

NUTS & VOLTS

M A G A Z I N E



\$3.50
VOL. 16 NO. 8
AUGUST 1995

Exploring Electronics And Technology For The Hobbyist And Professional

Among the interesting properties of light
is the fact that its speed changes
in different substances.

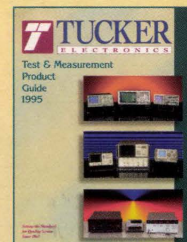
And we experimenters can actually . . .

MEASURE THE SPEED OF LIGHT

Electronics Safety
Expert PCB Prototyping
Use an IBM Mouse with Your Mac
Batteries: Playing Pinball with Atoms
Today's Electronics — Introduction to SMT
Build a Computer Controlled Linear Motion Table



Call, Write or Fax for Your Choice of FREE Catalogs! Radios, Test Equipment or Both...Your Choice

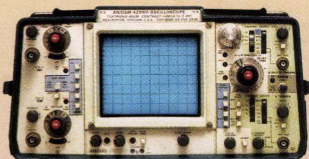


Protective Front Covers Available ... Only \$25!

Tektronix 465M
100 MHz Portable Oscilloscope

\$695

Why Pay Over
\$1200 For A
New 50 MHz
Or 60 MHz
Dual Trace
Oscilloscope,
When You Can
Own A
Tektronix 100 MHz Scope For Only \$695?



**Tucker
PRE-OWNED
Quality**

Here is your chance to own a version of one of the most popular oscilloscopes Tektronix ever made and at a price that everyone can afford! Tektronix built these instruments rugged, with ease of serviceability in mind. The 465M is a solid-state, dual channel, 100 MHz, delayed sweep, general purpose oscilloscope. Each of the two channels have a vertical range from 5 mV/div to 5 V/div (10 calibrated steps). The horizontal system ranges from 0.05 μ S/div to 0.5 S/div (22 calibrated steps) and delayed sweeps rates of 0.05 μ S/div to 50 mS/div (19 calibrated steps). A X10 magnifier expands each horizontal sweep rate to a maximum of 5 nS/div. An X-Y display mode is provided through vertical mode and horizontal sweep speed selection. Includes probes and manual. Ease-of-use, functionality, reliability, and ruggedness, this scope will provide years of service, order your 465M today!



An Incredible Deal ...

**A Complete System,
A New CRT, and
A New Low Price!**

**FULLY CALIBRATED
TO NIST SPECS.**

**Hewlett Packard 141T/8552B
Plus RF Plug-In of Your Choice!**

Spectrum Analyzer System

We've reduced the price on these fully calibrated, solid-state Spectrum Analyzer Systems and we're including BRAND NEW CRTs...all for about what a new CRT alone would cost! It's not just a great price with a new CRT, it's a great system too. It offers Variable Persistence Storage capabilities while providing absolute calibration of frequency and amplitude, high resolution and sensitivity, plus a wide dynamic range. Your system will include a Brand New CRT installed in an HP 141T Display Unit along with an 8552B IF section and your choice of either an 8553B or 8555A RF section. Many other plug-ins are available so when your requirements change, your Spectrum Analyzer can too! Call today while supplies last.



**Tucker
PRE-OWNED
Quality**

**Brand
New CRT**

**All Test Instruments
Include Manuals and
are Completely
Operational Unless
Otherwise Stated.**

**We Take
Trade-Ins!**

With 8555A RF Section ... \$2495

- Frequency Range: 0.01-18.0 GHz (w/internal mixer), 12.4-40.0 GHz (w/external mixer)
- Scan Width: 16 calibrated scan widths from 2 kHz/div to 200 MHz/div in a 2, 5, 10 sequence
- Bandwidth Range: selectable 3 dB bandwidths from 100 Hz to 300 kHz in a 1, 3, 10 sequence
- Measurement Range: -60 dBm to +10 dBm (Log ref. level); 0.1 μ V/div to 100 mV/div (Linear sensitivity)

With 8553B RF Section ... \$1995

- Frequency Range: 1 kHz to 110 MHz
- Scan Width: 18 calibrated scan widths from 20 Hz/div to 10 MHz/div in a 1, 2, 5 sequence
- Bandwidth Range: selectable 3 dB bandwidths from 10 Hz to 300 kHz in a 1, 3, 10 sequence
- Measurement Range: -130 dBm to +10 dBm (Log ref. level); 0.1 μ V/div to 100 mV/div (Linear sensitivity)

OPTOELECTRONICS GoldStar EXTECH BK PRECISION LEADER Protek WAVETEK HAMEG

RS-232C Optoelectronics 3000A Plus HandiCounter

\$349

Advanced hand held 10 Hz to 3 GHz counter with dual 50 Ω /1 M Ω input amplifiers. Measures Frequency, Period, Ratio, & Time Interval. Features high resolution/high speed counting, digital filter and digital auto capture for hands free recording, signal strength bargraph, RS-232C interface and 6+ hour battery operation. Antenna sold separately.

**TCXO Time
Base Option
\$100**



**FACTORY
NEW**

Optoelectronics 3300 HandiCounter

\$139

This pocket sized LCD Frequency Counter covers the range from 1 MHz to 2.8 GHz while providing ten digit resolution! The design of the Model 3300 makes it easy to use and the display has excellent viewing characteristics in both direct sunlight and indoors. The 3300 is

256 times faster than the older models and offers longer battery life. Only 3.7"H x 2.75"W x 1.2"D. Antenna sold separately.



**FACTORY
NEW**

Optoelectronics Scout 40 Frequency Scout

\$439

The Scout 40 can record up to 250 hits on each channel and store into memory 400 unique frequencies (10 MHz to 1.4 GHz). Features Digital Filter/Auto Capture and the ability to automatically Reaction Tune or Memory Tune many receivers. 10 digit LCD, EL backlight, and 16 segment signal strength bargraph. Includes NiCad batteries, AC adapter/charger and PC utility disk.



**FACTORY
NEW**

Optoelectronics R10 Communications Interceptor

\$359

Excellent for two-way communications tests, security, counter-surveillance and recreational communications monitoring applications. Covers 30-2000 MHz. Measures deviation (wide and narrow band), relative signal strength, signaling tones (CTCSS, DCS, and DTMF) using the companion DC440 Decoder or TC200 Tone Counter. Features pocket sized, demodulated audio output, and built-in speaker.



**FACTORY
NEW**

Radio Hotline: 800-559-7388

Call: 800-527-4642

**TUCKER
ELECTRONICS**

ALL ITEMS IN THIS AD

**30 DAY
NO RISK
GUARANTEE**

1717 Reserve Street
Garland, TX 75042
Local Call 214-348-8800

ALL PRE-OWNED ITEMS IN THIS AD

**SIX
MONTH
WARRANTY**

P.O. Box 551419
Dallas, TX 75355-1419
24-Hour Fax 214-348-0367

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!

Huge SCSI Hard Drive

- ◆ Fujitsu M2266S Full Height 5.25" Hard Drive
- ◆ 1.2 Gigabyte (1.08 GB Formatted)
- ◆ SCSI Interface (SCSI-II Capable)
- ◆ 14.5 ms avg. access time
- ◆ Great for File Server
- ◆ Looks like new, 90-day warranty

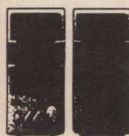


HSC# 15365

\$299.00

Multimedia Speakers

- ◆ Two styles to choose from, both new in box
- ◆ White plastic enclosures, grey grilles
- ◆ Econo-import model MSS-1000 has:
 - Volume control, Bass boost switch
 - Uses 3 C-cells per side, measures 3.5" x 3.5" x 5"
- ◆ CS-550 by Labtec (pictured below) has:
 - Volume control, Bass boost switch, Treble-boost switch, measures 4" x 4" x 6"
 - CS-550 has 40 - 16000 Hz freq. response, 3" speakers, and power light.
 - 4 watt amplifiers (uses 2 C-cells per side)
- ◆ Both feature magnetically shielded enclosures, "enhanced bass-response cabinet design", and attractive beige styling.



MSS-1000 HSC# 15127

Pair/ **\$6.95**

CS-550 HSC# 15517

Pair/ **\$9.95**

Dealer Inquiries Invited...

Quantity Discounts Available!

CD-ROM Specials!

- ◆ Tested Good CD-ROM Drives removed from systems
- ◆ 90-Day Warranty ◆ 2x and 3x Speeds available
- ◆ NEC Drives are standard SCSI 50-pin interface
- ◆ Phillips drives are proprietary 16-pin interface

Phillips CM-206 2X-Drive HSC#15366 **\$49.95**

NEC CDR-55JD 2X-Drive HSC# 15386 **\$99.00**

NEC CDR-510 3X-Drive HSC# 15327 **\$139.95**

HiFi Speaker Special!

- ◆ 40W Max, 20W RMS Woofer, 4Ω
- ◆ 5.5" dia. mounting, 1.7 lb. overall weight
- ◆ Black Injection-molded Graphite Cone
- ◆ Foam Suspension, Plastic Trim Ring
- ◆ Two-way Crossover Network with connection panel from same speaker system, freq. unknown



5.5" Woofer, new HSC# 15295 **\$9.95**

Crossover, new HSC# 15296 **\$3.95**

Laser Diode

- ◆ Toshiba TOLD-9200
- ◆ 3 to 4 mW at only 75 - 100mA of current!
- ◆ 670nm wavelength (visible red)
- ◆ Brand new prime
- ◆ Uncollimated, needs current regulation
- ◆ Application sheet with suggested circuit supplied



HSC# 15163 **\$17.95**

Handy Power Supplies

A) Switching power supply rated at 5VDC, 3A, Measures 2.75 x 3.25 x 5.25", IEC receptacle for universal (100 - 250VAC, 47 - 63 Hz) input, IEC cord not included, 6' Output cord with DIN plug
New in box, HSC#14996 **\$5.95**



B) Linear supply rated at 12VDC @ 1200 mA. Input is strapped for 240 VAC input, use as is with 110VAC for lower voltage output, or re-strap it for 110VAC use at 12VDC. Measures 2.5 x 4 x 6.5", IEC cord not included.
HSC# 14980 **\$5.95**

C) Standard 6' IEC power cord for use with above supplies, misc. colors & styles, used. HSC# 80119 **\$9.99**

D) Multi-output linear supply rated at 5VDC @ 600mA, +12VDC @ 250mA, -12VDC @ 250mA, 110VAC input, measures 2.5" x 3" x 4.75", generous 4' AC input cord, 5-pin DIN output cord, HSC# 15137 **\$14.95**

E) Same as "D" above, only 5VDC @ 500mA, +12VDC @ 1A
HSC# 15139 **\$9.95**

Network Cable Special

- ◆ Dual Workstation Installation Kit
- ◆ Two high-quality 10' RG-58 coax BNC cables
- ◆ Two BNC tee's
- ◆ Two BNC 50Ω terminators
- ◆ One BNC coupler
- ◆ Enough to cable two Thin-net workstations to the wall-plate distribution point

HSC# 14967

\$9.95

SCSI Disk Drive Case

- ◆ Low-profile case for 5.25" drives
- ◆ Perfect for lower-power drives
- ◆ 9.5" x 2.5" x 10.5" overall size
- ◆ 50-pin SCSI daisy-chain connectors
- ◆ Internal audio cable, RCA jacks on back, SCSI ID switch
- ◆ Uses External 15-16VDC, 1-2A Supply (Not Included)
- ◆ Internal Regulator board can deliver +5, +12 @ 1.5A



HSC# 15245 Low-Profile 5.25" Drive Case **\$17.95**

Digital Multimeter Deal!

- ◆ Low-cost Digital Multimeter with High-end Features!
- ◆ 3.5 Digit, case measures 2.75" x 5" x 1"
- ◆ DCV to 1KV, ACV to 750
- ◆ DC Current to 10A, Ohms to 2 Meg
- ◆ Diode, Transistor check with hFE
- ◆ Test Leads, 9V Battery included.
- ◆ Brand New, 90-day warranty



HSC# 80370

\$19.95

SCSI Controller times two!

- ◆ Adaptec 1542A 16-bit ISA Bus SCSI Controller
- ◆ 5MB/Sec Transfer Rate
- ◆ New OEM stock (no box) with book, 90-day warranty
- ◆ HSC#97775 **\$49.95**
- ◆ DTC 3292 16-bit EISA Bus SCSI & Floppy Controller
- ◆ 64K Cache, 4-Floppy Support (1.44 & 2.88)
- ◆ New in box with manual, ASPI Software, 90-day warranty
- ◆ HSC#15363 **\$25.00**

Computer Parts Specials!

- A. Western Digital WD1003V-MM1 MFM Disk Controller
 - ◆ New in box with inst. 16-Bit, No Floppy controller.
 - HSC# 15362 **\$9.95**
- B. HP Sketchpro Digitizing Tablet (Pad Only, no Pen)
 - ◆ 11" x 11" New in box, buy cursor from HP direct
 - HSC# 14739 **\$25.00**
- C. Prosonic 16 Sound Card with SCSI Controller
 - ◆ Soundblaster compatible, will control SCSI-CD-ROM's
 - HSC# 15531 **\$49.00**

Serial Smartswitch

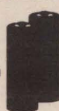
- ◆ Two computers can share one serial printer or plotter
- ◆ Automatically detects and switches to active line
- ◆ User-selectable Auto form-feed ensures each print job starts on new page
- ◆ Printer-ready light shows status at a glance
- ◆ X-on / X-off light show print job status
- ◆ External power supply, instructions included
- ◆ New in box, 90-day warranty

HSC# 15449

\$19.95

High Power AA NiCads!

- ◆ New Kenwood AA NiCad Batteries
- ◆ High quality, new, shrink-wrapped
- ◆ 1.2V at 800 mAh!
- ◆ Regular AA NiCads are only 300mAh
- ◆ Standard charge 15 hrs. @ 80mA
- ◆ Sorry, no quantity discounts



HSC# 15281

\$2.99 / pr.

Network Card Bargain!

- ◆ Racial Interlan 16-Bit Ethernet Cards
- ◆ High Quality Dual Interface, 10-Base-T or Coax
- ◆ Manual, Software, BNC tee included
- ◆ NE2100 Compatible, N16510 Compatible
- ◆ Handy 5-pack contains 5 cards, 1 Manual and 2-disk software pack)
- ◆ Summer Special -- New Lower Price!
- ◆ HSC# 15364 **\$99.95 / 5pk.**

386 CPU Special!

- ◆ Special deal on 25MHz 386 Processor / Oscillator Combo!
- ◆ Intel 80386DX-25 Chip (New, prime)
- ◆ Four-pin 50MHz Dip Oscillator for clock rate
- ◆ Use with Motherboard at right for bargain workstation!



HSC# 15375

\$9.95

386 Motherboard, CPU's

- ◆ "Baby AT" Size 386DX-33 Motherboard, no CPU
- ◆ 64K Cache included, SIMM Sockets for 8 modules
- ◆ On-board SIO, PIO ports, with Cables
- ◆ Chips & Technology Chipset, Co-processor Socket
- ◆ New in Box, with Book, 90-day Warranty
- ◆ Two speeds CPU chip avail. (see 25MHz combo at left)
- HSC# 15359 386DX Motherboard **\$24.95**
- HSC# 80357 386DX-33 CPU (Limited Avail.) **\$29.95**

Computer Case Close-out!

- ◆ Mini Tower Case (no power supply) 16.25" x 6.75" x 13.25"
- ◆ Hardware kit, stand, One 5.25" bay, two 3.5" bays
- ◆ Baby-AT style Desktop Case, 16.5" x 17" x 6.75"
- ◆ Hardware kit, 200W Power Supply, three 5.25 bays, two 3.5" bays. Both cases are new with 90 day warranty.
- Mini-Tower Case HSC# 15356 **\$19.95**
- Baby-AT Style Case HSC# 15355 **\$34.95**

Trackball for Mac!

- ◆ Mouse Systems A* Trackball for ADB-type Mac's
- ◆ "Three-button Power Control Panel" Software
- ◆ High Resolution (680 dpr) for smooth, fingertip operation
- ◆ 100% A/UX, MacX, X Window and Mac OS compatible
- ◆ Multi-mode operation: Standard or 3-Button Power
- ◆ Reassignable buttons for left- or right-handed use
- ◆ New in box with software, 90-day warranty

HSC# 15432

\$27.50

Remote Control for your Computer!

- ◆ Infrared Remote operates your computer from 50 feet
- ◆ Perfect for sales presentations, training, demonstrations
- ◆ Serial Interface (IBM version) or ADB (Mac version)
- ◆ Handheld remote is 7" x 2.5" x .5"
- ◆ Included software provides screen pointer for emphasis
- ◆ Keystroke mapping table can be customized, saved
- ◆ Roam the room, make eye contact with your audience
- ◆ Like using a TV set remote control (easy to set-up, use)
- HSC# 15240 IBM Remote Keyboard **\$29.95**
- HSC# 15241 Mac Remote Keyboard **\$39.95**



Digital Bathroom Scale

- ◆ General Electric Model EDS1B3 Digital Bathroom Scale
- ◆ Weighs from 25 to 299 lbs.
- ◆ LED Readout, attractive beige case
- ◆ Requires 9V Battery (Not Included)
- ◆ Easily adjustable offset for calibration
- ◆ Strain-gauge transducer and readout unit should be useful for many electronic "Hacker" applications



HSC# 15336

\$12.50

Easy File Transfers!

- ◆ SmartSync Software by Nomadic Systems
- ◆ Provides easy way to keep multiple computers in synch
- ◆ Fast and efficient, transfers only the changes
- ◆ Works with modems, cables or diskettes
- ◆ Automatically updates multiple files, single and multi-user
- ◆ Prevents accidental overwrites, can remotely copy

HSC# 15305

\$19.95

Tiny Trackball for DOS!

- ◆ Mouse Systems NewPoint Trackball for DOS/Windows
- ◆ Portable Trackball for the Laptop on the go!
- ◆ High Resolution in a small package
- ◆ 100% DOS and Windows compatible
- ◆ Mini-trackball with two buttons, ergonomic shape
- ◆ Clamps to keyboard, comes with padded carrying case
- ◆ New in box with software, 90-day warranty

HSC# 15433

\$19.95

HALTED
specialties co.

HSC Electronic Supply

Toll Free (Orders Only) 1-800-4 HALTED
For Internet-return e-mail, post mail to:
3500 Ryder St., Santa Clara, CA 95051
4837 Amber Ln., Sacramento, CA 95841
6819 Redwood Dr., Cotati, CA 94931

(1-800-442-5833)
HSC-Info@hsc.cue.com
(408) 732-1573
(916) 338-2545
(707) 792-2277
Fax your orders to:
(408) 732-6428



HSC now on Internet!

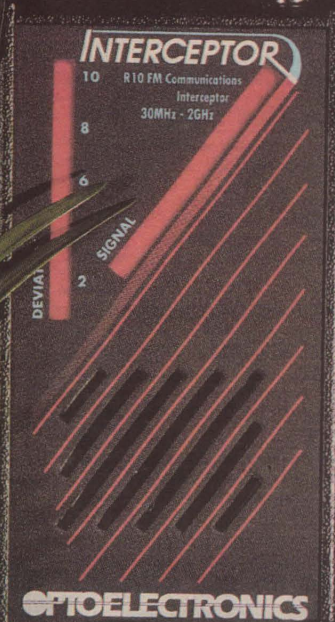
- ◆ Now you can request return e-mail from HSC!
- ◆ Simply send a posting to HSC-Info@hsc.cue.com
- ◆ Automatically receive an info package via return e-mail

To subscribe to our e-mail "Mailing list", send a posting to HSC-server@hsc.cue.com with the single line message:
SUBSCRIBE HSCmail <full name>
You will get future unsolicited mailings. You can "Unsubscribe" at any time in the same manner.

HSC-Info@hsc.cue.com

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 5PM PST.

YOU CAN'T HIDE



FROM THE INTERCEPTORS

The New and Improved Model R10 FM Communications Interceptor®

If RF security is a concern then the R10 Interceptor® may be the answer. FM signals just can't hide from the R10. It provides a shield of protection that no FM signal can penetrate without being detected.

The proprietary circuitry was developed exclusively by Optoelectronics. Thousands of customers including security professionals, radio technicians, and monitoring enthusiasts appreciate the near field capabilities of the R10.

For the first time since its introduction two years ago the R10 has been upgraded with a new high intensity bargraph LED display, a

low battery indicator and a delayed squelch. The new squelch circuit provides continuous reception of a signal during most multi-path drop outs. Now when used with our DC440 Decoder, Digital Coded Squelch codes can be checked as well as CTCSS Tones and DTMF Characters.

- Check deviation with 10KHz (1KHz step) or 100KHz (10KHz step) range.
- Check relative signal strength.
- Skip button lets R10 scan to next signal.
- Continuous 30MHz to 2GHz coverage in less than one second.
- Completely automatic with no tuning required.
- 400 foot pick up range from hand held radios. (Distance will vary with RF background.)
- Use built in speaker or earphone/headphones.

Model R20 Interceptor/Bug Detector AM Communications Interceptor®

The R20 is a compact RF signal strength detector with a 10 segment bargraph display. There is also an audio output from the detector that is processed for constant volume for use with ear phone.

The audio output is useful for room sweeps where in close proximity to a transmitter a quieting effect can be heard due to detector saturation.

Transmitters can be easily checked for output and AM modulation.

- The 10 segment LED bargraph responds to all RF signals with nominal 3dB increments
- Pocket sized with built in telescoping antenna.
- 9 Volt battery operation.
- Monitor Aircraft, CB, AM broadcast transmissions when close.
- Check Microwave oven leakage.
- Wide .5MHz - 3GHz+ frequency range.

OPTOELECTRONICS

Order Line: **1-800-327-5912** Fax 305-771-2052

305-771-2050 • 5821 NE 14 Avenue, Fort Lauderdale, FL 33334
Visa, Master Card, C.O.D., Cash or Money Order • Shipping Charges Additional.
All specifications & prices are subject to change without notice or obligation.



R10 checks coded squelch codes with DC440 Decoder

R10 FM Communications Interceptor®.....	\$359.
R20 AM Communications Interceptor®.....	\$119.
DC440 Decoder.....	\$259.
CX12 RS-232C Interface Converter (Interface DC440 to PC).....	\$ 89.

NUTS & VOLTS MAGAZINE

Published Monthly By
T & L Publications, Inc.
430 Princeland Court
Corona, CA 91719
(909) 371-8497
FAX (909) 371-3052
CompuServe ID# 74262,3664

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

Publisher
Jack Lemieux
N6ZTD

Editor
Larry Lemieux
KD6UWV

Managing Editor
Robin Lukasik
KD6UWS

On-The-Road Exhibit
Coordinator
Audrey Lemieux
N6VXW

Events Calendar
Shawn Vander Ploeg

Subscriptions
Natalie C. Sigafus

Classified Ads
Lisa Wharton

Copyright 1995
by T & L Publications, Inc.
All Rights Reserved

NOTICE TO ADVERTISERS

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 Princeland Court, Corona, CA 91719.

The closing date for each issue is the 10th of the prior month, e.g., the closing date for the June issue is May 10th. 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.

CONTENTS

ARTICLES

VOLUME 16 NO. 8 AUGUST 1995

GPS HANDHELDS WITH MAPS! <i>Gordon West</i>	9
The boater's inexpensive GPS receiver is just as much at home on land or in the car, as it is at sea. Get a sampling of what these sets can do.	
OVERLOOKED TEST EQUIPMENT:	
THE SOUND METER <i>Jim Ford</i>	14
Even if you aren't a stereo buff, there are several good reasons to have a sound meter.	
TODAY'S ELECTRONICS <i>Anthony Charlton</i>	34
Introduction to Surface Mount Technology.	
EXPERT PCB PROTOTYPING <i>Scott Edwards</i>	45
Yes, you can make double-sided circuit boards direct from your CAD program and laser printer!	
ELECTRIC CAR AERODYNAMICS <i>Shari Prange</i>	56
One of the dominant factors in electric car performance has nothing to do with the drive system — it's aerodynamic drag.	
BUILD A FUNCTION GENERATOR <i>Fred Blechman</i>	62
In building and testing electronic circuits, the FG-500 described here has endless applications.	
ELECTRONICS SAFETY — IT'S YOUR LIFE <i>Ronald Reis</i>	71
Stay safe while building, testing, and repairing electronic projects and devices.	
LINEAR MOTION TABLE <i>John Iovine</i>	76
Build a computer-controlled linear motion table by incorporating a dedicated integrated circuit to last month's stepper motor.	
BATTERIES: PLAYING PINBALL WITH ATOMS <i>Tim Hawkins</i>	108
To fully understand how a battery works, one must look at the merging of physics and chemistry.	
USE AN IBM MOUSE WITH YOUR MAC <i>Phillip Combs</i>	112
Comfortable interaction with a machine makes the experience pleasant. Convert your IBM-compatible's to add a better mouse to your Mac.	
BUILD A PASSIVE INFRARED MOTION SENSOR <i>George Babec</i>	125
Use this Pyroelectric detector in a myriad of applications.	

COLUMNS

AMATEUR ROBOTICS <i>Karl Lunt</i>	100
PP144Pro continued, shopping around, visiting MBARI, and good-byes.	
OPEN CHANNEL <i>Joseph J. Carr K4IPV</i>	117
Follow St. Brendan across the Atlantic . . . on two meters.	
RESOURCE BIN <i>Don Lancaster</i>	26
Electronic music then and now.	
SOFTWARE WIZARDRY <i>Harry Helms</i>	83
The ultimate multimedia development tool.	
STAMP APPLICATIONS <i>Scott Edwards</i>	132
Silicon steroids for the Stamp help your projects heft big loads.	
THE LASER EXPERIMENTER <i>Anthony Charlton</i>	17
The speed of light.	
THE SOLDERLESS BREADBOX <i>Don Wilcher</i>	135
Strain gauges and instrumentation amplifiers: Part 1.	

DEPARTMENTS

ADVERTISER'S INDEX	143
CLASSIFIED AD INFO	144
DEALER DIRECTORY	131
EVENTS CALENDAR	52
MONTH AT A GLANCE	142
NEW PRODUCT NEWS	40
NV ADMART	120
NV HAPPENINGS	7
READER FEEDBACK	6
TECH FORUM	92

To Subscribe to NUTS & VOLTS

Send payment to the address below or call 1-800-783-4624 and use your Visa or MasterCard.

MAILED THIRD CLASS — USA ONLY

\$19.00 — One Year

\$35.00 — Two Years

MAILED FIRST CLASS — ONE YEAR ONLY

\$50.00 — USA

\$50.00 — Canada/Mexico

\$100.00 — Foreign/Air Mail

\$50.00 — Foreign/Surface

Nuts & Volts Magazine, 430 Princeland Court, Corona, CA 91719

EDITORIAL CONTRIBUTIONS

Nuts & Volts Magazine encourages article submissions and queries. Send a SASE for a copy of our writer's guidelines.

All submissions should be on 5-1/4 or 3-1/2 inch diskettes and include hard copy as well. If return of materials is requested, include a SASE with your submission.

Deadlines should be discussed in advance with the editor, but generally all material should be submitted by the 1st of the month for the next month's issue.

CHANGE OF ADDRESS

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

Your magazine WILL NOT automatically be forwarded to you by the post office, so it's important to submit your change of address directly to Nuts & Volts.

We will not be able to replace missed issues of the magazine due to unreported address changes.

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

INDEX TO CLASSIFIED ADS

10. Ham Gear for Sale	7
20. Ham Gear Wanted	13
30. CB/Scanners	13
40. Music & Accessories	21
50. Computer Hardware	21
60. Computer Software	37
70. Computer Equipment Wanted	43
80. Test Equipment	51
85. Security	89
90. Satellite Equipment	90
95. Military Surplus Electronics	95
100. Audio/Video/Lasers	95
110. Cable TV	97
115. Telephone/Fax	105
120. Components	111
125. Microcontrollers	115
130. Antique Electronics	115
135. Aviation Electronics	116
140. Publications	116
145. Robotics	116
150. Plans/Kits/Schematics	116
155. Manuals/Schematics Wanted	123
160. Misc. Electronics For Sale	124
170. Misc. Electronics Wanted	129
175. BBS & Online Services	137
180. Education	137
190. Business Opportunities	137
200. Repairs/Services	138

reader FeedBack

Dear Nuts & Volts:

John Iovine's article "Using a Printer as a Chart Recorder," *Nuts & Volts*, Apr. '95, page 41, presents some interesting and useful ideas.

Since many users who have PCs will also have a spreadsheet program, modifying Mr. Iovine's program to produce a text file that can be imported into a spreadsheet may give readers more flexibility. Once the data is in the spreadsheet, it can be compared with other data collected and statistically analyzed, as well as charted and printed in a variety of ways. Here's a modification of Mr. Iovine's code to produce a text file:

The text file will have three comma delimited fields, event date, event time, and the event

count (Geiger counter clicks). Since there's no semicolon following the event count ("jn"), each event measured will be on a separate line.

Next, import "output.txt" into a spreadsheet program as a comma delimited text file. In Excel choose File\Open, click Text and select Comma as the column delimiter. Other spreadsheets have similar commands to import text files. If a spreadsheet program only accepts tab delimited text files, replace (",") with Chr\$(9).

I've attached a hard copy of a sample text file output and some Excel charts. Keep up the good work!

Noel Nyman
Seattle, WA

```
DIM FileName $
DIM EndTime AS Single
DIM TotalSampleTime AS INTEGER
DIM SampleTimeInSec AS INTEGER
DIM SamplesToTake AS INTEGER
DIM jn AS INTEGER
DIM i, b AS INTEGER
```

'to hold output file name and path
'target TIMER value to end loop
'total sample time in seconds
'sample length in seconds
'how many samples
'events being measured
'loop counters

```
FileName$ = "c:\temp\output.txt"
SampleTimeInSec = 600
'sample for 24 hrs, 60 min/hr, 60 sec/min
TotalSampleTime = 24 * 60 * 60
SamplesToTake = TotalSampleTime / SampleTimeInSec
```

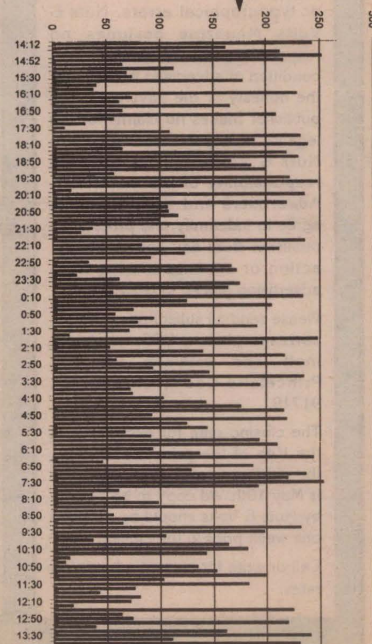
```
OPEN FileName FOR OUTPUT AS #1
FOR i = 0 TO SamplesToTake
    EndTime = TIMER + SampleTimeInSec
    jn = 0
    WHILE TIMER < EndTime
        STICK (0) > 10 THEN 'event occurred, add to count
            jn = jn + 1
            FOR b = 1 to 1500: NEXT
        END IF
    WEND
    PRINT #1, DATE$; ","; 'comma field delimiter, note trailing ;
    PRINT #1, TIME$; ","; 'comma field delimiter, note trailing ;
    PRINT #1, jn 'no trailing ;
```

```
NEXT
CLOSE
```

04-15-95, 14:12:27, 243	04-15-95, 18:10:27, 239	04-15-95, 22:10:27, 83	04-16-95, 02:10:27, 53	04-16-95, 06:10:27, 93	04-16-95, 10:10:27, 182
04-15-95, 14:22:27, 162	04-15-95, 18:20:27, 65	04-15-95, 22:20:27, 212	04-16-95, 02:20:27, 140	04-16-95, 06:20:27, 137	04-16-95, 10:20:27, 143
04-15-95, 14:32:27, 213	04-15-95, 18:30:27, 219	04-15-95, 22:30:27, 123	04-16-95, 02:30:27, 217	04-16-95, 06:30:27, 244	04-16-95, 10:30:27, 15
04-15-95, 14:42:27, 252	04-15-95, 18:40:27, 230	04-15-95, 22:40:27, 91	04-16-95, 02:40:27, 59	04-16-95, 06:40:27, 46	04-16-95, 10:40:27, 11
04-15-95, 14:52:27, 216	04-15-95, 18:50:27, 167	04-15-95, 22:50:27, 33	04-16-95, 02:50:27, 235	04-16-95, 06:50:27, 187	04-16-95, 10:50:27, 135
04-15-95, 15:00:27, 65	04-15-95, 19:00:27, 186	04-15-95, 23:00:27, 167	04-16-95, 03:00:27, 93	04-16-95, 07:00:27, 129	04-16-95, 11:00:27, 153
04-15-95, 15:10:27, 113	04-15-95, 19:10:27, 199	04-15-95, 23:10:27, 172	04-16-95, 03:10:27, 146	04-16-95, 07:10:27, 237	04-16-95, 11:10:27, 200
04-15-95, 15:20:27, 69	04-15-95, 19:20:27, 57	04-15-95, 23:20:27, 22	04-16-95, 03:20:27, 235	04-16-95, 07:20:27, 220	04-16-95, 11:20:27, 103
04-15-95, 15:30:27, 74	04-15-95, 19:30:27, 222	04-15-95, 23:30:27, 62	04-16-95, 03:30:27, 128	04-16-95, 07:30:27, 253	04-16-95, 11:30:27, 183
04-15-95, 15:40:27, 178	04-15-95, 19:40:27, 248	04-15-95, 23:40:27, 175	04-16-95, 03:40:27, 194	04-16-95, 07:40:27, 192	04-16-95, 11:40:27, 76
04-15-95, 15:50:27, 41	04-15-95, 19:50:27, 122	04-15-95, 23:50:27, 164	04-16-95, 03:50:27, 72	04-16-95, 07:50:27, 61	04-16-95, 12:50:27, 43
04-15-95, 16:00:27, 38	04-15-95, 20:00:27, 17	04-16-95, 00:00:27, 56	04-16-95, 04:00:27, 74	04-16-95, 08:00:27, 36	04-16-95, 12:00:27, 81
04-15-95, 16:10:27, 229	04-15-95, 20:10:27, 236	04-16-95, 00:10:27, 234	04-16-95, 04:10:27, 103	04-16-95, 08:10:27, 66	04-16-95, 12:10:27, 72
04-15-95, 16:20:27, 74	04-15-95, 20:20:27, 99	04-16-95, 00:20:27, 125	04-16-95, 04:20:27, 143	04-16-95, 08:20:27, 98	04-16-95, 12:20:27, 18
04-15-95, 16:30:27, 62	04-15-95, 20:30:27, 219	04-16-95, 00:30:27, 205	04-16-95, 04:30:27, 176	04-16-95, 08:30:27, 169	04-16-95, 12:30:27, 225
04-15-95, 16:40:27, 166	04-15-95, 20:40:27, 107	04-16-95, 00:40:27, 75	04-16-95, 04:40:27, 216	04-16-95, 08:40:27, 49	04-16-95, 12:40:27, 64
04-15-95, 16:50:27, 65	04-15-95, 20:50:27, 108	04-16-95, 00:50:27, 58	04-16-95, 04:50:27, 92	04-16-95, 08:50:27, 56	04-16-95, 12:50:27, 74
04-15-95, 17:00:27, 209	04-15-95, 21:00:27, 117	04-16-95, 01:00:27, 94	04-16-95, 05:00:27, 219	04-16-95, 09:00:27, 99	04-16-95, 13:00:27, 220
04-15-95, 17:10:27, 57	04-15-95, 21:10:27, 100	04-16-95, 01:10:27, 79	04-16-95, 05:10:27, 125	04-16-95, 09:10:27, 65	04-16-95, 13:10:27, 39
04-15-95, 17:20:27, 30	04-15-95, 21:20:27, 226	04-16-95, 01:20:27, 191	04-16-95, 05:20:27, 144	04-16-95, 09:20:27, 232	04-16-95, 13:20:27, 162
04-15-95, 17:30:27, 11	04-15-95, 21:30:27, 37	04-16-95, 01:30:27, 71	04-16-95, 05:30:27, 67	04-16-95, 09:30:27, 198	04-16-95, 13:30:27, 241
04-15-95, 17:40:27, 109	04-15-95, 21:40:27, 26	04-16-95, 01:40:27, 15	04-16-95, 05:40:27, 91	04-16-95, 09:40:27, 105	
04-15-95, 17:50:27, 232	04-15-95, 21:50:27, 123	04-16-95, 01:50:27, 248	04-16-95, 05:50:27, 193	04-16-95, 09:50:27, 37	
04-15-95, 18:00:27, 189	04-15-95, 22:00:27, 236	04-16-95, 02:00:27, 196	04-16-95, 06:00:27, 210	04-16-95, 10:00:27, 164	

Text file output from
QBASIC program

Excel Chart



CABLE TV

UNIVERSAL Descrambler
NEW PRODUCT



MODEL 5000 Fully Assembled \$199.95

Our fully assembled product is factory tested and **GUARANTEED** to work on your system. We will also include an AC power adaptor and complete hookup instructions. This unique product will be available for a limited time only!

4000 And 5000 Features

- The latest in Video Amplification Technology.
- New clocking circuits to stabilize color and the picture performance.
- The most advanced picture locking circuitry.
- Inverted Video Option is available.
- Connects easily to the VCR.
- NO CONVERTER BOX is necessary.

NO Florida Sales! Anyone implying theft of cable service will be denied assistance.

CALL THE HALCYON GROUP 1-800-664-6999

MODEL 4000 KIT \$79.95

The 4000 KIT comes with all the electronic components and our Cad designed PC board. We provide a schematic, parts list, wiring diagram, tutorial and FREE in-house support.

MODEL 4000A Enc. \$44.95

The 4000A Enclosure Package will provide the hobbyist, who has our 4000 Kit, a custom enclosure, AC adaptor and finish accessories to professionally enclose their kit.

HAM GEAR FOR SALE

10

RUSTRAK CHART recorder. Dual 0-100 0-100 UA. 4 recorder mounted on 19" RM panel. \$125. 818-989-3848.

PACKET FOR Commodore 64 users. Digicom modem wired, tested. Software and documents. \$49. Crawford Amateur Radio Society, PO Box 653, Meadville, PA 16335.

WANTED: ROCKWELL-Collins HF-8021 3KW Amp. Jim Stitzinger, 805-259-2011, fax 805-259-3830.

MANUALS FOR AMATEUR, AUDIO AND RADIO-RELATED EQUIPMENT. Lafayette, Drake, National, Hammarlund, Hallicrafters, Eico, etc. Quality is always our Number 1 customer priority. Catalog available. Send two \$.32 stamps to: Pete Markavage, The Manual Man, 27 Walling St., Sayreville, NJ 08872-1818. 908-238-8964.

SPECIAL ON CONNECTORS. Mike chassis mounts: 2, 3, 4 pins for \$1.75 each; 5, 6, 7 pins \$2; 8 pins \$2.25. Mike plugs 2, 3, 4 pins \$2 each; 6, 7, 8 pins \$2.75 each. Minimum order \$10. All orders FOB. Visa, MC, Discover and Amex cards accepted. Write to: Shalom Electronics, PO Box 1450, Loganville, GA 30249.

DAS 9200 system: 92A16 Data acquisition board; 92S16 Pattern generator; 2 megabyte memory board; 400K floppy drive; 21 megabyte hard drive; Serial Number is B011380. \$4,500. 818-989-3848.

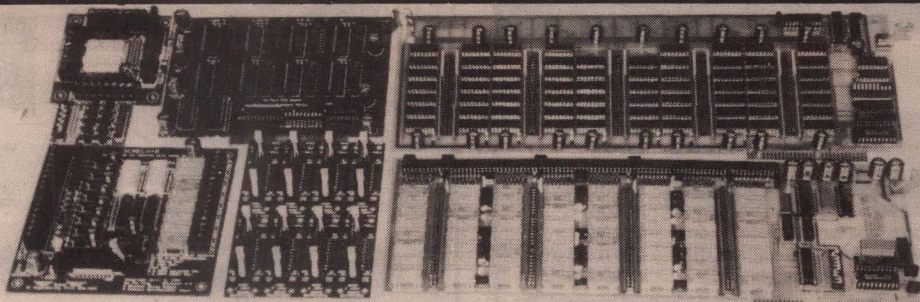


FREE HAM and IBM Shareware Catalog. Morse Code IBM Computer Interfaces use COM1 Serial Port \$49.95. Add \$3 shipping. IBM License Study Programs \$10. Over 700 IBM Shareware Collections (No Adults) \$2.95 each. Quantity discounts. No minimum order or shipping charges on shareware orders. Dynamic Electronics, Box 896, Hartselle, AL 35640, 205-773-2758, FAX 205-773-7295.

VISA

SUPERCHARGED I/O 1-800-546-2529

MASTERCARD



SCPIO16

128 Channel I/O Board

- FREE I/O Tester board when you buy SCPIO16
- Directly drive many popular Solid State Relays.
- Directly drive sensitive mechanical relays.
- Control many different types of devices.
- Monitor wide range of sensors & events.
- Interface to TTL, LS, HCT, ALS, AS, FCT, etc...
- Blows away performance of 8255 I/O boards.
- Outputs source & sink more current than 8255s.
- Powerful yet very inexpensive. With software.
- 16 Byte wide ports. 8 In + 8 Out. 1/2 card size.
- Sustained I/O > 500 K Bytes / Second.
- High noise immunity low load CMOS inputs.
- With power, ground, read & write strobes.
- Cards can share same space via extended I/O.
- Machine pin sockets make field repairs a snap.
- Silk screened, solder masked, & gold plated.
- See SCREWTERM, TERMACK, SCRELAY8

SCREWTERM

16 Channel Screw Terminal Board

- Directly interfaces to any port on SCPIO16.
- Supports 8 Input + 8 Output channels.
- LED Bargraph Displays monitor inputs & outputs.
- Screw terminals for all I/O, control & power lines.
- Termination resistors increase noise immunity.
- Fuse protected power lines.
- Screw terminal blocks socketed for quick release.
- Minimize your setup time.
- Reduce maintenance and repair costs.
- Saves many hours of building & wire wrapping.
- Shrouded Gold plated header with ejectors.
- Boards are Solder Masked & Silk Screened.
- I/O, Pwr, Gnd, Cntrl identified with legends.
- 3"x3" board with mounting holes & hardware.

TERMACK

128 Channel Termination Board

- Directly interfaces to SCPIO16
- Supports full set of 8 SCPIO16 cables.
- Supports 128 channels. 64 Input / 64 Output.
- 2 solder pads for ea. signal, control, & power line.
- Provides simple interface to Solid State Relays.
- Easy interface to many other devices.
- Simple interface to wide range of sensors.
- Saves many hours of building & wire wrapping.
- Shrouded Gold plated headers with ejectors.
- Boards are Solder Masked & Silk Screened.
- I/O, Pwr, Gnd, Cntrl identified with legends.
- Large solder pads with plated through holes.
- Wide dual signal traces increase reliability.
- Plenty of well spaced mounting holes.

SCRELAY64

64 Channel Relay Board

- 64 SPST 10VA 100 VDC 70 VAC 0.5 AMP relays.
- Use to drive solenoids, valves, relays, contactors.
- 16 Relays per 64 line gold plated header.
- 2 pins per relay line reduces resistance
- Independent A & B lines on all relays
- High density board reduces computer slots used.
- Sensitive relays minimize power consumption.
- Only 1.0 milliseconds to turn on/off relays.
- Long life relays (10,000,000 operations).
- Cards can share same space via extended I/O.
- Power on reset leaves relays open on power up.
- Uses 16 Byte wide ports. 8 Input + 8 Output.
- Full length PC AT form factor card for 8 bit slot.
- Input ports can read back state of any relay.
- Gold plated 64 line headers support 16 relays ea.
- Silk screened, solder masked, & gold plated.
- Includes manual and software.

SCPROBE

240 Channel Stimulus/Response

- Ideal to test cables, wire harnesses, PCBs
- Use for ATE, testing switch matrices & boxes.
- 240 Output paired with 240 Input channels.
- Use to stimulate any line
- Then monitoring all other lines for responses.
- Set port 0 to stimulate any 1 of 240 channels
- Set port 1 to monitor selected channel.
- Read port 0 to determine response.
- Then scan 1 to 240 channels for response.
- Multiple boards may be used in system.
- Open collector outputs with 5.1K pullups.
- Every output paired with an input channel
- Uses only 4 ports in PC I/O space.
- Full size fuse protected PC/AT form factor card.
- Gold plated 50 line headers. 48 signal+pwr/gnd.
- Machine pin sockets make field repairs a snap.
- Silk screened, solder masked, & gold plated.

Order 7 Days A Week 24 Hours A Day

SCPIO16	Sink/Source	Price
Standard	7.50 / 7.50 ma	168.00
Commercial	24.0 / 24.0 ma	189.00
Industrial	48.0 / 48.0 ma	229.00

SCPIO16 Accessories

Cable set	Eight 4' cables	32.00
SCRELAY8	8 optos + 8 rlys	129.00
TERMACK	8 hdrs / 128 chnls	35.00
SCREWTERM	1 hdr / 16 chnls	29.00

SCRELAY64	64 Relays	495.00
	32 Relays	295.00
	16 Relays	195.00

Cable set	Four 4' cables	59.00
SCPROBE	240 Channels	489.00
	192 Channels	429.00
	144 Channels	369.00
	96 Channels	299.00
	48 Channels	199.00

Cable set	Five 4' cables	59.00
SCMIDI16	128 Channels	295.00
Cable set	Eight 4' cables	32.00
IOTESTER	Leds&Switches	29.95

Shipping & Handling

Quantity Discounts Available

□ We send FAX data sheets & love FAX orders.

SCRELAY8

8 Optoisolators + 8 Relays

- Drive solenoids, valves, relays, & contactors.
- Monitor external events & power sources.
- Directly interface to any port on SCPIO16 board.
- 1500 V optically isolated inputs.
- SPST 10VA 100VDC 70VAC 0.5Amp relays.
- Sensitive relays minimize power consumption.
- LED Bargraphs display input & output status.
- Opto inputs monitor AC/DC 0..32 volt lines.
- Independent A & B lines on all relays
- Power on reset leaves relays open on power up.
- Fuse protected power lines.
- Supports use of optional external power supply.
- I/O, Pwr, Gnd, Cntrl identified with legends.
- 5"x5" board with mounting holes & hardware.

MIDI

SCMIDI16

MIDI

128 Line MIDI Digital I/O Board

- Control real world devices from MIDI systems.
- Turn 64 digital devices on/off as music plays.
- Accept commands from up to 64 digital inputs.
- FREE I/O Tester board when you buy SCMIDI16
- Accepts MIDI commands from MIDI controllers
- Programmable MIDI Channel number 1..16
- On board computer converts notes to Outputs
- On board computer converts inputs to Notes
- MIDI IN/OUT/THRU on 5 pin DIN connectors.
- Will drive any SCPIO16 accessory
- Uses same cables as SCPIO16
- Drives SCREWTERM, TERMACK, SCRELAY8
- Will drive upcoming light dimmer board.

SC Engineering 1961 E. Whittier Blvd La Habra, CA 90631-4131 (714) 870-4237 (Voice & FAX!)

Write in 180 on Reader Service Card.

NV Happenings

At Nuts & Volts, we get a ton of mail. There are many commonly asked questions and comments that we receive, but do not have the time or resources to answer individually. So, as space permits, we will try to do so here. Also, we will keep you up-to-date on policies, events, points-of-interest, and any other "happenings" or goings on around Nuts & Volts that we think you should be aware of.

E-Mail

As near as we can tell, E-Mail seems to be a fairly reliable way of sending or receiving correspondence. That is, if everything is working correctly. In our case, it wasn't. In the last two months or so, we have experienced some problems with our off-line navigator software and some messages were never received. The problem has been solved. However, if you sent us a message requiring an answer and never got one, try sending it again, you may have been one of the unlucky few.

We try to answer all mail within 2 to 3 days and check it every day at least once. Sending subscriptions, classified ads, tech forum Q&As,

or any other type of correspondence by E-Mail will usually result in faster processing. For orders requiring payment, you can send your Visa or M/C info along also. If you have a CompuServe account, we are told it is very secure, but not quite so over the Internet.

Reader Service

Many readers have asked why we don't have a "circle the number" type of reader service card like some other publications do. Well, we started out that way, and found that the majority of cards returned had 15 or less numbers circled on them. (Although, there were some people who circled every number on the card every month — even numbers that did not correspond to ANY ads.)

Also, our computer has only 25 input spaces, so if you circle more numbers (or write them in), we can only accept the first 25. That's why there are only 25 blanks. Also, it is harder to write in the wrong number by mistake, but easier to circle the wrong one.

Since it costs advertisers a great deal of time and expense to send material to you (and they're only doing it because they think you might buy something from them), we feel that this helps to weed out the literature collectors from the truly interested.

NV

GPS HANDHELDS WITH MAPS

Boater GPS navigation receivers are now available for under \$300.00 in most marine catalogs. Fixed mount for 12 volts DC, or handheld portables, \$279.00 is the price to beat.

What you get is a five-channel L1 carrier frequency receiver operating at 1,575.42 MHz for the C/A-code 50 bps navigation message. The message includes satellite clock correction data, data for that particular satellite, almanac data for the entire constellation, and a resulting readout of latitude and longitude that is good down to the radius of a 300-foot circle.

The relatively inexpensive civilian GPS receiver generates an internal duplicate of the C/A-code sequence, and shifts that code in time until it correlates with the received C/A-code at 1,575.42 MHz. The C/A-code is relatively short at 1,023 bits, and therefore a bit-by-bit search for correlation can be accomplished within a minute or two from turn-on. The correlation process can resolve the time of arrival (TOA) of the received signal to a fraction of the C/A-code's one microsecond bit.

After your little handheld or mobile unit locks onto the satellites, the position readout is updated every half second.

The boater's inexpensive GPS receiver is just as much at home on land or in the car, as it is at sea. Here is a sampling of what you can do with these inexpensive GPS sets:

- Real-time latitude and longitude position readouts.
- Rough altitude readout.
- 100+ programmable bench-

by Gordon West

marks with alphanumeric designators.

- Trip planning, individual routes with automatic reverse.
- Universal transmercatur (UTM) readouts for land hiking map applications.
- Miles range and magnetic bearing to any selected benchmark.
- Your speed in miles per hour.
- Estimated time of arrival.
- Cross-track error from beeline approach.
- Magnetic heading as you move.
- Benchmark search by name or number.
- Quick memo for emergency event location.

You are probably thinking that the inexpensive boating GPS sets may not be as accurate as more expensive hiker and aeronautical handheld and fixed units. Accuracy doesn't suffer with these under \$300.00 sets — only benchmark memory and features, a slightly smaller screen that must be viewed straight on, and a few bells and whistles that you could care less about on land than on the water.

GPS accuracy is within the radius of a 300-foot circle almost all of the time. It COULD be better, but the Defense Department strategically selects who could be available for reception of the more-precise L2 carrier frequency and Y-code at 1,227.6 MHz, encrypted as the P-code. It would take a tie-in with the Defense Department's government network to

run this type of equipment, and accuracy then improves down to the radius of a 75-foot circle. If the Defense Department should turn off selective availability by slight dithering of time on the satellite clocks, our C/A-code reception of the L1 carrier frequency would get us down to the radius of a 100-foot circle.

It's not that your inexpensive GPS set isn't accurate — the fact is the Department of Defense for security reasons denies routine accuracy of better than a 300-foot circle most of the time, or 150 feet at least half the time.

Mariners can tune into low-frequency 300 KHz-400 KHz differential stations operated by the U.S. Coast Guard for harbor approach navigation with accuracy exceeding a five-foot circle! But this low-frequency differential receiver is an add-on to a regular GPS set, and the reception of LF gets real marginal in downtown cities with high noise levels, and out of the question when you are more than 75

miles away from a local Coast Guard radio beacon differential transmitter.

You can pay extra for better accuracy by subscribing to the FM subcarrier reception of VHF differential signals — but this again requires a second receiver — not something you would carry in your back pocket. And the same thing with the proposed FAA wide-area correction signals — this too might require a secondary satellite receiver.

Differential reception for almost pinpoint accuracy revolves around a reference station looking at incoming L1 civilian GPS signals, computing the error caused by DOD selective availability, plus the errors caused by ionospheric and atmospheric refraction, and then sends out a local signal to upgrade the position down to just a few feet this way or that way.

For the time being, plan to live with 150-foot accuracy at least half the time. You'll like it.

But what are latitude and longitude readouts if you don't have a map to look them up? Mid-priced boaters GPS sets, around \$600.00, have track plotters to help you retrace your steps to get back to that parking spot or

GPS equipment is inexpensive and plentiful in the boater's marketplace.

Raytheon GPS handheld with map capabilities.

camp site when you're lost out there in the stadium parking lot or mountain trail. The track plotters can faithfully record your position in time or in distance, and give you a visual track on where you've been, and range and bearing on how to get back to the point where you started.

But better than that are two new boater GPS sets, priced under \$999.00, with on-screen mapping capabilities.

Raytheon Marine

Model: Raystar 198 GPS
46 River Road
Hudson, NH 03051
(603) 647-7530

Panasonic

Model: KX-G5700 GPS
1 Panasonic Way
Secaucus, NJ 07094
(201) 392-4222

Yes, I know there is Sony, but they haven't revealed to me details on their marine GPS sets with charts. And I recently spotted some of their equipment being blown-out by a national liquidator catalog which gives me the idea they may be coming up with a new model, or simply regrouping and analyzing the relatively small market there is in boater handheld charting GPS sets.

Both Panasonic and the Raytheon have their own built-in cartography of the United States. But the cartography only gets down to 64 miles, and this is not close enough to really be of help to you unless you're driving to the East Coast or West Coast and want to know about how much further it will be until

you hit the surf. But both the Raytheon and the Panasonic have provisions for uploading marine electronic charts that are filled with so much data that you could tell the names of the different pillings that are used in the narrow channel for navigation.

But for the time being, only marine details are found on these marine chart cartridges, so your local city map on a handheld GPS is still a few more months away. Indeed, you can get street maps on a GPS chart readout, but this is where the GPS is tied into a laptop computer that is reading the street atlas information from a CD-ROM or a gang of floppies. For the relatively inexpensive boater, portable GPS charting devices, you will need to settle with water cartography.

The Raytheon GPS receives its cartographic information from popular C-Map marine chart cartridges. C-Map, the company, is an authorized NOAA chart agent, selling paper charts to end-users. Updated C-Map

Consumers Are Ready to Go On-The-Road with Navigation Devices

When it comes to vehicle navigation devices, consumers are most interested in sending emergency distress signals, receiving directions, being shown a current location on a map, and tracking mileage information on trips according to a survey conducted by the Electronic Industries Association.

On a scale of 1 to 5, where 1 means Not Interested and 5 means Very interested, here are the responses when asked to indicate interest in functions a car navigation system could potentially provide. We have provided ranking based on average choice.

	Average
Sending emergency distress signals.	3.80
Showing your current position on a map.	3.14
Step-by-step directions to any location.	3.08
Mileage information on trips.	3.00
Receiving up-to-the-minute traffic information.	2.91
Reviews of restaurants and hotels.	2.85
Receiving messages.	2.52
Sending digital messages, like a pager.	2.37
Paying tolls automatically.	1.59
Info about businesses, like the yellow pages.	1.47

Survey respondents ranked the ability to send emergency distress signals first in interest. This makes sense as 83 percent of consumers join an auto club for emergency assistance services like roadside towing. Seventy-three percent believe it is necessary for their security.

A large number of survey respondents — 61 percent — are already aware of vehicle navigation systems which use a small TV-like screen mounted in the car to show electronic maps, provide directions to any address, or give information about restaurants, hotels, and other attractions. At least 20 percent of consumers are likely to invest in a car navigation system, if available.

Americans Are On-The-Road

Car navigation systems are one of the major benefits anticipated with the introduction of ITS. The survey indicates that there is an established base of U.S. drivers who would benefit from this feature. U.S. drivers like to take long car trips, and when they do, they rely on maps to get them where they are going. With 83 percent of Americans making at least one "road trip" of 100 miles or more each year, ITS products have a ready-made market. When they do travel, the typical driver — 64 percent — uses a road map to plan their route.

How many times a year do you make personal trips in your car where you travel at least 100 miles away from home?

56%	3 or more times per year
27%	1 or 2 times per year
6%	Every couple of years
11%	Rarely, if ever

When you travel long distances by car, do you typically use a road map to plan your route?

64%	Yes
35%	No

Methodology

The survey was conducted through the Electronics Industries Association's Consumer Electronics Group (EIA/CEG) Consumer Research Service by CEG and The CEG Mobile Electronics Division. The survey was designed by Market Research Department Staff.

The telephone survey was administered by The Verity Group, Inc., to 1,000 U.S. households. Calls were made using industry standard random-digit-dialing techniques from a representative random U.S. sample provided by Survey Sampling, Inc.

The complete survey on *Need & Acceptance of Consumer Navigation Devices* is available from EIA/CEG Market Research Department for \$2,000.00 each by sending a check or money order to: EIA Marketing Services Department, Attn: Survey Orders, 2500 Wilson Blvd., Arlington, VA 22201. Please indicate the name of the study in your request. The survey is free to EIA/CEG members.

EIA

EIA is the 71-year-old Arlington, VA-based trade association representing all facets of electronics manufacturing. EIA's Consumer Electronics Group represents U.S. manufacturers of audio, video, home office, and home automation products, mobile electronics, accessories, as well as assistive devices for people with disabilities.

Watertight battery compartment on Panasonic map GPS.

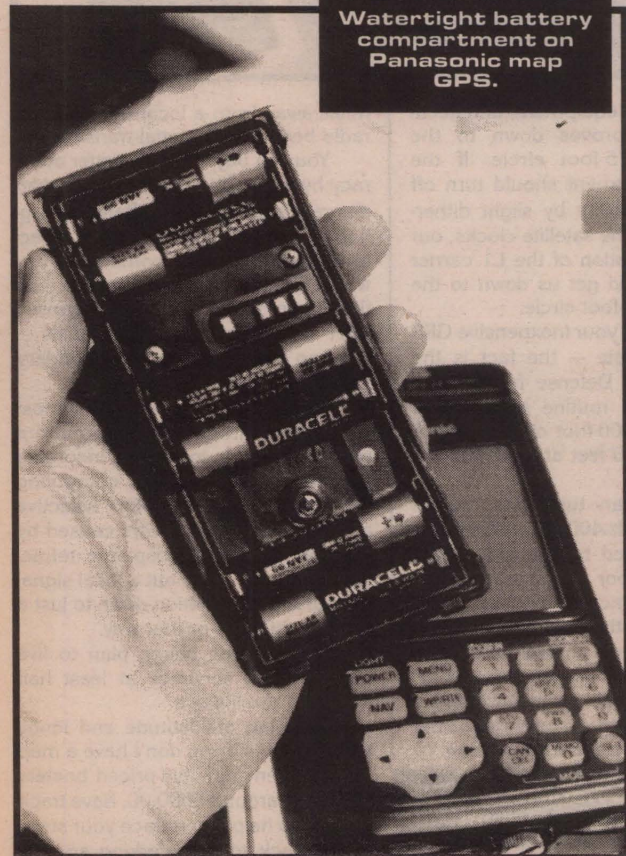


chart cartridges are traceable to the source, meaning that mariners can safely use the electronic chart in conjunction with the most current paper charts available to them.

One marine electronics manufacturer, Lowrance, is right now working closely with C-Map to come up with chart cartridges of popular lakes, rivers, and estuaries — including roadmap cartography that leads in and out of the popular boating area. Once C-Map gets through mapping inlet waters, they may take to the highways.

The Raytheon portable GPS set takes the cartographic information and stores it in memory for portable use. You get about 100 miles of coastline high-resolution detail. You will see land, but not streets or mapping contours.

The Panasonic unit runs the common PCMCIA card, and a company called Navionics has digitized all popular boating areas throughout the world with one chart cartridge hold-

ing hundreds of miles of cruising information. Another PCMCIA card system is available from Furuno, the most recognized name in marine electronics. While they don't have a portable GPS set, their "CDC" cards provide detailed cartography of coastlines and harbors around the world. But their PCMCIA card only works with their own exclusive Furuno equipment.

Both the Panasonic and Raytheon charting GPS sets are relatively waterproof. I gave both units a thorough hose-down, and both units survived. I would judge the Panasonic portable charting GPS set as slightly more susceptible to water damage because the Navionics PCMCIA card continuously stays inside the unit behind a trap door, and the trap door could leak if the unit were accidentally submerged. On the Raytheon set, the card stays behind, and the Raytheon equipment is completely sealed up against a quick submersion.

The Panasonic handheld charting

GPS unit runs about five hours on a set of six AA alkaline cells. The Raytheon equipment goes for about eight hours of continuous use. Both units have the plot mode, and during plot, battery consumption is less, giving you up to 14 hours of continuous operation. Of course, running these sets with their night light turned on will cut battery life about in half! Make sure the light is off during daylight hours!

Soon we will probably see both C-Map and Navionics come up with chart cartridges that will contain a road atlas and hiking topography. It wouldn't surprise me to see, by the end of this year, automobile associations selling digitized chart cartridges for selected cities, or a digitized chart cartridge of major highways for road warriors. I would see backpacking stores selling chart cartridges for hiking trails, streams, rivers, and topography contours.

In the aviation field, you can already buy chart cartridges that show NAV-aids, like VOR, plus airports.

Soon you will see tour guides sell chart cartridges that will illustrate points of interest in downtown cities. But manufacturers of GPS equipment will need to insure that their equipment will indeed be compatible with the type of cartridges being sold. This will be a year or two coming when it comes to compatibility.

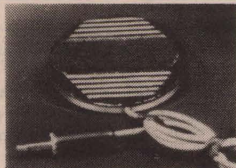
If you just can't wait, you can create your own framework of land cartography by developing checkpoints as you ride or walk along a route. You will see them as little dots on your screen; and if you connect the dots, you could even come up with roads. And, of course, after you go to all this trouble, someone will come up with a chart cartridge with all that information already on it.

If you're a boater, the system is available now. Check with Panasonic and Raytheon for their latest catalogs. Your contact at Raytheon is Kimmy Weeks, and at Panasonic your contact is Ken Walsh. Tell them Gordo sent you. **NV**

#10 HAM GEAR FOR SALE *cont.*

KIT BUILDERS! At last! Complete list of over 180 kit vendors. Send #10 SASE + \$3 to: Rutenber Engineering, 37220 Little Sycamore St., Palmdale, CA 93552.

HEWLETT PACKARD 3437A System volt-meter. \$225. HP 5005A Signature Multimeter \$300. 818-989-3848.



ATTN: LAW ENFORCEMENT, INVESTIGATORS, SECURITY, ATTORNEYS. Now you can turn your briefcase, desk, file cab. into a super sensitive microphone from the inside out with our latest hightech vacuum audio contact sensor. The most sensitive microphone in the world, NEW Model S-2204BM \$69.95. Security to monitor activity through walls simply attach sensor to a wall or place on the floor covers ten thousand ft. area. Now let your briefcase hear for your tape recorder in a lecture hall, vehicle, home, or office. It works so incredibly well that you literally won't believe your ears. Send check or MO to ILIADIS, add \$5 for shipping, FL residents add 6.50%. ILIADIS, 1760 Dibble Circle West, Jacksonville, FL 32246. 904-641-9942.

ANTENNA TUNER Collins 180L-3 with vacuum variable capacitor, motorized variable inductor \$100. List of test equipment available on request. 405-247-3480.

HEWLETT PACKARD 8011A Pulse generator. \$225. 8011A with burst generator \$265. Pulse generator. EH133A. 1Hz to 5MHz. \$225.818-989-3848.

HEWLETT PACKARD 3551A Transmission Set, rack mount. \$400. HP 3581 Wave Analyzer. \$400. 818-989-3848.

MILITARY RADIO equipment. SASE for list. Frank Moreland, 14788 Poway Mesa Dr., Poway, CA 92064.

REPEATER CONTROLLER on a chip \$24.95 + \$5 S/H. PC board available. Ambient Systems, POB 14183, Gainesville, FL 32604. 904-371-7694.

FOR SALE: 2KW antenna tuner by Cubic Communications, 160-10 meters, reduction drive, lighted power and SWR meters. Tektronics 453 dual trace, 50MHz oscilloscope with probes. Both excellent. \$200 each. Larry Steeno, K9LWI, 1838 Blue Spruce Court, Green Bay, WI 54311.

KENWOOD TS-690SAT, HF plus 6MI Built-in antenna tuner, International CW filter, SP-430 Speaker, PS-430 Supply, Mike, Books, Cartons, Fitted Zero Aluminum case, like new, \$1,100 plus shipping. Harvey, N6HL, 818-784-9501.

MOTOROLA RADIOS AND FACTORY PARTS & ACCESSORIES. UP TO 30% OFF LIST. PROGRAMMING ALSO AVAILABLE. STARCOMM, 1-800-590-0742.

HEWLETT PACKARD 5245L Frequency counter with 5262A time interval unit. \$225. 818-989-3848.

COLLINS REPAIR. Keep that real radio working in top order. We've worked on Collins gear for over 30 years and have the resources to keep your gear in good shape. We will consider buying old hulks of S line style gear, too. Contact: MARTRONICS, 4820 Deer Creek Way, Paso Robles, CA 93446. 805-239-1932.

HEWLETT PACKARD 6515A 0-1600 volt 0-5mA power supply. \$150. HP 6271B 0-60V 0-3A power supply. \$150. HP 6268B 0-40V 0-30A. \$650. 818-989-3848.

HOW-TO conversion books land mobile to ham, packet and repeater conversions. Most GE and Motorola radios some converted units available. VHF Micor-conversion kit. John Lansdell, 424 E. Shamrock, Rialto, CA 92376.

EIGHT STANDARD model 867 VHF transceivers, 30 watts output crystal controlled on 155.265 megacycle. Complete, A1 condition. One Force AM200, same condition & frequency. \$125 each or all for \$1,000. Nelson R. Lueking, 1601 Rock Road, De Soto, MO 63020. 314-586-2329.

JVFAX HAMCOM Interface xmit and rec includes shareware software JVFX 7.0 HAMCOM 3.0 Pakmon 1.0 Wefax, color ham fax, SSTV, CW, RTTY, Amtor, (Packet rec only). \$24.95, \$4.50 S&H in plastic case. Send #10 SASE for catalog. A&L Engineering, 741 E. Benton St., Aurora, IL 60505.

HEWLETT PACKARD 8016A Word generator. \$550. HP 334A distortion analyzer. \$450. 818-989-3848.

TEXSCAN BLOODHOUND Receiver FDM-2 and Transmitter FDM-1. Both pieces \$400. 818-989-3848.

Asset Sales

Used Equipment Outlet Center

Hewlett-Packard

7550 Plus 8 Pen Plotter Serial/Parallel Interfaces \$299.

3311A Function Generator 0.1Hz-1MHz \$299.

Tektronix

492A-22 Portable Spectrum Analyzer 50KHz-60GHz

\$8995.

7L18 Spectrum Analyzer Plug-in 1.5-60GHz

\$2995.

Fluke 73-II Multimeter

w/Test Leads \$65.

Retail Store Locations

& Hours:

California Retail Store

1190 Kern Ave.

Sunnyvale, CA 94086

Mon.-Sat. 10AM-6PM

Sunday 11AM-6PM

408-735-0657

Washington Retail Store

281 S.W. 41st St.

Renton, WA 98055

Thursdays Only 10AM-6PM

206-251-6653

RF Directional Wattmeters

"As-New"

Struthers Model 1219-D

50Ω, Frequency Range: 2MHz to 1GHz, Uses plug-in elements (3 included) 2-30MHz in ranges 0-50W, 0-100W, 0-500W, 0-1KW; 25-250MHz in ranges 0-10W, 0-50W, 0-100W, 0-500W; 200MHz-1GHz in ranges 0-10W, 0-50W, 0-100W, 0-500W; VSWR ≤ 1.08:1; Transit Case; Type N Connectors

\$199.

Visa • MasterCard

Order Desk Hours:

Mon.-Fri.

8:30AM-4:30PM

Looking for Test Equipment Manuals? Contact: Manuals Plus (206) 531-8031 Fax (206) 536-1121

Limited quantities available. All items subject to stock on hand. Ask about warranty details. Shipping and Handling will be added to all orders.

We Buy Used Test Equipment

(206) 251-6653 • Fax (415) 579-5777

Test Equipment

SURPLUS TEST EQUIPMENT

HEWLETT PACKARD

11664C, Detector	\$150
11678A, Low Pass Filter Kit	\$750
11713A, Attenuator Switch Driver	\$500
11720A, Pulse Modulator 118 GHz	\$1250
11975A, Amplifier, 2.0-8.0GHz	\$1500
1630A, Logic Analyzer	\$700
1630D, Logic Analyzer	\$800
1725A, 275 MHz Oscilloscope	\$500
1741A, 100 MHz Storage Oscilloscope	\$450
182T/8755C, Swept Amplitude Analyzer	\$850
3310A, Function Generator	\$250
3310B, Function Generator, .001Hz-5MHz	\$250
3312A, Function Generator	\$750
332A, Distortion Analyzer	\$150
334A, Distortion Analyzer	\$500
3400A, True RMS Voltmeter	\$200
3437A, High Speed Digital Voltmeter	\$250
3455A, Digital Voltmeter	\$500
3468B, 3.5 Digit Multimeter	\$250
3497A, Data Acquisition System	\$450
355C, Variable Attenuator	\$125
3570A, Tracking Receiver	\$600
3575A, Phase Gain Meter 1Hz-13MHz	\$1200
3580A/ANALOG, Spectrum Analyzer, 5Hz-50KHz	\$1200
3580A/LED, Spectrum Analyzer, 5Hz-50KHz	\$2000
3581A, Wave Analyzer	\$750
3581C, Selective Voltmeter	\$800
3582A, Spectrum Analyzer, .02Hz-25.5KHz	\$2500
4274A, LCR Meter, 100Hz-100KHz	\$4500
428B, DC Ammeter w/Probe	\$200
435A, Power Meter	\$250
435B, Power Meter	\$600
4800A, Vector Impedance Meter	\$800
489A, Amplifier, 1.0-2.0 GHz	\$100
491C, TWT Amplifier, 2-4GHz, 1 Watt, 30dB	\$350
495A, Amplifier, 7.0-12.4 GHz	\$150
5005B, Signal Analyzer	\$700
5254A, Frequency Converter, 3-3.0 GHz	\$100
5255A, Frequency Converter, 3-12.4 GHz	\$100
5256A, Frequency Converter, 3-18 GHz	\$100
5314A, Frequency Counter, 10Hz-100MHz	\$250
5315B, Universal Counter, DC-100MHz	\$300
5316A, Universal Counter, DC-100MHz	\$600
5328A, Universal Counter, DC-100 MHz	\$225
5328B, Universal Counter	\$2000
5335A, OPT, 10/20, Frequency Counter	\$1450
5340A, Frequency Counter, 10Hz-18GHz	\$1000
5341A, Counter, 10Hz-4.5GHz	\$500
5342A, Frequency Counter, 0.5-18GHz	\$2500
5345A, Frequency Counter Mainframe	\$650
6002A, Opt. 01, Power Supply, HP-IB, 0-50V/0-10A	\$800
6111A (HAR), Power Supply, 0-20V/0-1A	\$75
6114A, Precision Power Supply, 0-20V/0-2A	\$550
6227B, Dual Power Supply, 0-25V/0-2A	\$600
6260B, DC Power Supply, 0-10V, 0-100A	\$125
6284A (HAR), Power Supply, 0-20V/0-3A	\$450
652A, Test Oscillator, 10Hz-10MHz	\$200
7475A, 6 Pen Graphic Plotter	\$350
7550A, Plotter	\$300
8007B, Pulse Generator, 100MHz	\$550
8015A, Pulse Generator, 1Hz-50MHz	\$525
8082A, Pulse Generator, 250MHz, Dual Output	\$1000
8160A, Precision Pulse Generator, 50MHz	\$2500
8341A, Synthesized Sweeper, 10MHz-20GHz	\$17,500
8350A, Sweep Oscillator Mainframe	\$2500
8405A, Vector Voltmeter 1MHz-1GHz	\$2500
8410B, Network Analyzer System	\$600
w/8412A, 8743A & 8411A	\$250
8411A, Frequency Converter	\$250
8411A/018, Frequency Converter, .11 to 18GHz	\$500
8443A, Tracking Generator/Counter	\$350
8445B, Automatic Preselector	\$600
8447A, Amplifier, 0.1-400MHz	\$300
8447B, Amplifier, 0.4-1.3GHz	\$350
8447C, Amplifier, 30-300MHz	\$300
8505A, Network Analyzer	\$2500
8552B, IF Section Plug-in	\$600
8552B & 8553B, Spectrum Analyzer	\$1800
w/141T Mainframe	\$2250
8552B & 8555A, Spectrum Analyzer	\$2250
w/141T Mainframe calibrated w/manuals	\$2250
8554B, RF Plug-in, 500KHz-1250MHz	\$800
8557A/182T, Spectrum Analyzer .01-350MHz	\$1850
8559A W/182T, Spectrum Analyzer, 0.01-21GHz	\$4000
8565A, 10MHz-22GHz Spectrum Analyzer	\$6500
8569B, 10MHz-22GHz Spectrum Analyzer	\$6500
Microprocessor Based	\$6250
8614A, Signal Generator, 0.8-2.4GHz	\$300
86290A, RF Plug-in, 2-18 GHz	\$1800
86290B, RF Plug-in, 2-18.6GHz	\$2000
8640B, Signal Generator, 0.5-512MHz	\$1500
8640B, Signal Generator, Opt. 002, 5-1024MHz	\$2500
8654A, Signal Generator, 10-520MHz	\$650
8656A, Signal generator, 0.1-990MHz	\$2850
86601A, RF Plug-in, .01MHz-110MHz	\$350
86603A, RF Plug-in, 1-2600 MHz	\$1750
8660C Opt. 100, Signal Generator, 1-1300MHz	\$3000
w/86602B RF Plug-in & 86632A Mod. Plug-in	\$3000
8741A, Reflectometer Test Set	\$200
8743A, Reflection Test Unit, 2.0-12.4 GHz	\$100

8746B, S Parameter Test Set\$600

HUNDREDS OF POWER SUPPLYS IN STOCK. CALL FOR SPECS.

TEKTRONIX

1410, NTSC Generator, w/SPG1, TSG1, TSP1, TSG3, TSG5, TSG6	\$3000
176, High Current Test Fixture	\$800
2215, Oscilloscope, 60MHz	\$600
2235, 100MHz Oscilloscope	\$850
466, Storage Oscilloscope, 100MHz	\$800
466/DM44, Storage Oscilloscope, 100MHz	\$700
475, 200MHz Oscilloscope	\$650
475A, 250MHz Oscilloscope	\$800
492, Spectrum Analyzer Opt. 1, 2, 3	\$7500
w/Mixers to 40GHz	
494P, Programmable Spectrum Analyzer, 10KHz-21GHz	\$14,500
577 D2, Curve Tracer w/177 Fixture	\$1700
5A48, Dual Trace Amplifier, 50MHz	\$200
5L4N, Spectrum Analyzer, 20Hz-100KHz	\$950
7104, 1GHz Mainframe W/(2) 7A29, 7B10, 7B15	\$4500
7B54, Waveform Processing Oscilloscope	\$700
7904, Oscilloscope Mainframe, 500MHz	\$400
7904A, Oscilloscope Mainframe, 500MHz	\$600
7A13, Differential Amplifier	\$125
7A19, Dual Trace Amplifier, 600MHz	\$125
7A26, Dual Trace Amplifier, 200MHz	\$95
7B53, Dual Time Base	\$95
7B92A, Delaying Dual Time Base to 500MHz	\$250
7L12, Spectrum Analyzer, 0.1-1800MHz	\$1800
7L13, Spectrum Analyzer, 1KHz-1.8GHz	\$2250
7L14, Spectrum Analyzer, 10KHz-1.8GHz	\$3000
7L5, Spectrum Analyzer, 20Hz-5MHz	\$2500
w/Opt. L3/025	
AA5001, Programmable Distortion Analyzer	\$2000
DC5010, 350MHz Programmable Counter/Timer	\$1000
FG5010, Programmable 20MHz Function Gen.	\$1000
FG502, 11MHz Function Generator	\$300
FG504, Function Generator Plug-in, .001Hz-40MHz	\$850
FG507, 2MHz Function Generator	\$975
OF150, Fiber Optic Cable Tester	\$2500
P6042, Probe	\$300
PG501, Pulse Generator	\$275
PG508, Pulse Generator Plug-in, 50MHz	\$600
R2445, Rackmount O-scope, 150MHz, 4 Channel	\$1750
RT613, Storage Oscilloscope Mainframe, 100MHz	\$300
S-4, Sampling Head	\$250
S-52, Pulse Generator Head	\$550
S-6, Sampling Head	\$500
SC503, 10MHz Storage Oscilloscope Plug-in	\$650
SC504, 80MHz Oscilloscope Plug-in	\$650
SC504, 80MHz Oscilloscope Plug-in	\$500
SG5010, Programmable Oscillator	\$1500
TM506, 6 Slot Power Module	\$100
TR503, Tracking Generator for 492/4/5/6	\$1200

MISCELLANEOUS

Claroast 240C, Decade Resistor	\$100
Eaton 2052B, Amplifier, 100-512 MHz	\$1000
Eaton RT18A, Ratio-Trans	\$400
ESI 242B, Resistance Measuring System	\$2250
Fuke 335D, DC Voltage Standard	\$1250
Fuke 382A, Current Calibrator	\$1000
Fuke 510A, AC Reference Standard, 400Hz	\$550
Fuke 5101B/03, Calibrator	\$9000
Fuke 5200A, AC Voltage Calibrator	\$2250
Fuke 540B, Transfer Standard	\$1200
Fuke 6071A, Opt. 130, Signal Generator, 200KHz-1040MHz	\$3000
Fuke 732A, D.V. Reference Standard	\$2000
Fuke 752A, Reference Divider	\$3250
Fuke 8505A, 6.5 Digit Digital Multimeter	\$1000
Fuke 8506A, Digital Multimeter	\$2250
Fuke 8520A, Digital Multimeter	\$1000
Gen-Rad 1433P, Decade Resistor	\$300
PAR 5208, Two-Phase Lock-In Analyzer	\$2500
Valhalla 2701B, DC Calibrator	\$950
Wavetek 166, Pulse Function Generator	\$1200
Wavetek 178, Automatic Synthesizer	\$1850
Wavetek 186, Phase Lock Generator, 5MHz	\$400
Wavetek 3000, Signal Generator, 1-520MHz	\$900
Wavetek 3000-200, Signal Generator	\$900
Wavetek 3001, Signal Generator 1-520MHz	\$1100
Wavetek 3006, Signal Generator, 1KHz-520MHz	\$1200
Wavetek 801, Pulse Generator, 5Hz-50MHz	\$800
Wavetek 802, Pulse Generator, 5Hz-50MHz w/Delay	\$600
Wavetek 8501, Peak Pwr Meter 30MHz-40GHz	\$2250
Wavetek 859, Prog. Pulse Gen., 5Hz-50MHz	\$1500
Wavetek 907A, Signal Generator, 7-12.4 GHz	\$850
Wiltron 560, Scalar Network Analyzer	\$650
Wiltron 6640, Sweep Generator, 26.5-40.0GHz	\$2500

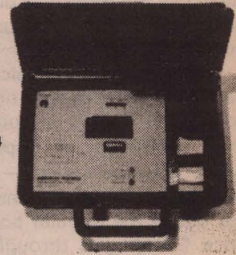
R & S Surplus

1050 E. CYPRESS STREET, COVINA, CA 91724

(818) 967-0846 • FAX (818) 967-1999



EPROM+ PROGRAMMING SYSTEM USES PARALLEL PORT



EPROMS (UV & FLASH) (24, 28, 32, 40* PIN PLUS 27C, 29C, 28F & 29F) 1702*, 2708, TMS2716*, 2716, 32, 32A, 64, 64A, 128, 128A, 256, 512, 513, 01, 010, 101 1001, 1000, 1024, 210, 020, 2001, 220, 2048, 4001, 040, 080, 240, 4096, 2516, 32, 64, 6876A EEPROMS AND NVRAMS (18, 24 & 28 PIN PLUS CXXX) X2210, 2212 2804, 2816, 2816A, 2817, 2864, 2865, 28C256, 28C010, DS12XX

SERIAL EEPROMS* (8 & 14 PIN PLUS CXX) ER1400, M58657, 2401, 02 04, 08, 16, 32, 65, 2444, 59C11, 80011A, 8572, 82, 92, 9306, 46, 56, 66, 16811, 16911 **BIPOLAR PROMS*** (16 THROUGH 24 PIN) 74SXXX, 82SXXX FAMILY **MICROCONTROLLERS*** (UV, EE AND FLASH) 8741, 42, 48, 48H, 49, 49H 8751, 87C51, 52, 87C5XXX, 87C751, 752, 89C51, 52, 68705, 68HC705, 68HC711E9 TMS742, PIC16C5X, PIC16C6X, PIC16C7X, PIC16C8X

*ADAPTER REQUIRED - DIAGRAMS INCLUDED IN MANUAL

- SOFTWARE - READ, VERIFY, PROGRAM, COPY, DISK FILE LOAD & SAVE, CHECKSUM, FULL SCREEN BUFFER EDITOR W/20 CMDS
- READS INTEL HEX, MOTOROLA S-RECORD AND BINARY FILES
- FAST-MOST DEVICES PROGRAM IN UNDER 20 SECONDS
- RUGGED (9" X 6" X 3") PORTABLE ENCLOSURE W/CARRY HANDLE
- MADE IN THE USA - 30 DAY MONEY BACK GUARANTEE
- SYSTEM INCLUDES: PROGRAMMING UNIT, PRINTED MANUAL, PRINTER PORT CABLE, POWER PACK AND SOFTWARE

\$289

ADD \$5.00 SHIPPING
\$5.00 COD
VISA / MASTERCARD

ANDROMEDA RESEARCH, P.O. BOX 222, MILFORD, OHIO 45150
(513) 831-9708 FAX (513) 831-7562

WHOLESALE FLEAMARKET merchandise directory. 60 pages, hundreds of distributors listed that you may contact who supply fleamarket/swapmeet dealers. All kinds of items, incredible prices! Electronics too! Useful for business or personal use. \$12. JACOMM-HG, Box 142, Wharton, NJ 07885-0142.

HAM LICENSE PLATE KEY TAGS. Call sign engraved. All states available \$4 each, includes S&H. Geniac Technologies, Inc., 8105 NW 33rd Street, Miami FL 33122. Attn: Key Tags. Phone; 305-599-7384.

TEST RECEIVERS. Stodart NM25T, radio interference and field intensity meter, \$1,200, offers. Poarad Test Receiver, ESH-2, all modes 9KHz-32MHz. Offers, all working in excellent condition. Psitech Plus, 707-745-4804, fax 707-747-5277.

POWER INVERTERS 10, 5 to 16.5 VDC in, 115VAC True RMS \pm 5% out @ 60Hz, modified sinewave, 90% efficiency, 2 yr. warranty. 100 watt (800W surge) \$89, 400 watt (3000W surge) \$289, 700 watt (3000W surge) \$369, 1,300 watt (6000W surge) \$569. Dexis Corp., 612-944-7670.

FREE! THE ETC Catalog of Manuals for amateur, audio & test equipment. A.G. Tannenbaum, Box 386, Ambler, PA 19002. 215-540-8055, FAX 215-540-8327.

FOR SALE: Sun Air 100 watt exciter model GSE-924. LSB, USB, ISB, AM, CW 1Hz 29.9999MHz, 300,000 channels! Ready for operation \$550 OBO. 805-542-9574, leave message.

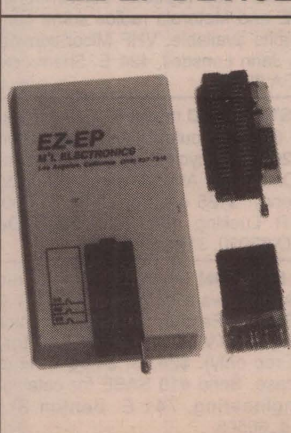
TEKTRONIX 465 Oscilloscope. 100MHz, dual trace delayed sweep, calibrated. \$400. 818-989-3848.

PROGRAMMABLE COUNTER. Works with ANY VFO rig! Get a digital display for your rig, 100Hz resolution. You can read the tuned frequency directly, no need to calculate offsets. Counts to 40MHz, up OR down. Counter Kit \$69.95. Kit w/case \$99.95 Assembled w/case, \$139.95. S&H \$6 (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.

YAESU 757GX all mode HF transceiver, like new, extras, \$599. 10CV/67 WW2 microwave tube, NIB, make offer. Will buy or trade WW2 and/or RCA aircraft radios. Ken Gillis, 27217 Garden Way, Franklin, MI 48025. 810-851-3240.

REPEATER CONTROLLERS: Assembled MPU board with interface boardkit. All parts and cables included, \$125. FCC approved autopatch. Dialing tones regenerated, direct dial 911 and user programmed 7 digit no. Reverse patch. Toll restrict or allow. Call, times, and codes RS-232 programmable data in EEPROM. Cwid, beep, antikerchunk, hang, timeout, commercial or ham ID time, 2 user output bits, tone output for bulletin board activate or paging. Beep same as ID or different tone. Audio ALC on Rec. & phone. Xmit, patch, reverse patch, & 911 remotely disableable. Tom, W8SBD, 209 Dawson St., Mason, OH 45040. 513-398-1516.

EZ-EP DEVICE PROGRAMMER - \$149.95



INEXPENSIVE - Best programmer under \$200.
PORTABLE - Attaches to PC parallel port.
FAST - Programs 27C010 in 23 seconds.

VERSATILE - Supports devices 2716 thru 27080 plus EE and Flash to 32 pins. Reads and writes binary, ASCII hex, Intel Hex, and Motorola S formats.

SERVICE - Information and software updates via BBS or voice. 30 day money back guarantee.

ADAPTERS for additional devices are available.

EP-51 (8751,C51)	\$39.95	EP-PIC (16C5X,71,84)	\$49.95
EP-SOIC28	\$49.95	EP-SEE (24xx,93xx Serial EE)	\$34.95
EP-11 (68HC11)	\$59.95	EP-16 (16bit EPROMs)	\$49.95
EP-55 (8755)	\$39.95	EP-49 (8741,42,48,49)	\$49.95
EP-PLCC32	\$49.95	EP-PEEL (18v8,20g10,22v10)	\$59.95

M2L ELECTRONICS

3526 Jasmine, Suite #4

Los Angeles, CA 90034

CA orders add 8.25% sales tax. Ground Shipping - \$5.00 3 Day - \$7.00 2nd Day Air - \$10.00 Overnight - \$15.00 COD \$4.50

310/837-7818

Voice: 9AM - 1PM M-S

BBS/FAX: other hours

TEKTRONIX TM504 4-slot module power supply \$150. TEK TM501 1 slot. \$125. 818-989-3848.



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 \$5 per unit shipping. MC/VISA accepted. A&A Engineering, 2521 W. La Palma #K, Anaheim, CA 92801. 714-952-2114.

FREE ELECTRONICS CATALOG. Quality parts at surplus prices. All new, never used distributor and OEM overstocks. Call IME, 817-473-1730 or write PO Box 170415, Arlington, TX 76003.

THERMOTRON PRODUCT Saver. Protect -125 to +375 degrees F. \$150. 818-989-3848.



LARGE LED CLOCK! 2.50 inch digits. Unusually attractive, eye-catching! KIT or assembled. **FREE CATALOG!** Whiterook Products, 309 South Brookshire, Ventura, CA 93003-4413. 805-339-0702.

AN/GRC-142C Radio Teletype sets shelters incomplete sets, fit on pick-up truck beds, many available. Call or write Dave Martin WA6TYJ, 805-239-1932, 4820 Deer Creek Way, Paso Robles, CA 93446.

LOW PRICED quality two way gear GE mstr 2 40W VHF or 42-50MHz w/acc \$35. Deltas LB \$150 EX2 mobile extender VHF \$100. For list call, 909-873-1319 or FAX 909-820-1885. Write: John Lansdell, 424 E. Shamrock, Rialto, CA 92376.

UNHOLZ DICKIE D11 Charge amplifier. 4 available. \$100 ea. More Unholz available. 818-989-3848.

YAGI ANTENNAS for 100MHz to 1GHz, custom made up to 12 elements. For prices and information call or write Dave Martin WA6TYJ, 805-239-1932, 4820 Deer Creek Way, Paso Robles, CA 93446.

LAMBDA POWER Supplies. Call with your specification. We have many available \$25 and up. 818-989-3848.

LOW PRICED quality two way gear. Mot Mitrec VHF 45W w/Mocom 70 acc \$50. VHF ham cut Syntor 45W PL w/acc \$100. VHF SyntorX 45W 32 ch PL w/acc \$200. Much more. For list call, 909-873-1319 or FAX 909-820-1885, or write: John Lansdell, 424 E. Shamrock, Rialto, CA 92376.

HEWLETT PACKARD 333A distortion analyzer \$400. HP 334A distortion analyzer \$550. 818-989-3848.

HAM GEAR WANTED

20

WANTED: SQUIRES sanders SS1BS, SS1RS, SS1V, SS1S, Eddystone 850/4. Weber, 4845 W. 107th St., Oak Lawn, IL 60453.

MOTOROLA EXPO: Walkie Talkies wanted. UHF/DPL or PL. Must be in good working condition. Chargers needed also. Call/FAX, Dan, 301-428-9076.

I WANT it and I want it now. I want all of your SIMM memory. IBM, Mac, new, used, even defective. I want it all. Highest \$ paid. Call 1-800-4-MEMORY now! Voice/FAX.

WANTED: BRAINSTORM Engineering 2nd. RX board for SR-4 repeater controller to make repeater full duplex. Harry Binder, PO Box 35657, Fayetteville, NC 28303.

ICOM R-100, R-7000, 7100, 9000 or R-1 receiver with cell band used. Call Les, 702-642-0325.

CB - SCANNERS

30

WANTED: ESN reader by Curtis or other similar model. Call Tony, 415-493-8148.

CRAZY BOB'S

Lowest Prices - Fastest Service



Only
\$19

Internet Access is the only Internet CD to include Tutorials, Tools, Information Files, & Navigational Aids. The 1995 version now includes Mosaic, Cello, and Winamp internet access programs and the 1995 Internet Guide

2 CD Set
Only
\$19



Games To Treasure is the action packed, two CD set filled with arcade hits, flight simulators, board games, crosswords, cheats, card games and much more. Dare to take the challenge!



Only
\$15

Ham Radio + now includes the Amateur Radio Call Sign Directory, Mail List Down Loading, Packet Radio, Frequency Lists, Equipment Mods, FCC Regulations, Exam study, SSTV, FAX, CW Practice, Plus lots More! This is the most comprehensive Ham Radio resource ever published!

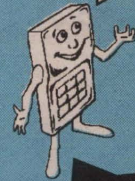
EnviroMedia Preformatted HD
3.5" Floppy Disks
as low as \$.24

Hundreds of CD Titles
Call Today for Free Catalog!
800-410-BOBS (2627)
email to nutvolt@crazybob.com



50 New Salem St.
Wakefield, MA 01880
Tel 617-246-6767
Fax 617-246-6776

WE BUY!!!



**NEW
or
USED!**

**CABLE
EQUIPMENT!**

- We Buy All Types U.S. Systems
- Offers of 200 Pieces Or More
- **CALL TODAY!**

1 402 392-2284

FAX: 1 402 392-0991

Ask For Purchasing...
and
Let's Deal!!

Write in 42 on Reader Service Card.

Low cost Microcontroller Development System

80C552 (8051 core processor) 8 channel 10-bit A/D, PWM, 32K ROM, 64K RAM, RS-232, 24 more I/O, \$120 each SBC, optional 40x2 LCD \$20. Complete development system (add \$70) features assembler, real time execution and debugging, monitor program, examples, and more.

68HC11 8 channel 8-bit A/D, 32K ROM, 32K RAM, RS-232, 24 more I/O, \$120 each SBC. Development software \$70 more. Other CPU development systems and custom design are also available.

Universal Microprocessor Simulator/Debugger V2.1

Simulates popular 8-bit CPUs. Includes Assembler, Disassembler, Simulator/Debugger, and more functions, \$100 each CPU.

ROMY-16 EPROM EMULATOR

Emulates ROM or RAM in 8- and 16-bit systems. \$195 (2716-27256) or \$245 (2716-27010). Window/menu driven interface. 90 day warranty. 15 day money-back guarantee. Optional assembler, disassembler, ROM-debugger \$100 each CPU.

J&M Microtek, Inc.

83 Seaman Road, W Orange, NJ 07052
Tel: 201-325-1892 Fax: 201-736-4567

Write in 27 on Reader Service Card.

SUPER CABLE TV TURN-ON MODULES

CUSTOM MANUFACTURED FOR EXCELLENCE!!

TEST YOUR CABLE BOX FOR OPTIMUM PERFORMANCE

Excellent Detailed Instructions • Complete With Illustrations

STAR-6 • STAR-7 • CF-SERIES

P5-D & PV5-D
PV7-D & PBB7-D (Including R or V Models)
NEW 1 Wire Smart Board Available
NEW CF-Series
1 Wire Smart Board Available

- ✓ EASY 5 MINUTE INSTALLATION
- ✓ FULLY ASSEMBLED & TESTED
- ✓ DISGUISED OPERATION
- ✓ TECHNICAL SUPPORT
- ✓ ONE YEAR REPLACEMENT WARRANTY

T.C. SERIES

03V & 07

PIONEER MODULES

BA-5100 thru BA-6150
BA-6300 thru BA-6700

SCIENTIFIC ATLANTA SMART BOARDS

8500 Dual Module	8536 Dual Module	8580 Smart Board
8530 Dual Module	8550 Smart Board	8590 Smart Board
8535 Dual Module	8570 Smart Board	8600 Smart Board

ZENITH Z-TAC MODULES

ST-1000 thru ST-5612

MASTER COMPONENTS (800) 233-0570

Write in 25 on Reader Service Card.

OVERLOOKED TEST EQUIPMENT: THE SOUND METER

by James Ford



If you don't have a sound meter, you are missing a valuable, but inexpensive piece of test equipment. Even if you aren't a stereo buff, there are many good reasons to have a sound meter . . . read on.

Sound meters consist of a microphone feeding a variable gain audio amplifier with a calibrated readout. Note the meters shown. These meters measure sound pressure levels directly in dB from either 50-126 for Radio Shack models 33-2650, or from 60-126 dB for the discontinued model 42-3019. (A new digital model is available in this range.)

All of these meters have at least the following features: fast or slow response selection; A or C frequency weighting; amplified audio output on RCA phono jack; 1/4-20 camera tripod mount; and run on a 9-volt battery.

Hams can use sound meters for several purposes. Frequency response of a receiver system can be measured. For this, you would use the C weighting of the meter which is frequency flat. On single sideband receivers or transceivers, a simple technique would be to turn on a frequency calibrator and zero beat the tone. Then move off the zero beat frequency after noting the zero beat frequency dial. The receiver dial offset from zero beat would be the audio frequency that is generated. Place the sound meter at your usual listening position and plot away. This is a total system response since all the receiver IF filters, audio amplifier, AGC, and speaker are involved.

Take a second plot by turning off your AGC if possible, or using a much weaker signal as the source to see if the AGC affects your frequency response. Remember, frequency flatness is not the desired goal here, but good communication audio with a peak in the 1-2 KHz range being desirable. Easy adjustments are changing speakers or pass band tuning.

AGC tests are easy for many with built-in attenuators. For example, I tuned in a steady carrier on my Icom 735 with an S9 signal strength before switching in the 20 dB attenuator. The audio level dropped less than 1 dB, whereas an S3 signal dropped 9 dB under similar conditions. If your AGC can be turned off, then you can perform antenna or other A,B tests by measuring the audio output. This must be done carefully, preferably in an AM mode with signal levels just strong enough that background noise doesn't upset the measurement, but not too strong that IF and other stages in the receiver start to saturate.

FM deviation can be measured on a relative basis. For example, if your friend knows for sure that his transceiver's deviation is 4.5 KHz, then using his transceiver as a reference, you can modulate your transceiver with the same frequency and level and see what the sound meter says. If your transceiver audio is 3 dB less

than your friend's, then your deviation is 2.25 KHz.

Test conditions here require strong signals so that the receiver stages are saturated, and a common audio source. An audio oscillator driving a speaker (might require a matching transformer) with acoustic coupling would be a simple method.

One of the strengths of the sound meter is because the human ear is very poor at A,B comparison tests when there is a separation in time of more than a few seconds.

One of the definitions of a 1 dB change that I've heard is that which a trained observer can just barely tell, with many untrained observers being able to tell changes only

when it gets to 3 dB, and only when the changes are immediate.

Some of these tests can be made using a multimeter across the speaker terminals instead of a sound meter. I have noticed, however, some multimeters aren't calibrated in dB and the ranges are not as good, particularly in the high sensitivity ranges. The sound meter has a slow response and a switchable frequency weighting which is not available in most multimeters.

The sound meter has another advantage: that no hook-up is needed.

One rather strange use of the sound meter involved putting a low power audio oscillator/tweeter with a frequency of approximately 20-25 KHz at the focal point of a 2' parabolic dish. The purpose was to project an annoying sound at ground level to keep some four legged creatures off my lawn. Testing without being able to hear the sound was at first a head scratcher, but the sound meter came to the rescue setting up the proper feed position for maximum output and determining even the 3 dB bandwidth. By the way, the project was a flop.

Another use came when I tried to quiet a noisy computer hard drive. I tried various baffles until I got some improvement. The newer Radio Shack model 33-2050 was much better than my old model because it was at a maximum sensitivity limit for this purpose. The older model, however, is quite adequate for most purposes and I have seen them at swap meets for \$10-\$15.

The A weighting is used for any noise-related measurements since at this weighting it rolls off at lower frequencies and is a better "annoyance match" to the human ear.

Another noise measurement was when I wanted to change from a very noisy 8-pin to a quieter 24-pin printer. The dB levels listed in a computer magazine for various printers must have been published measurements because they bore no resemblance to what I measured at various stores with many noisier printers being quieter. Perhaps one manufacturer measured the noise level at 2' and another at 10'.

My friend Hal Collins W6JES, who introduced me to the usefulness of sound meters, did a before-and-after when undercoating his passenger car and found a quieting of approximately 6 dB. I was hoping for the same when I bought a one year old Chevy S10 Blazer with still good knobby tires, but got only 2 dB. That was definitely not worth while, but my tires had a much lower pitched noise than his. This might explain the disappointment.

The high/low pitch noise difference can be measured by switching between the A and C weighting. The A weighting is 3 dB down at 500 Hz and 30 dB down at 50 Hz. So, if there is little difference between the A and C weighting, then most of the energy must be above 500 Hz since the A weighting would eliminate it.

Incidentally, Hal found his Radio Shack sound meter calibration was within about 1 dB compared to a professional quality meter. The manual states accuracy of within 2dB at the 114 dB level only. There is a calibration adjustment on the side of the meter, but unless you have access to a sound pressure generator it is best left alone. The manual incidentally is a small fold up which fits inside of the carrying case, but it is well done.

One last feature which should not be overlooked is the amplifier output available on a phono jack at the side of the meter. Where can you find a microphone/amplifier combination with known characteristics with a switchable 70 dB range for this price? I measured 353 MV RMS when the meter indicated 0 dB regardless of range setting at the amplifier output jack with a high impedance AC voltmeter. In other words, the 353 MV RMS was output when a tone amplitude was adjusted to exactly 60, 70, 80 dB etc., and shows consistency which should exist for an accurate meter. A or C weighting affects the amplifier output, as well as the front panel meter.

The manual shows plots of frequency response for both A and C weighting and directional characteristics, as well. It shows, for example, that the meter has omnidirectional properties at 1 KHz, but has an 8 dB front/back ratio at 15 KHz.

Perhaps the most important use of a sound meter involves safety. Figure 1 is an extract from the U.S. Department of Labor noise regulations. This shows maximum sound levels in hours per day. Note, all these measurements for exposure are for A weighting with SLOW response.

Perhaps with the sound meter you can equalize your teenager's stereo (the manual has a section on room acoustics) and give the scientific basis to turn it down . . . right? Check out your vacuum cleaner, leaf blower, or air compressor.

You only have one set of ears. There are many uses for a sound meter that just need some imagination. Although the Radio Shack meters are highlighted here, there are other meters available as well, but the Radio Shack models are reasonably priced. NV

Duration per day Hours	Sound level (db) A-Weighting SLOW Response
8	90
6	92
4	95
3	97
2	100
1½	102
1	105
½	110
1/4 or less	115

Figure 1

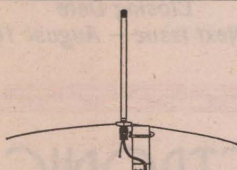
SCANNER HACKERS BIBLE Volume 1. 122+ modifications. Pro-2004/5/6, 23, 33, 34, 37, 39, 43, 46, 51, Yaesu, Kenwood, Bearcat, Icom, Alinco and Regency. Frequency Fixes, Scan Rates, interfaces, programmable channels, improving operation, antennas, and MORE!! \$33.45. VISA/MC 520-782-2316. TELECODE, Box 6426-NV, Yuma, AZ 85366-6426.

TOMCAT'S BIG CB Handbook, by Tom Kneitel! 221 pages, illustrated. Everything they never told you about AM, SSB, DX, Freeband, legal and otherwise. Only \$15.95 (+\$5 postage, \$6 to Canada). CRB Research, Box 56, Commack, NY 11725. (NYS residents add \$1.78 tax). MC/Visa OK. Phone orders 516-543-9169.

"BREAKER" SAVE big on Connex, Galaxy, Texas Star, Palamar and many more. Send to L & S Electronics, PO Box 655, Hazelton, PA 18201-0655. Enclose money order, payable to Lawrence Smith for S&H of catalog. Cost is \$5.50 deductible from first order.

OLD CB RADIO'S WANTED looking for Browning's Trams Sonar's, Demco's, etc. 23 or 40 channels, mobil or bases. Call after 9 o'clock pm. EST. 1-800-974-4861.

SCANNER MODIFICATION HANDBOOK. Big! 160 pages! More than 20 performance enhancements for PRO-2004 and PRO-2005. Restore cellular, increase scanning speed, add 6,400 memory channels, etc. Step by step instructions, photos, diagrams. Only \$18.95, +\$5 shipping (\$6 Canada). (NYS residents add \$2.04 tax.) CRB Research, Box 56, Commack, NY 11725. Visa/MC welcome. Tel. 516-543-9169.



SCANNER ANTENNA VHF/UHF ground plane base station antenna receives all signals in VHF & UHF range. Comes with 40' low-loss coaxial cable w/BNC connector & all mounting hardware. Only \$18.75 ea., plus UPS. MDM Radio, Ltd., 7112 Roosevelt, Rd., Oak Park, IL 60304. 708-848-4210. Visa/MC.

UNDETECTABLE PHONE TAP

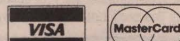
- **SOPHISTICATED ULTRA HIGH IMPEDANCE CIRCUITRY AS USED BY CIA AND KGB**
- **NOT DETECTABLE BY EVEN THE MOST ADVANCED TAP SWEEPING EQUIPMENT**
- **MONITOR CONVERSATIONS, FAXES AND DATA WITHOUT FEAR OF DETECTION**
- **PLUG INTO ANY TELEPHONE LINE WITH NO CLICK, HUM, NOISE OR VOLTAGE CHANGE**
- **UNIVERSAL DESIGN ALLOWS MONITORING WITH HEADPHONES, TELEPHONE OR TAPE RECORDER**
- **VOICE ACTIVATED TAPE RECORDER CONTROL**
- **DISGUISED AS "TELEPHONE LINE TESTER"**
- **COMPACT SIZE - BATTERY POWERED**



Ar² Communications Products

Box 1242 Burlington CT 06013

\$109.95 VISA MC COD



(203) 485-0310

Write in 40 on Reader Service Card.

SECRET CB Books 1-29, \$10 ea; Sams Books \$15 ea; RCI 2950-2970 service manual, \$10. Call for free catalog of other goodies, 1-800-536-0109.

1995 EXPORT CB catalog, best prices on Galaxy, TNT, and Texas Star. Send 2 stamps for catalog. J. Scott & PO Box 1896, Highland, IN 46322-0896.

CB RADIO Hacker's Guide! New! Big 150 pages; pictorials, diagrams, text. Peaking, tweaking & modifying 200 AM & SSB CB radios. Improved performance, extra capabilities! Which screws to turn, which wires to cut, what components to add: Cobra, Courier, GE, Midland, Realistic, SBE, Sears, Uniden/President. \$19.95 plus \$5 shipping (\$6 Canada). NY State residents add \$2.12 tax. CRB Research, Box 56-NV, Commack, NY 11725. Visa/MasterCard accepted. Phone order M-Tu-Th-F, 10-2 Eastern Time, 516-543-9169.

WANTED: ICOM R-100, 7000, 7100, 9000 or R-1 receiver with cell band used. Call Les 702-642-0325.

CELLULAR RESTORATION on your 800MHz scanner performed expertly for \$40 including return shipping. Guaranteed. Keith Perry, 607 Osage Dr., PO Box 816, Leander, TX 78641. Phone 512-259-4770.

THE "WORLD Scanner Report" is for novice & expert radio hackers committed to excellence and rarity in the pursuit of VHF-UHF scanning. Edited and published by Bill Cheek, author of "The Ultimate Scanner" and Scanner Modification Handbooks. \$5/sample issue or SASE for details. Box 262478-N; San Diego, CA 92196; BBS/FAX, 619-578-9247, 5:30pm-1:30pm, voice-only 1:30pm-5:30pm, PST.

COBRA 140GTL 40-Channel Solid State Citizens Band SSB/AM Two Way Radio. CB radio, manuals, box and fender mount antenna. \$125 + \$5 UPS SHIP. Bill, 301-564-0081 after 6pm EST.



RADAR/JAMMER This new x and k digital radar jammer works at any distance 100% of the time. We guarantee it! Dealers welcome. Call, 717-671-8650 or 1-800-671-8117 for a brochure. Write, BLUE MOON GADGETS, 6059 Allentown Blvd #608, Harrisburg, PA 17112-0992.

CHEEK

The Ultimate Scanner! There's only one BEST!

The King of Scanners takes this step-by-step, richly illustrated, bench manual beyond everything ever printed on scanner mods. Bill is a perfectionist who will help you convert your scanner into precisely what you've always wanted!

May 1995

244 pages, large format, \$29.95.

Cheek's Scanner Modification Handbooks Vol 1: 160 pgs. Vol 2: 220 pgs, both large format & \$19.95. Best Sellers for years!

Monitor America ESSENTIAL!

Federal/state/local frequencies, with super detail. Everything you need! 800+ pages, \$24.95

Scanners & Secret Frequencies

Henry Eisen's best seller. Novice to pro, it's MUST reading. Highly praised by the experts. 320 pages, \$19.95

Emergency Radio! Norm Schrein Scanning news as it happens. FUN! 214 pages, \$14.95

Television Gray Market

How they steal cable programming! Eisen, 160 pages, \$23.75

Index Publishing Group, Inc. 1st book: \$4.50

3368 Governor Dr, Ste 273N Add'l: \$2 ea

San Diego, CA 92122 CA: add

7.75% tax

1-800-546-6707 - credit cards

Write in 33 on Reader Service Card.

SYNTAX - J The State of the Art in Cable Solutions

TRI-MODE CABLE PANS

- **Replaces STEALTH, TNT, TVT, etc.**
- **No tuning, flashing, flickering or troubles**

Quality Control
100% Testing
Assures
No Returns

QTY.	PRICE
10	= \$45 ea.
100	= \$30 ea.
500	= Call

Price includes shipping
(Not sold in singles)

DEALERS CALL:

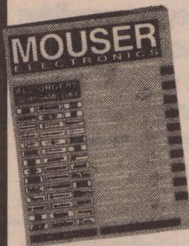
1-800-676-8131

(9 AM to 5 PM EST)

51,092 ELECTRONIC COMPONENTS

Whether you order 1 part or
all 51,092...MOUSER stocks
and...ships same day!!

CALL...(800) 992-9943



for your
**FREE
CATALOG**

958 N. Main St.
Mansfield, TX 76063

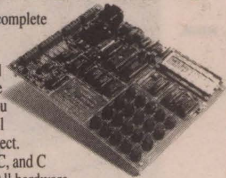
MOUSER[®] ELECTRONICS

Sales & Stocking Locations Nationwide

Write in 29 on Reader Service Card.

Learn MICROCONTROLLERS EMBEDDED SYSTEMS and PROGRAMMING with the New AES-10

The AES-10... a complete learning system, a complete embedded control system. Extensive manuals guide you through your 8051 development project. Assembly, BASIC, and C programmable. All hardware details, complete schematics. Learn to program the LCD, keypad, digital and analog I/Os. The entire board is software reconfigurable for your applications. Everything you need, nothing extra required.



80C32 Computer/Microcontroller board with:

- 32K Byte ROM, 32K Byte RAM • 2 by 16 Liquid Crystal Display • 4 by 5 Keypad • Two serial ports • 5 interrupt sources • 3 timers
- A/D, D/A, PWM and digital I/O • Built in Logic Probe • Power supply (can also be battery operated) • Extended Intel BASIC and AES Monitor in ROM • RS-232 cable to connect to PC for programming • 8051/52 DOS Cross Assembler • Program disks with well documented examples • User's Manual, Language Manual, and Text (over 400 pages).

AES-10 \$285

Money Back

Guarantee

CALL

1-800-730-3232

Free Info Pack

M/C Visa

714 - 550-8094

Fax 714 - 550-9941

**ADVANCED
EDUCATIONAL
SYSTEMS**

970 West 17th Street, Santa Ana, California 92706, USA

ANTENNAS! FILTERS! BOOSTERS!

Many unique products including indoor amplified loop antennas, lightning and overload protectors, and modification enhancements that can add 10x signal boosting, extra-narrow AM/FM/SSB filtering, SCA decoding and more to your shortwave radio! For complete catalog, send two 32-cent stamps. Worldcom, Box 3364-N, Fort Pierce, FL 34948. 407-466-4640.

FINALLY READY, Bill Cheek's The

Ultimate Scanner (Cheek 3) doesn't just build on his two earlier bestsellers. His new, indispensable bench manual goes further and faster, detailing scanner modification technology including memory enhancements, up to 25,600 channels, cellular restoration, simple ways to automate arduous scanning tasks, signal discrimination, computer interfaces, optimum antennas, autologging "hits," power options, SCA decoders, autorejecting, hacking, and tons more. With a wealth of step-by-step procedures, photos, charts, diagrams and schematics. Cheek shows us how to dramatically improve scanner performance. 250 pages, large format, \$29.95 (plus \$4 S&H; CA add 7.75% tax). Index Publishing Group, Inc., 3368 Governor Drive, Suite 273N, San Diego, CA 92122, Order line 800-546-6707.

240+ CHANNELS AM/FM/SSB/CW

export/Domestic CB/Ham/Marine radios: RCI, Superstar, Galaxy, Mirage, Connex, Stalker, Yosan, Uniden, Midland, & Cobra. Service & modification manuals, antennas, meters, mics, kits, linears, modulators, 99 channel readout freq. modification kit for 148/2000GTL/Grant XL. Infra-red night scopes & tons more stuff. Catalog \$3 cash, check, MO, Amex. Maxtech, PO Box 8086, New York, NY 10150. 718-547-8244.

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. 203-283-9492.

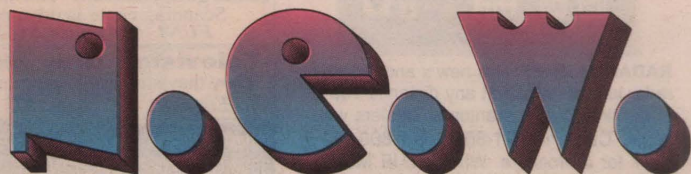
READOUT CHANNEL Kit for Cobra 148, \$54.95; Modulation kits for RCI 2950, HR 2510, Galaxies, Cobras, Ranger 3300, plus more. Call 1-800-536-0109 for free catalog.

VINTAGE TUBE CBs. LSASE list. RFD 1 Box 75, Fort Kent, ME 04743. 207-834-6273. Evenings/weekends only.

FEDERAL FREQUENCY Directory! Kneitel's "Top Secret" Registry of government Frequencies, New 8th Edition. 268 Pages! FBI, DEA, Customs, Secret Service, BATF, Immigration, Border Patrol, IRS, FCC, State Dept., Treasury, CIA, etc. & surveillance, bugs, bumper beepers, worldwide US military, 225 to 400 MHz UHF aero band, Canadian listings, & more. Ultimate "insider's" directory! Standard reference of law enforcement, news media, private security, communications industry & scanner owners. \$22.95 + \$5 shipping (\$6 to Canada). NY State residents add \$2.38 tax. CRB Research Books, Box 56-NVT, Commack, NY 11725. Visa/MC welcome. Phone orders 516-543-9169 weekdays (ex-Wed.) 10 to 2 Eastern.

CB & Ham, accessories, antenna, radios, mobile & base microphone, echo boards, noise toys, expander kits, SWR & Power meters power supply, books. West Coast Sales, 1-800-713-3532, Visa or MasterCard only.

**Closing Date
For Next Issue - August 10th!**



NATIONAL ELECTRONIC WHOLESALE★ ★ ★ ★ ★

YOUR WHOLESALE HEADQUARTERS FOR ELECTRONIC COMPONENTS

MODULES COMPATIBLE WITH Xxxxxxx

One-Wire Quick Board for X2, Z5, and BXZ

(1-5)\$29 (6-10)\$25 (11-20)\$23 (21-50)\$20 (51+)\$18

**NO BATTERY-CUT
VERSION**

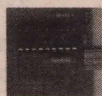
WORKS ON ALL ONE TOO!



**ALSO AVAILABLE IN
3-WIRE VERSION**

MULTI-MODE -- 3-WIRE BOARD

(1-5)\$29
(6-10)\$24
(11-20)\$20
(21-50)\$18
(50+)\$16



WORKS ON ALL X2, Z5, AND BXZ
MODELS THAT USE MULTI-MODE.
WORKS ON UNITS THAT DON'T USE
MULTI-MODE TOO!

SPACECOM SEVEN THREE-WIRE MODULES

(1-5)\$13 (6-10)\$10 (11-20)\$9 (21-50)\$8 (51+)\$7



FOR MODELS THAT DON'T HAVE X2, OR Z5
AS PART OF THE MODEL NUMBER. NOT FOR
BXZ MODELS.

ALSO: 28-PIN MOD FOR BPB 5 -- (1-10)\$10 (11-20)\$7

MODULES COMPATIBLE W/SCIENTIFIC ATLANTA:

QUICK-BOARDS for MODELS 8550, 8570, 8580, 8590, 8600

(1-5)\$22 (6-10)\$20 (11-20)\$19 (21-50)\$17 (51+)\$14.75



THE MOST RELIABLE BOARDS ON THE MARKET! DON'T SETTLE
FOR IMITATORS, WHEN YOU CAN HAVE THE BEST!!

OTHER MISC. ITEMS:

SA 40-PIN mods: (1-5)\$21 (6-10)\$20 (11-20)\$18 (21-50)\$15

PIO 3-WIRE: 6100series \$29EA -- 6300series \$49EA

TOKEONE: 03607 - 28-PIN \$AS LOW AS \$5.

ZENITH: ZL-1 (1-10)\$9 (11-20)\$6 (21+)\$4.49

PIC 16C56 RCP BLANKS (100+)\$2.45 (500+)\$2.39 (1K+)\$2.3

MOTOROLA 40-PIN BLANKS (100+)\$10.50 (500+)\$9.50

STEALTH 1000-P

(1-5)\$56 (6-10)\$50 (11-20)\$46 (21-50)\$43 (50+)\$41

1-800-618-7480

WE GLADLY ACCEPT VISA, MASTERCARD AND C.O.D. ORDERS.
ALL CREDIT CARD ORDERS ARE THOROUGHLY VERIFIED!
SHIPPING BY FEDEX

NO
CA
SALES

THE LASER

EXPERIMENTER

Conducted by
Anthony Charlton

Welcome! Light: All of our existence depends upon it. Can you imagine what life would be without light? No visible sun, no moon, no stars, no planet of which we inhabit, and certainly no life. Anywhere.

The interactive play of the electromagnetic spectrum of visible light, invisible infrared light, and other wavelengths of electromagnetic energy are essential to the very engines that drive the Universe as we know it.

Electromagnetic light-emanations power the mechanisms of Nature — from the emission of heat and light wavelengths beginning inside our star, down to the intricate biochemical reactions in unicellular algae, whose ubiquitous presence in our oceans insure that an ample supply of oxygen is released to the environment insuring the survival of all air-breathing organisms.

Imagine: The birth of a photon, among countless others taking place inside the Sun at any given moment, and whose travels may take it thousands of years to migrate from the Sun's hellfire core to its surface [1], only to be radiated out and to traverse the greatly vaster distances between the planetary bodies in just minutes or hours. In our planet's case, the traverse time is only about eight minutes, and the speed of light is what this month's column is all about.

Little wonder mankind has been instinctually pre-occupied with the manifestation of the infinitesimal wave-particles we humans call photons. And thusly, little wonder we have been searching for ways to identify, qualify, and quantify the properties of light, whatever its wavelength may be; from long, long radio wavelengths to ultra-short cosmic rays, whose oscillation distance from crest-to-crest may span only a fraction of the diameter of the atomic nucleus.

Among the interesting properties of light is the fact its speed changes in different substances. And we laser experimenters can actually . . .

Measure the Speed of Light!

Light speed can be measured in several ways. In olden times, Galileo wanted to determine the speed of light (among several other admirable scientific pursuits of his, like proving gravity has a fixed speed and effect on different weight objects, and observing the heavens through telescopes of his own design).

Galileo Galilei (1564-1642) enlisted the aid of an assistant, who stood on a hilltop about a mile away. Galileo would flash his lantern at his assistant, who was to return his flash as soon as he spied it. The experiment, while useful for determining the speed of a much slower medium like sound, failed dismally with light. Galileo didn't realize that light could travel the distance in only about a five-millionth of a second, or about 40,000 times faster than the combined reaction time of both men! Thus, Galileo concluded that the speed of light was infinite, or at least much faster than the

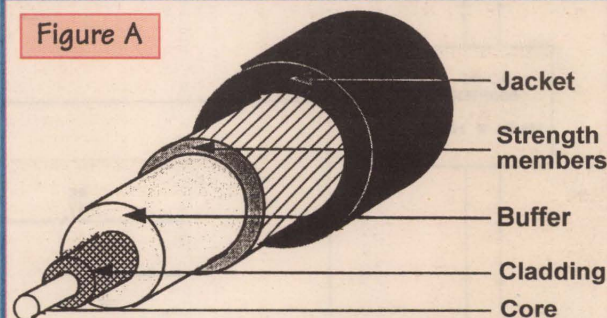
reaction time that any human-based experiment could attempt to calculate.

It wasn't until the 1670s that the Danish astronomer Olaus Roemer (1644-1710) discovered something significant while making painstaking observations of Jupiter's satellites. Theoretically, the orbits of the satellites could be mathematically worked out with great precision, and hence one could faithfully predict the exact times that they would be eclipsed by the giant planet. However, Roemer noticed sometimes the satellites eclipsed early and sometimes late in their supposed schedules. It was discovered that when the Earth and Jupiter were on the same side of the sun, the eclipses came earlier. When they were on opposite sides of the sun, the eclipses were later by several minutes.

Taking the distance of the Earth's orbit into consideration, Roemer calculated that to span the distance believed at the time, the speed of light would be about 250,000 kilometers or 150,000 miles per second. Although this figure is off from the accepted modern-day measurement of 299,792.4562 kilometers per second (186,282 miles) considering the equipment of the day, it wasn't a bad guesstimate.

The next player in the long quest to find just how fast light travels was the English astronomer James Bradley (1693-1762). In the year 1728, he performed an experiment utilizing the principle of ABERRATION OF LIGHT, which put simply, is similar to picturing a raindrop falling vertically. If you walk or drive through the raindrop, it appears to fall at an angle because of your velocity relative to it. Such it is with light.

Figure A



Cross-section of a typical optical cable

If the light from a distant star is observed, it will be angled slightly due to the relative motion of the Earth combined with the velocity of light. If the velocity of light were infinite (or the Earth was at a standstill in space) there would be no aberration. Bradley calculated the velocity of light at 190,000 miles per second — over the mark, but much closer to its real speed.

In 1849, the French physicist Armande Hippolyte Louis Fizeau (1819-1896) used Galileo's hill-top idea, but substituted a 720-tooth rotating wheel to mechanically interrupt a beam of light, and a mirror to reflect it from a distant hilltop. By varying the speed of the wheel, he was able to receive the "chopped" pulses, and eventually calculated the speed of light at 194,000 miles per second. Interesting, isn't it, the mechanical device was not as accurate as Bradley's measurement using the orbit of the planets? This indicates, by exam-

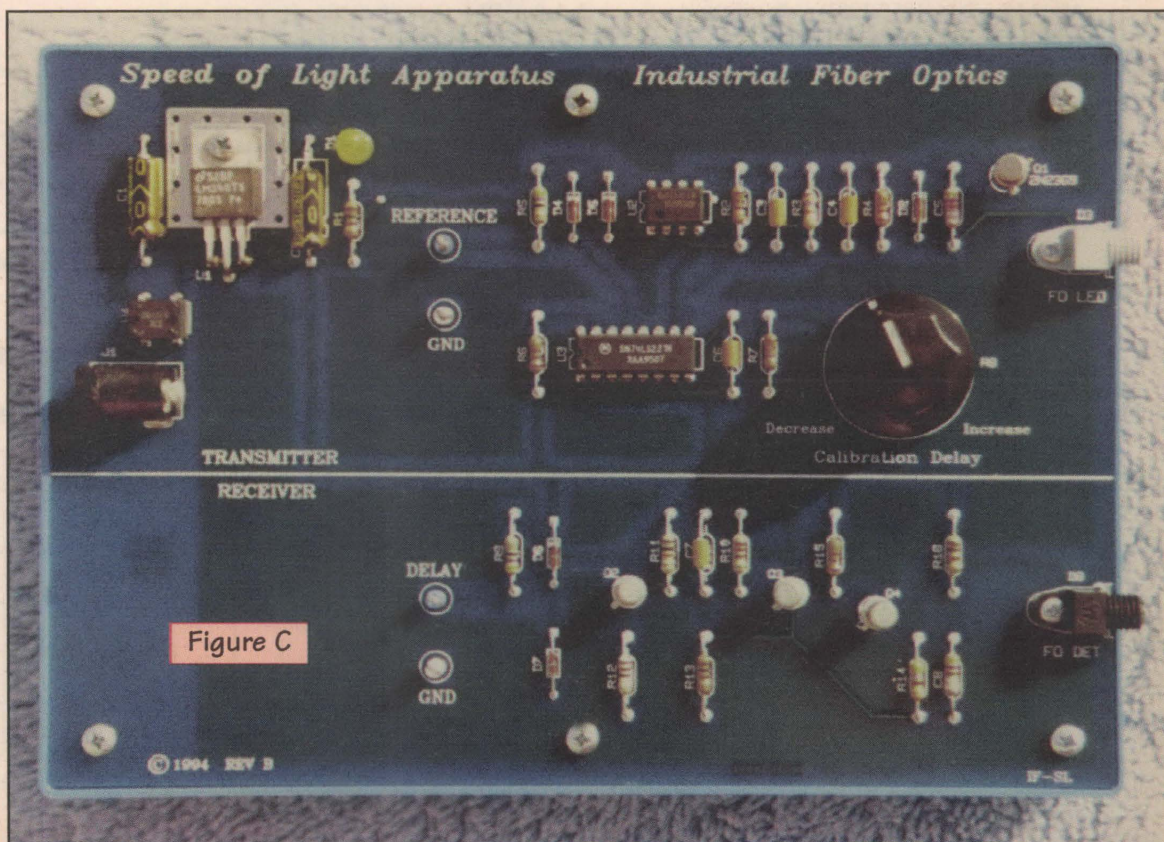
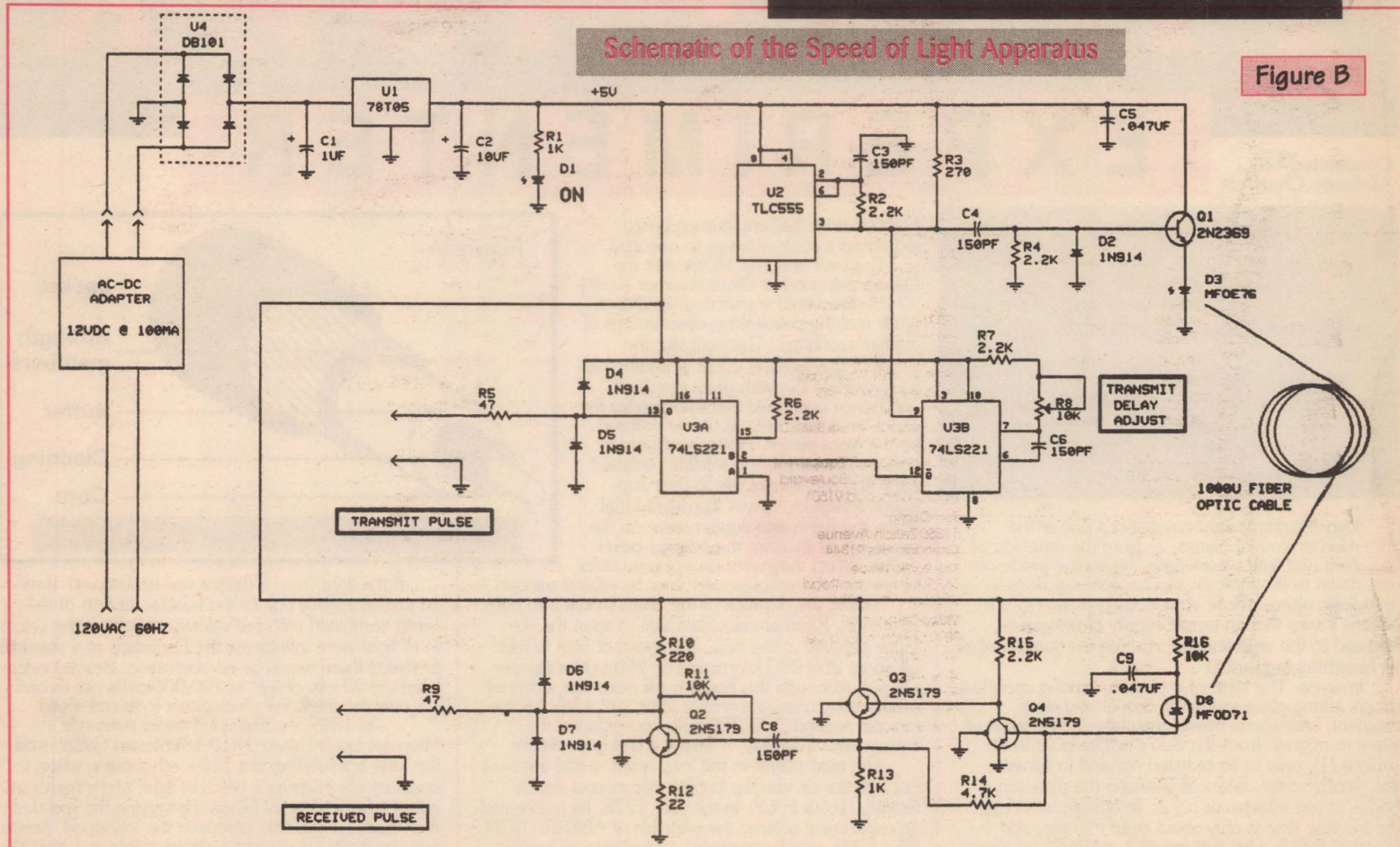


Figure C

Schematic of the Speed of Light Apparatus

Figure B



ple, how stable the orbit of the planets is, albeit the fact they orbit in ellipses rather than in perfect circles.

Albert Michelson (1852-1931) really increased the precision of light speed measurements in 1926. He used an eight-sided rotating mirror reminiscent of a laser scanner mirror, and again a distant hilltop. The path of measurement was increased to 44 miles, and the experiment yielded a result of 186,284 miles per second. This is only a little off the actual speed accepted today by about two miles per second — a remarkable achievement of Michelson's genius.

Homemade Light-Speed Measurements

Industrial Fiber Optics (see "Sources") puts out a fine learning kit called *Speed Of Light Apparatus* that can enable you to measure light's velocity yourself {2}. This kit is an excellent learning tool for schools and other establishments who might consider incorporating it in their curriculum. Priced in the \$100.00 range (depending upon the distributor's pricing and whether you choose to build the kit yourself or purchase it already assembled), it certainly is a good value.

I was really impressed with the kit's informative, light-hearted, and understandable manual. Instructions

Notes:

- {1} Photons born of the atomic process in the core of the Sun take this astoundingly long time to weave their way to the surface. The reason being, the fact they are being absorbed and re-emitted constantly throughout the dense, tremendously hot plasma of the sun, which blocks their free traverse to the surface.
- {2} Alphabetical figures courtesy of Industrial Fiber Optics.

CREE

RESEARCH • INC

The Leader in Silicon Carbide Solid-State Technology

Fig. 1. Forward Current vs. Forward Voltage

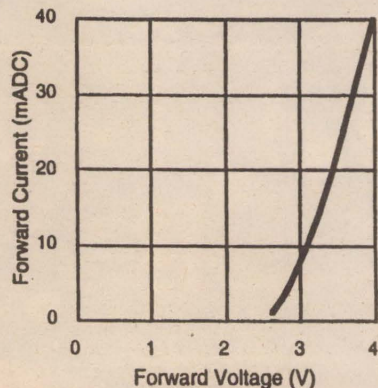


Fig. 2. Relative Intensity vs. Wavelength

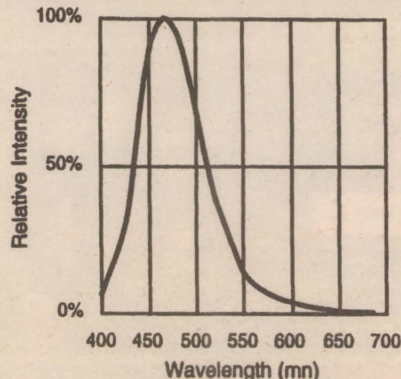
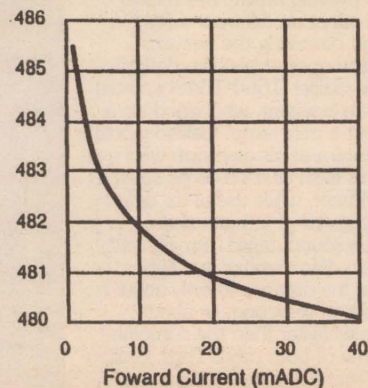


Fig. 3. Dominant Wavelength vs. Forward Current



Silicon Carbide Blue LEDs

T-1, T-1 3/4

SOURCES

Industrial Fiber Optics, P.O. Box 3576, Scottsdale, AZ 85271-3576. Laser and fiber optic project kits primarily for the educational market. Sells mostly through distributors; Digi-Key is one. OEM sales as well. Ph: (602) 804-1227, FAX: (602) 804-1229.

Anderson Lasers, Inc., 2883 West Royalton Road, Broadview Heights, OH 44147. New and surplus industrial and scientific lasers & equipment. Carries high-power commercial grade equipment, not a hobbyist supplier. Professional inquiries contact: Richard Anderson, ph: (216) 237-6629, or FAX: (216) 237-0656.

Small Parts, Inc., 13980 N.W. 58th Court, P.O. Box 4650, Miami, FL 33014-0650. Free catalog. Catalog requests: (305) 558-1255.

LNS Technologies, 20993 Foothill Blvd., Suite 307, Hayward, CA 94541. Inquiries: (510) 886-9296, orders: (800) 886-7150. Visible laser diodes and a driver kit, also carries a line of high-technology electronic kits. Accepts major credit cards. Catalog \$1.00.

MWK Industries, 1269 West Pomona, Unit 112, Corona, CA 91720; ph: (909) 278-0563, FAX: (909) 278-4887. Hours: 8-5 PST weekdays, 10-3 Saturdays. Free catalog. Source for new and used laser equipment, supplies and optics. Carries a wide variety of He-Ne and other lasers suitable for the experimenter & hobbyist.

Images Company, P.O. Box 140742, Dept. N, Staten Island, NY 10314; ph: (718) 698-8305. Carries holography supplies, optical components, components for laser power supplies, stepper motors.

Geo-Monitor, 65 Washington Street #400, Santa Clara, CA 95050; ph: (408) 749-6770, FAX: (408) 249-3780. Publishes a technical newsletter about earth science, and may be useful to those interested in using lasers to record seismic activity.

Edmund Scientific Company, 101 East Gloucester Pike, Barrington, NJ 08007-1380; ph: (609) 573-6250, FAX: (609) 573-6295. Free catalog. Supplier of a wide variety of educational and scientific equipment including lasers and an extremely comprehensive line of optics.

Midwest Laser Products, P.O. Box 2187, Bridgeview, IL 60455; ph: (708) 460-9595, FAX: (708) 430-9280. Free catalog. Carries new and used laser equipment and inexpensive start-up systems.

Mouser Electronics. Mouser is a first class hobbyist and industry supplier of a very wide range of new electronic parts, equipment, and supplies. Free catalog. Call (800) 346-6873 for catalog and location of facility nearest you.

Amidon Associates, P.O. Box 956, Torrance, CA

90508. Ph: (310) 763-5770, FAX: (310) 763-2250. Hobbyist and experimenter supplier of ferrite materials in many shapes and sizes.

Digi-Key Corporation, 701 Brooks Avenue South, P.O. Box 677, Thief River Falls, MN 56701-0677; ph: (800) 344-4539, FAX: (218) 681-3380. Free catalog. Top quality new electronic parts supplier.

Imaging Concepts Bulletin Board Service. A free scientific bulletin board that contains, among other topics, laser information. Georgia area code. Parameters: 9600 baud, N81. Accessable 24 hours a day by calling (404) 466-3932.

Herbach & Rademann, P.O. Box 122, 17 Canal Street, Bristol, PA 19007; ph: (215) 788-5583, FAX: (215) 788-9577. Free catalog. An excellent experimenter source for quality mechanical, optical, electronic, and electromechanical surplus.

Allegro Electronic Systems, 3 Mine Mountain Road, Drawer NV, Cornwall Bridge, CT 06754. Mail order supplier of He-Ne laser systems, experimenter-level laser communication & data acquisition kits; plans, specialized equipment & hard-to-find electronic parts. Catalog \$1.00.

Viking Office Products. Quality office products of all kinds at a discount. Listed here because of the value to the experimenter wanting to organize his or her laboratory. Viking features free catalogs and unsurpassed delivery promptness. Call (800) 421-1222 or FAX to (800) SNAPFAX [(800) 762-7329] for free catalog. Accepts prepaid, net 30 and credit card orders. Free delivery of orders over \$25.00 and free UPS pick-up of items that have problems or you aren't satisfied with.

Dyna-Art Designs, 3535 Stillmeadow Lane, Lancaster, CA 93536-6624; ph: (805) 943-4746, FAX: (805) 943-3776. Desk-top fabrication equipment for printed circuit boards; toner-transfer paper for easy hobbyist & OEM prototype do-it-yourself PC board making.

Society for Amateur Scientists, 4951 D. Clairemont Square, Suite 179, San Diego, CA 91777, ph/fax: (619) 239-8807. Internet: scarlson@sas.org

Lionel Trains, Inc., P.O. Box 748, New Baltimore, MI 48047-0748. Ph (800) 727-7297, FAX: (810) 949-5429. Source of inexpensive CCD camera capable of seeing near infrared spectrum, as well as visible light.

The Electronic Goldmine, P.O. Box 5408, Scottsdale, AZ 85261. Free catalog. Ph: (602) 451-7454, FAX: (602) 451-9495. SMC components and a wealth of high-tech experimenter electronics, components, and project kits.

Be sure and mention Nuts & Volts when you contact the above suppliers so your request goes to the right department.

measure just how long it takes for light to traverse the loop. Figure A shows the construction of a jacketed fiber optic cable. Light travels at a different speed in a fiber optic than in a vacuum or air. The speed difference is called INDEX OF REFRACTION, and is expressed numerically.

In this case, the index is 1.5 for the fiber, which means light is slowed down about 33% in the fiber. We can also calculate what the refractive index is for different fibers and their effect upon the circuit. Refractive index is calculated by the formula:

$$C / V = N$$

where:

C is the speed of light in a vacuum;

V is the measured speed in the medium you are testing; and N will then be the refractive index of the medium under test.

The circuit shown in Figure B works like this: Power is first provided by the plug-in AC-DC adapter and bridge rectifier U4. U1 and associated filtering and bypass capacitors convert the unregulated power into five volts of regulated DC. U2 provides an output pulse of about 500 KHz which is coupled to and drives transistor Q1. Q1's job is to provide high-current pulses for driving D3, the transmitting LED. U3A and U3B condition the signal from U2 to form a very narrow pulse. This is fed into one channel of a dual-channel 20 MHz or faster oscilloscope, which this project requires.

The light received at the end of the fiber is detected by a photodiode, D8, and the pulses are converted into electrical signals which are amplified by transistors Q2-Q4 and conditioned by the associated passive components. The received pulses are then connected to the other channel of the 'scope, where they are compared with the transmitted pulses.

The phase delay between the transmitted pulses and the received pulses is equivalent to the speed of light in the fiber. The measurement between the crests and the speed the 'scopes timebase is set to enable you to calculate the speed of light.

The clear directions and simple calculations are included in the manual. But it's a little too lengthy to reproduce here, and besides, I don't want to risk giving you a mis-step by trying to condense it. Figure C shows the circuit board, which is also the front panel of the unit.

Laser Distance Measuring Possibility

It is certainly possible to convert this system into a simple laser radar or LIDAR device by reflecting the laser beam off a distant object, and dispensing with the fiber loop. One would have to substitute a solid-state collimated laser for the LED, taking into consideration the electrical drive requirements of the laser. I would imagine that the repetition rate of the transmit pulses would want to be lowered, so that fewer samples are taken per second.

Next, the receiver photodiode will require a lensing

help make all the difference; the *Speed Of Light Apparatus* manual is carefully laid out. It includes a PC board which is roomy and silkscreened, and whose step-by-step building instructions are a snap and a pleasure to follow. There is even a Glossary and a Further Reading section in the manual. Plus the finished prod-

uct is quite good looking in its attractive enclosure.

Fiber Loop: The Focal Point

By using a loop of fiber optic 20 meters long and some electronic circuitry, plus an oscilloscope, we can

Fig. 4. Relative Intensity vs. Forward Current

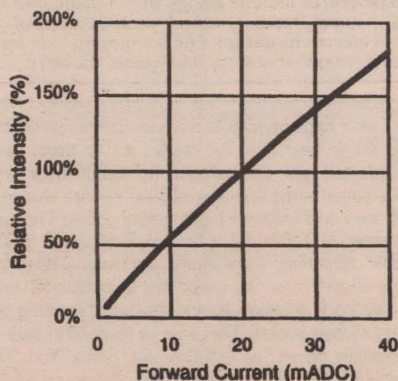


Fig. 5. Relative Intensity vs. Lead Temperature

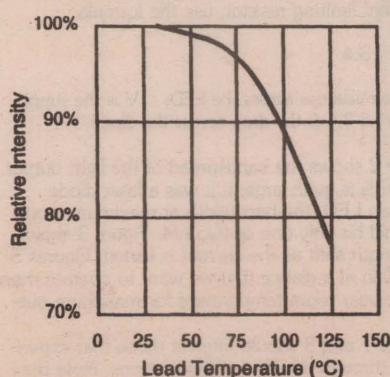


Fig. 6. Forward Current vs. Ambient Temperature

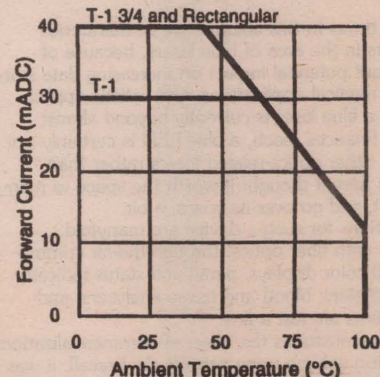


Fig. 7. Peak Forward Current vs. Forward Voltage
(100 μ s test pulse; 1% duty cycle)

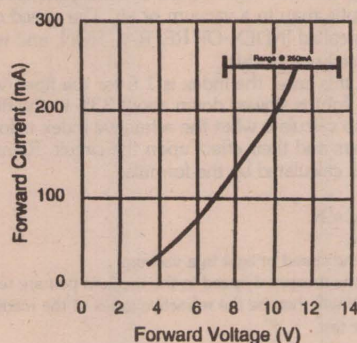


Fig. 8. Relative Intensity vs. Peak Forward Current
(350 μ s pulse width; 10ms period)

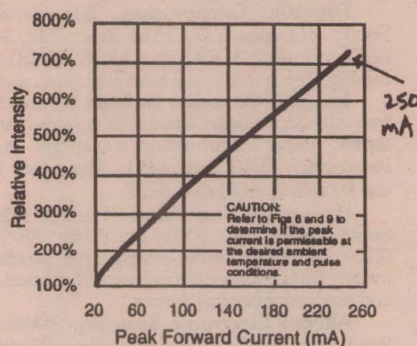
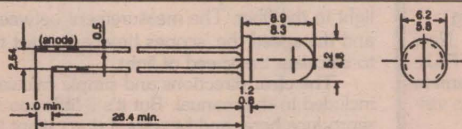
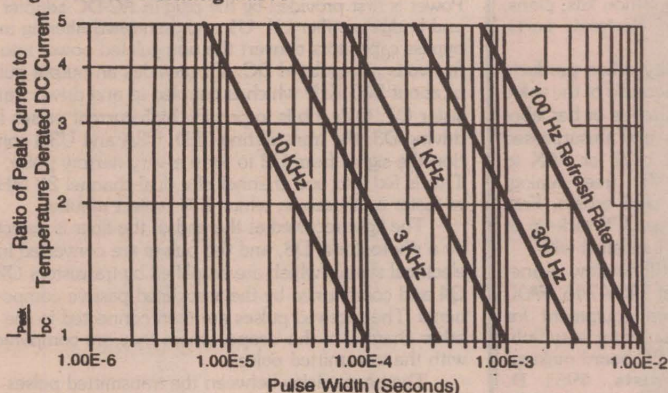
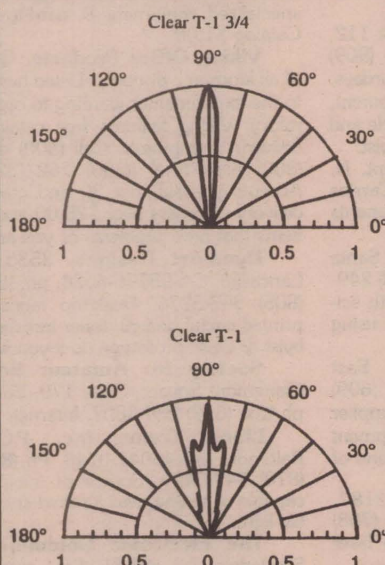


Fig. 9. Pulse Derating Curve



T-1 3/4 Mechanical Specification (in mm)

Fig. 10. Typical Radiation Pattern



system, to get enough light to activate it. Several simple optical systems have been discussed in prior issues of this column, and any one of them should work satisfactorily.

One very nice thing to add to this system would be a timebase to allow digital counting and display of the distance rather than depending upon an oscilloscope. I'll investigate this, and if it's feasible (and can be built for a reasonable price), I'll come up with a design to add to the system for future publication here. In the meantime, you have a fine kit designed for speed of light experiments that Galileo would have never dreamed of! Contact Industrial Fiber Optics for current pricing and distributors for this kit.

Blue LED Available Cheaply

Several times in this column, we've mentioned developments in the area of blue lasers, because of their significant potential impact on increasing data storage density, medical applications, and artistic applications. While a blue laser is currently beyond almost everybody's financial reach, a blue LED is certainly not. Since we do other optics-related topics rather than strictly lasers here, I thought it worth the space to mention the LED, and go over its specs. a bit.

Applications for such a device are manifold. Experiments with fiber optics, through-the-air communications, full-color displays, panel and status indicator lights, colorimeters, blood and tissue analyzers, and imaging systems are just a few.

It also demonstrates the effect of commercialization and production volume upon pricing. As I recall, it was 1987 when samples first became available for \$100.00

each. A little pricey for us laser (or LED) experimenters, eh? At the time, I predicted they would drop to \$3.00 each within a couple of years. Now Digi-Key has Cree silicon carbide blue LEDs available for 78 cents in quantities of 10. Bundling 10 together makes a real nice, truly blue display. While the light output isn't fantastic at only 16 millicandela, it's comparable to a standard LED.

Let's go over a few of the specs. a bit that are not self-explanatory. First, the part number. The pick of the lot is Digi-Key's #101CR-ND, which is Cree's number C470-5C18. That has a water-clear lens, a narrow viewing angle of 16 degrees, a luminous intensity of 16 mcd (typical), and a maximum continuous drive current of 40 mA. These LEDs have a large voltage drop of 3.4 volts across the diode junction. To determine the series current limiting resistor, use the formula:

$$mA = V - 3.4$$

where:

mA is the milliamps across the LED; V is the supply voltage; and 3.4 is the drop across the diode.

Figure 2 shows the bandspeed of the light output. Note that this is quite large; if it was a laser diode instead of an LED, the bandwidth at maximum input power would be only one or two nm. Figure 3 shows the wavelength shift as the current is varied. Figures 5 and 6 explain at a glance that we want to operate these LEDs at or near room temperature for maximum output.

Figures 7 and 8 should interest those that experiment with through-the-air communications. Note the LEDs will take up to 250 mA (which I arrowed in

Figure 8) with a narrow pulse width. If the width was 100 mS, and the duty cycle 1%, as shown in Figure 7, that gives us a repetition rate of only 100 pulses per second max.

If the duty cycle was 350 mS and 10 mS period, that translates to the LED being on for 1/3500th of a second pulsed 100 times per second. The essence of this example is the LED can be driven faster if the pulse is narrowed. For instance, you could drive it at 1,000 Hz if the width was narrowed to 35 mS, and 10 KHz if it was narrowed to 3.5 mS. At 10 KHz, you can do decent voice modulation, or send low-speed digital data.

Figure 9 shows the Derating Curve for pulse width, repetition rate, and peak power input graphed out, so that may be helpful to people who want to do serious calculations for through-the-air communication set-ups. Figure 10 shows the radiation pattern. You can instantly see that a collimating lens is required if you want a respectable distance of detection with any communication system. However, the 16-degree divergence width is admirable for an LED.

Another possibility is to cool the diode with a thermoelectric cooler. Thermoelectric coolers generate heat on one side and cold on the other when hooked up to a power source. They are available from surplus dealers that advertise in *Nuts & Volts* at a significant savings over purchasing them from a manufacturer. Although I haven't tried this approach yet, it seems logical.

A good copper heatsink wrapped around the LED's case, and in good thermal contact with the cooler is required. Insulation of some kind is also required to prevent the cooler from trying to cool the ambient air instead of its proper heatload! The cooler itself must have a heatsink on its hot side, which is exposed to free air to remove the heat. Then the cool side can do its best job, otherwise you're just wasting power. Coolers of this type aren't particularly efficient, but they do a good job nevertheless if installed properly for a reasonable application. Until next time, when we shall continue with our experiments. And coming up soon is a

project that will allow us to send VIDEO — yes, pictures! over a laser beam to a distant receiver. As always, your commentaries or questions are welcomed at The Laser Experimenter's P.O. Box listed elsewhere in this column. NV

CLOSING QUOTE:

"Chance favors the trained mind."
— Louis Pasteur

Anthony Charlton is an active electronics and science "do-it-yourself" project designer, does custom R & D, and writes technical articles. Previous work experiences include design of hardware and software for microprocessor-based process control systems and electronic design. His hobbies include lasers, gardening, target shooting, and model rocketry.

The Laser Experimenter is a reader-interactive column. We like to hear from the reader, and in many cases, the best projects have come directly from your suggestions. If there is some particular facet of laser science that interests you, we would welcome hearing from you at: The Laser Experimenter, P.O. Box 74, Cornwall Bridge, CT 06754. Questions, comments, suggestions, and material relating to lasers are all welcome. We would like to publish letters in Reader Feedback occasionally. Indicate whether using your name and address is okay. We can now respond to your letters personally on an "as time permits" basis. Your FAX number, which will be kept confidential, will speed replies.

OPTOSCAN USERS! "Probe" is the Ultimate Software for the OptoScan Computer/Scanner Interface. "Probe" Software features: Fastest scanning speed. Easiest to use. Most onscreen data. Works on virtually all DOS computers. CTCSS, DCS, DTMF decoding. AutoSquelch/read signal strength. AutoLogging. Variable alarms, delays. Versatile frequency management: 4000 groups, 99 descriptive banks per group, 1000 frequencies per bank. Imports PerCon's FCC frequency data. And more! Free details: DataFile, Box 20111-NV, St. Louis, MO 63123.

WANTED to buy a copy of "Guide to the AR1000" scanner book, by Howard Bornstein. Joe Guillette, 78 Tanner Street, Manchester, CT 06040 or phone, 203-647-0222.

ICOM R1 with cellular and following accessories: MB30, LC59, OPC254, CP72, BP89, and quick charger, sold as package deal only! \$870. Bill, 612-980-6503.

CE-232 SCANNER/Computer Interface! VHF-UHF scanning at its best with cyber-powered AutoProgram; AutoLog; AutoBirdieReject; Auto Look Up; scripts and more for PRO-2006/5/4 and IBM/compatibles w/512K, MSDOS 3.1/up! Kit, program disk, manual: \$194.95 + \$5 S&H; SASE for info: COMMtronics; Box 262478-N; San Diego, CA 92196. FAX/BBS at 619-578-9247, after 5:30pm & before 1:30pm. Voice only: 1:30pm-5:30pm, PST.

MUSIC & ACCESSORIES

40

TURNTABLE/PHONO parts. Stereo needles/styli, magnetic, ceramic, crystal cartridges. Idlers, Astatic type metallic cartridges rebuilt. Obsolete idlers resurfaced. 78 needle fabrication. New Product News. Economical 45 RPM stacker (stacks 5) or 78 RPM semi auto player for magnetic or ceramic inputs. Only \$44.95 postpaid. Catalog \$2. West-Tech, Box 1415, Sebring, FL 33871. Phone 941-471-0922.

GARRARD TURNTABLE, good condition. Collector's item. Best offer. 714-494-0072.

COMPUTER HARDWARE

50

BRAND NEW new with warranty! Motherboards Pentium 90/100 w/CPU, 256K cache, EIDE \$550/650. Fastest 486DX4/100 \$275. DX2/66 \$195. SX2/66 \$165. 386SX40 \$65. FAX/modems 14,400 BPS \$65. Monitors, Lazer printers 8ppm \$420. Hard drives IDE, SCSI 60meg 1.7 gig. \$55-750. Notebook hard drives 120-540 meg available. Call for items not listed. CCI, 714-778-0450.

PARADYNE 3480 19.2K sync and 3460 14.2K sync modems. Some 2030 MUXs. Call 615-758-8774, leave message.

CD-ROM DRIVES REALLY CHEAP!!! CM-205 Kit including card, cables, drive, and software only \$45. Toshiba 3201B Internal SCSI CD-ROM \$40. Toshiba External 3301B SCSI 2 CD-ROM \$65. Ideal for the Macintosh or add a PC interface for \$20. Call UTWE, 818-797-2569 or fax 818-797-0384 or E-Mail JohnUTWE@aol.com or BobUTWE@aol.com

WE BUY MEMORY SIMMS & DIPS. Dynamic & Static Memories. IBM Clone as well as Macintosh Memories. Call: 907-227-4637.



Wandel & Goltermann TSA-1 Transmission System Analyzer

Frequency range 100 Hz to 180 MHz, spectrum analyzer, selective level, demodulation and phase jitter.

\$2250.00

Above unit with Network Analyzer.

\$2750.00

Hewlett-Packard 3456A

Digital Voltmeter, 6.5 digit system measures dc, true RMS ac voltage and resistance. Five full scale dc ranges from 0.1 V to 1000 V, 100 nV resolution.

\$1000.00 Special

Hewlett-Packard 3312A

Function Generator combines two functions in one instrument, AM-FM, sweep, trigger, gate and burst. 0.1 Hz to 13 MHz in 8 decade ranges.

\$950.00

Anritsu ML422B

Selective Level Meter, 50 Hz to 30 MHz, providing highly accurate measurement of signal levels, with the stability of frequency needed to manufacture, install and maintain FDM systems. Functions as a wideband level meter, psophometer or voice band analyzer.

\$1250.00 New

Tektronix AM503/ A6302

Current Probe Amplifier and Current Probe. 1 mA to 20A current measurement range, 50 A peak pulse measurements, dc to 50 MHz bw.

\$850.00

Tektronix AM503/ A6303

Current Probe Amplifier and Current Probe. 100 A ac and dc measurements, dc to 15 MHz bw, peak pulse measurements to 500 A, ac or dc coupling, clamp around probe.

\$1150.00

Please call for our Free 1995 Catalog

14455 NORTH 79TH STREET, UNIT #C • SCOTTSDALE, ARIZONA 85260
(602) 483-6202 • Fax (602) 483-6403

Write in 31 on Reader Service Card.

DATel MULTIPLEXER DCP5016 \$250. Datel CSU/DSU DCP3080 \$175. 818-989-3848.

NEW MATH Coprocessors. Intel 80386DX-16/25/33 \$16/\$25/\$33. Cyrix available also. Call Under The Wire Electronics, 818-797-2569 or fax 818-797-0384. 235 E. Colorado Blvd. #211, Pasadena, CA 91101.

HISTORIC AND CLASSIC hardware support magazine. **The Computer Journal** provides how-to information on keeping S-100, Kaypro, Z80, 6809, CP/M, and PC/XT systems running. Over TEN years of hardware, software projects. 6 issues \$24. Free sample. 1-800-424-8825. TCJ, PO Box 535, Lincoln, CA 95648.

LAPLINK CABLES plugs in your printer port to allow data transfer at 4 times the speed of serial data transfer. \$5.95. Call Today! Stewart & Associates. 1-800-704-6500.

FREE ADVERTISING. Buy, sell trade. Computer, software, ham and video related equipment. SASE: Advertizer, 39652 West Idylwild, Bass Lake, CA 93604-9711. Phone/Fax 209-642-3220.

NEW AT power supplies for full size AT case \$22. Cube AT power supplies with switch on the side, 235 watt, \$28. New full tower supply, 230 watt, \$30. New XT power supplies 150/135 watt new! \$18/\$12 ea. Call UTWE, 818-797-2569. Fax your supply needs to 818-797-0384.

DOS 5.0/6/6.1 \$20/\$25/\$15, Windows for Workgroups \$25. ACT for Windows best contact management software \$45. OS/2 \$20. Corel SCSI \$45 hard drives from 65 meg to 9 gigabytes SCSI and IDEs. Cordless mouse \$30. CCI 714-778-0450.

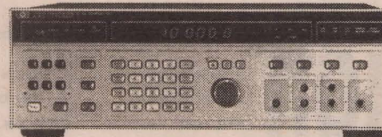
DEC VT-100 Terminal with keyboard. \$100. DECLA 120 \$200. Lear Siegler ADM12 w/kybd, \$125. 818-989-3848.

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.

Quality Reconditioned Test Equipment

Hewlett-Packard 3336B Synthesizer/Level Generator

This level generator is an excellent precision source from 10 Hz to 20.9 MHz, frequency resolution of .001 Hz, level accuracy within .15 dB over full range, AM and phase modulation. Fully programmable over HP-IB, harmonics down more than 5 dB.

\$650.00

Hewlett-Packard 3586B Selective Level Meter

Makes carrier measurements to 32.5 MHz, voice channel measurements from 50 Hz to 100 kHz, can use the 3336B Level Generator as an automatic tracking generator. Includes options 001, 003, & 004.

\$850.00

Buy both together as a set for \$1300.00

Hewlett-Packard 8673D

Synthesized Signal Generator, 50 MHz to 26.5 GHz, +11 to -100 dBm calibrated output, internally leveled AM/FM pulse modulation, low spurious and phase noise.

\$34500.00

Hewlett-Packard 8341B

Synthesized Sweeper, 10 MHz to 20 GHz, 1 to 4 Hz frequency resolution, low spurious and phase noise, 100 ns pulse width capability, +10 dBm to -110 dBm calibrated output, complete analog sweeper, dc to 100 kHz amplitude modulation.

\$24500.00

Hewlett-Packard 8553B

Spectrum Analyzer- RF Section, frequency range is 1 kHz to 110 MHz, resolution bw range from 300 kHz to 10 Hz, signal levels as low as -140 dBm can be measured using the 10 Hz bw.

\$500.00 Special

Wanted Used Test Instruments!

Call or fax us a list.

Hewlett-Packard 8554B Spectrum Analyzer RF Plug-In

Frequency range is 10 MHz to 18 GHz, high sensitivity (-125 dBm), 100 Hz resolution.

\$900.00 Special

Hewlett-Packard 8015A Pulse Generator

1 Hz to 50 MHz, two independent $\pm 16V$ outputs, 1 ns to 1 s widths, 20 ns to 1 s delay.

\$875.00

Hewlett-Packard 8620C/ 86290C Sweep Oscillator System

86290C RF plug-in, 2 to 18.6 GHz, +13 dBm maximum leveled output. The 8620C has sweep and cw functions. Both are like new condition.

\$2900.00

Tektronix 475A DM44 Oscilloscope

250 MHz bw, dual channel, 5 mV/div sensitivity, 1 nS/div sweep rate. Has differential-time/DMM option Includes 2 probes.

\$975.00

Wandel & Goltermann PS-19

Level Generator, 80 Hz to 25 MHz, 0.1 Hz resolution, level displayed in dB/ dB0 or in dBm/ dBm0.

\$2850.000

Tektronix Plug-In Special

7A13 Differential Comparator	\$350.00
7A19 Amplifier	\$350.00
7A22 Differential Amplifier	\$350.00
7A24 Dual Trace Amplifier	\$450.00
7A26 Dual Trace Amplifier	\$250.00
7B53A Dual Time Base	\$175.00
7B80 Delayed Time Base	\$200.00
7B85 Delaying Time Base	\$250.00
7B92A Dual Delaying Time Base	\$200.00
7D15 Counter/ Timer Plug-In	\$350.00

DANBAR SALES COMPANY



NOVAPLEX

The One-Stop Source for Cable Parts, Tools & Accessories

Announcing the Centurion — great performance at an incredible price!

Centurion

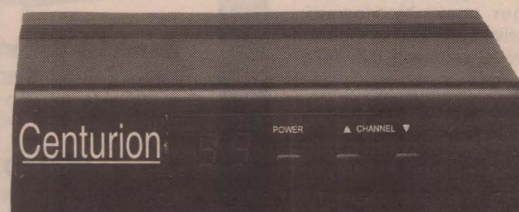
Introductory Offer! For a limited time only, 10-lot price is only:

\$65

The New Centurion converter offers a number of powerful features:

- parental control
- switched AC outlet
- sleep timer
- remote control included
- auto/manual fine-tune
- favorite channel memory
- batteries included
- jumper cable included
- illustrated user manual
- LED display

please place your orders soon — demand for the Centurion is high!



Panasonic & SA Converters

Panasonic TZPC 145 Converter SA 8511-300 Converter

Units sold with wireless remote control & batteries
Features include: parental control (Panasonic only), last channel recall, favorite channel memory, sleep timer, channel 2 or 3 available.

In quantities of 10 or more, **\$65**

Also: Panasonic TZ-PC 175 Series Converter w/volume.
Topcases for Panasonic, SA and Jerrold (all models) also available. Call for pricing and availability.



Panasonic TZPC 145 \$65
channel 2 or 3; 10-lot prices

SA 8511 channel 3 \$65



Quality capacitors (1,000-lot price)

Capacitor	Cost	Capacitor	Cost
1uF - 50V	.06	3.3uF - 50	.06
100uF - 50V	.10	33uf - 35V	.06
100uF - 63V	.11	33uF 50V	.07
1000uF - 16V	.15	330uF - 50V	.14
1000uF - 50V	.30	330uF - 63V	.14
.22uF - 50V	.06	4.7uF - 50V	.07
22uF - 50 V	.06	47uF - 50V	.08
2200uF - 16V	.22	47uF - 63V	.08
600uF - 50V	.24	470uF - 50V	.19

Security Bits (10-lot)

Pioneer 6300 Oval Bit \$15.50

Jerrold-compatible bits

1/4" Female Bit \$9.50
1/4" or 5/16" Bits 8.50
AVSAFE #4 round D series 14.50

TORX Bits

Tocom T-7 \$3.95
Zenith T-10, T-15 3.95
Pioneer T-20 3.95
SA T-20 3.95
Magnetic bit driver 4.75

Novaplex Converters (10-lot)



Novavision full-featured converter

Watch one channel and record another using inVIEW technology **\$180**

Millennium multi-option converter

Configure the various optional packages to suit your specific needs **\$62**

Remotes (10-lot)

Novaplex R1000 Universal Remote
6-in-1 for TV, Cable, Satellite, VCR, Audio & More **\$11.50**
Jerrold-compatible 400/450/550 5.75
CFT 2000 7.50
Scientific Atlanta-compatible
075 / 175 5.75
475 with volume control 6.25
8600 with on-screen display 6.25
Zenith-compatible (all Z-TACs) 6.00
Panasonic-compatibles
120 / 140 7.75
170 with volume control 8.75
Pioneer-compatible for 81 / 82 7.00
Tocom-compatible (all models) 7.00

Dozens of other items in stock!

Panasonic-compatible topcases with lenses **lower price** from \$7.25
SA-compatible cases from 5.55
Toggle switches from .75
Batteries (9V, AA, AAA & more) from .15

Call for quantity discounts!

Kester Solder 44 Coresize from \$8.45/roll
Jumper cables (1, 3 & 6 ft.) from .60
Jerrold-compatible bezels from .95
IC Socket / 14 count (28-pin wire wrap) 1.19

Call for your free catalog!

Call 1-800-644-NOVA today!



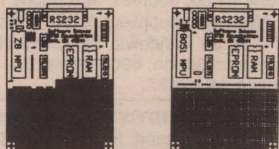
Call Toll-Free 8am-6pm PST 800-644-6682

Novaplex, Inc. 8818 Bradley Ave, Sun Valley CA 91352
FAX: 818/504-6522 COD, MasterCard, Visa, Credit Terms

Panasonic™, Jerrold™, Zenith™, Tocom™, Pioneer™ and Scientific Atlanta™ are trademarks of their respective corporations and are not affiliated with Novaplex, Inc.

MACINTOSH/APPLE Repairs, Parts and Peripherals. Low prices on Macintosh, Apple II and peripheral repairs. Repairs of whole units or repair or exchange of parts. Sales of new third party peripherals. Used equipment available. Mac Shack 716-377-9230, FAX 716-377-9573.

DISK CONTROLLERS for the IBM PC 8/16/32 bit MFM, RLL, ESDI, SCSI and IDE CD-ROM too! Call UTWE with your needs. New 16 bit 1:1 MFM \$20 ea., cables add \$2.50 Adaptec 2322B \$29 8 bit SCSI interface \$25, 5/100. Call 818-797-2569 fax 818-797-0384, E-Mail John-UTWE@AOL.com



PROTOQUICK Z8 AND 8051 Complete single board computer systems with large prototype area, serial port, operating system in EPROM, cross assembler, documentation and application notes, \$99 ea. Call for technical flyer. Software Science, 3750 Roundbottom Rd., Cincinnati, OH 45244. 513-561-2060.

CANON BUBBLEJET, Apple Writer Ink Jet Refill Kit, highest quality complete with instruction and 10 refills, \$29.95. LOALCO, Box 7117, Delray Beach, FL 33482. 407-241-9990.

COMPUTER REPAIRS for Atari, Commodore, Coleco, Sinclair/Timex, Osborne, TI, TRS-80 and IBM compatibles. Reasonable flat rate plus parts and shipping. Buy, sell, trade, upgrade. SASE appreciated. Computer Classics, RT-1, Box 117, Cabool, MO 65689. 417-469-4571.

HEWLETT PACKARD Plotters. HP 7475A \$199.95, HP 7550A \$299.95. Both do up to 11x17 Drawings, and work with all popular CAD and graphics programs. Call about other models in stock. Comes with pens too! Stewart & Associates. 1-800-704-6500.

NEW HARD and Floppy Disk Drives 720K 3.5 inch, \$15 each, \$60/5, \$190/20 360K floppy drives \$8 each, \$50/10. Conner 40 meg IDE NEW \$45. Toshiba 106 meg SCSI NEW \$65. Call UTWE, 818-797-2569 or fax 818-797-0384.

NOTEBOOKS 386/486 from \$650. 386/486 desktop systems from \$395. Pentium 60/90MHz, 8 meg RAM, 540 HD SVGA card \$1,350/\$1,550, 17/20 inch multiscan monitors \$475/\$995. VGA monitors \$135. Laser printers 8ppm 1.5 meg RAM. Originally \$850, now \$420. New w/warranty 714-778-0450.

CALLER ID in your PCI Patented Pass and Block feature for **COMPUTER ACCESS SECURITY!** 8-bit card with software. Database included. Pager Forwarding. More. Technical reference to write your own applications. Now only \$109.95! Pewee Valley Innovations, Inc., 6601 Old Zaring Road, Crestwood, KY 40014. 502-241-4295.

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.

16 BIT Memory Cards for 286, 386, 486 systems \$15. (OK installed) NEW! Holds up to 3 meg of DRAM (41256 chips). Add memory @ \$25/meg. Memory Card that uses SIMMs also available. Call UTWE, 818-797-2569 for details.

WAREHOUSE CLEARANCE: Hundreds of **LAST GENERATION** used computers, parts, printers, modems, peripherals, CD-ROMs, network equipment and software. **Single pieces or case and pallet lots. Bulk sale discounts. Over 10 thousand square feet must be cleared for move. All equipment sold at low prices as-is on a first come, first served basis. SRG Associates, 508-443-8084.**

TOWER CASES! Baby AT desktop cases! New mid-tower with 3 5-1/4 bays, 2 3-1/2 inch bays, digital display 200 watt, \$40, \$375/10. Baby AT case, 230 watt, only \$35 each! Call Under The Wire Electronics, 818-797-2569 or fax 818-797-0384.

1-800-458-6778 FLOPPY DRIVE REPAIRS \$1-\$15. Consistently reliable since 1983. 2 day avg. Turnaround, 6 mo. warranty. ISR, 2217 Downing Ln., Leander, TX 78641.

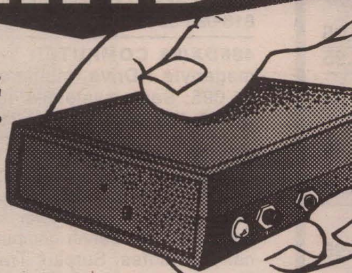
WHOLESALE USED parts, CGA cards \$5 ea., qty. 10. Para/serial cards \$5 ea. qty. 10. 360K floppy \$5 ea., qty. 5. 720K floppy \$5 ea., qty. 5. 10 Meg HH, DH \$10 ea., qty. 5. XT Motherbd \$5 ea., qty. 5. AT Mboard \$9 ea., qty. 5. Mono monitors \$15 ea., qty. 3. Mono cards \$4 ea. qty. 5. Plus hundreds more parts, monitors, and complete systems. Raven Tech, Inc., 862 W. Third Ave., Columbus, OH 43212. 614-298-8494, FX 614-298-8495. Service and repair 614-298-8493.

VGA MONITOR \$125, EGA, CGA monitor \$60, \$40, 386 computer \$250, VGA boards \$25. 286 computer \$100, Epson printer \$40, HP 7475A plotter \$125, HP 7550A plotter \$200, HP Vectora 286 computer \$100, XT computer \$45, HP 85 computer \$50, HP ThinkJet printer \$75, Apple IMG II printer \$125. Much more. 714-827-7345.

WHOLESALE FLEAMARKET merchandise directory. 60 pages, hundreds of distributors listed that you may contact who supply fleamarket/swampmeet dealers. All kinds of items, incredible prices! Electronics too! Useful for business or personal use. \$12. JACOMM-CH, Box 142, Wharton, NJ 07885-0142.

RAINBOW KITS

The 10GHz Transmitter is back...



The "ZAPPER II"

With it's new and improved design it will not only test your radar detector...BUT it's tuned to the amateur radio band.

- While your out on American highways personally test yours and your fellow travelers radar detectors.

The "ZAPPER II" is a 10.450 GHz to 10.550 CW oscillator. It has a code key jack installed for those who want to send Morse code.

BUILT \$49⁹⁵ KIT \$39⁹⁵

TV NOTCH FILTERS
FOR CHANNELS 2 thru 22 ONLY



Our TV filters eliminate unwanted TV channels or interference that alters both sound and video with a beep beep beep. Works on cable channels 2 thru 22) only.

NOTE: All TV Filter Kits are sold for educational purposes only. You must obtain permission from your local cable company before using these filters on your cable system.

DF-222 KIT \$14.95

This Manual contains schematics, parts lists & P.C. board layouts for many of the Rainbow Kits. Use your own parts to construct our kits.

KIT BOOK

\$14.95 \$9.95 with the purchase of any kit.

Please add sufficient postage First lb \$5.00 Canada \$7.00 Additional LB. Add \$1.00 US FUNDS ONLY We will accept telephone orders for Visa or Mastercard



To Order Call 317-291-7262



ELECTRONIC RAINBOW INC

6254 LaPas Trail • Indianapolis, IN 46268
FAX 317-291-7269

5K

FM STEREO TRANSMITTER



Own your own FM radio station. Any stereo signal you plug into the FMST-100 will be transmitted to any FM radio tuneable from 76 to 108MHz FM. Transmit a wireless link through an auditorium, from your car to your camper, listen to your CD's while mowing the lawn, Play music on one channel sing on the other. Clarity is excellent, approx. 40dB stereo separation. Length of antenna determines the distance of transmission. Complete with stereo input level controls & crystal for stereo separation. 9v battery operation. SIZE: 1.5" x 2.5" x 3"

FMST-100 KIT \$29.95 / Cabinet \$8.95

PHONE TRANSMITTER



Small but mighty, it fits anywhere. Phone line powered, never needs batteries. Transmits both sides of a phone conversation loud and clear, wireless, to any FM radio at great distances. Variable tunes from 70MHz to 130MHz FM. You can also use it as a speaker phone. SIZE: 1.25" x .6"

TEL-B1 KIT \$12.95 BUILT \$29.95

SUPER SNOOPER BIG EAR



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 KIT \$10.95 BUILT \$29.95

WIRELESS FM MICROPHONE



Small but mighty this little jewel will out perform most units many times its price. It really stomps out a signal.

The WM-1 kit is a buffered wireless mike that operates from 80MHz to 120MHz FM, the frequency of any broadcast FM radio. Includes a mini-electret mike. 6 to 12v DC. SIZE: 1.25" x 1"

WM-1 KIT \$14.95

DC VOLTAGE MONITOR



If battery status is important, you need this kit. This kit uses 7 LEDs to monitor 12v DC in 1v, 1/2v, or 1/4v steps. Monitor 8v or 5v in 1/4v steps. Great for boats, motor homes, model planes or race car n-cads. All parts and instructions are included. SIZE: 1.3" x 2.7"

VM-1 KIT \$7.95

STROBE LIGHT



Do you need an attention getter, warning light, or flashing light for model airplanes?

Then this kit is for you. Use it as an emergency light for your auto, radio tower, even use it on your bicycle. Has a variable flash rate. Power requirement 6 or 12v DC. Size 3.5"x1.9"

ST-1 KIT \$9.95

MICRO-LIGHT

Visible Over 1 Mile.

This is truly an indestructible flash light.
• Comes in red or yellow light.
• Bulb will not burn out.
• Uses a 5 year shelf life lithium battery.
• Case made of tough ABS.

MLR (red light) MLY (yellow light) CHOICE \$9.95



4.0mW Laser Diode

Great for making a gun sight, use as a transit, makes a super experimenters project.

The beam is visible with a wavelength of 670 nm. Size of beam is 6mm at 5 meters. Power requirement 3 volts DC at 85mA. Size: 10.5mm x 18.5mm

LDM-5 New Low Price \$59.95



VOICE ACTIVATED SWITCH

This VOX circuit can be used to operate a tape recorder, ham radio, CB radio, or turn on an alarm. The VOX-1 kit has 100MA of output that operates a relay, light, motor, ? What could you do with a sound activated switch? Power requirement 7.5 to 18vDC. SIZE: 1.5" x 1.3"

VOX-1 KIT \$6.95



WIDE BAND PREAMP

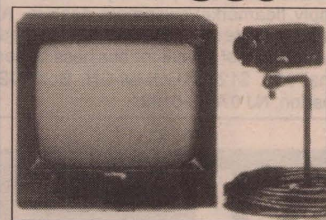
The ideal preamp for scanners, hand held radios, frequency counters. Amplifies low level

(weak) signals. If the signal is extremely low 2 amps can be used in series. 1MHz to 2.5GHz @ 2.8dB NF. 1dB compression = +0 dBm. Gain: 1MHz=20dB to 2.5GHz=6dB. Power requirement 12v DC @ 6mA. SIZE: 1.2" x .8"

WBA-6 KIT \$19.95

ALL PHASE VIDEO SECURITY Complete 1 Camera Surveillance System

EXPANDABLE
USES STANDARD
COAX CABLE
Special!
\$369⁹⁵



INCLUDES:

- 9" Monitor B/W • 1/3 Chip Camera - 380 Lines Resolution • 100 ft. Cable 12VDC Pwr Supply
- Universal Wall/Ceiling Mount
- 4mm Wide Angle Lens
- .1 Lux Sensitivity

Extra Camera

model #B7106

INCLUDES:

- APPRO Pwr Supply 12VDC
- 4mm Wide Angle Lens

\$189.95

Wall / Ceiling Mount #CST-125 **13.95**

50' Video Cable BNC to BNC
model #BNC-50 **10.95**

100' Video Cable BNC to BNC
model #BNC-100 **14.95**

4 Input Sequential Switcher
model #GSWT-4 **99.95**

4 Input Quad View,
Record 4 Cameras At Once
model #RSQ2 **449.95**

24 Hr. REAL TIME Recorder w/
Time Date & Security Lock
Sanyo #SRT-500 **849.95**

Sony 24 Hr. Time Lapse
model #SVT-100 **729.95**

Sony - Sony -
Panasonic & More

**Call For
FREE
Catalog & Technical
Assistance**

Add \$8.95 Shipping/Handling
NYS Add Tax
Visa/MC/Discover/Amex

MAIL ORDERS TO:
70 CAIN DR.
BRENTWOOD, NY 11717

ALL PHASE
VIDEO SECURITY INC.
WHOLESALE VIDEO WAREHOUSE

1-800-945-0909

FAX: 516-435-7494

Write in 35 on Reader Service Card.

The Smallest, Most Secure, Best Range, 3 Channel Remote Receiver.



**Security Receiver for...Home Automation,
Garage Doors, Home Security Add On, Auto Convenience
Package (Door Locks, Trunk Pop, Windows-Up/Down,
Car Start), N/O or N/C Contacts.**

Security - 70 billion hopping codes with anti-scan processing. Unbreachable security; never repeats the same code twice. Double EEPROM memory.
Incredible Range - No cross talk or blockage. Range up to 1000 feet.
3 Channel - Our universal receiver controls up to 3 items with only one receiver (optional relay needed). Push both buttons together for third channel output.
Interfaces with most home & auto security systems for easy remote integration. Comes with (1) three channel receiver, (2) long range three channel remotes, (1) universal 120 VAC transformer. ALL FOR ONLY \$89.95 + 7% sales tax & shipping.

E-Meter
Actual Size
The **Ultimate Battery Monitor**
0-50V (0-500V Optional)
Lift Lockout & RS-232 Available
The **E-Meter's** multi-color bar graph shows battery status at a glance. The digital display gives you Volts, Amps, Amp-hours, Time Remaining, and Kilowatt-hours. It also tracks historical battery information including Charge Efficiency Factor (CEF), # of CEF recalculations, deepest discharge and average discharge.

Under \$200.00!
Fits in 2" round hole!
Cruising Equipment Co.

Cruising Equipment Company
6315 Seaview Ave. NW, Seattle, WA 98107 USA
(206) 782-5869 Fax: (206) 782-4336

Write in 207 on Reader Service Card.

LASER PRINTERS. Xerox 4045 (NBI 10) \$200. QMS KISS (similar to HP I) \$200. 818-989-3848.

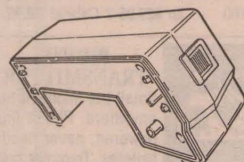
486DX/66 COMPUTER systems 540 megabyte HDrive, multimedia system \$1,095. Same system w/486DX 4/100 \$1,195. Fax machines from 714-778-0450.

ZENITH COMPUTERS. We have Zenith laptops and desktop computers in used working condition. Also, we have replacement boards, drives, power supplies, batteries, etc. for Zenith computers. Please call for quotes. Surplus Trading Corp., Benton Harbor, MI. 616-849-1800.

PCs CUSTOM designed and built, special features incorporated to your requirements. We can build them small, wall mount, anti-vibration, sealed, super cooled, or whatever your needs. Quantities as low as 10. Fax requirements to Fujimi Ltd., Hong Kong, +852-2834-0463.

UPGRADE PARTS! 486DX2/66 VLB Motherboard. New with 1 yr warranty, AMI BIOS and 256K Cache Memory \$99. Mini Tower Case with 200 watt power supply \$39. 3-1/2" 1.44MB Floppy Drives \$32. MB floppy drives \$39. Plus lots, lots more. Call for other pricing. Stewart & Associates. 1-800-704-6500.

DEALERS, TECHNICIANS: Do you throw away bad power computer switching power supplies? I can show you how to fix 9 out of 10 in less than a half for under \$10. I'm selling a schematic, extensive theory of operation, and a complete troubleshooting guide. The price? \$40, the cost of one supply. It will pay for itself with the first repair. Jim, 520-623-8994. PO Box 5123, Tucson, AZ 85703.



ZENITH LAPTOP BATTERIES. For Zenith SupersPort Laptop Computers. New. 4 Amp hour \$25 each. Quantity discount available. STC-Surplus Trading Corporation, Benton Harbor, MI. 616-849-1800, 616-849-2995 FAX. We ship UPS/COD.

IRQ/DMA conflict eliminator: Easy to build board does what software can't. A must for troubleshooting pcs. Laser printed schematics, drawings and parts list, \$15. Mark Lopez, 306 Roosevelt, Irvine, CA 92720.

KEYBOARDS 101 New (AID) \$16.50 5 or more \$12 ea. 286AT CPUs stuffed, working \$100. 509-922-2179.

PAPER WHITE VGA MONITORS NEW! 1024*768 14" only \$79 ea. or \$375/5, \$690/10. Call UTWE Fast before they are gone! Sales/Tech support 818-797-2569, fax 818-797-0384, E-Mail JohnUTWE@aol.com.

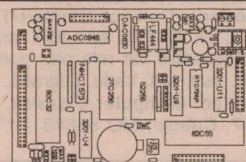
WYSE GENICOM DEC Used Equipment (11) Wyse Terminals, (3) Genicom Model 3310 Printers, DEC, PDP11/34. CPU, LA120 printer, RL02 drives and disks, MDSI plotter. 213-587-9125.

NEED MONITOR SCHEMATICS? 200+ FCC ID code cross reference to monitor company name, address, and phone numbers. Also, parts suppliers phone numbers. 3-1/2" disk for Windows. Send \$15 check to: Computer Vision, 6905 Indian Bay Rd., Montague, MI 49437.

COMPUTER HOBBYISTS, programmers, experimenters wanted. Heath/Zenith Z-100 is CP/M and MS-DOS capable, reasonably priced. Parts, "Z-100 LifeLine" newsletter for H/Z-100 suppliers and users, \$15/yr. in US. Add'l info 919-338-8302, 6-9:00 pm EST.

SYQUEST DRIVES. One: Model 555 (44MB SCSI). Two: Model SQ319RD (15MB RLL), all with cartridges. Used, guaranteed. Contact Tom Mynar, 714-236-5868 (West Coast), tommynar@deltanet.com. CIS: 73637,30.

NEC RAM cartridge PC-8207A. \$25. Archive tape drive model 5945-L2 \$65. 818-989-3848.



VERSATILE 80C32 single board computer 32K RAM and 32K EPROM. Extended BASIC-52, 8 channel A/D, D/A, real time clock, parallel printer port 24 bits of I/O. Power supply, terminal emulator software and utility disk included. \$200 assembled, \$175 kit plus \$5 S&H, add \$5 for COD. DC Micros, 1843 Sumner Ct., Las Cruces, NM 88001. 505-524-4029.

COMPUTERIZE YOUR business for \$500 or less. How to kick tire on a used computer. Buying a used computer. Using low cost computers on the Internet. Special Reports \$3 each. Computer News, PO Box 50127, Casper, WY 82605.

FRANKLIN COMPUTER, all models, including PC-8000 complete \$89, other models, parts, software, manuals, 610-356-6183, after 12:00pm.

GANDOLPH LDS309A Async-sync 19.2K modem. 4 units \$150 all. Call 615-758-8774 leave message.

HARD DISK Technical reference on Disk. This disk is a complete technical reference for all major hard drives & controllers. Provides all the info and parameters you need to install, set up, and troubleshoot most mfg. hard drives and controllers. If you work on IBM compatible computers, this is a must have. To receive yours, send check or money order for \$7.95 to: Stewart & Associates, 244 Mid Rivers Centre, St. Peters, MO 63376.

SOLA REGULATOR. Micor/Mini computer constant voltage transformer 8.34 amps. \$125. 818-989-3848.

TAPE DRIVE. STC 1950 vacuum drive with 1935 controller 5 foot cabinet. \$475. 818-989-3848.

SECURITY ACCESSORIES:

- Dual Stage High/Low Electromagnetic Impact Sensor\$14.50
- Microwave Field Disturbance Sensor\$38.00
- 3 Channel 4 watt Mini Pager\$88.50
- Digitally Controlled Starter/Ignition Disable N/O Contacts with 280,000,000,000 Possible Codes\$60.00
- Digital Keypad Starter Kill\$31.00
- Programmable 4 Channel Voice Module (4) 8 second Voice Message\$74.00
- Power Door Lock Motor/Actuator\$14.50
- Window Roll Up Module with Safety Shut Down\$34.50
- Window Up/Down/Vent Module with Safety Shutdown\$65.00
- Car Start Module Designed to Control and Monitor EFI Equipped Automatic Transmission Vehicles\$88.50
- Power Trunk Release Solenoid\$24.00
- 120db 6 Tone Programmable Siren\$13.85
- Pulse Timer - Adjustable 1 to 90 seconds - 30 A Relay\$12.50
- Active Relay - Latching Relay 5A Load\$18.00

ALL ABOVE COMPONENTS USE 12VDC CURRENT & ARE FCC & UL APPROVED

Street Smart Security
(619) 462-1167

7147 University Avenue • La Mesa, CA 91941

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

LINUX Operating System on CD-ROM

A UNIX System with extra features for a lot less!!

- Slackware Professional Linux 2.3** **\$61.95**
4 CD-ROM set * 640 page Manual * Ready to run from CD-ROM * X Window C/C++ compiler * Emacs * Internet Tools * Complete Source Code
- OSF/Motif v2.0** **\$139.95**
A 100% OSF/Motif compatible graphical user interface X Window Manager for PC's running Linux. Includes a 100+ page user's manual and sample source code
- The Linux Bible New Edition!** **\$34.95**
1300+ pages of Linux documentation * Includes Installation and Getting Started guides.

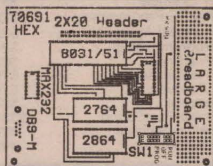
A Wide Variety of Products Available from Yggdrasil, Walnut Creek, InfoMagic, O'Reilly & Associates, and others...

Just Computers! (800) 800-1648 Int'l (707) 586-5600 FAX (707) 586-5606
E-mail: sales@justcomp.com P.O. Box 751414 Petaluma, CA. 94975-1414
COD & Visa/MasterCard Gladly Accepted For more information, send e-mail to: info@justcomp.com

Write in 43 on Reader Service Card.

KINGSTON 8 Meg memory card KTC2337/8. Out of Compaq 486/33 lite qty 2. \$200 each. Call 615-758-8774, leave message.

IBM PARALLEL TO HP/IEEE488. Drive your HP/IB plotter or printer directly from an IBM parallel port using our device driver and special cable. \$79 + \$4 S&H. Orion Engineering, 7691 Lincoln Trail, Plainfield, IN 46168, or call 317-839-9673.



8051 SBCs with Bootstrap Loader. Economical SBC with 128 byte memory, 24 I/O Ports. Contains preprogrammed Bootstrap software that allows loading of .OBJ files to EEPROM through Serial Port of PC. Run programs without burning EPROMs. IBM DOS compatible Utility Disk included (3.5 or 5.25 in). \$59 plus S/H. Also; Learn Assembly code with the perfect 70691HEX companion; "Assembly Language BASICS". A 64pg booklet devoted to the programming of the 8031/51. Written with the novice programmer in mind. \$15 plus S/H. Suncoast Technologies, Spring Hill, FL. 904-596-7599. V/MC Accepted.

A WHOLE mess of Commodore 64 stuff cheap. Cheap: Lot deal. Too much to list. Call for details and make offer. 603-329-6651 after 6pm EST.

ANALOG/DIGITAL I/O CARDS from \$29. Up to 8 different boards can be operated simultaneously from your PC's printer port. Available boards include 24-bit A/D converters, 12-bit DACs, LCD displays, relays, digital I/O, thermocouples, etc. Atlantic Technologies, Inc., POB 26, Newtown Square, PA 19073.

SYTEK NETWORK system. Large variety cards, boxes, amps, mux etc. 818-989-3848.

CANON BJ10 sheet feeders, \$30 each, Telex 1260 CPUs with 640, case, motherboard \$30 each. S&H extra. 910-867-3446.

MI TECHNOLOGIES, 3310 East Peterson Rd., Troy, OH 45373. 513-335-4568 FAX 513-339-6344. We stock over 420 schematics for monitor and computer repair. Same day shipping. We specialize in reverse engineering of monitors and power supplies. FCCID monitor codes on disk \$50. Techips Monitor repair data base \$99.95. Workshop control repair database \$249.95.

DEC 486DX33 PC pizza box workstation, DEC barebones closeout, special case. PS 2 meg VRAM SVGA, 2S, 1P, & MP, IDE, H&F cont. Token Ring, ext. SCSI-2 P. You supply: CPU 486SX to DX2-66, monitor mag 15" or equal, 1 or 4 meg SIMMs mem., 1.44M FD, notebook HD, keyboard, mouse, for a \$4,999.95 system. New bulk packed with manual, cables & software. Size: 15"x15"x2.5". Use as a portable or workstation. Only \$149. 20" SVGA 1280x1024 monitors for above systems, \$299. Many parts & CPUs available to complete these fantastic systems! OEM accounts welcome. Our 31st yr. Call or faxback cat'l, 508-532-2323. BNF, 119 Foster St., Peabody, MA 01960, 508-532-2323.

NK JET REFILL KITS. Complete line of ink cartridge refill kits for Canon, HP, Epson, and most other printers and faxes. Save major dollars! Color and black ink. Call with your model. **Printers Plus**, 717-421-7138.

I WANT it and I want it now. I want all of your SIMM memory. IBM, Mac, new, used, even defective. I want it all. Highest \$ paid. Call 1-800-4-MEMORY now! Voice/FAX.

C and H sales co.

1-800-325-9465

FAX: 818-796-4875

2176 E. Colorado Blvd., Pasadena, CA 91107

Mailing Address: P.O. Box 5356, Pasadena, CA 91117-9988



BUY & SELL

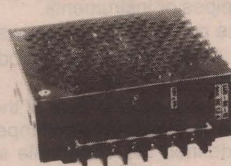
Since 1947

POWER SUPPLIES

DC POWER SUPPLY

SWITCHING SYSTEMS INTERNATIONAL #SQV402-1444-1. Four Output - 5 VDC @ 50 amps. Aux. 1 - 24 VDC @ 10 amps. Aux. 2 - 24 VDC @ 5 amps. Aux. 3 - 24 VDC @ 5 amps. Aux. 2 & 3 can be series to produce 48 VDC @ 5 amps.

Stock #PS9404 \$99.50 each
10 for \$750.00



SWITCHING POWER SUPPLY

LAMBDA #LUS-8A-12. 12 VDC 1.3 amps.

Stock #PS93514 \$20.00 each
10 for \$175.00

LINEAR POWER SUPPLY

POWER ONE #HB28-1-A. 28 VDC @ 1 amp.

Stock #PS9400 \$20.00 each
10 for \$175.00

DC TO DC CONVERTER

INTRONICS #S1635-1. Input: 30 to 60 VDC. Output: 5 V @ 4 amps ± 15 V @ 150 mA.

Stock #PS9405 \$20.00 each
10 for \$150.00



±15 VDC POWER SUPPLY

BECKMAN, #MPS-60. Input 120 VAC 60 Hz @ 1 amp. Dual adjustable outputs 0 to ±15 VDC @ 0.2 amps. Resolution 10 mV and 100 mA. Accuracy ±20 mV and 100 mA. Has digital display for voltage and current. Dim.: 12" wide x 4 1/4" high x 13 1/4" deep. Weight 16 lbs. New, with manual.

Stock #PS9410 \$195.00

TEST EQUIPMENT

HEWLETT PACKARD

- #140T. Spectrum Analyzer. Mainframe \$500.00
- #8555A. Spectrum Analyzer. RF Plug-in \$1,000.00
- #204C. Oscillator \$125.00
- #333A. Distortion Analyzer \$695.00
- #432C. Power Meter \$250.00
- #3330B. Automatic Synthesizer \$650.00
- #8614B. Signal Generator. 0.8-2.4. GC \$695.00
- #216A. Pulse Generator \$295.00
- #8445B. Automatic Preselector.. \$495.00
- #8057. Noise Generator \$295.00

See our catalog for more models in stock.

SOLID STATE SCOPE

HP OSCILLOSCOPE

- #180A. 100 MHz bandwidth. Accepts standard 1800 series plug-ins. Stock #OS8901 \$395.00

CALL OR WRITE FOR OUR FREE 128 PAGE CATALOG!

Write in 44 on Reader Service Card.

WE BUY EXCESS ELECTRONIC INVENTORIES

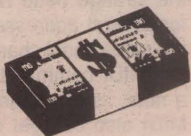
Obsolete or Overstocked ICs, Damaged or Overstocked PC Boards, Hard Disk Drives, Anything Electronic . . .

WE PULL ICs FROM PRINTED CIRCUIT BOARDS

- ★ We have "IN HOUSE PULLING" facilities!
- ★ We BUY both socketed and soldered parts!
- ★ We BUY PC Boards for IC value!
- ★ WE BUY PC Boards for precious metal value!
- ★ WE OFFER "Certificate of Destruction."

Guaranteed quick response to all inquiries. . .
If you have any surplus Electronic Inventory that you would like to

turn into



call!

SPI

Worldwide distribution

SEMICONDUCTOR
(818) 349-4495 • (818) 349-6562

Write in 64 on Reader Service Card.

Nuts & Volts Magazine/August 1995 25

Don Lancaster's

RESOURCE BIN

number forty-three

Electronic music then and now.

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.

A portion of my PSRT RoundTable on *GENie* has also been set aside for you *Nuts & Volts* readers. This is the place you go for instant tech answers. Among the many files in our library, you will find complete reprints for all the *Resource Bin* columns.

I did manage to wrangle one super special sign-up deal for you *Resource Bin* readers. Ten free hours.

GENie now offers far lower day-time rates, a direct Internet access, plus a Windows graphics interface, so it's an even better deal than ever.

See the trailer blurb for details.

Electronic Music

Electronic music is a rather highly technology-driven field. Defined by what was possible at the time.

Several goals do include: producing sounds that are not restricted to the physics of acoustic resonance; reducing costs of orchestral, video, theater, CD, and motion picture sound production; adding sound and music to computers; enhancing a traditional instrument; and creating new sounds.

The earliest electronic music device was an instrument called a *Theremin*. This dates from the late 1920s. There were two radio frequency oscillators, each connected to sensitive antennas.

Bring your hand near one antenna to change the *pitch*. The other varies *loudness*. Playing in mid air.

Traditional Theremin sources often do advertise in *Sound Practices*. *PAIA Electronics* has new Theremin kits.

Next came electronic organs. They usually started off with a *Top Octave Generator* which produced the 12 notes of the highest octave. Cascaded binary divider chains then produced lower-frequency sawtooth waves.

A sawtooth wave has all harmon-

ics present and rather strong. Suitable filters could emphasize or reduce any given harmonic to voice the various organ pipes or instruments.

The rule was to use sinewaves for flutes, squarewaves for woodwinds, and sawtooths for strings.

The "locked in" nature of the notes and the limited note envelopes very much defined the obtainable sounds. The best early book on these was the classic *Electronic Music Instruments*. Authored by Richard Dorf.

A source for replacement parts and organ electronics is *Fistell's*.

By far, the finest of all the electronic organs was (and remains) *Allen*.

NEXT MONTH: Don looks at national and local resources for the physically disabled.

Who went so far as to produce a separate oscillator for every note, simulated air supply variations known as *electronic wind*, and even a *chiff*, that sudden start-up transient when a traditional organ pipe gets hit with a burst of air. An outstanding read on this is *Trials and Triumphs of an Organ Builder* from Allen's *Vox Humania Press*.

Moog and Company

Next in line was the era of the *Moog Synthesizer*. Using analog VCO voltage controlled oscillators, VCA amplifiers, and VCF filters. VCOs set your pitch, driven from a keyboard voltage.

Those VCAs set the attack-sustain-decay envelope of the note. The VCFs created the note's timbre.

All VCOs had to be stable and have a wide *log* range. Major problems did include stability and the restriction to *monophonic* single notes.

One supplier for traditional analog SSM synth chips is *PMI*.

The next electronic music milestone got reached when a person by the name of Chowning made an amazing discovery. By *frequency modulation* a note, different harmonics result.

All this happens because of certain obscure properties of all those

Bessel Functions underlying FM modulation. You could now create different tonal colors without needing either fixed or tracking filters. On the fly.

'Round about the same time, others decided to work out from the supply side. Designing all sorts of personal computer software products, which let you compose, translate, and print musical scores. The *Sonata* font from *Adobe Systems* was one example.

Along with MIDI links between PCs and intelligent instruments.

As with all other electronics, the switch to digital became inevitable. Digital once and for all solved the old polyphony problems. Because your keyboard was now isolated from the tone generators. A pressed key gets a generator assigned. That assignment continued until the note's decay.

Also new to digital was the concept of *wavetable synthesis*. Where the note harmonics and its envelope could be stored and executed separately.

Wavetable synthesis also drew no distinction between traditional tones, speech, or even oinking pigs. It was a totally generalist solution to creating variable pitch and amplitude.

The early leader here was *Ensoniq*, whose chips went into nearly all of the mainstream synthesizers. Not to mention such computers as the Apple IIGS and many others.

Ensoniq never seemed too excited about selling individual chips. Since that time, *Integrated Circuit Systems* has become a leading supplier of low-cost digital synthesizer chips.

Yet another source of digital synth chips is *Yamaha*. A fourth significant resource here is *Crystal Semiconductor*, the foremost supplier of high-quality delta-sigma A/D converter chips.

Competing with *Crystal* are *Analog Devices* and *Burr-Brown*.

About this time, toy music all of a sudden started sounding real good. Letting certain \$39.00 consumer products outperform \$8,000.00 electronic organs.

These days, we're in the midst of a *Digital Signal Processor* revolution. In which the entire sound gen system is totally flexible, fully programmable, and software driven.

MIDI

The centermost key to everything even remotely electronic musical is called MIDI. MIDI is an asynchronous 31.5 kilobaud channel remarkably similar to ordinary old serial computer comm. The main two differences are the strange baud rate and the ability for several addressable sites to share the same serial channel.

MIDI commands typically specify a note, its envelope, and its duration. MIDI also can get used to upload or download presets. Or anywhere else

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.

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

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	\$32.50
PostScript Tutorial/Cookbook	\$19.50
PostScript by Example	\$31.50
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
PostScript Insider Secrets	FREE
Hacking Insider Secrets	FREE

POSTSCRIPT SECRETS

A Book/Disk combination crammed full of free fonts, insider resources, utilities, publications, workarounds, fontgrabbing, more. For most any PostScript printer. Mac or PC format. \$29.50

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 two volume set shows you tested and proven real-world alternatives. \$8.50

BLATANT OPPORTUNIST I

The reprints from all Don's Midnight Engineering columns. Includes a broad range of real world, proven coverage on small scale technical startup ventures. Stuff you can use right now. \$24.50

RESOURCE BIN I

A complete collection of all Don's *Nuts & Volts* columns to date, including a new Index and his master names and numbers list. \$24.50

FREE SAMPLES

Well, nearly free anyway. Almost. Do join us on *GENie* PSRT to sample all of the Guru's goodies. The downloading cost on a typical Guru file is 21 cents. Modem access: Dial (800) 638-8369. On prompt, JOINGENIE, then DMD524 on key.

FREE VOICE HELPLINE VISA/MC

SYNERGETICS
Box 809-NV
Thatcher, AZ 85552
(520) 428-4073

Write in 158 on Reader Service Card.

you'll want to exchange intelligence between music modules, instruments, or even entire orchestras.

There's a dozen good MIDI books out. The oldest and finest is Craig Anderton's *MIDI For Musicians*. The Internet primary MIDI home page is [HTTP://WWW.EEP.ELE.TUE.NL/MIDI.INDE.X.HTML](http://www.eep.ele.tue.nl/midi.inde.x.html)

RESOURCE BIN

ELECTRONIC MUSIC RESOURCES

Adobe Systems PO Box 7900 Mountain View CA 94039 (800) 833-6687	Diapson 380 E Northwest Hwy Des Plaines IL 60016 (708) 298-6622	GENie 401 N Washington St Rockville MD 20850 (800) 638-9636	Mechanical Music 887 E Orange Avenue St Paul MN 55106 (612) 774-2490	Piano Technicians Journal 3930 Shawnee Street Kansas City MO 64111	Rough & Tumble Engineers Box 9 Kinzers PA 17535 (717) 442-4249
American Organist 75 Riverside Dr. Ste. 1260 New York NY 10115 (212) 870-2163 FAX	Early Keyboard Journal Box 32022 Charlotte NC 28232 (919) 842-4322	Glass Audio PO Box 876 Peterborough NH 03458 (603) 924-9464	MIX Bookshelf 6400 Hollis St #12 Emeryville CA 94608 (800) 233-9604	Play Meter PO Box 24970 New Orleans LA 70184 (504) 488-7003	Sound Practices Box 180562 Austin TX 78718 (512) 339-6229
Analog Devices PO Box 9106 Norwood MA 02062 (617) 329-4700	Elderly Instrument 1100 N Washington Lansing MI 48901 (517) 373-7890	Guitar Player 20095 Stevens Creek Cupertino CA 95014 (408) 446-1105	Modern Keyboard 1115 Broadway 8th Fl. New York NY 10010 (212) 807-7100	Player Piano Company 704 E Douglas Wichita KS 67202 (316) 263-3241	Synergetics Box 809 Thatcher AZ 85552 (602) 428-4073
Audio Amateur Box 576 Peterborough NH 03458 (603) 924-9464	Electronic Musician 6400 Hollis St #12 Emeryville CA 94608 (415) 653-3307	Integrated Circuit Sys PO Box 968 Valley Forge PA 19482 (610) 630-5300	Music & Sound Retailer 25 Willowdale Avenue Port Washington NY 11050 (516) 767-2500	PMI 1500 Space Park Dr Santa Clara CA 95052 (800) 843-1515	Theater Organ Box 417490 Sacramento CA 95841 (916) 966-3172 FAX
Burr-Brown 6730 S Tucson Blvd Tucson AZ 85706 (602) 746-1111	Ensoniq 263 Great Valley Pkwy Malvern PA 19355 (215) 647-3930	Journal AES 60 E 42nd St Rm 2520 New York City NY 10165 (212) 661-2355	Music Retailing 70 Rt 202 North Peterborough NH 03458 (603) 924-0058	Ragtime 4218 Jessup #AB Ceres CA 95307 (209) 668-0366	Tracker Box 26811 Richmond VA 23261 (804) 253-9226
Clavier 200 Northfield Road Northfield IL 60093 (708) 446-5000	Exp Musical Instruments 1700 Old Rancheria Rd Nicasio CA 94946 (415) 662-2182	Jnl Am Organbuilding Box 130982 Houston TX 77219 (713) 529-2212	MMR/Musical Merch Review 100 Wells Avenue Newton MA 02159 (617) 964-5100	Reed Organ Society Bulletin 6907 Rix Street SE Ada MI 49301 (616) 676-1188	Ulrichs Dictionary 121 Channon Rd New Providence NJ 07974 (908) 771-7714
Computers & Music 647 Mission Street San Francisco CA 94105 (800) 767-6161	Factsheet Five R Seth Friedman PO Box 170099 San Francisco CA 94117	Journal ASA 335 E 45th St New York City NY 10017 (212) 661-9404	PAIA Electronics 3200 Teakwood Ln Edmond OK 73013 (405) 340-6300	RePlay 22157 Clarendon St Woodland Hills CA 91365 (818) 347-3820	Vox Humania Press 150 Locust St Macungie PA 18062 (215) 966-2200
Crystal Semiconductor PO Box 17847 Austin TX 78744 (800) 888-5016	Fistall's Microelectronics 7023 E Colfax Denver CO 80220 (303) 393-6000	Keyboard 20085 Stevens Creek Blvd Cupertino CA 95014 (408) 446-1105	Pedal Steel News Box 248 Floral Park NY 11001	Roland Digital 7200 Dominion Circle Los Angeles CA 90040 (213) 685-5141	Yamaha 6600 Orangethorpe Ave. Buena Park CA 90622 (714) 522-9011

Roland offers a free newsletter on their MIDI products. Also see the 88-page *Computers & Music* catalog.

Electronic Musician

The most obvious mainstream publication is, of course, *Electronic Musician*. A monthly mag chock full of reviews, theory, and commercial ads. A recent issue covered such topics as multimedia careers, the review of online commercial services, and hot new DSP plug-ins.

MIX Bookshelf

Electronic Musician also publishes *MIX* magazine for sound recording studios. Together, they also offer the *MIX Bookshelf*. Which now stocks the definitive collection of pretty much everything on electronic music, MIDI, audio, and video recording.

Their free catalog is a must. One excellent beginning book is *Electronic Projects for Musicians*.

PAIA Electronics

The long time leader in lower end electronic music kits, PAIA offers a wide variety of unique products.

By musicians for musicians. Three current projects are their *Fat Man Analog MIDI Synth*, their brand new Theremin kit (you did see it here first), and their "vacuum tube sound" front end preamps.

Free catalogs are offered. See elsewhere for their web home page.

Many thanks to PAIA honcho John Simonton, who contributed several key resources to this column.

JASA and JAES

Much in the way of original tech research and "horses mouth" music papers comes down in a pair of classic journals. The older of the two is JASA, or the *Journal of the Acoustical Society of America*. The newer is the *Journal of the Audio Engineering Society*.

Experimental Musical Instruments

This is one superbly well done and little-known magazine. While mostly about strange new ways of blowing on a gourd or twanging a coat hanger, both electronics and traditional are covered in depth.

Online Resources

Most current electronic music info appears online these days. Including the music itself. Let's look at a few more examples...

<http://www.paia.com.paia> is quite strong on electronic music kit support.

<http://rowlf.cc.www.edu:8080/~n9343176/schems.htm> focuses on their schematics for guitar effects and related stomp boxes.

<http://www.hyperreal.com/machines> has lots of synthesizer schematics.

<http://www.hk.net/~prs.midi.html> publishes the *Archives of Classic MIDI Sequences*.

<http://www.galaxy.einet.net/hytel-net/fu1063.html> is a music and brain info.

<http://www.cecer.army.mil/~burnett/MDB> is a database on commercial music albums.

telnet: runner.utsa.edu login: lmr

provides the *CARISS* or *Computer-Assisted Retrieval Service System* for *Music*. Which covers music medicine and music therapy.

anonymous ftp: ftp.uwp.edu; path: pub/music is a music archive on artists, discography, lyrics, and pictures.

rec.music.makers.builders is the newsgroup for instruments and electronics.

rec.music.makers.synth is one newsgroup with useful homebrew info in it.

To subscribe to the *synth-diy*, mail **:majordoma@horus.sara.nl** then you **subscribe synth-diy <your.email.address>**. This is a new synthesizer resource.

To subscribe to *Bode*, route mail to **magordoma@veda.is** followed by a **subscribe bode <your.email.address>**.

To subscribe to *analogue.heaven*, use **majordomo@hyperreal.com**

Commercial online forums include America Online's SSS, plus GENie's MIDI (an 8,000+ file library) or the MUSIC (5,000+ files) RoundTables.

Special Musical Interests

There are zillions of music special interest magazines, newsletters, and trade journals. As always, your best starting point is using that *Ulrichs Periodicals Dictionary*, available online or at your local library.

A second great source for the really off-the-wall stuff is *FactSheet 5*.

Vacuum tube traditionalists should find *Glass Audio* and *Sound Practices* of interest. All any vacuum tube does is unreliably and inefficiently add hum, noise, and distortion to an otherwise clean audio channel.

A surprisingly large number of my

helpline callers are building their own real pipe organs. Important resources here do include the *American Organist*, *Clavier*, *Diapson*, *Tracker*, *Journal of American Organbuilding*, the *Reed Organ Bulletin*, and *Theater Organ*.

Older musicians should appreciate *Elderly Instruments*, or else that *Early Keyboard Journal*. Younger ones might favor *Guitar Player*, *Modern Keyboard*, *Pedal Steel News*, and *Keyboard*.

Hobby music projects often appear in *Popular Electronics*, *Electronics Now*, *Nuts & Volts*, and *Audio Amateur*.

For player pianos, *Mechanical Music* or the *Piano Technicians Journal*. Three good parts sources include *Player Piano Company*, *Rough and Tumble Engineers*, and *Ragtime*. For modern coin-op stuff, *RePlay* and *Play Meter*. We saw lots on jukebox resources in HACK73.PDF on my GENie PSRT. And in the *Hardware Hacker* reprints.

The main music store trade journals do include *Music* and *Sound Retailing*, *Music Retailing*, and *MMR*.

For actual music production, try out *Recording* and *Mix* magazines.

This Month's Contest

I used to publish lots of homebrew electronic music projects way back in *Popular Electronics*. Circa 1965-1973. But since I can not carry a tune in a bucket, I have tended to lose touch with the latest in the field.

So, for this month's contest, just tell me about any new electronic music resource I don't know about.

There will be a largish pile of my new *Incredible Secret Money Machine II* books 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.

Let's hear from you. NV

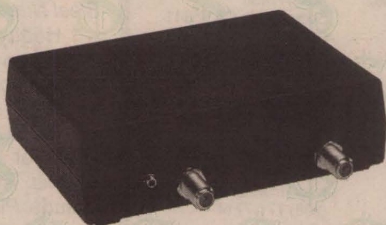
Microcomputer pioneer and guru Don Lancaster is the author of 32 books and countless tech articles. Don maintains his no-charge tech helpline found at (520) 428-4073, besides offering all of his own books, reprints, and all of his consulting services. He also has a free catalog full of his resource secrets waiting for you. Your best calling times are 8-5 on weekdays, Mountain Standard Time.

Don is now the sysop of GENie PSRT, where a special Resource Bin topic has been reserved for Nuts & Volts readers. For modem access: (800) 638-8369. When prompted, enter JOINGENIE. When asked for an offer code, enter DMD524.

You can also reach Don at Synergetics, Box 809, Thatcher, AZ 85552. Or send any messages to his Internet address of SYNERGETICS@GENIE.GEIS.COM

WE HAVE WHAT YOU THE BEST PRICES AN

DECODERS



STEALTH 1000-P
5 x 4 PLASTIC CASE W/TOGGLE

QTY 10	QTY 20
\$49	\$45

TNT
6 x 9 METAL CASE W/TOGGLE

\$45	\$42
------	------

TVT-3G
6 x 9 METAL CASE

\$42	\$39
------	------

MINI-TVT
3 x 6 METAL CASE

\$42	\$39
------	------

GOLD
3 x 6 PLASTIC CASE

\$42	\$39
------	------

APOLLO-J
3 x 6 METAL CASE
REPLACES PURPLE & SIP

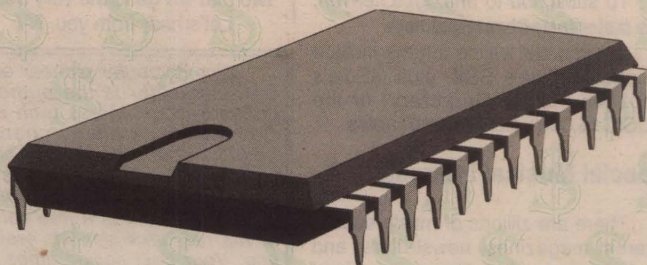
\$49	\$45
------	------

FTB-3
6 x 9 METAL CASE

\$43	\$39
------	------

IMP-30
4 x 4 BOARD ONLY
NO CASE, NO AC

\$39	\$35
------	------



PIO-6300
6 x 9 METAL CASE W/TOGGLE

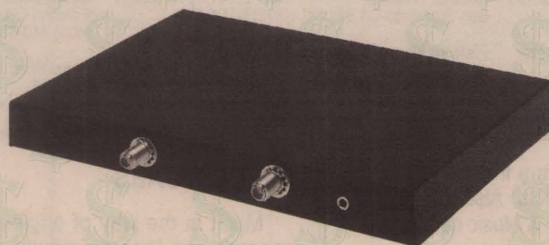
QTY 10	QTY 20
\$69	\$59

PIO+/TNT
6 x 9 METAL CASE W/TOGGLE

\$69	\$59
------	------

PIO RED
3 x 6 METAL CASE
REPLACES GREEN & APOLLO-P

\$69	\$59
------	------



STEALTH 80-P
5 x 4 PLASTIC CASE W/TOGGLE

QTY 10	QTY 20
\$55	\$49

M-80
6 x 9 METAL CASE W/TOGGLE

\$65	\$59
------	------

NEW!!!

MULTIMODE
QUICK BOARD
R-V 3 WIRE
SA QUICK BOARDS
PIO QUICK BOARDS
PIO WRITER

QTY 10	QTY 20
-----------	-----------

Z3
PV7-PV5 2 WIRE, 3 WIRE
AND 28 PIN

\$35	\$29
\$29	\$25
CALL	
\$29	\$25
\$55	\$49
\$11	\$ 9
CALL	

HIGHLANDER

6325-9 Falls of the Neuse Road, Raleigh, NC 27615

WANT AND MORE !!! THE BEST SERVICE!!!

NEW CONVERTERS

	QTY 10	QTY 20
STARGATE ELITE 550-PC	\$59	\$55
TIMELESS TPI-550-PC	\$60	\$57
CENTURY CT-3000	\$65	\$61
PANASONIC TZPC1453G2	\$79	\$69

REFURBISHED CONVERTERS

REGAL, SA, PANASONIC ... CALL



COMBOS

BOSS 1 QTY
10
\$225
REPLACES ALL PIONEER MODELS
AND SA MODELS 8500-8590
(NO INVERSION)

BOSS 2 \$235
REPLACES TC 03/07 MODELS
INCLUDING WIRELESS

THESE UNITS ARE BUILT INTO
BRAND NEW PANASONIC
CONVERTERS, w/REMOTE,
VOLUME CONTROL, PARENTAL
LOCKOUT, LCR, AND MORE

SSA TV86 \$149
S7COMBO \$125
TPI550-PC w/BUILT-IN
BOARD REPLACES ALL TRI-MODE



MasterCard

VISA

DISCOVER

AMERICAN
EXPRESS

COD

All prices are for 10 pieces, subject
to change without notice. Some
quantities may be limited. 30-Day
Money Back Guarantee. One year
parts and labor warranty.

1-800-854-7119

Mon-Fri 10-7 EST; Sat 10-3 EST-FAX 1-800-854-7118

SONY MULTISCANS 0.26DP 15.7 thru 36KHz \$175. Monitors SVGA 800x600 \$145. Loop 286-12 PCs 1M, MFM EGA, I/O keyboard \$145. Western Digital WD1003V FD/HD cont. \$25. Hercules Monographic \$15. CGA color \$10 refurbished. Guaranteed. Rich, Pikul & Assoc., 101 Glenfield Dr., Festus, MO 63028. 314-937-0335.

CHAFFIN ELECTRONICS INC. Call us for all your IC needs. Let us save you \$\$\$\$\$. Call Cindy or Lawrence, Sales 614-574-4456, Sales 614-574-6906, FAX 614-574-2124.

NEW NCR Computers: Model #C-5067 LBN adapter. Contains: Motherboard with built-in modem, video card, RS232 port, parallel port, section for 3-1/2" drive, ports for: financial keyboards, validation printer, mag stripe reader, pin pad. ISE price \$20 ea. ISE, ph: 210-350-5555, FAX: 210-350-5574.

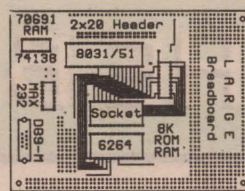
CRTs CHEAP. Buy direct from the manufacturer, save money. Mfg. all CRT types over 45 years. 3 Year Warranty. 19 inch tubes \$60, 25 inch \$90. We specialize in Hi Resolution computer/video CRTs and complete repair of all monitors. T.M.C. 215-226-0749/223-0388 9:00am-10:00pm EST.

DEC EQUIPMENT WANTED! We are buying DEC systems, boards, terminals, drives and peripherals. Also Scientific Micro Systems (SMS), DSD, Datability, Dilog, other DEC compatibles, and Computer Output Microfilm (COM) units. Please call for a quote or fax us your equipment list. We buy, sell, and trade. **KEYWAYS, INC.**, 513-847-2300 OR fax 513-847-2350.

DATA ACQUISITION PC based DAQ 201 features fast multi-channel A/D conversion, digital I/O, D/A conversion, precision time interval measurement. \$119 plus \$4.50 S&H. Tri-Tech Microproducts, 196 Laurel Drive, Carmel Valley, CA 93924. Phone/FAX 408-659-4200.

HEWLETT PACKARD 2227A Quietjet Plus inkjet printer. \$150. Telex 287-C printer. \$125. 818-989-3848.

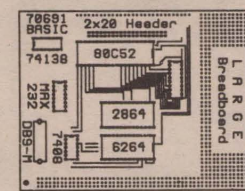
HEWLETT PACKARD HP 2673A printer. \$75. HP 85A computer \$200. HP 7475A plotter. \$275. 818-989-3848.



ECONOMICAL 8051 SBCs. The 70691RAM, a complete SBC with large breadboard area, serial port, 8K RAM/ROM and 40 pin Header for Easy interfacing. Also includes programming software (3.5 or 5.25in), documentation and sample .ASM codes. Assembled/ Tested \$50 plus S/H. Suncoast Technologies, Spring Hill, FL. 904-596-7599. VMC Accepted.

BUILD YOUR OWN IBM COMPATIBLE COMPUTER from parts for as little as \$399 with the help of an easy to view 63 Minute Video Tape that shows you how. This easy to view award winning Tape will show you how to save money by assembling any compatible 286, 386, 486 or Pentium Computer in a step by step easy to follow procedure. It also shows the common pitfalls that you might run into if you try to assemble a computer by yourself and gives you secrets on how to overcome problems that might occur during assembly. When complete, you will have gained the confidence and experience to maintain your very own computer for years to come and even service it if necessary. Don't let this opportunity pass you by, order your Video Tape today while supplies last for only \$29 (reg. \$59.95) plus \$2.95 P&H. Send check to: **EVP, PO Box 2201, Northlake, IL 60164-0201** or call: **1-800-754-5096** Now!

HP60C worm library mechanism, 88 disk capacity, 57.2GB storage, dual drive. SCSI II interface. Freight damaged \$5,500 OBO. 619-632-9775.



PROGRAM THE 8051 in BASIC with our inexpensive development SBC. Assembled/ Tested board contains Intel's BASIC-52 Interpreter (80C52). Allows programming through serial port of PC. Also contains 8K RAM/ROM, Hi-address decoder, large breadboard area, 40-pin header and 2864 EEPROM that allows auto-startup of your saved programs. Programming software also included (3.5 or 5.25 in.) \$70 plus S/H. Also learn how to program your purchase with the "BASIC-52 User's Manual." A 150-page book containing the proper usage of all commands/statements, \$20 plus S/H. Suncoast Technologies, Spring Hill, FL. 904-596-7599. V/MC Accepted.

SBC-8K MICROCONTROLLER. Complete 68HC11 development package. 8704 bytes EEPROM. 272 bytes RAM. Programs via RS-232 port from PC. \$79.95 plus \$5.00 shipping. MC/Visa. Phone/FAX 410-586-2177. LDG Electronics, 1445 Parran Road, St. Leonard, MD 20685.

SEC Sun Equipment Corporation

LODESTAR Lodestar Electronics Corp. Since 1979

3121-A Glen Royal Rd., Raleigh, NC 27612

1-800-870-1955/(919)870-1955 or 24-hr Fax:(919)870-5720
One Year Warranty. 15 Day Money Back Guarantee. Quantity Discount.
School purchase order accepted, net 30 days. Bids accepted.
3% discount for prepaid order, certified check or money order.
We accept C.O.D. or credit cards.
SALES REP/DISTRIBUTORS/ OEM WANTED.

MICROPROCESSOR/CONTROLLER TRAINING

Now, you can learn and apply computer control on your PC with our low-cost trainers and lead yourself to the advanced 80386, 80486, etc.. Our systems will help you learn BASIC, C, and ASSEMBLY languages programming and debugging, and Microprocessor and Microcontroller based system hardware design and troubleshooting. Experiment guide and example programs are included. Our trainers are widely adopted by technical colleges.

8088 Trainer \$699.00. 8088-8088, teach yourself 8088 assembly language programming.

Features: Assembly language coding, assembler, disassembler, single step and multi-breakpoint program debugger, display and register, download/upload programs from/to external systems, I/O drivers, 56-key large size keyboard, LCD display, RS-232, UART, printer interface, two expansion slots, +5V, +12V switching power supply, 20 I/O controls available, e.g. servo and stepping motor control, dot matrix display, D/A, A/D, sensors.

CONTROL APPLICATIONS FOR IBM PC/COMPATIBLE AND PCG-8088 TRAINER:

EDS-8811 \$289.00 EPROM programmer. Burn your own EPROM in just a minute.

BCG-8052 \$279.00 learn yourself Intel 8051/8052 Embedded Microcontroller controls.

U-DBGR \$1599.00 Debugger/In-Circuit Emulator for Microprocessors and programmer

8051/52 In-Circuit Emulator, APEX-IE, \$699.00
CIC-100 \$549.00 I/O control applications, learn Assembly, C, and BASIC programming languages, 800-pin solderless breadboard for circuit design and test.

EDS-8802 \$109.00 Dynamic scanning controls.

EDS-8803 \$159.00 A/D, thermal sensor controls.

EDS-8804 \$89.00 A/D and D/A converter applications.

EDS-8805 \$239.00 Servo and stepper motor controls.

EDS-8806 \$159.00 Basic I/O application experiments.

EDS-8807 \$16.50 Dot matrix LED controls, 16 pins.

EDS-8807N \$419.00 Dot matrix LED controls, 8 pins.

EDS-8808 \$269.00 Opto-coupler controls.

EDS-8809-1 \$589.00 IBM PC/compatible add-on adapter.

\$99.00 and BCG-8088, stepper motor control, digital clock, speaker control, dot matrix LED control, matrix keyboard, sign lights, electronic piano, stop watch, etc.

24 experiments, example programs included.

PRODUCTS OF THE MONTH

Grid DIP Meter DM-4061 \$89.95

AC Millivolt Meter MV-J100A \$159.95

TV Color Pat. Gen. CPG-1366A \$159.95

mW RF Power Meter 340 \$219.00

1.8-500MHz, RF power: 20mW/200mW/2W, Imp. 50Ω, Accuracy: ±10% full scale, N-type connector, SWR: 1:15

341 \$219.00, 500-800MHz, **342 \$219.00**, 800-1000MHz

Power Supply R202 3 outputs 30V/30V/5V/3A

Function Generator FG-2100A \$169.95

RF Signal Generator SG-4160B \$119.00

Frequency Counter FC-5250C \$119.95

VHF/UHF Attenuators RTR815/RTR815U \$199/\$359.00

See Specifications Below or Call

DC POWER SUPPLY

PS-303J \$159.00
0-30VDC, 0-3A, 0.02%+2mV line regulation, 0.02%+3mV load regulation, 1mVrms noise & ripple, Short circuit overload protection, constant current constant voltage (C/C & CV).

PS-303D \$314.95 dual outputs

PS-305 \$219.95, 0-30VDC, 0-5A.

PS-305D \$399.95, dual outputs

8110 \$289.95 0-60VDC, 0-3A

8112 \$399.95 0-60VDC, 0-5A

8108(8109) \$549.95(\$699.95) 0-60VDC, 0-3A(SA), dual, independent tracking, Low ripple.

8102(8103) \$399.95(\$489.95) dual 0-30VDC/0-3A(SA), fixed 5VDC/3A, independent operation, constant voltage and constant current. Slave/Master, Serial/Parallel connection.

PS-1610S(8107) \$289.00(\$399.95) 0-16VDC(0-30VDC), 0-10A.

PS-2242(\$245) \$139.00(\$159.00) 0-120-24VDC, 3A(SA)

8200(8201) \$179.95(\$239.95) 0-30VDC (digital meter), 0-3A(SA)

8210(8211) \$199.95(\$259.95) 0-30VDC, 3A(SA), 2 digital meters.

8202(8203) \$499.95(\$549.95) 3 outputs, digital display.

8204(8205) \$499.95(\$549.95), a fixed 5VDC/3A, independent tracking operation, constant voltage and current.

AM/FM SWEEMER SCOPE

SM-6225B/C \$199.95
Freq Range: (AM)400KHz, (FM) 10-11.4MHz, Accuracy: ±0.1%
Marker: (AM)455KHz, ±5KHz, ±10KHz, (FM)10.7MHz, ±7.5KHz, ±150KHz.

STEREO SCOPE OS-7505B \$369.00 trigger, 0-10MHz.

ALIGNMENT SCOPE OS-7001A \$369.00 0-200KHz.

AM/FM STD SIGNAL GEN.

SG-4110A \$1799.00
Freq: 100KHz-110MHz
Display: 6-digit LED
Accuracy: ±.5(Sx10-E5 +1 count)
Resolution: 100Hz (100-34.99MHz), 1KHz (35MHz-10MHz)
Output: -19dBu, -99dBu, 1dB steps, Impedance: 50Ω VSWR 1.2.

TV COLOR PATTERN GEN.

CPG-1366A \$159.95
VHF NTSC
Freq: 45.75, 175.25, 187.25 MHz
RF Output: 10mV
Impedance: 75 Ohm
Video Output: BNC, 1Vp-p

SWR/RF POWER METER

310 \$89.95
Freq Range: 1.8-150MHz
RF Power: 0.4W/20W/200W
SWR Measure: 1.0 - ∞ 4W min.
Accuracy: 5%-10%, SO-230 plugs.
Insertion Loss: 0.3dB.

Input/Output Imp: 50Ω

320 \$89.95, 130-520MHz

330 \$119.95, 1.8-520MHz

SWR-3P \$26.95 1.7-50MHz

RF Power: 0.5-10W, 0.5W-100W

SWR-2P \$22.95, 1.7-30MHz, RF Power: 0.5-10W

PM-330 \$136.00 1.8-500MHz, 0.5W/20W/120W

RF SIGNAL GENERATOR

SG-4160B \$119.00
100KHz-150MHz up to 450MHz on 3rd harmonics, 6 ranges, AM modulation.
RF Output: 100mVrms to 35MHz
Modulation: Int. 1KHz AM, Ext. 50Hz-20KHz FM.
Audio Output: 1KHz, 1Vrms.

SG-4162AD \$229.95, with Freq. Counter 1Hz-150MHz, 0 digits, for internal & external signals. Specification see SG-4160B above.

AUDIO GENERATOR

AG-2601A \$119.00
10Hz-1MHz, 5 ranges;
Output Level: sine wave 0-8Vrms, square 10Vp-p.
Output Impedance: 600 Ohm.
Distortion: <0.05% 500Hz-50KHz, <0.5% 50KHz-500KHz.

AG-2603AD \$229.95, with Freq. Counter 1Hz-150MHz, 0 digits, for internal & external signals. Specification see AG-2601A above.

FUNCTION GENERATOR

FG-2100A \$169.95
0.2Hz-2MHz in 7 ranges, Sine, Square, Triangle, Pulse & Ramp
Output: 5mVp-p to 20Vp-p, 1% distortion
FCF: 0-10V control freq. to 1000:1

FG-2102AD \$229.95 generates signals same as FG-2100, 4-digit counter display, TTL & CMOS outputs, 30ppm +1 count accuracy.

FC-2020B \$159.00 0.5Hz-500KHz, Sine, Square, Triangle.

(FC)2103 \$329.95, Digital sweep generator, 0.5Hz-5MHz in 7 ranges

Operating Mode: sweep, AM, gated burst, VCV

Freq. Counter: Int. 0.5Hz-5MHz, Ext. 5Hz-10MHz

STEREO MULTISIGNAL GENERATOR

AG-2011A \$549.00
RF SECTION:
Carrier: 98MHz+2MHz
Output: 10mV, 1mV & 0.1mV

COMPOSITE SIGNALS:
Pilot: 19KHz ±2Hz, 0.8Vrms
INT. MODULATION: 400KHz, 1KHz ±1%, 1Vrms, distortion %₂±R Separation: -50dB

EXT. MODULATION: Freq: 50Hz-15KHz
L-R Separation: -45dB 100Hz-3KHz, -35dB 50Hz-15KHz.

AC MILLIVOLT METER

MV-J100A \$159.95 wide band 5-Hz-1MHz, 3 scales, mV, dB, dBm, 300V-100V in 12 ranges, 10μV resolution, -70-40dB in 12 ranges, 0dB-1Vrms, 0dBm-0.755V, ±3% accuracy, input impedance 10MΩ.

Noise: 2% **MV-3201B \$309.95** dual channels, simultaneous measurement.

OSCILLOSCOPE

OS-7305B \$249.00 DC-7MHz, Vertical: 10mV/Div, Horizontal: 25mV/Div, 10Hz-100KHz in 4 ranges, 3" CRT, Internal and External Sync, Input: 1MΩ/35pF Probe included

OS-7010A \$369.00 DC-10MHz, 5" CRT, 1MΩ/Vcm-10V/cm, 1MΩ

OS-622B \$344.95 20MHz, dual trace

OS-653 \$699.95 50MHz, dual, delay sweep, ALT triggering, TV syn

OS-6100B \$1329.95 100MHz, 4ch, 8 traces, delayed sweep, best buy

GRID DIP METER

DM-4061 \$89.95 1.5-250MHz, 0 bands, 0 plug-in coils, 2 transistor, and 1 diode.
Modulation: 2KHz Sine wave, Crystal Oscillator: 1-15MHz.
Wave absorption meter. Using 9VDC power supply.

AUTO DISTORTION METER

DM-3104A \$799.95
MEASUREMENT:
Range: 0.01%-30%, 0.1/0.3/1/3/10/30% full scale.
Freq: 400Hz to 10%, 100Hz to 10% (HPF)
Input: 3mV-100V, ratio measuring 20dB.
Auto Switching Ranges: Fundamental Freq.: (f)±10%, Fund. Rejection: -80dB at (f)±5%, -70dB at (f)±10%, Harmonic Accuracy: ±0.5dB, 1.8(f)-20KHz.
DM-3204 \$1,599.00 dual channels.

FREQUENCY COUNTER

FC-5250C \$119.95
Freq Range: 10Hz-220MHz (HF)10Hz-20MHz, (VHF)10MHz-200MHz, Gate Time: 0.1 & 1sec.
Max Input: 10Vp-p

FC-5270 \$149.95
10Hz-1.2GHz

FC-5600B \$321.00
10Hz-600MHz

(FC)5700 \$329.95 10Hz-1.3GHz

SIGNAL TRACER/INJECTOR

SE-6100 \$134.95
TRACER: Gain Max. 60dB
Attenuation: 0/20/40/60dB
Input Imped: 100K Ohm
Output Imped: 600 Ohm
Speaker: 8 Ohm

INJECTOR: Freq: 1KHz S-wave, Output Level: Continuously variable 0-45Vp-p

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 (1digit to 99.9μF, 1% of full scale: 1digit to 99.9μF).
Display: 3 digit LED.

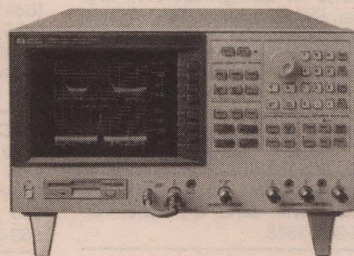
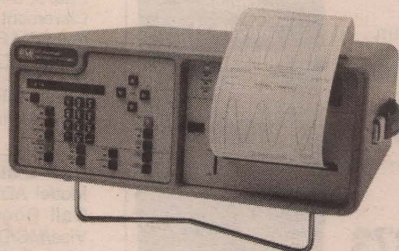
WOW-FLUTTER METER

WF-3103A \$699.95
Freq Range: 3KHz to 10%
JIS/CIR, 3.15KHz to 10% DIN
Range: 0.03/1/3/3% full scale.
Accuracy: ±5%
WF-3105A \$799.95, digital, Function: LIN/WOW/Flutter/WTG
Freq Cntr: 10Hz-99MHz
Indication: CTR/LIN/JIS

SUMMER SPECIALS

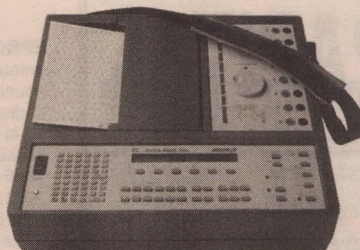
Save Big On
Brand-Name,
Pre-owned
Test and
Measurement
Equipment

We also purchase
pre-owned test
equipment...turn
your surplus
equipment
into cash!



Mention
this ad &
receive a 5%
discount!

Subject to
availability.
Prices
subject to
change.
90 Day
Standard
GE Warranty



Call today for your free catalog!

Mfg./Model	Description	List	Sale
AILTECH 17/27A ANTENNA NM17/27A	ANTENNA KIT FOR NM-17/27 RF/EMI ANALYZER	7845 26675	3765 2750
ANRITSU ML93A ML93B	OPTICAL POWER METER OPTICAL POWER METER	2700 2400	425 425
BOONTON 4200 4E	RF MICROWATTMETER 1 nW-10 mW 100 KHZ-18 GHz SENSOR	3000 850	1350 385
DATA I/O 1020L 288L2 2900PLCC 2900SOIC P 2900SYS 29B 20800 351B 103P 3900LCC 3900SYS CHIPSITE LOGICPAK PINSITE SETSITE SR28 UNIPAK2B UNISITE PIN DRVR US40L R	PARALLEL PROGRAMMER MULTI PROGRAMMER MAIN FRAME PLCC/LCC ADAPTOR-2900 SOIC ADAPTOR-2900 LOGIC/MEMORY PROGRAMMER W/2MB PROGRAMMER MAIN FRAME 44-PIN PLCC ADAPTOR-UNIPAK 2B LCC ADAPTOR-3900 SYS PLCC PROGRAMMING SYSTEM PLCC/SOIC MODULE-UNISITE LOGIC PROGRAM MODULE-29B PROGRAMMING MODULE-UNISITE GANG PROGRAM MODULE-UNISITE 28-PIN PROGRAM RAIL-1020L UNIVERSAL PROGRAM MODULE-29B 4-PIN DRIVER CARD-UNISITE UNIVERSAL PROGRAMMER	5595 2795 1200 600 4495 4795 695 500 7295 3355 3195 4875 3145 5595 3195 600 11745	840 1395 360 300 2695 500 250 200 4740 850 250 2340 1575 1680 350 390 5875
HEWLETT-PACKARD 86245A 008 86250D 8640B 001 003 8660C 001 005 86632B G382A P752D	5.9-12.4 GHz RF PLUG-IN 8-12.4 GHz SWEEPER PLUG-IN 5-512 MHz AM/FM SIGNAL GENERATOR 110 MHz SIGNAL GENERATOR MAINFRAME AM/FM MODULATION PLUG-IN FOR 8660 3.95-5.85 GHz ROTARY VANE ATTENUATOR 12.4-18 GHz 20 dB DIR. COUPLER	10400 7500 15655 13960 4360 3080 1430	1040 900 2900 2250 600 125 295
HONEYWELL 1858	18 CH OSCILLOGRAPH RECORDER	15745	2495
KROHN-HITE 3750	1 CH .02 Hz-20 KHz VARIABLE FILTER	1950	685
TEKTRONIX 650HR 73A 453 7603 7623 7633 7834 7854 7A13 7A18 7A19 7A22 7A26 7B53A 7B80 7B85 7B87 7B92A 7S12 AM502 DC504 DC504A DM502A DM502A 02 FG501 J16 J16 02 J6502 J6523 02 P6055 01 P6156 P6461E P6464 PS503A SC502 SD22 SD42 TR503	NTSC COLOR PICTURE MONITOR BUS SIMULATOR 100 MHz OSCILLOSCOPE MAINFRAME 100 MHz STORAGE OSCILLOSCOPE 100 MHz ANALOG STORAGE OSCILLOSCOPE 400 MHz STORAGE OSCILLOSCOPE 400 MHz DIGITAL STORAGE OSCILLOSCOPE VERTICAL AMPLIFIER PLUG-IN 75 MHz AMPLIFIER PLUG-IN 600 MHz AMPLIFIER PLUG-IN 2 CH 1 MHz DIFF. AMPLIFIER PLUG-IN 2 CH 200 MHz AMPLIFIER PLUG-IN 100 MHz DUAL TIME BASE PLUG-IN 400 MHz DELAYED TIME BASE 400 MHz DELTA DELAYING TIME BASE 400 MHz TIME BASE PLUG-IN 500 MHz DUAL TIME BASE TDR SAMPLING UNIT FOR 7000 DIFFERENTIAL AMPLIFIER 100 MHz 6 DIGIT COUNTER/TIMER PLUG-IN 100 MHz 6 DIGIT COUNTER/TIMER PLUG-IN 3.5 DIGIT DMM PLUG-IN 3.5 DIGIT DMM PLUG-IN 2 MHz FUNCTION GENERATOR PLUG-IN PHOTOMETER/RADIOMETER-US PHOTOMETER/RADIOMETER-METRIC LIGHT PROBE ILLUMINANCE PROBE-METRIC DC-60 MHz 10X PROBE FOR DIFF. AMPLIFIER 3.5 GHz PASSIVE PROBE 8 CH ACQ. PROBE-DAS9200 9 CH PATTERN GENERATOR PROBE 5/20V 1/1A DC POWER SUPPLY PLUG-IN 2 CH 15 MHz PLUG-IN OSCILLOSCOPE SAMPLING HEAD 12.5 GHz 2 CH OPTICAL-TO-ELECTRICAL CONVERTOR TRACKING GENERATOR PLUG-IN	4950 3100 5625 12350 9950 13365 17000 4795 2025 3995 2785 3985 1890 2750 2800 1890 5100 3890 1945 760 845 1695 1615 1095 1495 1495 700 1875 390 275 1400 1400 995 3295 3780 9350 7080	1500 1000 600 650 450 900 900 350 150 400 400 200 350 300 250 250 950 650 150 250 250 195 445 375 125 465 150 200 125 125 195 750 2080 1050 900



GE Capital
Test Equipment Management Services

Our Business Is Helping Yours®

Call 1-800-235-6497

or 510-476-7200 ext. 7492 or fax your request to 510-476-7504

Toner Cartridge Recharge

& Laser Printer Supplies



Three Ways to Earn Cash

You Do It

Dealer Program 1

You do the recycling work, and we'll supply all the materials, training, and technical support.

- Supplies cost from \$6 each
- Free Directions
- 1 Free Video Training Tape
- Starter Kit approx. \$500 supplies for 36 recharges
- For complete information, see Fax document# 2040*

We Do It For You

Dealer Program 2

You ship us your customer's toner cartridges and OPC cartridges, and we'll recycle them at a reduced price for you.

- Attractive Marketing Flyers with your name available
- Fast Turnaround
- Generic Packaging
- See Fax document# 2092*

We Do It For Your Customer

Dealer Program 3

You recommend us and give literature with our name to your customer. We'll deal direct with your customer. You have your code on our prepaid shipping label.

- You earn commission
- You recommend us
- Prepaid UPS shipping labels
- For complete information, see Fax document# 2090*

*To obtain Fax documents, use our Fax-On-Demand system. Call 516-467-0772 from any fax machine equipped with a touch-tone phone, 24 hrs/day, 7 days/week. Dial document# 4633 for an index.



Cheneko Products Inc.
2221 5th Ave., Suite 4, Ronkonkoma, NY 11779
Phone: 516-467-3205 E-mail: cheneko@aol.com
Fax: 516-467-3223 Fax-On-Demand: 516-467-0772

800-221-3516

Write In 95 on Reader Service Card.

#50 COMPUTER HARDWARE cont.

QUALITY NAME brand computer products, excellent prices; AST, Digital, Hewlett Packard, MicroSoft, 32,000 products, new and used desktop and notebook computers; custom configurations; major credit cards accepted; Call/FAX for complete catalog on disk. Applied Computer Technologies, 703-771-8152. FAX 703-771-8588.

NEW ITEMS: Kodak Diconix 150+, ink jet printer (parallel) for notebooks, portable 6 lbs., AC/battery powered, tractor/sheet feed, used like new, w/new HP ink jet cartridge, manual, \$99, \$289/3. Operating computers w/FD, HD, MEM, & more, AT286 \$98, 386 \$198. Our 31st year. Catalog call/faxback 508-532-2323. BNF, 119 Foster St., Peabody, MA 01960, 508-532-2323.

SIMM 1,2,4,16,32 Meg: Brand New 1 Meg 30pin 70ns/60ns \$39/\$41. 4 Meg 30 pin 70ns/60ns \$125/\$130. 4 Meg 72 pin 70ns/60ns \$130/\$140. 8 Meg 72 pin 70ns/60ns \$265/\$280. 16 Meg 72 pin 70ns/60ns \$490/\$520. 32 Meg 72 pin 70ns/60ns \$950/\$1,100. All SIMM modules available. 1 yr. warranty. Call Yub Sung, 603-893-5866. Salem, NH for current price/availability.

SBC PROGRAMMING? (Dis)assemblers for 6502, 68000, 8051, z80, more! See "Latest shareware" in computer software section.

PLOTTERS HP 7470 \$75, HP 7475 \$169, HP 7550 \$249, Calcomp 1023 D-size \$399, IBM Optical read/wr disk drive \$149, 402-563-2866. Evenings.

GNT 4604 paper tape punch. \$200. Paper tape readers, \$100. 818-989-3848.

New SuperBright

5mW pocket laser

"bright as a He-Ne"

Our new SuperBright laser includes all drive electronics, heatsink, & collimating optics. The laser will run over five hours on 4 AA alkaline batteries. Red laser beam 635nm is 10 times brighter than 670nm.

This laser blazes like a torch.

Price: \$169.00

Please include \$7.00 for shipping and handling. CA residents add 8.25% sales tax.

TO ORDER CALL

1 (800) 996-6873



HI-Q PRODUCTS, INC.

506 N. Garfield Ave., Suite 200, Alhambra, CA 91801
TEL: (818) 308-4400 FAX: (818) 308-4406

Write In 48 on Reader Service Card.

NETWORKING KIT all the hardware necessary to network your computers. Works with Windows for workgroups 3.11 and then popular. SW (2) systems \$49, (4) systems \$99. Dexis, 612-944-7670.

WEFAX RTTY packet SSTV Amtor CW interfaces for IBM. And more from A&L Engineering. Send a #10 SASE for our free catalog. A&L Engineering, 741 E. Benton St., Aurora, IL 60505.

TEXAS INSTRUMENTS 810 w/VFC dot matrix printer. With serial & parallel I/O. \$250. 818-989-3848.

PLOTTERS: HP 7580B 8-pen drafting plotter (up to 24" x 48") \$1,475. **ColorPro HP 7440A** (8-pen, 8-1/2" x 11") \$275. **HP 7475A** (6-pen, up to 11" x 17") \$275. **HP 7550A** (8-pen, up to 11" X 17", with sheet feeder) \$650. Excellent condition, with warranty. Pepper Systems, 214-353-0257.

BOOT YOUR COMPUTER, INSTALL SOFTWARE FROM EITHER YOUR A: OR B: DRIVES REGARDLESS OF THE SOFTWARE DISKETTE DESIGNATION OR SIZE, AT THE FLIP OF A SWITCH! WITHOUT ANY CHANGES TO YOUR CMOS SETUP. System comprises of a) switch box, b) a simple internal wiring harness with a 25 pin connector and c) A three foot ribbon cable with mating connector. Complete instructions for installing the harness and the 25 pin DB25 connectors is included. **Price \$35 plus \$6.50 S&H.** We accept Visa, Discover and Mastercharge Cards. We also ship UPS collect plus shipping and COD costs. **Quantities Limited.** Send mail orders to Paul's, 946 W. Foothill Blvd, Suite #208, Claremont, CA 91711 or call between 9AM and 5PM PST, 909-624-1401.

HP PLOTTER, 7475A, 6 pen, A & B Size paper, with cables. Serial or HP-IB interface available, \$395. DEXIS, 612-944-7670.

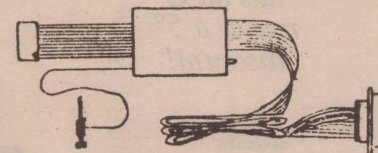
DSP EMULATOR by Analog Devices. Model ADSP-2100 w/software @ \$2,000. Call Roger @ GS&E, 716-338-7001. Visa/MC/Discover.

ANYBUS OWNERS! I am searching for information regarding AnyBus riser cards, motherboards, BIOS revisions, etc. Sources, schematics, and/or chipset information for EISA, VLB, PCI, PCMCIA riser/translator cards appreciated. I will gladly share the fruits of my efforts. Greg Chabra, 23 Davis Street, Binghamton, NY 13905. 607-724-3196.

SELL/SWAP: 3 Apollo DN300 computers (68010), NEC APC computer (CP/M and DOS), Ithaca Systems 18 slot S100 CP/M. Want Maxtor 4380E disks, IBM RT, or ?. Scott Dallmeyer, 708-501-5780, PO Box 338, Winnetka, IL 60093.

MACINTOSH PLUS with external hard drive \$145. TI expansion box \$20. Atari ST with color monitor \$49.95. Epson action laser II new missing paper tray & drum \$50. IBM PS/2 model 30 parts. Call, 601-863-3208.

REFURBABLE SURPLUS equipment for resellers, hobbyists: laptops, lasers, large monitors, fax machines, etc. Steady supply available. Stoicheff, POB 1022, Laurel, MD 20725-1022. FAX, 301-498-8915.



EPROM EMULATORS. Includes cables, manual and PC software. Each emulator is housed in a durable case. Test your code in disconnecting equipment. All ICs mounted in sockets. Emulators may be linked for 16/32 bit bus. 100 ns. access. **MODEL 32** (2764-27256) \$109. **Model 64** (2764-27512) \$129. **PRO-SERIES** includes battery back-up, Bi-directional communications with PC and other features for the professional. **PRO-128** (2764-27010) only \$199. **PRO-512** (2764-27040) for \$259. \$5 shipping. Visa OK. **LOGICAL DESIGN TOOLS, INC.,** 5403 Everhart #55, Corpus Christi, TX 78411. 512-888-4535. FAX 512-883-3711.

MASTER MONITOR REPAIR. Monitor training helps you grow into an expert. Start training today. Tech support on all monitors. Schematics include key test points, case histories, tips, tech support, etc. Free brochure. Computer King Co., the leader in computer monitor servicing. Home of the monitor Man. 25453 Wiseman, Roseville, MI 48066.

From Auto-Routing to CNC Routing.....

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
- 24 Hr On-Line Modem (Up to 19,200 Baud)

Printed Circuit Boards

- Single & Double Sided
- Multi-Layer & Flexible PCB's
- From QUICK TURN PROTOTYPES to Scheduled Production Runs
- Fine Lines, SMT
- Electrical Testing
- Precious Metal Plating

Assembly Services

- Fast Turn Board Stuffing
- Wire Harnesses
- Wave Soldering
- Chassis Assembly
- Acquisition of Parts
- Final Testing
- Turnkey Services

QUALITY IS OUR CAPITAL CONCERN

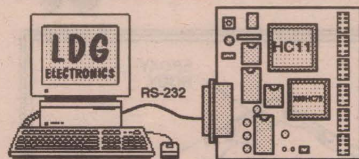
FOR QUICK & COMPETITIVE PRICING OR MORE INFORMATION, PLEASE CALL US TODAY!

852 Foster Avenue • Bensenville, Illinois 60106

(708) 350-9510 • Fax (708) 350-9760 • Modem (708) 350-9761

CHINON 8-1/2 x 11 object scanner serial \$90. VMKEYII+ speech recognition synthesis parallel \$40. NEC8201A laptop loaded color mini printer 9 volt 1.5 MEG RAMcard \$16, Pocket Packet 3 volt for any computer includes 16K mailbox video director, 2.0 windows edits titles. 408-637-1796. Darick.

ADAM COMPUTER, all original shipping carton. Many accessories and spare parts boxed separately. Good collectible. All offers considered. W. O'Connell, 1790 Roxbury Road, Northfield, VT 05663. Tel 802-485-7090.



68HC11 MICROCONTROLLER. SBC8K complete development package. 8704 bytes EEPROM. 272 bytes EEPROM. 272 bytes RAM. Programs via RS-232 port from PC. \$79.95 plus \$5 shipping. Call or write for catalog. MC/Visa. Phone/ FAX 410-586-2177. LDG Electronics, 1445 Parran Road, St. Leonard, MD 20685.

HP 7475A COLOR PLOTTERS. Excellent condition. Checked and working. \$150 plus freight. Credit cards OK. FAX/Msg 501-223-9406. **Software City**, Box 23016, Little Rock, AR 72221.

E(E) PROM PROGRAMMER SYSTEM \$199 (E)EPROMS, 9346, Flash, Gals & Micros. Systems including PICs and Erasers by AMS, Tribal and Xetelk. 24Hr BBS device updates free to our clients. Build-Your-Own 9346 Programmers too. **TRI-ANGLE PRODUCT DISTRIBUTORS USA**, 5750 Lakeshore Dr., Holland, MI 49424. 616-399-6390, M-F 9am to 2pm EST.

EPSON FX185 9 pin printer. Draft & NLQ. \$100. Okidata U939 pin draft printer. \$65. 818-989-3848.

ATARI SUPER Sketch graphics tablet with paint cart. \$12 ppd. For our Atari and other systems flyer, send #10 SASE: More Than Games, 8207 Briarwood Lane, Austin, TX 78757-7642.

FOR SALE: Tandy 1000 HX with external 5-1/4 inch drive and CM-11 color monitor \$200. Tandy TWP 230 Printer \$100 or best offer. Phone Bud, mornings PDT 510-439-7143.

FREE CATALOG. 286 system 640K, 20MB floppy, keyboard, serial & parallel ports & CGA color monitor \$125, same with EGA color monitor \$150. 286 board, case & power supply \$25, RS200 laptop \$50, VGA color monitors \$125, mono VGA \$40, EGA color \$75. \$9 pin printers \$30 & up. Video cards: long CGA \$10, long EGA \$20, short EGA \$25. 1.2MB drives \$25. 20MB MFM drive \$20, 30MB RLL \$30. HP 7550A 8 pen A/B plotter \$399, Apple IIe parts, call, DEC boards call, 8 bit ethernet cards \$10, 386DX25 Board w/1MB \$45. Visa & Mastercard. Oasis Technologies, 9-5 Pacific Monday-Friday. Orders: 1-800-585-3818. Local & tech support. 360-373-3818, BBS 360-613-1737, Box 267, Tracton, WA 98393.

BLACK BAG TRIVIA QUIZ on 2.5 MS-DOS disk. Includes unique shareware and restricted book catalogs (over 21 only). **FREE!** Mentor Publications, Box 1549-N, Asbury Park, NJ 07712.

REPAIR OF computer monitors and computer power supplies. We repair all brands, makes and models. Call Moore's Electronics, 209-957-3610 for more information. 10am-8pm PST.

MOTOROLA MINITOR PAGERS

DELIVERED ON YOUR FREQUENCY AND CODE*

Monitor your frequency or respond to your individual call. Excellent for Volunteer Fire, Rescue Squads, Auxiliary Police, Civil Defense, C.A.P., or Amateur. Frequency ranges 148-160, 33-37, 45-50, 450-470, or 500-512 Mhz., single code. Dual code option available at extra cost. Limited supplies, excellent condition. Supplied ready for service with batteries and charger. Amp/charger available at \$35.00. Warranty 90 days parts 30 days labor. Fax orders to 708.848.0230

*Motorola and Minitor are trademarks of Motorola Inc.

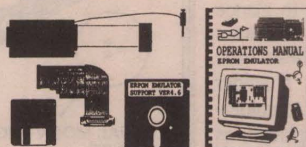
\$149



(708) MDM Radio, Ltd.
848-4210
7112 W Roosevelt Rd.
Oak Park, IL 60304

Write in 131 on Reader Service Card.

TEKTRONIX 4693D Color Image Printer 300 DPI, new \$8,995, asking \$995 with supplies. DEXIS, 612-944-7670.



EPROM EMULATORS. Includes cables, manual and PC software (HEX, Mot-S, Binary). Each Emulator is housed in a durable case. Test your code thru printer port without disconnecting equipment. All ICs in sockets. Multiple Emulators support 16/32 bit buss. 100 ns. access. **STD-SERIES**. STD32K (2764-27256) \$109. STD64K (2764-27512) \$129. **PRO-SERIES** includes instant recovery battery back-up, 28/32 pin cables, Bi-directional communications with PC and other features for the professional. PRO128KB (2764-27010) \$199. PRO256KB (2764-27020) \$229. PRO512KB (2764-27040) \$259. \$5 shipping. VISAMC, COD. LOGICAL DESIGN TOOLS, INC., 5403 Eberhart \$55, Corpus Christi, TX 78411. 512-888-4535. FAX 512-883-3711.

REPAIRING MACS? Need schematics? We have reverse engineered 14 Macs from 128 to Quadra 840AV and 54 peripheral items: printers, SMPS, floppy drives, monitors, etc. Send \$5 (refundable with order) ask for **COMPUTER** catalog. **BOMARC SERVICES**, Box 1113, Casper, WY 82602. 307-234-3488.

OVER 100 Dasey wheel printers, all types. Your choice \$10 each. For complete list: ISE, Ph: 210-350-5555, FAX: 210-350-5574.

COMPUTER PARTS unbeatable prices. 1.2GB IDE hard drives \$309! 486 DX2 80MHz motherboards \$209! Much More! Send SASE for catalog, check or money order to: ByteMark, 7714 Trent St. #105, Orlando, FL 32807. Add \$8 S/H. Visa/MasterCard orders call 1-800-679-3184.

T199/4A computer owners, 13th Chicago TI International World Faire will be held October 28th, at the Evanston Public Library in Evanston, Illinois. The event will consist of vendors, seminars and user group presentations. For information call, Hal Shanafield, 708-864-8644.

HP PLOTTERS, 7475A, A&B sizes, 6 pens, \$149, 7550A, A&B, 8 pens, autoteed \$229. Fully PC, Windows, DOS compatible. Warranty. Manuals included. 10 years selling HP Plotters. THUS, Inc. 1402 Route 611, Stone Church, PA 18343. Voice: 610-588-2600. FAX 610-588-1727.

ACECAT5" x 5" graphics tablet, new @ \$40 ea., 3/\$100. Call Roger @ GS&E, 716-338-7001. Visa/MC/Discover.

KODAK DICONIX PRINTER, \$99. Kodak Diconix 150 ink jet printer, 150 CPS, 2.75 lbs AC or DC operation, perfect laptop companion. Tractor feed 6.5"x11"x2" comes with manual, ink cartridge, and power transformer. **Printers Plus**, 717-421-7138.



The RF Connection
213 North Frederick Ave.
Suite 11NV
Gaithersburg, MD USA
20877

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 \$5.75 Pins Only \$1.50
UG-21D/9913 \$4.00 Extra Gasket50

Amphenol 83-1SP-1050 PL-259 \$0.90
UG-176/U Reducer RG-59/8X25 or 5/\$1.00
UG-175/U Reducer RG-58/58A25 or 5/\$1.00
J&I Silver Teflon PL-259 MIL-Spec
..... \$1.25 or 10/\$10.00

MIL-Spec Coax Available (Teflon, PVC 11A)
Certified CQ Flexi 4XL811A (Flexible 9913)

New Product: International's 9096-2A Low Loss RG-8 Size, Stranded Center Conductor. Same Specs As 9913.70/ft or \$59.00/100ft

Also New: RG-8X Clear w/UV Jacket 98% Cu Intro Price \$14.00/100ft

Call for Specials of the Month

Full Line of Audio Connectors for Icom, Kenwood, and Yaesu

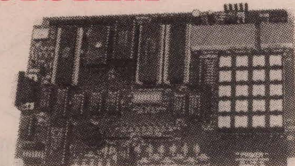
8 Pin Mike Female \$2.00
8 Pin Mike Male Panel \$2.50
13 Pin DIN for Kenwood \$2.75
8 Pin DIN for Icom \$1.00
8 Pin DIN for Kenwood \$1.50

Prices Do Not Include Shipping

Orders 800/783-2666
Info 301/840-5477
FAX 301/869-3680

Write in 51 on Reader Service Card.

THE BEST 8085 MICRO-PROCESSOR TRAINING SYSTEM



JUST GOT BETTER!

No other training system we know of comes close to matching the PRIMER's features at this low price. The PRIMER teaches more and is easier to use than other comparably priced trainers. The over 100 page Self Instruction manual takes you from binary number systems, to processing interrupts. At the end of the manual are working examples of using a photocell, a temperature sensor, making a wave form generator, a timer with alarm, and a motor speed controller using back EMF. The PRIMER comes with everything you need to start programming the 8085 in machine language. Continue on to program in Assembler, Forth, and BASIC with optional upgrade and software. Upgrade includes: RS232 serial port, cable, and 32K of battery backed RAM. Picture shown with upgrade option and optional heavy-duty keypad installed. The PRIMER is \$119.95 in kit form. The PRIMER assembled & tested by EMAC is \$169.95. Order now and receive one free power supply. Please add \$5.00 for shipping in USA.

EMAC, inc.

618-529-4525 FAX: 618-457-0110
BBS: 529-5708 ~ P.O. BOX 2042
CARBONDALE, IL 62902

DEVICE PROGRAMMERS

NEEDHAM'S EMP-20 UNIVERSAL \$429	EETOOLS ALLMAX+ UNIVERSAL \$689	NEEDHAM'S PB-10 EPROM+ \$129	ADVANTECH LABTOOL-48 UNIVERSAL \$1295	MOD-MCT EMUPA UNIVERSAL \$569
\$ 49 SUNSHINE 1 GANG EPROM	\$1295 ADVANTECH LABTOOL-48	\$ 85 SUNSHINE 4 GANG EPROM	\$ 695 ADVANTECH UPROG	
\$125 SUNSHINE 8 GANG EPROM	\$ 250 KELTEK SUPERPRO II	\$199 SUNSHINE 16 GANG EPROM	\$ 429 KELTEK SUPERPRO II	
\$ 15 MOD-MAC PC INTERFACE	\$ 159 KELTEK ROMMASTER I	\$169 MCT-MOD MUP UNIVERSAL	\$ 239 KELTEK ROMMASTER 4	
\$449 MCT-MOD EMUP UNIVERSAL	\$ 135 EETOOLS ROM MAX I	\$669 MCT-MOD EMUPA UNIVERSAL	\$ 189 EETOOLS ROM MAX4	

General Device Instruments

GDI WILL BEAT ANY PRICE - NEVER UNDERSOLD

SALES 408-241-7376 FAX 241-6375 BBS 983-1234 Internet ICDEVICE@ix.netcom.com

Write in 50 on Reader Service Card.

Write in 52 on Reader Service Card.

Introduction To Surface Mount Technology

Electronic technology has evolved so rapidly, it's difficult for people to keep abreast of new developments. In order to address this problem, we'll be doing a series of articles that are designed to bring new electronic technology and techniques to the reader, and

also to update him or her about existing technology, filling in the gaps other magazines have left open. We believe that you will find this series of articles interesting, challenging, and informative. Also, in order to serve the reader better, a special post office box is available for your comments, questions, and constructive criticisms. This address appears elsewhere in this article.

The reader needs to understand that the aforementioned gap is due to the gulf between engineering journals and the popular magazines. That gulf is rather wide; much technology you would be interested in learning about falls through this chasm. Take for instance, Surface Mount Technology (SMT). In this article, we'll introduce you to SMT, one of many topics the well-informed reader will want to keep abreast of.

Hello, Surface Mount Technology!

Electronic technology we are most familiar with uses (D)ual-(I)nline (P)in integrated circuits, individual resistors, transistors, and other semiconductors; separate batteries, switches, potentiometers, meters, and so forth. Let us nickname this familiar technology (P)roto-(E)lectronic (T)echnology; PET for short, although

this is the author's word-invention, and not an industry recognized acronym.

But, did you know PET technology is actually quite outdated in the manufacturing arena? It is likely that most of the new electronic items you now purchase are based on SMT already, and surely this technology will be dominant in the future. Ergo, SMT is here to stay, and for good reasons.

SMT differs from PET because the parts are mounted to the foil side of the board, instead of in holes drilled through the board. Figure 1A shows a typical PLCC integrated circuit (we'll be using a lot of alphabet soup to describe parts, so you might want to glance through the glossary first). Figure 1B shows the pads where that IC will go. These have been pre-tinned or covered with a solder paste *BEFORE* soldering, in contrast to soldering the part in *AFTER* it has been placed, as with PET. Note the solder wicking properly up the IC pins at Figure 1C. This wicking action is essential for reliable operation.

Let us make another distinction, and that is, our name for PET technology describes the board as a Printed Circuit Board, or PCB, whereas the SMT nomenclature encourages use of PWB, an acronym for (P)rinted (W)ired (B)oard. The PWB may have components wired to one side, both sides, or involve hybrid technology mixing PET and SMT on the same board using one or both sides. This latter case is common where power components in large packages are mixed with control components in tiny SMT packages. So, a hybrid board can be a complicated affair, but not beyond our understanding.

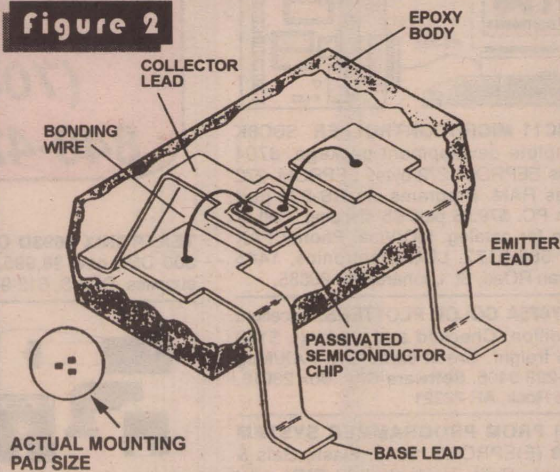
To gather an idea of a typical SMT package, let's take a garden-variety SMT transistor. Figure 2 shows a blow-up (a very *BIG* blow-up!) of this component. Note the actual size mounting pad pattern. Transistors in SMT occupy only one-quarter or less the cubic volume of their equivalent in PET.

Integrated circuits have potentially even greater space savings. Figure 3 shows the comparison between the footprint of a standard 16-pin DIP IC and a few SMT ICs. Integrated circuits come in several package types (the glossary lists acronyms of the types, as well as other SMT terms and associated electronic shorthand). And you will encounter many configurations of pinouts with SMT, ranging from 6 pins to an amazing 468 pins on one IC package, and probably more pins than that by the time this work appears in print.

Why SMT when there is already an established technology using PET? The answer is threefold: One, SMT is faster and easier to mass-produce electronic goods with. The mass-produce equipment's dollar investment is high. Figure 4 shows a sketch of an automatic pick-and-place machine that typically might cost \$20,000.00 or so. But assembly times are much faster. Pick-and-place speeds may be 3 to 10 times the rate using PET, and fewer assembly machines are needed because the components come in quantity on standardized reels that look like old-time movie reels.

Figure 5 shows such a reel, which may have

Figure 2



4,000 or more identical parts on it. You won't have to worry about buying any of this though, because we'll show you how to design and build projects on a student's budget.

Reason two is: The size reduction results in lower material cost, both with the chips themselves and the PWB board's "real estate" area, or "footprint," which costs money both in PC board material and associated processing costs, and the size of the enclosure that will house the finished product. Hence SMT is less expensive overall to put things together with. But not less in quality, because special techniques and materials have been developed to insure SMT assemblies have a high degree of reliability.

And reason three: Really complex assemblies require really compact and reliable electronics. Imagine putting 10 or so 48-pin DIP ICs together to make a

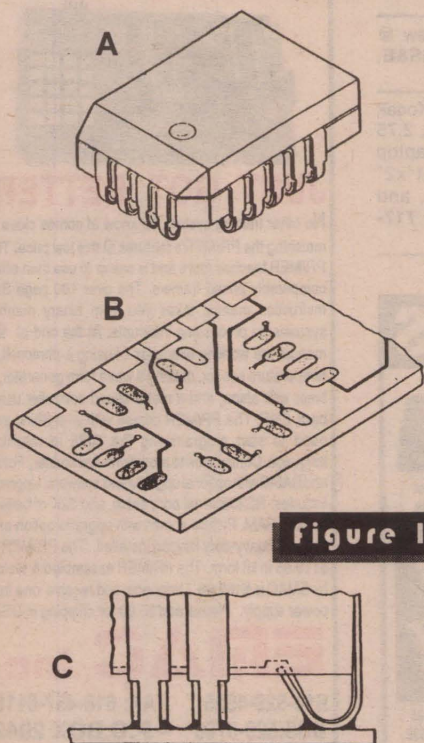
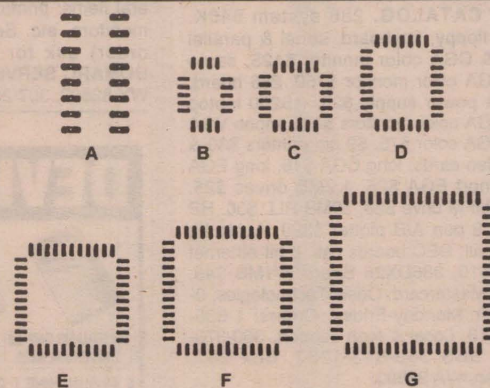


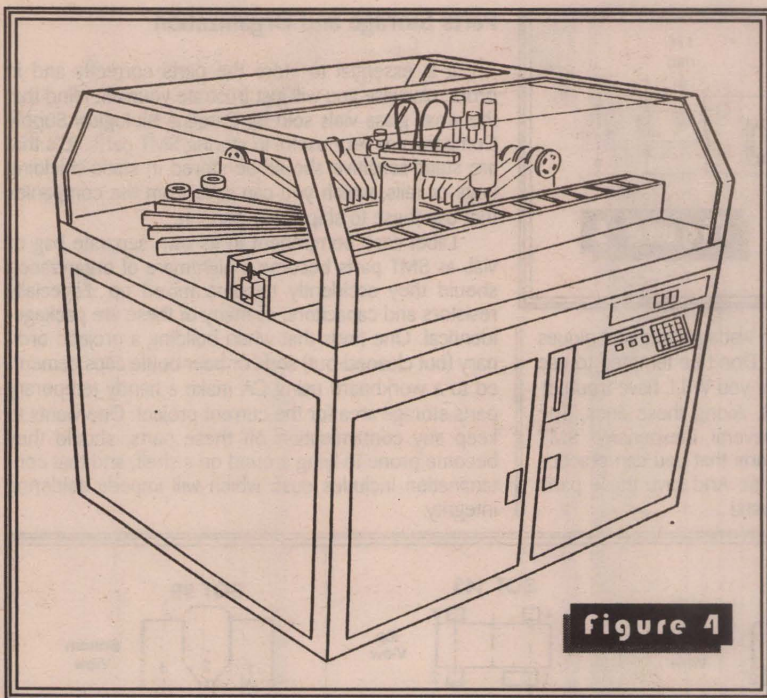
Figure 1



- A = IC pin DIP
- B = .290" x .425" 18 pin PLCC Surface Mount
- C = .400" x .400" 24 pin PLCC Surface Mount
- D = .450" x .550" 32 pin PLCC Surface Mount
- E = .650" x .650" 44 pin PLCC Surface Mount
- F = .750" x .750" 52 pin PLCC Surface Mount
- G = .950" x .950" 68 pin PLCC Surface Mount

Figure 3

All SMC Pad Outlines
courtesy: The Data Corporation



super-complex piece of equipment such as a Digital Signal Processor or a Pentium-class computer. Nightmare! The level of difficulty and expense involving board layout, assembly and testing procedures, burn-in, and so forth can be greatly reduced by using just ONE 468-pin SMT or whatever number of pins needed in this hypothetical scenario. Although that's a great deal more complex a project than we'll ever touch on, you'll get a taste of SMT and appreciate its advantages once we proceed to design and build several useful projects later on.

Case Types and Sizes

One box lists many of the industry-accepted chip capacitor and resistor case sizes. It is necessary to realize that there are so many types of cases, it would bore the reader to list them all, so we have "digested" that list

that socket until one is found that gives the right iron heat performance for you.

Circuit Design Differences

With SMT, the circuit is designed differently than with PET. You can lay out the traces for your project using tape and component outlines. There are computer programs (CAD, that is) that can generate the pattern required, but I haven't seen any yet that are priced reasonably for the hobbyist. By reasonable, let's pick \$50.00 as a typical investment for the active SMT hobbyist and experimenter. I would love to hear from anyone who is aware of, or any firm who has written an SMT CAD program and would like me to test it out for possible recommendation in these articles. (Address this or any questions to my "Free Reader Assistance" P.O. listed elsewhere.)

Getting back to generating a pattern, I have found one of the best ways to painlessly produce artwork is to use Data's family of dry rub-on transfers to create

down to the ones you will likely encounter. Notice how tiny some of them are! Figure 6 shows a size 1206 resistor package, a good size for us to work with, and how it's put together.

Keep in mind the necessity for a pair of tweezers when using SMT! These little parts can "fry" fairly easily, so you will want to invest in a small wattage and small tip soldering iron. I find that a standard 25-watt iron will work well if you grind down its tip to a fine point using a bench grinder, and then use a homemade lamp dimmer to reduce the voltage, and hence, wattage the iron will develop.

Another alternative is to place a 120-volt socket in series in the soldering iron's circuit path, and try different lamp wattages in

your circuit, after you have laid it out in pen on paper. These transfers are etch-resistant plastic, adhesive-backed traces and pad outlines that can be rubbed onto a clean copper PC board and then etched. They leave the copper underneath unaffected. Then you simply rub steel wool over the traces, exposing clean copper foil underneath which can be soldered to. However, this is a one-time only method, unless you wish to keep re-laying the pattern on each board.

When making multiple boards, a good method is to lay the traces out on Mylar film, and then either use standard photographic methods to do the boards, or transfer the pattern to a special Toner Transfer Sheet (TTS). There is a neat product which is sold by DynaArt Designs and also distributed by Digi-Key. The TTS method is certainly easier, and involves using a high-end, quality copier which can do a dark, high-contrast copy to the TTS product.

After the image is copied to the special paper, the toner is ironed on the clean copper board using an ordinary household iron. Then the TTS paper is floated off the board using warm water, and the image of the circuit traces remains on the board. You can proceed to etch immediately, and the transferred pattern will protect the copper circuit traces underneath.

Parts Placement

This topic is open to some interpretation, as individual preferences will determine how you find it most efficient to build your projects. I find using a fraction of a drop of cyanoacrylate (CA) glue to bond the parts to the PWB is helpful. That prevents the parts from sliding when the soldering iron is applied. Eight-pin SOIC ICs seem to have this tendency; and — oh boy! — do those tiniest of the SMT resistors do this dance, too! But the CA glue solves this problem. One just has to be careful not to apply too much solder (or glue), or the component may have its leads bridged, which will result in shorts or at least a messy job.

Sometimes bridges occur under the part, which is exasperating because it frequently doesn't show up until the project is tested, and doesn't work properly. Should a bridge occur, wipe clean your soldering tip, invert the board, and press the tip to the excess solder for a second or two — only that long, or else you may destroy the SMT part from overheating.

The solder should wick to your clean iron, at which point you can wipe, or in some cases, flick it off — but only use the latter technique if you are wearing protective eyewear, as there is a definite risk of getting molten

Surface Mount Technology Glossary

LCCC — Leadless Ceramic Chip Carrier, used with ICs. High-temperature type of package used with MIL(itary) devices or fast ICs that run at high temperatures.

MELF — Metallized ELectrode Face. A tubular package used for diodes, rectifiers, and some resistor types.

MQFP — Plastic Metric Quad Flatpack. A 10 x 10 millimeter IC package with a 31 mil pin spacing which is equal to 0.8 mm.

PCB — Conventional through-hole Printed Circuit Board.

PGA — Pin Grid Array. Type of IC connection format that has two or more rows of connector pins nested inside the periphery of the chip.

PLCC — Plastic Leaded Chip Carrier, used with ICs.

PWB — Printed Wired Board. A PC board used for SMT. Components usually mounted on foil side only.

QFP — Quad Flat Pack. A type of IC package that has pins on its four sides. Very densely packed, with only a 25 mil lead spacing compared to 100 mils with DIP technology and 50 mils with the majority of SMT ICs.

SEM — Scanning Electron Microscope. Used in industry to examine the quality of the materials used in assembly and for determining the integrity of a finished circuit assembly.

SMC — Surface Mountable Component.

SMD — Surface Mountable Device.

SMP — Surface Mountable Product.

SMT — Surface Mount Technology.

SOIC — Small Outline Integrated Circuit.

SOT — Small Outline Transistor.

SSOP — Shrink Small Outline, Plastic. An IC package with 25 mil pin spacing.

TAPEPAK(r) — An IC package with pin spacing down to 12 mils apart.

TSOP — Thin Small Outline, Plastic. An IC package that has a 20 mil pin spacing and with the pins placed on the two ends only.

Resistor and Chip Capacitor Size Chart

Size Code	Length In. (mm)	Width In. (mm)	Thickness In. (mm)	Solder Area In. (mm)
0402	.040 (1.00)	.020 (0.50)	.014 (0.35)	.010 (0.25)
0504	.050 (1.27)	.040 (1.02)	.040 (1.02)	.010 (0.25)
0603	.063 (1.60)	.030 (0.80)	.018 (0.45)	.012 (0.30)
0805	.080 (2.03)	.050 (1.27)	.050 (1.27)	.020 (0.50)
1005	.100 (2.54)	.050 (1.27)	.050 (1.27)	.020 (0.50)
1206	.125 (3.18)	.060 (1.60)	.060 (1.52)	.030 (0.75)
1210	.125 (3.18)	.100 (2.54)	.065 (1.65)	.030 (0.75)
1505	.150 (3.81)	.050 (1.27)	.050 (1.27)	.030 (0.75)
1706	.170 (4.32)	.065 (1.65)	.060 (1.52)	.030 (0.75)
1808	.180 (4.57)	.080 (2.03)	.065 (1.65)	.030 (0.75)
1812	.175 (4.45)	.125 (3.18)	.065 (1.65)	.030 (0.75)
2221	.220 (5.59)	.125 (3.18)	.070 (1.78)	.030 (0.75)
2225	.220 (5.59)	.250 (6.35)	.070 (1.78)	.030 (0.75)

Notes:

Thickness dimension is maximum, units typically thinner. Solder area is a tinned band on either end which commonly is a silver, palladium-silver alloy, 100% tin or tin/lead alloy.

Various manufacturers will have slightly different dimensions.

Note, the logical categorization of the numerical resistor/capacitor size code vs. the dimensions of length and width of the component in inches; e.g., 1808 is .18 inches in length and .08 inches in width.

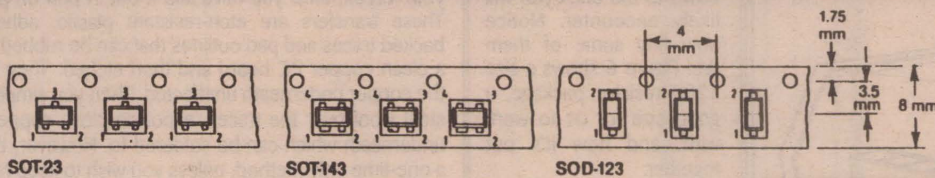


Figure 5

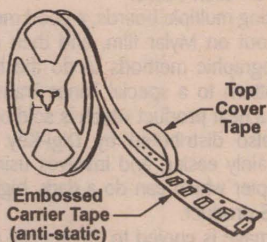
Parts Storage and Organization

It is essential to store the parts correctly and in order, otherwise you will just frustrate yourself. I find that the small glass vials sold by Carolina Biological Supply Company are very useful in storing SMT parts. IC's that are static-sensitive should be stored in static-shielding bags or rails, which you can save from the companies that use these to ship those parts in.

Label each component in its own separate bag or vial, as SMT parts become a nightmare of organization should they accidentally become mixed up. Especially resistors and capacitors, as many of these are package-identical. One finds that when building a project, ordinary (but cleaned-out) soda or beer bottle caps cemented to a workboard using CA make a handy temporary parts storage area for the current project. One wants to keep any contamination off these parts, should they become prone to lying around on a shelf, and that contamination includes dust, which will impede soldering integrity.

observe the proper solder iron wattages and techniques for each separate technology. Don't be tempted to use a 30-watt, large tip on SMT, or you WILL have trouble!

• Practice makes perfect. Along these lines, The Electronic Goldmine sells several inexpensive SMT boards already stuffed with parts that you can practice soldering and de-soldering with. And save those parts that are useful for future projects!



Tape Feed Direction

solder in your eyes if they are unprotected and you start throwing your soldering iron around.

Soldering Procedures

SMT soldering techniques are similar to PET. The important points to remember are:

- The PWB must be absolutely clean and preferably tin-plated. Use #0000 steel wool and clean up afterward using isopropyl alcohol before soldering, if needed. Pre-tin your work with a smidgeon of solder, or place solder paste on the PWB pads before soldering.

- While soldering paste is recommended, it isn't necessary for doing one-of-a-kind, non-production jobs. Use the highest quality, fine diameter solder you can find for your SMT projects. You will find this investment worthwhile, and that little roll will last a long time. Digi-Key carries both top-quality wire and paste solder.

- Watch for soldering "holidays" and "slops." The former are missed areas and the latter is where too much solder has accumulated, probably causing shorts between pins, pads, or traces.

- Mixing SMT and PET technology requires one to

TODAY'S ELECTRONICS

CHIP RESISTOR Cross Sectional View

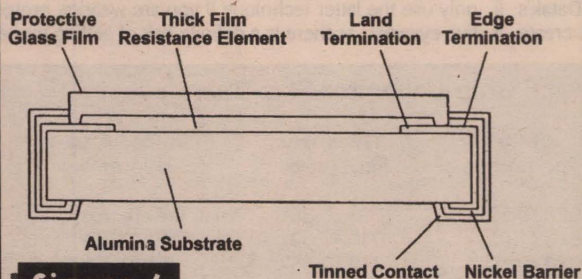
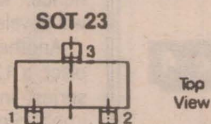
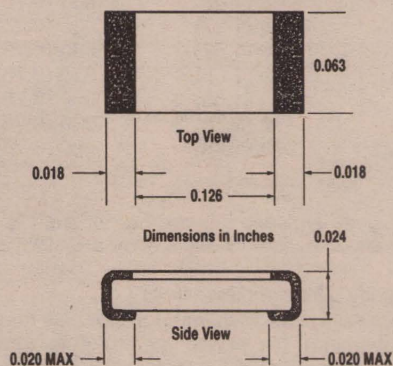
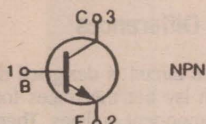


Figure 6

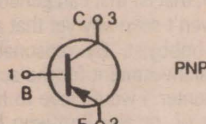
Typical Size 1206 Chip Resistor Dimensions.
Size Will Vary Somewhat From Different Manufacturers



Transistors

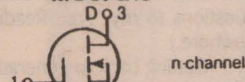


NPN

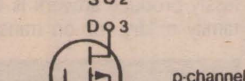


PNP

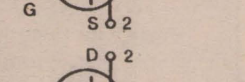
MOSFETs



n-channel

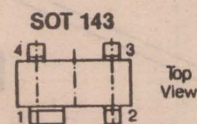
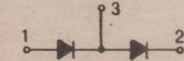
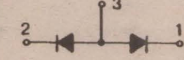
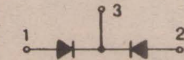


p-channel

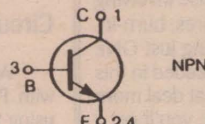


n-channel

Diodes

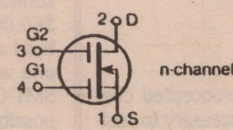


Transistor



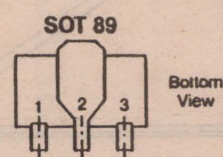
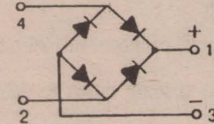
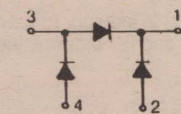
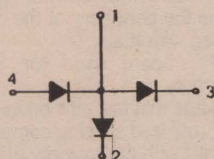
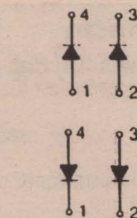
NPN

MOSFET

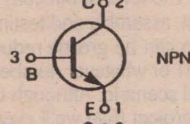


n-channel

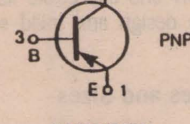
Diodes



Transistors

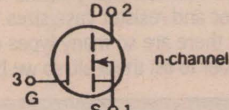


NPN

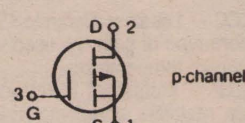


PNP

MOSFETs

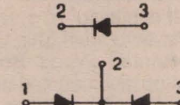


n-channel



p-channel

Diodes



■ SOT-23 Transistor Surface Mount Pattern

■ SOT-143 Dual Diode, Transistor

■ SOT-89 Power Transistor

Actual Size Mounting Pads

Figure 7

All SMC Pad Outlines
courtesy: The DataK Corporation

Conclusion

We hope you have enjoyed this overview of Surface Mount Technology. Next time, we'll start actually building projects using SMT, which I hope will give you the knowledge and experience to incorporate this fascinating technology in your projects. And we'll check into part marking codes and testing techniques to help you identify what you may run across in the surplus market, where a lot of bargains lurk. But that won't be the end of it, we'll have a lot of projects and technology to share with you in the articles ahead. NV

Today's Electronics Reader Helpline

"Today's Electronics" is a Reader Interactive forum. We appreciate your interest, and would like to hear your comments, questions, and suggestions for future articles. Address your letters to:

Today's Electronics

Attn: Anthony Charlton
P.O. Box 74
Cornwall Bridge, CT 06745

Your fax number, which will be kept confidential, will greatly speed replies.

SUPPLIER LIST

All Electronics Corporation, P.O. Box 567, Van Nuys, CA 91408-0567. Ph: (800) 826-5432, FAX: (818) 781-2653. Some SMT parts and occasional surplus. SMT boards useful for parts salvage and experimentation. Free catalog.

Carolina Biological Supply Company, 2700 York Road, Burlington, NC 27215. Ph: (919) 584-0381, FAX: (503) 656-4208. Lab supplies including test tubes, plastic, and glass vials handy for use categorizing SMCs. Contact for current price of their 30,000 item, full-color catalog.

Contact East, 335 Willow Street, North Andover, MA 01845-5995. Ph: (508) 682-2000, FAX: (508) 688-7829. SMT and electronic repair tools; chemicals. Free catalog.

Data Corporation, 55 Freeport Blvd., Unit

#23, Sparks, NV 89431. Ph: (702) 359-7474, FAX: (702) 359-7494. Dry transfers for PWB fabrication, chemicals, Circuit-Fix™ products. Free catalog.

Digi-Key Corporation, 701 Brooks Avenue South, P.O. Box 677, Thief River Falls, MN 56701-0677. Ph: (800) 344-4539, FAX: (218) 681-3380. Top-of-the-line supplier of SMT components; features a large selection. Free catalog.

DynaArt Designs, 3535 Stillmeadow Lane, Lancaster, CA 93536-6624. Ph: (805) 943-4746. Provider of and seller (through distributors, as well) of the Toner Transfer System (TTS) method of PCB fabrication. Also sells a desk-top integrated package for small OEM and prototype PCB fabrication.

Electronic Goldmine, P.O. Box 5408, Scottsdale, AZ 85261. Ph: (602) 451-7454, FAX: (602) 451-9495. SMT surplus PWBs and SMT

components. Some great values here. Free catalog.

ESP Solder Plus, 14 Blackstone Valley Place, Lincoln, RI 02865-1145. Ph: (401) 333-3800, FAX: (401) 333-4954. Small manufacturer, educational and industry SMT repair kits and solder cream.

Garrett/IEU, Inc., 3130 Skyway Drive #104, Santa Maria, CA 93455. Ph: (805) 922-0594, FAX: (805) 922-3643. Small and bulk quantities of surface mountable components.

Pace, Inc., 9893 Brewers Court, Laurel, MD 20723-1990. Ph: (301) 490-9860, FAX: (301) 498-3252. Manufacturer of SMT soldering/desoldering equipment and workstations.

Techni-Tool, 5 Apollo Road, P.O. Box 368, Plymouth Meeting, PA 19462. Ph: (215) 941-2400, FAX: (215) 828-5623. Soldering/desoldering equipment and electronic tools of all types.

Suggested SMT Tools

Here are suggested tools broken down into basic and advanced equipment. You can improvise with some of this, re-working your present equipment to suit SMT's requirements:

Basic

- Tweezers (steel and static safe plastic for MOS and CMOS devices).
- A good quality magnifying glass.
- Crazy Glue™ or other cyanoacrylate (CA) cement.
- A soldering iron, preferably temperature-controlled.
- Appropriate soldering and de-soldering tips for the iron.
- Solder iron tip wiper — this can be a damp sponge, or a commercial product.
- A very fine diameter solder containing silver such as Kester SN 62 or SMT solder cream.
- Precautions against ESD such as a wrist strap, grounded soldering iron, and work surface.
- Solder flux remover chemical.
- Isopropyl alcohol.
- Desoldering wick, desoldering bulb or syringe (solder sucker).
- IC test clips.
- Static-free PWB storage bags and a component storage facility.
- A set of small screwdrivers for slotted and Phillips™ head screws.
- A large, clean eraser for cleaning PWBs off.

Advanced

• SMT Test Tweezer™ or SMT Microtip™ Test Probe — these are two products manufactured by ITT Pomona and distributed by Garrett Instruments & Components/IEU, Inc., which enable precision probing of SMT devices, and they are equipped with a standard banana jack which can plug into your DMM.

• An inspection light. This may be as simple as a penlight, or for frequent work, a combination magnifying glass and fluorescent lamp. Regular bulbs don't work well in magnifying lamps, as they cast too much shadow.

Quality Microwave TV Systems

**WIRELESS CABLE - ITFS - MMDS
ATV - INTERNATIONAL - S-BAND**
Amplifiers • Antennas • Books • Components
Filters • Systems • Video Products

- RF Frequency 1990 - 2700 MHz
- Cable Ready - VHF - UHF Outputs
- SASE For "FREE" Catalog or Send \$1

PHILLIPS-TECH ELECTRONICS

PO Box 8533 • Scottsdale, AZ 85252

CHALLENGER SYSTEM
33-Channel 52dB+ Gain
Complete Grid \$265
Five Year Warranty
FREE SHIPPING

ORDER LINE 800-880-MMDS
CATALOG / INFO 602-947-7700
FAX LINE 602-947-7799

Visa • M/C • Amx • Disc • COD's • Qty Pricing

Write in 178 on Reader Service Card.

#50 COMPUTER HARDWARE cont.

IBM PC 386-586 Motherboards, great prices? 386DX16 with CPU \$18 NEW!! 486 ISA NEW for only \$40!!! Call for the latest deals! UTWE, 818-797-2569 or fax 818-797-0384. Other "back to school" deals on bare bones systems, too!!!

HEWLETT PACKARD calculators. We buy, sell and trade 41C, CV, CX, 100LX, 200LX, palmtops and 71B calculators and portable printers. Phone: 610-588-2600. FAX 610-588-1727.

COMPUTER REQUEST Fax line. Fax your computer, peripherals, system needs. DEC, SUN Wang or any manufacturer (no PCs or VGA monitors). Old, hard to find, parts, filters, etc. Nationwide network. Fax 818-989-2667.

OPTICAL 650MB, SCSI External-Rewritable Disk Drive RICOH RS-9200EII) and two 650MB optical cartridges, manuals. Lab liquidation, excellent condition, used once for computer show! Original cost \$4,900, all for only \$995. First come first serve! 215-336-7277.

The Digital Multimeter with Computer Interface for

\$189.95

Featuring:

- True RMS mode
- Capacitance and Inductance
- Temperature mode
- Dual display for frequency
- Decibel measurement
- Time mode with alarm, clock and stop watch.
- Continuity, Logic and Diode Test.
- Pulse signal injection function.
- RS-232C interface
- Back light and auto power off.

-includes manual, software, interface cable and test probes.

To Order - Send \$189.95 plus \$4.00 S+H to
green brook electronics

269 U.S. Hwy 22 Dept BJ
Green Brook, NJ 08812

Credit Cards accepted: AMEX, Visa, MC or C.O.D.
TEL: 908-968-3500 FAX: 908-968-3378
N.J. residents add 6% sales tax

**Protek
506**

Snap-on Holster
Available - \$10.95

Write in 196 on Reader Service Card.

COMPUTER SOFTWARE

60

SAVE ON Shareware. Call 1-800-848-6974 for free catalog.

HUBBLE TELESCOPE Photographs (GIFS) challenge QUASAR Theory (Series \$9.99)+ \$2 shipping. Entire public Hubble Series available. SPACEPICS, PO Box 75711, Oklahoma City, OK 73147.

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 RG/Sync-B \$55. VA12 VGA to PGA (DB9) \$45. Rich, Pikul & Assoc., 101 Glenfield Dr., Festus, MO 63028. 314-937-0335.

WANG SMD cartridge drive. Wang 7565-IT (CDC9762 OEM) \$200. Many Wang printer, computer. Call. 818-989-3848.

Subscribe to Nuts & Volts Today!

Serving the public since 1981

XANDI ELECTRONICS, INC.
1270 E Broadway # 113, Tempe AZ 85282

Electronic KITS!

BUY WITH CONFIDENCE

• 30-DAY REFUND POLICY
• TECH SUPPORT NUMBER
(602-894-0992)

- Miniature photo battery mounts right on circuit board. (Included with kit)
- Tunes 88-108 MHz.
- Up to 1/2 mile range.
- Sensitive 2 stage audio amplifier, picks up sounds at the level of a whisper.

MICRO-MINIATURE FM TRANSMITTER

Including the battery, this is the Worlds smallest FM transmitter. Use with any FM broadcast receiver. Easy to assemble, uses pre-assembled circuit board.

XWB1000 E-Z KIT \$49.95

- Smallest FM transmitter anywhere!
- Tunes 88-108 MHz.
- Powerful 2 stage audio amplifier.
- Sensitive, picks up sounds at the level of a whisper.
- Up to 1 mile range.

SUPER-MINIATURE FM TRANSMITTER

Worlds smallest FM transmitter. Use with any FM broadcast receiver. Easy to assemble, all chip components are pre-assembled to the circuit board.

XST500 (E-Z) Kit \$44.95

- Digital voice changing: male to female, female to male, adult to child, child to adult.
- 16 levels of voice masking.
- Button for normal operation.
- Complete anonymity on all calls.
- Not a kit, fully assembled.

VOICE CHANGING TELEPHONE

STOP THOSE ANNOYING TELEPHONE CALLS! Sound older and tougher when you want to. Not a kit! Fully assembled. Single phone operation only.

TRANSITION 2000 \$89.95

- Uninterrupted coverage of 800 to 950 MHz.
- Works with any scanner that can receive 400 to 550 MHz.

800-950 MHz SCANNER CONVERTER

If your scanner can receive 400-550 MHz, just add the XLC900 for uninterrupted 800-950 MHz coverage. It converts all 800-950 MHz signals down to 400-550 MHz so your scanner can receive them! Add our custom case and knob kit for that "Professional" look.

XLC900 KIT \$49.95

XLC-MATCHING CASE SET \$13.95

WE ACCEPT VISA, MC, MO, COD
Master Card VISA

- Transmits at 143 MHz.
- Up to 1/2 mile range.
- Miniature photo battery mounts right on circuit board. (Included with kit)
- Amazing audio sensitivity, picks up sounds at the level of a whisper.

CRYSTAL CONTROLLED TRANSMITTER

This is the Worlds smallest crystal controlled FM transmitter. Transmits to any scanner type receiver. Easy to assemble, uses pre-assembled circuit board.

XTL1000 E-Z KIT \$69.95

- Smallest Phone transmitter anywhere!
- Tunes 88-108 MHz.
- No batteries required, powered by phone line.
- Up to 1/4 mile range.
- Attach to phone line anywhere in house.

SUPER-MINIATURE PHONE TRANSMITTER

Worlds smallest FM phone transmitter. Use with any FM broadcast receiver. Easy to assemble, all chip components are pre-assembled to the circuit board.

XSP250 (E-Z) Kit \$34.95

- Digital voice changing: male to female, female to male, adult to child, child to adult.
- Use with any modular phone.
- 16 levels of voice masking.
- Connects between handset and phone.
- Not a kit, fully assembled.

VOICE CHANGING ACCESSORY

STOP THOSE ANNOYING TELEPHONE CALLS! Sound older and tougher when you want to. Not a kit! Fully assembled. Use with single or multi-line phones.

TRANSITION 2001 \$59.95

- Transmit high quality stereo to any FM stereo receiver.
- Built in output level monitor for quick and easy tuning.
- Ideal for use with personal CD player.

FM STEREO TRANSMITTER

Transmit full bodied Hi Fi stereo to any FM stereo receiver. Separate left and right inputs and gain controls. Includes an output booster stage for greater range.

XFS108 KIT \$41.95

XFS-MATCHING CASE SET \$13.95

- Uses sensitive microwave transistor amplifier.
- Covers 1 to 2,000 MHz.
- Compact hand held unit.
- Includes miniature loud speaker for audio indication of detected signals.

SUPER SENSITIVE BUG DETECTOR

When the XBD200 intercepts a signal in the 1 to 2,000 MHz range, it emits a growl that increases to a high pitched squeal as the signal strength in-

XBD200 (C) Kit \$49.95

- Powerful 2 stage audio amplifier.
- Up to 1 mile range.
- Use with any FM broadcast receiver.
- Hear every sound in an entire house!

MINIATURE FM TRANSMITTER

The XFM100 has a super sensitive microphone and is capable of picking up sounds at the level of a whisper and transmitting them to any FM broadcast receiver.

XFM100 (C) Kit \$32.95

- Transmits a continuous beeping tone.
- Adjustable from 88 to 108 MHz.
- Up to 1 mile range.
- Works with any FM broadcast receiver.
- Operates from battery voltages of 3 to 18 Volts.

TRACKING TRANSMITTER

Measuring 0.7 by 2.4 inches, the XTR100 is ideal for use in locating lost model rockets, bicycles, automobiles, games of hide and seek, and contests.

XTR100 (C) Kit \$33.95

- Dial your phone from anywhere and listen to the sounds inside your home.
- Two digit Touch Tone code for secure operation.

TELEPHONE SNOOP

The latest in home or office security. Dial home from any other telephone, enter a two digit security code, and listen to all the sounds in your home. Automatically turns on without ringing the bell, waits for code, then remains activated for one and a half minutes.

XPST000 KIT \$49.95

XPS-MATCHING CASE SET \$13.95

SEND MAIL ORDERS TO:
XANDI ELECTRONICS
BOX 25647
TEMPE, AZ 85285-5647

ASK FOR FREE CATALOG OF OUR PRODUCTS

Write in 82 on Reader Service Card.

Javanco 40,000 FT² OF REAL BARGAINS:

- computer parts & software
- terminals
- TV/VCR service parts
- ICs
- sockets

- transistors
- diodes
- LEDs
- phone stuff
- resistors
- capacitors
- switches & relays

- connectors
- tie-wraps
- batteries
- fuses
- crystals
- oscillators
- fans, meters

- speakers
- wire
- "old junk"
- equipment racks
- knobs & hardware
- circuit boards
- subassemblies



We've slashed the price on an old favorite: used tested Teletype 925 terminals, excellent for use with serial packet radio TNCs. Our stock no. CPS-2188, \$19.95 each.



**Call or write
for a catalog**

Orders Only: 1-800-528-2626
615 244-4444
BBS 244-4445 FAX 244-4446

501 12th Ave S Nashville TN 37203 VISA/MasterCard/Discover

New Hours: 8:30a-5:30p MF, 9a-1p Sat

Write in 57 on Reader Service Card.

DATA CONVERSION 9-Track Reel to any format 1600/6250 BPI. \$5 Best Price Anywhere! \$97-227-4637.

COMMODORE 64 Ham Programs, 8 disk sides, over 200 Ham programs, \$16.95. 32c stamp gets unusual software catalog of utilities, games and British disks. Home-Spun Software, Box 1064-H, Estero, FL 33928.

CD-ROMS, SOFTWARE, how-to videos, 1000s of titles. Not shareware. Send (refundable) \$10 for catalogs. Infovideos, Box 26031, Columbus, OH 43226-0031.

HACKING DISKETTES: magstripe card cloner plans \$20; thirteen different tone box phreaking programs \$15; eighteen different sequential modem "war" dialers \$15; electronic germ warfare and virus source code creation equal to 1200+ pages of text \$15; convert any XK radar detector to jammer \$10; Celtel phreaking and cloning software \$25. Free catalogue. Peregrine Dynamics, 720 Portage Trail, Cuyahoga Falls, OH 44221.

HAVE PROCESSOR WILL TRAVEL Work smarter with **SUNBURST TECHNOLOGY**. 50+ years computer/electronics experience. Custom made software to control real time. Automotive, industrial, marine and robotics. **IS 200 MPG POSSIBLE?** Free article send \$3 P&H. PO Box 598, Lithia Springs, GA 30057. 404-949-2979; 404-942-6091 FAX.



UNION JACK'S®, MOTOROLA CELLULAR PHONE, AMPS/NAMPS EMULATOR PROGRAMMING SYSTEM (FOR BRICK-UC, FLIP & BAG PHONES). UJMP-1 SOFTWARE SET, 5 EACH, 3.5" 1.44MB DISKS, MFDP-1: Programs firmware below 9122s without a loader phone, MFDP2: Programs firmware 9122 to 9340 with a loader phone (FLIP-BRICK OR BAG, having a firmware below 9122) FDP3, 4 & 5 are a conglomeration of Cellular emulating etc., information. 60-page illustrated programming manual included. **FREE technical backup & yearly updates.** 4-DISK SOFTWARE SET UJMP-1 \$199.95 COMBINATION OFFER (A), SAVE \$50, COMPLETE REPROGRAMMING SYSTEM \$419.95, CONSISTS OF 1 SET UJMP-1 \$199.95, 3 TYPES MOTOROLA COMPATIBLE, COMPUTER PROGRAMMING CABLE HARDWARE SETS, 1-6PCs-CSFP FOR FLIP-POCKET PHONES \$99.95, 1-3PCs-CS689/UC FOR BRICK/ULTA CLASSICS \$99.95 AND 1-3PCs-BP FOR BAG PHONES \$69.95. *PRICES: Computer-Cellular loader phone not included. **S&H: UPS COD CASH ONLY, 2ND DAY AIR \$12. FREE 2 PAGES OF ADDITIONAL INFORMATION & COMBINATION PRICES, AVAILABLE BY MAIL OR FAX.** CALL LES, LESS BUSTERS ELECTRONICS, 702-642-0325, 2039 CIVIC CENTER DRIVE #176, N. LAS VEGAS, NV 89030.

FREE INFORMATION disk 3-1/2" over 150 reports from business to opening a store for free. Send \$15 for S/H to: DD, PO Box 171, Genoa, OH 43430. Shipped 2nd day.

FREE DISKETTES! Brand new report details how to get as many free diskettes as you need! Wow! Order Now! Only \$3! Bates, 426 West Belmont, Chicago, IL 60657.

CABLE T.V. EQUIPMENT

Friendly, Knowledgeable Service



ORDERS CALL:
1-800-361-4586

- All Equipment New
- Converters & Descramblers
- 30 Day Money Back Guarantee
- 6 Month Warranty
- Visa, MC, C.O.D. Welcome

KDE ELECTRONICS, INC.

P.O. Box 1494
Addison, IL 60101
Info. 708-889-0281
Fax 708-889-0283



CATV SYSTEM COMBOS

SA-M-80-COMBO:	150.00
SA-M-80-DECODER ONLY:	85.00
PIO-COMBO:	165.00
PIO-DECODER:	95.00
DIGITAL J-COMBO:	150.00
DIGITAL J-DECODER:	85.00
ZENITH COMBO: (RECONDITIONED)	235.00
ZENITH DECODER: (RECONDITIONED)	170.00
OAK COMBO:	135.00
OAK DECODER:	70.00
(ALL COMBOS CONSIST OF TUNER, REMOTE, AND DECODER + PATCH CORD.)	

CATV 1 PC. SYSTEMS

NOVA-5700:	245.00
NOVA-5800:	245.00
NOVA-5600:	245.00
8580:	250.00
8590:	CALL
8600:	CALL

(1 PC. UNITS CONSIST OF A CONVERTER WITH BUILT-IN DESCRAMBLER & REMOTE.)

FILTERS

CHANNELS	
#2 THRU #23	20.00

CONVERTERS: (PARENTAL LOCKOUT)

PANASONIC:	89.00
NOVA CENTURY:	79.00
VOL - CONTL:	105.00
REMOTE A/B SWITCH:	35.00
PATCH CORDS:	1.25
REMOTE CONTROLS:	24.00

• ANY COMBO WITH PANASONIC CONVERTER ADD 10.00 PER UNIT.

FREE CATALOG. We have the latest versions of shareware for the lowest prices. Our service is the best and fastest. Hundreds of great programs for the IBM and compatibles. The Software Shoppe, PO Box 2440, Matthews, NC 28106.

FREE DISK CATALOG and discount coupon! Inexpensive, quality, IBM, Shareware and CD-ROMS. <ASP> vendor: **MOM 'N' POP'S SOFTWARE**, PO Box 15003-N, Springhill, FL 34609-0111. 904-688-9108.



EMATH PRO electronic calculator utility. Contains over 325 formulas for all fields of electronic engineering. Solves for all variables with unique solutions. Extensive on-line help for every formula, including text, data tables, diagrams, and references. Units conversion and hardcopy capability. IBM PC/XT/AT and hard disk with 1.3M free space required. \$29 plus tax for CA residents. Specify disk size. Send check to **PROTECH**, 5074 Pine Tree Terrace, Campbell, CA 95008.

CP/M SOFTWARE also Amstrad PCW software and hardware. 3", 8" and hard sector disks. Disk copying, 400 formats. Send \$2 for catalog, SASE for free flyer. Specify computer. Elliam Associates, PO Box 2664, Atascadero, CA 93422. 805-466-8440.

REPAIR SOLUTIONS — more than 17,200 VALUABLE, TIME SAVING, MONEY MAKING REPAIRS for servicing TVs, VCRs, CAMCORDERS & other electronics, organized in an easy to use computer program — **The TIP REPAIR Program**. **PROFESSIONAL BOARD/COMPONENT LEVEL REPAIRS** with Part numbers, Component locations/values & test voltages (when available). **ADD** your own tips. **PRINT** tips. Owners of our **COMPUTERIZED TIP PROGRAM** say this is the **BEST** technical tip program on the market today. Works on **ANY** IBM compatible computer with a hard drive & 16 Megabytes free space. **NEW VERSION** — works in DOS and WINDOWS. Only \$200. **FREE Shipping** for prepaid orders (USA). **FREE Demo!** Have your own tips? Ask about our **TIP EXCHANGE** policy with **FREE Updates!** CALL 1-800-215-5081/516-643-7740. **HIGHER INTELLIGENCE SOFTWARE**, 60 Farmington Lane, Melville, NY 11747.

NEED MONITOR SCHEMATICS? Database for over 250 names, and tech phone numbers for monitor, computer and parts supplier companies. 3-1/2" disk for Windows. Send \$10 check to: Computer Vision, 6905 Indian Bay Rd., Moutague, MI 49437.

I WANT it and I want it now. I want all of your SIMM memory. IBM, Mac, new, used, even defective. I want it all. Highest \$ paid. Call 1-800-4-MEMORY now! Voice/FAX.

APPLE II+/IIe/IIc CBS Felony. Solve 12 crimes game. 1/\$6, 6/\$25, 24/\$84, post-paid. More Than Games, 8207 Briarwood Ln., Austin, TX 78757-7642.

SEMICONDUCTOR CROSS-REFERENCE LIBRARY on disk, for IBM PC with 640 mem, EGA or better, 10 meg HD space. Over 234,000 devices (transistors, diodes, ICs, SCRs, etc.) Specification, lead and case configuration drawings for most. Send \$49 to Custom Software Creators, PO Box 1092, St. Bethlehem, TN 37155. 615-647-6120.

SIMPLY THE FINEST IBM SHAREWARE! LATEST VERSIONS! PROMPT DELIVERY! DOLLAR SPECIALS! Free disk catalog! Specify disk size. Kathleen Lewis, c/o **PDUG**, Box 720396N, San Diego, CA 92172-0396.

DISCOUNT SOFTWARE All kinds, MSDOS 6.22 \$29.95, QEMM 7.0 \$24.95, Windows 3.0 \$19.95, Star Trek Screen Saver \$14.95, Star Trek Judgement Rites \$10, Quatro Pro SE \$10, Math Blaster \$19.95, 1000's of other products. Call for Free catalog. 1-800-230-7638.

ATARI 800/XL/XE/ST and IBM software, great selections, free catalogs! Specify machine. Lotsa Bytes, Box 1756, Winton, CA 95388. 209-358-1160.

PC DOS 6.1 New! Complete with factory shrink wrap with hologram \$15, 5 for \$60 Star Trek Judgement Rites \$15 Generic CADD 6.0, 5 User pack \$125. Other titles: Productivity, Games, etc. So many, so stupid cheap! Quantity discounts! Call, 818-797-2569 or fax 818-797-0384.

WITH PROMATIC software you can easily implement logic functions in inexpensive, OR tem rich PROM devices. Only \$39. Call or write for free 30 day trial. Special Economics, 3 Margit Street, Wilmington, DE 19810. 302-475-2846.

C64/128 HUNDREDS of public domain shareware programs, ham radio, utilities, games. Send SASE for catalog. RJR, 94 Hancock St., Malden, MA 02148.

FIX ANY PC Fast! Use DiagTech Software to test all major hardware components in your system. With DiagPost ROMs Fix Dead PCs. All tests are displayed on your video screen. H. Ross Designs, 408-374-4518, POB 110233, Campbell, CA 95011-0233.

SHARE REPAIR, E-Mail tech support for TV-VCR technicians. For information, E-Mail: rhett@dump.com.

CUSTOM WINDOWS programs for small businesses, schools or individuals. Will write to your specifications. Send me the details and I'll send you a free estimate. No obligation. Visual Solutions, 2305 East Willis, Fresno, CA 93726, or FAX 209-224-9869.

ALFA ELECTRONICS

HIGH QUALITY TEST EQUIPMENT
BEST PRICE

<p>DMM 89 \$199.95 <i>Most Advanced DMM</i> All Purpose & Communication -80.7 to 81.4 dBm with 4Q-1200Q 20 reference impedances True RMS Frequency counter: 0.01Hz-10MHz Capacitance: 1pF-50,000pF Measure AC volt to 20kHz 5000 counts, 0.1% accuracy Auto/manual range, fast bar graph Min/Max/Ave/DH/Relative/Zoom Auto power off Input warning Splash proof Volt, amp, ohm, logic, diode, continuity Ruggedized case Rubber holster included</p>	<p>DMM 2360 \$119.95 <i>DMM+LCR Meter</i> Very Versatile DMM Inductance: 1µH-40H Capacitance: 1pF-40µF Frequency: 1Hz-4MHz Temperature: -40-302 °F TTL Logic Test: 20MHz Diode, Continuity Volt, Amp, Ohm 3999 count display Peak Hold Auto power off Ruggedized case. Rubber Holster \$8.00 Temperature probe \$7.00</p>	<p>DMM 21 \$74.95 Inductance: 1µH-40H Capacitance: 1pF-200µF Frequency: 1Hz-1MHz Volt, amp, ohm, diode, continuity 3999 count display TTL logic, HFE Peak hold Ruggedized case Rubber holster \$8.00 Full line of DMMs, economy, compact, ruggedized, solar cell, automotive, heavy duty, industrial, starts from \$15.95</p>	<p>Fluke Multimeter Fluke 12 \$84.95 Holster C-10 \$10 Fluke 70 II \$67.5 Fluke 73 II \$94 Fluke 75 II \$129 Holster C-70 \$16 Fluke 77 II \$149 Fluke 79 II \$169 Fluke 29 II \$169 Fluke 83 \$225 Fluke 85 \$259 Fluke 87 \$287 Fluke 97 Scope Meter \$1785</p>
<p>LCR Meter 131D \$229.95 <i>Most Advanced LCR</i> Dual display: L/Q or C/D Inductance: 0.1µH-1000H Capacitance: 0.1pF-10,000µF Impedance: 1mΩ-10MΩ 0.7% basic accuracy Dissipation factor & Q factor Serial & parallel mode Relative mode for comparison and to remove parasitics Statistics, tolerance Best for design, incoming testing & production SMD and chip component test probe \$25.00</p>	<p>LCR Meter 814 \$189.95 <i>Best Resolution LCR</i> Inductance: 0.1µH-200H Capacitance: 0.1pF-20,000µF Resistance: 1mΩ-20MΩ 1% basic accuracy Dissipation factor indicates leakage in capacitor and Q factor in inductor Zero adjustment to reduce parasitics from test fixture Best for high frequency RF and surface mount components. SMD and chip component test probe \$25.00, Deluxe carrying case \$5.00</p>	<p>Frequency Counter FC-1200 \$129.95 Frequency: 0.1Hz-1.25GHz Display: 8 digit LCD Period: 0.1µs-0.1s Records: Max/Min/Average Data hold, relative mode Telescoping antenna \$8.00 Deluxe case \$5.00 Also Available: AC/DC clamp meter, Light meter, Thermometer, pH meter, High voltage probe, Digital caliper, Anemometer, Electronic scale, Force gauge, Tachometer, Stroboscope, Humidity & EMF adapter, Sound level meter, Frequency counter, SWR/field strength/power meter, Dip meter</p>	
<p>20 Mhz Oscilloscope with Delay Sweep PS-205 \$429.95 Dual Trace, Component test, 6" CRT, X-Y Operation, TV Sync, Z-Modulation, CH2 Output, Graticule Illum, 2 probes each has x1, x10 switch. Best price with delay sweep. PS-200 20 MHz DUAL TRACE \$339.95 PS-400 40 MHz DUAL TRACE \$494.95 PS-405 40 MHz DELAY SWEEP \$569.95 PS-605 60 MHz DELAY SWEEP \$769.95 Scope Probe: 60MHz x1, x10 \$13, 100MHz x1, x10 \$22</p>	<p>20 Mhz Digital Storage Oscilloscope DS-203 \$729.95 Switchable between digital and analog modes 2 K word per channel storage Sampling rate: 10 M sample/sec 8 bit vertical resolution (25 Level/div) Expanded Timebase 10ms/div - 0.5 s/div Refresh, Roll, Save all, Save CH2, Pre-Trip Plotter Control 250MHz x1, x10 \$29, 250MHz x100 \$39</p>	<p>DC Power Supply PS-303 \$159.00 0-30 VDC, 0-3A output Constant voltage & constant current mode 0.02% + 2mV line regulation 0.02% + 3mV load regulation 1 mVrms noise and ripple Short circuit and overload protected PS-3200 with digital voltmeter \$179.00 Also available: 30V/5A, 60V/3A, 60V/5A 15V/10A, 30V/10A</p>	<p>DC Power Supply Triple Output PS-8202 \$499.95 Two 0-30 VDC, 0-3A outputs One fixed 5VDC, 3A output Capable of independent or tracking operation Constant voltage and constant current mode Four digital meters for volt and current display Excellent regulation and low ripple Short circuit and overload protected Also available: 30V/5A, 60V/3A, 60V/5A Dual tracking 30V/3A, 30V/5A, 60V/3A, 60V/5A</p>
<p>RF SIGNAL GENERATOR SG-4160B \$119.00 100 kHz-150MHz sine wave in 6 ranges RF Output 100mVrms to 35 MHz Internal 1kHz, External 50Hz-20kHz AM modulation Audio output 1 kHz, 1 Vrms</p>	<p>AUDIO GENERATOR AG-2601A \$119.00 10Hz - 1MHz in 5 ranges Output: 0-8Vrms sine wave 0-10Vp-p square wave Synchronization: ±3% of oscillation frequency per Vrms Output distortion: 0.05% 500Hz - 50kHz 0.5% 50Hz - 500kHz Output impedance: 600 ohm</p>	<p>FUNCTION GENERATOR FG-2100A \$169.95 0.2 Hz - 2 MHz in 7 ranges Sine, square, triangle, pulse and ramp Output: 5mV-20Vp-p 1% distortion, DC offset ± 10V VCF: 0-10V control frequency to 1000:1</p>	<p>FUNCTION GEN/COUNTER FG-2102AD \$229.95 Generates signal same as FG-2100A Frequency counter 4 digits Feature TTL and CMOS output</p>
<p>RF SIGNAL GEN./COUNTER SG-4162 AD \$229.95 Generates RF signal same as SG-4160B Frequency counter 1Hz - 150 MHz for internal and external source Sensitivity <50mV</p>	<p>AUDIO GEN./COUNTER AG-2603AD \$229.95 Generates audio signal same as AG-2601A Frequency counter 1Hz-150MHz for internal and external sources Sensitivity <50mV</p>	<p>SWEEP FUNCTION GEN./COUNTER FG-2102AD \$329.95 0.5Hz to 5 MHz in 7 ranges Sweep: Linear 10:1/Log 10:1 20ms to 2s AM Modulation Gated Burst, Voltage Control Generator Generator Control Voltage & 6 digit counter 1Hz-10MHz for internal & external sources</p>	

ALFA ELECTRONICS

(800) 526-2532/(609) 520-2002 15 DAY MONEY BACK GUARANTEE. 1 YEAR WARRANTY
FAX: (609) 520-2007
741 Alexander Rd., Princeton, NJ 08540
Visa, Master Card, American Express, COD, Purchase Order Welcome

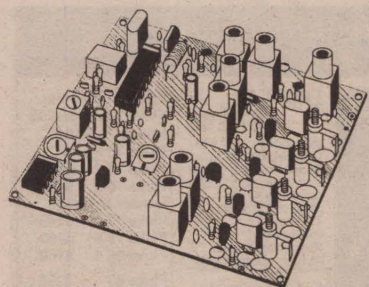
New Product

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

R150 VHF MONITOR RECEIVER



The new Hamtronics® R150 is a full crystal-controlled dual-conversion receiver with 0.2 μ V sensitivity and 60 dB adjacent channel selectivity. The main difference between this receiver and their repeater-grade receivers is that the R150 uses a transceiver-grade IF filter instead of expensive crystal filters.

You can plug in crystals for up to four frequencies, which have channel frequencies separated by less than a few MHz. Selection is done by grounding one of the four control lines with an external switch you provide. Volume and squelch controls on the board can be preset for comfortable listening level. An external toggle switch can be used to defeat the squelch, or you can use external volume and squelch controls.

If you would like to be able to scan, you can do that too! A model AS-138 Scan Adapter is available.

For more information, contact:

HAMTRONICS, INC.
65-F MOUL RD., DEPT. NV
HILTON, NY 14468-9535
716-392-9430 FAX: 716-392-9420

ADAPTOR TEST KIT



L-Com offers a unique assortment of adaptors as a kit which allows any BNC equipped coaxial to be used as a test cable set. Five basic

components allow flexibility to interface any number of connector matching situations.

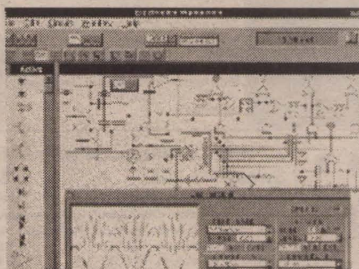
Each adaptor kit contains: One each, BNC Male-Male and Female-Female gender changers. One each, male and female BNC to dual binding posts. And one BNC female to dual banana plug adaptor. All components are stored in a handy high-impact hinged plastic storage/carry case.

The Model BC2700K has a user price of only \$20.95.

For more information, contact:

L-COM, INC.
1755 OSGOOD ST., DEPT. NV
NORTH ANDOVER, MA 01845
508-682-6936 FAX: 508-689-9484
1-800-343-1455

ELECTRONICS WORKBENCH® VERSION 4.0



Electronics Workbench® version 4.0 offers electronics engineers, technicians, and enthusiasts true mixed-mode simulation of electronic circuits.

Electronics Workbench lets users design and verify circuit configurations — faster. The intuitive interface supports drag-and-drop techniques for adding parts, running wires, and hooking up simulated test instruments. This provides the flexibility needed for modifying and substituting components and exploring what-if scenarios.

Electronics Workbench gives users the ability to simulate analog, digital, and mixed-code circuits. With more components in multiple parts bins and over 350 real-world analog and digital models (over 2,000 available), version 4.0 allows users to create larger and more complex circuits.

It is a fully integrated schematic capture, simulator, and graphical waveform generator. When the circuits are simulated, the on-screen waveforms are the same as would be displayed on real test equipment. It is even possible to make adjust-

ments while the circuit is running to instantly see the effects of the changes. Once the design is verified, users can print out a detailed schematic and parts for final construction.

To provide a real-world environment, Electronics Workbench includes an array of simulated electronic test instruments: function generator, oscilloscope, Bode plotter, multimeter, word generator, logic analyzer, and logic converter.

Electronics Workbench version 4.0 is available for DOS, Windows, and Mac; and is priced at \$299.00.

For more information, contact:

**INTERACTIVE IMAGE
TECHNOLOGIES**
416-977-5550 FAX: 416-977-1818
INTERNET:
skerzner@interactive.com
TECHNICAL SUPPORT:
1-800-361-4937

CONDUCTIVE THERMOFORMED TRAYS



Custom thermoformed plastic trays fabricated from conductive translucent PETG sheeting to protect electronic products during their manufacture, assembly, shipping, and storage are introduced by Capco Plastics, Inc. of Providence, RI and El Paso, TX.

Capco Conductive Trays are thermoformed from an electro conductive coated semi-transparent (translucent) PETG sheeting and feature custom cavities that fit the components exactly. Configurations include open cell trays and two-piece packages which create a Faraday cage and also provide environmental protection. The thermoformed trays shield, cradle, and pro-

tect products.

Custom thermoformed in sizes ranging from 2" up to 28" sq. and varying thicknesses, Capco Conductive Trays provide 104 to 106 ohms/sq. surface resistivity per ASTM D257 and a static decay rate of <1 second per EIA-541. Trays can be fabricated for manual and fully automated assembly, storage, and shipping operations.

Capco Conductive Thermoformed Trays are priced according to size, complexity, and quantity.

For more information, contact:

CAPCO PLASTICS, INC.
297 DEXTER ST., P.O. BOX 9591
DEPT. NV
PROVIDENCE, RI 02940
401-272-3833 FAX: 401-751-1859

INDUCTIVE COUPLER

RF Industries introduces its new Inductive Coupler for cellular applications with universal adapter.

The PT-4000-200 RFI Unidapt® Inductive Coupler allows you to perform test measurements on cellular units with fixed or retractable antennas. The operation is based on the inductive signal transfer between the coupler and the original factory installed antenna of the cellular phone.

When used with the Unidapt or Celludapt® kits or any Unidapt connector, you can also perform power measurements on those cellular units with fixed antennas for which you have no adapter to bridge between your test equipment and the antenna port. By using the chart included with the coupler, power measurements can be made to determine up to 2.5 watts transmitter output power.

The coupler assembly is 39" long and terminated with a Unidapt male universal fitting. This allows the coupler to be mated with any Unidapt or Celludapt adapter to form any interface required by your diagnostic equipment.

For more information, contact:

RF INDUSTRIES, LTD.
7621 MIRAMAR RD. DEPT. NV
SAN DIEGO, CA 92126-4202
619-549-6340 FAX: 619-549-6345
1-800-233-1728

TEST COVERAGE ANALYZER

Bullseye Software has announced BC-Cover version 3.0, a branch coverage analyzer for C and C++. C-Cover increases testing productivity and saves time by quickly identifying untested control structures, functions, C++ classes, source files, and sub-systems. This tool measures true branch coverage.

A new feature allows forcing execution flow through specified branches. This allows testing error conditions which are otherwise too difficult to reproduce. C-Cover can analyze multi-threaded code, dynamic link libraries, device drivers, and system-level code. C-

New Product News

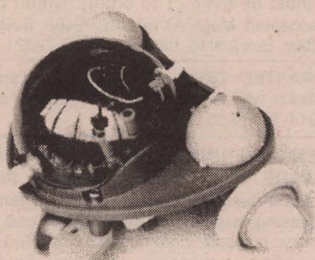
Cover is designed to analyze very large projects and includes a powerful capability for sorting, filtering, and summarizing large amounts of coverage information. Under Windows NT, C-Cover takes advantage of the Win32 API to provide additional features. C++ is fully supported, including inline functions, templates, and exceptional handling. Run-time source and utility programs are included.

C-Cover is available for Windows, Windows NT, DOS, Unix, and OS/2; and supports all popular compilers.

For more information, contact:

BULLSEYE SOFTWARE
5129 24TH AVE. N.E., STE. 9, DEPT. NV
SEATTLE, WA 98105-3230
1-800-278-4268 FAX: 206-524-3575
E-MAIL: info@bullseye.com

HYPER PEPPY



Explore the fundamentals of robotics with this informative and entertaining robot kit. Appropriate for ages 10 and up, Hyper Peppy is an intelligent robot with a touch/sound sensor. If it comes in contact with an object or hears a loud noise, such as hands clapping, Hyper Peppy automatically reverses, then turns left before embarking on a new course.

Hyper Peppy requires only basic hand tools. The kit contains complete step-by-step instructions, pre-assembled printed circuit board, condenser microphone, and an easy-to-assemble mechanical drive system. Hyper Peppy's suggested retail price is \$29.95.

For more information, contact:

OWI, INC.
1160 MAHALO PL., DEPT. NV
COMPTON, CA 90220-5443
310-638-4732 FAX: 310-638-8347

THREE-CHANNEL REMOTE RECEIVER

Street Smart Security, Inc., introduces its new three-channel high-security extra long range remote receiver. Seventy billion randomly hopping codes with anti-scan processing to defeat high-tech code grabbers and scanners. Three-channel output N/O or N/C to open garage doors, turn home security

systems on/off, activate car door locks, power windows, remote car start modules, home automation systems, or anything you can think of.

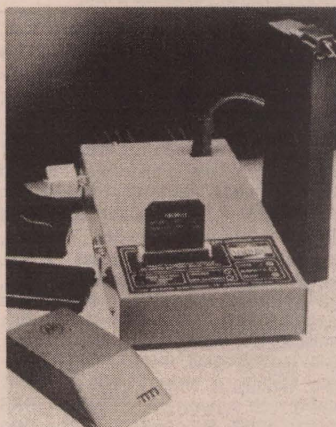
434 MHz SAW resonators produce range up to 700 feet, and yes it's FCC approved!

All three-channel receivers come with two extra long range transmitters and a universal 120 VAC transformer. All this high-tech security for only \$89.95.

For more information, contact:

STREET SMART SECURITY, INC.
7147 UNIVERSITY AVE.
DEPT. NV
LA MESA, CA 91941
619-462-1167 FAX: 619-462-0652

ASTRATEC FASTCHECK BATTERY TESTER



The Astratec "Fastcheck" battery tester is now available for rapid testing of nickel cadmium, nickel metal hydride, and lead acid batteries.

The system is remarkably easy to use and requires no special training or battery knowledge to operate. A calibration card is inserted, the battery connected, and the test is performed automatically in less than 10 minutes.

Fastcheck is available with various contact plates and adapters for ease of battery handling. The calibration modules are available as fixed cards or as user-adjustable modules that are connected to the test module.

The Fastcheck can be used in incoming QC, production testing, and troubleshooting applications.

For more information, contact:

ADCOUR, INC.
18 BILLINGS ST., DEPT. NV
SHARON, MA 02067
617-784-8123 FAX: 617-784-5563

HI PRO REPEATER

Maggiore Electronic Laboratory announces the Model R1 Repeater. A new line of low-cost repeaters and links with a starting

price of \$589.00. The repeaters can be used as a main system or in a back-up system.

The units start as a complete receiver and transmitter in a rack mountable 19" x 3.5" x 9" deep completely enclosed steel cabinet with DC power cord, panel mounted fuse, and power switch. Separate compartments are used to house the transmitter, receiver, and controller.

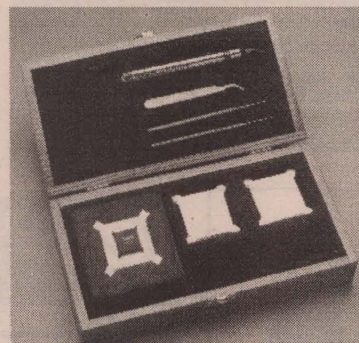
All repeaters are designed for 100% duty cycle at -20° to +60°C and are available in power outputs from 5 watts to 35 watts in VHF and 2.5 watts to 20 watts in UHF. Power outputs are adjustable for ease in matching high-power amplifier inputs.

All repeaters now come with the new Hi Pro studio quality audio and ultra stable Hi Pro TCXO oscillators. A computer controlled, voice synthesized CAT-300 with auto patch and auto dialers, voice messages, and controller inputs and outputs is also available installed. All repeaters include a two year warranty.

For more information, contact:

MAGGIORE ELECTRONIC LAB.
600 WESTTOWN RD., DEPT. NV
WEST CHESTER, PA 19382
610-436-6051 FAX: 610-436-6268

THE LEADER TOOL



TopLine introduces The Leader Tool QFP Lead Straightener. The Leader Tool is an accurate and cost-effective way to straighten bent leads on gull-wing quad flat packs. Using this system of lead-straightening, you will be able to correct lead problems and recover otherwise lost components.

The leader tool is an easy-to-use hand tool. It comes complete with precision templates containing QFP part geometry (pad/lead) etched into it. As the part is straightened, the part's leads are held in place by pockets on the template, allowing the technician to move them into alignment without disturbing their placement. After using this tool, the parts may be returned to pick-and-place machine operation for assembly.

Included in the "Leader Tool" set are one Vampire vacuum pick-up tool, two probes (for straightening the leads), one pair of tweezers, laboratory grade AA surface plate gran-

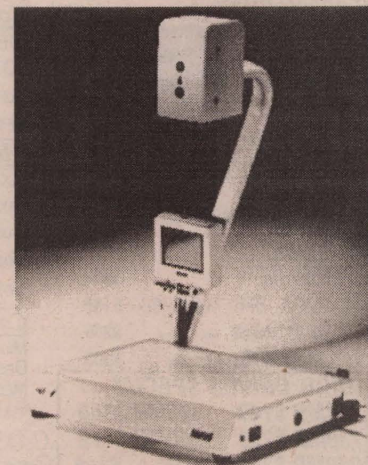
ite block, 16 standard templates, and an instruction manual, all packaged in a rugged wooden storage case.

The templates conform to EIA/JEDEC standards and are chemically-etched to exact tolerances.

For more information, contact:

TOPLINE
310-433-7000 FAX: 310-498-0490

DA-CAM MC-7/MC-7P



Da-Lite Screen Company, Inc., announces the introduction of Da-Cam MC-7 and MC-7P multimedia presenters. The Da-Cam MC-7 and MC-7P can display three-dimensional objects, artifacts, slides, photos, documents, articles, transparencies, etc., all in full color. Both units are easy to use, all critical functions such as focus and white balance are controlled automatically so you can concentrate on your presentation. The 8X zoom can be controlled manually. Output terminals are provided for video, S-video, and audio.

The LCD color pre-view screen makes it possible for the presenter to see exactly what is being shown to the viewing audience without the need to turn or move to see what is being viewed. The Da-Cam MC-7 and MC-7P can be connected to a variety of multimedia products like video projectors, TV monitors, VCRs, color video printers, or connected to a computer to capture images with the use of a video card.

The Da-Cam MC-7 and MC-7P come complete with a lighted slide stage, lens cover, video cable, and padded carrying case. The Da-Cam MC-7 works with any NTSC video device. The Da-Cam MC-7P works with any PAL video device.

For more information, contact:

DA-LITE SCREEN COMPANY, INC.
3100 N. DETROIT ST.
P.O. BOX 137, DEPT. NV
WARSAW, IN 46581-0137
219-267-8101 FAX: 219-267-7804
1-800-622-3737

100% Satisfaction & Every day Low Price Leader

ALL Motherboards w/CPU:

386 SX40 MHZ	\$55
386 DX40 MHZ/128K	\$89
486 SL33 MHZ	\$75
486SLC50 MHZ	\$95
486 SLC40 MHZ VESA	\$95
486SLC 2-66 VESA IBM w/64k	\$149
486 75 MHZ VESA IBM w/256k	\$219
486 DX33 MHZ W 256K VLB	\$179

PENTIUMREADYT24

4 ISA & 3 VESASLOTS	
486 DX66 MHZ W/256 VLB	\$229
486 DX2 80 MHZ W/256	\$259
486 DX 2 100 MHZ/W/256K	\$279

Floppy Drives:

1.44 MITSU	\$28
1.2 MITSU	\$39
1.44 TEAC	\$31
1.2 TEAC	\$42
1.2/1.44 COMBO	\$84

Member of
Better
Business
Bureau

Tapebackup Drives:

CORE 250MB	\$119
Col(DJ 20) 250MB	\$139

Math-Co
\$23

Monitors:

14" MONO.VGA	\$84
14" SVGA 39 DP 1024x768	\$185
14" .28 1024x768 N4, Low-R	\$205
15" .28 1024x768 N4, Low-R	\$305

HARD DRIVES SPECIAL

214MB \$149	420MB \$165
730MB \$229	540MB \$179
850MB \$229	1GB \$329

C.D. Rom QUAD Speed

Mitsumi/Sony dbl sp	\$115
Quad sp (4x sp) IDE	\$195

All Kinds Drives , Sound Cards

Speakers and CD Titles: Please Call

Bism Computer, Inc 1298

Reamwood Ave Sunnyvale, CA 94089 Tel: 408 745-7203

Resellers
Dealers
Welcome

Keyboards:

101 KEYBOARD	\$15
101 SPILL PROOF	\$15
KEYTRONIC	\$23

Focus 2000/2000+/8000 \$CALL

VGA Cards:

VGA 256K	\$27
TRIDENT SVGA 512K	\$38
TRIDENT 1MB	\$59

VESA VGA 1MB EXP 2MB \$69

PCI VGA 2MB DRAM \$139

SVGA CARDS WITH VRAM CALL

ANY OTHER VGA CARDS PL CALL

Controller Cards:

IDE CARD (2FD/2HD)	\$11
I/O (2S, 1P & 1G)	\$11
SUPER IDE-I/O (2S, 1P & 1G)	\$12
VESA IDE-I/O (ENHANCED)	\$19

Modem/Fax/Modem:

MX-96/96/24 1 MB Simm	\$27
Fax/Mod. 14.4	\$36.95
Fax/Mod. 28.8 v.34	\$139
Voice M/Fax/Mod 14.4	\$69
Voice M/Fax/Mod 28.8	\$CALL

Cases with P.SUPLIES

MINI TOWER CASE PREMIUM	\$41
DESK TOP CASE PREMIUM	\$45
MED TOWER CASE PREMIUM	\$64
FULL TOWER CASE PREMIUM	\$84

C.O.D Credit Cards Ok
Govt P.O.

"Triton" Intel Mother Boards with CPU

Pentium 90 Mhz w/CPU	\$625
Pentium100 Mhz w/CPU	\$695
Pentium 120 Mhz w/CPU	\$1095
Pentium 133 Mhz w/CPU	\$1395

15% Restock fee for Non Defective
Orders of \$350 or more
ground shipping free.

Except Case, Monitor, Keyboard & Drives

Buy with
Confidence
Risk Free
30 days
Money Back

WE DO
CARRY
COMPLETE
SYSTEMS

Printer
Memory.

ONE YEAR
WARRANTY
ON PARTS
LIFE TIME
Labor
Warranty

Terms:
No minimum Charge
No Hidden Charge
Prices change w/o Notice
Orders of \$350 or more
ground shipping free.

Except Case, Monitor, Keyboard & Drives

Cellular Extensions

from

"THE CELLULAR EXPERTS"

Motorola 3 Watt Bag Phone from \$299.

Nec P120 12oz. Portable \$399.

Motorola PT 550 10oz. "Flip" Phone \$449.

Others available, buy new from us, or send us your phone.
Get a second or third phone with no additional monthly charges!
Motorola, NEC, Panasonic, Audiovox and many others.

Fax Back Hotline For 24hr info. call from your FAX
(714) 581-7460 or call (714) 581-2121 9 to 5 PST
CA Grapevine. World wide inquiries welcome.

Write in 94 on Reader Service Card.

#60 COMPUTER SOFTWARE cont.

TEST CLIPS. No need to remove ICs. Clips onto chip and plugs into programmer to read or write. Available: 8, 14, 16, 20, 24, 28, and 40 DIP. \$39.95 each. ALL 7 FOR \$239.95 PPD. TELECODE, Box 6426-NV, Yuma, AZ 85366-6426.

HAM SHAREWARE disks. We have it all. Specs for "bare bones", set-up to transceive FAX, CW, SSTV, and more. Send \$1 for catalog, refundable with your order. CERAC, PO Box 31443, Tucson, AZ 85751.

WINDOWS 95 upgrade for Windows 3.1 users. Taking orders to ship when released (late August). \$112 delivered. Payment with order - Check or VISA/MasterCard. Used software available.: MASM 5.1 \$20, Glocksenspiel C++ \$20, MS Access 1.0 \$20, Smartterm 240 \$20, AT&T 6300 Users guide, DOS & BASIC 3 book set \$25, Lotus Freelance \$20, dBase IV \$30, Lotus Manuscript \$20, many others. Free Catalog. Oasis Technologies, 9-5 Pacific Monday-Friday. Catalog or orders" 1-800-585-3818. Local & tech support 360-373-3818, BBS 360-613-1737. Box 267, Tracyton, WA 98393.

QUICK MONEY: FREE SOFTWARE. 5 in 1 combo disk: Mail order, modern business strategies, 101 free things, legal forms print ready, Internet ads. Send \$10 to cover postage and handling for info disk to: Sunshine Development Co., 1911 Park Ave., Monroe, LA 71201.

CD-ROMS. Free flyer with monthly specials! Discount prices. Titles from family to adult. June Special: "Beauties" only \$10 postpaid (must be over 21 to order). Credit cards accepted. Msg/FAX 501-223-9406. Software City, Box 23016, Little Rock, AR 72221.

WANTED: TSR program to eliminate snow & flicker when using older CGA adapter cards. 914-738-6830.

ENGINEERING PUBLIC DOMAIN SOFTWARE. For IBM PCs and clones. Printed circuit design, logic simulation, signal processing, pspace models, and autocad electronic symbols. Free catalog. Over 400 engineering programs. Sector Systems Company, Inc., 416 Ocean Ave., Marblehead, MA 01945. 617-639-2625.

PCSIG14 CD-ROM \$35inc. S&H. JCSD Shareware CD-ROM \$15 incl. S&H. PC Game or archive disk with catalog \$3.50 inc. S&H (DOS or Windows and disk size). Texas Residents incl. 8.25% sales tax. ASP Member. MC & Visa accepted. HALPENNY SALES, PO Box 543, Aubrey TX 76227-0543, 817-440-2995.

Amway

EASILY USED distributor and customer order processing using latest prices. Eight programs speed-up your paperwork. Used by thousands since 1985. Author is retired former Emerald with over 30-years in Amway. 30-day money back guarantee. AMBIZ-PAK 3.1 for IBM DOS 3.3 or higher. \$39 postpaid. Cont. USA only! VISA/MC. Fred, 818-346-7024 Pacific Time. (Not an Amway product.)

WHERE CAN you learn so much about a useful topic with so little effort? NV June 1995. ALL ABOUT PUMPS and RUSSELL'S "P11" ANIMATION MACHINE as reviewed by Fred Blechman in Nuts & Volts June, 1995. Call today for more information, 1-800-551-2726. Only \$34.95 + \$4 S&H.

FREE SOFTWARE, NEW POWERFUL Software shows you how to MAKE BIG MONEY by giving away FREE Software! For your FREE copy on IBM 3.5" Disk, RUSH \$3 for First-Class Shipping and Handling to: TRONICS, PO Box 688, Pepperell, MA 01463-0688.

THE GLOBAL DATABASE FOR BUYERS AND SELLERS



The World's Classified Ads For Used Hi-tech Equipment And Components

BUY, SELL, RENT, TRADE, WANTED
Updates Daily - Easy to Use - Fast - Convenient
All Types Of Used Equipment "FOR SALE" By :

Dealers Universities
Corporations Individuals



You Can Reach Us On The INTERNET :

Telnet to TECNET.COM

Email to POSTMASTER@TECNET.COM

LOGIN FOR FREE DEMO 800.297.2483 / 407.876.4092

VOICE 800.774.0996 / 407.876.6226

FAX 407.876.6339

TECNET P.O. Box 1509 Windermere Florida 34786 USA

Write in 60 on Reader Service Card.

CUNARD ASSOCIATES

R D 6 Box 104, BEDFORD, PA 15522
TEL / FAX 814 623 7000

THE POWER PRO

BATTERY PACKS

ALL MAKES & MODELS

FACTORY NEW

ALINCO DJ 580T / F1T

EBP20NX 7.2/1500	\$42.95
EBP22S 12/800	\$47.95
EBP16N 7.2/800	\$37.95
EBP18N 12/800	\$47.95

ICOM SAT / W2A

BP83 7.2/750	\$29.95
BP8AC 9.6V/600 FOR 2AT	\$34.95
WITH CHARGER	\$34.95

KENWOOD TH27A / 47A

PB13 7.2/800	\$42.95
PB14 12/800	\$49.95

YAESU 23/26/41/470/418

FN17 7.2V/800	\$29.95
FN12 12V/800	\$39.95
FN25 7.2/800	\$34.95
FN26 7.2/1000	\$44.95
FN27 12/800	\$44.95
FN82 11/800	\$19.95

CELLULAR BATTERIES

ALL BRANDS - CALL

BATTERY REBUILD SERVICE

WE OFFER COMPLETE BATTERY PACK REBUILDING. OUR FULL SERVICE INCLUDES: MINOR REPAIRS REPLACEMENT OF ALL PROTECTION DEVICES SANYO CELLS OF EQUAL OR IMPROVED CAPACITY YOUR ORIGINAL PACK IS REBUILT AND RETURNED. 12 MO. WARRANTY / SATISFACTION GUARANTEED.

GENERAL ELECTRIC

MPD/PLS	
19A704850P(1200MAH)	\$39.95
19A704860P(1800MAH)	\$44.95
MPR/MPX/MPX/MARK V	
PL19D429763G1/3	\$34.95
PL19D429777G1/3	\$39.95

MOTOROLA

P200HT600MT1000	
NTN5521/4585	
4824/5414	\$39.95

UNIDEN

APX850	\$34.95
APX1200	\$39.95

ICOM

BP2 / BP3 / 22	\$18.95
BP6/CM6/BP8	\$24.95
BP7 / CM7	\$34.95



BENDIX KING

KR105/E	\$34.95
LAA100	\$34.95
LAA0125	\$39.95

KENWOOD

PB2 / KNB3	\$32.95
PB25/H/26	\$22.95

YAESU

FN83/4A/12	\$32.95
FN81/14/10S	\$29.95
FN817	\$23.95

BATTERY INSERTS - BEST PRICES!

MANY OTHERS AVAILABLE WRITE OR CALL

12 MONTH WARRANTY ON ALL ITEMS

FREE CATALOG

ADD \$4.50 SHIPPING & HANDLING PER ORDER

Master Card

VISA

Write in 61 on Reader Service Card.

Freedom 16

16 Bit Data Acquisition & Control System

Easy to use, fast,
us \$299 tons of memory, I/O & features

16.8MHz 68HC16
DSP capabilities
RS-232 & RS-485

34 digital I/Os (7 IRQ)
+ LCD/Keypad port
+ 8 ch 10b A/D

Affordable "C" compiler/library
RT clock available
Up to 256K ea. SRAM Flash EPROM

INTEC INOVENTURES INC. Phone: (604) 721-5150

2751 Arbutus Rd., Victoria, B.C. Canada V8N 5X7 FAX: (604) 721-4191

Write in 88 on Reader Service Card.

LATEST SHAREWARE Great stuff! HAM radio, antenna design, CW tutors, BBS, satellite tracking, electronics. MC68000 assemblers/disassemblers. Much more! For DOS/Windows, 89¢ each. Catalog on 1.44MB or 1.2MB disk, \$1 (with samples). Charles Santos, Box 14111, Arlington, TX 76094-1111.

CYCLE ANALYSIS finds patterns in scientific, financial data. Performs Fourier analysis plus data extrapolation, filtering, congruency, more. For IBM order Cycle Analyst \$19.50, or Stock Cyclist \$22.50 (does above plus strategy, pattern analysis). Rotch Design, POB 165, Washington, ME 04574.

FOR NEW computer books at a great discount call README.DOC. Ask for a FREE Catalog-on-a-Disk when you call 1-800-678-1473. README.DOC Supplies books from all the major computer book publishers. Government and corporate PO's are welcome.

ARCHIVE DATA TO CD-ROM: Call, write or fax for a quote on our CD writing service. Data security, confidentiality and 100% guaranteed service and quality. Allmedia Data Services, Inc., 10263 John Hollis Rd., Hammond, LA 70403. 1-800-490-0547/504-294-6441/fax: 504-567-3202.

APPLE-II SOFTWARE! Large selection! \$1 a disk. Free catalog! PMA-NV2, Box 2424, Scottsdale, AZ 85252.

COMMODORE 64 Ham Programs, 8 disk sides, over 200 Ham programs, \$16.95. 32¢ stamp gets unusual software catalog of utilities, games and British disks. Home-Spun Software, Box 1064-H, Estero, FL 33928.

IBM SHAREWARE! Huge selection! Over 10,000 programs! \$1 a disk! Over 1,000 35¢ program specials. Established dealer. Excellent ham radio selection. Please specify disk size desired. Free catalog! PMA-NV, Box 2424, Scottsdale, AZ 85252. Phone 602-496-6547.

SCHEMATIC CAPTURE/PCB software. PADS, ISIS, & OrCAD. Includes LOG/ic PLD Compiler and more! Full working Shareware Packages. 1.2MB or 1.44MB \$19.95. VISA/MC 520-782-2316. TELECODE, Box 6426-NV, Yuma, AZ 85366-6426.

COMPUTER EQUIPMENT WANTED

TANDY MODEL 100 or 102 wanted. Also need carrying case, direct-connect modem cable, AC adaptor, technical reference manual, owners manual, memory modules. Latest version of the CAT Color Converter for PC wanted. 908-689-1665.

WANTED: PROGRAMMER for Cutler-Hammer D-120 PLC industrial programmable logic controller. Call Louie at, 502-966-3279, or write to: LASCO, PO Box 32053, Louisville, KY 40232.

WANTED: TELEVIDEO terminal. Model 905, 924, 955, 9550 or 970. Alen Gordon MD, 160 NW 176th St., Miami, FL 33169. 305-653-8000.

WANTED: APPLE 1, Mark 8 and early microcomputers. Also journals for museum. PO Box 341, Floyd, VA 24091. 703-231-6478, 703-763-2321.

PRINTED CIRCUIT BOARD MAKING SOFTWARE

from Datak... available from stocking electronic parts distributors everywhere. The new PCDATAK® MS-DOS software is powerful; make one or two sided boards. Print your own circuits including the component outlines and automatic solder mask.

AFFORDABLE at \$59.95 !
and **VERY PROFESSIONAL**

FREE! just call for the the name of your nearest stocking dealer: 1-800-645-2262, and ask for the Free PCDATAK Brochure too.
minimum system: 386 with mouse, VGA color monitor and hard drive.
Datak is a registered trade name of LKG Industries
Rockford Illinois, USA

28 VDC 50 AMP SUPPLY



PP-4763A/GRC power supply produces 28 VDC 50 amps from 115/230 VAC 22/11 amp 47-63 Hz input; +/-0.5% regulation. Has meters 0-50 VDC and 0-80 amps DC; 13.5x19.5x15, 145 lbs. (Shipped UPS) **USED** \$195.00

HANDS-FREE HEADSET

U'NICOM 49.86 MHz FM radio headset for use in high noise areas. Has throat mic and ear cushions with EPA noise-reduction rating of 23 DB. Also Volume and Squelch, Velcro adjustable head web and mic straps, 6" antenna, and fiberglass case. Requires two 9V batteries; 6 lbs. **MODEL 7800H, NEW** ... \$99.50 each



50 UH ROLLER INDUCTOR



38-TURNS 3/8"W edgewound silvered ribbon forms 8"Lx4.3" dia coil; fiberglass end plates. P/o 1 KW antenna tuner; o/a 7.3x13x5.2, 8 lbs. sh.

#L1/CU938, **USED** \$65.00

10 UH ROLLER INDUCTOR, 18-turns #16 silver-tinned wire forms 2" dia coil. 3.5x4.5x2.6, 3 lbs. #021-7029, **NEW** \$28.00

AUDIO OUTPUT METER

TS-585 output meter for audio amps, filters, oscillators. Ranges 0.1-5 mw, -10-+7 dbm; 1-50 mw, 0-+17 dbm; 10-500 mw, +10-+27 dbm; 100-5000 mw, +20-+37 dbm read on 3.5" dia meter. Multiplier circuit x0.1, x1, x10, x100 allows input impedances 2.5 to 20000 ohms in 40 steps; 30-10000 Hz response. 8.5x11x5.5, 17 lbs. **USED** \$79.50
MANUAL-REPRO \$8.50



TEST EQUIPMENT

HP-400E AC VOLTMETER, 1 mv-300 V full scale & -72-+52 DBM in 12 steps.

Used-checked \$155.00

HP-410C MULTIMETER, +/-15 mv-1500 VDC in 11 steps, 0.5-300 VAC in 7 steps,

DC current 1.5 ua-150 MA, & 10 ohms-10 Megohms. **Used-checked** \$195.00

Limited quantities; "used-reparable" condition:

HP-141T/8552B/8555A SPECTRUM ANALYZER, 10 MHz to 18 GHz \$1995.00

HP-8556A RF SECTION 1/141T, 20 Hz-300 KHz \$175.00

HP-8445B TRACKING PRESELECTOR for 8555A \$495.00

Prices F.O.B. Lima, O. • VISA, MASTERCARD, DISCOVER

Allow for Shipping • Write for latest Catalog

Address Dept. NV • Phone 419/227-6573 • Fax 419/227-1313

FAIR RADIO SALES

1016 E. EUREKA • Box 1105 • LIMA, OHIO • 45802

Write in 85 on Reader Service Card.

Your complete IBM warehouse

Call to check out our low prices!

60,000 ft. of inventory

- ☐ complete systems
- ☐ software
- ☐ printers
- ☐ peripherals
- ☐ monitors
- ☐ computer parts
- ☐ printheads
- ☐ notebook/laptop parts
- ☐ upgrades
- ☐ IBM clones

CALL FOR DETAILS
ABOUT OUR COMPLETE,
LIQUIDATION
AUCTION SERVICE

FREE
CATALOG!

90 DAY
WARRANTY
unless sold as is

We buy IBM parts!
Call or fax your excess inventory.

Phone
(800) 666-9373
(717) 233-6650



Fax
(800) 288-9373
(717) 233-2774

PC Parts, INC.
1800 Paxton St., Harrisburg, PA 17104

BRIGAR electronics

7-9 ALICE ST.

BINGHAMTON, NY 13904

Offices and Warehouse

SERVING: INDUSTRY - SCHOOLS - HOBBYISTS - EXPERIMENTORS
CONSUMERS

TO ORDER:
PHONE: (607) 723-3111
MONDAY-FRIDAY 7:30AM TO 4:30PM
SATURDAY 7:30 TO 12:00 NOON

FAX: (607) 723-5202
24 HOURS A DAY, 7 DAYS A WEEK

QUANTITY DISCOUNTS AVAILABLE

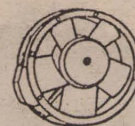
IMMEDIATE SHIPMENT FROM STOCK
PHONE, MAIL OR FAX IN YOUR ORDER TODAY



VISA AND MASTERCARD
ACCEPTED

FREE
CATALOG

LET ONE DOLLAR
DO THE
WORK OF TEN!



\$15.95 EA.
5 FOR \$60.00

NIDEC-TORIN TA600S
HIGH VOLUME FANS 115VAC
MODEL #A32060-10 115VAC .250/.20A
50/60HZ IMPEDANCE PROTECTED.
135CFM 3200RPM SIZE: 6.25" DIAM
1 1/2" THICK - BRAND NEW FACT-
ORY BOXED. PRICE

A.C. OVAL CAPACITORS

GE PART # 61L1254

12 UF - 660 VAC

4"H X 2 3/4"W X 1 3/4"TH

PRICE \$4.95



GE PART # 26F6652

6 UF - 660 VAC

3 1/2"H X 2 3/4"W X 1 3/4"TH

SALE \$3.00

ANALOG METER MOVEMENT
50 MICRO AMP D.C. FULL SCALE
LARGE 4.5" DIAMETER - MIL. SPEC.
PANEL METER 3.6" DIA. VIEWING AREA.
ZERO ADJUSTMENT KNOB. WHITE FACE.
SCALES: IN GREEN, BLACK, AND BLUE
LETTERS. THREE AC AND THREE DC
VOLT SCALES. 0 - 2.5, 5 AND 10. ONE
RESISTANCE SCALE FROM 0 TO INFINITY.
INCLUDES RUBBER GASKET, MOUNTING
HARDWARE. 1 1/4" BEHIND PANEL DEPTH
BRAND NEW FACTORY BOXED.

ANALOG PANEL METERS

MULTIMETERS

PHASTRON # 40-013857

PRICE

..... \$4.95 EA.



ANSWERING MACHINE CODE-A-PHONE 1750

FEATURES:

- *ONE TOUCH PLAYBACK
- *AUTO OUT GOING MESSAGE CHECK
- *BUILT IN CASSETTE
- *VOICE-ACTIVATED RECORDING
- *FAST FORWARD, PAUSE, & REWIND
- *RING DELAY (1, 2, 3, 4)
- *LED MESSAGE DISPLAY
- *VARIABLE OUT GOING MESSAGE
- *NO CALL DISCONNECT

(SUPER MINT CONDITION) COMMERCIAL QUALITY

ORIGINAL COST \$179.00

BRIGAR SALE PRICE \$7.95



STEPPING MOTOR

FUJI MODEL #GPF3945-2B

OR SANYO #103-820-2

"STEP - SYN" 4.5VDC,

1.4AMP 2 DEG STEP ANGLE

CLASS B WITH OPTICAL ENCODER.

45 PULSE PER REVOLUTION. 2 SETS

OF PULSES WITH PHASE OVERLAP

2 CENTER TAPPED WINDINGS.

(REMOVED FROM EQUIPMENT MINT CONDITION)

LIST PRICE \$45.00

BRIGAR PRICE ONLY \$6.95ea.

SLOW-SYN DC
STEPPING MOTOR

CMOS EPROM

#AM27C128-205DC

MFG:AMD

28 PIN DIP 128K (16K X 8)

SPEED 200NS -

CMOS EPROM

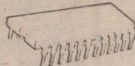
#NMC27C256Q-200

MFG:NATIONAL SEMI

28 PIN DIP 256K (32K X 8)

SPEED 200NS -

EPROMS



BRIGAR Sale Price....

1-9 10-99 100 +
\$2.00 ea. \$1.75 ea. \$1.50 ea.



HEWLETT PACKARD

GREEN RECTANGULAR LED

PART# HLMP-S500 DIFFUSED

SIZE: 5MM X 2MM 200,000 PCS. IN STOCK

SALE PRICE 100 @ .10EA. 1000 @ .05 EA.



CIRCUIT BREAKERS

MECHANICAL PRODUCT

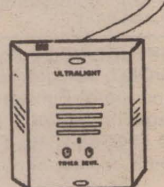
PART# 1600-001-100

10 AMP 250VAC/50VDC

PRICE 1- 99 PCS \$1.00 EA.

100 PCS. FOR \$70.00

AUTOMATIC LIGHT SWITCH



URNS LIGHTS ON & OFF AUTOMATICALLY

COLOR: WHITE

SIZE 5" SQ X 1 3/8" THICK

LIST PRICE

\$99.95

Sensors

BRIGAR SALE PRICE

\$12.95 EA.

5 FOR \$60.00



115 VAC VIBRATOR ALARM OR SIGNAL HORN

For fire, burglar alarm or general purpose use. Produces a loud
piercing signal. Wire leads. Steel case 2 dia. x 1-1/8" deep.
New. Shipping Weight, 8 ozs.

LATCHING

RELAYS

24 VDC DPDT

P&B #R30-E0011 or Allied Control #T351X-41
Sold according to availability - no selection.
Coil 600 ohms operating, 1.6K release. Contacts gold
flushed, 2.0 Amps 28 VDC. Dual coil, impulse or
maintained operation. Latching will energize or de-
energize with short impulse. PC board mount, with
terminals and stud or can be used with socket. Size 3/4
x 15/16 x 1-3/16" H. New. Shpg, 4 ozs

..... \$3.00
10 for \$25.00

TELEDYNE

SOLID STATE RELAY

PART# 615-8500

CONTROL VOLTS: 3-32VDC

RATED: 10A @ 250VAC 50/60HZ

OPTO ISOLATED

CONNECTION: SCREW OR QUICK

CONNECTS.

PRICE (1-99) (100-UP)

\$10.95 \$9.95

Power Transformers and Power Cord

POWER TRANSFORMER

WITH 6' BLACK SVT 3 COND 18AWG

POWER CORD. TRANSFORMER #GBI 1721-001-B

INPUT: 115VAC 60 HZ. OUTPUT ONE: 9.5VDC 1000MA

OUTPUT TWO: 38VDC 250MA GREAT FOR MAKING

POWER SUPPLY. TRANSFORMER & 6 FT. POWER

CORD BRAND NEW PACKAGED.



..... \$3.49 ea.

Lots of 25 \$3.00 ea.

Lots of 100 \$2.50 ea.

ULTRASONIC LIGHT SWITCH

LITRONIC - ULTRALIGHT

DECORATOR AUTOMATIC WALL SWITCH

Litronic wall switch is an attractive light switch replac-
ement that installs in place of existing wall switch to
turn lighting on when a person enters a room or
office and off when the space is vacated.

VOLTAGE: 120 OR 277VAC 50/60HZ

MIN LOAD: 80 WATT 120V, 160WATT 277V

MAX LOAD: 1000W 120V, 1500W 277V

SENSOR TYPE: Low power ultrasonic 25kHz crystal.

SENSOR COVERAGE: 250 SQ. FT. WITH 180°

DETECTION FIELD

Adjustments: Sensitivity & Time out (5 to 25 minutes)

* minimum time can be reduced to zero by removing itw 224

capacitor (below red led indicator). Causing switch to shut off as

soon as motion is absent. This feature makes litronic switch great

for alarm systems, door entry alarm or can be used with a counter to

count objects sensed.

RED LED LIGHTS WHEN MOVEMENT IS SENSED.

Switching capacity: 800 WATTS, BALLAST LOADS

SINGLE OR DOUBLE SWITCHES.

OFF/AUTO SWITCHES: turns lights off manually

when necessary, or leaves lights in automatic

control mode.

ENERGY SAVINGS FROM 30 TO 60% SINCE LIGHTING

WILL NO LONGER REMAIN ON ONCE ROOM IS VACANT.

LIST PRICE \$99.95 - BRIGAR SALE PRICE .. \$12.95 EA.

5 FOR \$60.00

'LINE CORDS

GROUNDING PLUGS

3-WIRE

14/3 SJT

GRAY

4 FT.



— 2 @ \$1.50 EA.



COMPUTER
PRODUCTS

POWER CONVERSION

5-9W DC/DC Converters

LOW-COST UNREGULATED

PC-Mountable Excellent Isolation

PI Input Filter High Efficiency

COMPUTER PRODUCTS MODEL # EM951S

5-9W DC/DC CONVERTERS

- PI INPUT FILTER
- 500V ISOLATION
- SHORT CIRCUIT PROTECTED
- HIGH EFFICIENCY - 75%
- NON-CONDUCTIVE PLASTIC ENCLOSURE
- 2" X 2" X 0.4" PACKAGE
- OUTPUT VOLTAGE ±12V/ ±375MA
- INPUT VOLTAGE: 5VDC
- REGULATION LINE: 1.2% LOAD 8%
- REFLECTED RIPPLE: 75mA P-P
- 6 PIN PC MOUNTABLE

BRAND NEW FACTORY BOXED.

PRICE \$ 6.95



Yes, You Can Make Double-Sided Circuit Boards Direct from Your CAD Program and Laser Printer!

The most expensive component in most projects is the printed circuit board (PCB). And the most expensive PCB is the first one — *the prototype*.

I've spent considerable effort gathering tools and honing techniques to reduce the cost of prototype PCBs. I recently got my hands on a prototyping system that eliminates the voodoo that the process previously required. Since the PCB needs of serious hobbyists, electronics clubs, schools, and small businesses are quite similar, I'd like to share some of my hard-won secrets with you.

If you're new to PCB fabrication, this article will move a little fast for you. Don't worry. Here's help:

- Check out the glossary accompanying this article for definitions of unfamiliar terms.

- Dig out your May '95 issue of *Nuts & Volts* and turn to page 51. John Iovine presents a concise introduction to making simple PCBs using the toner-transfer (iron-on) method.

- Get a copy of *Making Printed Circuit Boards* by Jan Axelson (TAB Books/McGraw-Hill 1993). If your bookstore doesn't have it, order it direct (see Sources). This book covers circuit design and component selection, PCB CAD software and design issues, etching and drilling methods, soldering technique, enclosure design, and circuit board repair. This book is a great self-paced course in the fundamentals of circuit board design and fabrication.

- Invest in *Printed Circuits Handbook* by Clyde F. Coombs, Jr. (McGraw-Hill 1988, third edition; fourth edition due out this year). This \$85.00 book describes PCB fabrication in detail. It's great for improving your understanding of how the professional board houses work. The board houses have a code of silence — ask them how you might improve a design, and they'll say, "It's perfect the way it is!" Sure, the customer is always right. Read this book, figure out what you're doing wrong, and fix it.

Why Bother?

First of all, why prototype your own PCBs? The cost of having prototype boards made has recently declined substantially, thanks to computer technology that allows the fabricators to combine lots of small PCB runs into one big job. They return these savings in aggressive pricing. For instance, AP Circuits (Sources) turns out double-sided prototypes in a week at a typical cost of around \$100.00.

I have read and heard the argument that the value of an engineer's or technician's time outweighs the money saved by on-site prototyping. And if the board is going into production, it's smart to gamble on reusing the tooling from the prototype.

But there are cases that don't fit this scenario:

- The hobbyist who wants to build 10 projects a year without spending a thousand bucks.

- The small business with a tight budget and no fixed value on the proprietor's time.

- The big organization with a bureaucracy that takes forever to approve small purchases like PCB prototypes.

- The creative technician who designs quickie test circuits that would be more reliable and portable if constructed on PCBs.

- The educator who believes that technical people with hands-on experience are better prepared for the real world.

- The designer who hates wire wrapping, but would still like to evolve a design through a series of prototypes.

The biggest advantage may be this: When that end-of-the-world project has to be done on time, wouldn't it be comforting to know that you can design a board in the morning and have a prototype ready that afternoon?

Expert PCB Prototyping

by Scott Edwards

Instant-PCB Methods

There are several methods of prototyping PCBs, including photographic, direct-etch, and computer-driven milling. I use toner transfer, in which laser-printed artwork is used as an etch resist. Toner transfer has these advantages:

- Toner transfer uses equipment you probably already have. A laser printer used around the office can also serve as the heart of your set-up.

- Toner transfer minimizes the number of exotic and dangerous chemicals you must mix, store, handle, dispose, and accidentally inhale or ingest.

- With the right equipment, toner transfer requires less experimentation and manual labor than other do-it-yourself methods.

- The quality of toner transfer boards is often comparable to commercially made protos.

A Sudden About-Face

I have been making toner-transfer PCBs for years, slowly perfecting the process in my own shop. About five years ago, I bought a T-shirt press to use as a fuser and fiddled with various combinations of heat, pressure, and time.

During this time, Frank Miller of DynaArt Designs was building a business around the idea that toner-transfer prototyping could be changed from a handicraft to a science by bringing together key pieces of equipment, custom materials, and some intelligent procedures.

I had almost finished this article when I spoke to Frank about his system. He agreed to lend it to me so that I could round out my article. Although my old way of doing things worked superbly, I found that DynaArt's system is better, faster, and cheaper. What was intended to be a footnote to my article turned into a total rewrite!

The Toner-Transfer System, Step by Step

The toner-transfer process for a double-sided PCB consists of the following steps:

- (1) Preparing the artwork
- (2) Transferring the toner
- (3) Etching the board
- (4) Drilling the board
- (5) Assembling the board

We'll go through each of these steps, discussing techniques, options, and shortcuts. We'll be talking about double-sided boards, but the same rules apply to single-sided, except for issues like alignment, creation of vias, and through-board connection of component leads.

Figure 1 shows the basic equipment required for making toner-transfer PCBs.

PREPARING THE ARTWORK

All circuit board CAD programs can produce a checkplot — a printout of the PCB pattern. This is where the toner-transfer process begins. You design the board as usual, then make a prototype by transferring laser-printed toner to a blank for etching.

The only changes you might want to make in your normal style of PCB layout are these:

- Add four registration targets to the layout on both layers. These will be drilled later. If you don't want extra holes in your board, place them outside the board perimeter. I use mounting holes at the corners of rectangular boards for registration.

- Eyelets can be used to connect top and bottom layers of the board (see "Assembling the Board"), but you may have to enlarge some pads and vias. The eyelet heads are 62 mils in diameter; the shanks fit into 40-mil holes. For

best results, use 70-mil pads.

• Manual drilling is easier if pads and vias have dimples marking their centers. Most CAD programs can place and size these centerpunch marks automatically. I like a 10-mil dot.

Once your design is complete, you should determine whether your laser printer can reproduce it. DynaArt's rule of thumb is that a 300-dot-per-inch (dpi) laser can make boards with 15-mil traces; 600 dpi is good down to 10 mils. This is good basic advice, but a little misleading. Traces are the easiest features to reproduce. Curved edges of pads are tougher. The printer's page-description language (HPGL, PostScript, PCL, etc.) will also affect the results.

Make an actual-size print of your design and inspect it with a magnifier. Pay special attention to closely spaced pads and traces. Visualize what might happen if the toner spread slightly. Would some features merge? If you answer "maybe," borrow a higher-resolution printer for making transfers.

Transfers are applied face-down, with the toner in contact with the copper. CAD programs' reckoning is based on an X-ray view of the PCB from the top down. The bottom layer gets printed normally—but the top layer must be mirrored, reversed left to right. Since toner is the etch resist, the images must be printed with black representing unetched copper areas.

Toner-transfer paper costs \$3.00 a sheet, so it pays to figure out how to place both layer images on one sheet with at least a ½ inch blank border around them. Practice with regular paper! If the board is small and you want multiple prototypes, place as many images of the board layers as you can fit on one sheet. Save unused pieces of the transfer paper for future projects.

DynaArt recommends special high-density toner cartridges for printing transfers. However, if your printer can lay down a solid black area, you can do without the special cartridge. My LaserJet 4M Plus does fine with the stock HP cartridge. In either case, temporarily adjust the printer's density control higher than normal. If small details start to fill in, reduce the setting.

Once you have made a couple of trial runs, you're ready to print on the toner-transfer paper. Handle the paper by the edges, and ensure that image is printed on the glossy, coated side. If your printer has a "bypass" slot with a straight paper path, use it.

The print will curl a little. Printing causes the sides of the paper to shrink unevenly. This "dimensional instability" of paper is a minor drawback of this process.

Fortunately, there's an easy fix, with beneficial side effects. Tack the

transfer sheet by the corners to a flat surface, image-side up. Whip out a heat-shrink or paint stripping gun and blast the whole image. You want to come close to toasting the paper. This removes residual moisture from the paper. It also melts the porous surface of the toner, leaving it slick and shiny. When this glazed toner is transferred to the PCB, it makes a more uniform etch resist, especially in large, solid areas.

TRANSFERRING THE TONER

Cut the top and bottom artwork out of the sheet, leaving a larger border around the bottom-layer image. Tape the bottom-layer piece image-side up to a light table. No light table? Tape it to a window or sheet of glass with a light behind it. Lay the top-layer art toner down on the bottom-layer art. With the help of the back-lighting, align the two images, then tape them together at the edges. Use a fine-point pen to lightly dot the centers of the four registration targets on the back of the top-layer artwork.

Cut a double-sided PCB blank to be larger than the artwork sandwich by ½ inch or more in width and length. DynaArt recommends FR-4 board stock with ½ ounce copper. Most boards are clad in 1-ounce copper. DynaArt reasons that thinner copper speeds etching and reduces the chance of undercutting.

However, I prefer to use CEM-1 board stock, which is generally available only with 1-ounce copper. CEM-1 is a fiberglass/paper laminate commonly used in automotive electronics. Its electrical and physical characteristics are nearly identical to FR-4. I like CEM-1 because it's much easier to drill and cut than FR-4. Instead of brittle, expensive carbide drills, I can use tough, cheap steel bits.

Even with 1-ounce copper, I have never had undercutting problems. Unless your shop makes a lot of prototypes, it's more likely that your etchant will lose potency from chemical aging

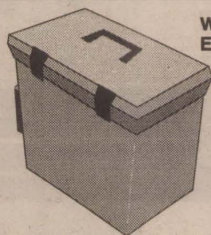
Shop Equipment for Printed-Circuit Prototyping

Super Fuser Toner Applicator (\$299)



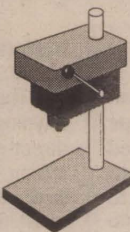
This product is exclusive to DynaArt—a motorized toner-transfer applicator based on a commercial laminating machine. Essential to advanced, on-site pcb prototyping. Substitutes, such as T-shirt presses and dry-mount machines, do work, but they cost more and are more difficult to use.

Wave Master Etching Tank (\$299)



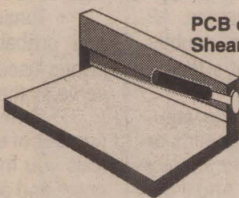
DynaArt's etching tank uses a unique, low-force circulating system for fast pcb etching. Includes convenience and safety features like a digital thermometer, in-tank etchant storage, universal board coverage without adjusting etchant volume, and anti-shock GFCI wiring. This is a luxury machine; budget-conscious users can substitute a cheaper bubble tank such as the GC unit for \$100, or even a homemade tank. Tray etching is not a good idea, since it is slow and prone to undercutting of traces.

Miniature Drill Press (\$80 and up)



Just about any small drill press will suffice for pcb drilling, provided that it can be adjusted for high speeds (5000+ rpm) and low runout (see text). The little Dremel presses are great for drilling, but aren't rigid enough for pressing eyelets. General-purpose benchtop drill presses are rigid, but really too slow for pcb drilling. DynaArt offers a jeweler's press that's strong enough and fast enough for both purposes at \$150. Since I own a Dremel and a conventional drill press, I drill with one and press eyelets with the other.

PCB or Sheet-Metal Shear (\$400 and up)



This is a luxury item, since you can substitute a handsaw, bandsaw or circular saw with fine-toothed blade; a heavy paper cutter; a metal shear; or even tin snips for really small boards. Kepro carries a basic pcb shear for \$465. DynaArt's ProForm is a shear and precision sheet-metal bender for \$600 to \$1450, depending on size.

Figure 1. Essential equipment for high-quality PCB prototypes.

before it becomes saturated with dissolved copper.

Another board stock suitable for prototypes is the polyester laminate offered at bargain prices by BG Micro (Sources). This stuff is even easier to drill than CEM-1. However, it's sold without any pedigree, and is probably a surplus deal. Don't get too fond of it unless you buy a lifetime supply!

Back to making the board: Place the sandwiched artwork on the PCB blank. Tape the edges of the bottom-layer artwork to the blank. Now drill 40-mil holes through the registration targets (marked by dots on the back of the top-layer artwork) and through the PCB beneath. You've now got precise alignment holes through both layers of the artwork and the PCB.

At this point, clean both copper surfaces of the PCB blank. You've probably read that the copper should be bright as a new penny or even "hot pink" and shiny. Not true! In fact, the toner may not adhere properly to a board that's too smooth. Just make sure that the board is free of tarnish and oily fingerprints. You can scrub these off

with non-chlorine scouring powder and a Scotch Brite pad under running water. If you take PCB stock directly from the manufacturer's packaging, it's probably clean enough. A few swipes with a Scotch Brite pad will debur the registration holes and add light surface scratches that painters call "tooth" to help the toner adhere.

After cleaning, dry the board and remove any lint or dust.

The next step tacks the two transfers to opposite sides of the board in perfect alignment. Begin by unplugging the drill press and replacing the drill bit with the eyelet-forming tool (eyelets and the forming tool are available from DynaArt). Pick up four eyelets with tweezers and stack them up on the shank of a map pin, heads toward the head of the pin. Place the top-layer transfer on the board, toner-side down, and line up its holes with the holes in the board. Press an eyelet through each of the holes. Flip the board over. Lay the bottom-layer transfer, toner-side down, over the protruding eyelets. Fit the holes in the transfer to the eyelets, working the paper down so that it's

pinned in place.

Take the board to the drill press and lower the eyelet-forming tool onto the ends of the eyelets. The tool willpeen the eyelets, trapping the transfer sheets to the PCB in perfect alignment.

The actual transfer step is totally automatic with DynaArt's Super Fuser. The device consists of a set of motor-driven pressure rollers and two thermostatically controlled heating elements. You feed the board in one end, and it slowly emerges from the other end, perfectly fused. There is a thermostat dial on the underside of the machine, but I found the factory setting to be right on the money.

As soon as the circuit board is out of the Super Fuser, it's time to remove the transfer paper, leaving the toner on the board. This just requires a soak in a tray of warm water. Don't try to hurry this process. Although the eyelets will hold the paper in place, you will be able to tell when it's ready by the way the paper bellies away from the board when you rock the tray.

Take the board out of the water and remove the paper, tearing it away from the eyelets. A perfect toner image remains. Or maybe not perfect — toner sometimes chips here and there. Blot the board with a paper towel and let it dry. Examine the toner, preferably with

a checkplot close at hand, and touch up any chipped areas with a Sharpie permanent marker. Don't draw with the marker; you may snag it on the ragged edge of the chipped toner. Dab the ink. If you go too far, let the ink dry, and scrape away the excess with the tip of an Xacto knife.

ETCHING THE BOARD

Most hobbyists and prototypers use ferric chloride etchant. It's nasty, smelly stuff that stains clothing. When first mixed with water, it releases heat and fumes. Over time and use, it develops a foul sludge. Since ferric chloride is opaque, you have to remove the board from the etchant to check progress. And the only way to tell whether the solution is exhausted is to monitor the etching rate. On the plus side, ferric chloride etches rapidly and dissolves a lot of copper per unit volume.

An alternative is ammonium or sodium persulfate (sold premixed with catalyst). It mixes readily in warm water to form a clear solution. As it is used, it turns blue, providing a relative indication of how much copper it has dissolved. It doesn't etch as quickly as ferric chloride, nor does it remove as much copper per unit volume, but it

does seem to etch more evenly. Persulfates deteriorate in storage, becoming nearly useless after a month or so on the shelf.

I've given up ferric chloride for ammonium persulfate. My usual etching tank is the GC bubble tank (Sources). This is a vertical tank, shaped like a narrow aquarium. It uses a fish-tank air pump and heater to agitate and warm the solution.

DynaArt's tank also uses aquarium components, but the similarity ends there. This tank uses two pumps, two heaters, and a custom acrylic guideway to generate a continuously moving horizontal sheet of etchant. A digital thermometer gives a continuous indication of solution temperature.

My old tank works fine with toner-transfer, but DynaArt's design has several advantages: Its latching top prevents the escape of etchant mist and allows etchant to be stored right in the tank. It has a low center of gravity, making tip-over spills almost impossible. The built-in digital thermometer lets me keep etchant temperature in the useful 100° to 130° F range. At 150° F, persulfate etchants break down. Below 110° they work somewhat slowly.

The Wave Master tank makes the most of one gallon of etchant. Since a thin, moving sheet of etchant does all the work, the same

quantity is required whether you're etching one square inch or 93.5 square inches (an 8.5x11 inch board — the maximum size supported by the system).

The tank's pumps and heaters are wired to a ground-fault circuit interrupter (GFCI). This is a fast-acting power cutoff that can save your life when electricity finds a ground path through your body. It includes two GFCI-protected outlets for the fuser and drill press.

The tank is not designed for ferric chloride. Several key metal parts must be replaced with ceramic versions before it can safely handle ferric chloride. Even with the modification, I'd expect reduced pump life and horrendous cleaning duties due to the buildup of sludge.

Etching with the DynaArt tank is simple: Mix up one pound of persulfate etchant with water to make one gallon of solution. Turn on the tank to heat the solution to 110° to 120° F. Attach four self-stick bumpers (the kind often used as feet for small cabinets) to the corners of the board. Place the board, bumpers down, onto the flat surface of the wash plate inside the tank. Turn the tank back on. You'll see a sheet of fast-flowing etchant bathing the board. The action is smooth and there's very little splashing, but you still should turn off

Glossary of Printed Circuit Terms

Artwork. The PCB pattern; a photoplot or printed toner-transfer sheet.

Blank. A piece of PCB material whose copper cladding is still intact (unetched).

CAD. Computer-aided design software. For simple PCBs, PC drawing software may suffice, but real PCB CAD software is required if the board is to be professionally manufactured later on.

Carbide drill. Carbide is an ultra-hard material that can hold a sharp edge even when cutting abrasive materials like fiberglass. Carbide drill bits, though expensive and brittle, are used extensively in professional PCB fabrication.

CEM-1. A paper-filled fiberglass material used as a PCB substrate. CEM-1 has most of the desirable qualities of FR4 fiberglass, but is easier to cut and drill.

Checkplot. A printout of a PCB pattern. Actual-size checkplots can be used to create toner-transfer PCBs.

Chuck. A mechanism for holding the bit in a drill. A chuck adjusts to hold bits of various sizes.

Clad, cladding. The copper foil lamination on a PCB blank.

Collet. A non-adjustable mechanism for holding the bit in a drill.

Double-sided PCB. A board with copper foil (and therefore traces) on both sides.

Etch resist. A coating that protects copper from etching solution. PCBs are made by applying etch resist in the desired pattern of pads and traces, then etching away the unwanted copper.

Etchant. A chemical solution that dissolves unprotected copper. Two common etchants are ferric chloride and ammonium persulfate.

Eyelet. A tiny metal cylinder that can be inserted into a hole in a PCB to serve as a plated-through hole for vias and pads that have connections on both sides of the board. In DynaArt's fabrication method, eyelets are used to secure top and bottom toner-transfer sheets to a board while they are passed through a machine that fuses the toner to the PCB blank. The eyelets ensure good registration (alignment) of the two layers during the trip through the fuser.

Foil. The thin copper layer laminated to the surface of the insulating board material. Foil is selectively removed by etching to leave a pattern of interconnecting traces and pads on the board.

FR-4. The most common type of PCB substrate, a translucent green fiberglass. Difficult to cut and drill.

Fuser. A device that applies heat and pressure to cause powdered plastic toner to melt and fuse to a surface — paper in the case of the fuser assembly in a laser printer; PCB cladding in the case of a toner-transfer fuser.

High-speed-steel (HSS) drill. High-speed steel is a tough grade of steel used in making tools. HSS drills dull quickly compared to carbide, but tolerate side forces and knocks that would shatter a carbide bit.

Laminate. Term for PCB material — refers to the way that the substrate

and foil are built up as layers of different materials.

Layer. A plane of copper-foil wiring (traces). For example, a PCB with traces on both sides is said to have two layers; top and bottom.

Mil. Standard U.S. unit of measure for PCB features; equals 1/1000th (0.001) inch. A sheet of bond paper is about 4 mils thick. The thinnest trace that most prototype-quality PCB processes will reliably reproduce is approximately 8 mils.

Over-etch. To remove too much copper from the PCB, allowing the etchant to eat away copper from the edges of traces and pads. Caused by leaving a PCB in the etching solution too long, or using etchant that is too strong or too hot.

Pad. An area of foil to which a component lead will be soldered.

Plated-through holes. Holes through the board that are plated with metal in order to join pads or vias on two or more layers. Plating is routinely done by PCB fabricators, but is very difficult under home/small-shop conditions.

Registration targets. Marks in the same locations on two or more layers of the PCB used to aid alignment.

Registration. The alignment of layers of a PCB.

Resist or Etch Resist. A coating that prevents etchant from dissolving selected areas of copper foil on a PCB. The resist acts like a kind of stencil to reproduce the PCB layout in copper foil.

Shear. A guillotine-type machine with a sharp, heavy blade for cutting PCB material. Small shops sometimes substitute a heavy-duty paper cutter for a shear.

Single-sided PCB. A board with copper foil (and therefore traces) on one side only. Generally reserved for very simple circuits and hobby projects as the cost of double-sided fabrication has dropped.

Toner. The solid plastic "ink" applied by laser printers and copying machines. Toner may be melted and transferred to the foil of a bare PCB for use as etch resist.

Trace or Track. The PCB equivalent of a wire; a strip of foil connecting pads on the board.

Under-etch. To remove too little copper from a board, often resulting in unintentional shorts between pads and traces. Caused by leaving the PCB in the etching solution for an insufficient time, or using etchant that is weak or cold.

Undercut. To remove copper from beneath the edges of features like traces and pads by allowing the etching process to continue too long. In extreme cases, undercutting can cause tiny shards of copper to peel away, possibly causing shorts.

Via. A hole through the PCB used to interconnect two or more layers of circuitry. In manufactured PCBs, this connection is made by plating the inside of the via hole with copper. In small-shop prototypes, vias are generally connected by soldering a piece of wire on both sides, or by soldering and/or crimping small eyelets into the via holes.

the pumps when you inspect the board.

As soon as etching is complete (5 to 25 minutes, depending on the weight of the copper and activity of the etchant), remove the board. Rinse the board for about five minutes to remove residual etchant. Blot it with a paper towel and let it dry. Do not remove the toner at this stage; it will protect the copper from handling during drilling.

DRILLING THE BOARD

In the steps below that involve an operating drill press, please follow all safety procedures. Be especially conscientious about wearing safety glasses.

Good drilling starts with a properly adjusted drill. If you're using an existing drill press, install a bit, set the press for its lowest speed, and turn it on. Observe the bit closely. If you can safely do so, lightly touch the shank of the bit — the part without grooves — with the tip of a fingernail. Is the sensation smooth or does it pulsate? Pulsation indicates that the chuck is wobbling or the bit is off-center, resulting in excessive runout. Some of the causes are a loose or improperly installed chuck, dirt in the chuck, improperly installed bit, or a damaged or defective spindle.

Fix runout before using a drill press for PCBs. Excessive runout causes inaccurate drilling, out-of-round or oversized holes, and the early destruction of drill bits.

If you're using an older Dremel tool, use a collet, not an adapter chuck. Chucks add too much runout and most are not intended for the full speed of the tool.

The next step is selecting the proper bits for the job. You want common-shank bits, the ones that have a standard 1/8-inch shank for mounting in a chuck or collet. At the smaller drill sizes, the shank portions of straight-shank drills (the normal, hardware-store variety) are too small for a chuck or collet to grip properly.

Two materials are commonly used to make PCB drill bits: steel and carbide. Steel bits are cheap (< \$2.00) and will take a lot of abuse. They dull quickly. After a couple hundred holes in CEM-1, it's time to throw 'em out. Carbide bits are expensive (> \$6.00) and break easily. However, if you don't break them, they'll outlast steel bits several times over and drill cleaner holes throughout their useful lives.

How to choose? If you use FR-4 board material, you almost have to use carbide. With CEM-1, you can get away with cheaper steel bits. That's what I do. I keep four sizes on hand (see Table 1).

In addition to the drill press, I consider one other item essential for drilling PCBs: a shop vacuum cleaner. I clamp the vacuum hose with its intake a few inches away from the drill bit.

Running the vacuum reduces the amount of dust in the air, and gives me an unobstructed view of the board.

If your CAD program didn't dimple the holes for you, you should center-punch them. Don't use a regular centerpunch tool — it's too big. Use a jeweler's centerpunch, a small scratch awl, or even a heavy sewing needle. Use only enough pressure to dent the copper foil.

Before drilling, mount the board on a piece of back-up material. Use a scrap of smooth, hard wood or laminated paper hardboard. Tape the board by the edges to the smooth side of the hardboard. Tape all the way around so that drilling waste (swarf) can't get under the board.

A back-up supports the PCB material and foil when the drill breaks through the board. This prevents tearing and delamination of the foil. Don't re-use back-up pieces. An unlucky partial alignment of a hole in the backup with the one you're drilling can pull the bit off course.

Adjust the drill to its highest speed. Bench drill presses like Black and Decker's top out at 3,100 RPM; DynaArt's press, 6,500 RPM; a Dremel tool, 20,000 RPM. The faster the bit spins, the faster you can drill. Commercial PCB drills run at 80,000 RPM or better.

Adjust the press so that the bit hovers very close to the board. The less the quill (business end) of the press has to be extended, the more rigid it is. If your drill press has a depth stop, set it to drill through the board and 1/16" into the back-up material.

Drilling is learned through practice, but here are a couple of pointers. Lower the bit until its point touches the dimple or centerpunch and pause while the bit centers itself. Then feed the handle smoothly at a rate that feels effortless; no resistance at all. The swarf should come out as continuous corkscrew pieces. If it's powdery, your bit may be dull, or your feed rate is wrong.

Don't move the PCB while the bit is touching it. You'll break the bit or enlarge the hole. If you've drilled a hole off-center, it's usually better to complete the hole and deal with the flaw during assembly. If you back out, move the PCB and drill again, the bit may be pulled into the aborted hole anyway. This will ruin the hole and probably break the bit.

When I'm done using a drill bit, I mark its protective cover with indelible (Sharpie) ink. When a bit has lots of marks, it's just about used up. It would be more scientific to track the number of holes drilled, but I'm not that dedicated. When I'm done drilling, I inspect the breakthrough side of the board for signs of bit wear. Raised burrs around a hole indicate that the bit that drilled it is

→ Sources

Lakeview Research

2209 Winnebago Street

Madison, WI 53704

Phone (608) 241-5824

E-Mail 71163.3555@compuserve.com

The book, *Making Printed Circuit Boards*, is \$19.95 plus \$3.00 shipping.

AP Circuits

#3-1112 40 Ave., N.E.

Calgary, Alberta, Canada T2E 5T8

Phone (403) 250-3406

BBS (403) 291-9342

Rapid PCB prototyping service.

DynaArt Designs

Phone (805) 943-4746

Carries high-quality equipment for making toner-transfer PCBs as described in this article, including a heat-transfer machine, etching tank, drill press, circuit-board shear/sheet-metal bender, special toner cartridges, eyelets, and accessories. A five-pack of Toner-Transfer Paper is \$14.95. A bulk package of 50 sheets is \$129.95.

Kepron Circuit Systems, Inc.

630 Axminster Drive

Fenton, MO 63026-2992

Phone (800) 325-3878

(in MO, (314) 343-1630)

Carries FR-4 and CEM-1 board stock in various sizes. Also provides professional-quality equipment and services for traditional (non-toner-transfer) PCB fabrication, including a heavy-duty PCB shear.

BG Micro

P.O. Box 280298

Dallas, TX 75228

Phone (214) 271-5546

At the time of this writing, BG had double-sided board stock made from a white polyester laminate, ideal for double-sided prototypes because of its easy cutting and drilling properties. Four 8"x6" pieces are \$2.95.

Digi-Key

701 Brooks Avenue South, P.O. Box 677

Thief River Falls, MN 5670-0677

Phone (800) DIGI-KEY

Fax (218) 681-3380

Big mail-order electronics dealer, carries GC bubble tank (part no. GC394-ND, \$101.36) and Kester 331 solder with water-washable flux (1-lb roll, part no. KE1300-ND, \$10.10).

Jameco Electronic Components

1355 Shoreway Road

Belmont, CA 94002-4100

Phone (800) 831-4242.

Big mail-order electronics dealer, carries inexpensive PCB drill bits, spray flux remover.

getting dull.

Before assembly, it's necessary to trim the board to final size. PCB shears (Sources) cost \$500.00 to \$1,800.00 new. Usable alternatives include (from best to worst): sheet-metal shear, bandsaw, table saw (with pusher sticks for safety), scrollsaw, hacksaw, or coping saw.

Some folks use a heavy-duty paper cutter or even tin snips, but the blade angles are wrong, and the cut edges can crack. You can deeply score a PCB with a file, then snap it over the edge of a table, but the edges come out ragged. Sawing with a fine-pitch blade seems to be best. Use a miter box or guide to ensure a straight cut.

ASSEMBLING THE BOARD

After drilling, and just before assembly, remove the toner from the PCB. If you don't plan to assemble a board for awhile, leave the toner on as a protective coating. If you remove the toner, and then decide to delay assembly, you can coat the board with brush-on rosin flux. This dries to a clear finish like tacky varnish. Don't leave it in place indefinitely, however, as fluxes can promote corrosion and the formation of shorts between close-spaced features on the board.

To remove the toner, you may dissolve it with acetone or scrub it off with a Scotch Brite pad.

At this point, DynaArt recommends dipping the finished board in a tin-plating solution. The idea is to make it easier to solder. However, the solution is not cheap, and tends to go stale on the shelf. As discussed in assembly below, brush-on flux is generally a better bet. The tin plating does look nice, though.

The biggest assembly issue for a double-sided board made by the toner-transfer method is how to connect the top and bottom layers of the board. There are basically three ways: eyelets; top-and-bottom soldering; and through-hole wiring.

Eyelets. Eyelets work great. The main limitations on their use are size, time, and cost. The eyelets DynaArt carries are some of the smallest I've seen, requiring just a 40-mil (0.040") hole and a 63-mil pad. In some designs, that may still be too big. Eyelet installation is relatively fast, but it takes longer to install 20 eyelets in vias than to complete the same vias with wire (see below). Finally, eyelets aren't cheap at roughly 11 cents each.

Installing eyelets is easy, as discussed in the artwork-registration step. Just press the little copper cylinder into a hole, then peen the end over using a special tool that fits into a drill press. Make sure to hold the board down when withdrawing the eyelet forming tool. If its probe gets stuck inside the eyelet and the board is lifted at an angle, part of the tool can break off.

Since the eyelets are firmly crimped to the pads on both sides of the board, they form a good electrical connection. However, there's no law against soldering them in place for good measure.

Top-and-bottom soldering. This is the classic way to connect pads through the board. It's easiest with components like resistors, whose leads can readily be soldered on both sides of the board. What about IC sockets and header strips, whose leads aren't accessible from the top? You can either use eyelets (above) or through-hole wiring (below).

There are variants of IC sockets and header pins known as machine-

Diameter (in.)	Drill no.	Used for..
0.040	59	Eyelets, loose fit on header posts.
0.036	64	Large leads, snug fit on header posts.
0.031	68	ICs, standard components.
0.021	75	Small (50-mil) pads, vias.

pin types. These are used in high-reliability applications. Each contact of a machine-pin socket or header sits on a metal turret. You can often reach this turret with the tip of your soldering iron. In those cases, soldering the top side is straightforward.

Even if you can't get at the turret, you can still solder it. Before inserting the socket or header into the board, tin the bases of the turrets. Also tin the top-layer pads. If the holes tend to fill with solder, stick the point of a toothpick into them before tinning.

With the turrets and pads tinned, insert the machine-pin socket or header. Place the board component-side down against a surface that will help hold the components in place. I use a scrap of foam-rubber packing. Hold your soldering iron against one of the machine pins, but not in contact with the pad. You'll feel a subtle shift as the tinning melts. Hold the iron in place a couple of seconds more, then slide it down the pin to contact the pin and pad. Solder the pin to the pad and withdraw the iron. Turn the board over and look: Heat conducted through the machine pin melted the tinning and formed a gorgeous solder joint on the top layer!

Through-hole wiring. This technique is most useful for vias, but can also help with conventional (non-machine-pin) sockets, PCB-mount connectors, and other components that, for whatever reason, won't yield to the other methods. It's an obvious method with some subtle variations. The idea is that you run a piece of wire through holes in the board and solder it on both sides.

The common method for doing this is to use clipped component leads, installing and soldering them one at a time. Whew! A lot of work. Instead, I strip a 1-2 foot piece of 30-AWG wire and lace it through all of the vias on the board. I solder every pad on one side, flip the board, then solder every pad on the other side. When I'm done, I clip off all of the loops with wire cutters. Done.

You can also run 30-AWG wire through holes alongside flat socket leads and square header posts. Solder the wire on the top layer and stick it through the hole. Install the component over the wire and solder it on the bottom. The 30-AWG wire doesn't conduct much heat, so it won't desolder itself from the top layer while you're soldering the bottom.

My last hints for assembly apply to all boards, not just toner-transfer pro-

→ **TABLE 1**
totypes:

- When you're done soldering, clean the board promptly with flux remover. If you used regular solder and/or brush-on flux, this requires a powerful solvent-type flux spray. Better yet, switch to a water-soluble flux solder like Kester's 331 (Sources). The flux works better than rosin and washes off with warm water.

- To dry the board thoroughly, shake out the water and set it someplace hot for awhile. I dry boards under an infrared heat lamp for a few hours.

Lately, I've started to use one of those new-fangled lettuce dryers. They're sold under names like Salad Spinner, and consist of a slotted basket inside a bowl with a lid. Turn the crank on the lid, and the basket spins rapidly to fling the water off the lettuce. I lined the inside of the basket with anti-static foam to make my very own Circuit Spinner. Place the board on end in the basket with the component side outward. Put a small counterweight (scrap of wood or PCB material, or another board) in the opposite side of the basket. Turn the crank for a minute or so. The board comes out bone dry. I still bake it for good measure, but there's less chance of hard-water minerals staying behind. And no water spots!

If your prototype board will be used for more than just testing, you may coat the bare copper traces with clear acrylic lacquer (sold under the trade name Krylon, among others) to prevent tarnishing. Just be sure to mask off sockets and connectors before applying a few light coats.

Summary

I began this article by persuading you that it's worthwhile and easy to make advanced PCBs using toner transfer. I hope my detailed description of the process and frank discussion of its limitations hasn't cooled your enthusiasm. Preparing CAD files to a PCB vendor's requirements, or guiding a work order through an organization's bureaucracy are also complex procedures fraught with pitfalls, workarounds, etc. And they rarely generate the pure satisfaction that you get from holding in your hand a working electronic prototype that, an hour before, was a mere ghost on a monitor screen. **NV**

MOORES COMPUTER

**816 PATTERSON
MONROE MI 48161**

**Meda vision 15" base
speaker cabinet with
speaker. \$25.00**

*External Nec 25 1x scsi cdrom.
Works with IBM, MAC, AMEGA.
Can daisy chain up to 7 drives off
one card GOOD 4 BBS \$65.00
Card for above drive ONLY \$29.00*

*Parallel to SCSI adaptor, hook-up
hard drives, etc to any IBM parallel
port. Use your printer simultaneously
Great for lap tops, or when you
want a portable scsi device \$79.00*

2x cd roms only \$74.00

**36"blow guns with darts not a
toy nice unit \$18.00**

**Atech mouse with 9 to 25 pin
adp. \$5.00 each or 10 for \$40.00**

*12 volt nicad rechargeable battery
for NEC 36 cdrom good for many
things only \$10.00*

*Single plug in surge protector U.L.
listed retale box \$2.00 EA. OR 50
FOR \$50.00*

**How to book on 40 top games
on your computer from years
past only \$1.50**

*Future Domain 8 bit scsi card
and all doc,s \$19.95*

100 360 k disks only\$ 2.50

6'printer cabel only \$2.00

*True IBM disk drive box with p/s
many applications nice box \$21.00*

80 pound cross bow\$39.00

**MECC AWARD WINNING
Oregon trail software \$10.00**

16 bit sound card \$41.00

Wangtech 120 meg tape drive\$10.00

*We buy bad or used cd
roms. 50 at a time min.*

**MOORES COMPUTERS
WHERE YOU GET MORE
FOR LESS**

**MON-FRI 10:00-5:00
1-313-243-1117**

SOME OF OUR COMPETITORS TRY TO SUCCEED WITH GIMMICKY CORNER CUTTING & LOWERING QUALITY STANDARDS IN ORDER TO INCREASE PROFIT MARGINS. WHILE OTHERS TRY THE FAMILAR SCAM OF "WE'LL BEAT ANY PRICE" OR THIS ONE "WE HAVE THE ABSOLUTE LOWEST PRICE"

HERE AT VISUAL COMMUNICATIONS WE HAVE BUILT OUR COMPANY ON A PLATFORM OF THE FOLLOWING FAMOUS QUOTES & IDEOLOGIES =

RULE # 1 " IF WE DON'T TAKE CARE OF THE CUSTOMER... SOMEONE ELSE WILL "

ATTITUDE: " ATTITUDE IS A LITTLE THING THAT MAKES A BIG DIFFERENCE "

SUCCESS: " SUCCESS IS A JOURNEY NOT A DESTINATION "

OPPORTUNITY: " IN THE MIDDLE OF DIFFICULTY LIES OPPORTUNITY "

EXCELLENCE: " SOME SUCCEED BECAUSE THEY ARE DESTINED TO, MOST SUCCEED BECAUSE THEY ARE DETERMINED TO "

QUALITY: " THE RACE FOR QUALITY HAS NO FINISH LINE "

PERSISTANCE: " PERSISTANCE PREVAILS WHEN ALL ELSE FAILS "

IMAGINATION: " A MIND ONCE STRETCHED BY A NEW IDEA, NEVER REGAINS ITS ORIGINAL DIMENSIONS "

LEADERS: " LEADERS ARE LIKE EAGLES, THEY DON'T FLOCK, YOU FIND THEM ONE AT A TIME "

BENJAMIN FRANKLIN: " THE BEST WAY TO BE FREE OF THE LAW IS TO OBEY IT "

**NEW PRICE POLICY
BUY FIVE MODULES
AND GET ONE FREE!**

CABLE CONVERTER DIAGNOSTIC TEST MODULES

	1 PC - 10 PC
STAR VI QUICK KIT	19.95 - 16.95
NEW STAR 7 QUICK KIT	34.95 - 29.95
STAR 7 R/2V/5/ 1WIRE	
MULTI MODE QUICK KIT	39.95 - 34.95
STAR 7 R/2V/5 3 WIRE	29.95 - 24.95
GENESIS STANDARD	154.95 - 144.95
GENESIS "RE-SPAWN"	199.95 - 189.95

PIONEER COMPATIBLE*	1 PC - 10 PC
BA-51XX - BA-61XX	34.95 - 29.95
BA-63XX - BA-67XX	34.95 - 29.95
NEW NEVER RESET E-4	39.95 - 34.95
GENESIS STANDARD TRANSMIT	154.95 - 144.95
GENESIS MORPHING MODE 6300	199.95 - 189.95
NEW MULTI-MODE BOARD	39.95 - 34.95

NEW 6300 PIO WRITER	
CLEAR E-2 THRU E-8	59.95 - 54.95
ZENITH 1000 TO 2660	16.95 - 12.95
TOKEONE 03&07 28 PIN	19.95 - 16.95

SCIENTIFIC ATLANTA COMPATIBLE*

	1 PC - 10 PC
S/A 8600 QUICK BOARD	34.95 - 29.95
S/A 8590 QUICK BOARD	34.95 - 29.95
S/A 8580 QUICK BOARD	34.95 - 29.95
S/A 8570 QUICK BOARD	34.95 - 29.95
S/A 8580 40 PIN PLUS +	34.95 - 29.95
S/A 8570 /90 /8600 40PIN	34.95 - 29.95
S/A 8550 14 PIN EAROM	34.95 - 29.95
S/A 8550 QUICK BOARD	34.95 - 29.95
S/A 8536 AUTO BOARD	34.95 - 29.95
S/A 8535 AUTO BOARD	34.95 - 29.95

ANYONE IMPLYING THEFT OF SERVICE IN ANY WAY SHAPE OR FORM, DO US AND YOURSELF A FAVOR DON'T BOTHER CALLING US.
"AND YES WE DO MEAN YOU"
THESE PRODUCTS ARE FOR QUALIFIED BENCH TECHNICIANS. FOR DIAGNOSTIC PURPOSES ONLY PERIOD III NO PA. SALES.

INTRODUCING

GENESIS

GENESIS IS THE NEW STATE OF THE ART DESIGN IN DIAGNOSTIC TRANSMITTERS. ALLOWS FULL DIAGNOSTIC TEST MODE OF RAW CONVERTERS. IN STOCK FOR MOST BRAND NAME CONVERTERS!!

NEW JUST ARRIVED & LONG AWAITED, THE PIONEER 6300 WRITER!! CLEAR UP YOUR E-2 BLUES. **NEW** PIO WRITER CLEARS E-2 THRU E-8.

NOTE: THE ABOVE MENTIONED NAMES ARE ALL REGISTERED TRADEMARKS. ALL REFERENCES TO THE ABOVE MENTIONED EQUIPMENT IS FOR IDENTIFICATION PURPOSES ONLY. WE ARE IN NO WAY IMPLYING THAT ANY OF THE PRODUCTS IN THIS AD ARE ORIGINAL EQUIPMENT. VISUAL COMMUNICATIONS IS IN NO WAY AFFILIATED WITH THE ABOVE MENTIONED COMPANIES OR CORPORATIONS!!

WE STOCK A COMPLETE LINE OF SECURITY SCREW TOOLS FOR ALL BRAND NAME CONVERTERS

VISUAL COMMUNICATIONS INC.
800-GO-CABLE FOR ORDERS ONLY
717-620-4363 FOR CATALOG & TECH. SUPPORT
ESTABLISHED 1975

NEW GENESIS

SCIENTIFIC/ATLANTA CUBE
NEW FEATURES
RE-SPAWN MODE - MORPHING MODE
MULTI-FREQUENCY - BATTERY OP.

IC MASTER



\$95 From Publisher **\$190 From Publisher**

LIQUIDATING WAY Below Distributor Cost

The 3 Volume ICM is the Most Comprehensive IC Reference Ever Published. 100,000 IC's of EVERY KIND from Every Manufacturer. Specifications, Datasheets, Crossreferences, Alternate Sources, Manufacturer Profiles & Distributors. The 4 Volume EEM is the largest Component Parts Directory available. All the Major Parts Manufacturers display Entire Product Lines with Pictures & Data Sheets. Cabinets, Packaging, Transformers, Pots, Semi's, Displays, an Endless list! This Extraordinary Library is perfect for Service, Designers, Distributors & Experimenters. The Complete Set Weighs in at 27 Pounds! Finallyit's AFFORDABLE! (EEM is available for \$25 ONLY to those who purchase the ICM) Ask about ICM CD.

Call NOW 8am -10pm 7 Days Netcom 516 826 1808 Extn 6300

Write in 119 on Reader Service Card.

#70 COMPUTER EQUIPMENT WANTED cont.

LCD COLOR PANELS/PROJECTORS
WANTED working or not. Fax description and price to 610-935-7666 or call 610-983-0100 ask for Neil.

\$100 GOLD! There is a circuit chip made by IBM that contains more than \$100 each in scrap gold, and another worth \$20. Almost nobody knows this. They are just starting to show up in resale outlets and junk yards. You can score big with this knowledge. Complete info with photo \$35 to: Jim Sciuto, Box 128, Methuen, MA 01844.

WANTED: PRE1980 Microcomputers for museum collection. Microcomputer magazines and manuals also needed. 703-231-6478, 703-763-3311.

WANTED TO BUY IBM and MacIntosh computers, printers, hard drives, peripherals, CPUs, notebooks, Verifone POS equipment any quantity, in working condition. Call 714-778-0450.

KAYPRO PIGGYBANK CP/M RAM disk board wanted. Doug Margolis, 153 East 57th St., #8-G, New York, NY 10022.

WANTED: ZENITH portable laptop computers. We are buying and selling older Zenith laptops. Always paying a fair market value. If you have a Zenith portable just sitting around, call Les or Mike for a quote! 616-849-1800.

ANYBUS OWNERS! I am searching for information regarding AnyBus riser cards, motherboards, BIOS revisions, etc. Sources, schematics, and/or chipset information for EISA, VLB, PCI, PCMCIA riser/translator cards appreciated. I will gladly share the fruits of my efforts. Greg Chabra, 23 Davis Street, Binghamton, NY 13905. 607-724-3196.

COMPUTERS, PARTS to build, software, and peripherals wanted. New/used, excess, or obsolete stock. Any quantity. Anything computer related. Memory, monitors, laptops, notebooks, LAN equipment. CD-ROM drives, tape drives, scanners, printers, hard drives, Micro Channel equipment, fax machines, etc. 914-738-6830.

WANTED: TSR program to eliminate snow & flicker when using older CGA adapter cards. 914-738-6830.

I WANT it and I want it now. I want all of your SIMM memory. IBM, Mac, new, used, even defective. I want it all. Highest \$ paid. Call 1-800-4-MEMORY now! Voice/FAX.

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.**, 513-847-2300 OR fax 513-847-2350.

WANTED: motherboard 386DX33 or better, with dimensions of 8-1/2" wide by 12" long. Send info to Ron, 16270 W. 13th Ave., Golden, CO 80401.

WANTED: KAYPRO 10 computer, and operating software and manual. Also, Vector Graphic 4 boot disk, also Tandy 6000 Fortran77 Software. 26-6451. Clarence Dolan, 4553 White Horse Trail, Rockford, IL 61101-6147. 815-964-7994.

TEST EQUIPMENT

80

HEWLETT PACKARD MD. 8673D synthesized signal generator \$22,500. HP 11713A, 8497K, 8494H, 355C, 355D, G382A. 517-876-6363 MI.

HP 8553B 100MHz SPECTRUM ANALYZER RF SECTIONS; 10Hz resolution probe power, \$275. 619-439-1345.

SPECTRUM ANALYZERS: Tektronics 491 10MHz to 40GHz, \$995; HP 141T with 8552B, 8553B, 8554B, & 8555A, \$2,500. **Calibrated.** In perfect working condition, **guaranteed** for 90 days. ISA, PO Box 6955, Laguna Niguel, CA 92607. 714-488-0010, FAX 714-488-0299.

GR TEST Equipment: GR1142A frequency discriminator, \$75; GR1216A, IF unit, \$75; GR1360A, microwave oscillator 1.7-4.1 GHz, \$150; GR1432J, decade resistor, \$100; GR1432M, \$100; GR1432P, \$100; GR1421B graphic level recorder, \$300; GR1522 DC recorder, \$350; GR1568A wave ana, \$150; GR1606A RF bridge, \$400; GR1650A RLC bridge, \$250; GR1633A incremental inductance bridge, \$350; GR1925 multimeter, \$500, GR222 precision condenser, 1500 PF, \$150; GR546-C, audio microvoltmeter, \$150; GR722-D precision variable cap, \$200; GR874-D50; 50CM stub, \$50; GR874-F500L 500MHz low pass filter, \$60; GR916AL RF bridge, \$250; A-Comm Electronics, 303-290-8012, 303-290-8133 FAX.

TEKTRONIX 7000 SERIES: 7854 400MHz oscilloscope mainframe with GPIB, digital storage, waveform measurement capability \$975. 7633 100MHz storage mainframe \$475. 7904 or R7903 500MHz mainframe \$435. 7B53A 100MHz dual time base \$190. 7B85, 7B80 delaying, delayed 400MHz time bases \$225, \$175. 7B92A 500MHz dual time base \$325. 7B15, 7B10 delaying, delayed 1000MHz time bases \$550, \$475. 7CT1N curve tracer \$475. 7D15 225MHz counter/timer \$275. 7D20 digital storage plug-in featuring cursor measurements, min/max enveloping, signal averaging \$825. 7L5/L3 spectrum analyzer, 20Hz-5MHz, digital storage \$1,500; with tracking generator \$2,000. 7S12 time domain reflectometer with S-6, S-52 - can measure cable length to resolution of .1" (20 psec) per division \$1,600. 7S14 1GHz dual trace delayed sweep sampler \$675. Excellent condition! Other plug-ins, mainframes, package discounts available. All with warranty. Pepper Systems, 214-353-0257.

HP1B CABLES: HP 10833A 3.3 ft, \$15 ea.; 10833B 6.6 ft, \$25; HP 10833D, \$10. A-Comm Electronics, 303-290-8012.

PORTABLE SCOPE Tek 465B/DM44 (100MHz) \$635. Tek 475 (200MHz) \$595. Tek 475 (200MHz) \$595. Tek 475/DM44 (200MHz) \$660. Tek 475A (250MHz) \$695. Tek475A/DM44 (250MHz) \$760. Tek 485 (350MHz) \$790. HP 1727A (275MHz storage) \$925. Tek 466 (100MHz storage) \$850. Tek 2465 & 2465DVS (300MHz) call. All with Bright CRT's excellent condition, warranty. Pepper Systems, 214-353-0257.

AFFORDABLE - UPGRADABLE NOTEBOOK COMPUTER

\$1995⁰⁰

Color 486DX4-100

8MB RAM • 340MB Hard Drive



Upgrade to 540MB Hard Drive for \$120 additional

Upgrade to 16MB RAM for \$295 additional

Please call for other configurations.
Prices may change without notice
Dealer Inquiries Welcome

800-A1-MIKON

Mikon, Inc. • 13602 Merriman, Livonia, MI 48150 • In MI: 313-266-5544 • Fax: 313-266-7788

Write in 90 on Reader Service Card.

MARCONI TF 2304 MODULATION METER. This popular meter measures modulation in the 9 to 1000MHz frequency range. FM: 8 ranges from 1.5KHz to 150KHz. AM: 3 ranges 10, 30, and 100%. Fully checked, with manual, quantities available. \$365 includes CONUS shipping. Brian Kent (Kentrionix), PO Box 2444, Farmingdale, NJ 07727. 908-681-3229, FAX 908-681-3312.

WAVETEK 3000-200, 1-520 MHZ FREQUENCY SYNTHESIZERS with AM, FM, internal/external modulation/level meter. UNDER \$750 with manual and 90-day warranty. Fixers available. 619-439-1345, 1-800-TO-BUY-TE.

BOONTON 102E SIGNAL GENERATOR 450KHz to 520MHz, AM/FM modulation, attenuated output: -130dBm to +13dBm leveled. Digital readout reads frequency and may also be used as an external frequency counter. Accuracy is 1 PPM. Fully checked, with manual, quantities available \$990 includes CONUS shipping. Brian Kent (Kentrionix), PO Box 2444, Farmingdale, NJ 07727. 908-681-3229, FAX 908-681-3312.

WANTED! 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.

SURPLUS ELECTRONIC test equipment for sale at deep discounts. Write, phone, or fax to request the current list. Jim Stevenson, 3401 Sunny Slope Road, Bridgewater, NJ 08807 Phone: 908-722-6157 Fax: 908-722-6391.

EQUIPMENT MANUALS we have 1000's of service and operators manuals for all types of test and measurement equipment from 1950 to present. All test equipment manufacturers are represented. Call, write, or fax your want list. Please include mfg.'s manual P/N unit serial no's if known. **Manuals Plus**, Box 937, Spanaway, WA 98387. 206-531-8031 or FAX 206-536-1121.

Micro-Size CCD Cameras

"The Beretta's"

High Res. CCD in Diecast Case. 9V Batt. Optional.

- Selection of Color & B/W Monitors.
- Selection of Lens & Options.
- Switchers/Multiplexers/Monitors Mounts/Optics.
- Full Selection of B/W & Color CCD Cameras with Many Options to Fit Your Application.

Introductory Price
\$119.95
w/o Lens

#DC-750

#DC-750CX
With "C" Mount

MB-750
High Res. B/W
Lens Optional.

Wireless Monitoring Systems

Ask About Our Complete WIRELESS PACKAGES

#VP-40 Wireless Receiver

#VP-50 Camera Transmitter

- 900 MHz For Best Picture Quality.
- Monitor In Darkness with IR LEDs.
- Monitor has Dual Channel Mode.
- Battery or AC Operation.
- Plug & Play Quick Installation.
- Mobile Security.
- Condenser Mic.
- VCR Compatible.

#VP-20 Camera Transmitter

#VP-30 Monitor Receiver

* Detachable Antenna

Polaris Industries

Prices Subject to Change Without Notice. Prices Do Not Include Shipping.

141 West Wieuca Road • 300-B • Atlanta GA 30342-3251 • Order Desk: 800-752-3571 • Tech Info: 404-252-3340 • FAX: 404-252-8929

Write in 195 on Reader Service Card.

Nuts & Volts Magazine/August 1995 51

Events

CALENDAR

WESTERN REGION

AUGUST 5

CA - OAKLAND — Robert Austin Computer Show. **LOCATION:** Oakland Convention Center, Exhibit Hall West. **HOURS:** 10am-4pm. **FEATURES:** C. **CONTACT:** Robert Austin Corp, 1-800-346-0100, FAX 415-347-0350.

CA - SANTEE — Ham Radio, Computer & Electronics Swap Meet. **SPONSOR:** ARC of El Cajon. **LOCATION:** Santee Drive-In, 10990 N Woodside. **HOURS:** 6:30am-7 **ADMISSION:** 50¢. **TALK-IN:** 146.520. **FEATURES:** C - E - FM - F/R - H. **DEALER INFO:** \$7 vehicle. **CONTACT:** Pat WA6MHZ, AR-CEC, Box 50, El Cajon CA 92020. 619-561-0052.

AUGUST 5-6

CA - POMONA — Computer Marketplace. **SPONSOR:** National Productions. **LOCATION:** Fairplex Exposition Center, Exit Highway 10 at Fairplex Dr. Go N to McKinley Ave, turn right. Turn left on White Ave to Gate 14. **HOURS:** 10am-5pm. **ADMISSION:** \$7. **CONTACT:** National Productions, 408-778-5200 or 1-800-800-5600. FAX 408-779-1374.

WA - SPOKANE — The Original Spokane Hamfest. **SPONSOR:** The ARCs of the Spokane Area. **LOCATION:** University High School, 10212 E. 9th Ave. **HOURS:** Sat: 9am-5pm, Sun: 8am-Noon. **ADMISSION:** \$4 adv, door \$5, under 12 free. **TALK-IN:** 146.52 147.38 + 223.90. **FEATURES:** CB - DP - EX - F/R - S. **DEALER INFO:** Set-up tables \$5, Set-up 6pm-9pm Fri., 8am-9am Sat. **CONTACT:** KBARA - JoAnn Gemmrig, 6812 E. Third, Spokane WA 99212. 509-928-1808, 509-448-8445.

AUGUST 6

CA - LIVERMORE — East Bay Area Amateur Radio/Electronics/Computer Swap Meet. **SPONSOR:** Livermore Amateur Radio Klub (LARK). **LOCATION:** Las Positas College, N of I-580 at Airway Blvd exit. **HOURS:** 7am-Noon, rain or shine. **ADMISSION:** Free. **TALK-IN:** 147.045 + (PL 94.8) from W, 145.350 (PL 100) from E. **FEATURES:** E - H - FP - F/R. **DEALER INFO:** Set-up after 7am only. \$10 space fee. Covered spaces avail. If rain. **CONTACT:** Noel Anklam KC6QZK, 510-447-3857 eves or 510-783-2803 message days.

CA - STOCKTON — MarketPro Computer Show & Sale. **LOCATION:** Civic Auditorium. **HOURS:** 10am-5pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

AUGUST 12

CA - BAKERSFIELD — MarketPro Computer Show & Sale. **LOCATION:** Kern County Fairgrounds. **HOURS:** 10am-5pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

CA - FONTANA — Amateur Radio & Electronic Equipment Swap Meet. **SPONSOR:** Inland Empire ARC & A.B. Miller High School ARC. **LOCATION:** A.B. Miller High School, 6821 Oleander Ave. **HOURS:** 7am-7 **ADMISSION:** Free. **FEATURES:** E - EX - F/R - H. **DEALER INFO:** Set-up 6am. **CONTACT:** Bill Gruber 909-822-4138 eves.

CA - LONG BEACH — Amateur Radio Ham Auction. **SPONSOR:** Long Beach ARA & Police Athletic League Hams. **LOCATION:** PAL-HAM facility, 1401 W 9th St. **HOURS:** Preview 7am-9am, Auction: 9am-2pm. **TALK-IN:** 145.550 Simplex. **CONTACT:** Mike Levonius KC6YHF, 714-539-5353 aft 6pm. Chuck Williams KN6DB, 310-431-3488. Packet address: N6WZR@NGYNSOCAL.CA.USA.NA

CA - RESEDA — Computer Marketplace. **SPONSOR:** National Productions. **LOCATION:** Sherman Square Entertainment Center, 18430 Sherman Way. From 101 Freeway take Reseda off ramp, turn left to Sherman Way, turn right. Go 1 blk to Canby St. **HOURS:** 10am-5pm. **ADMISSION:** \$5. **CONTACT:** National Productions, 408-778-5200 or 1-800-800-5600. FAX 408-779-1374.

WA - TACOMA — Electronics Flea Market. **SPONSOR:** Radio Club of Tacoma. **LOCATION:** Charles Wright Academy, 7723 Chambers Creek Rd West. **HOURS:** 9am-3pm. **ADMISSION:** \$4, under 12 free. **TALK-IN:** 147.28 +. **FEATURES:** C - CB - DP - E - EX - FM - FP - H - RV-S. **DEALER INFO:** Tables: Commercial \$40, non-commercial \$15. Set-up: Fri 5pm-9pm, Sat 5am-9am. **CONTACT:** Radio Club of Tacoma, Box 11188, Tacoma WA 98411. Alan Hughes, 206-840-4947, pager 206-596-7472.

AUGUST 13

CA - BUENA PARK — Computer Marketplace. **SPONSOR:** National Productions. **LOCATION:** Se-

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.

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
CompuServe 74262,3664
Internet
74262,3664@compuserve.com

quoia Conference Center. Take Beach Blvd exit off 91 Freeway. Go 1-blk N to 7530 Orangethorpe. **HOURS:** 10am-5pm. **ADMISSION:** \$5. **CONTACT:** National Productions, 408-778-5200 or 1-800-800-5600. FAX 408-779-1374.

CA - GOLETA — 75th Anniversary Hamfest. **SPONSOR:** Santa Barbara ARC. **LOCATION:** Elk's Lodge #613, 150 N Kellogg Ave. **HOURS:** 8:30-7 **TALK-IN:** 146.19/79 131.8 PL. **FEATURES:** DP - EX - FM - FP - F/R - H. **CONTACT:** SBARC, POB 3232, Santa Barbara CA 93130-3232. 805-569-5700.

CA - SANTA ROSA — MarketPro Computer Show & Sale. **LOCATION:** Sonoma Co. Fairgrounds. **HOURS:** 10am-5pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

AUGUST 19

CA - ANAHEIM — Robert Austin Computer Show. **LOCATION:** Anaheim Stadium, Conference Level. **HOURS:** 10am-4pm. **FEATURES:** C. **CONTACT:** Robert Austin Corp, 1-800-346-0100, FAX 415-347-0350.

CA - SAN FRANCISCO — Robert Austin Computer Show. **LOCATION:** Cow Palace, Hall DEF. **HOURS:** 10am-4pm. **FEATURES:** C. **CONTACT:** Robert Austin Corp, 1-800-346-0100, FAX 415-347-0350.

CA - SANTEE — Ham Radio, Computer & Electronics Swap Meet. **SPONSOR:** ARC of El Cajon. **LOCATION:** Santee Drive-In, 10990 N Woodside. **HOURS:** 6:30am-7 **ADMISSION:** 50¢. **TALK-IN:** 146.520. **FEATURES:** C - E - FM - F/R - H. **DEALER INFO:** \$7 vehicle. **CONTACT:** Pat WA6MHZ, AR-CEC, Box 50, El Cajon CA 92020. 619-561-0052.

WA - LONGVIEW — 4th Annual Ham Radio, Computer & Electronic Swap Meet. **SPONSOR:** Lower Columbia ARA. **LOCATION:** Cowlitz County Fairgrounds. **HOURS:** 9am-3pm. **ADMISSION:** \$3. **TALK-IN:** 147.26 +. **FEATURES:** C - CB - DP - E - FM - H - RV-H - T. **DEALER INFO:** Tables: Commercial \$15. Others: Before Aug 5 \$12, after \$15. Taggating: \$5. Set-up: Fri 5pm-9pm, Sat 6am-8:45am. **CONTACT:** LCARA, POB 906, Longview WA 98632. 360-425-6076, 360-425-9184.

AUGUST 19-20

CA - OXNARD — MarketPro Computer Show & Sale. **LOCATION:** Community Center. **HOURS:** 10am-5pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

CA - SACRAMENTO — MarketPro Computer Show & Sale. **LOCATION:** Scottish Rite Center. **HOURS:** 10am-5pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

AUGUST 20

CA - FRESNO — MarketPro Computer Show & Sale. **LOCATION:** Holiday Inn. **HOURS:** 10am-5pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

NV - CARSON CITY — Swap Meet. **SPONSOR:** W7IND Nevada. **LOCATION:** Custom Computer Concepts parking lot, Hwy. 50 E. N of high school. **HOURS:** 8am-noon. **ADMISSION:** Free. **DEALER INFO:** Sellers, \$3 space. Set-up 7:30 am. **CONTACT:** 702-883-8900.

AUGUST 26-27

CA - POMONA — Computer Marketplace. **SPONSOR:** National Productions. **LOCATION:** Fairplex Exposition Center, Exit Highway 10 at Fairplex Dr. Go N to McKinley Ave, turn right. Turn left on White Ave to Gate 14. **HOURS:** 10am-5pm. **ADMISSION:** \$7. **CONTACT:** National Productions,

408-778-5200 or 1-800-800-5600. FAX 408-779-1374.

CA - VALLEJO — MarketPro Computer Show & Sale. **LOCATION:** Solano Co. Fgrds. **HOURS:** 10am-5pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

AUGUST 27

CA - SAN DIEGO — MarketPro Computer Show & Sale. **LOCATION:** Scottish Rite Center. **HOURS:** 10am-5pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

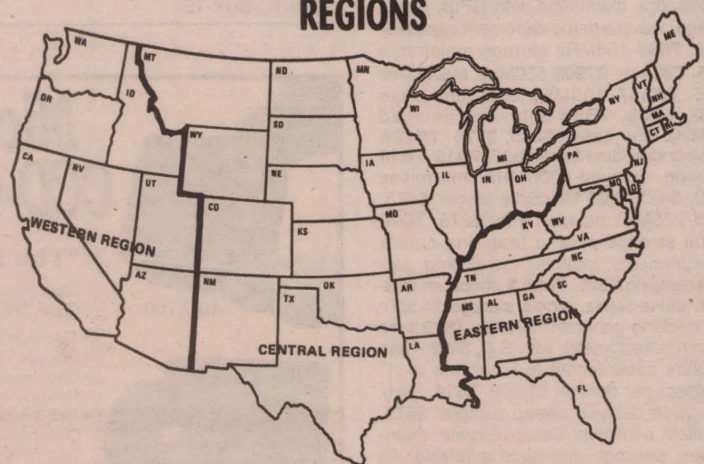
SEPTEMBER 1-2-3

CA - LONG BEACH — Hamcom '95, ARRL Southwestern Division Convention. **SPONSOR:** Hamcom, Inc. **LOCATION:** Queen Mary. **HOURS:** Fri: 5pm-8pm; Sat: 9am-5pm; Sun: 9am-Noon. **ADMISSION:** Adv \$12, Door \$15. **TALK-IN:** 145.52MHz Simplex. **FEATURES:** B - CB - DP - EX - F - FM - F/R - H - RV-S - S. **CONTACT:** Nate Brightman, 310-427-5123 or Hamcom, Inc, POB 2111, Winnetka CA 91396.

SEPTEMBER 2

CA - ANTIOCH — MarketPro Computer Show &

REGIONS



FEATURES KEY

- AC — Air Conditioned
- B — Banquet
- C — Computers
- CB — Commercial Booths
- DP — Door Prizes
- E — Electronics
- EX — FCC Exams
- F — Forums
- FM — Flea Market
- FP — Free Parking
- F/R — Food & Refreshments
- H — Amateur Radio
- RV/H — RV Parking w/hookups
- RV/S — RV Parking Self Contained
- S — Seminars
- T — Taggating

COMPUTER SHOW PROMOTER INFO

AGI Computer Fair — 317-299-8827
KGP Computer Shows — 908-297-2526
MarketPro Computer Shows
West (CA) — 415-388-8893
East (MD, OH, PA, VA) — 301-365-9696
N.E. (CT, MA, NJ, NY, RI) — 201-265-1075
NARISAAM Computer Shows — 800-436-6707
Northern Computer Shows — 508-744-8440

Events CALENDAR

SEPTEMBER 9

CA - FONTANA — Amateur Radio & Electronic Equipment Swap Meet. **SPONSOR:** Inland Empire ARC & A.B. Miller High School ARC. **LOCATION:** A.B. Miller High School, 6821 Oleander Ave. **HOURS:** 7am-7. **ADMISSION:** Free. **FEATURES:** E - EX - FP - F/R - H. **DEALER INFO:** Set-up 6am. **CONTACT:** Bill Gruber 909-822-4138 eves.

CA - FRESNO — MarketPro Computer Show & Sale. **LOCATION:** Holiday Inn. **HOURS:** 10am-5pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

CA - RESEDA — Computer Marketplace. **SPONSOR:** National Productions. **LOCATION:** Sherman Square Entertainment Center, 18430 Sherman Way, From 101 Freeway take Reseda offramp, turn left to Sherman Way, turn right. Go 1 blk to Canby St. **HOURS:** 10am-5pm. **ADMISSION:** \$5. **CONTACT:** National Productions, 408-778-5200 or 1-800-800-5600. FAX 408-779-1374.

SEPTEMBER 9-10

CA - VENTURA — MarketPro Computer Show & Sale. **LOCATION:** Ventura Fairgrounds. **HOURS:** 10am-5pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

SEPTEMBER 10

CA - BUENA PARK — Computer Marketplace. **SPONSOR:** National Productions. **LOCATION:** Sequoia Conference Center, Take Beach Blvd exit off 91 Freeway, Go 1 blk N to 7530 Orangeforpe. **HOURS:** 10am-5pm. **ADMISSION:** \$5. **CONTACT:** National Productions, 408-778-5200 or 1-800-800-5600. FAX 408-779-1374.

CA - SACRAMENTO — MarketPro Computer Show & Sale. **LOCATION:** Scottish Rite Center. **HOURS:** 10am-5pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

SEPTEMBER 16

AZ - NORTH SCOTTSDALE — Family Amateur Radio Event. **SPONSOR:** 16 Local Amateur Clubs. **LOCATION:** Rawhide Rodeo Pavilion, 23000 N Scottsdale Rd. **HOURS:** 9am-2pm. **ADMISSION:** Adv \$1, door \$2, under 18 free. **TALK-IN:** 146.76-. **FEATURES:** C - CB - DP - FM - F/R - S - T. **DEALER INFO:** Tailgating \$5. **CONTACT:** Len Winkler KB7LPW, 602-861-0303.

CA - PALM SPRINGS — MarketPro Computer Show & Sale. **LOCATION:** Riverside County Fair. **HOURS:** 10am-5pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

CA - SANTA BARBARA — Computer Marketplace. **SPONSOR:** National Productions. **LOCATION:** Earl Warren Showgrounds. Take Highway 101 to Las Positas Exit. Follow signs to fairgrounds. **HOURS:** 10am-5pm. **ADMISSION:** \$5. **CONTACT:** National Productions, 408-778-5200 or 1-800-800-5600. FAX 408-779-1374.

CA - SANTEE — Ham Radio, Computer & Electronics Swap Meet. **SPONSOR:** ARC of El Cajon. **LOCATION:** Santee Drive-In, 10990 N Woodside. **HOURS:** 6:30am-7. **ADMISSION:** 50c. **TALK-IN:** 146.520. **FEATURES:** C - E - FM - F/R - H. **DEALER INFO:** \$7 vehicle. **CONTACT:** Pat WA6MHZ, AR-CEC, Box 50, El Cajon CA 92020. 619-561-0052.

SEPTEMBER 16-17

CA - SAN DIEGO — MarketPro Computer Show & Sale. **LOCATION:** Scottish Rite Center. **HOURS:** 10am-5pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

OR - PORTLAND — Ham Fair. **SPONSOR:** Hoodview ARC. **LOCATION:** Portland Meadows Race Track, Pari-mutual area, 1001 NE Schmeier Rd. **HOURS:** Sat: 9am-5pm, Sun: 9am-2pm. **ADMISSION:** Adv \$5, door \$6. **TALK-IN:** 147.28/88. **FEATURES:** CB - DP - F - FM - F/R - H - RV-S - S. **DEALER INFO:** Tables \$12 + admission, set-up Fri: 2pm-6pm, Sat: 7:30am. Darrell AA7BD, 503-760-0572. **CONTACT:** Portland Ham Fair, POB 20876, Portland OR 97220.

SEPTEMBER 17

AZ - PHOENIX — Computer & Electronic Swap Meet. **SPONSOR:** Electronic Materials & Computers. **LOCATION:** Electronic Materials & Computers parking lot, 3102 W Thomas Rd #902. **HOURS:** 8am-3pm. **ADMISSION:** Free. **FEATURES:** FP. **DEALER INFO:** Vendor spaces \$15. **CONTACT:** 3102 W Thomas Rd #902, Phoenix AZ 85017. 602-272-3200.

CA - STOCKTON — MarketPro Computer Show & Sale. **LOCATION:** Civic Auditorium. **HOURS:** 10am-5pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

NV - CARSON CITY — Swap Meet. **SPONSOR:** W7IND Nevada. **LOCATION:** Custom Computer Concepts parking lot, Hwy. 50 E, N of high school. **HOURS:** 8am-noon. **ADMISSION:** Free. **DEALER INFO:** Sellers, \$3 space. Set-up 7:30am. **CONTACT:** 702-883-8900.

SEPTEMBER 22-23-24

OR - MILTON-FREEWATER — ARRL Hamfest. **SPONSOR:** Walla Walla Valley ARC. **CONTACT:** Jack Babbitt WA5ZAY, POB 951, Walla Walla WA 99362. 509-525-7003.

SEPTEMBER 23

OR - BEND — Northwest VHF/UHF Conference. **LOCATION:** Central Oregon Environmental Center. **HOURS:** 9am-3pm. **ADMISSION:** \$15. **CONTACT:** Don Krug K7HJS, 1126 NE Burnside, Bend OR 97701.

SEPTEMBER 23-24

CA - VALLEJO — MarketPro Computer Show & Sale. **LOCATION:** Solano Co. Fairgrounds. **HOURS:** 10am-5pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

SEPTEMBER 24

CA - OXNARD — MarketPro Computer Show & Sale. **LOCATION:** Community Center. **HOURS:** 10am-5pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

CA - SANTA ANA — ACP Computer Swap Meet. **SPONSOR:** Advanced Computer Products. **LOCATION:** 1310 E. Edinger. **HOURS:** 8am-2pm, rain or shine. **ADMISSION:** Free. **FEATURES:** C - E - FP. **CONTACT:** 714-558-8813.

SEPTEMBER 30 - OCTOBER 1

CA - SAN DIEGO — MarketPro Computer Show & Sale. **LOCATION:** Scottish Rite Center. **HOURS:** 10am-5pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

OCTOBER 1

CA - LIVERMORE — East Bay Area Amateur Radio/Electronics/Computer Swap Meet. **SPONSOR:** Livermore Amateur Radio Klub (LARK). **LOCATION:** Las Positas College, N of I-580 at Airway Blvd exit. **HOURS:** 7am-Noon, rain or shine. **ADMISSION:** Free. **TALK-IN:** 147.045 + (PL 94.8) from W, 145.350 - (PL 100) from E. **FEATURES:** E - H - FP - F/R. **DEALER INFO:** Set-up after 7am only. \$10 space fee. Covered spaces avail. If rain. **CONTACT:** Noel Anklam KC6QZK, 510-447-3857 eves or 510-783-2803 message days.

OCTOBER 7

AZ - BULLHEAD CITY — Fallfest. **SPONSOR:** Tri-City ARC. **LOCATION:** Chamber of Commerce Bldg, 1251 Arizona, Hwy 95. **DEALER INFO:** Inside tailgating: \$15, outside: \$5. **CONTACT:** Dave Sumner KG7XS, 520-763-2589.

CA - SANTEE — Ham Radio, Computer & Electronics Swap Meet. **SPONSOR:** ARC of El Cajon. **LOCATION:** Santee Drive-In, 10990 N. Woodside. **HOURS:** 6:30am-7. **ADMISSION:** 50c. **TALK-IN:** 146.520. **FEATURES:** C - E - FM - F/R - H. **DEALER INFO:** \$7 vehicle. **CONTACT:** Pat WA6MHZ, AR-CEC, Box 50, El Cajon CA 92020. 619-561-0052.

OCTOBER 7-8

CA - SACRAMENTO — MarketPro Computer Show & Sale. **LOCATION:** Cal Expo. **HOURS:** 10am-5pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

OCTOBER 8

CA - FRESNO — MarketPro Computer Show & Sale. **LOCATION:** Holiday Inn. **HOURS:** 10am-5pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

CENTRAL REGION

AUGUST 2-3-4-5

IL - ELGIN — Radiofest '95. **SPONSOR:** Antique Radio Club of Illinois. **LOCATION:** Holiday Inn Holiday and Convention Center, 345 River Rd. **FEATURES:** B - FM. **CONTACT:** Jeff Aulik, 1708 Parkview Ave, Rockford IL 61107. 815-399-1902 eves.

AUGUST 4-5-6

TX - AUSTIN — West Gulf Division Convention. **SPONSOR:** Austin ARC & Austin Repeater Assn. **LOCATION:** Wyndham Southpark Hotel, 4140 Go-

vernor's Row. **HOURS:** Fri 7pm-9pm; Sat 8am-5pm; Sun 8am-noon. **ADMISSION:** Adv \$7, door \$9, under 17 free. **TALK-IN:** 146.34/94. **FEATURES:** B - CB - EX - F - FM - F/R. **DEALER INFO:** Tables \$8 Fri thru Sun, and \$6 Sat only. **CONTACT:** Summerfest, Box 13473, Austin TX 78711-3473; Joe Makeever W5EBJ, 512-345-0800. VE Exam: Larry Gunter WB5BEK, 512-345-7281.

WY - JACKSON-HOLE — Rocky Mountain Division Convention, WIMU '95. **LOCATION:** Virginian Hotel. **HOURS:** Fri: 5pm-8pm; Sat: 8am-7; Sun: 8am-2. **ADMISSION:** Adv. \$10, Door \$13. **FEATURES:** CB - DP - EX - F - FM. **CONTACT:** Warren (Rev) Morton, 1341 Trojan Dr, Casper WY 82609. 307-235-2799.

AUGUST 5

IN - VALPARAISO — Porter County Hamfest & Computer Show. **SPONSOR:** Porter County ARC. **LOCATION:** Porter County Expo Center, US 30 & Ind 49. **HOURS:** 8am-7. **ADMISSION:** \$4 adv. \$5 door, under 12 free. **TALK-IN:** 146.775/-6kc 131.8 PL 146.520 Simplex. **FEATURES:** C - EX - FP - F/R - H T. **DEALER INFO:** Indoor tables \$8, w/elec \$13. **CONTACT:** PCARC, POB 1782, Valparaiso IN 46384-1782. Rich N9QLQ, @ 219-762-8701.

MI - TAYLOR — Computer Trade Show. **LOCATION:** Democratic Club of Taylor, 23400 Wick Rd, 4 blks E of Telegraph. **HOURS:** 10am-3pm. **ADMISSION:** Adults \$4; Seniors & students w/ID \$3; under 12 free w/adult. **FEATURES:** C - DP. **CONTACT:** Computers & You, 313-283-1754.

MO - SPRINGFIELD — Hamfest. **SPONSOR:** Southwest MO ARC. **LOCATION:** University Plaza Trade Center. **HOURS:** 8am-3pm. **ADMISSION:** \$5. **TALK-IN:** 146.91. **FEATURES:** EX - F. **CONTACT:** Ernie DeCamp, % SMARC, POB 11363, Springfield MO 65808; 417-831-8611.

AUGUST 6

IL - PEOTONE — Hamfesters Hamfest. **SPONSOR:** Hamfesters Radio Club. **LOCATION:** Will County Fairgrounds, Take I-57 to Peotone Exit 327 East. **HOURS:** Exhibits 8am-7, Outside flea market 6am-3pm. **ADMISSION:** \$4 adv. \$5 door, under 12 free. **TALK-IN:** 146.52 Simplex, 146.64-, 146.94-. **FEATURES:** AC - C - CB - FM - FP - F/R - H - RV-S. **CONTACT:** John Fleming N9NDH, 13800 Division St, Lot 215, Blue Island IL 60406. 708-489-5872.

IN - ANGOLA — Annual Hamfest. **SPONSOR:** Land of Lakes ARC. **LOCATION:** Steuben County 4-H Fairgrounds, @ 200 W & 200 N, at Crooked Lake. **HOURS:** 7am-2pm. **ADMISSION:** Adv \$3, door \$4. **TALK-IN:** 147.18/78 444.35. **FEATURES:** EX - FP - F/R - H - T. **DEALER INFO:** Tables \$8, set-up Sat 3pm-10pm & Sun 4am-7am. Trunk sales \$2. **CONTACT:** Sharon Brown WD9DSP, 905 W Parkway Dr, Pleasant Lake IN 46779. 219-475-5897.

MI - GRAND RAPIDS — Computer Trade Show. **LOCATION:** Holiday Inn Crown Plaza, 5700 28th St SE, E of I-96 Exit #43. **HOURS:** 10am-3pm. **ADMISSION:** Adults \$4; Seniors & students w/ID \$3; under 12 free w/adult. **FEATURES:** C - DP. **CONTACT:** Computers & You, 313-283-1754.

OH - RANDOLPH — Portage Hamfair '95. **SPONSOR:** Portage ARC. **LOCATION:** Portage County Fairgrounds on St. Rte 44, 3 mi South of I-76. **HOURS:** 8am-4pm. **ADMISSION:** \$4 adv., \$5 door. **TALK-IN:** 145.39 -600MHz 28.390MHz. **FEATURES:** C - DP - FM - FP - H. **DEALER INFO:** Indoor tables \$8, Flea Market Space \$3. **CONTACT:** Joanne Solak KJ30, 216-274-8240, or Portage ARC, 9971 Diagonal Rd, Mantua OH 44255.

AUGUST 12

IL - QUINCY — Ham Radio & Computer Swapfest 1995. **SPONSOR:** Western Illinois ARC. **LOCATION:** Eagles Alps Grounds, 3737 N 5th Street. **ADMISSION:** \$2.50 adv, \$3 door. **TALK-IN:** 147.63/03. **FEATURES:** C - EX - FM - F/R - H. **DEALER INFO:** Indoor Flea Market table \$5, Outdoor tailgating free. **CONTACT:** Randy Jackson N9REY, 217-223-7226; or WIARC, POB 3132, Quincy IL 62305.

IN - INDIANAPOLIS — Indianapolis Computer Fair. **LOCATION:** Quality Inn East. **HOURS:** 10am-3pm. **ADMISSION:** \$4, under 12 free. **FEATURES:** C - DP. **CONTACT:** Ben Yanto, AGI Computer Fairs.*

KS - CHANUTE — Hamfest '95. **SPONSOR:** Chanutte Area ARC. **LOCATION:** Chanutte National Guard Armory, 3051 S. Santa Fe. **HOURS:** 8am-2pm. **ADMISSION:** \$5, under 12 free. **TALK-IN:** 146.745-. **FEATURES:** DP - FM - H. **DEALER INFO:** Flea Market tables \$5. **CONTACT:** Jerry Young, 316-431-3268 eves, Charlie Ward 316-431-6402 eves, Ted Nantz 316-537-6001 eves.

OH - SHARONVILLE — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Sharonville Convention Center. **HOURS:** 10am-4pm. **ADMISSION:** \$6. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

SD - HURON — Amateur Electronics Swapfest. **SPONSOR:** Huron ARC. **LOCATION:** National Guard Armory, SD State Fairgrounds. **HOURS:** 8am-3pm.

ADMISSION: \$3. **TALK-IN:** 146.82(-), 146.22/.82MHz. **FEATURES:** DP - E - EX - FM - F/R. **DEALER INFO:** Tables \$5, Set-up 7am. **CONTACT:** Lloyd Timperley, WBOULX, POB 205, Huron SD 57350. 605-352-7896 eves.

WI - SUGAR CAMP — Northwoods Hamfest. **SPONSOR:** Rhinelander Repeater Assn & Northwoods ARES. **LOCATION:** Sugar Camp Town Hall, N of Rhinelander on Hwy 17 to Camp Four Rd. **HOURS:** 8am-2pm. **ADMISSION:** \$2. **TALK-IN:** 146.940-. **FEATURES:** DP - EX - F/R - H. **DEALER INFO:** Tables \$5. **CONTACT:** Mary Berger NS9Q, 367 Lois St, Rhinelander WI 54501. 715-362-9296.

AUGUST 12-13

LA - BOSSIER CITY — ARRL Hamfest. **SPONSOR:** Shreveport ARA. **CONTACT:** Alice Prudhomme KG5ZZ, 171 Sloan Rd, Mansfield LA 71052. 318-872-5988.

OH - PAULDING — 5th Annual Hamfest & Saturday Nite Flea Market. **SPONSOR:** Paulding County ARC. **LOCATION:** Paulding County Fairgrounds. **HOURS:** Flea Market: Sat 3pm-8pm, Hamfest: Sun 8am-4pm. **ADMISSION:** Sat Flea Market: Free, Sun Hamfest \$3, under 12 free. **TALK-IN:** 147.285 + 444.225 +. **FEATURES:** CB - DP - EX - FM - F/R - H. **DEALER INFO:** Sat Flea Market: Space/table \$2, Sun Hamfest 8' inside table \$10, outside space \$4 + admission. **CONTACT:** Jerry or Dorothy Rhodes, 10392 SR 500, Paulding OH 45879. 419-399-4507.

AUGUST 13

IA - Cedar Rapids — ARRL Hamfest. **SPONSOR:** Cedar Valley ARC. **CONTACT:** Wayne Kolosik NOUGK, 65 Samoa Dr, Hlawatha IA 52233. 319-393-4224.

MI - DEARBORN — Computer Trade Show. **LOCATION:** Adray Sports Arena, 14900 Ford Rd (M-153), 1 blk E of Greenfield. **HOURS:** 10am-4pm. **ADMISSION:** Adults \$4; Seniors & students w/ID \$3; under 12 free w/adult. **FEATURES:** C - DP. **CONTACT:** Computers & You, 313-283-1754.

AUGUST 13-14-15-16-17

MI - DETROIT — The 61st Annual Conference of the Associated Public Safety Communications Officials - Internl. **LOCATION:** COBO Conference/Exposition Center. **CONTACT:** APCO, 1-800-949-2726 ext. 249, 250, 226.

AUGUST 20

IL - ORLANDO PARK — The Orland Park Computer Show. **LOCATION:** Orland Park Civic Center, 147th St & LaGrange Rd (Rte 45). **HOURS:** 9:30am - 3pm. **ADMISSION:** Adults \$5 - \$1 off with copy of this ad. 8-12 yrs \$2, under 8 free. **FEATURES:** AC - C - CB - FP - F/R - All indoors. **CONTACT:** 24-hour Hotline 708-974-3123.

MI - MADISON HEIGHTS — Computer Trade Show. **LOCATION:** UF & CW Hall, 876 Horace Brown Dr, 1 blk E of I-75, 1 blk S of 13 Mile Road. **HOURS:** 10am-3pm. **ADMISSION:** Adults \$4; Seniors & students w/ID \$3; under 12 free w/adult. **FEATURES:** C - DP. **CONTACT:** Computers & You, 313-283-1754.

OH - AKRON — Computer Trade Show. **SPONSOR:** Peter Trapp Shows. **LOCATION:** Tadmor Shrine Temple. **HOURS:** 10am-3pm. **ADMISSION:** \$6, \$1 off w/this ad or coupon, under 12 free. **FEATURES:** C - FP - F/R. **CONTACT:** Peter Trapp Shows, 607-369-2796.

OH - BROADWAY — Hamfest & Computer Show. **SPONSOR:** Union County ARC. **LOCATION:** Community & Civic Complex on Rte 347, 1 mi West of St. Rte 31. **HOURS:** 8am-2pm. **ADMISSION:** \$4 adv., \$5 door. **TALK-IN:** 147.39 + no PL. **FEATURES:** C - CB - EX - FM - F/R - H. **DEALER INFO:** Inside table \$15, 10' flea market space \$5, Set-up, Sat noon-9pm or Sun 6am-8am. **CONTACT:** Gene Moore, 24461 Claiborne Rd, Marysville OH 43040. 513-246-5943.

OH - WARREN — 38th Annual Hamfest. **SPONSOR:** Warren ARA. **LOCATION:** Kent State Univ, Trumbull Branch Campus @ State Rte 5 bypass and State Rte 45. **HOURS:** Outside Area open @ 6am. Inside area opens @ 8am. **ADMISSION:** \$4, under 12 free. **TALK-IN:** 146.97MHz 443.00MHz. **FEATURES:** AC - DP - EX - F - FM - H. **DEALER INFO:** Outside Flea Market \$3/10' space. **CONTACT:** WARA, POB 809, Warren OH 44482. Al Van Slyke, N8IKX, 216-889-3378.

AUGUST 26

MI - WESTLAND — Great Lakes Computer Expo & Sale. **SPONSOR:** Progressive Computer Productions. **LOCATION:** Wayne-Ford Civic League, 1645 Wayne Rd, 1 blk S of Ford Rd. **HOURS:** 10am-4pm. **ADMISSION:** Adults \$4, Seniors/Students \$3, under 12 free w/adult. **FEATURES:** C - DP - FP - F/R. **DEALER INFO:** Covered 8' table \$35 ea. **CONTACT:** Progressive Computer Productions, 23814 Michi-
Continued on page 139

HOMESAFE! Infrared Security Light System

The heart of the HOMESAFE! is the infrared sensor which creates an invisible security shield wherever you place it. HOMESAFE! "sees" and "feels" the heat and movement of people - and of some objects like automobiles as they enter the invisible security shield. The result is instant light - when you need it. And HOMESAFE! turns the lights off automatically after the person or object is gone. New, in box.

95Z011 \$9.95 each

SIGNAMAIL™

This transmitter/receiver pair is designed to alert you when your mail comes. The transmitter is activated by a tilt switch and broadcasts a coded tone that turns on a light and plays a tune in the receiver. These units have dozens of other uses such as perimeter or driveway alarms, gate warning, game trails, etc. The internal tilt switch is easily bypassed for remote switching. Both units run on 9V. Documentation included.

95Z012 \$14.95 each

DELTROL 12VDC 0.5A SOLENOID

Pull type. Measures approx. 1" x 0.5" x 0.5". Stroke 0.5".

93B007 95¢ each

CIRCUIT WORKS CONDUCTIVE PEN

Makes instant silver conductive traces on most surfaces. Dries in minutes at room temperature. Valved pen tip for easy application. Solderable at low temperatures. Use where conductive electronic traces are needed.

93Z002 \$9.49 each

SILICON VALLEY "GOLD"

Over 50 pounds of printed circuit boards from computers, monitors, modems, test, RF and microwave equipment, all stuffed with goodies such as toroids, ICs, switches, sockets, connectors, oscillators, crystals, transistors, diodes, varactors, varistors, etc. A gold mine of usable parts.

92U033 50 Lbs for \$49.95

SLEUTHPIECE

Sherlock would have liked this 3" double magnifier. The main lens magnifies 2X. For a closer look, a small inset lens magnifies 4X. It beats squinting.

MW7507 \$5.69 each

PELTIER JUNCTIONS

Thermoelectric heat pumps as used in '486 fans, drink coolers, coffee warmers, and other neat stuff that wants to be heated or cooled. Up to 65°C temperature differential.

94U001 - 1.56" sq. \$34.95 each

93U004 - 1.1875" sq. \$24.95 each

COLOR CCD TV CAMERA

Adjustable focus 4.3mm lens, f1.8. Runs on 10-18 VDC @ 1.6W. Output is NTSC video with 330 x 330 resolution, sensitivity 3 Lux. Chinon CX-062/4.

95V009 \$299.95 each

SEMIPOTPOURRI

One pound of mixed transistors and diodes. Big assortment of signal, power, UHF, RF, Schottky - all kinds of goodies.

95Z013 \$19.95

DISK MAGNET

3/4" diameter with 1/4" center hole, 1/4" thick.

95N005 25¢ each

FRESNEL LENS

15 1/2" diameter lens with 10 1/2" square usable area. Approx. 9" focal length.

95L006 \$11.95 each

AIRPAX MINI STEPPER MOTOR

15°/step, 1" diameter. Has mounting ears and small pulley attached.

94M002 \$1.49

RACK MOUNT CABINETS

These industry-standard 19" rack mount cabinets are made from 0.04" steel, with the front and rear panels being made from 0.06" aluminum for easier, custom fitting. These cabinets have been finished in gunmetal grey and come flat packed, ready for final assembly. These enclosures have die punched venting. Handles are furnished on all cabinets except RC3120A. These are sturdy, well-made, commercial quality cabinets and are sure to make your project look its best.

RC3120A - Front panel 19" x 1.6875" 1.5"H x 16.625"W x 9.625"D - \$38.00

RC3120B - Front panel 19" x 3.4375" 1.5"H x 16.625"W x 9.625"D - \$46.00

RC3120C - Front panel 19" x 3.4375" 3.25"H x 16.625"W x 13.1875"D - \$53.00

RC3120D - Front panel 19"x 5.1875" 5"H x 16.625"W x 13.1875"D - \$58.00

RC3120E - Front panel 19" x 5.1875" 5"H x 16.625"W x 16.75"D - \$63.00

RC3120H - Front panel 19" x 8.6875" 8.5"H x 16.625"W x 16.75"D - \$83.00

ROBOTICS RELAY

Control circuits up to 2500 Watts with a DC pulse. This 12-30V latching relay will stay in position until it receives a second pulse. Control the unit from a simple SPDT-NO switch or from logic. Ideal for robotics, power control, remote control or controlling a load from several locations. Application notes included.

94B010 \$7.95 each

MINIATURE C-BAND LNB

Low-noise block converter. Better than 40°K noise temperature. Spec sheet included.

94G001 \$49.95 each

LASER POINTER

The latest technology in laser light pens! This solid-state laser emits a red light up to 5mW at 670nm that will produce a spot on objects up to 100 ft. away. Use as a pointer/instructional aide, tease your cat, or use as a sight for your peashooter. Buy two so you and a friend can have lightsaber battles on foggy nights. Two AAA cells and carrying case included.

94L007 \$49.95 each

PRECISION EYEPIECE

21mm f:3.5. Four coated glass lenses in black aluminum case measuring 1.15625" long by 1.0" diameter. Excellent correction of all aberrations for an angle of 35 deg. without vignetting. Resolution in focus is 385 lines/mm when the image of object is in focus (D=6mm), or 500 lines/mm when object is in focus (numerical aperture 1.41). Possible applications include: objective lens for scanners; photographic objective enlarging nearly 10X; objective for a hand-held microscope, enlarging from 30X to 120X (numerical aperture=1.41); lens working with light sensor or emitter as a precise focusing element; or lens for shaping a laser beam.

92L031 \$9.95 each

BRAND NEW SOLAR PANELS

12 Volt, 1 Watt - 4" x 12" (92E005) \$14.95

12 Volt, 2 Watt - 6" x 12" (92E006) \$24.95

12 Volt, 4 Watt - 12" x 12" (92E007) \$39.95

Other sizes and voltages available.

Call of fax for stock check.
OEM pricing and custom panels available.

THE WORLD BELOW 500 KILOHERTZ

By Peter Carroll, Jr. A handy introduction to the world of longwave listening. Covers VLF, GWEN, Loran, Omega, ELF, Lowfres, frequency use, receiver and antenna information, tuning tips and much more. Not a beacon directory. 64pp.

92X015 \$4.95

TELEPHONE LINE TEST MODULE

When hooked up to your phone line, this unit will flash and answer the line after the first ring - then hang up! Originally used for testing. Can be used to thwart prank phone callers. Two alligator clips make hookup easy.

95Z002 \$2.49 each

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

SUPER MOUSE

This mouse comes with its own house - a pocket to hang on the side of your computer for storage. Three buttons with hi-res microswitch type click switches, 400 DPI. Comes with its own mousepad, DB9 to DB25 adapter, DOS and Windows compatible software on both 3.5" and 5.25" disks.

MUSGD All for \$9.95

UNIVERSAL FLOPPY DRIVE CABLE

Has both IDS and IDE connectors and works with one or two drives. 24" long.

95C006 99¢ each

CD-ROM JEWEL CASES

Use for CD-ROMs sold without a case or as a replacement for a broken one. These have been salvaged from unsold, obsolete software.

95U004 Three for \$1.00

VOICE MESSENGER C-64 Speech Synthesizer

This ROM cartridge is a completely self-contained text to speech synthesizer that plugs into your C-64 / O port.

95C016 \$9.95 each

RECYCLED DISKETTES!

1.44MB, 3 1/2", bulk erased, from unsold software.

95C017 100 for \$25.00

COMPACT PRINTER BUFFER

256K, parallel interface.

PB256 \$49.95 each

POWER CENTER

Individually lighted control switches. Lighted master on/off switch. Five heavy duty grounded power outlets controlled individually by front panel switches (Computer, Monitor, Printer, Aux1, and Aux2). 15A circuit breaker.

94C006 \$14.95 each

MULTI-VOLTAGE POWER BRICK

+5V DC @ 500mA, +12V and -12V DC @ 415mA.

95E023 \$9.95 each



ALLTRONICS

2300 Zanker Road - San Jose, CA 95131-1114

(408) 943-9773 - Fax (408) 943-9776

Catalog by E-Mail: info@alltronic.com

On-Line Ordering (408) 943-0622 • 14400-N-8-1-24 Hrs

Visa, M/C, AmEx Accepted.
Minimum Order \$15.00.
California Residents Add Sales Tax.
Shipping Additional on All Orders.

Store Hours:
10-6 M-F - 9-3 Sat.



TEST EQUIPMENT: We buy and sell late model HP, TEK, Fluke, Wavetek, GR, etc. All equipment we sell is calibrated and guaranteed to meet manufacturers specifications. **KANDEL ELECTRONICS, Inc.**, PO Box 204, Orelan, PA 19075. Toll Free 1-800-582-TEST (8378), 215-233-6100, FAX 215-886-7017.

LOGIC ANALYZERS: HP1630D logic analyzer (100MHz timing, 25MHz state) \$995. Pods for HP 1600A \$39 each. Tek 7D01/DF1 logic analyzer plug-in (to 100MHz) \$225. Tek DAS 9129 color systems, up to 660MHz — low prices. Analyzers sold with pods, warranty. Pepper Systems, 214-353-0257.

TEK 78440 oscilloscope dual beam 400MHz \$700. Dexis, 612-944-7670.

HP 8640B OPT 323 solid state signal generator frequency range 450KHz to 512MHz to 1100MHz with external frequency doubler. 713-473-6462, \$850.

BUY, SELL, late model test equipment, all makes. Buy parts for HP, Tek and Fluke. Jim, JCS, Ph: 800-44-TESLA, FAX: 510-475-0442.

HUGHES MD 1277H TWTA 8.0-12.4 GHz. AT 20 watts Singer microwave amplifier MD. 563A 7-12.4 GHz. 1 watt. Krohn-Hite MD. DCA-10 wide band amplifier 10 watt DC. 517-876-6363 MI.

K&L TUNABLE BAND PASS FILTERS model 5 BT-250/5005N. Frequency range is 250-500 MHz. These lab quality filters are 5 section and have N(F) connectors. Quantities available. \$130 includes CONUS shipping. Brian Kent (Kentrionix), PO Box 2444, Farmingdale, NJ 07727. 908-681-3229, FAX 908-681-3312.

EIP MD 575 sourcelocking microwave counter opt. 04 Austron, Inc. 2100F Lorian-C frequency monitor Natel Engineering Co., MD. 2088 8 channel carrier amplification system. 517-876-6363 MI.

TEKTRONIX 7000 SERIES VERTICAL AMPLIFIERS: 7A13 105MHz differential comparator (LED) \$375. 7A18 75MHz dual-trace \$65; 7A18A (newer version) \$90; 7A18A/6 (with variable offset) \$120. 7A22 1MHz high-sensitivity, differential \$375. 7A24 400MHz dual-trace \$250. 7A26 200MHz dual-trace \$135. 7A29 1000MHz single-trace \$750. 7A42 350MHz 4-channel \$595. Excellent condition! Other plug-ins, mainframes, package discounts. Pepper Systems, 214-353-0257.

WANTED! 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.

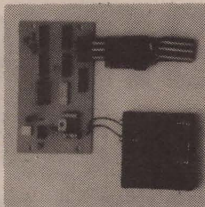
HP 8683B 2.3-6.5 GHZ SIGNAL GENERATORS. UP TO 5MHZ MODULATION DEPTH AT DC-10MHZ RATE! Built-in pulse generator. LED readouts. '89 HP price \$16,000; \$2,600/offer. 90-day warranty. 619-439-1345 or 1-800-TO-BUY-TE.

SUREWRIT 9™ PLUS DEVELOPMENT SYSTEM. For Hackers Only who like to study the VC II Plus and old VC II. Send SASE for flyer of SW9 Plus features. **TRI-ANGLE PRODUCT DISTRIBUTORS USA**, 5750 Lakeshore Dr., Holland, MI 49424. 616-399-6390, M-F 9am to 2pm EST.

BUY AND SELL late model test equipment: HP, Fluke, Genrad, Tek and Wavetek. Call Dennis at G P T E Surplus, 408-749-9805, FAX 408-749-9806.

As Seen On "Good Morning America"

EASILY DISARM MOST AUTO ALARMS in less than 10 minutes with the *Alarm Dominator Jr!*



- ▶ Portable, remote device needs no access to auto.
- ▶ Easy to use, just flip a switch and wait for the "Chirp, Chirp."
- ▶ Perfect for locksmiths, law enforcement, alarm installers, repo pros, tow truck operators, etc...
- ▶ Battery operated PC board measures just 2 1/2" X 4 1/2" and comes complete with easy to use instructions.

Sales to qualified buyers ONLY. Prepaid orders, C.O.D.s, and the American Express Card are gladly accepted.

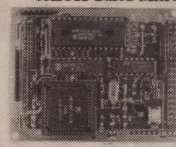
Easy to Build Kit : \$69.95
Assembled & Tested: \$99.95
Enclosure: \$10.00
Standard Shipping: \$5.00

Dominator Technologies, Inc.
12062 SW 117 Ct., Suite 132
Miami, FL 33186
(305) 271-2737

Write in 99 on Reader Service Card.

OEM WME2

68HC11 Based Micro-Controller



STANDARD FEATURES

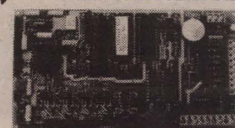
- Supports A and E Series HC11's
- Single 5 Volt Supply Operation.
- 32K x 8 On-Board RAM.
- 9.8304 Mhz Crystal Oscillator.
- Serial Host / Reload Port.
- Supports ALL HC11 Operating Modes.
- Designed for easy Board-Stacking.
- Full Reset / Power Supply Management.
- Tiny 2.5 by 3.5 inch footprint.
- RAM can be Battery Backed.
- Easy Memory Banking Logic.



\$119 Plus \$5 S&H
CT Residents please add 6% Sales Tax.
Single Piece Price!

STAND ALONE WMS11

68HC11 Based Micro-Controller



STANDARD FEATURES

- FAST 9.83 Mhz Operation.
- RS-232 Host Interface.
- 32K RAM - 32K EPROM.
- Trimmable Crystal Oscillator.
- Configurable Analog Input Buffers.
- Buffered and Optically Coupled I/O.
- Single Supply - Local Power Regulation.
- Full Reset / Power Supply Management.
- Battery Backup the RAM or Entire Board.
- Banked Memory Logic allows up to 2Ming.
- Four Pre-Decoded Chip-Selects Available.
- Buffalo Monitor Supplied on EPROM.
- BASIC1 and Real-Time Kernel Available.

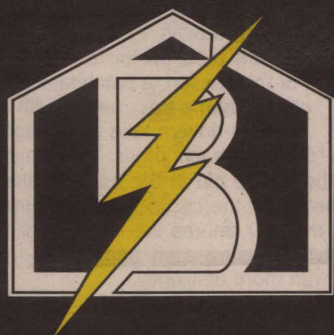


\$159 Plus \$5 S&H
CT Residents please add 6% Sales Tax.
3 Marine Avenue
Clinton, CT 06413
(203) 669-0401 fax (203) 669-2838

Write in 139 on Reader Service Card.

❖ ATTENTION CABLE VIEWERS ❖

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



BASIC ELECTRICAL SUPPLY & WAREHOUSING CORPORATION

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 • 708-582-2099

Electric Car Aerodynamics

by Shari Prange

When people think of improving electric vehicle performance, they automatically think about batteries and controllers and so forth. However, one of the dominant factors in performance has nothing at all to do with the drive system. It's aerodynamic drag.

If you've driven cars with different body shapes, you've felt the difference. A sports car slices through the air much more easily than a boxy van. In fact, a typical subcompact sedan expends 35% of its energy just overcoming aerodynamic drag. That's energy stolen from speed and range.

Aerodynamic drag affects performance in a more subtle manner, too. It causes the vehicle to work harder, and draw more current from the batteries. This stresses components more and generates heat.

How important aerodynamic drag is to you will depend on the kind of driving you do. At low speeds, it isn't very significant. However, drag is calculated by the vehicle's velocity squared. This means its rate of increase is exponential, not linear. Since most of us do a portion of our driving at freeway speeds, it is a very relevant issue.

Form Drag

Although there are many aspects of aerody-



The optimum aerodynamic shape is the flattened teardrop used by this solar race car.



This tiny electric racer has optimum aerodynamics — but limited practicality.

Once you've chosen a body style, you can look for the optimum shape within that category. Look for rounded features. Avoid fenders that sit higher than the hood.

The shape of the back of the car is just as important as the shape of the front. A squared-off rear window or trunk creates a pocket of partial vacuum or "negative pressure" behind it as the car moves through the air. This vacuum pulls on the car from behind. For this reason, a hatchback is a better choice than a boxy sedan with a trunk.

Race drivers take advantage of this

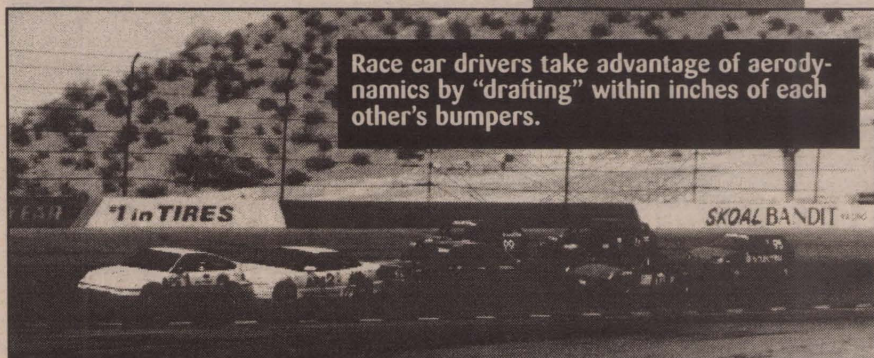
effect by "drafting" each other, with only inches between them. The car in the front breaks a path through the air for the car in the rear. Surprisingly, the car in the rear returns the favor by eliminating the negative pressure area behind the front car. They both run more efficiently.

All those nifty styling creases and vents are a drag — literally. That's why, as manufacturers have all worked to increase gas mileage in recent years, all the late-model cars have come to resemble pats of slightly melted butter, with no "character line."

In general, the newer the car, the better the aerodynamic design. Fairly subtle changes in things like door handles, mirrors, and rain gutters from one year's model to the next will make a substantial improvement in drag.

Think of the air as perfectly still while the car moves through it. The goal is to disturb the air as little as possible. Small details can generate vortices of turbulence. The energy that sets the still air spinning into motion is energy stolen from the moving car.

Race car drivers take advantage of aerodynamics by "drafting" within inches of each other's bumpers.



rounded teardrop shape. However, most of us don't have the resources to build a car from scratch. Even if we did, we would have to allow for practical considerations, such as kids, groceries,

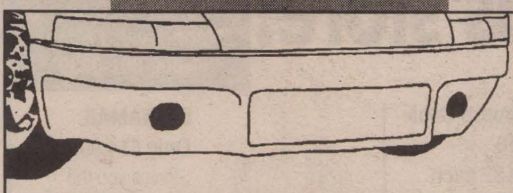
and personal comfort.

Your choice of vehicle type for conversion will be determined by your mission for the vehicle. A sports car is fine for commuting alone, but you may need a sedan to carry a large family, or a pickup truck to haul materials.

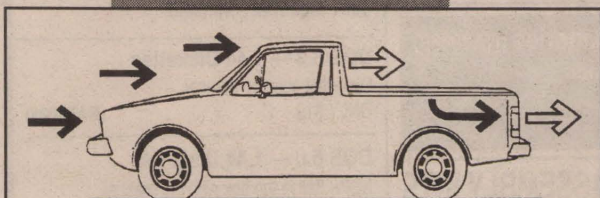
namic drag, this is the one we think of first. "Form drag" refers to the way the car's shape affects the flow of air over it. Obviously, a boxy shape has more drag than a streamlined one.

If we could build a car from scratch, we could minimize drag. The final result would be a low,

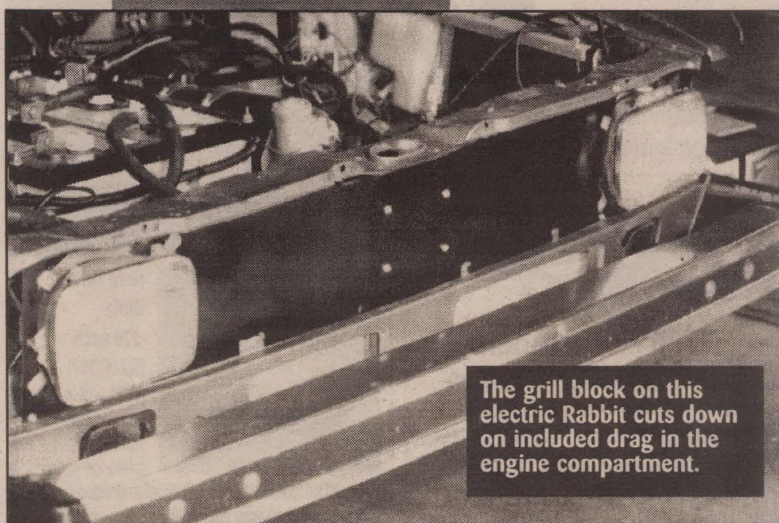
ELECTRIC CAR CONVERSION



A chin spoiler helps direct the airflow smoothly to the sides of the car. (Drawing courtesy of Electro Automotive.)



Aerodynamic drag can take the form of positive air pressure pushing (black arrows) or negative air pressure pulling (white arrows). (Drawing courtesy of Electro Automotive.)



The grill block on this electric Rabbit cuts down on included drag in the engine compartment.



A mid-engine car like the Porsche 914 already has a bellypan under the front.

Ground Clearance

While form drag refers to airflow over and around the car, there is also airflow between the car and the road. Formula race cars are confined to manicured race courses because they have almost no ground clearance, and will bottom out on a deep shadow.

In real life, unfortunately, we have to contend with potholes and speed bumps. But there are chin spoilers and side skirts suitable for street use and available for many models of cars.

A chin spoiler fits below the front bumper and directs the air around the car rather than under it. Side skirts fill in the area between the front and rear wheels, and keep air from swirling in from the sides.

A little care is called for when shopping for these accessories. Some models are designed to genuinely enhance airflow. Others simply enhance the driver's image. You will also need to exercise care when driving, and watch out for those potholes and speedbumps.

Included Drag

We've talked about airflow over, under, and around the car. Now, we'll look at airflow through it.

"Included drag" refers to the air that gets trapped inside the engine compartment. In an internal combustion vehicle, a certain amount of this is unavoidable, because the airflow is needed for cooling. However, since an electric car is so much more efficient, it doesn't throw off a lot of waste heat, and therefore doesn't need as much cooling.

The two parts of the electric car that need some airflow are the speed controller and the motor. With careful planning, air can be directed to these two areas only. You may need to use a duct. If you do this, it is also important to give the air a clear escape path. If the components are thoroughly sealed off, you may need to add a fan.

Blocking off the front grill area improves aerodynamics enormously. In addition, you may be able to mount your controller on the inside of an aluminum plate that doubles as a grill block and controller heat sink.

Air also flows up into the engine compartment from below. Since you no longer need frequent access to the underside of the car for oil changes, you can cover it with a bellypan. This has the added benefit of protecting your motor and other components from road splash, dust, rocks, and winter sand and salt.

A bellypan can be made from any sturdy, smooth, lightweight material. It should NOT be installed permanently with rivets, welding, or epoxy. You don't need to access the bottom of the car often, but someday you may want a new clutch or motor brushes or something.

Although the engine compartment is the most important area to seal off, any place there is an indentation or protrusion under the car will be improved by a bellypan.

Ride Height

Restoring the car's original ride height and weight ratios front-to-rear is important for many reasons. One of them is aerodynamic drag. Even a slight change in the angle of the car's horizontal axis can make a significant difference in the airflow.

A common mistake in electric car conversions is gathering all the components into one nice big box under the hood, then stashing all the batteries in the trunk (and maybe back seat). This is compounded by neglecting to make any adjustments to the suspension to compensate for the poor weight distribution.

The car rides nose high and tail heavy. It is unsafe in turns, and has lousy aerodynamics.

Especially on later model cars, the body has been designed for optimum airflow at a specific height and angle. Be sure your finished conversion maintains these numbers.

Pickup Trucks

Light pickups are popular conversions, but they offer their own challenges. As with sedans, the later models will have more aerodynamically designed noses. However, there are also the problems of negative pressure areas behind the cab and the tailgate. The inside of the bed also provides a great big dose of included drag.

The best solution is a streamlined cap on the truck bed. This removes the negative pressure behind the cab and the included drag of the bed, all at once.

A cheaper and slightly less effective solution is a *tonneau* cover for the bed. This will reduce (but not eliminate) the negative pressure behind the cab, and eliminate the included drag against the tailgate.

The third solution is replacing the tailgate with a net. This allows the air to flow through, and eliminates included drag and negative pressure at the tailgate, although it does nothing for the negative pressure behind the cab.

As with the bellypan, don't do anything permanent and irrevocable to the tailgate, like throwing it away, or cutting it off if it can't be unbolted. Someday, you may want a solid tailgate behind your load.

Flares

The effect of boxy rear ends on vans and truck caps can be reduced by using add-on flares. These are sold as accessories to help keep the back of the vehicle clean. They do this by subtly breaking up the negative pressure area that sucks up road dirt and exhaust fumes (on gas cars) and sprays them against the vehicle.

A little forethought in choosing a chassis can make a big difference in the performance of an electric car conversion. Even after the fact, big improvements can be made fairly easily. After all, driving an electric car shouldn't be a drag. NV

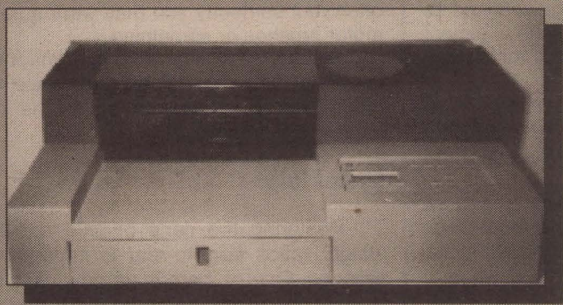
RA Enterprises. . . A real surplus store!

ORDER HOT LINE

8:00 am — 4:30 pm PST

Monday — Friday

1-800-801-0230



HP 7550A 8-pin Automatic Sheet Feed Plotter (RA00066)

Tested good! Serial and HP-IB interface

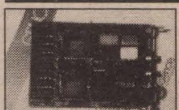
- High throughput
- Ideal for high volume, shared environments
- Uses drafting media and pens
- Requires minimum operator supervision
- Accepts A3/B- and A4/A-size paper

ONLY \$195



MacQuil by Nest Software \$10 each

A nice little word processor with page layout features for Mac Plus, SE, Classic, LC, Mac II, Notebook or Quadra systems with 6.0.2 or later operating system. (RA00057)



Genoa Super EGA HiRes+ Adapter . . . ONLY \$19

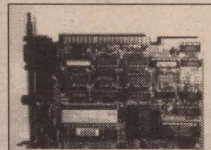
New, in the box with manual and software. Up to 800 x 600 on multisync monitors. (RA00042)



MacVision ONLY \$10 each European PAL ver.3.0

- Capture images from video camera, VCR's and other video sources easily

- Integrate images into databases and personal files
- Desktop publishing (Not for NTSC systems) (RA00058)



Sperry 8-Bit CGA Card Only \$10 ea

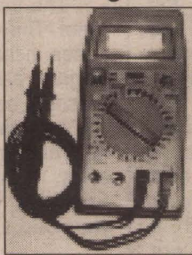
or \$7.50 for 20+
• New, in the box
F4764 short-port
(RA00061)

color interface card

DTC CONTROLLER CARDS NEW - In Box - 30-day Warranty!

Description	Interface	Description	Price
3250AS	SCSI	8-bit Hard/Floppy	\$30
5150XL	MFM	8-bit Hard Drive Only	\$15
5160X	RLL	8-bit Hard Drive Only	\$10
5187	RLL	16-bit 2:1 Hard Drive Only	\$10
5280	MFM	16-bit 2:1 Hard Drive/Floppy	\$15
5287	RLL	16-bit 2:1 Hard Drive/Floppy	\$15
7180	MFM	16-bit 1:1 Hard Drive Only	\$15
7187	RLL	16-bit 1:1 Hard Drive Only	\$10
7287	RLL	16-bit 1:1 Hard Drive/Floppy	\$15
DT3767	IDE	16-bit Hard Drive Only (Not DTC)	\$5
CCI	SCSI	8-bit Hard Drive Only (Not DTC)	\$20

Digitek DT-3800 Full Range DMM — ONLY \$22



- 5DCV ranges ± 0.5 %
- 5 ACV ranges ± 0.8 %
- 7 DCA ranges ± 0.5 %
- 7 ACA ranges ± 1 %
- 6 Ohms ranges ± 0.8 %

- Diode & Transistor Tester
- Continuity Buzzer
- Leads, manual and battery

New — In the box!
(RA00039)



Keyboard Cable KB-10 Only \$2 each

New, in the box from The Info

Cable. Ideal for IBM PC XT/AT or other compatible keyboards. (RA00052)

CMOS Clock Batteries (RA00069)

NEW! ONLY \$4 each

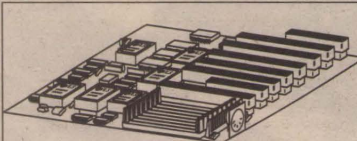
4.5 Volt alkaline with standard 4-pin keyed connector

COMPUTER ASSEMBLY KITS (RA00070)

Kit contains:

- Speaker and mounts
- Drive rails
- Rear panel filler plates
- Hardware
- Standoffs
- AA Battery holder fits 4-AA's
- Rubber feet (4)

ONLY \$5



386 Motherboard

ONLY \$24 each, Five for \$100

386SX-16 with CPU. Standard size board six 16-bit slots, two 8-bit slots, AMI BIOS, keyboard controller, tested with info sheet for hookup. Will take eight—30-pin SIMMs.



Zircon Electra Level ONLY \$10

This is a new electronic water level that you can use for any project you have that you need to make sure it's level —

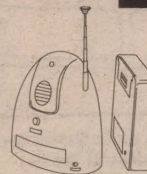
even around corners. Ideal for business or at home. (RA00065)



Block and Tackle \$15

This is a new item with maximum capacity of 750 lbs.

These are priced to move quickly. (RA00028)



SIGNAMAIL

Only \$14.95 ea

Signals you the moment your mail is delivered. Separate transmitter and

receiver (49MHz narrowband FM) Range 500+ feet. Xtal controlled.

DOS 6.2 — 1.44 Diskettes

Diskettes only, no manual

ONLY \$19 (RA00038)

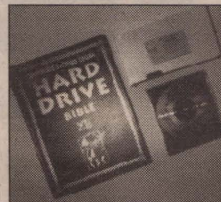
DOS 5.0 — 1.44 Diskettes

NEW! Still in the box with the manual.

ONLY \$19 (RA00072)

High-Grade Shielded Cables

- Heavy duty 6 ft parallel printer cable. 45° angle DB25, ground wire on electronics connector. \$5 each (RA00033)
- 25 ft DB25F to DB25M with 25 pins connected straight through. \$10 each (RA00031)
- 100 in. DB25F to DB25M with all 25 pins connected straight through. \$19 ea (RA00029)



Hard Drive Bible

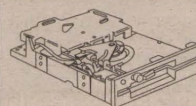
\$29 each

(RA00047)

NEW, Still in the box. This is the definitive

reference source

for hard drives. It includes CD-ROM and video tape. It will look great on your bookshelf.



1.2 MB FLOPPY DISK DRIVES MIXED BRANDS

Panasonic - HP -

Teak. Tested good and come with a 30 day exchange warranty. Sorry no choice of brand at these prices. (RA00051)

\$19 each or 10 for \$12.50 each

Laser Labels

210 4" x 3-1/3" Shipping Labels

- \$3 ea. or 12 pkgs \$25 (RA00055)

510 2-3/4" x 1" Clear Matte Labels

- \$3 ea. or 12 pkgs \$25 (RA00054)

50 sheets of 8-1/2" x 11" Transparency Film

- \$5 ea. or 12 pkgs \$40 (RA00056)

Special ORDER HOT LINE ONLY

1-800-801-0230

Order Line Hours: 8:00 am — 4:30 pm PST

Monday through Friday

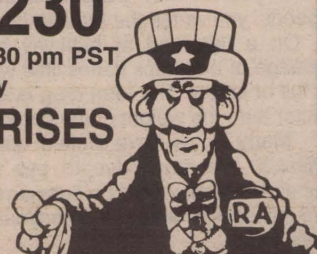
RA ENTERPRISES

2260 De La Cruz Blvd.

Santa Clara, CA 95050

Tel: 408-986-8286

Fax: 408-986-1009



We Accept Discover Card, VISA, Mastercard, Check, Money Order and COD Orders.

This Advertisement is our catalog. All items subject to prior sale. Minimum order \$10.00 plus shipping and handling charges. All orders shipped FOB Santa Clara, CA via UPS ONLY. Ground shipping unless otherwise requested. There is a \$5.00 UPS charge added to COD orders. All items are sold as-is, and no warranty is expressed or implied unless otherwise noted.

Metric Equipment Sales, Inc.

800-432-3424

Fax: 415-341-8874

E-mail: metricsale@aol.com



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 84 on Reader Service Card.

#80 TEST EQUIPMENT cont.

TEKTRONICS OSCILLOSCOPES: TEK 465, 100MHz \$450; Tek 465M, 100 MHz, \$425; TEK 466 100MHz \$995; Tek 468 100MHz \$1,200; Tek 475 200MHz \$595; Tek 485 350MHz, \$795. **Calibrated**, in perfect working condition, **guaranteed** for 90 days. ISA, PO Box 6955, Laguna Niguel, CA 92607. 714-488-0010, FAX 714-488-0299.

TEST EQUIPMENT Sale: Halycon 803B Datalink ana, \$300; Guildline 9936 voltage calibration system, \$1,000; Weksler 0811PU 7-day vacuum circular chart recorder, 0-30" \$150; Wayne Kerr B221, Q221 Z bridge, \$150; video research AN/TNH-21 reel-to-reel tape recorder, \$200, digital VR160 color monitor, \$150 (for digital equipment). A-Comm Electronics, 7198 S. Quince St., Englewood, CO 80112. 303-290-8012, 303-290-8133 FAX.

HEWLETT PACKARD 5245L counter, DC to 50MHz, \$69. **1MHz** oscillator assembly, \$35. **Readout cards** with nixies, \$15. Misc. parts, covers. **Ed Matsuda**, PO Box 390613 San Diego, CA 92149. 619-479-0225.

TEST EQUIPMENT, ETC: HP 8112A 50MHz programmable pulse generator \$3,300. HP 8350B sweeper mainframe \$4,300. HP 11869A 86200-series plug-in adapter for 8350B \$375. HP 214B high-power pulse generator \$1,650. HP 7580B 8-pen drafting plotter, sizes A-D \$1,475. Fluke 540B thermal transfer standard \$1,500. Tek 1105 portable battery-operated inverter, for 465, 475 etc. scopes, and TM 500 series mainframes \$195. Tek 390AD dual-channel waveform digitizer \$600. HP 6002A autoranging 200 watt power supply \$750. HP 6227B 0-25V 0-2.0A dual tracking lab power supply \$475. HP 6443B 0-120V 0-2.5A power supply \$450. Kikusui PLZ 300W electronic load \$600. HP 8405A vector voltmeter \$395. HP 8015A 50MHz pulse generator \$425. HP 8016A 50MHz 9-channel ECL/TTL word generator \$400. GR 1689 LCR meter \$2,400. HP 59401A bus system analyzer for GPIB \$675. Excellent condition! All with warranty. Pepper Systems, 214-353-0257.

SOR-POWER supply 0-10 volt, 0-40 amp, DCR 10-40B \$140. Dexis, 612-944-7670.

UNITEK WELDERS wanted for cash. Parallel heads and power supplies. Call 608-643-5434, FAX: 608-643-4439.

QUICK BOARDS

- SA 8550.....\$15 ea.
- SA 8580 6 BU or 7 BU\$15 ea.
- SA 8570.....\$15 ea.
- SA 8590 10 BU or 11 BU\$15 ea.
- SA 8600.....\$15 ea.
- PIONEER\$15 ea.
- ZENITH (NO PM2 OR P21).....\$5 ea.

The M58657P or M5G-1400 can be programmed for \$7.00 ea. (no less than 10 pcs).

- SA 8530.....\$6 ea.
- SA 8535 OR 8536\$6 ea.
- SA 8550 (14 PIN)\$10 ea.
- SA 8500 310/320\$5 ea.
- SA 8500 311/321\$15 ea.
- SA 8570, 8580, 8590, 8600 (40 PIN)1\$16 ea.

CALL FOR INFORMATION FOR ANY OTHER MODEL NOT LISTED.

Prices are based on a 100 piece quantity.

CALL NOW

ALAN COMPONENTS, INC.

TOLL FREE

1-800-859-6523

NO FLORIDA SALES.

Write in 203 on Reader Service Card.

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

RULINCO		
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+I
- MasterCharger i+IIa
- 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 TH22AT/79A		
PB32	6v @ 600 mAh	
PB33	6v @ 1200 mAh	
PB34	9.6v @ 600 mAh	

YAESU FT-11/51R		
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	

MOTOROLA		
GP-300	7.5v @ 1200 mAh	



BATTERY-TECH, INC.

SEND FOR FREE CATALOG • DEALER INQUIRIES WELCOME

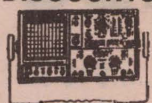
28-25 215th PLACE, BAYSIDE, NY 11360

800-442-4275 • FAX 718-631-5117

IN NEW YORK STATE CALL: 718-631-4275

Write in 86 on Reader Service Card.

GoldStar DISCOUNTS



FREE!

The First 25 Callers receive a Auto-Ranging DM-333 with the purchase of a GoldStar Scope. A \$70.00 value

100 MHz OS-9100P

- ☐ Dual Trace
- ☐ 2-Channel
- ☐ ALT-triggering
- ☐ Full Scale def. sweep
- ☐ Signal-delay
- ☐ Delay line
- ☐ TV-sync.-sep/hold-off
- ☐ Auto focus
- ☐ Probe, 1:1 - 10:1
- ☐ 2 year warranty

\$999.95

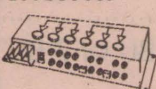
2 Ch -2 Trace Scopes

- OS-3020 20Mhz Storage \$1223.75
- OS-902RB 20Mhz w/Cursor \$623.75
- OS-904RD 40Mhz w/Cursor \$748.75
- OS-902OG 20Mhz w/F. Gen. \$486.25
- OS-902OA 20Mhz \$386.25
- OS-904OD 40Mhz \$648.75
- OS-908OD 60Mhz \$786.25

All with Probes/2yr warranty

Carver... Factory Close Outs

Electronic Crossover



Model: SX-2/3
2/3 way, will handle up to 12 separate Amplifiers.

Retail \$499.95

\$119.95

High Power Car - Truck Amplifiers



Call...For other limited Carver items

Mdl. 2022 30 Watt- 4 Ohm

Rtl. \$199.95 **\$59.95**

Mdl. 2062 80 Watt- 4 Ohm

Rtl. \$299.95 **\$109.95**

Mdl. 2150 150 Watt- 4 Ohm

Rtl. \$339.95 **\$249.95**

Mdl. 2200 200 Watt- 4 Ohm

Rtl. \$399.95 **\$279.95**

Electronic Mall
19502 56th Ave West
Lynnwood Wa 98036

since 1968

206-776-0311

Fax: 206-776-2972

M-F 9-5:30

SAT 9-5

Credit Cards Accepted

Write in 87 on Reader Service Card.

GIGATRONICS 1026-01 50MHZ-26GHZ LEVELED SYNTHESIZED SWEEPER WITH FREQUENCY SELECTIVE COUNTER AND POWER METER. 0.1HZ RESOLUTION using included external synthesizer \$14,500. GIGATRONICS 840 26-40GHZ LEVELED FREQUENCY DOUBLER/AMPLIFIER, CALIBRATED VARIABLE WAVEGUIDE OUTPUT TO OVER +10dBm. 13-20 GHz SMA INPUT. '88 Gigatronics price \$22,000; NOW \$1,900. 90-DAY WARRANTY. 619-439-1345, 1-800-TO-BUY-TE.

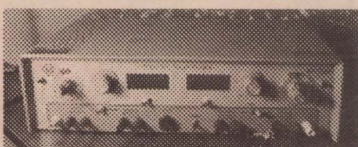
IFR 500/500A WANTED. Must be in excellent physical and operating condition. will PAY \$2,500++. Ask for Spence Porter, Communications Specialists, 1-800-854-0547.

HP OSCILLOSCOPES: HP 1707A 100MHz WITH BATTERY \$695; HP 1741 100MHz \$695, calibrated, in perfect working condition, guaranteed for 90 days. ISA, PO Box 6955, Laguna Niguel, CA 92607. 714-488-0010, FAX 714-488-0299.

NICOLET ANALYTICAL Instruments MD. 60 SX FTIR spectrometer 1985 MD. with 8 pin plotter and printer. 517-876-6363 MI.

WAVETEK 1062 sweep generator, 1 to 400 MHz output +10 to -60dBm, calibrated in perfect working condition, 90-day guarantee. ISA, PO Box 6955, Laguna Niguel, CA 92607. 714-488-0010, FAX 714-488-0299.

SUPER DEALS! Wavetek 3000-200 AM/FM/CW frequency generator/deviation meter. Synthesized 1 to 520 MHz x 1KHz steps plus variable, +13dBm to -137dBm, 0.001% frequency accuracy, reverse power protected, internal and external AM & FM modulation. \$750. **Fluke 5100B opt 03/05/Y5000 multifunction calibrator opt. 03 adds wideband ACV (10Hz to 10MHz). Opt 05 adds IEEE 488 interface, Y5000 buffer is needed to interface w/Fluke 5205A or 5220A. Very Good condition. \$5,250. 30-day guarantee. Lehman Scientific. 717-252-4211, 717-244-7540, FAX 717-252-4266.**



POWER SUPPLY two outputs of 0-20 @ 2A and one output of 5VDC @ 4A. Dual digital Amp/Volt meters, excellent condition. \$200. 415-244-9254.

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.



Test Equipment Sales



HP 3325A	\$1995	Tek 465B	\$525
HP 3336B	\$595	Tek AM503	\$395
HP 8754A	\$2995	Tek FG503	\$225
Tek 465	\$449	Tek FG504	\$575
Tek 475	\$625	Tek TG501	\$525
Tek 475A	\$750	Datron 1065	\$750
Tek 485	\$825	Wavetek 178	\$1495
Tek 2336	\$895	Rod-L M100AVS4	\$ 895

Customer Satisfaction is our #1 Priority.

Call For Price List Phone (603)434-2544 We buy surplus equipment
Fax (603)425-2945

Write in 90 on Reader Service Card.

RF EQUIPMENT: HP 5342A/1 18GHz microwave counter (oven time base) \$2,220. Tek TR 503 .1 to 1800MHz tracking generator, calibrated \$1,400. HP 3403C/3,6 true RMS digital voltmeter (DC-100MHz, autoranging, remote control, dB display) \$375. HP 8660C/005, 100 synthesized signal generator mainframe \$1,700. HP 8622B .01 to 2.4GHz sweep oscillator plug-in \$1,600. HP 8505A RF network analyzer .5 to 1300MHz, 100dB dynamic range, with phase-lock option 005 and HP 8501A storage normalizer. Bright CRT. \$3,700. Tek P6201 900MHz active probe \$350. Excellent condition, with warranty. Pepper System, 214-353-0257.

WANTED: TEST equipment in working condition. TEK, HP, FLUKE and others! DEXIS. Fax list to 612-942-9712 or voice at 612-944-7670.

TEKTRONIX TDR 1503, as new, calibrated with manual \$2,350. 1502 with strip chart recorder, needs battery \$1,550. Psitech Plus, 707-745-4804, fax 707-747-5277.

DRANETZ 3110 Phase angle voltmeter. \$1,995/offer. Dexis, 612-944-7670.

TEKTRONIX PLUGINS: 5A48 50MHz vertical or 5B42 dual timebase, unused with manual \$175. 7B80 \$125. 7B53A \$99. 7A13 (LED) 100MHz differential comparator \$250. 90-day warranty. 619-439-1345, 1-800-TO-BUY-TE.

ELECTRONIC EQUIPMENT, surplus, misc. electronic and scientific equipment. For list contact T-Minus-7, 45845 Warm Springs Blvd. #F, Fremont, CA 94539. 510-651-9477, FAX 510-651-3657.

FLUKE TEST Equipment: Fluke 382A, voltage current calibrator, \$250; 1900 80MHz counter, \$100; 1920A 550MHz counter, \$200; 2030A printer, \$300; 2190 thermometer \$250 2440C data logger, 2300A scanner, \$200, 3330A voltage current calibrator, \$500; Fluke 4265A binary programmable source, \$300; 710B Z bridge, \$150; 893A, \$150; 8300A, \$200; 8010A, \$100; 8010M, \$100. A-Comm Electronics, 7198 S. Quince St., Englewood, CO 80112. 303-290-8012, 303-290-8133 FAX.

AFFORDABLE HP power sensor repair! For example most HP 8481As repaired for \$195. Call or write for information and pricing. Willamette RF, Inc, PO Box 1599, Corvallis, OR 97339. Phone 503-754-7226, FAX 503-753-4629.

HP 3325A Synthesizer/function gen. \$2,150. Dexis, 612-944-7670.

TIRED OF paying high prices to get Tektronix, Hewlett Packard, Wavetek, IFR, etc., repaired, calibrated, certified? Give us a call. Free estimates, fast service. We also sell and rent test equipment. For information: Feitek, 2752 Walton, St. Louis, MO 63114, 314-423-1770.

** QUALITY COMPUTER COMPONENTS **

MOTHER BOARDS

- 386SX-40 W/CPU \$ 85.00
- 386DX-40 W/CPU & 128K \$ 125.00
- 486DX VESA L/B W/256K \$ 128.00

VIDEO & IDE CONTROLLERS

- IDE & I/O W/CABLES \$ 14.00
- VESA L/B IDE & I/O \$ 36.00
- 1 MB OAK ISA VIDEO \$ 48.00
- 1 MB VESA VIDEO \$ 96.00

ADD ON CARDS & MISC

- 2400 DATA MODEM \$ 28.00
- 96/24 FAX/MODEM \$ 38.00
- 101 DELUXE KEYBOARD..... \$ 19.00
- MINI TOWER W/PS & LED. \$ 52.00
- MITSUMI CD-ROM \$ 180.00
- 14.4 FAX/MODEM \$ 148.00

FLOPPY DRIVES

\$85.00

PER SET!!

HARD DRIVES

130 MB

SEAGATE

\$ 168.

250 MB

SAMSUNG

\$ 235.

..... SPECIALS

486 VESA LOCAL BUS
MAINBOARD W/ 256K CACHE
— PLUS —
1 MB 32 BIT VESA VIDEO &
32 BIT VESA IDE I/O CARD
COMPLETE WITH CABLES & SOFTWARE
ONLY \$ 249.00

250 MB SAMSUNG HARD DRIVE
— & —
250 MB CONNOR TAPE DRIVE
ONLY \$ 389.00

ALL PRODUCTS ARE 1ST QUALITY FACTORY
NEW & FULLY WARRANTIED.
WE DO NOT CARRY ANY REFURB OR USED
GOODS. CALL FOR OUR COMPLETE PRODUCT
LIST. DEALERS WELCOME - TERMS AVAILABLE.

WE STOCK IT ALL CPUs, MEMORY, COMPLETE & BAREBONE SYSTEMS

B W C COMPANY, INC.

PHONE : (803) 764-0474

FAX : (803) 824-0278

DEALERS WELCOME ... TERMS AVAILABLE ... CALL FOR FREE PRICE LIST

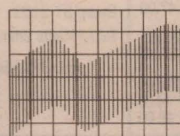
WANTED

All Types of Test Equipment

WE BUY & SELL

Attn: Richard

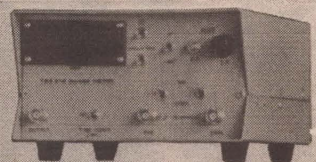
3802 North 27th Ave., Phoenix, Arizona 85017



MHZ ELECTRONICS

602-278-4062 • 602-269-1737 Fax

TEKTRONIX TEST EQUIPMENT FOR AUDIO, BROADCAST, VIDEO: AM 503 & A6302 current probe & amplifier (to 5 A/div; DC to 50MHz) \$890. **FG 502** audio to 11MHz function generator \$275. **FG 504** audio to 40MHz function generator, lin/log sweep \$750. **PG 508** 50MHz pulse generator (variable rise, fall times) \$325. **DM 502A** auto-ranging multimeter \$215. **AA 501** distortion analyzer \$1,250. **DA 4084** distortion analyzer (like AA 5001) \$1,250. **466** 100MHz portable storage oscilloscope \$845. **485** 350MHz portable oscilloscope \$795. **7633** 100MHz storage mainframe \$475. **7A22** high-sensitivity differential vertical amplifier \$375. **AM 502** high-sensitivity differential amplifier \$375. **7854** 400MHz oscilloscope mainframe: digital storage, waveform processing, GPIB \$975. **7D20** digital storage plug-in: cursor measurements, min/max enveloping, signal averaging \$825. **149A** NTSC generator \$775. Excellent condition, with warranty. Pepper Systems, 214-353-0257.



DIGITAL PHASE METERS 10Hz to 30MHz 0.01 Deg resolution, 4 1/2 LED display, autogain autozero, no adjustments, accepts any waveforms from 5mV to 50V peak. Prices start at \$395. FREE application manual for asking. **DIGITAL C, L METERS** Accurate bench top instruments with 0.001 pF and 0.001 uH resolution. Test frequency 1MHz down to 1KHz, accuracy 0.2%. Many more features, factory new. Prices start at \$380. All equipments manufactured in USA by TBE Electronics, PO Box 42, Candor, NY 13743. Tel. 607-659-3030/FAX 607-659-3650.

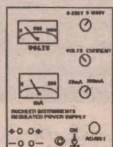
WANTED: SERVICE monitors-IFR, Motorola, Marconi, HP, Hewlett Packard signal generators, etc. 716-661-9964 or FAX 716-763-0371.

WANTED: MEASURING & Test equipment, microwave components, RF connectors, etc. **Top price paid!** Write or FAX you list to: **Steigerwald GmbH**, Ungererstrasse 180, D-80805 Munich, Germany. FAX 011-49-89-3615899.

HP 5328B Universal counter. \$995. Dexis, 612-944-7670.

HP PLOTTERS: HP 7044A, XY with sweep, \$400; 7045A, \$400; 7045B, \$400, HP 7225A XY HPIB, \$150, 7225A, RS232, \$150; HP 7225B, HPIB, \$150; HP 7470A 6 pen with HPIB, \$200; 7470A RS232 \$200; 7440A, RS232 8 pen, \$200; HP 7475A 6 pen plotter RS232, \$200; HP 7475A, HPIB, \$250; HP 9872A 4 pen plotter, \$250; 9872S, \$300. A-Comm Electronics, 303-290-8012, 303-290-8133 FAX.

RADIO REPAIR: Commercial and amateur two-way. Portables a specialty. Reasonable rates. Call Mike N9VWW at REYNOLDS RADIO, 219-482-5630.



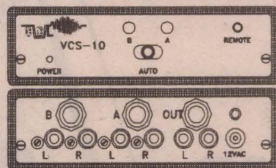
POWER SUPPLY 0-1000VDC @ 200mA voltage or current regulation \$250. 415-244-9254.

WANTED: TRUETIME Omega Clock Model OM-DC. **TRUETIME Model GPS-DC** GPS Clock. Call Bill Scolnik, 1-800-634-7036 or FAX 1-800-788-5005.

COMMUNICATIONS SYSTEMS LABORATORIES

1-800-529-9483

Multi-Media Control Systems For Home And Industry.
Custom Design And Manufacturing.



VCS-10 A/B loss of video switch. Fully Automatic switch to A port if B loses video. Switches Stereo Audio in conjunction with Video. Will rack mount with available bracket (mounts 3 units) Signals fully buffered, may be manually or remotely switched. Introductory Price \$225.00.

VCS-25 Commercial Insertion from Video Tape or Laser Disc. Fully automatic, responds to all valid network call tones, has event logging capability to support detailed customer billing. \$1595.00.

VCS-75 Channel Controller. Integrate four VCRs, two Laser Discs, and two standby sources for fully automatic 24 hour unattended operation. Supports blackout programming requirements. \$2995.00.

MMCS-10 Home entertainment 8x8 Video/Stereo Audio Cross Point Switch. Interconnect any of 8 inputs to any or all of 8 outputs. Ideal for interconnecting complex systems requiring periodic changes in signal routing. Re-program easily from front panel keypad. All inputs fully buffered, available in kit (\$595.00) or fully assembled/tested (\$695.00).

MMCS-11 Rack mountable commercial version of the MMCS-10, has additional feature of built in serial interface for external computer control. Assembled only \$895.00.

To place an order or request detailed catalog of products and services call TOLL FREE 1-800-529-9483. MasterCard/VISA accepted.

Write in 134 on Reader Service Card.

When Visiting Disney World And Sea World.
Come To The World Of Electronic Surplus!

SKYCRRAFT

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

★ ★ ★ ★ ★ ★ ★ ★

We Buy Surplus
Electronic Parts —
FAX your list.

FAX 407/647-4831

PH 407/628-5634

P.O. BOX 536186

ORLANDO, FLA. 32853-6186

HOURS:

Monday - Friday 8:30-6:00
Saturday 8:30-5:00



TEKTRONIX TEST Equipment: 200C scope cart, \$100 7403N, \$250; 603A XY storage, \$250; 634 video monitor, \$250; 7633 100MHz storage, \$350; 7633R, \$350; 7704A, \$350; 7834 400MHz storage, \$450; 7908 500MHz frame, \$400, plugs available. Call for quotes. TM504, \$150; TM506, \$200, TM503, \$150; TM515, \$200, T912 10MHz storage, \$250. A-Comm Electronics, 7198 S. Quince St., Englewood, CO 80112. 303-290-8012, 303-290-8133 FAX.

EPROM PROGRAMMER EE tools model Rommax-4G, 4 gang programmer brand new in box, \$170 or best offer. Ph. 305-486-8472 or 305-521-6969.

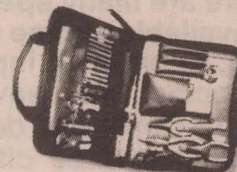
SIGNAL GENERATORS, Complete as new Polarad 1106M-L & 1020T with manual & accessory package \$585, 1106E-L \$325. All with warranty. Why pay more? Late serial Hewlett Packard 86290C 2-18.6 GHz \$1,450. 86242D 5.9-9.0 GHz RF insert \$385. 8616A w/manual 1.8-4.5 GHz signal generator, excellent \$300. 8620C sweep frames \$285. Psitech Plus, 707-745-4804, fax 707-747-5277.

SENCORE: VA62 \$1,000; SC61 \$1,000; ST66 \$400; SR68 \$200; RG67 \$100; B&K NTSC Generator with audio & RG&B rasters \$350, B&K 467 CRT rejuvenator \$300. All like new with manuals and leads! Call Steve at 908-281-0300.

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... \$389.99
800T Case Only... \$114.80

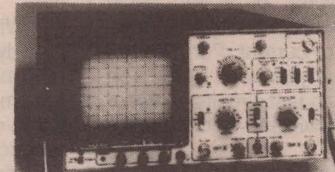


platt — Case — Cordura Exterior. Two exterior pockets & one literature pocket. 660ZT Case, complete with tools... \$208.00
660ZT Case Only... \$57.40
Optional Sperry meter #DM6510 as shown... \$63.95



Weller WCC100 — Electronically controlled station, temperature adjustable from 350°F-850°F. Zero voltage circuit-safe for sensitive components, 40 Watt pencil... \$92.00

OptiVISOR — Superior magnification, Optical Glass Prismatic lenses, (not plastic) Select any one of (6) magnifications... \$22.50



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... \$370.80

Electro Tool, Inc.

9103 Gillman, Livonia, MI 48150
Customer Service: (313) 422-1221
ORDERS ONLY: 1 (800) 772-3455
"Tools American Made."



Write in 91 on Reader Service Card.

HP 3585A Spectrum analyzer. \$6,250. Dexis, 612-944-7670.

TEST EQUIPMENT Sale: HP 204B, \$150; HP 204C, \$150, HP 203A variable phase function gen., \$250; HP 3550B transmission test set, \$350; HP 415E SWR meter, \$200; HP 3746A selective level meter, \$800; HP 411A RF meter, \$200; HP 3400A, \$250; HP 428A, \$200; HP 428B, \$250; HP 313A tracking gen., HP 608E, \$300; HP 5004A signature ana, \$200; Boonton 260A Q meter, \$200; Boonton 250A RX meter, \$300, Delta Design 2300R oven chamber, \$500. A-Comm Electronics, 303-290-8012, 303-290-8133 FAX.

Build a Function Generator

There are many specialized signal generators available, some costing hundreds of dollars, to produce input signals of different frequencies and waveforms. The FG-500 Function Generator described in this article will produce three different types of waveforms — sine, square, or triangle — from less than 1Hz (cycle per second) to above 150,000 Hz (150 KHz), and with adjustable voltage output for the sine and triangle waveforms.

Available as a complete kit, or pre-assembled, this article provides all the details to allow you to build the FG-550 from parts you might already have, or from parts available from the kit source.

Background

In building and testing electronic circuits, it would be nice if you could just LOOK at a circuit and see the electrons flowing, or if you could touch a wire with your finger to measure voltage or current. For all practical purposes, you need some sort of instrument to test circuits — especially if the circuit isn't working properly, or at all!

For simple "static" (nothing changing rapidly) testing, probably the most common test instrument is a multimeter. This will measure current, voltage, resistance, and sometimes capacitance.

If the circuit is operating under "dynamic" (fast changing) conditions, you really need a "signal tracer" to see where the desired signal is getting blocked. A typical signal tracer would be an oscilloscope, amplifier, speaker, or specialized detector. The more specialized the circuit, the more sophisticated a device might

be required as a tracer. For example, television or microwave troubleshooting requires more specialized equipment than an audio amplifier.

With circuits that create their own dynamic action, such as oscillators, no other input is needed. But for amplifiers and many other electronic devices, you need a device to produce an appropriate input signal for tracing. This is generally known as a "signal injector," "signal generator," or "function generator."

This brings us to the FG-500 Function Generator. Powered either internally by a nine-volt battery (for portable or short-time use), or an external DC power supply of from 9 volts to 18 volts, the FG-500 will produce sinewaves, squarewaves or trianglewaves, as shown in Figure 1.

A selector switch chooses three different frequency ranges from 1 Hz to above 150 KHz. Although this primary frequency limit is below broad-

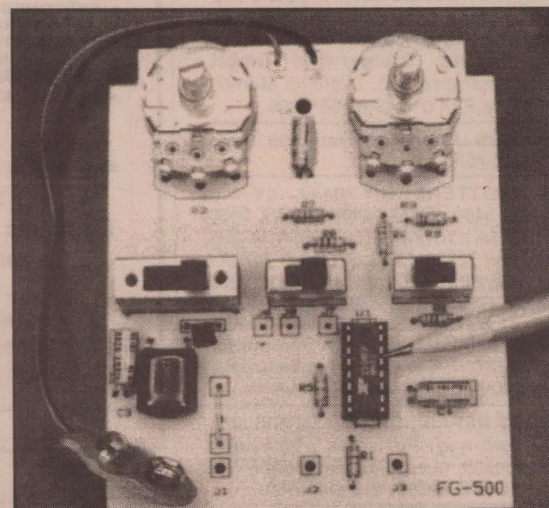
cast frequencies, since squarewaves consist of many harmonics they can be useful for testing AM and even FM radio circuits. The published technical specifications of a properly assembled FG-500 are shown in Table I, although the unit I built provided higher output voltages than shown.

Circuit Description

Figure 2 shows the schematic of the FG-500. The heart of the circuit is an XR-2206 monolithic function generator integrated circuit, which can generate sine, square, triangle, ramp, and pulse waveforms. A pinout and functional block diagram of the XR-2206 is shown in Figure 3. In this project, only the sine, triangle, and squarewaves are used.

Power is provided either from an alkaline rectangular 2U6 style nine-volt battery connected to a snap-on connector (J4 and J5), or from an external DC power source of 9-18 VDC into a power jack. When the external power plug is inserted into the power jack, the battery is disconnected. To assure that a typical DC wall transformer (which might be unregulated and have significant "ripple voltage") can be used, a high-value electrolytic capacitor (C6) is used to filter the ripple.

The frequency of operation is determined by the value of the capacitor selected by switch S1, and the setting of potentiometer R2. Should you wish to set your own frequency ranges, the formula for determining the frequency is $F=1/RC$, where F is the output frequency in Hertz, R is the total resistance of resistor R1 and the setting of potentiometer R2 in megohms, and C is the ACTUAL value (not necessarily the MARKED value) of the chosen



The heart of the FG-500 circuit is a 14-pin XR-2206 integrated circuit function generator.

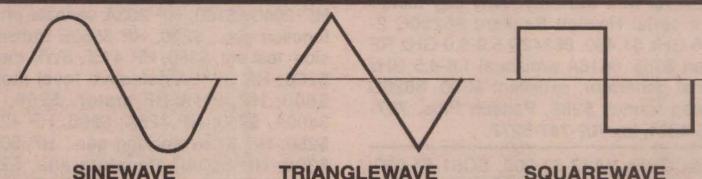


Figure 1

Three types of waves are produced by the FG-500 function generator: sine-, triangle-, and squarewaves.

capacitor, C1, C2, or C3, in microfarads. Note that the frequency is INVERSELY proportional to the value of R times C; that is, the higher the value of either R or C, the lower the frequency.

Table II shows the CALCULATED maximum and minimum frequencies for each of the three settings of

switch S1. Bear in mind that typical component values are usually considerably higher or lower than the marked value, especially for capacitors, and even more especially for electrolytic capacitors!

Switch S2 selects either the sine or triangle waveshape that appears at output terminal J1. When resistor R6 is in the circuit, a sinewave is produced; when no resistor is in the circuit, the output is a trianglewave.

In both cases, potentiometer R9

and integrated circuit chip), it will probably cost you more than \$34.95 for the complete kit. If you prefer, you can buy the FG-500 completely assembled and tested for \$49.95 — but what fun is that?

(NOTE: If you build the FG-500 from the kit, the front panel and Instruction Manual use the term "sawwave" in several places as a contraction of the proper term, "sawtooth wave." In any case, this is incorrect, since the signal produced

experienced electronic project builder, to buy the complete kit.

In constructing this project, only a few of the parts have a specific polarity or orientation. When installing the electrolytic capacitors C3, C4, C5, and C6, make sure the positive lead is installed with the proper polarity. Also be sure the integrated circuit notch, the pin 1 end, is positioned as shown in the parts layout (Figure 5).

The subminiature power jack



nies recent kits.

The cabinet that comes with the kit has an internal wall at the bottom, intended to provide a compartment for the battery. If your battery won't fit (mine didn't), simply use a pair of pliers to break out the wall; it snaps off easily.

Modifications

If you always use a battery to power the FG-500, then electrolytic capacitor C6 shown on the schematic is NOT required. It is not included in the kit. If you use a common wall-plug unregulated external power supply, it probably has a lot of "ripple" (AC voltage riding on the DC voltage), which will drastically impair performance, and C6 WILL be required. It can be from 100 to 1000 microfarads at 25 working volts and should be mounted on the foil (underside) of the PC board. The positive lead connects to a center terminal of the S3 power switch, and the negative lead is soldered to any nearby convenient ground trace.

While constructing the unit, either from scratch or from a kit, you might give some consideration to adding a small LED (light-emitting diode) in series with a 1000-ohm resistor to act as an ON light. Wire them between the ON terminal of the power switch S3 and ground, observing LED polarity, and placing

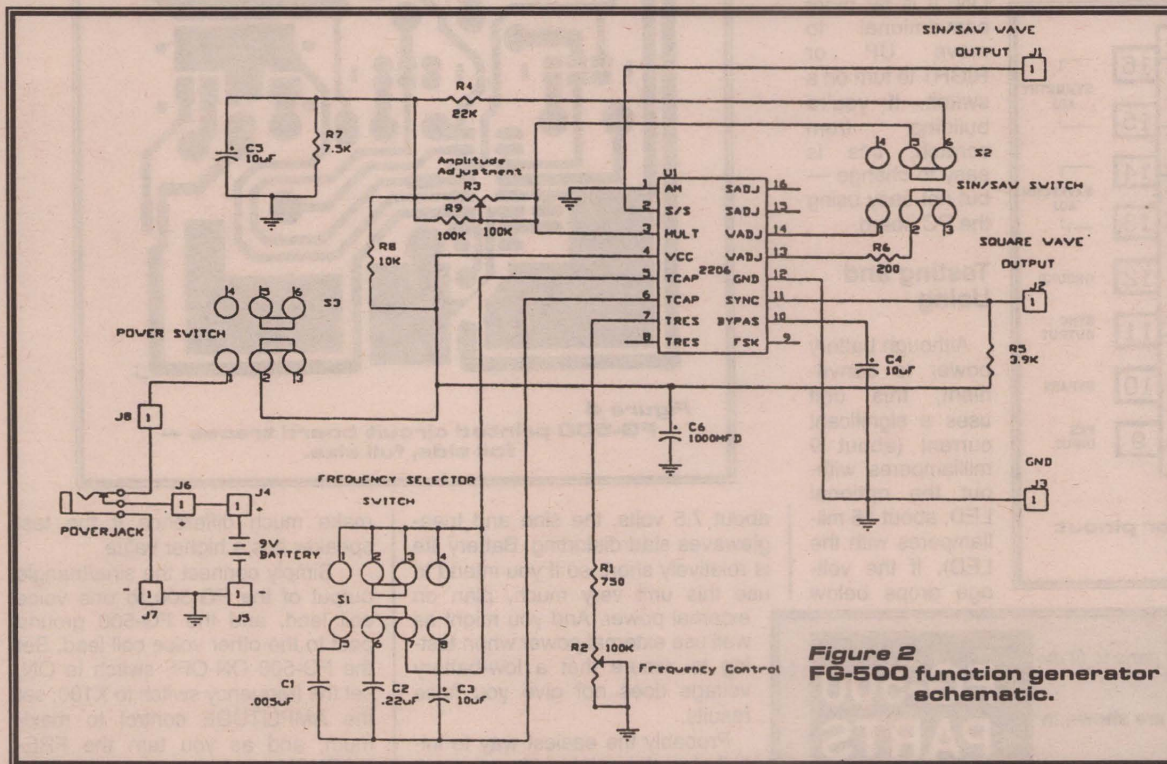


Figure 2
FG-500 function generator
schematic.

adjusts the amplitude of the output. The squarewave has no amplitude adjustment, and appears at terminal J2.

Construction

You have several choices in deciding how to build this kit. You could simply buy the complete kit from C & S Sales, as noted in the Parts List. This includes all electronic parts and hardware, a drilled and silk-screened printed circuit board, a cabinet with a punched and silk-screened panel, hook-up wire, solder, and a liberally illustrated Assembly & Instruction Manual. The result is a professional looking instrument, with no hunting for odd parts.

Or, you could use parts you already have or can get locally, and just purchase the special parts from C & S Sales. The C & S part numbers for the unique or hard-to-find parts are shown in the Parts List. However, by the time you get the individual parts (especially if you order the PC board, case, top panel,

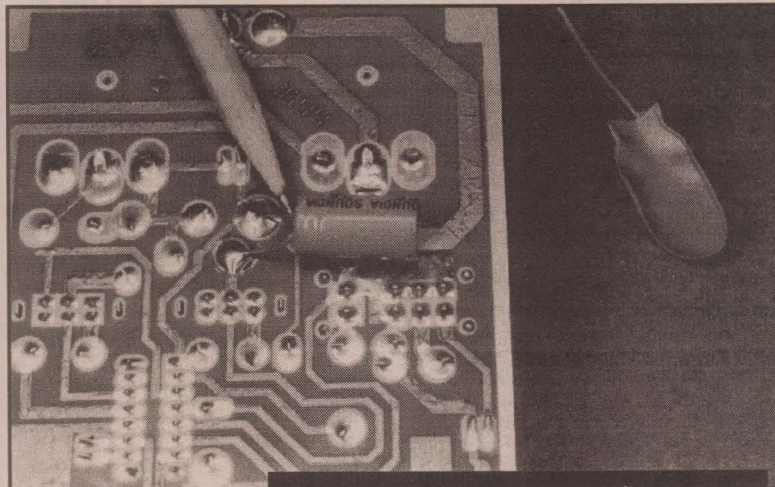
is a "trianglewave" with equal rise and fall times. A true sawtooth waveform has a relatively slow rise time and a fast fall time. I will refer to this signal as a trianglewave for the remainder of this article.)

The printed circuit board traces for this project are shown in Figure 4. Notice that no holes are shown, since the parts you use may require different sized holes than those used with the kit parts. Parts locations, using the kit parts, are as shown in Figure 5. The kit PC board, available separately (see Parts List), comes with all holes drilled, and the part locations silk-screened on the component side.

If you provide your own parts, and make your own PC board, you may have to adjust some part locations, depending on the size and shape of the parts you use.

For example, you may use different sized potentiometers or switches than those provided with the kit, and they may be mounted differently.

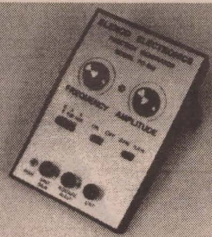
Here, again, I wish to emphasize that it is far easier, unless you're an



If you'll be using an external power supply rather than an internal battery, you'll need to add an electrolytic capacitor on the foil side of the PC.

provided in the kit is apparently internally wired differently than those furnished previously. The red and green wires going between the PC board and the power jack upper terminals are shown incorrectly in the Instruction Manual. They should be reversed, as shown in a bulletin that accompa-

ny the LED so it shows on the front panel. This is especially important when operating on a battery, since there is no way to tell when the unit is on, and the battery draws considerable current when switch S3 is



ON. Sure, the LED draws even MORE current, but it could save you from draining the battery when the Function Generator is not in use. When using external power the extra LED drain is not important, and you'll

know when the unit is on.

You might also want to consider changing the subminiature power jack to a more rugged and common closed-circuit miniature jack, or a coaxial type of power jack.

Also, although some may consider this a small point, my opinion is that the power switch, S3, is "backwards." As provided on the printed circuit board (and shown on the schematic), you must push the switch to the LEFT to turn the unit

ON. It is far more conventional to move UP or RIGHT to turn on a switch. If you're building from scratch, this is easy to change — but not easy using the PC board.

Testing and Using

Although battery power is convenient, this unit uses a significant current (about 9 milliamperes without the optional LED, about 15 milliamperes with the LED). If the voltage drops below

about 7.5 volts, the sine and triangle waves start distorting. Battery life is relatively short, so if you intend to use this unit very much, plan on external power. And you might as well use external power when testing to assure that a low-battery voltage does not give you false results.

Probably the easiest way to initially test the unit is with any small speaker. These usually have 4- to 10-ohm voice coils, but it won't

make much difference if the test speaker has a higher value.

Simply connect the sine/triangle output of the FG-500 to one voice coil lead, and the FG-500 ground post to the other voice coil lead. Set the FG-500 ON-OFF switch to ON, set the frequency switch to X100, set the AMPLITUDE control to maximum, and as you turn the FREQUENCY control you should hear the sound through the speaker. Turn the AMPLITUDE control to see that it

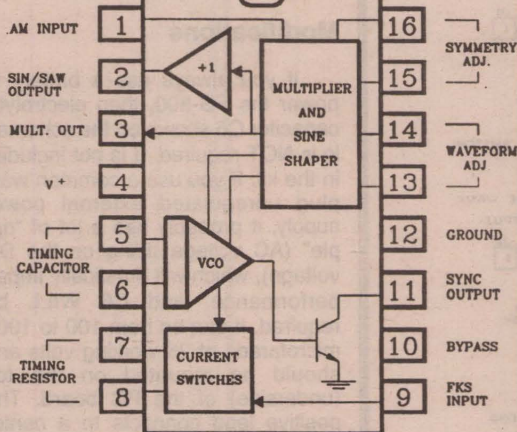


Figure 3
XR-2206 function generator pinout and block diagram.

(NOTE: C & S part numbers are shown for parts to fit the C & S drilled and silk-screened PC board.)

Resistors (Carbon, 5%, 1/4-watt. Values are shown in ohms.):

- R1 - 750
- R2, R3 - 100K potentiometer (C & S #192612)
- R4 - 22K
- R5 - 3.9K
- R6 - 200
- R7 - 7.5K
- R8 - 10K
- R9 - 100K

Capacitors:

- C1 - .005uF @ 100V
- C2 - .22uF @ 100V
- C3, C4, C5 - 10uF electrolytic @ 16V

Semiconductor:

- U1 - XR-2206 integrated circuit (C & S #332206)

Miscellaneous:

- J1, J2 - Red binding post (C & S #625011)
- J3 - Black binding post (C & S #625010)
- S1 - Double-pole three-position slide switch (C & S #541203)
- S2, S3 - DPDT slide switch (C & S #541009)
- Socket - For 16-pin integrated circuit (C & S #664016)
- Power Jack - Subminiature closed-circuit (C & S #622130)
- PC board - Drilled, silk-screened (C & S #517018)
- Case - Black plastic with handle (C & S #623015)
- Case Top Panel - Punched and silk-screened (C & S #614101)
- Knobs (2) - For Frequency and Amplitude (C & S #622009)
- Battery Snap - For nine-volt battery (C & S #590098)
- Hardware, hook-up wire, solder.

Source:

A complete kit including all the above parts (Kit FG-500K) is available from C & S Sales, Inc., 1245 Rosewood Ave., Deerfield, IL 60015; (800-292-7711, or 800-445-3201 in Canada) for \$34.95 plus \$5.00 shipping (\$8.00 to Canada). A completely assembled and tested unit (Model FG-500) is \$49.95 plus shipping. Individual parts are available; call for prices and shipping. IL addresses add 6.5% sales tax. Continental USA and Canada only.

FG-500 PARTS LIST

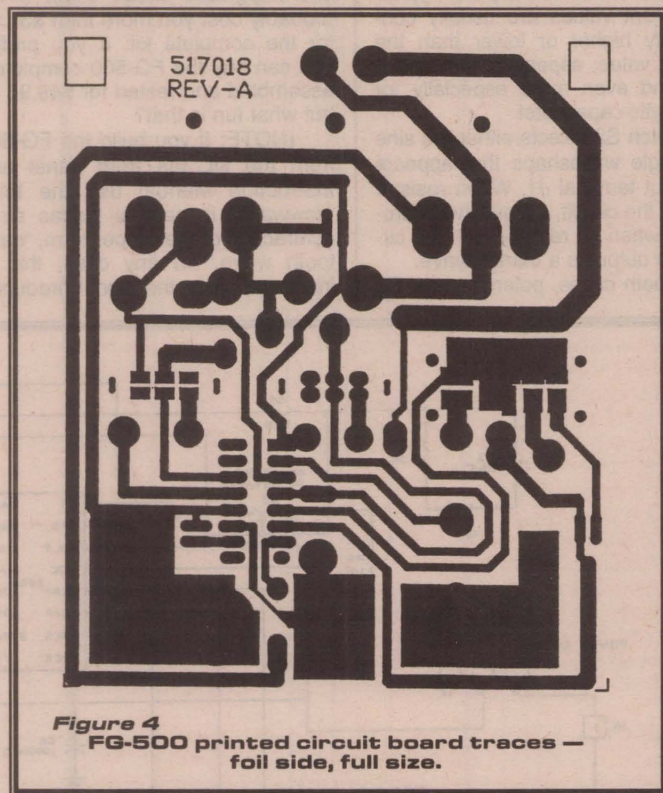


Figure 4
FG-500 printed circuit board traces — foil side, full size.

Table I — FG-500 Specifications

Output Waveforms: Sine, square, triangle waveforms		
Frequency: 1 Hz - 150+ KHz		
Impedance: 600 - ohms \pm 10%		
Amplitude: Sine/triangle - 0 to 3V+ at 12 VDC input		
Squarewave - 5V+ no load at 12 VDC input		
Frequency Ranges: See Table II		
Sinewave:		
Distortion: Less than 1%		
Flatness: \pm 0.5 dB from 1 Hz to 100 KHz		
Temperature Stability: \pm 200ppm/centigrade typical		
Squarewave:		
Symmetry: Less than 5% (at 1 KHz)		
Rise and Fall Time: Less than 30ns (at 1 KHz)		
Trianglewave:		
Linearity: Less than 1% (up to 100 KHz)		
Power Requirements:		
9V to 18 VDC		

Table II — CALCULATED Frequencies
(Note: Frequencies are approximate)

Switch Setting	Minimum Freq. (Hz)	Maximum Freq. (Hz)
X1	1	133
X100	45	6060
X10K	2000	270,000

varies the sound intensity.

Now switch the frequency switch to X10K, and the sound should go up in pitch and vary as you turn the FREQUENCY control. Again check the AMPLITUDE control.

Next switch the "hot" (ungrounded) voice coil lead to the squarewave output post of the FG-500. While the FREQUENCY control and switch still work, the AMPLITUDE control does not affect the squarewave output.

If you have an oscilloscope handy, power the FG-500 at about 9 volts and you should get a sinewave or trianglewave of about 3 volts or greater peak-to-peak at maximum amplitude with the FREQUENCY control at maximum and the selector switch set at X1. The squarewave output should be 5 volts or greater peak-to-peak.

Troubleshooting

Most problems encountered when troubleshooting items made

from kits can be traced to poor soldering, wrong parts placement, or reversed installation of polarized parts.

After checking the soldering, if

there is no sine/triangle or squarewave output, first check that voltage is getting to and past the ON/OFF switch. Be sure the integrated circuit notch-end is properly placed, and that the electrolytic capacitors are not oriented backwards.

The DC supply voltage should appear on pin 4 of IC1.

If you're getting the wrong frequency range settings, see that the capacitors are connected to the proper switch positions on S1. For any other malfunction, check the associated components for soldering and misplaced resistor values.

Using the FG-500

Your use of the FG-500 will largely depend on the type of equipment you'll be testing. For analog equipment, such as audio amplifiers, the FG-500 provides a sinewave input signal

in the audio range, with a speaker as your output "signal tracer." For digital circuits, use the squarewave output, and the lowest frequency setting so you can see the effect of each signal transition.

For radio frequencies, the FG-500 offers enough strength and harmonics to allow you to clip the output lead from the squarewave post directly to a receiver antenna to get a solid signal. Use the X100 or X10K positions of the frequency selector switch. You can move through a circuit stage by stage to determine proper operation.

You can check for distortion by using the FG-500 for sine or trianglewave input and monitoring the output of a circuit with an oscilloscope to see if it changes the wave-shape.

There are endless applications for a function generator. You would not have read this far unless you have an idea how to use a function generator, and what use you might have for one. Enjoy! NV

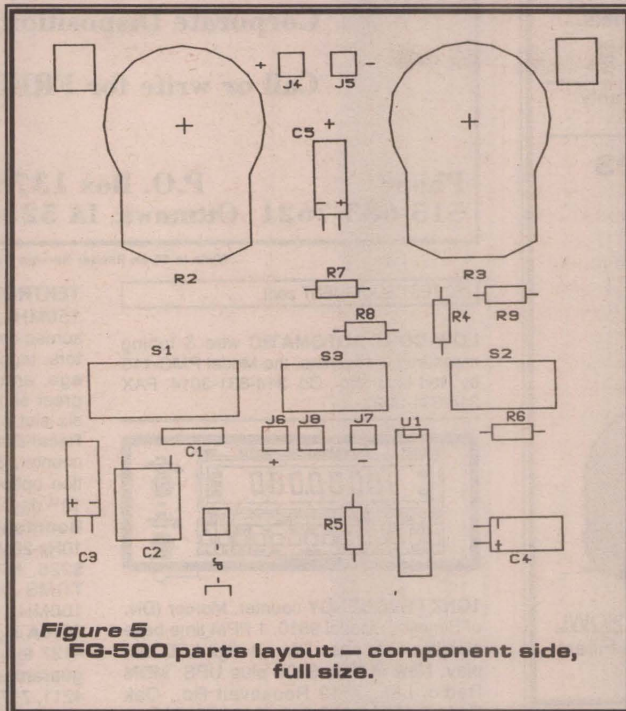


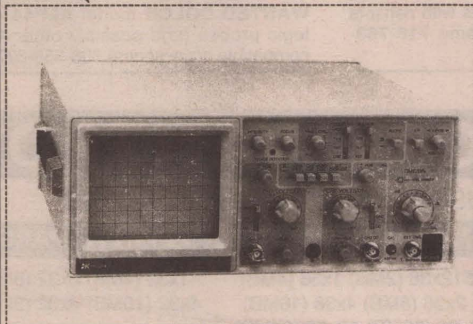
Figure 5
FG-500 parts layout — component side,
full size.

LOWEST SCOPE PRICES GUARANTEED!!!

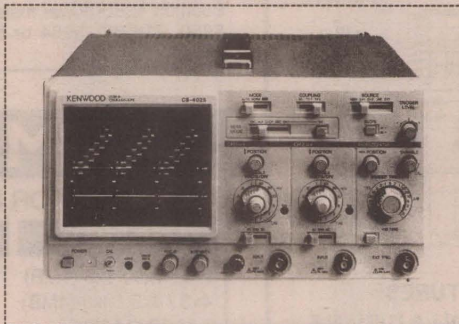


KENWOOD

INSTEK



Model 2120
REG. \$549.00
SALE \$389.95



Model CS-4025
REG. \$559.00
SALE \$389.95



Model OS-622B
REG. \$499.00
SALE \$389.95

PRINT™
Products International

84 PAGE CATALOG!!!
Call today for your free copy
of our test & measurement
equipment catalog!



800-638-2020



8931 Brookville Road, Silver Spring, MD, 20910 * 800-638-2020 * 301-587-7824 * 24 Hour TOLL FREE FAX 800-545-0058

The Filter Company, Inc.

INTERNET Email FILTERS@pipeline.com

1-800-235-8080 ext.#8080

Large STOCK on all channels for fast delivery. Available Ch. # 2 thru 24 and 0,1,60,61,98,99,A-2, A-1. Order by single channels. NOBODY BEATS OUR PRICE.

Monday - Friday (8am to 8pm) Central Time

All Filters are 75 db deep and carry our exclusive 2-year Warranty EXACT FILTER ALL CABLE Company's Use.

We Specialize in Large Quantities

PRICES AS LOW AS \$6.00ea

Standard Positive Filters

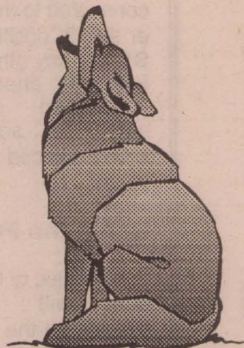
1pc @ \$16.00 5pcs @ \$14.00ea
10pcs @ \$12.00ea 25pcs @ \$10.00ea
50pcs or more CALL! We will beat any competitor's price. Mix & Match.

Visa, Mastercard, Discover, American Express & UPS COB

We do not sell Data Blockers, Bullets or FM Traps !!!

Anyone implying theft of Cable Service will be denied assistance.

A "TFC, Inc." Company



Give our 800 line a **HOWL** for the best Positive Filters and SERVICE.....

FALKNER ENTERPRISES

NiCad and Gel Cell Battery sales

Electronic Surplus Liquidation

Corporate Disposition Services

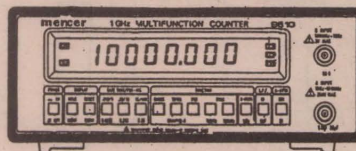
Call or write for FREE catalog

Phone 515-683-7621 P.O. Box 1378 Ottumwa, IA 52501 FAX 515-683-7631

Write in 96 on Reader Service Card.

#80 TEST EQUIPMENT cont.

LOW-COST AUTOMATIC wire & tubing measure/cut machine, the Model PMC-110 by Red Line Mfg., Co. 314-831-3014. FAX 314-831-3927.



1GHZ FREQUENCY counter. Mercer (Div. of Simpson) Model 9810. 1 PPM time base stability, Low pass filter, 8 digit LED display. New in box, \$209 plus UPS. MDM Radio, Ltd., 7112 Roosevelt Rd., Oak Park, IL 60304. 708-848-4210. Visa/MC.

TEKTRONIX ACCESSORIES 7A26, \$75; 7B15 delaying time base, \$185; 7B50 & 7B50A, \$115; 7B53A, \$95; 7B71 \$125; 7B85 400MHz, delaying time base, \$155. 7B92A \$195. S-2 \$85. S-3A \$100. Working scope at affordable price. Tek 7603 bright CRT with 7A16A, 7A18 & 7B53A, \$365. 465 opt 7 bright CRT \$300. FET power supply 1101A opt 4, \$125. 1360P programmable switch, as new, \$200. DC-501A opt 1 \$150; DC-505A \$195; DM-502A \$150; DD-501 \$90; PG-501 \$150. Volume discounts and offers. Psitech Plus, 707-745-4804, fax 707-747-5277.

HEWLETT PACKARD 182T/8558 1500MHz spectrum analyzer \$1,800, HP 1630D logic analyzer with probes \$1,200, Boonton 42BD power meters with sensors \$250. 716-661-9964 or home 716-763-9104.

TEKTRONIX 2440 OSCILLOSCOPE DC-150MHz, 4 trace, delayed sweep, on screen cursors, CRT readouts of scale factors, trigger levels, Delta time, Delta voltage, and other auxiliary information. A great scope! \$1,595. Tektronix TM5006 six slot programmable mainframe. \$450. Racal-Dana 9921 opt 04B 60. Frequency counter, 3GHz, 9 digit LED, 0.1Hz resolution option 04B; TCXO rated ± 5 parts in 10^{10} days. Option 60: rack mount. \$495. Boonton 93AD digital TRMS voltmeter, 10Hz-20MHz, 300 μ V. -300V fs autorange, \$225. HP 3403C opt 1.6 or 3.6 digital TRMS voltmeters, 0.01V-1000VDC, 100MHz, autorange and dB, \$375. HP 8616A signal generator, 1.8 to 4.5 GHz, -127 to +10dBm into 50 Ω , \$375. **30 day guarantee.** Lehman Scientific. 717-252-4211, 717-244-7540, FAX 717-252-4266.

TEST EQUIPMENT Manuals, mostly Hewlett Packard and Tektronix. Buy, sell, trade. Send us your want list. Ed Matsuda, PO Box 390613 San Diego, CA 92149. 619-479-0225, FAX: 619-479-1670.

BIOMEDICAL TEST EQUIPMENT, new and used. Test defibs, centrifuges, esu, IV-pumps and many others. Great deals in all units. Thousands of medical electronic and mechanical parts also available. Call or fax requests today: JM Baragano Biomedical 809-722-4007, FAX 809-722-4491.

HP 5245L Elec counters with plug-ins, \$85. Tek 453A dual trace o'scopes \$175. Call, 904-897-6482.

WANTED: ESN reader by Curtis or other similar model. Call Tony, 415-493-8148.

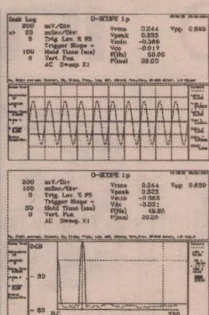
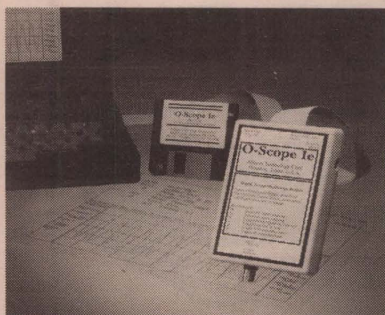
WANTED DOLCH model ALP44 active logic probes (and possibly other 4850A compatible accessories) 708-358-3275.

DIGITAL STORAGE OSCILLOSCOPE

WITH SPECTRUM ANALYZER, DVM, FREQ. COUNTER, AND DATA LOGGER

\$189.

ALLISON O-SCOPE MODULES CONVERT PC'S INTO MULTIPURPOSE TEST AND MEASURING INSTRUMENTS



Screen Capture of Sine Wave

Spectrum of Captured Sine Wave

INCLUDES SOFTWARE & INSTRUCTIONS.

ASSEMBLED AND TESTED..... \$169.
ENHANCED SOFTWARE..... \$ 20.
KIT (WITHOUT CASE)..... \$129.
SHIPPING..... \$7.50 (2ND DAY \$11.50)
TO ORDER: SEND CREDIT CARD INFO., M.O., OR CHECK,
OR YOU MAY CALL **1-800-980-9806**

FEATURES:

- SMALL & PORTABLE
- USES PRINTER PORT
- USES STD. PROBES
- DC TO 50 KHz
- 10 v/div. TO 50 mv/div.
- MADE IN U.S.A.
- SAME DAY SHIPPING

OPTIONS:

- PROBE SETS
- EXTERNAL TRIGGER
- DUAL TRACE
- BATTERY PACK

ALLISON TECHNOLOGY CORPORATION

8343 CARVEL, HOUSTON, TX. 77036 U.S.A.
PHONE: 1-713-777-0401 FAX: 1-713-777-4746
BBS: 1-713-777-4753

MEMORY WANTED

NEW OR USED - SIMMS / SIPPS / D-RAM -SOJ'S

30 PIN

1x3 / 1x9 / 1x8 (1MB)
4x3 / 4x9 / 4x8 (4MB)
16x9 / 16x8

72 PIN with PARITY

512x36 (2MB) 1x36 (4MB)
2x36 (8MB) 4x36 (16MB)
8x36 (32MB) 16x36 (64MB)

72 PIN No PARITY

1x32 (4MB) 2x32 (8MB)
4x32 (16MB) 8x32 (32MB)

We also buy any memory manufactured for
AST - IBM - COMPAQ - DELL - HP
NEC - PACKBELL - TT - TOSHIBA

Any product with memory such
as DIPS/ZIPPS/SOJ'S soldered
to boards O.K.

Z MEMORY EXPERTS

Fax: 702-293-7686
Toll Free: 1-800-252-5959

Hours
7am - 4:30 pm
P.D.T.
M - F

HP TEST Equipment, HP 432A, cable and mount power meter, \$300, opt 01, \$350; HP 8411A opt 018, \$500; HP 8555A, \$900; 8554B, \$600; 141T, \$500; 8552B, \$700; 8553B, \$500, 8556A, \$500; HP 8698B, \$300, HP 8660A, \$600; HP 8709A synchronizer, \$200; HP 8731B pin modulator .8-2.4 GHz, \$200; HP 8755A swept ana, \$200 HP 626A sig. gen. 10-15 GHz, \$250, HP 628A sig. gen. 15-21 GHz, \$250; HP 200CA, \$80; HP 200 CD, \$125; HP 651A, \$150; HP 651B, \$200; HP 653A, \$200; HP 654A, \$200, HP 8403A modulator, \$150; HP 8405A vector Z meter, \$550; HP 4800A Z meter, \$550; HP 8407A network ana, \$400. Send for test equipment sales list. A-Comm Electronics, 7198 S. Quince St, Englewood, CO 80112. 303-290-8012, 303-290-8133 FAX.

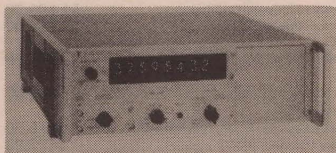
GENERAL RADIO 1650-B impedance bridge \$325, Dexis 612-944-7670.

TEST EQUIPMENT, electronic and scientific equipment to sell or buy, call **Wall Surplus**, 908-681-2032.

SELECTIVE VOLTMEETER, HP 3581C clean, quaranteed \$495. Gould Brush 220 2 ch oscillograph with alum. case and acc. \$475. **Technologies West**. 503-267-6064.

NI-CD BATTERY analyzers: charge, discharge, cycle and test. PC controlled using serial port and DOS software. \$289. PO Box 672, London, ON N6A 4Y4. Lamantia Products, 519-472-5566, FAX 519-472-1702.

HP 6260A power supply 0-10 volt, 0-100 amp \$325. Dexis, 612-944-7670.



HEWLETT PACKARD 5245L counters are all gone, but **PRETESTED REPAIR PARTS ARE STILL AVAILABLE**: Readout with Nixie, \$14.95. A17 card, \$14.95. Other cards, \$9.95. Nixies, \$7.50. Xtal oven assy, \$39. Add \$5 shipping. Send stamped addressed envelope for quote on any other part. Check/MO plus part number/description to: **TURCOTRON-IX**, 1000 E. 14th, Suite 429A, Plano, TX 75074.

SPECTRUM ANALYZER HP 3585A \$4,800; **HP 8640B** signal generator \$1,000, opt 001 002 \$1,700; **Fluke 8920A** RMS coltmetre \$275; **Tek T932A** oscilloscope \$200; **HP 1200A** oscilloscope \$100; **Boonton 92BD** RF millivoltmeter \$200, **92B** \$150, **HP 5327C** Frequency Counter; **SKTU** 1 GHz Noise Generator \$100; Call evenings, 301-977-7408.

TEAM AMERICA'S "PERIPHERAL BARGAINS"



CONTROLLER CARDS:

- SCSI 8bit TM850 FUTURE D \$30
- SCSI 8bit T100w/CD ROM sw \$20
- SCSI 16bit ADAPTEC 1542B \$130
- SCSI MC 1640 Adaptec \$95
- IDE I/O s/p- game 16bit \$15
- IDE 16 bit DT3767A 16bit HD only \$4
- RLL 8 bit WD1004-27X \$25
- RLL 16bit Seagate ST22R HD/FD \$20
- RLL 16bit Adaptec 2372C HD/FD \$20
- MFM 8bit SMS 5510 to 20MB \$20
- MFM 16bit SMS OMTI 8240 HD/FD \$20
- MFM 16bit DTC 7180 HD \$20
- MFM 16bit Everex EV349 HD/FD \$35
- ESDI 16 bit WD1007WA2 HD/FD \$49
- ESDI Ultra Store 12F 16bit HD/FD \$65
- ESDI 16 bit FASTOR 721 HD/FD \$45
- ESDI 16 bit DTC 6280 HD & FD \$45

CARDS:

- MEMORY CARD 16 bit 2MB EXP \$45
- MEMORY CARD 16 bit 8 simm slots \$15
- AT Multi I/O Holds 4 MB w/OMB \$15
- SVGA 16bit 256K \$30
- VGA 8 bit 256 K \$25
- CGA 8 bit \$10
- MODEM 2400 INT or EXT \$10/\$15
- MODEM 9600 EXT \$20
- SOUND CARD Microsoft 16 bit \$50 stereo, speakers, HP, mic.

MOTHERBOARDS

- 386DX40 W/CPU INTEL \$85
- 386DX NO CPU \$40
- 486DX NO CPU \$75

FLOPPY DRIVES:

- 360K 5.25" FDD blk/bge HH \$12
- 720K SMD FDD BLK \$20
- 1.44 FDD BEIGE \$31
- 1.2 FDD beige \$35

HARD DRIVES:

- 20 MB MINI 8425 MFM 3.5 " \$49
- 40MB IDE CONNER CP3044 \$75
- 40MB WD40 SCSI \$50
- 210 MB QUANT PRO210 IDE \$125
- 212 MB LXT 213SY SCSI 3.5 \$100
- 340MB CONNER IDE \$150
- 540 MB MAXTOR 7540 IDE 3.5 \$195
- 1 GIG 516-12 5.25 FH ESDI \$295
- C D ROM DRIVE 2X w/controller \$99
- CD ROM DRIVE 2X SCSI \$110
- MORE TERRIFIC VALUES
- Minitor Case BEIGE W/230W PS \$45
- XT/AT Case w/oPS \$10
- Cable Sets, HD, MFM, RLL or ESDI \$3
- Adapter Kits 3-1/2 to 5-1/4HD or FD \$5
- 101 Key Board AT/ XTSwitchable \$19
- MOUSE 3 button beige or black \$7
- Disk file boxes 30 Ct. & 80 Ct. \$5 & \$8
- LARGE ASSORTMENT OF SOFTWARE



MULTIMEDIA KIT 2X CM205
PRO-AUDIO 16 SOUND CARD
LABTECH SPEAKERS \$100

Call: 818 787-1920 Fax: 818-787-9118 16104 Covello Street Van Nuys, CA 91406

Write in 81 on Reader Service Card.

TEK PRISM 3000 microP adapters, 80186, 80286, 80386, 68000. 508-634-3806.

TEST EQUIPMENT for sale. All major brands including HP, TEK, FLUKE, Keithley and others. Savings up to 90% off list price. We also buy test equipment. Call ValueTronics, John, at 1-800-552-8258 for free catalog, or with your "For Sale" list.

SPECTRUM ANALYZERS FOR AUDIO, BROADCAST, VIDEO: Tek 7L5/L3 spectrum analyzer, 20Hz-5MHz, digital storage \$1,500; with tracking generator \$2,000. **HP 3580A** spectrum analyzer, 5Hz through 50KHz, 1Hz resolution bandwidth, digital storage, adaptive sweep, tracking generator \$1,195 to \$1,695. **Anritsu MS420B** powerful spectrum/network analyzer, 10Hz through 30MHz, 3Hz resolution bandwidth, digital storage, tracking generator \$2,700. All in excellent condition. All with warranty. Pepper Systems, 214-353-0257.

JULIE #RS-703 laboratory resistance standard 110K max. 22 individual resistors, hermetic sealed, 100 ohm increments .0015% accuracy \$400. Julie NB 403 individual resistors 4K and 1K .0015% \$75 each. L&N 4000 series standard resistors, 10 ohms and 1K \$150 ea. Beckman Helipot SB 104 3-1/4", 15 turn, 20K, .05% brand new, \$50. Also, #San-1342 1-3/4", 30K, .05%, \$60. Litton 10 turn 1-3/4" 100K, .01% \$40. 818-761-8594.

Get the latest technology in cable converters and descramblers



- Best prices
- Save on equipment rental fees
- Quality merchandise by brand-name manufacturers
- Friendly personal service
- Thirty-day money back guarantee
- All orders delivered fast and conveniently via FedEx Economy Two-DaySM service

You'll appreciate the premium view when you order from us!

1-800-841-7835

Call for free catalog

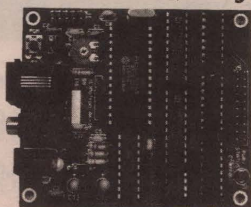
CABLE BOX
WHOLESALE, INC.

460 W. ROGER RD. #106, TUCSON, AZ 85705

Motron
ELECTRONICS

310 Garfield St Suite 4
PO Box 2748
Eugene, Oregon 97402

New Product!
\$99.00

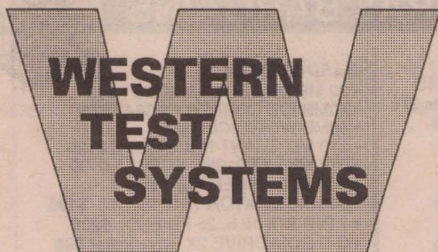


Auto-Kall® AK-16

VISA, MasterCard, AMERICAN EXPRESS, DISCOVER.
COD (\$5) on Cash or Money Order basis only.
S/H: \$6 USA; \$10 Canada; \$15 Foreign. Price and Specifications are subject to change without notice

Catalogs are also available via the Internet motron.info@emerald.com
Info: (503) 687-2118 **Orders: (800) 338-9058** Fax: (503) 687-2492

DTMF Controller Board features 16 relay driver outputs and DTMF to X10 control capability!
>CW ID >0-12 digit security code
>User programable using your DTMF keypad!
>ASCII Serial Output of incoming DTMF
>Watch-dog timer reset
>Relay driver outputs may be mated with our **RB-8/1** or **RB-16/1** relay boards
>Several modes of operation allow combinations of real-time control, on/off/momentary output control, and CW response tones
>Small size, only 2.75 X 3.25 inches
>12VDC @ 25ma



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 100MHZ

TEK 5440 50 MHz 4-Trace Oscilloscope System, w/(2)5A48, 5B42	\$650.00
TEK 5A13N Differential Comparator	\$300.00
TEK 5A18N 2 MHz Dual Trace Amplifier	\$125.00
TEK 5A19N 2 MHz Differential Amplifier	\$175.00
TEK 5B10N 2 MHz Time Base / Amplifier	\$100.00
TEK 7A13 100 MHz Differential Comparator Amp., LED display	\$400.00
TEK 7A18 75 MHz Dual Trace Amplifier	\$100.00
TEK 7A22 1 MHz High CMRR Differential Amplifier	\$400.00
TEK 7B53A 100 MHz Dual Time Base	\$200.00
TEK SC502 15 MHz Dual Trace Oscilloscope, TM500 series	\$375.00

ABOVE MHZ

TEK 475 200 MHz Dual Trace Oscilloscope	\$850.00
TEK 485 350 MHz Dual Channel Oscilloscope	\$1,100.00
TEK 7904 500 MHz 4-slot frame	\$500.00
TEK 7904 500 MHz System, with 7A24, 7A26, 7B92A	\$1,100.00
TEK 7904 500 MHz System, with 7A24, 7A26, 7B80, 7B85	\$1,100.00
TEK 7A16A 225 MHz Single Trace Amplifier	\$150.00
TEK 7A19 600 MHz Single Channel Amplifier	\$250.00
TEK 7A24 400 MHz Dual Trace Amplifier	\$450.00
TEK 7A26 200 MHz Dual Trace Amplifier	\$250.00
TEK 7A29 1 GHz Single Channel Amplifier	\$850.00
TEK 7B10 1 GHz Time Base	\$500.00
TEK 7B15 1 GHz Delaying Time Base	\$600.00
TEK 7B80 400 MHz Delayed Time Base	\$200.00
TEK 7B85 400 MHz Delta Delaying Time Base	\$250.00
TEK 7B92A 500 MHz Dual Time Base	\$450.00

STORAGE

TEK 5441 50 MHz 4-Trace Storage System, w/(2)5A48, 5B42	\$850.00
TEK SC503 10 MHz Dual Trace Storage Oscilloscope, TM500 series	\$700.00

DIGITAL

TEK 2201 20 MHz Analog & Digital Oscilloscope, 20 MS/s	\$1,250.00
--	------------

SAMPLING

TEK 7854 400 MHz Waveform Processing frame, GPIB	\$1,500.00
TEK 7S11 Sampling Unit	\$450.00
TEK 7S14 1 GHz Dual Channel Sampling Unit	\$700.00
TEK 7T11 Sampling Sweep Unit	\$950.00

PROBES

TEK 1101 Accessory Power Supply, for FET probes	\$250.00
TEK P6201 900 MHz 1X/10X/100X FET Probe	\$500.00

CALIBRATION

TEK CG551AP/TM506A Oscilloscope Calibrator, with pulse head & power module	\$3,500.00
--	------------

WAVEFORM & GENERATORS

FUNCTION

HP 3310A 5 MHz Function Generator	\$325.00
HP 3310B 5 MHz Function Generator, TM500 series	\$425.00
HP 3312A 13 MHz Function Generator, sweep, AM, FM	\$850.00
HP 8015A 50 MHz Dual Output Pulse Generator	\$650.00
HP 8015A-002 50 MHz Dual Output Pulse Generator, burst mode option	\$750.00
TEK DD501 Digital Delay & Burst Gen., for function & pulse gen's	\$375.00
TEK FG502 11 MHz Function Generator, TM500 series	\$325.00
TEK FG504 40 MHz Function Generator, TM500 series	\$875.00
TEK RG501 Ramp Generator, TM500 series	\$225.00
WAVETEK 142 10 MHz Function Generator	\$275.00
WAVETEK 148 20 MHz Function Generator, AM/FM/PM modulation	\$700.00
WAVETEK 166 50 MHz Pulse/Function Generator	\$1,250.00
WAVETEK 188 4 MHz Sweep/Function Generator, 20 Vp-p	\$275.00

PULSE

HP 214B 10 MHz Pulse Generator, 50 V/50 Ohms, auto duty cycle	\$2,250.00
HP 8005B 20 MHz Dual Output Pulse Generator	\$450.00
HP 8007B 100 MHz Pulse Generator	\$650.00
HP 8013B 50 MHz Dual Output Pulse Generator, 3.5 nS fixed Tr	\$700.00
HP 8080A/81A/82A/83A 300 MHz Word Generator	\$900.00
HP 8080A/91A/92A/93A 1 GHz Dual Channel Pulse Generator	\$1,650.00
HP 8080A/91A/92A/93A 1 GHz Single Channel Pulse Generator	\$1,400.00
HP 8080A/91A/93A 1 GHz Clock Generator	\$900.00
HP 8082A 250 MHz Dual Output Pulse Generator	\$1,400.00
PHILIPS PM5785B 125 MHz Dual Output Pulse Gen., burst mode, 1 nS Tr	\$1,100.00
PICOSECOND PULSE LAB 4600A 10V Step/3V Impulse Gen., 70 pS Tr, 0-100 kHz rep. rate	\$650.00
TEK PG501 50 MHz Pulse Generator, TM500 series	\$300.00
TEK PG502 250 MHz Pulse Generator, Tr<1nS, TM500 series	\$700.00
TEK PG505 100 kHz Pulse Generator, 80V, TM500 series	\$275.00
WAVETEK 801 50 MHz Pulse Generator	\$550.00

PROGRAMMABLE

HP 3325A Synthesizer / Function Generator, 1 uHz-21 MHz	\$2,500.00
HP 8165A Programmable Signal Source, 1 mHz-50 MHz	\$2,600.00

TEK AWG5102 Arb. Waveform Gen., 20 MS/s, 12 bits, 50ppm synthesis <1MHz	\$1,800.00
TEK AWG5105 Arbitrary Waveform Generator, 50 MS/s, 12 bits	\$2,200.00
TEK AWG5105-opt.02 Arbitrary Waveform Generator, dual channel option	\$3,000.00
TEK PFG5505 Programmable 12 MHz Pulse/Function Generator	\$1,275.00
WAVETEK 275-opt.02 12 MHz Arbitrary Function Gen., GPIB	\$1,250.00

VOLTAGE & CURRENT

VOLTMETERS

HP 3456A 6-1/2 digit Voltmeter	\$850.00
SOLARTRON 7150 5-1/2 / 6-1/2 digit Multimeter, GPIB	\$550.00

CALIBRATION

FLUKE 332B/AF DC Voltage Calibrator, 0-1111 V, 0-50 mA, 7 decades	\$675.00
FLUKE 343A DC Voltage Calibrator, 0-1100 V, 7 decades, 20 ppm acc.	\$1,375.00
FLUKE 510A AC Reference Standard, 10 VRMS, 19.2 kHz, <0.1% acc	\$450.00
FLUKE 752A DC Reference Divider	\$2,500.00

VOLTAGE SOURCES

HP 6114A Precision Dual Range Power Supply, 20 V 2 A / 40 V 1 A	\$875.00
HP 6115A Precision Dual Range Power Supply, 50V 0.8A / 100V 0.4A	\$875.00

CURRENT METERS & SOURCES

DRANETZ 656A / (3)TR2019A Current Demand Analyzer, w/(3) current probes 300A max.	\$5,000.00
HP 6177C DC Current Source, to 50V, 500mA	\$600.00
HP 6181C DC Current Source, to 100 V, 250 mA	\$675.00
HP 6186B DC Current Source, to 300V, 100mA	\$750.00
KEITHLEY 225 Current Source, 1 nA-99.9 mA, 10-100 V compliance	\$450.00
KEITHLEY 480 Picoammeter, 1 nA-1 mA f.s., 3 digit	\$3,900.00
KEITHLEY 642 Electrometer	\$650.00
LEEDS & NORTHROP 4360 Precision Current Shunts, 15-500 Amp	\$650.00
TEK CT-5 High Current Transformer for P6021/A6302, to 1000A	\$650.00

IMPEDANCE & COMPONENT TEST

L.C.R.

BOONTON 62AD 1 MHz Inductance Meter, 2-2000 uH	\$700.00
BOONTON 72BD 1 MHz Digital Capacitance Meter, 2-2000 pF	\$700.00
E.S.I. 296V 4-1/2 Digit LCR Bridge, 120 Hz & 1 kHz	\$850.00
HP 4261A 3-1/2 digit LCR Meter, 120 Hz/1 kHz	\$1,100.00
HP 4262A 101 3-1/2 digit LCR Meter, 120 Hz/1 kHz/10 kHz, HPIB	\$2,100.00
HP 4275A Multi-Frequency LCR Meter, 10 kHz-10 MHz	\$6,250.00
MEGURO MQ-171 VHF Q Meter, 20-230 MHz, Q=10-500, freq. readout 10 Hz	\$1,100.00

STANDARDS

E.S.I. RS-925 9-Decade Resistor, 0.01 ohm-1.2 Megohm	\$2,000.00
E.S.I. SR1010 Resistance Transfer Standards, 1 ohm-100 K/step	\$800.00
E.S.I. SR104 10 kilohm Standard Resistor, 0.5 ppm/year	\$2,500.00
FLUKE 5450A Programmable Resistance Standard, 2 & 4 wire	\$2,750.00
GR 1409-SERIES Standard Mica Capacitors, 0.05% accuracy	\$150.00
GR 1413 5-Decade Precision Capacitor, 0-1.1110 uF, 1 pF res.	\$1,675.00
GR 1422-N Precision Cap., 100-1150 pF, 0.2 pF res., 1% to 10 MHz	\$650.00
GR 1432-N 5-Decade Resistor, to 11,111.0 ohms, 0.1 ohm res.	\$275.00
GR 1432-U 4-Decade Resistor, 0-111.10 ohms, 0.01 ohm resolution	\$175.00
GR 1433-X 6-Decade Resistor, to 111,111.0 ohms, 0.1 ohm res.	\$550.00
GR 1434-G 7-Decade Resistor, 0-1,111,111.0 ohms, 0.1 ohm res.	\$500.00

HI & LO RESISTANCE

GR 1666 DC Resistance Bridge, 1 micro-ohm - 100 kilohms	\$1,000.00
HP 4328A-001 Milliohmeter, 0.001-100 ohms f.s., battery option	\$1,350.00
HP 4329A High Resistance Meter, 500K ohm-2x10E16 ohm, 10-1000V	\$1,350.00
VALHALLA 4150-ATC 4-1/2 digit Ohmmeter, 20 milliohms-2 kilohms, 4-wire	\$1,000.00

CURVE TRACERS

HP 4145A Semiconductor Parameter Analyzer	\$12,000.00
TEK 577D1/177 Storage Curve Tracer, with standard test fixture	\$2,250.00
TEK 577D2/177 Curve Tracer, with standard test fixture	\$1,950.00
TEK 7CT1N Curve Tracer, to 0.5W, 7000 series	\$500.00

T.D.R.

TEK 1502-opt.04 Time Domain Reflectometer, 0-2,000 feet, chart recorder	\$2,250.00
TEK 1503-opt.04 Time Domain Reflectometer, 0-50,000 feet, chart recorder	\$2,000.00

POWER SUPPLIES

SINGLE OUTPUT

GLASSMAN PS/EG-05R06 5KV CV/CL Power Supply, to 6mA	\$500.00
HP 6002A-001 Programmable Power Supply, 0-50 V / 0-10 A / 200 Watts	\$875.00
HP 6023A Autoringing Power Supply, to 20 V / 30 A / 240 Watts	\$1,000.00

HP 6207B 160 V at 200 mA CV/CC Power Supply	\$300.00
HP 6260B-027 10V at 100A CV/CC Power Supply	\$675.00
HP 6261B-027 20 V at 50 A CV/CC Power Supply	\$675.00
HP 6263B 20 V at 10 A CV/CC Power Supply	\$400.00
HP 6267B 40 V at 10 A CV/CC Power Supply	\$550.00
HP 6268B 40 V at 30 A CV/CC Power Supply	\$850.00
HP 6299A 100 V at 750 mA CV/CC Power Supply	\$250.00
HP 6384A 4.0-5.5 V at 8 A CV/CC Power Supply	\$175.00
HP 6438B 60V at 5A CV/CC Power Supply	\$375.00
SORENSEN DCR 110-45T 110 V at 45 A CV/CC Power Supply	\$2,200.00

MULTIPLE OUTPUT

HP 6227B Dual 25 V at 2 A CV/CC Power Supply	\$650.00
HP 6253A Dual Output 20 V 3 A CV/CC Power Supply	\$500.00
HP 6255A Dual Output 40 V 1.5 A CV/CC Power Supply	\$500.00
ACME PS2L-1000 Programmable Load, 0-75 V / 0-150 A / 1000 Watts max.	\$450.00
HP 59501A HPIB Isolated DAC/Power Supply Programmer	\$175.00
HP 6824A Bipolar Power Supply/Amplifier, to 50 V, 1 A	\$400.00
HP 6827A Bipolar Power Supply/Amplifier, to 100 V, 500 mA	\$800.00
KEPCO BOP-100-4M 100 V, 4 A Four Quadrant Bipolar Supply / Amplifier	\$1,000.00
KEPCO BOP-36-5M Bipolar Op Amp/Power Supply, to 36 V, 5 A	\$550.00

TIME & FREQUENCY

UNIVERSAL COUNTERS

HP 5314A 100 MHz/100 nS Universal Counter	\$225.00
HP 5315A 100 MHz/100 nS Reciprocal Counter, high res. audio	\$550.00
HP 5315A-001 100 MHz/100 nS Universal Counter, TCXO reference	\$650.00
HP 5316A-003 100 MHz/100 nS Universal Counter, HPIB, 1.0 GHz C-chan.	\$1,000.00
HP 5335A 200 MHz Universal / Statistical Counter	\$1,500.00
HP 5370B-001 100 MHz Univ. Time Int. Counter, 20 pS single shot, OCXO	\$2,250.00
HP E1420A-010, 030 VXL card 200 MHz/2 nS Univ. Counter, TCXO & 2.5 GHz C-ch	\$1,500.00
PHILIPS PM685A/056 120 MHz/2 nS Programmable High Res. Counter, OCXO, GPIB	\$950.00
TEK 7D15 225 MHz Universal Counter/Timer, 7000 series	\$275.00
TEK DC5004 Programmable 100 MHz/100nS Counter/Timer, TM5000 series	\$475.00
TEK DC5009-opt.01 Programmable 135 MHz Univ. Counter/Timer, TCXO, TM5000	\$750.00
TEK DC5010 350 MHz/3.125 nS Univ. Counter, TM5000 series	\$1,200.00
TEK DC503A 125 MHz Universal Counter/Timer, TM500 series	\$500.00
TEK DC509 135 MHz High Resolution Universal Counter/Timer, TM500	\$700.00
TEK DC510 350 MHz/3.125 nS Universal Counter, TM500 series	\$900.00

FREQUENCY COUNTERS

EIP 545-opt.05, 08 18 GHz Frequency Counter, OCXO and GPIB	\$1,875.00
FLUKE 7220A-opt.111 1.3 GHz Communications Counter, TCXO option	\$650.00
HP 5305B/3300B-001 1.3 GHz Counter Package w/TCXO ref., high res. audio	\$450.00
HP 5340A-001, 011 18 GHz Frequency Counter, OCXO reference, HPIB	\$1,900.00
HP 5342A-01, 04, 05, 11 24 GHz Frequency Counter, OCXO, DAC, and HPIB	\$3,900.00
HP 5345/5355/5356A-006 Pulsed/CW Frequency Counter, 0.4-18.0 GHz, 75 nS pulse	\$3,500.00
HP 5361A-006 20 GHz Pulsed/CW Frequency Counter, 10 Watt protection	\$6,750.00
SYSTRON-DONNER 6054B 24 GHz Frequency Counter	\$1,875.00
SYSTRON-DONNER 6054B-opt.05, 26.26 GHz Frequency Counter, GPIB	\$2,400.00
SYSTRON-DONNER 6245A-opt.12 18 GHz Frequency Counter, OCXO option	\$1,500.00
TEK 7D14 525 MHz Frequency Counter, 7000 series	\$175.00
TEK DC504 80 MHz Frequency Counter	\$125.00

STANDARDS

HP 5087A-031 Distribution Amp., 0.1/1.0/5.0 MHz x 4 channels each	\$1,800.00
HP 5359A Time Synthesizer, pulse width 5 nS-160 mS, jitter <200 pS	\$2,000.00

AUDIO & BASEBAND

SPECTRUM ANALYZERS

HP 3580A-002 Spectrum Analyzer, 5 Hz-50 kHz, 1 Hz res., bal. input	\$1,850.00
HP 3581A Wave Analyzer, 15 Hz-50 kHz	\$1,000.00
HP 3582A FFT Spectrum An., 25.6 kHz max., dual channels, HPIB	\$2,500.00
HP 3585A Spectrum Analyzer, 20 Hz-40 MHz, 3 Hz res., HPIB	\$6,000.00
HP 3586C Selective Level Meter, 50 Hz-32.5 MHz, 50 & 75 ohms	\$1,750.00
HP 8556A LF Section, 20 Hz-300 kHz \$500.00	

DISTORTION ANALYZERS

HP 334A Distortion Analyzer, 5 Hz-600 kHz, -60 dB, auto nulling	\$550.00
HP 339A Distortion Analyzer, built-in low distortion osc.	\$2,400.00
TEK DA408A Programmable Distortion Analyzer, 0.0025% THD, w/frame	\$1,500.00

RMS VOLTMETERS

FLUKE 8920A True RMS Voltmeter, 180 uV-700 V, 10 Hz-20 MHz	\$700.00
--	----------



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



HP 3400A RMS Voltmeter, 10 Hz-10 MHz \$250.00
HP 400FL AC Voltmeter, 100 uV-300 V f.s., 20 Hz-4 MHz \$200.00

OSCILLATORS

FLUKE 6011A Synthesized Signal Gen., 10 Hz-11 MHz, 10 Hz res. \$1,200.00
HP 204D Oscillator, 5 Hz-1.2 MHz, 5 VRMS, 80 dB step attenuator \$200.00
HP 209A Sine/Square Wave Generator, 4 Hz-2 MHz, 5 VRMS max. \$225.00
HP 652A Test Oscillator, 10 Hz-10 MHz \$300.00
ROCKLAND 5100 Synthesizer, 1 mHz-1.999999999 MHz \$400.00

FILTERS, MISCELLANEOUS

HP 3575A-002 Phase-Gain Meter, 1 Hz-13 MHz, dual display \$900.00
KROHN-HITE 3202 Dual High-Pass/Low-Pass \$600.00
Filter, 20 Hz-2 MHz, 24 dB/oct
KROHN-HITE 3342 Dual HP/LP Filter, \$1,100.00
0.001 Hz-99.9 kHz, 48 dB/octave
KROHN-HITE 3343 Dual HP/LP Filter, \$950.00
0.01 Hz-99.9 kHz, 48 dB/octave
TEK AM502 Differential Amplifier, 0.1 Hz-1 MHz, TM500 series \$575.00

RF & MICROWAVE

SPECTRUM ANALYZERS

HP 11970A WR28 Harmonic Mixer, 26.5-40 GHz \$1,100.00
HP 11970U WR22 Harmonic Mixer, 30-60 GHz \$1,400.00
HP 11970U WR19 Harmonic Mixer, 40-60 GHz \$1,400.00
HP 5371A Modulation Domain Analyzer, 125 mHz-500 MHz \$5,900.00
HP 9406A Comb Generator, 1/10/100 MHz increments, to 5 GHz \$450.00
HP 8443A Tracking Generator, 0.1-110 MHz, LED display \$700.00
HP 8444A Tracking Generator, 0.1-1300 MHz, for 8554B \$800.00
HP 8444A-059 Tracking Generator, 0.5-1500 MHz, \$1,500.00
for 8554, 8558, etc.
HP 8445B Preselector, 1.8-18.0 GHz, for HP 8555A \$800.00
HP 8552B IF Section, 1 kHz-110 MHz \$750.00
HP 8553B RF Section, 1 kHz-110 MHz \$500.00
HP 8554B RF Section, 0.1-1250 MHz \$800.00
HP 8554B/8552B/141T Spectrum Analyzer, \$2,000.00
100 kHz-1250 MHz, 100 Hz resolution
HP 8555A RF Section, 0.01-18 GHz \$950.00
HP 8555A/8552B/141T Spectrum Analyzer System, \$2,250.00
10 MHz-18 GHz, 10 Hz res.
HP 8555A/8552B/8445/141 As above, w/1.8-18 GHz \$3,000.00
Preselector, opt.003 freq. display
HP 8558B/181TR Spectrum Analyzer, \$2,250.00
0.1-1500 MHz, 1 kHz res., w/display
HP 8559A/181TR Spectrum Analyzer, 0.01-21 GHz, \$4,500.00
1 kHz res., w/display
HP 85711A CATV Measurements Personality, for 8590 series \$375.00
TEK 496P Spectrum Analyzer, \$5,500.00
10 kHz-1.8 GHz, 30 Hz res., GPIB
TEK 718/7603 Spectrum Analyzer, \$3,400.00
1.5-18.0 GHz, 30 Hz res., w/display
TEK TR503 Tracking Generator, 0.1-1800 MHz, for 492/415/6 \$1,750.00

NETWORK ANALYZERS

HP 11590A Bias Network, 1.0-12.4 GHz, N(f) \$375.00
HP 11590A-001 Bias Network, 1.0-18.0 GHz, APC7 \$450.00
HP 11665B Modulator, 0.15-18.0 GHz, for use with 8755/6/7 \$375.00
HP 8407A/842A/8501A Network Analyzer, \$1,250.00
100 kHz-110 MHz, with sweep generator
HP 85020A Directional Bridge, 0.01-4.3 GHz, N(f), for 8755/6/7 \$750.00
HP 85021A Directional Bridge, 0.01-18.0 GHz, \$1,200.00
APC7, for 8755/6/7
HP 85021C Directional Bridge, 10 MHz-18 GHz, N(f), \$1,200.00
for 8755/6/7
HP 85027E Directional Bridge, 10 MHz-26.5 GHz, \$2,000.00
for 8757 series
HP 85050D APC7 Calibration Kit, for 8510 series \$1,100.00
HP 8755C/11666A-02/181T Scalar Network An. \$1,750.00
w/dir. bridge, 10 MHz-18 GHz & frame
HP 8756A Scalar Network Analyzer \$3,000.00
NARDA 7000A/7202/7206 Microwave Multimeter \$1,950.00
System: scalar analysis 0.1-18 GHz
WILTRON 560/3x-7550 Scalar Network Analyzer, \$2,000.00
w/3 detectors, 0.01-18.5 GHz
WILTRON 560/560-98K50 Scalar Network Analyzer, \$2,950.00
w/VSWR Autotester 0.01-40 GHz
WILTRON 640/G50/E(2)/7B50(2) Network An., \$1,675.00
w/1-1500 MHz source, (2) log amp, (2) det.

SIGNAL GENERATORS

BOONTON 1020 Synthesized Signal Gen., 0.15-540 MHz, GPIB \$1,850.00
BOONTON 102C Signal Generator, 0.45-520 MHz, AM, FM \$850.00
FLUKE 6060A-488 Synth. Signal Gen. \$3,500.00
100 kHz-1040 MHz, 100 Hz res., GPIB
FLUKE 6060A/AN Synthesized Signal Gen., \$2,000.00
10 kHz-520 MHz, 10 Hz res., GPIB
GIGATRONICS 8050/01-8.0, opt.3 Synthesized Source, \$3,000.00
10 MHz-8 GHz, 1 kHz res.
GIGATRONICS 605/10-18, opt.3 Synthesized Source, \$3,000.00
10-18 GHz, 1 kHz res.
GIGATRONICS 875/50 Levelled Multiplier, \$3,500.00
4x, 50.0-75.0 GHz output, -3 dBm
GIGATRONICS 875/86 Levelled Multiplier, \$7,000.00
26.5-40.0 & 50.0-75.0 GHz outputs
GIGATRONICS 905/01-8.0, opt.10 Synthesized Source, \$4,250.00
50 MHz-18 GHz, 1 MHz res., +10 dBm
GIGATRONICS 905/2-18, opt.10 Synthesized Source, \$3,750.00
2-18 GHz, 1 MHz res., +10 dBm out
GIGATRONICS 910/039 Synthesizer/Sweeper, \$20,000.00
0.01-40 GHz, 1 Hz res.
HP 85100V Frequency Mult., \$4,250.00
10-15 GHz in / 50-75 GHz out >0 dBm

HP 8660B/86601A/86633B Synthesized Signal Generator, \$1,500.00
0.1-110 MHz, AM, FM
HP 8660B/86602A/86632A Synthesized Signal Generator, \$2,500.00
1-1300 MHz, AM, FM
HP 8660C/86602B/86633B Synthesized Signal Generator, \$2,750.00
1-1300 MHz, AM, FM
HP 8660C/86603A-002/35A Synth. Sig. Gen., MHz \$4,900.00
FM, phase mod. to 10 MHz
HP 8660C/86603A/86633B Synth. Sig. Gen. \$4,500.00
1-2600 MHz, AM, FM, digital sweep
HP 8683B Signal Generator, 2.3-6.5 GHz, AM, WBFM, Pulse \$5,000.00
HP 8684B Signal Generator, 5.4-12.5 GHz, AM, WBFM, Pulse \$5,000.00
WILTRON 6742A Synthesizer/Sweep Generator, \$9,000.00
18.0-26.5 & 26.5-40.0 GHz

SWEEP GENERATORS

EIP 928-opt.9201 Sweep Gen., 1.0-18.6 GHz, \$4,000.00
step atten., power sweep, GPIB
GIGATRONICS 900/01-05.12, opt.3 Synthesized Sweep/Sig. \$4,500.00
Gen., 50 MHz-12 GHz, 1 kHz res.
HP 8350A/86209B-H08 Programmable Sweep System, \$5,500.00
2.0-22.0 GHz, +4 dBm I/d
HP 8601A Generator/Sweeper, 0.1-110 MHz, +20 dBm levelled \$500.00
HP 8620C Sweep Oscillator Frame \$550.00
HP 8620C-011 Sweep Oscillator Frame, GPIB programmable \$675.00
HP 86210A RF Plug-In, 3-350 MHz, +13 dBm levelled \$450.00
HP 86222A-002 RF Plug-In, 10-2400 MHz, 70 dB step attenuator \$1,750.00
HP 86222B-002 RF Plug-In, 10-2400 MHz, \$1,950.00
crystal markers, 0-70 dB atten
HP 86240B RF Plug-In, 2.0-8.4 GHz, +13 dBm levelled \$1,000.00
HP 86240C RF Plug-In, 3.6-8.5 GHz, +16 dBm levelled \$1,200.00
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 86250D-001 RF Plug-In, 8.0-12.4 GHz, +10 dBm levelled \$700.00
HP 86260A RF Plug-In, 12.0-18.0 GHz, +10 dBm levelled \$1,000.00
HP 86290A RF Plug-In, 2.0-18.0 GHz, +7 dBm levelled \$1,750.00
HP 86290B RF Plug-In, 2.0-18.0 GHz, +10 dBm levelled \$2,000.00
WAVETEK 1001A Sweep Generator, 0.5-300 MHz \$350.00
WAVETEK 1067 Sweep Generator, 1-400 MHz, \$500.00
+10 dBm, 75 ohms
WAVETEK 2002 Sweep Gen., 1-2500 MHz in \$1,500.00
4 bands, +10 dBm levelled
WAVETEK 954 Signal/Sweep Generator, 3.7-7.6 GHz, \$2,000.00
+7 dBm levelled
WAVETEK 962 Sweep Generator, 1.0-4.0 GHz, markers, \$2,500.00
+12 dBm univld.

POWER METERS

BOONTON 42B41-4E Analog Power Meter, with \$650.00
1 MHz-18 GHz sensor
BOONTON 42B42A-S3 Analog Power Meter, with \$375.00
1 MHz-8.4 GHz N(f) sensor
GENERAL MICROWAVE 4764/240A Power Meter & Sensor, \$375.00
0.01-18 GHz, -35 to +10 dBm
HP 11683A Range Calibrator, for HP 435/67/8 \$750.00
HP 432A/478A Power Meter, 0.01-10 GHz, -20 dBm to +10 dBm f.s. \$375.00
HP 432A/8478B Power Meter, 0.01-18 GHz, -20 to +10 dBm f.s. \$500.00
HP 432C Autorangeing Digital Power Meter, 10 uW-10 mW f.s. \$425.00
HP 435A/8481A Power Meter, 10 MHz-18 GHz, -30 to +20 dBm \$1,000.00
HP 435A/8482A Power Meter, 0.1-4200 MHz, -30 to +20 dBm \$1,000.00
HP 435A/8482B Power Meter, 0.1-4200 MHz, -15 to +34 dBm \$1,150.00
HP 435A/8484A Power Meter, 10 MHz-18 GHz, -70 to -20 dBm \$1,000.00
HP 435A/8484B Thermistor Mount, 18.0-26.5 GHz, for 432 series \$400.00
HP Q486A Power Sensor, 33.0-50.0 GHz, WR22 waveguide \$1,500.00
HP R486A WR28 Thermistor Mount, 26.5-40.0 GHz, for 432 series \$400.00

RF MILLIVOLTMETERS

MILLVAC MV-723BBS RF Millivoltmeter, \$375.00
RACAL 9303 TRMS Level Meter \$875.00
10 kHz-2 GHz, -77 to +23 dBm, GPIB 10 kHz-1.2 GHz, 1 mV-30 V

AMPLIFIERS, MISCELLANEOUS

ALITECH 7616 Noise Source, 1.0-12.4 GHz, N(m), 15 dB ENR \$375.00
ALITECH 7618E Noise Source, 10 MHz-18 GHz, \$500.00
SMA(m), 15 dB ENR
AMPLIFIER RESEARCH 1W1000 Amplifier, 30 dB gain, \$650.00
1-1000 MHz, 1 Watt output
BOONTON 82AD FM/AM Modulation Meter, 10-1300 MHz \$1,000.00
ENI 240L Amplifier, 50 dB, 20 kHz-10 MHz, 40 Watts \$1,250.00
ENI 403LA Amplifier, 37 dB gain, 150 kHz-300 MHz, 3 Watts \$700.00
ENI 600L Amplifier, 24 dB, 0.8-1020 MHz, 150 mW \$450.00
ENI A150 Amplifier, 55 dB, 0.3-35.0 MHz, 150 Watts \$2,000.00
ENI A300 Amplifier, 55 dB, 0.3-35.0 MHz, 300 Watts \$3,500.00
M.P.D. LAB2-1020-2A Amplifier, 34 dB, 1.0-2.0 GHz, 2 Watts \$1,000.00
M.P.D. LAB2-110-1E Amplifier, 30 dB, 100-1000 MHz, 1 Watt \$700.00
M.P.D. LAB2-714-3A Amplifier, 34 dB, 0.7-1.4 GHz, 3 Watts \$1,000.00
MICROWAVE SEMI.CORP. MC5112 Noise Source, \$325.00
25.5 dB ENR, 1.0-12.4 GHz, N(m), +28 VDC

COAXIAL & WAVEGUIDE

AEROWAVE 15-3000/10 WR15 Directional Coupler, \$400.00
10 dB, 50-75 GHz
AEROWAVE 22-3000/10 WR22 Directional Coupler, \$400.00
10 dB, 33-50 GHz
ANX42 MDC-171 Mixer, RF/LO=4-18 GHz \$135.00
LO +7 dBm, IF=DC-4 GHz, SMA
AVANTEK Y083-4037 YIG Tuned Osc. \$100.00
5.4-10 GHz, +15/-5 V, TUNE & FM coils, NEW
EM SYSTEMS A6110 Dual Polarized Horn, \$750.00
0.5-2.0 GHz, 0-10 dB gain, N(f)
GR 874-LTL Constant Impedance Trombone \$450.00
Line, 0.44 cm, DC-2 GHz
GR 900-LB Precision Slotted Line, 3-8.5 GHz, 50 Ohms 0.1% tol. \$450.00
GR 900-Q GR900 14mm Interferometry Adapters \$125.00
HP 11691D Directional Coupler, 22 dB, 2-18 GHz \$500.00

HP 11692D Dual Directional Coupler, 22 dB, 2-18 GHz \$900.00
HP 33330D Detector, 0.01-33.0 GHz, APC3.5(m)/SMC(f) \$275.00
HP 7780-011 Dual Directional Coupler, 20 dB, 100-2000 MHz \$400.00
HP 7790 Directional Coupler, 20 dB, 1.7-12.4 GHz \$375.00
HP 8472A Crystal Detector, 10 MHz-18 GHz, \$150.00
neg. pol., SMA(m)
HP K532A WR42 Frequency Meter, 18.0-26.5 GHz \$500.00
HP K752A WR42 Directional Coupler, 3 dB, 18.0-26.5 GHz \$425.00
HP K752C WR42 Directional Coupler, 10 dB, 18.0-26.5 GHz \$425.00
HP K752D WR42 Directional Coupler, 20 dB, 18.0-26.5 GHz \$425.00
HP K914B WR42 Sliding Load, 18.0-26.5 GHz \$425.00
HP Q752D WR28 Directional Coupler, 20 dB, 33-50 GHz \$650.00
HP R532A WR28 Frequency Meter, 26.5-40.0 GHz \$500.00
HUGHES 45342H-1110 WR22 Dual Directional Coupler, \$875.00
10 dB, 33-50 GHz
KRYTAR 20202016 Directional Det., 2-20 GHz \$200.00
SMA(f/m)/SMC(f), 10 uV/uW
M/A-COM 3-19-300/10 WR19 Directional Coupler, \$450.00
10 dB, 40-60 GHz
MAURY MW. J320-series WR22 Calibrated Mismatch, \$375.00
VSWR values 1.1-2.0
MICROWAVE FILTER CO. 4043A 'Terrestrial Tracer' \$300.00
Dual Indep. Notch Filter, 3.7-4.2G
MILLIWAVE S90-1060 Amp., 8 dB, 18-26.5 GHz \$475.00
+19 dBm Po, 5V 500mA, SMA(f)
MILLIWAVE S91-1777B Amp., 8 dB, 18-26.5 GHz \$325.00
+16.5 dBm Po, 12V 600mA, SMA(f)
MILLIWAVE S91-1777B Amp., 2.75 dB, 18.0-26.5 GHz \$150.00
+19 dBm Po, 12V 200mA, SMA(f)
MITEQ AMP-1269 Amplifier, 30 dB gain, 700-1200 MHz, \$175.00
1 Watt, 24V 500mA
NARDA 26298 20 dB Attenuator, 150 Watts, DC-1 GHz, N(f) \$200.00
NARDA 3000-SERIES Directional Couplers \$150.00
NARDA 3020A Dual Directional Coupler, 20 dB, 150-1000 MHz \$325.00
NARDA 3090-SERIES Precision High Directivity Couplers \$225.00
NARDA 4000-SERIES SMA Miniature Directional Couplers \$75.00
NARDA 4203-6 Directional Coupler, 6 dB, \$225.00
2-18 GHz, SMA(f/f)
NARDA 5070-SERIES Precision Reflectometer Couplers \$300.00
NARDA 792FF Variable Attenuator, 0-20 dB, 2.0-12.4 GHz \$375.00
OMNI-SPECTRA 2082-5810-02 Adj. Phase Trimmer, \$50.00
8-18 GHz, 10 deg./GHz range, SMA(m)
PRD N233A/232 Slotted Line, 3-12 GHz, N(m/f) \$175.00
w/cable & detector
RLC AV-70124-R Level Set Attenuator, 0-20 dB, \$75.00
7.0-12.4 GHz, SMA(f)
SPACEK LABS DQ-1 WR22 Flat Broadband \$550.00
Detector, 33-50 GHz
TRG B510 WR22 Precision Rotary Vane Atten., \$1,000.00
0-50 dB, 33-50 GHz
TRG B551 WR22 Precision Rotary Vane Atten., \$550.00
33.0-50.0 GHz
TRG V510 WR15 Precision Rotary Vane Atten., \$1,000.00
0-50 dB, 50-75 GHz
TRG V551 WR15 Frequency Meter, 50.0-75.0 GHz \$600.00
TRG/ALPHA V559-10 WR15 Directional Coupler, \$400.00
10 dB, 50-75 GHz
WEINSCHEIL 1515 Power Divider, DC-18 GHz, SMA(f/f) \$125.00
WEINSCHEIL 1579 Power Divider, DC-26.5 GHz, \$275.00
APC3.5(f/f) 'NEW'
WEINSCHEIL 3200-1 Programmable Step Atten., \$200.00
0-127 dB, DC-2 GHz, SMA 'NEW'
WILTRON 60A50-opt.1 SWR Bridge, 5-2000 MHz \$550.00
APC7 test port, 46 dB directive
WILTRON 60N50-opt.1 SWR Bridge, 5-2000 MHz, \$550.00
N(f) test port, 46 dB directive
WILTRON 64A50 VSWR Bridge, 3-8 GHz, 36 dB dir., \$400.00
APC7 test port
WILTRON 87A50 VSWR Bridge, 2-18 GHz, 35 dB dir., \$950.00
APC7 test port

LOGIC

HP 5005A Signature Multimeter \$350.00
HP 8170A-002 Logic Pattern Generator, 2 MB/s, \$1,400.00
address driver option
TEK 1240 Logic Analyzer, w/(36) 50 MHz channels \$1,500.00

COMMUNICATIONS

HP 3551A Transmission Test Set \$750.00
HP 4935A Transmission Test Set, 20 Hz-110 kHz \$1,675.00
HP 59401A HP1B Bus Analyzer \$700.00
TEK 14110R-opt.04 NTSC Test Signal Gen. w/ \$2,750.00
SPG2, TSG1, TSP1, TSG3, TSG5, TSG6
TEK 1411R-opt.04 PAL Test Gen. w/ \$2,750.00
SPG12, TSG11, TSP11, TSG13, TSG15, TSG16
TEK 144 NTSC Test Signal Generator \$675.00
TEK 147A NTSC Test Signal Generator, with noise test signal \$950.00
TEK 1485R Dual Standard Waveform Monitor, NTSC & PAL \$1,850.00
TEK 520A NTSC Vectorscope \$1,250.00

MISCELLANEOUS

HP 59307A HP1B VHF Switch \$200.00
P.A.R. 5205-94, 95, 96, 98 Lock-In Amp, \$2,750.00
20 Hz-20 kHz, int. osc., lin/log, GPIB
P.A.R. 5206 Two-Phase Lock-In Amplifier, 2 Hz-200 kHz \$3,000.00
TEK TM5006 5000-series 6-slot \$600.00
Programmable Power Module
TEK TM503 500-series 3-slot Power Module \$175.00
TEK TM504 500-series 4-slot Power Module \$175.00
TEK TM506 500-series 4-slot Power Module \$250.00
TEK TM515 500-series 5-slot Traveller Power Module \$275.00

CABLE TV DESCRAMBLERS

Best Wholesale Prices in the U.S.A.!

	1-4	5-9	10-19	20-49	50+
TNT+	69	62	55	45	40
Stealth+	55	49	44	39	34
FTB3	49	39	35	32	30
<i>For Scientific Atlanta Systems</i>					
M80	69	62	55	45	40
SA3	55	45	40	36	33
<i>For Pioneer Systems</i>					
Super-PIO+	69	62	55	45	40
<i>Panasonic Converter</i>					
TZPC1003	75	67	62	59	57

If you see a lower price in the Nuts & Volts,
please give us a call, we will beat anyone's price!

**Fast Shipping
Best Service**

1-800-818-9688

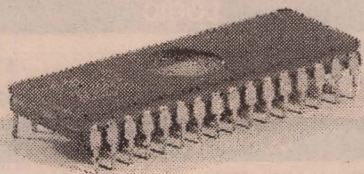
U.S. Cable TV Inc. M-F: 9-6 EST

4100 N.Powerline Rd., Bldg.F4 Pompano Beach, FL 33073

U.S. Cable will only sell the cable equipment to authorized cable subscribers. It is illegal to operate this equipment without paying for the basic and the premium services. U.S. Cable will not sell to anyone who will not comply with Federal and State laws.

No Florida Sales.

Write in 201 on Reader Service Card.



**NEW!!! FROM
"L.R.T. ELECTRONICS"**

ONLY \$19.95 PLUS \$2.95 S&H

The "60 Second" 800 MHz scanner modification. No disassembly required!

No complicated codes. Just results.

Guaranteed the first time you use them. These mods are simple and easy to perform
right from your scanner's keypad!!!

Your little sister could do it, it's that easy!!!

Visa and MasterCard welcome. When using money order or personal checks, please allow 4-6 weeks for personal checks to clear. For Visa or MasterCard, please call: 606-920-9086, 24 hours a day.

Send check or money order to:

L.R.T. ELECTRONICS, 1111 Council Street, Flatwoods, KY 41139

THANK YOU!!!

**This information is for informational purposes, law enforcement, and cellular employees testing only!!!
L.R.T. Electronics Will Not Be Responsible For Misuse Of This Information In Any Way.**

ELECTRONIC COUNTER-SURVEILLANCE

Offering the latest in high tech counter-surveillance
equipment

- Bug detectors (wide band / scan lock / spectrum analyzer)
- Telephone privacy (voice / fax / modem)
- Video cameras (IR / pinhole / wireless)*
- Tone decoders
- And more

For complete catalog send \$5.00

Dealers
welcome

DSI

DIGITEQ SECURITY, INC.

373 Pleasant Ave. Hamburg, NY 14075

Phone (716) 646-0027

Fax (716) 646-4538

Write in 132 on Reader Service Card.

#80 TEST EQUIPMENT cont.

TEKTRONIX 545 and **535** oscilloscopes. Both work with 1 type-W and 1 type-M plug-in units. 1 Mercury 204 tube tester in very good working and cosmetic condition. Make offer. Mike McGary, 1801 Mountainbrook Drive, Huntsville, AL 35801. 205-539-4804.

HP 8614A, 800-2400 MHz, \$300. **HP 8616A**, 1.8-4.5 GHz, \$250. **HP 8656A**, .1-990 MHz, \$2,000. **HP 3455A**, 6.5 digit volt mtr. \$400. **Racal Dana 1992** universal counter, \$395. **Schlumberger SI-1253** gain phase mtr. Tek scopes, 465M, \$350. 465, \$400. 475, \$450. 464, \$500. 323, \$200. **HP scopes**, 1741A, \$350. 1725A \$450. **HP spectrum analyzer 8559A/182T**, .01-21 GHz, \$3,000. **Bafco 911A** freq. response analyzer. Call for list of others. Don Phelps, 909-279-7347.

TEST RECEIVERS, Stodart NM25T, Radio interference and field intensity meter, \$1,200, offers. Poarad test receiver, ESH-2, all modes 9KHz-32MHz. Offers, all working in excellent condition. Psitech Plus, 707-745-4804, fax 707-747-5277.

ACME P5 2L-1000 electronic load \$675/offer. Dexis 612-944-7670.

BIRD 4308 Thru line wattmeter, cellular emulators, Motorola, Triplet, IFR, Wavetek, Marconi, Etc., Used. Call Les, 702-642-0325.

HP 8151A optical pulse power meter \$700, **HP 5180A** waveform recorder \$600, **HP 400EL** AC voltmeter \$125, **HP 1610A**, 1610B Logic state analyzer \$100, **HP 6940B** multiprogrammer \$150, **HP 5359A** Time synthesizer \$900, **HP 8410A** network analyzer \$175, **HP 8412B** phase-mag display \$175, **TEK 7844** 400MHz oscilloscope \$300, **HP 3500** attenuator set \$100, **HP 34702A** multimeter \$100, **Fluke 1953AE** counter timer \$200, **Fluke 8000** digital multimeter \$60, **TEK 7B71** \$100, **TEK P6452DATA** acquisition \$45, **H-H Scott** random noise generator \$50, **Tek P6105**, **P6106** Prob \$45. **HP 85** \$50, **KIKUSUI** electronics power supply **PBA 32-2** \$100, **Gould K450L** Logic Analyzer \$100 **TEK 4957** digitizer \$100, **Lamda LP-521-FM** V=20V, I=3.3A, **LP-520-FM** V=10V, I=5.0 \$100, **HP 7475A** plotter \$125, **HP 7550A** plotter \$200, **JDR** instrument oscilloscope 2000 \$300. **Beckman PH** meter G \$50, signal source **1208A** selectable rate TV test pattern generator \$175, **Philips PM 3214** oscilloscope 0-25MHz \$175, pulse instruments **451A-16**, \$125, **Prom** programmer series 22. Call 714-827-7345.

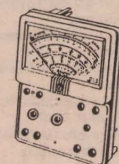
TEK DAS9220 mainframes. 92A16 acquisition cards. P6460, P6461 probes. 92S16 pattern generation cards. P6464, P6465 probes. 92A90, 80386 adapter and S/W. **DAS9200** LAN cards. 508-634-3806.

TEK 7104 1GHz mainframe warranty \$4,995. Dexis 612-944-7670.

HP 3456A NIST traceable calibrated by GE, Electronics services on 4/12/95, \$1,500. Call Chris at, 509-735-9446, at Belhaven Applied Technologies, 415 N. Quay, Kennewick, WA 99336.

TEKTRONIX 1240A logic analyzer \$1,500, 9129 DAS logic analyzers \$1,000 ea., **HP 1980** scope \$1,500, **Rockland 500kc** spectrum analyzer \$500. 818-352-6619.

WANTED! 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.



BRAND NEW Simpson 260-6XLP VOM Meter fronts with taut-band meter only requires outer case and internals for completion. \$33 post paid. Ordinance Unlimited, 20945 Osborne St., Canoga Park, CA 91304. Ph: 818-700-2905. Ask for Dean.

Electronics Safety — It's Your Life

by Ronald Reis

If you're a hobbyist, working in the den, garage, or basement, the electricity pulsing through your projects and equipment could, if not properly contained, kill you. Furthermore, the myriad of toxic and hazardous chemicals you're using to clean, lubricate, and etch circuit boards with are often noxious and corrosive. And then there are the hand and power tools you use to cut, drill, grind, and solder. If mishandled, you're likely to wind up laid up, at home or even in the hospital.

In this article, we'll look at external body parts susceptible to damage; electrocution, the heart of the matter; electricity, the tingle that hurts; avoiding being exposed to toxic and hazardous chemicals; safety hazards caused by the misuse of hand and power tools; and creating a safe working environment. We will do so, for the most part, in a do's and

don'ts format that will provide you with the specifics needed to stay safe and keep building, testing, and repairing electronic projects and devices.

External Body Parts Susceptible to Damage

The human body is a fragile thing. It is easily cut, bruised, burned, irritated, shocked, and poisoned. External organs associated with our five senses and internal organs vital to our very lives are susceptible to injury, not only in the workplace, but at home in the den, garage, or basement.

Injury to the eyes can cause permanent blindness. Small objects, such as clipped component leads and flying solder balls, can stab and burn sensitive parts of the eye. Furthermore, a splash of acid or the spray from a cleaning solvent can, at the very least, irritate; at the worst, it

can destroy the entire eye. Even a bright flash of light from a strobe light project, for example, can cause a serious accident. If you are only momentarily blinded, it may be enough to make you susceptible to other forms of injury.

Loud sounds and high-pitched tones can be very irritating to the ears. In extreme cases, they

may cause temporary or even permanent hearing loss. It isn't just heavy metal rock bands that can produce such noises. Many types of electronic devices can blast forth with ear piercing decibels.

You may not think your nose is vulnerable to dangers found in your work area. Yet toxic fumes can be irritating to the membranes lining the nasal passages. More importantly, the nose is one entry leading to the lungs. Damage there can be very serious, as it may affect your ability to breathe properly.

Your mouth, or throat, can also be an opening for foreign and hazardous particles. Of course, you wouldn't knowingly put any acid solution or solder wire (which is 40 percent lead) in your mouth. But if etching acid (ammonium persulfate, for example) gets under your fingernails, and you bite your nails, you could be

in trouble. The greatest danger, however, lies in using your mouth as a temporary vise to hold small pieces of hardware, tiny transistors, and short strips of wire. Accidental swallowing, or a quick slap on the back from a friend, and presto — it's time to have your stomach pumped.

Then there is the skin, the outer layer designed to protect the entire body. Destruction of nerve endings as a result of electrical shock, burns from soldering irons and hot components, acid irritations, and, of course, common cuts, bruises, and abrasions can occur in an environment where safety is lax.

Clearly, your entire body is subject to harm. However, there is no cause for alarm, only a healthy concern. Shortly, we'll see how you can eliminate most of these dangers from your work area by taking simple precautions and following commonly

I hear it now: "You've got to be kidding, an article on safety? That's a subject for schools. Maybe they also cover it at work, from time-to-time. But I'm an experimenter, a hobbyist, what does safety have to do with me?" Actually, plenty. It's exactly those who have been out of school for some time, or aren't employed in the industry, that are likely to need a safety refresher course the most.

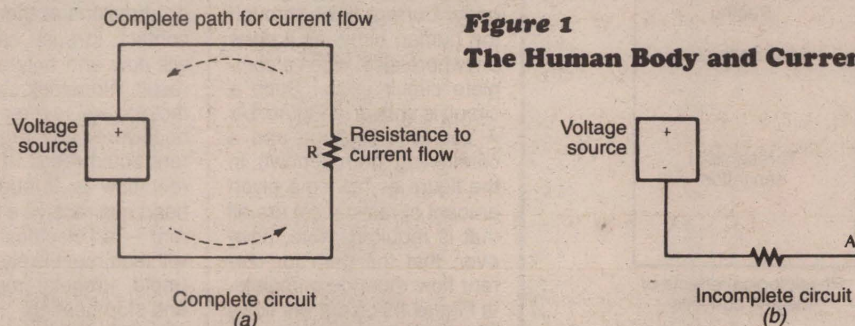
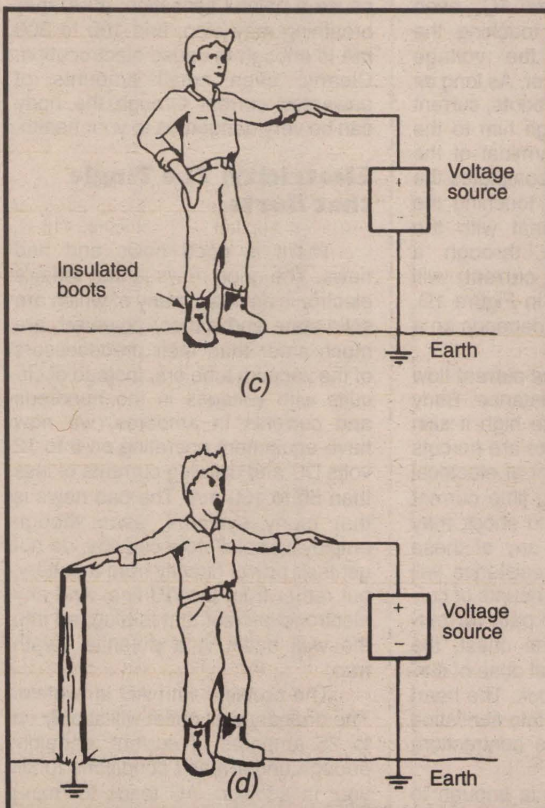


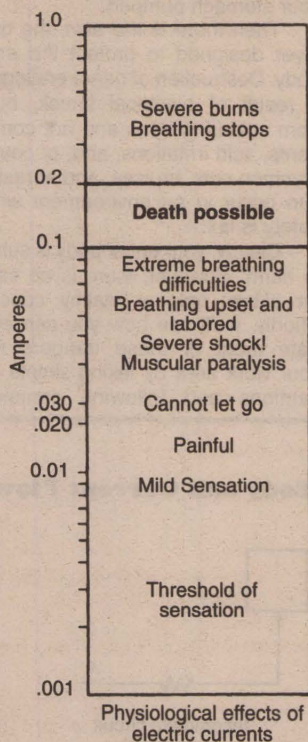
Figure 1
The Human Body and Current Flow

Figure 3**Do's and Don'ts: Working with Electricity****The Do's**

- * Do work with one hand behind your back while testing live circuits. In that way if you complete the path for current flow, at least it won't be through your heart.
- * Do use an isolation transformer or Variac (autotransformer) while working on AC-powered equipment. These devices isolate the powered equipment from the power source, adding a strong measure of safety.
- * Do make sure all capacitors (components that store an electrical charge) are discharged before troubleshooting begins. Use an insulated screwdriver to short out capacitor leads.
- * Do use three-conductor grounded line cords and polarized plugs with AC-operated equipment. Both items reduce the danger from short-circuited chassis.
- * Do keep your fingers out of live chassis. Test all circuits with a voltmeter or specially designed test lamps.

The Don'ts

- * Don't install or remove any electronic components while the circuit is connected to a power source. Following this procedure will protect you, as well as the component.
- * Don't overfuse. Using a fuse with a higher rating than is recommended only defeats the fuse's purpose.
- * Don't work with wet hands. As noted earlier, if body resistance goes down, current flow goes up. Even sweat can moisten the hands enough to cause excessive current flow.
- * Don't cut wires carrying electricity. Again, it isn't just the AC line cord that is lethal. Assume all wires carry enough current to harm you.
- * Don't disconnect electrical devices from the wall outlet by pulling on the line cord; pull the plug handle.

Figure 2**How much current is enough to kill?**

accepted safety practices.

Electrocution — The Heart of the Matter

Protecting external body parts is one thing, preventing damage to various internal organs, particularly the heart, is vital. If the heart stops, even for only four to six minutes, death can result. Many factors can cause the heart to stop beating. For purposes of discussion here, **electrocution**, or **electrical shock**, is the most relevant. Let's see just what electrical shock is and how it can destroy the heart.

Electrical shock is the passage of current through the body. Current flows through the human body, as it does anywhere else, when a complete circuit exists. Such a circuit is shown in Figure 1A. A source of voltage and a conducting path (shown in the figure as having a given amount of resistance) are all that is required. Note, however, that the path for current flow must be complete. In Figure 1B no current flows to point A. The reason is that

Figure 4**Do's and Don'ts: Working with Toxic and Hazardous Chemicals****The Do's**

- * Do read the labels on all the chemicals you use. Pay particular attention to printed warnings.
- * Do work in well-ventilated areas. This is particularly important when using paint and chemical sprays.
- * Do wear eye protection when working around hazardous chemicals.
- * Do wear rubber gloves when working with acid solutions. Be sure they are washed or thrown away when work is done.
- * Do hold printed circuit boards securely with tongs when placing them in or removing them from an acid solution when etching.
- * Do immediately clean all tools that have come in contact with hazardous chemicals. This will prevent someone from inadvertently touching the toxic substances.

The Don'ts

- * Don't pour solvents, paints, or acids down the drain. In addition to being a health hazard, in many localities it is illegal.
- * Don't transfer chemicals to unlabeled containers.
- * Don't inhale fumes from soldering paste. Such fumes can be harmful to your lungs.
- * Don't leave any chemicals in open containers where they can be splashed or spilled. Put all unused chemicals safely away, preferably in a locked metal cabinet.
- * Don't place any chemicals near sparks or open flames. Assume all chemicals are highly combustible.

although it has a place to come from (in this case, the battery's negative terminal), it has no place to go (in this case, the battery's positive terminal).

The same is true when the human body is the conducting path. As illustrated in Figure 1C, even though the person is touching the positive terminal of the voltage source, he is in no danger. As long as he is wearing insulated boots, current can find no path through him to the negative, or ground, terminal of the battery. However, if he completes the circuit by, for instance, touching the negative battery terminal with the other hand (possibly through a ground connection), current will indeed flow, as shown in Figure 1D. Just how much current depends on a number of factors.

One way to increase current flow is to reduce circuit resistance. Body resistance may be quite high if skin moisture is low and there are no cuts or abrasions at the point of electrical contact. In such cases, little current will flow and only a mild shock may result. Nonetheless, if any of these factors are reversed, resistance will be lowered and large amounts of current could result. If the path for current flow is through the chest, the heart can receive a lethal dose of current — an electrical shock. The heart will then most likely go into fibrillation (rapid, irregular muscle contraction) and stop beating.

How much current is enough to

kill? Although the amount varies widely and especially depends on the organs that current passes through, it is less than you probably think. Figure 2 gives the effects of even mild doses of current. A mere 1 to 20 mA can cause a painful sensation; at 30 mA, breathing may stop; and 100 to 300 mA is enough to cause electrocution. Clearly, even small amounts of unwanted current through the body can be very dangerous to your health.

Electricity: The Tingle that Hurts

There is good news and bad news. The good news is that today's electronic devices, many of which are solid-state and battery powered, are much safer than their predecessors of the vacuum tube era. Instead of circuits with voltages in the hundreds and currents in amperes, we now have equipment operating on 5 to 12 volts DC and drawing currents of less than 50 to 100 mA. The bad news is that many systems, even though employing solid-state circuitry, do not get their power directly from a battery, but rather from the AC line. And any electronic project that is plugged into the wall outlet is a potential death trap.

The problem with AC is twofold. The ordinary wall outlet will supply up to 25 amperes of current, certainly enough under many conditions to kill you. In addition, AC tends to "hang

on." The victim can be prevented from releasing the source of voltage, thus increasing the damage to the body.

But circuits powered from the AC line are not the only problem. A serious shock can be had from many circuits, DC or AC, containing charged capacitors, faulty wiring, or shorted components. Treat every electronic circuit as potentially hazardous. Electricity, though not to be unduly feared, must be respected.

One solution to being safe while working with electricity is to follow some basic "do's and don'ts." A list of the more important ones are shown in Figure 3.

There is not much you can do for yourself if severe electrical shock occurs. All the more reason you should avoid working alone whenever possible. At the very least, if you are fiddling around in a garage or basement, make sure someone is in the house and knows what you are doing.

When I am out in the garage alone, I plug in — don't laugh — a line-operated "nursery monitor," the kind used to listen to your baby from another room. The transmitter is in the garage, the receiver, in the house with my wife. If anything happens, chances are she'll hear me yelling.

Exposure to Toxic and Hazardous Chemicals

With toxic and hazardous chemicals, you should be concerned about inhaling vapors, swallowing liquids, acid burns on the skin, contact with the eyes, and the overall danger of fire and explosion. Chemicals such as etching solutions, spray paints, component cleaners, glues, photographic developing solutions, and general household solvents can cause health hazards if improperly

used or stored. To minimize risks, follow the do's and don'ts listed in Figure 4.

If an emergency occurs, follow all first-aid directions printed on the label of the chemical you have been using. Read the label before use so that you won't be confused if trouble develops. For example, some instructions tell you to induce vomiting if the substance is swallowed; others tell you not to. Do what the label says and call a physician immediately.

More specifically, in the case of acid burns and eye irritations, wash and flush thoroughly with cold running water. When exposure to vapors has occurred, get yourself outside in the open air.

Safety Hazards Caused by the Misuse of Hand Tools

Hand tools, those held in the hand and not powered by electricity, can be more dangerous than power tools. Why? Because they are used more often and we tend to dismiss their risk. Do not be deceived. A slip of a hacksaw blade or the launching of a loose hammerhead can maim you — or someone else — for life. Whether it's a puncture from a file tang, a gash from a saw blade, or a slit from a knife, hand tools can do plenty of damage. To avoid the obvious dangers, consider the list of do's and don'ts in Figure 5.

Injury from hand tools usually results in a cut or burn. What specific action to take when a laceration occurs depends on its severity. In all cases, clean the wound, apply direct pressure, and elevate the injured body part. With regard to burns, flush the affected area with cold water (do not apply ice directly) and cover with a clean cloth. Now seek medical aid.

Figure 5

Do's and Don'ts: Working with Hand Tools

The Do's

- * Do keep hands free of dirt, grease, or oil when using hand tools.
- * Do keep hand tools sharp. A dull tool is more dangerous than a sharp one because with a dull tool you tend to apply more pressure, increasing the likelihood of slippage.
- * Do cut away from your body, not toward it.
- * Do secure all small pieces of work in a vise or with appropriate clamps.
- * Do put sharp tools away when not in use. Leaving knives, awls, and punches lying around for someone to lean on is extremely dangerous.

The Don'ts

- * Don't carry hand tools in your pocket; they may injure you or someone else.
- * Don't use a file without a handle. An exposed file tang can easily puncture your hand or wrist.
- * Don't run your hands over the edges of sheet metal. Such edges are sharp and can cause severe cuts.

Safety Hazards Caused by the Misuse of Power Tools

Power tools — those that use electricity — can burn, cut, scrape, and even hit you with flying objects. Because most of them plug directly into the wall outlet, they can also give you a nasty electrical shock. Injuries from power tools occur by long hair or unsuitable clothing getting caught in a revolving machine, by small objects flying out of a drill press vise, by guards or safety devices being removed, or by a hot soldering iron being left where someone can lean against it. To prevent such injuries, follow the do's and don'ts shown in Figure 6.

Injuries resulting from misuse of power tools are similar to those occurring with hand tools, so the first-aid procedures are essentially the same. The accident itself, however, may be more severe. Get help immediately, then follow the appropriate first-aid measures.

A Safe Working Environment

Following the do's and avoiding the don'ts presented here will do much to keep you safe while working in your chosen hobby. Yet, more than

anything else, establishing a good, clean, well lit working environment is the key to safety success.

Try to locate a workbench in an area that will provide a minimum of distractions. Such a location will increase the likelihood that the bench will be used only for its intended purpose: electronic project building and circuit testing and repair.

The workbench should remain relatively clean. The dirt and mess associated with normal mechanical assembly (such as would occur when working on your car, for example) is incompatible with modern electronics fabrication and repair.

Your workbench should be bathed in direct and indirect light. You might not think this lighting is necessary, but when you are working with tiny circuits and minute letters and numbers printed on small components, you will need all the brightness you can muster. A drafting lamp can provide a concentrated direct beam of light.

An even better choice is a swivel lamp with an illuminated magnifier. Such lamps are particularly useful when you are inspecting or assembling printed circuit boards.

That should do it. Enjoy your electronics experimenting, building, and repairing. And stay safe. NV

Figure 6

Do's and Don'ts: Working with Power Tools

The Do's

- * Do turn on and off all power tools yourself. Do not allow others to do it for you.
- * Do make sure all objects being drilled or cut are securely fastened. Small objects, and especially sheet metal, should be held in a vise, clamp, or suitable gripping tool such as pliers or vise grips.
- * Do see to it that all implements and adjusting tools are removed from your work area.
- * Do remove the chuck key from a drill press before turning on the machine. A flying chuck key is a frequent cause of injury.
- * Do ease up on the drill pressure as you break through the work. This will reduce the possibility of the material "grabbing."
- * Do grasp a soldering iron only by the handle. Don't reach for a falling soldering iron — let it fall.
- * Do return a soldering iron to its holder. It should be in either one of two places: your hand or in the holder.

The Don'ts

- * Don't ever leave power tools unattended. If the tool is on, stay with it until it is off — and until all parts have stopped moving.
- * Don't wear clothing or accessories (jewelry) that can get tangled in revolving machine parts.
- * Don't stand in the direct "throw" of any machine. Don't line yourself up with a revolving saw blade or spinning grinding wheel.
- * Don't remove guards or safety devices from power tools. They have been installed for a good reason; keep them in place.
- * Don't test a soldering iron with your hand. Assume all soldering irons are hot. Test them by attempting to melt a piece of solder.

TONY TALLI'S ORIGINAL *SINCE* 1984 TELEVIEW DISTRIBUTORS

WHERE OUR VALUED CUSTOMERS' BUSINESS
IS HONESTLY APPRECIATED

1 • 800 • 847 • 3773

VEGA ONE ORDERS ALSO ACCEPTED

1 • 800 • 525 • 0428 P.M. SALES

90 DAY + GUARANTEE

NOT
AFFILIATED
WITH
NCCA

Good guys wear
white hats.
Free golf hat
with \$150
purchase.

Get a free
T-shirt with
every order of
\$500.00 or
more!

NO PERSONAL CHECKS
U.P.S. INSURED

PRICES EFFECTIVE AUGUST 1995

NO NEVADA SALES
HOURS: M-F 9-4 PST

	PAN	COMBO	SCI.ATL.	PAN	COMBO
NEW B3	\$50.00	\$110.00	8500 to	\$55.00	\$120.00
TRI BI	\$65.00	\$125.00	8569		
FAST TRI BI	\$90.00	\$150.00	8570 to		\$175.00
HAMLIN			8580		
MLD	\$50.00	\$110.00			
OAK					
N12VS	\$50.00	\$110.00			
PIONEER					
BA5135	\$75.00	\$135.00			
BA1200	\$75.00	\$135.00			
BA6110	\$130.00	\$190.00			
BA6150		\$175.00			

SCI.ATL.

8500 to
8569

8570 to
8580

YES ZENITH

YES BASEBAND BB

ORDERS CALLED IN BY 1:00

SHIPPED SAME DAY

\$15.00 Shipping

**FREE 1 YEAR
SUBSCRIPTION
TO NUTS & VOLTS
WITH \$500.00
MIN. ORDER**

VISA

MasterCard

Nuts & Volts August Special

SSA86 \$160.00

GIVE TELEVIEW TONY A CALL TODAY

1-702-253-1852 • FAX 1-702-253-1854 • P.O. BOX 71465 • LAS VEGAS, NV 89170-1465

**Tony Talli's Original Teleview is not affiliated with Teleview, Inc. NV Corp.
or Teleview Distributors, Inc. of Illinois.**

☐ Yes, I am paying for full service, this unit is only to be used as an extra unit.

WAIVER

1. **WARNING:** The ownership of a cable decoder DOES NOT give the owners of the decoder the right to decode or view premium cable channels without AUTHORIZATION from their cable company.
2. **AUTHORIZATION:** In general terms, proof of payment to a cable company for viewing their premium channels is AUTHORIZATION. I, the undersigned, understand paragraphs 1 and 2 above and agree that: **AS A USER:** I will not use any cable products purchased from Teleview Distributors by myself or my company, for the purpose of decoding or viewing unauthorized premium cable channels or avoiding rightful payment to any cable company. **AS A SELLER:** I will not sell, trade, give or dispose of any goods I have purchased from Teleview Distributors to any third party or customer to whom I know, believe or suspect of using said goods for the purpose of decoding unauthorized premium cable channels or avoiding rightful payment to any cable company. **AS AN ADVERTISER:** I agree I will not advertise, tell or communicate to anyone in any manner, that products I have purchased from Teleview Distributors can be, should be or are intended to be used for the purpose of decoding unauthorized premium cable channels or avoiding rightful payment to any cable company.

Signature _____

Date _____



PLEASE FOR ORDERS ONLY

1-800-742-2567

**P.O. BOX 538
BENSENVILLE, IL 60106**

Call 708 • 616-8050 OR Fax 708 • 616-8094

*** SSA-86-1 pc. (Scientific Atlanta, Pioneer) . . . \$160.00**

Starbase B3 **\$50.00**
ED+ (TVT-3G) **65.00**
Scientific Atlanta SA-3B **55.00**
SA-4 (8580) **100.00**
Pioneer SMod (6100) **120.00**
Pioneer+ **75.00**
Oak N12 **50.00**
Hamlin MLD 1200 **50.00**
* FTB 312 **90.00**
85 Ch. Converter w/Remote **65.00**

85 Ch. Converter w/Remote & Volume . . . \$ **85.00**
B3 Combo **110.00**
ED+ Combo **125.00**
SA-3B Combo **120.00**
SA-4 Combo (8580) **165.00**
* FTB 312 Combo **150.00**
Pioneer SMod Combo (6100) **180.00**
Pioneer Combo **135.00**
Oak N12 Combo **110.00**
Hamlin MLD 1200 Combo **110.00**

★ASK ABOUT THE NEW MILLENNIUM 3★

★WE NOW SHIP FED-EX★ 1-800-742-2567 FOR ORDERS ONLY

Hours: Mon.-Fri. 8-6 CST Sat. 10-2 CST

★SIX-MONTH GUARANTEE (30-DAY MONEY BACK)★

QTY.	ITEM	OUTPUT CHANNEL	PRICE EACH	TOTAL PRICE
SHIPPING + HANDLING CHARGES NON-REFUNDABLE NO PERSONAL CHECKS — NO ILLINOIS SALES Cashier's Check • Money Order • COD • VISA • MC SPECIAL SHIPPING RATE ON 5 & 10 LOT ORDERS VISA <input type="checkbox"/> MASTERCARD <input type="checkbox"/>			SUBTOTAL	
			HANDLING ADD 5%	
			SHIPPING ADD \$7.00 PER UNIT	
			TOTAL	

PLEASE PRINT

CARD #

EXP. DATE

Name _____
Address _____
City _____ State _____
Zip _____ Phone/No. () _____

It is not the intent of Greenleaf Electronics to defraud any pay television operator and we will not assist any company or individual in doing the same.

THIS FORM MUST BE SIGNED AND SENT BACK TO INSURE GUARANTEE

WAIVER

☐ Yes, I am paying for full service, this unit is only to be used as an extra unit.

1. WARNING: The ownership of a cable decoder DOES NOT give the owners of the decoder the right to decode or view premium cable channels without AUTHORIZATION from their cable company.

2. AUTHORIZATION: In general terms, proof of payment to a cable company for viewing their premium channels is AUTHORIZATION.

I, the undersigned, understand paragraphs 1 and 2 above and agree that:

AS A USER: I will not use any cable products purchased from Greenleaf by myself or my company, for the purpose of decoding or viewing unauthorized premium cable channels or avoiding rightful payment to any cable company.

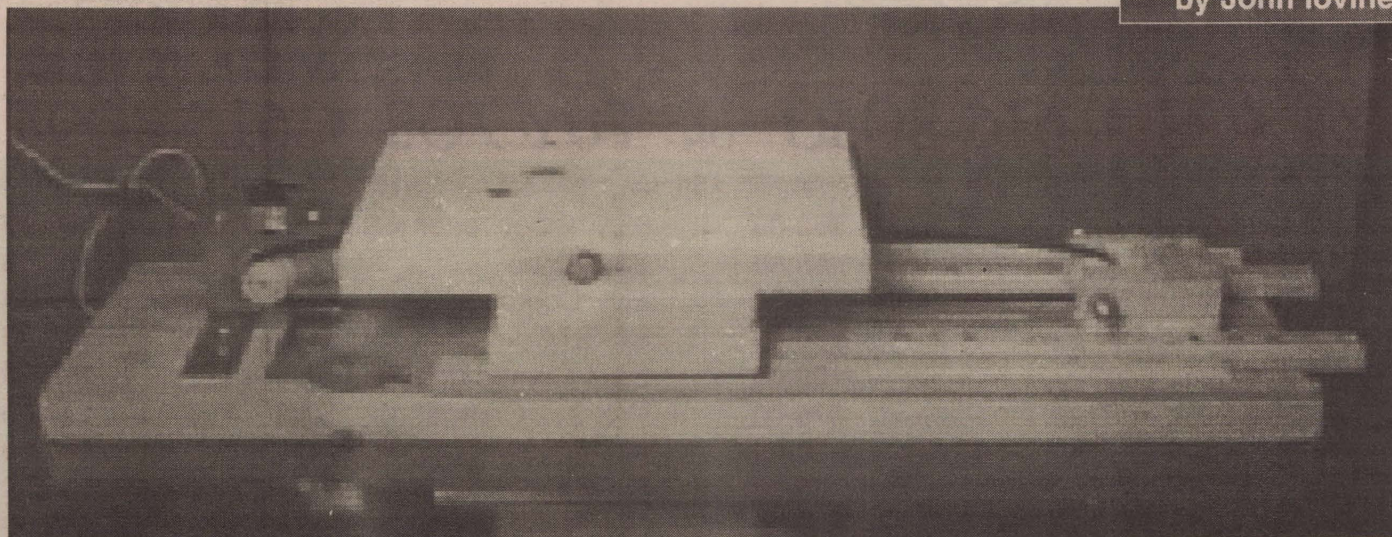
AS A SELLER: I will not sell, trade, give or dispose of any goods I have purchased from Greenleaf to any third party or customer to whom I know, believe or suspect of using said goods for the purpose of decoding unauthorized premium cable channels or avoiding rightful payment to any cable company.

AS AN ADVERTISER: I agree I will not advertise, tell or communicate to anyone in any manner, that products I have purchased from Greenleaf can be, should be or are intended to be used for the purpose of decoding unauthorized premium cable channels or avoiding rightful payment to any cable company.

Signature: _____ Date: _____

Linear Motion Table

by John Iovine



This is a continuation of last month's article on stepper motors. We will introduce and incorporate a dedicated integrated circuit to control the stepper motor. The computer will now control the IC that controls the stepper motor. Secondly, we will build a computer-controlled linear motion table using the stepper motor and the new IC circuit.

UCN-5804

Figure 1 is a schematic pin-out of the UCN-5804. The IC is designed to control and drive a four-phase unipolar stepper motor, such as the one we are using. The IC has a continuous output rating of 1.25 amperes per phase at a maximum voltage of 35V. This is more than enough power to run our 24-volt stepper motor.

The UCN-5804 internal logic sequences its output pins in time with a squarewave pulse delivered to pin 11. Each squarewave pulse (high to low transition) delivered to this pin increments the stepper motor

sequence.

When you reach the end of the table, the sequence repeats starting from the top of the table. To reverse the stepper motor direction, start sequence from bottom and work towards top. Notice that both table's sequences are identical to the sequences described last month for controlling the transistors Q1 through Q4.

Pin 15 is the Output Enable. When this pin is held high, all outputs on the IC are disabled (OFF). If this function isn't required by your circuit or system, this pin should be tied to ground (LOW).

Pin 14 is the Direction. When this pin is tied LOW, or connected to ground, it will follow the sequence in either Table 1 or 2, starting from the top line and working downward. When this pin is tied HIGH (+5V), it will reverse the sequence direction starting from the bottom and work its way to the top.

Using the UCN-5804

Figure 2 is the schematic interfacing the UCN-5804 to the computer's printer port. We are using three lines off the parallel port. The line off of pin 2 provides the squarewave step input to pin 11 on the IC. The line off pin 3 controls direction, and the line off pin 4 controls the step sequence, either half stepping or full stepping.

You may question why one would use a dedicated IC to control the stepper motor since the computer's parallel port can do the job itself using just one more line. Using three lines off the parallel port to control the UCN-5804 is not much of a line savings from controlling the stepper motor directly. True enough, however, with judicious use of electronics, a few 2/4 decoders, combined with a few 4016 electrical switches, five parallel port lines can control four stepper motor's ICs. Using five lines, the computer can independently control — step (half

or full) and direction — on four stepper motors.

Linear Motion Table

The first step toward robotics and automation is the implementation of controlled mechanical motion. A simple linear motion table will take our programming outside the internal systems of the computer into real world motion.

To keep the project simple, we will use hardware available in most local hardware stores. Tools are kept to a minimum. To assemble this project, you will only need a jig saw, drill, and screw driver.

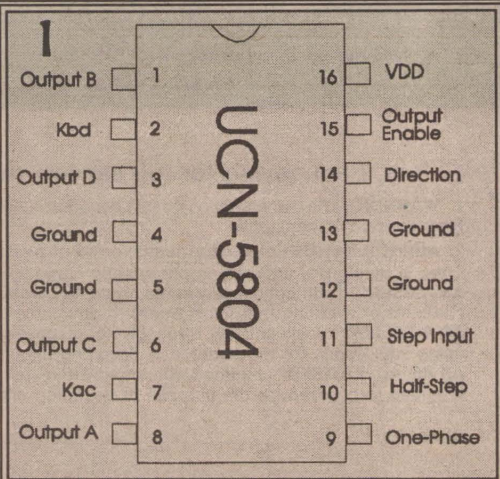
The base of the table is made from 1" x 8" pine wood cut to a length of 22". Purchase a four-foot length of wood because we will be using the wood to build other components to the table, as well. Pine is a soft wood and is easier to work with than the

Table 1
Full-Step Sequence
Output pins on UCN-5804
(see Figure 1)

A	B	C	D
on	-	-	-
-	on	-	-
-	-	on	-
-	-	-	on

Table 2
Half-Step Sequence
Output pins of UCN-5804

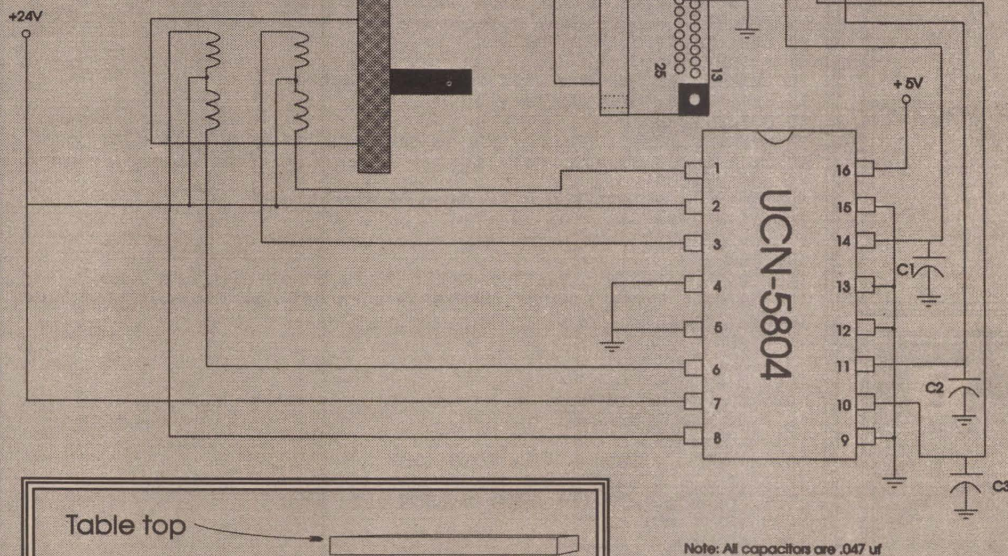
A	B	C	D
on	-	-	-
on	on	-	-
-	on	-	-
-	-	on	-
-	-	on	on
-	-	-	on
on	-	-	on



2

DB 25 Pin Male Connector
to IBM Printer Port

Stepper Motor



evenly and flush. Now attach the second spacer board onto the first spacer board. To secure the spacer board, I recommend drilling an 1/8" hole through both boards, then attaching the boards together with a #6 1-3/4" wood screw. Drilling a pilot hole first will help prevent splitting the wood with the screws.

Cut a 9" length of the 1" x 8" pine for the table top. Place the table top on top of the spacer boards. Slide the table back and forth on the sliders to insure everything operates smoothly. Then line up everything evenly and attach the table top to the spacers using a drilled hole and 1-3/4" wood screws.

Idle Gear Assembly

The idle gear assembly is made from two pieces of pine cut into a block "C" shape. The size is approximately 2.5" wide x 2.5" long. See Figure 4. The first "C" block is attached to the end of base board, between the sliders. The second "C" block has a hole drilled through for a 10-24 bolt, gear, and nut. The bolt holds the gear in position. It should be able to rotate freely on the 10-24 bolt. Do not tighten the nut onto the bolt. This would snap the pine "C" block. Instead, just secure the nut onto the bolt close to the wood. The nut is there to prevent the bolt from falling out.

Figure 5 shows how the idle gear assembly appears on the linear motion table.

Stepper Motor

Mix a small amount of two-part epoxy together. Coat the internal hole of the plastic gear and insert the gear onto the shaft of the stepper motor. Allow 24 hours for the epoxy to fully cure before placing the timing belt on the gear.

The stepper motor is attached to the base board with two small "L" brackets. You can purchase the "L" brackets at the hardware store or fashion them yourself out of some scrap metal. Holds are drilled in the "L" bracket aligned to the holds on the stepper

Table top

Spacer Boards

Drawer Slides

Baseboard

3

Typically, there are two drawer slides to a package. Each drawer slide is made up of two components that fit together and are capable of sliding. Attach the one component of each slide to each side of the board. See Figure 3.

Next, cut four pieces of wood 2.5" x 4.5". These are the spacer boards. The spacer board's function is to add space between the base board and the table top. This is necessary to fit the drive components, timing belt, and gears under the table top properly.

Attach the mating side of the each drawer slide to a spacer board. Mate the slide components on the spacer to the one secured to the base board together. Slide each spacer board up and down the track to insure that it operates smoothly. You may notice the spacer slide assemble canters inward, don't worry about this. When the table top is secure, it will hold everything

hard woods.

The sliding mechanisms for our linear table are "Drawer Slides." When in the hardware store, look at a few different types of "Drawer Slides." The drawer slide you choose must be able to work in a horizontal (flat down) position. Most drawer slides are installed on the drawer sides, in a vertical position. The drawer slide you choose shouldn't be any longer than 16" so it can fit on the base easily, while leaving enough room for the other components.

Other components you need are a 26" timing belt (1/5" pitch), two gears, stepper motor, 1/4-20 bolt (4" long), two 1/4-20 nuts, scrap pine wood, UCN-5804, DB-25 connector, and power supply.

Beginning Assembly

Cut a 22" inch length of 1" x 8" wood. This we will use as the base of the linear motion table.

4

Gear

10-24 Nut

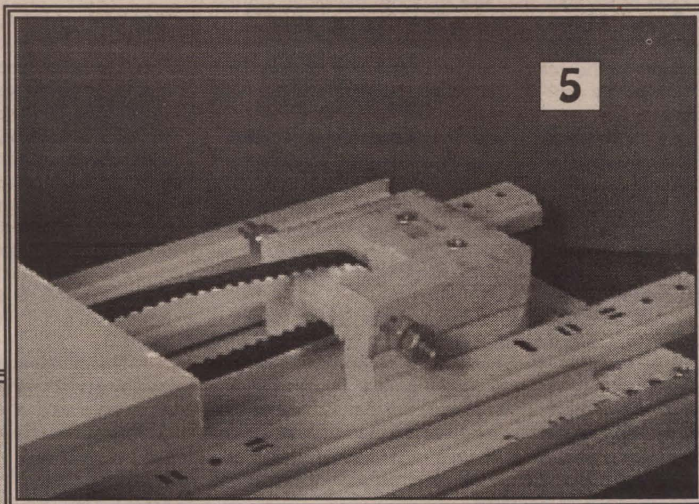
Drill hole to accept 10-24 bolt

10-24 Thread Bolt

1st C wood Block

2nd "C" wood block w/ drilled hole for bolt

5



motor. Secure the stepper motor to the "L" bracket using 6-32 machine screws and nuts.

Before securing the stepper motor to the table, we must align and attach the timing belt.

Aligning the Timing Belt

The timing belt we are using is 26" long. This is a little small for our application. Cut the timing belt so that you have a length of timing belt instead of a circular belt. Look at

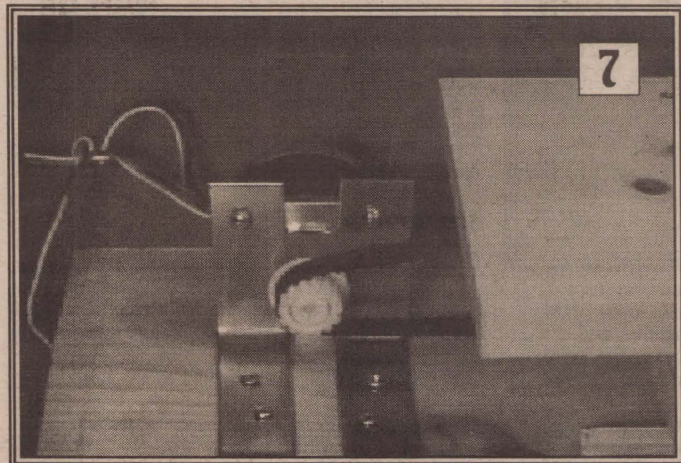
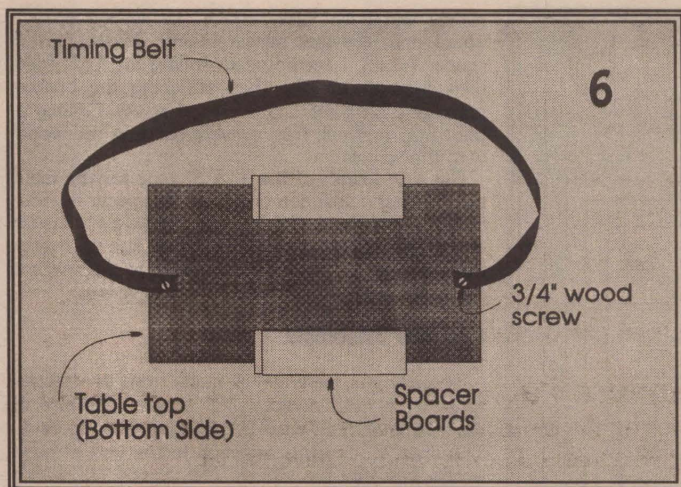


Figure 6. Remove the table top from the slides. (In the drawing, the slides attached to the spacer boards aren't shown.) Attach the timing belt, as shown in Figure 6, the teeth on the timing belt should face inward. Use 3/4" wood screws to secure the timing belt.

Re-position the table top back onto the slides. Place one end of the timing belt around the idle gear assembly. (You must disassemble the idle gear assembly to do this.) Position the stepper motor on the opposite end of the base board. Place the timing belt around the gear on its shaft. The stepper should be so positioned that most of the slack of the timing belt is taken up.

While holding the stepper motor in this position with one hand, move the table top back and forth with the other hand. It should move smoothly. Mark the stepper motor position with a pencil. Secure the "L" brackets to the stepper motor. Put the stepper motor in its marked position and secure the "L" brackets to the base board using #6 3/4" wood screws.

Figure 7 illustrates what the stepper motor looks like mounted to the table.

Programming the Table

To program the linear motion table effectively requires the use of a few Basic language logic commands. We are using two pins off the parallel port to control direction and step sequence (half or full). These two control lines must remain stable while we generate a squarewave pulse on pin 1. Logic is the most effective method to accomplish this.

The IBM printer port is an eight-bit output port. A eight-bit number may contain any decimal value between 0 and 255. Graphically, it looks something like this:

```
8 Bit #
00000000 = decimal 0
11111111 = decimal 255
```

For electrical purposes, we consider the binary

```
5 REM Linear Motion Table Controller
10 REM John Iovine 7-11-95
15 REM First find the Printer Port Address
20 DEF SEG = 0
25 a = (PEEK(1032) + 256 * PEEK(1033))
40 CLS
45 PRINT : PRINT : PRINT : PRINT "Linear Motion Table Demo"
50 PRINT : PRINT "First move table 1000 steps CW:"
55 REM ct = count: dr = direction: hs = half step
60 ct = 1000: dr = 2: hs = 0
65 GOSUB 1000
70 PRINT : PRINT "Now will reverse direction"
75 ct = 1000: dr = 0: hs = 0
80 GOSUB 1000
85 PRINT : PRINT : PRINT "Now do the same thing in half step mode"
90 ct = 2000: dr = 2: hs = 4
95 GOSUB 1000
100 PRINT : PRINT "Now will reverse direction."
105 ct = 2000: dr = 0: hs = 4
110 GOSUB 1000
120 CLS
125 PRINT : PRINT : PRINT : PRINT "This completes this demo."
130 PRINT : PRINT : PRINT "REMEMBER turn off power supply when not
in use!!!"
140 END
```

```
1000 b = 0
1005 FOR c = 1 TO ct
1010 n1 = b + dr + hs
1020 OUT a, n1
1025 IF b = 0 THEN b = 1: GOTO 1035
1030 IF b = 1 THEN b = 0
1035 FOR t = 1 TO 150: NEXT t: REM slow down
1040 NEXT: OUT a, 0
1045 RETURN
```

values 0 and 1 to be voltages. For instance, binary 0 equals 0 volts and binary 1 equals +5 volts.

I recommend that anyone wishing to program this table extensively spend an hour or so studying a few boolean logic commands available in the Basic language: AND, OR, XOR. Also study the command INP.

The Program

Our demo program doesn't use any logic statements. Instead, we assign numerical values to each output pin. For example, pin 2 has the numerical values of 1 or 0. When a 1 is sent to the printer port, +5 volts appear on pin 2. When a 0 is sent to the printer port, 0 volts appear on pin 2.

Pin 3 has the numerical value of 2 or 0. When the number 2 is sent to the printer port, +5 volts appear on pin 3. When zero is sent, 0 volts appear on pin 3.

Pin 4 has the numerical values of 4 or 0. When the number 4 is sent to the printer port, +5 volts appear on pin 4. When zero is sent, 0 volts appear on pin 4.

The numerical values may be combined in any combination. For instance, if we want to output +5 volts on pins 2 and 4, we add the numerical values 1 + 4 together. By sending the number 5 to the printer, port pins 2 and 4 are raised high.

Notice we didn't have to place a 0 on pin 3 to keep it low. Not adding the positive value for the pin to the printer port automatically places a zero in that position. One final example, in the previous example we sent the number 5 to the printer to raise the output on pins 2 and 4. If we now wanted to bring pin 2 low while keeping pin 4 high, we simply output the number 4 to the port.

Pins 2, 3, and 4 each have a specific function tied to them. Pin 2 supplies the squarewave input to pin 11 on the UCN-5804. Pin 3 controls the direction. When low, stepper rotates CCW. When pin 3 is raised high, the stepper motor rotates in a CW direction. Pin 4 controls the stepping sequence. When pin 4 is low, the chip outputs a full-step sequence. When pin 4 is brought high, the chip outputs a half-step sequence.

Power Supply

The power supply from last month's circuit may be used for this circuit. The only change

needed is to take out the 7812 voltage regulator and replace it with a 7805 voltage regulator.

Going Further

An immediate improvement to the table would consist of adding two limit switches at each end of the table-top travel. The limit switches would signal the computer when the table has reached the end of its travel, regardless of its programming. This is a necessary fail safe mechanism employed in most commercial motion tables. The fail safe switches prevent a table from attempting to go past its design limits. These are a good idea to keep a table functional for years.

The standard IBM printer port has four input lines (in addition to its eight output lines). The input lines are ideally suited for limit switch detection, which makes the job of adding the necessary switches easier.

X-Y tables are constructed of two linear motion tables, one mounted on top of the other. It follows that X-Y-Z tables are constructed of three linear motion tables, one mounted on top of the other with the third one positioned perpendicular to the first two.

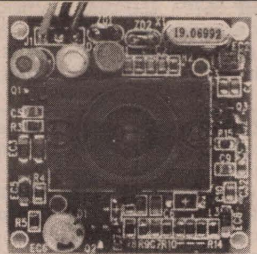
As stated previously, our IBM printer port can handle four stepper motors. If you would like to see another article detailing the interfacing and programming of three or more stepper motors write to me in care of *Nuts and Volts*. NV

Parts List

Stepper Motor 24-volt	
1.8 degree per step	\$10.00
26" Timing Belt 1/5" pitch	\$6.00
Plastic Gears 1/4" bore	\$8.50 ea
UCN-5804 Stepper Controller IC	\$10.00
DB-25 Male Connector	\$2.00
7805 5-volt Regulator	\$1.25
1" x 8"x4' Pine Board Drawer Slides	
Available Locally	

Available from:
Images Company
P.O. Box 140742
Staten Island, NY 10314
(718) 698-8305

Mail order add \$5.00 postage and handling.
NY state residents add appropriate sales tax.



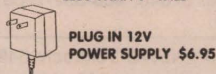
ACTUAL SIZE B&W CCD BOARD CAMERA WITH 3.6 mm ADJUSTABLE MANUAL FOCUS LENS

WILL FOCUS DOWN TO APPROX. 1/4" WITH APPROX. 1/3" FULL FRAME

LATEST **SONY** HYPERHAD[®] IMAGE SENSOR

- ◆ RESOLUTION: MORE THAN 380 LINES
- ◆ MIN. ILLUMINATION: 0.4 LUX
- ◆ S/N RATIO: BETTER THAN 50DB (AGC OFF)
- ◆ POWER: 9 - 13 VDC LESS THAN 150 MA
WILL OPERATE ON 9 VOLT BATTERY
- ◆ BUILT-IN ELECTRONIC AUTO IRIS
- ◆ SHUTTER SPEED: 1/60 - 1/50,000 SEC
- ◆ VIDEO OUTPUT: 75 OHM, 2/1 INTERLACE
1.0 VOLT P/P COMPOSITE 75 ohm
- ◆ CONNECTS TO ANY MONITOR OR VCR

1.5" LESS THAN 1" TALL



BC ELECTRONICS

1508 LEXINGTON • BEDFORD, TEXAS 76022
PHONE (817) 267-7792 FAX (817) 283-7797

QTY.	PRICE EA.
1-3	\$ 115.00
4-9	\$ 110.00
10-24	\$ 105.00
25-99	\$ 100.00

Write in 133 on Reader Service Card.

#80 TEST EQUIPMENT cont.

HP 6032A power supply 0-60V, 0-50A, autoranging, \$1,995. Dexis 612-944-7670.

SCOPES: (3) unused Kikusui COS6100M, 100MHz, 5 channel, 12 trace, w/ probes, cover etc. \$700; (1) used, only w/manual, \$350; Tek 454A \$400; Tek 453, \$250; Tek 465M \$325; Tek 434, \$400; Tek 485, \$695; HP 1720A, \$450; HP 1725A \$500; HP 1722B \$500; HP 180C/1805A/1825A \$300. Generators: (3) HP 8640B/323, \$600, \$700, \$800; HP 8640B/003, \$1,100. Counters: (5) HP 5328A/096 (500MHz), \$200 each; (4) unused HP 5345As, \$750 each. Call John, 912-922-8244.

SPECTRUM ANALYZER Sale, Hewlett Packard 141T with 8552B IF & 8553B RF \$1,245 with complete manuals \$1,290. 141T frame, \$405. 8552B \$425. 8553B from \$225-\$450. All with warranty. Offers call. Psitech Plus, 707-745-4804, fax 707-747-5277.

TELECOM AC voltmeter Hewlett Packard model 403B excellent condition. 714-494-0072.

WAVETEK PROGRAMMABLE sweep/function generator, Model 273 \$4,500 1992 catalog \$1,000. Psitech Plus, 707-745-4804, fax 707-747-5277.

TEKTRONIX PLUG-INS: **AA501** DISTORTION ANALYZER \$1,250. **DA 4084** distortion analyzer (like AA 5001) \$1,250. **AM 503 & A6302** current probe & amplifier (to 5A/div; DC to 50MHz) \$890. **DM 502A** auto-ranging multimeter \$215. **PG 508** 50MHz pulse generator (variable rise, fall times) \$325. **PS 503A** power supply \$250. **TR 503** .1-1800MHz tracking generator \$1,400. **5D10** Waveform digitizer with readout, for 5000-series \$475. Excellent condition! With warranty. Many others available; mainframes available. Pepper Systems, 214-353-0257.

FREE! THE ETC Catalog of Manuals for amateur, audio & test equipment. A.G. Tannenbaum, Box 386, Ambler, PA 19002. 215-540-8327, 215-540-8055 FAX.

HP 5340A 18GHz counter, \$900. Fluke 5200A AC calibrator \$1,600. Marconi TF2015/2 sig. gen, 10-520MHz, AM FM, \$200. Racal Dana 9035/11A Computer Counter, OPT 01/06/55, Brand new \$499. HP 3325A synthesizer, function gen. opt 2, \$1,800. HP 8640B Sig. gen opt. 001/003 \$1,600. Don Phelps. 909-279-7347.

HP 6264B power supply 0-20V, 0-20A, \$450. Dexis 612-944-7670.

CABLE TV Descrambler Kits

"NEW & IMPROVED UNIVERSAL KIT"

Universal Kit 1995.....\$79.95

Includes all the original parts plus the improvements and a silk-screened PC Board. New Product.

Enclosure Package.....\$44.95

Includes all the switches, hardware, AC Adaptor, and a black silk-screened box for above Universal kit.

Tri-Mode Kit.....\$59.95

Includes all the parts (with a SAW filter), a silk-screened PC Board, and AC Adaptor. Not included is the enclosure.

SB-3 Kit.....\$44.95

Includes all the parts, a silk-screened PC Board, and AC Adaptor. Not included is the enclosure.

Kill Caller ID "Blocker".....\$69.00

Protect your privacy, automatically.

Notch Filters.....\$39.00

Tunable.

CALL TOLL FREE 1-800-886-8699

Visa, MasterCard, or COD

Add \$7.50 Shipping and Handling.

Northeast Electronics, Inc.

PO Box 3310-N, North Attleboro, MA 02761

Write in 143 on Reader Service Card.

Robot Kits

- ✓ Academic-Level Books
- ✓ Build it Yourself
- ✓ Action Packed

EASY TO BUILD You do ALL electronic & mechanical assembly using 2-color Instruction Books with step-by-step, well-illustrated directions for assembly, experiments and testing. Each Robot Kit applies different electronic & robotic principles. Learn how Robots work and have fun at the same time!

606A "Scrambler" All Terrain Robot This 6-legged Robot walks over rough terrain. Uses high-tech infrared beam to sense and avoid avoid objects in its path. 32 page Book. \$37.95



603A "Copycat" Programmable Robot Program direction, light and sound using detachable keypad (included) or optional PC. Learn digital logic basics. 44 page Book. \$57.35

602A "Blinky" Pathfinder Robot Follows path made with a marker pen or tape. Red/green LEDs react to steering changes, adding fun and interest. 28 page Book. Infrared emitter/detectors. \$36.95



601A "Scooter" Sound Controlled Robot Backs up, changes direction, goes forward when it hears loud noise or hits an object. Florescent red. 24 page Book. Fast-paced excitement! \$18.95

DEPENDABLE PRODUCTS Since 1963, Graymark's ONLY business has been producing educational electronic kits. We do one thing and we do it right. That's why Graymark has the largest selection of electronic kits. And, our "It works or we fix it" policy guarantees success for YOU!

ORDER TODAY! Phone: VISA/MasterCard/Discover/AMEX
Mail: Check/Money Order, Credit Cards
Add: \$4.00 Shipping

Graymark

P.O. Box 2015, Tustin, CA 92681

**CALL FOR FREE
40 PAGE CATALOG**

800-854-7393

Write in 130 on Reader Service Card.

Nuts & Volts Magazine/August 1995 79



EPROMS

27C64 \$2.50
27C128 \$3.00
27C256 \$3.50
27C512 \$4.50
OTHERS CALL

TUBES ONLY PROGRAMMERS

by EE TOOLS
4-GANG \$195.00
PRO-MAX .. \$425.00
1-800-677-3773

H.E.A.R.T. & Associates

14121 W. CANTRELL
L.R., AR 72212



SMART AC or SOLAR BATTERY CONTROLLERS

FOR GEL-CELLS OR LEAD-ACID



BATTERIES

6 TO 28V.
110/220 VAC, 50/60 HZ.
WILL NOT OVERCHARGE.

USES UC3906 I.C. SWITCHABLE CURRENT, PTC FUSE, REVERSE BATTERY PROTECTION, TRICKLE START-UP, DBLE SIDED PCB, QUICK CONNECT TERMINALS, PROGRAMMABLE VOLT OR CURRENT, DETAILED MANUAL, PURCHASE BASIC UNIT OR COMPLETE KIT W/ METER, LO-VOLT OPTION TRANSFORMER, & ALL METAL ENCLOSURE.

COMPLETE KIT:

BC-CONTL-06 FOR 6 V; 1 AMP MAX. \$126.95
BC-CONTL-12 12 OR 14 V; 1 AMP MAX. \$126.95
BC-CONTL-28 24 OR 28 V; 1/2 AMP MAX. \$136.95

BASIC CONTROLLER:

6 TO 14V; 1 AMP MAX. \$54.95
24 TO 28V; 1/2 AMP MAX. \$64.95
OPTIONS: TRANSFORMER KIT \$18.95
AUTO LOW VOLT DISCONNECT \$18.00

SOLAR CONTROLLER: SENSES IF LIGHT SOURCE IS ADEQUATE. DUAL LEVEL VOLT CONTROL. CAN BE USED W/ XFMR FOR LINE POWER BACK-UP.

SC-CONTL-00 (COMPLETE) 6 to 14 V, 1 A. \$109.95
SC-BASIC-00 BASIC KIT \$54.95
FOR 24-28 VOLTS ADD \$10.00

BC-24 UP TO 5 AMPS CHARGING RATE, 12-14 V, HEAVY DUTY XFMR, FOR DEEP CYCLE HIGH POWER USAGE, 110 VAC 60 HZ \$199.95

CURTIS KEYSER KIT

INCLUDES AUDIO AMPLIFIER, IAMBIC KEYING, ADJUSTABLE SPEED. \$39.95
POS/NEG KEY, WEIGHT/TONE CONTROL. \$10.00
SPEED METER OPTION \$14.95

COMPONENTS

UC3906 BATTERY CHARGER CHIP (\$7.00); LM350K (\$7.50); 8044ABM CURTIS KEYSER CHIP (\$19.95); LM338K (\$10.50); MC3423P1 (\$3.00); NE804AN (\$5.00); NE602AN (\$2 EA. 6/\$10.00); & MORE

ANTENNAS

MARCONI: 80 M - \$37.95; 160 M - \$44.95
J-POLES: (2M, 6M, 220, 440 MHZ) \$10.95 - \$44.95
"WINDOM" W/ 1:4 BALUN + 50' FEED LINE \$89.95
G5RV MULTIBAND (80 THRU 10M) \$44.95

TO ORDER CALL 1-800 JADE PRO (523-3776)
VISA, MASTERCARD, CHECK OR MO ACCEPTED
USA SHIP COST: \$6.00 1ST \$100 + \$1.00 /EA. ADD'L \$10.00.

P.O. BOX 368
E. HAMPSTEAD, NH 03826
PHONE: 603-329-4995
FAX: 603-329-4499

MADE PRODUCTS, INC.
PUTTING THE AMATEUR BACK IN RADIO
PRICES AND SPEC. SUBJECT TO CHANGE

TEKTRONIX 7904 \$150, 7704 \$125, 575 \$150, DF2 \$50, 7612D \$300, 2901 \$150, HP 1640A \$125, HP 9872 Plotter/Manual/PC Interface \$250, HP 1615 \$250, HP 1610 \$250, Intel Prompt48 \$125, Multisync1 Manual \$20, HP 7475 Plotter \$450 new, Three 17" MultiScan monitor 0.26 DP \$495 new, HiPad Digitizer \$150, Tango PCB/ROUTE/SCHEMATIC \$500, Mustek MFS6000CX Color Flatbed Scanner/software/interface \$495 new. Trades considered - need CRT for 465, Bickerton, 164 Buttonwood, Fairhaven, NJ 07704, 908-842-3762 evenings, SASE listing.

DEC EQUIPMENT WANTED! We are buying DEC systems, boards, terminals, drives and peripherals. Also Scientific Micro Systems (SMS), DSD, Datability, Dilog, other DEC compatibles, and Computer Output Microfilm (COM) units. Please call for a quote or fax us your equipment list. We buy, sell, and trade. **KEYWAYS, INC.**, 513-847-2300 OR fax 513-847-2350.

TECHNICAL ARTS US-II non-contact laser inspection system, open to offers. Dexis 612-944-7670.

HP 3710A & 3716B IF/BB transmitter \$2,250, 3702B & 3705A IF/BB receiver \$2,250, 3730B & 3739B down converter \$6,400. Dexis 612-944-7670.

VALHALLA SCIENTIFIC 2500E current calibrator \$285. Dexis 612-944-7670.

WANTED: SERVICE manuals: Fluke 3800A; Anadex printer DP-9501A, Sharp JX-9500; Motorola Exorset 110; CTE Lenxurt test alignment set; Also need CRT for Tek o'scope 434 T4341-400 154-0666-10; Manual for JVC GXS700-U Video Camera. Charles Wells, 5934 West Rd., Washington, MI 48094.

WANTED: HP 3570A ALU card; teaching manuals for exploring electronics B/G 5A learning by discovery by Brodhead Garret. Allen Fulmer, 2538, Sweetgum Way West, Clearwater, FL 34621. 813-796-3424.

HP 4815A Z-METERS: Sanford Associates is your source for repair of the Probe and Main Frame. Former HP 4815A tech/supv., with factory expertise, specs, parts, special tooling, restores & warranties probes to HP/QA specs. many other HP 4815A factory parts available. Tel/write: Sanford Associates, 110 High view Terr., Hackettstown, NJ 07840. 908-852-7989, CIS: 72540,1345.

WANTED: INEXPENSIVE Tektronix 549 storage scope and Tektronix 1A1 plug-ins. Phone, Bud, mornings, PDT 510-439-7143.

TEKTRONIX EQUIP: 7A13 (LED) \$125, 7B10 \$175, 7B53A \$80, 7A18 \$45, 7D13 \$50, DC503 \$125, DC505A \$75, DAS9129 logic analyzer w/91A08, 91P16, 91A32, and pods \$300, PS501-2 \$75, P6452 \$30, P6453 \$40, P6454 \$20, P6455 \$30, P6456 \$30, P6460 \$35, P6464 \$40, 91A04 \$75, **HP EQUIP:** 5328A w/HP1B 100MHz \$110, 5345A 500MHz \$300. Call Jeff for details, 508-533-5944.

WANTED: CESIUM and rubidium standards, any condition. Want manuals (no copies) for HP 5061A or B, and FTS 4050. Corby Dawson, 805-736-0288.

JULIE RESEARCH Laboratories (JRL) Standards for sale: ND106, PVP1000, VDR106, SVD108DC, SCO106, RCO-105/7, DVS106C, VDR307H, PVP1001J, DCS105, VDR307, PRB205C, ND106. Cesium Beam Atomic Clock, HP Model 5061A w/opt. 003 and 004. Large list available. Dr. Ko 316-686-4864.

IMAGE PROCESSOR. Mfg by Image Technology Co of Deer Park NY. Stand alone unit powered by 115VAC. Inputs for two video cameras, output to AT type computer. No further information at this time, but if someone can get us info we will pay a reward. 100 units available. \$80.00 Postpaid



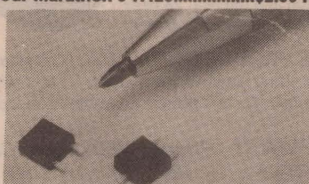
RGBPHOTOMETER. This is called a supermatch display calibrator pro. Made by Supremac Technologies. Contains three detectors, each with a filter in front (red, green, blue). Was used to calibrate monitors. Useful for many other purposes. At press time no schematic or manual was available, but we are trying. **RGB PHOTOMETER.....\$25.00 Postpaid**

Thanks to everybody for the enthusiastic response to our ads. Just a reminder that our merchandise are state of the art systems and components at savings of 75% and more. Our smaller items are postpaid, to make it easier for you to order, no shipping and handling fees! Most orders are shipped within 24 hours. Personal or business checks are OK. Sorry we are not taking credit cards, WE WOULD RATHER SAVE YOU THE 2.5 TO 5 %. CODs are OK, but it costs an additional \$4.75 that goes to UPS. Very truly yours, Franklin G. Fink

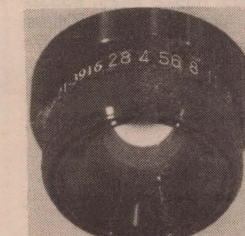
VISION AND MOTION SURPLUS
241 East Main Street, Unit A
Westboro MA 01581-1745
Telephone 508-366-8370

Aircraft type Nickel Cadmium batteries. These are the ideal batteries for robotics and vehicle applications. Compared to lead-acid or gel cells, they perform much better at low temperatures, last longer, have higher short period discharge rates, charge much faster, have slightly better power/weight ratio, and are much more maintenance free. They can be stored charged or discharged, which lead-acid types cannot. All cells are military surplus, used, but fully tested and guaranteed. All cells are 1.35 volts, prices are per cell.

40 ampere-hour SAFT VP400KH.....\$7.00 4 LBS
23 ampere-hour SAFT VP230KH.....\$5.00 2 LBS
14 ampere-hour Marathon BB-431/U.....\$3.25 1 LBS
13 ampere-hour Tadiran, Israel BB-475/A.....\$3.50 1 LBS
5 ampere-hour Marathon 5-HL-20.....\$3.00 POSTPAID
3 ampere-hour Marathon 3-H120.....\$2.50 POSTPAID



Hammamatsu g5842 Ultra Violet Sensor. With built in filter to block other wavelengths. With simple circuits to build a radiometer and dosimeter. Response 260 to 400 nm. Detects UV-B radiation which can cause skin cancer. Many other applications. Subminiature GaAsP chip.....\$18.00 postpaid

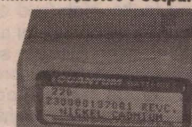


Computer 50mm F2.8 Enlarging Lens. This is a precision multicoated lens used in a scientific application. Equal or better than the El-Nikor 50mm 2.8. In Leica thread mount, with added adapter. Each has exact focal length to nearest 1/100 mm engraved on side.....\$40.00 Postpaid



Dynamite Motor by Barber Coleman. Excellent for Robotic and prosthetic applications. 1.5 in diam x 3 in long. 1/4 in x 3/8 in splined shaft. Model BYLM 90112. 28VDC. Produces 1/10 HP on an intermittent basis (2 minutes on, 8 minutes off). 12,600 RPM.....\$20.00 Postpaid

AA Size Nickel Cadmium Battery Pack. Contains 4 cells Manufactured by Quantum batteries. Brand new, packed 4 packs per sealed carton. 4 Battery packs (16 cells) \$10.00 Postpaid



Sony XC-37 Scientific grade 2/3 inch CCD high resolution video camera. With built-in DC37 12 VDC power supply. Free micro-adjustable mount now included.....\$260.00 Postpaid **Unconditional money-back guarantee:** Items are exactly as represented or your money back. All items are unused.

Closing Date For Next Issue — August 10th

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.



STEREO MICROSCOPES refurbished, several Olympus stereo zooms on boom stands. B&L zoom4 on jack-knife stands. \$500 to \$750+ ship. Strip chart recorder-Philips XY&T model PM 8272 LCD readout \$300. Seabird Technical, Box 2438, Menlo Park, CA 94026. 415-365-4532.

TEST EQUIPMENT for sale. 1 ea. Tektronix 492 Spectrum Analyzer w/opt2 excellent cond., just calibrated, \$4,500. 5 ea. Tektronix 491 spectrum analyzers \$2,700 all (\$900 ea). 11 ea. Tektronix 7B53A Dual Time base plug-ins \$600 all. 1 ea. Boonton 4200 RF Microwave watt meter w/opt 01b-03 \$325, 1 ea HP 3456A Digital Voltmeter w/HPIB \$450, 1 ea HP 5335A Universal Counter w/opt 12 \$850, 1 ea HP 5340A w/opt11 \$925. Call Scott, 805-542-9574. Leave mess.

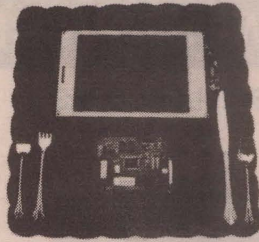
WANTED: USED communications service monitor. 10MHz to 800MHz, CRT, excellent condition, motorola IFR or similar. 913-336-3579.

X-Y PLOTTER HP 7035B \$125, Timebase plug-in \$25, HP 427A DMM \$40. 219-487-6914. Weekdays.

SERVICE MONITORS, IFR3000S in perfect working condition \$3,500. Wavetech (CT SYS) 3000S almost new, perfect condition \$5,400. Also, Kenwood, TS440S \$575. 504-769-5754.

FOR SALE: Service monitors, Motorola R-2038/D/HS with spectrum/sweep, 1-1000MHz gen/rec, DPL/PL, digital power meter, digital volt meter, cellular E-amps test, TDR ANT Tester, freq counter, new price over \$23,000 asking, \$6,250. RF Imaging, 408-929-2244.

Flat Panels Served Here



House Specialty - Monochrome LCD Kit \$249

Le Earth LCD Restaurant Menu

<i>Appetizers</i> (Controllers for PC ISA Bus)	
Earth LCD/M Monochrome LCD Controller	\$149
EarthVision/ISA Color LCD Controller	\$299
<i>Entrées</i> (Include LCD, ISA Controller, Cable & Backlite Inverter)	
Monochrome 9.4"	\$249
Color Single Scan 8.2"	\$450
Color Dual Scan 9.4"	\$749
Color 9.4 TFT	\$995
<i>À la Carte</i> (LCD Only)	
Mono 9.4" LCD	\$95
Color 8.2" Single Scan	\$125
Color 9.4 Dual Scan	\$399



Computer Technologies

"The Flat Panel Solutions Company"

P.O. Box 7089 - Laguna Niguel - California - 92607
Phone: (714) 448-9368 - Fax: (714) 448-9316 - BBS: (714) 448-8093

Write in 216 on Reader Service Card.

WANTED: SOUND Technology Test Equipment, FM Generator 1,000A, switching system 1,200A, Oscillator 1,400A, Distortion analyzer 1700 A/B, Tape recorder test system 1,500A. Call Tom at Butternut Audio, 802-879-4921.

TEKTRONIX P601S HV probe with 10ft. cable, comp box & manual. \$500. 417-546-4318 or leave message.

INDEPENDENT SEARCH for Extraterrestrial Intelligence seeks test equipment donations to upgrade Small SETI Radio Telescope. Especially need 1420MHz synthesizer, spectrum analyzer, 486DX micros. Ask for our newsletter. Contact Robert Gray, 312-278-8080, 3071 Palmer Square, Chicago, IL 60647; E-Mail U39732@uicvm.cc.uic.edu.

CASH for your microscopes. I need your scopeheads, eyepieces, light sources, StereoZoom preferred. Brian 6-9PM PST or LVE/MSG 909-359-8368.

CUSHMAN CE50 service monitor 1GHz \$2,100. **Calibrated** in perfect working condition, 90-day **guarantee**. ISA, PO Box 6955, Laguna Niguel, CA 92607. 714-488-0010, FAX 714-488-0299.

CABLE TV DESCRAMBLERS NOBODY BEATS OUR PRICE!

**SAVE MONEY-DON'T RENT
REPLACEMENTS FOR ALL
MAJOR MAKES AND MODELS**

QUANTITY DISCOUNTS! 24 HOUR SHIPPING

CALL VIDEO CONNECTION, INC.

1-800-677-0321

Anyone implying theft of service will be denied assistance.
NO FLORIDA SALES

Write in 129 on Reader Service Card.

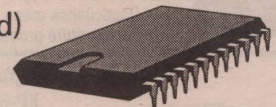
Your choice has got to be...

M.F.M. COMMUNICATIONS.

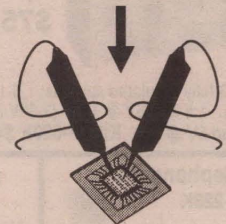
"We Can Read Protected PIC's & Microcontrollers"

GUARANTEED

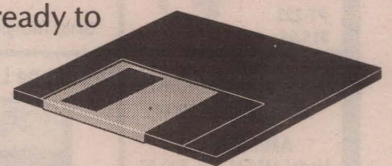
- 1 The Protected (Locked) Chip. Most PIC's & Microcontroller's.



- 2 Reading the chip's contents.



- 3 The chip's data, ready to use.



Please Enquire
For More Details.

Call Us Now on... 011-44-188-333-0060

M.F.M. COMMUNICATIONS.
57 Addison Road, Caterham. CR3-5LU. UK.

"For Information Purposes Only"

FLUKE. TEST EQUIPMENT 1-800-90METER

> FLUKE 21-2	MULTIMETER - YELLOW W/ 10A & 300MA	\$121.00
> FLUKE 23-2	MULTIMETER - YELLOW W/HOLSTER	\$141.00
> FLUKE 25	MULTIMETER - YELLOW or GRAY	\$197.00
> FLUKE 27	MULTIMETER - YELLOW or GRAY	\$251.00
> FLUKE 33	CURRENT CLAMP - W/ MIN-MAX	\$250.00
> FLUKE 37	MULTIMETER - BENCH / PORTABLE	\$270.00
> FLUKE 45	MULTIMETER - DUAL DISPLAY	\$625.00
> FLUKE 51	K/J THERMOMETER	\$125.00
> FLUKE 52	K/J THERMOMETER - DUAL INPUT	\$167.00
> FLUKE 73-2	MULTIMETER - GRAY W/ 10A	\$88.00
> FLUKE 77-2	MULTIMETER - GRAY W/HOLSTER	\$142.00
> FLUKE 78	MULTIMETER - AUTOMOTIVE W/ TEMP/RPM	\$195.00
> FLUKE 79-2	MULTIMETER - W/FREQ / CAP / LO OHMS	\$175.00
> FLUKE 83	MULTIMETER	\$214.00
> FLUKE 85	MULTIMETER	\$267.00
> FLUKE 87	MULTIMETER - W/ TRUE RMS	\$273.00
> FLUKE 88	MULTIMETER - AUTOMOTIVE	\$335.00
> FLUKE 80T-IR	INFRARED TEMPERATURE PROBE	\$167.00
> FLUKE 80I-410	A/C - D/C CURRENT CLAMP - 400A	\$151.00
> FLUKE 80I-1010	A/C - D/C CURRENT CLAMP - 1000A	\$250.00
> FLUKE 80TK	DMM THERMOCOUPLE MODULE	\$58.00
> FLUKE T88	AUTOMOTIVE DMM TRAINING PACKAGE	\$110.00
> FLUKE 860	GRAPHICAL MULTIMETER SERIES	\$CALL
> FLUKE 97/808	SCOPEMETER - AUTOMOTIVE	\$1800.00
> FLUKE 99	SCOPEMETER**	\$2195.00
> FLUKE 96	SCOPEMETER**	\$1895.00
> FLUKE 92	SCOPEMETER**	\$1595.00

WE STOCK

- ✓ CARRYING CASES
- ✓ FLUKE LITERATURE
- ✓ TEST LEADS & CLIPS
- ✓ REPLACEMENT FUSES
- ✓ SCOPEMETER ACCESS.
- ✓ TEMPERATURE PROBES

WE WELCOME

- ✓ SCHOOLS
- ✓ GOVERNMENT
- ✓ CORPORATE POS
- ✓ DEALER INQUIRIES



+ SOME RESTRICTIONS MAY APPLY

GMP Parts Company
8765 Cooperston Way
Elk Grove, CA 95624
(916) 685-1055
FAX (916) 685-3139

VISA & MC ACCEPTED AUTHORIZED DISTRIBUTOR

Write in 187 on Reader Service Card.

Write in 136 on Reader Service Card.

Nuts & Volts Magazine/August 1995 81

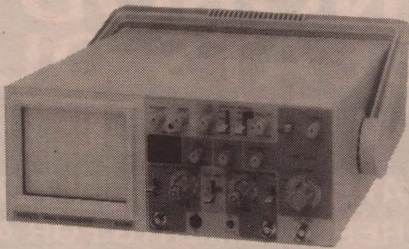
24 HOUR
SHIPPING

ELENCO • HITACHI • B&K PRODUCTS

GUARANTEED LOWEST PRICES

TO ORDER
CALL TOLL FREE
1-800-292-7711
1-800-445-3201 (Can.)

AFFORDABLE - HIGH QUALITY 2 YEAR WARRANTY

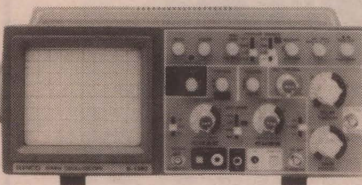


STANDARD SERIES
S-1325 25MHz \$325
S-1340 40MHz \$489
S-1365 60MHz \$795

Features:

- High Luminance 6" CRT
- TV Sync
- 1mV Sensitivity
- 2 - x1, x10 Probes
- X-Y Operation
- Complete Schematic
- Voltage, Time, + Frequency differences displayed on CRT thru the use of cursors (S-1365 only)
- Plus much, much more

ELENCO OSCILLOSCOPES



DELUXE SERIES
S-1330 25MHz \$439
S-1345 40MHz \$569
S-1360 60MHz \$759

Features:

- Delayed Sweep
- Automatic Beam Finder
- Z Axis Modulation
- Built-in Component Test
- Plus all the features of the "affordable" series
- Dual time base
- Illuminated internal gradicule

Hitachi Compact Series Scopes

V-252 - 20MHz, Dual Trace \$449
V-555 - 50MHz, Cursors \$1,095
V-552 - 50MHz, DC Offset \$949
V-422 - 40MHz, DC Offset \$849
V-222 - 20MHz, DC Offset \$695
V-665A - 60MHz, DT, w/cursor \$1,449
V-1560 - 100MHz, Dual Trace \$1,595
V-1065A - 100MHz, DT, w/cursor \$1,695
V-1585 - 100MHz, QT, w/cursor \$2,095

B&K OSCILLOSCOPES

2120 - 20MHz Dual Trace \$389
2125 - 20MHz Delayed Sweep \$539
1541B - 40MHz Dual Trace \$749
2160 - 60MHz Dual Trace, Delayed Sweep, Dual Time Base \$949
2190 - 100MHz Three Trace Dual Time Base, Delayed Sweep \$1,379
2522A - 20MHz / 20MS/s Storage \$869



Digital Multimeter
EDM-83B
\$175.00

Almost every feature available
Bargain of the decade



Elenco LCR + DMM
LCM-1950
\$79

12 Functions
Freq to 4MHz
Inductance
Capacitance



Digital Capacitance Meter
CM-1555
\$49.95

- Measures capacitors from .1pf to 20,000µf
- 3-1/2 Digit LCD readout with unit indicator



Digital LCR Meter
LCR-680
\$79.95

- 3-1/2 Digit LCD Display
- Inductance 1µH to 200H
- Resistance .1Ω to 20MΩ
- Capacitance .1pf to 200µF



Function Generator
GF-8026
\$225

Int/Ext Operation
Sine, Square, Triangle, Pulse
Ramp, .2 to 2MHz, Freq. Ctr.



3-3/4 Digit Multimeter
BK-390
\$139.00

- 0.1% DCV accy
- Analog bar graph
- Auto/manual ranging
- 4,000 count LCD display
- Capacitance meas.
- Temperature probe



Digital Multimeter Kit
with Training Course
By Elenco
M-2665K
\$49.95

- Full function 34 Ranges
- Extra large display • Ideal school project
- M-2661 (Assembled) \$55.00



Frequency Counter
F-1225
\$225.00

- 8 Digit LED display
- Wide measuring range
- High sensitivity
- Data hold function
- Input impedance 1MΩ or 50Ω
- 10:1 Input attenuation function

FLUKE MULTIMETERS

(All Models Available Call)

Scopemeters

Model 93	\$1,225.00	70 Series	
Model 95	\$1,549.00	Model 70II	\$69.95
Model 97	\$1,795.00	Model 77II	\$149.00
		Model 79II	\$175.00
10 Series		80 Series	
Model 10	\$62.95	Model 87	\$289.00
Model 12	\$84.95		



Triple Power Supply
XP-620
By Elenco
\$75.00

3 fully regulated supplies; 1.5-15V @ 1A, -1.5 to -15V @ 1A or (3-30V @ 1A) and 5V @ 3A Kit XP-620K \$49.95



Quad Power Supply
XP-581
By Elenco
\$79.95

Four supplies in one unit; 2-20V @ 2.5A, 5V @ 3A, -5V @ .5A and 12V @ 1A. All regulated and short protected



High Current DC Power Supply
BK-1686
\$169.95

- 3 to 14 VDC Output
- 12A @ 13.8V (less current at lower voltages)
- For servicing high power car stereos, camcorders, ham radios, etc.
- Connect 2 or more in parallel or series

Wide Band Signal Generators
SG-9000
\$119.95



RF Frequency 100K-450MHz AM modulation of 1KHz Variable RF output
SG-9500 150MHz built-in counter \$235

Telephone Kit
PT-223K

\$14.95

Available Assembled
PT-223 \$15.95



Function Generator
Blox #9600



By Elenco
\$29.95
Kit \$26.95

Sine, Triangle, Square wave

Learn to Build and Program Computers with this Kit

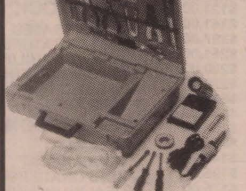


MM-8000
By Elenco
\$129.00

From scratch you build a complete system. Our Micro-Master trainer teaches you to write into RAMs, ROMs and run a 8085 microprocessor, which uses similar machine language as IBM PC.

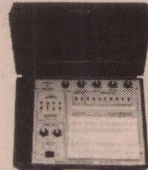
Electronic Tool Kit
TK-1000

\$39.95



A professional organizer tool kit at affordable prices. Includes 25 high quality tools in a high impact carrying case which includes a pocket for meter.

Digital/Analog Trainer
Complete Mini-Lab For Building, Testing, Prototyping Analog and Digital Circuits



KX-525
\$159.95
Kit KX-525K
\$129.95

Elenco's trainer is designed for school projects, with 5 built-in power supplies. Includes a function generator with continuously variable, sine, triangular, square wave forms. All power supplies are regulated and protected against shorts.

The case can include a full line of tools and meter of your choice.

WE WILL NOT BE UNDERSOLD

UPS SHIPPING: 48 STATES 5% OTHERS CALL
IL RES-add 7.75% TAX
PROBES INCL ALL SCOPES & METERS

C&S SALES INC.

150 W. CARPENTER AVE., WHEELING, IL 60090
FAX: (708) 520-0085 • (708) 541-0710



15 DAY MONEY BACK GUARANTEE
FULL FACTORY WARRANTY
WRITE FOR FREE CATALOG
PRICES SUBJECT TO CHANGE

by
Harry Helms

I'm writing this month's column with mixed emotions. In addition to writing columns like this, I also develop Windows multimedia titles commercially. While I like telling readers about things I find useful and exciting,

I hate to give away my "trade secrets."

he wanted to try some different directions in software instead of going back to full-time work with Microsoft. While Gates has always been interested in pushing the technical envelope as far as possible in software,

SOFTWARE WIZARDRY

This month, I'm going to spill the beans about what I feel is clearly the best all-around Windows multimedia development tool available.

While it's a readily-available tool from a respected company that offers excellent support, it's not that well known compared to such multimedia authoring packages as Director or Authorware. One part of me wants to keep this tool from getting too much exposure, since using it gives me a competitive advantage!

Don't think that you have to be a multi-million dollar company to be involved in multimedia development. A lot of the really fast growth — and big profits — in multimedia is coming in corporate training and development. Several large companies, like Ford and BP Oil, are moving from training seminars and video tape to Windows PC-based training courses using multimedia. Many of these training courses are developed by individuals or small (two or three person) companies. This type of multimedia development isn't as glamorous as doing interactive encyclopedias or games, but it is growing and profitable. A tool like the one I'm going to describe this month, along with a good Windows PC, can put you in the middle of this field.

And the name of this tool? It's Multimedia ToolBook from Asymetrix. Unlike Visual Basic, it's not suitable for a wide range of applications or situations. (For example, most Multimedia ToolBook projects will need the storage space of a CD-ROM or hard drive, whereas many Visual Basic packages can fit on a floppy.) However, when it comes to quickly producing fully interactive Windows multimedia titles with minimum headaches, there's nothing around that can touch it. In fact, 95% of my current multimedia work is done in Multimedia ToolBook.

Now you know my secret. I'm doomed.

What Is ToolBook?

You may never have heard of Asymetrix, but you may have heard of its founder, Paul Allen. Allen co-founded Microsoft with Bill Gates and is still the second largest shareholder in Microsoft after Bill Gates (i.e., he's a billionaire, too). Allen left Microsoft in the mid-1980s after a bout with cancer. He fully recovered and re-joined Microsoft's board of directors, but decided

Allen has been more interested in simplifying tasks through software. Multimedia ToolBook is a prime example of that philosophy.

ToolBook was developed back in 1990, but really came into its own with a new version introduced around the same time as Windows 3.0 (indeed, it's clear that Asymetrix is very well informed of Microsoft's plans and acts accordingly!). The original ToolBook billed itself as a "software construction set for Windows." It has been enhanced since then. The latest version, introduced in 1994, included numerous enhancements to handle multimedia elements and was called Multimedia ToolBook. For the sake of simplicity, we'll refer to Multimedia ToolBook as "ToolBook"

The Ultimate Multimedia Development Tool

throughout this column. However, only Multimedia ToolBook will have all the features we'll discuss.

The key to what ToolBook is all about can be found in its name — it uses a "book" metaphor and is a collection of "tools."

The various screens in ToolBook applications are like pages in a book (during development, pages are "numbered" and can be referred to and accessed by number, just like a printed book).

Like Visual Basic and other visual programming tools, ToolBook development involves placing different objects — command buttons, text fields, graphics, etc. — on a screen (or "page") and writing code to enable those objects to respond to different events, such as mouse clicks.

The various properties (color, border type, whether they are functional, or "enabled," etc.) are set by selecting from menus and message boxes.

Object properties can be altered by user events or execution of code. ToolBook code is written in OpenScript, a scripting-type language that is easier to use, especially for non-programmers, than conventional Windows languages like Visual Basic.

Where ToolBook really shines is in its media handling capabilities. While it's possible to write procedures in languages like Visual Basic to handle video and audio files, ToolBook makes it

incredibly easy through its mmPlay command. All you have to do is specify the name of the video or audio file you want to play, and mmPlay does the rest.

ToolBook also includes a stage object, which is an area in which a video file can be played. Like all other objects, you can place a stage anywhere you want on the screen (or page) to display video. You can "attach" audio or video clips to other controls or events. For example, a video or audio file can play whenever you enter a new page (screen) or when an event, like a button click, takes place.

ToolBook also has very strong text-handling capabilities. Text can be entered directly on each page or imported in rich-text format (RTF) from a word-processing program. Unlike many multimedia authoring tools, ToolBook does not treat text as a bitmap file; it is possible to directly edit text on a page or alter its font, size, color, and add superscripts or subscripts. Full text and keyword searching is provided, and ToolBook can accept user input as text. You can even allow users to alter text on a page, including adding or cutting text, or you can "lock" text so users cannot alter it.

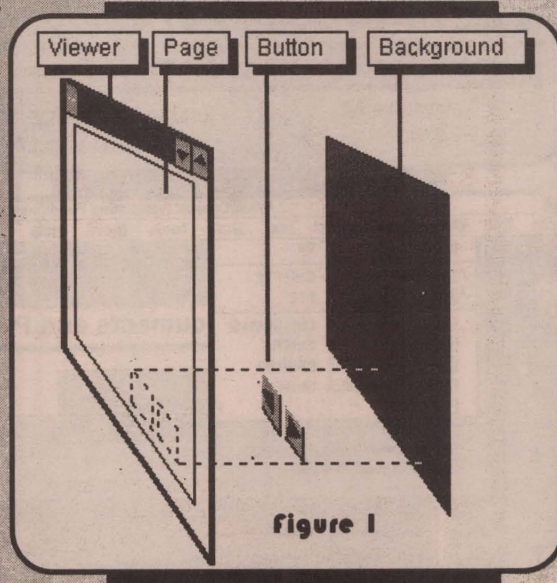
While OpenScript is simple compared to other programming languages, it does include numerous mathematical and financial functions.

One of the really great features of ToolBook is the script recorder. This makes simple animations a snap. Using script recorder, you can drag various objects around on a page and automatically record the sequence of movements as an OpenScript procedure. You can then "paste" the procedure into the code for that object. In this way, you can program complex movements of various objects without having to write a single line of code — all you have to do is paste in the procedure captured by the script recorder!

If ToolBook is so great, why hasn't the whole world changed over to it? For one thing, it is not suitable for any application where you need original high-speed performance. Compared to Visual C++, ToolBook moves along at a, shall we say, casual pace!

While ToolBook will run on any Windows 3.1 PC, it will strain the capabilities of a PC with an 80386 processor; it's best to restrict ToolBook development work to 486 systems. (In fact, most ToolBook applications, especially those with plenty of video and audio elements, really need a 486 PC to run with satisfactory performance.)

Another problem is that the run-time "engine"



SOFTWARE WIZARDRY

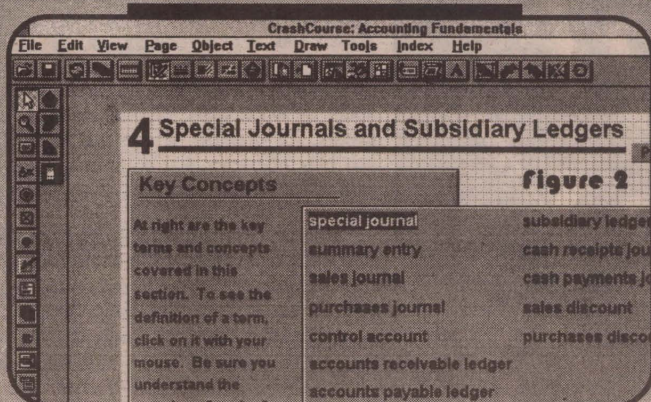


Figure 2

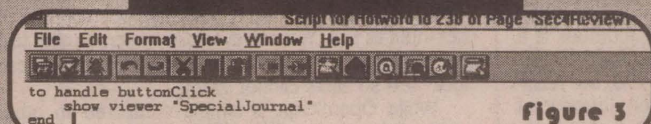


Figure 3

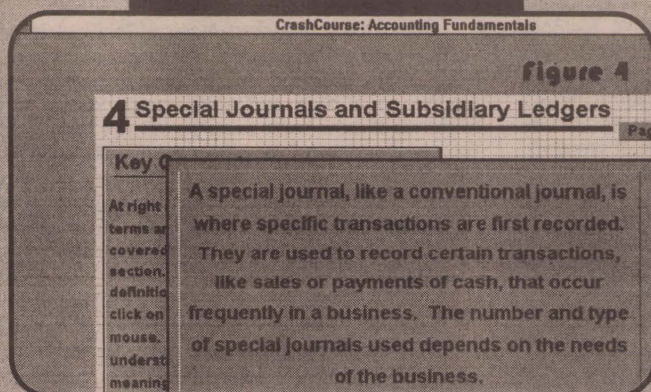


Figure 4

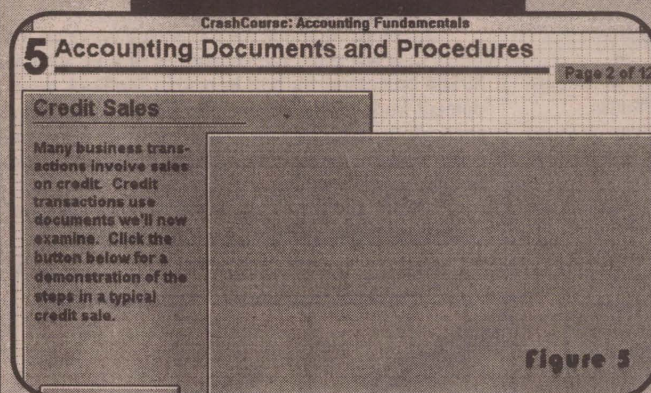


Figure 5

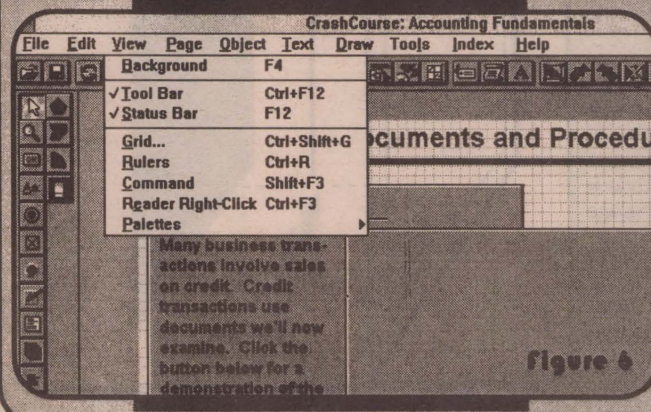


Figure 6

necessary to include with ToolBook applications is big. It's tough to fit any meaningful ToolBook application on a floppy, especially if you want to include sound files (forget including video on a floppy!). As a result, ToolBook applications almost have to be put on a hard drive or a CD-ROM. And, for some reason, Asymetrix has been less aggressive in its promotion of ToolBook than have competing vendors of multimedia authoring tools. This means ToolBook is less well known than other tools like Director or Authorware.

But if your application is one where people will take the time to "read" or use each screen, you need to include multiple video and sound files, and you're looking to save as much time and money as possible while still achieving professional results, then ToolBook is definitely something you must seriously consider. It is especially well-suited for developing tutorial and training materials; the speed and low cost with which ToolBook applications can be developed makes custom Windows multimedia development for companies and institutions practical. (ToolBook is already being used to develop multimedia lesson materials at places like Virginia Tech.)

As I said at the start of this month's column, I do most of my current development work in ToolBook. I have experimented with multimedia authoring tools, such as Microsoft's Visual Basic (discussed in an earlier column) and Viewer, Macromedia's Director for Windows, and even Apple's original HyperCard. While other packages have their strong points and features, none provide the range of capabilities and advantages that ToolBook does.

Pages, Backgrounds, and Objects

Pages, backgrounds, and objects are the fundamental "pieces" of ToolBook. *Objects* in ToolBook are essentially the same as objects in Visual Basic and other object-oriented environments, namely bundles of data and code with distinct properties that can be re-used as often as needed.

ToolBook objects include command buttons, radio buttons, text fields, labels, list boxes, check boxes (similar to radio buttons, but a check mark appears inside when clicked), graphics and figures, groups (collections of other objects that are treated as a single object), and OLE objects. ToolBook also includes a unique *stage* object. A stage is an area on the video display where a video file can be displayed.

ToolBook includes numerous drawing tools for boxes, circles, polygons, lines, and other common shapes. However, ToolBook is not as useful as

most drawing or painting programs when it comes to producing graphics. However, it is possible to create graphics using such programs and import them into ToolBook as bitmap files. Once imported into ToolBook, these external graphics behave as other ToolBook objects, including (as we'll see next) the ability to have scripts to respond to events.

As with most other visual development tools, objects in ToolBook have properties (color, size, whether or not it is visible, etc.) that can be selected from menus or lists. All objects can have their own procedures, known as *scripts* in ToolBook, to perform various tasks (mathematical calculations, move to another screen, play a video or sound file, etc.), when an *event* (like clicking the mouse button) happens. Events trigger *messages* that object scripts respond to.

For example, suppose you want a ToolBook application to go to the next "page" in a ToolBook "book" when a command button is clicked once. Here's the actual script for the command button to "handle" the message produced by the "button click" event:

```
to handle buttonClick
  go to next page
end
```

In this script, "buttonClick" is the message produced by the event of clicking the mouse button. A script like this that responds to a message is called a *handler*.

ToolBook has an especially rich set of events its objects can respond to. ToolBook events include left and right mouse button clicks, mouse button "down" and "up" events, and "enter" and "leave" events. A "MouseEnter" event would generate a message whenever the mouse pointer entered an object (like a graphic or text field) and the object's script can include a handler for the MouseEnter message. For example, suppose you have a figure and would like users to hear a voice explanation of different areas of the figure whenever the mouse pointer entered certain areas. You could place transparent fields at different locations on the figure and give those figures scripts like the following:

```
to handle mouseEnter
  mmPlay clip "tailfins" wait
end
```

In this script, the "mmPlay" command would cause the sound clip named "tailfins" to play whenever the mouse pointer entered the field with this script (this would probably be a field near a set of "tail fins," like a figure showing a 1958 Oldsmobile!). The "wait" parameter following the clip name would cause all other program execution to be halted until the clip had finished playing. Enter and leave events can even be used with pages or entire applications. For example, you could write a script for a "leavePage" event that would clear all selections a user may have made and reset them to their default values whenever a user went to the next screen in an application. Similarly, an "enterApplication" message handling script could do the same for an entire ToolBook application.

ToolBook also lets you forward messages to other objects. For example, the "buttonClick" message produced by clicking a command button could be forwarded to another object, like a graphic, and its script. This would let you change the graphic's color or start an animation sequence for it by clicking a button instead of clicking the graphic itself. You can do the same for other events; the mouse pointer entering a certain area of the page could produce a message

SOFTWARE WIZARDRY

sent to another object that would change the object's color or start an animation sequence involving that object. Messages can be sent to other pages.

ToolBook introduced the concepts of *pages* and their *backgrounds* to multimedia development. Each screen of a ToolBook application consists of two parts — a page and its background — although to users of the application there seems to be only one screen display (or "page").

Perhaps the best way to understand pages and backgrounds is to think of animation "cels" used to produce cartoons and animated Disney movies. Ever notice in a cartoon how the background scene (like the living room in "The Simpsons" or the "wild west" in a Roadrunner cartoon) never seems to change? To save on production time and cost, cartoon animators draw one background and re-use it as often as necessary. The foreground characters and scenes are drawn on a sheet of clear film, and then placed atop the background. When placed together like this, the foreground and background seem to be a single image.

This is very much what happens in ToolBook. You can create a single background, and as many pages as you want can share that background. You can't separate a page from its background; every page must have a background. However, you can change a page's background or design a new background for a page. Figure 1 shows the relationship between backgrounds, pages, and an object known as a "viewer" which we'll soon discuss.

Pages and backgrounds can have their own scripts. Common messages that page handlers process are "leavePage" and "enterPage" messages. Messages can be sent to and from different pages, or even between objects on different pages. A user might enter some data or answer a question on one page, and the object that accepted the user's input on one page could communicate that input (such as the user's name) to another page in the book. When the user reached that other page, their previous input would — so to speak — be waiting for them!

Objects can be placed on pages and backgrounds, although one class of objects (record fields) can only be placed on a background. Adding, deleting, or changing an object on a page only affects the object on that page, while adding, deleting, or changing a background object affects all pages sharing that background. If you delete a command button from a background, the command button will disappear from every screen using that background.

A page is "transparent," much like the clear film used in an animation cel. The background can be seen "through" the page. Only the background can have a color or pattern. However, you can add objects to a page (like fields or graphics) that can have colors or patterns, and these can obscure parts of the background. Pages can be "named," like objects, or can be referred to by number. This makes navigation between different pages in a book easy.

Separating pages from backgrounds can really cut down in the time need to develop a ToolBook application. For example, you can place objects needed on every screen, like exit and "next page" buttons, on the background. You only have to create such objects and write scripts for them once, regardless of how many pages your application might have. In some other multimedia authoring tools, you would have to re-create those objects (and their scripts) on every screen of your application.

Viewers and Hotwords

One useful feature of ToolBook is the *viewer*. A

viewer is simply a window. Each ToolBook application will have at least one viewer, which would be the window it appears in. ToolBook provides many other types of viewers, such as custom message boxes, logo displays, "palettes" of tools and colors, other pages from the application, and "pop up" windows with text and graphics. Viewers can be named and displayed by scripts in response to messages, such as displaying a certain viewer in response to a mouse button click.

Like other windows, most viewers can have horizontal or vertical scroll bars, resizable borders, captions, and "minimize" and "maximize" icons. A *dialog box* viewer is similar to the message box in Visual Basic and many Windows applications. A dialog box can contain text and control buttons with specified options; it is useful when you need to inform users of some situation and let them select a course of action (such as whether or not to save a file before quitting). A dialog box can't be resized and has no minimize or maximize icons, however. A *pop-up text box* can contain text or graphics and can be closed by clicking once anywhere within the box. It is the simplest type of viewer, since it has no caption or other border; it looks much like an unruled index card.

Viewers are often used with *hotwords*. A hotword is a word or phrase in text that is treated like an object; a hotword has a script that can handle messages. A common use for a hotword is to provide a definition of a word or concept. Users can point to a hotword, click on it, and the hotword can run a script to display a viewer, play an audio file, jump to another page in the book, etc. Hotwords normally use a different kind of type color (such as blue when normal text is black) to indicate they are hotwords.

Here is an example of how viewers can be used with hotwords. Figure 2 shows a screen from an actual ToolBook project I'm now working on — a multimedia introduction to accounting. Note that the term "special journal" is highlighted. I've done so because I wish to make it a hotword that will display a viewer named "SpecialJournal" when the user clicks on it. To display that viewer, I need to write a handler for the hotword. Figure 3 shows the script for that handler.

What you see in Figure 3 is known as the *code window*. All objects in ToolBook have a code window that you can open and enter a script for the object. Figure 4 shows what happens when the user clicks the hotword "special journal." The viewer "SpecialJournal" appears in the middle of the screen. Since it is a pop-up viewer, the user can "close" it merely by clicking anywhere on it.

More About OpenScript

ToolBook scripts are written in the OpenScript language. OpenScript contains many elements that will be very familiar to anyone with experience with languages such as BASIC, C, or Pascal. However, OpenScript is generally easier to use than other programming languages since

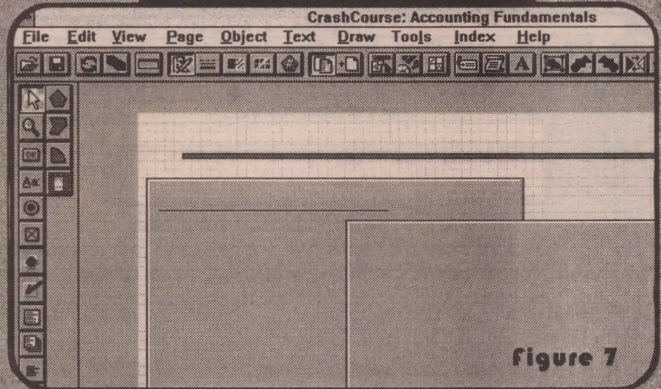


Figure 7

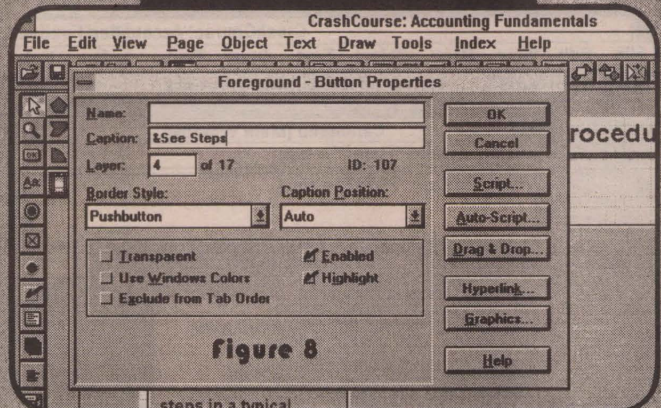


Figure 8

to handle buttonClick

```

sysCursor = 4
visible of group "Connector" = false
visible of line "Arrow1" = false
visible of line "Arrow2" = false
visible of line "Arrow3" = false
visible of line "Arrow4" = false
visible of line "Arrow5" = false
visible of field "Field1" = false
visible of field "Field2" = false
visible of field "Field3" = false
visible of field "Field4" = false
visible of field "Field5" = false
visible of field "Field6" = false
visible of field "Field7" = false
pause 50 ticks
visible of field "Field1" = true
pause 1 seconds
visible of line "Arrow1" = true
visible of field "Field2" = true
pause 1 seconds
visible of line "Arrow2" = true
visible of field "Field3" = true
pause 1 seconds
visible of line "Arrow3" = true
visible of field "Field4" = true
pause 1 seconds
visible of group "Connector" = true
visible of field "Field5" = true
pause 1 seconds
visible of line "Arrow4" = true
visible of field "Field6" = true
pause 1 seconds
visible of line "Arrow5" = true
visible of field "Field7" = true
pause 1 seconds
visible of line "Arrow3" = false
visible of field "Field4" = false
pause 1 seconds
visible of line "Arrow4" = false
visible of field "Field6" = false
sysCursor = 1
    
```

Figure 9

end

SOFTWARE WIZARDRY

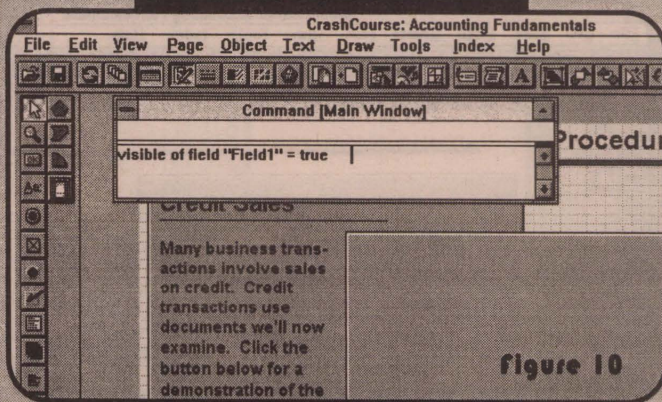


figure 10

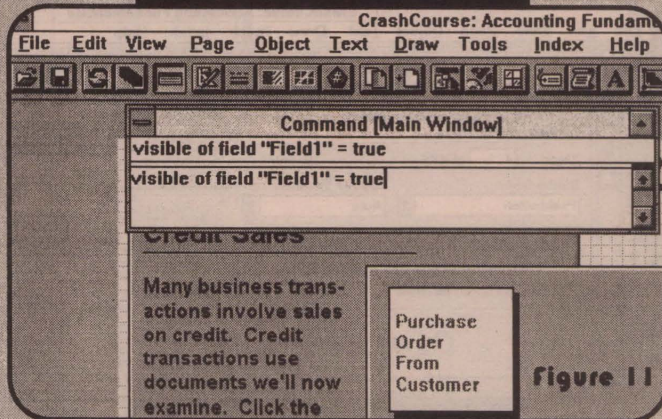


figure 11

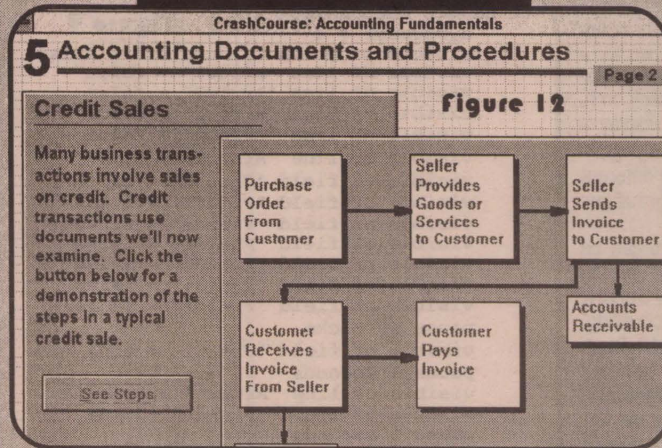
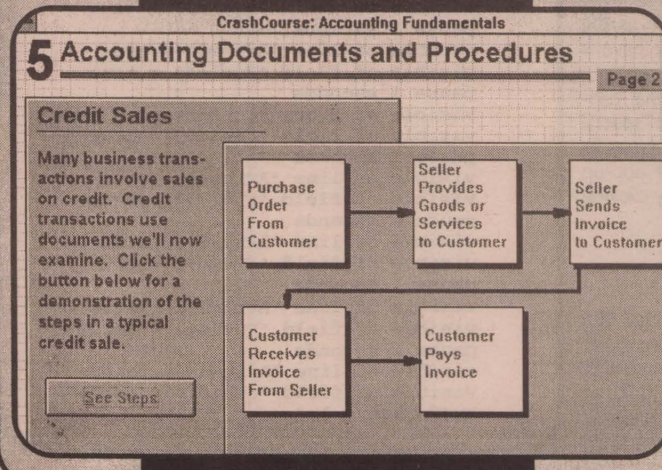


figure 12



its syntax is more natural and "English-like" than such languages.

Variables in OpenScript can be declared with or without a data type; variables do not have to be declared before use. Variable names must begin with a letter or underscore, contain only alphanumeric characters (or @ as a prefix), and cannot be an OpenScript keyword; otherwise, there are no restrictions on variable names. Nineteen data types are available. In addition to the usual integer and floating-point types of varying size, OpenScript supports such data types as colors, points (locations on a page), dates, times, and stacks. Arrays of variables are permitted, but arrays must be declared before use.

The scope of variables can be restricted to a single object or script, to a page within an application, or any script in an application can be allowed access to a variable. OpenScript has the usual control structures found in other programming languages such as if/then/else and the do/while, while, condition, and step constructs for looping. It also includes a "to handle" structure to handle messages sent to an object (note that the code in Figure 9 is a "to handle buttonClick" structure) and a "to set" structure that lets you change an object's properties during a script's execution. By using different "to handle" structures, you can have an object respond in different ways to different messages. For example, you could make an object visible (using a "to set" structure) when the mouse pointer enters the object (a "mouseEnter" message) and have it return to invisibility when the mouse pointer leaves the object (a "mouseLeave" message) by using "to set" structures to control the object's visibility. You could include a third handler in the object's script that could permanently set the object to visible when the left mouse button was clicked, and even include a fourth handler to make the object invisible again if the right mouse button is clicked.

Control structures can be nested within other control structures. The "break" keyword lets you terminate a loop or other control structure if an error or other conditions are found, and the "continue" keyword lets you resume the flow of the control structure following a break. You could use "break" to stop a control structure and alert the user to some condition (like a value being outside the normally expected bounds) through a message box. By clicking "OK" in the message box, the user could send a "continue" message back to the control structure, which

would resume at the point where the "break" condition occurred.

OpenScript includes over 50 pre-defined functions for arithmetic, statistics, string manipulation, and financial calculations. The latter are largely unique to ToolBook, permitting the calculation of the net present value of an investment, interest rates, and the depreciation and salvage value of an asset with just a single keyword (like "irr" for interest rate calculations) followed by a list of parameters.

The OpenScript environment has a full set of diagnostic tools, including a syntax checker and debugger with an execution tracer and breakpoints. There's also a command window in which you can write and execute single lines of OpenScript code. ToolBook comes with a large library of commonly-used scripts (for such purposes as going to the previous or next page in a book) that can be copied and pasted onto controls as needed. You can add your own scripts to the library, meaning that you don't have to do any original coding for most routine tasks.

ToolBook In Action

Let's return to the accounting tutorial I'm now developing with ToolBook. Figure 5 shows another page from it.

Like all ToolBook applications, each screen consists of a page and a background. To see the background alone, I can select the Background from the View menu, as shown in Figure 6. The background itself is shown in Figure 7. By comparing Figures 5 and 7, you can see which objects are placed on a page and which are placed on the background. All of the pages in my application will share the same background.

This particular page has several fields and connecting lines whose visible property has been set to false. My plan for this page was to reveal each of the fields and connecting lines (that is, set their visible property to true) in sequence and tie the "return to visibility" of each field and connecting line to the playing of a .wav (sound) file. To do this, I needed to write a script that would be run when the button labeled "See Steps" was clicked. I started by opening the button's properties window, as shown in Figure 8.

Take a look at the properties window. There is a space for the caption that appears on the button. Notice that the caption is entered as "&See Steps" and the "S" in "See Steps" is underlined on the page. By placing the "&" in front of the caption, users can activate the button by holding down the "S" key while pressing the "Alt" key if they don't feel like using the mouse. There is a space to give the button a name it can be referred to in OpenScript; since I didn't plan to refer to it in other scripts, I left the space blank.

The properties box also includes drop-down menus for the type of button and where the caption should be placed. I selected the "pushbutton" style, which means the button appears to press inward, like an actual pushbutton, when clicked. There are several other properties I could set or options I could choose, but all I want to do now is write a script for the button. To do so, I click the Script button in the button's properties window. This opens a "script window," much like a word-processing document window. I can then write a script in the script window.

The preliminary script I wrote is shown in Figure 9. I term this a "preliminary" script because the audio for the sound files had not yet been recorded when I wrote it. Since I wanted the visibility of the different elements to be synchronized to the playing of the sound files, I used "pause" statements at every point where I intend to play a sound file with "mmPlay clip" statements.

SOFTWARE WIZARDRY

When the sound files are ready, I'll replace all the "pause" statements in the script with "mmPlay clip" statements followed by the name of the appropriate .wav file.

The script in Figure 9 shows how clear OpenScript code can be. The event to be handled is a click of the mouse button. The first statement following the handler — `sysCursor = 4` — turns the mouse pointer into an hourglass figure. I did this throughout my application to indicate to users when an operation was in progress. The last statement in the script changes the hourglass back to a conventional mouse pointer. I next included statements to set the visible property of all fields and lines to false. On the previous page of this application, I included similar statements in the page's script as a handler for a "leavePage" event. However, I wanted to give users the option to "replay" the page if they wanted. The statements setting the properties to false will clear the page so users could see the entire sequence from the start.

The "pause" statement will suspend execution of a script for the time specified ("50 ticks" is equal to approximately a half-second). As the script executes, the various fields and connecting lines are revealed (their visible property is set to true) in the sequence indicated. Note that a couple of fields and lines are later hidden (visible set to false) in the script.

As mentioned earlier, the command window is a handy development tool since it allows execution of a single line of OpenScript code. The command window is opened by clicking one of the icons in the horizontal toolbar at the top of the ToolBook window. Figure 10 shows the command window and a line of OpenScript

code that I entered. To execute the code in the command window, the Enter key is pressed. The result is shown in Figure 11. The highlighted line of code indicates that it has been executed, and "Field1" is now visible. Note that the field has a "shadow effect." This is one of the properties that can be selected from the field properties menu.

Figure 12 shows the complete set of fields and connecting arrows with their visible property set to true. Figure 13 shows the same view, but after the visibility properties of Field4, Field6, Arrow3, and Arrow4 have been set to false (see the last few lines of the script in Figure 9). If you know something about accounting, you can probably guess why these items are made invisible and what the voice narration on the synchronized .wav file will say. If you aren't familiar with accounting... well, buy this project when it becomes available later this year!

The process of converting an analog audio signal into a digital .wav file isn't difficult, but it is a subject that deserves a complete discussion. We'll be looking at that subject very soon in this column.

Is ToolBook For You?

Asymetrix Multimedia ToolBook has a lot going for it. It's easy to learn and easy to use, yet offers remarkable capabilities. In particular, you can produce professional-quality Windows multimedia with sound and video for a fraction of time and expense required when using a programming language like Visual C++ or Visual Basic. Applications developed in ToolBook can be distributed on a royalty-free basis.

ToolBook does have some problems. Its execution speed is slower than programs written in Visual C++ or other compiled languages; ToolBook is most suitable for applications where users will spend some time at each screen. It is not suitable for developing applications requiring high-speed graphics or animations. However, it is possible to prepare such graphics or animations using a separate animation tool and playing the resulting files in a ToolBook stage. ToolBook applications are inevitably large, and must be installed on a hard drive or a CD-ROM. Finally, ToolBook is not cheap; the street price for the current version (3.0) is usually about \$500.00.

As we mentioned earlier, you will need a healthy Windows PC for ToolBook development, meaning a 486 processor (the faster, the better) along with eight megabytes of RAM. You'll also need a hard drive with about 200 megabytes or so of empty space. While ToolBook itself only occupies 8 to 24 megabytes of hard drive space (depending on the installation options you select), ToolBook applications grow rapidly as you start adding sound, videos, and animations. Many ToolBook developers find a separate hard drive of about 500 megabytes to store ToolBook project files to be a good investment. A separate hard drive makes it easy to send your finished project to a CD-ROM duplicator or to a customer to load the project on his/her system.

But all things considered, ToolBook is the best overall tool for multimedia development on Windows PCs. If you are seriously interested in getting aboard the Windows multimedia bandwagon, ToolBook is probably just the ticket you've been looking for! NV



CELLULAR EXTENSION PHONES...*The Easy Way*



Expand your profit margin in a highly competitive market with decreased incentives coming from your cellular carrier.

Stand-alone programmer (only 10 oz.)

No computer required to program

Complete with programming cables

Easy-to-use instructions

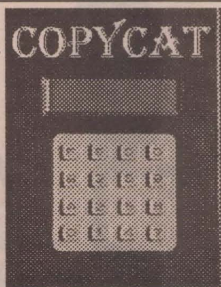
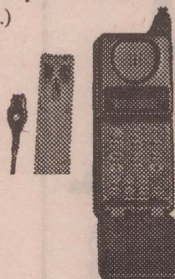
24-hour telephone tech support

Easy to read digital display

Simple alpha/numeric keypad

Self-contained, battery operated

Completely Mobile—can be field operated by any employee



From \$1995.

PROGRAM ESN AND NAM

EASILY PROGRAMS RENTALS OR LOANERS

REACTIVATE DEAD CELLULAR PHONES TUNE AND PEAK YOUR CELLULAR PHONES REPAIR LOANER & 0000FFFF

We are open Monday thru Friday 9:00AM- 2:00PM, 5:30PM- 8:00PM

Also open Saturday and Sunday 9:00AM til 5:00PM

Programs available for the following brands:

Motorola • Motorola Digitals • Audiovox

Uniden • Mitsubishi • NEC • Ericsson

Panasonic • Sony • DiamonTel • GE

Copycat, MPC, G2, Checksum converters, EEPROM

Locations also available.

WE REPAIR COPYCATS AND CAN UPDATE COPYCAT SOFTWARE

If you don't see what you want, ask us. **ALSO WE HAVE NEW AND USED CELLULAR PHONES.**

EXTENSION PHONE PROGRAMMING SERVICES AVAILABLE FROM \$99.95!

CALL NOW ! (305) 491-5555 CPS Company

WARNING: TELECOMMUNICATION THEFT AND FRAUD IS A LOCAL AND FEDERAL CRIME TITLE 18-1029

FTS 4050 and **HP 5061A** cesium standards, Tracor 308A and 304D rubidium standards for sale. W9th manuals and warranty. Corby Dawson, 805-736-0288.

HP 3550B test set. Consists of **HP 204C** 5Hz-1.2MHz oscillator, **403B** 10Hz-2MHz AC/dB meter (.001-300V 12 ranges), and **353A** 110dB attenuator. Tested with manual, \$125. Untested, \$75. Modules also available individually. Telephone ringing generators, new 110V 30Hz output. \$10. Much more. List-LSASE. Ellis, 203 Edgebrook Drive, Pikeville, NC 27863. 919-242-6000.

HP 141T, 8552B, 8554B, \$1,400. 141T, 8552B, 8555A, \$1,600. Tek 492 opt. 1,2,3 \$6,500. Tek 7L13/7623, \$1,995. **HP 8444A/059**, \$995. Schlumberger, SI-1253 gain phase meter, \$1,200. Racal Dana 1992 universal counter, opt. 04A, \$499. **BAFCO 911A** freq. response anyz., new, \$399. Wavetek 3000-200, \$599. Wavetek 164, \$499. Wavetek 185, \$299. **HP 8601A**, \$299. **HP 3570A/3330B** \$995. Tek 1503 TDR, \$1,295. **HP 432A/478A**, \$300. Don Phelps, 909-279-7347.

PHILIPS OSCILLOSCOPE PM3094 four channel, 200MGHz \$1,500 or B/O. Apollo Computer Equipment, make offer??? 310-205-0128.

WALL SURPLUS has **HP 7550A** plotter S/N:2848A for \$750. Also **HP 7475A** plotter S/N:2908V \$450. For more bargains, call 908-681-2032.

TEST EQUIPMENT Sale: Tektronix 7904 500MHz frame, \$400; 7A13, \$300; 7A22, \$300; **HP 3497A** data acquisition control unit, \$450; **HP 3466A** DVM, \$250; **HP 4204A** oscillator, \$250; **HP 3762A** data gen., \$800; **HP 3964A** 3 channel data recorder, \$650; **HP 5340A**, \$1,000; **HP 618C**, \$300; **HP 3403C**, \$300; **HP 7562A** log converter, \$200; **HP 7561A**, \$100; **HP 789C**, \$150; **HP 35601A**, spec. ana. interface, \$400. A-Comm Electronics, 303-290-8012.

FS73 "SIGNAL Cube" RF field strength meter. Calibrated 1-100 MHz. Relative readings to GHz range. Dipole antenna for constant readings. Nye Engineering, Inc., 4020 Galt Ocean Dr. Suite 606, Fort Lauderdale, FL 33308. Tel 305-566-3997, FAX 305-537-3534. \$169 Visa/MasterCard.

PHILIPS OSCILLOSCOPE PM3094 four channel, 200MGHz \$1,500 or B/O. Apollo Computer Equipment. Make offer? 310-205-0128.



FS73 "SIGNAL Cube" RF field strength meter. Calibrated 1-100 MHz. Relative readings to GHz range. Dipole antenna for constant readings. NYE Engineering, Inc., 4020 Galt Ocean Dr., Suite 606, Fort Lauderdale, FL 33308. Tel. 305-566-3997, FAX 305-537-3534, \$169. Visa/MasterCard.

WAVETEK 148 AM/FM/PM generator \$425. Dexis 612-944-7670.

TEK 501A function generator 0.001Hz-2MHz. Like new condition. \$250. 415-244-9254.

EQUIPMENT SALE. Hewlett Packard 3400 RMS voltmeter w/manual, \$135. 4328A milliohm meter excellent condition, \$195. 6130C, 50V @ ±1A, Digital voltage source, as new \$200; 6140A digital current source, 120V @ ±200mA, as new \$200. 432A power meter with cable manual and 8478B thermistor mount \$300. Psitech Plus, 707-745-4804, fax 707-747-5277.

TEKTRONIX 650HR 12" broadcast. Color monitors w/602 vector. \$1,100 ea. 818-352-6619.



THIS LOW circuit loading SCOPE PROBE produces a 60dB **SPECTRUM ANALYZER** display on your inexpensive scope. Excellent EMI/compliance tool. Request Technical Tips for line conduction, field strength, and current probe. 255 Spectrum Probe 30KHz to 2.5MHz \$279. 107 Probe 1 to 100 MHz \$249 (\$279 extra shielding). Accessory Current Adapters: IA5 \$19, IA7 \$29. **SMITH DESIGN**, 215-661-9107, 207 E. Prospect Ave., N. Wales, PA 19454.

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.

WANTED: AUSTRON Model 1201 Linear Phase Recorder. **HP-DY2509A** Digital Clock, **GENERAL RADIO** Model 816 Precision Clock. Call Bill Scolnik, 1-800-634-7036 or FAX 1-800-788-5005.

TEK 7103 1GHz scope, \$2,475. **TEK 485** 350MHz scope \$675. 508-634-3806.

RANK BROTHERS Microelectro Phoresis Apparatus MKII, \$2,495. Dexis 612-944-7670.

HP 141T/8554B/8552B spectrum analyzer w/8444A tracking generator. 500KHz to 1250MHz -122 to +10dBm log. 0.1µV/div lin. Great analyzer, great price! \$1,750. 30-day guarantee. **Lehman Scientific**. 717-252-4211, 717-244-7540, FAX 717-252-4266.

S
K
Y
V
I
S
I
O
N



Let *Skyvision* help.

Largest inventory of
DISCOUNT SATELLITE TV PRODUCTS
all ready for *FAST* shipping.

Complete systems • Upgrade packages.
Full line of dish antennas, receivers, feedhorns,
LNBs and actuator arms.

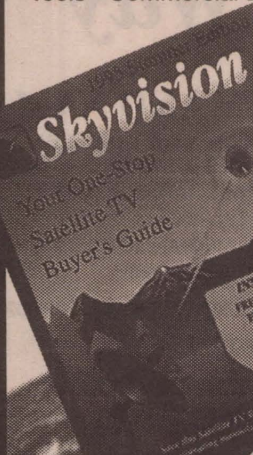
30-50% savings with SkyPacSM programming.

18" Mini-dish systems and accessories.

Tools • Commercial Equipment • Books • Software.

It's **MORE** than
a catalog!

Comparison Charts
Product Reviews
Tech Tips



#1 in Customer Satisfaction

Call Now. It's **FREE** 800-334-6455

Skyvision® • 1016 Frontier Drive • Fergus Falls, MN 56537
International 1-218-739-5231 • Fax 218-739-4879

Remember the
fun you had
when you could
do it yourself?

YOU
STILL
CAN!



WANTED: LATE MODEL TEST EQUIPMENT (Tektronix, HP, Fluke). Especially: Tek SG 505/2, Tek S-6, Tek 2465A/B. Also, we buy test equipment **service manuals and catalogs**. Pepper Systems: 214-53-0257; 214-902-9511 FAX.

TEKTRONIX 492 SPECTRUM ANALYZERS 50KHZ-21GHZ+, INCLUDES DIGITAL STORAGE, MAX-HOLD, COMPARISON OPTION, 300 HOURS USAGE \$5,975; 492 WITH ABOVE AND PRESELECTION (tracking pre-filter) AND FREQUENCY STABILIZATION/100HZ RESOLUTION OPTION \$6,850. Our 492s are newer production, calibrated units with front covers, manuals, and diplexers. Option 21 precision external waveguide mixer set to 40GHz available. 10-day inspection, 90-day warranty. Hamilton Instruments, 619-439-1345, 1-800-TO-BUY-TE.

WHEATSTONE BRIDGE Anthony Pattern #4230 ration 1,000-1 :1-1,000. Dytronics Co., Inc. MD. 311 primary phase angle standard 30 CPS to 10,000 CPS. Tektronics 2901 time mark generator. Tex. Type 545 & 575 oscilloscope. HP 8057A, K61-5214L, 1105A. Generators. 617-876-6363 MI.

TEKTRONIX 338 SI LOGIC ANALYZER 32 parallel data channels, maximum synchronous and asynchronous sample rate 20MHz. Includes manual, P6107 probe, 4 ea. 6451 data acquisition probes. Like new condition. \$750 CONUS shipping included. Brian Kent (Kentronix), PO Box 2444, Farmingdale, NJ 07727. 908-681-3229, FAX 908-681-3312.

Don't Miss A Single Issue Of Nuts & Volts. Call 1 800 783-4624 And Use Your Visa Or Mastercard To Subscribe!

HP TEST equipment, you fix it. HP 5306A \$35, HP 5314 \$45, HP 1120A 500MHz probe \$30, HP 436A \$70. 415-244-9254.

MANUALS: HP, Tektronix, Fluke. Please be patient if you are waiting for lists. Am updating. For specific needs call 813-796-3424 or write: Allen Fulmer, 2538, Sweetgum Way West, Clearwater, FL 34621. On vacation August 5-19.

SECURITY

85

WANTED D-MOUNT lenses. For 1/3" CCTV need all sizes except 8mm, will buy or trade for CCTV stuff. Rick, 617-933-0827.

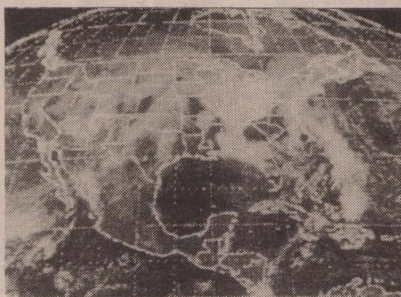
SECURITY CAMERA equipment and related products. 1000s of pieces of equipment, from cameras, lenses, cable, video recorders, switchers, mounting brackets. All equipment is new with manufacturer's warranty. WEI Systems and Equipment. 1-800-348-4448.

SECURITY TECHNICAL help online 24 hours a day on the HES BBS via modem: 908-840-6921.

Lapse Recorders for video surveillance systems. We repair and service all brands, makes and models. Warranty Authorized for GYYR, Diebold, Koyo, D/A, and Sanyo. Moore's Electronics, 209-957-3610, 10am-8pm, PST.

PROFESSIONAL ALARM Control panels, power supplies, contacts, detectors, sirens, enclosures, timers, water, gas and temperature sensors and more. Send \$2 for catalog to HES Electronics, PO Box 183, Brick, NJ 08723.

Get A New Image

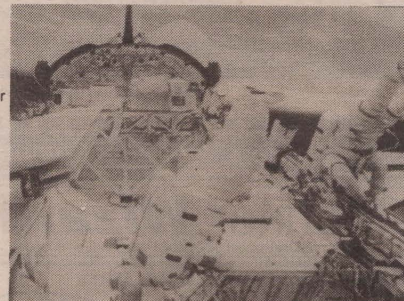


PC HF Fax Plus \$129

PC HF Fax Plus is a simple, yet comprehensive HF system that receives Fax, RTTY, CW, and AMTOR on an IBM PC or compatible. It includes an FSK demodulator, advanced signal processing software, tutorial audio cassette, and complete reference manual. Just plug the demodulator into a serial port, install the software and get text and vivid images on your PC.

PC SSTV \$149.95

PC Slow Scan Television is a complete system for sending and receiving full color amateur SSTV. The package includes an SSTV FSK modem, SSTV software, image capture utilities and reference manual. All popular formats are supported including Robot, Scottie, Martin and AVT. The system requires a 286, 386 or faster PC with VGA or super VGA display.



Have It All For Only \$199.95

For a limited time we are offering both software packages with a single FSK modem for under \$200. This combination offer will let you send and receive the popular HF image and text transmission modes.

Call or write for our free catalog. Visa and Mastercard welcomed.

Software Systems Consulting

615 S. El Camino Real, San Clemente, CA 92672
Tel.(714) 498-5784 Fax.(714) 498-0568

Write in 212 on Reader Service Card.



Southern California!

Tired of renting a second-rate cable box?

NOW YOU HAVE A CHOICE!

CABLE CHOICE—DON'T GET BOXED IN!



Freedom from cable company tyranny is as easy as:

1
2
3

Call or stop by our store for the details or a demonstration on our exclusive service for your area. Our trained representatives are waiting.

Bring in your current cable bill and receive your custom-programmed replacement converter. We program each unit individually on-site.

Return your old converter to your cable provider and begin saving money and enjoying a new level of cable technology.

From Santa Barbara to San Diego, begin saving today. Call 800-644-6682 for details on starting your own Cable Choice franchise.

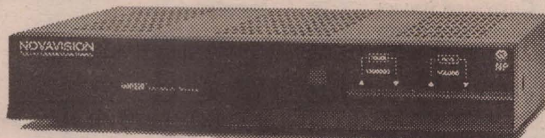
"Cable Choice is the answer I've been looking for. Watching my old TV has never been better, and I've saved lots of money!"

—Phil Brown, Glendale, Calif.



14555 Ventura Blvd.
Sherman Oaks
800-404-0436
DON'T GET BOXED IN

limited offer—special intro rate of \$99; normally retails for \$249



- RCA DirectTV mini-dish
- full line of cable accessories
- remotes for every converter
- splitters, connectors & more!

Write in 128 on Reader Service Card.

Nuts & Volts Magazine/August 1995 89

Prototype Plated Thru Circuit Boards

example
less than \$90 for two 5"x6" 2-layer boards

your order shipped next business day
if data is received by 7:00 AM

AP Circuits
#3-1112 40 AVE NE
Calgary, Alberta
Canada T2E 5T8
(403) 250-3406



for complete information download
newuser.exe from our 24 hr BBS
(403) 291-9342 (8N1)
Email: staff@apcircuits.com
Internet (www): http://www.apcircuits.com/html/apc/apde2.html

Write in 126 on Reader Service Card.

Check Monitors *Without a Computer!*

Monitor Wizard

Deluxe Computer Monitor Pattern Generator

Deluxe Sync Modes PC & MAC:

PC TTL : MGA, CGA, EGA
PC VGA : 640x480, 800x600, 1024x768
Mac : MacII/LC 640x480 @67Hz refresh

Customize Your Wizard!

Any standard sync mode may be changed to a Custom Sync Mode.
Most MAC & VESA modes in STOCK! We can make UNUSUAL
SYNC MODES for you! Call for details.

Buy
Factory
Direct

Uses:
Identify Unknown Monitors!
Verify CORRECT Monitor operation!
Make all Monitor Adjustments with just one BOX!
Great for BENCH SERVICE tool!

Features:
Easy to Use! No Technical Knowledge Required!
Small Size! - Only 6.5"x5.5"x1.75" Wt 2.25lbs
Color Bars, Cross Hatch & Solid Color Screens
30 to 50 Hours Battery Life! Bat Low Light!
Battery AC/DC & MAC Adaptor Included!

816-836-1094

Independence Electronics Inc.
119 S Main, Independence Mo. 64050

Write in 116 on Reader Service Card.



Rugged all metal case!

Only...
\$299.95
Made in USA

MasterCard

VISA

Monitor Wizard for Mac: CALL
Coming soon...
In Circuit CAPACITOR Wizard!

STUN BATON or high voltage ozone
replenisher, \$30 plus \$3.90 shipping each.
Knight Industries, Box 1525, Woodinville,
WA 98072, 206-481-9491. Knight Sticks
are personal, non-lethal, high voltage
defense products direct from manufacturer,
us!



**SURVEILLANCE: ALL ELECTRONICS
SECURITY DEVICES AND ALL YOU
NEED FOR PRIVACY AND SECURITY,
BUGGING/ PHONE TAPPING DETECTORS,
TELEPHONE RECORDING,
TELEPHONE/FAX SCRAMBLERS, VEHICLE
TRACKING SYSTEM, COVERT
VIDEO CAMERA, TRANSMITTER KITS,
AND MORE. FULL CATALOG AVAILABLE.
A.B. ELECTRONICS, NY, 1-800-U-
ANTIBUG, 718-253-3637.**

CALLER ID in your PC! Patented Pass
and Block feature for COMPUTER
ACCESS SECURITY! 8-bit card with software.
Database included. Pager
Forwarding. More. Technical reference to
write your own applications. Now only
\$109.95! Pewee Valley Innovations, Inc.,
6601 Old Zaring Road, Crestwood, KY
40014. 502-241-4295.

VOICE CHANGER board! Fully assembled
and tested! Not a kit! 16 levels of change,
many applications! \$39.95 + \$4 (S&H) US
funds! PARSEC Electronics, PO Box
34594, Phoenix, AZ 85067.

SPY EMPORIUM privacy security.
Professional recorders, parabolic mic.,
Wireless covert video, bugging/phone tap
detectors, scramblers, locksmith tools, etc.
FOR CATALOG, SEND \$5 to Security
Trade, 6065 Hillcroft, Suite 413, Houston,
TX 77081. 713-774-1000, FAX 713-270-
4708.

**AMERICAN SECURITY & Communications
Technology Corporation**, secret surveillance
equipment, auto satellite tracking
systems, auto alarms & accessories, motor
home security systems designs, cellular
products. Domestic and international distribution.
Tel: 209-741-7262. FAX 209-635-
1831. Visalia, CA USA.

CCTV EQUIP. New 6 Watec 202 CCD
color cams w/Tamron zoom 6-12mm \$450
ea 6/\$2,400, CCTV lenses all sizes &
types \$10 up 150 available. Sanyo CCD
cams 200 avail. 1/3" B&W w/8mm lens/12
VDC PS \$100 ea/10-\$85 ea. Beautiful
stuff. Toa wireless lav. mic systems 6
avail. \$100 ea. 6 Sony 4" B&W Flat screen
monitors FDM-402A \$85 ea. 6-\$75 ea.
Rick, 617-933-0827.

SATELLITE EQUIPMENT

90

OAK ORION: THEORY OF OPERATION.
Theory, fixes, software, schematics, and
more. \$37.45. VISA/MC 520-782-2316.
TELECODE, Box 6426-NV, Yuma, AZ
85366-6426.

USED SATELLITE EQUIPMENT. You
name it, we have it. LNA's, downconverters,
drives, receivers. Working condition
guaranteed. Call 317-385-2305.



25K LNB \$55.95, 20K LNB \$79.95, complete
systems, C/KU, RCA, DSS 18",
Orbitron, Ajak, Drake, Chaparral, Echostar,
HTS, Accessories, expert advice. Free catalog.
Satellite Warehouse. 1-800-851-
6534.

SATELLITE RADIO BOOK AND GUIDE.
New book covers all Audio Services,
SCPC, Subcarriers, FM Squared,
Facsimile, Press Services, Weather
Services. Simple how-to-receive instructions.
\$16.95 plus \$3 Priority Mail. UNIVERSAL
ELECTRONICS, 4555 GROVES
ROAD, #12, COLUMBUS, OH 43232. 614-
866-4605.

NEW 18 inch satellite system with one
month free HBO. Call 317-385-2305.

SUBSCRIBE TO the North Star Gazer,
YOUR monthly Satellite Industry News
Connection. Geared at the satellite enthusiast
& professional. Full reports on the
Satellite Underground. \$48 per year US.
Send check today to: North Star, PO Box
1023; Lapeer, MI 48446, 810-664-4022.

BUYING TOCOM, SCIENTIFIC ATLANTA
8536s, 8550s, 8580s, 8590s, and 8600s.
JERROLD DPV and DPBB. PIONEERS,
all, and Zeniths, all. Any quantity. Top \$\$\$
paid. Contact National Cable Brokers,
Plymouth, IN. Phone 219-935-4128.

EARN \$2,000 wk. installing, selling mini
satellite dishes. VHS tape \$19.95. Basic
units from \$599. CV, 29637 S. Dixie Hwy.,
Ste. 324, Homestead, FL 33033. Phone
305-247-3469.

GET SOUND for VCII and VCII Plus without
codes. Free detail. Send SASE to:
Nassirian, Box 382-V, Rio Linda, CA
95673.

RCA DSS TEST CARD Dealers/Distributors
wanted. Testing, educational, and
repair purposes only. For more information,
send a business size SASE to: Test
Card, Suite 142, 39 West Alexis Rd.,
Toledo, OH 43612.

Viewstar



Model 2020-85 CH CONVERTER w/REMOTE

Includes these great features and many more
Last Channel Recall Parental Control
Favorite Channel Scan Sleep Timer

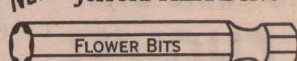
Model 2520-w/vol control
1 10 20+
79.95 77.95 **75.95**

Panasonic Converter TZPC145 IS BACK

Includes:
Last Channel Recall
Parental Control
Favorite Channel Scan
Sleep Timer

1 10 20+
73.95 69.95 67.95

NEW Jerrold HEX Drive



1/4" x 2" 1-9 12.50
1/4" x 4" 1-9 14.50

These security bits are compatible
with all the following companies:

Pioneer 6300 round bit (tri-notch) 13.95
Avsafe #4 round "D" bit 13.95
Pioneer round bit (no notches) 13.95

NEW Jerrold Flower-head
Security Screwdriver-7" 16.50

NEW Hex-drive Hand Ratchet
Fits all our TORX and Hex bits 9.95

**Steel-shank
magnetic screwdriver
for Hex-insert bits 5.35**



KIT
Includes
Screwdriver
and any four
1" TORX bits
(also shown: 2" and 3" bits)

only
19.95

REMOTE CONTROLS

Remotes compatible with these companies:

	1-9	10-25
Jerrold		
400/450/550	7.65	6.40
CFT-2000	8.75	7.65

	1-9	10-25
Scientific Atlanta		
075/175	7.65	6.40
475 Remote works w/DMX w/Vol Control	8.10	6.90
8600 On-screen Display	8.10	6.90

	1-9	10-25
Zenith 1000 Series		
RD3Z	8.35	7.15
Prices for all of the following:	8.75	7.65

Panasonic
PA 120
PA 140

Hamlin
RCPX, CRP-5,
CRP-6, CRP-7

Oak
Sigma Series

Pioneer
BR-82

Tocom
All Models



TORX BITS

	1"	2"	3"
Tocom T-7	3.95	4.95	na
Zenith T10	3.95	4.95	na
Zenith T15	3.95	4.95	5.95
Scientific Atlanta T20	3.95	4.95	5.95

VISION DISTRIBUTORS

CUSTOMER SERVICE
(909) 483-3848

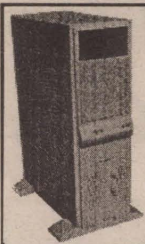
ORDERS ONLY
(800) 233-8431

pacific time
Rancho Cucamonga, CA

We don't Sell
Decramblers
Many Other Items
VOLUME PRICING
COD (ADD TO ORDER)
California Sales Tax 7 3/4%
Prices Subject to Change

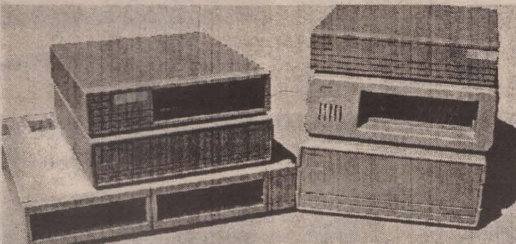
COMPUTER PARTS - SCSI DRIVE ACCESSORIES - SURPLUS ELECTRONICS

QTY DISCOUNTS AVAILABLE* - GOVERNMENT/EDUCATIONAL PURCHASE ORDERS ACCEPTED - APPLE II / MAC & IBM



Full Size 6 Bay Tower Case

- 200W P/S
 - 6 HH Bays
 - LED's & Rst
 - Fits Fullsize bd.
 - No-tip stands.
- Great for Servers or BBS Use. Lots of room inside. No rails required. Fits any size motherboard. w/300W P/S
- \$49.00** **\$59.00**



External Floppy Drive Case
Made for PS/2 but modifiable for others.
Power Supply & DB37 Cable included!
Fits one HH 5.25" or 3.5" Drive

Made by IBM

\$24.95

\$19 - \$65.00

Power Supplies

Mini Tower Power Supply. 145 Watts. Refurbished.....\$20.00
New.....\$25.00
XT Power Supply. 135W\$15.00
XT Power Supply 150W\$19.00
IBM XT 65Watt P/S\$5.00
300W. Tower or AT Type.....\$39.00
AT Power Supply. 200W.....\$29.00
Compaq Prolinea P/N141668-003 80W. Standard PC Connectors. Use for custom enclosures. \$19.00

FLOPPY & CD DRIVES

Used 360K 5.25" Drive.....\$5.00
Used 1.2 Meg 5.25" HH\$25.00
Used 720K 3.5" Drive.....\$15.00
IBM PS/2 720K Drive OEM \$29.00
5.25 -> 3.5 Floppy Adapter.....\$2.95
CD ROM Drives
NEC 2x CD Internal.....\$79.00
NEX 2x CD External.....\$99.00

External Drive Enclosures • SCSI • CD ROM • Floppy • Computer Cases

External Floppy Drive Case 1 FH/2HH.....\$19.00
SCSI Case: Uses Apple 19 Pin floppy port for power. Quantum EPS type drive only!.....\$19.00
Open Face HH SCSI Case. Use for a SyQuest, Bernoulli, CD-ROM, etc\$39.00
"Lunch Box" SCSI Case & P/S 3.5" Only.....\$35.00
Closed Face HH SCSI Case for 5.25/3.5" Drive. 30 Watt P/S.....\$39.00
External MFM/RLL Case & P/S\$19.95

FH Close Face SCSI Case & P/S for 1 Full Height 5.25" drive or two HH drives.\$65.00
External IDE CD ROM Drive case. AND controller card. P/S and Fan.....\$29.00
Desktop XT/AT Case & PS (150W). Reset & Turbo Switch, LED, 2 Exposed HH bays ..\$29.00
Desktop PC Case (No P/S)\$14.00
Side by Side open face SCSI Case. For two CD ROMs, or 1 CD & HD, or 2 3.5" HD...\$59.00

Monitors

Open frame composite 9". B&W Monitor assembly. Build your own monitor.....\$19.00

9" B&W Security Monitor. "Box" type with 75 Ohm input.....\$59.00

9" Composite "Box" type cabinet. Green screen. Good for security monitor. Input for 75 Ohm (standard) or High impedance\$35.00

Color Composite Monitor. Not suitable for 80 column text but can be used for computer games, Nintendo, as a video monitor. Some have sound input also. Specify.\$69.00

Used/Refurbished Mono. DB9.....\$29.00

Olivetti 9" Refurb. 9" MonoVGA
with new tube installed.
Mono VGA Monitor.
Excellent for small places,
where color is not needed.
Makes a great POS terminal.
Use for word processing,
accounting and more!
Standard VGA 640x480
resolution. Windows looks
really good! Excellent
Sharp Picture. Very
Nice!.....\$99.00



Monthly Specials

Systems • CD ROM Drives • Accessories

NEC Double Speed CD ROM Drive.
External for Mac or PC...(Specify)\$99.00
Internal for Mac or PC...(Specify).....\$79.00
MediaVision Jazz-16 & 2x CD ROM
PC Sound Card Combo & Speakers...\$135.00
Mono Handheld Microphone.....\$9.95
External Speaker Set.....\$9.95
6 BAY FULL SIZE TOWER CASE & P/S
NEW • 200W • 6 HH OPEN BAYS \$49.00
Eagle NET10T-HUB 8 Port Novel Cert...\$99.00
Jazz-16 Stereo Sound Card w/SCSI...\$59.00
IDE Ext. CD Case, & P/S . Inc. 8 Bit Ctlr.
For Panasonic or Mitsumi 40 Pin.....\$29.00

Fujitsu Cash Drawer



24V DC Trigger required to open drawer. Unit is supplied with RJ-45 Cable. Serial Version works w/any COM port @ 300 baud.

\$75.00 / Serial \$99.00

Refurbished PC Systems

Tandon 286

8MHz • 1.2 Floppy • 1024 K Ram • Kybd
Mono Monitor • Midsized Case ..\$109.00

IBM PC-XT

640K Ram • 2 360K Drives • Keyboard
Mono Monitor\$59.00

Alltech Electronics Co

2618 Temple Heights Oceanside, CA 92056

(Stores) 9-6 PM Mon-Fri. - 9-5 PM Sat.

Phone Orders :



619/724-2404

Fax: 619/724-8808

School & Government POs Accepted!

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

3 Southern California Locations!

Santa Ana - Lomita - Oceanside

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

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

1401 El Camino Real. Oceanside - 619/721-0093

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

Cables

IDE or Floppy (Flat ribbon).....\$1. ea
MFM/RLL/ESDI Cable Set.....\$2.00
Int. Tapedrive cable (Jumbo).....\$4.00

IDE Extension. 40 Pin Flat Ribbon cable. 18". Male to Female.....\$3.00
SCSI Cables

3 Foot 25/50 SCSI Cable.....\$9.95
50 Pin Pass-Through Term.....\$5.95
50 Pin Single Ended Term.....\$3.95

Laptop Carry Case

18" x 13" x 3.75"

\$14.95

EPSON Carry case. Black trim exterior. Non collapsible rigid sides. Includes shoulder strap. Exterior 15" x 8" x 1.25" pocket for manuals, papers, batteries, etc. Extremely well built! Great deal!!



Laptop Carry Case

12" x 15" x 2.75"

\$19.95

Zippered Exterior pocket 12" x 12" x 1". Carry handles & Shoulder Strap. Greyish color. Originally for Mitsubishi.



Notebook Carry Case

10.5" x 8.5" x 1.75"

\$14.95



Exterior pocket 13" x 9" x 1.5" Simulated leather exterior. Padded case. Black with lt. blue pinstripe, adjustable shoulder strap. Side flat pocket for papers, thin books. Originally for NCR

Combo Notebook Case

11.5" x 9.5" x 2.35"

\$19.95

Combo! 2 Bag set. Other is 11.5" x 9.5" x 1.75" Two attach together with hooks and snaps. One side for computer, other holds papers, disks, etc. Adjustable Shoulder Strap



EPROMs MICROCONTROLLERS

2716 or 2732......75¢
2764/27128/27256.....\$1.50
27512.....\$2.00
271000 (32 Pin).....\$4.00
27010.....\$6.00
8748.....\$4.00
8749.....\$6.00
8751.....\$9.00

CHIPS & ROMs

80287-8.....\$19.00
80387-33.....\$19.00
V20-8.....\$2.00 V20-10.....\$6.00
16550 (Enh. serial port chip).....\$13.00
82450.....\$2.00 8250.....\$1.00
RAM
short lead 41256 -12 or -15.....50¢
41024 (1 Meg x 1)\$3.00
4 4256-80.....\$4.00
256x8 -15 SIMM.....\$3.00 / -12.....\$4.95
256x9 SIP -12.....\$5.95
256x9 SIMM -80.....\$10.00
Batteries
1/2 AA size, 3.6V lithium.....\$4.95
AT type "plug in" 3.6V or 6V.....\$6.95

PC Cards / Addons/ Systems

IBM XT System (Refurb): 2 360K Drives • Mono Monitor • 640K • Keyboard.....\$59.00
Tandem 286 System (Refurb) w 1024K • Keyboard 1.2 Floppy Drive • Mono Monitor\$109.00
Jazz-16 Stereo Sound Card w/SCSI Port.....\$59.00
CGA/EGA Video Card.....\$19.00
256K VGA Card.....\$19.00
AT 2 Meg Mem. Exp Card w/2 Meg.....\$35.00
Future Domain 8 bit SCSI Card (NEW/IBM) \$19.95
5 Pin kybd to PS/2 adapter (Specify direction).....\$2.95
AT Floppy, Serial & Par Controller.....\$12.95
XT or AT MFM HD & Floppy Ctrl (Specify)n.....\$14.95
AT IDE HD Controller.....\$4.95
AT IDE HD & Floppy Controller.....\$7.00
I/O Card 2 Serial & 1 Parallel.....\$4.95
Mono/Parallel Port.....\$9.95
8 or 16 Bit VGA Card (Specify).....\$19.00
Full Length CGA w/RCA out.....\$14.95
Microsoft InPort Mouse Card (only).....\$9.00
32 Bit Mem Exp. (9 Meg/0K) SiliconValley.....\$20.00
101 XT/AT Keyboard.....\$29.00
101 AT Keyboard (NEW).....\$14.95
Keyboard Wrist Pad.....\$1.95
Slot Expander (3/4 & 5 Slot, vertical).....\$9.95
XT Multi I/O Card: Clock, Serial, Parallel, Game, Floppy.....\$7.95
XT Motherboard w/640K.....\$9.95
AT Motherboard.....\$24.95

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 acquired a used OKI #1150 portable cell phone. The phone came with no information, only an OKI's owners manual. I would like to know how to put this phone into the test mode to extract the information that has been programmed into it as I'm able to do with my Motorola 8000.

8951

Andrew Flock
Englewood, FL

I would like to find out if monies wise, is it practical to modify a general CB-radio for the use as a Ham 10 meter rig? If so, which CB would I need to buy, and where can I buy a schematic etc., to do this modification? Next, does anyone have an idea who sells study material for the new Advanced written exam, where I can use my VCR to study such, in other words, is there a VCR tape for this?

8952

R.H. Perkitny
Cocoa, FL

I have a stereo receiver from Pioneer, 7 yrs old, and surround output. I also have a 40 ohm powered 15" sub-woof. Problem: Surround out is 8 ohm, sub-woof works fine with stereo 40 ohm output. How can I correct the resistance problem? Do I just add another resistor to the output line?

8953

Steve Wade
Graham, FL

I have been unable to find a company called "BISHOP GRAPHICS" that supplied (1970s) a printed circuit prototyping system consisting of copper foil tape in various widths that allowed applications directly to pre-drilled boards. A touch of solder wherever the tape crossed provided a good connection. If they went out of business, then perhaps you know of someone else with a similar system. It's fast and slick!

8954

Jan W. Zumwalt
Anchorage, AK

Regarding personal computer keyboard connector, is the circular "Din" 5 contact standard? What is the hook-up to use above the keyboard to a Wang #PC250/16 (A "286") to its "Din" 8 contact connection? (There is a center contact — all active?)

8955

D. Testa
Newkirk, NJ

I have a telescope which has an Altitude Azimuth mount. I would like to attach electronic encoders so that I can get digital output from each of the two axis. I do not want the encoders to output in degrees, just a relative output. At first, I would like to just use opti-

cal encoded up/down counters with a resolution of say four digits. I need optical encoding because an analog-to-digital will be sensitive to temperature variations. In the future, I would like to attach the encoders to my PC which has a program I created to position the scope. I have noticed that bath scales have encoders on them, but they also have specialized counters. Maybe some combination of encoders from a scale and simple circuitry would work.

I would like to have the two encoders/counters to cost under \$50.00 each if possible. Thoughts for building, locating, and or buying simple, inexpensive devices and parts would be appreciated.

8956

Ron Wagner
Troy, OH

I am 82 years old, 15 years back my brother attached the spark plug wire to a sharpened nail from a Model A Ford coil and put a pin wheel on top. When he applied 6 volts to the coil, the pin wheel rotated. My brother has passed away including his shop. I have been trying to duplicate his set-up. I have bought Model T Ford coils from everywhere. I now have 25 coils. From the old lecture I have, I know that there were a number of manufacturers making coils for Ford. Possibly one manufacturer's coil had a higher secondary voltage? I desperately need this information if somebody has it.

8957

Clarence Day
Bloomfield, NJ

Is there a converter, chip, or cable assembly that will enable a NTSC signal to be shown on a CGA monitor? (Say, from a VCR or TV tuner?)

8958

F.D. Washington
Kansas City, MO

Can anyone identify the following 16-PIN RAM chips? NMBS, AAA2801-P-07, 8832, Japan.

8959

Joe D'Agostino
Thomasville, GA

I have an Apple IIc computer complete with printer, modem, two floppy disk boxes at 5.25. I want to interface this with my ham radio transceiver. I need to know what I need and where to get the parts.

89510

Charles F. Rogers
Deepwater, WV

I have two questions, can someone please help: 1) My students would like to buy computers for themselves, but they don't know what type to buy. Apple or IBM. The Pros and Cons of the above computer systems such as, how much is the software for each type of computer, how easy is it to

upgrade each system, how much are the parts for each system, and so on. 2) I would like to know if there are any vendors selling a good hard disk, and data recovery software program, I would like to recover data from hard drives as a part-time job.

89511

Anthony Cadena

The current project I am working on has a requirement that we perform processor diagnostics upon start-up. I am wondering if anyone knows of any diagnostic firmware that has been developed for the 8031/8051? Something that runs through the instruction set, the timers, and the RAM, etc. If this exists, it will help out a lot.

89512

Phil Wilkinson

I have purchased a kit from Ramsey Electronics that will descramble most of the cordless freq. on scanners except the spread spectrum. It's part #SS-70. My question is: has anyone out there come up with some modifications for that unit? One of my phones that uses the inversion scrambling technique must be at a different frequency or something, it will invert the audio back to understandable, but it still sounds like robots talking. Any detailed help will be greatly appreciated.

89513

D. Kouns
Kenova, WV

I've been looking for a way to get a bunch of recorded voices to be played at a push of a button, like that Yak Back sound, but with more than one sound that can be played. Push button #1, hear sound #1; button #2, hear sound #2. Could you get me a schematic or information — is there an IC that can handle that?

89514

Joshua Strick

I need to improve the range of my cordless phone. Radio Shack 900 MHz to 1.5-2 mi. If anybody can help me with this matter it will be more than appreciated.

89515

Yulian Gershfang
Portsmouth, VA

Does anyone still make a micro that can be programmed in machine language from a dumb terminal? Or, can anyone recommend a good book on random logic design?

89516

Daniel Gates
Wichita, KS

ANSWERS

ANSWER TO #7956 - JULY 1995

Many methods are used to detect an out-of-phase loudspeaker in an over-

ANSWER INFO

- Include the question number that appears directly below the question you are responding to.

- Payment of \$25.00 will be paid within four weeks of publication if your answer is printed.

- Only one answer per question will be printed.

- If you do not want your name, address, or phone number available to the reader please so indicate or it will be assumed that you have no objection.

- In the event that more than one person submits the same solution, the choice will be made at the discretion of the publisher.

- 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.

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.

head sound system. One way is to drive the sound system with a low-frequency signal so that the test method is not too dependent on distance. This reference signal is also fed to one input of a simple phase detector; with its other input coming from a microphone mounted on the end of a long wand. As the mike is placed in front of each speaker, a meter or light can be used to show the phasing of that speaker. An oscilloscope can be used here.

Another way is to drive the sound system with short pulses (about one per second). Each speaker cone will

tend to follow each pulse, its first movement being a jump either inward or outward depending on its wiring. If a pickup is held on the end of a wand in front of each speaker in turn, the first swing of its output will be either plus or minus. A simple plus or minus detector now lights a red or green light.

Still another method is to use the speakers as microphones. Disconnect the 70-volt line from the PA amplifier and connect it to an oscilloscope. Mount a small loud speaker on the end of a wand and drive it with short DC pulses. Use an LM555 and driver transistor here. Hold the sound-pulse generator in front of each speaker in turn. Observe the oscilloscope, the pulse polarity will show differences in phasing. There will be some interaction here as all transformers and speakers are in parallel.

If testing sound systems is something that you do often, there have been a whole series of articles in *Nuts & Volts* by Richard Schroeder over the last few years giving construction plans for test devices for audio systems. They range from audio spectrum displays to speaker impedance meters.

Frank Williams
Santa Maria, CA

ANSWER TO #7959 - JULY 1995

A number of companies supply diagnostic test units that also display on a screen the car trouble codes provided by the modern car computer. One of the most popular is the OTC Monitor 2000. This is a microcomputer based handheld diagnostic tester for use on GM, Ford, and Chrysler, as well as some imported cars. This unit can monitor and store data from 22 separate sensors during road tests and download it for display on a PC or transmit it via modem to a diagnostic center for expert analysis. Car data is loaded from ROM and is selected from a menu using the VIN number. One was advertised in *Nuts & Volts* a few months ago.

Another unit is by JIF; it is based on a Z80 microcomputer and has a built-in printer to display the engine data provided by the car computer. It can be set up to provide a continuous record of data such as battery voltage, engine RPM, MPH, air/fuel ratio, engine and air temperature readings, and transmission settings, as well as the position of various sensors on the engine. Car data is loaded by plastic punch cards chosen by a VIN number. OTC Tool & Equipment Division, SPX Corporation, 655 Eisenhower Drive, Owatonna, MN 55060, 507-455-7000. JIF was sold through Snap-On Tools.

Frank Williams
Santa Maria, CA

ANSWER TO #79510 - JULY 1995

Providing a print for a typical PC clone power supply is next to impossible. Just as there is no typical PC clone, there is no typical PC clone power supply. However, all of them comprise a voltage doubler to give a source voltage of about 300 volts. This is used to power a power switch that is driven by a pulse width modulator (PWM). The switch controls pulses somewhere between 30 and 200 KHz that are fed to a transformer with sev-

eral output windings to provide the approximate voltages. The AC out of the transformer is rectified using high-speed diodes then filtered with LC networks. One of these voltages (usually the high current 5 volt) is sampled then reduced and compared with a reference. The comparator output then is fed back to the pulse width modulator to control the power fed into the primary of the transformer, so as to regulate the monitored voltage. The other voltages either have three-terminal regulators or just track the PWM regulated voltage. The PWM feedback is either optically or transformer coupled to isolate the line voltage from the output. Often the current is monitored to provide for shutdown in case of overcurrent. Some units have overvoltage protection as well.

Frank Williams
Santa Maria, CA

ANSWER TO #6958 - JUNE 1995

I found your ancient IC listed in the catalogs of two advertisers that use *Nuts & Volts*: R&D Electronics, 216-441-8500 and Javanco, 615-244-4444.

In the *Fairchild Linear Data Book*, a pin for pin replacement for the 706 is the TBA641B.

RD Van Dyke
Charlo, MT

ANSWER TO #7957 - JULY 1995

In regards to the problem of RF interference activating security lighting, the answer is simple.

Our Code Rotator is a three-channel transmitter; receiver set using code hopping technology (cannot be activated using a code grabber), anti-scan technology, and it operates on 434 MHz using a surface acoustic wave resonator. We use these on garage doors, gates, security systems, and more. We have seen no problems with "phantom operating" due to RF induced interference.

Matthew Brzescinski
La Mesa, CA

ANSWER TO #7952 - JULY 1995

A very usable circuit for an ultrasonic cleaner was published in Metz and included a 8751 microcontroller to act as a timer/temperature controller. A kit of parts costs \$250.00, so if you wish, this section can be eliminated and only the oscillator/power sections need be used. The only expensive component of the oscillator is the transformer. At \$70.00, you may want to wind your own. Instructions are provided for this, using the Ferroxcube 4223-PA275 ferrite core. Two windings of Lit wire are used, the primary of 20 turns and the secondary of 99 turns. A 3.5 turn feedback winding of #22 AWG is also needed. The two ceramic piezoelectric transducers RES1 & RES2 cost \$32.00. Oscillator frequency is between 40 and 60 KC and power level is appropriate for three quarters of a gallon of liquid.

As an alternative you can use the parts of a defunct PC switching power supply. While many high-power units now use frequencies over 100 KHz, in many cases the transformer cores will still be usable down to 50, though at reduced power out. Your main problem with adjusting the frequency of the

cleaner will be ceramic transducers. The output falls off if you move too far away from their resonant frequency.

Contact A&T Labs, PO Box 4884, Wheaton, IL 60187 for the complete kit or any part thereof or, Philips Components Discrete Products, Saugerties, NY 12477 for the transformer core.

Frank Williams
Santa Maria, CA

ANSWER TO #7954 - JULY 1995

Sets manufactured by Zenith in the last few years have "undocumented" service menus which are activated as follows:

On the remote, press and hold the "menu" key until the channel display disappears. Then key in "9," "8," "7," and "6," then "enter." Presto, service menus! Quite a few programmable features accessible such as volume limit, channel lock etc.

Rich Gordon
Selkirk, NY

ANSWER TO #79521 - JULY 1995

A simple noise limiter can be added that uses only a few parts. But it will not work nearly as well as a true noise blanker that removes the narrow noise pulse before it has been widened by processing in the receiver. In the simple "rate of change" noise limiter, a diode is placed in series with the audio. With normal sounds the diode is biased in the conducting mode, but when a sharp noise spike is superimposed on the audio, an RC circuit shifts the bias so as to reverse the diode and thus block the audio for the duration of the pulse.

Frank Williams
Santa Maria, CA

ANSWER TO #79514 - JULY 1995

The two CPM disks that you are using either were not formatted using SYSGEN or no longer have the files and cannot be used to boot up the computer under CPM. You will have to obtain a good CPM boot disk, and once you boot up, then use a disk with SYSGEN.COM on it to make bootable backup disks.

Frank Williams
Santa Maria, CA

ANSWER TO #79518 - JULY 1995

Concerning the VGA monitor that is slow to warm up and has a dim display, you did not mention if the display is in focus.

First, make sure the external brightness and contrast controls on the monitor are functioning. If they are, the most likely cause of your problem is the flyback transformer.

The flyback transformer inside your monitor has two adjustments on it; one is for brightness and the other is for focus. Of course, you will have to open the monitor to make these adjustments which can be dangerous. There are very high voltages present inside the monitor so be extremely careful! Flyback voltages can be around 15,000 to 30,000 VDC! If adjusting the flyback transformer does not correct the problem or if the correction does not last, you probably need a new flyback transformer.

To replace the flyback you will need a soldering iron and solder sucker. You

must make sure the monitor is off, unplugged, and that there are no capacitive voltages present.

To order a new flyback you need the model number off the flyback itself. Most vendors cannot look up a flyback by the monitor model number. A new flyback transformer will probably cost around \$30.00 or less. There are some vendors in *Nuts & Volts Magazine* that sell flybacks. Once the new flyback is installed, adjust the brightness and focus controls on the flyback until the display is correct. Then your monitor should work fine.

Michael E. Young
Newville, AL

ANSWER TO #79532 - JULY 1995

I believe the solution to Kevin Cramer's problem in re-inking heat transfer ribbons can be easily answered by Computer Friends, Inc., 14250 N.W. Science Park Drive, Portland, OR 97229. I have been buying ink and ribbon refills from this company for years, including heat transfer ribbons and inks. A letter or a postcard should bring a current catalog in a matter of days.

Cost per ribbon will be determined by how the ribbon cartridge is re-inked; my Panasonic cartridges use an internal foam roller (cheapest), while some ribbons are best serviced by one of their inking machines (more expensive to start, but quickly pay for themselves if you do a lot of printing). Replacement ribbon refills are also available; the shells (the most expensive part of the ribbon assembly), if opened carefully, will last forever. Talk about saving money — if I had started dropping the cost of a ribbon into a piggy bank when I first started re-inking my ribbons, I would now have enough money to pay cash for a top-of-the-line Pentium™ based laptop!

Ronald J. Potaczala
Paisley, FL

ANSWER TO #79529 - JULY 1995

High Frequency Apparatus by Thomas Stanley Curtis is available as a reprint from Lindsay Publications, Inc., POB 538, Bradley, IL 60915. Telephone 815-935-5353. The book is their catalog number 20030 for \$11.95 plus postage and handling. For those of you who don't know about them, Lindsay Publications is the source for all kinds of turn-of-the-century reprints of science, physics, radio, and technical publications, as well as more modern works for those of you interested in machining technology. They are an excellent source of material for Tesla fanatics and antique radio collectors.

Dean Huster
Oklahoma City, OK

ANSWER TO #79526 - JULY 1995

I have a TEAC model A2300S, but would presume the remote unit wiring would be the same as the A5500. The service manual schematic shows that the 11 pin remote/timer connector jumpers pins 1 & 11 together when installed. Yes, it must be plugged in for the unit to operate. Pins 1 and 11 complete a circuit which activates the solenoids that operate the tape drive.

George G. Peterson
Bellevue, WA

PRINT T-SHIRTS FOR FUN OR PROFIT!

With your computer!



FAST, EASY with Heat Transfer Printer Ribbons!

1. Put Ribbon into your printer.
2. Print message or design onto regular paper but print it in a mirror image. (Print Shop and other programs have this capability.)
3. Place paper face down on T-shirt and iron the back of paper to transfer the image.

Available in red, green, blue, or black at \$10.95 each for the following printers (specify make and colors wanted):
 Panasonic 1080/1180/1090/1190/1123/1124, IBM
 Proprinter, Epson MX/FX/RX 80/85/86/LX800/
 LQ500/LQ510/LQ570/L1000, Star NX/NL/NP10,
 Seikosha SP800/1000, Tandy DMP130, Apple
 Imagewriter, Citizen 120D/180D/GSX140, Okidata
 182/192/320.

\$11.95 each for Epson MX/FX-100/286e, LQ1000/
 1050, LQ2500/2550/EX800/1000/LQ860, AP3250/
 LQ100 Star NX1020/2400/2410/2415/2420,
 Panasonic KX-P 2180/2123/2124/1624/1524,
 Toshiba P321/351/1340, \$5.95 each for Okidata 82/
 92/83/93, Gemini 10X/15X.

Available in **BLACK** only at \$10.95 each for Star
 NX1000, NEC P2200, Commodore MPS-801.

Available in 4-Color Heat Transfer for Imagewriter II,
 \$12.95; Star NX1000 \$14.95; Star NX1020 \$23.95;
 Star NX2420 \$23.95; Star NX2450 \$23.95; Citizen
 GSX-140 \$23.95; Epson LQ2500/2550/EX800/1000
 \$16.95; Fujitsu DX2100/2200/2300/DL 3300/3400/
 3600 \$27.95; Panasonic KX-P 2180/2123/2124
 \$23.95.

HEAT TRANSFER MARKING PENS

Add colors to the computerized design or use alone.
 Set/5 Colors (red, orange, yellow, green, blue) wide pens
 \$15.00, narrow pens \$14.00.

HARD-TO-GET PRINTER RIBBONS



Gorilla Banana, Commodore 1525 \$8.00; Adam
 Coleco \$12.00; TI-850/855 \$6.00; Centronics 700
 Zip Pack \$5.00; C. Itoh Prowriter Jr., Riteman
 C+/F+ \$6.00; Riteman Infomrunner \$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.

Over 200 different ribbons in stock. All ribbons new, not re-
 linked. Fully guaranteed. Order directly or send SASE for
 complete list.

Add \$2.00 per order shipping. California residents add 7.75% sales
 tax. On ribbon orders over \$30.00 deduct 10% discount.

H.T. ORR Computer Supplies
 249 Juanita Way, Placentia, CA 92670



714-528-9822

800-377-2023

FAX 714-993-6216

Write in 74 on Reader Service Card.

WHOLESALE CABLE

CONVERTERS AND DESCRAMBLERS

- ✓ Quality merchandise by brand name manufacturers
- ✓ Satisfaction guaranteed
- ✓ Free gift on first order
- ✓ Technical support
- ✓ 1 year warranty on new descramblers
- ✓ 2 year warranty on new converters
- ✓ COD shipping & overnight shipping by request
- ✓ Experience where it counts
- ✓ Volume pricing

ADD-ON DESCRAMBLERS: TVT, FTB-3, STEALTH, SA-3, SA-3DF, M-80,
 PIO-GREEN, DMTBA, KN12, EAGLE PD-3, HAMLIN MLD-1200

COMBINATION DESCRAMBLER/CONVERTERS: PIONEER, SA,
 ZENITH, OAK, EAGLE, HAMLIN

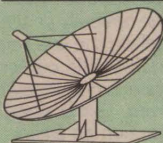
PLAIN CONVERTERS: PANASONIC, SA, STARGATE

REMOTE CONTROLS: ALL MAJOR BRANDS, INCLUDING 2-4
 FUNCTION UNIVERSAL REMOTES

WHOLESALE CABLE M-F 11am-6pm EST • (718) 262-0900 • FAX (718) 657-4015 • (718) 297-9221

No NY sales. Federal and local laws provide criminal and civil penalties for
 unauthorized use. Check with your cable providers for permission to use
 equipment. Must be paying for all services you receive. Order by model
 number only. Some equipment refurbished as new.

*Tell us the
 best price
 you were
 offered,
 where you
 got it from,
 and let us
 try to beat it.*



#90 SATELLITE EQUIPMENT cont.

VIDEOCIPHER INFORMATION. We are
 still the most complete source of
 VideoCipher II information. 9 books with
 over 1,500 pages and over 650 IBM-PC
 files for all VideoCiphers. Call or write and
 ask for VC2 info pack! 520-782-2316.
TELECODE, Box 6426-NV, Yuma, AZ
 85366-6426.

VIDEOCIPHER 2 PACKAGE OFFER.
 Includes: VC Primer, VideoCipher video
 and 50 programming files for all models of
 VideoCiphers except Plus Series (029 or
 VCRs) \$39.95 Postpaid. **VISA/MC** 520-
 782-2316. **TELECODE**, Box 6426-NV,
 Yuma, AZ 85366-6426.

WANTED: BMI (BONNEVILLE) stock and
 commodity quote FM receiver set. Set has
 2 boxes, data receiver and data converter.
 Will consider either piece separately.
 Satellite set may be the same. I need a
 back-up set. Call, describe your box or set.
 I will call back. Tom, 312-271-8066.

SATELLITE RECEIVER for C band.
 Digital tuning stereo audio, VC II ready,
 remote control, built-in antenna motor drives
 for two axis. Never used! \$200.
 Including full service manual. 415-244-
 9254.

WANTED: EQUIPMENT and/or informa-
 tion for satellite telephony, including
 INMARSAT. Eric Gullichsen, voice: 415-
 331-6203, FAX: 415-332-8003. Internet:
 eric@warpc.com.

HEAR NON-COMMERCIAL satellite radio
 programs right in your ares without the
 use of a dish or any other expensive
 receiving equipment. Thousands of these
 programs are operating today across
 America. Programs may include talk
 shows, weather, sport events, news feeds,
 financial reports, music programs, and
 data ports. This technology is received
 through a high tech SCSRT1 card. Find
 out today what you have been missing! 1-
 800-944-0630. Credit card orders accept-
 ed.

SATELLITE EQUIPMENT: New program-
 mable stereo C/KU receivers with remote
 control, \$179. 25 degree C-Band LNBS,
 36VDC motors, RF modulators, complete
 satellite systems. Call 714-548-5521.

VIDEOCIPHER 2 PLUS. 17 pages com-
 puter drawn schematics, video-only chip
 file (V1.07), disassembled ROM listing on
 diskette, and diagnostic screen data expla-
 nation. Specify 1.2MB or 1.44MB \$29.95.
VISA/MC 520-782-2316. **TELECODE**, Box
 6426-NV, Yuma, AZ 85366-6426.

SPORTS BARS & SATELLITE DISH OWNERS. Like free sports; news; discov-
 ery; network programming- ABC, BBC,
 CBN, CBS, FOX, NBC, Movies, PPV, Old
 Time Movies, weather, cooking, home
 improvements, dog & horse tracks and lots
 more. **No Hits or Codes needed to work.**
BMAC and OAK DECODERS from \$299
 up. **TRIANGLE PRODUCT DISTRIBUTORS USA**, 5750 Lakeshore Dr., Holland,
 MI 49424. 616-399-6390, M-F 9am to 2pm
 EST.

KU-BAND satellite TV systems: 2 ft. dish
 w/mount, 0.9dB H/V LNB, Horizon 2000
 C/KU receiver w/150 ch. program capacity
 \$269.95 + S&H. 2 ft. KU band dishes
 w/mount \$39.95 + S&H. Great for DSS.
 Dealer inquiries welcome, quantity dis-
 counts available. Call 813-886-8669.

RCA DSS 18" SATELLITE SYSTEM
FREE INSTALLATION VIDEO and 50 foot
 cable, \$675. **DELUXE SYSTEM**, \$850. 1-
 800-208-8522.

REPAIRS, SOFTWARE, etc. for satellite
 equipment. No TX sales. Buying 010, 018,
 019 VCII's. K. Perry, PO Box 816,
 Leander, TX 78646-0816. Phone: 512-
 259-4770.

COLLINS TXRX 11GHz microwave televi-
 sion transmitter, receiver, no antenna,
 \$3,750. 818-352-6619.

SYNC-A-LINK UNIVERSAL VIDEO SYNC GENERATOR is an educational trou-
 bleshooting tool for those persons seeking
 technical support for evaluating different
 types of video difficulties. It will restore all
 horizontal & vertical sync lines from stan-
 dard or distorted analogue video-type for-
 mats. It requires pretuned baseband video,
 and comes complete with operations man-
 ual & 90-day warranty. Total package case
 with power pack completely assembled,
 aligned, tested, \$150. Voice orders and
 information 918-479-6451 or write to Sync-
 A-Link Communications, PO Box 4, Locust
 Grove, OK 74352.

1.2 MEGABYTES of satellite tracking
 programs, lists every satellite visible in US,
 co-ordinates, channel frequencies, audio
 carriers, scrambling methods. Computes
 solar outages, telemetric data sources for
 low orbiting satellites. \$8. Cabletronics,
 Box 30502N, Bethesda, MD 20824.

SATELLITE DISH MOTORIZED MOUNT.
 Horizon 180, new! 24VDC motor, limit
 switches, 10 counts per degree. \$100 ea.
 2/\$180 plus shipping. 63# UPS shippable.
 Call Roger @ GS&E, 716-338-7001.
 VISA/MC/Discover.

SATELLITE ANTENNA CONSTRUCTION. Over 100 pages of specifications
 and plans for constructing low-cost satellite
 dish antennas. Detailed plans for high per-
 formance 10, 20, and 30 foot dishes!
 \$33.45. **VISA/MC** 520-782-2316. **TELE-**
CODE, Box 6426-NV, Yuma, AZ 85366-
 6426.

STEREO FOR BMAC & OAK DECODERS \$99. Dynamic Digital Stereo
 for Live TV or VCR recording. Add stereo
 to any mono equipment. Easy AC & RCA
 plugs. **TRIANGLE PRODUCT DISTRIBUTORS USA**, 5750 Lakeshore Dr., Holland,
 MI 49424. 616-399-6390, M-F 9am to 2pm
 EST.

VIDEOCIPHER II descrambling manual
 Schematics, video and audio. Explains
 DES, EPROM, CloneMaster, Pay-per-view
 (HBO, Cinemax, Showtime, Adult, etc.)
 \$16.95, \$2 postage. Schematics for
 Videocypher Plus, \$20. Schematics for
 Videocypher 032, \$15. Collection of
 Software to copy and alter EPROM codes
 \$25. VCII Plus EPROM, binary and source
 code, \$30. Cabletronics, Box 30502N,
 Bethesda, MD 20824.

HOUSE OF BATTERIES®

BATTERIES FOR EVERY ELECTRONIC APPLICATION...

ALL UNDER ONE ROOF!

- ALKALINE
- LITHIUM
- NI-CD
- NI-MH
- LEAD ACID
- CHARGERS
- HOLDERS
- EVEREADY, DURACELL
- SANYO, SAFT, EVEREADY, POWER CONVERSION
- SANYO, GP, SAFT, ENERGIZER, VARTA
- GP, SANYO, ENERGIZER
- YUASA/EXIDE, POWERSONIC
- AULT, XENOTRONIX
- MPD



CUSTOM OR STOCK FOR ALL APPLICATIONS, INCLUDING
COMPUTER ■ COMMUNICATIONS ■ UPS ■ MEMORY BACK UP ■ TWO WAY RADIO

TEL (800) 432-3385 or (714) 375-0222 FAX 375-0235

Miniature Transmitters and Receivers

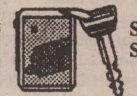
Small, Attractive, High End Quality, 2 Channel Transmitter
\$9,049 Settable Codes, 150'-300' Range, 1-1/4"x2"x7/16", Assembled



	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

Visitect Inc. (510) 651-1425 Fax (510) 651-8454
P.O. Box 14156 Fremont, CA. 94539

Write in 179 on Reader Service Card.

HOW VIDEOCYPER-II and plus owners receive sound without codes. \$18.95. Request information services, 5201 Kingston Pike, Suite 6-106, Knoxville, TN 37919. Quick service.

SATELLITE HACKERS BIBLE. Covering: Satellite data communications, RTTY, SCPC, WEFAX, frequencies. Schematics for BMAC, stock market quote receivers, and more! Includes: 200+ IBM-PC software files. \$56.95. VISA/MC 520-782-2316. TELECODE, Box 6426-NV, Yuma, AZ 85366-6426.

TOP OF THE LINE SATELLITE EQUIPMENT AT DISCOUNT PRICES. Complete Houston Tracker Systems with (module, IRD, dish, and electronics) \$1,059 and up. Electronics pkg. \$169, 10' Paracclipse dish (UPS) \$499. Shipping additional. Many top brand IRDs and Satellite Equipment available. Computer 486 systems complete starting at \$879. EVCO can now offer long distance calling for 14 cents a minute anytime anyday. 800 numbers \$10 a month. Call or send SASE for catalog. 410-335-7511, EVCO, 3316 Choptank Ave., Baltimore, MD 21220-4328.

COMPLETE CO-OPS satellite digest. 52 historical issues. \$100. Call 913-432-5976.

15 CCOR cable TV trunking amplifiers, w/fail safe, new, \$200 ea. 818-352-6619.

RCA DSS SYSTEM HAS BEEN BROKEN. Find out how people are receiving over \$1,000 worth of programming for only \$50 a year. Don't miss out on this hot new information package. Send \$29.95 to Request Information Services, 5201 Kingston Pike, Suite 6-106, Knoxville, TN 37919. Quick Service.

MILITARY SURPLUS ELECTRONICS

95

MILITARY RADIO equipment. SASE for list. Frank Moreland, 14788 Poway Mesa Dr., Poway, CA 92064.

AUDIO - VIDEO - LASERS

100

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.

VHS-VCR Repair Solutions Sets I through IX. Each contains 150 symptoms and cures, free assistance, \$19.95 each, all nine \$39.95 plus \$3.00 shipping. Visa/MC. FAX 219-272-6612. Eagle Electronics, Box C, 52053 Locks Lane, Granger, IN 46530.



THE ALC245M AUTOMATIC VOLUME CONTROLLER will keep your transceiver or scanner volume constant from a whisper to a scream. \$29.95. Other models are also available. **FREE BROCHURE.** C&S Electronics, PO Box 2142, Norwalk, CT 06852-2142. Phone/FAX 203-866-3208.

ALTEC SHURE sound equipment all types. SARA-COMM, 25 Gladwish Rd., Delmar, NY 12054. 518-439-9531.

SCIENTIFIC EQUIPMENT, surplus, misc. electronic and microwave equipment. For list contact T-Minus-7, 45845 Warm Springs Blvd. #F, Fremont, CA 94539. 510-651-9477, FAX 510-651-3657.

SATELLITE RECEIVER for C band. Digital tuning stereo audio, VC II ready, remote control, built-in antenna motor drives for two axis. Never used! \$200. Including full service manual. 415-244-9254.

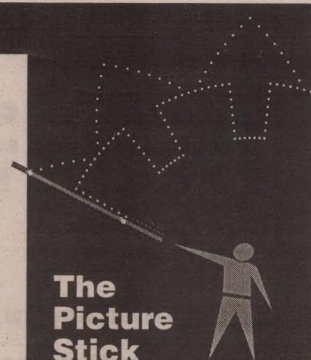
BUYING TOCOM, SCIENTIFIC ATLANTA 8536s, 8550s, 8580s, 8590s, and 8600s. **JERROLD** DPV and DPBB. **PIONEERS**, all, and Zeniths, all. Any quantity. Top \$\$\$ paid. Contact National Cable Brokers, Plymouth, IN. Phone 219-935-4128.

Scott Edwards Electronics

We sell kits and BASIC Stamp® accessories based on Scott's construction articles in *Nuts & Volts* and other electronics magazines. Our new catalog is hot off the press—call or write to get your copy.

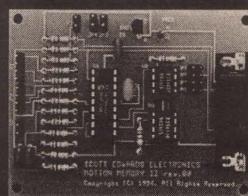
Safe Halloween Fun!

Kids think carrying flashlights for Halloween safety is dorky, but they love the Picture Stick! When they wave the flickering light wand, two-dimensional images magically appear. PC software lets them create their own images on your PC's VGA screen. Our parts package includes software, all ICs and a printed-circuit board; you kick in some LEDs, batteries, etc. Just \$39.



The Picture Stick

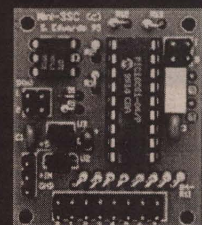
Motion Memory II



Speaking of Halloween, what could be more fun than costumes or displays that move? The MM2 controls two model-airplane servos via a PC-compatible game joystick, recording more than two minutes of motion into memory. Playback can be triggered on command, or continuously looped, depending on a switch setting. A package of all ICs and printed-circuit board is \$45; complete kit, \$59; assembled unit is \$99. (*Nuts & Volts*, March '95)

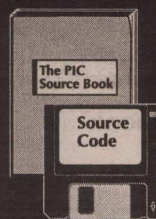
SSC mini

The Mini SSC controls eight servos from your computer or BASIC Stamp at 2400 or 9600 baud. Up to 32 Minis can operate from the same computer. Build walking robots, animations! A full kit is \$29. An assembled and tested unit is \$45. (*Nuts & Volts*, July '95)



Only 1.4 x 1.6 inches!

PIC Source Book



Curious about the inner workings of the BASIC Stamp? Programming the PIC in assembly language? This book/disk combination provides assembly-language source code cloned from more than 30 BASIC Stamp instructions. Shows how to perform serial I/O, read resistance, generate sounds, measure pulses, perform 16-bit math, and more. The package is \$39. (*Nuts & Volts*, September '94)

ORDERING INFORMATION • ORDERING INFORMATION • ORDERING INFORMATION

All prices postpaid to the U.S. and Canada. We accept Visa, Mastercard, and American Express. Personal/company checks OK for mail orders. Terms available for qualified businesses and schools. CODs incur a \$7 handling fee.

Scott Edwards Electronics • 964 Cactus Wren Lane • Sierra Vista • AZ • 85635
ph: 520-459-4802 • fax: 520-459-0623 • e-mail: 72037.2612@compuserve.com

If you have a retail electronics store or newsstand, and would like to sell *Nuts & Volts Magazine*, contact us for details by one of the methods below. Add your name to our growing list of distributors and give your customers access to the most popular electronics magazine published today!

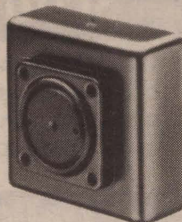
Nuts & Volts Magazine

430 Princeland Ct.
Corona, CA 91719
phone - 909-371-8497
fax - 909-371-3052
orders - 800-783-4624
E-Mail - CompuServe 74262,3664
Internet
74262,3664@compuserve.com

THE WORLDS SMALLEST VIDEO CAMERA

CME-007P (B & W PINHOLE VERSION)

SIZE: JUST 1" x 1" x 1/2" in EPOXY CASE
SENSITIVITY: .3 LUX
RESOLUTION: 380 TV LINES
OPERATING VOLTAGE: 9 VDC
OUTPUT: STANDARD NTSC (1 VPP)



(CAMERA SHOWN ACTUAL SIZE) \$ 245.00

NEW PRODUCT

CME-100P(M) (PINHOLE VERSION)

BLACK & WHITE CAMERA with BUILT in MICROPHONE (Extremely Sensitive)

SIZE: 1-1/8" x 1-1/8" x 1/2"
SENSITIVITY: .3 LUX
OPERATING VOLTAGE: 8 - 14 VDC
OUTPUT: STANDARD NTSC (1 VPP)



(CAMERA SHOWN ACTUAL SIZE) \$ 145.00

BOARD CAMERAS

CME-060/3 B&W Standard Lens Camera	\$ 125
CME-060P B&W Pinhole Camera	135
CME-100CM "C" Mount Camera	145
CME-200SCP Color Standard Lens Camera	245

WE SUPPLY WIRELESS TRANSMITTERS & RECEIVERS

WE ALSO SELL LASER PRODUCTS

CME, Inc. (Creative Micro Electronics, Inc.)

P.O. Box 4477, Englewood, CO 80155

PHONES: (800) 771-1295

(303) 771-1288 FAX: (303) 771-1136

CALL - WRITE OR FAX FOR FREE CATALOG



Write in 177 on Reader Service Card.

#100 AUDIO - VIDEO - LASERS cont.

NIGHT VISION KITS, and brand name US and Foreign units. Complete kits include all necessary components to build your own night vision scope. **SAVE \$.** US Military Intensifiers, IR, Foreign and more. Call or write: **NENVIS, INC.**, 320 Main St., Box 1088 Sturbridge, MA 01566 or 508-347-7238, 10-4pm EST.



DIGITAL VIDEO STABILIZER. Restores & stabilizes the source video signal to its original strength. Removes automatically viewing problems from movies. **ON/OFF** (B/A) switch, **GOLD** plated connectors, free power adapter. VHS \$49.95, SVHS \$79.95, S&H \$8. MC, Visa accepted, CODs \$4.50. Video Equipment, Inc., 1-800-831-2050.

WANTED: VIDEO Projector CRTs for Zenith/GE Imager Series. Need sets or singles. Remote control for Barco monitor AM2740, or will pay you to program one. Rick, 617-933-0827.

12 VDC Electrical Video. Basics of electrical service: Voltage, Amperage, Resistance, series/parallel circuits, sizing wire, produced by Tim Hawkins, author of "Batteries: Playing Pinball with Atoms"; \$12.95, \$2.95 S&H. Check/M/O; Technologies Instructional, 2860 Porter, Suite 29-NV1, Soquel, CA 95073.

WANTED: PICK-UP head with needle for Thorens T124 turntable. Also T124 manual. Please quote price and give your phone number to: Mordant, PO Box 300, Hickory, NC 28603.

RCA DSS 18" SATELLITE SYSTEM **FREE INSTALLATION VIDEO** and 50 foot cable, \$675. **DELUXE SYSTEM**, \$850. 1-800-208-8522.



ETVM-2000 20 SECOND RECORD AND PLAY NATURAL SOUND SYSTEM. The ETVM-2000 offers and easy, simple and low cost solution for natural voice record and playback on a miniature 1.0" x 2.4" PC board. Using state of the art **CHIP-ON-BOARD** technology (which provides unbeatable sound quality), the ETVM-2000 is ready to integrate into custom prototypes or production runs of thousands. The module has 20 seconds of record time, a superb **microphone**, high quality **speaker**, 4 AA **battery case** and an **LED recording indicator**. Extra through holes for push to record, play, LED indicator locations and a motion sensor are available. **PRICE:** \$25 (Quantities of 2-25), \$15 (Quantities of 1000) Visa or MasterCard accepted, Ohio orders add 6.25%. EDTM Inc. Ask for Jeff or Mark. 419-389-0354. **DISTRIBUTORS WELCOME.**

TEAC TASCAM 800/24 Digital Audio Recorder. New cost was \$100k will deal! 619-632-9775.

PELCO PAN/tilt heads, PT-270-24V with joystick controller, \$285/set. Panasonic D-5000 color CCD cameras w/12 x 1 lens and PSU \$345. 703-319-1431.

1" VIDEO C format VTRs, 2 RCA TR800 w/8000 TBC, 1 Sony BVH1100 w/BVT 1000 TBC, \$3,500 ea. 818-352-6619.

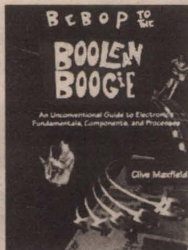
When Was The Last Time You Bebopped To The Boolean Boogie???

A long time, we bet. But HighText has the remedy!

Bebop to the Boolean Boogie

An Unconventional Guide to Electronics Fundamentals, Components, and Processes
 by Clive (Max) Maxfield

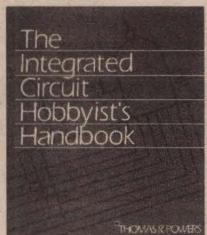
This is the damndest book on electronics you've ever seen! It's a thorough A to Z guide to contemporary electronics laced with the author's sometimes bizarre sense of humor. You'll find useful, real-world information about finite state machines, multichip modules, circuit board design, integrated circuit fabrication, and logic family interfacing techniques along with a recipe for terrific seafood gumbo and tips on the best times of day to eat smoked fish. Pete Waddell of *Printed Circuit Design* magazine says, "This is a dangerous book. . . not only do you stand a chance of learning something from it, but ten years from now you will still remember it." Replace those boring old handbooks on your shelf with this hip, heavily-illustrated, 500+ page wonder! A steal at \$35.00.



The Integrated Circuit Hobbyist's Handbook

by Thomas R. Powers

Like to build stuff using ICs or design your own circuits on a breadboard? If so, you need this book! It discusses the major types of ICs—op amps, linear, TTL, and CMOS—and how to breadboard circuits using them. There are also details on interfacing different device families, power supplies, and "deglitching" techniques. There's in-depth treatment of the most popular ICs, complete with pin numbering diagrams, internal circuit diagrams, logic tables, specifications, and a ton of applications information. Includes hundreds of applications circuits on its 8.5x11" pages. Don't buy another IC without buying this book first! Only \$19.95.



AND DON'T FORGET THESE OTHER GREAT BOOKS. . .

CONTROLLING THE WORLD WITH YOUR PC by Paul Bergsman shows how to control stepper and servo motors, monitor fluid levels, switch appliances on and off, and do other neat things using circuits connected to the parallel port of IBM-compatible PCs. Includes schematics, operational theory, construction hints, and control software source code in BASIC, Pascal, and C for each circuit. Accompanying HD disk includes all source code plus compiled .EXE files. A lot of cool stuff for just \$29.95!

THE FORREST MIMS ENGINEER'S NOTEBOOK by Forrest Mims (who else?) is the latest edition of his classic guide to IC applications. Includes pin-outs, logic tables, specs, and plenty of applications circuits. What?!?! You don't have a copy yet??? Grossly underpriced at \$14.95.

VIDEO DEMYSTIFIED by Keith Jack. Interested in multimedia, video games, or other applications using video on a PC? If so, you need this book! Covers everything from the basics of NTSC to color space conversion and MPEG compression. "This 435 page book more than lives up to the promise of its title," said *EDN* magazine. Essential information for only \$29.95.

HighText titles are available at larger bookstores, technical bookstores, and leading electronic parts and equipment dealers. Or you can order direct by including \$3 shipping per book (\$4 Canada, \$10 elsewhere). California residents must add sales tax. U.S. funds only, please. Or call our order number and charge it!

Call 1-800-247-6553 to order!

HighText
 publications inc.

P.O. Box 1489, Solana Beach, CA 92075

LASER RANGEFINDER measures distances up to 1800 meter: 10cm accuracy @ 1Hz update rate, 5mW laser diode, battery operated, w/microcontroller. \$2,000. Plans \$20. 20MHz preamplifier/detector \$160. Send \$1 ea. for data sheets. Laser Sensor Technology, 3873 Easy Circle, Marietta, GA 30066. 404-928-2867.

BEAMSCAN BY RED LINE self-contained microprocessor controlled laser scanning systems, \$595 complete. Red Line Laser Products, 1935 Fernwood Trail Dr., St. Louis, MO 63031. Tel: 314-831-3014, FAX: 314-831-3927.

AUDIO OUTPUT meter by Cooper Electronics, TS-585 D/U measures audio and impedance level \$55 with manual, volume discounts. Densitometers by Macbeth, RD 919 \$200; TD-904 \$275, \$435 both. Northeast Electrical, TTS-44R. Transmission testset, \$200, TTS-41-3A, service analyzer, \$200, offers. Psitech Plus, 707-745-4804, fax 707-747-5277.

FREE! THE ETC Catalog of Manuals for amateur, audio & test equipment. A.G. Tannenbaum, Box 386, Ambler, PA 19002. 215-540-8055, Fax 215-540-8327.

LI LITE Laser Light Show Controller. 68000 based board connects to PC through the printer port. Produce laser light shows in 8 colors. Uses ILDA format. Will also custom design your system for your specialized application. Laser Illusions, Box 754, Anaconda, MT 59711. 406-563-7506.

SHARE REPAIR, E-Mail tech support for TV-VCR technicians. For information, E-Mail: rhett@dump.com.

SIMPLEX 35MM XL Telecine projector w/telemation camera PAL NTSC \$4,000. 818-352-6619.

CABLE TV

110

PIONEER COMPATIBLE test kits, No. E4, mapping and non-mapping in one kit! **ONLY \$15 Each.** 407-676-2530.

2R/5V/TCF one wire, HRC/STD switchable Ch. #3/4, fast version. Limited time offer. \$14, min. 10. Call 1-800-831-2050.

FREE PAY TV, NEED MONEY? Learn how to make money descrambling pay TV like the pros. You can make up to \$20,000 a month. Anyone can do it almost anywhere in the U.S. No electronics background needed. Order the **NEW BOOK**, Pay TV-The Inside Scoop. Send \$9.95 to A/V Publishers, 16281 S.F. Mission Blvd. #407-N, Granada Hills, CA 91344.

CABLE CONVERTER diagnostic and test modules for sale. Internal and external. Call John, 1-800-879-9657.

PIONEER 6310 boxes. This month's special \$250. Also low prices on other cable units and test aids. Magic Communications, 805-944-6865. No CA sales.

"BASEBAND VIDEO EXPLAINED." Discover what a Baseband Signal is and how it's constructed. Learn the advantages of doing things the "Baseband" Way. \$10. Visa/MC. **ELECTROMAN**, Box 24474, New Orleans, LA 70184. 504-482-3017.

2R/5V/TCF one wire, HRC/STD switchable Ch. #3/4, fast version. Limited time offer. \$14, min. 10. Call 1-800-831-2050.

BUYING: JERROLD 450, Trimode test kits. All models. Wanted Jerrold 550, Trimode test kits. Call 301-986-2436. Leave message.



LA PAZ Electronics International COMPUTER PARTS

DRAM MEMORY

1MX9-70 (3chip) SIMM.....	\$38.00
1MX9-70 (9chip) SIMM.....	\$39.00
4MX9-70 (3/9chip) SIMM.....	\$125/149
1MX36-70 (4MB) 72-PIN SIMM.....	\$155.00
2MX36-70 (8MB) 72-PIN SIMM.....	\$315.00
4MX36-70 (16MB) 72-PIN SIMM.....	\$549.00
1MX1-80/70 DRAM.....	\$4.90
256KX4-80 DRAM.....	\$5.25
1MX4-80 DIP DRAM.....	\$29.50
256KX8-60 VIDEO SOJ DRAM.....	\$21.50
256KX16-70 VIDEO ZIP (WE/CAS).....	\$39.00
256KX16-70 VIDEO SOJ (WE/CAS).....	\$29.00

CACHE SRAM

64KX1-15ns 22-DIP.....	\$7.95
64KX4-15ns 24-DIP.....	\$8.95
32KX8-20/15ns 28-DIP.....	\$5.95/\$6.50
128KX8-20/15ns 32-DIP.....	\$26.00/27.00
128KX16-20/15ns 4mil 32-DIP.....	\$27.00/28.00

NETWORK COMPONENTS

ETHERNET CARD 16-BIT Combo (BNC/UTP).....	\$39.00
ETHERNET CARD VESA COMBO (3 in 1).....	\$145.00
ETHERNET CARD PCMCIA.....	\$129.00
8-PORT ETHERNET HUB (RJ-45 PORTS).....	\$155.00
9-PORT ETHERNET HUB (1 BNC PORT).....	\$160.00
2-PORT BNC ETHERNET REPEATER.....	\$265.00
AUI TO RJ45 UTP TRANSCEIVER.....	\$45.00
CRIMPING TOOL - RJ45.....	\$14.50
RJ45 CABLE TESTER.....	\$49.95
and many more patch cables RG58/UTP LVL3/LVL5	

CALL FOR PRICE AND AVAILABILITY

CPU & COPROCESSORS

80287-12 IIT 40-DIP.....	\$19.00
386DX-33 INTEL.....	\$29.00
486DX2-50 INTEL.....	\$99.00
486DX2-66 INTEL.....	\$155.00
PENTIUM 60/66 INTEL.....	\$275/300
PENTIUM 80/100 INTEL.....	\$455/525
387SX/387DX CYREX MATH-CO.....	\$49/55

OTHER CHIPS

16550AFN UART.....	\$10.50
DS1287/A DALLAS CLOCK.....	\$9.95/15.50
27C128-200 CMOS EPROM.....	\$3.75
27C256-150 CMOS EPROM.....	\$3.95
27C512-150 CMOS EPROM.....	\$4.50
27C010-150 CMOS EPROM.....	\$5.45
Plus.....FLASH EPROM's, PAL's, GAL's, LINEAR, TTL and more. Other components... TRANSISTORS, DIODES, SOCKETS, BATTERIES, CONNECTORS, ADAPTERS, TOOLS, WIRE, and CABLES.	

UPGRADES - Lasers, Notebooks, Portables

HP500...256K RAM.....	\$39.00
HP II/III 2MB RAMCARD.....	\$79/95
HP 4, 4M, 4SI 4MB RAM.....	\$155
HP OMNIBOOK 425 2MB MODULE.....	\$219
PANASONIC 4410/4420 2MB RAMCARD.....	\$99/115
AST PREMIUM EXEC 4MB MODULE.....	\$219
IBM CONSULTANT 8MB MODULE.....	\$390
Other custom modules available...48-hour delivery on most upgrades. CALL FOR QUOTE	

TO ORDER CALL: 1(800)586-4199

OTHER PARTS AVAILABLE, CALL FOR QUOTE VOLUME DISCOUNTS OFFERED
PRICES SUBJECT TO CHANGE WITHOUT NOTICE TERMS: COD(CASH),VISA/MC
MINIMUM ORDER: \$20 FREIGHT: \$5.00 MINIMUM

LA PAZ ELECTRONICS INT'L

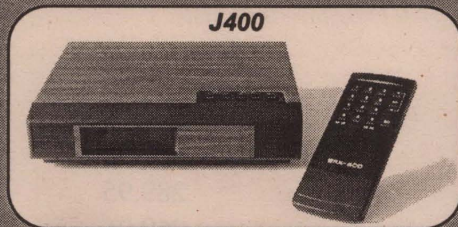
P.O. BOX 261095, SAN DIEGO, CA 92196
TEL (619) 586-7610 FAX (619) 586-1482

Write in 176 on Reader Service Card.



A CONVERTER FROM K.D. VIDEO IS CHANNEL SURFING AT ITS FINEST

CALL
1-800-327-3407
FOR ALL YOUR CABLE TV NEEDS



- * 61 CHANNELS
- * FINE TUNING



- * DIGITAL TUNING
- * EXCELLENT PICTURE QUALITY



- * 86 CHANNELS
- * LOADED WITH FEATURES



- * 99 CHANNELS
- * UNSURPASSED PICTURE QUALITY
- * COMPATIBLE TO S.A. 8500 THRU 8580 SYSTEMS EXCEPT 8570



- * VOLUME CONTROL
- * ANTI FLASH TECHNOLOGY
- * COMPATIBLE TO ALL ZENITH ST-XXXX SYSTEMS

NOTCH FILTERS
FOR CHANNELS 2, 3 AND 14 THRU 23

EXTRA REMOTE CONTROLS
FOR JERROLD, SCIENTIFIC ATLANTA,
ZENITH, PIONEER, TOCOM

JERROLD & SCIENTIFIC ATLANTA TYPE
SECURITY SCREW REMOVAL BITS

IF YOU DO NOT SEE THE EQUIPMENT YOU
NEED LISTED, PLEASE CALL US.
WE HAVE OTHER MODELS AVAILABLE.

* WE SPECIALIZE IN DEALER PRICING!
10 AND 20 LOT!

* FOR A FREE CATALOG WRITE TO:
P.O. BOX 29538 • MPLS., MN 55429

* PLEASE HAVE THE MAKE AND MODEL
NUMBER OF THE UNIT USED IN YOUR AREA
WHEN CALLING FOR INFORMATION

1-800-327-3407

Write in 108 on Reader Service Card.

Nuts & Volts Magazine/August 1995 97

The Filter Company, Inc.

INTERNET Email FILTERS@pipeline.com

1-800-235-8080 ext.#8080

Large STOCK on all channels for fast delivery. Available Ch. # 2 thru 24 and 0,1,60,61,98,99,A-2, A-1. Order by single channels. **NOBODY BEATS OUR PRICE.**

Monday - Friday (8am to 8pm) Central Time

All Filters are 75 db deep and carry our exclusive 2-year Warranty EXACT FILTER ALL CABLE Company's Use.

We Specialize in Large Quantities

PRICES AS LOW AS \$6.00ea

Standard Positive Filters

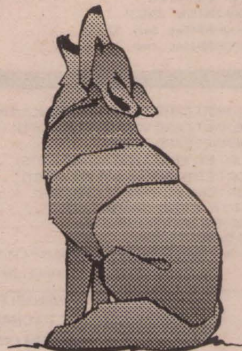
1pc @ \$16.00 5pcs @ \$14.00ea
10pcs @ \$12.00ea 25pcs @ \$10.00ea
50pcs or more CALL! We will beat any competitor's price. Mix & Match.

Visa, Mastercard, Discover, American Express & UPS COD

We do not sell Data Blockers, Bullets or FM Traps !!!

Anyone implying theft of Cable Service will be denied assistance.

A "TFC, Inc." Company



Give our 800 line a HOWL for the best Positive Filters and SERVICE.....

BUYING TOCOM, SCIENTIFIC ATLANTA 8536s, 8550s, 8580s, 8590s, and 8600s. **JERROLD** DPV and DPBB. **PIONEERS**, all, and Zeniths, all. Any quantity. Top \$\$\$ paid. Contact National Cable Brokers, Plymouth, IN. Phone 219-935-4128.

RCA DSS TEST CARD Dealers/Distributors wanted. Testing, educational, and repair purposes only. For more information, send a business size SASE to: Test Card, Suite 142, 39 West Alexis Rd., Toledo, OH 43612.

CABLE UNSCRAMBLER. Everything you want to know about Cable, but are afraid to ask. \$10. VISA/MC/AMEX. **ELECTROMAN**, Box 24474, New Orleans, LA 70184. 504-482-3017.

"DESCRAMBLER SCHEMATICS REVEALED." A powerful guide to descrambling schemes. \$10. VISA/MC/AMEX. **ELECTROMAN**, Box 24474, New Orleans, LA 70184. 504-482-3017.

UNIVERSAL DESCRAMBLER. Unscramble signals using your VCR as the tuner. Works with virtually any system, this is the only one you need. Declare cable box independence! Fully assembled. \$129.95 + \$5 S&H. VISA/MC/AMEX. **ELECTROMAN**, Box 24474, New Orleans, LA 70184. 504-482-3017.

PIONEER UNITS 5XXX-63XX boxes, call for prices, E2-E5 clear modules for 5XXX-61XX \$30 ea, 63XX-67XX modules with # \$35 each. All modules are no. E4. I can help you with E2 on 63-67XX boxes. RF transmitter \$150. Box repairs. Compatible test kits \$20 each. Call, 216-428-6910.

RFT2s, STEALTH FSKs, multi-mode test modules, and FSKs, reverse engineering and programming. Best in the business. 707-763-7939.

ZENITH COMPATIBLE TEST KITS. ZL1, ZF1, ZZ chip, your choice \$6 each. 407-676-2530.

BLOW OUT SALE. 8600, \$235, 8580 comp. \$125, 8580 pan decoder \$50. Lots of 5. ST7 comp. \$125. ST7 pan decoder \$50. Lots of 5. Six month warranty unconditional. We need your business. 615-546-0836.

WANTED: ZENITH ST4030! Base-Tac cash waiting. Call 907-522-1223.

NEW! "PROGRAMMABLE" PIONEER TEST MODE ACTIVATOR ALLOWS USER TO PROGRAM ANY SERIAL NUMBER INSTANTLY! THIS PRODUCT IS SOLD FOR TEST PURPOSES ONLY. \$199, PLUS SHIPPING AND COD. CALL KEN ERNY ELECTRONICS, 24 HR ORDER AND INFORMATION LINE. 516-389-3536.

DESCRAMBLE CABLE with simple circuit added to Radio Shack RF Modulator part # 15-1273 and using cable ready VCR as tuner instructions, \$10. Telcom, Box 832-V, Brusly, LA 70719.

CABLE EQUIPMENT FOR ALL YOUR TV NEEDS. ALL BRANDS AVAILABLE. DISCOUNT ON QUANTITIES. WE BEAT EVERYBODY'S PRICES. CALL 713-444-2477. NO TEXAS SALES. VISA, MASTERCARD, DISCOVER.

3 WIRE modules 10 @ \$12 ea., 2 wire modules 10 @ \$10 ea., 28 pin EPROM soft, 10 @ \$8 ea. Multimode module \$30 ea., Pio BA5100 thru BA6100 @ \$22 ea. Pio BA6300 @ 29 ea. Zenith ZL3 10 @ \$12 ea., SA 8500, 8550, 8570, 8580, 8590, 8600 \$25 ea. Mapping and non-mapping EPROMS for other systems are available. KCS, 1-800-879-8820. 30-day money back guarantee.

**BUY 5
GET
5 FREE**

TEST MODULES

* WHOLESALE PRICES AVAILABLE *

	1 Pc
5-VPD	19.95
7-VPD	29.95
VR/5&2	39.95
SA 8550	29.95
SA 8570	39.95
SA 8580	39.95
SA 8590-11	39.95
ZENITH - ZF 1	19.95
ZENITH - ZF 2	19.95
0355	19.95
0755	19.95
PIO 5000 & 6000 Series	49.95

**BUY 5
GET 5 FREE**

	1 Pc
7VPD	269.95
BBPD7	289.95
SA 8570	259.95
SA 8580	269.95
SA 8590	289.95
0355-0755	259.95
PIO 51XX	259.95
PIO 61XX	289.95
PIO 63XX	299.95
PIO 67XX	329.95

1 Year Guarantee with this AD signed and returned.

☐ YES, I AGREE ALL UNITS ARE TO BE USED OR RESOLD IN COMPLIANCE WITH FEDERAL AND STATE LAWS.

Signature X _____

1-800-841-0244

PRICES SUBJECT TO CHANGE WITHOUT NOTICE
* BUY 5 GET 5 FREE APPLIES TO TEST MODULES ONLY *

BTV DESCRAMBLERS. Make your own! or under \$10. 7 easy steps, Instructions how you how! All parts are available at Radio Shack. Plans including S&H. Only 7. Send to: Information Wholesale, PO Box 9359, Toledo, OH 43697.

AVAILABLE NOW test aids for the discerning customer at a fair price. Quickboards, Notch filters, mappers, etc. Volume Discounts. **NO FL SALES.** 1-800-77-2649.

CABLE HACKERS! Blow out sale! Cable Hacker's Handbook, \$15.95! Also, build a universal descrambler for under \$50! Works on any system! Guaranteed! Easy to build! Plans only \$7.50! Send to: Bates, 541 West Quincy, Chicago, IL 60644..

BUYING SCIENTIFIC Atlanta 8600, 8580, 8550, 8500. Software available. SA, Pioneer. Will program your 8550, 8500 forms for \$7.50. Cable security key gets last collars \$25. Add \$5 shipping. No TX sales. Send postal money order to: K. Perry, PO Box 816, Leander, TX 78646-816. Phone: 512-259-4770.

TEST KIT BLOW OUT AND CLEARANCE SALE. Compatibles: Pioneer \$15, Zenith \$6, SA 40 pin \$20, SA Quickboards \$18, and others, call 407-952-0664. No minimum purchase, and no Florida sales.

FOR SALE: DSE 1000 encoder, excellent condition, great for testing and repairing. Trimode and S/A converters and descramblers. \$1,500 or best offer. Call, 1-800-09-4333.

FULL SERVICE BOXES: ZENITH ST1612 with anti-flashing circuit and remote, \$149 5-lot, \$169 2-lot, \$189 single **SCIENTIFIC ATLANTA 8600** (2 versions, 8600STNN, 8600S2NN) with remote \$249 UPS/COD. Dirk Braem, 4928 Aquatic Rd., Nashville, TN 37211. 615-331-9637 voice/fax. No TN sales/Canadian orders welcome.

2ND GENERATION FTGs, the Stealth FSK, complete auto operation, better than the RFT-1 \$145. Genesis Automode FSKs \$170. Super 2R/FTC test modules \$25. **SLOPPY JOE'S** 707-778-7488.

FTB, TVT, Panasonic combo, \$135. Test mode devices for BA-51XX, BA-61XX \$30 ea. BA-63XX \$35 ea. Call Vinn at: 1-800-184-7250 then dial 7525.

T-TACs FOR Sale. ST1000 with 288-01. Call 419-385-3100. Ask for John.

PIONEER ZENITH ST 1200 and ST 1600 or sale. Quantity pricing available. Call 18-297-9221, 718-297-4877, or FAX 18-657-4015. Ask for Fred.

ACP's 70th GIANT COMPUTER SWAP★MEET

Orange County's Original!

Be a Seller! ...for space call Mary...



Sunday, 8am-2pm

Sept. 24th

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**



TOTAL CONTROL PRODUCTS TRACKER NOW AVAILABLE. Too much to list. 1-800-690-4456.

PIONEER COMPATIBLE TEST KITS. New all-in-one. Multi-mode, mapping and no map all-in-one small kit. \$15 each. Call 407-676-2530. No Florida Sales.

SCIENTIFIC ATLANTA AND PIONEER COMPATIBLE DESCRAMBLERS. 1-PIECE, NON-BASEBAND, FREQUENT BUYER AND VOLUME DISCOUNTS. NO CA ORDERS. ACME CABLE PRODUCTS. 1-800-866-ACME.

DEALERS NEEDED: Universal boxes that work on all systems. Also filters and blockers. Call 1-800-676-6342.

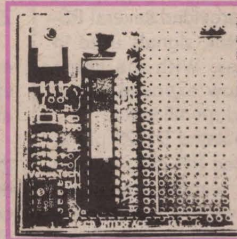
DESCRAMBLE CABLE with simple circuit added to Radio Shack RF modulator, part #15-1273, and using cable ready VCR as tuner. Instructions \$10. Parts for all four circuits, \$12.95. S&H \$1. Telcom, Box 832-V1, Brusly, LA 70719.

DEALERS ONLY TVPD and BBPD starting at \$95 10 lot. Stealth 1000 AT \$35 10 lot. Stealth SA AT \$46 10 lot. Pio Plastic AT \$46 10 lot. Call 702-895-9120.

NEW FBASIC TICKIT™

- FAMILIAR TECHNOLOGY:** Based on the popular PIC16C57® micro controller.
- LOTS OF MEMORY:** 48 bytes internal RAM and 2k or 8k byte eeprom for program storage.
- EASY TO PROGRAM:** Uses FBASIC, a structured Basic dialect that does compile time error checking.
- EASY TO DEBUG:** Source level Debugger single steps through program. Memory variable peeking and poking.
- EASY TO INTERFACE:** Library routines for external 8bit and 4bit busses. Pulse routines, RC measurement, RS232, 16 I/O lines, Square wave generator, etc.
- EASY TO AFFORD:** TICKits from \$49 each. Development systems are only \$45. IBM compatible with a serial port works as compiler and downloader.

CALL FOR INFORMATION, TICKits ARE AVAILABLE NOW!



VersaTech Electronics™
P.O. Box 18476
Boulder, CO 80308-1476
(800) 940-5590
(303) 440-5590
Fax: (303) 440-9467
BBS: (303) 440-7828

PIC is registered trademark of Microchip Technologies, Inc.

Your choice has got to be...

M.F.M. COMMUNICATIONS.

for...

CELLULAR PROGRAMMING KITS

All Kits are Supplied with Cables and Software, unless indicated.

!!! NEW PRODUCTS ADDED !!!

(Look for the "" to find them.)*

"Guaranteed Lowest Prices" or we beat by \$10!

We want you to have the best deal and at MFm we are sure that we are offering you unbeatable prices. To back this up; if you have seen any of our products at lower prices, then we will beat them by a further \$10.

NEC. P200, 201, 300, 301. **\$149.**

NEC. P400, 600, 601, 100, 120, TT180, 181. **\$399.**

*NEC. *P7. **\$499.**

*MITSUBISHI DIAMONDTel. 20x, 22x, *99x. **\$499.**

PANASONIC. HH 700, 900, EBH40. **\$249.**

PANASONIC. HH 600, HP600. **\$149.**

MOTOROLA (software). 9122 & above (AMPS G2). **\$149.**

MOTOROLA (software). 9122 & above (MPC). **\$49.**

CHECKSUM Calculator. suitable for Panasonic, Tandy, RadioShack, Mitsubishi and Nokia Models. only **\$99.**

Call Us Now on... 011-44-1-88-333-0060

M.F.M. COMMUNICATIONS.

57 Addison Road, Caterham. CR3-5LU. UK.

*Prices do not include shipping.
"For Information Purposes Only"*



SOLAR ELECTRICITY LOWEST PRICES UNDER THE SUN !

TOLL FREE 1-800-842-5678 (24 HRS)

CALL COLLECT (619) 581-0051 FAX (619) 581-6440 E-MAIL SOLAR@CTS.COM



SOLAR ELECTRIC INC.

AT THE ROSE CANYON BUSINESS PARK
4901 MORENA BLVD. #305
SAN DIEGO, CA 92117 U.S.A.



WE FEATURE **SIEMENS** **TRACE ENGINEERING** AND OTHER FINE PRODUCTS

AMATEUR ROBOTICS

Last month, I went well down the path to creating a robot-ready computer from a Practical Peripherals 14.4 ProClass modem (PP144Pro). Refer to that article for details on the hacks necessary to convert this small circuit board into a powerful 68302 embedded controller.

As you'll recall from that article, I had removed three small surface-mount technology (SMT) chips just to the right of the DB-25 connector. Removing these chips (U1, U2, and U3) completely disabled the normal RS-232 communications, allowing me to add in my usual four-pin MTA serial connector.

Removing these chips had a secondary purpose, however. These chips sensed or provided several RS-232 signals to the DB-25 connector, signals used in normal modem communications. With the chips removed, the connections are now exposed at the empty pads, ready for rewiring and modification.

For example, removing U2 isolated DB-25 pin 2, which is wired to U2-1 and supplied RS-232 data out to the host PC. We have already re-routed the serial data to the MTA connector, so we are free to wire another signal to the pad at U2-1, making that signal available at pin 2 of the DB-25.

By adding suitable cuts and jumpers, we can turn the now-defunct DB-25 serial connector into an I/O expansion connector. We'll just wire selected 68302 signals to pins on the DB-25 connector. Later, in your robot, you can use these signals as needed for I/O.

We will leave two pins unchanged. DB-25 pins 1 and 7 already connect to the PP144Pro's ground plane, and changing them would be too much hassle. They will provide the ground signal for our expansion port.

Next up is the +5 VDC line. Cut two 4" lengths of 30 AWG wirewrap wire, and remove 1/8" of insulation from one end of each. Remove the solder from pin 11 of the DB-25 connector, using a good solder sucker or copper braid. Connect one wire to this pin, then solder in place.

Repeat the above to connect the second wire to pin 9 of the DB-25.

Strip 1/8" of insulation from each of the two remaining ends of these wires, then solder both wires to the upper lug on the power switch, SW1. Pins 9 and 11 of the DB-25 connector now supply +5 VDC, controlled by the on-board power switch.

On the underside of the board, cut the trace between pins 12 and 23 of the DB-25 connector. This isolates pin 12 completely, and leaves pin 23 connected to pad U1-3.

The following mods each require a tiny jumper, made of bare 30 AWG wirewrap wire. Make each jumper by clipping a 1/4" length of wirewrap wire. You will use these jumpers to connect between two pads on selected SMT layouts.

When soldering these jumpers in place, be very careful that you don't allow them to contact any nearby traces or pads. You can dress these jumpers away from the board, so they clear any problem areas.

Connect a jumper between pads U3-10 and U3-8. This hooks the 68302 signal *IACK6 (PB1) to pin 6 of the DB-25 connector.

Connect a jumper between pads U3-13 and U3-11. This wires the *IACK1 signal (PB2) to pin 8 of the DB-25 connector. Take care, when soldering this jumper to U3-11, that you don't accidentally bridge the trace-cut you made earlier when wiring up the MTA connector.

Connect a jumper between pads U1-5 and U1-6. This hooks the 68302 signal TCLK2 (PA3) to pin 15 of the DB-25 connector.

Connect a jumper between pads U1-8 and U1-10.

This wires the RCLK2 signal (PA2) to pin 17 of the DB-25 connector.

Connect a jumper between pads U1-11 and U1-13. This hooks the 68302 signal *TOUT1 (PB4) to pin 22 of the DB-25 connector.

Connect a jumper between pads U1-2 and U1-3. This wires the TIN1 signal (PB3) to pin 23 of the DB-25 connector.

This completes my initial mods to the DB-25 expansion connector. Refer to the accompanying expansion port diagram for details on the new pin assignments.

Note that six of the DB-25 pins connect to pads that are presently empty. You can bring your own signals to these pads as needed, provided you do so carefully. It helps to take advantage of existing wiring on the PP144Pro board.

For example, last month's article lists signals that drive some of the panel LEDs. You might choose one of these signals, say PB0 which drives the leftmost green LED, and wire it to pin 24 of the DB-25 connector.*

To do so, cut a piece of 30 AWG of the proper length and trim 1/16" insulation from each end. Solder one end of this wire to pad U2-13, which is associated with pin 24 of the DB-25 connector.

You have to be a little careful selecting the connection point for the other end of this wire. You have to find a trace, via, or pad connected directly to the 68302 pin of interest. In this example, the proper connection point is the pad labeled T114 on the underside of the board.

Using an ohmmeter, you can verify that the resistance between pad T114 and pin 112 of U13 reads nearly 0 ohms. Solder the free end of your 30 AWG wire to the T114 pad; this completes the connection to the I/O expansion port.

Tracking down traces or pads to pins of interest on the 68302 can prove entertaining, and boost the options available to you in your robot design. Be sure to double- and triple-check your signal traces, to make sure you get a trace that goes directly to the desired pin.

Also, watch out for side effects. For example, 68302 signal RXD2 hooks to U21-2. You could probably run a wire from this pin to a likely I/O port connection, such as U2-10. But doing so means that U21, a 74HCT251, will feel the effects of whatever you do to RXD2. You have to allow for these side effects whenever you make connections to the board.

If your chosen signal is already hooked to an output pin of some device, you will have to lift that pin from the circuit board, then make your connection to the freed pad.

If, however, your signal is hooked to the input side of a chip, you may not have a problem. You can simply drive the selected 68302 pin, and the input to the affected chip will just go high or low, as necessary. You will, of course, need to allow for any resulting changes on the chip's output pins.

Simply lifting input pins of CMOS devices can cause internal oscillations in the modified device. This will result in increased power drain and, in extreme cases, latch-up and destruction of the device. To protect lifted input pins, you can wire them to ground or

tie them to +5 VDC through a 10K resistor.

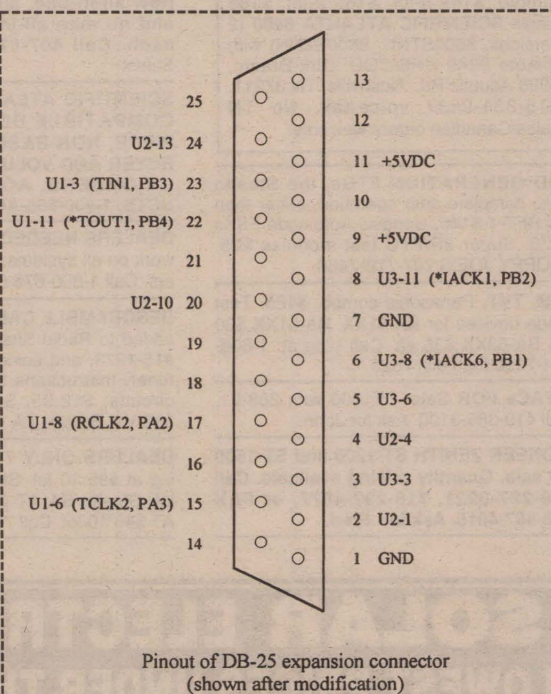
An easier fix to this floating input problem involves simply removing the chip. This, of course, will affect all lines connected to output pins on the removed chip, so you will have to check for ripple effects of this fix.

I'll leave you with the PP144Pro board at this stage. I've had a blast hacking this board, and will eventually work it into a robot. For now, look on it as the starting point of a larger, more powerful robot brain. Have fun!

Shopping around

During a recent trip to San Diego, I spent time roaming some of the electronic stores, in search of robot parts. If my results are any indication, this part of the West Coast offers the robot builder lots of opportunities.

I first stopped at California Electronics and Industrial Surplus, in a San Diego suburb called El Cajon. CEIS has been around for several years, and carries a large selection of older electronics, as well as heavy industrial surplus and bulk materials. The



store reminds me of the surplus outfits I used to frequent while I lived in Phoenix.

The aisles are kinda cramped, and the labels on many of the parts bins miss being current by at least one shipment. Some of the stock is down-right unrecognizable, at least by this software guy. But the bargains are there if you know what you need and are patient.

I found a real-live traffic light for \$100.00, but passed it up as my traffic light needs right now are not pressing. I noticed a vintage Motorola digital frequency meter for \$95.00. This is one of those tank-like metal boxes with a very simple user interface; a

few switches, a couple of dials, and a seven-digit Nixie readout. Those readers too young to remember Nixies missed an exciting era of electronics.

I found plenty of relays, wire, project boxes, gear-head motors, lasers, and smaller components needed in a well-stocked junk box. I loaded up on trimpots, and even found a power cord for my PC monitor that I just had to have.

I counted 225 plastic bins loaded with pulleys, belts, grommets, and nylon components. You could probably design a pretty good robot drive system while digging through these bins.

About two blocks down the street from CEIS, you can find Murphy's Electronic and Industrial Surplus Warehouse. Murphy's apparently opened within the last year or so, as the aisles are relatively open and uncluttered. The shelves, however, stand floor to ceiling and are filled to bending with power supplies, computer gear, test equipment, and miscellaneous small components.

I spotted several large micro-fiche viewers at \$35.00 each, and a table-top fiber optic splicing station for \$450.00. I passed up the \$7.50 weather balloons, though, to get a better look at a Data-I/O Model 22B EPROM programmer.

The 22B was formerly owned by the US Navy, and contains an on-board UV eraser. As near as I could tell, it was complete and ready to go, and at \$150.00, I worked hard to talk myself out of buying it.

Next up was Gateway Electronics, a regular advertiser in *Nuts & Volts*, and a required stop on any robo-visit to San Diego.

The Gateway store is well-lit and sparsely laid out, but filled with vitally important robot parts. When I walked through the door, I was greeted by an electronic voice welcoming me to the store.

Someone had hooked up a proximity detector and voice recorder board to an amplifier and speaker. When the detector saw me walk by, it started up the 12-second message. Needless to say, you can buy all the components for this system at Gateway.

I just had to pick up a couple of 12 VDC gel-cell batteries. Rated at 1.3 AHR, the batteries measure just 3.75" x 1.75" x 2", and are surprisingly light. They will fit well in my next robot, and the \$6.95 price was reasonable.

I also found several of the Ramsey and Electronic Rainbow kits for sale. I bought the Ramsey TV transmitter kit (\$27.95), as I see a looming need for it, and one of the regulars in comp.robotics had recommended it. I'll build it up soon and let you know what I think of it.

I picked up a few more trimpots (you can't have too many trimpots), and some fuse clips for an upcoming project. Then I spent a lot of time wandering around the store, checking out the displays.

I couldn't overlook the glass cabinet at the front of the store, complete with two working video displays. One monitor showed the typical black and white image from a CCD pinhole camera. The camera that supplied the signal was so TINY; it looked to be only 1" x 1".

But the monitor on the top shelf really caught my eye. It showed a color video picture from a small CCD camera sitting on the same shelf. I had not seen the output from one of these cameras before, and was impressed.

The color camera is larger than the B/W pinhole camera, but not excessively so; it looked to be 2" x 2.5". The price was a bit high for me, at \$280.00, but that should drop as these cameras become more widely available. I enjoyed visiting all three of these stores, and definitely rate Gateway as a "must-see."

Visiting MBARI

The Monterey Bay Aquarium Research Institute's Marine Lab sits at the end of Monterey Bay, in the lit-

tle town of Moss Landing. Stretching out from this point into the Pacific Ocean runs the Monterey Canyon, an immense underwater chasm that drops rapidly to a depth in excess of 6,000 meters, or over 19,500 feet.

The proximity of such deep water makes Monterey Bay unique in the United States, and possibly in the world. Monterey Bay is an ideal focal point for deep-water research, which explains the presence of MBARI.

Several years ago, MBARI developed the remotely-operated vehicle (ROV) *Ventana*, a deep-water submersible used to explore the Monterey Canyon to depths of 1,000 meters. *Ventana* (which means "window" in Spanish), uses a three-chip Sony color camera and pure-white HMI lights to return real-time video of the ocean depths. The ROV also carries specimen collecting gear and grippers for performing deep-water experiments.

In 1991, MBARI engineers began the design of *Ventana*'s successor, *Tiburon*. This vehicle, whose name means "shark," measures 9.5' long by 6' wide and will descend to 4,000 meters (about 13,000 feet). It is due for "wet test," or actual ocean submersion, in September of 1995 and real launch in mid-1996.

Powered by three large electric motors and armed with sophisticated computers, cameras, and collection equipment of all types, *Tiburon* will open up vast new areas of exploration to deep-water researchers.

I spent a day at MBARI, discussing *Tiburon*'s design with two of the Institute's engineers. Andy Pearce walked me through many of the software and electronics issues involved in controlling such a complex piece of machinery. Bill Kirkwood pointed out many of the mechanical innovations needed to cope with the extreme pressures of deep-water work, and even took me on a tour of the Institute's research vessel.

And I always thought a living room was a hostile robot environment! At 4,000 meters, the pressure on *Tiburon*'s frame will hit 7200 PSI. When I asked Bill for some type of comparison, he said, "Imagine standing two Cadillac Coupe de Villes on your big toe."

Then there is the corrosion factor. The salt water, and resultant galvanic reaction, limits the effective life of even such well maintained craft as *Ventana* and *Tiburon*. Despite meticulous care, large sections of *Ventana* have already been replaced, and *Tiburon* will probably not last, in its original form, much beyond five years.

Both machines rely on a tether to deliver power for motor control, and to exchange video and data with the support ship. For *Tiburon*, this tether consists of a 5,000 meter cable 0.68" in diameter. The cable contains an inner core of three large copper wires and three tiny fiber optic cables. This inner core is protected by two thick steel jackets.

Each jacket consists of many steel wires; the wires of the inner jacket are wrapped opposite to those of the outer jacket. This reversed winding minimizes any kinking effects as the cable rolls and unrolls from the spool.

I called them "wires," but the three large power conduits inside the tether cable more closely resemble solid copper rod. The three wires need to be large; they must carry 25K watts of power to the submersible, passed as 1800 volts at 400 Hz.

The bulk of MBARI's design efforts focus on canceling the effects of the tremendous pressures involved. The engineering labs in MBARI's downtown office, in nearby Pacific Grove, are a testament to the ingenuity brought to bear on the problem.

I saw several polished titanium containers, beautifully machined and welded, designed to protect fragile power systems and electronics. Each cylinder measured about 8" in diameter by about 20" long;

just the machining budget for these items would have built thousands of Huey robots.

A foam shell, artistically sculpted into smooth lines, covers *Tiburon*'s upper body. To deal with the extreme pressures, the MBARI engineers built the shell (called the foam pack), from a special epoxy resin. The resin is mixed with millions of tiny glass spheres, then molded to the desired shape. Even at 4,000 meters, the foam pack will only compress a tiny fraction of an inch.

Tiburon's frame construction uses a different method for handling the high pressures of deep submergence. The frame, made of hollow 2" aluminum tubes only 1/8" thick, is riddled with holes. The holes permit the sea water to flood all parts of the tubular frame, equalizing pressures on the tube walls as the craft changes depth.

Even the cabling between subsystems on the ROV gets special treatment. In some cases, engineers employ specially-designed high-pressure cables to carry power and data wires.

Sometimes, however, *Tiburon*'s designers use a novel oil-filled jacket to protect the wiring. In this case, the wires run through a flexible, clear plastic outer shell. The shell is filled with a light vegetable oil, similar to cooking oil. The oil barely compresses at depth, protecting the enclosed wires. Should the jacket leak or burst, the non-toxic oil floats to the surface, then evaporates.

It takes a lot of computing power to run the *Tiburon* ROV. The vessel carries a VME cage with three 68040 processors and a DSP. These computers exchange data with MBARI's onshore computers over a TCP/IP network.

Having network access to all of the computers on-board, the *Tiburon* creates some powerful debug and development capabilities. MBARI engineers can do a full-system re-load over the network, even if the vessel is at depth. The ability to monitor or change system variables, while the control software is actually running on the ocean floor, really improves debug efficiency.

The 68040 computers handle the high-level tasks for controlling *Tiburon*. The actual motor control and sensor data collection fall to 15 80c196 processors scattered throughout the vessel and hooked to the VME cage with a custom RS-485 network.

MBARI engineers developed nearly all of the electronics used in *Tiburon*, including the controllers for the three drive motors. Here, the circuit board design posed a special problem, again caused by the intense pressure.

The controller circuitry is housed in an oil-filled container that is kept at pressure. Initial designs used commercially available potted power modules, but the intense pressures would crush the module's epoxy housing wherever an internal void existed. Ultimately, MBARI had to design a custom power module, built with discrete devices whose housings could withstand the pressures.

Ventana, the current ROV, runs nearly every day. In fact, images from *Ventana*'s sled-mounted camera are fed live to monitors in an auditorium of the Monterey Bay Aquarium, located a few blocks from MBARI's headquarters.

The MBARI offices and labs also contain numerous TV monitors, each showing the current view from *Ventana*'s camera. The video images, transmitted by microwave from the support ship, apparently run continuously, so long as the camera has power. Thus, you can tell at a glance what *Ventana* is doing, from nearly anywhere in the MBARI facilities.

As always, you can reach me at:
Karl Lunt
2133 186th Pl., S.E.
Bothell, WA 98012
E-Mail: karl@mav.com



Photo courtesy of Peabody & Flynn©

While I was visiting, Bill Kirkwood noticed that the monitor showed a dock-side image; *Ventana's* support craft was tied to the pier across the street. He asked me if I would like a tour of the ship; naturally, I agreed.

The support ship, *Point Lobos*, contains a small deck that is nearly filled by *Ventana* and its associated machinery. Normally at sea during work hours, *Point Lobos* returned to Moss Landing because of a ruptured O-ring somewhere inside *Ventana*. When I walked on board, several engineers and technicians were poking and prying about the ROV.

Ventana's sled holds many different mechanisms designed to capture deep-sea data. These gadgets are bolted, clamped, or welded to all sections of the sled, and range from cutting-edge to surprisingly low-tech.

I noticed a small, cigar-shaped appliance bolted to the frame's upper rail; a cable ran from the device back into *Ventana's* innards. Bill mentioned that it was a high-quality color video camera. I found that impressive; the camera's outside diameter was little more than an inch.

I asked about the camera's alignment, as it was aimed at one of *Ventana's* side rails, rather than forward. Bill pointed to a vertical row of three gauges, all bolted to the side rail. He said that the pilot onboard *Point Lobos* uses the camera to visually inspect the old-fashioned gauges, as a backup to the digital data sent up from the onboard computers.

Slung below the lower rail up front rides a beautiful, studio-quality Sony color camera in a high-pressure container. This camera feeds all the monitors scattered throughout MBARI, and the picture quality is excellent.

On the very top rail, also up front, sat a white plastic barrel about 5" long and 4" high; its body contained several baffles and surfaces. It seemed oddly out of place, looking like something you would pick up at a garage sale. I reached up and gave it a spin, and it rotated freely on its horizontal axis.

While it was spinning, I noticed a set of small magnets glued to one of the side rims, evenly spaced along the rim's circumference. When I asked Bill about the device, he said it was the current sensor.

Apparently, prior to *Ventana's* work, scientists had no reliable method of determining current flow at depths of 1,000 meters. This little plastic device, with its reed-switch and magnets, gave researchers their first glimpse of deep-sea current rates.

Next, I went inside the ship to the control room. Here, the pilot, the chief scientist, and the assistant scientist sit in padded chairs before a group of eight relay racks crammed with gear. Several color monitors provide pictures from various cameras, both onboard *Ventana* and from other sites on the ship or

in the research lab.

The racks also contain several PCs and Unix boxes, linked via network to other machines throughout MBARI. While I was admiring the view, a technician walked in and rebooted one of the PCs. The usual boot messages scrolled up, superimposed on a high-quality color picture of the bow of *Point Lobos* as seen through *Ventana's* camera.

The pilot controls *Ventana* using a seat-mounted joystick that looks like it was pulled right out of a jet fighter's cockpit. Beside the pilot's chair sits a large, color touch screen display running a control program; the program allows the

of their work.

So long, Bob

About the time you read this, the Seattle Robotics Society will say "Goodbye" to one of the club's first members and long a driving force. Bob Nansel and his wife, Karen, are packing up and heading to Japan, where they will teach English classes.

I first heard about Bob and the SRS through articles Bob wrote for the (sadly) defunct magazine, *Micro Cornucopia*. Bob's writings encouraged me to consider Seattle as a future home; after all, any city with a robot club has to be a great place, right?

Since Linda and I moved here, back in '89, Bob did a tour of duty as the club's newsletter editor, and made the *Encoder* arguably the finest robotics newsletter in the country. He and Karen were also instrumental in organizing and running at least two major hobby robotics events in those years.

As the only club member I know of who is truly

a robotics engineer (his degree is in robotics engineering), Bob was always explaining arcane electronic or mechanical problems to those of us more robotically challenged. And he used his skills in woodworking and machining to craft quality robot frames and bodies.

Best of luck to both of you, Bob and Karen, in your new Japanese lives. Hopefully, you'll keep the rest of us posted on robotics in Japan, and maybe come back to the States now and then for a visit.

Another "Goodbye"

The book *Star Trek Creator* describes the fascinating life of Gene Roddenberry. Shortly before his death in 1991, Gene asked writer David Alexander to prepare Gene's biography. David was given full access to the family archives, and drew upon literally thousands of pages of memos, letters, contracts, and reports, and countless interviews, in his efforts.

The resulting book, complete with an introduction by Majel Barret Roddenberry, covers the 70-year life of a man known to millions as the creator of the *Star Trek* shows. David pulled no punches in this book, as attested to by Majel's comments. Gene's life, the good parts and those less so, get full exposure.

David describes the background struggles and torturous efforts needed to develop the different *Star Treks*. Gene's allies, including noted authors Isaac Asimov and Ray Bradbury, helped him through the difficult years, as he fought battles that probably should have broken him (and might well have).

But throughout this book runs a constant thread; Gene's vision of a better tomorrow. Gene brought an eager enthusiasm to his view of humanity's future, a 23rd century in which our technology and our human-ness carries us to peace, and to the stars.

More than simply dream his dreams, Gene worked harder than most would have dared, to bring his visions into our living rooms and onto our movie screens. This book is filled with his struggles and triumphs, and with personal glimpses of those people intimately involved with the birth and growth of the various *Star Treks*.

Gene has left us, a fact I regret beyond words. But the 23rd century isn't that far away, and we have a lot more yet to do.

Time to get on with it. NV

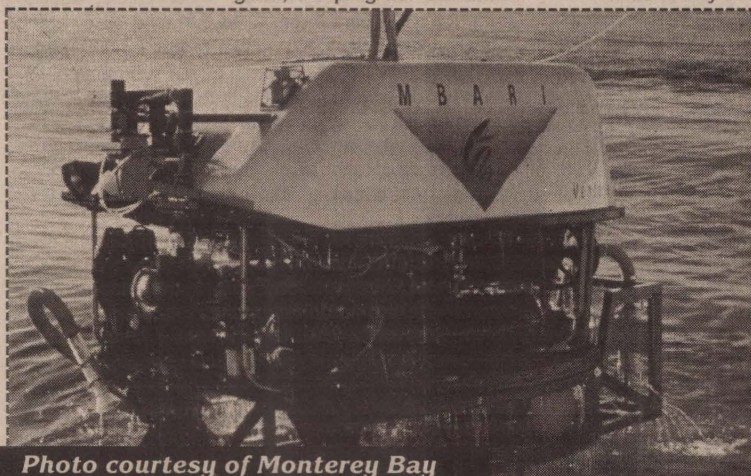


Photo courtesy of Monterey Bay Aquarium Research Institute©

pilot to switch video feeds to any monitor in the ship.

A large readout at the top of one rack constantly displays the current longitude and latitude of *Point Lobos*, based on GPS technology. Behind the racks, a large steel trough carries a cable bundle, as thick as my thigh, back to the bowels of the ship.

Bill took me back to the Marine labs and, as a final treat, showed me a shelf of tiny styrofoam cups that one engineer has been collecting.

This guy writes the day and depth of the dive on a foam coffee cup, then stashes the cup inside *Ventana* prior to a dive. When the vessel returns, he retrieves the cup and adds it to his mounting collection.

Following the 1,000-meter descent, each 8-oz. cup is squashed to the size of a sewing thimble; the 32-oz. soft drink cups wind up about 1 inch tall. In both cases, the writing is perfectly legible, though about 1/8th normal size.

I saw far more than this article can cover, and am indebted to Andy and Bill for spending so much time showing me around and answering my questions. The MBARI engineers are designing a truly beautiful machine for one of the most hostile robotic environments imaginable, and I was totally impressed with the ingenuity and quality

Gateway Electronics
9222 Chesapeake Dr.
San Diego, CA
(619) 279-6802

California Electronics & Industrial Supply
221 N. Johnson Ave.
El Cajon, CA
(619) 588-5599

Murphy's Electronic & Industrial Surplus Warehouse
401 N. Johnson Ave.
El Cajon, CA
(619) 444-7717

CABLE TV BLOW- OUT

MicroCom Industries Inc.
800-665-2002

Call for FREE Brochure

- Quantity Orders Only
- All Other Models Available
- Call for Pricing of Smaller Quantities

**Best Dealer Prices
Available Anywhere**

MasterCard • VISA • AMX • COD

Scientific Atlanta and Pioneer are registered
trademarks and all references are for
identification purposes only.

“The Originals”

TVT - 3G

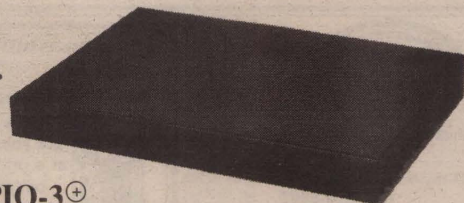
TNT - “DIGITAL DYNAMITE”
Activates all except Baseband.

SCIENTIFIC ATLANTA® M80
Activates all Sci. Atl. except Baseband.

NEW IMPROVED!!!

PIONEER® PIO-3⁺
This is NOT the Pioneer Green! This PIO-3⁺
always works, even when the “Green” doesn’t!!

MicroCom still offers
these add-on descramblers and
the **BEST** dealer prices
available anywhere!



550 Mz BASIC CONVERTERS:

MILLENNIUM³

PANASONIC TZPC 145 CONVERTER

SA 8511-300 CONVERTER

VISION³ CONVERTER

Comes with wireless remote control.
Options include: parental control (except
8511), last channel recall, favorite channel
memory, sleep
timer, and many
more. Channel
2 or 3 available
also.

**All other models available.
Call about our specials on
the Zenith ST1600.**

NEW!!!

NOVAVISION

Revolutionary new universal one-piece converter and descrambler. Fully activates all
Scientific Atlanta, Pioneer systems, and others except Baseband. Options include:

- Picture in Picture
- Simultaneous watch/record
- Clock/sleep timer
- Volume/Mute
- Parental control
- On-screen display
- Stereo
- Last channel recall
- Favorite channel memory
- Ch 3/4 switch



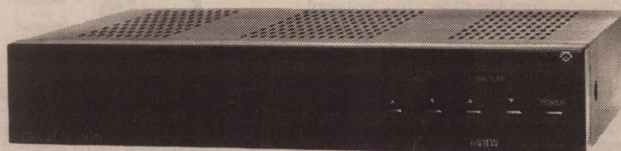
NEW!!!

MILLENNIUM³⁺

The Millennium³ with built-in TVT, TNT, M80, or PIO III for a
complete one-piece converter and descrambler. Fully activates all Scientific
Atlanta, Pioneer systems, and others except Baseband. Options include:

- Picture in Picture
- Simultaneous watch/record
- Std/HRC switch
- Parental control
- Remote A/B switch
- Last channel recall
- Favorite channel memory
- Ch 3/4 switch

**Call for Pricing on
Novavision and Millennium³⁺**



DESCRAMBLING, NEW secret manual. Build your own Descramblers for Cable and Subscription TV. Instructions, schematics for SSAVI, Gated Sync, Sinewave, (HBO, Cinemax, Showtime, UHF, Adult) \$12.95, \$2 postage. Cabletronics, Box 30502N, Bethesda, MD 20824.

SMART-2, miniature transmitter activates wireless your cable box. Within 10 seconds it falls into a full test mode. No wiring no hassle, no interference. High quality. Outperforms the rest. \$145. Makfit Research, 1-800-220-3543. E-Mail makfit@delphi.com.

CABLE HACKERS BIBLES Volume 1. 275+ pages covering all aspects of most cable systems. Schematics, fixes, theory and more. Volume 2. All different information including software. \$44.45 each. Catalog, \$3. VISA/MC 520-782-2316 FAX 520-343-2141. TELECODE, Box 6426-NV, Yuma, AZ 85366-6426.

PIONEER 63XX/67XX MASTER PROGRAMMING FILES \$325. Pioneer 63XX units \$200 w/remote. Master files for ALL other test modules/chips except DPBB/R2/V5/CFT \$200. Zenith and Tecom 507 @ \$8 ea. Min of 10. Pioneer NO-E4 (PicChip) \$18 ea. Min of 5. 63/67 custom chips \$25 ea. NO CALIFORNIA SALES. 1-800-MODULE-0.

CABLE CONVERTERS: 550MHz-PANASONIC, REGAL, STARGATE. Brand new. Converters feature: IR remote, parental guidance Control, favorite channel programming, mfg. warranties, available in Ch-3 or Ch-2. **SPECIAL 10 LOT PRICING:** *WHOLESALE ACCOUNTS WELCOME* FOR PRICING AND AVAILABILITY CALL 1-800-757-8186.

MULTIMODE BASEBAND 2R/5V kits \$15. Blank pic16c56 \$3.50, pal1618 \$1, gal22v10 \$2. Scientific Atlanta 8600, 8580-6 quickboards \$20. SA microprocessors \$20. Pioneer \$30. Zenith, 3055, 7055 kits \$5. 7xxxDV and 7xxxDBB \$10. Complete 8600 \$225. Master files available. COD only. \$50 minimum. Leave message 818-578-8449 or 1-800-574-2116.

SCIENTIFIC ATLANTA 8580, \$160; Quick board for 8600, 8580, 70, 50, \$35; 8500 \$10. 313-482-6958.

POWER SUPPLIES. Wall adapters for sale with mini plugs. Voltage good for SA 3.TVT-3, TBI. If you change polarity or mini plug, you can use them on FTB-3 and SB-3. 100% guaranteed, 100 pieces. \$2.85. Call for pricing on smaller or large quantities. 718-262-0900, FAX 718-657-4015.

DEALERS NEEDED: Fast moving cable TV industry new technology available. Free catalog. Products and pricing, 1-800-676-6342.

ZENITHS! ATTN: CANADIANS: Paradise cable is your connection to all makes and models of Z-Tacs. Completely refurbished raw, beautiful Zeniths guaranteed working. Prices start at \$30. Canadian sales are welcome as well as state sales, so call 702-895-9120.

HAVE YOU lost your master file for a PAL GAL, or microcontroller? We can help. We work with most Motorola, Intel, Microchip and other microcontrollers. Please call us about all your PIC 16C54 and PIC 16C56 needs. If you have a secured chip, we can read out your program and send you out an unsecured chip and or file on disk. Pricing is quoted per project. We also make and sell custom readers. GAL 16V8 20V8, 22V10, 6001, and 6002, turn around as fast as 48 hours. Call 703-764-5361 and leave a message with your needs, or write to: ACD, Inc., 5765-F, Burke Centre Parkway, Suite 317, Burke, VA 22015.

MASTER COMPONENTS CABLE TV TEST MODULES EXPERT DESIGNS. 1-800-233-0570 See our DISPLAY AD on Page 13.

REMOTE CONTROL and CONVERTER ELIMINATION. Parts and complete units. Sold as-is, and may need repairs. No Florida Sales. 407-676-2530.

ICs DUPLICATED. We can duplicate your memory devices or micros for \$2 each. 1 years experience. We do 16CXX, 17CXX, X68HCXX and other micro's. Call for others! Credit cards OK. **Software City**, Box 23016, Little Rock, AR 72221. FAX 501-223-9466.

(E)PROM PROGRAMMER SYSTEM \$199 (E)EPROMS, 9346, Flash, Gals & Micros. Systems including PICs and Erasers by AMS, Tribal and Xeltec. 24H BBS device updates free to our clients. Build-Your-Own 9346 Programmers too. **TRIANGLE PRODUCT DISTRIBUTOR: USA**, 5750 Lakeshore Dr., Holland, MI 49424. 616-399-6390, M-F 9am to 2pm EST.

WANTED TO buy: Current models Pioneer 5000 and 6000 series, Tocom 5503 VII 5507, SA 8500-321, 8550, 8570, 8580 etc. Jerrold DBBB 7312, PR20C, 7322F DPV 5 212, 210 R3, etc. Call or fax. 718-262-0900, FAX 718-657-4015.

REMOTE VIDEO A-B switch. Operate with a X-10 appliance module for control. Uses 75 ohm "F" connectors. \$36.50. Please check or MO to Nautel, PO Box 236 Nevada City, CA 95959 or 916-273-7674.

MULTI-MODE TEST MODULES for all R, V and CF BLACK UNITS. Extensively tested in every model. Most advanced technology. 2 bucks each. Call for quantity discount. Standard test modules also available. Need the software? Make me an offer. Soon: Multi Mode tracking circuit. 717-462-4657.



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

HOW TO KEEP YOUR VCR ALIVE

\$24.95
Cleverly subtitled VCR REPAIRS ANYONE CAN DO, this book is one of our best sellers. This is probably true because you really don't have to read the whole book! Organized by symptoms, How To Keep Your VCR Alive is written in an easy-to-understand format without the usual

technobabble. Illustrations and appendices provide additional help as you endeavor to keep your vcr up and running.

HOW TO KEEP YOUR VCR ALIVE

Panasonic Nicad Batteries NEW!!!

\$15.00 per package



Thanks to a special purchase, we've got your favorite nicad battery sizes at a price you'll love! 1.25 volt nicad batteries can be recharged upto 1000 times.
Please specify:
D-cell 4 pc package 1200 mAh
C-cell 4 pc package 1200 mAh
AA-cell 8 pc package 500mAh

30 pc. TAMPER-PROOF SECURITY BIT SET \$16.95

Drive bits with hollowed tips designed for those security screws often found in computers and other modern equipment. This set includes 9 different sizes of Torx bits (TT-7 thru TT-40), 4 sizes of square drive bits (S0 thru S3), 7 different sizes of hex bits (from 5/64 to 1/4), as well as flat and Phillips bits, a socket holder, a 1/4" adapter, and a magnetic tipped handle to accommodate all the bits in the set. Handle also has a storage compartment for pocket use, and the complete set comes in a sturdy plastic storage case. Ideal for the bench or toolbox.

NOT-SO-BIG SOLAR PANEL II \$14.95

A smaller version of the popular Big Solar Panel, this 12" X 6" X 3/16" thin film glass solar panel is ideal for experimenters, small applications, and conservative budgets! 21 V no load, 12V 125mA with load.

BIG SOLAR PANEL* \$36.50

A whopping 1' X 3' X 3/16" this thin film glass solar panel puts out a hefty 12-14 volts @ 700-750 mA (3/4A). Imagine this as a power supply for your handheld or other project requiring 12 VDC.

*big solar panel mail order customers please include \$15.00 to cover shipping/handling on this item

PASSIVE INFRARED RECEIVER (PIR) \$14.50

A great find for experimenters, hobbyists and users with a real-world application!!! New boxed with instruction, these PIR units detect motion by temperature. Each unit is self-contained with normally open or closed relay output. Mounts on ceiling like a smoke detector. Operates on 9-12 VDC. Please specify unit:
PIR7540 covers area 40' X 40' PIR75100 covers area 6' X 100'

SCANNER MODIFICATIONS #3 -- THE ULTIMATE SCANNER! \$29.95



Scanner guru Bill Cheek has at long last completed the third scanner book, and it was well worth the wait! From resource listings to computer interfaces, from history to helpful hints, memory mods, cellular mods, and more mods. Circuit diagrams, illustrations, photographs, and tables make this a good book, Bill Cheek's writing style (easy to read and fun!) make this a great book! So grab your scanner, fire up your computer, and embark upon a journey to create your own Ultimate Scanner!

X-BAND TRANSMITTER KIT \$39.95

Great for testing and calibrating radar receiving equipment! Go wild with the latest state-of-the-art technology using teflon PCB, microstripline, surface mounted parts, and GaAs FET's to prove to the world that it is possible for a small package to do big things... and talk about impressive buzz words! The X-band transmitter is ideal for testing long range X-band receiving equipment approximately 15 mV on 10 GHz with FM pulse modulation. CAUTION: this device will activate radar detectors up to 1 mile away. Kit comes complete with all parts, schematic, and 2-1/4" x 3-3/4" x 1" cabinet to give your X-band transmitter a professional appearance. Operates from a 9v battery (not included)

12 Volt 50 Amp Transformer \$29.50*

Ideal for high current power supplies, these units are a compact size (4.5"x3.5"x3.75") to fit comfortably in your latest project!



*mail order customers please add \$7.00 shipping/handling for 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 FREIGHT ARE NOTED) * \$4.25 FOR THE FIRST ITEM, \$0.50 FOR EACH ADDITIONAL ITEM. RESTOCKING CHARGE MAY BE ASSESSED ON RETURNED ITEMS. EVER STOP TO THINK, AND FORGET TO START AGAIN?



ultra low-profile camera with pinhole lens! \$175.00

PINHOLE - that means you can conceal this camera behind almost anything and you only need a hole the size of a pin for it to "see" through! For the super-spy in all of us, here's the latest in little CCD cameras. It is about 1/2" thick and about one square inch (like those little crockers that are good for you!) it can be housed in almost anything due to it's small size. Requires 12 VDC and a little imagination. This camera is a tiny 1.3"x1.3"x0.6", features a pinhole lens, a 0.4 lux 1/3 CCD sensor, 380 lines of resolution, and electronic shutter time of 1/100,000 sec. Whether you're spying on your mother-in-law or navigating your RC car, this is the ultimate in miniature surveillance.

ELECTRONICS TRAINER

\$74.50

No, this unit will not teach your resistors to shake hands or bring you your slippers, but it is a great device for learning about electronics, designing circuits, and testing projects without all the soldering and etching. An ideal item for students, electronics labs, and testbench technicians. Made by Heathkit, the unit features a variable and regulated, positive and negative 1.2 to 15 volt DC power supply, a 200 Hz to 20 kHz variable signal generator with sine wave and square wave outputs, a 15 volt and a 30 volt 60 Hz sine wave signal source, a large breadboard, and 1 K and 100 K ohm potentiometers. Units are like-new - pulled from a large company's in-house training center.



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")

Passive Infra-red Talking Motion Detector III \$27.50



"Stay out of that refrigerator!" "Watch your step!" ... The possibilities are mind-boggling with this talking motion detector. You speak into it to record your message (upto 12 seconds long), turn the unit on, and instantly your voice (or your mother-in-laws) 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".



5 MW LASER MODULE \$55.00

Mini 5 mW visible laser module WAVELENGTH 630 - 680 NM. 3/4" x 1/2" COMPLETE UNIT HAS A built-in power supply and an adjustable CULMINATING LENS. OPERATES ON 3 VOLTS DC (A pair of AA or AAA BATTERIES WORK GREAT)

WARNING: AVOID DIRECT EYE CONTACT

BBBB RAW units tested 10-125 ea. Comm 0007 raw 10-125 ea. V003 in full mode 10-175 ea. 0066RC NIB 30 ea. Raw X2X3 2223 5.00 ea. S&Z raw call 602-254-4931, 10am-4pm Pacific time.

TEST KITS, ALL MAJOR BRANDS IN STOCK WITH INSTRUCTIONS, QUANTITY DISCOUNTS, GREAT PRICES, LATEST TECHNOLOGY, NO BULL GUARANTEE. ORDERS ONLY. CALL 1-800-581-7974, TECH SUPPORT OR INFO. 407-335-9922. NO FLORIDA SALES.

CABLE TV DESCRABLERS. The best price in the nation! We will beat any price! **ALL CABLE SYSTEMS AND SOFTWARE.** Call now for latest prices. **GULF COAST INSTRUMENTS, 1-800-854-8559.**

CABLE DESCRABLER! Build with 7 **RADIO SHACK** parts for **UNDER \$12** Complete instructions. \$8. **FAST, Box 369-VN, Ft. Salerno, FL 34992-0369.**

PLANE JANE converters: 500MHz from \$40, 450MHz from \$28, 400MHz from \$19. Addressable converters from \$80. Also original M80 from \$65, TVT-3G from \$40. Please call, 407-398-9051. No Florida sales.

NEW PV7s tested 10 lot \$180 ea, 5 lot \$200 ea, 1 pc \$225. No NJ sales, 201-728-3217. 10am-6pm EST.

MASTER PROGRAMMING FILES. Memory devices programmed. Reverse engineering. Circuit boards made and much more. 407-676-2530.

WIRELESS CABLE dipole/feedhorn w/built in cable ready downconverter and power supply \$125. About half price. 36 channels. 30dB gain "stinger" type. 512-259-4770. 10AM-6PM CST.

2R/5V/TCF one wire, HRC/STD switchable Ch. #3/4, fast version. Limited time offer. \$14, min. 10. Call 1-800-831-2050.

CABLE HACKERS BIBLE Volume 2. Covers: Tri-Mode, DI, DIC, 400, and Star 6, Sig. 3, SB-3. Fixes, theory, CM/CCM, software for 5503/7 VIP, and more! \$44.95. Catalog, \$3. **VISA/MC 520-782-2316. TELECODE, Box 6426-NV, Yuma, AZ 85366-6426.**

TELEPHONE - FAX

115

CELLULAR HACKERS! The ultimate cellular modification manual is available! It covers NAM maps, scanning, ESN/MIN programming, SID/HESN codes, and keypad and PROM programming methods for 30+ phones. Too much to list! Only \$10 disk version/\$20 paper version. Get a free copy of Motorola programming software with any order! Wow! Bates, 426 West Belmont, Chicago, IL 60657.

HANDHELD CELLULAR PROGRAMMER: The Pro-1 will program an ESN on: Motorola (including Elite), NEC, Sony, GE-Ericsson, Audiovox, and Diamondtel. The Pro-1 allows activation of the programmer phone menus simply by entering pass-words Activate 1 or more menus to begin with, and add other menus later, all without the delay, risk, and cost of sending your valued programmer by mail. **PROGRAMMERS ARE GUARANTEED.** Call 1-800-690-3431 for more info. (Se habla español.)

What is the absolute cheapest way to advertise - and still get great results? The **Nuts & Volts** classifieds! Complete details on page 144

PHONE PHREAKER'S BIBLE. Covers: Boxes, ISDN, MCI services, ANI, direct and international dialing, electronics, pay-phones, glossary of terms, how it's done, box secrets, history of phone phreaking, operator etiquette, phone tapping, tracing, ISDN, and lots more! \$33.45. **VISA/MC 520-782-2316. TELECODE, Box 6426-NV, Yuma, AZ 85366-6426.**

MINIATURE JACKFIELDS. Telephone industry type 19" rack mount jackfields with bantam jacks. Several styles available. Connectorized, \$40/unit. More info? Phone 415-665-5606 or FAX: 415-665-0616.

UNIDEN CELLULAR phone programming, all models, except handhelds. Motorola Brick phones programmed. Digitals & Micro Tac Elites and new TX-400s programmed. Loader TX-300 with IC for \$399 each (no cables or handset). Call 617-764-5000.

PHONE BOX BIBLE. 35 plus plans and articles on phone boxes. Covers: Red, beige, and 22 other boxes. Includes the new "QUARTER" box plans. For educational use only! \$43.45. **VISA/MC 520-782-2316. TELECODE, Box 6426-NV, Yuma, AZ 85366-6426.**

Scanners/CB/Weather Stations

New Scanner Products Available

Now it's easy to purchase communications, emergency management supplies, weather forecasting equipment and more directly from Communications Electronics Inc. Your free fax-on-demand catalog including unadvertised specials is instantly available by calling 313-663-8888 from your fax machine.

Bearcat Scanners

- Monitor police, fire, marine, aircraft, emergency medical transmissions and more with a Bearcat Scanner.
- Bearcat 9000XLT-R base/mobile \$374.95
 - Bearcat 3000XLT-R handheld \$344.95
 - Bearcat 890XLT-R base/mobile/weather alert \$228.95
 - Bearcat 860XLT-R base \$154.95
 - Bearcat 760XLT-R base/mobile \$189.95
 - Bearcat 700A-R information mobile \$148.95
 - Bearcat 560XLA-R base/mobile \$76.95
 - Bearcat 220XLT-R handheld/SPECIAL \$208.95
 - Bearcat 178XLT-R base with weather alert \$128.95
 - Sportcat 150-R handheld with 800 MHz \$159.95
 - Bearcat 148XLT-R base with weather alert \$83.95
 - Bearcat 120XLT-R handheld \$124.95
 - Bearcat 80XLT-R handheld with 800 MHz \$159.95
 - Bearcat BC77-R information mobile \$168.95

Weather Stations

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. 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. Our package deal includes the new ultra high resolution 1/100 inch rain collector part #7852-R, and the external temperature/humidity sensor, part #7859-R. The package deal is order **DAVI-R** for \$479.95 plus \$15.00 shipping. If you have a personal computer, when you order the optional Weatherlink computer software for \$139.95, you'll have a powerful computerized weather station at an incredible price. For the IBM PC or equivalent order part #7862-R. Apple Mac Plus or higher including PowerBook, order part number 7866-R.

- The Weather Monitor II (7440) comes complete with 40 feet of cable, external temperature sensor with 25 feet of cable, junction box with 8 feet of cable, AC power adapter, detailed instruction booklet and a year limited factory warranty.
- Davis Weather Monitor II 7440-R \$334.95
 - Davis Weather Wizard III 7425-R \$154.95
 - Davis Perception II Indoor stand-alone weather monitor 7400-R \$124.95
 - Davis Remote Display Unit 7815-R \$84.95
 - Davis Rain Collector II 0.01" 7852-R \$59.95
 - Davis Rain Collector II 0.2 mm 7852METRIC-R \$59.95
 - Davis Rain Gauge Stand-alone 0.01" 7520-R \$79.95
 - External Temperature/Humidity Sensor 7859-R \$99.95
 - Davis Anemometer Mast Mount 7890-R \$115.95
 - Weatherlink Software for IBM PC/Version 3.0 7862-R \$139.95
 - Weatherlink Software for Apple/Version 3.0 7866-R \$139.95
 - 4-Conductor 40' (12.2 m) extension cable 7876-R \$17.95
 - 4-Conductor 40' (12.2 m) extension cable 7878-R \$21.95
 - 8-Conductor 25' (7.6 m) junction box cable 7880-R \$14.95
 - 8-Conductor 50' (15.2 m) junction box cable 7881-R \$24.95
 - 8-Conductor 100' (30.5 m) junction box cable 7882-R \$44.95
 - Modem Adapter 25-pin for communications port 7870-R \$9.95
 - Car/Bat/TV Lighter Power Cord 7873-R \$9.95
 - 2400 baud modem for Weatherlink MEXT-R \$39.95
 - Talking weather card - Call 313-994-9000 for demo TTI-R \$474.95
 - Weatherlink language disks: Francaise, Deutsche, Italiana, Española 7863-R \$24.95
 - Barometer, Indoor Hygrometer & Thermometer, Clock/Calendar 8488-R \$99.95
 - Indoor/Outdoor Thermometer/Barometer & Hygrometer by OSI 8A213-R \$79.95
 - Thermometer with transparent calendar & clock display by OSI TTI88-R \$19.95
 - Thermometer with AM/FM clock radio by Oregon Scientific CR388-R \$39.95
 - Indoor/Outdoor Thermometer with Jumbo Display by OSI JB880EX-R \$24.95

Bearcat® 9000XLT-R Radio Scanner

Mfg. suggested list price \$769.95/CE Special \$374.95
500 Channels • 20 banks • Alpha numeric display
Turbo Scan • VFO Control • 10 Priority channels
Auto Store • Auto Recording • Reception counter
Frequency step resolution 5, 12.5 & 25 KHz.
Size: 10-1/2" Wide x 7-1/2" Deep x 3-3/8" High
Frequency Coverage:
25,000-549.995 MHz., 760.000-823.995 MHz.,
849.0125-868.995 MHz., 894.0125-1,300.000 MHz.

The Bearcat 9000XLT gives you pure scanning satisfaction with amazing features like TurboScan™ to search VHF channels at 300 steps per second. This base and mobile scanner is ideal for surveillance professionals because it has a selectable attenuator to help eliminate annoying intermodulation from adjacent frequencies in highly populated areas and selectable AM, Wide FM and Narrow FM modes that allow you to change the default receiving mode of the BC9000XLT. 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. **Hi-Cut filter** to help eliminate unwanted static noise. You can even get an optional **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: PS001 Cigarette lighter power cord for temporary operation from your vehicle's cigarette lighter \$14.95; PS002 DC power cord - enables permanent operation from your vehicle's fuse box \$14.95; MB001 Mobile mounting bracket \$14.95; BC005 CTCSS Tone Board \$54.95; EX711 External speaker with mounting bracket & 10 feet of cable with plug attached \$19.95. The BC9000XLT comes with AC adapter, telescopic antenna, owner's manual and one year limited warranty from Uniden.

CB/GMRS Radios

- The Maxon GMRS 210+3 transceiver is a PLL synthesized 10 channel radio on General Mobile Radio Service frequencies. It's the ideal radio for long range communications. Two repeater channels are programmable and one channel (462.675 MHz.) is set aside for emergency and safety communications. The seven remaining interstitial frequencies 462.5625, 462.5875, 462.6125, 462.6375, 462.6625, 462.6875, 462.7125 MHz. are all-purpose GMRS radio channels. 2 watts of RF power for exceptional transmitting range. Up to 5 watts when used with the supplied 12 volt vehicular DC power cord. CTCSS built-in. Includes 450mAh Ni-cad rechargeable battery pack, AC/DC wall battery charger, owner's manual, FCC license application, belt clip, antenna. Call 1-800-USA-SCAN to order.
- Maxon GMRS210+3-R1 GMRS transceiver \$188.95
 - SPECIAL Buy 2 or more GMRS210+3 at \$174.95 each
 - WT1A0T-R1 Ni-cad battery charger for WT1A0GNA & WT1A0GNA \$69.95
 - WT1A0GNA-R1 Ni-cad pack gives 4 watts power with 210+3 \$29.95
 - WT1A0GNA-R1 Ni-cad pack gives 2 watts power with 210+3 \$29.95
 - WT1A0GNA-R1 Alkaline battery case - requires 6 AA batteries \$9.95
 - WT1A0GNA-R1 Carrying case for Maxon GMRS210+3 \$29.95
 - WT1A0G-R1 Speaker/microphone for Maxon GMRS210+3 \$18.95
 - WT1A13G-R1 Push-to-talk mini-VOX headset for GMRS210+3 \$47.95
 - WT1A13-R1 Antenna board w/screw-in male to BNC connector \$9.95
 - ANT4GM-R1 1/4 wave UHF magnetic mount mobile antenna \$29.95
 - Cobra 2010GT-LWX-R SSB base with weather alert \$379.95
 - Cobra 148FGTL-R CB with frequency counter \$209.95
 - Cobra 291TDWX-R CB with weather alert \$114.95
 - Cobra HH40-R CB 40 channel handheld transceiver \$99.95
 - Ranger RC12950-R 25 watt 10 meter transceiver \$239.95
 - Uniden GMR100-R GMRS handheld transceiver \$144.95
 - Uniden WASHINGTON-R SSB CB Base (±25.00 shipping) \$199.95
 - Uniden GRANTXL-R SSB CB Mobile \$139.95
 - Uniden PRO538W-R CB & Weather \$59.95



PAGER OWNERS! Use your pager as a security monitor to monitor your home or business, using the **Telepager** Device. Save that monthly monitoring fee! Call, 410-483-6211.

WHOLESALE: COMMAND RD4000 4 channel ring decoders \$74.95. Caller ID units, fax switches, phone accessories, including the all new **COBRA AN8420 30** minute all digital answering machine with 3 password protected mailboxes. Fabtronics Wholesale, 5714 W. Wautoma Beach, Hilton, NY 14668. 1-800-294-3228, FAX 716-392-1234. MC/Visa. Ask for flyer.

VHF Transceiver

RELM® WHS150-R Transceiver/SPECIAL

Mfg. suggested list price \$481.67/CE price \$299.95
Police and fire departments depend on the RELM WHS150 transceiver for direct two-way communications with their police, fire department, civil defense agency or ham radio repeater. The WHS150 is our most popular programmable 16 watt, 16 channel handheld transceiver that has built-in CTCSS, which may be programmed for any 39 standard EIA tones. Frequency range 148.000 to 174.000 MHz. Will also work 144.000-148.000 with slightly reduced performance. 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 both 5.0 and 6.25 KHz. increments. Other features include 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 WHS150 from Communications Electronics Inc., you'll get a complete package deal including antenna, battery, belt clip and user operating instructions. Other accessories are available. A leather carrying case with swivel belt loop part **LCWHS** is \$49.95; rapid charge battery charger, part **BCWHS** is \$69.95; speaker/microphone, part **SWHS** is \$54.95; extra Ni-cad battery pack, part **FBP007** is \$59.95. The radio technician maintaining your radio system must order programming instructions part **PM150** for \$18.00 to activate this radio. FCC license required for United States operation.

Other neat stuff

- WX704 weather radio with National Weather Service storm alert \$39.95
- WTR USA Today Weather Book. Guide to USA weather by Jack Williams \$15.95
- PSUNAR Party Sunny, Weather Junkie's Guide to Weather by Alan Fields \$11.95
- Grundig Satellit 7004 digital portable shortwave with 512 memory \$459.95
- Grundig Yacht Boy 400A digital portable shortwave - 40 memory \$179.95
- Grundig Yacht Boy 230A portable shortwave receiver \$109.95
- Sangean AT800A-R portable 20 memory shortwave receiver \$69.95
- Sangean AT800A-R portable shortwave w/AC adapter - 9 memory \$129.95
- Sangean AT800A-R1 portable 45 memory shortwave receiver \$129.95
- Uniden EX2920A-R 900 MHz 1 or 2 line spread spectrum cordless phone \$189.95
- Uniden EX2910A-R 900 MHz 1 line cordless spread spectrum telephone \$129.95
- Bogen FR3110-R digital FAX Friday Fax-on-Demand & answering system \$399.95
- Bogen FR3020-R memory module for Fax Friday/Up to 36 minutes \$99.95
- Bogen FR2000-R Digital two-line voice mail & answering machine \$279.95
- Bogen FR018-R memory module, doubles recording time to 36 minutes \$79.95
- FANS P161P-R 60 name/number call ID, unwanted call blocker, paging \$149.95
- SN ID2008 Bouncer name/number call ID, call reject, forward \$89.95
- IDOM CP212-R handheld global positioning system (GPS) \$494.95
- RELM WHS150-R VHF handheld 5 watt, 16 channel transceiver \$299.95
- RELM RH256NB-R VHF 25 watt, 16 channel synthesized transceiver \$289.95
- Ranger RC12950-R 25 watt 10 meter ham radio transceiver \$239.95
- Cobra KDX115W-R Safety Alert & Super Wideband Laser/Radar receiver \$159.95
- Uniden L209000W-R Super Wideband Laser/Radar receiver \$139.95
- ANTK-R VHF scanner/VHF transmitting antenna PL259 connector \$29.95
- ANTMBNCR magnet mount scanner antenna w/ BNC connector \$29.95
- ANTMMOTR magnet mount scan antenna w/Motorola plug \$29.95
- ANTMPLR magnet mount scan antenna with PL259 connector \$29.95
- ANTSGNCR glass mount scanner antenna with BNC connector \$29.95
- ANTSGMTR glass mount scanner antenna with Motorola jack \$29.95

Buy with confidence

It's easy to order from us. Mail orders to: Communications Electronics Inc., P.O. Box 1045, Ann Arbor, Michigan 48106 U.S.A. Add \$15.00 per radio product or weather station for U.S. ground shipping and handling in the continental U.S.A. unless otherwise stated. Add \$10.00 shipping for all accessories and publications. Add \$10.00 shipping per antenna. For Canada, Puerto Rico, Hawaii, Alaska, Guam, P.O. Box, or APO/FPO delivery, shipping charges are two times continental U.S. rates. Michigan residents add state sales tax. No COD's. Satisfaction guaranteed or return item in 31 days for refund, less shipping. 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 or MasterCard. Call anytime 1-800-USA-SCAN or 800-872-7226 to order toll-free. Call 313-996-8888 if outside the U.S.A. FAX anytime, dial 313-663-8888. For technical assistance, call our technical support hotline for \$2.00 per minute at 1-900-555-SCAN. Dealer and international inquiries invited. Dial 313-663-8888 for fax-on-demand info. Price schedule effective 6/1/95 AD #080195XZ. Copyright © 1995 Communications Electronics Inc.

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

COMMUNICATIONS ELECTRONICS INC.
Emergency Operations Center
P.O. Box 1045, Ann Arbor, Michigan 48106-1045 U.S.A.
For information call 313-996-8888 or FAX 313-663-8888

Electronics Made Easy With UCANDO!



UCANDO's unique computer animation makes learning electronics fast and easy. These videos will...teach you more in less time...allow you to learn at your own pace...help you to remember more of what you learn...become a valuable source of reference material...make your understanding of electronics complete...and help you build your future today. Call today and see how UCANDO is...

"Changing The Way The World Learns Electronics."

VT102 Intro to VCR Repair	\$44.95	VT304 Digital 4	\$44.95
VT103 VCR Maint. & Repair	\$29.95	VT305 Digital 5	\$44.95
VT201 Direct Current	\$44.95	VT306 Digital 6	\$44.95
VT202 Alternating Current	\$44.95	VT401 AM Radio	\$44.95
VT203 Semiconductors	\$44.95	VT402 FM Radio Part 1	\$44.95
VT204 Power Supplies	\$44.95	VT403 FM Radio Part 2	\$44.95
VT205 Amplifiers	\$44.95	VT404 TV Part 1 "Intro to TV"	\$44.95
VT206 Oscillators	\$44.95	VT405 TV Part 2 "The Front End"	\$44.95
VT301 Digital 1	\$44.95	VT501 Understanding Fiber Optics	\$44.95
VT302 Digital 2	\$44.95	NEW VT406 TV Part 3 "Audio"	\$44.95
VT303 Digital 3	\$44.95	NEW VT502 Laser Technology	\$44.95

SAVE! Buy any 6 videos for only \$240...OR...Buy any 12 videos for only \$450

SATISFACTION GUARANTEED!

Call Toll Free 1-800-678-6113

or mail check or money order to:

UCANDO Videos, P.O. Box 928, Greenville OH 45331

FREE Shipping ... FREE Catalog

Write in 206 on Reader Service Card.

DIAGNOSTIC TV NOTCH FILTERS

COMPARE OUR QUALITY STANDARDS

PROFESSIONAL CYLINDRICAL CASE DESIGN, HERMETICALLY SEALED. EXCLUSIVE EIGHT STAGE FILTER DESIGN, NO CORNER CUTTING!! YIELDS RAZOR SHARP SELECTIVITY, DEEP CARRIER SUPPRESSION. OUR FILTERS PRODUCE A 75DB EXTRA DEEP NOTCH!! EVERY FILTER IS INDIVIDUALLY INSPECTED & PROOF TESTED ON A SPECTRUM ANALYZER, OUR QUAL. CONTROL IS SECOND TO NONE!! PERFECT FOR MAINTAINING DIAGNOSTIC TEST MODE WHILE YOU ARE REPAIRING OR TESTING CABLE CONVERTERS, OR SUPPRESSION OF STRONG INTERFERING FM CARRIERS. . SUCH AS HERRINGBONE.

THESE FILTERS ARE CUSTOM MADE EXCLUSIVELY FOR US BY THE LEADING FILTER MANUFACTURER IN TAIWAN AND EXCEED INDUSTRY SPECIFICATIONS.

NOTICE: WE DO NOT SELL POSITIVE TRAPS OF ANY KIND!!

THE SALE OF THIS PRODUCT IS LIMITED TO QUALIFIED BENCH TECHNICIANS, MSO'S & CABLE COMPANY REPAIR DEPARTMENTS. THESE PRODUCTS ARE DESIGNED FOR THE EXPRESS PURPOSE OF TESTING AND REPAIRING CABLE CONVERTERS, MAINTAINING CABLE CONVERTERS IN DIAGNOSTIC TEST MODE, AND SUPPRESSION OF FM CARRIER INTERFERENCE. . . . SUCH AS IN HERRINGBONE PATTERNS!!

ANYONE IMPLYING THEFT OF SERVICE IN ANY WAY SHAPE OR FORM, WILL BE DENIED SALE. . . SORRY NO PA. SALES!! . . WE SHIP UPS AND FEDERAL EXPRESS!!



VISUAL COMMUNICATIONS INC.

FOR ORDERS ONLY

1-800-462-2253

TECH. SUPPORT

717-620-4363



REMOTE VIDEO SYSTEMS

NEW CAMERAS
Series 65 B/W,
Reduced \$ 125.00
PINHOLE-Special
at only \$ 145.00

Color cameras, 2 to choose from:
Low LUX (2L) low power @ \$325 or Small size (20lux) higher power @ \$275.
MEMBER R.C.T.V. ASSOC.

UNDERWATER
SVS Series Dn. to 100 ft.
1.8" dia. x 2.4" (L) cbl xtra
SVS 60: \$ 489.00
SVS 1: \$ 459.00
25' std, 50-100 add \$

TRANSMIT VIDEO TO ANY TV

Our MiniLink II™ 2.4GHz transmitter and receiver are all you need to legally transmit audio-video (B/W or color) to any TV set. **FCC approved** Range: 500' up to 1* mile. Trans: \$640; Receiver: \$770. w/std ant. *With optional add on antenna. Patch Ant. \$139, Dish \$156.

CALL TODAY FOR FREE CATALOGUE

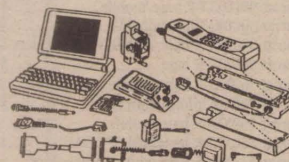


MICRO VIDEO PRODUCTS

Orders: (800) 473-0538 FAX (714) 847-4486 Tech. info: 714 842-4648
16201 Osborne St. Westminster, Ca. 92683 Satisfaction Guaranteed



ESN LOADER INTERFACE for Motorola bag phones allows ESN transfer on newer phones (ver. 9122-94xx). Does all flips, micro-tacs, ultra-lites, pocket phones, ultra-classics, series three and four bag, install phones \$200, \$200 amps also! Uses standard programming cables and connects to your PC. Payment by US Postal Money Order. Call 512-259-4770. Keith Perry, PO Box 816, 607 Osage Drive, Leander, TX 78646-0816. Internet: cia@paranoia.com.



UNION JACK'S®, MOTOROLA CELLULAR PHONE, AMPS/NAMPS EMULATOR PROGRAMMING SYSTEM (FOR BRICK-UC, FLIP & BAG PHONES). UJMP-1 SOFTWARE SET, 5 EACH, 3.5" 1.44MB DISKS, MFDP-1: Programs firmware below 9122s without a loader phone, MFDP2: Programs firmware 9122 to 9340 with a loader phone (FLIP-BRICK OR BAG, having a firmware below 9122) FDP3, 4 & 5 are a conglomerate of Cellular emulating etc., information. 60-page illustrated programming manual included. **FREE technical backup & yearly updates. 4-DISK SOFTWARE SET UJMP-1 \$199.95 COMBINATION OFFER (A), SAVE \$50, COMPLETE REPROGRAMMING SYSTEM \$419.95, CONSISTS OF 1 SET UJMP-1 \$199.95, 3 TYPES MOTOROLA COMPATIBLE, COMPUTER PROGRAMMING CABLE HARDWARE SETS, 1-6PCS-CSFP FOR FLIP-POCKET PHONES \$99.95, 1-3PCS-CS689/UC FOR BRICK/ULTRA CLASSICS \$99.95 AND 1-3PCS-BP FOR BAG PHONES \$69.95. *PRICES: Computer-Cellular loader phone not included. S&H: UPS COD CASH ONLY, 2ND DAY AIR \$12. **FREE 2 PAGES OF ADDITIONAL INFORMATION & COMBINATION PRICES, AVAILABLE BY MAIL OR FAX. CALL LES, LESS BUSTERS ELECTRONICS, 702-642-0325, 2039 CIVIC CENTER DRIVE #176, N. LAS VEGAS, NV 89030.****

CELL PHONE cloning for the guy who has (two of) everything. Must have current service contract. Motorola, Tandy. For more info, call Keith 512-259-4770.

12 HOUR TELEREORDER complete unit. Records automatically and clearly all telephone conversations 12 hours on a single tape. Special offer just \$79 including shipping. Send cheque to Vakis Efthychiou, 1402 Pine Ave. #400, Niagara Falls, NY 14301. Dealers wanted.

CELLULAR TELEPHONE. Reprogram from your computer, Motorola bag changed in minutes. Compare, ours is at a much lower cost. Software & manual \$199. Voice or FAX 903-389-8352. Call now. MC/VISA, COD. Loader phone kits, \$150.



\$44.95 CELLULAR PHONE, MOBILE STARTER KITS. COMPATIBLE, MOTOROLA FLIP/POCKET, NOKIA 232/RADIO SHACK 352, H-H CELLULARS. SERIES A: NEW STYLE, AUTOMATIC DUAL MODE (QUICK-TRICKLE) BATTERY CHARGER \$29.95 EACH. DUAL COLORED LED INDICATES BOTH CHARGE MODES, ELIMINATES BATTERY PROBLEMS. WILL NOT OVERCHARGE BATTERY. INPUT VOLTAGE 12-24 VDC FOR CAR, BOAT, ETC. MODEL ACM FOR MOTOROLA FLIP/POCKET PHONES, MODEL ACNRS FOR NOKIA 232/RADIO SHACK CT-352. SERIES B: BATTERIES \$29.95 EACH, COLOR DARK GRAY, MOTOROLA MODEL BBEM 1070MA, 120 MINUTES EXTENDED TALK, THICKNESS 3/4" T. MODEL BBSM 800MA 95 MINUTES TALK, 5/8" T. NOKIA 232/RADIO SHACK CT-352, MODEL BBENRS, 800MA 110 MINUTES TALK, 5/8" T. SERIES C: DELUXE BLACK, LEATHER CARRY CASE, \$29.95 EACH. ROBUST, RIVETED BELT CLIP, DETACHABLE WRIST CARRY STRAP, SOFT TOUCH PLASTIC, KEY PAD COVER. MOTOROLA FLIP PHONE MODEL CMCFP, POCKET PHONES 1200/200 MODEL CMCPF, NOKIA 232/RADIO SHACK CT-352 MODEL CN/RS. DISCOUNT, COMBINATION SALE, 1 EACH OF SERIES A, B, & C \$59.95, ELSEWHERE \$99 OR MORE. 1 EACH SERIES A&B, A&C, B&C, B&A, C&A, OR C&B \$44.95. **FREE S&H VIA PRIORITY MAIL. UPS, COD, ADD \$4.50. CHECK/MO. LESS BUSTERS ELECTRONICS, 2039 CIVIC CENTER DRIVE #176, N. LAS VEGAS, NV 89030. CODs/CATALOG, CALL 702-642-0325.**

CELL PHONE vehicle mounted RF amps model EB-PO385 unused \$15. BPE Associates 1977 High Street, Longwood, FL 32750. 407-330-3408, FAX 407-330-3498.

CELLULAR PROGRAMMING cables and equipment, for our current prices contact us via E-Mail at capcon.ix.netcom.com or FAX us at 508-977-00122. Direct mail request can be sent to CCS at PO Box 3315, Peabody, MA 01961.

Accept Credit Cards and Increase Your Sales!

MasterCard, Visa, American Express*, Discover*

All Types of Businesses Considered

Why limit yourself to only customers with cash in their pocket or checking account? Accept credit cards and you open the door to the rest of the buying public!

Jim Krause will pay your sign-up fee to Cardservice International (Limited time offer)

No sign-up fees if you act now!

Call or Fax for Free Info:

Jim Krause, Cardservice

Voice & Fax (310) 694-0565

Cardservice International, A Registered Agent for Bank of Oakland, Oakland, CA; First Bank of Beverly Hills, Calabasas, CA; Humboldt Bank, Eureka, CA; Redding Bank of Commerce, Redding, CA; Tehama County Bank, Red Bluff, CA (All Banks FDIC Insured)

*American Express & Discover subject separate approval

Write in 125 on Reader Service Card.

ESN READER connects between scanner and personal computer, reads and logs to disk. Scanner and computer not included. \$895 US postal money order to K. Perry, PO Box 816, Leander, TX 78646-0816. SASE for info.

TELECODE™

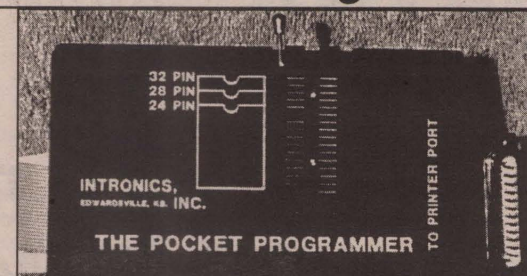
CELLULAR HACKERS BIBLE VOLUME 2

Covers: NAM format maps reverse voice channel hacking, RVC & FOCC message, unit ID code hacking, SID, control channel frequencies, reverse scanning, Mitsubishi M800 modifications, data stream encoding, control channel signalling, qualification codes, central office codes, 40-50 MHz television tuner hack, ESN codes, ESN/MIN scanning hack. PLUS! Software to program Motorola bag, flip, brick, (9121 plus Amps-G21), Nokia, NEC, Radio-Shack, Panasonic, and Mitsubishi phones. WOW! All this and much more. \$79.95 PPD. Specify 1.2/1.44MB. **CELLULAR PROGRAMMERS BIBLE** 250+ programming instructions, \$54.45 **BAGPHONE VIDEO BIBLE**. New video shows and tells ALL about Radio Shack bagphones. Covers: ESN, cloning, resurrecting "dead phones," checksums, security, covers R-S and Nokia phones, \$39.95. **VISA/MC** 1-520-782-2316 or **FAX** 520-343-2141. **TELECODE**, Box 6426-NV, Yuma, AZ 85366-6426.

FIVE ESN/NAM modification installed in your OKI 900 for \$350. Chip only \$250. This one works great! Other OKI stuff, too. Call Keith at 512-259-4770.

CELLULAR HACKERS! Hot new software programs up to 39 different phones using your PC. All Motorola phones! Nokia, OKI, Novatel, etc. 8.6 megabytes of info. covers ESN/NAM programming, test modes everything! manual and diagrams to make own cables included. Guaranteed! No need to spend \$200 or more! Mention Nuts and Volts, get a disk of unbelievable underground stuff! Hot! Order now! \$99.95 to: Bates, 426 West Belmont, Chicago, IL 60657. Phone, 312-213-7023.

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

Write in 169 on Reader Service Card.

LOWEST PRICES on Underground Information and Products including Hacking, Phreaking, Cellular, Electronics, Viruses, Anarchy, Scanners, Cable-TV, Encryption, Wardialers, Internet, and many other items. **Disks as low as \$3.** Send \$1 or SASE for current catalog. **Byte Bandits**, PO Box 861, North Branford, CT 06471.

CALLER ID in your PC! Patented Pass and Block feature for **COMPUTER ACCESS SECURITY!** 8-bit card with software. Database included. Pager Forwarding. More. Technical reference to write your own applications. Now only \$109.95! **Pewee Valley Innovations, Inc.**, 6601 Old Zaring Road, Crestwood, KY 40014. 502-241-4295.

TURN ON YOUR CELLULAR PHONE through key-pad programming. Manual \$22. Cabletronics, Box 30502N, Bethesda, MD 20824.

FREE DISCOUNT calling card! You pay only 17-1/2¢ per minute with no surcharge. Save up to 69% on all your phone calls away from home or office. Send SASE for free application. **Sordillo**, PO Box 927, Dept. FC, Skowhegan, ME 04976.

OFFER A-KSU-LESS business phone system with plenty cordless phone big discount. Remote control answering system. Home telephones, etc. 216-456-8177. **Alex Mastin (Ent)**, 1107 85th Street NE, Canton, OH 44704.

PHONE BOXES REVEALED. Plans and instructional articles on box usage. Covers blue, red, beige, and many more. For educational use only. \$20. **DC Publications**, 2235 Green Dr., El Cajon, CA 92019.

CELLULAR SURPLUS PHONES \$19. Complete cellular handset phone. Great for hams and experimenters. All phones checked for transmit and receive function. For more info E-Mail wduncell@aol.com or call 408-272-3075. Send \$19 per cellular and \$3.50 for shipping costs in check or money order to **Walter Duncell**, 1941 Primo Court, San Jose, CA 95131. Order 3 or more phones and get a free battery pack.

FREE CALLS! Plans to build a Red box using a Radio Shack tone dialer. Now affordable. Sells elsewhere for \$50, here only \$19.95. Send check or money order to: **Bates**, 5541 West Quincy, Chicago, IL 60644.

DESCRAMBLERS

NEED Only 1,2/More Descrambler Combos?

We **GUARANTEE** to beat anyone's similar "All In One Special" pricing on orders of 1, 2, 3...25+ (Basebands or used equipment not included)

ALL IN ONE SPECIALS:		Quantity
Converter/Descrambler "One Piece" unit means no more messy wires or power supply cables required. Brand new.		1-5 5-20
ViperII...Replace TNT, TTV, Merlin, FTB systems	\$125	CALL
Viper800...Replace Scientific Atlanta 8600 & lower	\$145	CALL
SSA-80...Replace SA8600, 8590, 80, 70, 55, & lower	\$140	CALL
Novavision Replace SA, TNT, TTV, Merlin, FTB, Pioneer	\$LOWEST	

PANS

TVT-3G...\$32 PIONEER...\$55
STEALTH...\$39 FTB...\$32
M80...\$49 N12(OAK)...\$40

CABLES

Coax (6ft)...\$2.50
Coax (3ft)...\$2.00
Coax (1ft)...\$1.50

CONVERTERS (1..25+)

Millennium3...Best Price Guarantee

RX11 Video Stabilizer...\$20 remove all copyright, jitter color fade from your home VHS tapes.

PM ELECTRONICS

IF YOU DON'T CALL WE BOTH LOSE

OUR PRICES SPEAK FOR THEMSELVES

(909) 688-1768

MONEY BACK GUARANTEE

Write in 199 on Reader Service Card.

Decco Electronics

4025 Edwards Road, Cincinnati, OH 45209

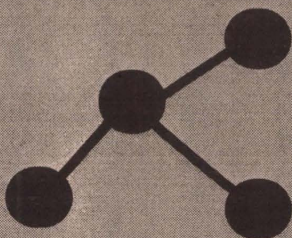
Toll Free Order Hot Line 1 (800) 423-4499

Information - (513) 531-4499

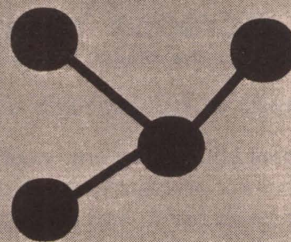
Millions of Chips, Transistors and Electronic Components in Stock!

74LS00	45	LM338	75	LM309	89	ULN2803	119
74LS01	45	LM337	75	LM309	425	ULN2877	339
74LS02	45	LM337	75	LM310	230	ULN2878	339
74LS03	45	LM337	75	LM311	—	LM201	—
74LS04	45	LM337	75	LM312	—	LM203	49
74LS05	45	LM337	75	LM313	—	LM204	49
74LS06	45	LM337	75	LM314	—	LM205	49
74LS07	45	LM337	75	LM315	—	LM206	49
74LS08	45	LM337	75	LM316	—	LM207	49
74LS09	45	LM337	75	LM317	—	LM208	49
74LS10	45	LM337	75	LM318	—	LM209	49
74LS11	45	LM337	75	LM319	—	LM210	49
74LS12	45	LM337	75	LM320	—	LM211	49
74LS13	45	LM337	75	LM321	—	LM212	49
74LS14	45	LM337	75	LM322	—	LM213	49
74LS15	45	LM337	75	LM323	—	LM214	49
74LS16	45	LM337	75	LM324	—	LM215	49
74LS17	45	LM337	75	LM325	—	LM216	49
74LS18	45	LM337	75	LM326	—	LM217	49
74LS19	45	LM337	75	LM327	—	LM218	49
74LS20	45	LM337	75	LM328	—	LM219	49
74LS21	45	LM337	75	LM329	—	LM220	49
74LS22	45	LM337	75	LM330	—	LM221	49
74LS23	45	LM337	75	LM331	—	LM222	49
74LS24	45	LM337	75	LM332	—	LM223	49
74LS25	45	LM337	75	LM333	—	LM224	49
74LS26	45	LM337	75	LM334	—	LM225	49
74LS27	45	LM337	75	LM335	—	LM226	49
74LS28	45	LM337	75	LM336	—	LM227	49
74LS29	45	LM337	75	LM337	—	LM228	49
74LS30	45	LM337	75	LM338	—	LM229	49
74LS31	45	LM337	75	LM339	—	LM230	49
74LS32	45	LM337	75	LM340	—	LM231	49
74LS33	45	LM337	75	LM341	—	LM232	49
74LS34	45	LM337	75	LM342	—	LM233	49
74LS35	45	LM337	75	LM343	—	LM234	49
74LS36	45	LM337	75	LM344	—	LM235	49
74LS37	45	LM337	75	LM345	—	LM236	49
74LS38	45	LM337	75	LM346	—	LM237	49
74LS39	45	LM337	75	LM347	—	LM238	49
74LS40	45	LM337	75	LM348	—	LM239	49
74LS41	45	LM337	75	LM349	—	LM240	49
74LS42	45	LM337	75	LM350	—	LM241	49
74LS43	45	LM337	75	LM351	—	LM242	49
74LS44	45	LM337	75	LM352	—	LM243	49
74LS45	45	LM337	75	LM353	—	LM244	49
74LS46	45	LM337	75	LM354	—	LM245	49
74LS47	45	LM337	75	LM355	—	LM246	49
74LS48	45	LM337	75	LM356	—	LM247	49
74LS49	45	LM337	75	LM357	—	LM248	49
74LS50	45	LM337	75	LM358	—	LM249	49
74LS51	45	LM337	75	LM359	—	LM250	49
74LS52	45	LM337	75	LM360	—	LM251	49
74LS53	45	LM337	75	LM361	—	LM252	49
74LS54	45	LM337	75	LM362	—	LM253	49
74LS55	45	LM337	75	LM363	—	LM254	49
74LS56	45	LM337	75	LM364	—	LM255	49
74LS57	45	LM337	75	LM365	—	LM256	49
74LS58	45	LM337	75	LM366	—	LM257	49
74LS59	45	LM337	75	LM367	—	LM258	49
74LS60	45	LM337	75	LM368	—	LM259	49
74LS61	45	LM337	75	LM369	—	LM260	49
74LS62	45	LM337	75	LM370	—	LM261	49
74LS63	45	LM337	75	LM371	—	LM262	49
74LS64	45	LM337	75	LM372	—	LM263	49
74LS65	45	LM337	75	LM373	—	LM264	49
74LS66	45	LM337	75	LM374	—	LM265	49
74LS67	45	LM337	75	LM375	—	LM266	49
74LS68	45	LM337	75	LM376	—	LM267	49
74LS69	45	LM337	75	LM377	—	LM268	49
74LS70	45	LM337	75	LM378	—	LM269	49
74LS71	45	LM337	75	LM379	—	LM270	49
74LS72	45	LM337	75	LM380	—	LM271	49
74LS73	45	LM337	75	LM381	—	LM272	49
74LS74	45	LM337	75	LM382	—	LM273	49
74LS75	45	LM337	75	LM383	—	LM274	49
74LS76	45	LM337	75	LM384	—	LM275	49
74LS77	45	LM337	75	LM385	—	LM276	49
74LS78	45	LM337	75	LM386	—	LM277	49
74LS79	45	LM337	75	LM387	—	LM278	49
74LS80	45	LM337	75	LM388	—	LM279	49
74LS81	45	LM337	75	LM389	—	LM280	49
74LS82	45	LM337	75	LM390	—	LM281	49
74LS83	45	LM337	75	LM391	—	LM282	49
74LS84	45	LM337	75	LM392	—	LM283	49
74LS85	45	LM337	75	LM393	—	LM284	49
74LS86	45	LM337	75	LM394	—	LM285	49
74LS87	45	LM337	75	LM395	—	LM286	49
74LS88	45	LM337	75	LM396	—	LM287	49
74LS89	45	LM337	75	LM397	—	LM288	49
74LS90	45	LM337	75	LM398	—	LM289	49
74LS91	45	LM337	75	LM399	—	LM290	49
74LS92	45	LM337	75	LM400	—	LM291	49
74LS93	45	LM337	75	LM401	—	LM292	49
74LS94	45	LM337	75	LM402	—	LM293	49
74LS95	45	LM337	75	LM403	—	LM294	49
74LS96	45	LM337	75	LM404	—	LM295	49
74LS97	45	LM337	75	LM405	—	LM296	49
74LS98	45	LM337	75	LM406	—	LM297	49
74LS99	45	LM337	75	LM407	—	LM298	49
74LS100	45	LM337	75	LM408	—	LM299	49
74LS101	45	LM337	75	LM409	—	LM300	49
74LS102	45	LM337	75	LM410	—	LM301	49
74LS103	45	LM337	75	LM411	—	LM302	49
74LS104	45	LM337	75	LM412	—	LM303	49
74LS105	45	LM337	75	LM413	—	LM304	49
74LS106	45	LM337	75	LM414	—	LM305	49
74LS107	45	LM337	75	LM415	—	LM306	49
74LS108	45	LM337	75	LM416	—	LM307	49
74LS109	45	LM337	75	LM417	—	LM308	49
74LS110	45	LM337	75	LM418	—	LM309	49
74LS111	45	LM337	75	LM419	—	LM310	49
74LS112	45	LM337	75	LM420	—	LM311	49
74LS113	45	LM337	75	LM421	—	LM312	49
74LS114	45	LM337	75	LM422	—	LM313	49
74LS115	45	LM337	75	LM423	—	LM314	49
74LS116	45	LM337	75	LM424	—	LM315	49
74LS117	45	LM337	75	LM425	—	LM316	49
74LS118	45	LM337	75	LM426	—	LM317	49
74LS119	45	LM337	75	LM427	—	LM318	49
74LS120	45	LM337	75	LM428	—	LM319	49
74LS121	45	LM337	75	LM429	—	LM320	49
74LS122	45	LM337	75	LM430	—	LM321	49
74LS123	45	LM337	75	LM431	—	LM322	49
74LS124	45	LM337	75	LM432	—	LM323	49
74LS125	45	LM337	75	LM433	—	LM324	49
74LS126	45	LM337	75	LM434	—	LM325	49
74LS127	45	LM337	75	LM435	—	LM326	49
74LS128	45	LM337	75	LM436	—	LM327	49
74LS129	45	LM337	75	LM437	—	LM328	49
74LS130	45	LM337	75	LM438	—	LM329	49
74LS131	45	LM337	75	LM439	—	LM330	49
74LS132	45	LM337	75	LM440	—	LM331	49
74LS133	45	LM337	75	LM441	—	LM332	49
74LS134	45	LM337	75	LM442	—	LM333	49
74LS135	45	LM337	75	LM443	—	LM334	49
74LS136	45	LM337	75	LM444	—	LM335	49
74LS137	45	LM337	75	LM445	—	LM336	49
74LS138	45	LM337	75	LM446	—	LM337	49
74LS139	45	LM337	75	LM447	—	LM338	49
74LS140	45	LM337	75	LM448	—	LM339	49
74LS141	45	LM337	75	LM449	—	LM340	49
74LS142	45	LM337	75	LM450	—	LM341	49
74LS143	45	LM337	75	LM451	—	LM342	49
74LS144	45	LM337	75	LM452	—	LM343	49
74LS145	45	LM337	75	LM453	—	LM344	49
74LS146	45	LM337	75	LM454	—	LM345	49
74LS147	45	LM337	75	LM455	—	LM346	49
74LS148	45	LM337	75	LM456	—	LM347	49
74LS149	45	LM337	75	LM457	—	LM348	49
74LS150	45	LM337	75	LM458	—	LM349	49
74LS151	45	LM337	75	LM459	—	LM350	49
74LS152	45	LM337	75	LM460	—	LM351	49
74LS153	45	LM337	75	LM461	—	LM352	49
74LS154	45	LM337	75	LM462	—	LM353	49
74LS155	45	LM337	75	LM463	—	LM354	49
74LS156	45	LM337	75	LM464	—	LM355	49
74LS157	45	LM337	75	LM465	—	LM356	49
74LS158	45	LM337	75	LM466	—	LM357	49
74LS159	45	LM337	75	LM467	—	LM358	49
74LS160	45	LM337	75	LM468	—	LM359	49
74LS161	45	LM337	75	LM469	—	LM360	49
74LS162	45	LM337	75	LM470	—	LM361	49
74LS163	45	LM337	75	LM471	—	LM362	49
74LS164	45	LM337	75	LM472	—	LM363	49
74LS165	45	LM337	75	LM473	—	LM364	49
74LS166	45	LM337	75	LM474	—	LM365	49
74LS167	45	LM337	75	LM475	—	LM366	49
74LS168	45	LM337	75	LM476	—	LM367	49
74LS169	45	LM337	75	LM477	—	LM368	49
74LS170	45	LM337	75	LM478	—	LM369	49
74LS171	45	LM337	75	LM479	—	LM370	49
74LS172	45	LM337	75	LM480	—	LM371	49
74LS173	45	LM337	75	LM481	—	LM372	49
74LS174	45	LM337	75	LM482	—	LM373	49
74LS175	45	LM337	75	LM483	—	LM374	49
74LS176	45	LM337	75	LM484	—	LM375	49
74LS177	45	LM337	75	LM485	—	LM376	49
74LS178	45	LM337	75	LM486	—	LM377	49
74LS179	45	LM337	75	LM487	—	LM378	49
74LS180	45	LM337	75	LM488	—</		

BATTERIES:



PLAYING PINBALL WITH ATOMS



by Tim Hawkins

A battery is much like a pinball game; you stack up electrons on one side of the battery just as you would stack up pinballs at the shooter on a pinball game. Each pinball shot brings on a multitude of reactions, such as flashing lights, buzzers, bells, and whistles. Batteries can do such things by sending electrons through a wire conductor.

When you run out of pinballs and there are no quarters left, the fun is all over. When the excess electrons on the negative side of the battery are shifted to the positive side and there is no way of getting them back, the fun is all over, or, plan on having your fun in the dark.

To fully understand how a battery works one must look at the merging of physics and chemistry; EMF (electromotive force), or voltage, is produced by means of chemical manipulation to force positive ions towards the cathode (+) terminal of the battery, while at the same time, forcing negative ions towards the anode (-) terminal. We are going to concentrate on the lead-acid type "storage" battery, such as the common type found on mobile equipment, automobiles, and boats. A storage battery is simply one which is rechargeable.

Atoms and Ions

The important concept in the operation of a battery is that of what ions are, and how they are formed. This process is not only the central theme in the operation of batteries — it extends to just about every cause-effect process that happens in the world, including corrosion.

An ion is an atom (it could be a hydrogen atom which normally has one proton and one electron, or a silver atom that normally has 47 protons and 47 electrons), with a greater number of electrons than protons, or visa versa.

To help in understanding how ions are formed, it is useful to review two important conditions that atoms seem to strive for,

which are based on hundreds of years of observation by physicists and chemists. These conditions are:

1) Atoms, either single or in groups (which include compounds — atoms with differing atomic numbers), tend to want to have the same number of electrons as protons.

2) Many types of atoms (but not all) want to have eight electrons in their outer or "valence" orbit. This is called the "octet rule." One exception is the hydrogen atom which has only one valence electron. Hydrogen tends to want two electrons spinning in its valence orbit.

Some atoms enjoy the best of both these worlds. These atoms naturally have eight electrons in their valence orbits. Elements which fall into this category are the gases helium, neon, and argon. These elements don't feel the need to be social and bond to other atoms to share their electrons; neither do they feel the need to "steal" electrons from elsewhere. For this reason they are considered "inert." A major player in the lead-acid pinball game which does not fall into this category is the oxygen atom.

That Rascal, the Oxygen Atom

Oxygen is often viewed as a saintly character complete with halo and slightly closed eyes. It is referred to as "the breath of life." This is probably because we, as highly complex organisms, have evolved to make use of this highly tenacious and influential element. If

one looks more closely at the interactions of this element, then it could be considered more of an "electron-thirsty trouble-maker."

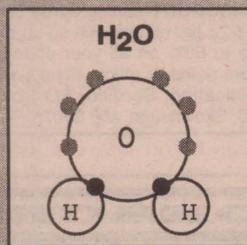
Oxygen normally has eight electrons; two of these electrons, however, reside in the first electron orbit or "energy level." This leaves it with six electrons in the valence orbit. Every oxygen atom wants dearly to have eight electrons in its valence orbit. This hunger for those extra electrons is referred to as being "electronegative." Oxygen is, in fact, the second most electronegative element (the first is fluorine, with seven electrons in its valence orbit).

Suppose you are an atom that does not have eight electrons packed nice and tightly in your valence orbit (you are not inert). You are sitting in a room and an oxygen atom walks in. At this point you probably have three options:

Option 1 • Run very, very fast; this option may not be available to you.

Option 2 • Covalently bond with the oxygen atom and share your electrons with it.

An example is when two hydrogen atoms cling to an oxygen atom to form a water molecule.



Option 3 • Give up an electron to the oxygen atom in which case you become a positive ion and it becomes a negative ion. This is the interaction we take advantage of in batteries.

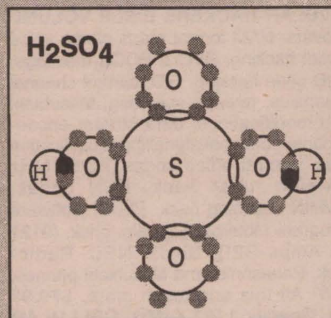
Option number one is not viable in our battery because a battery is very much like a closed room with a floor, a ceiling, four walls, and nowhere to go. Option number three describes the process of "oxidation" (loss of electrons by an atom) and "reduction"

(a gain of electrons by an atom). The term "oxidation" comes from our electron-thirsty oxygen atom.

The Plot Thickens with Acids

Our story gains a soap-opera quality with the introduction of another character to form a chemical group of elements called the "acids." This new character is called sulfur.

Sulfur has 16 protons and 16 electrons, with six of those electrons being in its valence orbit. Sulfur, like oxygen, is electronegative, but is a bit less electron-thirsty because its six valence electrons are located further from the nucleus of the atom. When we combine oxygen, sulfur, and hydrogen together we come up with the acid compound sulfuric acid.

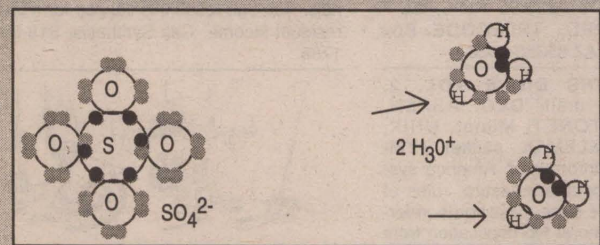


In this group, everyone is happy because each atom has the normal amount of both electrons and protons. In addition, the one sulfur atom and four oxygen atoms all have eight electrons in their valence orbits.

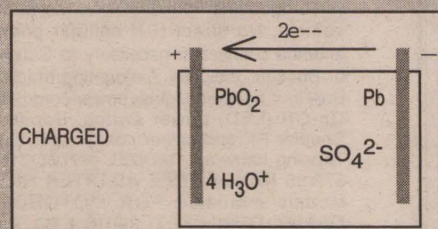
The two hydrogen atoms seem to be content with two electrons in their valence orbits.

All acids have hydrogen atoms. A unique feature of acids is that all or some of these hydrogen atoms are stripped of their electrons when mixed with water to form hydrogen ions. These ions are nothing more than lonely protons that migrate to the oxygen sides of the water molecules. In this state, the sulfur-oxygen parts of the solution have a negative charge (more electrons) and the hydrogen-oxygen parts of the solution have a positive charge

(more protons).

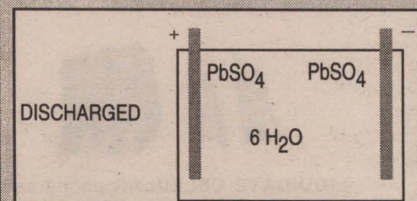


One more character is brought into our room: lead (Pb). Actually there are two, one piece of lead on one side, and some lead-dioxide (lead with two oxygen components clinging on) on the other side. When oxygen bonds with other atoms a "polar" molecule is created. The oxygen side has most of the electrons. Positive ions tend to be attracted to these areas. The lead-oxide terminal in our battery, therefore, becomes the cathode (+), while the lead terminal becomes the anode (-).



Pinballs are Loaded

Our battery is now like a pinball machine with a freshly-inserted quarter. If we externally connect the terminals with a conductor, and some resistance, we send electrons from the anode (-) to the cathode (+). As this happens, both the lead and lead-oxide become lead sulfate. The acid also changes to water.



One way to measure the state-of-charge of the battery is to determine how close the electrolyte (our mixture of acid and water) is to pure water. We use a unit of measurement called specific gravity to determine this state. Specific gravity is the ratio of the density of a fluid (in this case sulfuric-acid) divided by the density of water:

$$\text{specific gravity} = \frac{\text{density of fluid}}{\text{density of water}}$$

If the electrolyte turns to pure water, the specific gravity reading would be 1. The specific gravity

reading of a fully charged battery is usually about 1.26 or above.

The tool used to measure specific gravity is a hydrometer. This is a large test-tube looking unit which is used to suck up some of the electrolyte solution. It has a float apparatus in it which sinks to a lower level the less dense the fluid is. The float lines up with graduations marked on the tube to give readings. Listed below are some common readings:

Specific Gravity	Charge State of Battery
1.26 and above	Fully Charged
1.25	75% Charged
1.22	50% Charged
1.19	25% Charged
1.13 and below	Discharged

One must keep in mind the mixing process that goes on in the electrolyte, during both charge and discharge. After charging, for instance, it may take some amount of time before an accurate specific gravity reading can be taken to determine the true state-of-charge of the battery. Likewise, during an intense period of discharge (such as the continual cranking of an engine that refuses to come to life) which results in a dead battery, the acid in the immediate vicinity of the lead plates is converted to lead-sulfate first. After a period of time, more acid finds its way towards the lead plates giving a new burst of energy (and another chance to start that stubborn engine).

Replay or Tilt?

Bringing a battery down to an

- Do not allow battery acid to contact the eyes, skin, or any clothing. Acids can cause severe burning. A mixture of water and baking soda will neutralize the acid.

- Be sure the batteries are mounted in a well-ventilated location and away from sources of flame or spark. Toward the end of the charging cycle (and during over-charging), oxygen and hydrogen gases may be emitted. Hydrogen is a highly flammable gas in the presence of oxygen.

- Avoid overcharging, which will cause oxygen and hydrogen gases to boil off.

- Do not let the electrolyte level of each cell fall below the top of the lead plates.

- Avoid using anything but distilled water when maintaining the electrolyte level. Tap water contains minerals and other substances which can collect at the bottom of the battery case, eventually shorting out the plates.

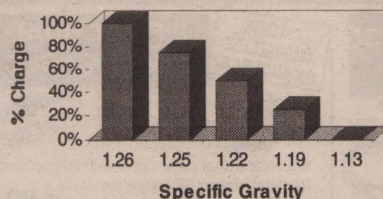
- Keeping a cranking battery at or near full charge, will increase its life expectancy.

- Leaving a battery in a state of discharge leads to crystallization and flaking of the lead sulfate on the positive plates. When transporting a discharged battery, try to avoid excess jarring, which can make lead sulfate

extreme state of discharge before recharging, is known as "deep cycling." During repeated deep cycling the lead sulfate (PbSO_4) tends to flake off the positive plates to the bottom of the battery case during the discharge part of the cycle. If enough accumulates, the plates can short out rendering the cell useless.

Leaving a battery in a discharged state for long periods of time leads to crystallization of the lead sulfate on the positive plates, making the transformation back into acid difficult or impossible. These situations reduce the life span of the battery prohibiting the

Specific Gravity vs Charge State of Battery



replay capacity of our chemical pin-ball machine.

Conventional Batteries vs. Deep-cycle Batteries

Each cell of a battery can provide a maximum of approximately two volts. Three cells are situated in series to make a six-volt battery, while six cells in series make up a 12-volt battery. The amount of amperage (the flow of a volume of electrons), however, is limited only to the amount of surface area of lead dioxide (cathode+) and lead (anode-) that is exposed to the acid electrolyte. One way of achieving more surface area is to use lead in a porous or "spongy" form. Another way is to stretch the anode (-) and

cathode (+) into many thin "plates."

Conventional or "cranking" batteries, as they are sometimes called, contain a large amount of very thin plates to gain a maximum amount of surface area. These batteries must provide a large amount of current flow (typically 150 amps or more) for a short duration of time to start an engine. After the engine has started, the alternator immediately recharges the battery to (hopefully) full capacity.

Deep-cycle batteries are made with thicker plates in fewer numbers, which are less likely to warp during periods of extreme discharge. They also contain materials to help reduce lead sulfate flaking during discharge, and are generally of heavier construction.

Since there is less surface area exposed to the acid electrolyte, deep cycle batteries will not generally provide as much instantaneous current as cranking batteries. They are, however, the much preferred choice for lighting and house-device systems on

marine and RV applications. NV

Tim Hawkins, owner of Technologies Instructional, has an AS in Industrial Technology, and is currently pursuing a BS in Mechanical Engineering. He works as a machinist at Ballenger Spar Systems in Santa Cruz, CA and is building a 34 ft. steel hulled cutter designed by Bruce Roberts.

BIBLIOGRAPHY

- Physics for Scientists and Engineers*, Raymond A. Serway, Saunders College Publishing Co., © 1990.
- Introduction to Chemistry*, T. R. Dickson, John Wiley & Sons Inc., New York, © 1971-1991.
- Chemistry*, Stanley R. Radel/Marjorie H. Navidi, West Publishing Co., New York, © 1990.
- Industrial Electricity, Principles and Practices*, James E. Adams/Gordon Rockmaker, McGraw Hill Book Co., Atlanta, © 1985.
- Auto Mechanics*, Jay Webster, Glencoe Publishing Co., Encino CA © 1986.

BATTERY MAINTENANCE TIPS

particles flake off the plates.

- Keep the outer surfaces, especially the top, clean and free of dust and dirt. Moisture tends to accumulate in the dust and dirt which, in turn, will allow the battery to self-discharge.

- When removing a battery, the ground cable should always be removed first. Likewise, when installing a battery, the ground cable should be connected last. This will reduce the possibility of the positive cable shorting against the frame (if in a vehicle) or engine block.

- Keep the battery post cable connections clean. Lead sulfate will also build up on the battery posts where the positive and negative cables are connected. This is the white/yellow powdery substance which will increase resistance and inhibit current flow at these connections. These connections should be cleaned with a wire brush or sand paper as part of a regular maintenance routine. Furthermore, this should be the first step of troubleshooting electrical failures (this includes an engine which will not start).

PC DTMF DECODER you can build for under \$20. Kit includes: Windows software, decoder plans, (bonus) phone tap plans, suppliers list. \$15. Doug Campanella, 2235 Greenfield Dr., El Cajon, CA 92019.

MULTIPLE CELLULAR PHONES, ONE NUMBER! Enjoy convenience of 2 or more Cellular Phones all using same phone no. & one monthly bill. Consumer brochure \$5, dealer \$10. Become a CelluSoft Agent, with no investment by you. **CelluSoft™ Technologies USA**, 5750 Lakeshore Dr., Holland, MI 49424, 616-399-6390, M-F 9am to 2pm EST.

SUPERHACKERS BIBLE Vol. 1. Covers: ATM hacking, crimes, abuses, service codes, PIC/PIN code format, theory, bogus cards, scams, magstripe, ANSI/ISO/BCD formats, computer fraud, security procedures, hacking techniques, computer virus detection, prevention, Trojan horses, worms, history, law, countermeasures, and lots more! \$33.45. **VISA/MC** 520-782-2316. **TELECODE**, Box 6426-NV, Yuma, AZ 85366-6426.

FAX SWITCH fully automatic. Connects your fax, phone, and answering machine onto a single line. \$39.95 plus \$5 UPS. Phil Spargo, 130 Dellbrook Ave., San Francisco, CA 94131 or call 415-641-9346 between 6:00-8:00 pm PST.

TEST CLIPS. No need to remove ICs. Clips onto chip and plugs into programmer to read or write. Available: 8, 14, 16, 20, 24, 28, and 40 DIP. \$39.95 each. **ALL 7 FOR \$239.95 PPD.** **TELECODE**, Box 6426-NV, Yuma, AZ 85366-6426.

SUPERHACKERS BIBLE VOL. 2. Covers: Voice mail, DEC, ASPEN, VAX/VMS, AUTONET, Milnet, UNIX, CompuServe, TELEMAIL, packet, TYMNET, PBX, and Information America systems. Hacking, countermeasure, rules of the game, how it's done, passwords, references, and lots more! No duplication from Vol. 1. \$33.45. **VISA/MC** 520-782-2316. **TELECODE**, Box 6426-NV, Yuma, AZ 85366-6426.

UNLIMITED LONG distance from 7am to 7pm on the MCI network for \$299 per month. Call from any phone, no busy signals. You can resell this service for a large residual income. Call Synthesis, 818-504-1788.



POWER-RITES®, CELLULAR SIGNAL BOOSTER'S, REDUCE DROPPED CALLS, IMPROVE RANGE and system access. MODEL TXRXBANT-1 consists of 3dB gain antenna with **ACTIVE, BIDIRECTIONAL, TX-RX AMPLIFIER-DUPLEXER**, built into its glass mounting base housing! (PLUS GAIN: Transmitter 2.7dB, Receiver 12dB) Boosters 16 ft. coax cable and 20 ft., 12.6VDC powerline, plug into Hands Free Adapter Kit or Cordless Antenna Coupler. MODEL TXRXBANT-1 \$159.95. **NEW, REVOLUTIONARY, CORDLESS ANTENNA COUPLER, BUILT INTO, QUICK HOLD-RELEASE PHONE CRADLE**, couples H-H Cellular Phones EMF RECEIVE-TRANSMIT signals to outside Booster Antenna, when operating from anywhere inside the vehicle. No direct H-H cellular phone antenna connection necessary to Coupler or Booster. Includes Z mounting bracket, Built in Y adapter, Lighter power cord-plug, On-Off (LED) power switch, Booster-Coupler RF and power connectors, Self-Tapping hardware. MODEL ANTCCOR-1 \$79.95 **HANDS FREE ADAPTER KITS**. Models available FOR MOTOROLA FLIP/ELITE/POCKET, 89/UC ETC. Any Model, Hands Free Adapter Kits \$129. Without Antenna \$114.95. **DO IT YOURSELF INSTALLATIONS, NO SOLDERING OR DRILLING!** S&H UPS: 2nd DAY AIR COD, CASH ONLY \$14.95. **ADDITIONAL LITERATURE CALL 702-642-0325. LESS BUSTER'S ELECTRONICS, 2039 CIVIC CENTER DR. #176, N. LAS VEGAS, NV 89030.**

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.**, 513-847-2300 or FAX 513-847-2350.

LIQUIDATE CELLULAR phone sale! Shintom reconditioned complete set hand-phone, bat, chgr, ant all \$79, mobile \$49, transportable \$59. 30-day warranty or as-is condition from \$29. Some accessories available. 310-809-0531, phone/fax. Thrifty Electronics.

TELECODE™

CELLULAR PROGRAMMERS PACKAGE OFFER! Volumes 1 & 2 of the Cellular Hackers Bibles, Cellular Programmers Bible, Bagphone Video Bible, and Cloning Cellular Telephones Video. Includes software to program Motorola Bag, Flip, brick (9121/lower Plus Amps-G2) NEC, Panasonic and Nokia, \$179. We pay postage within USA! **VISA/MC** 520-782-2316 or **FAX: 520-343-2141. TELECODE**, Box 6426-NV, Yuma, AZ 85366-6426.

ALL ELECTRONICS CORP.

QUALITY PARTS • DISCOUNT PRICES • FAST SERVICE

INCREDIBLE SAVINGS! 30' CABLE

A GREAT DEAL!

Originally made to connect Digital Audio Tape machine to a remote controller, this "snake" cable consists of four separate 9 conductor plus drain wire, foil-shielded cables in one jacket. The conductors are stranded 24 AWG wire. Each end of each smaller cable is terminated with DB-9P connectors. The cable is well-made and quite flexible for its size. Snake cable nominal O.D. is 0.52". Interior cable O.D. is 0.15". The outer jacket can be slit and re-moved if only the 9 conductor cable is required. DB-9 connectors include thumb-screw hold-downs. If you are using multiconductor shielded cable this is a great deal.

\$5.50 each
CAT# CBL-3 2 for \$10.00

720K 3.5" INTERNAL FLOPPY DRIVE

Sony # MP-F11W-2Z Brand new 720 KB floppy drives. Built for an OEM product, these are, in every way, compatible with PC/XT/AT computers except that the faceplate is slightly larger than those on exact replacements. The faceplate size on these is 4.04" X 1.23". (Normal size is 4" X 1"). The faceplate is removable and can be trimmed if desired. In some cases it may work without trimming. Also, we have found that, when used in 5.25" bays with the adapter kit below, the adapter can easily be modified to accommodate the unit. Because of this slight inconvenience, we are selling these drives at an incredibly low price.

\$14.00 each
CAT# MPF-11SF 10 for \$120.00

INSTALLATION KIT for MPF-11SF allows for installation into 5.25" drive bays. Simply cut and remove three plastic gussets to install. **CAT# FDD-3.5 \$3.50 each**

LARGE QUANTITY AVAILABLE!

9 FOOT DUAL AUDIO CABLE

9' shielded dual audio cable with color coded (red and yellow) RCA style pin plugs either end. Black cable. **\$1.00 each**
CAT# DCB-108

10 for \$8.50 • 100 for \$75.00
1000 for \$500.00

SMALL STEPPING MOTOR

Airpax # NB82115-M3 12 Vdc, 65 ohm stepper motor with 6 leads. 15 degree step angle. 1" diameter x 0.5" high. Mounting flange with holes on 1.25" centers. 0.08" (2mm) dia. X 0.2" long shaft. 0.27" dia. pulley is press-it onto shaft. Great for robotics and experimentation. **\$1.50 each**
CAT# SMT-13 10 for \$12.50

6' VIDEO HOOK-UP CABLE

High quality 6' video patch cables. Belden # 9104 "Duobond" dual shielded RG-59 cable with heavy-duty F connectors hex-cripped onto each end. Large quantity available. **\$1.00 each**
CAT# VHU-6S

10 for \$7.50 • 100 for \$60.00

"HI-8" VIDEO CASSETTE (USED)

8 mm Video Camcorder Users!

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. Satisfaction Guaranteed! **\$3.00 each**
CAT # VCU-8 10 for \$28.00 100 for \$250.00

NOW! Visit Our World Wide Web Site.. <http://www.allcorp.com/allcorp/>

9 VOLT 60 MA SOLAR PANEL

These 6" X 6" glass enclosed photovoltaic panels produce 9 Vdc at 60 mA. Ideal for charging batteries and powering small devices. Put two or more together for more current and voltage. Includes metal connectors and instructions for soldering directly to panel.

\$5.25 each

CAT # SPL-960

640 X 480 LCD PANELS WITH BUILT-IN DIGITIZER

Two sizes available, both originally designed for laptop computer/note pad. Built-in digitizer to be used with a stylus for hand written notations. Onboard drivers operate on 5 vdc (logic) and 18 vdc (LCD). Full documentation on both units.

SHARP LM64P90

Built-in CCFT backlight. Overall dimensions: 10.19" x 7" x 0.35" Viewing area: 7.88" X 6" Dot size: 0.27mm X 0.27mm. White dots on black background. **\$40.00**
CAT # LCD-31

SHARP LM64194F

Overall dimensions: 8" x 5.75" Viewing area: 6" X 4.5" Dot size: 0.21mm X 0.21mm Black dots on white background. **\$40.00**
CAT # LCD-32

MANUFACTURERS - We Purchase EXCESS INVENTORIES... Call, Write or Fax YOUR LIST.

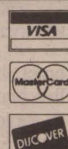
CALL, WRITE or FAX For A Free 64 Page CATALOG. Outside the U.S.A. send \$2.00 postage.

ORDER TOLL FREE

1-800-826-5432

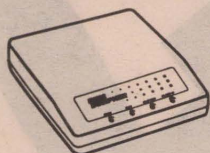
MAIL ORDERS TO:
ALL ELECTRONICS CORP.
P.O. BOX 567
VAN NUYS, CA 91408-0567

E-MAIL allcorp@allcorp.com
FAX (818) 781-2653
INFO (818) 904-0524



NO MINIMUM ORDER • All Orders Can Be Charged to Visa, Mastercard 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.

WANTED: MOTOROLA bag (carry), car phones, series SUN1600-1999, OKI-1335-1375 H-HP, Etc., used. Call Les 702-642-0325.



RING DECODER. Decodes up to 4 unique rings purchased from your local phone company. Not available in all areas. Have up to four phone numbers on one line. FCC 68 cert. Save big monthly bills. \$79.95. \$5 UPS. Accept VISA. Call for COD. LOGICAL DESIGN TOOLS, INC., 5403 Everhart, Box 55, Corpus Christi, TX 78411. Phone 512-888-4535.

HOLD & MUSIC ON HOLD Only \$29 including shipping. Puts callers on hold and plays your customized message or music. Attaches easily to any phone. Send cheque to V. Eftechiou, 1402 Pine Avenue, Niagara Falls, NY 14301.

CELLULAR HACKERS! amps/G2 software only \$100! Ready to use loader bag phones \$200 software, manual and chip to make loader phone only \$100! Blow Out! Order Now! Bates, 426 W. Belmont, Chicago, IL 60657. 312-213-7023.

COMPONENTS

120

\$100 GOLD! There is a circuit chip made by IBM that contains more than \$100 each in scrap gold, and another worth \$20. Almost nobody knows this. They are just starting to show up in resale outlets and junk yards. You can score big with this knowledge. Complete info with photo \$35 to: Jim Sciuto, Box 128, Methuen, MA 01844.

ELECTRONIC COMPONENTS BOUGHT: all transistors, diodes, resistors, capacitors, ICS, milspec, commercial. FAX LABB Associates, 215-364-5415.

68HC11AO \$2 each. Add \$3 shipping and handling. Used processors that may have open analog input pins. Call after 5:30pm EST, 216-974-8091.

80% OFF, INVENTORY CLEARANCE, ALL NEW PARTS. IC sockets/adapters, braid, heat shrink, wire, cable, connectors, headers, housings, backshells, gaskets, pins, cable assys., clamps, chokes, beads, resistors, capacitors, transistors, diodes, lugs, standoffs, spacers, washers. Lists available, \$20 min order. E-Z Parts, 8577 Raglan Rd, Vienna, VA 22182, 703-255-2706.

WANT TO Buy: ICs, military & aircraft relays, diodes, transistors, electronic test equipment & most components. Hoffy Electronic Ent., 818-718-1165, FAX 818-341-5506.

ELECTRONICS EXCHANGE ST. LOUIS the only surplus electronics store in the St. Louis area. We buy anything in electronics that's a bargain. Call or FAX, 314-426-4848. 24 hours 7 days.

LOW-COST AUTOMATIC wire & tubing measure/cut machine, the Model PMC-110 by Red Line Mfg., Co. 314-831-3014. FAX 314-831-3927.

CATALOG, LOW cost RF chokes, inductors, ferrite and powdered iron cores, capacitors, resistors, semiconductors, more. Two stamps please. Johnson Shop Products, Box 2843, Cupertino, CA 95015.

SCHOTTKY RECTIFIERS: MOTOROLA MBR1645 or MBR1080 (16A@45V or 10A@80V). **TOUGH** and usually **EXPENSIVE**. Our price: 20 for \$10 postpaid. Also: MBR1035, 30 for \$10. TURCOTRONIX, 1000 E. 14th, Suite 429A, Plano, TX 75074.

12V/1-2AH Nicad \$4, 6V 4AH lead \$3, charger \$3, 6V air pumps \$3, pressure transducers 3-6 meters, power supplies, oxygen CO2 sensors. Catalog EDS, Box 502, Columbus, NE 68601. 402-563-2866. Evenings.

RF TRANSISTORS and tubes. 2SC1307, 2SB754, TA7222AP, 2SC2879, 2SC2029, 2SC2166, 2SC1946A, 2SC1947, 2SC1969, MRF454, tubes, 4CX250B, 811A, 3-500 graphite. Electrolytics, all types. Westgate, 1-800-213-4563.

MICRO MEASUREMENTS 350 ohm strain gages. 53 matched sets of 5. PTI 350 ohm strain gages. 276 units. \$150 lot. PB relays. R10 DPDT 12 VDC, 64 units. KUP14D15 3PDT 12 VDC with sockets, 26 units. \$50 lot. G. Fasse, 810-757-3943.

PLEASE WRITE, call or fax for your free catalog of parts. MHz Electronics, Inc., 3802 N 27th Ave., Phoenix, AZ 85017. Phone 602-265-0731, or FAX 602-285-9066.

CRTs CHEAP. Buy direct from the manufacturer, save money. Mfg. all CRT types over 45 years. **3 Year Warranty.** 19 inch tubes \$60, 25 inch \$90. We specialize in **Hi Resolution** computer/video CRTs and complete repair of all monitors. T.M.C. 215-226-0749/223-0388 9:00am-10:00pm EST.

TI 27C512-1JL \$2, Intel 27C020-150V10 \$4.25, Lattice GAL 20XV10B-20LP \$2, MMI PAL 20L10ACNS \$2. All parts unused. Send check or money order to Lloyd's, 28410 Front St. Ste. 104-84, Temecula, CA 92590. \$3 for postage and handling.

WE BUY gold plated parts, transistors, hybrids, ICs, diodes, circuit boards, patch panels, military pins, tantalum capacitors, relays, old test equipment and all types of electronic material. **GOLD'N WEST SURPLUS** in Corona. Ph: 909-340-1501, FAX: 909-340-1504. ASK FOR MARK.

RESISTOR SELECTION 10,000 total quarter watts. Fifty each of 200 different values. \$95. Murphy's Surplus, 401 North Johnson Ave., El Cajon, CA 92020. 619-444-7717.

IT'S LEGAL!
Cable TV Converters
& Remotes

TAKE CONTROL OF YOUR TV!

- Full Service
- Highest Quality
- Original Equipment

BOSS
DISTRIBUTORS

P.O. Box 1282 • Beloit, WI 53511

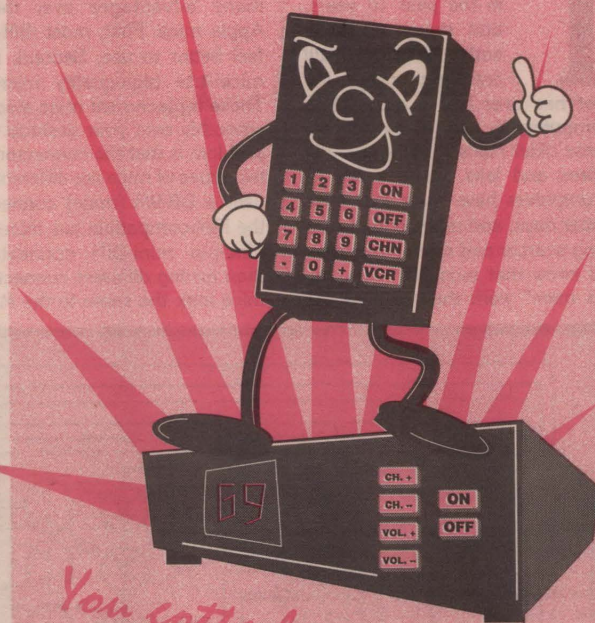
CALL TODAY!!!
1-800-228-2677

Mon. thru Fri. / 8 am - 8 pm
Saturday / 9 am - 2 pm



Tired of Paying Rent To Your Cable Company?

WHY RENT WHEN YOU CAN OWN?



You gotta luv it!!!

- Over 5 Yrs. Experience
- Excellent Customer Service
- Prompt Delivery Anywhere
- Tell Your Friends About Us
- Call Today For Our LATEST SPECIALS!



USE AN IBM MOUSE WITH YOUR MAC



by Phillip Combs

The Macintosh celebrated its 10th birthday last year. Many Macs have been sold in the past 10 years, and many of those early Macs are still cranking away. My employer has over half a dozen Mac Plus computers in use. Many schools have these older Macs working away in classrooms and labs. Quite a few of these computers have mice that have seen better days, and replacements are becoming scarcer and more expensive. Did you know that most IBM-compatible "bus mice" work the same as the

original Apple mouse, and can be adapted to work on the early Macs (up through the Mac Plus)?

The IBM-type replacements have many advantages over the original Apple mice. First, most IBM-type mice feel better to use. Second, many IBM mice use high-quality microswitches. These replacement mice also roll more smoothly over your desktop. The only problem is that the connectors on these two types of mice are different. The Mac uses a DB-9M (male) connector, while the IBM-compatible bus mice employ a nine-pin mini-DIN connector. Other than having different connectors, these mice look the same to the Mac. Please

note that Macs newer than the Plus cannot use IBM-style mice. These Macs incorporate the Apple Desktop Bus (ADB), which is a totally different connection method.

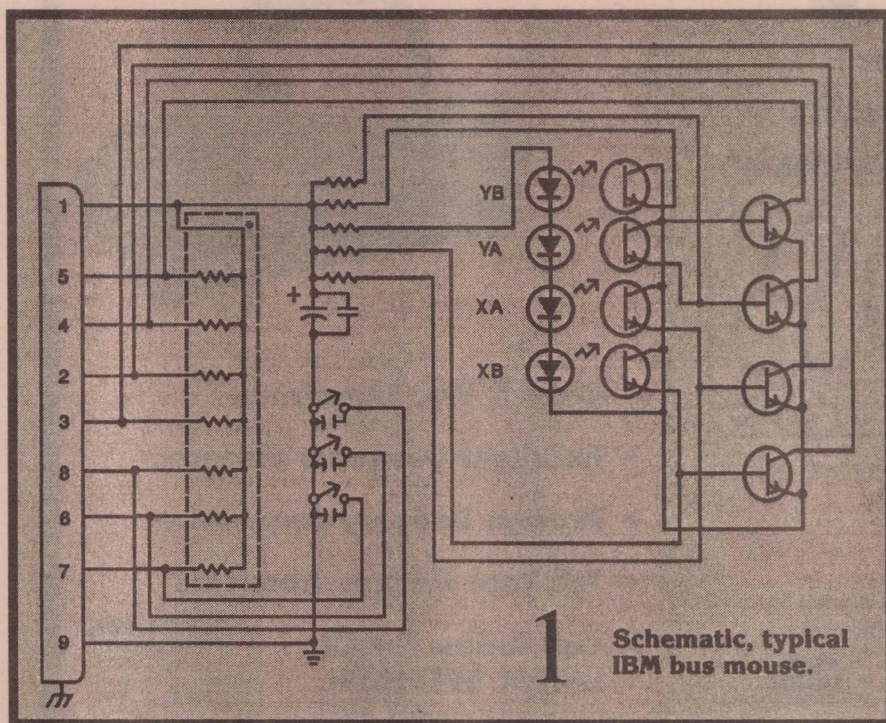
I will tell you how to adapt these IBM-type mice to your early Mac. You need experience in basic electronics and assembly techniques to tackle this project. If you lack these skills, talk a skilled friend into doing the work. If you don't know anyone skilled in electronics, visit your local user's group. Every user's group usually has at least one person with electronic expertise. You will also need certain tools before starting this project. These are listed in Table 1.

axle is for the X axis (left and right movement) and the other is for the Y axis (up and down movement). Mounted on one end of each axle is a plastic disk with slits around its edge. On one side of each disk are two infrared LEDs. Mounted opposite the LEDs are two infrared phototransistors. The LEDs are always on, and they shine through the slits in the disk onto the phototransistors. When the mouse ball rolls, the axles rotate and turn the disks. The bands between the slits break the flow of light to the phototransistors, causing them to turn on and off, producing pulse trains. The two pulse trains from each axis are sent to the computer for processing. One pulse train from each axis is 90 degrees out of phase from the other. The computer uses this phase information to determine mouse direction.

Most mice of the same type differ somewhat in their internal circuitry. I discovered several design variations among the different IBM mice I tested while researching this project, and Figure 1 is only one example. Despite these differences, all the mice I tested performed flawlessly when connected to the Mac, as their signal outputs were Mac-compatible.

IBM-type mice connect to the PC in two ways — bus and serial. Serial mice connect through the RS-232 port. These mice cannot be used with the Mac, as they simply do not produce the proper signals. Bus mice connect to an interface card that plugs into the expansion bus. These mice employ a circular nine-pin mini-DIN connector, which looks similar to an eight-pin AppleTalk connector. My experimentation revealed that the mini-DIN's wiring scheme is standard.

I have successfully tested the following IBM-type mice with the conversion: The Logitech C-7 (gray case, wedge-shaped appearance); the



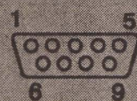
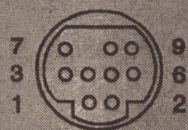
Mouse Types

Mice can be divided into three basic types: optical, electromechanical, and optomechanical. The Mac mouse, and most IBM-type bus mice, are optomechanical. The intimate details of mouse design are beyond the scope of this article. An excellent article on the subject, "The Mouse That Roared," can be found in the Nov. '90 issue of *Byte Magazine*. However, I will give you a basic explanation of optomechanical mice operation. Figure 1 is an example schematic of an IBM-type bus mouse.

The mouse translates your hand movements into cursor tracking information. The mouse ball contacts the table or mouse pad, and rolls when the mouse is pushed. Inside the mouse, two axles make contact with the ball. One

IBM Bus Mouse Plug

Mac Mouse Plug

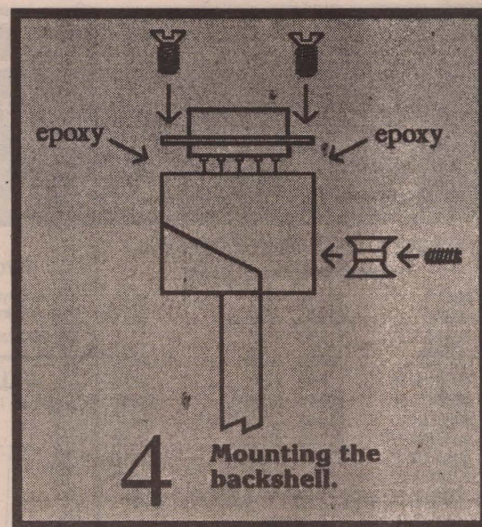
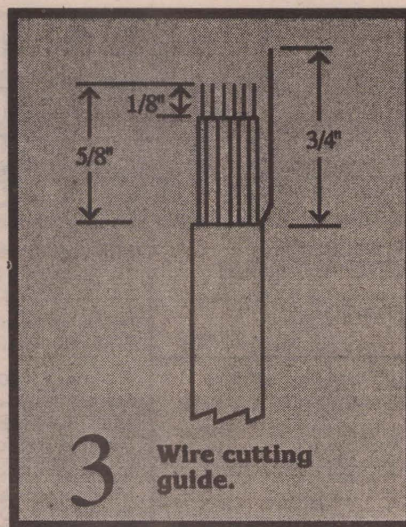


viewed from front
of plug
(pin end)

Translates To:

- | | |
|-------------------|---------------|
| 1 - +5 volts | 2 - +5 volts |
| 2 - XA | 4 - Left (X) |
| 3 - XB | 5 - Right (X) |
| 4 - YA | 9 - Up (Y) |
| 5 - YB | 8 - Down (Y) |
| 6 - Left Button | 7 - Switch |
| 7 - Middle Button | 7 - See text |
| 8 - Right Button | 7 - See text |
| 9 - Ground | 1 - Ground |

2 Mac and IBM plug configurations.



I cannot give you specific guidance here. However, there are some things you should watch out for.

First, **PROCEED CAREFULLY.** Do not rush this operation, as you could break something and prevent the mouse from reassembling properly. Second, if you do not see any screws to remove, carefully remove the mouse feet toward the rear of the mouse. Sometimes screws are hidden beneath the feet. Third, some mouse cases will hook together on one end, only requiring screws at the other end to hold the assembly together. The case halves usually hook together where the mouse cable enters.

After disassembling the mouse, use a volt ohmmeter (VOM) to trace which plug pins go where inside the mouse. Note these connection points by drawing a diagram to make wire connection easier later on.

2) Clip the mouse cable in two where you cut into the outer insulation and separate the plug and cable. If the wires inside the cable were not different colors, skip to step 4 now.

Carefully strip away the outer insulation from the short piece of wire connected to the plug, revealing the inner conductors. Now strip 1/8" of insulation off each wire and separate the wires.

3) Using a VOM and Figure 2 as a guide, trace each plug pin to its associated wire. Write the color of each wire next to the pin number in the figure.

4) Slide the backshell onto the mouse cable, with the smaller hole facing the mouse and the larger rectangular hole facing the cable end. Now refer to Figure 3. Strip the cable's outer insulation back 3/4" to reveal the inner conductors. If there is a shield wire (one with no insulation), separate it from the others and then clip 1/8" off of the remaining wires. Strip 1/8" of insulation off each wire and tin it with solder.

5) Now refer to Figure 2 and either the wire color information you noted, or the wire diagram you drew in step 2. Connect each mouse wire to the appropriate pin on the DB-9 male connector. When you get to pin 7 of the connector, you will have a choice to make.

Depending on the type of mouse you chose to adapt, there are either two or three mouse buttons. The Mac only uses one. The wire that connected to pin 6 of the mini-DIN is for the left button. The wire on pin 9 is for the right button, and the wire on pin 5 is allocated to the middle button on three-button mice.

If you wish all the mouse buttons to be active, solder the wires from mini-DIN pins 5, 6, and 9 to pin 7 of the DB-9 connector. If you only want to use one button, connect the appropriate wire to pin 7 and clip the other switch wires off.

If there was a shield wire, place an appropriate length of flexible insulation tubing over it, leaving approximately 1/8" of the end exposed. Now you will attach the shield wire to the metal frame of the connector. Tin the area of the connector between pins 1 and 6, or 5 and 9, where the inner plastic insert meets the metal. Soldering the wire here allows the backshell to slide over the connector unhindered.

6) It is now time to attach the backshell (see Figure 4). There are several ways to perform this task. Screws should be included with the backshell, but these will not allow the plug to seat properly into the Mac mouse port. I attached my shell using two 4-40 x 1/4" flat-head screws. This was possible after enlarging the holes in the connector and backshell with a #5, 82-degree countersink drill bit. The screw heads will then be low enough to allow proper connector seating.

If you don't have access to these

tools, you can use epoxy to attach the connector to the backshell. Use small C-clamps to hold the two parts together for 24 hours to allow a full cure. Use caution when plugging and unplugging the epoxied connector from the Mac — the glue will not be as secure as the screws.

Now insert the wing-shaped cable clamp into the hole in the backshell's side, followed by the setscrew. Before clamping the mouse cable, gently rotate the mouse cable 1/2 turn as you push it slightly into the backshell. This will help relieve any tension on the solder connections inside. Now tighten the screw snugly, but not too tight. You can tell when the wire is adequately clamped. The conversion is now complete.

Troubleshooting

This conversion is simple, and so is troubleshooting. If you move the mouse left and the cursor goes right, reverse the wires on pins 4 and 5. If the arrow goes down when you move the mouse forward, reverse the wires on pins 8 and 9. If the cursor quivers, but does not move when you move the mouse, check all the wires connected to pins 4, 5, 8, and 9.

The Look and Feel's the Thing

The Mac is an amazing computer. However, many users come away with a bad impression from the cheap "look and feel" of the mouse. My primary impressions of a machine are based on tactile response — the solidity of the keyboard and the feel of the mouse. Comfortable interaction with a machine makes the experience pleasant. By adding a better mouse to your Mac, you not only improve the human interface, but you save money in the process. **NV**

Phil Combs is a Technical Writer and LAN Administrator for a government contractor in Dayton, OH. He has written several computer-related articles, and is currently working on a novel. He expects that he will either finish it sometime before he dies, or it will finish him.

If you wish to contact the author, please send a SASE with your letter in care of *Nuts & Volts*. Letters without a SASE may not be acknowledged.

Adapting the Mouse

Follow these simple steps to adapt your mouse of choice:

1) Carefully cut into the outer insulation on the mouse cable, about 1" up from the connector. Be careful not to nick any of the wires inside the jacket. Bend the wire to separate the insulation, and verify that the wires inside are color-coded. If they are different colors, proceed with step 2. If not, you will have to disassemble the mouse and trace the wires from each plug pin to their location inside the mouse.

Mice assemble in various ways, so

Table 1. Tools Needed

- Soldering iron (15-25 watt)
- Rosin core electronic solder (60der(60/40))
- Small wirecutters
- Wire strippers
- Hobby knife
- Small Phillips and flat-blade screwdrivers
- Volt ohmmeter (VOM) preferably with continuity beeper
- #5, 82-degree countersink drill bit
- Drill
- (2) Small C-clamps (see text)
- Epoxy cement (see text)

Table 2. Parts List

- Tubing:**
1) 5/8" long, 1/16" diameter insulation.
- Connector:**
1) DB-9M nine-pin Male, Radio Shack # 276-1537.
- Backshell:**
1) DB-9 one-piece backshell, Cinch or Cannon DE-51218 Mousser Electronics 152-1109.
- Mouse:**
1) IBM bus-type optomechanical mouse or trackball.

PRIME ELECTRONIC COMPONENTS, INC.

150 West Industry Court, Deer Park, NY 11729

(ABSOLUTELY NO WALK-IN SALES)

516-254-0101 •

FAX 516-242-8995



EPROM & CPU/MPUs SOCKET PULLS

Math-Coprocessor & CPU

8087-1	\$19.95	8741	\$3.95
8087-2	\$14.95	8742	\$4.95
8087-3	\$12.95	8748	\$4.95
80287XL	\$24.95	8748H	\$6.50
80387SX-16	\$17.95	8749	\$5.95
80387SX-20	\$29.95	8749H	\$6.50
80387SX-25	\$22.95	8751	\$8.95
80387DX-20	\$17.95	8751H	\$9.95
80387DX-25	\$24.95	8752	\$13.95
80486SX-25 (PGA)	\$34.95	8755	\$6.95

All parts, all socket pulls (must be cleaned & erased). *Note: Speed selection available at additional charge and all parts subject to availability.

EPROMS

2516	\$0.65	27C256	\$2.25
2716	\$0.65	27512	\$2.45
2732	\$0.75	27C512	\$2.65
2764	\$0.95	27C010	\$4.95
2764A	\$0.95	27C100	\$4.95
27C64	\$1.25	27C1001	\$6.50
27128	\$1.45	27C1024	\$0.00
27128A	\$1.45	27C020	\$5.95
27256	\$1.90		

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 170 MEG 2.5" IDE HARD DISK DRIVE

Laptop replacement or up-grade 2.5" hard drive. Logical Translation 989 Cy1/110 heads/34 Sec. Check your BIOS. 15ms +5Vdc 0.5 Amp. (P/N 84G1745). IBM-H2172-A2/(84G1745).....\$124.95 Ea.

NEW MITSUMI 1.2 MEG 5-1/4" FLOPPY DRIVE

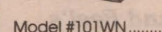
5-1/4" half height Mitsumi Model #D509V2 White face plate only. Mitsumi 1.2M FDrive.....PRICE REDUCED \$28.95 Ea.

USED ULTRASTOR EISA HIGH PERFORMANCE SCSI/2 CONTROLLER BOARD

Pulled from working equipment tested with 30-day warranty. Board supports two floppies and up to seven SCSI devices. Note: No manual or software supplied with card. UltraStor U24F-10F.....\$79.95 Ea.

NEW VICTOR/HONEYWELL ENHANCED 101 KEYBOARD

4 ft. coil cord with PS/2 type 6 PIN MINI DIN connector. AT and XT DIP switch selectable Model #101WN.....\$24.95 Ea.



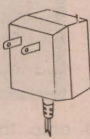
NEW MICROSOFT TWO-BUTTON PS/2 MOUSE

The old-style type, but old reliable. Note: No software included with mouse.

MS PS/2 Mouse.....\$19.95 Ea.

WALL PLUG WALL ADAPTERS

Input: 117 Vac 50/60 Hz. Outputs Available.



Quantity
Pricing
Available

6Vdc 400Ma	\$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 500Ma	\$3.50 Ea.
14Vdc 700Ma	\$5.95 Ea.
16Vdc 1.2Amp	\$6.95 Ea.

NEW 80486SX-25 BABY MOTHERBOARDS

Supports up to 32MB of RAM on-board. 256KX9/1Megx9/4Megx9/(80NS) 30 Pin type SIMM. Five 16 Bit Slots and One 8 Bit Slot. AMI BIOS/Supports loadable hard drive parameters 720K/1.2Meg/1.44Meg/2.88Meg (with proper controller) 8K Internal cache only. 486SX-25 Baby Motherboard (CPU included) (O-K RAM).....PRICE REDUCED \$89.95 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).



Available 16-Bit interface slot, Windows 3.1, 4 Meg RAM, 10 Meg of Available HD space (Min.), Mouse or Other pointing device.

Software Included: Picture Publisher LE 3.1. (Imaging Software). Perceive Personal 2.1. (OCR Software)

Niscan/GS Plus.....\$69.95 Ea.

USED 150MEG SCSI TAPE BACK-UP DRIVE

Pulled from working equipment 150Meg SCSI Cipher P/N ST150-II. 30-Day Guarantee. 5-1/4" Half Height, off-white color faceplate. Interface: SCSI/1, 50 Pin. Cipher ST150S-2.....\$49.95 Ea.

USED SVGA 16 BIT VIDEO CARD (ISA) TSENG LAB (ET4000AX) WITH 1 MEG DRAM

New Arrival: Pulled and tested SVGA 16 bit SVGA cards with 1 Meg (DRAM). Call for full specs.

SVGA (Tseng ET4000 1Meg.....\$39.95 Ea.

USED 1.44 MEG FLOPPY DISK DRIVE

Pulled from working equipment 1.44 Meg 3.5" in 5-1/4" mounting bracket. 30-day guarantee. 5-1/4" Half Height, off-white color face plate. Interface: 34 pin & 4 pin power. Sony MP-F17W-70D.....\$19.95 Ea.

USED 80 MEG 3.5" SCSI HARD DISK DRIVE

Pulled from working equipment. 80 Meg SCSI Quantum P/N ProDrive 80S. 30-day guarantee. 3-1/2". 1/3 Height (1-5/8"). Interface: SCSI/2, 50 pin. Quantum 80S SCSI.....\$49.95 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.



NEW PANASONIC 360K 5-1/4" FLOPPY DRIVE

5-1/4" half height Panasonic M# JU-455 Black face plates only. P/N: JU-455.....\$9.95 Ea.

NEW 112W BABY SWITCHING POWER SUPPLY

Input: 120-220V, 50Hz/60Hz, UL & CSA
Output: +12Vdc @ 4 Amp., -12Vdc @ 0.3 Amp.
+5Vdc @ 12.5 Amp., -5Vdc @ 0.3 Amp.
Model #PS2682L Nichimen.....\$14.95 Ea.

NEW 200W BABY SWITCHING POWER SUPPLY

Input: 120V-220V, 50Hz/60Hz, UL & CSA
Output: +12 Vdc @ 8 Amp., +5 Vdc @ 22 Amp.
-5 Vdc @ 0.5 Amp., -12 Vdc @ 0.5 Amp.
Model #SA201-3440 Astec.....\$24.95 Ea.

NEW AA HIGH CAPACITY NI-CAD BATTERY

1.2Vdc 800Ma/Hr. Charge Rate 15 Hours @ 80Ma. Manufacturer Kenwood/Batteries have nipped end. Kenwood NB-88 (KR-AA).....\$1.75 Ea.
Kenwood NB-88 (KR-AA) 4 or more.....\$1.50 Ea.

NEW PS/2 NOTE (N51) LAPTOP NI-CAD BATTERY

10.8VDC 1.2A/Hr. IBM P/N 07G1753
N51 Battery.....\$34.95 Ea.

USED ADAPTEC 1540A ISA SCSI-2 CARDS

Pulled from working equipment. The Adaptec's first generation 1540A SCSI-2 ISA BUS card. Includes 2 Device 50 Pin SCSI cable. (NO Software) (No Floppy support) 30-Day Guarantee.

ADPTEK 1540A.....\$34.95 Ea.

NEW MICROSOFT TWO BUTTON SERIAL MOUSE

New style type (Melted bar of Soap). DB9 Connector Female Connector only. Note: No software included with mouse. MS Serial Mouse.....\$29.95 Ea.

NEW ADAPTEC EISA SCSI/2 CONTROLLER BOARD

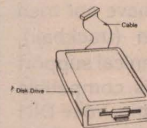
High Performance board supports two floppies and up to seven SCSI devices. Note: No manual or software supplied with card.

Adaptec AHA-1742A.....\$99.95 Ea.

PADDED LAPTOP NYLON CARRYING CASE

Features two zippered sections. First for laptop and second for charger and/or accessories. Includes detachable shoulder strap. Holds most laptop computers. Exterior (Fully packed) 12"H x 12.5"W x 5"D. Laptop Case.....PRICE REDUCED \$19.95 Ea.

NEW EXTERNAL 3-1/2" 720K FLOPPY DISK DRIVE



Made by Tandy for Tandy 1000EX Computer. Unit enclosed with cable for hook-up. Drive inside is a Teac Corp. Model #FD-35 FN-10-U. Color: White

Tandy Model #25-1061.....\$24.95 Ea.

WIRE TIES

4" Black Plastic, Packs of 100.....\$1.00

NEW ATI MACH 64 2 MEG VRAM UPGRADE MODULE

A steal. Check your software or the marking on the back of board for compatibility. ATI 2M 109-26400-10.....\$99.95 Ea.

NEW SYTOS PLUS (TAPE BACK-UP SOFTWARE)

Works with WangDAT DAT/1320 or Wangtek 150/525/1GB in a MS-DOS environment supporting Adaptec Host Adapters. 5.25 & 3.5 disks supplied. (Will work with other tape back-up if you get configuration file from Sytron.) (Sytron BBS 508-898-2608 Conf. Files.) Sytos Plus Ver. 1.32.....\$17.95 Ea.

We buy all defective Memory Boards/Modules from IBM, as well as computer scrap. Please contact Mr. Wiley Burke.

SATELLITE TV from 18 INCH DISHES?

PROFIT from the small dish revolution now upon us!

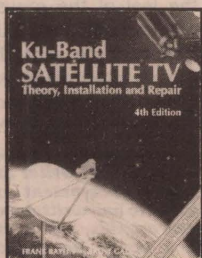
Ku-band Satellite TV "Bible"

- Operation, installation and troubleshooting of Ku-band satellite systems
- Footprint maps and video standards
- and much more

TO ORDER - Send \$30 plus \$4s/h to Baylin Publications
1905 Mariposa, Boulder, CO 80302

-CREDIT CARD orders accepted-
TEL:303-449-4551 FAX:303-939-8720

CALL 800-483-2423



432 pages, 8.5 x 11"

FREE CATALOG of books, videos and software on
Satellite Television, MMDS & SMATV

#120 COMPONENTS cont.

I WANT it and I want it now. I want all of your SIMM memory. IBM, Mac, new, used, even defective. I want it all. Highest \$ paid. Call 1-800-4-MEMORY now! Voice/FAX.

RESISTORS \$1 A DOZEN. Catalog \$1, foreign add \$1. ZIPFAST, Box 12238, Lexington, KY 40581-2238.

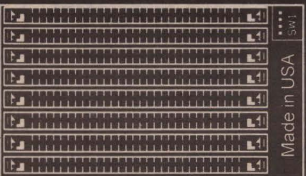
HARD TO Find, hi-voltage electrolytics, caps, power resistors, xtals, plugs. Free catalog. A.G. Tannenbaum, Box 386, Ambler, PA 19002. 215-540-8055, FAX 215-540-8327.

AMIDON TORROIDS 10% off list. No minimum order. Check or money order to: ByteMark, 7714 Trent St. #105, Orlando, FL 32807. Add \$3 S/H (\$5 S/H on orders under \$25). Visa/MasterCard orders call 1-800-679-3184. Send SASE for full catalog.

EXCESS INVENTORY WANTED Commercial and military. ICs, diodes, transistors, caps, relays, connectors, wire, and cable. M&M SALES, 602-807-8604 OR FAX your list to, 602-807-3320.

FREE ELECTRONICS CATALOG. Low low prices for high quality overstocked parts. Call 817-473-1730. IME, PO Box 170415, Arlington, TX 76003.

DID YOU KNOW that old personal computers, monitors, modems, electronic cash registers, and even old calculators contain valuable IC chips that are plated with pure gold. My "Big Color Photo" (8" x 10") shows over 25 of the most common gold plated IC Chip and the price I will pay for them. Chips are shown actual size. The price of gold keeps climbing higher and higher and is making it worthwhile to tear apart old equipment. To order "The Big Photo" send \$25 to Jim Sciuto, Box 128, Methuen, MA 01844.



30 to 72-pin adapter \$39
4 socket model \$19!

Buffered model available - High quality sockets.
 Other Adapters: DIP-SIMM, SIP-SIMM, SIMM-SIP,
 two 72-pin SIMMs into one 72 pin socket.

Memory Conversion Products
 428 NW 9th St., Corvallis, OR 97330-6133
503 753-7918

Modem 503 757-2679 Fax-back 503 758-5331
Dealers call 503 754-4904

MEMORY EXCHANGE

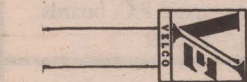
BUY - SELL - TRADE
30 & 72-PIN SIMM MODULES
FULLY GUARANTEED
VERY REASONABLE PRICES



INTERNET MEMORY EXCHANGE

3925 N. Clarey St.
 Eugene, Oregon 97402-9708
503-688-9263 (voice & fax)
 Internet: dany@efn.org

960 RISC processor \$50, 87C51H \$9,
2V10 \$7 563635 Half bridge amplifier \$2,
8-pin RAM socket battery backed \$2. Call
or catalog. Greenlux, 415-753-0251.



CRYSTALS: RADIO and microprocessor,
 low price, fast delivery, all brands, proto-
 type, production runs. Velco Electronics,
 16-924-2073, FAX: 716-924-2136.

ELECTRONIC PARTS. For list, send
 \$ASE to A&A Engineering, 2521 W. La
 Palma #K, Anaheim, CA 92801.

MICROCONTROLLERS 125

NEW CLASSIFICATION

ANTIQUE ELECTRONICS 130

WANTED: APPLE 1, Mark 8 and early
microcomputers. Also journals for muse-
um. PO Box 341, Floyd, VA 24091. 703-
331-6478, 703-763-2321.

WANTED: TUBE hi-fi and commercial sound
 gear by Western Electric, Altec, Marantz,
 McIntosh, Dyna, Eico, Heath, others. Vintage
 speakers by Altec, JBL, Tannoy, Jensen, EV,
 etc. Also guitars & amps, effects pedals,
 drums, audio tubes, old books about tube
 electronics, old radios, audio transformers,
 nics, related display & advertising items.
MORE! Have top cash, will travel. 1-800-666-
TUBE.

CRYSTAL SETS. Parts, plans, books, kits.
 Largest source in the world. Catalog \$2.
 MIDCO, PO Box 2288, Hollywood, FL
 33022.

WANTED: TELEGRAPH instruments, any
 kind, keys, sounders, books, signs. Also
 Western Union Postal Telegraph items.
 Goodman, 636 Grant, Charleston, IL
 61920. 217-345-6771.

VINTAGE MANUALS for all your radio-
 related equipment. Catalog available. We
 buy, swap, and sell. Pete Markavage, 27
 Walling St., Sayreville, NJ 08872-1818.
 908-238-8964.

FIXING UP NICE OLD RADIOS, the best
 antique radio book! Thousands sold! Direct
 from author, Ed Romney, N4DFX, Box
 487, Drayton, SC 803-597-1882.
 Visa/MasterCard.

WANTED: ELECTRON Tubes for auto
 radios. Fred Cranshaw, 1624 Bitter Ck,
 Garland, TX 75040. 214-494-4917.

ANTIQUE RADIO CLASSIFIED. Free
 sample copy! Antique radio's largest-circu-
 lation 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: \$17.95. Yearly rates: \$34.95
 (\$51.95 by 1st class). Foreign write: ARC,
 PO Box 802-G15, Carlisle, MA 01741.
 508-371-0512.

WESTERN ELECTRIC WANTED: 1927-
 1960S. Amplifiers, speakers, tubes, etc.
 Free offer. 1-800-251-5454.

RADIO, TV, industrial tubes for sale.
 Thousands in stock. DH Distributors, PO
 Box 48623, Wichita, KS 67201. 316-684-
 0050 voice/fax.

RADIO, TV, transmitting, receiving and
CRT tubes. Sams Photofacts and more.
 PEM tubes, 1816A Cirby, Roseville, CA
 95661-5522. 916-858-0376.

LIONEL TRAINS! Free catalog! Videos,
 books, metal signs, tin toys, the largest
 selection of toy train specialty items
 around! Request our catalog today! The
 RailRoad Press Company, PO Box 2644,
 Novato, CA 94948. Phone 415-898-7030.
 FAX 415-897-2705, E-Mail Railpress
 @aol.com.

VINTAGE SERVICE data from 1923 to
 present. A.G. Tannenbaum, Box 386,
 Ambler, PA 19002. 215-540-8055, FAX
 215-540-8327.

MICROPHONES: WANTED older broad-
 cast quality microphones from Altec, RCA,
 Western Electric, Shure, American
 Microphone, and others. Also literature
 and catalogs on the same. Call or FAX
 with a description and asking price. Mike
 408-749-0130 days or 408-749-1323 FAX.

REMEMBER WHEN they cost \$400?
 When the HP 35 was the smallest "com-
 puter?" Collect pocket electronic calcula-
 tors, \$12/yr. with quarterly newsletter.
 Sample \$2. International Association of
 Calculator Collectors, Box 345, Tustin, CA
 92681.

TUBES, NEW, up to 90% off, SASE.
 Kirby, 298 W. Carmel Dr., Carmel, IN
 46032.

RADIO AND TV tubes from 1927 to 1977.
 \$1 for list to: Preller TV, 208 South 2nd St.,
 Augusta, AR 72006. 501-347-2281.

RADIO, TV, transmitting, receiving and
CRT tubes. Sam's Photofacts and more.
 PEM Tubes, 7392 French Rd.,
 Sacramento, CA 95828. 916-383-9107.

TOP SECRET

CONSUMERTRONICS
 2011 Crescent, P.O. Drawer 537
 Alamogordo, NM 88310

Voice: (505) 439-1776,
439-8551; 8AM-7PM MST, Mon-Sat
Fax: (505) 434-0234,
434-1778 (orders only; if you get
voice, enter #11 #1 any time); 24-hr

Free Tech Support
 Relates directly to your order or prospective
 order: **Tues. and Thurs. only.**

10% Off on orders \$100+
15% Off on orders \$200+
 Add \$5 total SH (US, Canada). All items
 in stock. **VISA, MasterCard, NO CODs or**
"bill me". NEW CATALOG (200+
offers) \$2 w/order, \$5 w/b (check or MO)
- NO free catalog. NO dealers.

Since 1971. As seen on CBS "60 Min-
 utes," Forbes, etc. By John Williams - for-
 mer Lockheed Senior Engineer, NMSU Com-
 puter Science Professor, DOD Electronic
 Weapons Engineer, NIH Health Physicist.

Wanted: 7 MAC IIX, PC486, portable
 or better; software; modern electronic test
 equipment; small parts. Buy or trade.

"All software supports all IBM-PC
 compatible x86 systems (8086 - Pentium)

Off-the-Shelf Hardware
 Van Eck Systems • ATM2 • Data
 Card Reader/Writers • RF/EM/Radar/
 Ultrasonic/IR Detectors/Receivers/
 Xmitters/Jammers/Blasters • Secu-
 rity/Surveillance • EM Lab/Weaponry/
 Countermeasures • Resonant Crysta-
 l/Neurophone/Rife/Hieronymus Ra-
 dionics • Voice Disrupters • Phone
 Color Boxes • DTMF Decoders •
 Lineman's Handsets • Bug & Tap De-
 tector/Blaster • Carjack/Kidnap Foller
 • Hearing Assistant • Shriek Module
 • TENS • 6th Sense Communicator
 • Subliminal Mixer/Amp • Levitator
 • Vortex Generator • Noise Canceling
 System • Ultrasensitive Sound/
 Light/IR/EM Detectors • Electronic
 Dowsing • Laser • Bacteria Detection
 Kit - more! See our New Catalog!

SPECIAL PROJECTS

We design/build/obtain/repair/modi-
 fy/maintain/consult on any device/
 system/project/process - electrical/
 electronic/phone/computer/me-
 chanical/optical/automotive for busi-
 ness/personal/invention prototyping
 need. Confidentiality guaranteed.
 Describe and include \$30 pre-engi-
 neering fee (does not obligate you).
 Time and cost estimates in 7-10 days.

HI-TECH

RESEARCH SERVICES
 Unique 61+K electronic and computer de-
 sign article database accessed by title and
 subject: Digital, µP, µC, analog, hybrid, no-
 mograph, software. Many hacker, in-
 house, non-published articles. Provide us
 up to 25 keys (OK to combine topics). We
 return list, you select articles. \$25 search
 fee + \$1/selection + .25/page + \$5 SH.

AUTOMATIC

TELLER MACHINES
 ATM crimes, abuses, vulnerabilities and
 details exposed! 100+ methods detailed.
 Includes: Physical, Reg. E, cipher, PIN com-
 promise, card counterfeiting, magnetic
 stripe, false front, TEMPEST, Van Eck, tap-
 ping, spoofing, inside job, super-cool, vi-
 bration, pulse, high voltage - others. Case
 histories, law, countermeasures, detailed
 security checklist, labeled internal photos,
 figures. ATMs contain up to \$250,000 in
 cash! Recent \$350,000 ATM crime spree
 still unsolved! \$39.

CREDIT CARD SCAMS

Cardholders, merchants, banks suffer \$ Bil-
 lions in losses annually because of credit
 card fraud. Describes every known means
 of credit card fraud and scams. Protect
 yourself! \$29.

CONS, SCAMS & RELATED SWINDLES

Cons, scams and related swindles fleece
 Americans of \$100+ Billion per year! The
 most comprehensive survival manual on
 cons & scams of all kinds - from the clas-
 sic to hi-tech. Details 100s, their many
 variations, and countermeasures. Protect
 yourself! \$39.

Beyond

VAN ECK PHEAKING
 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
 Consumertronics and the original Top Se-
 cret Van Eck designs! \$29.

VORTEX GENERATOR

Heat and cool with amazing, simple 3-port
 device. Uses no moving parts, electricity,
 fossil fuel, liquid or freon. Guaranteed sci-
 entifically sound! Plans. \$9.

CELLULAR/CORDLESS PHREAKING

How cellphones operate and are modified.
 Vulnerabilities to hack attack and coun-
 termeasures. Comprehensive info on repro-
 gramming NAMS, ESNs, etc (cloning), con-
 trol data formats, computing encoded
 MINs, ESNs, SIDNs, operating systems,
 PROMs and their programming, forcing
 AOK, test mode and resets, scanning, track-
 ing, scanner restorations, freq and channel
 allocations, roaming, ESN and SIDN tables,
 parts/equipment sources, attendant sta-
 tions, non-USA bands, health concerns,
 and the ECPA and critique. Step-by-step
 descriptions to keypad-reprogram 100+
 popular cellphones. Plus complete section
 on phreaking cordless phones! Much more.
 Comprehensive, invaluable - 10 times more
 info than our competitor's \$79 manual!
\$69. (Do Special Projects (above) for
up-to-date hardware/software).

PBX HACKING

1000s of PBXs are hacked to the tune of
 about \$8 Billion/yr! While our "VOICE MAIL
 HACKING" (below) details how VMSs are
 hacked for "phun" and profit - including
 VMS methods for hacking PBXs them-
 selves - "PBX HACKING" addresses all
 other issues relating to PBX hacking, in-
 cluding countermeasures. Can your busi-
 ness or agency afford a \$90,000 phone
 fraud loss (average loss due to hacked
 PBXs)? As described in Forbes Magazine
 article. \$29.

VOICE MAIL HACKING

How Voice Mail Box systems are used and
 the specific ways they are hacked. Includes
 ASPEN, MESSAGE CENTER, BIX, GEN-
 ESIS, RSVP, SYDNEY, PHONE MAIL,
 AUDIX, CINDY, CENTAGRAM, SPERRY
 LINK, EZ, etc. Absolutely required for all
 users, sysops and security personnel! \$29.

PHREAKING

CALLER ID & ANI
 Details on how they work and dozens of ef-
 fective ways of defeating Caller ID, ANI,
 '69, '57, Call Blocking and '67. Also de-
 scribes Caller ID, Orange, Belt, Cheese
 and CF Boxes, ESS, SS7, E-911, various
 CLASS services, CNA, NON PUB DA,
 CAMA, DNR, 800-ECR, Diversers, LD Ex-
 tenders, Centrex - more. \$29.

Beyond

PHONE COLOR BOXES
 Dozen phone color boxes described - many
 circuits. Plus Call Forwarding, Conferenc-
 ing, Phreak History, Glossary, Diversers,
 Extenders, Loops, REMOBS, Bridging
 Heads & Cans, Oplocum, 3rd Party and
 many other non-box methods - more. \$39.

ROBOFONE AUTODIALER

Powerful, versatile, menu-driven "War-
 games" autodialer lets you dial any quantity
 (up to 10K) or mix of local/long distance
 phone #'s in any order, over any length of
 time, whether busy or answered (your
 choice) and log the times/commands/re-
 sults to monitor/disk/print. Quick-dial di-
 rectory of up to 600 numbers. BUSY re-
 sults. Direct menu command and control.
 All Result Codes, including VOICE and
 RINGING. Optional shell to terminal program
 upon CONNECT. Exit to menu or DOS (for
 batching). Manual + Disk* \$29.

COMPUTER PHREAKING

Describes in detail how computers pen-
 etrate each other, and how VIRUSES, TRO-
 JAN HORSES, WORMS, etc are imple-
 mented. Dozens of computer crime and
 abuse methods and countermeasures. In-
 cludes disk filled with hacker text files and
 utilities, and the legendary FLUSHOT+ pro-
 tection system (Ed. Choice, PC Magazine).
 BBS advice, password defeats, glossary -
 much more! Manual + Disk* \$39.

THE HACKER FILES

Compilation of 100s of the best articles
 written (in ASCII) by top hackers & phreak-
 ers. Covers every major topic in
 hackerdom! 3 HD Disks* \$59.

CRYPTANALYSIS TECHNIQUES

Five powerful menu-driven crypto programs
 (in .COM and .BAS source codes) to analyze,
 decrypt "secure" ciphertexts. Worked-out ex-
 amples. Recommended by prestigious "Com-
 puters & Security". Manual + Disk* \$29.

By an ORDER of the

MAGNITUDE

The most comprehensive, hard-hitting, hi-
 tech survival book ever written! Topics in-
 clude: electronic, computer, commo, chemis-
 try, energy, weapons, cryptography, com-
 sec, sealment, revenge, alarm, disguise & ID
 change, etc designs, tactics and strategies to
 survive an increasingly dangerous world. We
 face increasingly physically and financially
 brutal times! Field-expedient use of technol-
 ogy in various threat and conflict environ-
 ments and scenarios. Comprehensive. \$49.

ROCKET'S RED GLARE

Design and construction of solid-propellant
 amateur and survival rockets. Emphasis on
 formulation, manufacture, installation of
 propellants, motors, igniters, etc. Includes
 list of commonly available materials, and
 the design of launch pads and test beds
 (with schematics). \$29. **FIREWORKS:**
 How firecrackers (M-80s, blockbusters,
 cherry bombs), small rockets, volcanos,
 fountains, sparklers and safety fuses are
 made and colored. Simple, cheap, common
 ingredients. \$9. Both \$36.

STOPPING POWER METERS

As reported on "60 MINUTES": How cer-
 tain 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. Also de-
 scribes meter creep, overload droop, etc.
 Plans \$29. **THE I.Q. MANUAL:** Ex-
 ternal magnetic ways (applied to meter it-
 self) to slow down and stop watt-hour me-
 ters while drawing full loads. Plans. \$19.
KW-HR METERS: How watt-hour
 meters work, calibration, error modes
 (many), ANSI Standards, etc. Demand and
 Polyphase Meters. Other experimental re-
 sults to slow and stop meters by others.
 \$19. Any 2, \$38. All 3, \$59.

HIGH VOLTAGE DEVICES

HV device plans: Stun Gun, Taser, Prod,
 Cane, Flasher, Blaster, Zapper, Audio/RF/
 Radar Jammer, Jacob's Ladder, Plasma
 & Van de Graaff Guns, Fence Charger,
 Gopher Coulter, Ozone Gun, Fish Stun-
 ner, Plasma Stim, Kirlian, more! All plans
 for only \$29.

UNDER ATTACK!

Electromagnetic Interference and Electro-
 nics Weapon Attacks cause: Cancer,
 birth defects, and profound psychological,
 neurological, cardiovascular and immune
 system disorders! Destructive to people,
 animals, plants, equipment! Includes AC-
 TUAL CASES OF EM ATTACKS (we investi-
 gated) includes how to verify and point
 EM and electronic attack sources,
 and specific countermeasures. \$29. **EM BRAINBLASTER:** Tutorial and plans
 for powerful ELECTROMAGNETIC WEAP-
 ONS AND LAZERS. Optimum circuits,
 freqs, waveforms, duty cycles, intensities.
 Thorough. \$29. Both \$49.

RADIONICS MANUAL

Exciting electrical, electronic and electro-
 magnetic therapeutic, diagnostic and pre-
 ventive devices (mostly experimental). His-
 tory, descriptions, plans (dozens), avail-
 abilities of Radionics Devices from early to
 modern. While drugs cost \$ Hundreds,
 electricity costs pennies! \$29. **HEAL**
THYSELF: Plans for 3 major electronic
 therapeutic devices of types approved by
 FDA. \$24. **EMF & LIGHT THERA-**
PY: Systematic study of the germicidal
 properties of EMFs and lights *in vitro* and
in vivo. Bands include jwaves, 4 IR, 6 visible
 & 3 UV, using continuous, single-pulse,
 strobe, random pulse rate and width ex-
 posures. \$29. Any 2, \$48. All 3, \$69.

STEALTH TECHNOLOGY

Police radar is fascinating! It also has error
 rates of 10-20%! Every known error mode -
 stealth method and material used to mi-
 nimize radar reflections - tactic and strategy
 to fight against radar tickets (that cost you
 \$100s in insurance and legal cancellation) -
 methods to detect and jam signals - fully
 described! \$29.

SECRET & SURVIVAL RADIO

Optimum survival and security radio equip-
 ment, methods, freq allocations and voice/
 data scrambling/encoding. Includes small
 receivers/transmitters, telemetry, antenna
 optimizations, remote monitoring and con-
 trol, security, surveillance, and ultrasonic,
 fiber-optic and infrared comms. 70+ cir-
 cuit plans, tables. \$29.

SAVVY DRIVING

Detailed, comprehensive manual describes
 100+ tactical and strategic driving tips. In-
 cludes how to avoid and evade criminals,
 avoid and evade head-on collisions and other
 accidents, property repair to acci-
 dents, emergencies and police pullovers,
 avoid tickets, minimize insurance premi-
 ums and loss risk, prepare for trips and
 optimize routes and long-distance driving,
 optimize parking, more. For all drivers -
 beginners to pros. \$29.

ULTIMATE SUCCESS MANUAL

Underpaid, overworked, harassed or
 abused? Victim of office politics? Stuck in
 a dead-end job? Can't find a good job? Ex-
 pect to be laid off, fired or transferred
 soon? The ultimate no-holds-barred, look-
 ing-after-#1 Machiavellian techniques to
 find, obtain, optimize and keep top jobs,
 pay and benefits. THE RULES OF THE
 GAME FOR A GAME WITHOUT RULES!
 From resume to CEO. \$29.

HARD DRIVE MANUAL

Covers all hard drive and controller imple-
 mentations (emphasis on PCs). How to se-
 lect, interface, initialize, set up, use, main-
 tain, troubleshoot and repair them. How to
 protect them from mistakes, sabotage, pry-
 ing eyes and sticky fingers. How to recover
 damaged and lost files. How to prevent
 crashes. Includes software reviews.
 Loaded with info, advice, tips. \$39. **DISK**
SERVICE MANUAL: Maintain, ad-
 just, align, troubleshoot, repair floppies
 without special equipment or software.
 3.5"/5.25", PCx86, MAC, Apple, Atari,
 Commodore, etc systems. All floppies
 need some help. \$29. **DISK DRIVE**
TUTORIAL: Theory, practical facts on
 floppy drives, disks, including many tips,
 recommendations, formatting, interfacing,
 FDC, etc. \$25. Any 2, \$54. All 3, \$74.

Please Order Today!
 Sold for Educational Purposes Only



CONDOR D.C. POWER SUPPLY
PN# YCA426 115VAC INPUT
+5V, 4.0A / +12V, 3.0A
-12V, 0.8A / -5V, 0.2A
\$9.95

AC/DC UNIVERSAL ADAPTOR

Input: 110/220V, 60/50hz, 12W
Output: 1 to 12V, 1000mA
only \$9.95

LED SPECIAL!

Assortment of shapes, colors, and sizes.
GREAT DEAL!
100 pcs. - \$19.99

MUFFIN FANS

3 1/8 x 3 1/8 x 1"
New 12V Fan
\$8.95
2"x1" 12V Fan \$8.95

FAN CORDS - \$1.25
FAN GUARD - \$1.00



Joystick Assembly

5 microswitches, cord,
handle assembly \$3.99ea.
GREAT PARTS BUY!

PRINTER STANDS

DUAL LEG \$2.95

DUAL LEG
W/PAPER TRAY
\$4.95

80 COL. CLEAR
PLEXIGLASS
\$4.95

132 COL. CLEAR
PLEXIGLASS
\$6.95

386DX-25 COMPUTER*

4MB RAM, 135 HD, 1.2 FD
101 KB, VGA CARD, 30 DAY WAR.
\$395.00* (ADD \$95 FOR 1 YR WAR.)
\$550.00 with VGA MONITOR

POCKET PC REFERENCE

370 PAGES OF HARD TO FIND
INFORMATION FOR IBM PC'S
AND COMPATIBLES.
EXCELLENT BOOK
\$14.95

MINDSCAPE POWER PLAYER JOYSTICK
FOR COMMODORE 64, AMIGA, ATARI
\$4.99

EPSON LX-810 PRINTER (Draft & NLQ)
EXCELLENT 9 PIN, NEW 1 YR WARRANTY
\$149.95



HELPING HANDS
DUAL CLAMP
WITH LENS
\$9.95

COMPUTER "STUFF"

2X SCSI MULTIMEDIA KIT

2X CD ROM, SOUND CARD
SPEAKERS, 90 DAY WARR.
\$179.95

1X SCSI CD ROM DRIVE \$69.95

286 COMPUTER SYSTEM

20 HD, 1MB RAM, CGA MON, KB \$235.

COREL DRAW ver. 3.0

CD & 3.5 DISKS - \$59.95
CD ONLY - \$49.95

DOS 4.01 - \$12.95

WINDOWS FOR WORKGROUPS - \$89.95

MASTERING DOS

TUTORIAL AND USERS GUIDE
COVERS UP TO VER. 3.3
BUT GREAT BASIC REFERENCE
575 PAGES \$2.99



HEMOSTATS-3.5" to 8"

GREAT FOR HOLDING PARTS
\$2.95 to \$5.95

NEEDLE FILE SET
COARSE CUT - 10 pcs.
\$2.99

MULTIMETER
PORTABLE VOM
BP VM528
20K OHM
17 RANGES
\$12.95



Great Buy!

WIRE TIES

PKG. OF 100
4" WHITE - \$2.50
5" BLACK - \$3.40

WE SPECIALIZE
IN HARD TO FIND
COMPUTER AND
ELECTRONIC
ITEMS. CALL FOR
STOCK AND PRICE

COMPUTER TOOL SET

15 PCS W/TRAY
\$9.95

VARIABLE SPEED CONTROL
FOR CEILING FANS - \$2.50

TRIM POT ASSORTMENT

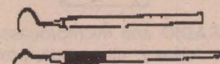
25 pcs - \$10.95
50 pcs - \$20.00

LC'S GALORE!!!
CALL FOR UPDATED LIST
OF CURRENT STOCK OR FOR
PRICE AND AVAILABILITY



ANTI-STATIC BAGS

Used once, Good Shape
Assorted Sizes, great for
protecting spare P.C. boards.
100 pcs. - \$11.99



PIK ASSORTMENT
5 pcs. \$10.00

WE BUY SURPLUS! - FAX US YOUR LIST FOR IMMEDIATE OFFERS

ELECTRONIC MATERIALS RECOVERY, INC.

3102 W. THOMAS #902, PHOENIX, AZ. 85017

PHONE (602) 272-3200

FAX (602) 269-3265

E.M.R. B.B.S. (602) 272-5300

Email us at emcphx@xroads.com

MINIMUM ORDER \$15.00 - VISA/M.C ACCEPTED - NO C.O.D.'S - UPS SHIPPING ADDED TO ALL ORDERS
QUANTITIES LIMITED - CALL FOR OTHER PRODUCTS AND SPECIALS - CALL FOR CATALOG

Write in 165 on Reader Service Card.

DID YOU KNOW that old personal computers, monitors, modems, electronic cash registers, and even old calculators contain valuable IC chips that are plated with pure gold! My "Big Color Photo" (8" x 10") shows over 25 of the most common gold plated IC Chips and the price I will pay for them. Chips are shown actual size. The price of gold keeps climbing higher and higher and is making it worthwhile to tear apart old equipment. To order "The Big Photo" send \$25 to Jim Sciuto, Box 128, Methuen, MA 01844.

WANTED: CALCULATORS, portable 1970s LED-type. Send manufacturer, model, condition to Guy Ball (Mr. Calculator), Box 345, Tustin, CA 92681-9345. E-Mail: mrccalc001@aol.com.

AVIATION ELECTRONICS

135

NEW CLASSIFICATION

PUBLICATIONS

140

EXTRACTION AND RECOVERY OF GOLD FROM SCRAP ELECTRONICS. Book describes how to inexpensively recover and refine scrap gold on small scale. \$35. Michael Young, PO Box 145, Newville, AL 36353.

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.

"POWER UP!" How to make commercial-battery adapters for: military radios, mine detectors, night scopes, field telephones, etc. Instructions/diagrams. \$14.95, plus \$5 S/H (\$6 Canada). NYS res. add \$1.70 tax. CRB Research, Box 56-NAV, Commack, NY 11725. Phone: 516-543-9169.

"FORBIDDEN SECRETS Of The Legion of Doom Hackers." Big 224-page handbook. Condemned programs & techniques from the infamous LOD's shut down BBS. Hacking, phreaking, & more! Limited edition. \$20.95 plus \$5 S/H (\$6 Canada). NYS add \$2.21 tax. VISA/MC OK. CRB Research, Box 56-NNV, Commack, NY 11725. Phone orders: 1-800-656-0056.

BACK ISSUES Pop Electronics, Radio-Electronics 25 + years; Trade Journals: EDN, Electronic Design; Computer Mags: Byte, PC World, PC Mag; IEEE journals; Comp/Engr Books; Software. Send SASE for list to TechArchives, 2449 Haymarket St., Thousand Oaks, CA 91362.

EARTHQUAKE ELECTRIC SIGNALS, experiments newsletter. Sample issue, \$1. Geo-Monitor, 65 Washington Street, #400-V, Santa Clara, CA 95050.

WORLD'S MOST UNUSUAL Communications Books! Large selection covering Scanners, "confidential" frequency (HF/VHF) registries, wireless history, bugging, wiretapping, electronic surveillance, monitoring, etc. Big free catalog! CRB Research, Box 56-NV, Commack, NY 11725.

FREE! THE ETC Catalog of Manuals for amateur, audio & test equipment. A.G. Tannenbaum, Box 386, Ambler, PA 19002. 215-540-8055, FAX 215-540-8327.

BLACK BOX BIBLE. A collection of cable, satellite, and VCR stabilizer schematics including software. 152 pages, \$33.45. VISA/MC 520-782-2316. TELECODE, Box 6426-NV, Yuma, AZ 85366-6426.

MILITARY MONITORING GUIDE. New book covers all phases of Military Monitoring. Military Frequencies All services, US Military bases, Military Black Projects. Major Air Force Installations, Monitoring Equipment and Systems, Navy/Coast Guard and more. \$19.95 plus \$4 Priority Mail. UNIVERSAL ELECTRONICS, 4555 GROVES ROAD, Suite 12, COLUMBUS, OH 43232. 614-866-4605.

VOICE SCRAMBLERS BIBLE. 168 pages on building voice scrambling equipment. Covers: Digital and analog designs (6), theory, schematics, parts sources, operation, usage. Includes software! \$34.45 ppd. VISA/MC 520-782-2316. TELECODE, Box 6426-NV, Yuma, AZ 85366-6426.

SAMS AR Sale: 10 for \$45 plus postage (above 18 only). A.G. Tannenbaum, Box 386, Ambler, PA 19002. 215-540-8055, FAX 215-540-8327.

ROBOTICS

145

NEW CLASSIFICATION

PLANS - KITS - SCHEMATICS

150

RESELL 200+ ELECTRONIC PLANS & KITS. Earn 100% profits. SASE for list dealer info. Matco Electronic Publications, POB 509-A2, Roseville, MI 48066-0509.

BUILD THE Handy Finder, direction finding phase detector. Similar to unit featured in QST, this unit covers 50-500 Mhz, a modes. Kit comes with: PC board, components, pre-formed stainless antennae, coax & BNC connector. You supply: PV pipe handle and 9V battery. \$18 + \$1.9 S&H. Richard Rockwell, AB6CP, PO Box 2140, Carmichael, CA 95609.

Closing Date For Next Issue - August 10th!

Follow St. Brendan Across The Atlantic . . . On Two Meters

by Joseph J. Carr
K4IPV

Open Channel

In the late 1950s, I received an engraved invitation to an awards dinner at the Carlton Hotel in Washington, D.C. As a teenager, I was somewhat taken aback to be invited . . . that stuff was for adults, wasn't it (yep, it was, and that's why they only let me drink ginger ale). My first writing gig was with the local ham radio newsletter, *AutoCall*, and it was that connection that got me on the invite list. The event was sponsored by the General Electric Company, who sponsored the Edison Award for technical achievement in radio.

The winners that year were two hams, one in California (W6) and the other in Hawaii (KH6), who managed two-way communications on the two-meter band (144-148 MHz) over the 2,000-mile-plus path between W6-land and KH6-land.

The two-meter band is in the VHF spectrum, so is normally "over the horizon only," except for times when special conditions are found (meteor scatter, auroras, etc.).

As far as I know, that record still stands for solely terrestrial communications on two meters (satellite communications are commonly very long distance, but not terrestrial). But that record might fall sometime in the near future.

The Irish Radio Transmitters Society (IRTS) has announced a contest for the first trans-atlantic communication on two meters. The winners will each receive one of two crystal glass trophies generously provided by the Waterford Crystal Company (whose products are known world-wide).

The crystal trophies are called the Brendan Trophies, after the legendary Saint Brendan. Among the Irish, he is probably second only to Saint Patrick, and is often referred to as "Brendan the Bold." And why was ol' Brendan so bold?

Well, if his travels, chronicled in *Navigatio Brendani* (The Voyages of Brendan), are history instead of storytelling, then he may well have sailed to the east coast of North America — trans-atlantic — in the end of the fifth, or beginning of the sixth centuries A.D. . . . in a leather boat! Internal evidence of the legend suggests that he probably reached Iceland or Greenland, and possibly Nova Scotia, nearly half a millennium before Leif Ericson. That Brendan's feat is at least possible was proved in 1976 by Tim Severin, who

repeated the journey in a leather boat of traditional design. If you are one to bend an elbow in honor of the bold (or foolish), then St. Brendan's feast day is May 16th each year.

The North Atlantic path has always been something of a challenge because it crosses magnetic lines of force at high latitudes, and is bombarded with assorted troubles such as the aurora, particles, and radiation from space. The short-term radio conditions predictions are usually made for the North Atlantic path because it describes nearly worst case conditions. An ionosonde device tests the path between the continents, and that data is published on radio stations such as WWV.

Marconi was the first to cross the Atlantic on a radio boat. He probably used LF frequencies, which were more practical than the shortwaves, to transmit the Morse code letter "S" from the west coast of England to a receiving site near St. Johns, Newfoundland, in Dec. 1903.

It took another 20 years for the shortwave radio to cross the Atlantic. On the night of Nov. 27, 1923, the contact was established by ham radio operators . . . and it startled the world!

Today, anyone with a few watts loaded into a wet string antenna can work trans-atlantic contacts with ease. Some people claim that the Two-meter Trans-atlantic Challenge sponsored by IRTS will be a greater technical achievement than Marconi's 1903 work . . . so here's your chance for immortality.

The award will go to the first two amateur stations who establish contact on two-meters, across the Atlantic ocean, without using a satellite or earth-moon-earth (EME) methods. Both stations must be physically located on land, or on non-tidal waterways, within the boundaries established by the continental shelves of Europe and North America. Each operator must be properly licensed as an amateur radio operator by his or her national government, and be operating within the provisions of that license (especially power and frequency limits). IRTS reserves the right to have its representatives inspect both claimant's station to ensure that things are on the up-and-up.

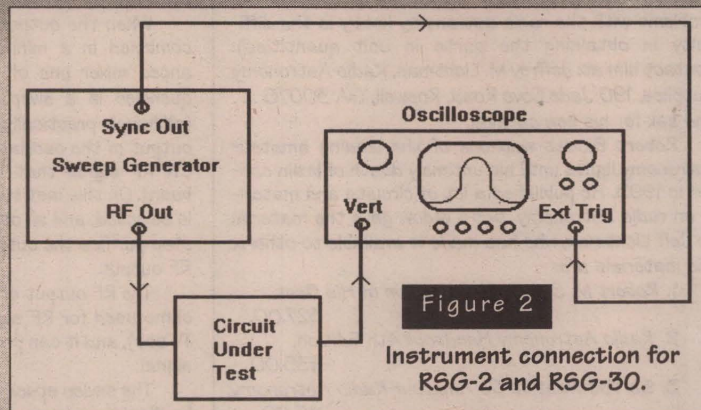


Figure 2
Instrument connection for
RSG-2 and RSG-30.

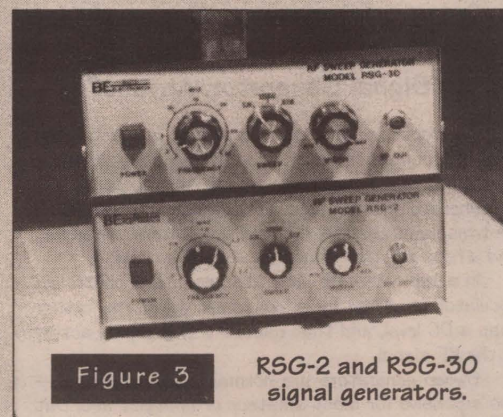


Figure 3
RSG-2 and RSG-30
signal generators.

The normal rules for an established ham QSO apply to the Two-meter Trans-atlantic Challenge. Both stations must receive the call sign of the other in full; signal reports must be exchanged (any recognized system — RS, RST, meteor scatter — can be used, but it must include at least two characters); each station must receive confirmation (Morse "R" or voice "Roger") from the other. The data must be exchanged within a single four-hour period. If the four-hour period expires, then a new contact-pair (another four-hour period) must be established.

In something of a "shades of Marconi" effort, the Radio Society of Great Britain (Lambda House, Cranborne Road, Potters Bar, Herts., EN6 3JE, England) is setting up a special account for donations to its RSGB Propagation Studies Committee to allow the establishment of permanent beacons on two meters. One beacon will be located near Lands End, England, and the other near St. Johns, Newfoundland. That project could result in some substantial propagation studies, and could lead to the information that will cause someone — or someones — to win the St. Brendan Trophy.

A good source of technical information on the problems of two-meter trans-atlantic propagation, check out "How To Win The Brendan Trophies" by Dr. Geoffrey H. Grayer in the June '95 issue of *Radio Communications* (RadCom is the journal of the RSGB,

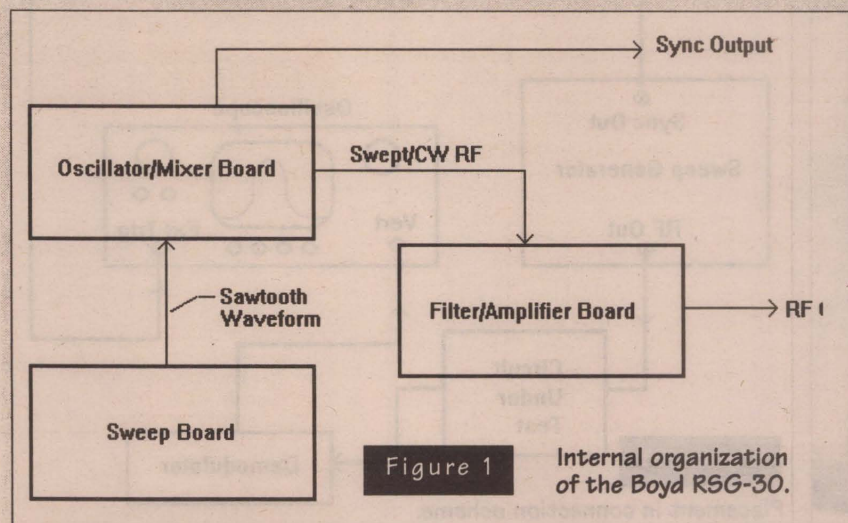


Figure 1
Internal organization
of the Boyd RSG-30.

Open Channel

and thus occupies a position similar to the ARRL's QST among British ham operators). The address for RadCom is the same as for the RSGB listed previously.

More on Radio Astronomy

My radio astronomy article drew a lot of positive comment from readers, including a letter from Jeffrey M. Lichtman. Jeff has authored a lot of material on radio astronomy, and sells a lot of pieces and parts of gadgets needed by radio astronomers (one of the problems with the radio astronomy hobby is the difficulty in obtaining the parts in unit quantities). Contact him at: Jeffrey M. Lichtman, Radio Astronomy Supplies, 190 Jade Cove Road, Roswell, GA 30076 ... and ask for his new catalog.

Robert Sickles was one of the leading amateur astronomy lights until his untimely death of brain cancer in 1993. He published a lot of circuits and material on radio astronomy. Bob's widow gave the material to Jeff Lichtman, who has made it available to others. The materials are:

1. Robert M. Sickles: A Collection of His Best, \$27.00.
2. Radio Astronomy Handbook 4th Edition, \$35.00.
3. So You Want To Do Amateur Radio Astronomy, \$6.00.

Contact Jeff if you want to obtain any of these items.

Sweep Signal Generator, Anyone?

One tool used on a lot of radio workbenches is the swept RF signal generator. These RF gens are designed to put out the usual continuous RF signal, as for any RF generator, but also a swept waveform. It is used to test resonant circuits, RF amplifiers, filters, antennas, and a host of other frequency sensitive circuits.

In a typical sweep generator, a voltage controlled oscillator is driven by a sawtooth waveform, rather than a DC level, and that causes the sweeping action of the RF signal.

Sweep generators are normally very expensive — too expensive for most amateur or hobbyist use. But now you can obtain two different sweep generators either ready-built or in kit form from Boyd Electronics Co., 1998 Southgate Way, Grants Pass, OR 97526; (503) 476-9583. Boyd's two offerings include their Model RSG-30 that sweeps 2 MHz to 30 MHz, and the RSG-2 that sweeps from 0 to 2 MHz. The latter signal generator is optimized for low-frequency IF fil-

ters and VLF receivers.

Figure 1 shows the block diagram for the RSG-30 sweep generator. It contains three printed circuit boards: sweep; oscillator/mixer; and filter/amplifier. The sweep generator contains the sawtooth generator, plus control circuitry that provides for three modes. The RF/mixer board contains two RF oscillators. One oscillator is a 50 MHz fixed frequency crystal oscillator, while the other is a voltage-controlled (swept) oscillator that tunes from 50 to 80 MHz.

When the outputs of these two mixers are combined in a mini-circuits SBL-1 double balanced mixer one of the resultant output frequencies is a swept signal of 0 to 30 MHz (although practically, 2 MHz to 30 MHz). The output of the oscillator/mixer board is either swept or CW RF signal that is applied to the filter/amplifier board. On this last board, the 2-30 MHz mixer product is selected, and all other frequencies are rejected. This step purifies the output so that it can be sent to the RF output.

The RF output of the RSG-30 is the standard 50 ohms used for RF signals (except those intended for TV use), and it can produce up to 100 millivolts RMS of signal.

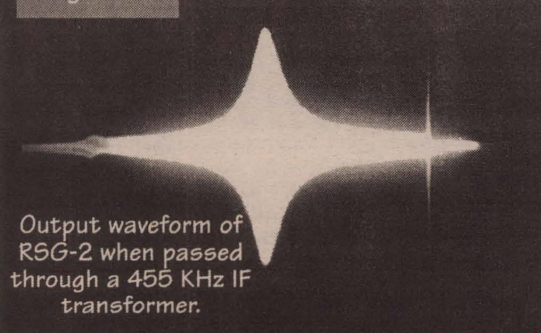
The sweep speed is 20 milliseconds so that it can be displayed on an oscilloscope at a setting of 2 milliseconds per horizontal division (2 ms/div).

A second output is a synchronization pulse derived from the sawtooth generator. This pulse is applied to the EXTERNAL TRIGGER input of an oscilloscope, and is used to sync up the sweep of the 'scope with the sweep of the signal generator so as to present only one sweep's trace on the 'scope screen at any one time.

Figure 2 shows how the sweep generator is connected for use. The oscilloscope used to display the waveform should be a triggered sweep model with the capability to receive an external trigger pulse. Such a pulse will initiate a single sweep of the 'scope's internal horizontal timebase. The sync out signal of the sweep generator is connected to the external trigger input of the 'scope, and the 'scope is set for use with external triggering. The RF output of the sweep generator is fed to the input of the circuit under test, while the output of the circuit under test is fed to the vertical input of the oscilloscope.

Figure 3 shows both the RSG-30 (2-30 MHz) and RSG-2 (0-2 MHz) sweep signal generators; I assembled both from kits received from Boyd

Figure 5



Output waveform of RSG-2 when passed through a 455 KHz IF transformer.

Electronics. On both instruments the RF output is through a front panel BNC connector, while the sync out is through a BNC connector on the rear panel. Both signal generators are powered from 12 VDC output wall transformers. One of my intended modifications is to use the same Radio Shack cabinet used by Boyd to house a common DC power supply for

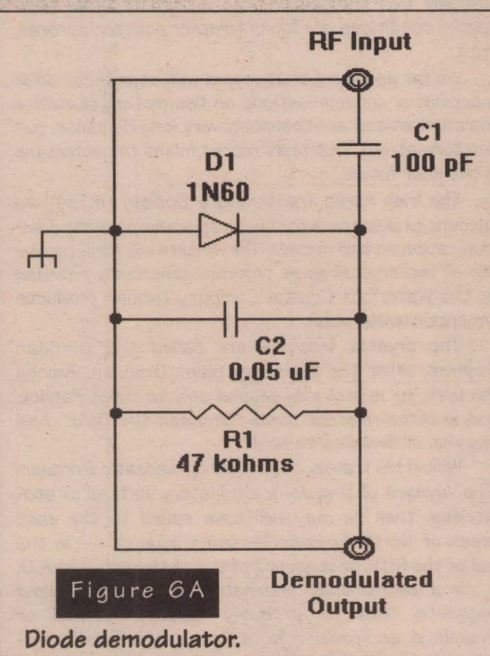
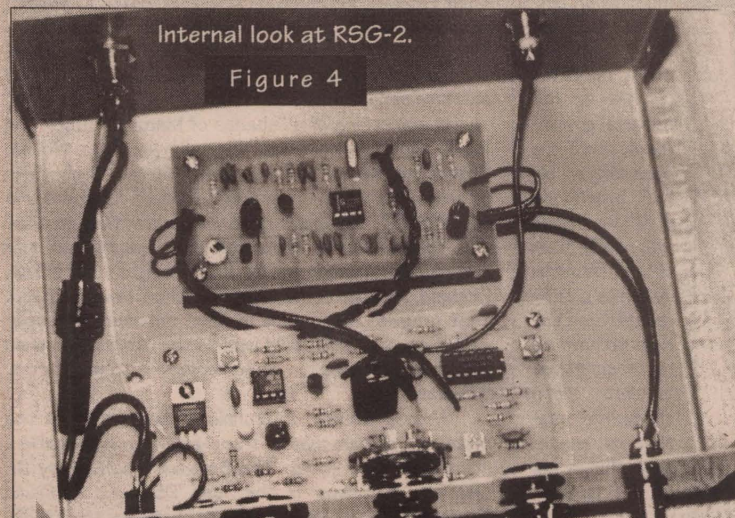


Figure 6A
Diode demodulator.



Internal look at RSG-2.

Figure 4

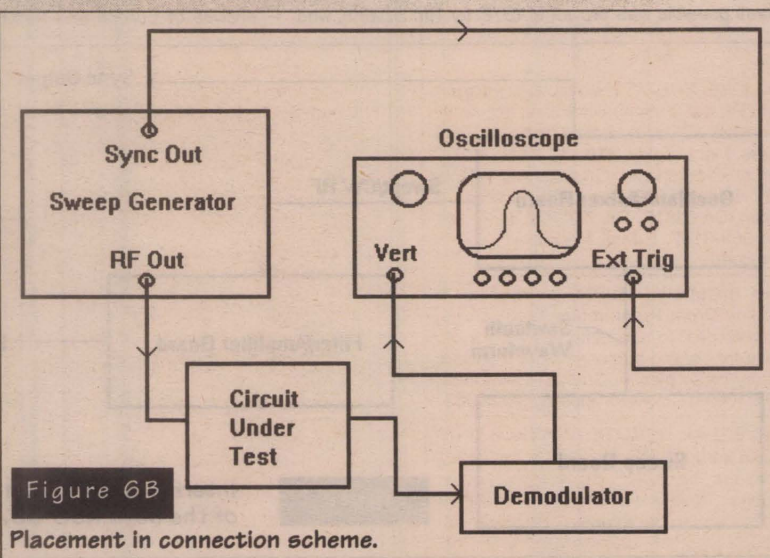
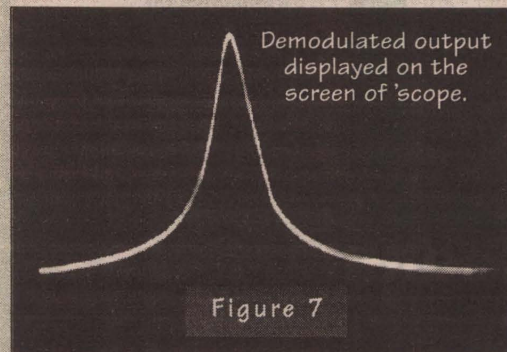


Figure 6B
Placement in connection scheme.

Open Channel

both units.

The 0 to 2 MHz low-frequency sweep generator produced by Boyd is similar to the RSG-30, although it has only two internal printed circuit boards: sweep and oscillator/mixer. These boards are shown in Figure 4 mounted in the cabinet.



Both RSG-30 and RSG-2 sweep generators have three output modes: Continuous Wave (CW); video; and Symmetrical (SYM). The continuous wave output is the same as any other RF signal generator. It produces a fixed amplitude RF signal that can be tuned over the range of 2 to 30 MHz by turning the FREQUENCY knob.

The VIDEO mode sweeps from the lowest frequency to the highest frequency (2-30 MHz on RSG-30 and 0-2 MHz on RSG-2). The FREQUENCY control has no effect in this mode, and the WIDTH control only affects the highest frequencies.

The SYMMETRICAL mode allows the sweep to center around the frequency set by the FREQUENCY control. The WIDTH control varies the sweep magnitude about the frequency set by the FREQUENCY control. The sweep width in this mode can be set from 5 KHz to 5 MHz. It is the SYMMETRICAL mode normally used to check filters, IF amplifiers, and the like.

Figure 5 shows the output of the RSG-2 when the swept RF signal is passed through a standard 455

KHz IF transformer. This trace was obtained using the connection scheme of Figure 2. Note that the trace is doubled, i.e., the same peak is seen both above and below the baseline. Further, the trace is filled in, indicating that we are displaying the RF signal on the screen of the oscilloscope. It is common practice to use the VERTICAL POSITION control on the oscilloscope to place the baseline at the bottom of the screen, obscuring the lower peak.

Another approach is to use a demodulator box between the output of the circuit under test and the vertical input of the oscilloscope. Figure 6A shows a typical demodulator, while Figure 6B shows the instrument connections modified to show its location and use. Figure 7 shows a typical trace obtained when the demodulator is used.

The sweep generator is sufficiently useful to RF and radio people that one ought to consider owning one — they are that useful. With the Boyd Electronics RSG-30 and RSG-2 sweep generators, that dream becomes a possibility. NV

#150 PLANS - KITS - SCHEMATICS cont.

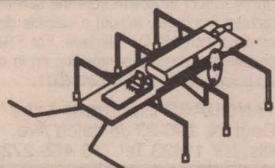
HOBBY CATALOG: Broadcasting, Ham, CB, Cable TV, Hobby and Computer stuff. Transmitters, amplifiers, bugging devices, science projects, TV add-ons, descramblers, books (start your own radio station!), software and more. **PAN-COM International**, Box 130-V8, Paradise, CA 95967.

VCR BELT KITS! Save big bucks by changing broken or worn belts. Send make, model & \$15 to Minute Man Electronics, 37111 Post St. #1, Fremont, CA 94536. Visa or MC. 510-791-5036.

CRYSTAL RADIO Kits: comes complete for an old style radio. \$22.50. Carl & Grace Ent., 5636 Romeyn, Detroit, MI 48209.

HEATH COMPANY is selling photocopies of most Heathkit manuals. Only authorized source for copyright manuals. Phone: 616-925-5899, 8-4 ET.

LASER LIGHT show plans. New, inexpensive, non-computerized. Exotic patterns from music! \$8.95. TJ Tek, 9318 S. Steele St., Suite 222, Tacoma, WA 98444.

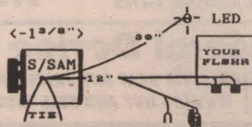


WALKING ROBOT. HexWalker six legged robot kit. Basic stamp controlled, servo driven. \$125 +\$5 S&H North America, \$15 all others. Manual only, \$10 +\$1 S&H (applicable to kit purchase). CA folks add 7.75%. M&T Systems, PO Box 7816, Huntington Beach, CA 92615. Tel. 714-969-3166, Fax 714-969-3167, E-Mail Mandtys@ix.net-com.com.

OAK SIGMA I/II/3D/PH2 schematic for building Prom Programmer, instructions, Prom Codes, to turn units into full service mode for Testing purposes, \$20. Postpaid, money order please. Surplus Electronics, POB 10009, Colorado Springs, CO 80932.

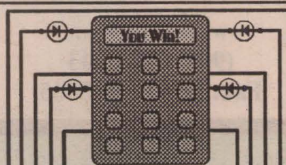
UNIVERSAL REMOTE CONTROL SYSTEMS infrared, RF miniature transmitters, receivers. Items for novice technician or educator. Combine your home and vehicle control automate anything. **FREE CATALOG.** Inventive Solutions, PO Box 8, Stratford, NY 13470.

IRQ/DMA conflict eliminator: Easy to build board does what software can't. A must for troubleshooting pcs. Laser printed schematics, drawings and parts list, \$15. Mark Lopez, 306 Roosevelt, Irvine, CA 92720.



IF YOU can make these connections you'll have the best Turn Signal Reminder in the business. **PATENTED.** \$22 + \$2.50 S&H. 30 day money back guarantee. Free Flyer. Call toll free, 1-800-398-5605. Visa/MC. Sam TSR Co., 1627 Basil Dr., Columbus, OH 43227.

ELECTRONIC KITS: Caller ID w/battery backup, 150 call memory and an RS232 interface, Multistation Thermometer w/4 separate temperature stations and an RS232 Interface, Telephone Dialer, 240 number storage and an LCD display. Call Genoa Group, 1-800-772-3945.



CAN A hidden computer beat a casino? You've seen them on network TV. Now get the **ACTUAL SCHEMATICS** to easily build your own! Beautiful 40 PAGE manual will give you every detail! For informational purposes only. \$12. WCN, 3283 Belvedere, Riverside, CA 92507.

HYDROGEN FUEL cell educational kit: PEM fuel cell, solar panel. Electrolyzer and more \$149. Greenlux, 415-753-0251.

OAK SIGMA I converter descrambler schematic \$15; Oak Sigma STV I/II schematic \$15; Jerrold Starcom-5 compatible XT5-211 baseband schematic \$10; Starcom-7 compatible DPV7212 schematic \$10; Starcom-7 compatible DPBB/M1 baseband schematic \$20; Money order please. Surplus Electronics, POB 10009, Colorado Springs, CO 80932-1009.

FREE! THE ETC Catalog of Manuals for amateur, audio & test equipment. A.G. Tannenbaum, Box 386, Ambler, PA 19002. 215-540-8055, FAX 215-540-8327.

EFFECTS DEVICES build your own analog guitar setup. Complete plans: Synthetech Research, PO Box 4860, Philadelphia, PA 19124-0860.

Don't Count Inventory... Count Cash!

Turn your surplus inventory into surplus cash. Phone or fax us about your excess inventory and we'll make you an offer on the spot.

Our purchasing power, personal service and integrity in the marketplace is unmatched. For over 20 years we've staked our reputation on it.



If cash for surplus is music to your ears, listen to a...
SYMPHONY
Electronics Corporation

WEST COAST: 10127 JEFFERSON BLVD. • CULVER CITY, CA 90230
PH (800) 347-0743 • FAX (310) 637-0150

EAST COAST: 2239 18TH STREET • UNIT B • SARASOTA, FL 34237
PH (813) 955-9656 • FAX (813) 955-5958

NOW! A QUALITY SATELLITE SCPC AUDIO RECEIVER

AT AN AFFORDABLE PRICE



UNIVERSAL SCPC-100 AUDIO RECEIVER

SERVICES ON SCPC RADIO

ALL SPORTS - NEWS NETWORKS - AP - UPI - RADIO NETS - HOMETOWN SPORTS - TALK SHOWS - MUSIC (CLASSICAL, JAZZ, ROCK) - MAJOR RADIO STATIONS - FINANCIAL NEWS - NEW, QUICK LOCATOR CHANNEL GUIDE FURNISHED - OVER 430 CHANNELS AND GROWING!

FEATURES OF THE SCPC-100

MICROPROCESSOR TUNING, EASY TO TUNE - 50 CHANNEL MEMORY RECALL - WORKS WITH 950-1450 SYSTEMS - 3-MINUTE HOOKUP - 1/2" DISPLAY - C AND Ku BAND SCPC - DOES NOT DISABLE VIDEO IN USE - USE WITH HI-FI SYSTEM - RECEIVES ALL SCPC CHANNELS - SIMPLE TO USE - TUNE ALL "HIDDEN" CHANNELS.

RETAIL PRICE \$399 + S&H

UNIVERSAL ELECTRONICS, INC.

4555 GROVES RD., SUITE 12, COLUMBUS, OH 43232
(614) 866-4605 FAX (614) 866-1201

NEW PRODUCTS WANTED

Established surveillance manufacturing company looking for ideas and inventions in the areas of surveillance, countermeasures, and cellular analysis (A.M.P.S., T.A.C.S., N.M.T., G.S.M., T.D.M.A., or C.D.M.A.).

We can develop, produce, and market on a partnership, profit sharing, or on an outright purchase basis.

Tech Support Systems

1040 Hamilton Court
Menlo Park, CA 94025
415-325-6691 • FAX 415-325-6693

SURPLUS SALE

200,000 WALL TRANSFORMERS



3.6 VDC	900 MA	2.25
12 VDC	100 MA	1.10
12 VDC	500 MA	1.75
12 VDC	800 MA	2.10
14 VAC	500 MA	1.75
16 VAC	1.25 A	2.95

Min 1000/type -- Call for other types

SURPLUS TRADERS

PO Box 276
Albany, Vt. 05440
Tel: 514-739-9328
Fax: 514-345-8303
FREE CATALOG!

WANTED

SIMMS

256x9	1x9	1x36
512x36	4x9	2x36

DRAM

1x1	256x4
-----	-------

**BEST PRICES PAID
CALL OR FAX NOW!**

ADD-ON America Corp.

(800) 576-2349

FAX (410)-987-3258



We'll Buy

your excess Inventory

All types of electronic components,
Test and Auto Insertion equipment

- Purchase outright
- Consignment
- Partnering agreements

**Send your excess list
for a quick offer!**

Contact Bob Harris
Phone (214) 343-2170, FAX 1854
Internet bcdselect@onramp.net

Serial Problems???

Use your PC compatible desktop or laptop computer to debug serial communications problems with Serial, our test tool for serial communications.

Serial works with the standard data rates and asynchronous serial formats commonly found in modern office and industrial environments. Suitable for development, service work, and end-user problem diagnosis.

- Easy to Use
- Menu and Windows
- Highly Configurable
- Contextual Help
- Autobaud Detect
- Time Stamping
- Custom font editor for EGA/VGA Screens
- Saves Configurations
- Extensive Manual
- Block transmit ability
- CRC/LRC generation

Serial, with manual\$99.95
Cable for full duplex monitoring\$49.95

For Orders and Inquiries Call: 1-800-980-9806

Allison Technology Corporation
8343 Carvel, Houston, TX 77036
FAX and BBS 1-713-777-4746

The NiCd Lady

N6WPA

Losing your source of power?
Why pay extra for a new case?
Get your old case refitted with NEW
higher quality cells and \$ave!

- Handhelds
- Portable Scanners
- LapTops/Notebooks
- Test Equipment
- Any Special Application

P.O. Box 654
Wildomar, CA 92595

(909) 678-0943

Fax: (909) 678-0065

DEVICE PROGRAMMERS

**Now Programs
Pics Micros
with a \$59.
Adapter**

\$159

32 PIN UNIVERSAL PROGRAMMER FOR
GALS, FLASH, E[EPROMS, PSD3XXX*
MICROCONTROLLERS* And PICS

ROMMASTER/1

ROMMASTER/4



**Now New
Low Sale
Price!**

\$239

**New Printer Port
Programmers**

4 SOCKET 32 PIN PROGRAMMER
E[EPROMS

General Device Instruments

GD! WILL BEAT ANY PRICE - NEVER UNDERSOLD
WE ALSO BUY AND SELL USED PROGRAMMERS

408-241-7376 SALES

408-241-6375 FAX

408-983-1234 BBS

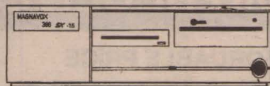
SEE OUR OTHER ADD IN NUTS AND VOLTS

FOSS WAREHOUSE DIS CENTER
289 Schenck St., North Tonawanda, NY 14120
1-800-473-0506 716-694-6400 1-800-488-0525 FAX

MAGNAVOX COMPUTER

Used - from bankruptcy stock

- 386 SX-16 INTEL
- 42 MEG HDD
- 3.5" FLOPPY DRIVE H/D
- 5.25" FLOPPY DRIVE H/D
- IDE CONTROLLER ON BOARD
- VGA CONTROLLER ON BOARD
- RAM 1 MEG ON BOARD
- EXPANDED MEMORY SLOT 1
- "72 PIN SIMMS-NP"
- MODEM 2400 BAUD HAYES COMPATIBLE INSTALLED
- 3 EXPANSION SLOTS



SPECIAL PRICE \$175.00
Call for special memory prices.

★BUYING LARGE QUANTITIES★ \$\$\$BEST PRICES AVAILABLE\$\$\$

**SCIENTIFIC
ATLANTA**
8536 THRU 8600

TOCOM
VIP
THRU
5507

JERROLD
DPBB212
THRU
DPV7,
DPBB7,
CFTs

ZENITH
1600 THRU 1622

PIONEER
5135 THRU 6300

Midwest's Largest Cable Brokers

(We buy quantities of one to one thousand units)

NATIONAL CABLE BROKERS
(219) 935-4128

SPY ON THE EARTH



**See live on
your PC
what
satellites in
orbit see**

Capture live breathtaking images of the Earth for fun or profit. Zoom in up to 20X. Send \$39 check or M.O. (\$45 air, \$50 overseas) for our fantastic SpySat, 8 diskette set of copyrighted programs (IBM type) that does satellite tracking, image acquisition, image processing, 3-D projections and more. Direct reception from the satellites guaranteed worldwide without a satellite dish. Schematics included for interface. For FREE information and demo programs log-on to our bulletin board anytime at: (718) 740-3911.

VANGUARD Electronic Labs
Dept. N, 196-23 Jamaica Ave.
Hollis, NY 11423 Tel. 718-468-2720

SPECIAL

ALL MAJOR BRANDS • ALL GUARANTEED

PROCESSOR	EPROM	STATIC RAM	
80C31	8741	27C040	6116
8202	8742	27C020	6264
8219			62256
8253	8748H	27C010	628128
8255			
8254	8749H	27C512	
8284	8751	27C256	256X9
82288			
	87C51	27C128	1MEG X9&3
FLASH EPROM			
28F010	8752	27C64	1X36
28F020	8755	27C32	4X32

**WE BUY YOUR EXCESS
MEMORY AND CIRCUIT BOARDS**

SINACO ELECTRONIC • 818-705-1880 • FAX 818-705-1881

Robot Explorer™

The Robot Explorer™ newsletter is your guide to the world of intelligent mobile robots. Each of the 8 yearly issues is packed with robot explorations: from Antarctica, to the depths of volcanoes, to desktop mechanical creatures.

Build the newest robot kits, review the latest books, and receive expert guidance from master robot crafters.

Whether you're a professional robot designer, researcher, educator, hobbyist, or simply love to read about robots, Robot Explorer contains the in-depth articles you need to keep up to date with the quickly evolving world of intelligent machines. Eight issues for \$14.95.

Call Now!

MC/Visa **1 (800)GO-ROBOT** (800)467-6268
POB 458, Peterborough NH 03458 603.924.6079
\$14.95 North America \$29.95 World-Wide

NEW BOARDMAKER SCHEMATIC and PCB CAD

For IBM PC and compatibles

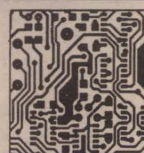
BOARDMAKER
Entry Level — Only \$95
Easy to use
Dot matrix, laser, plotter
Gerber & NC drill output

Advanced — \$395
Accepts netlists
Design rule checking

Board Capture — \$395
Full feature schematic capture

Board Router — \$200
Gridless autorouter

Free Demo



7840 ANGEL RIDGE ROAD
ATHENS, OHIO 45701
(614) 592-1810

Visa & MasterCard Accepted



TRUST THE EXPERTS...
50 YEARS SERVING THE LAMP INDUSTRY

- HARD TO FIND LAMPS
- FREE LAMP ID SERVICE
- \$25 MINIMUM ORDER
- WE PURCHASE EXCESS INVENTORY

USA: 800-8 LIGHTS • Local: 714-452-0900
FAX (24 Hours): 800-255-3141

**SUNRAY
LIGHTING INC**

1 Whitney, Irvine, CA 92718-2806
P.O. Box 50370, Irvine, CA 92619-0370

PCB's in Minutes From LaserPrint! *

8 1/2" x 11" Sheets
* Or Photocopier Use household iron to apply.

PnP BLUE or PnP WET

For High Precision Professional PCB Layouts
Easy Hobby Quality PCB's

1. LaserPrint
2. Iron-On
3. Peel-Off
4. Etch

Adds on Extra Layer of Resist for Super Fine Lines on Std Clad Bds

205h\$30/40h\$50/100h\$100 Blue/Wet (No Mix)
Sample Pack 5 Shs Blue + 5 Shs Wet \$20
VISA/MC/PO/CH/MO \$4.50 - 2nd Day Mail

Technics Inc. P.O. Box 463 Ringoes NJ 08551
(908)788-8249

100% Money Back Guarantee-Dealer Inquiries Invited

CCTV SPECIALS

Panasonic WV-BP114 • 1/3" CCD Camera
CHINON CX-060 • 1/3" PC Board Camera



• 0.1 lux • CS mount • 380 lines • ELC
• Lenses \$30 & up • 24vac strv \$10
Panasonic WV-CP214 • 1/3" Color Camera
TR-9308 9" B/W MONITOR



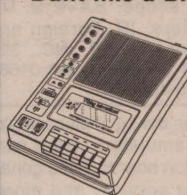
• 1.5 lux • CS mount • 380 lines • ELC
• Lenses \$30 & up • 24vac strv \$10
• 700 line resolution

• ALSO AVAILABLE -
Pinhole Board Camera
from \$229 • Video Motion
Detectors & Switches

4700 Loyola Lane, Suite 119 Austin, Texas 78723
(512) 345-8401 • FAX 926-0940

CCTV CATALOG \$5.00 - REFUND W/PURCHASE

PROFESSIONAL 10 HOUR RECORDER Built like a BATTLESHIP



- Special Nuts & Volts price \$149
- BUILT-IN voice activation add \$25
- Specifically engineered for long play recording
- 12, 14, and 16 hour versions available

CODs OK. California residents add tax.
Sorry, no credit cards
(All they "do" is increase the prices...)

FREE 32 page
special equipment catalog!

VIKING INTERNATIONAL SINCE 1971
150 Executive Park Blvd. #4600-N • San Francisco, CA 94134
Phone: (415) 468-2066 • Fax: (415) 468-2067

TRUE TAMPER-PROOF

SECURITY SCREW REMOVAL BITS



The SUPER TORX Kit Includes:

T-10, T-15, T-20 & T-25
COMPLETE SET FOR >> \$19.60

TOCOM 5503 Bit \$ 8.95
TOCOM 5507 Bit \$19.95
ZENITH PM/PZ-1 Bit \$10.95
JERROLD Starcom Bit \$19.95
PIONEER (Oval) Bit \$23.95
AAK Sigma (Oval) Bit \$23.95
*** Security Screws Available ***

TAMPER-BIT SUPPLY CO.

(310) 866-7125



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: \$34.95 (\$51.95 by 1st Class)

6-Month Trial - \$17.95. Foreign - Write.

A.R.C., P.O. Box 802-G16
Carlisle, MA 01741

Call: 508-371-0512 Fax: 508-371-7129

PAGERS PROGRAMMED!

We can offer you 1 or 51 to work
on your existing number.

Write, fax, or call us for free flyer.
We offer fast, friendly service and the
most affordable prices in the industry.

We also buy and sell
pagers of all types.

SOFTWARE CITY

9501 N. Rodney Parham Suite 120

Little Rock, AR 72207

Fax/Mtg (501) 223-9406

VISA • M/C • DISCOVER

MODEL	W x D x H (in)	PRICE
MPR-1	1.5 x 1.5 x 1.5	\$2.95
MPR-2	1.5 x 1.5 x 1.5	\$2.95
MPR-3	1.5 x 1.5 x 1.5	\$2.95
MPR-4	1.5 x 1.5 x 1.5	\$2.95
MPR-5	1.5 x 1.5 x 1.5	\$2.95
MPR-6	1.5 x 1.5 x 1.5	\$2.95
MPR-7	1.5 x 1.5 x 1.5	\$2.95
MPR-8	1.5 x 1.5 x 1.5	\$2.95
MPR-9	1.5 x 1.5 x 1.5	\$2.95
MPR-10	1.5 x 1.5 x 1.5	\$2.95
MPR-11	1.5 x 1.5 x 1.5	\$2.95
MPR-12	1.5 x 1.5 x 1.5	\$2.95
MPR-13	1.5 x 1.5 x 1.5	\$2.95
MPR-14	1.5 x 1.5 x 1.5	\$2.95
MPR-15	1.5 x 1.5 x 1.5	\$2.95
MPR-16	1.5 x 1.5 x 1.5	\$2.95
MPR-17	1.5 x 1.5 x 1.5	\$2.95
MPR-18	1.5 x 1.5 x 1.5	\$2.95
MPR-19	1.5 x 1.5 x 1.5	\$2.95
MPR-20	1.5 x 1.5 x 1.5	\$2.95
MPR-21	1.5 x 1.5 x 1.5	\$2.95
MPR-22	1.5 x 1.5 x 1.5	\$2.95
MPR-23	1.5 x 1.5 x 1.5	\$2.95
MPR-24	1.5 x 1.5 x 1.5	\$2.95
MPR-25	1.5 x 1.5 x 1.5	\$2.95
MPR-26	1.5 x 1.5 x 1.5	\$2.95
MPR-27	1.5 x 1.5 x 1.5	\$2.95
MPR-28	1.5 x 1.5 x 1.5	\$2.95
MPR-29	1.5 x 1.5 x 1.5	\$2.95
MPR-30	1.5 x 1.5 x 1.5	\$2.95
MPR-31	1.5 x 1.5 x 1.5	\$2.95
MPR-32	1.5 x 1.5 x 1.5	\$2.95
MPR-33	1.5 x 1.5 x 1.5	\$2.95
MPR-34	1.5 x 1.5 x 1.5	\$2.95
MPR-35	1.5 x 1.5 x 1.5	\$2.95
MPR-36	1.5 x 1.5 x 1.5	\$2.95
MPR-37	1.5 x 1.5 x 1.5	\$2.95
MPR-38	1.5 x 1.5 x 1.5	\$2.95
MPR-39	1.5 x 1.5 x 1.5	\$2.95
MPR-40	1.5 x 1.5 x 1.5	\$2.95
MPR-41	1.5 x 1.5 x 1.5	\$2.95
MPR-42	1.5 x 1.5 x 1.5	\$2.95
MPR-43	1.5 x 1.5 x 1.5	\$2.95
MPR-44	1.5 x 1.5 x 1.5	\$2.95
MPR-45	1.5 x 1.5 x 1.5	\$2.95
MPR-46	1.5 x 1.5 x 1.5	\$2.95
MPR-47	1.5 x 1.5 x 1.5	\$2.95
MPR-48	1.5 x 1.5 x 1.5	\$2.95
MPR-49	1.5 x 1.5 x 1.5	\$2.95
MPR-50	1.5 x 1.5 x 1.5	\$2.95

ORDER TODAY! (\$30.00 MINIMUM ORDER)
ALL PRICES INCLUDE WORLDWIDE SHIPPING!
A IS USA, CANADA & MEXICO, B IS REST OF WORLD

ORDER (800) 834-3457 • FAX (800) 551-2749
(702) 565-3400 • FAX (702) 565-4828

SESCOM, INC. 2100 WARD DR., HENDERSON, NV 89015

SESCOM, INC. is not responsible for inadvertent typographical errors and prices and specifications are subject to change without notice.

PERFORATED OR PLEXIGLAS PANELS ALSO AVAILABLE

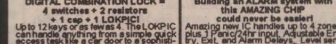
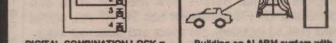
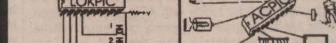
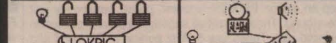
FOR INFO ON OTHER ENCLOSURES REQUEST FREE CONSTRUCTOR'S CATALOG

MENTION AD AND TAKE 5% OFF FIRST ORDER

New ELECTRONIC FIREPOWER!!!

email sales@hoopsware.com
web www.greatbasin-net/hoopsware

Amazing new Electronic Gun has only one moving part - the projectile! Inside the possibilities! This simple, silent, and inexpensive project uses parts mostly available from Radio Shack and can be built in as little as 30 minutes. The same principles can be used to build a target weapon with deadly force! Complete plans only \$16.50 (\$20.00 Canada and Mexico). Order #GOLINK



DIGITAL COMBINATION LOCK = 4 switches + 2 resistors
1 cap + 1 LOPIC
Amazing new LOPIC handles up to 12 zones plus a 12th zone for input. Adaptable to 12V or 24V operation. Lame alarm systems. Complete tripped zone annunciation per channel. A great companion for battery operation if desired. Requires low-voltage power for complete alarm system. (chip and application note only \$16.50 Canada and Mexico) Order #LOPIC

VISA/MC ORDERS (702) 322-8875 or HoopsWare
P.O. Box 5078, Dept. NV
Sparks, NV 89432-3078
send orders with check or M.O. to:

Convert RS-232 to RS-485 or TTL/CMOS for Only \$49.00

Communicate up to 1,000 feet, at up to 1 MEGA-BPS, full or half duplex, up to 32 units on one serial link, with 31 jumper options for flexible configuration, LED indicators.

COMMUNICATIONS CONVERTER

- FULL SCHEMATIC AND DOCUMENTATION
- FULL FAMILY OF MODULAR DESIGNS
- RS-485/RS-422 REMOTE I/O MODULE KITS
- NETWORK SOFTWARE AND SOURCE CODE
- AUTOMATIC OR RTS UNITS AVAILABLE
- RJ-11/12 CONNECTORS OR TERMINAL STRIP
- TURN YOUR PC INTO A DISTRIBUTED DATA ACQUISITION AND CONTROL SYSTEM

R.E. SMITH

(513) 874-4796
4311 TYLERSVILLE RD. ■ HAMILTON, OHIO 45011
FAX (513) 874-1236

Plug in HERE → to Maximize the Value of Your Oscilloscope!

NEW SuperProbe™

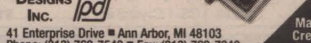
Oscilloscope Triggering Devices

- Complex triggering for digital circuits
- Easy to use
- Simplifies circuit debugging
- Works with any oscilloscope
- Models start at only \$99

PROGRAMMABLE DESIGNS INC.

41 Enterprise Drive ■ Ann Arbor, MI 48103
Phone: (313) 769-7540 ■ Fax: (313) 769-7242

All Major Credit Cards



EPS EPROMS AS LOW AS 50¢

27C256 8748 27C010
27C512 8749 27C020
2732A 8741 27C040
27128 8742 27C1024
2764 8744 STATIC RAM
2716 8751 6264 2016
27C512-90 8759 62256 6116

Flash EPROMS, CPUs, UARTs, PROMs & much more...

MEMORY

FOR ALL PCs & LASER PRINTERS
SIMM & SIP MODULE, D-RAMS

1MEGX9 1X36 & 32 44256
4MEGX9 2X36 & 32 1MEGX1
256X9 4X36 & 32 41256

TEL: (818) 774-9444 • FAX: (818) 774-0822

WE BUY EXCESS INVENTORY

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

BARCODE SCANNERS

Complete keyboard/wedge decoder with cable and wand \$ 225.00

Same system with Laser scanner \$785.00

Integrated 3" CCD wedge sys. \$ 395.00

Decoded magstripe reader 1&2 \$ 275.00

Serial versions add \$ 35.00

RF Laser scanner system \$ 1,695.00

Portable data collector wedge / RS232 64K, four line display, wand \$ 745.00

Barcode labeling software from \$150.00

Datamax/Fargo label printer \$1065.00

Time and attendance terminals call

Symbol, PSC, Fargo, Cipher
Eger International
5500 Coast Rd. Santa Cruz, CA.
95060, Vlsa, MC, COD
800/343/7773, Fax: 408/425-7888

OPERATING BUSINESS FOR SALE

Profitable, electronic surplus
operated for over 30 years.

One story, 5600 sq. ft.
building plus 5500 sq. ft.
parking. N.E. Philadelphia.

Owner 70 years, retiring.

LEON FERTIK

5400 ELLA ST.
PHILADELPHIA, PA 19120

PH/FAX 215-455-2121

* KITS *

Caller ID: 150 Name/Number memory, LCD Display, Serial Interface to a PC.

Multistation Thermometer: 4 separate temperature readings, LCD display, Serial interface to a PC. Indoor/outdoor operation.

Telephone Dialer: 240 Name/Number memory, LCD display, works with your telephone. Group/redial functions.

\$5 OFF ANY KIT ORDERED BY 9/30/95!

For information and prices call...

1-800-772-3945

GENOA Group

7304 S. Alton Way, Suite A Englewood, CO 80112
(303) 770-5747 Fax (303) 770-0494

Save Up To 60% ON DATA CARTRIDGES

Why would anyone
even think about
buying formatted
DC 2120 QIC-80 format
cartridges without
getting our price first?

- USA MADE QUALITY
- FREE SHIPPING USA MAINLAND

DC 2120 120/250 QIC 80 FORMAT

\$8.50 each (in lots of 5)

1-800-603-1008

FREE SHIPPING IN USA!

UNIVERSAL DATA CORP

VISA • MC • DISCOVER

Nuts & Volts Magazine/August 1995 121

BEST SPEAKERS and monitors ever! Build your own versions of 10 best speakers ever, at a fraction of cost, with plans for 10 best including, JBL, AR, Cerwin, Infinity and Bose. \$3. Sound Engineering, 425 Ocean, Laguna Beach, CA 92651.

FAVORITE ELECTRONICS circuits book, TV to computer, VGA to TV, computer 25MHz O'scope, and other adapters. 65KC and 25KC to 31KC monitor conversion plans. Send \$20 to Bob Davis, 222 West Fifth St., Emporium, PA 15834.

NIGHT VISION KITS, and brand name US and Foreign units. Complete kits include all necessary components to build your own night vision scope. **SAVE \$.** US Military Intensifiers, IR, Foreign and more. Call or write: **NEAVIS, INC.**, 320 Main St., Box 1088 Sturbridge, MA 01566 or 508-347-7238, 10-4pm EST.

THE CHIP chick has the kit or plans you're looking for. FSK emulators, Hard wire information, activation boards, Sync generators, programming service, and more. Catalog list \$2. Sorry Texas. The Chip Chick, Box 426, Bastrop, TX 78602-0426.

MINIATURE TRANSMITTERS! All types! Low to high power! Also voice activated switches! Telephone recording switches! 16 level voice changer plus complete plans on RF power amplifiers! Send \$2 for information, refundable on first order. **Parsec Electronics**, PO Box 34594, Phoenix, AZ 85067-4594.

NI-CAD ZAPPER can rejuvenate those unchargeable NI-CAD batteries. Instructions, schematic and parts list to construct NI-CAD ZAPPER: \$5. **TEN-TRONIX**, 3605 Broken Arrow, Coeur d'Alene, ID 83814.

LASER PEN pointer \$42.99 gun laser pointer with mount \$119.99 information. FAX 407-434-3882. Mail order plus \$4 S/H. TSAI, 98 Meadow Park Lane, Boynton Beach, FL 33462.

REMOTE CONTROL miniature encoded transmitters and receivers infrared and RF kits and assembled boards. Free catalog. Inventive Solutions, Inc., PO Box 8, Stratford, NY 13470.

CNC LOW COST 3 AXIS CONTROLLER KIT. CIMPLE COMPUTER NUMERICAL CONTROL (CCNC) IS HERE! THIS 3 axis motion controller receives step and direction pulses from parallel port. Will drive 3 unipolar stepper motors at 1.25A per phase with 2 phase on. XYZ home switch and overtravel protection inputs. Expandable to drive solid state relays. Works with CNC shareware. Kit includes PC board and all parts for controller board and demo software. Uses a computer power supply or 12V battery. Use to CNC control PC board drill machines, bandsaws, drill presses, wire measuring and cutting machines. Kit is \$95 plus \$5 S/H. Assembled and tested \$145. Send US check/MO to CAMTRONICS INC., 18230 130th PL NE, Bothell, WA 98011-3118. Tel: 206-487-0013.

VOICE CHANGER board! Fully assembled and tested! Not a kit! 16 levels of change, many applications! \$39.95 + \$4 (S&H) US funds! **PARSEC Electronics**, PO Box 34594, Phoenix, AZ 85067.

ORDER NOW 1-800 4 HOBBY KITS

AIRCRAFT RECEIVER

Hear exciting air-craft communications—pick up planes up to 100 miles away! Receives 110-136 MHz AM air band, smooth varactor tuning superhet with AGC, ceramic filter, adjustable squelch, excellent sensitivity and lots of speaker volume. Runs on 9V battery. Great for air shows or just hanging around the airport! New 30-page manual details pilot talk, too. Add case set for "pro" look.

AR-1 kit.....\$29.95 Matching case set, CAR.....\$14.95

FM RECEIVERS & TRANSMITTER

Keep an ear on the local repeater, police, weather or just tune around. These sensitive superhet receivers are fun to build and use. Tunes any 5 MHz portion of the band and have smooth varactor tuning with AFC, dual conversion, ceramic filtering, squelch and plenty of speaker volume. Complete manual details how to build and use. Applications: 2M FM transmitter has SW RF out, crystal control (146.52 included), pro-specs and data/mike inputs. Add our case sets for a nice finish.

FM Receiver kit Specify band: FR-146 (2M), FR-6 (6M), FR-10 (10M), FR-220 (220MHz).....\$34.95
CFR Matching case set for SR1, CSR.....\$14.95
FT-146 Two Meter FM transmitter kit.....\$99.95

MICRO-MIKE

World's smallest FM wireless mike. Smaller than a sugar cube including battery and mike. Two sets of SMT parts supplied in case you are clumsy! Terrific audio pick-up (pin drop at 5 ft) and transmit range of 300 ft. We include the battery (watch style), electret mike and even a tuning tool! Be a James Bond and learn SMT tool! FM-5 Micro Mike kit.....\$19.95

FM WIRELESS MIKES

Pick the unit that's right for you. All units transmit a stable signal in the 88-108 MHz FM band up to 300' except for High power FM-4 and PB-1 Phone bug that go up to 1/2 mile.

FM-1 Basic Kit.....\$5.95
FM-2, as above
but with added mike pre amp.....\$7.95
FM-4, long range with very sensitive audio pickup.....\$14.95
PB-1, Phone bug needs no battery, hooks to phone line.....\$14.95
MC-1, Micro size sensitive mike cartridge for FM-1,2,4.....\$2.95

SURROUND-SOUND/REVERB

Add concert hall realism to your stereo, TV or even 2-way radio! Easily synthesize a stereo effect from mono sources or richly enhance regular music. Add a big-voice reverb to your radio voice! Others will envy! Our reverb/surround sound kit uses a Bucket Brigade IC Device for reliable solid-state performance. Adjustable reverb, delay and mix controls to customize your sound. Easily connected to radios, stereos, CB's and TV's. Plenty of audio to drive a small speaker for stand-alone operation too. Experience the fun and realism that surround sound provides - without spending hundreds! Add our case set for a neat, pro look.

RV-1 Surround Sound/Reverb kit.....\$59.95 CRV Matching case set.....\$14.95
RV-1WT Assembled RV-1 and case.....\$99.95

TOUCH-TONE REMOTE CONTROL

Control virtually anything by Touch-Tone remote control. The URC-1 has 16 switched outputs, 4 adjustable voltage outputs (20 mV steps 0 to 5 VDC), two 10K digital pots (for volume, squelch, etc.) and 3 timers adjustable from 10 ms to 40 hours! Two level password control allows secure control and multi-level access. Six digit LED display shows currently entered codes and a crystal controlled touch-tone decoder provides reliable operation. There's nothing else like this unit, be in complete control of remote radios, thermostats, hi-fi's, homes or even factories with the URC-1. Add our matching case set for a handsome finish.

URC-1 Remote control kit.....\$129.95 CURC Matching case set.....\$14.95
URC-1WT Fully assembled URC-1 and case.....\$189.95

FM SUBCARRIER DECODER

Tap into the world of commercial-free music and data that is carried over many standard FM broadcast radio stations. Decoder hooks to the demodulator of FM radio and tunes the 50-100 KHz SCA subcarrier band. Many radios have a demod output, but if your radio doesn't, it's easy to locate, or use our FR-1 FM receiver kit which is a complete FM radio with a demod jack built-in. These "hidden" subcarriers carry lots of neat programming - from stock quotes to news to music, from rock to easy listening - all commercial free. Hear what you've been missing with the SCA-1.

SCA-1 Decoder kit.....\$27.95 CSCA Matching case set.....\$14.95
FR-1 FM receiver kit.....\$24.95 CFR Matching case for FR-1.....\$14.95

L-C METER

Measure inductors from 10 uH-10mH and capacitors from 2 pF-2uF with high accuracy by connecting the LC-1 to any digital multimeter. Two pushbutton ranges for high resolution readings and we even give you calibration components to assure proper accuracy of your kit! Active filters and switching supplies require critical values, no one should be without an accurate LC meter. For a pro look, add our matching case set.

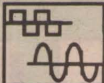
LC-1 LC meter kit.....\$34.95 CLC case set.....\$14.95

MOTOR CONTROLLER

Control the speed and direction of any motor. Use our SMD-1 for those nice steppers you see surplus, and our MSC-1 for DC motors. The stepper driver features variable speed, half step rotation, direction and power down control, can drive most any stepper motor. Our DC driver features pulse width modulation control allowing full motor torque even at low speeds and can drive motors up to 50 VDC @ 10 Amps! Add our case set for a professional assembly.

SMD-1 Stepper kit.....\$24.95 MSC-1 DC motor kit.....\$24.95
CSMD SMD-1 case.....\$14.95 CMSC MSC-1 case.....\$14.95

SYNTHESIZED AUDIO GENERATOR



DDS (Direct Digital Synthesis) technology brings you a terrific audio generator at a fantastic price! Generates from 0.01 Hz to 50 KHz with five digit LED display of frequency. Sine and square wave output adjustable 0-5 volt p-p. Frequency selected by direct keyboard entry and with handy continuous tune tuning knob. Crystal controlled accuracy of 10 ppm and two memories for rapid frequency changes. Retire that jury-rigged old generator and treat yourself to the pleasure of using a new state-of-the-art SG-550!

SG-550 Kit.....\$199.95 SG-550WT assembled.....\$269.95

SHORTWAVE RECEIVER

Fantastic receiver that captures the world with just a 12" antenna! Can receive any 2 MHz portion from 4-11 MHz. True superhet, has smooth varactor tuning, AGC, RF gain control, plenty of speaker volume and runs on a 9V battery. Fascinating Scout, school or club project, provides hours of fun for even the most serious DXer. For the car, consider our shortwave converter. Two switchable bands (in 3-22 MHz range), each 1 MHz wide—tunable on your car radio dial. Add some interest to your drive home!

Shortwave receiver kit, SR1.....\$29.95
Shortwave converter kit, SC1.....\$27.95
Matching case set for SR1, CSR.....\$14.95
Matching case set for SC1, CSC.....\$14.95

AM TRANSMITTER

High quality, true AM broadcast band transmitter is designed exactly like the big commercial rigs. Power of 100 mW, legal range of up to 1/4 mile. Accepts line level inputs from tape and CD players and mike mixers, tunable 550-1750 KHz. Complete manual explains circuitry, help with FCC regs and even antenna ideas. Be your own Rush Limbaugh or Rick Deese with the AM-1! Add our case set for a true station look.

AM-1 Transmitter kit.....\$24.95
CAM Matching case set.....\$14.95

SCANNER CONVERTER

Tune in on the 800-950 MHz action using your existing scanner. Frequencies are converted with crystal referenced stability to the 400-550 MHz range. Instructions are even included on building high performance 900 MHz antennas. Well designed circuit features extensive filtering and convenient on-off/bypass switch. Easy one hour assembly or available fully assembled. Add our matching case set for a professional look.

SCN-1 Scanner converter kit.....\$49.95
SCN Matching case set.....\$14.95
SCN-1WT Assembled SCN-1 and case.....\$99.95



STEREO FM TRANSMITTER

Run your own Stereo FM radio station! Transmits a stable signal in the 88-108 MHz FM broadcast band up to 1 mile. Detailed manual provides helpful info on FCC regs, antenna ideas and range to expect. Latest design features adjustable level inputs, pre-emphasis and crystal controlled subcarrier. Connects to any CD or tape player, mike mixer or radio. Includes free tuning tool! For a pro look add our matching case set with on-board whip antenna.

FM-10A Stereo transmitter kit.....\$34.95
CFM Case, whip ant set.....\$14.95



DR. NI-CAD CONDITIONER/FAST CHARGER

Quit spending big bucks for replacement battery packs, rejuvenate and condition your batteries for peak capacity. Advanced circuitry has optimized discharge before charge to eliminate memory effect and to condition batteries that have been poorly cared for in the past. Quick charge rapidly brings battery to full charge in less than an hour—just 15 minutes for some types! And "top-off" charge mode squeezes every last bit of energy into each cell for the absolute most capacity. Switch-mode regulator controls constant current charge while being monitored by a negative delta-V system that cuts off the fast charge at the exact point of full charge—batteries are charged, not cooked! Charges NiCads or NiMH packs from 2 to 10 cells (easily expanded) and current capacities up to 10 Amp-hours. Runs on 12 to 15 VDC. Quit cooking your batteries, buying new packs, waiting hours for recharge, get a Dr. Ni-Cad today! Available in money saving kit form or wired and tested with case at a special price. Kit builders: add our matching case set for a snazzy finish.

DN-1 Dr. Ni-Cad conditioner/fast charge kit.....\$49.95
CDN Matching case set.....\$14.95
DN-1WT Fully assembled Dr. Ni-Cad with case.....\$89.95

SPEED RADAR

New low-cost microwave Doppler radar kit "clocks" cars, planes, boats, horses, bikes or any large moving object. Operates at 2.6 GHz with up to 1/4 mile range. LED digital readout displays speed in miles per hour, kilometers per hour or feet per second! Earphone output allows for listening to actual Doppler shift. Uses two 1-1/2 coffee cans for antenna (not included) and runs on 12 VDC. Easy to build—add microwave circuitry is PC strip-line. ABS plastic case with speedy graphics for a professional look. A very useful and full-of-fun kit.

SG-7 Complete kit.....\$99.95

STEREO PEAK HOLD BARGRAPH

Finally a dual LED bar graph with a peak hold display! Bar graph displays are neat and eye catching but their speed is their downfall - they just can't capture the peaks. Our kit is like two units in one, a fast display to show the signal and a long persistence display to capture peaks, similar units go for hundreds of bucks! We offer 3 models: Linear for general use, Semi-Log for audio VU meters, and Log for power displays. Dual - for stereo! - 10 segment multi-colored LED display for snazzy, eye grabbing display and easily set ranges for virtually any signals, from voltmeters to audio VU meters to audio power amps to SWR meters. Complete instructions for easy hook-up to most any device. Add our matching case set for a sharp looking unit.

PH-14 Dual Linear bargraph kit.....\$39.95 PH-15 Dual Log bargraph kit.....\$39.95
PH-16 Dual Semi-Log bargraph kit.....\$39.95 CPH Matching case set.....\$14.95

SPEECH SCRAMBLER

Descramble most scramble systems heard on your scanner radio or set up your own scrambled communication system over the phone or radio. Latest 3rd generation IC is used for fantastic audio quality - equivalent to over 30 op-amps and mixers! Crystal controlled for crystal clear sound with a built-in 2 watt audio amp for direct radio hook-up. For scramble systems, each user has a unit for full duplex operation. Communicate in privacy with the SS-70. Add our case set for a line professional finish.

SS-70 Scrambler/descrambler kit.....\$39.95
CSSD matching case set.....\$14.95
SS-70WT Assembled.....\$79.95
SS-70 and case set.....\$79.95

CRYSTAL RADIO

Relive the radio past with a crystal set like your grandfather built. Uses genuine Galena crystal and catwhisker. Several different types of radios are built, including standard AM broadcast, shortwave and even WW II foxhole style. To compare modern semiconductor detectors, we include a diode for comparison. No soldering required and we even give antenna ideas. Radio for free, get it now before Clinton taxes it!

CS-1 Crystal set kit.....\$19.95

TOUCH-TONE DECODER

Grab Touch-Tone numbers right off the air, phone or tape. A simple hook-up to any radio speaker or phone line is all that is required to instantly decipher touch-tone phone numbers or codes. A 256 digit memory stores decoded numbers and keeps its memory even in the event of power loss. An 8 digit LED display allows you to scroll through the memory bank to examine numbers. To make it easy to pick out number groups or codes, a "dash" is inserted between sets of digits that were decoded more than 2 seconds apart. A "central-office" quality crystal controlled decoder is used allowing rapid and reliable detection of numbers at up to 20 digits per second! For a professionally finished look, add our matching case set. Start cracking those secret codes tomorrow with the Tone Grabber.

TG-1 Tone Grabber kit.....\$99.95 CTG Matching case set.....\$14.95
TG-1WT Fully assembled TG-1 and case.....\$149.95

DIGITAL VOICE RECORDER

Chatterbox digital voice storage unit will record your message of up to 20 seconds. Time is split up into four 5 second blocks which can be played separately or cascaded for longer messages. An LED display shows message location and current mode for easy operation. Nifty built-in interfaces allow simple connection to transmitters for automatic keying when the PTT is initially closed or after it is released. You can even loop your rig's mike through the Chatterbox. For contest or fun use, the CB-1 can drive an external speaker. Includes a built-in electret mike. For that finishing touch, add our matching case set.

CB-1 Voice recorder kit.....\$59.95 CCB Matching case set.....\$14.95

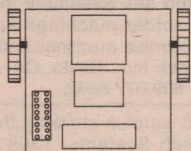
ORDERS CALL 1-800-4 HOBBY KITS (446-2295) ORDERS ONLY
TECH/ORDER/INFO (716)924-4560 FAX (716)924-4555

TERMS: Satisfaction guaranteed. Examine for 10 days. If not pleased return in original form for refund. Add \$4.95 for shipping, handling and insurance. For foreign orders add 20% for surface mail. COD (US only) add \$5.00. Orders under \$20 add \$3.00 NY residents add 7% sales tax. 90 day parts warranty on kit parts. 1 year parts & labor warranty on wired units.

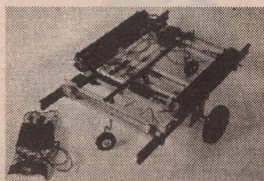
RAMSEY ELECTRONICS, INC. 793 CANNING PARKWAY VICTOR NY 14564



PHONELINE SIMULATOR kit. As featured in Jan '95 Popular Electronics Magazine. Microprocessor controlled system is used to demonstrate/test telephones, modems, fax machines, Voice mail, etc. Authentic dial tone, busy signals, and ringing. LED display shows dialed touchtone digits too! Kit includes printed circuit board, all electronic parts, technical manual. \$145 plus \$6.50 for USA shipping. CA residents include local Tax. MasterCard, Visa, Discover. Digital Products Company, 134 Windstar Circle, Folsom, CA 95630. 24 Hr. Voice 916-985-7219, FAX 916-985-8460.



MAX ROBOT KIT. Mobile base platform 1ft. x 1 ft. with dual 12 volt drive motors \$89.95 plus \$15 shipping. HC11 CPU board package with manual set, "C" compiler and robotics software libraries \$269.95 plus \$10 shipping. Encoder optics to measure speed and distance \$14.95 including shipping. Sonar package, assembled and tested \$CALL. Many more AI and robotics items! MO residence add 6% sales tax. Zagros Software, PO Box 460342, St. Louis, MO 63146-7342, 314-768-1328.



OPIE THE MOBILE ROBOT provides a complete course in robotics. OPIE comes with a 13 chapter manual covering transducers, digital and analog circuits, micro-controllers and more. Used in University, College and High School. Buy as little or as much as needed. MasterCard accepted. Precision MicroDynamics. Tel. 604-472-7249, FAX 604-472-1830.

MANUALS — SCHEMATICS WANTED

WANTED: SCHEMATICS for all types of Hi-pot testing equipment, service manuals also wanted. Youngson's Inc., 6701 Melrose Ave., Louisville, KY 40216.

WANTED: COLLINS Radio Company literature. Jim Stitzinger, 805-259-2011, FAX 805-259-3830.

WANTED INFORMATION and schematics on **ELECTRONIC SPEEDOMETERS** for American and Foreign automobiles. Top dollar paid for information about Lincoln Town-car 1990-1995. Please call 718-463-8746 or beep 917-249-3338.

WANTED: SCHEMATIC for Sanyo stereo integrated amplifier model number DCA611. Will buy or copy and return. Contact Colin G. Edwards, 245 Lenox Rd. 3F, Brooklyn, NY 11226. 718-284-7109.

MOTOROLA CAR radio about 1956. Repair manual needed. Mod. CTA7X. Ernie, 603-774-4254. Will pay all expense.

HELP! SCHEMATIC or info. needed for the following VCRs, Fisher FVH940 (display problem) Magnavox VR9550AT01 (power supply problem - ref no 1000 series) and a Samsung VP2303 loading gear alignment. Mike Denis, 151 Linebrook Rd., Ipswich, MA 01938. 508-356-5274.

WANTED: COMPLETE shop maintenance repair manual (original, or copy \$15 page) for a Sharp SF-7200 E.R. copier. L.E. Nyman, 3704 Woodlawn Dr., Eveleth, MN 55734.

MOTOROLA CELLULAR service bulletins, complete set to #215. (or what have you). Motorola, OKI, Cellular & ICOM R-100, 7000, 7100, 9000 & R-I service-repair manuals, etc. Call Les, 702-642-0325.

WANTED: OPERATORS manuals EICO oscilloscope DC wideband Model 460 and EICO signal tracer model 147A. Any help would be appreciated. Send any info to: Charlie Tomljanovich, Box 2804, Page, AZ 86040 or call 520-645-8820. Also looking for TDA1904, 2N6487, 2N5210 components.

WANTED: TEST EQUIPMENT SERVICE MANUALS! For late model Hewlett-Packard, Tektronix, Fluke, Wavetek, ESI test equipment. Pepper Systems: 214-353-0257; 214-902-9511 FAX.

MANUALS WANTED for amateur, audio, test equipment, TV, VCR. A.G. Tannenbaum, Box 386, Ambler, PA 19002. 215-540-8055, FAX 215-540-8327.

EICO MOD.950-A Resistance-Capacitance Comparator Bridge schematic wanted. It will be greatly appreciated. H.L. Hemken, 183 Glover Ave., Chula Vista, CA 91910-2515. 619-691-0576.

NEED A schematic for Tektronics o'scope model T912. P. Carlson, 3629 Stettinius, Cincinnati, OH 45208. 513-872-6563.

WANTED: ANY info. Intel Prom Programmer P/CUDD103 mfd 2/79 S/NDN1982. Roy Dodson, 8857 Emperor Ave., San Gabriel, CA 91775. 818-285-9521.

WANTED: HEATHKIT manual for IB-18m chart recorder. Greg Hiscock, 1232 N. Creyts Rd., Lansing MI 48917.

WANTED: WILL pay for copy of a service manual (with schematics) for a leader brand LBO-513 oscilloscope. Please send Xerox sample to Mac, 81 Seabury Rd., Bolingbrook, IL 60440.

Don't Miss A Single Issue!
Subscribe To Nuts & Volts Today
Call 1 800 783-4624

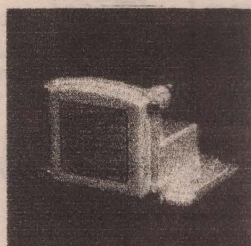
Buy Direct and Save!

Satellite Television FREE Information Pak Buyers Guide

800-350-0256

24 Hour Voice Mail - Press # 1 for Catalog

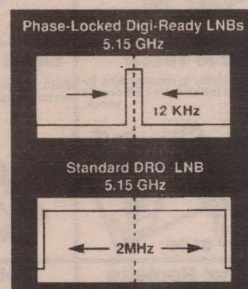
Digital Ready 20K LNB's \$119.00



California Amplifier

California Amplifier has created a new product which is superior to any other LNB....Anywhere! Utilizing new technology which enhances the performance of your standard systems through "Low Phase Noise" & limited frequency drift. Digi-Ready low phase noise technology features high stability and helps limit the drift associated with typical DRO "free running" oscillators. By limiting drift, narrow band signals including SCPC and other digital formats which require high stability over temperature ranges are more easily tracked. **Further, the burden on the receivers AFC circuits to track the signal is minimized.**

These LNB'S feature three year full replacement warranties, a power alert led, a gold plated connector and 65 db of gain. Our customers are taking their professional LNB's and phase locked loop LNB'S off their systems and seeing dramatic improvement with the new California Amplifier Mini Mag Plus Digi Ready LNB. Call us and see how crisp your reception can be!



#1 Selling C/Ku Upgrade

Best Reception

SX 7 (6'7") \$239

SX 8.5 (8'3") \$299

SX 10 (10') \$429



Co-Rotor Pak

7/20K

\$249

\$129

Von Weise 24"

Quietest Jack

High Count 48 per inch

Upgrade to General Instruments 650i

UHF Remote, VCR Timers,

Automatic Tuning

150 Favorite Channel Menu

Top Quality Picture

\$749

VCRS Decoder

\$389.00

Digital Signal Strength Meter
Focli Squawker \$179.00

Fully Compatible with all Block Receivers

LCD gives signal strength resolution to .1dB

Digital Readout with Audio tone for perfect positioning

Complete Satellite System With Decoder and Motor Drive only \$999

Loaner Installation Kits for Do-It-Yourselfers

14 Years Experience / Over 45,000 Customers

DBS Satellite 2316 "A" Channel Dr.
Ventura, Ca. 93003-4522

805-652-0255 Fax 805-652-2190



MISCELLANEOUS ELECTRONICS FOR SALE

160

ELECTRONIC EQUIPMENT, surplus, misc. electronic and scientific equipment. For list contact T-Minus-7, 45845 Warm Springs Blvd. #F, Fremont, CA 94539. 510-651-9477, FAX 510-651-3657.

DRILL MACHINE. Computer controlled X-Y-Z table for printed circuit board drilling. Affordable and not a kit. Also electronic project kits. Call 203-653-4278 or write for catalog. CBBi, PO Box 222, North Granby, CT 06060.

FOR SALE items list here. Big discount from suggested retail price. Telephones, recording answering machine, color TV, coaxial cable assemblies, modular telephone, connectors, and accessories. Slot machines, quality, cleaned, refurbished. Watches, computers, OEM 14" VGA monitor, OEM 9" color SVGA monitor. Nema Keyboards, Microsoft mice and industrial rat-trak. Alex Mastin (Ent) ph. 216-456-8177, PO Box 8802, Canton, OH 44711-8802.

NEW, USED, and "as is" Radio Shack items. Software, printers, computers, books, parts for R/C cars, etc. List \$3. B. and B. Enterprises, 208 S. Pulaski Street, Baltimore, MD 21223. 410-566-5388.

DID YOU KNOW that old personal computers, monitors, modems, electronic cash registers, and even old calculators contain valuable IC chips that are plated with pure gold! My "Big Color Photo" (8" x 10") shows over 25 of the most common gold plated IC Chips and the price I will pay for them. Chips are shown actual size. The price of gold keeps climbing higher and higher and is making it worthwhile to tear apart old equipment. To order "The Big Photo" send \$25 to Jim Sciuto, Box 128, Methuen, MA 01844.

TUBES, NEW, unused. Send self-addressed, stamped envelope for list. Fala Electronics, Box 1376-3, Milwaukee, WI 53201.

ELECTRON TUBES wanted. Cash for all types. Daily Electronics, Suite B-6, 10914 NE 39th St., Vancouver, WA 98682. 206-896-8856, 800-346-6667.

\$1,000,000 DISTRIBUTOR Inventory! Receiving tubes, Semiconductors, connectors, etc., etc. Loads of AMP connectors. Everything discounted. Special sheet SASE or call/FAX for immediate quotes. C & H Distributing, 215 So. George St., York, PA 17403. Phone 717-843-7881/FAX 717-843-3875.

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.

VISIT THE surplus store by the Jersey Shore. Tech Systems, 1309 Hwy 71, Belmar, NJ 07719. 908-280-0007.

BUYING TOCOM, SCIENTIFIC ATLANTA 8536s, 8550s, 8580s, 8590s, and 8600s. JERROLD DPV and DPBB. PIONEERS, all, and Zeniths, all. Any quantity. Top \$\$\$ paid. Contact National Cable Brokers, Plymouth, IN. Phone 219-935-4128.

LOW-COST AUTOMATIC wire & tubing measure/cut machine, the Model PMC-110 by Red Line Mfg., Co. 314-831-3014. FAX 314-831-3927.



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.

RADIO REPAIR: Commercial and amateur two-way. Portables a specialty. Reasonable rates. Call Mike N9VWW at REYNOLDS RADIO, 219-482-5630.

WANTED: TELEGRAPH instruments, any kind, keys, sounders, books, signs. Also Western Union Postal Telegraph items. Goodman, 636 Grant Charleston, IL 61920. 217-345-6771.

STATIC SHIELD BAGS. 3M #2100. 10" x 12". Package of 100, \$20. Carton or 1,000, \$175 postpaid. TURCOTRONIX, 1000 E. 14th, Suite 429A, Plano, TX 75074.

HIGH QUALITY TOOLS AND STAINLESS STEEL HARDWARE. European and American, electronic soldering stations, screwdrivers, nutdrivers, pliers, hex keys, balldrivers, and more! Free catalog. Robert Mink Import-Export, Box 6437V, Fair Haven, NJ 07704. Telephone or FAX 908-758-8388.

FOR SALE: KLM 10-30MHz 7el log periodic, cost \$1,000, sell \$500 or trade? John, 2175 Wagner Dr., Caro, MI 48723. 517-673-4312. WA8CKT.

SHRINK WRAP machine for high volume (production use) used for 5-1/4" floppies or CD's companion high volume labeling machine available for above. OFFER! 619-632-9775.

NEED NEW batteries? Don't pitch em', send them to Zappem for rebuilding! We install new batteries into your original case. Send batteries via UPS or US mail for free quotation to: Zappem, RD6 Box 104, Bedford, PA 15522. 814-623-7000.

CALL TOLL FREE 1-800-292-7711 1-800-445-3201 (Can)		C&S SALES EXCELLENCE IN SERVICE		CALL FOR A FREE CATALOG	
Educational Kits at Low Prices					
Space War Gun Rapid fire or single shot sound with 2 flashing LEDs. \$8.95 Speaker Incl. K-10	0-15V Power Supply A low-cost way to supply voltage to electronic games, etc. \$14.95 K-11	Strobe Light Produces a bright flash via xenon flash tube. The flashing rate is adjustable. \$8.95 K-12	Automatic Siren Can be used with a burglar alarm or as an attention getter. Speaker Incl. \$8.95 K-13	Christmas Tree Produces a dazzling effect. Use as an ornament. \$11.95 K-14	
Fish Caller Makes a sound that should attract hungry fish. \$7.95 K-15	Hidden Tormentor Your friends will go crazy trying to find it. \$7.95 K-16	LED Robot Bliker You'll have fun displaying the PC board robot. Learn about free running oscillators. \$6.50 K-17	Telephone Hold Button Put all incoming and outgoing calls on hold at the press of a button. \$6.50 K-18	Digital Bird You probably have never heard a bird sing like this before. \$8.95 K-19 Speaker Incl.	
Nerve Tester Test your ability to remain calm. Indicates failure by lit LED or mild shock. \$8.95 K-20	Signal Injector/Tracer Both signal generator & receiver. \$19.95 K-21A	Yap Box Makes six exciting sounds: Laser gun Siren Puppy Diesel horn Wolf whistle Machine Gun. Case Incl. Available assembled YAP-10 \$8.95 K-22A	Burglar Alarm Alarm for your car, house, room or closet. Buzzer Incl. \$6.95 K-23	Whooper Alarm Can be used as a siren or siren. \$7.95 K-24 Speaker Incl.	
Digital Roulette Sure winner with your friends. 32 LEDs are arranged in a 5" circle. \$19.98 K-25	Metal Detector Find new money and old treasure. Get started in this fascinating hobby. \$7.95 K-26	Logic Probe A must to check out logic circuits. \$14.95 K-27	Pocket Dice To be used with any game of chance. \$13.95 K-28	TV/FM Oscillator Learn about oscillators and FM transmitters. Use as FM transmitter. \$5.95 K-29	
FM Mic Transmit your voice on any FM radio. Range up to 1000'. Case Incl. \$8.95 K-30	Digital Lock Program your combination from thousands of different choices. \$19.95 K-31	Decision Maker Let this kit make decisions for you. 6 LEDs & speaker create mystic mood. \$9.50 K-32	Solder Practice Learn soldering techniques and build a flashing European type siren. \$7.25 K-33 Speaker Incl.	One Button Bandit Press the button and away she goes. If 3 LEDs light, you win. Our version of Vegas one arm bandit. \$15.95 K-34	
Telephone Bug Size of a dime, yet transmits both sides of a phone conversation to any FM radio. No battery needed. \$8.95 K-35	Sound Activated Switch Clap and the light comes on, clap again and off it goes. \$8.95 K-36	Resistor Substitution Box Contains 24 different value resistors from 10 ohms to 1 meg. \$12.95 K-37	Capacitor Substitution Box Contains 12 different value capacitors from 100pfd to 1MFD. \$12.95 K-38	Love Tester Test your sex appeal with this exciting kit. \$10.95 K-39	

WE WILL NOT BE UNDERSOLD

UPS SHIPPING: 48 STATES \$5.
IL RES \$5. TAX (\$5.00 min.)
OTHERS CALL

C&S SALES INC.

1245 ROSEWOOD, DEERFIELD, IL 60015
FAX: 708-520-0085 (708) 541-0710

15 DAY MONEY BACK
GUARANTEE

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

Build a Passive Infrared Motion Sensor

Motion detectors are one of the most popular devices used in security systems today. Most motion detectors use passive sensors that can detect infrared radiation emitted by the human body. To understand how the detector works, we must first understand the different sources of radiated emissions.

When they ride their bikes toward the traffic light, it turns red. After a few seconds, it changes back to green.

Circuit Description

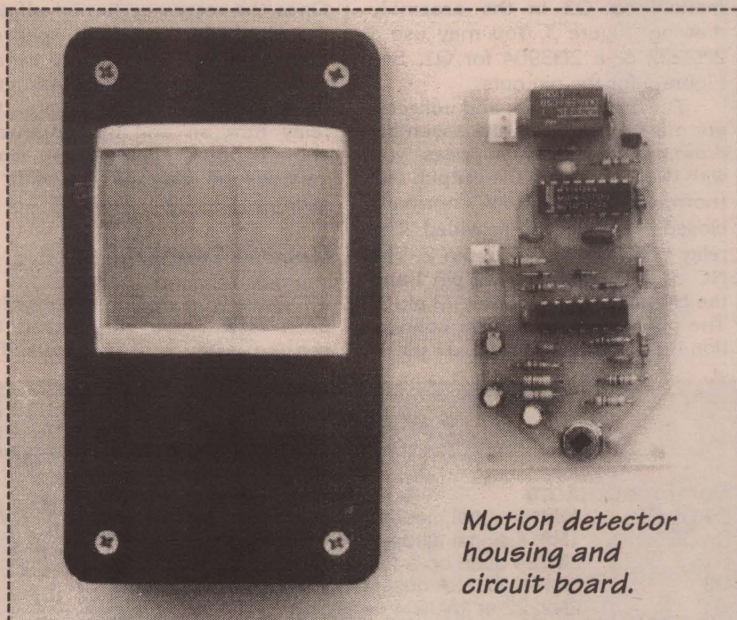
Figure 2 shows the schematic diagram for the motion detector. The circuit consists of five sections:

the detector, the FET circuit is turned on, thus allowing a large current flow through the detector source and drain pins. The detector also has a built-in infrared bandpass filter that only allows the required infrared wavelength to pass into the detector.

An LM324 U1 is used for the amplifier and comparator stages. The sensor output appears on pin 3 of U1A. U1A is set up as a non-inverting amplifier. The amplifier input impedance as seen by the sensor is very high. The gain of U1A is found by $R2/R3 + 1$. So the Gain = $1M\Omega/10K + 1 = 101$. Amplifier U1A is AC (alternating current) coupled. So only a change on the input will be amplified. That works out well because the sensor

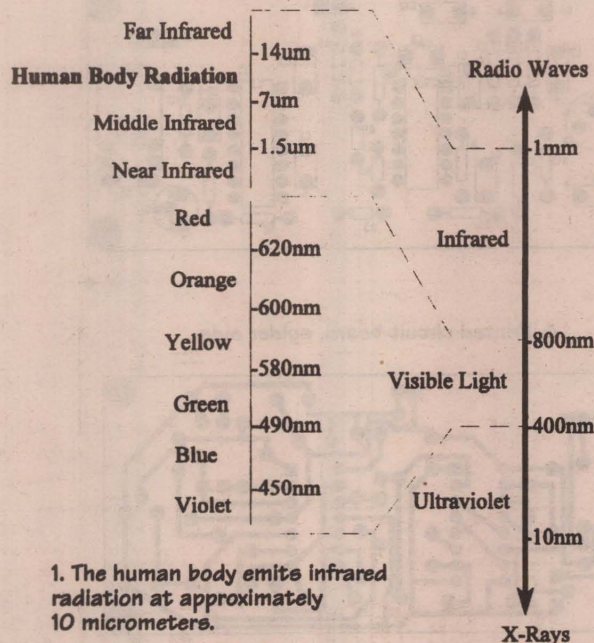
is ten thousand one hundred times greater than the input from the sensor.

The output at U1B pin 7 will fluctuate above and below 1/2 VCC. The voltage divider that provides the 1/2 VCC reference for U1B pin 5 also provides the references used for the comparator circuit. U1C pin 9 is held at about .7V (volts) above the 1/2 VCC point. So when the output of U1B goes higher than the reference on U1C inverting input, the output of U1C will go high to VCC. The opposite is true for U1D. The positive input of U1D is held at .7V below the 1/2 VCC point. When the inverting input of U1D goes lower than the reference input on pin 13, the output of U1D goes high to VCC. As a result, when the output



Motion detector housing and circuit board.

Electromagnetic Spectrum



Visible emissions — the light we can see — is only a small portion of light out of the total light spectrum. The wavelength of the visible spectrum ranges from about 400nm (nanometers) to 800nm. Infrared ranges from about 800nm to 1mm (millimeter). Ultraviolet radiation is from about 10nm to 400nm. See Figure 1.

The spectral response of the sensors used to detect the human body is around 7um (micrometers) to 14um. This type of sensor is called a *Pyroelectric detector*. Acting on the thermal radiation of the human body, these detectors tend to be unaffected by their environment. Room temperature changes or sun lamps have little effect on them. The normal operating temperature of such sensors is from 30 to 70 degrees Celsius.

You will find Pyroelectric detectors being used in many applications. Security systems, robotics, automatic door openers, automatic lighting, and environmental control systems are just a few. My kids had a great time after I used a sensor to activate a makeshift traffic light.

the sensor; amplifier; comparator; one-shot; and relay. The sensor is a SEA02 Pyroelectric detector, used to detect change in thermal radiation emitted by the human body. U1 is a quad operational amplifier of which sections A and B are used as two single supply amplifiers. U1 sections C and D make up a single supply comparator responding both to positive and negative voltage swings. U2 is a dual retriggerable one-shot used to generate a timing pulse to turn on the output relay.

Theory of Operation

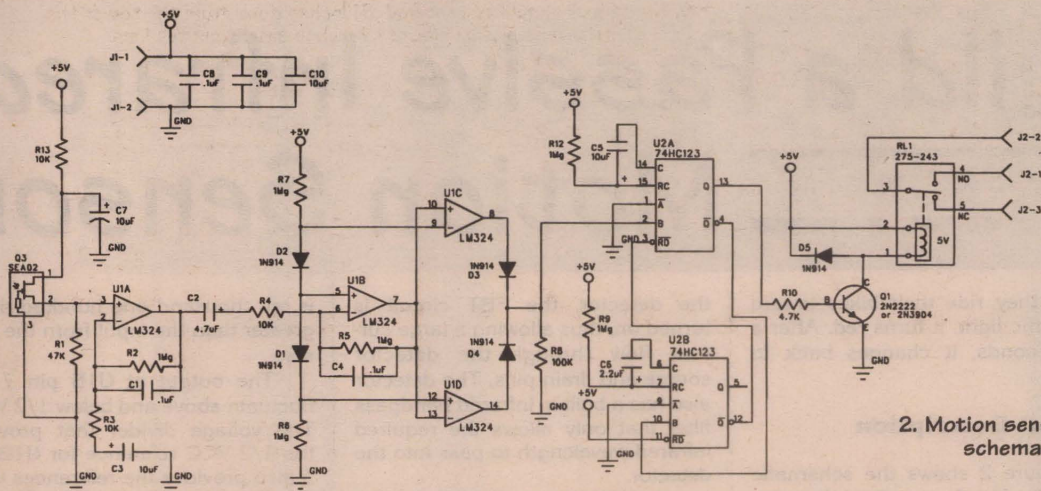
The heart of this project is the Pyroelectric detector. The detector consists of a crystalline material that generates a spontaneous surface charge. This charge is small and is quickly dissipated. But when the crystal is exposed to a temperature change, the electrical charge will not dissipate as fast and there will be a measurable current flow. The detector drives a FET (Field Effect Transistor) circuit internally. When there is a current flow from

only outputs a short current pulse after each thermal radiation change. The output of amplifier U1A is AC coupled through C2 into amplifier U1B.

Amplifier U1B is an inverting amplifier. R7, D2, D1, and R6 form a voltage divider on U1B pin 5. The voltage from this pin to ground should read 1/2 VCC or 2.5V. This voltage will not always be exact, due to component tolerance. The gain of U1B is given by $R5/R4$. So the gain of U1B = $1M\Omega/10K = 100$. The total gain of U1A and U1B is $101 \times 100 = 10,100$. The amplified output

of the amplifier swings .7V above or below the 1/2 VCC point, the output of the comparator will be at VCC (5V).

The outputs of the comparators drive two diodes that form an OR gate. If either comparator goes high, the input to the one-shot U2A will go high. The output pulse width of the comparators will be very short. A 74HC123 CMOS one-shot is used to capture and hold these pulses for a timed interval. This interval is determined by multiplying the external resistor by the external capacitor. For U2A, the



2. Motion sensor schematic.

time duration is $R12 \times C5$. $1M\Omega \times 10\mu F = 10$ seconds. So the relay will turn on for 10 seconds. The second one-shot U2B is triggered when the timing duration of the first one-shot U2A has expired. U2B then disables the input to the first one-shot for 2.2 seconds. When the relay turns off, it will create some noise in the circuit that will be amplified and could retrigger the first one-shot. The sec-

from static electricity. The CMOS components are susceptible to electric shock and damage from static electricity. Ground straps are available from your local electronics shop.

Figure 4 reveals the solder side of the single-sided circuit board. There are no jumpers or tracks on the component side. Figure 3 reveals the parts placement of all

sure this tab lines up with the tab marked on Q3 in the assembly drawing, Figure 3. You may use a 2N2222 or a 2N3904 for Q1. See Figure 5 for the pin outs.

The emitter, base, and collector are marked for Q1 in the assembly drawing. The relay supplies you with two options on the output. NO (normally open) and NC (normally closed) contacts are provided. The relay common pin is J2 pin 2. The NO contact is found at J2 pin 1 and the NC contact is found at J2 pin 3. The power supply positive connection is marked in Figure 3, J1 pin 1.

Pin 1 is marked with a square pad in the assembly drawing for J1, J2, U1, and U2.

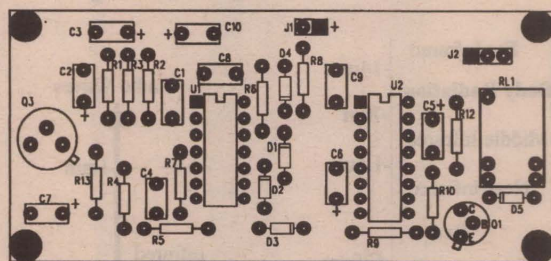
Using the Motion Detector

For best operation, a power supply voltage of $+5V \pm 2V$ should be used. You can attach an ohmmeter or a buzzer to the NO output of the relay to test the circuit. With power off, the ohmmeter should show an open circuit. When power is applied, the relay will turn on for a short time. The ohmmeter should show a short or 0 ohms. Capacitor C2 must partially charge and the sensor must not detect any motion for the relay to turn off. This could take a minute or longer. During this time, you must stand away to the side of the detector and be still. Once the relay has turned off and the ohmmeter shows an open circuit again, you are ready to try out your motion sensor. Walk in front of the motion detector and watch the relay turn on and the ohmmeter show 0 ohms again. If you stand very still the relay will turn off in 10 seconds.

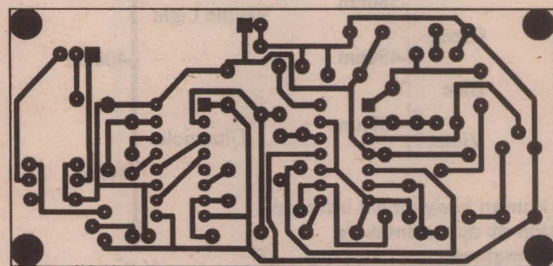
Extend Your Distance

Once your motion detector has been tested, you can extend the sensing distance in two ways. The

3. Circuit board assembly drawing, parts side.



4. Printed circuit board, solder side.



ond one-shot disables the first one-shot during this time. The 74HC123 is a dual retriggerable one-shot. This means that each time the input is pulsed high, the one-shot timing period is reset and starts a new timing period. If the sensor is continually excited by changing thermal energy, the one-shot output will remain high until 10 seconds after the last trigger pulse from the comparators.

Construction

Be sure to protect your circuit

components when compared to the circuit schematic in Figure 2. You may buy or make the printed circuit board. (See parts list for ordering information.)

Be sure to observe the proper polarity when connecting the tantalum or electrolytic capacitors. You will notice the + sign next to the positive pins for all polarized caps. You may use tantalum or electrolytic capacitors for C10, C7, C3, C2, C6, and C5.

The Pyroelectric detector case has a tab that designates pin 1. Be

Parts List

Semiconductors

D1, D2, D3,	1N914 signal diodes
D4, D5	1N914 signal diodes
U1	LM324 quad op-amp IC
U2	MM74HC123A dual monostable multivibrator
Q1	2N2222 or 2N3904 transistor
Q3	SEA02 Pyroelectric infrared sensor

Capacitors

C1, C4,	.1uF non-polar
C8, C9	.1uF non-polar
C6	2.2uF 10-volt electrolytic or tantalum
C2	4.7uF 10-volt electrolytic or tantalum
C3, C5, C7,	10uF 10-volt electrolytic or tantalum
C10	

Resistors (1/4watt)

R1	47K ohms
R2, R5, R6,	1Mg ohms
R7, R9, R12	1Mg ohms
R3, R4, R13	10K ohms
R8	100K ohms
R10	4.7K ohms

Misc.

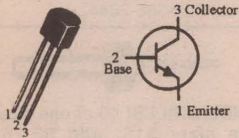
RL1	275-243 (Radio Shack) +5V Relay
Fresnel lens	
Printed circuit board	

Note: The following items are available from **Microsystem Technologies**, Rt. 2 Box 157, Harpers Ferry, WV 25425. WV residents add 6% sales tax. Ph: (304) 728-9947.

Part#	Description
#MST100	Motion detector printed circuit board \$15.00.
#MST101	Fresnel lens \$2.50.
#MST102	SEA02 Pyroelectric infrared sensor \$11.50.
#MST103	Complete Motion detector kit, includes circuit board, fresnel lens, Pyroelectric sensor, and all components listed in the parts list \$34.00. Add \$3.50 S/H for each kit.

5. Transistor pinout diagram.

2N3904



2N2222



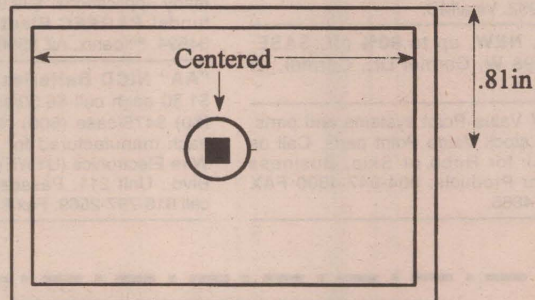
Top View

Detector



Grooved Surface

Front View



6. The sensor should be centered .81 inches down from the top of the Fresnel lens and be placed 1.2 inches away from the lens.

Best way is to use a Fresnel lens. See parts list for ordering information.) There are many different Fresnel lenses available for motion detectors. They can cover large, wide areas or tight, small areas, or even long hallways up to 75 feet. The sensor should be placed 1.2 inches away from the lens and centered .81 inches down from the top of the lens. See Figure 6. The lens material does not adhere well with most glues.

To mount your lens, you could make a frame out of plastic or wood, and screw the lens down by the borders with small screws. I made a lens

fixture out of a plastic cap from a spray paint can.

I sliced off 1/3 of the cap and cut out a rectangular hole smaller than the lens border. Then I used an old soldering iron to melt the borders of the lens into the cap around the rectangular hole. Next, I cut a hole in the lid of a plastic project box and secured the lens fixture by melting the edges of the fixture into the under side of the lid.

Your motion detector should be mounted about 6.5 feet off the ground when using a lens.

If you are covering a small area with your motion sensor you may not want to use a lens at all. Another way to increase the motion detector sensitivity is by changing the value of R4. Changing R4 to a 5K or small-

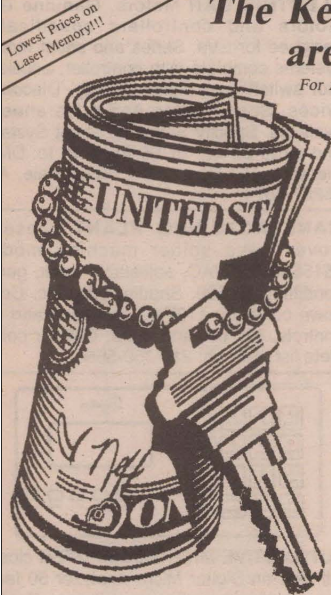
er resistor will help extend your sensing distance by increasing the amplifier gain.

Don't make R4 much smaller than 5K or your circuit amplifiers may become unstable and could cause your circuit to behave in a peculiar manner.

Have fun with your project! **NV**

The Key to Added Profits are Printer Trays

For All Popular HP & Canon® Printers



- SX Envelope\$19
- SX Legal, Letter, A-4...\$39
- LX Lower Cassette
(IIP, IIP, etc.)\$99
- 3si/4si Legal\$69
- HP 4 Legal\$49

Add-On America Corporation

CALL NOW!!

800-576-2349

Fax (410) 987-3258

Elite Products

Write in 123 on Reader Service Card.

160 MISC. ELECTRONICS FOR SALE *cont.*

AUBURN ELECTRONIC LABS. COMMUNICATION MONITORS, REPAIR, AND CALIBRATION. WE ALSO BUY AND SELL. 12345 BOWLING GREEN ROAD, BOX 447, AUBURN, KY 44206. 1-800-595-6515. FAX 502-542-7706. SINCE 1977.

VIRTUAL REALITY Cybermaxx VR headsets at wholesale prices. 10,000 misc. hardware programs on 2 CD-ROMs, only \$29.95. New & used computers, new & used high-end audio. Graham's Electronics & More, 1001 San Mateo SE, Albuquerque, NM 87108. 505-268-4655.

PROGRAMMABLE DISPLAY, with built-in MOS Functions 8-digit. Siemens model D 2816, have a 150 make offer. Pots 1ea, Clarostat 10 & 20K. Resistors 1K-50Ks (1000,000) 50 for a \$1. Min. order 20 or will trade for Micro CCD camera. Ralmage, 13208 Dogwood Ln., Grass Valley, CA 95945. 916-273-4025.

SOLAR KING'S MILLION DOLLARS OF SOLAR PANELS IN STOCK. Solar panels: 12"x24", 15V, 6.5W, .5A, \$170/10, \$800/50, \$1,550/100, 12"x36" 15V, 10W, .7A, \$259/10, \$1,200/50, \$2,349/100. 12"x12" 15V, 3W, .25A, \$17.95, \$150/10, \$700/50, \$1,350/100, 6"x12" 15V @.125A, 1.5W, \$13.95, \$120/10, \$1,100/100, \$1,000/100, 6"x6" 7.2V @ .065A, .75W, \$4.95, \$39/10, \$350/100, \$2,980/1000. Wholesale, retail, mail order. Material running low. New solar material coming in all the time. Our 31st year. Call/Fax back call: 508-532-2323. BNF, 119 Foster St., Peabody, MA 01960. 508-532-2323.

PROQUIP MODEL SU 4050 rigid disk burnish/glide tester & PROQUIP model PQ 5805 certifier, unused, \$12K ea OBO. 619-632-9775.

NEW HP 5328B 100MHz counter with option 10 (high stability), still sealed in original packaging, \$950. Also, new HP 328A with option 10, \$750. Megastar, 702-386-2844.

GET YOUR CATALOG OF HUNDREDS OF

LASERS

LASERS CAN BE USED FOR:

Communications Laser Light-Shows
Alarm Systems Weapon-sights, etc.
Experiments Machining & Cutting
Holography Optics & Night-Vision

We are always looking for surplus lasers, laser related and optical equipment. If you have equipment/components lying around, gathering dust & taking up valuable warehouse space, call us for an offer today!

MWK INDUSTRIES

1269 W. Pomona, Corona, California 91720
(909) 278-0563 FAX (909) 278-4887
FAX-ON-DEMAND SYSTEM (909) 278-1225

CALL FOR YOUR FREE CATALOG

Write in 71 on Reader Service Card.

ALPHA ELECTRONICS & Display: Ioline Plotters (vinyl cutters), CasMATE Pro 5.0 Designing Software, the best, extremely versatile. MultiCam router tables 2' x 4', 4' x 4', 4' x 8'. Unbelievable prices! Used for sign shops, engineers, architects. For more information, call 702-795-0033, Monday-Friday.

3 AXIS DNC Machine Center. Industrial quality, cost effective, precision engineered work centers. Can automate many of your complex and tedious metal cutting applications. Run direct from your PC via parallel port. Systems starting at \$7,999. Computerized Automation Technologies, 508-685-9584.

UNIQUE NOISE Quieting Headset with stereo play through, from ANVT. Listed best in national consumer magazine. Great for people who fly a lot. Sold for \$299.95. New in box, \$89.95 + S/H \$9.95 COD. Cert. Ck, cash. Sherwin Fields, 3702 E. Mercer Ln., Phoenix, AZ 85028. Voice/FAX: 602-996-0244.

BELOW WHOLESALE Prices. Hundreds of pieces of test equipment: Oscilloscopes, plugs, and carts. Generators: pulse, waveform, function, ultra sonic and signal. Monitors: color and storage. Analyzers: spectrum, logic, diskette, and trim balance. Recorders, counters, CRT cameras, 6" wafer prober, Talystep 1 surface scan w/manuals, Ernst Leitz laser failure analysis w/camera, MGI Systems 1282 automatic mass wafer transfer system, power conditioners, thousands of power supplies, millions of resistors (many 1%). Call for complete listing, 1-800-328-7845. Or for specific information on items, 507-754-5611. Or FAX 507-378-2102. AES, Inc., Grand Meadow, MN 55936.

WANTED: XY plotter. Flat paper type. Pen moves in X and Y axis. Working or dead. Call Paul, 714-522-1469.

WILL TRADE: one HP 7475 plotter working, for one Radio Shack 202 two meter radio. Also, have screen printing business for sale. Call or FAX, 219-259-4875.

RADAR/JAMMER. This new jammer works at any distance 100% of the time. We guarantee it! Dealers welcome. Call 1-800-671-8117 for a brochure. To order, write: **BLUE MOON GADGETS**, 6059 Allentown Blvd. #608, Harrisburg, PA 17112-0992. Visa/MC.

TUBES, NEW, up to 90% off, SASE. Kirby, 298 W. Carmel Dr., Carmel, IN 46032.

WE BUY Value Point systems and parts. We also stock Value Point parts. Call us first! Ask for Robb or Skip. Business Computer Products. 904-947-4800 FAX 904-947-4865.

TUBES \$2.98, 1,000 types. Also surplus components. SASE brings list. DNF, 6690 7 Mile Rd., South Lyon, MI 48178.

VOICE CHANGER board! Fully assembled and tested! Not a kit! 16 levels of change, many applications! \$39.95 + \$4 (S&H) US funds! **PARSEC Electronics**, PO Box 34594, Phoenix, AZ 85067.

"AA" NICD Batteries NEW! Prices + \$1.50 each cell \$6.50/sixpack \$54/carton (60) \$475/case (600) NEW Chargers \$6 each manufactured for DAK. Under The Wire Electronics (UTWE), 235 E. Colorado Blvd., Unit 211, Pasadena, CA 91101 or call 818-797-2569. Fax 818-797-0384.

FLOW SOLDER machines, 10 & 18", Lindberg 5 & 12" 5 zone belt furnace offer! 619-632-9775.

WANT TO start your own business? You can buy one to hundreds of pieces from Electronic power savers for home and supermarkets too. Phone ID blockers and more. Send five dollars for the sources to write to. Write to P. Frantz, Box 124, Coaldale, PA 18218. Send money order.

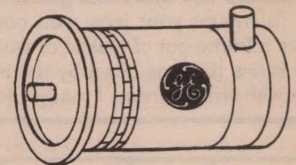
WANT TO Buy: ICs, military & aircraft relays, diodes, transistors, electronic test equipment & most components. Hoffs Electronic Ent., 818-718-1165, FAX 818-341-5506.

UNINTERRUPTIBLE POWER Supply Two SCI 10KVA UPS units, one Chicago, one in California, \$995 each 120V output, no batteries. Three each 3KVA units, 220V output, model Delt 7036R, one in Las Vegas, one in Northern California. 5KVA inverter \$250, located California. 702-386-2844.



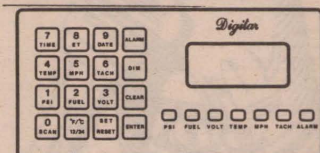
CARBIDE DRILLS! 10 of one size: \$4. of one size: \$15, add \$3.25, S& Check/MO only. Sizes avail; .033, .036, .041, .042, .043, .045, .046, .049 dia. Also electronic componen Send for flyer. Hoffman Industries, 8 Dundee Avenue, Elgin, IL 60120, 708-628201.

POWER INVERTERS 10, 5 to 16.5 V in, 115VAC True RMS \pm 5% out @ 60Hz modified sinewave, 90% efficiency, 2 year warranty. 100 watt (800W surge) \$89, 4 watt (3000W surge) \$289, 700 watt (3000W surge) \$369, 1,300 watt (6000 surge) \$569. Dexis Corp., 612-944-7670



ELECTRIC CAR Motors. Genuine C motors and controllers specifically designed for EVs. Series and shunt motor systems complete with controller, accelerator switch, and digital display. Discount prices. Specification and price sheet available. Specify Series or Shunt System and send \$3 ea. or \$5 for both to: DM Electric, PO Box 14574, Scottsdale, AZ 85267-4574.

MANUFACTURING PLANT Close Dover wave solder machine model #515530, 220VAC, adjustable track, good condition, \$5,600. Shuttleworth, Inc. Co down conveyor 110VAC, fan bank and controls, \$1,700, and more. Call for complete list. ISE, ph: 210-350-5555.



AUTOMOTIVE MICRO-COMPUTER close out sale on Digitar Micro Analyzer 50 feature gauge with audio-visual alarms. Scan and displays oil pressure, fuel level, system voltage, temperature, vehicle speed and engine RPM. Can be set to alarm user specified levels on all scan functions as well as elapsed time and clock. Bright display w/variable brightness. Original \$99.95, now \$34.95 (limited quantity, free shipping). Phone 206-885-0193.

25TH CENTURY Technology: Time travel psionic warfare, radionic boxes, Tesla coils, techno-shamanism, psionic generators and helmets, brain wave units, and much more! Huge catalogue, \$4. IGA 255 N. El Cielo Rd. A565A, Palm Springs CA 92262. 619-327-7355.

MICROWAVE PARTS. Detectors, couplers, amplifiers, XIGs, filters, waveguide and coax types. No list. Phone in your requirements. Bob, 415-854-5117.

WALL SURPLUS has Kocour electronic thickness tester. Tests thickness of circuit board plating \$400. Call 908-681-2032.

CAPACITORS, ENERGY storage 235 n @ 15KV (24KV test). 11 x 16 x 27" 325 unused. Qty's available. 619-632-9775.

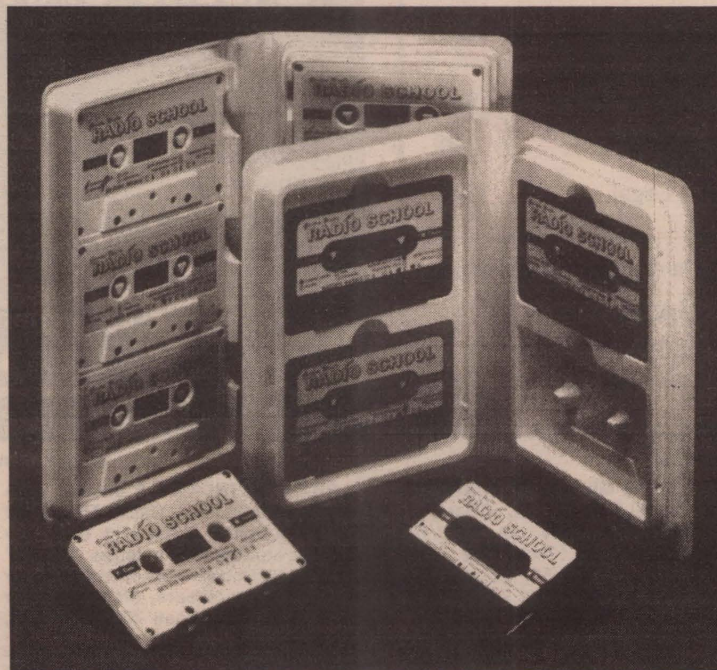
GORDON WEST Ham/Commercial Code Course

10 wpm through 30 wpm, 6 long-play stereo code cassettes

- ✓ Prepare for amateur radio Extra 20 wpm code test.
- ✓ Pass commercial 16 wpm, 20 wpm, and 25 wpm code tests.
- ✓ Earn both licenses with one code course from "Gordo."

This Gordon West Commercial/Extra code course actually OVER-QUALIFIES you for passing the amateur Extra class code test. Amateur Extra class operators automatically receive code credit for second class and third class radiotelegraph operator telegraph Elements 1 and 2.

Go on to pass telegraph Element 3, 20 wpm code groups, and telegraph Element 4, 25 plain language words for commercial first class radiotelegraph operator certificate.



All instructions spoken on tape on how to prepare for both commercial and amateur radio "top gun" exams. Many ham radio QSO-type tests and many commercial code groups (CG) and plain language (PL) examinations, ALL with narrated answers.

\$29⁹⁵

PLUS \$4 P&H

Checks only to:
Radio School, Inc. in
California

AVAILABLE DIRECT FROM

GORDON WEST RADIO SCHOOL

2414 College Drive, Costa Mesa, CA 92626

CLOSEOUT ITEMS: from BNF, wind speed indicator kit \$5, \$13/3, Tesla coil kit \$19, \$55/3, fan/motor speed control \$3, \$10/4, 2-1/2" ID, 1-1/2"D. Solder pot \$3, \$13/3, voice/sound activated switch modu. \$1. Components by the foot ass't'd, \$1/10, 500 pts. 4"x10" car/TV speakers \$2, \$10/6, 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, cable boxes oak L30 or Oak G26 \$4, \$10/3, mix or match. All working units, 2 to 1 cable splitters \$1. 4 Sony video cable M-M w/push-on connectors \$1, \$5/6, Sony push-on mat'g xformer 75-300 \$1/2, \$5/12, right angle F connector M to F screw on \$1/2, \$5/12. 16550AN high speed serial UART \$7, 14550 UART \$2. Our 31st year. Call/fax back catalog, 508-532-2323. BNF, 119 Foster St., Peabody, MA 01960. 508-532-2323.

FOR SALE: Hammond organ parts, tubes, keys, I/Cs, printed circuit boards, service manuals. Retiring my 45 year service collection. SASE for quotation and availability of your needs. Dick Stein, 249 Spring Creek Road, Northfield, OH 44067. 216-467-6704.

CNC BUILDERS: Stepper motors, machines, linear rails, several sizes of stepper motors, some servo motors and misc. drivers. Industrial equipment removals. Price list. Jim DuBois, 330 State Road 101, Amherst, NH 03031. 603-673-3645.

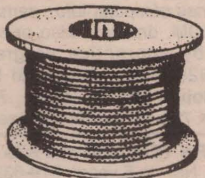
WIN AT Slots, Guaranteed! Quality reconditioned Japanese Casino Slot Machines. Latest technology. Under \$500. Send SASE to Fred Franklin, 3621 Marine Rd., Toledo, OH 43609 for info. and prices. Or enclose \$2 for color photos of available machines. Phone 419-241-8005.

MICROWAVE EQUIPMENT for sale: 4 microwave radio's complete with waveguide and antenna's. Andrews 6GHz, High performance antennas. Raytheon, KTR3A, Radios. Contact Randall at 606-633-4566.

FREE MISC. commercial & military electronics; equipment, boards, and components; tube & solid state; vintage & newer. Garage clean out, about half pick-up load; you pick-up, must take all. Terry, S.W. Fort Worth, TX. 817-297-3665.

ELECTRICAL TYPE solder 605n/40Pb, 635n/37Pb, Rosin or Organic (wash off with water) flux core. Various gauges, solid bars too. Made by Kester mostly. Also, some lead-free solder for plumbing \$5/lb. plus shipping. Call Dave, 816-231-2029.

TUBES OVER 2000 types send SASE for price list. Ellcott Electronics, R3, Calhan, CO 80808.



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.

MUST SELL: Equipment racks: Standard 19", many sizes and accessories, excellent condition. For list, ISE, ph: 210-350-5555, FAX: 210-350-5574.

KLEIN OPTICAL convergence gauge for measuring mis-convergence on color CRT screens. Know if you are really on-spec. Only \$800. RJK-Barauck, PO Box 60072, Palo Alto, CA 94306. 415-964-2213.

HY-GAIN LP 1402 AB log antenna (AS-2851), folds to 48"x8", 35 lb., 30 to 76 MHz, unused, complete with mast, guys, stakes, hammer. Great for field days. \$125 plus UPS. Frank Moreland, 14788 Poway Mesa Drive, Poway, CA 92064.

TEKTRONIX TDR 1503, as new, calibrated with manual \$2,350. 1502 with strip chart recorder, needs battery, \$1,550. Psitech Plus, 707-745-4804, fax 707-747-5277.

VOICE DESCRAMBLER 12 volt portable, military specs, HF FAX, shortwave w/computer interface. Also, can be used on hardwire with adaptor. Prints and parts list. Free 95 catalog w/price list. Send \$5 and SASE to: AFRO Engineering, Inc. (USA), 6320 Moselle Dr., San Jose, CA 95119.

SCANNING ELECTRON Microscope. Hitachi Model \$450. \$12K OBO. 619-632-9775.

ELECTRONIC SUPERMARKET at surplus prices. 1001 items, call or write, free list, LSASE. Fertik's, 5400 Ella Philadelphia, PA 19120. Ph/FAX 215-455-2121.

JENNINGS VAC relay, RE6B, SPDT, 30KV, \$30; Coils, 30uH, 15uH, \$8 ea.; VAC cap, EG&G HAC 710124-1, \$25; Capacitor, .18uF, 11KVDC, \$8; Capacitor, .5uF, 40KV, \$85; 3B28 replacement diode, pair \$10. Frank Moreland, 14788 Poway Mesa Drive, Poway, CA 92064.

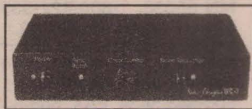
MISCELLANEOUS ELECTRONICS WANTED

WANTED: ELECTRON TUBES, ICS, SEMICONDUCTORS. ASTRAL, PO BOX 707NV, LINDEN, NJ 07036. CALL 800-666-8467.

BLACK FEATHER ELECTRONICS

VIDEO CLARIFIER

**ELIMINATES
ADVERSE
EFFECTS OF
VIDEO
COPY-
GUARDS!**

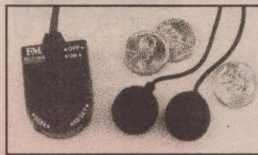


State-of-the-art circuitry restores original (master) quality to all video tapes. Allows for flawless viewing of all prerecorded video's whether rented, purchased or produced at home (even copy-protected tapes) for your personal home use. Unique auto Sync Boost feature eliminates horizontal instability and restores tapes to broadcast quality. Noise Reduction Circuit filters out the "snow" and other annoying interference. Compatible with all VCRs and T.V.s. Includes AC adapter.

CAT #VC-1 \$59.95 each

ULTRA-MINI FM RADIO

**WOW!
SOUNDS
GREAT!**

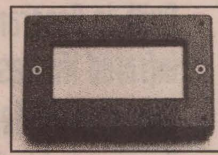


Fit an entire orchestra in the palm of your hand and still have room for the concert tickets with this Mini FM Radio that has an incredible sound. Features on/off button, seek button and reset button. Includes battery. If this isn't the world's smallest, it's close to it. But the sharp, clear sound that comes out will make you think you have a jam box. Black.

CAT #FM-1 \$19.95 each

3 1/2 DIGIT PANEL METER

This meter has many useful applications such as Voltmeter, Thermometer, Db Meter, Watt Meter, Current Meter, Capacitance Meter, Lux Meter and LCR

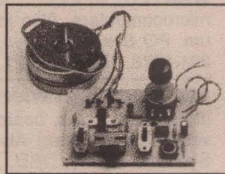


Meter. Features include: 200mV full scale input sensitivity, single 9VDC operation and decimal point selectable. In addition, it has 13mm figure height, automatic polarity indication, guaranteed zero reading for 0 volt input and high input impedance (>100M ohms). Specifications: Max input 199.9mV DC-Max. Display: 1999 counts (3-1/2 digits). Measuring method: Dual slope integration A-D converter system, plus many other features.

CAT #PM-1 \$9.95 each

STEPPER MOTOR CONTROLLER KIT

This kit allows you to adjust the speed and direction of a stepper motor. You can move the motor in one step increments or rotate it at a constant speed. There are a set of visual indicators that show the sequence of motor. Includes stepper motor, pc board, parts and instructions.



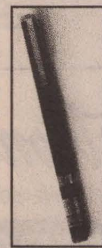
(12Vdc power source not included.)

CAT #SMK-1 \$25.00 each

LASER POINTER

5mW LASER POINTER!

Make a point with your laser pointer. Pointers are the most effective way to demonstrate your drawings, schematics, presentation, and charts. Just press and point! The beam shoots out across the room and puts a red dot on the wall up to 350 feet away. Operates on AAA batteries (included). wt. 2.3oz, wavelength 670nm/5mW output. Measures: .5" diameter x 5.75" L

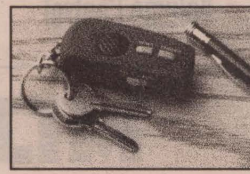


CAT #LP-1 \$39.99 each

TALKING MEMO RECORDER

TALKING MEMO RECORDER / KEY CHAIN

Records and plays messages up to 16 seconds (i.e. parking spaces, things to do, etc.) 16 seconds is a long time to dictate! Measures 3" x 1.25". Battery operated (included).

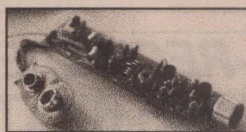


CAT #TM-1 \$19.95 each

FM WIRELESS MIKE KIT

POWERFUL

2 stage, wireless mike kit transmits over .5 mile (up to 1 Km in the open) Tunable to the upper part of FM broadcast band. Circuit does require the ability to "tweak" RF circuits by stretching or compressing coils. With mike and 9V battery clip. Operates from 6-12V DC. 2.75" x .625" x .5" WT .06

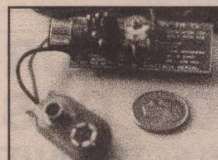


CAT #FM-32 \$10.95 each

9V DC FM TRANSMITTER KIT

POWERFUL

FM transmitter. Transmits over 100 meters in building and over 500 meters outside using .25 or .5 wavelength of wire. Transmits to the upper part of FM broadcast band (100-108MHz). Circuit requires the ability to "tweak" RF circuits. Operates on 9V DC. 1.75" x .75" x .375" WT .05



CAT #FM-18 \$9.95 each

CAMCORDER VIDEO TAPES

HI-8 120 MINUTE VIDEO CASSETTE TAPES (used)

They were recorded on once and played only a few times. Made by a major brand name manufacturer. Professional series metal tapes. Includes plastic jewel box.



NOTE: Other tapes available.
CAT #CCT-1 \$3.00 each
10 or more - 2.80 each

EMERGENCY LIGHT

THE AMAZING EMERGENCY LIGHT!

Never ever needs batteries! This waterproof unit is powered by pumping the handle-this action moves a flywheel which activates a dynamo. The dynamo produces a DC voltage and current that powers the light. Great for the car, home and boat. Never be without a light when the power goes out due to earthquakes, floods or other disasters. Operates when completely submerged in water. The dynamo can be stripped out for experimentation.

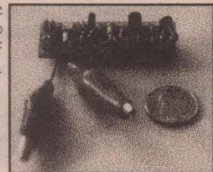


CAT # EL-1 \$9.95 each

TELEPHONE TRANSMITTER KIT

JUST LIFT THE HANDSET!

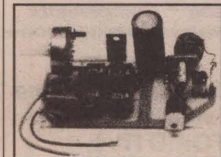
Phone line powered and activated when handset is lifted. Uses phone wires for antenna. Transmits over short distance (100ft) to the lower part of FM broadcast band (90-95MHz). Circuit does not require the ability to "tweak" RF circuits. WT .06



CAT #FM-16 \$9.95 each

STROBE KIT

This kit allows you to vary the rate of strobe flashes 60 to 120 flashes per minute. Operating voltage is adjustable depending on how you wire the kit. It will work on 4.5, 6 and 12 VDC. Includes pc board, parts and instructions.



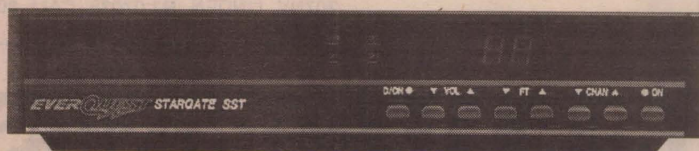
CAT #SX-1 \$7.50 each

CALL TOLL FREE! 1-800-526-3717

Write in 70 on Reader Service Card.

Nuts & Volts Magazine/August 1995 129

INTRODUCING STARGATE SST BASE BAND CABLE CONVERTER BOX



Replaces **SCIENTIFIC ATLANTA** and other major brands.

Features:

- Built-in Descrambler
- Infrared Wireless Remote Control
- Non-Volatile Memory
- Programmable Parental Lockout
- Switched Electrical Outlet
- Audio-Video Ports
- Sleep Timer
- Auto Fine Tuning
- Volume Control



Member of National
Consumer Cable
Association

**ONLY
\$319**



© JERROLD, STARCOM, PANASONIC, ZENITH, PIONEER, OAK, SCIENTIFIC ATLANTA, EAGLE, HAMLIN, and TOCOM are all registered trademarks. All references to the above mentioned equipment is for identification purposes only. We are in no way implying that any of the products in this advertisement are original equipment. M.D. Electronics is in no way affiliated with the above mentioned companies or corporations.

MD Electronics

875 S. 72 Street • Omaha, NE 68114

CALL NOW 1-800-624-1150 FOR YOUR FREE CATALOG!

Write in 161 on Reader Service Card.

DON'T REPLACE YOUR CAR—RECYCLE IT! CONVERT FROM GAS TO ELECTRICITY ELECTRO AUTOMOTIVE

SHOWS YOU HOW:

BOOKS: Including the new third edition of the definitive how-to manual, *Convert It*. Greatly expanded & updated, with improved printing quality. Now \$24.95, + \$3.50 postage. (In California, add sales tax.)

VIDEOS: From introductory information to technical instruction, including: *EVs—Fact, Fiction, & Fantasy*; *The EV Components Primer*; *Women in EVs*; *The Voltzrabbit™ Components Packaging Tour*; and many more! Coming soon—*Convert It—The Video*.



Conversion Components Since 1979
For Catalog, Send \$5.00 To:
ELECTRO AUTOMOTIVE
POB 1113-NV
FELTON, CA 95018

GIVES YOU THE MEANS:

COMPONENTS: Complete line of components for gas-to-electric conversions. All are in current production—no used or obsolete parts. Full tech support & warranty.

KITS: The easy, economical way to a reliable and safe conversion. *Deluxe Kit* fits any compact car or light truck (manual transmission). *Voltzrabbit™ Kit* is a bolt-in kit for a VW Rabbit—no design, fabrication, or welding needed. Coming soon—the *Voltsporsche™ Kit*, a complete bolt-in kit for a Porsche 914.

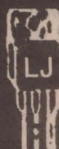


Write in 122 on Reader Service Card.

COMPONENTS

Franchised*
Phillips ECG
Distributor

"The Master
of Japanese
ICs"



**WE BUY
ELECTRONIC PARTS**

Stocking Distributor
Japanese and
American Semis,
Transistors, and Passives

LJ ENTERPRISES
An Elec-Cetera, Inc. Company
68 Railroad Avenue
Valley Stream, NY 11580

1N & 2N DIODES AND
TRANSISTORS

2SA - 2SK

AN, BA, BX, CX, DM, FT, GL,
HA, IRF, IX, KA, LA, LM, M5,
MA, MB, MC, MJ, NJM, ON, PA,
PC, PS, RB, RD, RU, SI, STA,
STK, TA, TC, TDA, UPC

(302) 378-3334

FAX (302) 378-3558

TOLL FREE: (800) 627-8755

Write in 160 on Reader Service Card.

WANTED: BUY & SELL all types of electron tubes. Harold Bramstedt, C&N Electronics, 6104 Egg Lake Rd., Hugo, MN 55038. 1-800-421-9397 or 612-429-9397. FAX: 612-429-0292.

UNITEK WELDERS wanted for cash. Parallel heads and power supplies. Call 608-643-5434, FAX: 608-643-4439.

EXCESS INVENTORY WANTED: Transistors, semiconductors, capacitors, PC boards, & diodes. We buy it all!! Contact: **SEMITECH, INC.**, 334 Cooper Road Bldg. A, Berlin, NJ 08009. Phone 609-768-0030, FAX 609-768-5690.

DO YOU have aluminum anodizing knowledge, experience, or equipment? Will trade your small set-up or info for my cash or toolmakers services. Call Philip, 408-244-0728.

WANTED: APPLE 1, Mark 8 and early microcomputers. Also journals for museum. PO Box 341, Floyd, VA 24091. 703-231-6478, 703-763-2321.

DEC EQUIPMENT WANTED! We are buying DEC systems, boards, terminals, drives and peripherals. Also Scientific Micro Systems (SMS), DSD, Datability, Dilog, other DEC compatibles, and Computer Output Microfilm (COM) units. Please call for a quote or fax us your equipment list. We buy, sell, and trade. **KEYWAYS, INC.**, 513-847-2300 OR fax 513-847-2350.

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.

TUBES WANTED Cash for new. 6L6GC, 5881, 6V6, 7027, 6550, 6CA7, EL-34, 7591. Alex, 610-767-9097.

WANTED: OLD, new, used, Western Electric, RCA, Telefunken, GE, Jan, McIntosh, Marantz, Dyna, Fisher, JBL, EV, Tannoy, Jensen, EMT, Thorens, Fairchild, Altec, Westrex: **TUBES**, speakers, amps, etc. Maury Corb, 713-728-4343, FAX 713-723-1301.

ROBOTS WANTED: Dead or Alive, Whole or Parts, Heathkit, Androbot, RB5X, Artec, Omnibots, Rhino, Hero 2000, Etc. Will pay cash. Please call 810-777-5900 or write to, Robert Doerr, 22407 Bayview Drive, St. Clair Shores, MI 48081.

ELECTRON TUBES: Microwave, transmitting, receiving, obsolete, ALL TYPES; large inventory. Contact Daily Electronics, Suite B-6, 10914 NE 39th Street, Vancouver, WA 98682. 206-896-8856, 800-346-6667.

LCD COLOR PANELS/PROJECTORS **WANTED** working or not. Fax description and price to 610-935-7666 or call 610-983-0100 ask for Neil.

WANTED: TUBES. I pay cash or trade for all types of transmitting or special purpose tubes. Mike Forman, 1472 MacArthur Blvd., Oakland, CA 94602. 510-530-8840.

HP 85 series computer info., parts, ROMs, service ROM, drawers, also print heads, needed by apprentice program free school. 929 Marion Highland Park, IL 60035. Robert Oakes Jordan, 708-432-7999. FAX 708-432-8999. Tax exempt.

NORTHERN TELECOM and AT&T boards and parts. New to 5 years. 619-632-9775.

OBsolete ICs, SLOW OR BAD SIMMS. We buy mother bds. All types of memory bds. **EVEN SOLDERED IN CHIPS.** We buy it all. Call John at L&M Technical Recycling Consultants. 1-800-514-3447.

WESTERN ELECTRIC audio equipment wanted. 1927-1960's. Amplifiers, "receivers," speakers, x-overs, tubes, etc. 1-800-251-5454.

SS WHITE AIRABRASIVE wanted, Model K, H, or similar. Call or fax Jack, 513-777-0800, 513-779-3931 (voice).

NORTHERN TELECOM and AT&T Boards and parts. New to 5 years. 619-632-9775.

DEALER DIRECTORY

ALABAMA

Alabama Radio
8907 Alabama Highway 9
Anniston 36201

Little Professor Book Center
2717 18th Street
Birmingham 35209

RT Systems Amateur Radio Supply
1827 Stephanie Drive
Huntsville 35802

ARIZONA

Lynntronics
3415 W. Glendale Ave. #4
Phoenix 85051

MJ Sales, Inc.
1842 West Grant Road
Tucson 85745

TRI-TEK
9014 N. 23rd Ave. #11
Phoenix 85021

Wholesale Satellite
706 E. Fort Lowell Road
Tucson 85719

CALIFORNIA

A & A Engineering
2521 W. La Palma #K
Anaheim 92801

ABC Electronics
1210 S. Garey Avenue
Pomona 91766

Abletronics
9155 Archibald Ave Unit E
Cucamonga 91730

Aerogen Electronics
7411 Garden Grove Boulevard
Garden Grove 92641

All Electronics
905 S. Vermont Avenue
Los Angeles 90006

All Electronics
14928 Oxnard Street
Van Nuys 91411

Alltronics
2300-D Zanker Road
San Jose 95131

California Compu-Books
3805 Ocean View Boulevard
Montrose 91020

Communications Specialists
426 W. Taft Avenue
Orange 92667

Computer Disk Service
3537 Old Conejo Road #115
Newbury Park 91320

Computing Technology
251 Balsam Street
Ridgecrest 93555

Darcell
4910 Santa Anita
El Monte 91732

Electronic Material Industries
10153½ Riverside Drive #194
Toluca Lake 91602

Ford Electronics
8431 Commonwealth Avenue
Buena Park 90621

Harding Way News
113 W. Harding Way
Stockton 95204

Henry Radio, Inc.
2050 S. Bundy Drive
Los Angeles 90025

Hi-Fi Doctor
1814 E. Ball Road
Anaheim 92805

HSC Electronic Supply of Sacramento
4837 Amber Lane
Sacramento 95841

HSC Electronic Supply of Santa Clara
3500 Ryder Street
Santa Clara 95051

HSC Electronic Supply of Santa Rosa
6819 Redwood Drive
Cotati 94931

JK Electronics
6395 Westminster Avenue
Westminster 92683

Murphy's Electronic & Industrial Surplus Warehouse
401 N. Johnson Avenue
El Cajon 92020

Opamp Technical Books
1033 N. Sycamore Avenue
Los Angeles 90038

Orvac Electronics
1645 E. Orangehorpe Avenue
Fullerton 92631

Pace Electronics
4680-J Los Angeles Avenue
Simi Valley 93063

Panaxis Productions
3460 Skycrest
Oroville 95965

Pioneer TV
8895 Laurel Canyon Boulevard
Sun Valley 91352

Roger's System Specialist
21021-504 Soledad Canyon Road
Santa Clarita 91351

Sav-On Electronics
13225 Harbor Boulevard
Garden Grove 92643

Servo Track
535 Salmar Avenue Suite D
Campbell 95008

Survival Books & Equipment
11106 Magnolia Boulevard
North Hollywood 91601

Tex-Comp
11550 Zelzah Avenue
Granada Hills 91344

The Radio Place
5675-A Power Inn Road
Sacramento 95824

Video Electronics
3829 University Avenue
San Diego 92105

Wheeler's CB
40095 Forest Road
Big Bear Lake 92315

CANADA

Com-West Radio Systems Ltd.
48 East 69th Avenue
Vancouver, BC V5X 4K6

RP Electronic Components
2113 W. 4th Avenue
Vancouver, BC V6K 1N7

COLORADO

Fistell's Micro Electronics
7023 E. Colfax
Denver 80220

International Tesla Society
2220 E. Bijou Street
Colorado Springs 80909

T H Electronics
216 Commerce Dr., Unit 2
Fort Collins 80524

Western Test Systems
530 Compton #C
Broomfield 80020

CONNECTICUT
Demic Electronics
1660 Whitney Avenue
Hamden 06517

FLORIDA
Alfa Electronics Supplies
1502 S. State Road 7
Hollywood 33023

ANI Specialties
1581 Gretchen Avenue
Lehigh Acres 33971

Clarks Out of Town News
303 S. Andrews Avenue
Fort Lauderdale 33301

International Radio & Computers, Inc.
3804 South U.S. 1
Fort Pierce 34982

J.T. Communication
579 NE 44th Avenue
Ocala 32671

Mike's Electronic Distributing Co.
1001 NW 52 Street
Fort Lauderdale 33309

Skycraft Parts & Surplus, Inc.
2245 W. Fairbanks
Winter Park 32789

Sunnys At Sunset
8260 Sunset Strip
Sunrise 33322

GEORGIA

Omar Electronics
2130 Highway 81 SW
Loganville 30249

IDAHO

Electrocom
846 6th Avenue South, Suite D
Payette 83661

RJM Electronics, Inc.
7544 Lemhi Street #2
Boise 83709

The Current Source
5159 Glenwood
Boise 83714

ILLINOIS

NUTRON Computers & Electronics, Inc.
821 E. Rosevelt
Lombard 60148

Pick's Electronics
Lewis Park Mall
Carbondale 62901

INDIANA

Harbourtown Sales
108 Park 32 West Drive
Noblesville 46060

New Horizons
Corner of SR 26 & SR 55
Pine Village 47975

SHF Microwave Parts
7102 West 500 South
La Porte 46350

KANSAS

Lloyd's Radio & Electronic, Inc.
220 W. Harry Street
Wichita 67213

Pioneer Technologies
1644 Elgin Drive
Salina 67401

Revcom Electronics
1104 S. Main
Scott City 67871

KENTUCKY

Security World Plus
212 Pike Street
Covington 41011

MARYLAND

Maryland Radio Center
8576 Lauredale Drive
Laurel 20707

Silicon Valley Electronics
2014-A Industrial Drive
Annapolis 21401

MASSACHUSETTS

Eastbridge Electronics
49 Cedar Street
East Bridgewater 02333

Lux Et Veritas
224 Main Street
Rowley 01969

MICHIGAN

Family Electronics
111 East Superior Street
Alma 48801

Hal-Tronix, Inc.
12671 Dix-Toledo Highway
Southgate 48195

Little Professors Book Center
22174 Michigan Avenue
Dearborn 48124

Purchase Radio Supply, Inc.
327 East Hoover Avenue
Ann Arbor 48104

MINNESOTA

Satellite City
2663 County Road I
Moundsview 55112

MISSISSIPPI
Bay Area News Services
603 Highway 90 #11
Bay St. Louis 39520

MISSOURI

Accurate Instruments
3123 Weatherford Road
Independence 64055

Electronics Exchange
8644 St. Charles Rock Road
St. Louis 63114

Independence Electronics
119 S. Main
Independence 64050

Missouri Radio Center
630 NW Englewood
Kansas City 64118

Stewart & Associates
204 Sonderer Street
O'Fallon 63366

NEBRASKA

Ladd Electronics Co.
111 N. 41st Street
Omaha 68131

NEVADA

Amateur Electronic Supply
1072 North Rancho Drive
Las Vegas 89106

Less Buster's Electronics
2930 N. Las Vegas Blvd. VSTG-22
North Las Vegas 89030

Radio World
1656 Nevada Highway
Boulder City 89005

NEW HAMPSHIRE

Cahill Electronics
160 Main Street
Kingston Plaza
Kingston 03848

NEW JERSEY

JR Tech Systems
1309 Route 71
Belmar 07719

NEW MEXICO

Vonn's Electronics Co.
1306 East Madrid
Las Cruces 88001

NEW YORK

All Phase Video Security, Inc.
70 Cain Drive
Brentwood 11717

GS & E
182 Avenue D
Rochester 14621

Hirsch Sales Co.
219 California Drive
Amherst 14221

Tony's Equipment
10065 Morley Road
North Collins 14111

OHIO

Bigelow Electronics
186 E. Jefferson Street
Bluffton 45817

Compustuff
2751 Medina Road
Medina 44258

Keyways, Inc.
611 S. Main Street
Miamisburg 45342

Digital One
7601 Mentor Avenue
Mentor 44060

Footsteps
4925 Jackman Road Store #58
Toledo 43613

Hastell Electronics, Inc.
2700 Sunset Boulevard
Steubenville 43952

Leo's Book Shop
330 North Superior Street
Toledo 43604

Mendelson Electronics
340 E. 1st Street
Dayton 45402

Mike's Surplus Stuff
132½ E. 3rd Street
Dayton 45402

North Olmsted Amateur Radio Depot
29462 Lorain Road
North Olmsted 44070

Powermaxx, Inc.
1587 U.S. Route 68 North
Xenia 45385

OREGON

News & Smokes
2295 W. Main Street
Medford 97501

News & Smokes #8
259-C Barnett Road
Medford 97501

Norvac Electronics
7940 SW Nimbus Ave. Bldg. 8
Beaverton 97005

Portland Radio Supply
234 SE Grand Avenue
Portland 97214

Powell's Technical Bookstore
33 NW Park
Portland 97209

PENNSYLVANIA

Asher Technology Services
69 Gingerbread Lane
East Stroudsburg 18301

Business & Computer Bookstores, Inc.
213 N. Easton Road
Willow Grove 19090

Lee Frank Electronics
6337 Evelyn Street
Harrisburg 17111

Lehman Scientific
2997-F Cape Horn Road
Red Lion 17356

Shop N Drive
3050 Canby Street
Harrisburg 17103

Surplus AI
RD 1 Box 337
Hunlock Creek 18621

The Insideoutlet
415 Arch Street
Norristown 19401

PUERTO RICO

Marval Security Equipment
Calle 6 #13, Ext. San Agustin
Rio Piedras 00926

SOUTH CAROLINA

555 Electronics
5646 Farrow Road
Columbia 29203

Discount Software
Route 1 Box 195 Highway 6
Cross 29461

R&D Associates
514½ West Avenue
North Augusta 29841

TENNESSEE

GBC Electronics
125 Birch Street
Blountville 37617

TEXAS

Tanner Electronics
1301 W. Bellline #105
Carrollton 75006

The Communication Source
2713 Galleria Drive
Arlington 76011

Tucker Surplus Store
1805 Reserve Street
Garland 75042

UTAH

Omega Electronics
1500 North 150 West
Provo 84604

VIRGINIA

Electronic Equipment Bank
116 Mill Street
Vienna 22180

Riley's Distributing
1045 Edom Road
Harrisonburg 22801

Satellite Headquarters
9310 Timberlake Road
Lynchburg 24502

WASHINGTON

A-B-C Communications, Inc.
17550 15th Avenue NE
Seattle 98155

Amateur Radio Supply Co.
5963 Corson Avenue S. #140
Seattle 98108

Supertronix
18650 68th Avenue South
Kent 98032

WEST VIRGINIA

IBIM-Colorsat
Route 1 Box 113
Morgantown 26505

WISCONSIN

Amateur Electronic Supply, Inc.
5710 W. Good Hope Road
Milwaukee 53223

Cudahy News & Hobby Center, Inc.
4758 Packard Avenue
Cudahy 53110

E.H. Yost & Co.
2211-D Parview Road
Middleton 53562

Rich's Surplus
Route 2 Highway H North
Stanley 54768-9418

Stamp Applications:

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

by Scott Edwards

One of the outstanding characteristics of the PIC microcontroller used in the BASIC Stamp is its ability to directly drive loads like LEDs through its input/output pins. The Stamp can source (conduct to +5) up to 20 mA and sink (conduct to ground) up to 25 mA. Total current sourced or sunk by all eight pins should not exceed 40 or 50 mA, respectively.

Silicon Steroids for the Stamp Help Your Projects Heft Big Loads

Now, I'll grant that 25 mA doesn't sound like a lot of current. But shop around. Other microcontrollers make a big deal out of having a few "high-current" pins capable of sourcing 2 mA and sinking 10.

Okay, so the Stamp is a muscle-bound brute by microcontroller standards. It still gets sand kicked in its face by applications that need to drive motors, incandescent bulbs, relays, solenoids, etc. In today's column, we're going to pump up the Stamp to new levels of power.

Let's start with the basic transistor switch. To keep matters simple, we will limit our discussion to current-sink capability — switching current to ground.

The tools for the job are simple and easy to obtain: a resistor and an NPN transistor. Figure 1 shows the capabilities of a common 2N2222, a high-gain transistor, and a low-power Darlington transistor.

In Figure 1, you can think of the collector (C) and emitter (E) of the transistor as forming a

switch to ground. Current at the base turns the switch on. If Stamp pin 0 were connected to this circuit, the instruction High 0 would turn on current to the load; Low 0 would turn it off.

Transistor switches are good, but not perfect. See the column in Figure 1 that says C-E Voltage Drop? The voltage across the load will be that much smaller than the supply voltage. For example, if you're driving a flashlight bulb with a 2N2222 transistor and a 6-volt supply, the bulb will actually see only 5.5 volts. The other half volt will be lost, "dropped," across the transistor.

The voltage drop, multiplied by the current drawn by the load, gives you the power in watts wasted by the switching transistor. Where does the wasted power go? It produces heat, sometimes lots of it. For example, the Zetex ZTX689B can conduct as much as 2 amperes of current with a 0.5-volt drop, losing 1 watt to waste heat in the process. When you consider that a small soldering iron has a 15-watt heating element, you can imagine how hot that little transistor can get.

Larger switching transistors have metal tabs on their cases for attachment to heat sinks. The large surface area and other properties of the

heat sink help spread and dissipate all that waste heat. (A 15-watt soldering iron is very hot; an electric blanket with the same wattage is barely warm.)

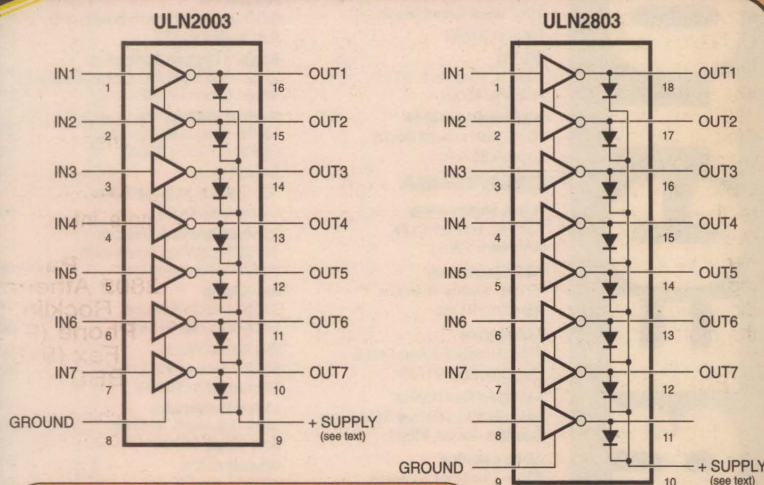
All three transistors in the Figure 1 table are compatible with Stamp output capabilities, but the third — the Darlington tran-

sistor — looks especially good from the Stamp's point of view. It requires only 1 mA to drive a 1-ampere load. But whoa, the C-E voltage drop is terrible at 1.5 volts. Can't we get a Darlington with better C-E specs?

In a word, no. Darlington transistors consist of two NPN transistors in the same case, wired in a way that multiplies their overall gain (ratio of current into current controlled). In the process, the Darlington adds one base-to-emitter junction worth of voltage drop, approximately 0.7 volts, to the C-E drop.

Despite this drawback, Darlington transistors are so handy for interfacing logic to loads that IC manufacturers offer arrays of seven or eight Darlington switches, complete with appropriate base resistors and protective diodes, in neat IC packages. Figure 2 shows two such units, the ULN2003 and ULN2803. These interface directly to a Stamp pin to drive loads of up to 500 mA per output.

The input pins of the ULN2x03s can connect



Handy power switches-on-a-chip: the ULN2x03 ICs.

Figure 2

Simple one-transistor switch boosts the Stamp's current switching capability

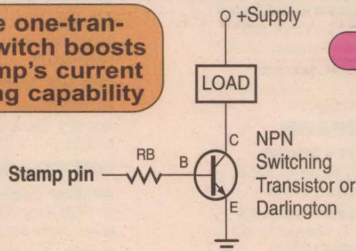


Figure 1

Transistor	RB	Base Current	Load Current	Max +Supply	C-E Voltage Drop	Remarks
2N2222	390Ω	11 mA	100 mA	30 V	0.5 V	Common
ZTX689B	390Ω	11 mA	2 A	12 V	0.5 V	High-gain
ZTX605	3.3k	1 mA	1 A	100 V	1.5 V	Darlington

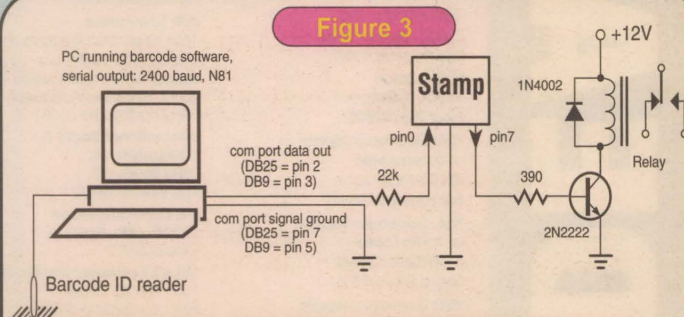


Figure 3

When the Stamp receives the proper code from the PC code reader, it activates a relay to unlock the door for club members

Stamp Applications:

directly to Stamp I/O pins. They're equivalent to connecting the pin to the left of RB in Figure 1. The output pins of the ULN2x03s are equivalent to the collector (C) connection of the transistor switch in Figure 1. They provide a switched ground connection for the load.

The ULN2x03s also feature something not shown in Figure 1 — a series of diodes connected to their outputs. When the devices are used to power inductive loads like relays and motors, these diodes should be connected to the positive supply that powers the load. When one of the ULN2x03 switches cuts power to the inductive load, the load's magnetic field collapses, generating a nasty negative power spike. The diodes short out this spike, preventing it from damaging the transistor switch.

If you construct your own switches with discrete transistors, you'd do well to copy this protective feature. Just add a common rectifier diode like a 1N4002 with its banded end (cathode: the negative connection when the diode is conducting) to the + connection of the relay or motor. The diode won't interfere with the normal operation of the motor or relay, but it'll snub those spikes!

A Real-World Example

Francis Rogers of Sun City West, AZ wrote me to describe an application he'd like to build with the Stamp. He has a PC with barcode software that can read membership cards for his S.C.W. Metals Club. The barcode software generates a code through the PC serial port when it's

presented with a valid card. Mr. Rogers would like the Stamp to read this code and energize a relay to unlatch a door.

This fits perfectly with the theme of this month's column. Figure 3 is the schematic. I've made some assumptions about Mr. Rogers' barcode software: that it can be set to output at 2400 baud; and that all valid cards output some common code for the Stamp to recognize.

Thanks to the serial-input (Serin) command's built-in "qualifier" feature, the entire program takes just a few lines of Stamp code:

loop:

```
low 7
serin 0,N2400,("OK")
high 7
pause 5000
goto loop
```

```
' Pin 7 low to latch door (relay open).
' Watch serial input until "OK" rec'd.
' Pin 7 high to unlatch door (relay closed).
' Wait 5 seconds.
' Latch door and resume watching serial input.
```

Of course, Mr. Rogers will have to substitute the actual password for "OK" in the program above.

That's it for this month. Next time, we'll look at a nifty IC that lets the Stamp transmit and receive DTMF tones (telephone touch tones). In addition to obvious telephone applications, DTMF can be used as a form of low-speed, high-reliability data transfer. Stay tuned! **NV**

Sources

For more information on the BASIC Stamp, contact:

Parallax Inc.

3805 Atherton Road # 102
Rocklin, CA 95765
Phone (916) 624-8333
Fax (916) 624-8003
BBS (916) 624-7101

For switching transistors and ULN2x03 ICs, order a catalog from:

Jameco Electronic Components

1355 Shoreway Road
Belmont, CA 94002-4100
Phone (800) 831-4242

Questions, suggestions, or requests for future Stamp Applications to:

Scott Edwards Electronics

964 Cactus Wren Lane
Sierra Vista, AZ 85635

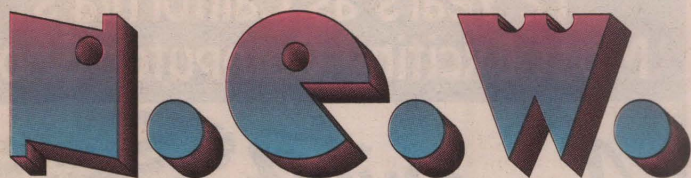
Phone (602) 459-4802

Fax (602) 459-0623

E-Mail (CompuServe) at 72037,2612

Internet: 72037.2612@compuserve.com

Contact Scott for a copy of his new catalog of Stamp accessories and neat electronics kits previously seen in **N&V** and other magazines.



NATIONAL ELECTRONIC WHOLESALE★☆☆

YOUR WHOLESALE HEADQUARTERS FOR ELECTRONIC COMPONENTS

MODULES COMPATIBLE WITH Xxxxxxxx

One-Wire Quick Board for X2, Z5, and BXZ

(1-5)\$29 (6-10)\$25 (11-20)\$23 (21-50)\$20 (51+)\$18

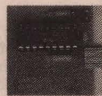
**NO BATTERY-CUT
VERSION**
WORKS ON ALL ONE TOO!



**ALSO AVAILABLE IN
3-WIRE VERSION**

MULTI-MODE -- 3-WIRE BOARD

(1-5)\$29
(6-10)\$24
(11-20)\$20
(21-50)\$18
(50+)\$16



WORKS ON ALL X2, Z5, AND BXZ
MODELS THAT USE MULTI-MODE.
WORKS ON UNITS THAT DON'T USE
MULTI-MODE TOO!

SPACECOM SEVEN THREE-WIRE MODULES

(1-5)\$13 (6-10)\$10 (11-20)\$9 (21-50)\$8 (51+)\$7



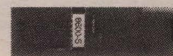
FOR MODELS THAT DON'T HAVE X2, OR Z5
AS PART OF THE MODEL NUMBER. NOT FOR
BXZ MODELS.

ALSO: 28-PIN MOD FOR BPB 5 -- (1-10)\$10 (11-20)\$7

MODULES COMPATIBLE W/SCIENTIFIC ATLANTA:

QUICK-BOARDS for MODELS 8550,8570,8580,8590,8600

(1-5)\$22 (6-10)\$20 (11-20)\$19 (21-50)\$17 (51+)\$14.75



THE MOST RELIABLE BOARDS ON THE MARKET! DON'T SETTLE
FOR IMITATORS, WHEN YOU CAN HAVE THE BEST!!

OTHER MISC. ITEMS:

SA 40-PIN mods: (1-5)\$21 (6-10)\$20 (11-20)\$18 (21-50)\$15

PIO 3-WIRE: 6100series \$29EA -- 6300series \$49EA

TOKEONE: 03607 - 28-PIN \$AS LOW AS \$5.

ZENITH: ZL-1 (1-10)\$9 (11-20)\$6 (21+)\$4.49

PIC 16C56 RCP BLANKS (100+)\$2.45 (500+)\$2.39 (1K+)\$2.3

MOTOROLLA 40-PIN BLANKS (100+)\$10.50 (500+)\$9.50

STEALTH 1000-P

(1-5)\$56 (6-10)\$50 (11-20)\$46 (21-50)\$43 (50+)\$41

WE GLADLY ACCEPT VISA, MASTERCARD AND C.O.D. ORDERS.
ALL CREDIT CARD ORDERS ARE THOROUGHLY VERIFIED!!
SHIPPING BY FEDEX

NO
CA
SALES

1-800-618-7480

NATIONAL CABLE PRODUCTS

CABLE TV DESCRAMBLERS

We specialize in original factory combination units.

- BEST RETAIL AND WHOLESALE PRICES
- TECHNICAL SUPPORT
- FRIENDLY CUSTOMER SERVICE
- ONE YEAR WARRANTY AND 30 DAYS MONEY BACK

We also have test modules. Multimode, Brooklyn, and Manhattan test modules are available.

WE BEAT ANY PRICE
NO CALIFORNIA SALES.

1-800-342-4509

Mon-Sat 8:00 am - 5:00 pm PST • Technical Support: 818-345-4509

WE DO NOT ASSIST ANY INDIVIDUAL IN DEFAUDING CABLE OPERATORS!

Write in 159 on Reader Service Card.

#170 MISC. ELECTRONICS WANTED cont.

WANTED: ELECTRICAL materials, Allen-Bradley, Agastat, Appleton, Crouse-hinds, T&B, Square D, Pyle National, Russel & Sfol, circuit breakers, fuses, connectors. Call Beiner Sales, 805-379-4484, FAX 805-379-3153.

BUYING TOCOM, SCIENTIFIC ATLANTA 8536s, 8550s, 8580s, 8590s, and 8600s. **JERROLD** DPV and DPBB. **PIONEERS**, all, and Zeniths, all. Any quantity. Top \$\$\$ paid. Contact National Cable Brokers, Plymouth, IN. Phone 219-935-4128.

WANTED: AUSTRON Model 1201 Linear Phase Recorder. **HP-DY2509A** Digital Clock. **GENERAL RADIO** Model 816 Precision Clock. Call Bill Scolnik, 1-800-634-7036 or FAX 1-800-788-5005.

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.

WANTED DOLCH model ALP44 active logic probes (and possibly other 4850A compatible accessories) 708-358-3275.

WANTED: TUBE Hi-Fi & Commercial equipment & speakers & horns, tubes. Altec, RCA, Fisher, Scott, Tannoy Dyna Co., Marantz, Heath, Eico, Craftsman, Brook, McIntosh, Jensen, Western Electric, JBL, EV, etc. Sonny Goldson, 1413 Magnolia Ln., Midwest City, OK 73110. 405-737-3312, FAX 405-737-3355.

BATTERIES — BATTERIES — BATTERIES

FOR HANDHELD RADIOS:

ICOM
KENWOOD

YAESU
ALINCO

MOTOROLA
G.E.

AND MANY OTHER RADIOS

BRAND NAMES:

SANYO
PANASONIC
GATES

VARTA
DURACELL
YUASA

SAFT
AND
MANY MORE!

BATTERIES FOR ALL YOUR POWER REQUIREMENTS!!! PLEASE CALL OR FAX FOR FAST SERVICE. WE STOCK THE MOST COMPLETE INDUSTRIAL & CONSUMER BATTERY SELECTION IN THE INDUSTRY!!!

E.H. YOST & CO.

2211-D PARVIEW RD., MIDDLETON, WI 53562 • PHONE: 608-831-3443 • FAX 608-831-1082

WANTED: BMI (BONNEVILLE) stock and commodity quote FM receiver set. Set has 2 boxes, data receiver and data converter. Will consider either piece separately. Satellite set may be the same. I need a back-up set. Call, describe your box or set. I will call back. Tom, 312-271-8066.

WANTED: TUBES, radios, transmitters, gyros, bearings, connectors, relays, lamps, synchros. Mail or fax your offerings to Hy Ness Company, 709 B Delair Road, Cranbury, NJ 08512. Phone: 609-395-1116, FAX: 609-395-1117.

WANTED: LATE MODEL TEST EQUIPMENT (Tektronix, HP, Fluke). Especially: Tek SG 505/2, Tek S-6, Tek 2465A/B. Also, we buy test equipment service manuals and catalogs. Pepper Systems: 214-353-0257; 214-902-9511 FAX.

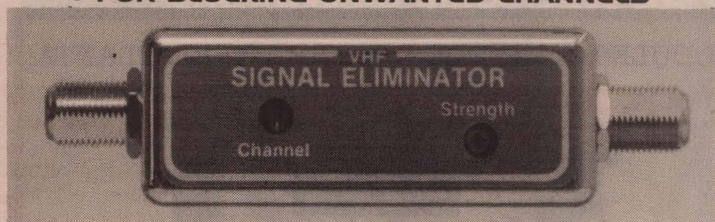
WANTED: SL11DB Relays, MC1466/MC1566, 4024 in cans, μ A-706, AD639 AD537, LF157, OP-17 Scintillation Crystals NaI(Th) or Li(Eu), Photomultiplier Tubes, H3 Neutron Detectors, Old Well Logging Tools and Electronics. Syd H. Levine & Associates, PO Box 201, Fordsville, KY 42343.

I WANT it and I want it now. I want all of your SIMM memory. IBM, Mac, new, used, even defective. I want it all. Highest \$ paid. Call 1-800-4-MEMORY now! Voice/FAX.

WANTED TO buy: complete cable boxes in turned off condition. First: Jerrold DP5-312, Second: Jerrold DP5-310 - single-double or riple depending on price and good condition for top cover. State price plus UPS shipping. Vern's TV, PO Box 613, Port Ewen, NY 12466.

CABLE - TV NOTCH FILTERS

- FOR ELIMINATING RF INTERFERENCE
- FOR BLOCKING UNWANTED CHANNELS



- ❑ AVAILABLE FOR VHF CHANNELS
Ø THRU 36 AND 95 THRU 99
- ❑ PRICING AS LOW AS \$12 EACH

Call or write for a
FREE brochure today!

STAR CIRCUITS

P.O. BOX 94917
LAS VEGAS, NV 89193

1-800-535-STAR

12 Years as California's Most Exciting Computer Show

Computer MARKETPLACE

Enjoy the Show in Our
Air Conditioned Buildings!

Consumer Trade Show
With Wholesale Prices

There is no other place where you can find such a huge inventory of computer products at low, wholesale prices! Hundreds of knowledgeable computer retailers and businesses each demonstrating their products and paying close attention to your needs.

August 5 & 6 **POMONA** Fairplex (LA Fairgrounds)

Saturday & Sunday
Exit Highway 10 at Fairplex Drive. Go north to McKinley Avenue, turn right. Turn left on White Avenue to Gate 14.

August 12 **RESEDA** Sherman Square Entertainment Center

Saturday
From the 101 Freeway take the Reseda offramp, turn left (east) to Sherman Way and turn right. Go one block to Canby Street, 18430 Sherman Way.

August 13 **BUENA PARK** Sequoia Conference Center

Sunday
Take the Beach Blvd. exit off the 91 Freeway. Go one block north to 7530 Orangethorpe.

August 26 & 27 **POMONA** Fairplex (LA Fairgrounds)

Saturday & Sunday

Browse Computer Marketplace on the Web. Go to <http://www.arrowfm.com>

All Shows
Open to the Public
10:00 A.M. TO 5:00 P.M.

CONSIGNMENT TABLE
300 EXHIBITS at the POMONA SHOWS

Admission
Pomona: \$7⁹⁹
All others: \$5⁹⁹

NATIONAL PRODUCTIONS, INC.

(408) 778-5200 or 800-800-5600

Fax# (408) 779-1374

THE SOLDERLESS BREADBOX

by Donald Wilcher

Strain Gauges and Instrumentation Amplifiers: Part 1

I remembered a community college course that taught the fundamentals of electronic instrumentation and measurement. This class introduced me to such equipment as strip chart recorders, total harmonic distortion analyzers, thermocouples, and signal conditioner amplifiers.

One device that I experimented with in the lab that really fascinated me was the strain gauge. This resistive element was no bigger than a PCB trace. The actual gauge had to be affixed to a metal bar using a special adhesive, and the test leads soldered to the resistive strip.

The experiment required that each student review a video tape on how to mount the strain gauge on the metal bar. The final grade for the experiment was dependent on the appearance of the strain gauge and if it worked according to the lab write-up.

Well, I was quite proud of my gauge unit and the grade I received from the instructor. The unit was able to measure different amounts of strain being applied to the metal bar. The project was quite interesting because I learned about stress and strain, and how

electronic instrumentation could be used to measure them — which brings me to this month's column.

You will have the opportunity of converting your bench into a mechanical strain lab. In the first installment of this two-part column, we will explore what all of this stress and strain stuff is about. We will then look at the construction of a strain gauge and analyze how it measures mechanical strain.

The Wheatstone Bridge will be discussed regarding its relationship to the strain gauge.

Last, there will be the usual hands-on circuits for you to explore the workings of strain gauges and mechanical strain.

Part 2 will focus on instrumentation amplifiers and how to use them with strain gauges for measuring mechanical strain.

So, without further delay, let's begin our discussion of what elasticity is and how it applies to the mechanics of metal.

What is Elasticity?

Elasticity deals with the deformation of solids when subjected to an external force. The force in this context means either a fluid or air pressure, mechani-

cal inertia, or gravity. The result is the same — the object will change upon a force being applied to it.

To illustrate this concept, take a look at Figure 1. A steel bar is subjected to a force in the form of a weight. With the added weight, the length of the bar will increase. Once the weight is removed from the bar, it will return to its original form.

The change in length resulting from the applied force is known as strain. This elastic condition will only exist if the force of the weight is non-destructive. With metallic solids like steel or aluminum, the strain before deformation is in the range of thousandths of an inch.

The property of elasticity is used in pressure transducer manufacturing because of the linear relationship between strain and the applied force. The mathematical expression for this relationship is:

$$S = k \times F$$

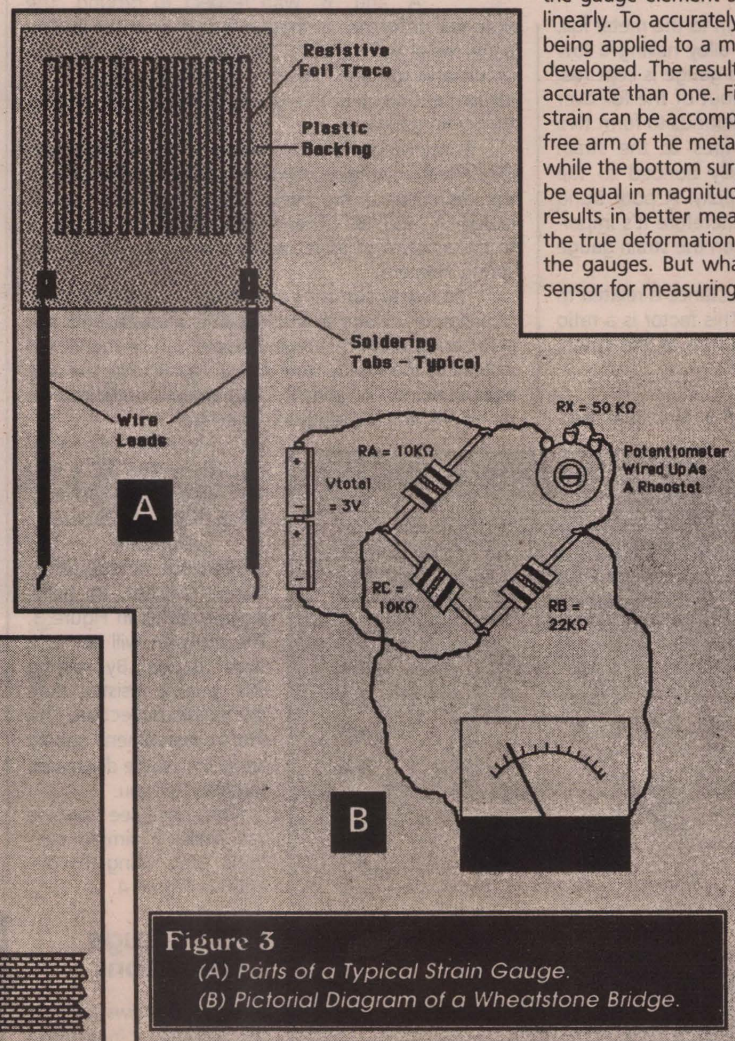
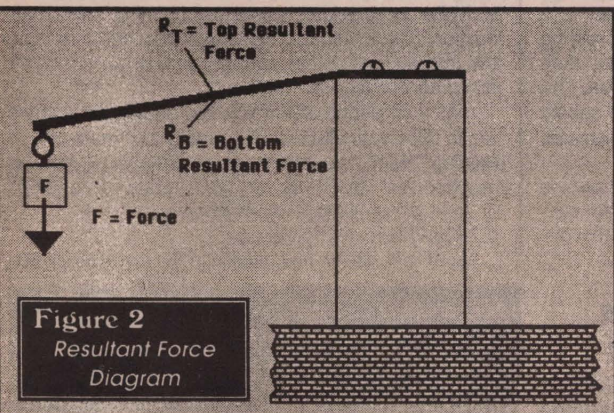
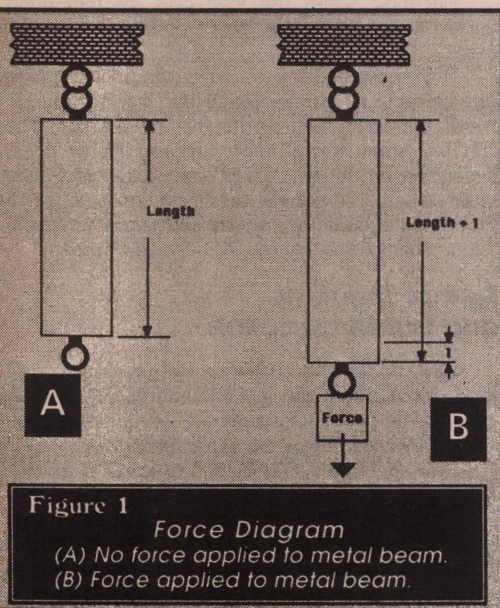
where F is the applied force, S is the resultant strain, and k is the solid's elasticity constant. This equation is known as Hooke's Law and was originally applied to coil springs, weights, and measures. This same equation can be used to analyze strain in solids, as well.

The important element for a strain gauge is its elasticity. This mechanical property is designed into the gauge element so that it translates applied force linearly. To accurately measure strain requires a force being applied to a metal bar whereby two strains are developed. The resultant from the two strains is more accurate than one. Figure 2 shows how this resultant strain can be accomplished. By applying a force to the free arm of the metal bar, the top surface will expand while the bottom surface will contract. The strains will be equal in magnitude, but opposite in direction. This results in better measurement conditions because of the true deformation of the solid being focused on by the gauges. But what makes a strain gauge a good sensor for measuring strain?

The Strain Gauge

The strain gauge is used to convert strain into equivalent resistance. As discussed briefly, a strain gauge is just a metallic conductor bonded to the spring element (the metal bar). One property of resistance is its value changes depending on the length of the conductor from which it was made. If the gauge is placed in tension, its length will increase, thereby increasing its resistance.

Put the strain gauge in an opposite condition and its resistance will decrease meaning a compression state of the metal bar. Figure 3 shows a diagram of a typical strain gauge. It is constructed of a thin foil conductor bonded to a plastic backing. The backing serves a carrier for the metal foil and provides insulation from the metal bar. This plastic backing must be



THE SOLDERLESS BREADBOX

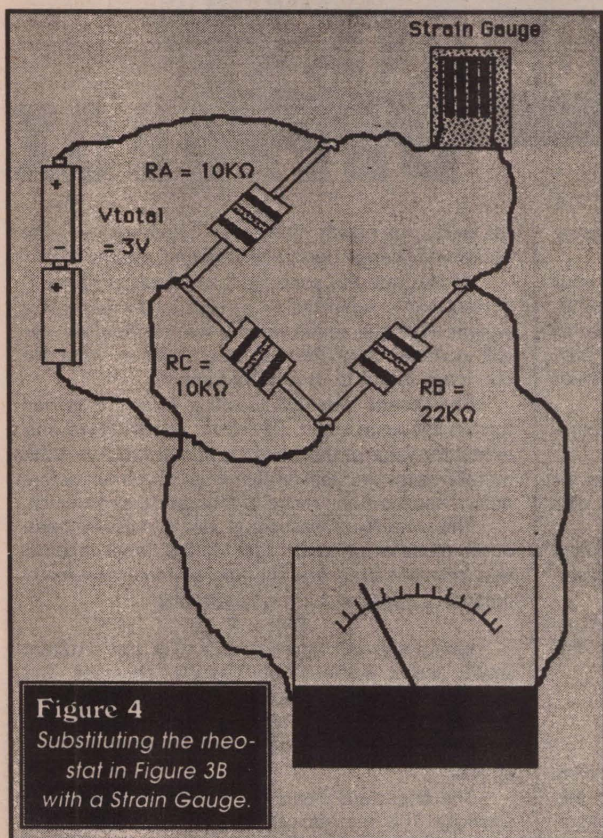


Figure 4
Substituting the rheostat in Figure 3B with a Strain Gauge.

flexible enough to transfer the strain to the metal foil. The foil is usually made from an alloy having a low temperature coefficient. The strain gauge is kept reasonably short by the criss-cross layout of the foil over the backing. At one end, the foil expands to form two solder tabs for attaching lead wires to the strain gauge. The strain gauge is usually bonded to the metal bar with an adhesive-like epoxy. A poor bond allows a slow changing reading, therefore it's important to have good adhesion between the strain gauge and the metal bar's surface.

The change in strain gauge resistance is related to strain by the strain gauge factor. This factor is a ratio between the unit change in resistance to the strain. The equation for the gauge factor is:

$$G = (r / R) / s$$

where G is the gauge factor, R is the initial resistance

of the gauge, and S is the strain. Most strain gauges have an initial resistance of 120 or 350 ohms. The gauge factor is usually between 2 and 3 for most metal foil gauges. The majority of the strain gauges are metal-foil, however, semiconductor devices are gaining popularity in some mechanical stress labs.

Now let's take a look at how a Wheatstone Bridge can be used to show the amount of strain on a metal bar.

The Wheatstone Bridge and Strain Measurements

The Wheatstone Bridge is an electrical instrument that can measure resistance. Figure 3 shows the schematic diagram for a typical Wheatstone Bridge.

The instrument works by taking an unknown resistor and connecting it across the measurement terminals of the bridge. By adjusting the meter for a null (zero) reading on the panel meter, the value of resistance is read directly from the adjustment dial.

A voltage drop is established across points "A" and "B" with respect to ground. The potential difference at these points is what the analog panel meter will measure. The difference between this circuit and the one shown in Figure 4 is there is no adjustment dial and the Rx (unknown resistor) is now the strain gauge.

By applying a force to the metal bar, a meter needle deflection reading will be observed. The reason for this deflection is the difference in voltage at points labeled "A" and "B." The needle will deflect according to the amount of force or strain being applied to the spring element.

The reason for using a Wheatstone Bridge instead of a simple voltage divider circuit is because both the static and dynamic voltage changes can be monitored instead of the steady state signal. To calculate the voltages at points "A" and "B," two analysis equations for points VA and VB required. They are:

$$V_A = (R_s / R_A + R_s) \times 5V$$

$$V_B = (R_B / R_C + R_B) \times 5V$$

where Rs is the resistance of the strain gauge. To illustrate this Wheatstone Bridge/Strain Gauge concept, try building the circuit in Figure 3. The rheostat will act as a strain gauge. By varying this variable resistor, note the needle deflection. This simple experiment should bring this whole discussion together for you.

Now, let's see how we can make a simple electronic scale using the diagram in Figure 4.

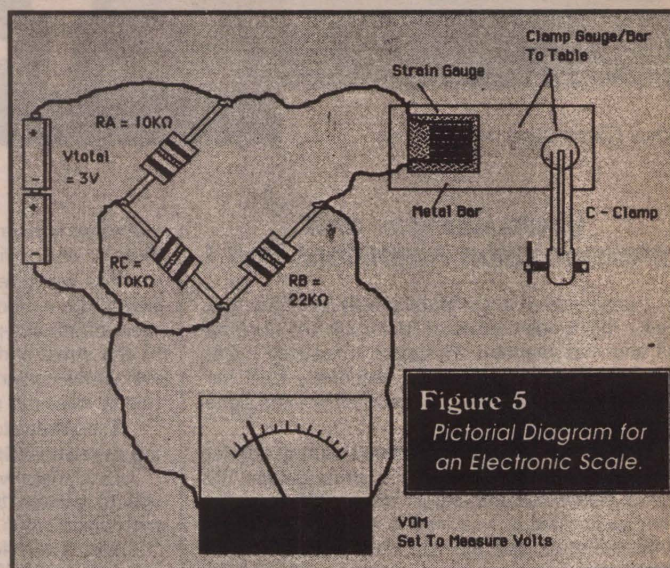


Figure 5
Pictorial Diagram for an Electronic Scale.

weight. By pushing down onto the metal bar, the needle should deflect towards zero. As less force is being applied, the needle should deflect upward. This example illustrates how an electronic scale works.

The electronic scales at the grocery store, for example, use four strain gauges connected in a Wheatstone Bridge configuration. They are packaged in a metal ring called a force ring which is used to detect mechanical forces. The whole assembly is called a load cell.

Electronic scales use load cells for measuring forces. Again, this circuit illustrates how a load cell works.

With some added electronics, the analog gauge can be replaced with a digital bar graph. Figure 6 shows the circuit diagram for this modification. The LED bar graph IC will drive the appropriate LEDs, depending on the amount of strain detected by the strain gauge. The original circuit can be modified to provide an audible tone which will translate into different strains being applied to the spring element.

Further Thoughts and Experimentation

Well, I hope this discussion will provide enough food for thought on experimenting with strain gauges. The circuits discussed are just the tip of the iceberg for other innovated applications.

One application that comes to mind is a force meter. By taking an instrumentation amplifier and a computer, several forces could be logged and stored into the machine. Using a spreadsheet package, the data can be manipulated into charts and graphs.

Next month's column will focus on how the bridge circuit can be connected to an instrumentation amplifier for providing signal conditioning and amplification. There will also be a brief discussion on how this measuring system can be tied to a Macintosh computer for data acquisition.

As a challenge, see if you can design the audible circuit that was discussed. I would be interested in hearing from you about your designs. I can be reached at the *Nuts & Volts* editorial address or send me an E-Mail. My mailbox is: t6790dw@infoctr.chrysler.com

Enuf said, see ya next month in the breadbox!!! NV

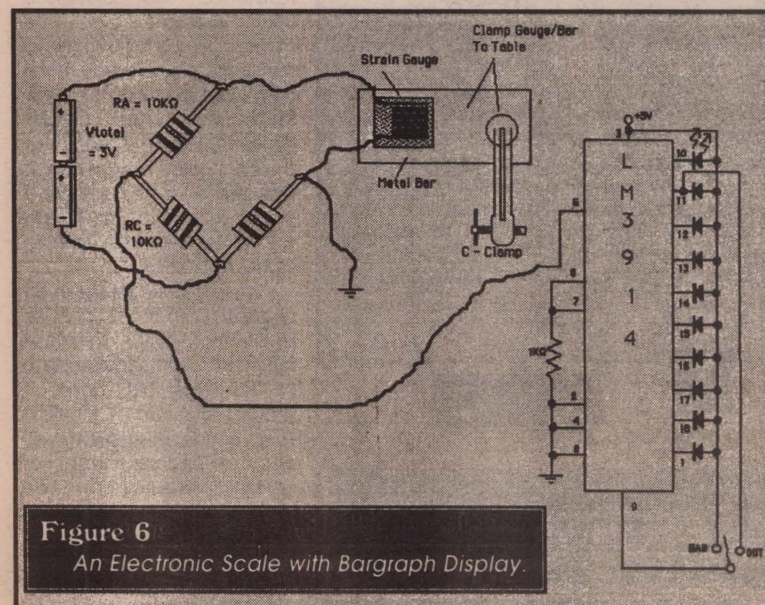


Figure 6
An Electronic Scale with Bargraph Display.

Strain Gauge Applications

Figure 5 shows a circuit set-up for measuring

Resources:

For information on strain gauges, contact Omega Engineering at (800) 826-6342.

KINGSLEY WIRE stamp machines, digital pressure gauges, Setra 370 IFR 401L, 402AP, 600A, RD300, 120043, etc. Auto pilot test equip. Jet, JT-1, FC110. Buy, sell, trade. 813-575-0138 P/F.

WANTED: ESN reader by Curtis or other similar model. Call Tony, 415-493-8148.

LATE ELECTRONICS, boards, equipment, medical, computer, industrial, phone parts etc. 619-632-9775.

ELECTRONICS EXCHANGE ST. LOUIS the only surplus electronics store in the St. Louis area. We buy anything in electronics that's a bargain. Call or FAX, 314-426-4848. 24 hours, 7 days.

EXCESS INVENTORY WANTED: Commercial and military. ICs, diodes, transistors, caps, relays, connectors, wire, and cable. **M&M SALES**, 602-807-8604 OR FAX your list to, 602-807-3320.

LATE ELECTRONICS, boards, equipment, medical, computer, industrial, phone parts etc. 619-632-9775.

WANTED: TRANSACTOR magazines. 602-266-3599.

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.

HEATHKIT WEATHER STATION ID-4001 wanted for parts or the micro-processor IC Heath PN 444-23 needed. Arnold Allen, 423 South Highland, Ada, OK 74820. 405-332-8044.

LOOKING FOR Jerrold DPBB7522/V5 or any DPBB series boxes, schematic or any information. Write to: K. Graham, 699 Linden Blvd., Brooklyn, NY 11203.

NEED ZENITH P/N 95-3176 (Thordarson FLY-564) Flyback transformer for 23GC45 model Zenith TV, also, have misc. computer equipment for sale. Call John at 803-665-5333.

AVIONICS MAINT. manuals. Collins, King, Narco, Cessna, RCA etc. Collins Proline Red Band, any condition, any type, control heads, King, Collins, Gables, Sperry, Radar, any. 813-575-0138 P/F.

WANTED: KEPRO BTE-202 Bench top PC, board spray etcher. Must be in good condition. Also need Kepro MS-6 bench shear. Cash waiting, 904-736-8420. No collects please. Ask for Tom.

WANTED: CREI home study course #270 "Engineering Mathematics," WK Cheatwood, Box 121, Hope Hull, AL 36043.

CRYSTAL SETS wanted pre 1960, galena and germanium diode, detectors, loose-couplers, carimeters, parts, incompletes, wood box for DeForest DT600. Want tubes WD11, WD12, UX199, Audions, and Fleming Valves. Ryders manuals wanted. PO Box 42351, Portland, OR 97242. 503-231-9708.

WANTED: AVIONICS test equipment. IFR 1200Y3, 401L, 750B, 600A, Also Collins, King, Microline, Proline, Silver, Gold Crown Ground Power Units, Fox Carts. Avionics Plus, 28000 Airport Rd., Box A17, Hangar 97, Punta Gorda, FL 33982. 813-575-0138 P/F.

BBS & ONLINE SERVICES

175

NEW CLASSIFICATION

EDUCATION

180

NORTHERN TELECOM and AT&T Boards and parts. New to 5 years. 619-632-9775.

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.

HUBBLE TELESCOPE Photographs (GIFS) with accompanying NASA Texts. GALAXIES in the YOUNG UNIVERSE Series, \$9.99 + \$2 shipping. Entire public Hubble Series available. SPACEPICS, POB 75711, Oklahoma City, OK 73147.

COLLEGE LECTURES on VCR tapes. Topics include electronics, computers and communications. Send for course list. OCS, PO Box 292, Fort Mill, SC 29715-1832.

LEARN PC ASSEMBLY LANGUAGE. Disk \$5. Book \$15. ZIPFAST, Box 12238, Lexington, KY 40581-2238.

125 WAYS to multiply and divide numbers. Make electronic calculations readily. Solving electrical problems becomes quicker and more interesting a must. "Practamatics & Arithmagic" \$12.50 PP. Mazal Electronics, 81 Market Sq., Newington, CT 06111.

MOBILE TRAINING Institute correspondence course cost \$375, Sell \$200, OBO. John Wagner, 2175 Wagner Dr, Caro, MI 48723. 517-673-4312.

ELECTRONIC ENGINEERING. 8 volumes complete. \$109.95. No prior knowledge required. Free brochure. **Banner Technical Books**, D-2 1203 Grant Ave., Rockford, IL 61103.

FCC COMMERCIAL License Radio Telephone RadioTelegraph. Fastest easy home study manuals. Audio, Video, PC disks. Q&A pool. GMDSS. Code tapes all speeds. "Career Guide" Guaranteed to pass. Free details, WPT Publications, 1-800-800-7588.

FOR SALE: Heathkit trainers, ET 3400 trainers \$125 ea. ET 3600 trainers \$100 ea., All in working condition. Call 205-350-5546. Leave message.

UNUSUAL TECHNICAL BOOKS. Courses on antique radio repair, camera repair, many other topics! Unusual tools. Free Catalog. **Ed Romney**, Box 487, Drayton SC 29333. Keep this address! It is hard to find!

BUSINESS OPPORTUNITIES

190

DID YOU know Chaffin Electronics offers: Programming service, circuit board manufacturing, thousands of obsolete and hard to find ICs, same day shipping, computerized parts search? Call for more information. Phone: 614-574-4456 or 6906, FAX: 614-574-2124.

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.

DISCOVER SECRETS OF HIGH-PROFIT MICROWAVE AND VCR REPAIR! Powerful new 2-cassette video shows you how to, when to, and what to do. **GUARANTEED** logical, practical, realistic, specific. **MONEY BACK** if not completely satisfied. Plus **FREE** technical support. Call **MICROTECH** toll-free, 1-800-700-UFIX (8349).

\$100 GOLD! There is a circuit chip made by IBM that contains more than \$100 each in scrap gold, and another worth \$20. Almost nobody knows this. They are just starting to show up in resale outlets and junk yards. You can score big with this knowledge. Complete info with photo \$35 to: Jim Sciuto, Box 128, Methuen, MA 01844.

NATIVE UKRAINIAN wants to be your Tech Rep in Ukraine or Eastern Europe. Fluent in four languages, BSE degree, highly skilled in IBM/DOS hardware, software, networking, LF to UHF communications, antenna and transceiver design. Training or temporary work in USA to learn your products ok. KC1VF/US5WE, 03-231-6478, PO Box 2490, Christainsburg, VA 24068.

SELL CD-ROMS. 100s of titles. Home-based Okay. Write: Cash-Rom, 1860 Dorsetshire Rd., Columbus, OH 43229-2139.

NEW BIG MONEY MAKING Opportunity. National Computer Help Desk Corporation seeks key joint venture partners in marketing expansion. \$50,000+/year revenue possible. For qualifying interview, call 907-227-4637.

MAKE \$100 an hour using your computer from home! 25 different ideas! Report tells all! Easy to do! Only \$51 Bates, 426 Belmont, Chicago, IL 60657.

!! SMART!!

MINIATURE DIAGNOSTIC DEVICE ACTIVATES WIRELESS YOUR CABLE BOX!

IT TAKES ONLY FEW SECONDS TO PUT IT INTO A FULL OPERATIONAL MODE
NO WIRING
NO INTERFERENCE
NO HASSLE
OUTPERFORMS THE REST

Order Toll Free
1-800-220-3543

10am-7pm PST

\$145

VISA, MC, MO, COD

* **MAKFIT RESEARCH** *

e-mail: Makfit@delphi.com

SMART device is intended to be use solely as a test device.

Do not use it without authorization from your local cable company.
No CA Sales.

HOME AUTOMATION. Become a dealer in this fast-growing field. Free information. Call, 1-800-838-4051 anytime.

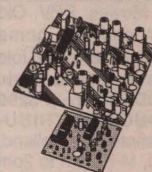
WHOLESALE FLEAMARKET merchandise directory. 60 pages, hundreds of distributors listed that you may contact who supply fleamarket/swapmeet dealers. All kinds of items, incredible prices! Electronics too! Useful for business or personal use. \$12. JACOMM-BO, Box 142, Wharton, NJ 07885-0142.

1 GIG-HDS \$100, 72 pin SIMMS mem \$15, 486-90MHz. Pentium motherboards \$135. Pentium CPUs \$75 to \$200. 14". 28 SVGA monitors \$65 lots more. Deal directly and save. Over 290 addresses \$20. We can also send COD if you like. FAX/Phone no's too. GR Stringer, PO Box 30563, Houston, TX 77249-0563 USA.

LEARN CAMERA REPAIR, ANTIQUE RADIO REPAIR Free catalog unusual books and courses. **Romney**, Box 487 Drayton, SC 29333. Keep this address! It is hard to find!

FREE 1995 600,000 items wholesale directory. TNT, Box 2614NV, Big River, CA 92242. (LSASE).

THE LOWEST COST WEATHER FAX RECEIVER!



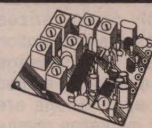
A very sensitive fm receiver especially for NOAA APT and Meteor weather facsimile images on the 137 MHz band. Use with any popular demodulator/software.

Excellent 0.2µV sensitivity, special wideband filters for low distortion, and four selectable crystal controlled channels.

Optional Scan Adapter allows you to automatically search for and record signals as satellites pass overhead while you are away from the shack.

- R138 Receiver \$129 kit, \$189 w/t
- Channel Crystals \$12 ea
- AS138 Scan Adapter \$39 kit, \$69 w/t
- LMG-137 Low-noise GaAsFET Preamp \$59 w/t
- ARRL Weather Satellite Handbook \$20

WWW RECEIVER



Get time and frequency checks without buying expensive hf rcvr. Very sensitive and selective xtal controlled superhet for

for listening to WWW on 10.000 MHz.

RWWW Receiver only \$59 kit, \$99 w/t

DIGITAL VOICE RECORDER

Records up to 20 sec. of your voice with built-in mic. or external mic. Extensive manual tells how to use multiple messages and adapt to many applications.

DVR-1 Module kit \$59, w&t \$99

DTMF REMOTE CONTROLLER

Turn devices on and off over any radio link by four-digit touch tone command.

TD-4 (one output) kit \$49, w&t \$89

TD-2 (five outputs) kit \$79, w&t \$129

RECEIVER PREAMPS

Many models of very low noise preamps for vhf and uhf bands from \$29.

We also make a full line of vhf & uhf fm voice & data link xmtrs & rcvrs, repeaters, autopatches, and converters.

CALL OR WRITE FOR FREE CATALOG

Our 33rd Year!

hamtronics, inc.

65-N Moul Rd; Hilton NY 14468
Phone 716-392-9430 (fax 9420)

WHITE-STAR ELECTRONICS

TEL: 405-631-5153
FAX: 405-631-4788

CONVERTERS:	20	50	100+
Regal CR-83	45	39	35
Regal CR-83 (AB)	47	41	37
DQN-5 (2 or 3) (unmodified)	45	39	35
DRZ-3 PJ (unmodified)	39	35	32
DRX-3 PJ (unmodified)	37	33	30
REMOTE CONTROL HAND UNITS:	20	50	100+
Jerrold Replaces: 400/450/550	5.00	4.50	4.25
Scientific Atlanta 075/175/475	5.00	4.50	4.25
8600: On screen display	7.00	6.50	6.25
Pioneer: BR, 81, 82	5.00	4.50	4.25
All Panasonic	7.00	6.50	6.25
All Zenith	5.00	4.50	4.25

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 9am to 5pm Central Time. Call for FREE catalog.

Write in 157 on Reader Service Card.

INTERNET ADS: How to place your ads on the Internet. Expose millions to your products and services. Send \$5 to cover postage and handling for **INTERNET ADS INFO DISK**. Mail to: Sunshine Development Co., 1911 Park Ave., Monroe, LA 71201

SPORTS BARS & SATELLITE DISH OWNERS. Like free sports; news; discovery; network programming- ABC, BBC, CBN, CBS, FOX, NBC, Movies, PPV, Old Time Movies, weather, cooking, home improvements, dog & horse tracks and lots more. **No Hits or Codes needed to work. BMAC and OAK DECODERS from \$299 up. TRIANGLE PRODUCT DISTRIBUTORS USA**, 5750 Lakeshore Dr., Holland, MI 49424. 616-399-6390, M-F 9am to 2pm EST.

SELL OUR SOFTWARE. Sell your hardware and time. Great vertical market. Computer experience required. Dispatching to tow yard experience helpful. California company expanding nationwide. 24 hour support for you and your clients. Recurring monthly revenue possible. No investment required. 310-426-2255.

LOOKING FOR EXTRA INCOME? Distribute the most exciting product of the century! Introducing **"FM RADIO BROADCASTER"** a completely computerized short range FM radio broadcasting station that continuously repeats your message indefinitely. This automated radio station can do anything! Its applications are unlimited! The electronic marketing revolution's here! Thousands of business people are waiting to see it. This product is truly explosive and the market is totally untapped! A ground floor opportunity with unlimited earning potential. No license required. Send \$1 for details: **SPECIAL INTERESTS, PO BOX 13, OSSINING, NY 10562-0013.**

HOW TO make money placing ads on the Internet. 30,000,000 or more prospects. 100 words for 1 year for \$95. Send \$10 for 3-1/2" computer program disk to: InfoVideos, Box 26031, Columbus, OH 43226-0031.

DAY TRADERS can make over 1% per day in a rising or falling stock market! If you can use a simple spreadsheet, you can too. \$35 for complete course including my proprietary formulas. K. Strom, Route 219, Hillsboro, WV 24946.

INVENTORS! MAKE BIG MONEY FROM YOUR ELECTRONIC IDEAS! Bi-Monthly magazine can help you succeed. Send \$15.95 to The Dream Merchant Magazine, 2309 Torrance Blvd., Suite 104, Torrance, CA 90501. (1-800-35-DREAM) Full money back guarantee if not 100% satisfied.

HOW TO get the best long distance rates, 800 #s, and calling cards **PLUS MAKE MONEY** by simply telling others. Free details, 1-800-294-3228. Mention "long distance."

MAKE \$100 hour with your computer and our books and software. Call 520-782-2316 for details or write to: **TELECODE**, Box 6426-NV, Yuma, AZ 85366-6426.

PROTOTYPING, REVERSE ENGINEERING, PRINTED CIRCUIT DESIGN. We will provide engineering services, manufacturing and assembly services, and finished products for businesses and individuals. We specialize in RF but will also do digital and linear work. Surface mount or through hole boards. Mechanical products are welcome, too. Contact: **MARTRONICS**, 4820 Deer Creek Way, Paso Robles, CA 93446. Tel. 805-239-1932.

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.

EXTRACTION AND RECOVERY OF GOLD FROM SCRAP ELECTRONICS. Book describes how to inexpensively recover and refine scrap gold on small scale. \$35. Michael Young, PO Box 145, Newville, AL 36353.

COMPUTER SEARCH reveals how you can earn money at home, full-time, part-time or in your spare time. Send just \$4.95 to: John Kazalia, 192 Lennox Ave., Columbus, OH 43228.

REPAIRS - SERVICES

200

MAGICIAN IS available to solve your RF problem. Have Laboratory & Instrumentation up to 10GHz. Prototyping, Consultation, Tutoring. **MINARET RADIO**, John Horvath, 2023 Gates Ave., Redondo Beach, CA 90278. Ph: 310-318-3156.

AFFORDABLE HP power sensor repair! For example most HP 8481As repaired for \$195. Call or write for information and pricing. Willamette RF, Inc, PO Box 1599, Corvallis, OR 97339. Phone 503-754-7226, FAX 503-753-4629.

PROTOTYPE DESIGN and development, embedded micro-controllers including PIC, multi-layer PCBs, assembly language programming, device replication, packaging, from concept to completion, high quality, great rates. Your "one-stop-shopping" prototype solution. Micro-Cosm, 2855 Masters Court, Pinckney, MI 313-878-3355.

PRODUCT/CIRCUIT development available. Specializing in RF and analog design of satellite communications equipment. Have complete microwave and digital development lab for RF, analog, digital and PCB design, Tom Hajjar, 543 W. Amherst, Satellite Beach, FL 32937. 407-773-5633.

RADIO REPAIR: Commercial and amateur two-way. Portables a specialty. Reasonable rates. Call Mike N9VWW at **REYNOLDS RADIO**, 219-482-5630.

PROTOTYPING SPECIALISTS providing quick turnaround on analog and digital designs. Wirewrap and printed circuit boards thru hole and surface mount available. Competitive pricing from concept to completion with on time delivery. **Contact:** NU-AGE Products, 2271-F Palmdale Blvd., Ste. B-38, Palmdale, CA 93550. 805-285-6000. FAX 805-285-6904.

MASTER BEEPERS repair. Motorola, Train technician fastest turn around. For more information, please call Mr. Felix at Procom-Plus, 718-329-3424, FAX 718-329-3423. Unbeatable prices, call for your price list or write to Procom Plus, 2936 Jerome Ave., Bronx, NY 10468. Attn: Mr. Felix.

ENGINEERING CONSULTING. Experienced engineering for your ideas. Product development from conceptual to manufacturing stages. Digital, analog, sensor, and RF expertise. Precision audio designs. Microcontroller designs for HCO5xx, HC11xx, PIC16C5x. Software design for IBM PC. ASIC design using XILINX. Enclosure and packaging design. In house schematic capture and PWB layout. Reasonable Rates. Contact Steve Hicks, Diastystems Electronics, 7508 E. Granada Rd, Scottsdale, AZ 85257. 602-970-3162.

CUSTOM COMPUTER & microprocessor software & hardware. Program in C, Basic, Forth, Fortran, etc. Design interfaces to telephones, lights, alarms, relays, motors, etc. 212-479-7805.

PINBALL MACHINES! New Catalog! Books, Magazines, Manuals, Diagrams, Supplies, Parts. Send \$2 for catalog Now to: Marco Specialties, Inc., 5290-N Platt Springs Rd., Lexington, SC 29073-9252. 803-957-5500. FAX 803-957-6974. E-Mail: tilt@ix.netcom.com.

HAM & Two-way radio repair, prompt service, competitive prices. Centurion communications, 892 N. Delsea Dr., Vineland, NJ 08360. 609-794-8000, FAX 609-794-8989.

REPAIR SOLUTIONS — more than 17,200 VALUABLE, TIME SAVING, MONEY MAKING REPAIRS for servicing TVs, VCRs, CAMCORDERS & other electronics, organized in an easy to use computer program — **The TIP REPAIR Program. PROFESSIONAL BOARD/COMPONENT LEVEL REPAIRS** with Part numbers, Component locations/values & test voltages (when available). **ADD** your own tips. **PRINT** tips. Owners of our **COMPUTERIZED TIP PROGRAM** say this is the **BEST** technical tip program on the market today. Works on ANY IBM compatible computer with a hard drive & 16 Megabytes free space. **NEW VERSION — works in DOS and WINDOWS.** Only \$200. **FREE Shipping** for prepaid orders (USA). **FREE Demo!** Have your own tips? Ask about our **TIP EXCHANGE** policy with **FREE Updates!** **CALL 1-800-215-5081/516-643-7740. HIGHER INTELLIGENCE SOFTWARE**, 60 Farmington Lane, Melville, NY 11747.

Don't forget, you can E-Mail your classified ads to N&V using your Visa or Mastercard!

Compuserve: 74262,3664

Internet: 74262,3664@compuserve.com

HAVE YOU lost your master file for a PAL, GAL, or microcontroller? We can help. We work with most Motorola, Intel, Microchip, and other microcontrollers. Please call us about all your PIC 16C54 and PIC 16C56 needs. If you have a secured chip, we can read out your program and send you out an unsecured chip and or file on disk. Pricing is quoted per project. We also make and sell custom readers. GAL 16V8, 20V8, 22V10, 6001, and 6002, turn around as fast as 48 hours. Call 703-764-5361 and leave a message with your needs, or write to: ACD, Inc., 5765-F, Burke Centre Parkway, Suite 317, Burke, VA 22015.

ICS DUPLICATED. We can duplicate your memory devices or micros for \$2 each. **11 years experience.** We do 16CXX, 17CXX, X68HCXX and other micro's. Call for others! Credit cards OK. **Software City**, Box 23016, Little Rock, AR 72221. FAX 501-223-9406.

ENGINEERING SOLUTIONS. If you are a small company that can't afford a full time engineering staff or need help with a product for a start-up venture, we can help. Our experienced staff provides fast solutions to your tricky engineering problems and product design requirements. Providing prototype development, analog, digital, software, embedded controller, instrumentation, sensor, PCB layout and design, packaging and mechanical design, reverse engineering, machine and process control, data acquisition, PLC, motion controls, optoelectronics. We also offer CNC machining, manufacturing and assembly services. We respond quickly to your needs, no project too large or small. Fax us your problem and we will contact you within 24 hours. Consolidated Technology, Piqua, OH. FAX 513-773-5562.

(E)EPROM PROGRAMMING done quickly and economically. One day turn around typical. Simple copy \$2.50 per device. Also prototyping, design, and consulting services available. Call or send SASE to: **Luzer Electronics, 4023 North Bayberry, Wichita, KS 67226. 316-687-4759, FAX 316-687-3103.**

SHARE REPAIR, E-Mail tech support for TV-VCR technicians. For information, E-Mail: rnett@dump.com.

ASSOCIATED TESTING Laboratories, a division of F.W. Bell, services the aerospace, government, and private industries. Atmospheric, environmental and dynamic conditions are simulated at the component and systems levels at 53 Second Ave., Burlington, MA. 617-272-9050.

PRODUCTS DEVELOPED from your concept or design. We provide: electro/mechanical/opto/pneumatic designs. PCB design, fabrication, packaging, tooling, assembly & test. Microcontrollers, custom controls, sensors, smart devices, process automation, scientific research. Call: **A SQUARED TECHNOLOGIES, 619-432-8285.**

REBUILD YOUR OKI Data 400/800, GCC, PLP11, BLP, Elite, BLP11, Imaging drum assembly only, \$99. Toner re-fill kit for above printers, only \$12. Send drum, check or money order to: APLC, 1316 North Cedar Lake Road, Roundlake, IL 60073. 708-740-0884.

HP 4815A Z-METERS: Info for repair or calibration. See the SANFORD ASSOCIATES ad appearing in #80 TEST EQUIPMENT column.

KITS BUILT 1 to 1000. Wirewrap, breadboard, thru-hole, SMT PCB assembly. Wiring, cables, harness, chassis, racks, panels. Custom test fixtures. Quick turnaround. Low rates, top quality, free quotes. Call: **A SQUARED TECHNOLOGIES, 619-432-8285.**

Events CALENDAR Continued from page 53

gan Ave, Ste 237, Dearborn MI 48124. 313-425-9276.

NM - ALBUQUERQUE — Duke City Hamfest. **SPONSOR:** National Guard Armory, 600 Wyoming Bl, NE. **FEATURES:** DP - EX. **DEALER INFO:** Tables \$10 prior to Aug 21. Set-up Aug 25 6pm. **CONTACT:** 505-821-2771.

TX - GAINESVILLE — Cooke County Hamfest. **SPONSOR:** Cooke County ARC. **LOCATION:** Civic Center. **HOURS:** 7am-5pm. **ADMISSION:** \$5 adv., \$6 door. **TALK-IN:** 147.34MHz 443.125MHz. **FEATURES:** AC - CB - DP - EX - FM - H. **DEALER INFO:** Tables: \$8 adv., \$10 door. Outside tallgate \$6. **CONTACT:** James Floyd, N52PU, 817-668-7511. Or: Cooke County Hamfest, POB 100, Gainesville TX 76241.

AUGUST 22-27

CO - WOODLAND PARK — 14th Annual MARC Campfest-Swapfest. **SPONSOR:** Mountain ARC. **LOCATION:** Quaker Ridge Camp. 6.5 mi N of Woodland Park city center on Hwy 67 North. **TALK-IN:** 146.82R. **FEATURES:** DP - F/R - T. **DEALER INFO:** \$10 per space daily. **CONTACT:** MARC, POB 1012, Woodland Park CO 80866. Fred NOPKA or Patty NOPSD, 719-687-9727, or Don AANOW, 719-687-3692.

AUGUST 27

IL - DANVILLE — 26th Annual Hamfest & Computer Show. **SPONSOR:** VCARA. **LOCATION:** UAW Civic Center, Tilton Rd. **ADMISSION:** \$3, 2 for \$5. **TALK-IN:** R-146.22/82. **FEATURES:** AC - C - DP - EX - F/R - H - RV-S. **DEALER INFO:** Indoor tables \$2. **CONTACT:** Chris, KA9VMN, 217-431-0110 or VCARA, Box 80, Catlin IL 61817.

IL - OAK BROOK TERRACE — Summer Hamfest. **SPONSOR:** Chicago ARC. **LOCATION:** Entrance @ Park View Dr. N of Cermack Rd. **HOURS:** 8am-3pm. **ADMISSION:** Adv \$4, door \$5, under 12 free. **TALK-IN:** 147.255 +, 444.825 +. **FEATURES:** H - T. **DEALER INFO:** 8' tables: \$12, set-up @ 6am. **CONTACT:** CARC, 5631 W Irvingpark Rd, Chicago IL 60634. George 312-545-3622, 312-545-4740.

IL - WOODSTOCK — Hamfest & Computer Show. **SPONSOR:** Tri-County Radio Group. **LOCATION:** McHenry County Fairgrounds, N of Rte 14 on Rte 47. **HOURS:** 6:30am-7. **TALK-IN:** 146.52. **FEATURES:** FM - H. **CONTACT:** TCRG, POB 3107, Skokie IL 60077-6107, Robert N9KXG, 708-658-1678.

MI - CORUNNA — Five County Swap 'N Shop. **LOCATION:** Shawassee County Fairgrounds, 2900 E Hibbard Rd. **HOURS:** 8am-7. **ADMISSION:** \$4. **TALK-IN:** 147.020 + 146.520 Simplex. **FEATURES:** DP - F/R - H - T. **DEALER INFO:** 8' tables, \$10 adv, \$15 door, Trunk sales \$7. **CONTACT:** Jan, 517-893-3475 or Five County Swap 'N Shop, 1214 McKinley Ave, Bay City MI 48708.

MI - FOWLERVILLE — Livingston County HamFair. **SPONSOR:** Livingston ARK. **LOCATION:** Fowlerville Fair Grounds. **HOURS:** 8am-3pm. **ADMISSION:** \$4. **TALK-IN:** 146.68. **FEATURES:** C - DP - E - H. **DEALER INFO:** Tables, \$8 ea & paid admission; covered trunk sales \$5 per space & paid admission. Set-up 6am. **CONTACT:** LARK, PO Box 283, Howell MI 48843. John, 517-548-1412.

MI - LANSING — Computer Trade Show. **LOCATION:** Holiday Inn South Convention Center, 6820 S Cedar St, Exit #104 off of I-96. **HOURS:** 10am-4pm. **ADMISSION:** Adults \$4; Seniors & students w/ID \$3; under 12 free w/adult. **FEATURES:** C - DP. **CONTACT:** Computers & You, 313-283-1754.

SEPTEMBER 2

IN - INDIANAPOLIS — Hoosier Hamfest & Computer Show. **SPONSOR:** Electronic Applications Radio Service. **LOCATION:** National Guard Armory, Holt Rd, & Minnesota off I-70. **HOURS:** 8am-7. **ADMISSION:** \$6. **TALK-IN:** 145.250. **FEATURES:** C - CB - E - F - FM - F/R - H. **DEALER INFO:** \$15 per space - tables limited, set-up 6am-8am. **CONTACT:** Marty Hensley KA9PCT, 317-253-7985 evs.

OH - TOLEDO — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** SeaGate Convention Center. **HOURS:** 10am-4pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

SEPTEMBER 3

IN - FT. WAYNE — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Allen County Fairgrounds. **HOURS:** 10am-4pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

SEPTEMBER 8-9-10

TX - ARLINGTON — 1995 ARRL Digital & Communications Conference. **SPONSOR:** Tucson Amateur Packet Radio & Texas Packet Radio Society. **LOCATION:** La Quinta Inn and Conference Center, 825 N. Watson Rd. **FEATURES:** F - H. **CONTACT:** Tucson Amateur Packet Radio, 8987-309 E Tanque Verde Rd, #337, Tucson AZ 85749-9399. 817-383-0000, FAX 817-566-2544.

SEPTEMBER 9

IL - ROLLING MEADOWS — W9DXCC Convention. **CONTACT:** William McConnel N9US, 2511 Arlingdale Dr, Palatine IL 60067. 708-397-9593.

IL - WHEATON — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Dupage County Fairgrounds. **HOURS:** 10am-4pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

IN - FT. WAYNE — Summit City Computer Show & Hamfest. **SPONSOR:** Fort Wayne ARC. **LOCATION:** Allen County 4-H Fairgrounds, 4 mi North of I-69 on State Road 3. **HOURS:** 8am-2pm. **ADMISSION:** \$4 adv, \$5 door. **TALK-IN:** 146.16/146.76. **FEATURES:** C - F/R - H - RV-S. **DEALER INFO:** \$12 Inside 8' table (2 bldgs), \$9 pavilion 8' table, \$5 tallgate. **CONTACT:** Clifford Shreve N9MKB, 219-483-7570, 3412 Parnell Ave, Ft. Wayne IN 46805.

IN - INDIANAPOLIS — Indianapolis Computer Fair. **LOCATION:** Quality Inn East. **HOURS:** 10am-3pm. **ADMISSION:** \$4, under 12 free. **FEATURES:** C - DP. **CONTACT:** Ben Yanto, AGI Computer Fairs.*

IN - LAPORTE — Hamfest. **SPONSOR:** Laporte ARC. **LOCATION:** Laporte County Fairgrounds. **HOURS:** 8am-2pm. **TALK-IN:** 146.61 - (131.8 PL) 146.52 Simplex. **FEATURES:** C - E - FM - H. **CONTACT:** LARC, POB 30, Laporte IN 46352.

MI - TAYLOR — Computer Trade Show. **LOCATION:** Democratic Club of Taylor, 23400 Wick Rd, 4 blocks E of Telegraph. **HOURS:** 10am-3pm. **ADMISSION:** Adults \$4; Seniors & students w/ID \$3; under 12 free w/adult. **FEATURES:** C - DP. **CONTACT:** Computers & You, 313-283-1754.

OH - DAYTON — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Montgomery County Fairgrounds. **HOURS:** 10am-4pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

SEPTEMBER 10

IA - DUBUQUE — Hamfest/Radiofest/Computer Expo. **SPONSOR:** Great River ARC. Iowa Antique RC & Historical Society. **LOCATION:** Tri-State Blind Society, 3333 Asbury Rd. **HOURS:** 8am-3pm. **ADMISSION:** Adv \$3, Door \$4. **TALK-IN:** 147.84/24. **FEATURES:** C - CB - DP - E - EX - FM - F/R - H - T. **DEALER INFO:** 8' Tables \$8. Outside tallgating free with paid admission. **CONTACT:** Loren Heber N0YH2, 319-556-5755, 9479 Laudeville Rd, Dubuque IA 52003, Jerry Ehlers, NONLU, 319-583-1016, 3115 Brunswick St, Dubuque IA 52001.

IL - HARRISBURG — Hamfest. **SPONSOR:** Shawnee ARC. **LOCATION:** Southeastern Illinois College Rte 13, 5 mi E of Harrisburg. **HOURS:** 8am-2:30pm. **ADMISSION:** \$4. **TALK-IN:** 146.880MHz, 392.65KHz. **FEATURES:** EX - F/R - H. **DEALER INFO:** Tables \$5, set-up 7am. **CONTACT:** Bob Bybee KF9YV, 2416 W North St, Harrisburg IL 62946, 618-252-7139. Ray Milhorn W9MXM, 512 S 27th St, Herrin IL 62948, 618-642-3375.

IL - JOLIET — Hamfest '95. **SPONSOR:** Bollingbrook ARS. **LOCATION:** Inwood Recreation Center, 3000 W Jefferson St. (Rte 52). **HOURS:** 8am-7. **ADMISSION:** \$4 adv, \$5 door. **TALK-IN:** 147.33 + 600KHz; 224.54 - 1.6MHz 146.82 - 600KHz. **FEATURES:** AC - C - CB - DP - E - EX - FM - H - RV-S. **DEALER INFO:** Dealer perimeter tables (electricity available) \$12. Main floor flea market tables (no electricity) \$8. Indoor Set-up: Sat 3-6pm, Sun 6am. Table reservations, write to: BARS Hamfest Chairman, Ed Weinstein WD9AYR, 7511 Walnut Ave, Woodridge IL 60517, or call 708-759-7005. **CONTACT:** General Information: Call the BARS Hotline at 708-759-7005 between 6am-9pm. Bollingbrook Amateur Radio Society, POB 1009, Bollingbrook IL 60440.

IL - PALATINE — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Harper College. **HOURS:** 10am-4pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

MI - FLINT — Computer Trade Show. **LOCATION:** Holiday Inn, 5353 Gateway Centre, Exit at Hill Rd from US-23 or I-475. **HOURS:** 10am-4pm. **ADMISSION:** Adults \$4; Seniors & students w/ID \$3; under 12 free w/adult. **FEATURES:** C - DP. **CONTACT:** Computers & You, 313-283-1754.

MO - MONETT — Hamfest & Picnic. **SPONSOR:** Ozarks ARS. **LOCATION:** Monett City Park, Hwy 60 & 37. **HOURS:** 8am-7. **ADMISSION:** Free. **TALK-IN:** 146.97. **FEATURES:** DP - H - T. **DEALER INFO:** Tallgating: Free.

OH - COLUMBUS — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Ohio Expositions Center (State Fairgrounds). **HOURS:** 10am-4pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

SEPTEMBER 15-16-17

IL - PEORIA — Superfest '95/Illinois State Convention. **SPONSOR:** Peoria Area Arc. **LOCATION:**

Exposition Gardens Fairgrounds, Northmoor and University. **HOURS:** 8am-7. **ADMISSION:** \$5, good both days, under 12 free. **TALK-IN:** 146.16/146.760. **FEATURES:** CB - EX - F - FM - RV-H. **DEALER INFO:** Inside tables \$10, flea market \$10, set-up Fri 2pm-9pm, Sat 6:30am, Sun 7:30am. **CONTACT:** Superfest, POB 3508, Peoria IL 61612-3508. 309-694-5009.

SEPTEMBER 16

MI - HUDSONVILLE — Super Swap '95. **SPONSOR:** Grand Rapids Area. **LOCATION:** Unity Christian High School, 3487 Oak St. **HOURS:** 8am-7. **ADMISSION:** Adv \$3, Door \$4. **DEALER INFO:** Tables, \$5. Set-up 6am. **CONTACT:** Jeff Belknap N8RWS, 454 Harp St SE, Kentwood MI 49548. 616-531-7899.

NM - SANTA FE — Hamfest. **SPONSOR:** Northern New Mexico ARC. **LOCATION:** Gloria Conference Center, Patio Bldg, 16 mi SE of Santa Fe on I-25, Exit 299. **HOURS:** 8:30am-3pm. **ADMISSION:** \$5. **TALK-IN:** 146.52 Simplex. **FEATURES:** DP - EX - F - FP - RV-H. **DEALER INFO:** Indoor tables \$10, Set-up 7am. **CONTACT:** Helenrose Burke WSIXS, Box 73 HCR, Ojo Sarco NM 87521. 505-689-2367.

OH - CLEVELAND — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Cuyahoga County Fairgrounds. **ADMISSION:** \$6. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

SEPTEMBER 17

IL - GLEN ELLYN — Computer Central. **LOCATION:** College of DuPage, Park Blvd & College Rd. **HOURS:** 9:30am-3pm. **ADMISSION:** Adults \$6, 8-12 \$2, under 8 free. \$1 off reg. adult admission w/this ad. **FEATURES:** AC - C - FP. **CONTACT:** Computer Central, Jay B. Robinson, 708-940-7547.

IN - SOUTH BEND — Camera & Computer Swap Meet. **LOCATION:** Century Center. **HOURS:** 10am-3pm. **ADMISSION:** \$5, under 12 free. **DEALER INFO:** 8' tables - \$50 ea. **CONTACT:** Roger L. Smith, 8863 E. Black Point Rd., Syracuse IN 46567. 219-856-3863 VM/FAX.

MI - FLINT — Five Star Computer Shows. **SPONSOR:** Five Star Productions. **LOCATION:** Flint Holiday Inn, Gateway Centre, US-23 at Hill Rd Exit 2 miles S of I-69. **HOURS:** 10am-4pm. **ADMISSION:** \$4. **FEATURES:** C - DP - FP. **CONTACT:** Five Star Productions. 810-239-3640.

MI - MADISON HEIGHTS — Computer Trade Show. **LOCATION:** UfB CW Hall, 876 Horace Brown Dr, I block E of I-75, I block S of 13 Mile Road. **HOURS:** 10am-4pm. **ADMISSION:** Adults \$4; Seniors & students w/ID \$3; under 12 free w/adult. **FEATURES:** C - DP. **CONTACT:** Computers & You, 313-283-1754.

MI - MT. CLEMENS — 23rd Annual Swap 'N Shop. **SPONSOR:** L'Anse Creuse ARC. **LOCATION:** L'Anse Creuse High School. **HOURS:** 8am-2pm. **ADMISSION:** \$5. **TALK-IN:** 147.08 +, 146.52MHz simplex. **FEATURES:** EX - F/R - T. **DEALER INFO:** Tables: \$12, trunk sale area \$5, set-up 6am. **CONTACT:** Mark Castiglione N8REZ, 26279 Fairwood, Chesterfield, MI 48051-3031, 810-949-2508. Vx Exams: Don Olszewski WA8IZV, 810-294-1567.

OH - AKRON — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Summit County Fairgrounds. **HOURS:** 10am-4pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

OH - CINCINNATI — ARRL Hamfest. **SPONSOR:** Greater Cincinnati ARA. **CONTACT:** John Haungs WA8STX, 10615 Thornview Dr, Cincinnati OH 45241. 513-563-2822.

SEPTEMBER 22

OH - CLEVELAND — Computera USA. **SPONSOR:** OMM Productions. **LOCATION:** Bronk Park Armory, 6225 Engle Rd. **ADMISSION:** \$5. **DEALER INFO:** Tables: \$40. **CONTACT:** Computera USA, POB 173, Bryn Mawr PA 19010-0173; 610-527-5903. E-Mail: 72172.3545@compuserve.com.

SEPTEMBER 23

OH - CINCINNATI — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Cincinnati Gardens. **HOURS:** 10am-4pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

SEPTEMBER 23-24

IL - GRAYSLAKE — Radio Expo '95. **SPONSOR:** Chicago FM Club. **LOCATION:** Lake County Fairgrounds. **HOURS:** 8am-4pm. **ADMISSION:** Adv \$5, Door \$6, good both days, under 12 free. **TALK-IN:** 146.16/76MHz (PL 107.2 Hz). **FEATURES:** C - EX - F - FM - FP - F/R - H. **CONTACT:** Radio Expo, 312-262-6773. Chicago FM Club, POB 1532, Evanston IL 60204.

SEPTEMBER 24

IL - ORLAND PARK — The Orland Park Computer

Show. **LOCATION:** Orland Park Civic Center, 147th St & LaGrange Rd (Rte 45). **HOURS:** 9:30am-3pm. **ADMISSION:** Adults \$5 - \$1 off with copy of this ad, 8-12 yrs \$2, under 8 free. **FEATURES:** A - C - CB - DP - FP - F/R - All indoors. **CONTACT:** 24-hour Hotline 708-974-3123.

IN - CRAWFORDSVILLE — Indianapolis Computer Fair. **LOCATION:** Holiday Inn. **HOURS:** 10am-3pm. **ADMISSION:** \$4, under 12 free. **FEATURES:** C - DP. **CONTACT:** Ben Yanto, AGI Computer Fairs.*

MI - SOUTHGATE — Computer Trade Show. **LOCATION:** Southgate Civic Center, 14700 Dix-Toledo Rd, between Northline & Eureka. **HOURS:** 10am-3pm. **ADMISSION:** Adults \$4; Seniors & students w/ID \$3; under 12 free w/adult. **FEATURES:** C - DP. **CONTACT:** Computers & You, 313-283-1754.

MO - COTTEVILLE — Swapfest. **SPONSOR:** St. Peters ARC. **LOCATION:** St. Charles County Community College Campus, 4601 Mid Rivers Mall Dr, take I-70 or MO Rte 94. **HOURS:** 7am-1pm. **ADMISSION:** \$2. **TALK-IN:** 145.41MHz & 442.275MHz. **TALK-IN:** EX - FM - F/R - H. **DEALER INFO:** Flea Market Space \$3. **CONTACT:** Jay Underdown WOOGS, 58 Judy Dr, St. Charles MO 63301.

OH - CLEVELAND — ARRL Hamfest. **SPONSOR:** Hamfest Assn of Cleveland. **CONTACT:** Glenn Williams AF8C, 513 Kenilworth Rd, Bay Village OH 44140-2476. 216-835-4897.

SEPTEMBER 30

IN - PERU — North Central Indiana Hamfest. **SPONSOR:** Miami County & Cass County ARCs. **LOCATION:** Miami County Fairgrounds, on County Rd 200 North (CRZOOM). **HOURS:** 8am-7. **ADMISSION:** \$5, ARRL Member \$4, under 12 free. **TALK-IN:** 147.345 K9ZEZ, 147.180 W9VMW. **FEATURES:** DP - H - T. **DEALER INFO:** 8' Indoor Table; \$5. Tallgate Space: Free w/admission. **CONTACT:** North Central Indiana Hamfest, % CCARC, POB 1092, Logansport, IN 46947.

MI - LIVONIA — Computer Trade Show. **LOCATION:** Livonia Elks Lodge Hall, 31117 Plymouth Rd, I block E of Merriman. **HOURS:** 10am-3pm. **ADMISSION:** Adults \$4; Seniors & students w/ID \$3; under 12 free w/adult. **FEATURES:** C - DP. **CONTACT:** Computers & You, 313-283-1754.

MI - WESTLAND — Great Lakes Computer Expo & Sale. **SPONSOR:** Progressive Computer Productions. **LOCATION:** Wayne-Ford Civic League, 1645 Wayne Rd, I blk S of Ford Rd. **HOURS:** 10am-4pm. **ADMISSION:** Adults \$4, Seniors/Students \$3, under 12 free w/adult. **FEATURES:** C - DP - F/R - S. **DEALER INFO:** Covered 8' table \$35 ea. **CONTACT:** Progressive Computer Productions, 23814 Michigan Ave, Ste 237, Dearborn MI 48124. 313-425-9276.

OCTOBER 1

OH - ASHLAND — North Central Ohio Hamfest. **SPONSOR:** Ashland Area ARC. **LOCATION:** Ashland County Fairgrounds. **HOURS:** 8am-3pm. **ADMISSION:** Adv. \$3, Door \$4. **TALK-IN:** 147.105 +. **DEALER INFO:** Indoor tables: \$7, Flea Market Space \$3. **CONTACT:** Wally Green W3YXS, 3 East Liberty St., Ashland OH 44805.

OCTOBER 7

IN - INDIANAPOLIS — Indianapolis Computer Fair. **LOCATION:** Quality Inn East. **HOURS:** 10am-3pm. **ADMISSION:** \$4, under 12 free. **FEATURES:** C - DP. **CONTACT:** Ben Yanto, AGI Computer Fairs.*

ND - GRAND FORKS — Hamfest/Computer Fair. **SPONSOR:** FORX ARC. **LOCATION:** University Lutheran Church, 2122 University Ave. **HOURS:** 7am-2pm. **ADMISSION:** \$5. **TALK-IN:** 146.34/94. **WAOJX.** **FEATURES:** B - C - DP - EX - F - H. **DEALER INFO:** Flea Market Tables: Adv. \$1, Door \$5. **CONTACT:** Jeff Sorell N0PPW: 701-594-5013.

TX - BELTON — Ham Expo '95. **SPONSOR:** Temple ARC. **LOCATION:** Bell County Expo Center. **HOURS:** 7am-7. **ADMISSION:** Free. **TALK-IN:** 146.82. **FEATURES:** AC - EX - H - T. **DEALER INFO:** Display Hall tables: \$10, Indoor tallgate area: \$10. **CONTACT:** Temple ARC, 2014 S 53rd, Temple, TX 76504. Mike WA5EQQ: 817-773-3590.

OCTOBER 7-8

TX - EL PASO — 8th Annual International Hamfest. **SPONSOR:** Various Area ARCs. **LOCATION:** National Guard Armory. **HOURS:** Sat: 8am-5pm, Sun: 8am-2pm. **ADMISSION:** Adv: \$5, Door: \$6. **CONTACT:** Interntl Hamfest, POB 10496, El Paso TX 79995. Clay Emerit K5TRW: 915-859-5502.

OCTOBER 8

OH - SPRINGFIELD — Hamfest & Computer Show. **SPONSOR:** Springfield Independent Radio Assn. **LOCATION:** Clark County Fairgrounds. **HOURS:** 8am-3pm. **ADMISSION:** Adv. \$4, Door \$5, under 12 free. **TALK-IN:** 145.45. **FEATURES:** C - FP - F/R - H. **DEALER INFO:** Tables: Adv. \$10, door \$12. Set-up Sat. 6pm. **CONTACT:** Sales: 513-323-6680 days, General: 513-964-8618. SIRA, POB 523, Springfield OH 45501.

Events CALENDAR

EASTERN REGION

AUGUST 5

MA - MARLBOROUGH — Computer Show. **LOCATION:** Royal Plaza Trade Center, near Boston, Mass. Tpke to I-495, 4 mi, use Exit #24-B, 1/2 mi. on right. **HOURS:** 9:30am-3pm. **FEATURES:** C. **DEALER INFO:** 500 + tables. **CONTACT:** KGP Computer Show.*

MD - WEST FRIENDSHIP — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Howard County Fairgrounds. **HOURS:** 10am-4pm. **ADMISSION:** \$6. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

NC - HIGH POINT — Lomer L. McMahan Memorial Hamfest. **SPONSOR:** High Point ARC. **LOCATION:** National Guard Armory, off Hwy 29-70, Business I-85. **HOURS:** 8am-3pm. **ADMISSION:** \$4 adv., \$5 door. **TALK-IN:** 147.765/165MHz. **FEATURES:** CB - EX - FM - H. **DEALER INFO:** Tables \$12. Inside flea market table \$8 + \$4 admission. Outside flea market \$2 space + admission/tables \$6. Set-up 6am. **CONTACT:** HPARC Hamfest, POB 1163, Jamestown NC 27282-1163. 910-887-3039.

NJ - RIVERDALE — Hamfest. **SPONSOR:** Split Rock & West Morris ARC's. **LOCATION:** National Guard Armory, Newark Pompton Turnpike (Rte 23). **ADMISSION:** \$5. **TALK-IN:** 146.985/385, 223.86/222.26. **FEATURES:** EX. **CONTACT:** Bernie Brownstein WB2YOK, POB 251, Flanders NJ 07836. 201-584-5399 or Steve KF2TI, on line KF2TI@AOL.COM.

NJ - SOMERSET — MarketPro Computer Show & Sale. **LOCATION:** Garden State Exhibit Center. **HOURS:** 9:30am-4pm. **ADMISSION:** \$6, under 12 free w/adult. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

NY - CLAYTON — Hamfest. **SPONSOR:** Jefferson County RAC. **LOCATION:** Clayton Recreation Park Arena. **HOURS:** 7am-5pm. **ADMISSION:** \$3. **TALK-IN:** 146.70/10. **FEATURES:** CB - EX - FM - F/R - T. **DEALER INFO:** Flea Market: 10' x 10' booth w/table \$5. **CONTACT:** Jefferson County RAC, POB 523, Brownville NY 13615. Janet Long N2ZMS, 315-788-8543.

WV - MINERALWELLS — Hamfest '95. **SPONSOR:** Mid-Ohio Valley ARC. **LOCATION:** Wood County 4-H Grounds, Near Parkersburg WV. **ADMISSION:** \$4. **TALK-IN:** 146.745. **FEATURES:** C - CB - DP - E - F - F/R - H - T. **DEALER INFO:** Inside tables \$5. Outside table \$4, Tallgating free. **CONTACT:** Bill McClure, C/O MOVARC, POB 791, Parkersburg WV 26102. 304-485-7777.

AUGUST 5-6

FL - JACKSONVILLE — 22nd Annual Amateur Radio & Computer Show. **SPONSOR:** Greater Jacksonville Hamfest Assn. **LOCATION:** Prime F. Osborn Convention Center. **HOURS:** Sat: 9am-5pm; Sun: 9am-3pm. **ADMISSION:** \$8. **FEATURES:** AC - CB - DP - EX - F - FP. **DEALER INFO:** Swap tables \$20 both days + admission. Contact: Karl Hassler N4DGH, 904-268-2302, 2767 Scott Cir., Jacksonville FL 32223. **CONTACT:** Greater Jacksonville Hamfest Assn, POB 27033, Jacksonville FL 32205.

PA - WHITEHALL — PC Dealer Showcase. **LOCATION:** Lehigh Valley Mall, Rte 22 & 145. **HOURS:** Sat: 10am-9:30pm; Sun: 11am-6pm. **ADMISSION:** Free. **FEATURES:** AC - C - FP. **DEALER INFO:** Tables \$95 table/day. **CONTACT:** Starware 610-584-8770.

AUGUST 6

MA - WELLESLEY — Ham Flea Market. **SPONSOR:** Wellesley ARS. **LOCATION:** Peppico Pavilion, Babson College. **HOURS:** 9am-2pm. **ADMISSION:** In-door: \$2, Tallgate area: free. **TALK-IN:** 147.03/63 repeater. **TALK-IN:** AC - EX - FM - H - T. **DEALER INFO:** Indoor tables \$10 adv., \$14 door. Tallgate area: adv., \$7, door \$10. **CONTACT:** Barbara Holdridge N1ICQ, 107 Church St, Westwood MA 02090, 617-329-2628. Gerry Driscoll NV1T, 617-444-2686.

MD - BALTIMORE — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Martins Eastwind. **HOURS:** 10am-4pm. **ADMISSION:** \$6. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

ME - PORTLAND — Computer Shows & Sales. **SPONSOR:** Northern Computer Shows. **LOCATION:** Verrillo's Conv. Ctr at Howard Johnson Motor Lodge, I-95 (Maine Turnpike) Exit 8. **HOURS:** 10am-3:30pm. **ADMISSION:** \$7, under 14 free w/adult. **FEATURES:** C. **DEALER INFO:** Set-up 8am. **CONTACT:** Northern Computer Shows.*

NJ - PARSIPPANY — MarketPro Computer Show & Sale. **LOCATION:** Parsippany Hilton. **HOURS:** 9:30am-4pm. **ADMISSION:** \$6, under 12 free w/adult. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

PA - NEW KENSINGTON — Hamfest. **SPONSOR:** Skyview Radio Society. **LOCATION:** Washington Township Volunteer Fire Dept, Rte 66 near Intersection of Rte 380. **HOURS:** 8am-3pm. **ADMISSION:** \$3 or 2/55. **TALK-IN:** 146.64-444.900 + . **FEATURES:** DP - FM - F/R - H. **DEALER INFO:** Indoor tables \$8, each addl table \$5, flea market space \$2. **CONTACT:** Bob Reihms N3NOS, 412-727-2194.

PA - WARRINGTON — Hamfest '95. **SPONSOR:** Mid Atlantic ARC. **LOCATION:** Bucks County Drive-In theater, Rte 611. **HOURS:** 8am-7. **ADMISSION:** \$5. **TALK-IN:** 147.06/R 145.35/R. **FEATURES:** F/R - H. **DEALER INFO:** Selling spaces \$5. **CONTACT:** Hamfest Info, Box 352, Villanova PA 19085. Bob WA3PZO, 215-624-4034, eves.

VA - BERRYVILLE — 45th Annual Winchester Hamfest & Computer Show. **SPONSOR:** Shenandoah Valley ARC. **LOCATION:** Clarke County Ruritan Fairgrounds. **HOURS:** 6am-7. **ADMISSION:** \$5, under 16 free. **TALK-IN:** 146.22-82 & 52 Simplex. **FEATURES:** C - CB - DP - E - EX - FM - F/R - H - T. **DEALER INFO:** Commercial & Indoor tables call Irv Barb, 703-955-1745, Tallgate Space \$7 + admission. **CONTACT:** Irv Barb, KD4BHV, Rte 3, Box 5385, Berryville VA 22611.

AUGUST 7-8-9-10-11

VA - MCLEAN — 7th Annual Surveillance Expo '95. **LOCATION:** McLean Hilton. **DEALER INFO:** Michael Sheehan, Ross Engineering, Inc., 127 E. Third St, Brooklyn NY 11218. 718-437-0160, FAX 718-437-0161. **CONTACT:** Marilyn Roseberry, American Technology Assn, POB 20254, Washington DC 20041. 202-331-1125. FAX: 703-318-8223.

AUGUST 11-12-13

VT - CHARLOTTE — ARRL Hamfest. **SPONSOR:** Burlington ARC. **CONTACT:** Ralph Stetson KD1R, RR 1, Box 185, Westford, VT 05494. 802-878-6454.

AUGUST 12

NJ - HACKENSACK — Computer Show. **LOCATION:** Fairleigh Dickinson University, Rothman Athletic Center, Rte 4 to Hackensack Ave. South, left at first light (Temple Ave.), near NYC. **HOURS:** 9:30am-3pm. **FEATURES:** C. **DEALER INFO:** 500 tables. **CONTACT:** KGP Computer Show.*

NY - DRYDEN — Finger Lakes Hamfest. **SPONSOR:** Tompkins County ARC. **LOCATION:** Dryden High School, near the intersection of Rte 13 & Rte 38. **ADMISSION:** \$4 adv, \$5 door, under 18 free. **TALK-IN:** 146.97 (-600). **FEATURES:** C - CB - E - EX - FM - F/R - H - RV-S. **DEALER INFO:** Indoor flea market 6' space w/table \$6. Outdoor flea market 8' space only \$2. **CONTACT:** Richard Spingarn, 607-387-5251 or, TCARC, 6067 Sirrine Rd., Trumansburg NY 14886.

NY - ITHACA — ARRL Hamfest. **SPONSOR:** Tompkins County ARC. **CONTACT:** Richard Spingarn, N2IYS, 6067 Sirrine Rd, Trumansburg, NY 14886. 607-387-5251.

VA - ANNANDALE — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Northern Virginia Community College. **HOURS:** 10am-4pm. **ADMISSION:** \$6. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

WV - ONA — TARA Hamfest & Computer Show. **SPONSOR:** Tri-State ARA. **LOCATION:** Cabell-Midland High School US Rt 60. **HOURS:** 9am-2pm. **ADMISSION:** \$5. **TALK-IN:** 146.76-146.64. 146.52s 444.85 + . **FEATURES:** AC - C - CB - DP - EX - F - FM - FP - F/R - H. **CONTACT:** Mike Taylor, KB8GCA, 304-429-1667, or TARA, POB 4120, Huntington WV 25729.

AUGUST 12-13

DE - NEWARK — PC Dealer Showcase. **LOCATION:** Christiana Mall, I-95 to Exit 4A. **HOURS:** Sat: 10am-9:30pm; Sun: 11am-6pm. **ADMISSION:** Free. **FEATURES:** AC - C - FP. **DEALER INFO:** Tables \$95 table/day. **CONTACT:** Starware 610-584-8770.

PA - MONROEVILLE — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Pittsburgh Expo Mart. **HOURS:** 10am-4pm. **ADMISSION:** \$6. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Show.*

AUGUST 13

FL - SAINT PETERSBURG — Computer Fair. **SPONSOR:** "We're Show Offs!" **LOCATION:** Best Western Mirage Hotel, 5005 34th St. N. (US 19 N). **HOURS:** 10am-3pm. **ADMISSION:** Adults \$4, \$3 w/ad, under 12 free. **FEATURES:** AC - C - DP - FP. **DEALER INFO:** Adv tables \$30/1, \$55/2. \$20/ea additional table. **CONTACT:** "We're Show Offs!" 813-545-5265.

KY - FT. MITCHELL — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Drawbridge Estate. **HOURS:** 10am-4pm. **ADMISSION:** \$6. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

KY - LOUISVILLE — Computer Fair South. **SPONSOR:** MEKA Enterprises, Inc. **LOCATION:** Executive West Hotel, I-65 & 264 Freedom Way at the Fairgrounds. **HOURS:** 10am-3pm. **ADMISSION:** \$4. **CONTACT:** William Ibarra, Meka Enterprises, 2656 E. 2nd St, Bloomington IN 47401. 812-333-4484, FAX: 812-333-4650.

MD - HAGERSTOWN — Computer Trade Show. **SPONSOR:** Peter Trapp Shows. **LOCATION:** Ramada Inn & Conference Center. **HOURS:** 10am-3pm. **ADMISSION:** \$6, \$1 off w/coupon or this ad, under 12 free. **FEATURES:** C - FP - F/R. **CONTACT:** Peter Trapp Shows, 607-369-2796.

MD - UPPER MARLBORO — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** The Showplace Arena. **HOURS:** 10am-4pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

MD - WESTMINSTER — Carroll County Computer & Hamfest. **SPONSOR:** Summit ARA. **LOCATION:** Carroll County Agricultural Center at the end of Smith Ave. **HOURS:** Tallgating @ 6am. **ADMISSION:** \$5. **TALK-IN:** 224.68, 224.64, 146.52. **FEATURES:** T. **DEALER INFO:** Inside tables, \$10; tallgating \$5 per space. **CONTACT:** Alan Parker KS3L, 410-859-1475, OR SARA Hamfest, 607 Brentwood Rd., Linthoum, MD 21090.

NC - CHARLOTTE — Hamfest & Computer Fair. **SPONSOR:** Charlotte ARC. **LOCATION:** Roll-A-Round Skate Center, 8830 E. Harris Bl. **HOURS:** 8am-4pm. **ADMISSION:** \$4 adv., \$5 door. **TALK-IN:** 147.06. **FEATURES:** C - DP - FM - F/R - H - T. **DEALER INFO:** 8' tables. Adv. \$8, Door \$10, Chairs \$1, Tallgaters \$2 per space & admission - 1st come. **CONTACT:** Buck Scott, 704-522-4971 x3330. Or Charlotte ARC, POB 33582, Charlotte, NC 28233-3582.

NH - MANCHESTER — Computer Shows & Sales. **SPONSOR:** Northern Computer Shows. **LOCATION:** Center of NH, Expo Complex at Holiday Inn, I-293 Exit 5 or 6. **HOURS:** 10am-3:30pm. **ADMISSION:** \$7, under 14 free w/adult. **FEATURES:** C. **DEALER INFO:** Set-up 8am. **CONTACT:** Northern Computer Shows.*

PA - EASTON — Hamfest. **SPONSOR:** Delaware Lehigh ARC. **LOCATION:** Career Institute of Technology. **HOURS:** 8am-7. **ADMISSION:** \$4, unlicensed spouse & under 12 free. **TALK-IN:** 146.70. **FEATURES:** C - DP - E - EX - F - F/R - H - T. **DEALER INFO:** Indoor tables \$25 (includes one admission), tallgaters \$7 (includes one admission). **CONTACT:** Chuck Drake, KD3SQ, 610-866-4714 or DLARC, 610-820-9110.

AUGUST 18-19-20

AL - HUNTSVILLE — Hamfest & Amateur Radio Group National Convention. **LOCATION:** Von Braun Civic Center. **HOURS:** 9am-7. **ADMISSION:** \$5 for both days, children free. **TALK-IN:** 146.94 (-600)MHz, onsite 145.38 (-600)MHz. **TALK-IN:** B - CB - DP - F - FM - H. **CONTACT:** Huntsville Hamfest, POB 12534, Huntsville AL 35815. 205-534-7175.

AUGUST 19

FL - FORT LAUDERDALE — Narisaam Computer Show. **SPONSOR:** Narisaam, Inc. **LOCATION:** Holiday Inn West, 5100 N State Rd. 7. **HOURS:** 9:30am-3:30pm. **ADMISSION:** \$5, \$4 w/ad, under 12 free. **FEATURES:** AC - C - FP. **CONTACT:** Narisaam.*

MA - WEST SPRINGFIELD — MarketPro Computer Show & Sale. **LOCATION:** Eastern States Exposition. **HOURS:** 9:30am-4pm. **ADMISSION:** \$6, under 12 free w/adult. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

PA - FORT WASHINGTON — Computer Show. **LOCATION:** Ft. Washington Expo Center, PA Turnpike Exit #26, 1/2 mile to light, turn right and follow signs to Center. **HOURS:** 9:30am-3:00pm. **FEATURES:** C. **DEALER INFO:** 500 + tables. **CONTACT:** KGP Computer Show.*

VA - RICHMOND — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** The Showplace. **HOURS:** 10am-4pm. **ADMISSION:** \$6. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

AUGUST 19-20

GA - MARIETTA — Charlotte Area Computer Show. **LOCATION:** Cobb County Civic Center, 548 S. Marietta Parkway, Exit 112 at I-75 (Hwy. 120 West). **HOURS:** Sat: 9am-5pm, Sun: 10am-4pm. **ADMISSION:** \$5 both days, \$4 Sun. only. **FEATURES:** AC - C - DP - FP. **DEALER INFO:** 8-ft tables \$40. **CONTACT:** Computer Show, POB 295, Riverdale GA 30274. 800-746-9001.

NJ - DEPTFORD — PC Dealer Showcase. **LOCATION:** Deptford Mall. **HOURS:** Sat: 10am-9:30pm, Sun: 12am-5pm. **ADMISSION:** Free. **FEATURES:** AC - C - FP. **DEALER INFO:** Tables \$95 table/day. **CONTACT:** Starware 610-584-8770.

PA - KING OF PRUSSIA — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Valley Forge Conv. Center. **ADMISSION:** \$6.50. **FEATURES:** C -

FP. **CONTACT:** MarketPro Computer Shows.*

AUGUST 20

CT - WATERBURY — MarketPro Computer Show & Sale. **LOCATION:** Sheraton Inn Waterbury. **HOURS:** 9:30am-4pm. **ADMISSION:** \$6, under 12 free w/adult. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

DE - GEORGETOWN — Delmarva Hamfest. **SPONSOR:** Sussex ARA. **LOCATION:** Delaware Technical & Community College, Rte 18. **HOURS:** 8am-2pm. **ADMISSION:** \$4, XYL & Children free. **TALK-IN:** 147.075 224.84. **FEATURES:** EX - F/R - H. **DEALER INFO:** Inside table \$8, Tallgating \$5. **CONTACT:** Delmarva Hamfest, Rte 2, Box 244G, Georgetown DE 19947.

FL - WEST PALM BEACH — Narisaam Computer Show. **SPONSOR:** Narisaam, Inc. **LOCATION:** Palm Beach Airport Hilton, 150 Australian Ave. **HOURS:** 9:30am-3:30pm. **ADMISSION:** \$5, \$4 w/ad, under 12 free. **FEATURES:** AC - C - FP. **CONTACT:** Narisaam.*

MA - CAMBRIDGE — Tallgate Electronics, Computer & Amateur Radio Flea Market. **SPONSOR:** MIT Radio Society and Harvard Wireless Club. **LOCATION:** Albany & Main Sts. **HOURS:** 9am-2pm rain or shine. **ADMISSION:** \$2. **TALK-IN:** 146.52, 449.725/444.725 - pl 2A - W1XX/R. **FEATURES:** C - FP - H - T. **DEALER INFO:** Tallgate room for 600 sellers. \$10 per space at gate, \$8 adv. Includes 1 admission. Setup 7am. For info call 617-253-3776. Mail advance reservations before the 5th. **CONTACT:** W1GSL, POB 397082 MIT BR, Cambridge MA 02139-7082.

MA - SWANSEA — Computer Shows & Sales. **SPONSOR:** Northern Computer Shows. **LOCATION:** Venus De Milo, Rte 6 (Exit 3 off I-195). **HOURS:** 10am-3:30pm. **ADMISSION:** \$7, under 14 free w/adult. **FEATURES:** C. **DEALER INFO:** Set-up 8am. **CONTACT:** Northern Computer Shows.*

VA - VIRGINIA BEACH — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Virginia Beach Pavilion. **HOURS:** 10am-4pm. **ADMISSION:** \$6. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

AUGUST 26

NJ - BRIDGEWATER — Hamfest. **SPONSOR:** Somerset County ARS. **LOCATION:** Somerset County 4-H Center, Milltown Rd off Rte 202. **HOURS:** 8am-1pm. **TALK-IN:** 448.175-. **CONTACT:** Eric NW2P, 908-753-8290, SCARS, PO Box 742, Manville NJ 08835.

NY - CHAFFEE — Hamfest. **SPONSOR:** Pioneer Radio Operators Society. **LOCATION:** Manion Park. **HOURS:** 7am-3pm. **ADMISSION:** \$3 adv, \$4 door. **TALK-IN:** 145.39. **FEATURES:** CB - DP - F/R - H - T. **DEALER INFO:** Flea market free w/paid admission. **CONTACT:** Michael Buttino, 716-496-8241.

NY - SYRACUSE — 40th Annual Hamfest. **SPONSOR:** Radio Amateurs of Greater Syracuse. **LOCATION:** Academy Green American Legion, one blk W of Rte 173 & South Salina St. **HOURS:** 8am-7. **ADMISSION:** \$5, under 16 free. **FEATURES:** C - DP - EX - F - FM - F/R - H. **DEALER INFO:** 10' space: \$3, set-up 7am. **CONTACT:** Mike Meltzer K2SDJ, 315-469-0590, Rags, POB 88, Liverpool NY 13088.

PA - HARRISBURG — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Harrisburg Farm Show Complex. **HOURS:** 10am-4pm. **ADMISSION:** \$6. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

VA - VIENNA — Computer Show & Sale. **SPONSOR:** Local Area Vendors. **LOCATION:** Vienna Community Center (Park St off Rte 123). **HOURS:** 9:30am-4pm. **ADMISSION:** \$4. **FEATURES:** C - DP - FP. **CONTACT:** Simon Sakkab, 703-255-3235.

AUGUST 26-27

CT - VERNON — 21st Eastern VHF-UHF Conference. **LOCATION:** Quality Inn & Conference Center. **HOURS:** Conference: Fri 4pm-7, Sat 8am-5pm. Swapmeet/Sun 8am-7. **ADMISSION:** Conference: adv \$20, door \$25. Swapmeet only/Sun \$15. **FEATURES:** B - F. **CONTACT:** Rae Bristol K1LXD, 328 Mark Dr, Coventry CT 06238, 203-742-8650.

NJ - EDISON — Computer Show. **LOCATION:** Raritan Center Exposition Hall, NJ Tpke Exit #10, right at toll, follow signs to Raritan Center, near SI & NYC. **HOURS:** Sat: 9:30am-3:30pm; Sun: 10am-3pm. **FEATURES:** C. **DEALER INFO:** 1000 + tables. **CONTACT:** KGP Computer Show.*

AUGUST 27

MA - ROCKLAND — Computer Shows & Sales. **SPONSOR:** Northern Computer Shows. **LOCATION:** Sons of Italy, Rtes 123 & 139. Rte 3, Exit 14 to Rockland Center. **HOURS:** 10am-3:30pm. **ADMISSION:** \$7, under 14 free w/adult. **FEATURES:** C. **DEALER INFO:** Set-up 8am. **CONTACT:** Northern Computer Shows.*

Events CALENDAR

NY - YONKERS — Hamfest/Computerfest '95. **SPONSOR:** Yonkers ARC. **LOCATION:** Yonkers Municipal Parking Garage, Main St. **HOURS:** 9am-3pm. **ADMISSION:** \$5, XYL, YL and under 12 free. **TALK-IN:** 146.865 & 440.150. **FEATURES:** C - F/R - H. **DEALER INFO:** Vendors: Adv \$10, Door \$14. Set-up 7:30am. **CONTACT:** Jim, N20NM, 944-969-5182.

PA - READING — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Sheraton Berkshire. **HOURS:** 10am-4pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

TN - LEBANON — Hamfest. **SPONSOR:** Short Mountain Repeater Club. **LOCATION:** Cedars of Lebanon State Park, US Hwy 231. **HOURS:** 7am-3pm. **ADMISSION:** Free. **TALK-IN:** 146.910. **CONTACT:** Thomas Page, AD4AI, 615-449-5610, PO Box 2741, Lebanon TN 37088-2741.

SEPTEMBER 2-3

NC - SHELBY — 39th Hamfest. **SPONSOR:** Shelby ARC. **LOCATION:** Cleveland County Fairgrounds. **TALK-IN:** 146.28/88. **FEATURES:** CB - FM - T. **CONTACT:** Barbara Elliott, POB 191, Fallstone NC 28042. 704-538-7919 after 1pm.

NJ - CHERRY HILL — PC Dealer Showcase. **LOCATION:** Cherry Hill Mall, Rte 38. **HOURS:** Sat: 10am-9:30pm, Sun: 12pm-5pm. **ADMISSION:** Free. **FEATURES:** AC - C - FP. **DEALER INFO:** Tables \$95 table/day. **CONTACT:** Starware 610-584-8770.

SEPTEMBER 6-7-8-9

NY - ROCHESTER — 34th Historical Radio Conference. **SPONSOR:** Antique Wireless Assn. **LOCATION:** Thruway Marriott Hotel. **FEATURES:** B - FM - S. **CONTACT:** AWA, Box E, Breesport, NY 14816. 716-359-1800.

SEPTEMBER 9

MA - WILMINGTON — Computer Show. **LOCATION:** Shriner's, N of Boston at I-93 Exit #39, right at bottom of ramp, follow signs to hall. **HOURS:** 10am-4pm. **FEATURES:** C. **DEALER INFO:** 500+ tables. **CONTACT:** KGP Computer Show.*

NY - BALLSTON SPA — 10th Saratoga RACES Hamfest. **LOCATION:** Fairgrounds. **HOURS:** 7am-7. **ADMISSION:** \$4. **TALK-IN:** 147.24/147.84. **CONTACT:** Lenny N2KKP, 518-885-4933.

PA - BETHLEHEM — Computer Trade Show. **SPONSOR:** Peter Trapp Shows. **LOCATION:** Stabler Arena. **HOURS:** 10am-3pm. **ADMISSION:** \$6, \$1 off w/this ad or coupon, under 12 free. **FEATURES:** C - FP - F/R. **CONTACT:** Peter Trapp Shows, 607-369-2796.

PA - ERIE — ARRL Hamfest. **SPONSOR:** Radio Association of Erie. **CONTACT:** Tom McClain N3HPR, 3954 Solar Dr, Erie PA 16506. 814-833-1640.

SEPTEMBER 9-10

AL - BESSEMER — Computer Show. **LOCATION:** Bessemer Civic Center, 1130 Ninth Ave, SW, exit 108 at I-20/I-59. **HOURS:** Sat: 9am-5pm, Sun: 10am-4pm. **ADMISSION:** \$5 both days, \$4 Sun. only. **FEATURES:** AC - C - DP - FP. **DEALER INFO:** 8-ft tables \$35. **CONTACT:** Computer Show, POB 295, Riverdale GA 30274. 800-746-9001.

NY - STONY BROOK — MarketPro Computer Show & Sale. **LOCATION:** Stony Brook University. **HOURS:** 9:30am-4pm. **ADMISSION:** \$6, under 12 free w/adult. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

VA - SPRINGFIELD — PC Dealer Showcase. **LOCATION:** Springfield Mall, I-95 & 495. **HOURS:** Sat: 10am-9:30pm, Sun: 12pm-5pm. **ADMISSION:** Free. **FEATURES:** AC - C - FP. **DEALER INFO:** Tables \$95 table/day. **CONTACT:** Starware 610-584-8770.

SEPTEMBER 10

KY - LOUISVILLE — Computer Fair South. **SPONSOR:** MEKA Enterprises, Inc. **LOCATION:** Executive West Hotel, I-65 & 264 Freedom Way at the Fairgrounds. **HOURS:** 10am-3pm. **ADMISSION:** \$4. **DEALER INFO:** Vendor tables \$45. **CONTACT:** MEKA Enterprises, 812-825-2889.

MD - GAITHERSBURG — FAR Fest '95. **SPONSOR:** Foundation for Amateur Radio. **LOCATION:** Montgomery County Fairgrounds, exit 11 off I-270. **HOURS:** 6am-7. **ADMISSION:** \$5, under 12 free. **TALK-IN:** 146.955-443.400+ and 146.52. **FEATURES:** C - CB - E - EX - H - T. **DEALER INFO:** 10' tallgate space: \$10 + admission, Mary Morris 703-971-3905. **CONTACT:** Al Brown, 301-490-3188.

NH - PORTSMOUTH — Computer Shows & Sales. **SPONSOR:** Northern Computer Shows. **LOCATION:** Frank Jones Center, Exit 5 off I-96 to Rte 1 Bypass South (behind U-Haul). **HOURS:** 10am-3:30pm. **ADMISSION:** \$7, under 14 free w/adult. **FEATURES:**

C. **DEALER INFO:** Set-up 8am. **CONTACT:** Northern Computer Shows.*

NY - BREWSTER — Pearlfest '95. **SPONSOR:** Putnam Emergency and Amateur Radio League. **LOCATION:** JFK Elementary School, Foggtown Rd, follow signs from Exit 19, Rte 84. **HOURS:** 9am-2pm. **ADMISSION:** \$5, ladies & under 12 free. **TALK-IN:** 145.130 MHz, down 600. **FEATURES:** C - DP - E - EX - FM - FP - F/R - H - T. **DEALER INFO:** Tables: Adv \$10, door \$12, tailgating \$7. **CONTACT:** Shirley Dahlgren N2SKP, 914-736-3558, POB 677, Verplanck NY 10596.

PA - BUTLER — Hamfest. **SPONSOR:** Butler County ARA. **LOCATION:** Butler Farm Show Grounds. **HOURS:** 8am-3pm. **ADMISSION:** \$5, under 12 free. **DEALER INFO:** 8' indoor table \$10, outdoor flea market space \$1. **CONTACT:** Hamfest Chairman, POB 1787, Butler PA 16001.

SEPTEMBER 16

MD - HUNT VALLEY — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Marriott's Hunt Valley Inn. **HOURS:** 10am-4pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

NJ - TRENTON — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Trenton State University. **HOURS:** 10am-4pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

NJ - WAYNE — Computer Show. **LOCATION:** William Paterson College, Recreation Center, near I-80, Rte 23 & Rte 46. **HOURS:** 10am-4pm. **FEATURES:** C. **DEALER INFO:** 400 tables. **CONTACT:** KGP Computer Show.*

NY - HAMBURG — Western New York Section Convention. **CONTACT:** Harold Smith K2HC, 300 White Spruce Blvd, Rochester NY 14623. 716-424-7184.

NY - Poughkeepsie — MarketPro Computer Show & Sale. **LOCATION:** Mid-Hudson Civic Center. **HOURS:** 9:30am-4pm. **ADMISSION:** \$6, under 12 free w/adult. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

NY - SYRACUSE — Computer Trade Show. **SPONSOR:** Peter Trapp Shows. **LOCATION:** New York State Fairgrounds. **HOURS:** 10am-4pm. **ADMISSION:** \$6, \$1 off w/this ad or coupon, under 12 free. **FEATURES:** C - FP - F/R. **CONTACT:** Peter Trapp Shows, 607-369-2796.

SC - ANDERSON — Hamfest & Computer Show. **SPONSOR:** Anderson ARC. **LOCATION:** New Civic Center, 4 ml off I-85. **HOURS:** 9am-2pm. **ADMISSION:** Adv \$4, Door \$5. **TALK-IN:** 146.79MHz repeater, 146.97MHz. **FEATURES:** AC - C - EX - F/R - H - RV-S. **DEALER INFO:** Tables, \$10. Outside flea free with paid admission. **CONTACT:** Anderson ARC, POB 1525, Anderson SC 29622-1525. FAX 803-225-0567. Rip Merrell W4FX, 803-225-0028.

VA - SOUTH BOSTON — Fallfest. **SPONSOR:** Piedmont ARC. **LOCATION:** Halifax County Senior High School. **HOURS:** 9am-3pm. **ADMISSION:** Adv \$4, Door \$5. **TALK-IN:** 147.06-. **FEATURES:** EX - T. **DEALER INFO:** Indoor tables \$8-\$12, outside tailgating \$3 per. **CONTACT:** Kathy Hendricks AC4LB or PARC, 2031 Robert Hester Rd, Hurdle Mills NC 27541.

VT - RANDOLPH — 7th Annual Fall Foliage Hamfest & Computer Fair. **SPONSOR:** Central Vermont ARC. **LOCATION:** Vermont Technical College, Judd Gymnasium. **HOURS:** 9am-3pm. **ADMISSION:** \$4. **TALK-IN:** 147.09/146.625/025. **FEATURES:** DP - EX - F - F/R. **DEALER INFO:** Tables: Adv \$6, Door \$8. Tailgating \$4. **CONTACT:** Barry Driscoll N1NPU, RRI Box 3165, Barre VT 05641, 802-479-1408. Tom Girardi WA1YNU, 802-244-7836.

SEPTEMBER 16-17

NJ - LAWRENCEVILLE — PC Dealer Showcase. **LOCATION:** Quakerbridge Mall, Rte 1. **HOURS:** Sat: 10am-9:30pm, Sun: 12pm-5pm. **ADMISSION:** Free. **FEATURES:** AC - C - FP. **DEALER INFO:** Tables \$95 table/day. **CONTACT:** Starware 610-584-8770.

SEPTEMBER 17

CT - NEWTON — Western CT Hamfest. **SPONSOR:** Candlewood ARC. **LOCATION:** Edmond Town Hall, Rte 6-exit 10 on I-84. **HOURS:** 9am-2pm. **ADMISSION:** \$4, under 12 free. **TALK-IN:** 147.12/72. **FEATURES:** C - CB - DP - E - FM - F/R - H - T. **DEALER INFO:** Tables: \$10, Tailgating: \$6 (each includes one admission). Set-up 7am. **CONTACT:** Ken Weith KD1DD, POB 3441, Danbury CT 06813-3441. 203-743-9181.

DE - NEWARK — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** University of Delaware (Bob Carpenter Center). **HOURS:** 10am-4pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Show.*

FL - BOCA RATON — Narisaam Computer Show. **SPONSOR:** Narisaam, Inc. **LOCATION:** Embassy Suites Hotel, 661 Northwest 53rd St. **HOURS:** 10am-4pm. **ADMISSION:** \$5, \$4 w/adult. **FEATURES:**

free. **FEATURES:** AC - C - FP. **CONTACT:** Narisaam.*

MA - CAMBRIDGE — Tailgate Electronics, Computer & Amateur Radio Flea Market. **SPONSOR:** MIT Radio Society and Harvard Wireless Club. **LOCATION:** Albany & Main Sts. **HOURS:** 9am-2pm. **ADMISSION:** \$2. **TALK-IN:** 146.52, 449.725/444.725 - PL 2A - W1XMR. **FEATURES:** C - FP - H - T. **DEALER INFO:** Tailgate room for 600 sellers. \$10 per space at gate, \$8 adv includes 1 admission. Set-up 7am. For info call 617-253-3776. Mail advance reservations before the 5th. **CONTACT:** WIGSL, POB 397082 MIT BR, Cambridge MA 02139-7082.

MA - PITTSFIELD — Hamfest. **SPONSOR:** Northern Berkshire ARC. **LOCATION:** Taconic High School, Valentine Rd. **HOURS:** 8am-2pm. **ADMISSION:** \$2. **TALK-IN:** 146.91. **FEATURES:** CB - EX - FM - H - T. **DEALER INFO:** Vendors: Adv \$5, Door \$7. **CONTACT:** Chuck Lowery N21Z, 413-447-8377.

MD - BALTIMORE — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** BWI Marriott. **HOURS:** 10am-4pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

NH - NASHUA — Computer Shows & Sales. **SPONSOR:** Northern Computer Shows. **LOCATION:** Stanislaus Hall, 1/4 mile E of Rte 3 (Everett Turnpike), Exit 6, follow show signs. **HOURS:** 10am-3:30pm. **ADMISSION:** \$7, under 14 free w/adult. **FEATURES:** C. **DEALER INFO:** Set-up 8am. **CONTACT:** Northern Computer Shows.*

NJ - PENNSAUKEN — 47th Annual Hamfest & Computer Show. **SPONSOR:** South Jersey Radio Assn. **LOCATION:** Pennsauken High School parking lot. **HOURS:** 8am-3pm. **ADMISSION:** Adv: \$4, Door: \$5. **TALK-IN:** 145.290-600. **FEATURES:** C - CB - DP - EX - FP - F/R - H - S - T. **DEALER INFO:** Tailgate space: \$5 + admission. **CONTACT:** Paul E. Hayden KF2YX, 519 N Elmwood Rd, Marlton, NJ 08053. 609-596-7749.

NY - SUFFERN — MarketPro Computer Show & Sale. **LOCATION:** Rockland Community College. **HOURS:** 9:30am-4pm. **ADMISSION:** \$6, under 12 free w/adult. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

SEPTEMBER 22-23-24

FL - MELBOURNE — Computer Software & Electronic Show. **SPONSOR:** Arflin Promotions. **LOCATION:** Melbourne Auditorium, 625 E. Hibiscus Bl. **HOURS:** Fri: 6-9pm, Sat: 10-9pm, Sun: 12-6pm. **CONTACT:** Bill Arflin: 407-777-9692, Arflin Promotions, 290 Park Ave., Satellite Beach FL 32937.

SEPTEMBER 23

GA - ATLANTA — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Lakewood Fairgrounds. **HOURS:** 10am-4pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

NJ - PENNSAUKEN — Computer Show. **LOCATION:** South Jersey Expo Center, off NJ Tpke Exit #4 on Rte 73. **HOURS:** 10am-4pm. **FEATURES:** C. **DEALER INFO:** 500+ tables. **CONTACT:** KGP Computer Show.*

PA - MONROEVILLE — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Pittsburgh Expo Mart. **HOURS:** 10am-4pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

PA - YORK — Computer Trade Show. **SPONSOR:** Peter Trapp Shows. **LOCATION:** York County Fairgrounds. **HOURS:** 10am-3pm. **ADMISSION:** \$6, \$1 off w/this ad or coupon, under 12 free. **FEATURES:** C - FP - F/R. **CONTACT:** Peter Trapp Shows, 607-369-2796.

RI - SMITHFIELD — MarketPro Computer Show & Sale. **LOCATION:** Bryant College. **HOURS:** 9:30am-4pm. **ADMISSION:** \$6, under 12 free w/adult. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

VA - MANASSAS — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Manassas Fairgrounds. **HOURS:** 10am-4pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

SEPTEMBER 23-24

NC - CHARLOTTE — Charlotte Area Computer Show. **LOCATION:** Metrolina Expo Center, 7100 N Statesville Rd I-77 N to Exit #16A (first exit N of the I-85 & I-77 intersection). **HOURS:** Sat: 9am-5pm, Sun: 10am-4pm. **ADMISSION:** \$5 both days, \$4 Sun. only. **FEATURES:** AC - C - DP - FP. **DEALER INFO:** 8-ft tables \$35. **CONTACT:** Computer Show, POB 295, Riverdale GA 30274. 800-746-9001.

VA - VIRGINIA BEACH — Hamfest/Computer Fair & ARRL Virginia State Convention. **SPONSOR:** Tidewater Radio Conventions. **LOCATION:** Pavilion Convention Center. **HOURS:** Sat 9am-5pm/Sun 9am-3pm. **ADMISSION:** \$6, good both days, under 12 free. **TALK-IN:** 146.97MHz. **FEATURES:** B - C - CB - F - FM - FP - H - T. **DEALER INFO:** 10' x 10' booth space \$150, set-up 10am after 2pm. **CONTACT:**

Lewis B Steingold W4BLO, 804-486-3800. FAX 804-486-0757.

SEPTEMBER 24

CT - WATERBURY — MarketPro Computer Show & Sale. **LOCATION:** Sheraton Inn Waterbury. **HOURS:** 9:30am-4pm. **ADMISSION:** \$6, under 12 free w/adult. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

FL - NEW PORT RICHEY — 5th Annual Pasco County Hamfest & Computer Show. **SPONSOR:** Suncoast ARC. **LOCATION:** New Port Richey Recreation Center. **HOURS:** 9am-3:30pm. **ADMISSION:** \$5, under 12 free. **TALK-IN:** 145.35 147.15. **FEATURES:** AC - C - DP - H. **DEALER INFO:** Tables, \$15. **CONTACT:** Ron N9EE, 813-376-6575, or Suncoast ARC, POB 1992, New Port Richey FL 34656.

GA - ATLANTA — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Cobb County Civic Center. **HOURS:** 10am-4pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

KY - FT. MITCHELL — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Drawbridge Estate. **HOURS:** 10am-4pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

MA - FRAMINGHAM — Fall Flea Market. **SPONSOR:** Framingham ARA. **LOCATION:** Framingham High School, A St., 1.3 ml N of Rtes 9 & 126 junction. **HOURS:** 9am/early bird: \$2/general. **FEATURES:** C - DP - E - EX - FM - FP - F/R - H - T. **DEALER INFO:** Tables: adv \$10, door \$14, set-up 8am, tailgating: \$10 per space. **CONTACT:** Lew Nyman K1AZE, 508-879-7456; FARA, POB 3005, Framingham MA 01701.

MA - TAUNTON — Computer Shows & Sales. **SPONSOR:** Northern Computer Shows. **LOCATION:** Taunton Holiday Inn, Exit 9 off I-495, between Rte 24 & I-95. **HOURS:** 10am-3:30pm. **ADMISSION:** \$7, under 14 free w/adult. **FEATURES:** C. **DEALER INFO:** Set-up 8am. **CONTACT:** Northern Computer Shows.*

MD - GAITHERSBURG — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Montgomery County Fairgrounds. **HOURS:** 10am-4pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

NY - YONKERS — Giant Electronic Flea Market. **SPONSOR:** Metro 70cm Network. **LOCATION:** Lincoln High School, Kneeland Ave. **HOURS:** 9am-3pm. **ADMISSION:** \$5, under 12 free. **TALK-IN:** 440.425 MHz PL 156.7, 223.760 MHz PL 67.0. **FEATURES:** DP - EX - F/M - FP - F/R. **DEALER INFO:** Vendors please call 914-969-1053. **CONTACT:** Otto Supliski WB2SLQ, 914-969-1053.

PA - ALLENTOWN — Computer Trade Show. **SPONSOR:** Peter Trapp Shows. **LOCATION:** Holiday Inn & Convention Center, Lehigh Valley. **HOURS:** 10am-3pm. **ADMISSION:** \$6, \$1 off w/this ad or coupon, under 12 free. **FEATURES:** AC - C - FP - F/R. **CONTACT:** Peter Trapp Shows, 607-369-2796.

PA - LANCASTER — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Lancaster Host Resort. **HOURS:** 10am-4pm. **ADMISSION:** \$6, free w/membership. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

SEPTEMBER 30

FL - FORT LAUDERDALE — Narisaam Computer Show. **SPONSOR:** Narisaam, Inc. **LOCATION:** Holiday Inn West, 5100 N State Road 7. **HOURS:** 9:30am-3:30pm. **ADMISSION:** \$5, \$4 w/adult, under 12 free. **FEATURES:** AC - C - FP. **CONTACT:** Narisaam.*

MA - FITCHBURG — MarketPro Computer Show & Sale. **LOCATION:** Royal Plaza Trade Center. **HOURS:** 9:30am-4pm. **ADMISSION:** \$6, under 12 free w/adult. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

SEPTEMBER 30-OCTOBER 1

PA - KING OF PRUSSIA — Computer Show & Sale. **SPONSOR:** MarketPro. **LOCATION:** Valley Forge Convention Center. **HOURS:** 10am-4pm. **ADMISSION:** \$6.50, free w/membership. **FEATURES:** C - FP. **CONTACT:** MarketPro Computer Shows.*

OCTOBER 1

FL - WEST PALM BEACH — Narisaam Computer Show. **SPONSOR:** Narisaam, Inc. **LOCATION:** Palm Beach Airport Hilton, 150 Australian Ave. **HOURS:** 10am-4pm. **ADMISSION:** \$5, \$4 w/adult, under 12 free. **FEATURES:** AC - C - FP. **CONTACT:** Narisaam.*

MA - ROCKLAND — Computer Shows & Sales. **SPONSOR:** Northern Computer Shows. **LOCATION:** Sons of Italy, Rtes 123 & 139; Rte 3, Exit 14 to Rockland Center. **HOURS:** 10am-3:30pm. **ADMISSION:** \$7, under 14 free w/adult. **FEATURES:** C. **DEALER INFO:** Set-up 8am. **CONTACT:** Northern Computer Shows.*

Events CALENDAR

NY - HEMPSTEAD — Computer Show. **LOCATION:** Hofstra University Field House, use Meadowbrook Parkway Exit M-4 to Hempstead Tpke, 1 mile past Coliseum. **HOURS:** 10am-3pm. **FEATURES:** C. **DEALER INFO:** 500+ tables. **CONTACT:** KGP Computer Show.*

OCTOBER 7

NY - TROY — MarketPro Computer Show & Sale. **LOCATION:** Troy Armory. **HOURS:** 9:30am-4pm. **ADMISSION:** \$6, under 12 free w/adult. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

OCTOBER 7-8

GA - NORCROSS — Computer Show. **LOCATION:** North Atlanta Trade Center, 1700 Jurgens Court, I-85 N to Exit 38 & turn right to Oakbrook Parkway, turn right to Jurgens Court. **HOURS:** Sat: 9am-5pm, Sun: 10am-4pm. **ADMISSION:** \$5 both days, \$4 Sun. only. **FEATURES:** AC - C - DP - FP. **DEALER INFO:** 8-ft tables \$45 + \$6 Business License. **CONTACT:** Computer Show, POB 295, Riverdale GA 30274. 800-746-9001.

OCTOBER 8

NH - MANCHESTER — Computer Shows & Sales. **SPONSOR:** Northern Computer Shows. **LOCATION:** Center of NH, Expo Complex at Holiday Inn, I-293 Exit 5 or 6. **HOURS:** 10am-3:30pm. **ADMISSION:** \$7, under 14 free w/adult. **FEATURES:** C - FP. **DEALER INFO:** Set-up 8am. **CONTACT:** Northern Computer Shows.*

NJ - LINCOLN — Shore Area Hamfest & ARRL State Convention. **LOCATION:** Brookdale Community College, Garden State Pkwy exit 109, West on Rte 520. **HOURS:** 8am-7. **ADMISSION:** Adv: \$5 w/2 stubs, Door: \$6 w/1 stub, under 12 free. **TALK-IN:** 145.485/-6. **FEATURES:** AC - C - CB - DP - EX - F - FP - F/R - H - T. **DEALER INFO:** 8' indoor table \$25, outdoor space \$10, set-up 6am. **CONTACT:** Al Allen K2LQ, Shore Area Hamfest, POB 635, Eatontown NJ 07724, 908-495-3246.

NY - WHITE PLAINS — MarketPro Computer Show & Sale. **LOCATION:** Westchester County Center. **HOURS:** 9:30am-4pm. **ADMISSION:** \$6, under 12 free w/adult. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

OCTOBER 14

GA - AUGUSTA — Hamfest. **SPONSOR:** Augusta ARC. **LOCATION:** Augusta College, Walton Way. **HOURS:** 9am-4pm. **ADMISSION:** \$5. **TALK-IN:** 145.49-. **FEATURES:** EX. **DEALER INFO:** Indoor tables: \$10, set-up Fri. 6pm-9pm. **CONTACT:** Ed KMA4QQ, 706-798-1918, Rhonda KE4DIM, 706-560-9600 or ARCA, POB 3072, Augusta GA 30914.

OCTOBER 14-15

KY - LOUISVILLE — Greater Louisville Hamfest & State Convention. **LOCATION:** Kentucky Fair & Exposition Center. **ADMISSION:** \$5. **DEALER INFO:** Bill Rufner W9CBQ, 812-948-0037. **CONTACT:** Herbert Rowe, W4WQD 812-294-4905. Greater Louisville Hamfest, POB 34444-E, Louisville, KY 40232-4444.

MA - MARLBOROUGH — Computer Show. **LOCATION:** Royal Plaza Trade Center, take MA Tpke to I-495 N, go 4 miles, use Exit #24-B, 1/2 mile on right. **HOURS:** Sat: 10am-4pm, Sun: 10am-3pm. **FEATURES:** C. **DEALER INFO:** 500+ tables. **CONTACT:** KGP Computer Show.*

OCTOBER 15

KY - LOUISVILLE — Computer Fair South. **SPONSOR:** MEKA Enterprises, Inc. **LOCATION:** Executive West Hotel, I-65 & 264 Freedom Way at the Fairgrounds. **HOURS:** 10am-3pm. **CONTACT:** William Ibarra, MEKA Enterprises, 2656 E. 2nd St., Bloomington IN 47401. 812-333-4484, FAX: 812-333-4650.

MA - CAMBRIDGE — Tailgate Electronics, Computer & Amateur Radio Flea Market. **SPONSOR:** MIT Radio Society and Harvard Wireless Club. **LOCATION:** Albany & Main Sts. **HOURS:** 9am-2pm rain or shine. **ADMISSION:** \$2. **TALK-IN:** 146.52, 449.725/444.725. PL 2A - V1XMR. **FEATURES:** C - FP - H - T. **DEALER INFO:** Tailgate room for 600 sellers, \$10 per space at gate, \$8 adv includes 1 admission. Set-up 7am. For info call 617-253-3776. Mail advance reservations before the 5th. **CONTACT:** WIGSL, POB 397082 MIT BR., Cambridge MA 02139-7082.

NJ - FAIRFIELD — MarketPro Computer Show & Sale. **LOCATION:** Radisson Hotel. **HOURS:** 9:30am-4pm. **ADMISSION:** \$6, under 12 free w/adult. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

OCTOBER 20-21

FL - STARKE — Hamfest & Computer Show. **SPONSOR:** Bradford Area ARC. **LOCATION:** Bradford County Fairgrounds, on US-301. **HOURS:** 8am-4pm. **ADMISSION:** Families: \$3. **TALK-IN:**

145.15, 146.52, 146.82. **FEATURES:** C - DP - H. **DEALER INFO:** Tables: \$5, tailgating \$4. **CONTACT:** Dan Phillips K4RVD, 8214 Carl Brook Rd., Keystone Hts FL 32656. 904-475-2695.

OCTOBER 21

NY - BUFFALO — MarketPro Computer Show & Sale. **LOCATION:** Buffalo State College. **HOURS:** 9:30am-4pm. **ADMISSION:** \$6, under 12 free w/adult. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

PA - SENECA — Ham Radio Auction & Flea Market. **SPONSOR:** Fort Venango Mike & Key Club. **LOCATION:** Christian Life Bldg, Rte 257 between Rte 3 & Rte 62. **HOURS:** 8am-7. **ADMISSION:** \$3, under 12 free. **TALK-IN:** 147.12 +, 145.23-, 145.19-, 444.125 +. **FEATURES:** DP - FM - F/R - H. **DEALER INFO:** Tables: \$5, Mary Housholder N3QCR, 814-437-2036. **CONTACT:** Fort Venango Mike & Key Club, RD1, Box 591, Cranberry PA 16319.

SC - SUMTER — 9th Annual Hamfest & Computer Show. **SPONSOR:** Sumter ARA. **LOCATION:** Sumter County Exhibition Center, 700 W. Liberty St. **HOURS:** 8am-4pm. **ADMISSION:** \$5. **TALK-IN:** 147.015. **FEATURES:** C - DP - EX - F - FM - F/R - H - T. **DEALER INFO:** Tables/tailgate space: \$6, set-up Fri: 4pm-9pm & Sat: 6am. **CONTACT:** Mike Dunlap KC4HUT, 803-481-4611 or Tommy Dubose KB4CIH, 803-469-5093.

TN - GRAY — Tri-Cities Hamfest. **SPONSOR:** Kingsport, Bristol & Johnson City ARCS. **LOCATION:** Appalachian Fair Grounds, off I-181. **ADMISSION:** \$5. **FEATURES:** FM - RV-H. **CONTACT:** POB 3682 CRS, Johnson City TN 37602.

OCTOBER 21-22

AL - HUNTSVILLE — Computer Show. **LOCATION:** Von Braun Civic Center, 700 Monroe Street, Exit 19-C off I-565. **HOURS:** Sat: 9am-5pm, Sun: 10am-4pm. **ADMISSION:** \$5 both days, \$4 Sun. only. **FEATURES:** AC - C - DP - FP. **DEALER INFO:** 8-ft tables \$45. **CONTACT:** Computer Show, POB 295, Riverdale GA 30274. 800-746-9001.

FL - WEST PALM BEACH — Hamfest & Computer Show. **SPONSOR:** Palm Beach Repeater Assn. **LOCATION:** South Florida Fairgrounds, Southern Blvd. **HOURS:** Sat: 9am-5pm, Sun: 9am-3pm. **ADMISSION:** Door \$5, good both days. **TALK-IN:** 147.165/147.765. **FEATURES:** AC - C - EX - FM - H - RV-H. **DEALER INFO:** Flea Tables: \$20 + admission, set-up Fri: 2pm-8pm VI Kleenapp KC4LCF: 407-585-9074. **CONTACT:** PBRA Hamfest, POB 461, Lake Worth, FL 33460.

KY - LOUISVILLE — Computer Fair. **SPONSOR:** Trade Show Productions. **LOCATION:** Kentucky Fair & Expo Center. **HOURS:** Sat: 10-5, Sun: 10-3. **ADMISSION:** \$5, good both days. **FEATURES:** C - CB - FM - S. **DEALER INFO:** Commercial booth: \$200, Flea Market space: \$30. **CONTACT:** Trade Show Productions/Mark Hanslip, 143 Schloss Ln, Dayton, OH 45418. 513-263-3378.

OCTOBER 22

NY - ROCHESTER — MarketPro Computer Show & Sale. **LOCATION:** The Dome Center. **HOURS:** 9:30am-4pm. **ADMISSION:** \$6, under 12 free w/adult. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

NY - SYRACUSE — Computer Trade Show. **SPONSOR:** Peter Trapp Shows. **LOCATION:** NY State Fairgrounds. **HOURS:** 10am-4pm. **ADMISSION:** \$6, \$1 off w/this ad or coupon, under 12 free. **FEATURES:** C - FP - F/R. **CONTACT:** Peter Trapp Shows, 607-369-2796.

PA - SELLERSVILLE — Hamfest. **SPONSOR:** RH Hill ARC. **LOCATION:** Sellersville Fire House, Rte 152, 5 mi S of Quakertown. **ADMISSION:** \$5. **TALK-IN:** 145.31. **FEATURES:** EX. **DEALER INFO:** Indoor space w/table: \$18, outdoor space only: \$6. **CONTACT:** Linda Erdman: 215-679-5764 or POB 29, Colmar, PA 18915.

OCTOBER 28

CT - WATERFORD — Ham Radio Auction. **SPONSOR:** Tri City ARC. **LOCATION:** Senior Citizens Center, Waterford Municipal Complex. **HOURS:** 10am-2. **ADMISSION:** Free. **TALK-IN:** 146.37/97. **FEATURES:** F/R. **DEALER INFO:** Set-up 9am. **CONTACT:** Bob KA1BB: 203-739-8016.

FL - PORT ST. LUCIE — Hamfest '95. **SPONSOR:** Port St. Lucie ARA. **LOCATION:** Port St. Lucie Yacht Club, 500 Prima Vista Blvd. **HOURS:** 8am-3pm. **ADMISSION:** \$2. **TALK-IN:** 146.955, 146.520. **FEATURES:** DP - F/R - H - T. **DEALER INFO:** Inside tables: \$10, tailgate space: \$5. **CONTACT:** Bill Perclasee, 407-879-4020, Roy Cox, 407-340-4319.

MA - WEST SPRINGFIELD — MarketPro Computer Show & Sale. **LOCATION:** Eastern States Exposition. **HOURS:** 9:30am-4pm. **ADMISSION:** \$6, under 12 free w/adult. **FEATURES:** C. **CONTACT:** MarketPro Computer Shows.*

OCTOBER 28-29

NJ - HACKENSACK — Computer Show. **LOCATION:** Fairleigh Dickinson University, Rothman Athletic Center, Rte 4 to Hackensack Ave South, left at first light (Temple Ave). **HOURS:** 10am-4pm. **FEATURES:** C. **DEALER INFO:** 500+ tables. **CONTACT:** KGP Computer Show.*

OCTOBER 29

MA - SOUTHWICK — Amateur Radio Fleamarket & Electronics Show. **SPONSOR:** Hampden County Radio Assn. **LOCATION:** Southwick Recreational Center, Powder Mill Rd, off Rte 57. **HOURS:** 9am-7. **ADMISSION:** \$3. **TALK-IN:** 146.52, 446.00. **FEATURES:** DP - EX. **DEALER INFO:** Tables \$15, tailgating \$6 per car, set-up 6am. **CONTACT:** Barry Mason N1IJK, 413-747-7010, John Walker N1QXV, 413-572-4592 or Hamfest Committee, 36 Kenwood Ter., Springfield MA 01108-1716. VE Exams: York Phillips, 413-566-3010.

FOREIGN

SEPTEMBER 8-9-10

CANADA - MANITOBA, AUSTIN — Hamfest. **SPONSOR:** Manitoba Amateur Radio Museum. **LOCATION:** Manitoba Agricultural Museum, 1-1/2 mi South of Hwy 1 on Hwy 34. **HOURS:** Fri 6pm-9pm; Sat 9am-midnight; Sun 9am-3pm. **ADMISSION:** \$5. **FEATURES:** CB-DP-FM-F/R-H. **DEALER INFO:** Tables & tailgaters \$5. **CONTACT:** Dave Snyder VE4XN or MARM, 25 Queens Crescent, Brandon Manitoba Canada R7B 1G1.

SEPTEMBER 9

CANADA - ONTARIO, LINDSAY — 3rd Annual Amateur Radio & Computer Flea Market. **SPONSOR:** Victoria-Halliburton ARA. **LOCATION:** Lindsay Fairgrounds, across from K-Mart, next to the hospital. **HOURS:** 9am-2pm. **ADMISSION:** \$5. **TALK-IN:** VELNZ-147.195 + and 52. **FEATURES:** DP - F/R. **DEALER INFO:** Commercial table \$10, 2 table min. Non-commercial tables \$10, no min. Tailgating \$5 + admission. **CONTACT:** Victoria - Halliburton ARA, Box 835, Lindsay Ontario Canada K9V 5N3 OR Drew VE3AAU, 705-786-3503 res., Lisa VA3AAU, 705-324-7586 wk.

EVENTS CALENDAR Month at a Glance

AUGUST 1995

AUGUST 2-3-4-5
IL - Elgin - Radiofest '95

AUGUST 4-5-6
TX - Austin - West Gulf Division Convention
WY - Jackson Hole - WIMU/Rocky Mtn Division Convention

AUGUST 5
CA - Oakland - Robert Austin Computer Show
CA - Santee - Ham, Computer & Electronic Swapmeet
IN - Valparaiso - Porter County Hamfest & Computer Show
MA - Marlborough - KGP Computer Show*
MD - West Friendship - MarketPro Computer Show*
MI - Taylor - Computers & You Computer Show
MO - Springfield - Hamfest
NC - High Point - Lomer L. McMahon Memorial Hamfest
NJ - Riverdale - Hamfest
NJ - Somerset - MarketPro Computer Show*
NY - Clayton - Hamfest
WV - Mineralwells - Hamfest '95

AUGUST 5-6
CA - Pomona - Computer Marketplace
FL - Jacksonville - 22nd Amateur Radio & Computer Show
PA - Whitehall - PC Dealer Showcase
WA - Spokane - Hamfest

AUGUST 6
CA - Livermore - Swap Meet
CA - Stockton - MarketPro Computer Show*
IL - Peotone - Hamfesters Hamfest
IN - Angola - Annual Hamfest
MA - Wellesley - Ham Flea Market
MD - Baltimore - MarketPro Computer Show*
ME - Portland - Northern Computer Show*
MI - Grand Rapids - Computers & You Computer Show
NJ - Parsippany - MarketPro Computer Show*
OH - Randolph - Portage Hamfair '95
PA - New Kensington - Hamfest
PA - Warrington - Hamfest '95
VA - Berryville - Winchester Hamfest & Computer Show

AUGUST 7-8-9-10-11
VA - McLean - 7th Annual Surveillance Expo

AUGUST 11-12-13
VT - Charlotte - ARRL Hamfest

AUGUST 12
CA - Bakersfield - MarketPro Computer Show*
CA - Fontana - Amateur Radio & Electronics Swap Meet

CA - Long Beach - Amateur Radio Auction
CA - Reseda - Computer Marketplace
IL - Quincy - Ham Radio and Computer Swapfest
IN - Indianapolis - AGI Computer Fair*
KS - Chanute - Hamfest '95
NJ - Hackensack - KGP Computer Show*
NY - Dryden - Finger Lakes Hamfest
NY - Ithaca - ARRL Hamfest
OH - Sharonville - MarketPro Computer Show*
SD - Huron - Amateur Electronics Swapfest
VA - Annandale - MarketPro Computer Show*
WA - Tacoma - Electronics Flea Market
WI - Sugar Camp - Northwoods Hamfest
WV - Ona - T.A.R.A. Hamfest & Computer Show

AUGUST 12-13

DE - Newark - PC Dealer Showcase
LA - Bossier City - ARRL Hamfest
OH - Paulding - 5th Hamfest & Saturday Nite Flea Market
PA - Monroeville - MarketPro Computer Show*

AUGUST 13

CA - Buena Park - Computer Marketplace
CA - Goleta - 75th Anniversary Hamfest
CA - Santa Rosa - MarketPro Computer Show*
FL - St. Petersburg - Computer Fair
IA - Cedar Rapids - ARRL Hamfest
KY - Fort Mitchell - MarketPro Computer Show*
KY - Louisville - Computer Fair South
MD - Hagerstown - Computer Show & Sale
MD - Upper Marlboro - MarketPro Computer Show*
MD - Westminster - Carroll County Computer & Hamfest
MI - Dearborn - Computers & You Computer Show
NC - Charlotte - Hamfest & Computer Fair
NH - Manchester - Northern Computer Show*
PA - Easton - Hamfest

AUGUST 13-14-15-16-17

MI - Detroit - 61st Annual APCO Conference & Expo

AUGUST 18-19-20

AL - Huntsville - Hamfest & A.R.G. National Convention

AUGUST 19

CA - Anaheim - Robert Austin Computer Show
CA - San Francisco - Robert Austin Computer Show
CA - Santee - Ham, Computer & Electronic Swap Meet
FL - Ft. Lauderdale - Narisam Computer Show*
MA - West Springfield - MarketPro Computer Show*
PA - Ft. Washington - KGP Computer Show*
VA - Richmond - MarketPro Computer Show*
WA - Longview - Ham, Computer & Electronic Swap Meet

AUGUST 19-20

CA - Oxnard - MarketPro Computer Show*
CA - Sacramento - MarketPro Computer Show*
CA - Marietta - Atlanta Area Computer Show
NJ - Depiford - PC Dealer Showcase
PA - King of Prussia - MarketPro Computer Show*

AUGUST 20

CA - Fresno - MarketPro Computer Show*
CT - Waterbury - MarketPro Computer Show*
DE - Georgetown - Delmarva Hamfest
DE - West Palm Beach - Narisam Computer Show*
IL - Orland Park - Orland Park Computer Show
MA - Cambridge - MIT Flea Market
MA - Swansea - Northern Computer Show*
MI - Madison Heights - Computers & You Computer Show
NV - Carson City - Swap Meet
OH - Akron - Computer Show & Sale
OH - Broadway - Hamfest & Computer Show
OH - Warren - 38th Annual Hamfest
VA - Virginia Beach - MarketPro Computer Show*

AUGUST 26

MI - Westland - Great Lakes Computer Expo & Sale
NJ - Bridgewater - Hamfest
NM - Albuquerque - Duke City Hamfest
NY - Chaffee - Hamfest
NY - Syracuse - 40th Annual Hamfest
PA - Harrisburg - MarketPro Computer Show*
TX - Galvestone - Cooke City Hamfest

AUGUST 26-27

CA - Pomona - Computer Marketplace
CA - Vallejo - MarketPro Computer Show*
IL - Woodstock - Hamfest & Computer Show
MA - Rockland - Northern Computer Show*
MI - Corunna - Five County Swap-N-Shop
MI - Fowlerville - Livingston County Hamfair
MI - Lansing - Computers & You Computer Show
NY - Yonkers - Hamfest/Computerfest '95
PA - Reading - MarketPro Computer Show*
TN - Lebanon - Hamfest

AUGUST 27

CA - San Diego - MarketPro Computer Show*
IL - Danville - 26th Annual Hamfest & Computer Show
IL - Oak Brook Terrace - Summer Hamfest
IL - Woodstock - Hamfest & Computer Show
MA - Rockland - Northern Computer Show*
MI - Corunna - Five County Swap-N-Shop
MI - Fowlerville - Livingston County Hamfair
MI - Lansing - Computers & You Computer Show
NY - Yonkers - Hamfest/Computerfest '95
PA - Reading - MarketPro Computer Show*
TN - Lebanon - Hamfest

SEPTEMBER 1995

SEPTEMBER 1-2-3

CA - Long Beach - HAMCOM 95-Southwest Div Convention

SEPTEMBER 2

CA - Antioch - MarketPro Computer Show*
CA - Santee - Ham, Computer & Electronics Swap Meet
IN - Indianapolis - Hoosier Hamfest & Computer Show
OH - Toledo - MarketPro Computer Show*

SEPTEMBER 2-3

NC - Shelby - 39th Annual Hamfest
NJ - Cherry Hill - PC Dealer Showcase

SEPTEMBER 3

CA - Livermore - Livermore ARC Swap Meet
CA - Santa Rosa - MarketPro Computer Show*
IN - Fort Wayne - MarketPro Computer Show*

Events CALENDAR

SEPTEMBER 6-7-8-9

NY - Rochester - 34th Historical Radio Conference

SEPTEMBER 8-9-10

CANADA - Manitoba - Austin - Hamfest
TX - Arlington - Digital Communications Conference

SEPTEMBER 9

CANADA - Ontario - Lindsay - Radio/Computer Flea Market
CA - Fontana - Amateur Radio & Electronics Swap Meet
CA - Fresno - MarketPro Computer Show*
CA - Reseda - Computer Marketplace
IL - Rolling Meadows - ARRL W9DXC Convention
IL - Wheaton - MarketPro Computer Show*
IN - Fort Wayne - Summit City Computer Show & Hamfest
IN - Indianapolis - AGI Computer Fair*
IN - Laporte - Hamfest
MA - Wilmington - KGP Computer Show*
MI - Taylor - Computers & You Computer Show
NY - Ballston Spa - 10th Saratoga RACES Hamfest
OH - Dayton - MarketPro Computer Show*
PA - Bethlehem - Computer Show & Sale
PA - Erie - ARRL Hamfest

SEPTEMBER 9-10

AI - Bessemer - Computer Show
CA - Ventura - MarketPro Computer Show*
NY - Stony Brook - MarketPro Computer Show*
VA - Springfield - PC Dealer Showcase

SEPTEMBER 10

CA - Buena Park - Computer Marketplace
CA - Sacramento - MarketPro Computer Show*
IA - Dubuque - Hamfest/Radiofest/Computer Expo
IL - Harrisburg - Hamfest
IL - Joliet - Hamfest '95
IL - Palatine - MarketPro Computer Show*
KY - Louisville - Computer Fair South
MD - Gaithersburg - F.A.R. Fest '95
MI - Flint - Computers & You Computer Show
MO - Monett - Hamfest & Picnic
NH - Portsmouth - Northern Computer Show*
NY - Brewster - Pearlfest '95
OH - Columbus - MarketPro Computer Show*
PA - Butler - Hamfest

SEPTEMBER 15-16-17

IL - Peoria - Superfest '95

SEPTEMBER 16

AZ - North Scottsdale - Family Amateur Radio Event
CA - Palm Springs - MarketPro Computer Show*
CA - Santa Barbara - Computer Marketplace
CA - Santee - Ham, Computer & Electronics Swap Meet
MD - Hunt Valley - MarketPro Computer Show*
MI - Hudsonville - Super Swap '95
NM - Santa Fe - Hamfest
NJ - Trenton - MarketPro Computer Show*
NJ - Wayne - KGP Computer Show*
NY - Hamburg - Western NY Section Convention/Hamfest
NY - Poughkeepsie - MarketPro Computer Show*
NY - Syracuse - Computer Show & Sale
OH - Cleveland - MarketPro Computer Show*
SC - Anderson - Hamfest & Computer Show
VA - South Boston - Fallfest
VT - Randolph - Fall Foliage Hamfest & Computer Show

SEPTEMBER 16-17

CA - San Diego - MarketPro Computer Show*
NJ - Lawrenceville - PC Dealer Showcase
OR - Portland - Ham Fair

SEPTEMBER 17

AZ - Phoenix - Computer & Electronic Swapmeet
CA - Stockton - MarketPro Computer Show*
CT - Newton - Western CT Hamfest
DE - Newark - MarketPro Computer Show*
FL - Boca Raton - Narisaam Computer Show*
IL - Glen Ellyn - Computer Central
IN - South Bend - Camera & Computer Swap Meet
MA - Cambridge - MIT Flea Market
MA - Pittsfield - Hamfest
MD - Baltimore - MarketPro Computer Show*
MI - Flint - Five Star Computer Show
MI - Madison Heights - Computers & You Computer Show
MI - Mt. Clemens - 23rd Annual Swap & Shop
NH - Nashua - Northern Computer Show*
NJ - Pennsauken - 47th Annual Hamfest & Computer Show
NV - Carson City - Swap Meet
NY - Suffern - MarketPro Computer Show*
NY - Woodbury - ARRL Hamfest
OH - Akron - MarketPro Computer Show*
OH - Cincinnati - ARRL Hamfest

SEPTEMBER 22

OH - Cleveland - Computarama USA

SEPTEMBER 22-23-24

FL - Melbourne - Computer Software & Electronic Show
OR - Milton-Freewater - ARRL Hamfest

SEPTEMBER 23

GA - Atlanta - MarketPro Computer Show*
NJ - Pennsauken - KGP Computer Show*
OH - Cincinnati - MarketPro Computer Show*
OR - Bend - Northwest VHF/UHF Conference
PA - Monroeville - MarketPro Computer Show*
PA - York - Computer Show & Sale
RI - Smithfield - MarketPro Computer Show*
VA - Manassas - MarketPro Computer Show*

SEPTEMBER 23-24

CA - Vallejo - MarketPro Computer Show*
IL - Grayslake - Radio Expo '95
NC - Charlotte - Atlanta Area Computer Shows
VA - Virginia Beach - State Convention/Hamfest

SEPTEMBER 24

CA - Oxnard - MarketPro Computer Show*
CA - Santa Ana - ACP's Computer Show
CT - Waterbury - MarketPro Computer Show*
FL - New Port Richey - Hamfest and Computer Show
GA - Atlanta - MarketPro Computer Show*

IL - Orland Park - Orland Park Computer Show
IN - Crawfordsville - AGI Computer Fair*
KY - Ft. Mitchell - MarketPro Computer Show*
MA - Framingham - Fall Flea Market
MA - Taunton - Northern Computer Show*
MD - Gaithersburg - MarketPro Computer Show*
MI - Southgate - Computers & You Computer Show
MO - Cottleville - Swapfest
NY - Yonkers - Electronic Flea Market
OH - Cleveland - ARRL Hamfest
PA - Allentown - Computer Show & Sale
PA - Lancaster - MarketPro Computer Show*

SEPTEMBER 30

FL - Fort Lauderdale - Narisaam Computer Show*
IN - Peru - North Central Indiana Hamfest
MA - Fitchburg - MarketPro Computer Show*
MI - Livonia - Computers & You Computer Show
MI - Westland - Great Lakes Computer Expo & Sale

SEPTEMBER 30-OCTOBER 1

CA - San Diego - MarketPro Computer Show*
PA - King of Prussia - MarketPro Computer Show*

OCTOBER 1995

OCTOBER 1

CA - Livermore - Swap Meet
FL - West Palm Beach - Narisaam Computer Show*
MA - Rockland - Northern Computer Show*
NY - Hempstead - KGP Computer Show*
NY - Queens - Semi Annual Hamfest
OH - Ashland - North Central Ohio Hamfest

OCTOBER 7

AZ - Bullhead City - Fallfest
CA - Santee - Ham, Computer & Electronic Swap Meet
IN - Indianapolis - AGI Computer Fair*
ND - Grand Forks - Hamfest/Computer Fair
NY - Troy - MarketPro Computer Show*
TX - Belton - Ham Expo '95

OCTOBER 7-8

CA - Sacramento - MarketPro Computer Show*
GA - Norcross - Atlanta Area Computer Show
TX - El Paso - 8th Annual International Hamfesta

OCTOBER 8

CA - Fresno - MarketPro Computer Show*
NH - Manchester - Northern Computer Show*
NJ - Lincroft - Shore Area Hamfest/ARRL State Convention
NY - White Plains - MarketPro Computer Show*
OH - Springfield - Hamfest & Computer Show

OCTOBER 14

GA - Augusta - Hamfest
MI - Alpena - Hamfest & Computer Fair

OCTOBER 14-15

CA - Oxnard - MarketPro Computer Show*
CA - Vallejo - MarketPro Computer Show*
KY - Louisville - Hamfest/State Convention
MA - Marlborough - KGP Computer Show*

OCTOBER 15

IL - Orland Park - Orland Park Computer Show
KY - Louisville - Computer Fair South
MA - Cambridge - MIT Flea Market
NJ - Fairfield - MarketPro Computer Show*
OH - Akron - Computer Show & Sale

OCTOBER 20-21

FL - Starke - Hamfest & Computer Show

OCTOBER 20-21-22

CA - Concord - Pacific Division Convention

OCTOBER 21

CA - Santee - Ham, Computer & Electronic Swap Meet
IN - Noblesville - AGI Computer Fair*
MI - Westland - Great Lakes Computer Expo & Sale
NY - Buffalo - MarketPro Computer Show*
OR - Medford - Swap Meet
OR - Rickel - Swap-toberfest & ARES/RACES Convention
PA - Seneca - Ham Radio Auction & Flea Market
SC - Sumter - 9th Annual Hamfest & Computer Show
TN - Gray - Tri-Cities Hamfest

OCTOBER 21-22

AL - Huntsville - Computer Show
CA - Del Mar - MarketPro Computer Show*
FL - West Palm Beach - Hamfest & Computer Show
KY - Louisville - Computer Fair

OCTOBER 22

CA - Stockton - MarketPro Computer Show*
MI - Flint - Five Star Productions Computer Show
MI - Warren - USECA Swap
NY - Rochester - MarketPro Computer Show*
NY - Syracuse - Computer Show & Sale
PA - Sellersville - Hamfest

OCTOBER 27-28-29

OK - Kingston - Texoma Hamarama

OCTOBER 28

CT - Waterford - Ham Radio Auction
FL - Port St. Lucie - Hamfest '95
MA - West Springfield - MarketPro Computer Show*
MN - St. Paul - Hamfest Minnesota & Computer Expo
PA - Bethlehem - Computer Show & Sale

OCTOBER 28-29

NJ - Hackensack - KGP Computer Show*

OCTOBER 29

IL - Glen Ellyn - Computer Central
IN - Lebanon - ARRL Hamfest
MA - Southwick - Amateur Radio/Electronics Fleamarket
NY - Poughkeepsie - MarketPro Computer Show*
OH - Marion - ARRL Hamfest
PA - Newton - Ham & Computer Tradefest
*See Computer Show Promoter Info Box

ADVERTISER'S INDEX

ACP Super Store	99	Just Computers	25
Add-On America Corp.	127	KD Video	97
Advanced Educational Systems	16	KDE Electronics, Inc.	38
Alan Components, Inc.	59	La Paz Electronics Int'l.	97
Alfa Electronics	39	LJ Enterprises	130
All Electronics Corp.	110	L.R.T. Electronics	70
All Phase Video Security, Inc.	24	M ² L Electronics	12
Allison Technology Corp.	66	MD Electronics	130
Alltech Electronics Co.	91	MDM Radio, Ltd.	33
Alltronics	54	Memory Conversion Products	115
Andromeda Research	12	Memory Experts	66
AP Circuits	90	Metric Equipment Sales, Inc.	59
Ar ² Communications Products	15	MFM Communications	81, 99
Asset Sales, Inc.	11	MHZ Electronics, Inc.	60
Basic Electrical Supply & Warehousing Corp.	55	Makfit Research	137
Battery-Tech, Inc.	59	Master Components	13
Baylin Publications	114	MicroCom Industries, Inc.	103
BC Electronics	79	Micro Video Products	106
Bismar Computer, Inc.	42	Midwest Electronics, Inc.	8
Black Feather Electronics	129	Mikon, Inc.	51
Boss Distributors	111	Moore's Computers	49
Brigar Electronics, Inc.	44	Motron Electronics	67
BWC Company, Inc.	60	Mouser Electronics	16
C & H Sales Co.	25	MWK Industries	127
C & S Sales, Inc.	82, 124	National Cable Products	134
CA Grapevine	42	National Electronic Wholesalers	16, 133
Cable Box Wholesalers, Inc.	67	Netcom	50
Capital Electronics, Inc.	32	Northeast Electronics, Inc.	79
Cardservice International	107	Novaplex	22
Chenesko Products	32	Optoelectronics	4, 147
CME, Inc.	96	Parallax, Inc.	Back Cover
Computer Marketplace	134	PC Parts, Inc.	43
Communications		Picotronic	8
Electronics, Inc.	105	Phillips-Tech Electronics	37
Communications Systems		PM Electronics	107
Laboratories	61	Polaris Industries	51
Comtrad Industries	145	Prime Electronic Components, Inc.	114
Consumertronics	115	Products International	65
CPS Company	87	R & S Surplus	12
Crazy Bob's	13	Radio School	128
Cruising Equipment Co.	24	RA Enterprises	58
Cunard Associates	42	Ramsey Electronics, Inc.	122
Danbar Sales Co.	21	Roger's Systems Specialist	146
DBS Satellite	123	SC Engineering	7
Debco Electronics	107	Scott Edwards Electronics	95
Digiteq Security, Inc.	70	Skycraft Parts & Surplus, Inc.	61
Dominator Technologies, Inc.	55	Skyvision, Inc.	88
Earth Computer Technologies	81	Software Systems Consulting	89
E.H. Yost and Company	134	Solar Electric, Inc.	99
Electro Automotive	130	SPI Semiconductor	25
Electro Tool, Inc.	61	Star Circuits	134
Electronic Mall	60	Street Smart Security, Inc.	24
Electronic Materials		Sun Equipment Corp.	30
Recovery, Inc.	116	Symphony Electronics Corp.	119
Electronic Rainbow, Inc.	23	Synergetics	26
EMAC, Inc.	33	Syntax	15
Fair Radio Sales	43	Team America	67
Falkner Enterprises of America	66	Tecnet	42
Gateway Electronics, Inc.	104	Televue Distributors	74
GE Capital	31	Test Equipment Sales	60
General Device Instruments	33	The Filter Company, Inc.	66, 98
GMP Parts Company	81	The Halcyon Group	6
Graymark	79	The RF Connection	33
Green Brook Electronics	37	Tucker Electronics & Computers	2
Greenleaf Electronics	75	UCANDO Videos	106
Halted Specialties Co.	3	Universal Electronics, Inc.	119
Hamtronics, Inc.	137	Universal Radio	8
H.E.A.R.T. & Associates	80	U.S. Cable TV, Inc.	70
Highlander	28-29	VersaTech Electronics	99
HighText Publications, Inc.	96	Video Connection, Inc.	81
Hi-Q Products, Inc.	32	Vision & Motion Surplus	80
House of Batteries	94	Vision Distributors	90
H.T. Orr Computer Supplies	94	Visitect, Inc.	95
Independence Electronics, Inc.	90	Visual Communications, Inc.	50, 106
Index Publishing Group, Inc.	15	Western Test Systems	68-69
Intec Inventions, Inc.	43	Wheatstone Microsystems, Inc.	55
Intronics, Inc.	107	White-Star Electronics	138
J & M Microtek, Inc.	13	Wholesale Cable	94
Jade Products, Inc.	80	Xandi Electronics, Inc.	38
Javanco	38		

CLASSIFIED ADS

READ BY 80,000 QUALIFIED ELECTRONIC BUYERS, SELLERS, AND TRADERS EVERY MONTH!

HOW TO PLACE A CLASSIFIED AD

TYPE or PRINT your **ELECTRONICALLY RELATED** ad copy **CLEARLY** (not all caps) on the form provided or on a separate piece of paper. 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 photo 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). Enclose your name, address, and *Nuts & Volts* account number from your mailing label (if available) for identification purposes. Include full payment — **CLASSIFIEDS ARE RUN ON A PRE-PAID BASIS ONLY** — and mail your completed order to: **NUTS & VOLTS MAGAZINE**, 430 Princeland Court, Corona, CA 91719.

RATE PER WORD

The ad rate for **current PAID subscribers** is 30¢ per word. All others pay 60¢ per word. These rates apply to the first 150 words of your ad. From 151-200 words, the rate per word doubles to 60¢ and \$1.20 respectively. We do not accept ads over 200 words. There is a **\$4.50 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 (e.g., Ohio = OH). A phone number is one word. It will be most helpful if you would spell out words when submitting handwritten copy.

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 or reduce line art, or **\$8.00** for halftone of

photographs. To **BOX** your ad, include an additional **\$25.00** for copy-only ads, or **\$50.00** for ads with artwork or photos.

FAXING IN AD COPY

You may fax in ad copy or changes before the closing date (5:00pm on the 10th) at 909-371-3052 using MasterCard or Visa. Be sure to include the credit card expiration date, the name that appears on the card, a daytime phone number, and your *Nuts & Volts* account number. Ads faxed in without credit card information will not be listed as received until payment is received in full. Due to the large number of ads received, **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 (10th of the month) will appear in the following month's issue. For example, ads received by May 10th will run in June. Ads postmarked through the 10th, but received after the closing date, will be placed in the next available issue. No cancellations or changes after the 10th. 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. The magazine is mailed on or before the 1st of the month. 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 30¢ 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 copy.

CHOOSING A CLASSIFICATION

Select the appropriate classification for your ad(s) to appear in and mark it in the space provided below. If no classification is indicated, the ad(s) will be placed in the Misc. Section or wherever we deem most suitable. Available classifications to choose from are:

- 10. Ham Gear For Sale
- 20. Ham Gear Wanted
- 30. CB/Scanners
- 40. Music & Accessories
- 50. Computer Hardware
- 60. Computer Software
- 70. Computer Equipment Wanted
- 80. Test Equipment
- 85. Security
- 90. Satellite Equipment

- 95. Military Surplus Electronics
- 100. Audio/Video/Lasers
- 110. Cable TV
- 115. Telephone/Fax
- 120. Components
- 125. Microcontrollers
- 130. Antique Electronics
- 135. Aviation Electronics
- 140. Publications
- 145. Robotics

- 150. Plans/Kits/Schematics
- 155. Manuals/Schematics Wanted
- 160. Misc. Electronics For Sale
- 170. Misc. Electronics Wanted
- 175. BBS & Online Services
- 180. Education
- 190. Business Opportunities
- 200. Repairs/Service

PLEASE TYPE or PRINT CLEARLY — ONE WORD PER SPACE

AD #1 CLASSIFICATION _____

_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____

Total Words ☐ 30¢ Paid Sub or ☐ 60¢ Non-Sub = Subtotal + ☐ Bold Caps and/or ☐ Art/Photo + ☐ BOX IT ☐ \$25 copy only ☐ \$50 copy/art = Subtotal x No. of Issues = Total

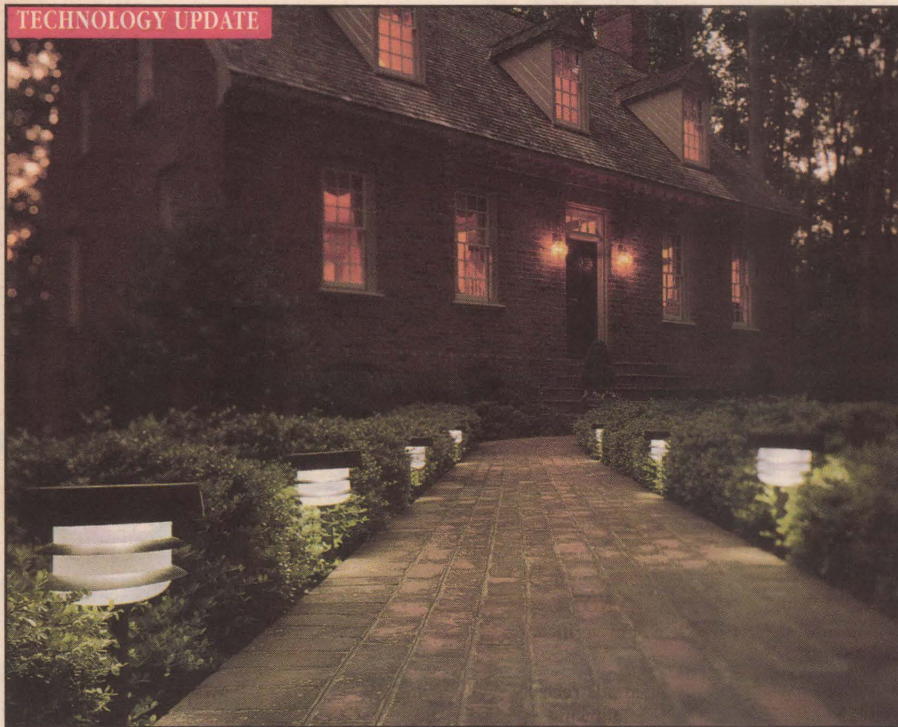
AD #2 CLASSIFICATION _____

_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____

Total Words ☐ 30¢ Paid Sub or ☐ 60¢ Non-Sub = Subtotal + ☐ Bold Caps and/or ☐ Art/Photo + ☐ BOX IT ☐ \$25 copy only ☐ \$50 copy/art = Subtotal x No. of Issues = Total

NV Account # _____ MC/Visa _____

Exp. _____ Name _____



Harness the power of the sun!

The breakthrough Solar Liteguard is the only solar light that accents your home at night and has a built-in motion detector that gives you an after-hours security system!

by Brad P. Richardson

Even police officers agree that light is one of the best deterrents to crime. Most of us feel uncomfortable if we come home after dark and have forgotten to leave a light on. And it's not just crime; there's always the possibility of tripping on something in the path. Darkened houses and walkways are unsafe in many ways—especially if you live in a populated area. Now you can harness the energy of the sun by day to protect you at night with the advanced technology of a pathway light that is also equipped with a motion sensor—the new Solar Liteguard.

The security of a motion sensor. The only one of its kind, Solar Liteguard is the first to combine the advanced technology of

passive infrared (P.I.R.) motion detection with the convenience of energy-saving solar technology. When motion is detected, Solar Liteguard automatically comes on and stays on for two minutes. If motion continues, the light automatically resets to deliver consistent light. When motion ceases, the light will remain on for two additional minutes. A special three-zone lens allows Solar Liteguard to detect motion from 20-30 feet away at an 80-degree angle.

Protect and beautify. Solar Liteguard gives you the option, you can set the lights to automatically come on after dark and stay on for up to three hours. Or choose the extra security of motion sensor lights to welcome guests or warn of intruders. Either way, the

advanced 2,000-hour incandescent bulb provides a soft glowing light that will accent gardens and walkways, and enhance the beauty of your home.

Aerospace solar technology. Solar Liteguard uses the latest technology to harness the sun's power. Originally for aerospace use, the advanced crystalline solar panels in Solar Liteguard are not affected by aging, so they will retain their charging efficiency indefinitely. Plus, the solar panels gather energy and convert it to charge the power source 30% faster than amorphous solar panels. And a special reflective coating actually increases the duration of the lighting time.

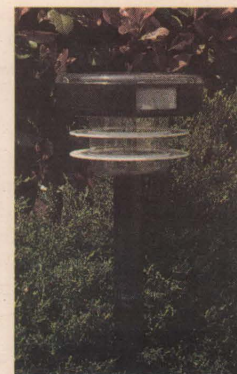
Weatherproof and maintenance-free.

Solar Liteguard's special weatherproof design allows water to pass right through the light fixtures. And, all circuits and switches are coated to protect them from the elements. Made of all non-corrosive materials, these lights are designed for years of reliable use. Since there's no wiring of any kind required, installation is a snap.

Try it risk-free!

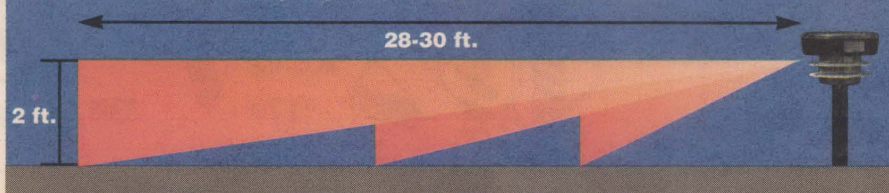
All Comtrad products are backed by our 90-day risk-free home trial. If you are not satisfied for any reason, just return Solar Liteguard and receive a full refund—"No Questions Asked." Solar Liteguard is also backed by a one-year manufacturer's warranty on the light and a five-year warranty on the solar panel. Most orders are processed in 72 hours and shipped UPS.

With Solar Liteguard, the energy of the sun can make your home more secure. And you are less likely to trip over objects in the path.



The only solar motion sensor available

Add the extra protection of motion sensor lighting to your home without having to wire a separate motion detector—Solar Liteguard has one built right in! Using invisible passive infrared lightwaves, it can detect motion from 28-30 feet away within an 80-degree arc. When motion is detected in this field, the infrared waves are interrupted, and Solar Liteguard automatically turns on and stays on—for two minutes or until motion ceases. You can also choose continuous lighting for up to three hours of illumination.



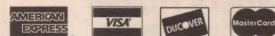
Special offer! Take advantage of this special factory-direct offer to protect and beautify your home for even less! For a limited time, when you buy any additional Solar Liteguard fixtures, you'll get \$10 off the cost of each light!

Solar Liteguard.....\$79 (each) \$6 S&H
additional Solar Liteguard lights...\$69 each

Please mention promotional code **982-NV-5816**.

For fastest service, call toll-free 24 hours a day

800-992-2966



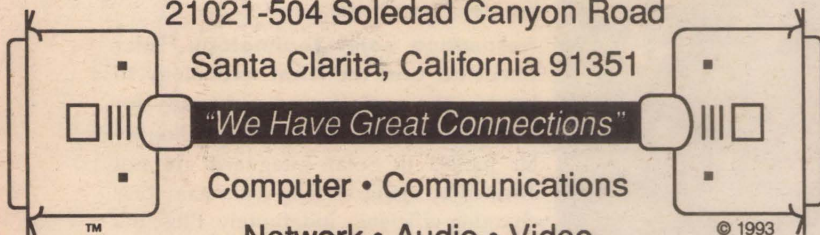
To order by mail, send check or money order for the total amount including S&H (VA residents add 4.5% sales tax.) Or charge it to your credit card by enclosing account number and exp. date.

COMTRAD INDUSTRIES

2820 Waterford Lake Drive, Suite 106
 Midlothian, Virginia 23113

Roger's Systems Specialist

21021-504 Soledad Canyon Road
Santa Clarita, California 91351



Computer • Communications

Network • Audio • Video

Cables ★ Connectors ★ Accessories

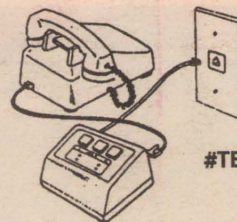
Free catalog with any order!

800-366-0579

805-288-2288



Fax 805-288-2293



#TE-SW4

\$5.00 each 4 for \$18.00

Two Line Telephone Switch

Connect two telephone lines to any single line telephone

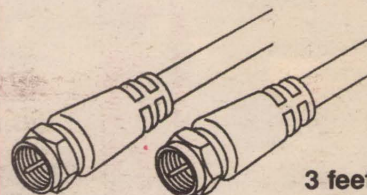
Hold Button

Ring Light

Indicator Light

Television Cable

50 feet "F" to "F" Cable
RG-59 Coax



\$2.50 each

#VC-50F

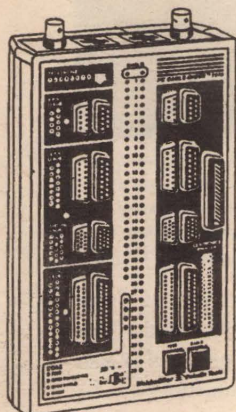
10 up **\$2.00**

3 feet to 25 feet also available

Paladin Cable Tester

Tests DB9, DB15, DB25
36 centronics
RJ-45, RJ-11, BNC & HD15
36 Individual L.E.D's for each line

\$139.00 #TM-157



Stereo Headphones

For Sound Cards or Compact Disc Stereo
10 Ft. Cord Super-Dynamic

\$8.00 #TM-170

Pear Shape High Quality
Walkman Type

\$3.00 #TM-171

Digital Stereo Headphone
Mono Microphone Combo!

\$18.00 #TM-169



SCSI I and SCSI II

3' SCSI I to SCSI II

\$20.00 #CC-679

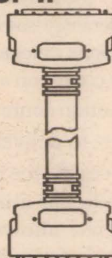
6' SCSI I to SCSI II

\$26.00 #CC-686

3' SCSI II to SCSI II

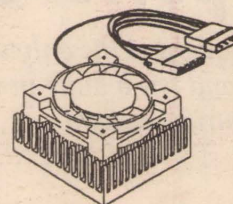
\$24.00 #CC-678

SCSI III also available



Heat Sink with Fan

Easy power hook-up!
works with ZIF Socket
Clips to Chip



486/66 CPU

\$7.00 #TM-FAN-2

Pentium 586/66 CPU

\$10.00 #TM-FAN-66

Pentium 586/90 CPU

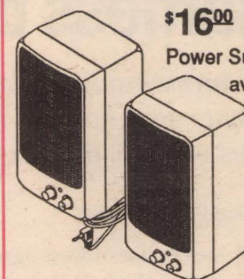
\$10.00 #TM-FAN-90

Koss Stereo Speakers

Separate Bass, Treble Controls
10 Watt per channel
Refurbished

\$16.00 #TM-172

Power Supply
available **\$4.00**

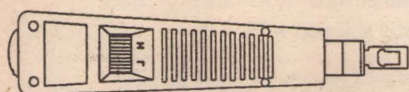


Computer Speaker

For IBM Clones
2" Internal Replacement Speaker
Easy to install

#TM-123

\$1.00 6 for \$5.00



110 66

Paladin

Impact Punch Down Tool
#TE-Pun-66 #TE-Pun-110

\$55.00 each

Power Supply Fan

For Mid-Tower or Auxiliary fan, 7 blades
12 volts 3 1/8" x 3 1/8" x 1"

\$5.00 20 up \$4.00 #TM-FAN



Ten Base "T" Cables

Category 5 / PVC Jacket

\$4.00 6 ft #TE-068-L5

\$6.00 12 ft #TE-128-L5

\$8.00 25 ft #TE-258-L5

\$14.00 50 ft #TE-508-L5

\$26.00 100 ft #TE-108-L5

CMOS Battery Holder

Holds 4 "AA" batteries
with 10" Lead

#TM-124

\$1.00 20 up .83¢

Duplex Wall Plate

Top Quality
Beige Color
MFG By Allen Tel
U.L. & CSA Approved

#TE-WPD-6
6c (RJ-14)



Other phone
accessories available

.75¢ 50 up .60¢

AC to DC Converter

Universal
Multi-voltage 1.5v - 12v DC
6 Different Connectors
Polarity Switch

#TM-307 \$3.00

500ma

#TM-310 \$5.00

1000ma



Game Port to MIDI Musical Instrument Interface

6' DB15 male-female
Soundblaster Compatible
2 - 5 pin DIN male



#CC-155

\$17.00

Microphones

General Purpose
Large Dynamic Mic
1/4" to 1/8"
Adaptor Included
20' cord

\$4.00 #TM-MIC

Condenser
Clip-on Mic
1/8" Plug
10' cord

\$3.00 #TM-MIC2

\$10.00 minimum order required • Add \$4.50 for shipping for pre-paid orders • California residents add 8.25% tax
Call for quantity discounts • No out of state checks accepted • Most orders shipped same day • Drawings are representations only

We don't make SCANNERS, We make them more *FUN* to use

Featuring The **OptoScan535:**
Computer Controlled Scanning,
Tone Decoding and Increased
Scanning Speed for the Pro-2035



Introducing the OptoScan535, the next generation in computer controlled interface boards for the Radio Shack series of scanners. A Pro-2035 with an OptoScan535 is not only faster than an unmodified Pro-2035, it is faster than any other scanner using computer control. And that's just scratching the surface.

The OptoScan535 comes with two built-in CI-V interface convertor jacks, eliminating the need for an external convertor box. The OptoScan535 modification provides decoding on screen of CTCSS, DCS, and DTMF (Touch Tone®).

In addition to the speed and performance computer control offers, the OptoScan535 can also be used with the revolutionary Scout™. The Scout Reaction Tune™ feature allows the Scout to simultaneously tune the Pro-2035 through the CI-V port the OptoScan535 modification provides.

Features:

- Computer control of the Pro-2035
- Decodes CTCSS, DCS, and DTMF tones
- Two built-in CI-V data ports
- Use with the Scout™ for Reaction Tune™
- Supported by Probe, Scanstar, Scancat, ScannerWear for Windows, Radio Manager for Windows and WAVE for Mac
- Import files from PerCon FCC database
- Records frequencies into memory locations while unattended
- AM, FM-Narrowband and FM Wideband modes are supported
- Includes Hardware, Computer serial cable, and Demonstration software

*We don't make scanners,
we make them more fun to use*

\$299

Scanner not included

CC50
Deluxe Vinyl
Opto Case.
Holds Laptop,
OS535
&
Accessories.
\$39



OPTOELECTRONICS®

5821 NE 14th Avenue Fort Lauderdale, Florida 33334

Ask about our ScanBlaster Systems; including the Scout™, OptoScan456 or 535 and an array of accessories at great savings.

Contact Factory for shipping prices. Visa, Master Card, & C.O.D. (cash or money order only)

All prices and specifications are subject to change without notice or obligation.

Order Line: (800) 327-5912

Tel: (305) 771-2050

Fax: (305) 771-2052

Made in the U.S.A

Write in 118 on Reader Service Card.

BASIC STAMP[®] MODULES

Stamp II has many useful new instructions

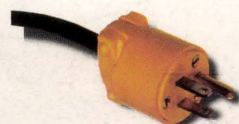
BASIC Stamps are perfect for many applications, from controlling model trains to monitoring factory sensors. They have 8 or 16 I/O lines, which can be used for a variety of digital and analog purposes. And to keep life simple, they're programmed in BASIC. Our special "PBASIC" language includes familiar instructions, such as GOTO, FOR...NEXT, and IF...THEN, as well as instructions for serial I/O, button debounce, DTMF tone generation, etc.

The BASIC Stamp Programming Package contains everything you need to program Stamps using your PC. The package includes our editor software, programming cables, manuals, application notes, and free technical support. The package is available for \$99; Stamps and carrier boards must be purchased separately.



DTMFOUT *

Generates DTMF tones with just one I/O pin, two capacitors, and a speaker. Another related instruction, **FREQOUT**, generates one or two tones simultaneously. Each tone is programmable in 1-Hz increments from 0-Hz to 32767-Hz.

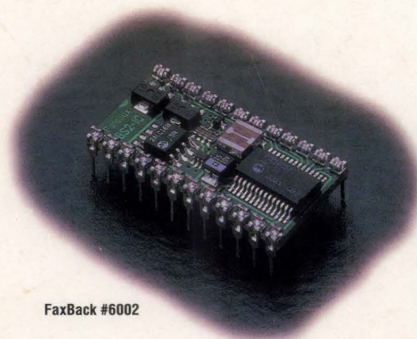


XOUT *

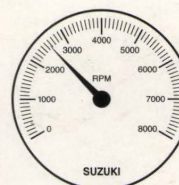
Generates standard X-10 powerline control signals using two I/O pins and an inexpensive TTL-to-AC converter module. Signals are received by small modules that control lights and appliances. Receiver modules are available from Parallax, Radio Shack, and other convenient sources.

* Only available on the Stamp II.

Attention local nerds and hackers: we're looking for 1 or 2 telephone tech helpers. A perfect set of abilities would include digital logic, PIC assembly language, and BASIC. Please call if you're interested.



FaxBack #6002



COUNT *

Counts cycles on an I/O pin. Makes tachometer and other count/time programs simple.

BASIC Stamp II Module (BS2-IC)

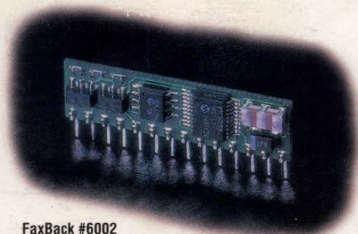
16 general-purpose I/O lines
2048-byte program space (600 instructions)
20-MHz clock (38400 baud serial, etc.)
\$49, \$69 with optional carrier board

SHIFTOUT *

Uses two I/O pins to control common serial-to-parallel shift registers. Can be used as a means of controlling many devices without using too many of the Stamp's I/O pins.

74HC595

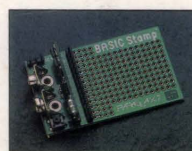
OUT1	1	16	VCC
OUT2	2	15	OUT0
OUT3	3	14	SERIN
OUT4	4	13	OE
OUT5	5	12	RCLK
OUT6	6	11	SCLK
OUT7	7	10	SCLR
GND	8	9	OUT7



FaxBack #6002

BASIC Stamp I Module (BS1-IC)

8 general-purpose I/O lines
256-byte program space (100 instr.)
4-MHz clock (2400 baud serial, etc.)
\$34, \$49 with optional carrier board



WHAT'S UP WITH THE STAMP II?

We've experienced countless delays with the Stamp II, and many callers have wondered what's wrong.

Well, there aren't any big bugs in the Stamp II, and the programmer didn't die. When we placed our first ads last year, we honestly thought we'd be done in December. With every passing month, we thought it was just a month away, which is why we didn't pull the ads.

As this is written in mid-July, we're shipping beta units and preparing to go into our first production run. This should lead to full production in August.

We're sorry for all the frustration we've caused, and we certainly don't wish to repeat the process anytime soon.



3805 Atherton Road, #102 • Rocklin, CA 95765 • USA • (916) 624-8333 • Fax: 624-8003 • FaxBack: 624-1869 (document #1000 is index) • BBS: 624-7101
E-mail: info@parallaxinc.com • Ftp: ftp.parallaxinc.com • World-wide-web: http://www.parallaxinc.com

Australia +61 3 720 5344 (PIC tools), +61 67 722 777 (Stamps) • Austria +49 241 15 4071 • Belgium +32 41 77 51 51 • Brazil +55 11 453 5588 • Canada (514) 336-9426 • Czech Republic +42 49 5813 252 • France +33 20 52 98 52 • Germany +49 241 15 4071 • Greece +30 1 902 0115 • Hong Kong +852 2720 0255 • Hungary +36 1163 2879 • India +91 422 232 561 • Israel +972 3 498 543 • Japan +81 3 3251 1779 • Netherlands +31 1803 17666 • Poland +48 34 648 882 • South Africa +27 11 907 8475 • South Korea +82 2 849 8567 • Sweden +46 223 228 67 • Switzerland +49 241 15 4071 • Taiwan +886 2 647 1978 • United Kingdom +44 1 977 683 665 • United States (800) 344-4539

BASIC Stamp & the Parallax logo are registered trademarks of Parallax, Inc. • Prices do not include shipping and applicable sales tax • Features and prices subject to change without notice. • Prices are U.S. prices only; prices in other countries may vary. 0795NV

NUTS & VOLTS MAGAZINE
430 PRINCELAND COURT
CORONA, CA 91719

FWD & ADDRESS CORRECTION REQUESTED