to provide content for its various channels. However, Netscape apparently did not anticipate the rapid adoption of Microsoft's competing Internet Explorer and the rise of search engines such as Yahoo and Excite. Netscape experienced some delays in getting Netcaster ready, allowing Microsoft's competing Active Channel technology to gain a foothold. As a result, Netcaster is being repositioned as a general-purpose push technology.

Unfortunately, creating Web sites and channels using Netcaster is not an easy process. Moreover, it works only with sites that have been created for Netcaster. If you want to keep up-to-date on sites that do not use Netcaster, you'll have to bookmark and remember to check them. Finally, buying a channel on the Netscape site takes a lot of money, and to date Netcaster is rarely used beyond the Netscape Web site.

Because of these factors, Netcaster does not seem to be a good choice for webcasting unless you're well-funded enough to buy a channel on the Netscape site. If you're a Web user instead of developer, Netcaster has a lot to offer, however.

Webcasting With Internet Explorer 4.0

Microsoft's Internet Explorer 4.0 browser comes with several features that facilitate webcasting. In fact, IE 4.0 supports a form of webcasting for any Web site, including those that have not been designed to support any form of push technology.

The secret to doing this is IE 4.0's built-in "spidering" capability. A "spider" is a program that searches and indexes the content of a Web page or site. Spiders are used by Internet search engines like Infoseek, Lycos, etc., to index and organize Web pages into different categories. Internet Explorer 4.0's spider searches the content of all bookmarked Web sites, and highlights any bookmarked site where new or changed material is detected. This spidering is done "in the background" by the browser whenever users are on-line,

even if they are visiting other Web sites.

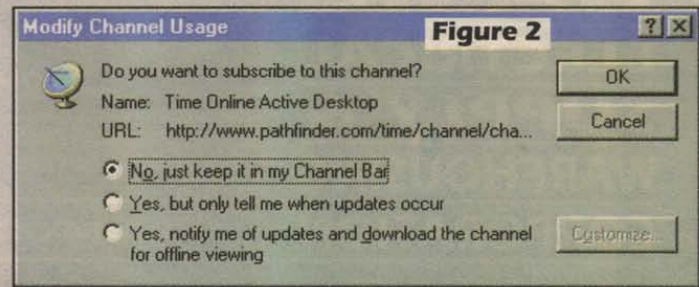
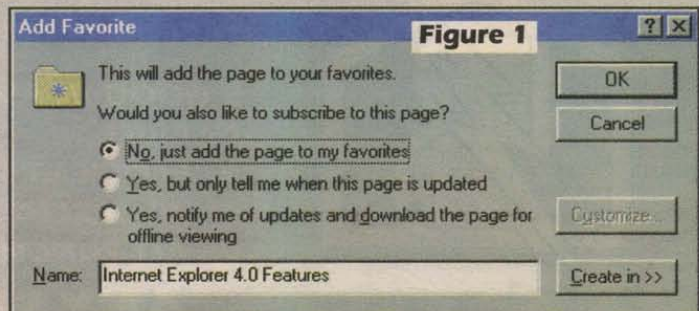
A more powerful form of webcasting with Internet Explorer 4.0 uses the channel definition format (CDF) specification that Microsoft has proposed to the World Wide Web Consortium (W3C). Unlike simple bookmarking, a CDF channel is a collection of frequently updated information. The CDF specification describes the information contained in the channel and when and how it is updated or changed. This allows the spidering process to be timed to when site content is typically updated. CDF also lets you designate which page(s) of a Web site are to be webcast.

CDF is one of the first applications of XML (eXtended Markup Language), the new page authoring language that promises to have a major impact on Web publishing in the near future. See the accompanying sidebar for more information on XML.

Microsoft is using the term Active Channel to describe Web content developed using the CDF specification. Active channel content can be delivered to a user's PC in four ways: full screen mode (that is, an ordinary Web page display); screen saver mode (Web page is displayed while the user's PC is idle); desktop mode (a "mini-page" display like a stock ticker or scrolling marquee); and channel mail mode (pages are delivered to the PC's mailbox).

The process of being notified by Internet Explorer 4.0 when a Web page has new or updated content is called a subscription. I think Microsoft made a mistake by using this term, since it implies that you need to pay money to get the new content. In this context, however, subscribing to a Web site means you simply add it to a list of favorite sites to be inspected by IE 4.0's built-in "spider."

Figure 1 shows the dialog box displayed when you select the "add to favorites" item from Internet Explorer 4.0's "favorites" menu. You have three options. The first just adds, or "bookmarks," the page to your list of favorite Web sites. The second option causes Internet Explorer 4.0 to "spider" the Web site and simply notify you if it finds new or updated content on the site. If this option is selected, a "gleam" will appear next to the item in the list of favorites; you then can go to the site in the usual way. The most interesting new option is the



Software Wizardry

third one. If this option is selected, Internet Explorer 4.0 will automatically download the page when you're on-line (often when you're viewing another page previously downloaded) and you can view it later.

If a site has been prepared using the CDF format, the dialog box shown in Figure 2 is displayed. A CDF-developed channel is easier and faster for Internet

Explorer 4.0 to "spider," since it is XML-based and the DTD for the XML page indicates specifically which sections have been changed. The page can be displayed in various ways on a user's desktop, including as a full screen, as a screen saver, as a desktop item of a desired shape and size, or delivered to the user's E-Mail mailbox. Developers can give users different

options as to how they want updated material delivered and displayed.

Like so many things about the Web, I have a feeling we're in the infancy of what will eventually evolve. I wouldn't be surprised in a few years if your subscription to *Nuts & Volts* is delivered via the Web instead of the mail! **NV**

About XML

Hypertext markup language (HTML) is the standard for Web publishing, but it has some real limitations. For example, suppose you want to include some Japanese characters or a mathematical notation on a Web page filled with English text. With HTML, your only solution will usually be to add the new characters or notation as graphics, such as .GIF files, instead of as text.

HTML has shortcomings even for the English alphabet. You're limited in the number of type fonts and sizes you can use, and HTML presents all sorts of formatting problems for laying out text and graphics.

META tags inside HTML documents are used to help search engines like Yahoo and Excite classify and index Web pages, but these are overly broad and limited in the amount of information they can convey. As a result, Web searches are usually much less accurate than most users would like.

The introduction of webcasting has made the limitations of HTML even more crucial. The "spidering" used by Internet Explorer 4.0 (and Web search engines) is not an optimum solution; it would be better if a Web site could somehow "announce" when it had updated content and point out just which pages had changed and not require the entire site to be "spidered."

It so happens that a solution to these problems has existed for several years. It's called standard generalized markup language (SGML) which became an international standard in 1986. SGML was developed as a platform-independent and extremely flexible way to markup text files for publication, and has since been used for everything from typesetting to databases to CD-ROM publishing. If it can be done on a page of printed text or on a video display containing text, it can be done with SGML. In fact, HTML itself is nothing but a subset of SGML.

So why not just use SGML for Web publishing? The big reason is the tremendous "overhead" of SGML. SGML includes many features useful for print, CD-ROM, etc., publishing that are not required for Web publishing and just take up space. The solution to this problem is to select those other elements of SGML that have relevance to Web publishing, add them to HTML, and ignore the rest. A group of SGML experts working with the World Wide Web Consortium (W3C) studied the problem and, in 1997, released a draft specification for eXtended Markup Language (XML). The final specification may be released by the time you

read this; it is expected to follow the draft specification very closely.

Perhaps the biggest advantage of XML over HTML is how it will allow easy conversion of existing SGML documents into Web-ready form. Since it was introduced in 1986, SGML has become the standard markup language for books, directories, databases, government documents, and almost any lengthy text document that's stored in digital form. HTML requires extensive reformatting and re-coding to convert from SGML, while XML would involve little more than changing the document type declaration (DTD) that is placed at the start of a SGML/XML document. The DTD describes such things as special characters, fonts and sizes, formatting, etc., used in a document.

Using a DTD means it will be easy to change the "look" of a Web page merely by changing the DTD for that document; you won't have to go through the document and carefully change text, headers, etc. It also means visitors can change how a Web page is displayed by selecting a new DTD in their Web browser. For example, Web users with vision problems could easily change to a large-print version of a Web page by selecting an optional DTD in their browser.

Another interesting aspect of XML is the flexibility of linking it offers. When you click a link on a HTML page, you either go to another section in the same page or to an entirely new page. With XML, it's possible to link to a specific paragraph or even sentence in another document. This means that you could keep a visitor to your site "anchored" there while permitting them to view selected sections of other pages (to see definitions or graphics, for example).

As mentioned in this month's column, CDF is the first use of XML, and so far Microsoft's Internet Explorer 4.0 is the only browser that supports XML. Given XML's many advantages over HTML, expect Netscape to soon incorporate XML in its browsers. (Remember that both HTML and XML are subsets of SGML; adding XML capability to a HTML browser is relatively simple.)

Fortunately, you won't be forced to start using XML immediately. XML is "overkill" for many purposes, especially simple pages. But since XML makes it possible to move so many existing documents to the Web, you can expect the majority of Web sites to be using XML about five years from now.

❖ 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

It is not the intent of B.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



**BASIC
ELECTRICAL
SUPPLY &
WAREHOUSING
CORPORATION**

DYNAMIC Technologies

Advanced Cable Products for a Competitive World

800-643-4258 • 402-731-9555

Suite 541064 • Boystown, NE 68154 Fax 402-734-4263

Stargate Elite

- Slim Line Remote
- 550MHz / 83 Channel
- Parental Control
- Unlimited Favorite Channel
- HRC / Standard Switchable
- Auto Fine Tune
- Manual Tune Override
- 1 Year Warranty

As Low As \$38.50

Stargate Elite Plus

- Volume Control
- Audio/Video Out
- Slim Line Remote
- 550 MHz / 83 Channel
- Parental Control
- Unlimited Favorite Channel
- HRC / Standard Switchable
- Auto Fine Tune
- Manual Tune Override
- 1 Year Warranty

AS
LOW
AS

\$59.95



Infinity 3000

- SHARP 125 Channel Tuner
- Dynamic Memory Recall
- Parental Control
- Last Channel Recall
- Unlimited Favorite Channels
- Slim Line Remote
- Automatic Fine Tune
- Micro Card Slot
- Volume Control
- Audio /Video Outputs
- Sleep Timer
- Automatic Low Signal Enhancer

SHARP's™ New Premium Dynamic Tuner
No Other Cable Box Gives a Sharper Picture



AS LOW AS \$77.00

Stargate Infinity 3000A

- Advanced Addressable Base Band Decoder
- Upgradeable Micro Decoder Card
- 125 Chnnel / 800 MHz
- Volume Control
- Audio/Video Outputs
- Sleep Timer
- Automatic Low Signal Enhancer
- Dynamic Memory Recall
- Parental Control
- Last Channel Recall
- Unlimited Favorite Channels
- Slim Line Remote
- Automatic Fine Tune

AS
LOW
AS

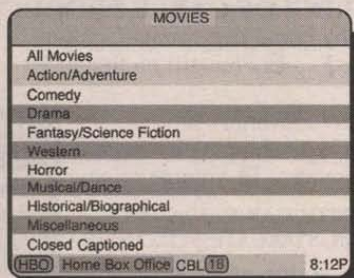
\$169.00

NEW

The Ultimate Navigator Series

- Advanced Baseband Replacement
- Interactive On Screen Display
- 250 Channel Capable
- Watch One Premium While Recording Another
- Parental Control with timed lock/unlock schedules
- Watch and Record
- Easy Read Clock
- Preloaded Channel Labels
- Unique Favorite Channel Theme System
- V-Chip Ready
- Audio/Video Input and Output
- Addressable/Programmable
- Electronic Program Guide Available*

Starting at \$219.00



*StarSight Electronic Program Guide Exclusive to the Navigator Series

- One Touch Recording
- Eliminates Complicated VCR Programming
- Current, Future or Series Recording
- Categorizes All Programming
- Displays Time, Date, Rating, Starring Actors, and More
- Seven Day Programming Schedule
- Free Ninety Day Subscription

All products are FCC approved and comply with the 1996 Telecommunications Act Section 304, Subsection 629 entitled Navigation Equipment. In accordance with the 1996 Telecommunications Act, all Dynamic products with decoding functions are addressable and must be activated by an authorized cable system.

ELECTRONIC TEST EQUIPMENT BOUGHT & SOLD

Altech 360D11, Frequency Syn. .01-2GHz	\$1,000	HP 8640B/02/03, Signal Gen., 5-1024MHz	\$1,800
Argosystems AS210, Frequency Calibration System	\$2,000	HP 8660A/86601A/86632A, Freq. Syn.	\$1,000
Balco 911A, Frequency Response Analyzer (unused)	\$400	HP 8755C, Network Analyzer Plug-in	\$500
Ball Etralon PC-10, Rubidium Standard	\$800	HP 8821A, Medium Gain Bank Amp	\$150
Bird 4381, RF Power Analyzer, Opt. 832	\$300	HP 8901A, Modulation Analyzer	\$2,500
Bontoon 102B, Signal Generator, 45-520MHz	\$650	HP 8903A, Audio Analyzer	\$2,000
Bontoon 42B0, Microwattmeter 2MHz-7GHz	\$300	Keithley 192, Programmable DMM, 6.5 Digits, HP/IB	\$600
Bontoon 518-A4, Q Standard	\$250	Keithley 614, Electrometer	\$700
Bontoon 82AD, Modulation Meter	\$650	Krohn-Hite 3202, Filter, LP, HP, BP, Unused	\$350
Bontoon 92A, RF Millivoltmeter w/Probe	\$300	Leeds & North 1091, Capacitor Decade, .001uF-1uF	\$150
Bruel & Kjaer 1612, Bandpass Filter	\$250	Marconi 2022A, Signal Generator, 10KHz-1GHz	\$2,000
Cushman CE24B, Frequency Selective Voltmeter	\$500	PMI 1018B, Peak Power Meter	\$350
Datron 1062, Digital Multimeter	\$300	Polarad 1105-E-L, Sig. Gen., 1020A Mod., 8-2.4GHz	\$300
DDC SR-400, Synchronizer Resolver Simulator	\$400	Polarad 1207, Signal Source 3.8-8.2GHz	\$200
DR Thiedig MILLI-T02, Ohmmeter, 1 Milliohm-2 Terraohms	\$400	Polarad SPNH, Generator 20Hz-20KHz	\$450
Eaton 380K11, Synthesizer, 1-2000MHz	\$2,500	Racal Dana 1515, Delay Pulse Generator	\$500
Opt. 01, 03, 183	\$2,500	Racal Dana 1992, Frequency Counter, High Stab.	\$500
EIP 371, Source Locking Microwave Counter, 18GHz	\$1,000	Racal Dana 9082P, Signal Gen. 1.5-520MHz	\$800
Fluke 3330B, DC Voltage, Current Calibrator	\$400	Racal Dana 9303, True RMS RF Level Meter	\$650
Fluke 335A, DC Voltage Standard, 0-1100VDC	\$600	Racal Dana 9515, Universal Counter, HP/IB, Opt. 41	\$200
Fluke 515A, Portable Calibrator	\$800	Sanders 5440C, Noise Figure Mtr., 10KHz-40GHz	\$400
Fluke 5200A, Programmable AC Voltage Standard	\$1,200	Sencore TF30, Super Cricket Transistor Tester	\$200
HPB	\$1,200	Tek 11302, Scope, 500MHz w/2(1) 11A71 Plug-ins	\$1,400
Fluke 6080A/AN Frequency Syn., 5-1024MHz	\$5,000	Tek 1241A, Logic Analyzer, with Accessories	\$650
Fluke 9010A, Micro-System Troubleshooter Opt. 001	\$450	Tek 1502/04, TDR, Option 03, 04	\$1,000
Fluke A55, Thermal Converter	\$200	Tek 178, Linear IC Test Fixture, For 577	\$300
General Microwave 478A, Peak Power Meter	\$700	Tek 2230, Storage Scope, 100MHz, Dual Trace	\$2,200
General Radio 1422-CB, Standard Cap.	\$200	Tek 2235, Scope, 100MHz Dual Trace	\$750
General Radio 1433G, Decade Resistor	\$350	Tek 2336, Scope, 100MHz, Dual Trace	\$800
General Radio 1433G, Decade Resistor, 1.111111m	\$350	Tek 2432, Scope, Digital, 300MHz, 4 Channel	\$3,000
General Radio 1531, Stroboscopes	\$150	Tek 2465, Scope, 300MHz, 4 Channel	\$2,500
General Radio 1538-P4, High Intensity Flash Capacitor	\$50	Tek 318, Logic Analyzer, with Pods & Acc.	\$500
General Radio 1633-A, Incremental Inductance Bridge	\$500	Tek 444, Scope, 100MHz Dual Trace, Storage	\$400
General Radio 1650A, Impedance Bridge	\$200	Tek 465, Scope, 100MHz Dual Trace	\$400
Gigatronics 600R-12, Synthesized Source	\$1,000	Tek 466, Scope, 100MHz Dual Trace, Storage	\$600
Goldstar OS-7040A, Scope, 40MHz, Dual Trace	\$200	Tek 475, Scope 200MHz, Dual Trace	\$600
Gould 4500, Digital Storage Scope, 35MHz	\$300	Tek 475A, Scope 250MHz, Dual Trace	\$650
Guideline 9154C, Transvoltage Standard Cell	\$300	Tek 485, Scope 350MHz, Dual Trace	\$700
Hilachi V-212, Scope, 20MHz, Dual Trace	\$200	Tek 492/01/02, Spectrum Analyzer	\$5,500
HP 1124A, 100MHz Active Divider Probe, Unused	\$100	Tek 492/02/03, Spectrum Analyzer	\$6,000
HP 11638A, Calibration Kit, Type N	\$600	Tek 492/02, Spectrum Analyzer	\$5,000
HP 11712A, Service Kit for 8670 Series Inst.	\$500	Tek 496P, Programmable Spectrum Analyzer	\$5,000
HP 15453A, Pod Set for 8170A	\$200	Tek 5003, Power Module	\$300
HP 1630G, Logic Analyzer, 65 Ch. 100MHz	\$800	Tek 624, XY Monitor	\$200
HP 16510B, Logic Analyzer Card, 16500A System	\$1,000	Tek 7020, Programmable Digitizer PI	\$600
HP 16530A/16531A, Digital Scope Card, 16500A System	\$1,000	Tek 7L5, Spectrum Analyzer / L3-1	\$800
HP 1741A, Scope, Storage, 100MHz	\$450	Tek 7S12/56, TDR Sampler	\$800
HP 1742A, Scope, 100MHz Dual Trace, DMM	\$400	Tek AA5001/TMS503, Distortion Analyzer	\$1,000
HP 1744A, Scope, Storage, 100MHz, Dual Trace	\$500	Tek CG551AP/515P, Scope Calibrator	\$1,000
HP 214B, Pulse Generator	\$1,000	Tek DC503, Universal Counter Timer TMS500	\$150
HP 2804A, Quartz Thermometer, No Probe	\$300	Tek DC504, Counter/Timer TMS500	\$100
HP 3325A/01 Function Generator	\$1,600	Tek MR501, XY Monitor Scope	\$200
HP 3325A/01/02, Function Gen. Opt. 01/02	\$2,000	Tek PG046, Differential Probe Kit	\$350
HP 334A, Distortion Meter	\$200	Tek P-6, Sampling Head	\$350
HP 3455A, Digital Multimeter	\$300	Tek SC502, Scope, 15MHz, Dual Trace	\$250
HP 3580A, Spectrum Analyzer, Opt. 02	\$800	Tek SG502, Sig. Gen. 5Hz-50KHz TMS500 Sys.	\$200
HP 3581C, Selective Level Meter	\$500	Tek TGS01, Time Mark Generator	\$400
HP 4270A, Automatic Capacitance Bridge	\$400	Tek TMS03, Mainframe 3 Slot, TMS500	\$100
HP 432A/8478B, Power Meter & Sensor, .01-18GHz	\$450	Texscan SSG2000, Freq. Syn., 100KHz-2GHz, AM, FM	\$1,800
HP 4800A, Vector Impedance Meter	\$600	Vu-Datta 5110, Semiconductor Tester, In/out Circuit	\$150
HP 5004A, Signature Analyzer	\$100	Wavetek 1038, Network Analyzer, 1MHz-26.5GHz	\$800
HP 5006A, Signature Analyzer	\$300	Wavetek 1045/14139, Power Meter	\$800
HP 5315A, Universal Counter	\$200	Wavetek 185, Sweep Function Gen. .0001-5MHz	\$400
HP 5334A/010/060, Frequency Counter, Unused	\$1,200	Wavetek 1910, XY Monitor, Dual Trace	\$600
HP 5335A, Frequency Counter, 11 Digit, Opt. 010/040	\$800	Wavetek 2002A, Signal Gen. Sweeper, 1-2500MHz	\$1,000
HP 5340A, Frequency Counter, 18GHz	\$800	Wavetek 3000, Signal Gen., 1-520MHz, AM, FM	\$600
HP 5340A/01/011, Frequency Counter, LEDs	\$1,200	Wavetek 3001, Signal Gen., 1-520MHz, AM, FM	\$600
HP 5342A, Frequency Counter, 18GHz, Opt. 01/02	\$2,000	Wavetek 452, Filter, Dual HiLo, 1Hz-10KHz	\$450
HP 5342A, Frequency Counter, 18GHz	\$1,800	Wavetek 7530A, FFT Spectrum Analyzer 0-100KHz	\$650
HP 5345A, Universal Counter	\$400	Wiltron 560A, Network Analyzer	\$800
HP 5385A, Frequency Counter, Opt. 004	\$800	Wiltron 610D/6237D, Sweep Generator, 2-18GHz	\$800
HP 54001A, 1GHz Active Probe for 54100-54110 System	\$300		
HP 54200A, Digital Storage Scope, Dual Trace, 200MG/S	\$1,000		
HP 6112A, Power Supply, 0-40V, 0.5A	\$200		
HP 6920A, Meter Calibrator	\$200		
HP 8015A, Pulse Generator, 1Hz-50MHz, 30V	\$500		
HP 8165A, Programmable Signal Source, .0001-50MHz	\$1,600		
HP 8445B, Spectrum Anyz., Automatic Pre-Selector	\$300		
HP 8553B, Spectrum Anyz., RF Plug-in, 1K-110MHz	\$200		
HP 8554B/8552B, Spectrum Analyzer 141T, 1.2GHz	\$1,500		
HP 8556A, Plug-in, Spectrum Analyzer, 20Hz-300KHz	\$300		
HP 8557A/180TR, Spectrum Analyzer, .01-350MHz	\$1,000		
HP 8558B/180TR, Spectrum Analyzer, 1-1500MHz	\$1,800		
HP 8559A/182T, Spectrum Analyzer, .01-21GHz	\$3,000		
HP 8559A/853A, Spectrum Analyzer, Digital, .01-21GHz	\$4,500		
HP 8565A, Spectrum Analyzer, .01-22GHz	\$3,500		
HP 8569A, Spectrum Analyzer, .01-22GHz	\$5,000		
HP 86222A, RF Plug-in, .01-2.4GHz	\$1,000		
HP 86222B/869, RF Plug-in, .01-4GHz	\$1,000		
HP 86241A, RF Plug-in, 3.2-6.5GHz	\$400		
HP 86260A, RF Plug-in, 12.4-18GHz	\$400		
HP 86290B, RF Plug-in, 2-18GHz	\$1,400		
HP 8640B/01, Signal Gen., 5-512MHz AM/FM	\$1,000		

PHELPS INSTRUMENTS

2631 Hillside Ave., Norco, CA 91760 • 909-279-7347



The RF Connection
213 North Frederick Ave.
Suite 11NV
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 Gasket75

Amphenol 83-1SP-1050 PL-259\$0.90
UG-176/U Reducer RG-59/8X .25 or 5/51.0C
UG-175/U Reducer RG-58/58A .25 or 5/51.0C
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 93 on Reader Service Card.

BECOME A NUTS & VOLTS DISTRIBUTOR Call 909-371-8497 Today!

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.



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 575 ANTON BLVD., SUITE 300, COSTA MESA, CA 92626, USA

SECURITY ELECTRONICS SYSTEMS AND CIRCUITS — Part 3

Contact-operated security circuits are units that are activated by the opening or closing of a set of electrical contacts. These contacts may take the form of a simple push-button switch, a pressure-pad switch, or a magnetically-activated reed switch, etc.

The security circuit's output may take the form of some type of alarm-sound generator, or may take the form of a relay that can activate any external electrical device, and may be designed to give non-latching, self-latching, or one-shot output operation.

Contact-operated security systems have many practical applications in the home, in commercial buildings, and in industry. They can be used to attract attention when someone operates a push switch, or

Ray Marston looks at contact-operated security circuits in the third episode of this series.

parallel, so that the alarm operates when any of these switches are closed. This type of circuit gives an inherently non-latching type of operation, and has the great advantage of drawing zero standby current from its supply battery.

A disadvantage of the basic Figure 1 circuit is that it passes the full 'alarm' current through the n.o. operating switches and their wiring, so the switches must be fairly robust types, and the wiring must be kept fairly short if excessive wiring voltage drops are to be avoided. This latter point is of particular importance in

security applications in which the circuit is used with several widely separated n.o. switches.

The solution to this problem is to activate the bell, via a 'slave' device (which is fitted close to the bell but requires a fairly low input current), and to activate this slave device (and thus the bell) via the security switches. Figures 2 to 6 show a variety of such circuits, in which the slave device takes the form of a relay, a power transistor, or an SCR.

Figure 2 shows a relay-aided version of the close-to-operate alarm circuit. Here, the parallel-connected

or more of the switches are closed, the relay is driven on and its contacts close and activate the alarm bell. Note in the latter case that the switches and their wiring pass a current equal to that of the relay coil; the switches can thus be fairly delicate ones, such as sensitive reed types, and the wiring can be reasonably long. Silicon diode D1 is wired across the relay's coil to protect the switches against damage from the coil's switch-off back EMF.

The Figure 2 circuit gives a non-latching form of operation, in which the alarm operates only while one or more of the operating switches are closed.

In most high-security applications, the circuit should be a self-latching type in which the relay and alarm automatically lock on as soon as any one of the n.o. switches is closed, and can only be deactivated via a security key.

Figure 3 shows the above circuit modified to give this type of operation. Here, the relay has two sets of n.o. contacts, and one of these is wired in parallel with the n.o. switches so that the relay self-latches as

soon as it is operated, and the entire circuit can be enabled or disabled/de-activated via key switch S1, which is wired in series with the battery supply line.

Circuits of this basic type are usually used in low-cost 'zone protection' applications, in which the 'zone' is a large room or shop floor, the S1 key switch is located outside of the zone, and the n.o. trigger switches are hidden pressure-mat switches or door- or window-operated microswitches fitted within the protected zone.

An alternative solution to the Figure 1 switch-and-wiring 'current' problem — but which can only be used in non-latching applications — is shown in Figure 4, in which npn power transistor Q1 is used as the slave device. Resistor R1 ensured that — when any of the activating switches are closed — Q1's drive current is limited to less than 60mA, which (assuming that Q1 has a nominal current gain of at least x25) enables the transistor to switch at least 1.5A through the alarm bell.

Another solution to the 'current'

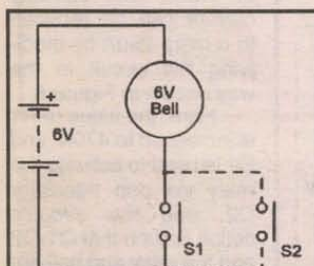


Figure 1. Simple door-bell type close-to-operate alarm circuit.

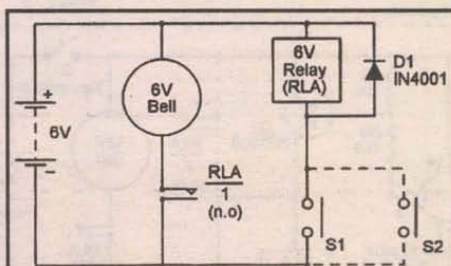


Figure 2. Relay-aided non-latching close-to-operate alarm.

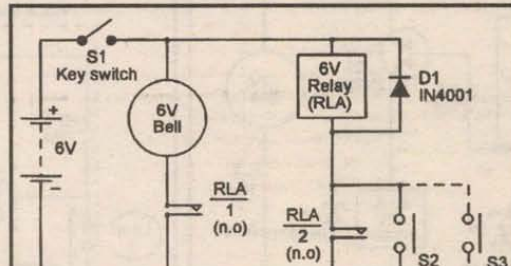


Figure 3. Relay-aided self-latching close-to-operate security alarm.

to give a warning when someone opens a door or treads on a pressure pad or tries to steal an item that is wired into a security loop, or to give some type of alarm or safety action when a piece of machinery moves beyond a preset limit and activates a microswitch, etc.

A wide range of practical contact-operated security circuits are described in this article.

BELL AND RELAY-OUTPUT CIRCUITS

CLOSE-TO-OPERATE CIRCUITS

The simplest type of contact-operated security circuit consists of an alarm bell (or a buzzer or electronic 'siren-sound' generator, etc.), wired in series with a normally-open (n.o.) close-to-operate switch; the combination being wired across a suitable battery supply, as shown in the basic 'door-bell' alarm circuit of Figure 1.

Note that any desired number of n.o. switches can be wired in

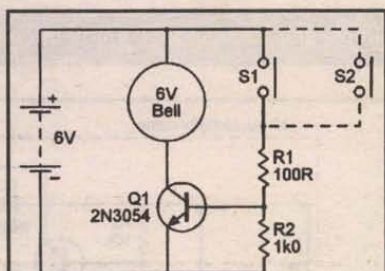


Figure 4. Transistor-aided non-latching close-to-operate alarm.

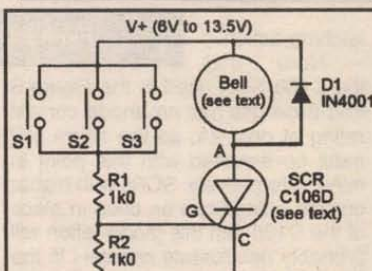


Figure 5. SCR-aided non-latching close-to-operate alarm.

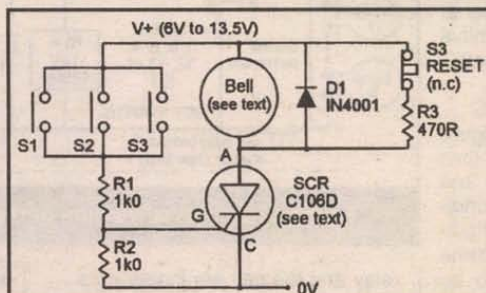


Figure 6. SCR-aided self-latching close-to-operate alarm.

n.o. switches are wired in series with the coil of a 6V relay (which typically draws an operating current of less than 100mA), and the relay contacts (which can typically switch currents of several amps) are wired in series with the alarm bell, and both combinations are wired across the same 6V supply.

Thus, when the switches are open, the relay is off and its contacts are open, so the bell is off, but when any one

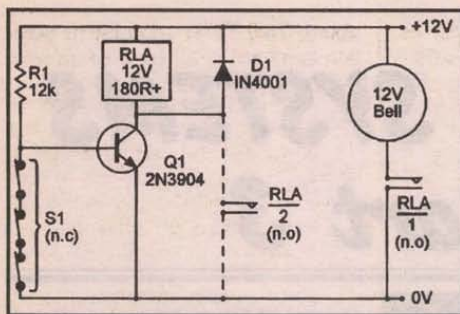


Figure 7. Simple open-to-operate alarm draws a 1mA standby current.

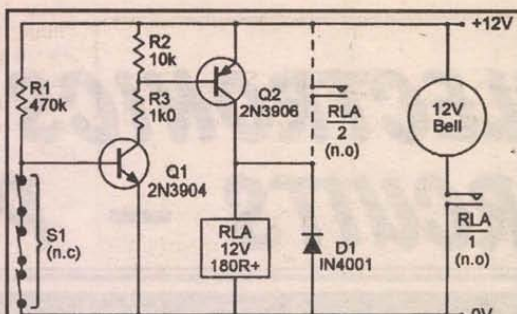


Figure 8. Improved open-to-operate alarm draws a 25µA standby current.

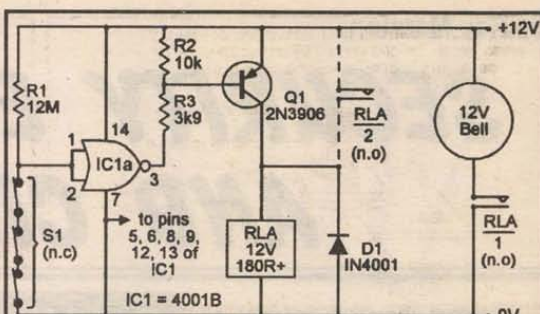


Figure 9. CMOS-aided open-to-operate alarm draws a 1µA standby current.

problem is to use an SCR (silicon controlled rectifier) as the slave device, as shown in Figures 5 and 6. These circuits rely on the fact that ordinary electromagnetic alarm bells are self-interrupting solenoid devices that incorporate a self-activating on/off switch in series with the solenoid's supply line.

This switch is normally closed, allowing current to reach the solenoid and throw out a striker that hits the bell dome and simultaneously opens the switch, thus breaking the current feed and causing the striker to fall back again until the switch closes again, at which point the

entirely self-latching devices that, once they have been initially turned on, remain on until their anode current falls below a 'minimum holding' value, at which point the SCR unlatches and turns off.

In the Figure 5 circuit, the SCR thus automatically unlatches each time the alarm bell self-interrupts, but in the modified Figure 6 design, the bell is shunted via R3, which is wired in series with n.c. switch S4, which ensures that the SCR's anode current does not fall below the C106's minimum holding current value when the bell self-interrupts, thus providing the circuit with a self-

switches, and a basic circuit of this type is shown in Figure 7.

In Figure 7, the coil of a 12V relay is wired in series with the collector of transistor Q1, and bias resistor R1 is wired between the positive supply line and Q1 base. The alarm bell is wired across the supply lines via n.o. relay contacts RLA/1, and n.c. operating switch S1 (which may consist of any desired number of n.c. switches wired in series) is wired between the base and emitter of the transistor.

Thus, when S1 is closed, it shorts the base and emitter of Q1 together, so Q1 is cut off and the

draws a quiescent current of 1mA via R1. When S1 opens or a break occurs in its wiring, Q1's base-to-emitter short is removed and the transistor is driven to saturation via R1, thus turning the relay on and activating the alarm bell via relay contacts RLA/1.

This basic circuit gives a non-latching type of alarm operation, but can be made to give self-latching operation by wiring a spare set of n.o. relay contacts (RLA/2) between the collector and emitter of Q1, as shown dotted in the diagram.

Thus, the Figure 7 circuit gives fail-safe operation, but draws a quiescent or standby current of 1mA. This standby current can be reduced to a mere 25µA by modifying the circuit in the way shown in Figure 8.

Here, the value of R1 is increased to 470K, and Q1 is used to activate the relay via pnp transistor Q2, and the circuit's action is such that Q1-Q2 and the relay and bell are all off when S1 is closed, but turn on when S1 is open.

The basic circuit gives a non-latching form of operation, but can be made self-latching by

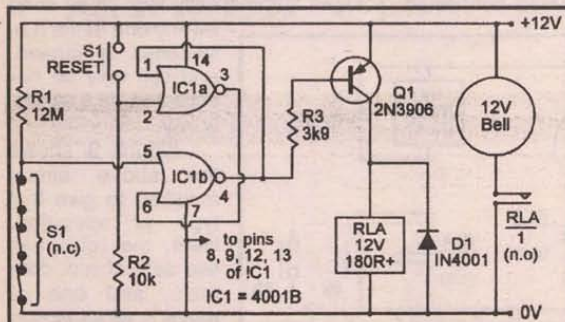


Figure 10. Self-latching CMOS-aided alarm draws a 1µA standby current.

whole process starts to repeat, and so on; the bell's operating current is thus drawn in pulsed form.

In the Figure 5 circuit, the alarm bell is wired in series with an SCR that has its gate current derived from the positive supply line via current-limiting resistor R1 and via the parallel-connected n.o. security switches, which (when R1 has a value of 1kΩ) pass operating currents of only a few milliamperes. When all the switches are open, the SCR and alarm bell are off, but when any one of the switches is closed it feeds gate current to the SCR via R1, so the SCR turns on and activates the bell.

Note in this design that, since the bell is a self-interrupting device, the circuit effectively gives a non-latching type of operation in which the SCR and bell only operate while one or more of the switches are closed.

Figure 6 shows how the above circuit can be modified to give self-latching operation. SCRs are inher-

latching action.

Note that the C106 SCR used in the Figure 5 and 6 circuits has an anode current rating of only 2A, so the alarm bell must be selected with this point in mind. Alternatively, SCRs with higher current ratings can be used in place of the C106, but this modification will probably necessitate changes in the R1 and R3 values of the circuits. Also note in these SCR circuits that — to compensate for the SCR's typical 1V anode-to-cathode volt drop — the supply voltage must be at least 1V greater than the nominal operating voltage of the alarm bell.

OPEN-TO-OPERATE CIRCUITS

A major weakness of the Figure 1 to 6 circuits is that they do not give a 'fail-safe' form of operation, and give no indication of a faulty condition if a break occurs in the contact-switch wiring. This snag is overcome in circuits that are designed to be activated via normally-closed (n.c.)

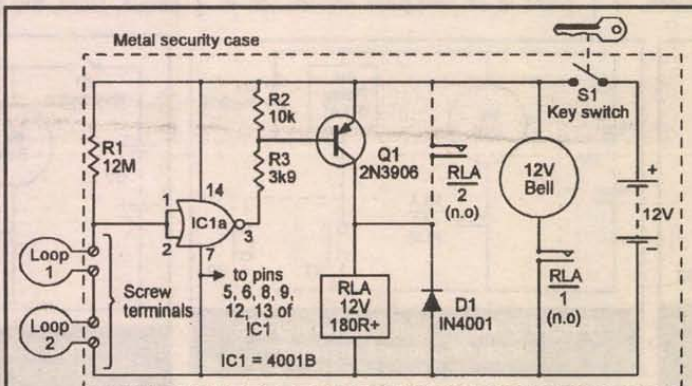


Figure 11. Simple self-latching loop alarm circuit.

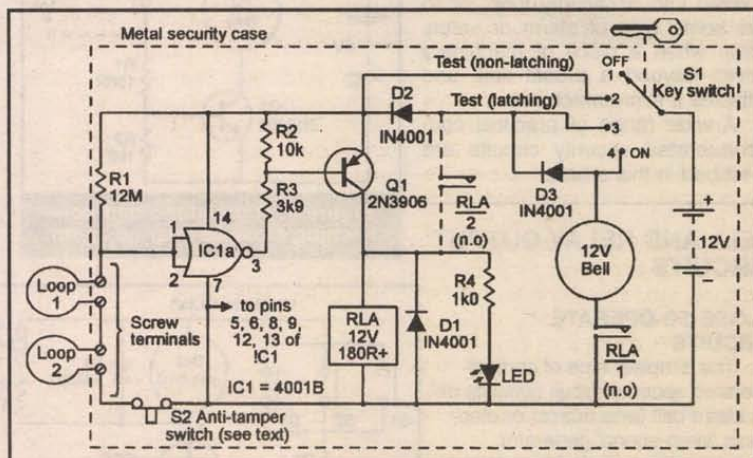


Figure 12. Improved version of the self-latching loop alarm.

relay and the bell are inoperative. Under this condition, the circuit

wiring a spare set of n.o. relay contacts (RLA/2) between the collector

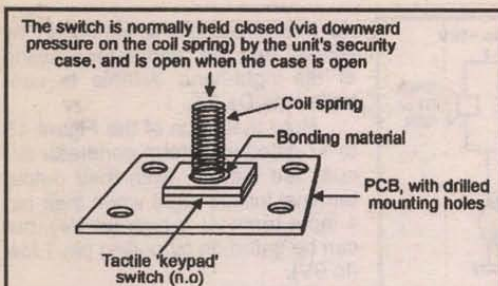


Figure 13. Basic way of constructing an anti-tamper switch (see text).

and emitter of Q2, as shown dotted in the diagram.

If desired, the standby current of the Figure 8 circuit can be reduced to a mere 1µA or so by using an inverter-connected CMOS gate in place of Q1, as shown in Figure 9. The gate used here is taken from a 4001B quad two-input NOR gate IC, and the three unused gates are disabled by shorting their inputs to the 0V line, as shown in the diagram.

The used gate has a near-infinite input impedance, and the standby current of the circuit is determined mainly by the R1 value and by the leakage current of Q1. The basic circuit gives a non-latching form of operation, but can be made self-latching by

and momentarily operating RESET switch S2, at which point the bistable's output latches back into the high state and turns off Q1 and the relay and bell. The circuit draws a quiescent current of about 1µA.

'LOOP' ALARM CIRCUITS

One type of contact-operated alarm circuit that is widely used in

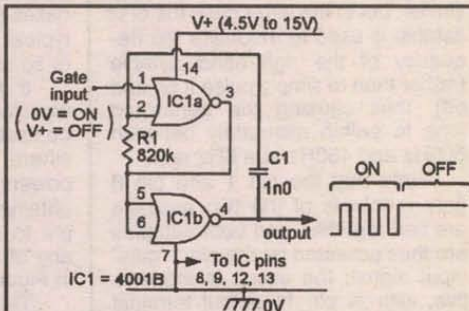


Figure 15. Basic 800Hz monotone 'siren' waveform generator circuit.

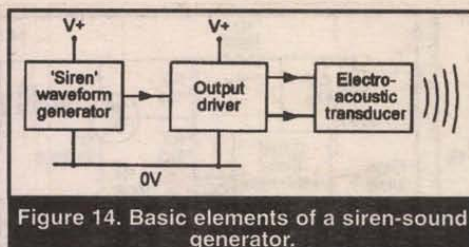


Figure 14. Basic elements of a siren-sound generator.

operated switch S1 is closed — activate the self-latching alarm if any part of the loop wiring becomes open circuit.

In the diagram, only two loops are shown, but in practice any desired number of loops can be used. The entire circuit (except the loops) is housed inside a metal security case, and the loops are connected to screw terminals on the main circuit board via grommet holes in the side of the case; unwanted

circuit, with its series-connected S1 security switches replaced by a number of series-connected wire 'loops' that — when key-

abled. This TEST (non-latch) position is meant to be used when testing the loop wiring.

When S1 is in the position '3' TEST (latching) position, all of the circuit except the bell is enabled. When S1 is in the position '4' ON position, the entire circuit (including the alarm bell) is enabled, and the circuit gives normal 'security' operation.

The final point to note about the Figure 12 circuit is that n.c. anti-tamper switch S2 is wired in series with the loop network and (when S1 is set to the ON position) activates the self-latching alarm if it (S2) takes up an 'open' state.

S2 is actually an ordinary n.o. tactile 'keypad' switch with a short coil-spring bonded vertically to its touch-pad, and is fixed to the main circuit board in such a way that the switch is held in the closed n.c.

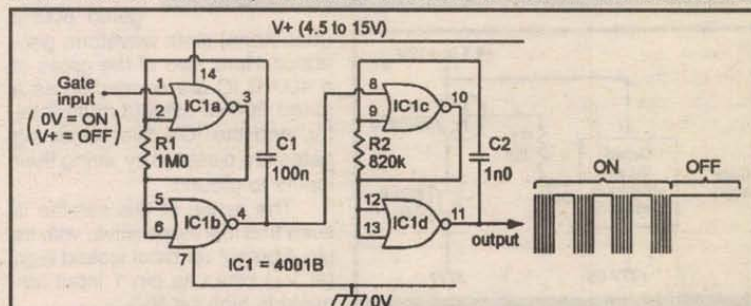


Figure 16. Basic pulsed-tone 'siren' waveform generator circuit.

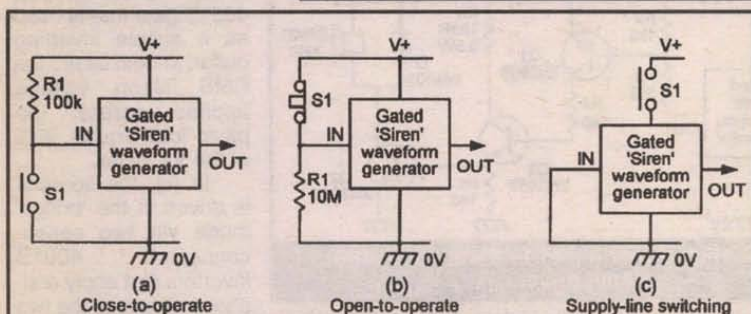


Figure 18. Alternative ways of gating the Figure 15 to 17 'siren' waveform generator circuits.

wiring a spare set of n.o. relay contacts (RLA/2) between the collector and emitter of Q1, as shown dotted in the diagram.

Figure 10 shows an alternative way of making the basic Figure 8 circuit give self-latching operation, without resorting to the use of a spare set of n.o. relay contacts. In this case, the relay-driving transistor (Q1) is driven by a pair of 4001B CMOS NOR gates that are configured as a bistable multivibrator and has an output that goes low and self-latches if S1 is briefly opened or its leads are broken.

As the bistable output goes low, it turns Q1 on, thus activating the relay and alarm bell. Once the bistable has latched the bell into the 'on' state, it can be reset into the standby or 'off' mode by closing S1

large shops and stores (and also in domestic garages and garden sheds) is the so-called 'loop' alarm, in which a long length of wire is run out from the alarm unit, is looped through a whole string of 'to be protected' items in such a way that none of them can be removed without cutting or removing the wire, and is then looped back to the alarm unit again, to complete a closed electrical circuit.

The alarm sounds instantly if an attempt is made to steal any of the protected items by cutting the wire loop, i.e., by effectively opening its 'contacts.' Figure 11 shows the circuit of a simple battery-powered unit of this type.

The simple Figure 11 loop alarm circuit is a modified version of the self-latching CMOS-aided Figure 9

loops can be replaced by short circuits connected between the appropriate screw terminals. The entire circuit can be turned on and off via key switch S1.

Figure 12 shows an improved version of the Figure 11 self-latching loop alarm circuit. The first points to note about this version of the circuit are that a LED is connected across the relay coil via R4 and thus illuminates and gives a visual indication whenever the relay is turned on, and that the circuit's +12V power feed is controlled via four-way key switch S1 and diodes D2 and D3. When S1 is in position '1,' the entire circuit is turned off. When S1 is in position '2,' the main part of the circuit (including the LED indicator) is active, but the alarm bell and self-latching facility are dis-

position (via the spring) when the circuit's security case is closed, but opens (thus sounding the alarm) if the case is opened while the alarm system is still turned on.

Anti-tamper switches of this basic type are quite easy to make from readily-available components. Figure 13 illustrates the basic method of construction.

Before leaving this BELL AND RELAY-OUTPUT CIRCUITS section of this article, note that the various relay-output circuits shown in Figures 2, 3, and 7 to 11 can, if desired, be used to activate any type of electrical or electronic alarm or system via their n.o. relay contacts when the relay is triggered in response to an input contact-switching action, and are thus not restricted to use with alarm

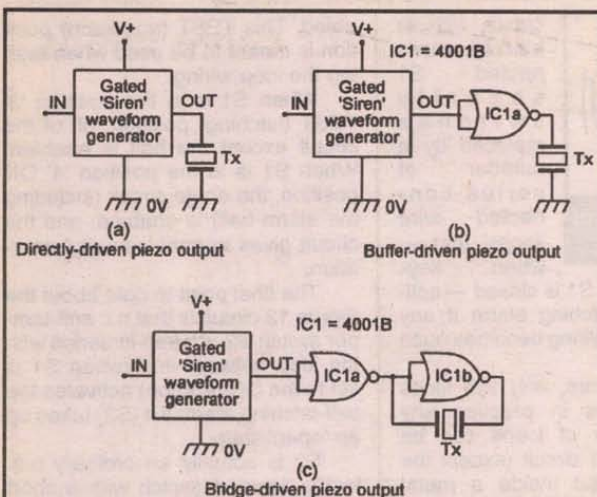


Figure 19. Alternative ways of driving a piezoelectric 'sounder' from the outputs of the Figure 15 to 17 'siren' waveform generator circuits.

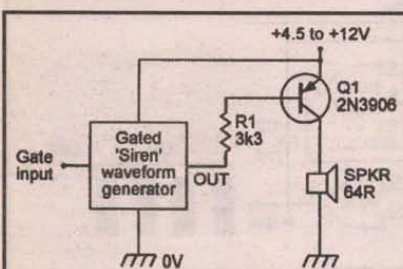


Figure 20. Simple output driver circuit that can feed up to 520mW into a 64R speaker load.

bells only.

SIREN-SOUND SECURITY CIRCUITS

Contact-operated security circuits can easily be designed to produce electronically-generated 'siren' alarm sounds in piezoelectric 'sounders' or in electromagnetic loudspeakers. Such systems can be made to produce a variety of sounds, at a variety of power levels, and may be designed around various types of semiconductor devices.

All siren-sound generators take the basic form shown in Figure 14, and consist of a siren waveform generator, an output driver, and an electro-acoustic transducer.

One of the cheapest and most useful semiconductor devices for use in this type of application is the CMOS 4001B quad two-input NOR gate IC, which draws near-zero standby current, has an ultra-high input impedance, can operate over a wide range of supply-rail voltages, and can be used in a variety of waveform-generating applications.

The rest of this article shows various ways of using one or two 4001B ICs and a few other components to make a variety of contact-operated siren-sound security circuits.

Figures 15 to 17 show three different ways of using 4001B ICs to

make practical siren waveform generators. Here, two of the gates of a 4001B IC are connected as a gated 800Hz astable multivibrator, and the IC's two remaining gates are disabled by wiring their inputs to ground.

The action of this astable is such that it is inoperative, with its pin 4 output terminal locked high (at V+) when its pin 1 input terminal is high (at V+), but acts as a square-wave generator when its input pin is low (at 0V). The generator can thus be gated on and off via the pin 1 input terminal, and produces its output signal on pin 4. The astable's operating frequency is controlled by the R1 and C1 values.

Figure 16 shows a single 4001B IC used to make a gated pulsed-tone waveform generator. Here, the two left-hand gates of the IC are wired as a gated low-frequency (about 6Hz) astable squarewave generator, and the two right-hand gates are wired as a gated 800Hz astable that is gated via the 6Hz astable.

The action of this circuit is such that it is inoperative, with its pin 11 output terminal locked high (at the positive supply rail voltage) when its pin 1 input terminal is high, but becomes active and produces a pulsed-tone output on pin 11 when its input pin is low (at 0V).

This generator can thus be gated on and off via the pin 1 input terminal and, when gated on, produces a 800Hz tone that is gated on and off at a 6Hz rate. The operating

frequency of the 6Hz astable is controlled by R1-C1, and that of the 800Hz astable is controlled by R2-C2.

Figure 17 shows how the Figure 16 circuit can be modified so that it produces a warble-tone alarm signal. These two circuits are basically similar, but in the latter case the 6Hz astable is used to modulate the frequency of the right-hand astable (rather than to simply pulse it on and off), thus causing the generated tone to switch alternately between 600Hz and 450Hz at a 6Hz rate.

Note that the pin 1 and pin 8 gate terminals of the two astables are tied together, and both astables are thus activated by the pin 1 'gate' input signal; the circuit is inoperative, with its pin 11 output terminal

right-hand astable is controlled by R2-C2, and the 'warble-tone' swing of the right-hand astable is controlled via D1-R3.

Note that each of the Figure 15 to 17 gated waveform generator circuits are inactive (with their output terminal locked high) when their pin 1 input terminal is high (at V+), but can be gated on by pulling pin 1 low (to 0V).

Each of these circuits can thus be gated on and off by using any of the three input connections shown in Figure 18. Thus, they can be gated on by closing an n.o. switch by using the input connections shown in (a), or by opening an n.c. switch by using the input connections shown in (b), or can be gated on or off by making or breaking the supply line connection by using the input connections shown in (c). In cases (a) and (b), the circuit draws a typical standby current of only 1µA or so when in the 'off' state.

If the Figure 15 to 17 gated waveform generator circuits are to be used in alarm-sound applications where fairly low acoustic output powers are required, these can be obtained by feeding the circuit's output to a low-cost piezo sounder in any of the three basic ways shown in Figure 19.

Thus, in (a), the sounder is driven directly from the generator's output, and in (b), it is driven via a 4001B gate that is used as a simple inverting buffer; in both cases the RMS 'alarm' voltage applied across the piezo load equals 50% of the V+ value.

In (c), the sounder is driven in the 'bridge' mode via two series-connected 4001B inverters that apply anti-phase signals to the two sides of the piezo load, causing the piezo load to 'see' a squarewave drive voltage with a peak-to-peak value equal to double the V+ value, and an RMS 'alarm' signal voltage that equals the V+ value. The (c) circuit thus gives four times more acoustic output power than either of the (a) or (b) circuits.

If the Figure 15 to 17 gated waveform generator circuits (which each have an output that is locked high when the generator is gated off) are to be used in alarm-sound applications where fairly high acoustic output powers are required, these can be obtained by feeding the astable's output to inexpensive 'low-fi' or horn-type loudspeakers (these have

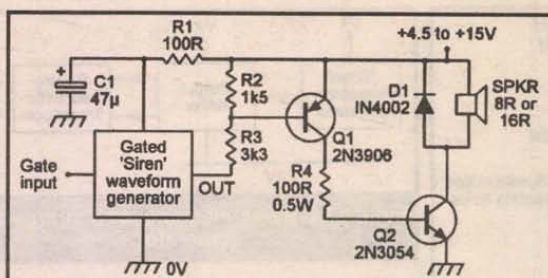


Figure 21. Medium power (up to 6.6 watts into 8R0) output driver.

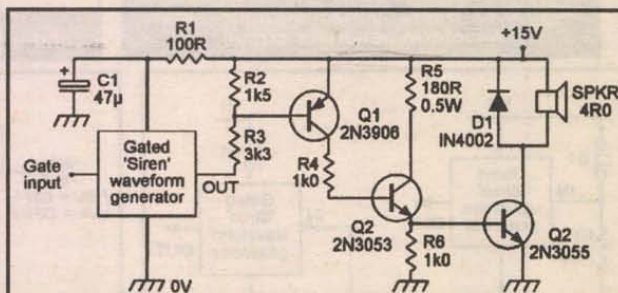


Figure 22. High power (up to 13.2 watts into 4R0) output driver.

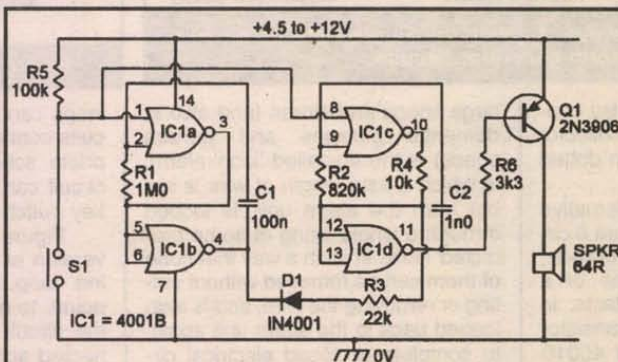


Figure 23. Low-power (up to 520mW) warble-tone alarm-call generator, activated by closing a n.o. switch.

locked high (at V+) when the pin 1 input terminal is high, but becomes active and produces a warble-tone output on pin 11 when the input pin is low (at 0V).

The operating frequency of this circuit's 6Hz astable is controlled by R1-C1, the center frequency of the

an electro-acoustic power conversion efficiency that is typically some 20 to 40 times greater than a normal hi-fi speaker) via one or other of the simple direct-coupled 'driver' circuits shown in Figures 20 to 22.

Thus, the simple Figure 20 driver circuit is designed to pump a maximum of only a few hundred milliwatts of audio power into a cheap 64R speaker. When the siren waveform generator is gated off, its output is high and Q1 is thus cut off, but when the generator is gated on, its output drives Q1 on and off and causes it to feed power to the 64R speaker. The output power depends on the supply rail voltage, and has a value of about 520mW at 12V, or 120mW at 6V, when feeding a 64R speaker load.

Note that, since Q1 is used as a simple power switch in this application, very little power is lost across the 2N3906 transistor, but its current rating (200mA maximum) may be exceeded if the circuit is used with a supply value greater than 12V.

The Figure 21 driver circuit can pump a maximum of 6.6 watts of audio power into an 8R0 speaker load, or 3.3 watts into a 16R load. Here, both transistors are cut off when the waveform generator is gated off, but are switched on and off in sympathy with the siren waveform when the generator is gated on.

Note in this circuit that the positive power supply rail is fed directly to the output driver, but is fed to the waveform generator via decoupling network R1-C1, that voltage divider R2-R3 ensures that the output stages are not driven on until the generator's output voltage falls at least 1.9V below the supply rail value, and that diode D1 is used to damp the speaker's back-EMF when driver Q2 switches off.

Finally, the Figure 22 driver circuit can pump a maximum of 13.2 watts into a 4R0 speaker load when powered from a 15V supply. Here, all three transistors are cut off when the waveform generator is cut off, but are switched on and off in sympathy with the siren waveform when the generator is gated on.

Thus, Figures 15 to 17 show three alternative 'siren' waveform generator circuits that can — when used in practical contact operated security circuits — each be gated in any of three basic ways and be used in conjunction with any of six basic types of acoustic output driver circuit, thus offering a total of 54 different circuit combinations.

Figure 23, for example, shows how the Figure 17, 18(a) and 20 circuits can be combined to make a warble-tone alarm-call generator that can be activated by closing an n.o. switch and which can pump 520mW into a 64R speaker load when operated from a 12V supply. NV

Quality
ELECTRONICS

Yes, we can help with all your cable needs

QUALITY PRICES

QUALITY SERVICE

QUALITY PRODUCTS

1-800-394-3043

9am-5pm M-S • Same Day Shipping

1 FULL YEAR GUARANTEE

CALL TODAY!

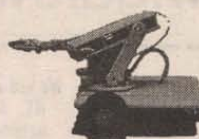
NO NV SALES

ROBOTICS cont.



ZAGROS ROBOTICS mobile robotic kits and parts. PO Box 460342, St. Louis, MO 63146-7342. 314-768-1328. <http://walden.mo.net/~zagros/zagros.htm> zagros@mo.net

AFFORDABLE CNC MACHINES! Also parts/drivers/software. Write: motivity, Attn. Pam, PO Box 428, Rocklin, CA 95677. Call 916-349-8757. www.motivityusa.com A great place to buy CNC.



MOBILE ARM, 5 axis arm including gripper plus mobile base. Control with PC or microcontroller. Everything you need to build your own robot. Includes a MiniSSC2 servo controller with software. \$250 complete. Add \$7.50 S&H USA. IL residents add 6.25%. VISA, MasterCard, Tel: 309-382-1816 Fax: 309-382-1254 Web: www.lynxmotion.com Free catalog with more robots.



POCKET-BOT miniature robot, measures only 63x48x38mm. This rugged kit utilizes a BS2-IC and includes prototyping area, encoders, and sensors. Powered by a long lasting 9V battery, prices start at just \$245. Diversified Enterprises, 805-968-5182, www.divent.com

Try a classified ad in Nuts & Volts. They're inexpensive and they work! Details on page 108.

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

LONGWAVE KITS AND PRODUCTS. Including 1750 meter license-free equipment. Catalog \$1. **CURRY COMMUNICATIONS**, BOX 1884, Burbank, CA 91507-1884. WEB: <http://www.fix.net/~jparker/currycom.htm>

TEST EQUIPMENT kits. If you liked Heathkit, you will love Technology Systems, 4 Prospect Pl., Torrington, CT 06790.

HEATH COMPANY is selling photocopies of most Heathkit manuals. Only authorized source for copyright manuals. Phone: 616-925-5899, 8-4 ET.

BEST PRICES

ONE STOP SUPPLIER

"One call does it all" 1-888-426-9787 Toll Free



Tri 550 Converter
\$55.00



Millennium Converter
\$69.00



Panasonic Converters
\$169.00

A DOZEN OTHER CONVERTERS AVAILABLE!

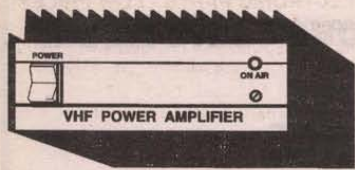
Call for Quantity Prices

Open Monday - Friday 10:00 a.m. - 5:00 p.m. Saturdays 10:00 a.m. - 2:00 p.m.

No Florida Sales • We ship same Day • 90 Day Limited Warranty • Visit us at our website www.onestopcable.com • E-Mail: Info@onestopcable.com

FILTERS

REMOTES!



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.

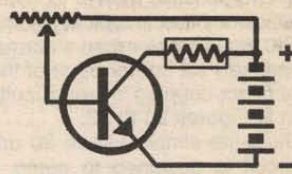
BUILD THE MENDOCINO MOTOR.

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

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>

PHONELINE SIMULATOR. Authentic dial tone, busy signals, 20Hz ringing. Test/demonstrate phones, modems, faxes, voice mail, etc. "Ring-It" kit includes PCB, all components, microprocessor, documentation, \$149. Custom enclosure \$34.95. Fully assembled \$325. Shipping \$6.50. Checks, credit cards. Digital Products Company, 134 Windstar Circle, Folsom, CA 95630. 916-985-7219, Fax 916-985-8460, E-Mail: digprod@aol.com Web site: www.digitalproductsco.com

PC BOARDS single-sided. Price list available. 808-949-5410 voice. 808-955-3959 fax.



TRANSISTOR THEORY SIMPLIFIED. A new, easier to understand approach. Other basic electronics theory included. Lots of useful information. 22 page text \$6.45 ppd. Credit card orders 703-549-5325 or mail to: **THERMADYNE, INC.**, 206 Birch St., Alexandria, VA 22305. Details on our web page: WWW.pacificocean.com/thermadyne

200+ ELECTRONIC PROJECTS. Build for pleasure or make 100% (or more) profits reselling printed plans. Loose 55¢ stamp for catalog & dealer info. **MATCO-A4**, POB 509, ROSEVILLE, MI 48066-0509.



BUILD A radar jammer out of your old radar detector. No electronic knowledge needed. Call 24 hr. for easy step-by-step plans. "GUARANTEED." New from "Image Master Publishing" 1-800-295-0953. Only \$9.95, \$2.50 S&H.

AMAZING MINI MICRO STEREO 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.

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.

surf the internet?

www.gatewayex.com

Projection Pocket Laser \$29.95

Pocket size laser pointer with clear case allows you to "see inside" and sports hi-brite LED "disco lights" when the switch button is activated. Use as a regular laser pointer or attach one of the 6 interchangeable bezels to turn the ordinary red laser dot into a large image. Select from an arrow, mud flap girl, peace sign fingers, skull, angel, or I (heart) U message. Can be projected on a wall, ceiling, etc. Great gadget to amuse and impress your friends. Includes 3 LR44 button batteries. Approx. 15mmx90mm. Includes keyring.



VX1-R CASE \$12.50

We had a case designed specifically for the popular little Yaesu HT. A fully adjustable case made of a durable polypropylene material, it features an elastic side slot to store your spare battery or drycell case (some aftermarket antennas fit well here too!), a heavy-duty velcro closure to keep your radio secure yet accessible, and a super strong velcro belt loop to attach conveniently to your belt. Case fits several other radios including the VX1-FRS radio from Vertex. (Note: Elastic side slot may not be appropriate for batteries on other radios.) A great case at a very affordable price! Yes, we do sell the Yaesu VX-1R as well as many other popular Yaesu, Kenwood, Icom and Alinco radios!

127 THERMOCOUPLES

PELTIER JUNCTIONS

The peltier junction is a solid-state thermoelectric device. Current applied to the device will produce heat on one side of the device and a cold surface on the other side. Water placed on the surface will freeze or boil depending on polarity of applied voltage. Ideal for applications from 3-12 VDC -- grab a battery and let your imagination run wild! DOCUMENTATION INCLUDED!!!

Small Peltier Junction \$20.00 (approximately 1.17"x1.17"x.12")

Large Peltier Junction \$29.50 (approximately 1.56"x1.56"x.15")

MEMBRANE TOUCHMOUSE \$19.50

This is a touchpad mouse REPLACEMENT. "Let your fingers do the pointing." It will function as a STANDARD SERIAL mouse REPLACEMENT. NO NEED for a clear desk space, mousepad, or even a trackball...you put your finger on the TOUCHMOUSE, swirl it around the flat MEMBRANE SURFACE, and presto, your pointer is exactly where you can put your finger on it!

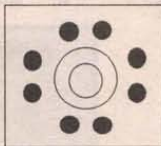
Passive Infra-red Talking Motion Detector!!! \$27.50

"Stay out of that refrigerator!", "Watch your step!", "Do your homework!", "Don't touch that remote!" ... The possibilities are mind-boggling with this talking motion detector. You speak into it to record your message (up to 12 seconds long), turn the unit on, and instantly your voice (or your mother-in-law's) reminds anyone in the vicinity that you were expecting them. Message can be changed with the flip of a switch. Uses 4 AA batteries (not included), or an external power source (built-in jack). May be used independently (80 db output) or with an amplified speaker to blast your message throughout the house. Approx 4"x3-1/2"x1-1/2".

Infra-Red CCD Camera

\$99.50

Black and white board-level camera is small but mighty. Operates on 9-12 VDC with adjustable lens. Features an infra-red LED boarder for viewing 'in the dark'...forget those night vision goggles! The whole thing measures a tiny 1.5"x1.5"x0.75". Small size is great for applications requiring a concealed camera. Same camera available without IR LED feature, \$85.00.



new! POWER ONE SWITCHING POWER SUPPLY \$19.50

Here's a great buy in a new switching power supply manufactured by POWER-ONE™. Great looking open-frame supply appropriate for 110/220 VAC

input with popular output values:
+5V @ 20A, +12V @ 5A, +12V @ 1A, -12V @ 1A

Approx. 8-1/2" X 4-1/2" X 2"

Note: Mail order customers please allow an extra \$ 2.00 for shipping/handling on this item.



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 a Shurtliff holds his breath, what color will he turn?

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

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. <http://www.cdsnet.net/Business/circuits/>

MILITARY COMPONENTS wanted. Capacitors, resistors, diodes, transistors, semiconductors, ICs. Electronic Material Industries, 818-769-1002, FAX: 818-769-1084.

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>

UNLIMITED UNDERGROUND electronics plans/kits, schematics, parts, assemblies, EMP, lasers, plasma, rail guns, electronic weapons, alternative energy, etc. High energy plasma generator, plans \$5; high power EMP generator weapon, plans \$8; 12" arc generator, plans \$2; Tesla earthquake machine, plans \$7; rail gun designs, plans \$5; cold fusion R1 gen. plans \$8; 12VDC to 115VAC inverter, plans \$2; radio freq/signal jammer, plans \$3. For orders or catalog send SASE to: 1839-D West Vistaway #515, Vista, CA 92083. <http://www.access1.net/ninteach/> 760-639-5527/vm. E-Mail: ninteach@access1.net

VAN DE GRAFF GENERATOR kit. Battery powered. Produces 70KV at 0.6uA. Send SASE for more information or \$29.95 + \$5 S&H (KY residents add 6% tax) by check, money order, VISA, or MasterCard to: American Laboratory Equipment, PO Box 592, Owensboro, KY 42302-0592.

DATA ACQUISITION 12 bit, bipolar, eight channel analog to digital converter module with I/O for your PC parallel port. Bare PCB \$15, kit \$65 or assembled \$85. Embedded Acquisition Systems, http://www.hooked.net/~jlong

LASER RADAR construction schematic, technical discussion, easily built, \$10; **RADAR JAMMER**, extremely simple construction circuit, jams X/K bands \$10. Both for \$15. Money orders only. Ponderosa Company, 7645 North Union Boulevard Suite 501, Colorado Springs, CO 80920.

MANUALS - SCHEMATICS WANTED

MILITARY COMPONENTS wanted. Capacitors, resistors, diodes, transistors, semiconductors, ICs. Electronic Material Industries, 818-769-1002, FAX: 818-769-1084.

MANUALS for felling: PRD 809 Klystron P/S, Motorola P-13-IA-L HT, radars: RCA AVQ 10,55 military APN 59, Raytheon 50KW HTMTRLOG, Sorensen FC-75 inverter. Box 10215, Pittsburgh, PA 15232.

MISCELLANEOUS ELECTRONICS FOR SALE

ELECTRON TUBES: All types bought and sold. Daily Electronics, B-6 10914 NE 39th St., Vancouver, WA 98682. 1-800-346-6667, 360-896-5476 FAX.



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.

IMPROVED: PHANTOM, POLICE LASER/RADAR JAMMER & DETECTOR: No more tickets or manufacturer pays them! Guaranteed lowest prices. Free brochures. 30-day money back guarantee, 3-yr. warranty. Visa/MC/COD. Kortes Marketing, order 303-548-3995. FAX or messages 303-699-6660.

HIGH QUALITY TOOLS AND STAINLESS STEEL HARDWARE. European and American screwdrivers, nutdrivers, 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 732-758-8388. E-Mail: W2TV@compuserve.com

RADAR GUNS: MPH Industries, model K-55. Displays your speed & target speed. Comes w/case & instructions. Only \$300. 1-800-539-2859.

ELECTRONIC ASSEMBLY MACHINERY. We buy and sell assembly machinery including solder machines and board cleaners, insertion machines and lead formers. Petlock Inc., Rialto, CA. 909-877-8900, FAX 909-877-8902.

FREE LIST of electronic parts and tools. Bigelow Electronics, PO Box 125, Bluffton, OH 45817.

CALL FOR a free electronics catalog or visit our web site at www.bgmicro.com. **B.G. Micro**, PO Box 280298, Dallas, TX 75228. Order line 1-800-276-2206.

NUCLEAR ELECTRONICS (NIM, 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 <http://www.oetech.com>

ELECTRONIC PARTS - LOW PRICES! Phone, fax, E-Mail for free catalog. Hoffman Industries, 853 Dundee Ave., Elgin, IL 60120, Ph: 847-622-8201, Fax: 847-622-8202, Toll free: 1-888-311-4248, E-Mail: hoffmanind@worldnet.att.net Visit our Web Site & browse our On Line catalog: www.hoffind.com

NEW, USED, and "as is" Radio Shack items. Software, printers, computers, books, parts for R/C cars, etc. List \$2. B and B Enterprises, 208 S. Pulaski St., Baltimore, MD 21223. 410-566-5388.

SEC Sun Equipment Corporation

P. O. Box 97903, Raleigh, NC 27624 E-mail: sunquipco@pass.net

To request FREE CATALOG, please call, fax, write, or e-mail us.

Quality Test Equipment for Cost-Minded People

DC POWER SUPPLY (CC/CV)

All models: protection of short ckt, overload, reverse polarity, over-voltage; Constant Current & Voltage (CC/CV) are fully adjustable. Regulation: $\leq 0.1\% + 3mV$ (line); $\leq 0.1\% + 3mV$ (load); $\leq 1mV$ ripple.

SINGLE OUTPUT

Analog Displays
PS-303 \$159.00, 30V/3A.
PS-305 \$219.95, 30V/5A.
PS-1610S \$289.00, 16V/10A.
PS-2243 \$139.00, 12V/24V select, 3A.
PS-2245 \$159.00, 12V/24V select, 5A.
8107 \$399.95, 30V/10A.
8110 \$289.95, 60V/3A.
8112 \$399.95, 60V/5A.

Digital Voltmeter & Analog Ammeter
8200(8201) \$179.95(\$239.95), 30V/3A(SA)
Digital Displays 8210/8300 \$199.95, 30V/3A.
8211/8301 \$259.95, 30V/5A.

DUAL OUTPUTS

Independent/Tracking Analog Displays
8108 \$549.95, 60V/3A.
8109 \$699.95, 60V/5A.
PS-303D \$314.95, 30V/3A. PS-305D \$399.95, 30V/5A.
TRIPLE OUTPUTS, a fixed 5V/3A output, Independent/Tracking
Digital Displays 8202(8203) \$499.95(\$549.95), dual 30V/3A(SA).
Analog Displays 8102(8103) \$399.95(\$489.95), dual 30V/3A(SA), with Parallel (30V/6A) and Series (60V/3A) Mode operation.

NTSC/PAL TV COLOR BAR GEN.

CPG-1366A \$159.95, VHF NTSC;
RF: 45.75, 175.25, 187.25 MHz;
RF Output: 10mV.
Impedance: 75 Ohm;
Video Output: BNC, 1V;
CPG-1367A \$159.95, VHF PAL.

SWR/RF/mW POWER METER

310 \$89.95, 1.8-150MHz, RF Power:
0-4W/20W/200W 3 ranges; SWR
Measurement: 1.0-∞, 4W minimum.
Accuracy: 5%-10%; Insert Loss: 3dB
Input/Output Imp: 50Ω, 50-239 pF
320 \$89.95, 130-520MHz. Spec. 310.
330 \$119.95, 1.8-520MHz. Spec. see 310.
SWR-3P \$26.95, 1.7-150MHz;
RF Power: 0.5-10W, 0.5W-100W.
mW-2F \$22.95, 1.7-30MHz; RF Power: 0.5-10W.

mW RF Power Meter 340 \$219.00, 1.8-500MHz; RF
Power: 20mW/200mW/2W 3 ranges; Imped: 50Ω; Accuracy: $\pm 10\%$
full scale; SWR ≤ 1.15 ; N-type connector; BNC type output.

FM STEREO MODULATOR

AG-2011A \$549.00
RF SECTION:
Carrier: 98MHz ± 2 MHz;
Output: 10mV, 1mV & 0.1mV
COMPOSITE SIGNALS:
Pilot: 19KHz ± 2 Hz, 0.8Vrms
INT. MODULATION: 400KHz
1KHz $\pm 1\%$, 1Vrms, distortion $< .5\%$; L-R Separation: > 50 dB.
EXT. MODULATION: Freq: 50Hz-15KHz
L-R Separation: > 45 dB 100Hz-3KHz; > 35 dB 50Hz-15KHz.

TOOLKITS - ELECTRONIC/PC

9245 \$299.95 U.S. Patented, 45-pcs. Content: IC inserter/extractor with secures & bows, 3-prong part retriever, #0 Phillips screwdriver, 1/8" flat screwdriver, self-hold tweezers, metal tweezers, extra parts tube, soldering iron, solder, crimping tool, long-nose plier, cutting plier, zipper vinyl case. Bids include: Phillips: #0/#1/#2/#3, Flat: 1/8"/3/16"/1/4"/9/32"; PZ1/PZ2; T8/T9/T10/T11/T20/T25; T27/T30/T40/T45; Hex: 5/64"/3/32"/1/8"/5/32"/3/16"; Sockets: 3/16" (5mm)/7/32" (5.5mm)/1/4" (6mm)/9/32" (7mm)/5/16" (8mm).
9232 \$34.95 23-pcs. Content: IC inserter/extractor with secures & bows, 3-prong part retriever, 3/16"/1/4" nutdriver, 3/16"/1/8" slot-screwdriver, #0/#1 Phillips, reversible T10/T11 bits, reverse #2 Phillips/1/4" slotted bits, tweezer, long-nose plier, cutter, 6" adj. wrench, soldering iron, solder, crimping tool, zipper case, manual.
Different packages available, call/write/e-mail/fax for detail.

STEREO ALIGNMENT/SWEEMER SCOPE

STEREO SCOPE OS-7505B \$369.00, 0-10MHz/20mV.
ALIGNMENT SCOPE OS-7001A \$369.00, 0-200KHz/1mV.
SWEEMER SM-6225B/C \$1999.95
Freq Range: (AM)400KHz, (FM)10-11.4MHz; Accuracy: $\pm 0.1\%$; Marker: (AM)455KHz, ± 5 KHz, ± 10 KHz; (FM)10.7MHz, ± 7 KHz, ± 150 KHz.

RF SIGNAL GENERATOR

SG-4160B \$124.95, 100KHz-150MHz up to 450MHz on 3rd harmonics in 6 ranges; AM modulation; Accuracy: $\pm 5\%$.
RF Output: 100mVrms to 35 MHz;
Modulation: Int. 1KHz (AM) $\pm 30\%$; Ext. 50Hz-20KHz, at least 1V_{in} input.
Audio Output: 1KHz, 2V_{in} minimum.
SG-4162AD (with Freq. Counter) \$229.95, Spec. see SG-4160B.
COUNTER SECTION: 10Hz-150MHz; Max. Input: $\leq 3V$ effective Gate Time: 1, 1sec. Input Sensitivity: 35mV, 10Hz-200MHz.
Input Impedance: 1MΩ(HF), 50Ω(VHF). Display: 7-digit LEDs.

AM/FM STD SIGNAL GEN.

SG-4110A \$1799.00, Freq: 0.1-110MHz; Display: 6-digit LED; Resolution: 100Hz (0.1-34.999MHz); 1KHz (35MHz-110MHz).
Accuracy: $< 4(5 \times 10^{-1} \pm 1)$ count; Output: -19dBm-99dBm, 1dB steps.
Impedance: 50Ω VSWR 1.2; 100 preset frequency & store functions.

AUDIO GENERATOR

AG-2601A \$124.95, 10Hz-1MHz in 5 ranges; Output: sine wave 0-8V_{pp}, square wave 10V_{pp}; Output Imped: 600 Ohm.
Distortion: $< 0.05\%$ 500Hz-50KHz; $< 0.5\%$ 50KHz-500KHz.
AG-2603AD \$229.95, with 6-digit, Int/Ext. Freq. Counter, 10Hz-150MHz.
Output Control: 0/20/40dB & Fine adjuster. Spec. see AG-2601A.

FUNCTION GENERATOR

FG-2100A \$169.95, 0.2Hz-2MHz in 7 ranges; sine, square, triangle, pulse & Ramp; Output: 5mV_{pp}-20V_{pp}, 1% distortion. VCF: 0-10V/freq. to 1000:1.
FG-2102AD \$229.95 see FG-2100A, 4 digit counter display, TTL & CMOS outputs, 30ppm ± 1 count accuracy.

FG-2020B \$159.00, 0.5Hz-500KHz; Sine, Square, Triangle.
FG-2103 \$329.95, Digital sweep generator, 0.5Hz-5MHz in 7 ranges.
Operating Mode: sweep, AM, gated burst, VCG.
Freq. Counter: Int. 5Hz-5MHz; Ext. 5Hz-10MHz.
FG-513 \$769.95, 13 MHz, Microprocessor embedded digital sweep; Sine, Square, Triangle, Pulse, Ramp, TTL & DC; $\pm 0.1\%$ ± 1 digit.
Freq. Counter & TCXO. 5Hz-100MHz, 6.5 digits. $\times 1/\times 20$ attenuator.

AC MILLIVOLT METER

MV-3100A \$159.95 wide band 5Hz-1MHz; 3 scales, mV, dB & dBm; 300V-100V in 12 ranges, 10μV resolution; -70-40dB in 12 ranges; 0dB=1Vrms; 0dBm=0.775V; $\pm 3\%$ accuracy; input impedance 10MΩ; Noise $< 2\%$; MV-3201B \$309.95 dual channels, simultaneous measurement.

OSCILLOSCOPES

OS-7305B \$249.00 DC-7MHz; 3" CRT; Horiz: 25V/div, 10Hz-100KHz in 4 ranges; Vert: 10mV/div, Int. & Ext. Sync; Input: 1MΩ/35pF.
OS-7010A \$299.95 10MHz, 5" CRT, Horiz: 2V/div; Vert: 10mV-10V/div.
OS-622G \$389.95 20MHz, 2 CHX-Y Alt trigger, trigger lock, hold OFF, TV syn., 8x10 div., 1mV/div. Horiz: 2us-5s/div; Vert: 1mV-5V/div.
OS-653G \$699.95 50MHz, 2 CH/delay sweep, Alt trigger, TV syn.
OS-6101C \$1499.95 100MHz, 4ch/8 traces, delay sweep, cursor readout. 2 years warranty for OS-622G, OS-653G, & OS-6101G.

UHF ATTENUATORS

RT-8815U (50Ω) \$299.00 / RT-8817U (75Ω) \$299.00, 950MHz, 81dB, 0.5W max.; Steps: 1/2/3/5/10/20/20/20, 8 switches.
085E-2 (50Ω) \$399.00 / 087E-2 (75Ω) \$399.00, 950MHz, 81dB, 0.5W max.; Steps: 10dB-71dBx10, Electronic adjustment knob.

MICROPROCESSOR TRAINER

BGC-808 \$699.00, learn computer theory. Excellent for school & individual who want to learn about ROM, RAM, I/O ports, programming, & run a 8088 Microprocessor. An easy to understand step-by-step manual guides you to achieve your goal. 56-key keyboard, LCD display, RS-232, UART...

LODESTAR

Lodestar Electronics Corp. Since 1979

One Year Warranty. 15 Day Money Back Guarantee. OEM WELCOME.

School purchase order accepted. Bids accepted. VISA, Mastercard

SALES REP./DISTRIBUTORS/OEM WANTED. Discover, AmrExpr

1-800-870-1955 / (919)870-1955 Fax: (919)870-5720

GRID DIP METER

DM-4061 \$89.95 1.5-250MHz, 6 bands; 6 plug-in coils, 2 transistor, and 1 diode. Modulation: ± 2 KHz Sine wave. Crystal Oscillator: 1-15MHz. Wave absorption meter. 9VDC battery.

FREQUENCY COUNTER

FC-5250C \$119.95 10Hz-220MHz (HF) 10Hz-200MHz (VHF) 10-200MHz. Gate Time: 1, 1sec. Max. Input: 10V_{pp}. Input Sensitivity: 35mV/10Hz-200MHz. Input Imped: 1MΩ(HF), 50Ω(VHF). Display: 7-digit LEDs; 9V adapter (\$6).

FC-5260A \$129.95 10Hz-600MHz, 7-digit LEDs.
FC-5270 \$149.95 10Hz-1.2GHz, 8-digit LEDs.
FC-5600B \$229.95 10Hz-600MHz; 10-digit LEDs.
FC-5700 \$299.95 10Hz-1.3GHz; 10-digit LEDs. Period measure.

SIGNAL TRACER/INJECTOR

(\$ Reduction) SE-6100 \$199.95 \$89.95
TRACER: Gain 60dB maximum. Attenuation: 0/20/40/60dB.
Input Imped: 100KΩ; Meter: Vu 100μA. Output Imped: 600Ω; Speaker: 8 Ω.
INJECTOR: ± 1 KHz Sine wave; Wave Level: Variable 0-4.5V_{pp}, 9V battery or adaptor (\$6.00).

LCR METERS

MIC-4070D \$179.95, Induct.: 0.1p-200H, Capacit.: 0.1p-20mF, Resist.: 1mΩ-20MΩ, 20 range, Dissipation factor measurement, Zero adjust, Surface mount device (SMD) test probe. LT-06 \$21.95

DIGITAL MULTIMETER

DM-120 \$24.95, 3 1/2 digit, 600VDC, 2ADC 500VAC, 2MΩ, hFE/diode/continuity test, 1.2%.
DM-123+ Capacitance \$44.95, 3 1/2 digit, 600VDC/600VAC, 10ADC/AC, 20Ω, 20pF, hFE/diode test, continuity probe, 0.8% accuracy.
DM-124+Cap.+Temp.+Freq \$69.95, 3 1/2 digit, 600VDC/500VAC, -58-752°F, 20Ω, 20mF, 200KHz, 3 1/2 place diode/continuity test, 1.2%.
DM-125 \$54.95, Autorange/Bargraph, 32MΩ, 600VDC/AC, 10ADC/AC, diode/continuity test.
MIC-35 \$89.95, Autorange, 3 1/2 LCD, 20MΩ, 1000VDC/750VAC, 20ADC/AC, data hold, diode/continuity test, free holster, 0.5% accuracy.
MIC-39 \$129.95, Autorange/Bargraph, True RMS, 3 1/2 LCD, 40MΩ, 40pF, 1000VDC/750VAC, 20ADC/AC, 600KHz freq. cnt, data hold, sleep mode, memory, read functions, holster, 0.3% accuracy.

AUTO. CAPACITANCE METER

CM3300A \$139.00 10 ranges, 99.9pF - 99.9mF, fully automatic. Resolution: 0.1pF lowest, 0.1% full scale. Accuracy: 0.5% of full scale ± 1 digit to 99.9μF, 1% of full scale ± 1 digit to 99.9μF. Display: 3 digit LED. Unit: pF, nF, μF, mF. Overrange indicators.

AUTO DISTORTION METER

DM-3104A \$799.95
DISTORTION MEASURE
Range: 0.01% to 30%, 0.1/0.3/1/3/10/30% 6 ranges.
Freq: 400Hz-10KHz, 1KHz $\pm 10\%$ (HPF).
Input: 3mV-100V; Ratio measure 20dB.
Auto. Freq. Switching Range:
Fundamental Freq. = (fo) $\pm 10\%$;
Fund. Rejection: > 80 dB at (fo) $\pm 5\%$; > 70 dB at (fo) $\pm 10\%$.
Harmonic Accuracy: ± 0.5 dB, 1.8Hz-20KHz.
LEVEL MEASURE Range: 0 to 100V in 0.3/1/3/10/30/100V.
Freq Response: > 0.5 dB/20-50KHz, ± 1 dB/20-100KHz.
DM-3204 \$1,599.00 dual channels; Spec see DM-3104A.

WOW-FLUTTER METER

WF-3103A \$699.95 Freq. Range: 3KHz-515KHz/CCIR, 3.15KHz-10% DIN. Measurement: 0.3/1/3/10/30% full scale. Accuracy: $\pm 5\%$ of full scale. Function: LIN/WOW/Flutter/WT. Freq Counter: 10Hz-9.9MHz. Indication: CCIR/DIN/ITS.

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

NEW 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

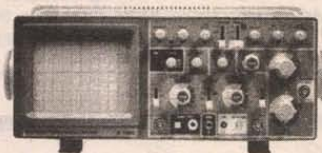


Made in the USA



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
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 \$179
DMM 914 \$229
DMM 916 \$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
\$399

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 261II	\$195	Model 12	\$84
Model 701II	\$85	Model B3	\$235
Model 731II	\$115	Model B5	\$269
Model 751II	\$139	Model B7	\$289
Model 771II	\$154	Model B63E	\$475
Model 791II	\$175	Model B67BE	\$650

B&K Precision Multimeters

Model 389	\$109	Model 388A	\$99
Model 390	\$127	Model 2707	\$75
Model 391	\$143	Model 2660A	\$79
Model 5360	\$195	Model 5370	\$219
Model 5380	\$265	Model 5390	\$295

NEW DIGITAL LCR METER

Model LCR-1810

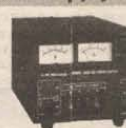
- Capacitance .1pF to 20µF
- Inductance 1µH to 20H
- Resistance .01Ω to 2000MΩ
- Temperature -20°C to 750°C
- DC Volts 0 - 20V
- Frequency up to 15MHz
- Diode/Audible Continuity Test
- Signal Output Function
- 3 1/2 Digit Display

\$99.95



B&K High Current DC Power Supply

- Variable 3-14 VDC
- Thermal Protection
- Current Limiting



Model 1686 12A
\$159
Model 1688 28A
\$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 @ 500mA • 1 Variable 0-12V @ 500mA



\$29.95

Digital Multimeter Model M-1700

\$39.95

11 functions including freq to 20MHz, cap to 20µF. Meets UL-1244 safety specs.



Standard FRS Model FRS-14

- 1/2 Watt Output, 14 Channels
- LCD Channel & Code Display
- 38 Selectable Channel Codes
- Back-Lit Display
- No License Required!

\$159.95 each or 2 for \$300.00



Handheld Universal Counter

Features:

- 10-Digit LCD Display.
- 250MHz Direct Count.
- 16 Segment & RR Signal Strength Bargraph.
- NiCad Battery Included.



Model F-2800
1MHz - 2.8GHz

\$99

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
- Audio Tone
- 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

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

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

PRIME ELECTRONIC COMPONENTS, INC.



OUR
WEB SITE IS
BACK UP!

150 West Industry Court, Deer Park, NY 11729
CHECK OUT OUR WEB SITE @ www.primelec.com

OUR
WEB SITE IS
BACK UP!



516-254-0101 • FAX 516-242-8995 • 1-800-707-8160 (ORDERS ONLY)

EPROM & CPU/MPUs SOCKET PULLS

Math-Coprocessor & CPU

8087-1	\$10.95	8748H	\$4.50
80287L	\$19.95	8749	\$5.95
80386DX-16	\$4.95	8749H	\$5.50
80387SX-16	\$14.95	8751H	\$8.95
80387SX-25	\$17.95	8752	\$13.95
80387DX-20	\$17.95	8755	\$6.95
80387DX-25	\$24.95	MC68020RC20	\$14.95
80486SX-25 (PGA)	\$14.95	MC68020RC33	\$19.95
AM486DX-33 (PGA)	\$17.95	MC68030RC25	\$24.95
80486DX-50 (PGA)	\$19.95	MC68030RC33	\$29.95
8741	\$3.95	MC68881RC20	\$9.95
8742	\$4.95	MC68882RC25	\$14.95
8748	\$4.95		

All parts, all socket pulls (must be cleaned & erased). *Note: Speed selection available at additional charge and all parts subject to availability.

EPROMS

2708	\$0.75	27C256	\$1.35
2516	\$0.65	27512	\$1.75
2716	\$0.65	27C512	\$1.95
2732	\$0.65	27C1010	\$2.25
2764	\$0.65	27C100	\$2.25
27C64	\$0.65	27C1001	\$2.25
27128	\$0.65	27C1024	\$2.25
27128A	\$0.65	27C020	\$2.95
27256	\$1.25		

All DRAMS are clean socket pulls and have full leads.
4164-15\$0.18 Ea. 41256-15\$1.00 Ea.
4164-12\$0.25 Ea. 41256-12\$1.25 Ea.
41256-10\$1.35 Ea.

NEW ALPS 2.88 MEG 3.5" FLOPPY DISK DRIVE FOR 755 SERIES THINKPAD LAPTOP

New 2.88 Meg 3.5" floppy disk drive mfr. by Alps for IBM Thinkpads 755 Series computers. This drive replaces the 1.44 Meg drive by transferring it into the original mounting bracket (5 min.) and it will be auto-detected when the computer is started. Supports 720K/1.44Meg/2.88Meg standards. TP755/2.88 (IBM P/N 1619718)\$49.95 Ea.

NEW HAYES ACCURA 28.8 INTERNAL FAX/MODEM

28.8 Hayes Accura internal plug-n-play fax/modem. Card comes with Quarterdeck InternetSuite 2 and Webtalk. Requires 16 bit ISA slot. Windows 95 Plug-n-play compatible. Five year manufacturer's warranty. Accura 28.8 Fax Modem\$49.95 Ea.

NEW INTEL A80487SX PGA MATH CO-PROCESSOR

New retail box Intel math co-processor comes complete with used guide, utility and diagnostic software. Great price and easy installation on upgradable systems. (Chip package 169 pin PGA.) A80487SX\$24.95 Ea.

NEC 6X CD-ROM DRIVE FOR VERSA 2400 SERIES

New fast 6X CD-ROM add-on or upgrade for NEC Versa 2400 laptop computer. Slides easily into VersaBay 2400 slot. One year manufacturer's limited warranty.
OP-260-65001 (Versa CD 6X Drive)\$69.95 Ea.

NEW COLORADO JUMBO 120 INTERNAL TAPE BACKUP DRIVE

New Colorado Jumbo 120 tape backup system has up to 120MB capacity using data compression. Installs in minutes connecting to most existing floppy controllers. Includes powerful, easy-to-use Colorado backup for DOS software program. Fits into 5-1/4" or 3-1/2" half height drive bays. QIC-40 compatible. Kit includes: drive, cable, mounting screws, and all documentation. Note: Tape not included.
Jumbo 120 Tape Backup\$29.95 Ea.

USED MICROSOFT PS/2 MOUSE

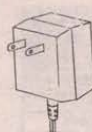
(New Style Contoured Type)

Used Microsoft PS/2 mouse, from older upgraded computer systems. All test with 30-day warranty.

Used MS PS/2 Mouse\$6.95 Ea.

WALL PLUG WALL ADAPTERS

Input: 117 Vac 50/60 Hz. Outputs Available.



Quantity
Pricing
Available

8Vdc 500Ma	\$2.00 Ea.
9Vdc 200Ma	\$1.50 Ea.
9Vdc 300Ma	\$2.50 Ea.
9Vdc 450Ma	\$3.50 Ea.
9Vdc 500Ma	\$2.95 Ea.
9.5Vdc 750Ma	\$3.50 Ea.
12Vdc 100Ma	\$1.25 Ea.
12Vdc 200Ma	\$1.50 Ea.
12Vdc 500Ma	\$2.95 Ea.
12Vdc 600Ma	\$3.95 Ea.
12Vdc 800Ma	\$6.95 Ea.
12Vdc 830Ma	\$4.95 Ea.
14Vdc 700Ma	\$5.95 Ea.
16Vdc 1.2Amp	\$6.95 Ea.

NOW UP-TO-DATE, WINDOWS 3.1 & WINDOWS 95 SCHEDULE AND CONTACT MANAGEMENT SOFTWARE

Powerful schedule, To-Do lists, Contacts, printing Avery labels, Day timer book formats. CD-ROM contains Windows 3.1 & Windows 95 versions. 10MB hard disk space, VGA or SVGA display, mouse required. New retail box.

Now Up-To-Date (CD-ROM)\$9.95 Ea.

NEW NISCAN/GS PLUS OCR/256 GRAY SCALE SCANNER

Brand New True 256 Gray Scale Hand Scanner. Resolution: 25-400 DPI. Scan Width: 4.2 in. Scan Length: 11 in. Interface: 16 Bit high speed (ISA) card, 64K SRAM. System Requirements: 286/386/486 PC Compatible (16MHz).



Niscan/GS Plus\$29.95 Ea.

NEW TANDY SUPER VGA 1 MEG DRAM (16-BIT ISA Bus Type)

This board is your basic super VGA video board with 1 meg of DRAM type memory. (ISA BUS TYPE) Core Logic Chip: WD90C31-25-00-02. Resolution/Color: 640x480/256C. 80x800/256C. 1024x768/256C. 1024x1024/16C. Note: Software drivers included with board. Windows 3.1, VESA, Autocad, etc.

Tandy SVGA 25-4055\$12.95 Ea.

NEW 300W BABY SWITCHING POWER SUPPLY UL & CSA RATED 110-220VAC

Input voltage: 110-220VAC 50Hz/60Hz UL & CSA. Output voltage: +12VDC @ 12 amp/-12VDC @ 0.5 amp; +5VDC @ 30 amp/-5VDC @ 0.5 amp.

Model # Hipro HP-300PPFS\$39.95 Ea.

NEW INTEL N80287XLT

MATH CO-PROCESSOR

New retail box Intel math co-processor comes complete with used guide, utility and diagnostic software. Great price on a hard-to-find part for 286 laptops. (Chip package 44 pin PLCC.)

N80287XLT\$19.95 Ea.

NEW CYRIX FASMATH COPROCESSOR CX-83D87-33-GP

New Cyrix FastMath coprocessors for 80386DX16-33 systems. This FPU unit is used in place of Intel's 80387DX16-33 part. Originally priced at \$100.00, a steal \$10.95. Case: 68 pin grid array.

Cyrix CX-83D87-33-GP\$10.95 Ea.

NEW SQUARE EQUIPMENT FANS

115 Vac 3.1" or 4.7"	\$7.95 Ea.
12 Vdc 3.1" or 4.7"	\$6.00 Ea.
12 Vdc 2-3/8"	\$4.95 Ea.
12 Vdc 2-5/8"	\$6.00 Ea.



HARVARD GRAPHICS 4.0 (CD-ROM)

The easy way to create professional presentations. Designed exclusively for Windows 95. Pentium 75 or better. 13MB to 44MB hard disk space, SVGA display, Windows 95, mouse. New retail box

Harvard Graphics 4.0 (CD-ROM)\$24.95 Ea.

512K PCMCIA SRAM CARD

New 512K PCMCIA SRAM card made by Fujitsu. Will work in most laptop, PDA, or handheld computers with PCMCIA socket and socket management software. HP100/200, OmniGo, Zaurus, etc. Requires one lithium coin battery (BR2325/CR2325). Note: Battery not included. Fujitsu (512K SRAM PCMCIA)\$24.95 Ea.

NEW 28.8/V.34 PCMCIA MODEM/FAX MADE SIMPLE TECHNOLOGY

New 28.8/V.34 PCMCIA modem/FAX, cellular ready (MNP10-EC & TX-CEL Protocol) with Flash upgradeability to 33.6. Windows 95 Plug n' Play. Hot swap capabilities. Bitware Fax software included. Note: Separate purchase of connecting cable from Simple Technology needed for cellular operation.

28.8 Communicator (Simple Tech.)\$49.95 Ea.

USED PULLED WORKING ASSORTED HARD DRIVES

Pulled from working equipment, tested and guaranteed for 30 days. IDE and SCSI, from 40 Megs to 500 Megs. Call for availability, model numbers, and current pricing.

NEW TEAC 1.2 MEG 5-1/4" FLOPPY DRIVE

5-1/4" Half Height Teac. Model #FD-55GRF. Tan face plate only.
1.2M TEAC FD-55GRF\$14.95 Ea.

NEW 500MEG SCSI 3.5" SEAGATE

ST1480N\$74.95 Ea.

NEW 16-BIT 256K ISA VGA CARDS

Designed for the PC-XT/PC-AT & compatibles, this is a basic low cost VGA video card. 256K DRAM with chips & technology 82C451. Full backward compatibility with EGA, CGA, MDA, and Hercules modes. Card type: ISA 16-bit.

Model # VGA 300 (VGA Card)\$9.95 Ea.

FIRST AID 95 BY CYBERMEDIA

New retail boxed CD-ROM version for Windows 95 and 3.1. Fixes Windows problems automatically. System Req. IBM Compatible 386 or higher PC with Windows 95, 3.1, 3.11 / 4MEG RAM / 7MEG HD Space.

FirstAid 95 Ver. 2.0\$9.95 Ea.

QUARTERDECK WINprobe4 (3.5" Disk)

Powerful troubleshooting software tool for Windows and Windows 95 operating systems. Program can run over 200 individual tests to keep your system running at full speed. 1MB free HD space required. New retail box.

Winprobe 4.0 (3.5" Disk)\$9.95 Ea.

NEW INTERNAL IMES 6X IDE CD-ROM DRIVE

New 6X IDE interface, Caddyless design. Drive comes with instructions sheet, IDE cable, and driver disk for DOS and Windows. Unit is Windows95 Plug & Play compatible.

IMES 6X CD-ROM Drive\$49.95 Ea.

NEW MICRONICS PENTIUM HX CHIPSET MOTHERBOARD

New Micronics Model D5CUB Pentium AT style motherboard. This motherboard comes with built-in I/O support for 4) IDE devices, 2 com ports, floppy controller, and printer port. The motherboard is built around the Intel HX Chipset and can support MMX and NON-MMX Pentium CPUs and Cyrix 6x86 CPUs 100MHz through 200MHz, 256K cache, 4) 72-pin SIMM sockets.

Micronics D5CUB\$74.95 Ea.

NEW 1.44 MEG 3.5" FLOPPY DRIVE

New 1.44 Meg 3.5" floppy drive with gray face plate. Floppy 1.44/Gray\$19.95 Ea.

NEW INTEL PENTIUM 60/66 CPU HEATSINK 12VDC FAN COMBO

New Pentium 60/66 heatsink 12VDC fan combo for cooling the older, hotter CPUs. Low profile type with seven inch wires. Can be used on other CPUs if you have the physical space.

Pentium 60/66 CPU Cooler\$4.95 Ea.

NEW TEAC COMBO 700 TAPE BACKUP AND FLOPPY DRIVE 1.44 3.5"

The Teac combo is a 3.5" floppy drive and QIC tape backup unit built into 5.25" half height frame. Great for systems with limited drive bays. Tape backup unit utilizes the PC's existing floppy controller. Capacity: 680MB compressed/340MB uncompressed. Tape Format: QIC-3010-MC. Data Trans. Rate: 0.5 & 1Mbps. Tape Media: 3M MC3000X (400 ft.). Software Incl.: Arcadia Backup for Windows 95, Windows 3.1 & DOS (1.44 Meg floppy). (Note: Backup tape or cables not included with drive.)

FF-3101/700 Combo\$69.99 Ea.

Write in 48 on Reader Service Card.

Mr. NiCd E.H. Yost & Co.-YOUR SOURCE FOR Mr. NiCd

BATTERIES!

- ☆ AMATEUR / COMMERCIAL / AVIATION RADIO ☆
- ☆ LAPTOP COMPUTERS ☆ VIDEO CAMCORDERS ☆
- ☆ CELLULAR & CORDLESS TELEPHONES ☆
- ☆ SEALED LEAD ACID ☆ PHOTOGRAPHY ☆
- ☆ MEDICAL EQUIPMENT ☆ TESTING EQUIPMENT ☆

CALL OR WRITE TODAY FOR OUR FREE CATALOG!

Phone (608) 831-3443 / Fax (608) 831-1082

E.H. Yost & Company 2211-D Parview Rd., Middleton, WI 53562

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

MILITARY TRANSISTORS & DIODES & INTEGRATED CIRCUITS WANTED. ELECTRONIC MATERIAL INDUSTRIES 818-769-1002, FAX 818-769-1084.

SATELLITE SAM'S inventory liquidation: 2000 low profile transformers dual output 14 & 42 VAC; saw filters; 24V DC motors w/gear boxes; opto-interruptors OPB-1819; transistors; capacitors; Draco power supplies. Call 1-800-424-1228 or fax 765-289-9403. Sun Distribution of IN.

INVENTORY LIQUIDATION: Transformers dual output 14 vac & 42 vac; saw filters; photodiodes; DC motors w/gear boxes; transistors; capacitors; many other items. Call 1-800-424-1228 or fax 765-289-9403. Sun Distribution of IN.

ALL ITEMS for sale. Pre-assembled cables for Toshiba, advance communication boards, local area network products, telephone products & fiber products, mounting & cable management tool, coaxial communications and I/O products. Ohio Service Supply Company, PO Box 8802, Canton, OH 44711-8802.

SOLAR KING'S MANY MILLION DOLLARS OF SOLAR PANELS IN STOCK. SOLAR PANELS: 6" X 12" 15V, @ .125A, 1.5W, \$17.95, \$150/10, \$1,300/100, 6" x 6" 7.2V @ .065A, .75W, \$7.95, \$59/10, \$500/100, \$3,980/1,000. Also credit card solar cells, call wholesale retail mail order, material running low. Cat'l on web: WWW.BNFE.COM BNFE, Rte. 1S, Peabody, MA 01960. T978-536-2000, F978-536-7400. Estab. 1964.

FREE FLYER on cable TV, phones, credit cards info, schematics, project boards, other misc. items. Bill 1-800-879-9657.

CLOSEOUT ITEMS. Tesla coil kit world famous \$19, \$55/3; wind speed indicator kit \$5, \$13/3; fan/motor speed control \$3, \$10/4; voice/sound activated switch modu. 1, 2 speed SW. Motor/lamp control \$1/2, \$12/5; Mallory Sonalert SC628 \$3.50, \$16/5, security keylock switch w/2 keys \$3/2. Cat'l on web, WWW.BNFE.COM BNFE, Rte. 1S, Peabody, MA 01960. T978-236-2000 F978-536-7400, estab. 1964.

RF FERRITE and iron powder cores. Free catalog. Palomar Engineers, PO Box 462222, Escondido, CA 92046, 760-747-3343. Palomar@compuserve.com

DESOLDER STATIONS: own pump: Hakko pistol style, \$250; Ungar 4024 mint, \$225; Weller DS1000 readout, \$350; Pace solder/desolder: MBT200, \$400, MBT210 digital w/TJ70 thermojet NU IR70, \$600; Hakko 850 mint w/SNU heads, \$900; desolder handpieces: Pace SX25, \$75; Ungar 4088AS, \$100; Raychem air pencil, \$200; Weller WTCP, \$45; EC2000ESD, \$100; 600 watt iron, \$100. Jim 310-515-2058.



ANAHEIM WIRE PRODUCTS. DISTRIBUTOR OF ELECTRICAL WIRE AND CABLE since 1973. Items available from our stock: Hook up wire, Automotive primary wire, GXL, SXL, Plenum cable, Teflon wire, Multi-conductor cable, Irradiated PVC, SO-CORD, Mil-Spec wire, Building wire, Welding cable, Battery cable, Telephone wire, Shrink tubing, Cable ties, Connectors. If interested, please call 1-800-626-7540, FAX: 714-771-5043. Visa/MC/Amex. SEE US ON THE INTERNET: <http://www.anaheimwire.com> OR E-Mail: info@anaheimwire.com

A NEW text, comprehensive filter design. Contains all transformation, design and charts, including finite Q considerations to design LP, HP, BP, BS filters. Software is also included. \$79 + \$6 S&H. Contact: Lee Watkins, 3134-93 East McKellips Rd., Mesa, AZ 85213.

MISCELLANEOUS ELECTRONICS WANTED

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.

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: ELECTRONIC OR VISUAL AUTOCOLLIMATORS, ALIGNMENT TELESCOPES, working or not. Taylor-Hobson, Hilger-Watts, Davidson or K&E products; optical instruments, components. METROPTICS, PO Box 726, Glendora, CA 91740. Phone: 626-335-5136, FAX 626-335-7896.

ALFA ELECTRONICS, INC.

HIGH QUALITY TEST EQUIPMENT PROVIDER

1-800-526-2532 (526-ALFA)

15 Days Money Back Guarantee!

	DMM DMM-10 (\$19.95): 3 1/2 digit, DC/AC V, Q, hFE, diode, signal output (+3V, -0.5V, 50% duty) DMM-17B (\$39.95): 3 1/2 digit, DC/ACV, contin., DC/ACA, Q, Capacitance, hFE, diode, Freq DMM-28 (\$49.95): AC/DC (V, A), Freq, cont., Capac, Induct., Q, hFE, diode, duty cycle DMM-22 (\$89.95): 4000 counts, bar graph, Freq, AC/DC (V, A), Q, Capacitance, diode, contin. DMM-23T (\$99.95): 4 1/2 digit, high resol. (10uV, 10mA, 10mΩ), hFE, diode, contin., true rms DMM-39S (\$179.00): true rms, AC/DC (V, A), Q, bar graph, freq, capac, dBm, logic, diode DMM-113 (\$24.95): Pocket Size, DC/ACV, Q, diode, Continuity beeper DMM-120 (\$24.95): economy type, DCV, ACV, DCA, Q, hFE, diode DMM-122 (\$59.95): DC/AC (V, A), Q, hFE, diode, capacitance, freq, logic, continuity DMM-123 (\$44.95): DMM + capacitance, DC/AC (V, A), Q, hFE, diode, continuity DMM-124 (\$69.95): Electro-H Temp, DC/ACV, capacitance, freq, 3 phase, diode, contin. DMM-125 (\$54.95): Autorange + bar graph, DC/AC (V, A), Q, diode, continuity beeper		LCR METER CAP-15 (\$49.95): 3 1/2 digit, 0.1pF-20mF, 9 Ranges, 0.1pF resolution zero adjustment LCR-195 (\$89.95): 1uH-200H (induct.), 0.1pF-200uF (Capac.), 0.01Ω-20M Ω (Resistance) LCR-314 (\$189.95): 0.1uH-200H, 0.1pF-20mF, 0.1Ω-20MΩ, Q Factor, dissipation, zero adjust LCR-131D (\$229.95): autorange, 0.1uH-10kH, 0.1pF-10mF, 1mΩ-10MΩ, Q Factor, serial/parallel, 120Hz/1kHz testing mode																		
	OSCILLOSCOPE Dual Trace, Component Test, 6" CRT, X-Y Operation, TV Sync, CH2 Output, Graticule Illum, 2 Probes (x1:x10) PS-200 20 MHz Dual Trace \$339.95 PS-205 20 MHz Dual w/ Delay Sweep \$429.95 PS-400 40 MHz Dual Trace \$494.95 PS-405 40 MHz Dual w/ Delay Sweep \$569.95 PS-605 60 MHz Dual w/ Delay Sweep \$769.95 PS-1000 100MHz Dual Trace \$999.95 Digital Scope DS-303 30MHz Digital, 20 Samples/sec \$849.95 DS-303P RS-232 interface, 30Mhz \$1,049.95 Scope Probe HP-9060 (60MHz) \$15, HP-9150 (150MHz) \$22, HP-9250 (250MHz) \$29, HP-9258 (250MHz, 100:1) \$39		FLUKE DMM <table border="1"> <tr> <th>Handheld</th> <th>Scope Meter</th> </tr> <tr> <td>12 \$ 84.95</td> <td>92B \$1,399</td> </tr> <tr> <td>70-II \$ 75.95</td> <td>96B \$1,699</td> </tr> <tr> <td>73-II \$ 97.95</td> <td>99B \$1,999</td> </tr> <tr> <td>75-II \$129.00</td> <td>165B \$2,499</td> </tr> <tr> <td>76-II \$175.00</td> <td>863E \$469</td> </tr> <tr> <td>77-II \$155.00</td> <td>867E \$659</td> </tr> <tr> <td>79/29-II \$175.00</td> <td></td> </tr> <tr> <td>87 \$287.00</td> <td></td> </tr> </table>	Handheld	Scope Meter	12 \$ 84.95	92B \$1,399	70-II \$ 75.95	96B \$1,699	73-II \$ 97.95	99B \$1,999	75-II \$129.00	165B \$2,499	76-II \$175.00	863E \$469	77-II \$155.00	867E \$659	79/29-II \$175.00		87 \$287.00	
Handheld	Scope Meter																				
12 \$ 84.95	92B \$1,399																				
70-II \$ 75.95	96B \$1,699																				
73-II \$ 97.95	99B \$1,999																				
75-II \$129.00	165B \$2,499																				
76-II \$175.00	863E \$469																				
77-II \$155.00	867E \$659																				
79/29-II \$175.00																					
87 \$287.00																					
	POWER SUPPLIES Single Output DC Power Supplies • Short Circuit & overload protected • Constant current, constant voltage mode • 0.02%/+2mV line regulation; 0.02%/+2mV load regulate Analog Meters Display PS-303 (\$159.00) 30V/3A PS-305 (\$219.95) 30V/5A PS-8110 (\$289.95) 60V/5A PS-8112 (\$399.95) 60V/5A PS-1610 (\$289.00) 16V/10A PS-8107 (\$399.95) 30V/10A Digital Voltage Analog Current PS-8200 (\$179.95) 30V/3A PS-8201 (\$239.95) 30V/5A Digital Volt & Current Display PS-8300 (\$199.95) 30V/3A PS-8301 (\$259.95) 30V/5A		AUDIO/RF/GEN. GENERATOR RF Generator SG-4160 (\$124.95) 100kHz-150MHz sinewaves in 8 ranges, 100mV at 35MHz SG-4162 (\$229.95) Generate same signal as SG-4160, but with int. counter (150MHz) Audio Generator AG-2601 (\$124.95) 10Hz-1MHz, 0-8Vpp sine, 0-10Vpp squarewave AG-2603 (\$229.95) Same as AG-2601, but with additional counter and digital display Function Generator FG-2100A (\$169.95) 2Hz-2MHz, 5mV-20V, 0-10Vpp FG-2102AD (\$229.95) same as FG-2100A, but with int. counter and TTL, CMOS output. FG-2103 (\$329.95) Sweep 0.5Hz-5MHz, linear/log, VCG, VCV, int. counter																		
	POWER SUPPLIES Triple Output • One fixed 5VDC, 3 Amp output • Parallel to double current output (PS-8102 & PS-8103 only) Triple Output (Analog display) PS-8102 (\$399.95) 30V/3A/30V/3A PS-8103 (\$489.95) 30V/5A/30V/5A Digital Display PS-8202 (\$499.95) 30V/3A/30V/3A PS-8203 (\$549.95) 30V/5A/30V/5A		POWER SUPPLIES Dual Tracking • Short Circuit & overload protected • Constant current & constant mode • Independent or Tracking Dual Tracking (Analog V & I Display) PS-303D (\$314.95) 30V/3A/30V/3A PS-305D (\$399.95) 30V/5A/30V/5A PS-8108 (\$549.95) 60V/3A/60V/3A PS-8109 (\$699.95) 60V/5A/60V/5A																		

INSTEK® Test & Measuring Instrument

ISO 9002 Cert. #934163 (2 Years Warranty)

OSCILLOSCOPE OS-653 \$699.95 50MHz Triggering OS-622B \$399.95 20 MHz Oscilloscope	DC POWER SUPPLIES Triple Output • 2 variable out 0-30V/0-3A • One fixed 5V/3A output • Auto track, serial, parallel • Const. volt, current mode • 4 analog or 2 digital display PC-3030 (\$499.95) PC-3030D (\$549.95)	Single Output • Const voltage, current mod • Voltage regulation <0.01% • Current regulation <0.2% • PS: 2 analog or 1 digital dis • PR: 2 analog or 2 digital dis Analog Meters Display PS-1830 (\$209.95) 18V/3A PS-1850 (\$219.95) 18V/5A	Programmable • High stability, low drift • One fixed 5V/3A output • 100point program (PPS ser) • 50point program (PPT ser) • Auto serial/parallel (PPT ser) • Auto track (PPT series), IEEE-488.2 and SCPI compatible command set (optional) PPS-1860G (\$1,099.95) PPS-3435G (\$1,099.95) PPS-4020G (\$1,099.95) PPT-1836G (\$1,399.95) PPT-3415G (\$1,399.95)	FUNCTION GENERATOR FG-8015G (\$189.95) Sweep • 0.02Hz-2MHz no counter • Sine/Sqr/TTL/Pulse/Ramp FG-8016G (\$239.95) • 0.02Hz-2MHz w/ counter • Pulse, function generator FG-8017C (\$249.95) Sweep • Sine/Tri/Sqr/TTL/CMOS • 0.02Hz-2MHz, FM mod. FG-8019 (\$399.95) Sweep • 0.02Hz-2MHz w/ counter • INT/EXT AM/FM mod FG-8019 (\$399.95) • 0.02Hz-2MHz w/ counter FG-8050 (\$499.95) Sweep • 0.05Hz-5MHz w/ counter • INT/EXT AM/FM mod	BENCHTOP DMM DM-8034 (\$179.95) 3 1/2 digit • AC/DC (V, A), Q, diode • 1000V, 20A, 0.5% accu. DM-8040 (\$339.95) 3 1/2 digit • ACV to 50kHz, true rms DM-8055 (\$499.95) 5 1/2 digit • 0.006% basic accuracy • 1uV, 1mΩ, 1nA resolution • dBm, auto, REL, min/max • Same funct. as DM-8055 Frequency Counters FC-8131 (\$469.95) 1.3GHz FC-8270 (\$629.95) 7.2GHz UC-2010G (\$294.95)
Programmable Electronic Load (PEL-300) (Patent No. 8101381234) • Operating Rating: voltage 3-60V, current 6mA-60A, power 300W, temp 0-40C (operating) 10-70C (store) • Over voltage, over current, over power protection • Operation mode: constant voltage, current, resistance • Transient Gen. Frequency 1Hz-1kHz, duty 10-90% • High Resolution: 20mV, 0.2mA, 0.3mΩ • Self-Test and Software Calibration • Meet IEC Safety regulation					

ALFA ELECTRONICS
P.O. BOX 8089
PRINCETON, NJ 08543

TEL: (800) 526-ALFA 2532 / (609) 897-1135
FAX: 609-897-0206
Email: alfa0168@aol.com

Call/Write/Fax for FREE CATALOG
Visa, MC, AMEX, COD, PO Accepted, OEM Welcome
1 Year Warranty (2 Years for Instek)

BATTERIES

**REPLACEMENT
BATTERIES**
ALL NEW • MADE IN U.S.A.

KENWOOD		
PB1	12v @ 1100 mAh	\$50.00
KNB-3	7.2v @ 1200 mAh	30.00
KNB-4	7.2v @ 2200 mAh	69.00
PB6	7.2v @ 760 mAh	35.00
PB7	7.2v @ 1500 mAh	49.00
PB8	12v @ 850 mAh	49.00
PB-13	7.2v @ 750 mAh	37.00
PB-14	12v @ 800 mAh	49.00
PB-18	7.2v @ 1500 mAh	47.00

ICOM		
7S	13.2v @ 1400 mAh	\$53.00
8S	9.6v @ 1400 mAh	51.00
BP7	13.2v @ 600 mAh	53.00
BP8	8.4v @ 1400 mAh	50.00

SA/SAT		
BP82, BP83A		
BP84	7.2v @ 1200 mAh 3"	\$39.00
BP85B	12v @ 600 mAh 3"	69.00

YAESU		
FNB-2	10.8v @ 600 mAh	\$19.00
FNB-4	12v @ 750 mAh	39.00
FNB-4A	12v @ 1000 mAh	55.00
FNB-17	7.2v @ 600 mAh	30.00
FNB-10S	7.2v @ 1200 mah	39.00
FNB-12S	12v @ 600 mAh	40.00
FNB-25	7.2v @ 600 mAh	35.00
FNB-26	7.2v @ 1200 mAh	44.00
FNB-26S	7.2v @ 1500 mAh	49.00
FNB-27S	12v @ 800 mAh	49.00

ALINCO		
EPB-10N	7.2v @ 700 mAh	\$36.00
EPB-12N	12v @ 700 mAh	47.00
DJ-F1T		
EPB-16N	7.2v @ 750 mAh	\$37.00
EPB-16N	12v @ 600 mAh	47.00
DJ-180, DJ580		
EPB-20N	7.2v @ 800 mAh	\$34.00
EPB-20NX	7.2v @ 1600 mAh	44.00
EPB-22N	12v @ 800 mAh	49.00

CAMCORDER		
Panasonic PB 80/88		
ORIG PAN.....		\$39.00
Sony NP77H	2400 mAh	39.00
Sony NP55	1200 mAh	29.00
Sony NP22	500 mAh	29.00
Canon 8mm	2000 mAh	36.00
Panasonic Palm	2400 mAh	39.00
JVC GR Type C	1500 mAh	36.00
Sharp BT 21/22	2000 mah	45.00
RCA/Hitachi 8mm	2400 mAh	39.00

ALL BRANDS AVAILABLE

SALE!
ALL 7.2 VOLT
@ 1500 mAh*
**BATTERY
PACKS**
\$39.00

*EXCEPT FNB-35(S)(S)

MasterChargers*

MasterCharger I DELTA V,
RAPID CHARGER
ALL VOLTAGE 4.8v - 13.2v 1/2-2 HOURS

MasterCharger IIa
TAPER CHARGER
ALL VOLTAGE 4.8v - 13.2v 0 HOURS

DUAL CHARGERS

- MasterCharger i+l
- MasterCharger i+l+a
- MasterCharger IIa+IIa*

*AUTOMATICALLY CHARGES TWO
BATTERIES AT THE SAME TIME

All MasterChargers
(Single and Dual) Feature:

- Interchangeable Cups
- Fully Automatic Operation
- Built in Overcharging Protection
- User Friendly
- More Than 50 Cups Available
- Optional DC Charger

NEW!

KENWOOD TI122AT/79A		
PB32	6v @ 600 mAh	
PB33	6v @ 1200 mAh	
PB34	9.6v @ 600 mAh	

YAESU FT-11/51A		
FNB-31	4.8v @ 600 mAh	
FNB-33(S)	4.8v @ 1500 mAh	
FNB-35SS	7.2v @ 1500 mAh	
FNB-38	9.6v @ 600 mAh	

ICOM-W21AT/2GX		
BP-157	7.2v @ 900 mAh	
BP-157(S)	7.2v @ 1500 mAh	
BP-132	12v @ 850 mAh	

*available with and without microphone**

MOTOROLA

GP-300	7.5v @ 1200 mAh
--------	-----------------



BATTERY-TECH, INC. 800 SOUTH BROADWAY, HICKSVILLE, NY 11801
800-442-4275 • FAX 516-496-9523

SEND FOR FREE CATALOG • DEALER INQUIRIES WELCOME

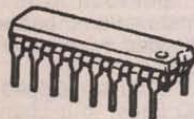
IN NEW YORK STATE CALL: 516-496-9520

Write in 131 on Reader Service Card.

WANTED: ELECTRICAL materials, Allen-Bradley, Agastat, Appleton, Crouse-hinds, T&B, Square D, Pyle National, Russel & Stoll, circuit breakers, fuses, connectors. Call Beiner Sales, 805-376-9044, FAX 805-376-8207.

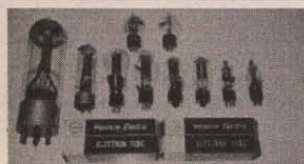
EXCESS INVENTORY WANTED: Transistors, semiconductors, capacitors, PC boards, & diodes. We buy it all! Contact: **SEMITECH, INC.**, 381 Roberts Road, Oldsmar, FL 34677. Phone 813-854-3311, FAX 813-854-3422.

WANTED: ELECTRON tubes, ICs, semiconductors. Astral, PO Box 707NV, Linden, NJ 07036. Call 1-800-666-8467.



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.

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.



HIGHEST PRICES paid for Western Electric tubes, new and used. Call Don Singerhouse/Singerhouse Sound. Toll free 1-888-715-tube.

BUYING USED and excess memory, EPROMs, circuit boards, etc. SMA 812-849-0007 fax lists 812-849-4035.

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. So., Seattle, WA 98118. Voice/Fax 206-723-8487.

MILITARY TRANSISTORS & DIODES & INTEGRATED CIRCUITS WANTED. **ELECTRONIC MATERIAL INDUSTRIES** 818-769-1002, FAX 818-769-1084.

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.

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.

WANTED: TUBE HiFi/commercial amps, preamps, corner/horn speakers. Altec, Marantz, McIntosh, Western Electric, etc. 405-737-3312 fax 405-737-3355.

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.

WANTED PIONEER 5XXX-6XXXX SERIES CONVERTERS, RAW, LOTS 5 OR MORE, TOP CASH PAID. 702-642-0325.

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.

WE BUY your electronic excess inventories. ICs, caps, transistors, LED, connectors, PCBs, computers and related products. Call Jim Eskue 714-558-8813, fax

WANTED: MORSE code equipment for learner. Please call 978-453-2833 or fax 978-441-9468 for further info.

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.

VISIT OUR WEB SITE AT WWW.ALLCABLE.COM

Closing Date For Next Issue – April 6th

C-TECH

Call for pricing on

Zenith 1600's
Scientific Atlanta

Jerrold
TOCOM

Pioneer
CFT's

We Repair and Sell Most CONVERTERS

I'm Back!

Page 1-800-478-0334

Hours

9-6 Pacific

Call

702-270-4341

*I'm Waiting
for your call!*

Genuine, Unmodified



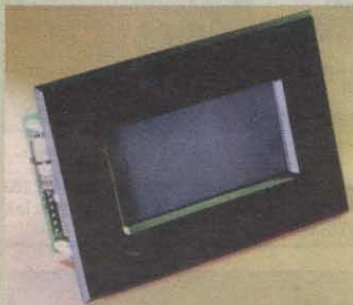
New Product

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

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

News

OP6400 TOUCH-SENSITIVE BACKLIGHTED OPERATOR INTERFACE



Z-World announces the release of a new touch-sensitive user interface display. Ideal for machine control, embedded systems, and OEM applications, the new OP6400 displays user-defined graphics on a bright, touch-sensitive screen. The OP6400 can store up to 400 user-specified screens, each having up to 48 software "buttons" or locations on the touchscreen that are defined to be active.

The OP6400 is designed so the OEM or user can easily create command sequences, or "script," and graphical screens using readily available word processing and paintbox tools, such as PC Paintbrush, NotePad, or Microsoft Word. DOS and Windows platforms are supported by the OP6400 software. Scripts and screens are stored in local memory for rapid recall. In addition, the unit will accept both binary and ASCII commands from host PCs or other control devices.

The OP6400's 256x128 graphical LCD and 15x15 touch-sensitive transparent matrix can sense "presses" and "releases" by a user. The touchscreen communicates with any Z-World controller or PC through an RS-232 port. Screw terminals on the OP6400 facilitate easy wiring to a PC or Z-World controller. Communication baud rates range from 600 to 57,600 bps, making it virtually a universal display. User screens and scripts may be recalled automatically on system power-up.

The size of the OP6400 makes it ideal for embedding into systems that are tight on mounting space. The unit may be either flush mounted using a bezel and gasket for a NEMA rating, or directly mounted in a cabinet with cutout.

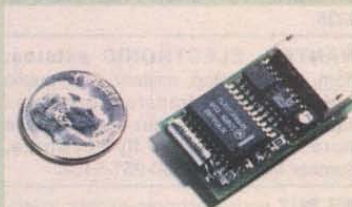
The OP6400 is available with a

development kit that includes a reference manual, serial cables, programming cable, wall power supply, and software diskette including sample programs. The OP6400 is available from stock, and is priced from \$756.00 each.

For more information, contact:

**Z-WORLD
2900 SPAFFORD ST., DEPT. NV
DAVIS, CA 95616
916-757-3737 FAX: 916-753-5141
E-MAIL: zworl@zworld.com
WEB: www.zworld.com**

ANI-1 MINIATURE ANI ENCODER



Communications Specialists' ANI-1 miniature ANI encoder is a microprocessor-based PCB that provides instant identification of mobile and portable two-way radios.

The ANI-1 uses a high-speed multi-tone sequence for data transmission on an RF channel. Incoming unit ID and status message transmissions can be decoded and displayed on a personal computer by using the ANI-2 station decoder. It is compatible with links and repeater systems.

The ANI-1 measures 1.13 x .66 x .22 inches with easy interface connector.

The ANI Automatic Numbering Identification System is available from stock and carries a five-year warranty.

For more information, contact:

**COMMUNICATIONS SPECIALISTS, INC.
426 W. TAFT AVE., DEPT. NV
ORANGE, CA 92665-4296
714-998-3021 FAX: 714-974-3420
1-800-854-0547**

VLF RADIO! "THE SOUNDS OF LONGWAVE"

The lowest radio frequency to which most people will ever tune is 530 KHz on their car's AM radio dial. The cassette tape VLF RADIO!

goes beyond this barrier with sound samples from virtually every type of radio signal that can be heard on longwave and below.

This 60-minute cassette provides narration and actual recordings of ships at sea, non-directional beacons, European broadcasters, experimental lowfers, military radioteletype stations, WWVB, 10-14 KHz Omega, and natural radio.

Many of these signals are considered "endangered species" and have been preserved here for their historical value. Included with the tape are reference notes, a long-wave spectrum chart, and a listener logsheet. VLF RADIO! is designed to serve as an introduction for the newcomer or as a reference tool for the seasoned DXer.

Tapes are available for \$11.95 each postpaid (US funds).

For more information, contact:

**KEVIN CAREY
P.O. BOX 56, DEPT. NV
WEST BLOOMFIELD, NY 14585
E-MAIL: kcarey@mdsroc.com**

CABLE AND HARNESS TESTER



The CableEye® Model M2 PC-Based Cable Tester lets users find defective cables instantly, display a wiring diagram, highlight the error or defect in color, save wiring notes and labels with text, print schematics, and much more.

Featuring a compact fixture with 152 test points which can be cascaded to achieve up to 1,000 test points, this unit connects to a PC or laptop via a serial port for testing complex cables and wiring harnesses.

Supplied with menu-driven software and an on-line database which holds an unlimited number of user cables and includes descriptive notes and label text for each one, the CableEye Model M2 PC-Based Cable Tester can be set up for one-button operation to easily execute

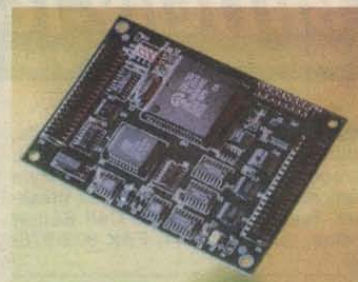
complex test sequences. Unlike stand-alone benchtop testers, this unit takes advantage of a PC's high-resolution graphic output to provide ISO-9000 documentation.

The CableEye Model M2 PC-Based Cable Tester sells for \$1,595.00 with 152 test points and software.

For more information, contact:

**CAMI RESEARCH, INC.
442 MARRETT RD., DEPT. NV
LEXINGTON, MA 02173
781-860-9137 FAX: 781-860-9139
E-MAIL: sales@camiresearch.com
WEB: <http://www.camiresearch.com>**

LP3100 LOW-POWER C-PROGRAMMABLE CONTROLLER



Z-World announces the release of a low-power C-programmable controller. The new LP3100 is ideal for applications where available maximum voltage and current are low. The LP3100 operates on 3.3 volts and consumes only 16 mA, drastically minimizing operating power. The LP3100 is perfect for reliable operation in mobile or remote installations, battery-powered embedded systems, and OEM applications.

The LP3100 is equipped with 20 digital I/O lines, four channels of conditioned 12-bit analog input, two RS-232 serial channels, an RS-485 port, 512K flash memory, a real-time clock and calendar, and an LPBus expansion port. The unit will operate on input power in the range of 3.5VDC-24VDC. The LPBus expansion port facilitates the addition of user-designed boards for direct use with the LP3100 controller.

The LP3100 is equipped with a sleep mode that shuts down the unit to conserve power. Sleep mode is invoked by software, and the real-time clock can be used to "wake-up" the LP3100 at a future date or time. The sleep mode will reduce the required current to 200 microamps.

The four channels of conditioned 12-bit analog inputs allow interfacing to a wide variety of analog sensors. Offset and gain of each analog channel is user-configurable. The 20 digital I/O lines can be configured in several combinations of inputs and outputs. A real-time clock and calendar allow time-date stamping of critical data. Daylight savings and leap year compensation are user programmable — ideal for remote applications. The LP3100's compact size — it's only 2.5" wide x 3.5" long x 0.5" thick — allows embedding into the tightest of

New Product News

spaces.

The LP3100 is available with a development kit that includes a reference manual, serial cables, programming cable, wall power supply, development board, 2x20 LCD, and mounting plate.

The LP3100 is available from stock. The unit is priced from \$119.00 each.

For more information, contact:

Z-WORLD
2900 SPAFFORD ST., DEPT. NV
DAVIS, CA 95616
916-757-3737 FAX: 916-753-5141
E-MAIL: zworld@zworld.com
WEB: www.zworld.com

SURGE SUPPRESSOR



This surge suppressor has modem/fax protection. It provides surge and noise suppression for both equipment power line and telephone line input. Suppresses up to 360 joules. It also handles up to 27,000A spikes.

Included are six electrical outlets and a 3-1/2 foot power cord. RFI/EMI line noise filtering exceeds 20 dB at 1 MHz.

For more information, contact:

JENSEN TOOLS, INC.
7815 S. 46TH ST., DEPT. NV
PHOENIX, AZ 85044
1-800-426-1194
602-968-6231 FAX: 602-438-1690
E-MAIL: jensen@stanleyworks.com
WEB: <http://www.jensentools.com>

OPTICON ALL-METAL RETROREFLECTORS AND ARRAYS



Opticon all-metal retroreflectors feature monolithic cast aluminum construction with tapped holes for bolt-in-place mounting to create arrays on back plates, cylinders, and in enclosures. Providing up to four times greater thermal sta-

bility than glass, they can be manufactured in virtually any shape with a 1/2" to 2" aperture and incorporate UV-VIS-IR coatings.

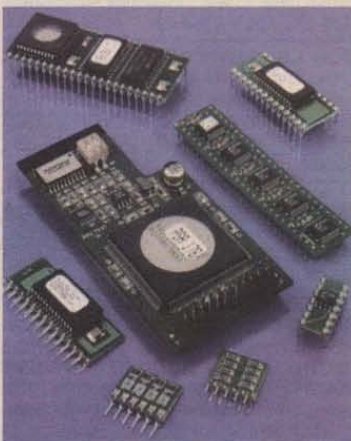
Ideally suited for demanding field applications, motion systems, and aerospace environments, Opticon all-metal retroreflectors and arrays are capable of withstanding up to 50,000 Gs shock while maintaining alignment. These truly monolithic individual hollow cube-corner and roof prisms exhibit up to two arc-second surface accuracy and one-quarter wave surface flatness.

Opticon all-metal retroreflectors are priced according to size, quantity, and design requirements.

For more information, contact:

OPTICON CORP.
76 TREBLE COVE RD., DEPT. NV
NORTH BILLERICA, MA 01862
978-663-6105 FAX: 978-663-0015

SURFACE MOUNT MODULES



Accutek's custom surface mount modules can be designed to solve space and volume constraints, enhance socket functionality, or replace end-of-life and obsolete parts. Typical modules include resistor terminators, RC filters, op amps, analog multiplexers, digital logic circuits, CPUs, and memory circuits in DIP, ZIP, SIP, QUIP, SIMM, pin grid array, and mezzanine packages.

Capable of 48-hour turnaround depending upon surface mounting integrated circuits, discrete semiconductors, passive components, and connectors on FR4 substrates. End-of-life or hard-to-find monolithic ICs and modules can be reconfigured using readily available products and used as drop-in replacements.

For more information, contact:

ACCUTEK MICROCIRCUIT CORP.
2 NEW PASTURE RD., STE. 1
DEPT. NV
NEWBURYPORT, MA 01950-4054
978-465-6200 FAX: 978-462-3396
1-800-652-7505
E-MAIL: accutek@seacoast.com
WEB: <http://www.accutekmicro.com>

ISOLATED TRANSCEIVER MODULE HYC3030

Shoreline Electronics, Inc. announces the HYC3030. The HYC3030 isolated transceiver module was designed specifically to handle noisy networking environments. The HYC3030 was also designed for extremely close node-to-node distances, without the usual reflection problems. The HYC3030 is a hybrid module that incorporates both a transformer for isolation and a custom IC to filter out noise.

The HYC3030 was specially designed to work in noisy environments like factory automation or industrial machines. A custom IC was incorporated in the design of the hybrid to filter out the noise.

The HYC3030 will support a node-to-node distance of only 50 cm at 312.5 KHz with minimal reflection between nodes. This is especially useful if networked machines have to be close together in an assembly line, POS terminals, or gaming machines.

For maximum safety an isolation transformer is incorporated in the hybrid circuit. The transmission speed can be increased to 5.0 MBs if the distance between the nodes is increased.

The HYC3030 is designed to be a drop-in replacement for existing industry standard isolated hybrid module HYC2488. It was also designed to be compatible with industry standard protocols, Arcnet, Ethernet, Carnet, RS-232, and RS-485.

For more information, contact:

SHORELINE ELECTRONICS, INC.
2098B WALSH AVE., DEPT. NV
SANTA CLARA, CA 95050
408-987-7733 FAX: 408-987-7735

NEW ENHANCED GPIB <-> SERIAL INTERFACE



ICS Electronics announces a new GPIB-to-Serial interface with expanded features. These new features give the user an expanded range of baud rates and better control of the serial interface for operation with RS-485 networks. The Model 4894A operates as a GPIB interface for serial devices and as a Serial-to-GPIB controller for a single GPIB device.

ICS has redesigned their GPIB <-> Serial Interface Module to make it compatible with the higher baud rates used in today's modems and in other serial devices.

The new Model 4894A lets the user select any standard serial rate from 50 to 115.2 Kbaud. The user can also enter any non-standard

baud rate and the 4894A will provide the closest baud rate based upon its 14.746 MHz internal oscillator. This feature assures that the 4894A will always be compatible with new serial devices.

Another new command lets the user select full or half duplex operation for controlling RS-485 networks.

The Model 4894A is CE certified for sale in Europe. Price starts at \$475.00 each.

For more information, contact:

ICS ELECTRONICS
473 LOS COCHES ST., DEPT. NV
MILPITAS, CA 95035-5422
408-263-5500 FAX: 408-263-5896
INTERNET: www.icselect.com

PK2400 C-PROGRAMMABLE CONTROLLER



Z-World announces the release of a C-programmable controller with built-in graphic display and keypad. The PK2400 is ideal for machine control, embedded systems, and OEM control applications that require a controller with built-in operator interface.

The PK2400 offers nine protected digital inputs, two conditioned analog inputs, six high-current outputs, two non-latching relays, two serial ports, graphic LCD, and 20-key keypad with three additional softkeys. The 128 Kbytes of non-volatile flash memory allows hassle-free in-system programming.

The keypad is constructed of membrane switches with snap-domes, offering tactile feedback to the user. The three softkeys are software programmable, allowing custom input prompts. The number and letter legend on the 20-key keypad can be easily changed to fit the needs of the user and the application.

The size of the PK2400 makes it ideal for embedding into systems that are tight on mounting space or those that require a slim package. The PK2400 measures just 8.25" L x 4.5" H x 1" W. The PK2400's wiring terminals make it easy to connect directly to photosensors, temperature and pressure sensors, strain gauges, and a variety of other sensing devices.

For more information, contact:

Z-WORLD
2900 SPAFFORD ST., DEPT. NV
DAVIS, CA 95616
916-757-3737 FAX: 916-753-5141
E-MAIL: zworld@zworld.com
WEB: www.zworld.com

Continued on page 106

Nuts & Volts Magazine/April 1998 89

WHITE-STAR ELECTRONICS

TEL: 405-631-5153 FAX: 405-631-4788

CONVERTERS:	20	50	100+
Regal CR-83 (RAN).....	45	39	35
Panasonic TZPC-175 (RAN).....	75	69	
Centurion CF-3000 (NEW).....	65	59	55
Regal CR-83 Volume (RAN).....	69	65	59

Call for **FREE** catalog.
405-631-5153



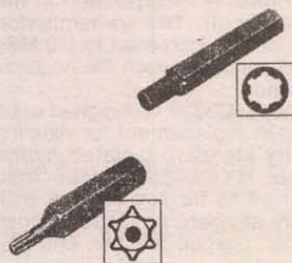
REMOTE CONTROL

HAND UNITS:	20	50	100+
Jerrold Replaces: 400/450/550.....	4.95	4.50	4.25
Scientific Atlanta: 075/175/475.....	4.95	4.50	4.25
8600: On screen display.....	7.50	7.00	6.50
Pioneer: BR 81, 82.....	4.95	4.50	4.25
Panasonic: Call for model #.....	7.50	7.00	6.50
Zenith: All.....	4.95	4.50	4.25
Tocom: 5503-VIP, 5503-A.....	7.00	6.50	6.25
Universal: 4 in 1 R/M.....	7.50	7.00	6.50

Call for Oak, Hamlin, Regal-83, Regency,
Texscan, and all others.

Tamper-Bit tools: (10-lot)

Jerrold compatible bits:	
1/4" Stacom Bit.....	\$8.00
Oval Round D.....	\$20.00
Torx Bit:	
Tocom T-8.....	\$8.00
Zenith T-10, T-15.....	\$8.00
Pioneer T-20.....	\$8.00
Scientific Atlanta T-20.....	\$8.00
Pio 63XX Oval.....	\$20.00
Bit Driver Handle.....	\$4.00



We carry most remote hand units. If you don't find the one you're looking for,
we can locate for you.

Specializing in large quantities.

HOURS: Monday thru Friday 9 am to 5 pm Central Time.

Call for **FREE** catalog • E-Mail: WSE405@AOL.COM

Write in 209 on Reader Service Card.

ALL CABLE TV NEEDS CABLE KING 1-800-544-9494

Write in 92 on Reader Service Card.

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 seventeenth(!) classic printing \$28.50. **SYNERGETICS PRESS**, Box 809-N, Thatcher, AZ 85552. 520-428-4073. Visa/MC.

BUSINESS OPPORTUNITIES

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.

RETIRED IN AUSTIN, TEXAS? We need part-time engineers & technicians for RF and digital product design and production testing. Daytime availability preferred. Emphasis on quality craftsmanship a must. Very interesting small quantity, high quality product environment. Contact Kathy Mitchell, 512-453-1133 9am-3pm.

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.

HOME AUTOMATION DEALERS WANTED. Free information. Call 1-800-838-4051 or fax name, address, and telephone to 402-729-3863.

MILITARY COMPONENTS wanted. Capacitors, resistors, diodes, transistors, semiconductors, ICs. Electronic Material Industries, 818-769-1002, FAX: 818-769-1084.

MILLIONS \$\$\$ in "scrap gold" from old computers and electronics junk. Message: 603-645-4776 or www.tiac.net/users/quiksand/goldtek.htm

WORK AT HOME, cash in on the WEB TV explosion. No PC necessary. Full training. Call now for all the details, 1-800-98 WEB TV, 1-800-989-3288.

Discount Computer Systems - SHOP US LAST !

Intel Pentium P166MMX MZH Multimedia System

Systems include:

Mid TW. CASE, MB W/VX CHIPS 512 CACHE, 16MB EDO RAM,
1.7 GB HARD DRIVE, 12X CD ROM, 1MB 64 BIT PCI VIDEO
CARD, 3.5" 1.44MB FD, 16 BIT 3D SOUND CARD, 33.6 FAX
MODEM WITH VOICE, WIN 95 MOUSE, WIN 95 104 KEYBOARD,
80 WATT SPEAKERS, WIN 95 REL. 2,
14" SVGA MONITOR INCLUDED

\$1185

Intel Pentium P200MMX MZH Multimedia System

Systems include:

Mid TW. CASE, MB W/VX CHIPS 512 CACHE, 32MB EDO RAM,
2.5 GB HARD DRIVE, 16X CD ROM, 2MB 64 BIT PCI VIDEO
CARD, 3.5" 1.44MB FD, 16 BIT 3D SOUND CARD, 33.6 FAX
MODEM WITH VOICE, WIN 95 MOUSE, WIN 95 104 KEYBOARD,
80 WATT SPEAKERS, WIN 95 REL. 2,
14" SVGA MONITOR INCLUDED

\$1499

Intel Pentium P233MMX MZH Multimedia System

Systems include:

Mid TW. CASE, MB W/VX CHIPS 512 CACHE, 32MB EDO RAM,
3.5 GB HARD DRIVE, 16X CD ROM, 2MB 64 BIT PCI VIDEO
CARD, 3.5" 1.44MB FD, 16 BIT 3D SOUND CARD, 33.6 FAX
MODEM WITH VOICE, WIN 95 MOUSE, WIN 95 104 KEYBOARD,
80 WATT SPEAKERS, WIN 95 REL. 2,
14" SVGA MONITOR INCLUDED

\$1775

Also: 266 MZH System Available at Similar Savings! See AD MART

800-804-6552 All Software Loaded & Tested



Don Lancaster's

RESOURCE BIN

number seventy five

Shattering a few virtual reality illusions.

Our 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.

I'm now in the process of setting up my new *Guru's Lair* web site you will find at (where else?) www.tinaja.com. This is the place you'll go for instant tech answers. Among the many files in our library, you will find complete reprint sets for all of the *Resource Bin* and other columns. Plus a brand new *Research InfoPack Service*.

You will get the best results if you have both *Netscape Communicator* and *Acrobat Reader 3.0* installed.

Virtual Reality Today

There is a company called *Doran* at www.doranprecision.com who is the leading purveyor for the high school driver's education auto simulators. These folks have long since branched out into delivering multi-passenger motion simms to arcades, museums, science centers, and similar venues.

These are typically a "short subway car" looking beastie up on hydraulic stilts. A dozen passengers watch high definition videos while they subject themselves to total surround sound, motion simulation, and related special effects of one kind or another.

Our local *Museum Of Discovery* has one. It's recently been reprogrammed by the incredible Leonard Wikberg III of *DigitalLight* (www.digitalight.com) in Flagstaff, AZ to create a spectacular solar system tour. You'll start off by dropping through the museum floor, riding up nearby Mount Graham, and circling their VAT optical and SMT radio telescope facilities.

From there, it is literally off to the moon, followed by a grand tour of the entire solar system. Fully detailing one planet and asteroid or

whatever at a time. Much of the content here is real planetary footage gotten from JPL, NASA, and elsewhere. This has been seamlessly combined with utterly amazing new computer animation.

I was commenting to Leonard how some of those fractal landscapes on Venus looked overstated to the point of being too obviously fake. But he assured me that all of his Venusian Fractals were quite real. It seems their only enhancement was his modest resolution improvement of the actual flyby footage. I'll keep the ride ending a secret, except to say that it happens rather suddenly and unexpectedly.

The term "virtual reality" can have many meanings, and it is real hard to get a grasp on what is important and what is not. It is even harder still to separate what is possible today from the absolute hype.

I'll call virtual reality the creating of an artificial environment that's used to immerse one or more individuals in a simulation task. Perhaps for design, fun, training, medicine, or profit.

NEXT MONTH:
Don looks into some home automation products and resources.

The VR task might be a video game such as a flight simulator or an "if it moves, kill it" slash and hack, or some more thoughtful *Riven* like adventure. Or a real flight simulator for fighters, jumbo jets, or even spacecraft. Or a walkthrough for a new architectural design. Or checking for any assembly interference in CAD/CAM models.

Or a tour of the town. Or dildons. Or amusement park and arcade rides. Perhaps an *Omnimax* show. Or special effects for some movie or video. Or a realtor's catalog. Or the training for a surgeon or an eye specialist.

Or the web itself. Which is nothing but one huge virtual reality machine. For you never really go anywhere or do anything when you surf it.

Here's a random sampling of a

few virtual reality resources ...

VR Publishing

This outfit seems to have a good bargain: For \$29.00 total, they'll offer six booklets which include a 600 entry virtual reality resource directory, a 436 pager on desktop VR, a IRML primer, their special virtual reality report, a longer *VR Infomania* book, and some virtual reality cartoons.

Their url is www.vr-publishing.com. Included is info on homebrew VR, a glossary, free VR trade show listings, and useful industry links.

Web Sites

There's gazillions of virtual reality web sites. The big problem is sorting them all out. One very useful "link to links" site is tin.ssc.plym.ac.uk/vr.html. Two others include www.sense8.com/resources/online_resources.html along with www.jmbe.com/vrpage.html.

A virtual reality bibliography is in www.cms.dmu.ac.uk/~cph/VRbib.html. A lengthy summary of hot VR sites is in www.itl.nist.gov/div894/ovrt/hotvr.html.

An interesting glossary is online at www.cyberedge.com/home/www/4al.html.

There are dozens more where these came from. Try ...

groucho.gsfc.nasa.gov/eve/Links.html
www.fes.uwaterloo.ca/u/mdelfgaa/plan220/group1/links.html

www.vrworlds.com/more/vrlist.html
webster.skypoint.net/members/kht/html/vrlinks.htm

www.hitl.washington.edu/projects/knowledge_base/onthenet_list.html

The real trick lies not in finding VR info, but in getting it all sorted out so that it makes some sense to you.

3D Graphics

The center of the virtual reality universe appears to be 3D graphics. Such graphics are created as a data base of numeric values. You'll often start with an *armature* supporting a *wire frame* that's full of triangles or polygons. Or possibly use something fancier such as *Nurbs* cubic spline surfaces. Some cubic spline basics do appear in www.tinaja.com/cubic01.html. It is not at all unusual for an object to consist of many thousands, or even millions of polygons.

At rendering time, the *wire frame* model applies its *hidden line removal* algorithms to present only the aspect to be viewed. Surfaces are then added to the wire frame. These surfaces are then modified by

new from
DON LANCASTER

ACTIVE FILTER COOKBOOK

The sixteenth (!) printing of Don's bible on analog op-amp lowpass, bandpass, and highpass active filters. De-mystified instant designs. **\$28.50**

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 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 I	\$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	\$22.50
Understanding PS Programming	\$29.50
PostScript: A Visual Approach	\$22.50
PostScript Program Design	\$24.50
Thinking in PostScript	\$22.50
LaserWriter Reference	\$19.50
Type 1 Font Format	\$16.50
Acrobat Reference	\$24.50
Whole works (all PostScript)	\$380.00
Technical Insider Secrets	FREE

BOOK-ON-DEMAND PUB KIT

Ongoing details on Book-on-demand publishing, a new method of producing books only when and as ordered. Reprints, sources, samples. **\$39.50**

THE CASE AGAINST PATENTS

For most individuals, patents are virtually certain to result in a net loss of sanity, energy, time, and money. This reprint set shows you Don's tested and proven real-world alternatives. **\$28.50**

BLATANT OPPORTUNIST I

The reprints from all Don's Midnight Engineering columns. Includes a broad range of real world, proven coverage on small scale technical startup ventures. Stuff you can use right now. **\$24.50**

RESOURCE BIN I

A complete collection of all Don's Nuts & Volts columns to date, including a new index and his master names and numbers list. **\$24.50**

FREE SAMPLES

Check Don's *Guru's Lair* at <http://www.tinaja.com> for interactive catalogs and online samples of Don's unique products. Searchable reprints and reference resources, too. Tech help, hot links to cool sites, consultants. email: don@tinaja.com

FREE US VOICE HELPLINE VISA/MC

SYNERGETICS
Box 809-NV
Thatcher, AZ 85552
(520) 428-4073

FREE Catalog: <http://www.tinaja.com>

RESOURCE BIN

SOME VIRTUAL REALITY RESOURCES

Alpha FX
600 Harrison St
San Francisco CA 94107
(415) 358-9500

Basic Service Am Rides
PO Drawer 8150
Ruidoso NM 88355
(800) 366-3991

Cinefex
Box 20027
Riverside CA 92516
(909) 781-1917

Computer Aided Design
655 Americas Ave
New York NY 10010
(212) 969-5900

Computer Graphics World
10 Tara Blvd 5th Flr
Nashua NH 03062
(918) 835-3161

CyberEdge Journal
1 Gate 6 Rd
Sausalito CA 94965
(415) 331-3343

Design News
8773 S Ridgeline Blvd
Highlands Ranch CO 80126
(617) 558-4342

Doron Precision Sys
174 Court St
Binghamton NY 13902
(607) 772-1610

Game Developer
600 Harrison St
San Francisco CA 94107
(415) 905-2200

Grainger
2738 Fulton St
Chicago IL 60612
(312) 638-0536

Hydraulics & Pneumatics
1100 Superior Ave
Cleveland OH 44114
(216) 696-7000

Intelligent Systems
2555 Cumberland #299
Atlanta GA 30339
(770) 431-0667

Machine Design
1100 Superior Ave
Cleveland OH 44144
(216) 696-7000

McMaster-Carr
Box 54960
Los Angeles CA 90054
(213) 692-5911

Measurement & Control
2994 W Liberty Ave
Pittsburgh PA 15216
(412) 343-9668

Mondo 2000
PO Box 10171
Berkeley CA 94709
(510) 845-9018

Motion Magazine
Box 6430
Orange CA 92613
(714) 974-0200

Museum of Discovery
1651 Discovery Park Blvd
Safford AZ 85546
(520) 428-8081

New Equipment Digest
1100 Superior Ave
Cleveland OH 44114
(216) 696-7000

New Media
901 Mariner's Is Blvd #365
San Mateo CA 94404
(415) 573-5170

PCIM
2472 Eastman Ave #33-34
Ventura CA 93003
(805) 658-0933

Power Transmission Des
1100 Superior Ave
Cleveland OH 44114
(216) 696-7648

Product Design & Dev
Box 945
New York NY 10159
(212) 633-7300

Sensors
174 Concord St
Peterborough NH 03458
(603) 924-9631

SIGGRAPH/ACM
1515 Broadway
New York NY 10036
(212) 626-0500

Simulators
4838 Ronson Ct
San Diego CA 92111
(619) 277-3888

Small Parts
PO Box 4650
Miami Lakes FL 33014
(305) 557-8222

Stewart
2356 Main Mall
Vancouver BC V6J 1Z4
(604) 822-2872

Sun Workstations
901 San Antonio Rd
Palo Alto CA 94303
(650) 960-1300

Synergetics
Box 809
Thatcher AZ 85552
(520) 428-4073

Telemedicine & VR
227 E Washington Sq
Philadelphia PA 19106
(800) 777-2295

VR Publishing
16486 Bernardo #378
San Diego CA 92128
(619) 485-5353

Virtual Reality Report
11 Ferry Ln W
Westport CT 06880
(800) 632-5537

Virtual Reality World
11 Ferry Ln W
Westport CT 06880
(800) 632-5537

Westrex
4545 E Industrial St #5B
Simi Valley CA 93063
(805) 520-2500

adding texture and color, by using specialized lighting algorithms or by literally growing fur, grass, or hair on them.

As you might guess, humongous computing power is required for a realistic rendering. *Sun Workstations* have been the norm, but ganged high end PCs are now starting to approach their capabilities. It is not unusual to spend 60 hours of computing per runtime second of rendering.

Some Magazines

The pricey *CyberEdge Journal* seems to be a leading magazine here. There's also a \$29.00 yearly *Virtual Reality World*, and a \$65.00 *Virtual Reality Now*.

Another useful pub is that superb *Game Developer*. Plus these guys ...

Alpha FX
CAD/CAM Update
Computer Aided Design
Computer Graphics World
Intelligent Systems Report
Mondo 2000
New Media
Retrograde Motion
Simulators
Telemedicine & Virtual Reality
Virtual Reality Report

More details on all these titles are in www.tinaja.com/webwb01.html.

There are also scads of multimedia magazines which are heavily into 3D graphics and touch on other virtual reality topics. We looked at these back in RESBN45.PDF, along with the video game tools and technique magazines of IRESBN65.PDF. Both of these can be found on www.tinaja.com/resbn01.html.

Many of these mags can be free to qualified subscribers.

Siggraph

One premier event for pretty near everything using computer graphics is the annual *Siggraph* conference, put on by those ACM people, short for the *Association for Computer Machinery*.

All the show proceedings are now available separately or included in the special issue of their quarterly *SIG Computer Graphics* publication.

Books

A well annotated review of all the major virtual reality books appears as the *CyberEdge Electric Best VR Books*. Found at www.cyberedge.com/4bl.html. A second useful listing is online at www.smokefreekids.com/virtbook.html.

Some of today's top virtual reality books include ...

Design of Virtual Environments
Experiments in Virtual Reality
How Virtual Reality Works
Information Sources for Virtual Reality
Possible Worlds: VR Social Dynamic
Virtual Reality Casebook
Virtual Reality Construction Kit
Virtual Reality Homebrewer's Handbook
Virtual Reality Systems

More info on these and other titles at www.tinaja.com/amlink01.html.

VRML

There is this fairly new computer language that is primarily intended for virtual reality extensions of the web. This ne is called VRML and is an acronym for *Virtual Reality Markup Language*. There's a lot of good VRML stuff on the web.

Some major new books on VRML include ...

3D Graphics and VRML 2.0
Advanced VRML Techniques
Annotated VRML 2.0 Reference Manual
Building 3D Worlds in Java and VRML
Building VRML Worlds
Creating Cool 3D Web Worlds with VRML
Creating your own VRML Web Pages
Delphi VRML for Internet Solutions
HTML, VRML, and JAVA Web Publishing
Java for 3D and VRML Worlds
Late Night VRML 2.0 with Java
Mecklemedia's Official Guide to VRML
Teach Yourself VRML 2 in 21 Days
Using VRML
Virtus VRML Starter Kit
VRML & 3D on the Web for Dummies
The VRML 2.0 Handbook
VRML 2.0 Sourcebook
VRML: Bringing Virtual Reality ...
VRML: Exploring Virtual Worlds ...
VRML: Flying through the web
VRML Clearly Explained
VRML Programmer's Library
Web Publishers VRML Quick Reference

You can get more info on any of these at www.tinaja.com/amlink01.html.

We have also seen above that *VR Publishing* has a concise 32-page *VRML Primer* book. And you should shortly discover a *comp.lang.vrml* newsgroup just below.

Newsgroups

There sure are a lot of newsgroups that involve themselves with virtual reality in one way or another. A few of these include ...

alt.3d
alt.cyberspace
comp.ai
comp.ai.games
comp.ai.philosophy
comp.cad.autocad
comp.graphics.algorithms
comp.graphics.animation
comp.graphics.misc
comp.lang.vrml
comp.multimedia
comp.graphics.visualization
comp.robotics.research
rec.aviation.simulators
rec.games.video.arcade
rec.video.desktop
sci.virtual.worlds
sci.virtual.worlds.apps

Mechanical Stuff

Besides *Doron*, a few of those other simulator manufacturers are *Stewart*, *Westrex*, and *Basic Service Amusement Rides*. A more complete list can be found in the above directories or via the *Thomas Register* link you'll find at www.tinaja.com/webwb01.html.

If you are interested in the actual design of simulators, rides, robots, tactile gloves, or whatever, your best starting point will often be the trade journals. As always.

Your biggies here include *Machine Design* and *Design News*. Individual bits and pieces are found in *Product Design and Development* and in *New Equipment Digest*. Also check *Design Engineering* and *Design Product News*.

Hydraulics and Pneumatics cover the obvious. Your robotic stuff is best found in *Sensors*, *Power Transmission Design*, *Measurement & Control*, *PCIM*, or *Motion* magazines.

The all time greatest place for small parts is, of course, *Small Parts*. Helped along by the usual *W.W. Grainger* and *McMaster-Carr*.

Your really big thing these days in motion platforms is called the *inverted hexapod*. These newly see major use in everything from milling machines to simulators. These are just six pivoted push or pull struts whose combined motions determine the head or pod movement.

All actions are simple extensions or compressions; you will find zero side loading and nothing whatsoever that resembles a precision way or a sliding friction surface.

Finally, the special effects goodies used by the movie magic folks is a secret industry all to itself. Their little known trade journal is *Cinefex*.

This Month's Contest

For our contest this month, just tell me about any virtual reality resource I may have missed out on.

Or, better yet, how about com-

ing up with a brand new virtual reality concept, use, or application. With all of that humongous new computing power available these days, and super web access to pretty near anything, there should be all sorts of new apps you can dream up.

I still strongly feel there are all sorts of potential new VR uses for lower pressure pneumatics. Actuated with simple bladders, rolling diaphragms, or bellows. Power can be easily done with an aquarium air pump. And control can be as simple as a low-cost automotive TCS or SCS three-way valve. More details on such valves at <http://www.tinaja.com/barg01.html>.

Another emerging new VR area involves tactile feedback. With gloves or surfaces that "push back" or let you "feel texture." Piezo microactuators might be one route here. Free samples from Amp Piezo.

The tactile problem lies in real-time management of zillions of actuators, each of which has to be very fast responding, low in cost, and provide an effect that is both realistic and safe.

Lots of possibilities here.

There should be a largish pile of my new *Incredible Secret Money Machine II* 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.

Send all your written entries to me here at *Synergetics*, rather than to *Nuts & Volts* editorial.

For More Help

Additional hot-linked VR content is found in www.tinaja.com/resbn01.html, while VR book access links are found at www.tinaja.com/amlink01.html. The VR magazine sources can be reached through www.tinaja.com/webwb01.html. Customized and personal consulting services for VR or nearly any other technical topic are reachable by way of www.tinaja.com/info01.html. NV

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

Don is the webmaster of his *Guru's Lair* found at <http://www.tinaja.com>

Full reprints and preprints of all Don's columns and ongoing tech support appear here. You can reach Don at *Synergetics*, Box 809, Thatcher, AZ 85552. Or send any messages to his US Internet address of don@tinaja.com

WORLD OF SAVINGS FROM I.E.S.

We can help with all your cable needs.

One stop source for converter parts, tools, and accessories.

- Low Prices
- Quality Service
- Quality Products

Call now for your **FREE** catalog.

Tel: 405-634-1535

Fax: 405-634-1587

Feature Of The Month

PIC16C54 \$1.90

PIC16C56 \$1.99

PIC16C621 \$3.15

PIC16C622 \$3.30

68H705C8P \$7.99

Minimum 100 lot

E-Mail: intek8111@aol.com

Write in 91 on Reader Service Card.

MICROCONTROLLERS

EXPANDABLE SBC for robotics, embedded control, OEM, teaching. 89CXX, 32K RAM, 64K E(P)ROM, RS232, RS485, 5 IRQs, 4.75"x3.2" and more. RS232 downloads program. Stack up to 7 expansion boards, ours or your designs. Boards: DI/O, 72 TTL and 24 hiccurent outputs. MI/O, 11 input 12 bit A/D, 4 channel 8 bit D/A, 2 channel 12 bit D/A, 24 TTL, LCD and keypad interface, three counters. Proto, size 4.75"x3.2". Starting at \$99. Includes assemblers, basic, simulator, disassembler, examples. Innovation West, 626-309-6085, lnovwest@aol.com <http://members.aol.com/lnovwest/>

GET STARTED with BASIC Stamps and PICs. Solderless breadboard has everything you need to prototype with Stamp I/II, PICStics, and 16C84/16F84. Details and free software: <http://www.alwilliams.com/awce.htm>

<http://www.dontronics.com> is Don-Tronics Home Page. Hardware: Atmel and PIC microcontroller prototype and development boards, programmers, SimmStick™. Software: BASIC Stamp II Windows 95 Front End, AVRBasic for the AT90S1200, BascomLT for the AT89C2051, multi-media "Pacman-like" tutorial for the PIC16F84, and lots more.

COMPLETE 68HC11 SBC with controller area network, LCD, RS232. Download programs to 32K flash. Plugs into solderless breadboard for rapid prototyping, great learning tool, \$175. **CAN-PORT: Connect PC to controller area network.** Includes DLLs, libraries, application, \$89. Order: EMICROS, 25759 Ridgewood, Farmington Hills, MI 48336. 248-477-6639. Info: www.emicros.com

COMPACT 68HC11 microcontroller 32K, RS232, LCD interface, compatible with interactive C, for your robotic and custom control applications. Bare PCB \$20, kit \$95 or assembled \$145. Embedded Acquisition Systems, <http://www.hooked.net/~jlong>

REPAIRS — SERVICES

HP POWER SENSOR REPAIR AND CALIBRATION 8400 series sensor repair from \$230 with return loss plot. NIST traceable commercial calibration with new reference cal. factor chart from \$100. Fast turnaround. MasterCard/Visa accepted. Call QuinStar Technology 310-320-1111, Fax 310-320-9968.

WELD ALUMINUM WITH PROPANE! EZ, INEXPENSIVE, STRONG. DETAILS: WEEKS, 36 CAROLINA ST., TAYLORS, SC 29687. FAX 864-244-6349. <http://www.page.biz.com/durafix/>

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 <http://www.pinballusa.com>



800.473.8080

Data Acquisition

MaxData...PRELIMINARY
16 Bit data acquisition board
MaxData.....\$229

Let Paramax develop, host and promote a web site for your company at a cost effective rate. Reach the market you've been missing.

webmaster@paramax.net

Digital I/O Controller

MaxI/O...PRELIMINARY
MaxI/O is the ultimate peripheral connector that allows you to control up to 65,535 devices at 16 bits per device from a single parallel port. Now there is no limit to what you can control with your computer.
MaxI/O.....\$229

Stepper Motor Controllers

MaxMover and MaxMover Pro
16 Bit Stepper Motor Controllers
The MaxMover Pro is a high output power model for more powerful stepper motors.
MaxMover.....\$259
MaxMover Pro.....\$359



MaxPhone...
Real-Time Internet telephone
Use the Internet to call long distance for just the cost of a local call.*
Full Duplex - no delayed audio - no dropouts.
MaxPhone.....\$139
*excluding ISP costs

Also available at Ford Electronics
714.521.8080

www.paramax.net

Write in 130 on Reader Service Card.

Nuts & Volts Magazine/April 1998 93

TORNADO COMMUNICATIONS

- ◆ SPECIALIZING IN ALL CONVERTERS
- ◆ WHOLESALE DEALERS ONLY
- PLEASE CALL MON-FRI
8:00AM THRU 6:00PM EST
- ◆ EXCELLENT PRICES
- ◆ CALL (800) 685-2497 Ext. 78

◆ ALL EQUIPMENT IN STOCK AND READY TO SHIP

20,000 + TECHNICAL REPAIRS for TVs, VCRs, PROJECTION TVs, CAMCORDERS, AUDIO on disk. **COMPONENT/BOARD LEVEL REPAIRS.** Installs on your hard drive. Easy look-up by model/chassis number. **ADD** your own tech repairs. **PRINT** out repairs. **Special Sale** this month - only \$125. Send this ad with check or send \$5 for sample program with over 300 repairs. **HIGHER INTELLIGENCE SOFTWARE, 60 FARMINGTON LANE, MELVILLE, NY 11747. 1-800-215-5081.**

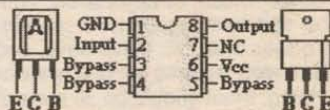
ENGINEERING CONSULTING. Product development from conceptual to manufacturing stages. Digital, analog, and RF expertise. Microcontroller designs for HC05xx, HC11xx, PIC16C5x. Software design for IBM PC. ASIC design using XILINX. In-house schematic capture and PWB. Steve Hicks, DiaSystems Electronics, 7508 E. Granada Rd., Scottsdale, AZ 85257. 602-970-3162. E-Mail: diasys@cyberhighway.net website: www.cyberhighway.net/~diasys

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.**

CATV REPAIR: most models, great prices, warranty included. Please call 573-363-0402.

Z-1600 TUNER & power supply repair. Call 573-363-0402.



SEMICONDUCTOR CROSS-REFERENCE Library (SCRL) software for the PC. 378,000+ devices, with descriptions, lead and case drawings for most. \$69 plus \$6 S&H. We will include the **ELECTRONIC REPAIR TIPS (40,000+)** for additional \$30, **FCC ID CODES** for additional \$10. Checks & credit cards accepted. E-Mail: customsoftware@usa.net web: <http://www.electronic-repair.com> Custom Software Creators, PO Box 30415, Clarksville, TN 37040-0007. 931-647-6120.

MILITARY SURPLUS ELECTRONICS

MILLIONS \$\$\$ in "scrap gold" from old computers and electronics junk. Message: 603-645-4776 or www.tiac.net/users/quiksand/goldtek.htm

Sell Nuts & Volts in your store!
Contact us for complete details.
phone 909-371-8497
fax 909-371-3052
E-Mail distributors@nutsvolts.com

New Company

Positive Filters

\$7.50ea

Min Purchase 10pcs

Channels In Stock

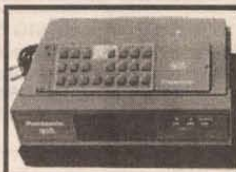
2-24 and 95-99

Visa, Mastercard, Discover and UPS COD

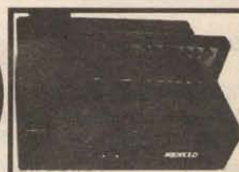
24 hours a day 7 days a week. Same day Shipments

800-684-0539

Cable TV Outlet



**Factory
Direct!**



**We Carry A Complete Line
Of Cable Television
Equipment!**

- Unbeatable Wholesale Pricing-
- Replacement Converters-
- Filters and Accessories-
- Full Satisfaction Guaranteed-

www.qbvideo.com

QB VIDEO

Open M-F 9a to 5p (CT)

1-800-249-3025

Visa, MC & C.O.D.'s Welcome

MI - GROSSE POINTE WOODS - South Eastern MI ARA Hamfest. Thom Duggan WA8RL1, 810-777-2443. E-Mail: wa8rl1@juno.com
MI - KALAMAZOO - Super Computer Sales. Wings Stadium, 3600 Vanrick Dr. 10am-4pm. Computers And You 734-283-1754
NY - POUGHKEEPSIE - Mt. Beacon ARC Hamfest. Ken Akasofu KL7JQC, 914-485-9617
OH - ATHENS - ARA Hamfest. Drew McDaniel WB8MH, 614-592-2106. E-Mail: mcdaniel@oak.cats.ohio.edu Web: <http://www.seorf.ohio.edu/~xx017/hamfest.html>
OH - CANFIELD - Hamfest & Computer Flea Market. Canfield Fairgrounds, Rt. 46. 8am-3pm. Don Stoddard N8LNE, 330-793-7072
PA - WILKES BARRE - Computer Show. Genetti's Best Western. 9:30am-4pm. MarketPro 301-984-0880
VA - ANNANDALE - Computer Show. Northern VA Community College. 9:30am-4pm. MarketPro 301-984-0880
VA - ROANOKE - Computer Show. Roanoke Civic Center. 9:30am-4pm. MarketPro 301-984-0880

MAY 1998

MAY 1-2

LA - BATON ROUGE - Hamfest & Computer Show. Fri. 5pm-9pm. Sat. 8am-4pm. Herb Ramey W5LSU, 504-654-6087. E-Mail: W5LSU@aol.com Web: <http://members.aol.com/w5lsu/index.html>

MAY 1-2-3

CA - VISALIA - International DX Convention. Rick Samolan W6SR, 714-993-0713 or 310-616-3912

MAY 2

AL - MOULTON - Hamfest. H. A. Alexander Park. 9am-5pm. Lee Kreuzer N8MHC, 205-584-0111. E-Mail: N8MHC@aol.com
AZ - SIERRA VISTA - Cochise ARA & SE Hamfest. Ronald Stominski KC7QXJ, 520-378-3018
CA - BAKERSFIELD - Computer Show. Kern Co. Fairgrounds. MarketPro 415-456-6730. Web: <http://marketpro.com>
CA - SANTEE - ARC of El Cajon Ham, Computer & Electronic Swapmeet. Santee Drive-In. 619-561-0052
CO - COLORADO SPRINGS - Pikes Peak RAA Hamfest. Phil Pearsall KC5LXC, 719-531-5319. E-Mail: pearsall@msn.com
CO - GRAND JUNCTION - Western CO ARC Hamfest. Diana Dodd KB0REW, 970-243-7441
KY - OWENSBORO - ARC Hamfest. George Stokes KD4CKT, 502-683-2169. E-Mail: w4nho@ock-uccy.campus.mcl.net
MD - GRASONVILLE - Anne Arundel RC & Kent Island ARC Hamfest. Glenn Durbin WN3G, 410-643-1125. E-Mail: K3ORC@amsat.org or pvtpilott@friend.ly.net
MI - CADILLAC - Hamfest. Cadillac Middle School. 8am-1pm. Dan KE8KI, 616-775-0998. E-Mail: ke8kidan@juno.com
MN - DULUTH - Arrowhead RAC Hamfest. Bud Fisher KB0SBL, 218-879-9284. E-Mail: kb0sbl@cp.duluth.mn.us
NC - GASTONIA - ARC Hamfest. Lynn KD4CDP, 704-735-2197
NH - SEABROOK - Computer Show. Seabrook Greyhound Racetrack. Northern Computer Shows 978-744-8440. E-Mail: tchc@iamerica.net
NY - OWEGO - Hamfest. Marvin Park Fairgrounds, Rt. 17C. 8am-4pm. BARA, POB 853, Binghamton, NY 13902. E-Mail: owego98@ibm.net Web: <http://www.wtsn.binghamton.edu/bara>
RI - SMITHFIELD - City Slickers Radio Operators. Frank Grzych KE1FJ, 401-231-3993. E-Mail: cobra@ibm.net
SC - ELKO - Tailgate Party. Rosewood Farm. 9am-4pm. Bill Wetzel W4OXA, 803-245-5522
WI - CEDARBURG - Ozaukee RC Hamfest. Gabe Chido, 414-377-2784 or 414-284-3271
WI - SUPERIOR - Arrowhead RAC Hamfest. Jeff Daniels N0VQF, 218-485-8131

MAY 2-3

CA - VALLEJO - Computer Show. Solano Co. Fgrds. MarketPro 415-456-6730 Web: <http://marketpro.com>
GA - LAWRENCEVILLE - Computer show. Gwinnett Fairgrounds. Georgia Mountain Productions 706-838-4827
TX - ABILENE - Hamfest. Civic Center. Sat. 8am-5pm. Sun. 9am-2pm. Peg Richard KA4UPA, 915-672-8889.

MAY 3

CA - LIVERMORE - Swapmeet. Las Positas College. Noel Ankdam 510-447-3857
CA - SAN DIEGO - Computer Show. Scottish Rite Center. MarketPro 415-456-6730. Web: <http://marketpro.com>
IL - SANDWICH - Kishwaukee ARC Hamfest. Bob Yurs W9ICU, 815-895-3219. E-Mail: mailto:n92na@aol.com Web: <http://tbcnet.com/~leopard/hamfest.htm>
MD - HAGERSTOWN - Hamfest. Junior College Athletic and Recreation Community Center. 8am-

3pm. Donald Jones KB8WHW, 304-728-7769. E-Mail: kb8zqm@intrepid.net
ME - LEWISTON - Computer Show. Central Maine Civic Center. Northern Computer Shows 978-744-8440. E-Mail: tchc@iamerica.net
NY - YONKERS - Flea Market. Lincoln High School. Kneeland Ave. 9am-3pm. Otto Supliski WB2SLQ, 914-969-1053
PA - WRIGHTSTOWN - Warminster ARC Hamfest. Tony Simek N3YNH, 215-674-5218
WV - RIPLEY - Jackson Co. ARC Hamfest. Gary Casto AG8RY, 304-372-2849. Web: <http://jackwv.simplenet.com/jcarc/index.html>

MAY 8-9

NH - ROCHESTER - HOSSTRADERS Hamfest. Joe Demaso K1RQG, 207-469-3492. E-Mail:

k1rqq@aol.com

MAY 9

CA - FONTANA - Inland Empire ARC Amateur Radio & Electronics Swapmeet. A B Miller High School. Bill 909-822-4138 eves
CO - GRAND JUNCTION - Western CO ARC Hamfest. Diana Dodd KB0REW, 970-243-7441
NH - MANCHESTER - Computer Show. Center of NH Expo. Northern Computer Shows 978-744-8440. E-Mail: tchc@iamerica.net
OK - EUFAULA - McIntosh Co. ARC & Pittsburg Co. ARC Hamfest. John Petersen KM5ES, 918-452-2279. E-Mail: km5es@eufaula.lib.ok.us
OR - HILLSBORO - Portland ARC Hamfest. Marilyn Lum KJ7AY, 503-236-4463. E-Mail: KJ7AY@juno.com

SC - GREENVILLE - Blue Ridge ARS Hamfest. Gene Owensby WB4BZ, 864-476-2609
WA - STANWOOD - Stanwood-Camano ARC Hamfest. Vic Henry N7KRE, 360-387-7705
WI - MANITOWOC - Hamfest & Computer Swapfest. Manitowoc County Expo Center. 8am-12pm. Glenn M. Debaker AA9MT, 920-684-7096. E-Mail: gdebaker@lakefield.net

MAY 9-10

CA - SACRAMENTO - Computer Show. Cal Expo. MarketPro 415-456-6730 Web: <http://marketpro.com>

MAY 15

OH - KETTERING - Annual Banquet. Alex's Continental Restaurant. Robert Dingle KA4LAL.

Continued on page 104

ALL ELECTRONICS CORPORATION

Special Purchase Video AB Switch

Jebsee # SW78S Compact, shielded two position co-ax slide switch. Standard F connectors for 75 ohm input and outputs. Good quality assembly with solid switching action.



CAT# ABS-2

\$1.75 each

10 for \$15.00
100 for \$100.00

PRICE REDUCTION! SL WABER "PowerMaster" Surge/Noise Suppressor

Protect your computer, phone, VCR, TV and stereo equipment from damaging transient voltage surges. Just plug in, and you've got full 3-line protection. Visual indicator lets you know that the device is functioning. UL, CSA listed.



CAT # PW-103
Formerly \$3.75

\$2.75 each

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

Digital Voice Module

Good-quality, natural voice or audio reproduction. 20 seconds of record time. Stores message practically forever without battery back-up. Includes electret microphone, speaker and 4 AA battery holder. LED recording indicator light. Motion sensor switch plays recorded message when module is moved. Can be easily replaced with a pushbutton. 0.5uA standby current. 30 mA playback current. Board size: 1" x 2.4".

CAT # DVM-2000 \$6.50 each

12 - 120 Vdc Worm Gear Drive Motor

UCC MODEL # DC-2DL This very unusual motor will operate on any AC or DC voltage from 12 to 120 volts. It has been prepped with a full wave bridge rectifier for AC use. If you bypass the bridge rectifier it works very nicely on any DC power from 12 volts on up. The final drive is a 0.8" long worm gear that turns a 0.8" diameter plastic gear at 120 RPM @ 12 Vdc (no load). Replaceable brushes. Motor body is 1.41" diameter x 2.75" long.

CAT # DCM-96 \$5.50 each

3 Volt Lithium Coin Cell

Panasonic # BR2330-1GU 3 volt, 255 mAh coin cell. Lithium batteries have a very long shelf life and are great for memory back-up protection. 0.9" diameter x 0.12" thick. 0.7" between positive and negative pc leads.

CAT #LBAT-16 20 for \$12.00
100 for \$45.00
1K for \$300.00

RED Ultrabright LED

PAINFULLY BRIGHT RED LED 2500 to 4000 mcd @ 20 ma. These T 1 3/4 (5 mm diameter) red LEDs are significantly brighter than conventional LEDs. At close range, they are painful to look at. They are great for attention getting displays that can be seen from a distance. Water clear in off-state.

CAT # LED-42 10 for \$5.00
100 for \$45.00
1000 for \$400.00

High Brightness FLASHER LEDs

T 1 3/4 (5mm) high brightness RED LEDs with built-in flasher unit. 3-5 Vdc operation

CAT # LED-4 2 for 90¢
100 for \$40.00 - 1000 for \$300.00

Stepper Motor

Airpax # LB82246 Unipolar, two-phase, 6 lead stepper motor. 500 ohm coil. 7.5 degrees per step. 1.4" dia. X 0.7" body. Oval mounting flange has holes on 1.65" ctrs. 0.08" (2mm) dia. shaft is 0.4" long and is fitted with a 0.31" dia. gear with 18 teeth. 15" leads.

CAT # SMT-28 \$2.00 each

"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.

CAT # VCU-8 10 for \$28.00
100 for \$250.00

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

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.

CABLE TV CONVERTERS
WE BEAT ANY COMPETITOR'S PRICE!

YOUR #1 SOURCE
FOR ALL YOUR CABLE NEEDS!
CONVERTERS • PICs
FILTERS • ALL MODELS
FULL 1-YEAR WARRANTY!
Dealers wanted, extremely
competitive. Lowest quantity
discount available! Act now!
Call today to order your own
viewing cable box.

QUALITY DIRECT ELECTRONICS, INC.
ORDERS ONLY 1-888-868-2020
TECH. 1-904-760-9538

ATTENTION DEALERS

WHOLESALE ONLY!

• ANY CABLE MFR
CONVERTERS & ACC

• BEST PRICING &
SERVICE

• SHOP US NOW

PANASONIC • NOVA, ETC.

800-777-7731

CCTV SPECIALS

Panasonic AG-TL500
168 Hour Time-Lapse VCR

Panasonic AG-RT600
40 Hour Real Time VCR

Built-in RS-232C Interface
On-Screen Display
2hr-168 hour modes
Repeat Pass Indicator

NEW!

8/24/40hr
Time/Date Generator
Auto Repeat Recording
Alarm Search • Alarm Input

Detection Dynamics DDC-5000P
Color Pinhole/Audio

Detection Dynamics DDLCD4
Active Matrix 4" Color LCD
Monitor

9 vdc • Built-in audio
Small 42mm x 42mm
400 TVL • 1.6 Lux

Lightweight for easy mounting
Video viewing angle
12 vdc • 380 mA
Pin Version 3325

Call us for all types of
security & industrial closed
circuit television equipment
www.ddaustin.com

7801 N. Lamar, Suite D-84 • Austin, Texas 78752
(512) 345-8401 • FAX 926-0940
CCTV CATALOG \$5.00 - REFUND W/PURCHASE

EPS

EPROMS AS LOW AS **25¢**

27C256	27C040	27C1024	87C51
27C512	27C400	28F010	87S1
2732A	27C4096	28F020	87S5
27C32	574000	28F040	68705
27C128	574200	8749H	2564
27C64	27C402	8748H	2516
2716	27C020	8741	8255
2708	27C210	8742	8254
27C512-90	27C010	8744	80C31

STATIC RAM MEMORY PROCESSOR

THIS MONTH **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: \$38.95 (\$55.95 by 1st Class)
6-Month Trial - \$19.95. Foreign - Write.

A.R.C., P.O. Box 802-G19
Carlisle, MA 01741

Call: 508-371-0512 • Fax: 508-371-7129
Web: www.antiqueradio.com

EQUIPMENT FOR SALE

ELECTRONIC TEST

TektronixEXT 330
Hewlett-PackardEXT 331
Other ManufacturersEXT 332
MEASURE & INSPECTEXT 333
VIDEO PRODUCTSEXT 370
SCIENTIFIC & LABEXT 335
LASERSEXT 340
POWER SUPPLIESEXT 334
COBWEB CORNEREXT 380
MFG

COMPLETE INDEXEXT 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 Mech. & 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 PIC16C55/64/70/80/
 - 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 ZIP - add \$15
40/28 pin ZIP adapter - \$39

PLUS: a PIC16F84-10/P
Electrically-Erasable
Microcontroller

Order Toll Free!
(888) 4-ITU-TEC

ITU Technologies

3704 Cheviot Ave. Ste. 3 Cincinnati, OH 45211
Phone: (513) 661-7523 Fax: (513) 661-7534
E-mail: sales@itutech.com

ENGINEERING & ASSEMBLY

Producible designs since 1970

Contract Engineering

Embedded Microprocessors
Analog Including RF to 1 GHz
Instrumentation
A/D and D/A
PCB Layout and Packaging Design

Contract Assembly

Kit or Turn-key
Through hole
Surface Mount
Run sizes one through thousands
Test and burn-in available

Bilcocon Corp.
800-736-5927
425-353-2276
www.bilcocon.com

Seabird Technical

650/367-8320
Fx-365-5845
VISA / MC

3580 Haven Ave.
Redwood City, CA
94063-4603

10 & 30X
Halogen lamp

ST201A Stereo \$325.00 Delivered

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 53578
TEL: (608) 643-8599 • FAX: (608) 643-6754

Discount Computer Systems

Intel Pentium II P266MMX MZM
Multimedia System

SYSTEMS INCLUDE:

Mid TW. CASE, MB W/P II CHIPS 512 CACHE,
64MB EDO RAM, 5.1 GB HARD DRIVE,
24X CD ROM, 4MB 64 BIT 3D VIDEO CARD,
3.5" 1.44MB FD, 16 BIT 3D SOUND CARD,
33.6 FAX MODEM WITH VOICE,
WIN 95 MOUSE, WIN 95 104 KEYBOARD,
80 WATT SPEAKERS, WIN 95 REL. 2,
17" SVGA MONITOR INCLUDED

\$2999

800-804-6552

PC ADAPTER FOR FIXED FREQUENCY



MING Graphics card will run
a Fixed Frequency Monitor
just like an SVGA monitor
on a standard PC with virtu-
ally all colors, DOS text, and
graphics up to 1600x1200
resolution.

Specifications - Controller: Tseng Lab 128-bit
ET6000, support 4MB MDRAM, MPEG, 3D apps,
Tseng Lab 64-bit ET40002P, support 2MB DRAM,
PCI or VLB bus. Driver Supported: Windows
3.X/NT/95, AutoCAD, Lotus 123, WordPerfect, 3D,
and others. Sync: sync on green (3 BNC conn.),
composite sync (4 BNC conn.), separate sync (5
BNC conn.), HV (13W3 conn.). Manufacturers sup-
ported: Radius, Hitachi, Sun, HP, Sony, Tektronics,
DEC, IBM, Mitsubishi, Ikegami, Appolo, and others.

Call us today at (909) 738-1416
or visit our web site at
<http://www.riverside.quik.com/ming>
Tech Support: (909) 372-0489
Fax: (909) 549-3628

Spectrum Research Engineering and Design

- Product Engineering
- Reverse Engineering
- RF Circuit Design
- Gal, Pal, Pic Chip Read
- Prototype Development
- Parts Aquisition

941-921-3484

DON'T MISS THIS ONE!

CABLE TV CONVERTERS
ALL MODELS AVAILABLE
LOWEST PRICE
QUALITY SERVICE

30-DAY MONEY BACK
1-YEAR WARRANTY
SAME DAY SHIPPING

OPEN 9 A.M. TO 9 P.M. MON-SAT

TL ELECTRONICS

Toll Free 1-888-823-6047

♦ CALLER IDS ♦

Only **\$3.99** each + S/H
reconditioned

Carbide Drill Bits & Router Bits
.40¢ each \$10.00 minimum

• FREE CATALOG •

3M Static Bags, Test Equipment,
Components, Phones, Computer
Equipment, and much, much more!

T.T.I.

300 EUGENE ST., S.E.
GRAND RAPIDS, MI 49507
616-475-8531 • 616-475-8534 FAX

Build a "Super" Etching Tank

Etch Printed Circuit Boards Faster and Conserve Etchant at the Same Time!

by Larry Ball



As anyone who's used an etching tray knows, sloshing etchant over copper is a poor way to make printed circuit boards. A "real" etching tank is faster, and far more convenient. For even more convenience, ammonium persulphate should be used with the tank. It's less messy than ferric chloride and has the advantage of letting you watch the etching cycle progress.

Unfortunately, once mixed, it has a limited shelf life, and due to the high volume of many "store bought" etching tanks, it often loses its potency before it's used up. Now you can have the low volume (and low waste) of the tray, and the convenience and speed of the tank. Not only that, you can build it yourself for less than the price of a "store bought" tank.

Build a "super" etching tank! It requires one-tenth the etchant of many "standard" etching tanks and it's faster!

The low volume of etchant required by the "super" etching tank will save you money, and the tank's

innovative design will save you time. This is because it forces rising bubbles around your PCB, rather than letting them diffuse in a tank much larger than most people need.

As shown in Figure 1, the "super" etching tank channels the flow of bubbles and etchant around the PCB to maximize etching speed. In addition, it creates a circular flow pattern to increase the overall flow rate.

You've probably noticed that PCBs etch faster where the bubbles contact them the most; the "super" etching tank takes full advantage of this.

Once you've used this tank, you'll never want to use a "standard" tank again. The "super" etching tank can also eliminate the hassle and expense of installing a heater, since it's made to be used in a container of warm water — and the container can be as simple as an old aquarium or five-gallon bucket (Figure 2).

In this day and age of conservation, it's nice when you find a device

that not only conserves, but does a better job as well.

Description

As shown in Figures 3 and 4, the "super" etching tank consists of two parts: a carrier and a tank. The carrier holds the PCBs and allows you to conveniently place them in and remove them from the etchant. The tank holds the etchant and is suspended in a container of warm water which provides heat to speed up the etching process. If you use the tank for less than two hours, a heater isn't needed. If you use the tank for longer than that, you can use a heater or simply exchange the water in the outer tank with warmer water.

The "super" etching tank can comfortably etch PCBs up to 5 by 5-1/8 inches (while using a miserly two cups of etchant!) and, if needed, can etch PCBs up to 7 by 5-3/16 inches. A check of hobbyist electronics magazines shows that most PCBs are 5 by 6 inches or smaller (mostly smaller). The "super" etching tank was designed to accommodate these sizes. Of course, you can "custom size" the "super" etching tank to meet your particular needs.

The carrier and tank can be built for under \$30.00 — including the air pump.

When you consider that "store bought" etching tanks cost \$40-\$80, and may continue to cost money by wasting etchant, this is quite a bargain.

Construction

The "super" etching tank is made of clear 1/8-inch thick acrylic plastic sheeting, which we'll refer to by a common brand name: "Plexiglas." The total amount of Plexiglas needed for the tank and carrier is two square feet, but you should get over three square feet to allow for practice, mistakes, etc. Additionally, you'll need a square, a straight edge, a drill, and a scoring tool.

Plexiglas is easy to work with, but some knowledge of how it's cut and fabricated is required. There are two basic methods of cutting plexiglas: sawing, and scoring, then

breaking. Sawing is best done with a table saw and a special plastic cutting blade (which few people have).

With that in mind, we'll cover only scoring, then breaking (cutting a groove in the plastic, then breaking it along the groove). For this method, you'll need an acrylic plastic scoring tool. A razor knife is an extremely poor substitute.

The technique is simple, but you should practice it before making your etching tank. Plexiglas comes with a removeable paper backing. Begin by using a pencil and a combination square (or carpenter's square) to mark the backing all the way across a piece of Plexiglas. Use a straight edge for alignment and drag the scoring tool over your mark to make a groove in the Plexiglas sheet (Figure 5).

A light pressure is best for the first few passes, then a moderate pressure may be used. Do this about 6-10 times in one direction, then in the other direction. Score the groove at least one-half the thickness of the Plexiglas (narrow strips will need to be scored more deeply).

Place the sheet on a sturdy table with the groove upward and aligned with the table's edge. Pin the sheet down with one hand and a straight edge (Figure 6). Use the other hand to press down quickly and firmly on the section hanging off the table. The Plexiglas should break neatly.

After some practice cutting Plexiglas, you can begin making

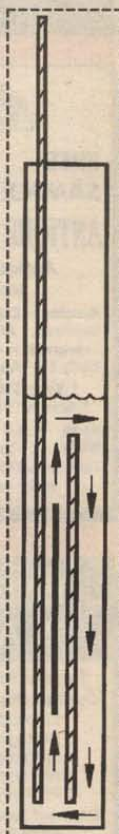
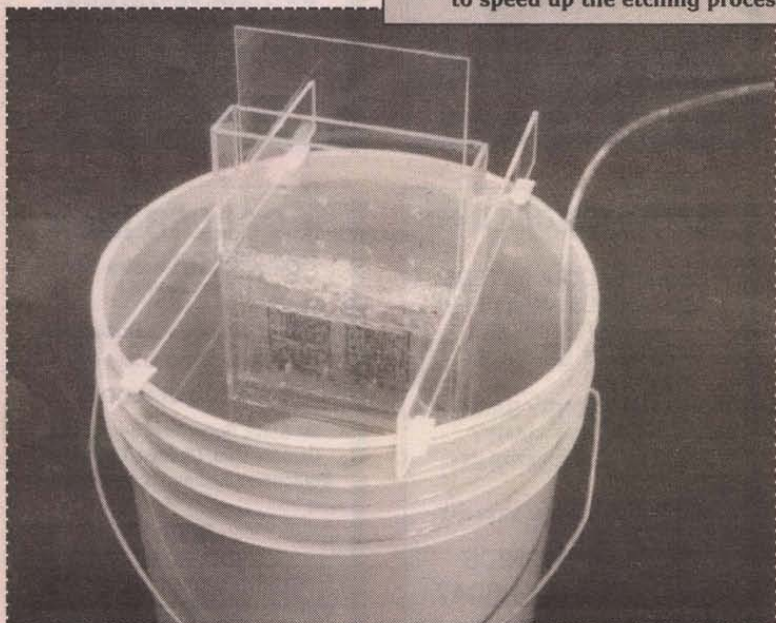


Figure 1. The "Super" etching tank forces bubbles and etchant over the PCB, then creates a circular flow pattern to increase the overall flow rate.

Figure 2. Place the "Super" etching tank in a container of warm water to provide heat to speed up the etching process.



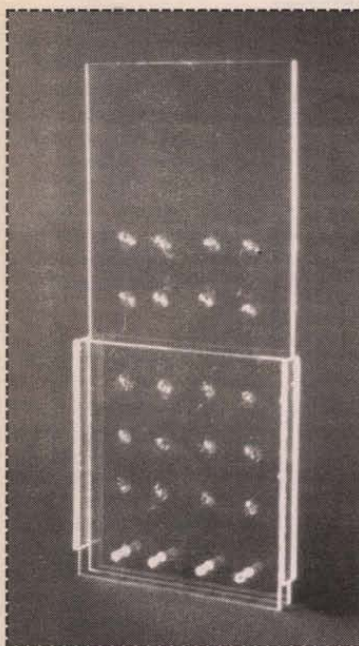


Figure 3. The carrier allows the PCBs to be conveniently placed in and removed from the etchant.

your etching tank. When marking the material for cutting, you can save time and avoid waste by placing sections which are the same width side by side. Keep in mind that

SIDEBAR

The air pump should be elevated above the level of the etching tank. If not, use an anti-backup valve on the air line, or you may find your pump in a puddle of etchant.

The stronger your pump is, the better. Two good reasonably priced air pumps are the "Apollo 3" and "Apollo 5," both sold at Wal-Mart.

If you choose to use a heater, get a 100-watt unit. If the etchant gets too hot, you can always turn a big heater down, but not vice-versa. In fact, on most heaters, you'll have to remove the adjustment knob so that you can force the heater to provide a higher temperature.

Occasionally, the carrier may "rattle" due to vibration caused by the bubbles. This doesn't hurt anything, but it can be annoying. You can eliminate the "rattle" by using an alligator clip to attach the top edge of the tank to the carrier's back.

Always mix ammonium persulphate etchant outside of the tank. This makes crystals of etchant clogging the air tube less likely. If the air tube does get clogged, it may be unclogged by forcing hot water through the air hose with a desolder bulb.

Since it's difficult to predict how much potency is left in a batch of stored ammonium persulphate, you may want to mix a new batch each time the tank is used. The small volume of the "super" etching tank makes this an economical option.

When mixing ammonium persulphate, use 120 degree Fahrenheit water. The etchant dissolves poorly in cold water. This also eliminates waiting for the water in the outer tank to warm the etchant.

Buy a real acrylic plastic scoring tool. Attempting to use a razor knife can result in untold frustration and wasted Plexiglas. Scoring Plexiglas is much easier with the proper tools and techniques.

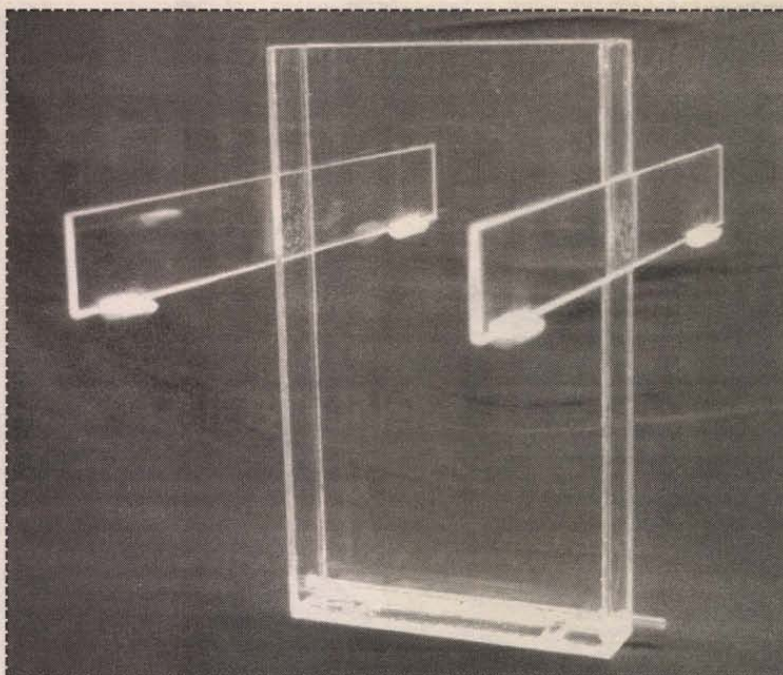


Figure 4. The "Super" etching tank can etch a 5-1/8 by 5 inch PCB while using only two cups of etchant! If needed, the tank can etch PCBs up to 7 by 5-3/16 inches.

all cuts must be completely across the sheeting. Also, don't automatically assume the corners on your material are square. After cutting the parts, use a sanding block with 180 grit sand paper to remove any burrs or rough edges. A smooth, even edge is needed to avoid leaks.

Finally, drill pieces as shown in Figures 7 and 8. Use a variable speed drill; drill slowly and carefully without too much pressure. Practice drilling some scrap before drilling the carrier and tank.

Air Tube and Carrier Support Pins

As shown in Figures 4 and 8, bubbles are provided by a 6-3/4 inch section of 3/16-inch O.D. hard aquarium air tube.

Follow the pattern in Figure 8 to carefully drill the holes with a drill press and a #77 bit. Hold the tube perfectly stationary while drilling, and don't attempt to drill both sides at the same time (Figure 9). It may seem that the tiny bits break if you look at them wrong, but with a steady hand you can drill hundreds of holes with a single bit.

If you don't have access to a drill press, you can make the holes with a #10 sewing needle. Heat the tip red hot and use it to puncture the tube (it's easier to complete one side, then flip the tube over and complete the other side.) The melted bumps which form around the holes can be scraped off with a knife. You may have to repeat this process to make sure the holes are cleared, but be careful not to make them oversized.

After you've made the

holes, use glue to plug the end opposite inlet. When the glue is dry, connect the tube to your air pump to test it; submerge the tube horizontally in six inches of water. If you've checked the tube to confirm all the holes are unobstructed, and bubbles still don't emerge from each and every hole, use a bigger air pump. **DO NOT skip this step!** The air tube should be tested *BEFORE* installation.

The carrier support pins are shown in Figures 3 and 7. Notice the wedge-shaped notches in them. These notches make the PCBs "self-centering." A file or razor knife can be used to cut them.

Assembly

Plexiglas may be glued with any glue made specifically for acrylic plastic. The best I've found is "Weld On #16;" it's thick, it "melts" the pieces together for an excellent bond, and it's fast setting, which speeds up the assembly process.

Once you've begun gluing, the assembly process is difficult to stop, so set aside a time when you won't be disturbed. Work on a flat, level, and uncluttered surface. If the assembly process is followed correctly (assuming the parts are cut correctly) the process is somewhat "self-squaring." However, a square is still needed, and at a minimum should be used to check your work before the glue sets.

Carrier Assembly

Before assembling the carrier, place a grid of evenly spaced 1/16-inch tall "glue bumps" on the inside back of the carrier (Figures 3 and 7). These bumps keep the PCB from sticking to the carrier via unwanted suction. They should be smooth and rounded rather than sharp and jagged (to avoid damaging the etch resist on double-sided PCBs). Since the glue will shrink, you'll need to apply several layers. Practice applying these bumps first, so you can get a "feel" for how to apply them neatly.

As shown in Figures 3 and 7, the sides of the carrier form caps over the front and back. Also note that the bottom edge of the sides is 5/8-inch above the bottom of the front and back.

Carrier assembly is as follows:

Rest one of the carrier sides on a flat surface. Apply a bead of glue to the side piece where the back will



Figure 5. Mark the pieces with a square and a pencil, then use a straight edge and scoring tool to make a groove one-half the material's thickness.

join. Place the back piece into position on the side and hold it perpendicular to it until the glue partially sets. Apply another bead of glue to the side, where the front piece will join. Place the front into position and hold it until the glue partially sets. Apply glue beads to the remaining side, then join it to the other pieces. While the glue is partially set, but still soft, stand the carrier on its bottom to be sure the front and back plates line up squarely.

Let the carrier dry before installing the PCB support pins. The pins fit into the carrier as shown in Figures 3 and 7. Insert the pins completely to test for proper fit. Then back the pins out of the front until they're only partly inserted into the holes in the back. Apply glue in the back holes and on the part of the pins sticking out of the front. Push the pins completely into position. Use pliers to rotate the pins so their notches face the top of the carrier.

Tank Assembly

Note Figures 4 and 8, which show that the sides of the tank form a cap over the front and back. The bottom, in turn, is a cap over the sides, front, and back. When assembling the tank, apply glue to BOTH surfaces, and remember that the glue also acts as a sealant.

Tank assembly is as follows:

Glue the tiny 1/4-by-3/4-inch blocks to the bottom piece. Set the bottom piece aside. Rest one of the side pieces on a flat surface. Apply a bead of glue on the side and front piece where they'll join. Position the front piece on the side and hold it perpendicular until the glue partially sets. Repeat this process with the back. Apply glue to the remaining side, front, and back where they'll join, then attach the remaining side.

While the glue joints are still flexible, apply glue to the bottom piece, sides, front, and back where they'll join. Attach the bottom piece and (with the tank resting on its bottom) make sure the tank is assembled squarely. When the glue has set, attach the support arms to the sides of the tank (Figures 4 and 8).

Finally, glue foam pads to the

support arms. No position is given since they'll line up with whatever warm-water container you have available. These pads dampen vibration and keep the arms from slipping (foam rubber earplugs, split in half, are ideal for this).

Let the tank dry before installing the air tube. Orient the tank as shown in Figure 4. Insert the plugged end of the tube into the hole on the tank's right side until it touches, but doesn't pass through, the hole on the tank's left side. Apply

so you won't have to wait for the outer tank's water to heat the inner tank's etchant. (It takes only two cups for a five-inch tall PCB!) Otherwise, wait 15 minutes for the water to warm the etchant in the inner tank. Your "super" etching

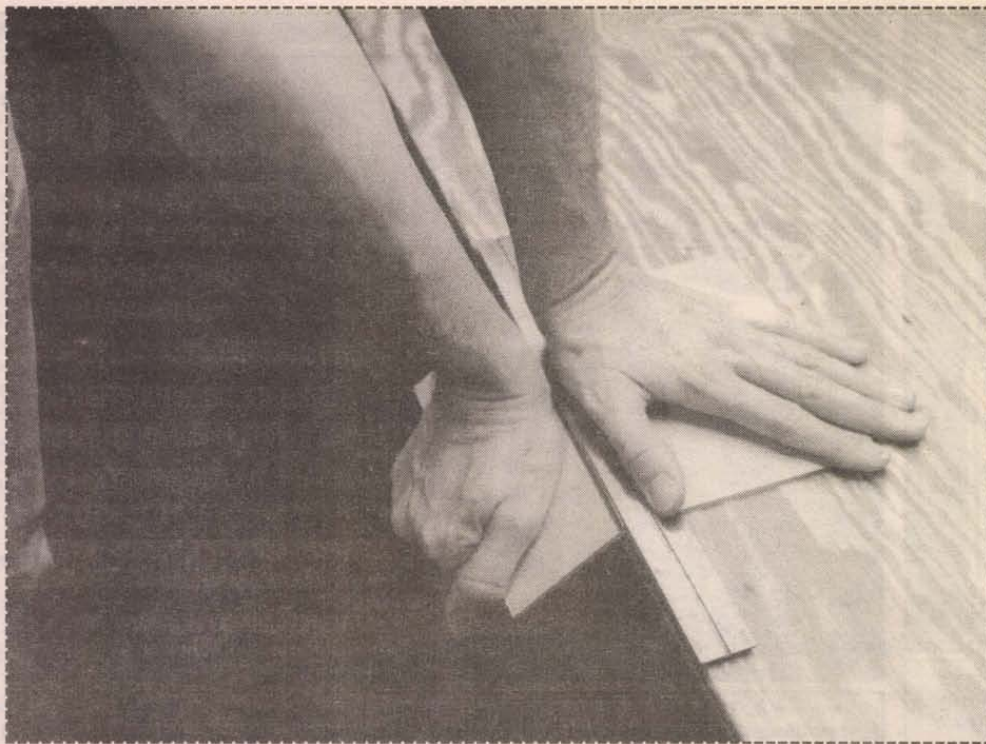
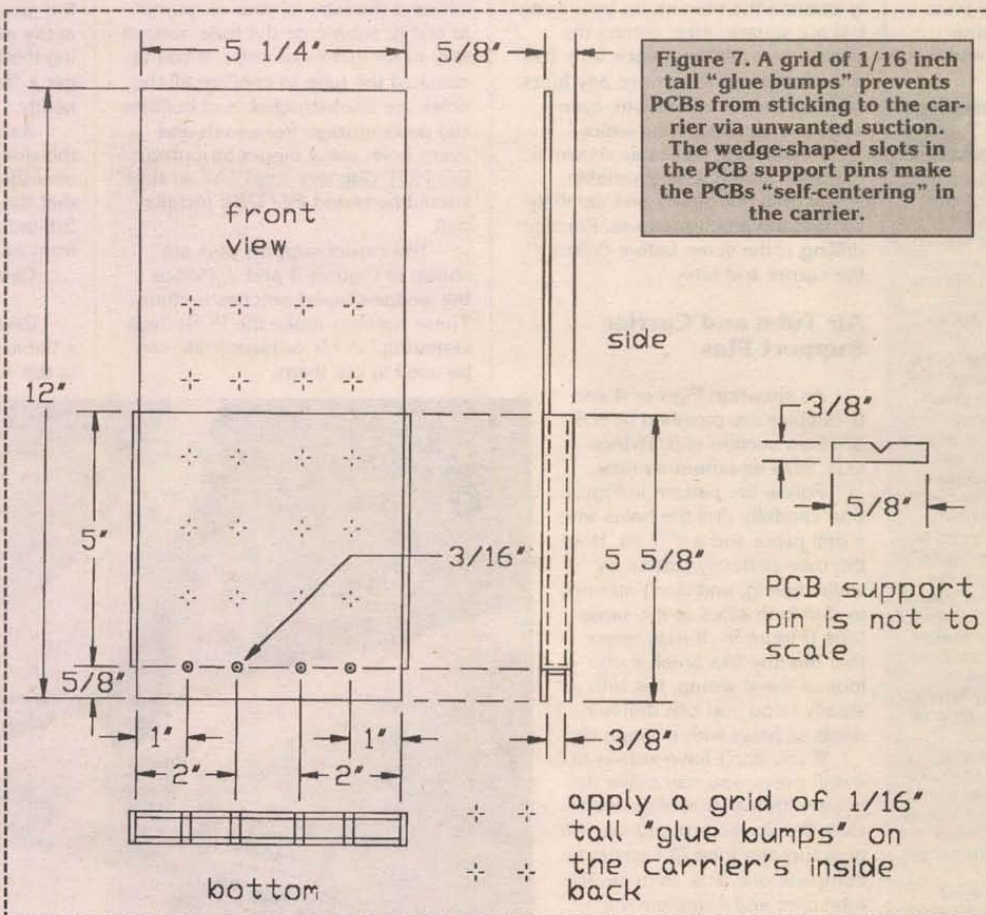


Figure 6. Hold the Plexiglas down with one hand and a straight edge. Use the other hand to press down quickly and firmly on the piece to be broken. The material should break easily.



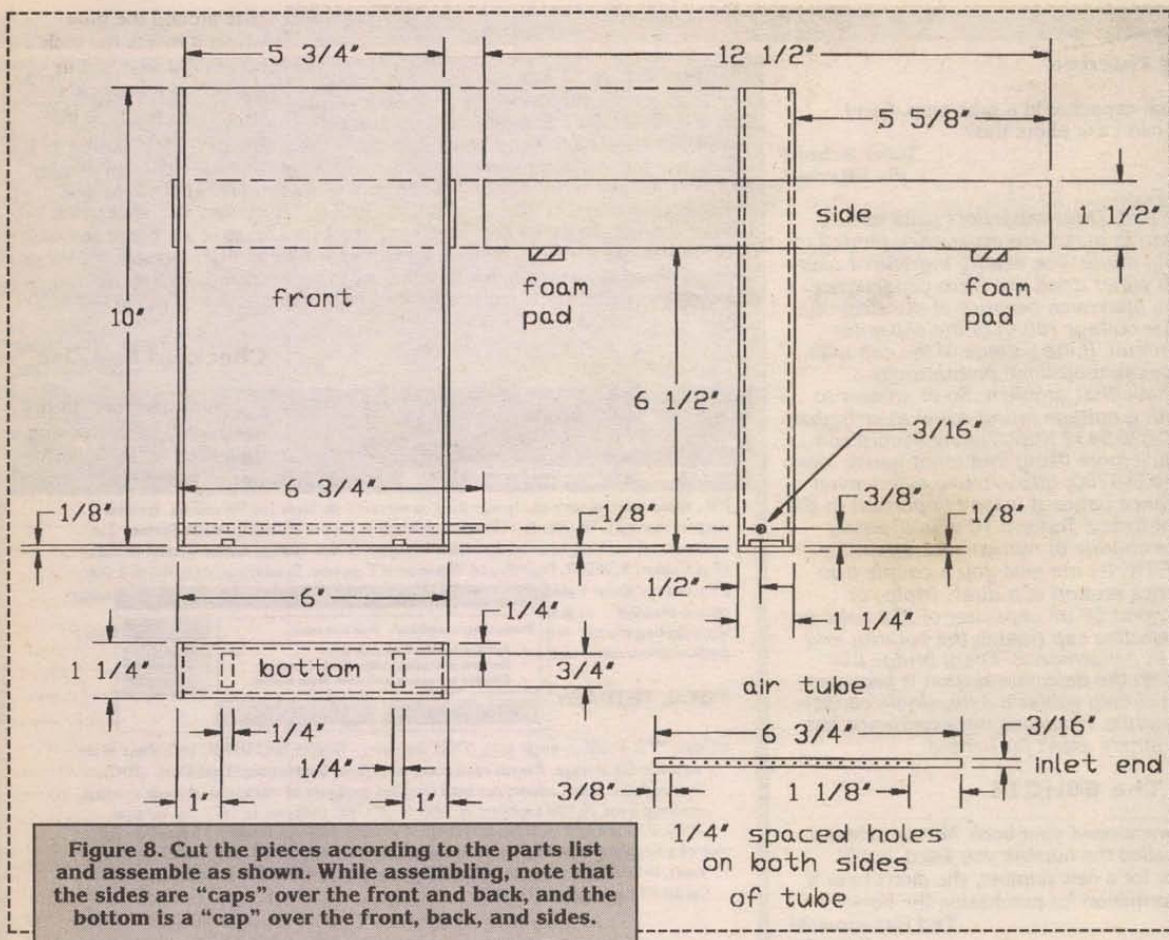
glue around the tube where it meets the tank's outer right side and in the hole on the tank's left side. Push the tube into the hole in the tank's left side and use glue to caulk where the tube meets the tank's sides. Last of all, rotate the tube so the bubble holes face the front and back of the tank.

Checkout and Use

Allow the tank to dry overnight before using. Checkout is straight forward. Make sure your tank and carrier match the drawings, place the carrier in the tank to check for proper fit, then check the tank for leaks. Individual leaks may be sealed with glue. However, if your tank has multiple leaks, you may find it easier to tilt the tank and carefully pour a stream of glue down the vertical inside corners. The tilted sides form a trough which channels the glue neatly down the inside edge where it's needed. You can also guide the flow of glue when it reaches the bottom to seal those edges. Let the glue set before sealing another corner.

To use your "super" etching tank, fill it with etchant up to the level of the top of the front of the carrier or to the top of your PCB (whichever is highest). Turn on your air pump. Place the etching tank in a five-gallon bucket (or whatever container you have available). Fill the container to one inch below its top with 125 degree (Fahrenheit) water. This should keep your inner tank near an efficient etching temperature for one to two hours.

If you plan to use the tank for longer than that, you should change the water when it drops below 110 degrees. If you prefer, you can install a heater in your container. If you're mixing a new batch of ammonium persulphate, use 120 degree water,



PARTS LIST

ETCHING TANK AND CARRIER
(all parts are 1/8-inch thick Plexiglas unless otherwise specified)

CARRIER

2—(sides) 5 by 5/8 inches
1—(back) 12 by 5-1/4 inches
1—(front) 5-5/8 by 5-1/4 inches
4—(PCB support pins) 3/16 inch (O.D.) hard aquarium air tube, 5/8 inch long (notched to align PCBs in carrier)

TANK

2—(front and back) 10 by 5-3/4 inches
2—(sides) 10 by 1-1/4 inches
1—(bottom) 6 by 1-1/4 inches
2—(tank supporting arms) 12-1/2 by 1-1/2 inches
2—(carrier support blocks) 3/4 by 1/4 inch
1—(bubble tube) 3/16 inch (O.D.) hard aquarium air tube, 6 3/4 inch long (drilled or pierced for air holes)

Miscellaneous 1—aquarium air pump
1—3/16 inch flexible aquarium air hose

SOURCES

* Plexiglas is available from hardware stores and businesses that specialize in acrylic plastic sheeting. In fact, some businesses that specialize in selling acrylic plastic also sell long strips of 1/8 inch thick scrap sheeting, 4 inches to 7 inches wide for as little as \$1.00 per pound. These strips are ideal for building your etching tank.

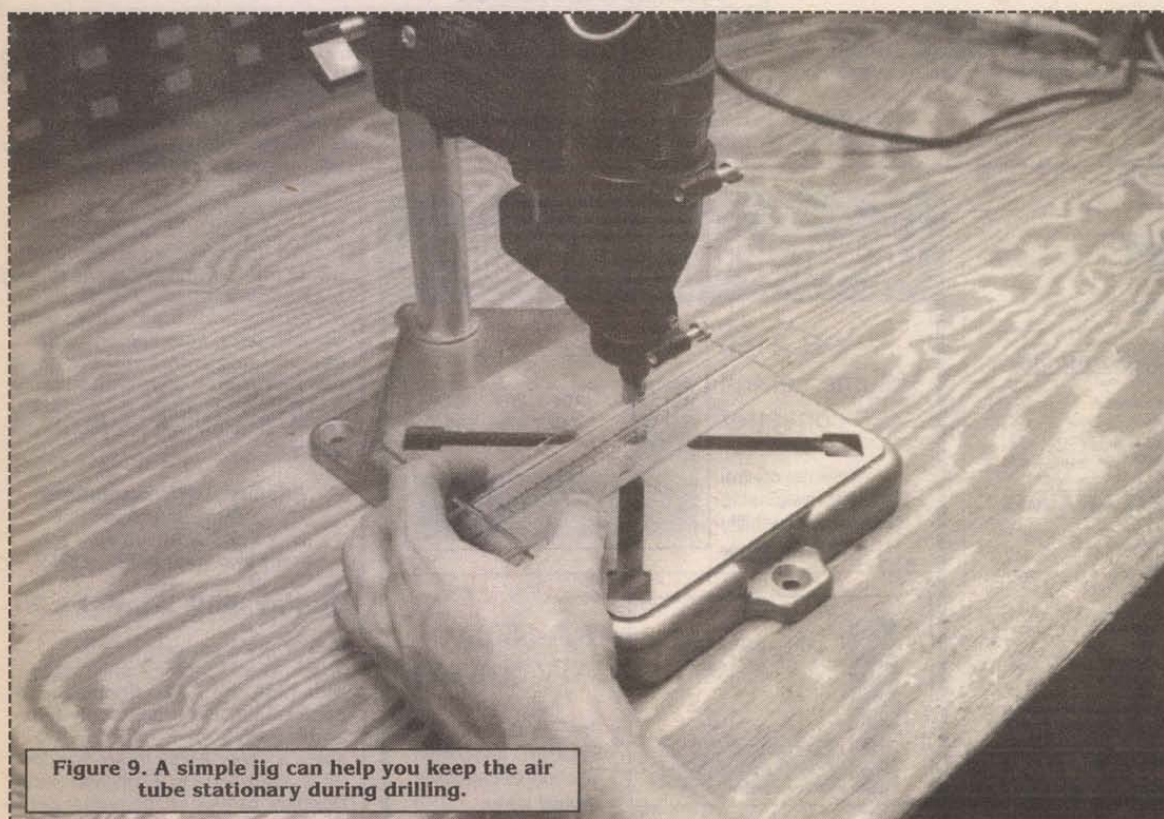
* Plastics specialty stores are the only place you're likely to find Weld-On #16 acrylic adhesive.

* Acrylic plastic scoring tools are available in hardware and building supply stores.

* Hard, 3/16 inch O.D. aquarium air tubes and flexible 3/16 inch air tubing are available from stores that specialize in aquariums and tropical fish.

* Ammonium Persulphate is available from **Mouser Electronics**, 958 North Main Street, Mansfield, TX 76063 (800) 346-6873.

The etching tank and carrier are available as a complete kit (professionally cut and completely pre-drilled, everything but the glue and the air pump) from: **Futuretech**, P.O. Box 6291, Gulf Breeze, FL 32561. The price is \$34.95 (plus \$5.00 shipping and handling) FL residents add 7% sales tax.



tank is now ready to save you time and money.

Variations

You can custom-design the carrier

and tank to fit your needs, and if you etch a lot of small PCBs, you can make a tank that REALLY conserves etchant.

My personal favorite is the tank I use to etch two 2-by-4-inch PCBs at

the same time. It uses only one cup of etchant!

While you're experimenting, remember that the fit of the carrier, the tank, and air tube are very inter-related. **NV**

Dual Electrolytic Capacitor Needed

Q. I cannot find a replacement for a dual capacitor in a tube amp. Can I replace it with two discrete caps? Who can I ask about this?

**Tater Schuld
via Internet**

A. You can ask me. Been there, done that. Dual capacitors used to be quite popular because they were cheap to make. However, they tended to fail a lot because they were so cheaply made. The deadly ingredient was a very caustic electrolyte paste which either dried out (zero capacitance) or leaked all over the place (the Blob). Moreover, because of the electrolytic paste, it was very important that the voltage rating of the capacitor matched the working voltage of the circuit. If the voltage of the cap was higher than the operating voltage, the cap would fail prematurely. Thankfully, today's capacitors don't have that problem. So in answer to your question, use two capacitors with a voltage rating equal to or higher than the original. All Electronics (800-826-5432 <http://www.allcorp.com>) usually has a couple in stock, but you'll more likely find what you're looking for from Allied Electronics (1-800-433-5700; <http://www.allied.avnet.com>). Don't worry about the capacitance value. It wasn't important in the days of old, and it isn't that important today. Today's 10 uF will easily substitute for an old 20 MFD (note the change in nomenclature), and a 100 uF will replace a dead 80 MFD. BTW, let me give you a couple trouble-shooting tips on finding the defective section of a dual, triple-, or quadruple-section capacitor. Using a good 50 uF capacitor of 250 volts or more, short it across the suspected defective cap (watch the polarity and your fingers!) and notice the change in performance. Every bridge will change something, but when you hit on the defective section it becomes immediately apparent. Often you can simply solder a new, single capacitor in place to fix the problem — for a while. However, my experience has been that when one section fails, the others aren't far behind.

Microprocessor Design For The 68HC11

Q. In the Feb. '98 Q & A column, you mentioned your book *Microprocessor Design Made Easy* for the 68HC11. I called the number you listed, but it doesn't work. When I asked the operator for a new number, she didn't have a clue. Could you please send me the information for purchasing the book?

**Ted Baranowski
Erie, PA**

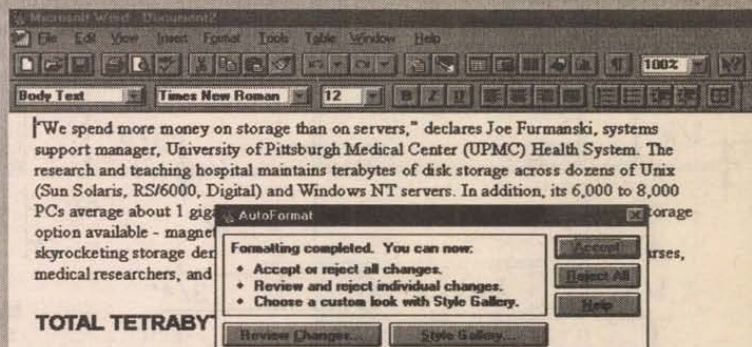
Q. I'm interested in purchasing the book you mentioned in the Feb. '98 column. I dialed the number you printed and all I got was a message that this number is not in service. I've also tried two local bookstores, but have had no luck. How can I get this book?

**Kerry Boura
via Internet**

Reader's Tip

You recently responded to a reader's request for converting HTML screens into text files. Here's another way you can do it using Word for Windows (WinWord versions 6.0 and Word 95). Using the Clipboard, copy and paste the HTML text into an open WinWord document. Click on Format, AutoFormat, and OK. You will now be prompted to review the formatting changes and either accept or reject them. (Hint: the Options button lets you select which format changes to make and which to keep.) Finally, save the document in TXT format (personally, I just keep them in WinWord DOC format). PC World recently listed similar routines for other word processors; check it out at http://www.pcworld.com/software/word_processing/articles/feb98/1602p296.html

**Frank Wildeboer
via Internet**



TOTAL TETRABY

estimate ** 2.4 million single user, 570K multiuser - Source IDC UPMC isn't alone in the scramble for storage. Recent market research from International Data Corp. (IDC), Framingham, Mass., shows the total installed terabytes of storage worldwide soaring, growing from 20,000 terabytes in 1993 to 500,000 terabytes in 1997. By the year 2000, IDC projects worldwide storage to reach 3 million terabytes. Meanwhile, the cost of a megabyte of storage is dropping like a rock (-41% compound annual growth rate), to \$0.45 per megabyte for multiuser systems in 1997. The price is projected to hit \$0.07 per megabyte by 2000.

VOLUME DRIVES DEMAND

A. Thank you Pa Bell, one more time. It seems that the original area code has been split. What used to be 305, Pompano Beach, FL is now 954; why the operator didn't catch it, I can't answer (the change happened only two months ago). So the new phone number is 954-784-0900. The same as before, but with a different area code. Oh yeah, the price of the book has increased, too, to \$55.00, but that includes all the software. If you're really serious about ordering, I'd use their 1-800-972-3733 number (at least that area code won't change). BTW, I'm only a contributor to this book, even though I wrote more than half the text, and make no royalties off of its sale. It's part of a training course that the company sells (along with optional hardware) and the book has hands-on experiments that will get you through a lot of the 68HC11's kinks. Here's their address.

**Advanced Microcomputer
Systems, Inc.**
1460 S.W. 3rd St.
Pompano Beach, FL 33069

Floppy Falls Windows 95

Q. I've got a pet peeve with Windows 95. Explorer only works with 1.2M and 1.44M floppies and applications allow me to only open and save to floppies of these two sizes. Is there a way to set Windows 95 to read/write to 720K and 360K floppies, as well as the higher densities?

**John McMichael
via Internet**

A. Well, I have no problems with 5 1/4-inch 360K or 3.5-inch 720K diskettes and Windows 95 Explorer. My guess is that the



LA PAZ
ELECTRONICS INTERNATIONAL
COMPUTER PARTS

DRAM SIMM

1MX3-70 SIMM.....	\$12.00
4MX3-70 SIMM.....	\$25.00
1MX32/36-70 72-pin SIMM (4MB).....	\$11/\$22
2MX32/36-70 72-pin SIMM (8MB).....	\$20/\$36
4MX32/36-70 72-pin SIMM (16MB).....	\$39/\$49
8MX32-60 72-pin SIMM (32MB).....	\$59/\$79
256Kx4 DIP DRAM.....	\$3.00
1Mx1 DIP DRAM.....	\$2.50
1Mx4-80 DIP/ZIP DRAM.....	\$15/\$14
256Kx8-80 VIDEO SQU DRAM.....	\$8.00
256Kx16-70 VIDEO SQU (2CAS).....	\$6.00
256Kx16-70 VIDEO ZIP (2CAS/2WE).....	\$18/\$20

CACHE SRAM

64Kx1-15ns 22-DIP.....	\$5.50
32Kx8-25/20/15ns 28-DIP.....	\$3/\$2/\$2.50
64Kx8-15ns 32-DIP.....	\$6.00
128Kx8-15/20ns 32-DIP Narrow.....	\$15/\$15.50/\$16
128Kx8-15/20/25ns 32-DIP Wide.....	\$15/\$15.50/\$16

We carry a complete line of memory for AST, Apple, Compaq, DEC, IBM, HP, Notebooks, and printers. CALL for current prices.

♦ International Sales & Shipping ♦

CPU & CO-PROCESSORS

NE2000 NET COMBO CARD.....	\$25.00
INTEL 486DX2-66 (5v) CPU.....	\$35.00
INTEL 486DX4-100 (5v) CPU.....	\$75.00
INTEL PENTIUM 133/166 CPU.....	\$95/\$125
80387SX/DX CO-PROCESSOR.....	\$19/\$32

MISCELLANEOUS

486 M/B+256K CACHE+100MHz CPU+8MB RAM.....	\$119.00
PENTIUM M/B 133MHz, 256K CACHE, 16MB RAM.....	\$199.00

MMX ADAPTOR allows your M/B to accept MMX CPUs.
\$35.00

AMD 486DX4-100+5v ADAPTOR+CPU FAN
This kit will allow you to upgrade your old M/B to a faster CPU.
\$65.00

LBA CARD upgrade your hard drive beyond 540MB
without the expense of upgrading your present BIOS.
\$29.95

SPECIALTIES

PACKARD BELL UPGRADES
CPU, CACHE, VIDEO, SIMM, & MOTHERBOARDS
CALL

* OTHER PARTS AVAILABLE. CALL FOR QUOTE * VOLUME DISCOUNTS OFFERED
* PRICES SUBJECT TO CHANGE WITHOUT NOTICE * TERMS COD (CASH), VISA/MC
MINIMUM ORDER \$20 * SHIPPING & HANDLING: \$7 MIN.
ORDER LINE (800) 586-4199

P.O. BOX 261095, San Diego CA 92196
TEL (619) 586-7610 FAX (619) 586-1482
e-mail: lapazusa@pobox.com

Lowest Dealer Price Available

*R-8750
Volume control
converter

- Parental control
- STD/HRC switchable
- 85 channel capability
- Brand New

	10+	20+	50+
	\$79	\$75	\$69

*RA-550E
CATV converter

- Parental lock
- STD/HRC switchable
- 85 channel capability
- Brand new

* Refurbished w/remote - from \$29/ea

No decoder sales

Warranty included

METRO SURPLUS 310-515-5085

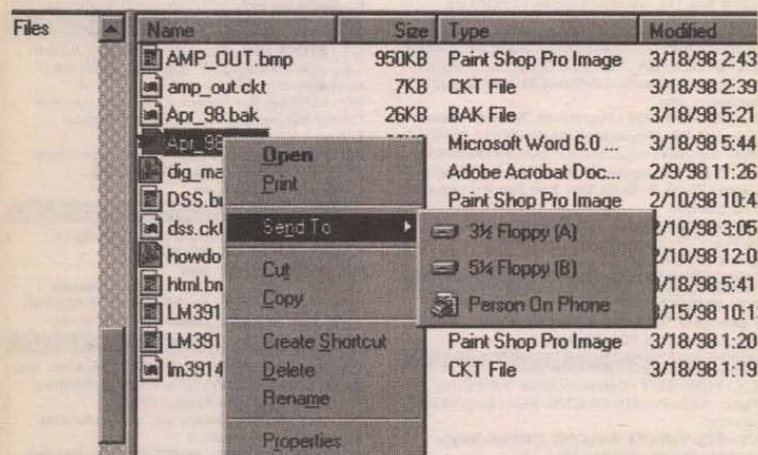
diskettes aren't properly formatted. For whatever reason, Windows 95 forces you to go to the MS-DOS prompt for this chore (often a low-density diskette that's been formatted from the Windows 95 prompt doesn't work properly). Click on Start, Programs, and MS-DOS Prompt. You'll now see a black screen. Type

FORMAT A:/F:720

This tells the A: drive that there's a 720K diskette in the drive, not the typical 1.44 MB. If your B: drive is a 5 1/4-inch, as most are, then the command is

FORMAT B:/F:360

which says to format the diskette in the B: drive with 360K. Well, you're starting to get the idea. You can identify a 1.44 MB diskette by the two holes punched at the top of the disk; a 720K has only one hole. Unfortunately, you have to look at the label of a 5 1/4-inch disk to know the difference between 360K and 1.2 MB; a 1.2 MB will have the word HDD, MD-2, or something similar on the label. When you're done with the formatting, type EXIT. Now bring up the Explorer and — using the right mouse button — do a Copy To command, as shown below. I expect you'll have no more problems.



BTW, if you're trying to format an Apple or Macintosh diskette for use with an IBM compatible, you may have to take the extra step of first reading a properly-formatted IBM diskette, ejecting it, and replacing it with the now-to-be-formatted Apple diskette before issuing the FORMAT command (this isn't always necessary, but it's worth mentioning).

Video Gamers Need Speed

Q. I read one of your reviews on video cards and thought maybe you could help me. I'm in the process of purchasing a Dell Dimension 300 MHz PII and they offer a choice of two video cards. One is the STB Velocity using the nVidia Riva 128 chipset and the other is the Diamond Fire GL 1000 Pro with 8 MB. I've asked Dell and they just give me the specs and won't comment on

which is best for gaming. I have a nine-year-old son and our single largest use of the computer is for games so this is very important to us. If you are familiar with either or both of these chips, I would appreciate your insight and recommendation.

Ken Wollman
via Internet

A. I'm glad that you're looking at the video engines (chips) and not the board's bells and whistles for making up your mind. I've tested video cards with both chips and found the nVidia Riva chip to be slightly faster than the S3 chip that's embedded in the Diamond Fire GL 1000 Pro. When it comes to gaming, though, the question isn't speed, but whether the games you play support one chip or the other. Each chip requires a different driver and not all games support both. So my suggestion is to check out the games you want to play and see which games support which chip, then choose between the two — you might be surprised. Good luck and stomp a Mech Warrior for me!

Mailbag

Dear TJ:

I was fascinated by your statement that 90% of the electron flow was in the outer 10% of a wire. I also found Arlen Raasch's formula about the region of void interesting, but I think that he is comparing apples to oranges. I believe that determining the amount of void is entirely different from determining the amount of current flow in a section of a wire. Do you stick by your statement?

Robert Olson
via Internet

Response:

Well, I didn't pull this number out of thin air. It actually comes from the "Standard Handbook For Electrical Engineers." However, the size of the wires they deal with are often times an inch or so in diameter, so I think Mr. Raasch has an argument for 24-gauge wire. My original point, though, was why pay premium bucks for gold-plated monster cables when there's no noticeable difference in the sound for normal use — and I stick by that statement. Now I'm sure Mick Jagger uses monster cables for his mile-high stage speakers, as well he should.

Dear Mr. Byers:

Thanks for publishing the JPL stepper motor controller circuit for Jack Shubert. It halved the number of flip flops in my design. I've started implementing it, and discovered two problems with the circuit. The clock input appears to be tied to the reset circuitry, and the TIP120s seem to be wired in the wrong way. I've done the timing by hand with the clock tied to the CP, and the circuit does what's expected of it.

Bruno Malisheski
via Internet

Response:

Yes, the transistors are reversed (see correction in the Mar. '98 column — mea culpa!) and the clock obviously drives the CP inputs. BTW, this design has drawn a lot of good response, and many readers have the circuit up and running with raves about its simplicity.

Converters ★ Remotes ★ Converters ★ Remotes ★ Converters ★ Remotes

Modern Communications • (405) 691-0594 TEL & FAX

Converters:	10	50	100+
Panasonic: TZPC175	\$75.00	\$69.00	\$65.00
Centurion CF-3000	\$65.00	\$60.00	\$55.00
DRZ-3 or DRX-3-105	\$29.00	\$25.00	\$18.00

Remotes:	10	50	100+
Jerrold: 400, 450, 550	\$4.50	\$4.00	\$3.75
CFT: 2XXX	\$4.95	\$4.50	\$4.25
S/A: 075, 175, 475	\$4.95	\$4.50	\$4.25
S/A: 8600 Original	\$5.95	\$5.50	\$5.00
Zenith (ALL)	\$4.95	\$4.50	\$4.25
Tocom 5503-VIP	\$4.95	\$4.50	\$4.25
Pioneer (ALL)	\$4.95	\$4.50	\$4.25
Pioneer: Made in Korea ...	\$5.95	\$5.50	\$5.00



Parts, Parts, Parts

	50	200	500
18 VAC, 300 MA P/S	\$3.00	\$2.50	\$2.00
65.8 MHz Saw Filters	\$2.50	\$2.35	\$2.10
PIC16C54	\$2.20	\$2.10	\$2.00
PIC16C56	\$2.35	\$2.30	\$2.25
Micro 68H705C8P	\$9.50	\$9.00	\$8.50
4 MHz			
(Resonance 2 pins)	\$0.45	\$0.40	\$0.35

Call for FREE CATALOG
(405) 691-0594

Converters ★ Remotes ★ Converters ★ Remotes ★ Converters ★ Remotes

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	\$68	\$64	\$60	\$55	CALL
COMMERCIAL-11	\$75	\$70	\$65	\$62	CALL
PANASONIC-1003	\$55	\$49	\$48	\$46	CALL
DIGITECH-550 MHZ	\$55	\$49	\$48	\$46	CALL

NOVAVISIONS

NV-5600	\$175	\$170	\$165	\$155	CALL
NV-5700	\$175	\$170	\$165	\$155	CALL
NV-5800	\$175	\$170	\$165	\$155	CALL
NV-6600	\$269	\$249	\$239	\$229	CALL

REFURBISHED CONVERTERS

PANASONIC-145R	\$55	\$50	\$42	\$38	CALL
----------------	------	------	------	------	------

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 51 on Reader Service Card.

Events CALENDAR

Continued from page 95

Southwest OH Chapter, 1117 Big Hill Rd., Kettering, OH 45429-1201

MAY 15-16-17

OH - DAYTON - Hamvention. Dick Miller N8CBJ, 937-276-6930. E-Mail: chair@hamvention.org Web: <http://www.hamvention.org/>

MAY 16

CA - FRESNO - Computer Show. Fresno Fgrds. MarketPro 415-456-6730 Web: <http://marketpro.com>

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

MA - WESTPORT - Computer Show. White's Convention Center. Northern Computer Shows 978-744-8440. E-Mail: tchc@iameica.net

MN - WILLMAR - Hamfest & Electronics Swapmeet. 9am-2pm. Steve Gardner WB0MAO, 320-235-1560. E-Mail: W0SW@AMSAT.ORG

TX - HONDO - Medina Co. ARC Hamfest, Ray Martinez N5VRE, 830-931-3307. E-Mail: n5vre@stic.net

MAY 16-17

GA - KENNESAW - Computer Show. Outlet Mall, I-75 @ Exit 117. Georgia Mountain Productions 706-838-4827

MAY 17

CA - STOCKTON - Computer Show. San Joaquin Co. Fgrds. MarketPro 415-456-6730. Web: <http://marketpro.com>

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

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

NH - PORTSMOUTH - Computer Show. Yoken's. Northern Computer Shows 978-744-8440. E-Mail: tchc@iameica.net

MAY 22-23

MS - PASCAGOULA - Hamfest. Jackson County Fairgrounds. Fri. 5pm-9pm, Sat. 8am-3pm. Charles Kimmery N5XGI, 228-826-5811

MAY 23

CA - YUBA CITY - Computer Show. Yuba-Sutter Fgrds. MarketPro 415-456-6730. Web: <http://marketpro.com>

CT - VERNON - Natchaug ARC Hamfest. Wayne Rychling N1QUS, 860-487-1921. E-Mail: wrych@neca.com

MAY 23-24

WY - RAWLINS - Carbon County ARS Hamfest. Ken Fults K7CRZ, 307-324-6067

MAY 24

CA - SAN DIEGO - Computer Show. Scottish Rite Center. MarketPro 415-456-6730. Web: <http://marketpro.com>

pro.com
CA - SANTA ROSA - Computer Show. Sonoma Co. Fgrds. MarketPro 415-456-6730. Web: <http://marketpro.com>

IL - CHICAGO - ARC Hamfest. 8am-3pm. DeVry Institute of Technology, 3300 N. Campbell. George Sopocko WA9JEZ, 773-545-3622

MD - WEST FRIENDSHIP - Hamfest. Howard Co. Fairgrounds. 8am-2:30pm. 301-879-2785. E-Mail: FSARC@aol.com

MAY 25

CA - MODESTO - Computer Show. Centre Plaza at Double Tree. MarketPro 415-456-6730. Web: <http://marketpro.com>

MAY 29-30

NE - SOUTH SIOUX CITY - Midwest/Dakota Div. Convention. Mike Nickolaus NF0N, 402-494-6070. E-Mail: nf0n@avalon.net

Web: <http://www.pionet.net/~k0brd/hamboree/>

MAY 29-30-31

NY - ROCHESTER - Atlantic Division Convention. Harold Smith K2HC, 716-424-7184. E-Mail: rochfst@frontiernet.net Web: <http://www.rochesterhamfest.org>

MAY 30

CA - STOCKTON - Computer Show. San Joaquin Co. Fgrds. MarketPro 415-456-6730. Web: <http://marketpro.com>

CO - LOVELAND - Superfest Swapmeet. Larimer County Fairgrounds, 700 S. Railroad. Michael Robinson N7MR, 970-282-1167

ME - PORTLAND - Computer Show. Expo Center. Northern Computer Shows 978-744-8440. E-Mail: tchc@iameica.net

MAY 30-31

CA - VENTURA - Computer Show. Ventura Co. Fgrds. MarketPro 415-456-6730. Web: <http://marketpro.com>

OR - SEASIDE - SEAPAC Ham Conv. Seaside Convention Center. Randy Stinson KZ7T, 503-297-1175. Web: <http://www.easystreet.com/~otvarc>

MAY 31

CA - SACRAMENTO - North Hills RC Hamfest. Bob Naylor AC6HF, 916-966-3654. E-Mail: ac6hf@juno.com Web: <http://www.ns.net/~NHRC>

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

CANADA - QUEBEC - SOREL-TRACY - Hamfest. Jean A. Gadoury VE2UL. E-Mail: jgadoury@sorel-tracy.qc.ca

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

JUNE 1998

JUNE 5-6-7

TX - ARLINGTON - West Gulf Division Convention. Tom Gentry K5VOU, 972-442-1721

JUNE 6

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

CANADA - QUEBEC - MONTREAL - ARC Hamfest. James Hay VE2VE, 514-697-7205. E-Mail: jrhay@haya.qc.ca

ME - HERMON - Pine State ARC Hamfest. Roger Dole KA1TKS, 207-848-3846

MI - GRAND RAPIDS - Annual Hamfestival. Hudsonville Fairgrounds, off I-96 x-way. Randy N8KQX, 616-532-5450

TN - NASHVILLE - ARC Hamfest. TN State Fairgrounds. 8am-5pm. Bob Malone WB5ZDS, 615-865-6225

JUNE 6-7

CA - SACRAMENTO - Computer Show. Cal Expo. MarketPro 415-456-6730 Web: <http://marketpro.com>

WA - DRYDEN - Apple City ARC Hamfest. Greg Johnson WA7TSP, 509-663-1081. E-Mail: g.c.johnson@mail.sprint.com

JUNE 7

CA - LIVERMORE - Swapmeet. Las Positas College. Noel Ankam 510-447-3857

CA - SAN DIEGO - Computer Show. Scottish Rite Center. MarketPro 415-456-6730. Web: <http://marketpro.com>

CT - NEWINGTON - AR League Hamfest. Ralph Borriello N1VIM, 860-828-1695

IL - PRINCETON - Starved Rock RC Hamfest. Debbie Burton N9DRU, 815-795-2201. E-Mail: dbkat@mtco.com

Web: <http://www.prairienet.org/srrc/>

IN - WABASH - County ARC Hamfest. Don Spangler W9HNO, 219-563-8487. Web: <http://www.netusal.net/~qrziota/>

NY - QUEENS - Hamfest. NY Hall of Science Parking Lot, Flushing Meadow Corona Park, 47-01 111th St. Stephen Greenbaum WB2KDG, 718-898-5599 night only. E-Mail: WB2KDG@bigfoot.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

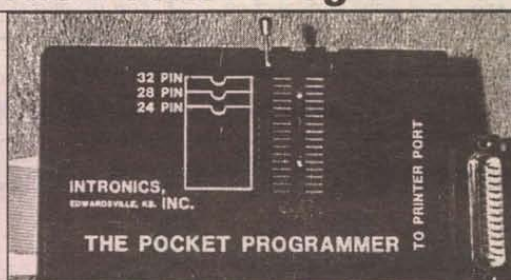
PH 407/628-5634

P.O. BOX 536186

ORLANDO, FLA. 32853-6186



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/29CXXXX & 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 and Eprom Emulator to 32K X 8. **Only \$129.95**

Same Name, Address & Phone Number for 13 Years.....
Now isn't that Amazing ?

Intronics, Inc.

Box 13723 / 612 Newton St.

Edwardsville, KS 66113

Tel. (913) 422-2094

Fax (913) 441-1623

Add \$4.75 COD

Add \$4.00 Shipping

Visa / Master Charge

Events CALENDAR

OH - MEDINA - Two Meter Group Hamfest. Mike Rubaszewski N8TZY, 330-273-1519
PA - BUTLER - Hamfest. Butler Farm Show Grounds. 8am-4pm. George Artnak N3FXW, 412-854-5593. Web: <http://www.users.sgi.net/~wolfie/>
VA - MANASSAS - Ole Virginia Hams ARC Hamfest. Mary Lu Blasdel KB4EFP, 703-369-2877
WI - JUNCTION CITY - Swapfest & Auction. US Army Reserve Ctr. John Feltz W9JN, 715-457-2506. E-Mail: jfw9jn@tznnet.com

JUNE 12-13

GA - ALBANY - ARC Hamfest. Arthur Shipley N4GPJ, 912-439-7055

JUNE 13

CA - FONTANA - Inland Empire ARC Amateur Radio & Electronics Swapmeet. A B Miller High School. Bill 909-822-4138 eves
CANADA - ONTARIO - FERGUS - Guelph & Kitchener-Waterloo ARCs Hamfest. Bill Smith VE3WHS, 519-821-6642. E-Mail: smith.ve3whs@sympatico.ca Web: <http://www.kwarc.org/fleamarket>
KY - PADUCAH - ARC Hamfest. Executive Inn Convention Ctr. 8am-3pm. Craig Martindale WA4WBW, 502-444-6822
NY - CORTLAND - Skyline ARC Hamfest. Andrew Slough KB2LUV, 607-753-0597. E-Mail: sany@sany.ips.com

JUNE 13-14

GA - DALTON - Computer show. North GA Fairgrounds. Georgia Mountain Productions 706-838-4827

JUNE 14

IL - WHEATON - Six Meter Club of Chicago Hamfest. DuPage County Fairgrounds, 2015 Manchester Rd. Joseph Gutwein WA9RIJ, 630-963-4922
KY - ERLANGER - Ham-O-Rama '98. Lions Park. 8am-3pm. Robert Blocher N8JMV, 513-797-7252 eves. E-Mail: krod@tso.cin.ix.net
MI - FLINT - Computer Show. Holiday Inn, Gateway Centre, US 23 @ Hill Rd. Exit. Five Star Productions 810-890-0988
NY - BETHPAGE - Long Island Mobile ARC Hamfest. Richie Selzer N2WJL, 516-520-9311. E-Mail: n2wj@juno.com
TN - KNOXVILLE - RAC of Knoxville Hamfest. David Bower K4PZT, 423-974-5064. E-Mail: d.bower@iecc.org Web: <http://www.kornet.org/rack>

JUNE 19-20-21

GA - ATLANTA - Hamfest '98. Greg Barrett N5BDJ, 770-649-1467. E-Mail: gbjb@mindspring.com Web: <http://www.saf.com/arc>

JUNE 20

CA - SANTEE - ARC of El Cajon Ham, Computer & Electronic Swapmeet. Santee Drive-in. 619-561-0052
NJ - DUNELLEN - Raritan Valley RC Hamfest. Doug Benner WB2NHJ, 908-469-9009. E-Mail: wb2nj@aol.com
WV - BLUEFIELD - East River ARC Hamfest. Don Williams WA4K, 540-326-3338. E-Mail: WA4K@AMSAT.ORG

JUNE 20-21

GA - KENNESAW - Computer Show. Outlet Mall, I-75 @ Exit 117. Georgia Mountain Productions 706-838-4827

JUNE 21

IN - CROWN POINT - Lake Co. ARC Hamfest. Lake Co. Fairgrounds. Malcolm Lunsford W9MAL, 219-769-3925. E-Mail: w9mal@cris.com
MA - CAMBRIDGE - Flea Market. Kendall Square area. MIT. Nick Altembernd KA1MQX, 617-253-3776. Web: <http://web.mit.edu/w1mx/www/swapfest.html>
MD - FREDERICK - ARC Hamfest. Eric Gammeter N8AAY, 301-865-0865
MI - MONROE - Monroe Co. Radio Comm. Assn Hamfest. Fred VanDaele KA8EBI, 313-242-9487
OH - MACEDONIA - Cuyahoga ARS Hamfest. Rich James N8FIL, 1-800-404-2282. <http://www.cars.org>

JUNE 27

FL - FT. MCCOY - ARC Hamfest. Tom Bench KT4VF, 352-546-3967. E-Mail: w4frc@qsl.net Web: <http://www.qsl.net/w4frc>

JUNE 28

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

JULY 1998

JULY 4

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

JULY 5

PA - WILKES-BARRE - Murgas ARC Hamfest. Robert J. Michael WB3FAA, 717-288-3532

JULY 11

CA - FONTANA - Inland Empire ARC Amateur Radio & Electronics Swapmeet. A B Miller High School. Bill 909-822-4138 eves
IN - INDIANAPOLIS - Central Division Convention. Rick Ogan N9LRR, 317-251-4407
MO - KANSAS CITY - PHD ARC Hamfest. Bob Roske WA0CLR, 816-436-0069. E-Mail: wa0clr@juno.com Web: <http://www.tfs.net/~caltman/phdara/>
NC - SALISBURY - NC Alligator Group Hamfest. Walter Bastow N4KVF, 704-279-3391. E-Mail: alliga.tor@juno.com
OK - ALTUS - Altus Area ARC Hamfest. Ronald Hughes KB5UVC, 580-482-7994
WA - KENNEWICK - Tri Cities ARC Hamfest. Dick N7WLD, 509-783-3479. E-Mail: dick_goranson@kcc-computers.com

JULY 12

IL - PEOTONE - Kankakee ARS Hamfest. Don Kerouac K9NR, 815-939-7548. E-Mail: K9nr@juno.com Web: <http://www.geocities.com/CapeCana/veral/Hanger/5711/>
MI - FLINT - Computer Show. Holiday Inn, Gateway Centre, US 23 @ Hill Rd. Exit. Five Star Productions 810-890-0988
NJ - AUGUSTA - Sussex Co. ARC Hamfest. Dan Carter N2ERH, 973-948-6999. E-Mail: scarnj@qsl.net Web: <http://www.qsl.net/scarnj/>
NY - ALEXANDER - Genesee Radio Amateurs Hamfest. David Carlson KA2OQZ, 716-786-3622. E-Mail: carlson@frontiernet.net Web: <http://www.frontiernet.net/~wittman/wittman/GRAM>
PA - KIMBERTON - Mid-Atlantic ARC Hamfest. Bob Haase W3SA, 610-293-1919

JULY 17-18-19

MT - EAST GLACIER - MT State Convention. Gerry Leach VE6BVZ, 403-285-5547. E-Mail: leachg@cadvision.com

JULY 18

CA - SANTEE - ARC of El Cajon Ham, Computer & Electronic Swapmeet. Santee Drive-in. 619-561-0052
TX - TEXAS CITY - Tidelands ARS Hamfest. Carl W. Steele Jr. WA5WVP, 409-948-0308

JULY 19

MA - CAMBRIDGE - Flea Market. Kendall Square area. MIT. Nick Altembernd KA1MQX, 617-253-3776. Web: <http://web.mit.edu/w1mx/www/swapfest.html>
MO - WASHINGTON - Zero Beaters ARC Hamfest. Keith Wilson K0ZH, 314-629-2264
NY - FARMINGVILLE - Radio Central ARC Hamfest. Jo Ann Colletti N2IME, 516-399-1877. Web: <http://www.li.net/~n2imdq>
OH - VAN WERT - Hamfest. County Fairgrounds, US 127 S. Louie Thomas WD8LLO, 419-238-2812. E-Mail: barnesrl@bright.net Web: <http://www.bright.net/~barnesrl/w8fy.htm>

JULY 24-25

CARL'S ELECTRONICS

POBox 722 LEOMINSTER, MA 01453*PHONE (978)840-8834*FAX (978)840-6172
 OVER 200 ELECTRONIC PLANS AND KITS, SPY AND SURVEILLANCE, PLUS THE
 LATEST INFO ON CABLE AND SATELLITE DESCRAMBLING.

SURFACE MOUNT FM TRANSMITTER	SURFACE MOUNT PHONE TAP	VOICE CHANGER
Used for remote monitoring/surveillance. Ultra small circuit 1" x 0.6". Transmits sound to any FM radio.	Ultra small circuit 0.6" x 0.7". Transmits both sides of a conversation to any FM receiver.	Disguise your voice with this easy to build kit. Just like the ones used on secret witnesses.
<ul style="list-style-type: none"> 9 Volt Battery or power source. Tunable from 88 - 108 MHz. Range up to 3/4 mile. Surface Mount Solder Guide. Kit - CK214 \$21.95 Assembled - CK214A \$49.95	<ul style="list-style-type: none"> Tunable from 88 - 108 MHz. Range up to 3/4 mile. Powered by phone line. Surface Mount Solder Guide. Kit - CK215 \$19.95 Assembled - CK215A \$49.95	<ul style="list-style-type: none"> Man to women. Several push button adj. Includes ROBOT voice Operates on 9Volt Bat. Kit - CK211 \$19.95 Assembled - CK211A \$49.95

ORDER BY PHONE, FAX, OR WEBSITE:
 PLEASE INCLUDE \$5.95 FOR SHIPPING.
 MASTER CARD, VISA, AND AMEX.

VIEW OUR ENTIRE CATALOG ON-LINE.
[HTTP://WWW.ELECTRONICKITS.COM](http://WWW.ELECTRONICKITS.COM)
 REQUEST A FREE CATALOG.

FL - MILTON - Milton ARC Hamfest. Mark McAnally KE4QKN, 850-626-7686. E-Mail: KE4QKN@AOL.COM
OK - OKLAHOMA CITY - OK State Convention. Harold Miller KB1ZQ, 405-672-7735. E-Mail: n1lpn@swbell.net

JULY 24-25-26

AZ - FLAGSTAFF - AZ State Convention. Mark Kesauer N7KKQ, 602-440-2039

JULY 25

NC - WAYNESVILLE - Western Carolina ARS Hamfest. Thomas Queen K4BNP, 704-258-2639
OH - CINCINNATI - OH-KY-IN ARC Hamfest. Dana Laurie WA8M, 513-761-7388

JULY 26

CA - SANTA ANA - Swapmeet. ACP parking lot. Mary Russo 714-558-8813
IL - GLEN ELLYN - Computer Show & Sale. College of DuPage. Main Arena of Phys Ed Bldg. Corner of Park Blvd. & College Rd. 9:30am-3pm. Computer Central Shows 847-940-7547

AUGUST 1998

AUGUST 1

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

Hamfest. Leon Garrett K4CIT, 502-842-5307
NC - HIGH POINT - ARC Hamfest. Mark McManahan KB4MFP, 910-887-3039
OH - COLUMBUS - Voice of Aladdin ARC Hamfest. Jim Morton KB8KJP, 614-846-7790

AUGUST 8

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

AUGUST 15

CA - SANTEE - ARC of El Cajon Ham, Computer & Electronic Swapmeet. Santee Drive-in. 619-561-0052
GA - ALBANY - Computer & Electronics Expo. Hasan Temple, 1822 Palmyra Rd. 9am-5pm. Sandy Rabb 912-888-9393. E-Mail: GODS@SURFSOUTH.COM

AUGUST 16

MA - CAMBRIDGE - Flea Market. Kendall Square area. MIT. Nick Altembernd KA1MQX, 617-253-3776. Web: <http://web.mit.edu/w1mx/www/swapfest.html>
MI - FLINT - Computer Show. Holiday Inn, Gateway Centre, US 23 @ Hill Rd. Exit. Five Star Productions 810-890-0988

AUGUST 23

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

OLYMP ELECTRONICS & VIDEO

OFFERS GREAT PRICES ON:

- Converters
- Remotes
- Filters
- Accessories
- One Piece Systems
- Tri-Vision

1-888-290-9102

MON-SAT 10 am-6 pm CST
 C.O.D. ONLY
 NO ILLINOIS SALES

ACP's 86th GIANT COMPUTER SWAP★MEET



Orange County's Original!
 Sunday, 8am-2pm

May 31st

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



New Product News

MFJ-4035MV DC REGULATED POWER SUPPLY



MFJ Enterprises, Inc. announces the new MFJ-4035MV 35/30 amp adjustable regulated DC power supply — only \$149.95.

MFJ's new heavy duty power supply features 35 amps surge and 30 amps continuous, and is adjustable and regulated.

The MFJ-4035MV voltage is front panel adjustable from 1 to 14 VDC with detect set at 13.8 VDC. The power supply has lighted front panel meters and an ON/OFF switch.

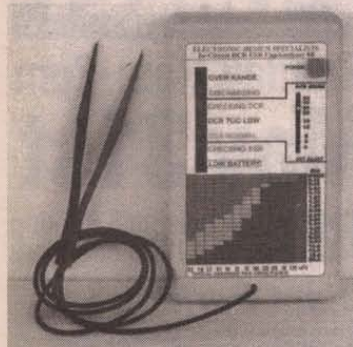
Three different OUTPUT terminals include a five-way binding post for HF/VHF radio, two pairs of quick connects for low current accessories, and a cigarette lighter socket for mobile accessories.

It has a front-panel fuse holder for convenient fuse replacement. The voltmeter and ammeter monitor load continuously. A quiet internal cooling fan generates a tremendous airflow, keeping components cool.

For more information, contact:

MFJ ENTERPRISES, INC.
P.O. BOX 494, DEPT. NV
MISSISSIPPI, MS 39762
601-323-5869 FAX: 601-323-6551
1-800-647-1800
E-MAIL: mfj@mjenterprises.com
WEB:
<http://www.mjenterprises.com>

THE CAPANALYZER 88



Electronic Design Specialists introduces an in-circuit electrolytic capacitor checker that is guaranteed 100% accurate in circuit, with a money back guarantee.

The The CapAnalyzer 88 automatically discharges the cap, measures DCR, checks for shorts, and measures ESR in circuit, all in one step.

Values from 0.47 uF to 2200 uF can be measured with 100% accuracy. Only 2.5 seconds is required for each cap, so that an entire PC board can be checked in just minutes.

All signals are under 50 millivolts with a 5-ohm test impedance to prevent semiconductors, resistors, or coils from causing false readings.

A slider control sets the value of DCR for the alarm beeper to warn the technician. The state-of-the-art design uses a microprocessor and a two-color 20 segment LED meter to read ESR with a resolution down to 0.1 ohm. A beeper allows eyes-off use by beeping from one to five beeps depending on the ESR reading and quality of the capacitor.

Included is a one-handed, gold-plated tweezer probe that can check both conventional and surface-mounted capacitors, and a handy three-color chart on the front panel that shows typical ESR readings for good and bad capacitors in reference to their capacity.

It is battery-operated (AAA batteries) and handheld to make it easier to use, either in the shop or in the field. A three minute warning beeper alerts the technician that the unit is on if no testing is detected.

The CapAnalyzer 88 is available at most electronics distributors, as well as from EDS directly, for \$169.00.

For more information, contact:

ELECTRONIC DESIGN SPECIALISTS
4647 APPALACHIAN ST.
DEPT. NV
BOCA RATON, FL 33428
561-487-6103

FIVE NEW ACCESSORY HEADS FOR PMM-1



Amprobe Instrument announces the release of their five new interchangeable accessory heads to expand the capabilities of their pen multimeter, model PMM-1. The accessory heads were designed with the HVAC Technician in mind.

The complete series extends the PMM-1's existing testing capabilities from AC and DC volts and resistance to now measure capacitance (start/run capacitor testing), DC microamps (flame rod and flame sensor testing), relative humidity, carbon monoxide (IAQ testing), and single or differential temperature (compressor efficiency testing).

AC amps to 300A is accomplished with the existing accessory,

model PMM-C.

Each new accessory head is designed to output imVDC per unit measured. The unique mechanical design allows each head to slide onto the PMM-1, but may be used with any DMM with a DC millivolt resolution in conjunction with the appropriate test lead, model TL-10S.

For more information, contact:

AMPROBE INSTRUMENT
630 MERRICK RD., P.O. BOX 329
DEPT. NV
LYNBROOK, NY 11563
516-593-5600 FAX: 516-593-5682

THE WIRELESS CONTROLGATE™

Emge Industries, Inc., announces the introduction of a new line of industrial radio remote controller modern systems designed to interface with electrically operated machinery and equipment. These systems are available in either simplex (one-way communication) or duplex (two-way communication) versions. A variety of analog, digital, RS-232, and RS-485 inputs and outputs are available for tailoring the system to the customer requirements.

The ControlGate™ ACE-928 utilizes state-of-the-art frequency hopping spread spectrum radio technology. Operating in the 902 to 928 MHz band, the ControlGate ACE-928 design offers unmatched noise immunity for the most stringent applications where communication reliability is of prime concern.

Electrical equipment or machinery controlled by a 0-5 VDC or 4-20 mA analog signal command can be safely and easily operated by the ControlGate ACE-928.

Eliminated by the ControlGate ACE-928 are the traditional wiring costs associated with long runs of control wiring and conduit to such devices as potentiometers, flowmeters, temperature sensors, pressure sensors, displacement sensors, velocity sensors, machine controllers, PLCs, and PCs.

The ControlGate ACE-928 systems also offer digital contact closures for simple ON-OFF commands. In addition, RS-232 and RS-485 ports are available on some models for easy computer interface. The duplex version offers standard two-way communication and the ability to setup a MODBUS network with master/slave units. Closed loop control is easily facilitated with the ControlGate products. All units are conveniently powered by low-voltage DC.

For more information, contact:

EMGE INDUSTRIES, INC.
1060 WINGFOOT ST., DEPT. NV
PLACENTIA, CA 92870-4444
714-996-5777 FAX: 714-996-5748

Continued from page 15

Connect each thermistor from ground to the five-volt supply through a resistor to limit the current. Select the resistors to keep the thermistor power dissipation at 10 to 80% of their rating over the temperature range.

The op-amps are used as simple comparators. One connects to the panel and reservoir thermistors, a second to the reservoir and water heater, and a third to the water heater and a pot to set the shut off point.

Each comparator can drive a solid-state relay and the corresponding pump.

You should be able to salvage the solid-state relays and thermistors from your present system.

Mike Beaver
Los Altos, CA

ANSWER TO #129713 - DEC. 1997

Your IC-2F and IC-3P by Inoue Communications Equipment were imported and marketed in the USA by Varitronics, Inc., of Phoenix, AZ — long since defunct.

The ICE models FDFM-2 and FDFM-2S preceded the IC-2F. Only after Varitronics' demise did Inoue market under the name Icom in the U.S.

Diodes D11 and D12 are in a circuit similar to the typical VSWR detector. D11 detects "forward" RF power and drives the meter via potentiometer FVR4. D12 detects any "reflected" RF power and drives the automatic protection circuit. Potentiometer FVR6 controls APC threshold adjustment.

Inoue typically used 1N60 germanium diodes in this function in similar equipment and a pair of 1N60's or equivalents such as ECG-110A should function perfectly. The TCG110 is most likely just a 1N60, certainly it is similar.

If you need a manual and adjust-

ANSWERS TO #3981 - MAR. 1998

A simple hardware method to obtain accurate low-frequency squarewaves begins with the construction of an astable multivibrator using a TLC555 CMOS timer IC configured to provide an adjustable frequency range of 100 times the desired output frequency range.

The output of the TLC555 timer is then divided by 100 using two stages of CMOS 4017 divide-by-10 ICs.

All ICs and components needed can be inexpensively obtained at Radio Shack. The IC pin-outs and data can be found in *Radio Shack's Semiconductor Reference Guide*.

John McMichael
Laramie, WY

ANSWERS TO #3981 - MAR. 1998

A good answer to this question can be found on page 37 of the same issue the question was in March '98, in TJ Byer's "Electronics Q & A" column. I recommend the TLC555 circuit.

Dick Moore
via Internet

TECH FORUM

ment information, contact me directly.
Robert G. Wheaton W5XW
 San Antonio, TX

ANSWER TO #2987 - FEB. 1998

The Intech VDAC 1842N is a video

DAC with binary input, .015 microsecond settle time, TTL logic, CMOS logic, and latches.

According to the *IC Master DataBook* [1994 edition], the 1842N is made by Advanced Analog [a division

ANSWERS TO #3985 - MAR. 1998

1. It is hard to give you an accurate answer to how you can learn the Morse Code better. You gave no indication of the process you are using now. Nor did you indicate the speed you are presently able to copy and your goal speed. As a person who regularly teaches Morse Code, I offer you these suggestions.

To learn code, first you must know each letter, number, and character or symbol required. Learning them is best with a computer to generate code. This is very easy to do as software is abundant and audio cards are cheap.

Determine your goal speed. Take that goal speed and use that as the actual speed for learning your code and each character. The trick is to use a method known as Farnsworth Spacing. This method sends the character at a higher speed and spaces the characters out, for a resulting "lower" speed of transmission. What you are trying to do here is recognize the "sound" or "rhythm" of each character at the higher speed, and as you progress, reduce the timing between characters to build your speed.

This is the most effective way to learn Morse Code, proven over many years. There are other methods people attempt to use, which "may" help you learn code, but my experience has been that these other processes create much confusion.

The International Morse Code is the "real" Morse Code used today. The other common code used in "telegraph" days was the American Morse Code. This was a code better-suited for the "click" of the telegraph systems. Don't spend time learning this for code tests. It is not the same, though similar.

Mark Hanz
 Houston, TX

2. The best way to learn Morse code is to practice for 15 minutes a day. Practice with a friend if you can, and don't skip any days! You'll attain five-words-per-minute in about a month, qualifying for a Novice class amateur radio license. In about two more months, you'll attain 13-words-per-minute and qualify for the General license.

There are no short cuts, but be sure to think of each letter as a SOUND made up of dits and dahs. Never think of dots and dashes, and don't think of the printed representation of the dits and dahs. That only adds a useless extra step.

A dit followed by another dit or dah

should be pronounced di (dih), not dit. For example, B is DAH-di-di-dit.

International Morse Code is the "real" Morse Code, being used almost exclusively today. It's the Morse Code you need to learn for your amateur radio license.

The "other" Morse Code is called the Continental Morse Code. It was widely used long ago in wire circuits, but is almost never used in radio.

Practice every day and don't get discouraged! I qualified for the General class license when I was 14, and it was a lot of fun.

John J. Herro
 Palm Bay, FL

3. I assume you are practicing on a regular basis, but that you've reached a plateau. This is common. The only way through the plateau is to press onward and keep practicing. You might speed the process by changing your mind set. Spend some time learning what common words and letter groups sound like. Just as "CG" probably has a sound all its own to you by now, so will words like "the," "GTH," "name," and "rig" some day.

If you keep that in the back of your mind while you're using the code, you might get there sooner. Get on the air, after a few weeks of operating, your speed will pick up on its own. If you're using a straight key, think about moving to a keyer. Your transmit speed will pick up faster than your receive speed and that will encourage your contacts to transmit faster to you. This will push you to keep up.

If you're not on the air yet, try to find practice tapes that send the characters at a rapid rate, but pause between characters long enough for you to recall the meaning. That way you won't be counting dits and dahs and translating, but will start to hear the pattern of the characters as a complete unit. Di dah dah just sounds like W to me, it is no longer one dit and two dahs. Likewise, dah dididit dit is THE not T H E.

As for your other question, the Morse Code (A.K.A. the American Morse Code) was used in early telegraph systems. Those systems had pens that actually drew the dots and dashes on a paper tape. The operators eventually learned to bypass the paper tape by decoding the sound of the mechanism directly. The International Morse Code (hopefully the code you are studying) is a slight variation on the original and is what is used in radiocommunication.

Tom Tillander
 Bay Village, OH

of Intech].

You probably can get a data sheet from a sales representative in your area. The following is all the information on sales representatives in your area. Also listed are three phone numbers and the company address of Advanced Analog, since I am not sure which is closest to you.

LaJolla KSA 619-453-5720;
 Manhattan Beach Pacific Edge 213-372-5435; and Sunnyvale Pass Assoc. 408-735-9040.

Company address:

Advanced Analog (Division of Intech)
 2270 Martin Ave.
 Santa Clara, CA 95050
 408-988-4930

Dennis Gifford
 Henagar, AL

ANSWER TO #2984 - FEB. 1998

I assumed you didn't want a tour of the factory, but some practical information on how to replace a defective bipolar cap during a repair job or how to make an odd-ball size for that weekend project.

This circuit will do the job just fine. There are a few important design considerations.

A. These capacitors are NOT in series for calculation purposes.

The total capacitance in the diagram is not

$$\frac{1}{C_{\text{total}}} = \frac{1}{10 \mu\text{F}} + \frac{1}{10 \mu\text{F}} = 5 \mu\text{F}$$

It's just 10 μF .

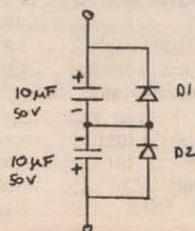
Also the total voltage capacity is not 100 volts. It's just 50 volts. These capacitors are not in series. The diodes simply put one capacitor into the circuit and then the other.

B. The diodes and the capacitors might have to carry some surprisingly high currents. Good examples are the power stage of an amplifier or the vertical deflection circuit of a television. Be sure to check the "ripple current rating" and "core temperature" for the capacitors and the "forward current rating" and PIV for the diodes.

If the old capacitor burned out, consider designing 20%-50% more current carrying capacity into the replacement.

C. Pay attention to safe design practices. If a diode "opens" due to high current or a bad solder joint, the associated capacitor can explode (just like any other reversed-biased electrolytic).

Robert V. Miller
 Trenton, NJ



ANSWER TO #1987 - JAN. 1998

Your problem is simple to build, thanks to a fairly new product from National Semiconductor.

The LM34CZ-ND is a precision temperature sensor that is packaged in a TO-92 case. The range is -40 to 230 degrees F. The device has a wide power supply range (3-15 VDC, I think) and the current drain is very low.

With the sensor that I made, I soldered three 24 ga. wires with shrink sleeving, added a little silicone adhesive, and shrank another piece over the whole thing exposing only the case of the device. This enables the sensor to be immersed.

The three connections are $\pm V$ and output voltage which corresponds to the temperature, i.e., 220-230 deg. = 2.200-2.300 VDC. The device is available from **Digi-Key 1-800-344-4539**.

Craig Dodds
 Pensacola, FL

reader FeedBack

Continued from page 6

Nuts & Volts audience includes beginners, as well as seasoned electronics engineers. A beginner is depending on an accurate circuit description of operation to learn from the article whether or not he actually builds the circuit.

I sincerely do not intend to discourage Mr. Blechman. I admire his writing ability, as well as his technical capabilities and I commend him for submitting interesting articles.

John Smith
 Plano, TX

Response:

John, you may have a good point regarding the use of the LED as a voltage stabilizer. I did not remove the LED to test the effect, but the unit is quite stable in operation with the LED, and since the telephone company is supplying the power, there's really no reason to remove it. It also acts as a "power-on" indicator.

Thanks for your kind comments about my articles. Twenty-two construction projects, many of which have appeared in past issues of Nuts and Volts, are in my new book, *Simple, Low-Cost Electronics Projects from LLH Technology Publishing* (www.LLH-publishing.com), 1-800-247-6553.

Fred Blechman
 West Hills, CA

After reading "Reader Feedback" about the "3-1/2 Digit Module Primer," I have a comment. Yes, one cannot connect the negative power supply to the negative of the measured voltage, but as long as the inputs are 1.5 volts within the power rails, the meter will work.

John Erskine
 Los Angeles, CA

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 Princland 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 Technologies62	Danbar Sales Company22	M2L Electronics58	Shreve Systems96
ABC Electronics36	Davilyn Corp.8	Manu Industries, Inc.7	Sinaco Electronics96
Ace Computers53	Detection Dynamics97	Maxtron38	Skycraft Parts & Surplus, Inc.106
ACP Super Store105	Dexis28, 97	Metric Equipment Sales, Inc.38	Software Buy Mail96
Advanced Educational Systems76	DYNAMIC Technologies75	Metro Surplus.....102	Solutions Cubed20
Alfa Electronics86	Earth Computer Technologies.....39	microEngineering Labs20	Spectrum Research97
All Electronics Corporation95	E.H. Yost & Co.85	Micromint58	Spy Outlet96
Allison Technology Corporation47, 96	ELECTRO MAVIN16	Midwest Electronics7	Square 1 Electronics26
Alltech Electronics30	Electro Tool, Inc.11	MING97	Street Smart Security16
Alltronics110	Electronic Goldmine15	Modern Communications103	Sun Equipment Corporation83
AM Research, Inc.7	Electronic Rainbow Ind., Inc.66	Modern Electronics58	Supercircuits13
ANA Instruments71	Electronix Express46	Motron Electronics29	Surplus Traders96
Andromeda Research6	EMAC, Inc.26	National Control Devices46	Synergetics91
Antique Radio Classified97	EPS97	Netcom16	Techniks, Inc.96
AST Global Electronics36	Fair Radio Sales71	New Company94	Technological Arts96
Basic Electrical Supply	Foss Warehouse Distributors96	Olymp Electronics & Video.....105	Televue Distributors56
& Warehousing Corporation74	Gateway Electronics, Inc.82	One Stop Supplier81	Test Equipment Plus47
Battery-Tech, Inc.87	General Device Instruments96	Optoelectronics.....111	The RF Connection76
Baylin Publications.....29	General Science & Engineering8	Parallax, Inc.Back Cover	Timeless Products72
BCD Electro96	Gillian Technologies, Inc.13	PARAMAX, INC.93	Timeline, Inc.27
Bell Electronics13	Graymark45	Phelps Instruments76	TL Electronics97
Bilcocon Corp.97	Greenleaf Electronics.....57	Pioneer Hill Software62	Tornado Communications94
Bisme Computers Outlet39	Halted Specialties Co.3	Polaris Industries27	Trenton Computer Festival.....45
Brick Wall Div., Price Wheeler Corp.38	H.T. Orr Computer Supplies.....58	Prairie Digital, Inc.97	T.T.I.97
Brigar Electronics54	I.E.S.93	Prime Electronic Components, Inc.85	Unicom Electronics63
C & S Sales, Inc.31, 84	Innovation West96	QB VIDEO94	USI Corp.11
C and H Sales Company7	Information Unlimited55	Quality Direct Electronics, Inc.97	Utopia Tools13
Cable King90	Interactive Image Technologies, Ltd.....5	Quality Electronics81	V&V Mach. & Equipment, Inc.96, 97
Capital Electronics, Inc.28, 37	Intronics, Inc.106	R & S Surplus63	VersaTech Electronics.....37
CARL'S ELECTRONICS.....105	ITU Technologies97	Ramsey Electronics, Inc.32	Viking International8
Cheneko Products, Inc.39	Jade Products, Inc.96	Resources Un-Ltd.21	Visitect, Inc.47
Communications Electronics, Inc.12	James' Electronic Services, Ltd.72	R.E. Smith96	Weeder Technologies36
Consumertronics.....35	JAN Crystals37	RKA Systems63	Western Test Systems64-65
Corporate Systems Center2	KDE Electronics Corp.71	Roger's Systems Specialist.....23	White-Star Electronics90
Cruising Equipment11	Kimtronix106	Scott Edwards Electronics20	Wholesale Cable76
C-Tech87	La Paz Electronics Int'l.102	Seabird Technical97	
Cunard Associates39	Linear Systems13	SGC45	



AMATEUR RADIO & TV

Abacom Technologies	62
Alltronics	110
Communications Electronics, Inc.	12
Gateway Electronics, Inc.	82
Jade Products, Inc.	96
JAN Crystals	37
Ramsey Electronics, Inc.	32
SGC	45
The RF Connection	76

BATTERIES/CHARGERS

Battery-Tech, Inc.	87
Cruising Equipment	11
Cunard Associates	39
E.H. Yost & Co.	85
Jade Products, Inc.	96
Solutions Cubed	20

BUSINESS OPPORTUNITIES

Chenesko Products, Inc.	39
-------------------------	----

BUYING ELECTRONIC SURPLUS

ABC Electronics	36
Alltech Electronics	30
C and H Sales Company	7
Dexis	28, 97
Earth Computer Technologies	39
Metric Equipment Sales, Inc.	38
Roger's Systems Specialist	23
Skycraft Parts & Surplus, Inc.	106

CABLE TV

Basic Electrical Supply & Warehousing Corporation	74
Cable King	90
CARL'S ELECTRONICS	105
C-Tech	87
DYNAMIC Technologies	75
Foss Warehouse Distributors	96
Greenleaf Electronics	57
I.E.S.	93
James' Electronic Services, Ltd.	72
KDE Electronics Corp.	71
Kimtronix	106
Metro Surplus	102
Modern Communications	103
Modern Electronics	108
New Company	94
Olymp Electronics & Video	105
One Stop Supplier	81
QB Video	94
Quality Direct Electronics, Inc.	97
Quality Electronics	81
Televue Distributors	56
Timeless Products	72
TL Electronics	97
Tornado Communications	94
White-Star Electronics	90
Wholesale Cable	76

CB/SCANNERS

Communications Electronics, Inc.	12
USI Corp.	11

CCD CAMERAS/VIDEO

Detection Dynamics	97
Polaris Industries	27
Ramsey Electronics, Inc.	32
Resources Un-Ltd.	21
Seabird Technical	97
Spy Outlet	96
Supercircuits	13
Timeline, Inc.	27
USI Corp.	11

COMPONENTS

Ace Computers	53
BCD Electro	96
Capital Electronics, Inc.	28, 37

Electronic Goldmine	15
Electronix Express	46
La Paz Electronics Int'l.	102
Linear Systems	13
MING	97
Skycraft Parts & Surplus, Inc.	106
Unicorn Electronics	63
Visitect, Inc.	47

COMPUTER

Hardware

Ace Computers	53
ACP Super Store	105
Allison Technology Corp.	47, 96
Alltech Electronics	30
AM Research, Inc.	7
Bisme Computers Outlet	39
Brick Wall Div., Price Wheeler Corp.	38
Consumertronics	35
Corporate Systems Center	2
Earth Computer Technologies	39
ELECTRO MAVIN	16
EPS	97
General Device Instruments	96
Halted Specialties Co.	3
Innovation West	96
La Paz Electronics Int'l.	102
Maxtron	38
Midwest Electronics	7
MING	97
Prime Electronic Components, Inc.	85
Roger's Systems Specialist	23
Shreve Systems	96
Techniks, Inc.	96

Software

AM Research, Inc.	7
Bisme Computers Outlet	39
Innovation West	96
Interactive Image Technologies, Ltd.	5
Pioneer Hill Software	62
Software Buy Mail	96

Microcontrollers / I/O Boards

Abacom Technologies	62
Advanced Educational Systems	76
AM Research, Inc.	7
Bisme Computer Outlet	39
EMAC, Inc.	26
Innovation West	96
ITU Technologies	97
La Paz Electronics Int'l.	102
Micromint	58
MING	97
Motron Electronics	29
National Control Devices	46
Parallax, Inc.	Back Cover
PARAMAX, INC.	93
Prairie Digital, Inc.	97
R.E. Smith	96
Scott Edwards Electronics	20
Solutions Cubed	20
Square 1 Electronics	26
Technological Arts	96
VersaTech Electronics	37

Printers/Printer Supplies

Chenesko Products, Inc.	39
H.T. Orr Computer Supplies	58

DESIGN/ENGINEERING SERVICES

Capital Electronics, Inc.	28, 37
Spectrum Research	97
V&V Mach. & Equipment, Inc.	96, 97

EDUCATION

Advanced Educational Systems	76
EMAC, Inc.	26
Sun Equipment Corporation	83

EVENTS/SHOWS

ACP Super Store	105
Trenton Computer Festival	45

KITS

Alltronics	110
C & S Sales, Inc.	31, 84
CARL'S ELECTRONICS	105
Earth Computer Technologies	39
Electronic Rainbow Ind., Inc.	66
EMAC, Inc.	26
Gateway Electronics, Inc.	82
Information Unlimited	55
Jade Products, Inc.	96
Ramsey Electronics, Inc.	32
Scott Edwards Electronics	20
USI Corp.	11
Weeder Technologies	36

LASERS

Information Unlimited	55
Resources Un-Ltd.	21
Unicorn Electronics	63

MISC./SURPLUS

All Electronics Corporation	95
Alltech Electronics	30
Brigar Electronics	54
C and H Sales Company	7
Consumertronics	35
Electronic Rainbow Ind., Inc.	66
Fair Radio Sales	71
Gateway Electronics, Inc.	82
General Science & Engineering	8
Halted Specialties Co.	3
Prime Electronic Components, Inc.	85
Resources Un-Ltd.	21
Shreve Systems	96
Skycraft Parts & Surplus, Inc.	106
Surplus Traders	96
Unicorn Electronics	63
Viking International	8
Visitect, Inc.	47
Weeder Technologies	36

PROGRAMMERS

Andromeda Research	6
General Device Instruments	96
Intronics, Inc.	106
M2L Electronics	58
microEngineering Labs	20
Sinaco Electronics	96

PUBLICATIONS

Antique Radio Classified	97
Consumertronics	35
Netcom	16
Square 1 Electronics	26
Synergetics	91

ROBOTICS

Abacom Technologies	62
PARAMAX, INC.	93
Solutions Cubed	20

SATELLITE

Baylin Publications	29
CARL'S ELECTRONICS	105
Maxtron	38

SECURITY

Gillian Technologies, Inc.	13
Information Unlimited	55
Polaris Industries	27
Street Smart Security	16
USI Corp.	11
Visitect, Inc.	47

SOLAR EQUIPMENT

Cruising Equipment	11
--------------------	----

STEPPER MOTORS

Alltronics	110
PARAMAX, INC.	93

TELEPHONE

Bilocon Corp.	97
Communications Electronics, Inc.	12
T.T.I.	97
Weeder Technologies	36

TEST EQUIPMENT

ABC Electronics	36
Alfa Electronics	86
Allison Technology Corp.	47, 96
ANA Instruments	71
AST Global Electronics	36
Bell Electronics	13
C & S Sales, Inc.	31, 84
C and H Sales Company	7
Cruising Equipment	11
Danbar Sales Company	22
Davilyn Corp.	8
Dexis	28, 97
Electro Tool, Inc.	11
Intronics, Inc.	106
Metric Equipment Sales, Inc.	38
Optoelectronics	111
Phelps Instruments	76
Pioneer Hill Software	62
R & S Surplus	63
RKA Systems	63
Seabird Technical	97
Sun Equipment Corporation	83
Test Equipment Plus	47
Western Test Systems	64-65

TOOLS

C & S Sales, Inc.	31, 84
Electro Tool, Inc.	11
Graymark	45
Intronics, Inc.	106
Sun Equipment Corporation	83
The RF Connection	76
Utopia Tools	13
White-Star Electronics	90

WIRE/CABLE & CONNECTORS

Manu Industries, Inc.	7
Roger's Systems Specialist	23
The RF Connection	76

MINI ISOLATION TRANSFORMER

Use for control circuits and other small-load equipment drawing 25 Watts or less. Step 240V down to 120V or 120V up to 240V, or use for 120V to 120V or 240V to 240V isolation. Split primary and secondary for versatility. 2" x 2.25" x 2.375". Wt. 1.5 lb. Signal P/N A41-25-230.

95N004 \$4.95 each

"T HUNT" TRANSMITTER

Good for "T Hunts," Beacon, CW, Rig, Telemetry experiments, etc. This one-Watt transmitter will operate from approx. 100 MHz to 150 MHz. 24 MHz crystal is included (may be tuned to harmonic). Assembled, with documentation. Must be modified to frequency of choice. Runs on 9VDC.

97K003 Only \$24.95 each

11-PIN SOCKET

98J001 \$1.49



11-PIN PLUG

98J002 \$1.49



BIPOLAR STEPPER ACTUATOR

12VDC @ 0.9A, 100s/rev, 3.6", with 2" x 0.25" lead screw. NEMA-17 size.

98M001 \$2.49 each



AC-DC METER

Scale calibrated to 24VDC and 240VAC. 10mA movement. Approximately 1.5 inches square.

98A002 \$2.95

MS DOS 5.0

3.5" diskettes, with manual.

97C048 \$4.95 each



V/H COAXIAL SWITCH

RLC Electronics No. 029-394707-004. 28 VDC, four SMA connectors, with pinout sheet.

96B001 \$90.00 each

24V 300mA MOTOR WITH FAN

1/8" x 1" shaft, 1-1/5" diameter x 2-1/4" long.

94M009 \$2.89 each



MAGNETIC CONTACTOR

Two poles, 600 VAC @ 30A contacts, 115 VAC coil. NEMA Size 1. GE P/N CR305K002.

98B004 \$19.95 each



LCD DISPLAY

1 Row, 8 characters, with backlight face 1-3/8" x 9/16". Standard 14-pin interface with pinout sheet.

97L001 \$7.95 each

SONY WALKMAN NiCd BATTERY

6V, 900mAh, 2.75" x 1.75" x 0.75". Part No. BP-MZ1. Sony list price \$79.95.

97E026 Our price \$19.95



ROTARY COAXIAL CABLE STRIPPER

For RG-58, RG-59, RG-62 type cables.

97Z025 \$9.95



CUTE LITTLE SUCKER

Mini-vac also works as a mini-blower. Runs on four AA batteries (not included). Accessories include dustbag, brush, crevice tool.

97Z028 \$5.99



UNIPOLAR STEPPER MOTOR DRIVER IC

UCN5804. Drives a unipolar stepper in one of three operating modes: single phase, two phase or half step. Up to 1.25 Amps per phase. Step and direction input. Drive with a 555 timer, parallel port, etc. Build your own robot, anything that requires precision positioning.

93I002 \$4.50 each

NIPPON PULSE MOTOR

7.5 deg./step, 48 s/rev, 5 V, stepper with brass gear mounted on shaft. NPM/P/N PF42-48ES. With spec sheet.

92M010 \$3.95 each

COMBO PACK!

One 93I002 IC and 92M010 motor (both shown above) with schematics.

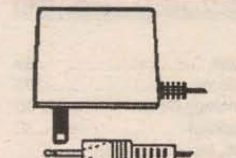
93I003 \$7.95/set



AIR VARIABLE CAP

30 - 1000 pF.

98P001 \$19.95 each



DIRECT PLUG-IN WALL WART

Input 120VAC, 60Hz, 16W. Output 12VAC @ 1A. Phone plug.

98E001 \$4.95 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



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



ATARI 1020 COLOR PRINTER

For all Atari 8-bit computers. (Not PC-compatible!) Package includes: printer, power supply, software, pens, paper and interface cable. These are new units in factory sealed boxes.

94C037 \$14.95 each



TV AUDIO DEMODULATOR

Unused unit from cable TV box takes channel 3, 4 or 5 signal and demodulates the audio. Comes with documentation and schematics, plus additional schematics to build add-on video demodulator board.

92A028 \$9.95 each



LOW LIGHT MINI TV CAMERA

I/R LED allows this camera to "see" in the dark. Element: 1/3" monochrome CCD. Lens: Fixed 3.5mm, f1.8. Field of view: 76° horiz., 55° vert. Automatic electronic iris. Resolution: 360 horiz., 420 vert. Illumination: Ambient light and/or I/R LED supplies additional light in low light conditions. Sensitivity: 0.1 lux @ f1.8. Video output: EIA std 75 Ohm 2:1 interlace. 1.0 Volt P/P composite video. Output connections: 7" video and power leads. Power: 12 VDC ±1V @ 150 mA. Size 2.125" x 2.5" x 1.2". Power supply included.

95V004 \$119.95 each

ROCKER SWITCH

European-style, DPST, 8A, 250V, mounts in 7/8" x 2" hole. Translucent amber switch.

97B026 \$1.25 each



9-PIN MINI DIN EXTENDER CABLE

9-pin mini-DIN M-F.

98W001 \$2.50



EXTRA BRIGHT RED LEDs

Flashing, T1-3/4 size, 750 mcd, 3-12VDC, water clear

SE5012G 69¢ each

• Extra bright, T1-3/4 size, 1000 mcd, 2VDC max at 45mA, water clear

SE5012H 59¢ each



'486 CLIP-ON HEAT SINK

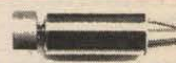
Will work on any 4.5cm PGA package. Plastic frame holds heatsink securely to CPU.

97C051 99¢ each

SUPER MINI MOTOR!

1.5 VDC @ 60 mA pager motor with counterweight. Size approx. 7/8" long by 1/4" diameter.

97M026 \$15.95 each



GENDER CHANGER

DB-9F to DB-9F.

98C002 \$1.85 each



INTRODUCTION TO AUDIO POWER AMPS

Kit uses discrete parts to construct a Class A and Class A/B power amplifier that delivers over a Watt into the supplied 8-Ohm speaker. Hands-on learning about bootstrapping, crossover distortion, push-pull outputs and complimentary pairs. Uses two 9V batteries. Terminal strips for inputs and outputs.

Kit 48 \$13.95 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

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



Send \$2.00 For Our Latest Catalog!
\$4.00 Foreign. Refundable on First Order.

010498

R11 TEST RECEIVER

.....
30MHz - 2GHz
.....

**Handheld
Receiver**



NEW PRODUCT SPOTLIGHT

Optoelectronics is pleased to introduce the all new R11 Nearfield FM Test Receiver. Capable of sweeping 30MHz - 2GHz in less than one second, the R11 can lock onto a 5 watt UHF signal as far away as 500 feet in less than one second, demodulate the signal through its built-in speaker, and display the general band the frequency is transmitting in on its LED indicator. The R11 Test Receiver presents all new performance, features, and capabilities.

Instruction Indicators:

LED's will illuminate which mode the R11 is configured for.

Built - in Speaker :

Instantly demodulate any receiver frequency between 30MHz - 2GHz (Cellular Blocked).

Power

Volume & Squelch Control Knobs

CI-V and Headphone jacks:

CI-V jack allows for connection to the Scout for Reaction Tune. The Headphone jack connection also allows for external speaker.

Frequency Band Indication:

Displays what band the received frequency is transmitting on.

Hold / Mute Button:

The Hold button allows the R11 to stay locked on the received signal.

Lockout / Lockouts on-off:

The R11 allows for 1000 user activated lockouts.

Shift / Off:

The Shift button controls all of the R11's secondary functions.

Skip / Clear Lockouts:

Press the Skip button to continue sweeping. Clear Lockouts will empty the lockout memory.



U.S. Patent No. 5,471,402

\$299

**MADE
IN
USA**

FACTORY DIRECT ORDER LINE: 800-327-5912

OPTOELECTRONICS®

5821 NE 14th Avenue • Ft. Lauderdale FL • 33334

Telephone: 954-771-2050 Fax 954-771-2052 Email: sales@optoelectronics.com

Visa • Mastercard • C.O.D. • Prices and Specifications are subject to change without notice or obligation.

Check Out Our Web Site: www.optoelectronics.com

This device 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.

Write in 124 on Reader Service Card.

PARALLAX

888.512.1024 (toll free)

916.624.8333

916.624.8003 fax

Monday-Friday 7 am to 5 pm PST

Tiny computers run PBASIC programs

BASIC Stamp® Modules

BS1-IC Module (#BS1-IC) \$34

8 I/O lines; 80 PBASIC instr max; 2000 instr/sec; 2400 baud serial I/O; 14-pin SIP module. PBASIC language with I/O instructions including BUTTON, HIGH, INPUT, LOW, OUTPUT, POT, PULSIN, PULSOUT, PWM, REVERSE, SERIN, SEROUT, SOUND, and TOGGLE.

BS2-IC Module (#BS2-IC) \$49

16 I/O lines; 500 PBASIC instr max; 4000 instr/sec; 50k baud serial I/O; 24-pin DIP module. Similar language as BS1-IC, plus DTMF, FREQOUT, SHIFTIN and SHIFTOUT, XOUT (X-10 powerline control), etc. I/O function have a higher resolution on the BS2-IC, due to its faster clock speed.

Starter Kits

BASIC Stamp I Starter Kit (#27205) \$99

BASIC Stamp II Starter Kit (#27203) \$149

Starter Kits include BS1-IC or BS2-IC module, carrier board w/prototype area & 9V battery clip, manual, application notes, software, and free tech support.

NEW! BASIC Stamp Activity Board (#27905) \$79

is used to learn and experiment with BS1-IC and BS2-IC modules. All components and current limit resistors are prewired to BASIC Stamp I/O pins. Board doubles as a "carrier board" with strip header access to I/O pins. Features include LEDs, pushbuttons, piezospeaker, an RC network for changing PWM into a smooth analog output, and an X-10 interface via RJ-11. Sample source code and power supply included!

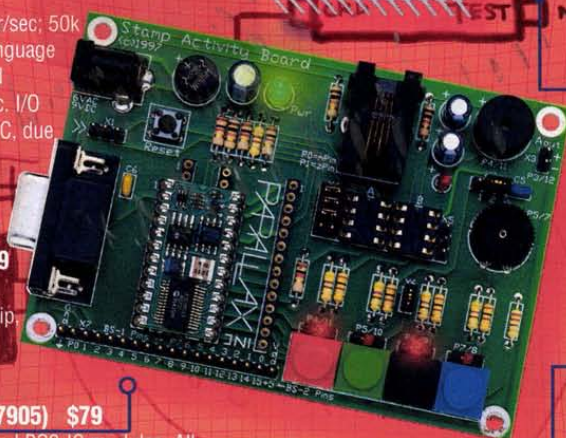
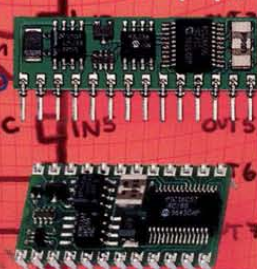
2-line x 16 character LCD Display (#27910) \$54

4-line x 20 character LCD Display (not shown #27919) \$109

Use the BASIC Stamp's SEROUT instruction (requires one I/O line, ground and power) to communicate with the Serial LCD display.



BASIC Stamps are small computers programmed in Parallax BASIC (PBASIC), a simple programming language with powerful I/O instructions. The Parallax web site (<http://www.parallaxinc.com>) provides free software, manuals, and application notes.



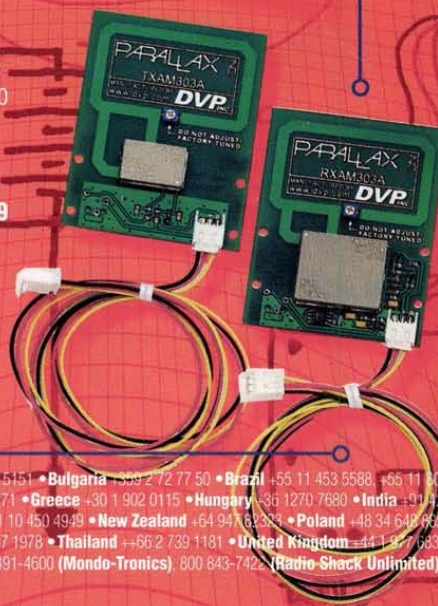
Using the PBASIC **HIGH** command and a 470 ohm resistor, BASIC Stamps can **electrify BLUE LEDs!** A stamper necessity! (#27355) \$8

BASIC Stamp Bug (#27922) \$129

(pictured above near Parallax Inc logo) The BASIC Stamp Bug is a walking robot with 6 legs that is controlled by the BASIC Stamp I interpreter chip. Antennas under the LED eyes attach to switches which detect obstacles and inform the robot to maneuver around them.

Wireless RF Modules (#27924) \$79

Designed by DVP and Parallax, these RF transmitter/receiver modules let you send RS-232 data (0-5 VDC) up to 1,000 feet away. Data transmission is most reliable with check sums and multiple string verification. Transmits at 303.825 MHz, a frequency reserved by the FCC for this type of use. The transmitter and receiver each have a 3-pin cable for connection to BASIC Stamp power, ground, and serial I/O pin. The optional power jack allows for a pluggable power solution if you don't want to use the included 3-pin cable for power.



• Australia +61 67 722 777 • +61 39 338 3306 • Austria +49 5232 6171 • Belgium +32 4 377 5151 • Bulgaria +359 2 72 77 50 • Brazil +55 11 453 5588 • +55 11 801 0045 • Canada (514) 336-9426 • Czech Republic +42 49 5813 252 • Finland +358 31 266 1885 • France +33 328 550 328 • Germany +49 5232 6171 • Greece +30 1 902 0115 • Hungary +36 1270 7680 • India +91 412 232 561 • Ireland +44 1 977 683 665 • +35 31 821 5060 • Israel +972 3 498 543 • Italy +39 0542 55400 • Japan +81 3 3251 1779 • Netherlands +31 10 450 4949 • New Zealand +64 947 61381 • Poland +48 34 642 662 • Slovak Republic +42 7 580 2574 • South Africa +27 11 493 6242 • Sweden +46 431 41 00 88 • Switzerland +49 241 918 900 • Taiwan +886 2 647 1978 • Thailand +66 2 739 1181 • United Kingdom +44 1 927 633 665 • United States 818 882-7621, 800 344-4539 (Digi-Key), 800 831-4242 (Jameco), 800 538-5000 (JDR), 800 652-6733 (Marlin P. Jones), 415 491-4600 (Mondo-Tronics), 800 843-7422 (Radio Shack Unlimited), 303 512-2060 (TechAmerica)

the Parallax Inc logo and BASIC Stamp are registered trademarks of Parallax Inc

Write in 194 on Reader Service Card.

NUTS & VOLTS MAGAZINE
430 PRINCELAND COURT
CORONA, CA 91719

CHANGE SERVICE REQUESTED

BULK RATE
U.S. POSTAGE
PAID
V.Q.S.
ENTERPRISES