

elementary Electronics

MARCH-APRIL 1979

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BE A TARZAN IN THE PARTS BUYING JUNGLE, page 33

ELECTRONIC FACTS THAT ALL

Guards
me

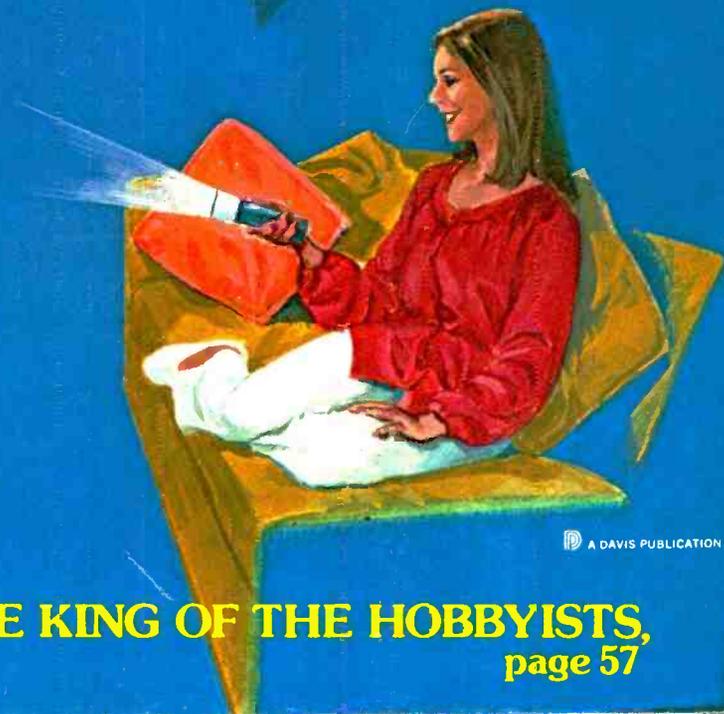
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- ✓ Updating the Radio Shack TRS-80
- ✓ Universal Whistle Switch
- ✓ Regency Flight Scanner
- ✓ Vigilite Timer
- ✓ E&L Mini Micro Designer
- ✓ Edmund Digital Thermometer
- ✓ Percom LFD-400 Floppy Disc
- ✓ Heathkit TV Vectorscope



FAREWELL TO THE KING OF THE HOBBYISTS, page 57

A DAVIS PUBLICATION



The Cobra 50XLR CB has it all. AM/FM Stereo. Cassette. And CB. All in one compact unit. All engineered to bring you the same loud and clear sound Cobra is famous for.

The remote mike houses the channel selector, squelch control, and channel indicator. So all you need for talking CB is right there in your hand. The cassette player features through the dial loading and four-way fader control.

Because they're only five inches deep, there's a Cobra in-dash radio to fit almost any car with little or no modification to the dash. This feature, plus the step-by-step Installation Manual and Universal

Installation Kit makes them the easiest in-dash radios to install. And our Nationwide network of Authorized Service Centers makes them the easiest to service.

There are four Cobra in-dash models to choose from including AM/FM/Stereo/8-track/CB. But no matter which you choose you can be sure of getting the best sounding radio going. The ultimate car radio.

The Cobra.



Punches through loud and clear.

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CIRCLE 6 ON READER SERVICE COUPON

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LX303

ALL THE MOST WANTED FEATURES AT A MOST WANTED PRICE...

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USE INDOORS OR OUT
200 HOUR 9V BATTERY LIFE
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100 nV DC F.S. SENSITIVITY
19 RANGES AND FUNCTIONS



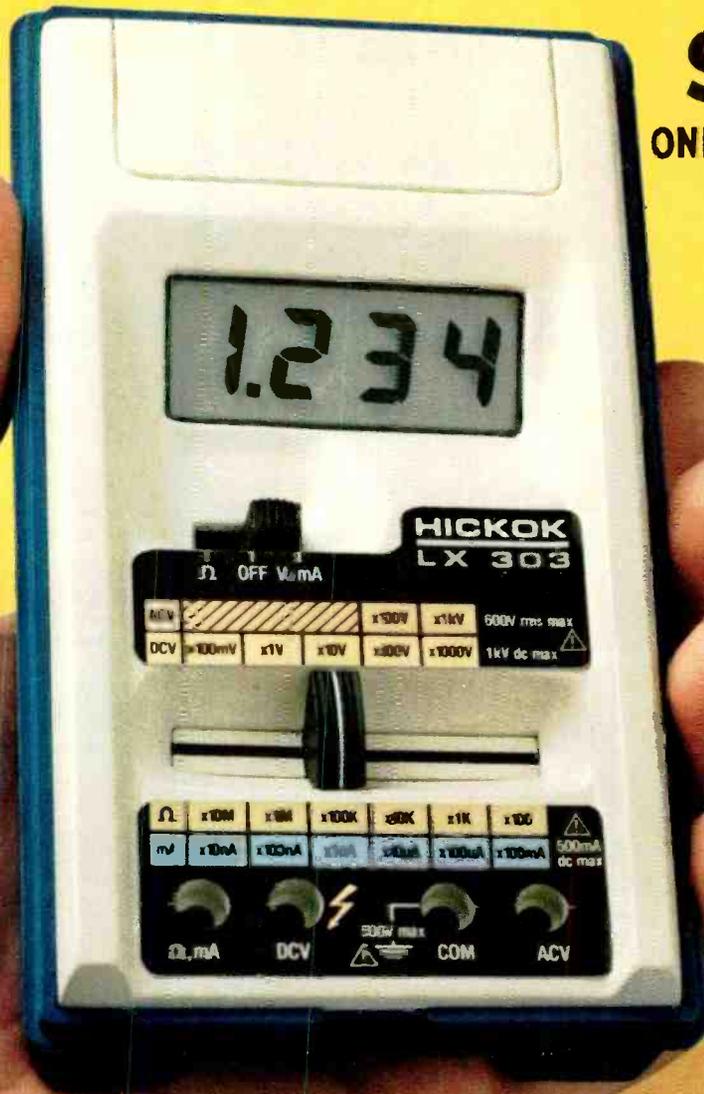
Removable cover stores test lead set furnished as part of the unit.



Available accessories include AC adapter, padded vinyl carrying case, 400V DC probe, 10 Amp EC shunt.



X-10 DCV probe adapter available for protecting input up to 10KV.



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Here is the handfull of accuracy you've been waiting for. Handsomely encased. Compact. Efficient. Only 12 ounces. Hickok's exciting, new LX 303, 3 1/2 digit Mini-Multimeter with high quality components, one year guarantee and rugged Cyclo-lac® case offers features previously found only in expensive units... at a price under \$75.00! So why wait any longer? The amazing LX 303 is here. NOW! Another American made test equipment breakthrough from Hickok, The Value Innovator. Order today!

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SPECIFICATIONS:

DC VOLTS (5 RANGES): 0.1mV to 1000V; Accuracy $\pm 0.5\%$ rdg $\pm 0.5\%$ f.s.; Input imped: 10M Ω ; Max. input 1kV except 500V on 200mV range.

AC VOLTS (40Hz to 5kHz): 0.1V to 600V; Accuracy: $\pm 1.0\%$ rdg $\pm 0.5\%$ f.s. (-2 dB max. at 5kHz); Max. input: 600V.

RESISTANCE (6 LOW POWER RANGES): 0.1 Ω to 20M Ω ; Accuracy: $\pm 0.5\%$ rdg $\pm 0.5\%$ f.s. ($\pm 1.5\%$ rdg on 20M Ω range); input protected to 120VAC all ranges.

DC CURRENT (6 RANGES): .01nA to 100mA; Accuracy: $\pm 1.0\%$ rdg $\pm 0.5\%$ f.s.

DIMENSIONS AND WEIGHT: 5-7/8" x 3-3/8" x 1-3/4", 12 oz.; **POWER:** 9V batt. (not incl.) or Hickok AC adapter; **READ RATE:** 3/sec. **OPERATING TEMPERATURE:** 0°-50°C.



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James Barbarello, Anthony Caristi, James Fred, Herb Friedman, Larry Friedman, Harry Helms, Jr., Don Jensen, Christopher Kilian, Lewis Kornfeld, Kathi Martin, Ralph Perry, Hank Scott, Gordon Sell, Walter Sikonowiz, Thomas Sundstrom, Thomas Williams



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It won't be hard.

Just tell yourself about the Adams—President's finest SSB mobile—and about how you'd enjoy the extra range and performance of SSB.

Take yourself into a President dealer and show yourself how beautiful this machine would look in your machine.

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And don't forget to point out how the Adams keeps an ear out for you on three channels at once—

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Now clinch the deal by mentioning President's superior quality in design, electronics and craftsmanship.

You'll have talked yourself into the best.

And, after all, don't you deserve it?

Because we want you to have the best in service, installation, warranty back-up and accessories—as well as the best CB—President is available through independent dealers specializing in CB.



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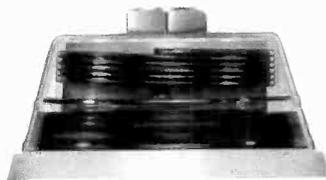
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ELEMENTARY ELECTRONICS/March-April 1979

3

These new **Persuader™ Antennas** low profile, extra long whip deliver performance equal to, or better than anything else on the road!

There's a hand-wound, hand-tuned coil in the cup...



a major advance in antenna technology from the Antenna Pros field tested and field proven by thousands of CBers

Only \$34.98 suggested retail. Compare with K-40 at \$38.50 or any other antenna. You'll see there's no comparison.

5 year guarantee

Materials and workmanship of PERSUADER ANTENNAS (Models 13505 & 17605) are guaranteed for a full five years if this antenna is installed by the dealer and a full three years if this antenna is installed by the consumer.

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When you buy this antenna, my reputation... built over 38 years in the antenna business... will be riding on your roof. I'm confident that the Persuader Antennas will persuade you... you've chosen the Best.

M.R. Friedberg, President
Antenna Incorporated

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Completely pre-assembled and pre-tuned

Just take it out of the package, and install it on the car. No tuning necessary... check it out with a watt meter and see for yourself!

Super-good looking low silhouette design. Your choice of cup colors design-coordinated to late-model cars.

SIERRA BRONZE



DIAMOND-FIRE BLACK



ATLANTIS BLUE



FIREHORN RED



SNOWCAP WHITE



CLASSIC SILVER AS SHOWN

AND CRYSTAL CLEAR

60" Stainless steel tapered whip... and NO spring

There's a Coil-in-the-cup

Magnet Mount



These features will persuade you... The Persuader™ Antenna is Your Best Antenna Choice

60" Stainless Steel Tapered Whip...and No Spring

The super-long whip increases the aperture of the antenna. This increases

- the signal capture area on reception
- the transmit signal and radiation intensity at the horizon
- bandwidth to well over a 40-channel capability

The .125" diameter whip is tapered, so shock is distributed evenly. There's no spring to stretch, break, or bend the whip away from the straightest possible upright position.

Exclusive coil-in-cup design

Loading of most low-profile antennas is by a simple printed circuit board that can't be tuned and will eventually burn out. These new Persuader antennas are completely pre-assembled and pre-tuned and feature an actual hand-wound, hand-tuned copper wire loading coil tested with 500 watts, rated at 100 watts continuous. It's even more efficient than our base-loaded coils because it's wound to a larger diameter, with fewer turns.

This unique design also involves fewer mechanical and electrical connectors—fewer resistive contacts between loading coil and cable terminations—less chance for dust, moisture or road gunk to contaminate the contacts.

This concept has been field tested by thousands of CBers in our Model 13503 (shorter whip, plain white cup). Your good buddies will tell you everything we say about it is true.

Available with Trunk-Lip or Magnet Mount

for performance:

- SWR of 1.5:1 or less across all 40 AM and SSB channels.
- Shunt-fed loading coil is DC grounded for quiet performance; bleeds off static from rain, snow, air particles. Performance is virtually identical to body mount antennas.
- Center-roof placement of magnet mount provides your most uniformly omni-directional signal. (Can also mount on trunk lid).
- Unique Antenna Incorporated design provides capacitive coupling. Aluminum plate puts the ground potential right at the mounting surface.

for convenience: Magnet and trunk lip, the two easiest installations! Place the antenna where you want it, plug the cable into the transceiver. No holes to drill. Readily removed for anti-theft protection. Magnet mount supplied with 12' RG-58/U coaxial cable with PL-259 type connector; trunk lip mount with 17' of cable.

for magnet mount adherence: Heavy-duty 2½" magnet in plastic cup with soft rubber gasket. Holds at top highway speeds of 55 mph. (Trunk lip mount recommended for vinyl roof cars.) Since it won't walk, it won't detune! "Oil-can" effect of cup; resting on gasket, provides a larger magnet plane than if the magnet itself were touching the surface—yet there's less weight on the car, less scratch potential.

All magnet mount benefits are standard... not an extra-cost accessory!

Hey, look me over

Showcase of New Products

Wireless Microphone

A micro-miniature wireless microphone developed by MLI Industries can pick up and transmit voices and other sounds through any standard FM radio. MLI's Micro Mike has an on-off switch. No need to take the battery out to turn it off. The Micro Mike is a condenser-type



CIRCLE 44 ON READER SERVICE COUPON

microphone. Approved by the FCC, the mike operates on a 1.3 volt battery with a life of 60-80 hours of continuous use. Micro Mike is continuously tunable to any frequency between 88 to 108 MHz, and has a range of up to 100 feet from the radio indoors, and 300 feet outdoors. Priced at \$19.95 (including battery) plus \$1.50 postage and handling charges, the mike can be ordered directly from MLI Industries, Dept. PR1, 50 Hunt St., Watertown, MA 02172.

CW/SSB Active Filter

The MFJ Enterprises MFJ-721 Super Selector CW/SSB Filter has a built-in 2 watt audio amplifier, switchable noise limiting, and an input selector switch for two rigs. The CW filter is an eight-pole (4 cascaded stages) active filter centered nominally at 750 Hz. It has four selectable bandwidths: 180, 150, 110, and 80 Hz. In the 80 Hz position, the



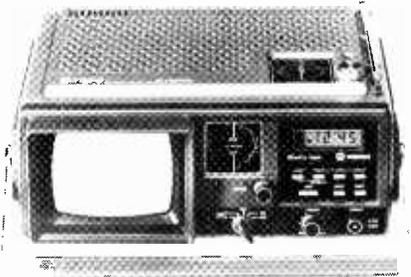
CIRCLE 69 ON READER SERVICE COUPON

response is at least 60 dB down one octave from the center frequency. It drastically reduces noise and provides up to 15 dB improvement in signal to

noise ratio. With a pair of stereo headphones, simulated stereo reception provides the narrow filtered signal to one ear and the unfiltered signal to the other. The ears and brain reject interference but allow off-frequency calls to be heard. The SSB filter dramatically improves readability by optimizing the audio bandwidth to reduce sideband splatter, remove low and high pitched QRM, remove hiss, remove static crashes, remove background noise, and eliminate 60 and 120 Hz hum. The MFJ-721 requires 9 to 18 VDC and an optional AC adapter is available. The price is \$59.95. To order, call toll-free 800-647-8660 or mail the order to MFJ Enterprises, P.O. Box 494, Mississippi State, MS 39762. Include \$2.00 for shipping and handling.

High Technology TV

Webcor has introduced a portable, lightweight TV and AM/FM radio with built-in LCD quartz alarm clock. The clock's alarm triggers the radio or TV, and the clock operates on its own battery so that it is always running. The screen size is 4½-inches, and a shadow mask around the screen facilitates daytime or outdoor viewing. Large Scale Integrated circuitry provides excellent sensitivity, picture definition, and brightness. Channel selection on the TV section is accomplished with an electronic varactor VHF/UHF tuner, and tuning of the AM/FM radio section is aided by an electronic eye. The unit operates on any of four power



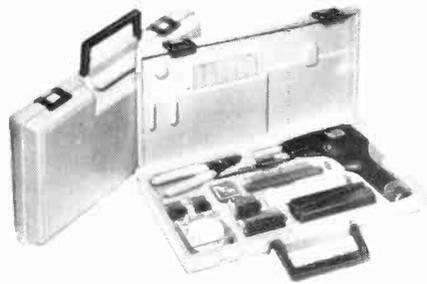
CIRCLE 76 ON READER SERVICE COUPON

sources: standard AC, D-cell batteries, rechargeable battery pack, or twelve volt car or boat electrical systems. Suggested retail price is \$249. An options package including a car/boat cord for twelve volt operation, rechargeable battery pack, and D-cell batteries retails for \$49. Webcor is a division of Leisurecraft Products, Ltd., 28 South Terminal Drive, Plainview, NY 11803.

Wire Wrapping Kit

A new Wire Wrapping Kit, Model WK-5B, contains a complete range of tools and parts for prototype and hobby applications, all conveniently packaged in a handy, plastic carrying case. The kit includes: Model BW-630 battery wire wrapping tool, complete with bit and sleeve, Model WSU-30, a remarkable new hand wire wrapping/unwrapping/stripping tool, a universal PC board, an edge connector with wire-wrapping terminals, a set of PC guides and brackets, a mini-shear with safety clip, industrial quality 14, 16, 24 and 40 pin DIP sockets, an assortment of wire-wrapping terminals,

HEY, LOOK ME OVER



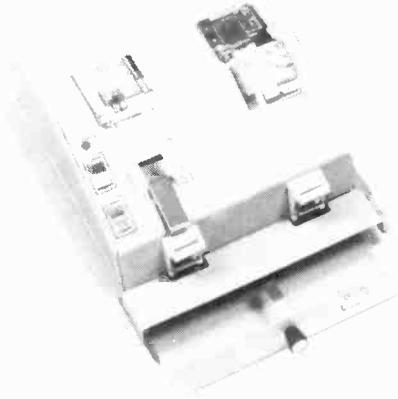
CIRCLE 59 ON READER SERVICE COUPON

a DIP inserter, a DIP extractor, and an unique 3-color wire dispenser complete with 50 feet each of red, white and blue Kynar insulated, silver-plated solid AWG 30 copper wire. Priced at \$74.95, the WK-5B wire wrapping kit is available from your local electronics distributor or directly from O.K. Machine and Tool Corporation, 3455 Conner Street, Bronx, NY 10475.

A Lot of Punch

The NCE/CompuMart has a warehouse full of still-in-the-box paper tape reader/punches which they interfaced to operate with a standard acoustic coupler or an RS-232-compatible interface. A version of this unit with a parallel interface is also available. The interface converts the mechanical reader contact inputs and punch solenoid outputs to RS-232 levels and ASCII codes for easy

connection to a computer. It can even be used as a remote paper tape terminal using an RS-232 acoustic coupler. Dump your complex programs on paper tape for long term, safe storage. Ready to plug in, the serial version of the unused units sells for \$895.00, and the parallel model sells for \$695.00. For



CIRCLE 49 ON READER SERVICE COUPON

more information, contact NCE/CompuMart, P.O. Box 8610, Ann Arbor, MI 48107, or call toll-free at 800-521-1534.

High-Style Base Station

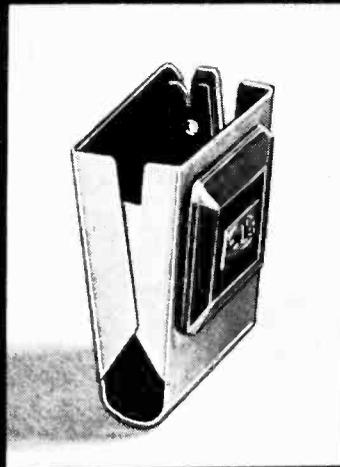
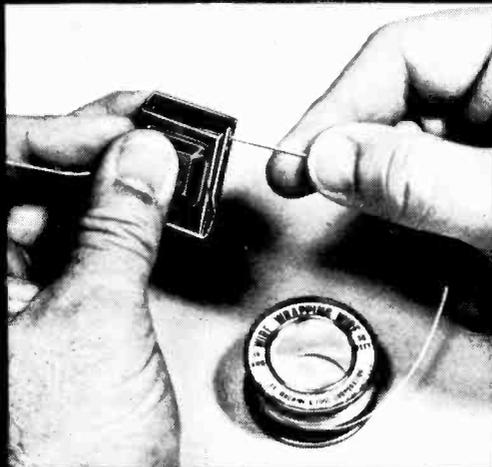
The new 40-channel Viking 430 CB base station by Johnson is a desk-top unit with styling features and a wood-grain



CIRCLE 66 ON READER SERVICE COUPON

vinyl-clad steel cabinet which incorporates Johnson's latest performance technology for crisp, authoritative transmissions, and quiet, clear reception. Johnson's noise blanker and an automatic noise limiter circuit clean up signals, and the large speaker gives crisp, clear audio quality. The built-in amplified speech compressor eliminates the need for power-boosting microphones and similar accessories. The Viking 430 also features PLL frequency synthesizer, solid-state T/R switching, two-position range control, touch-indexed knobs, built-in public address capability, and can be operated from AC household current, or 12-volt negative ground DC current. The unit comes with a detachable hand-held microphone. A desk top microphone is available. Viking 430 is U.S.-made and carries Johnson's one-year parts and labor warranty, with service available through Johnson's nationwide network of authorized service centers. Suggested retail price \$229.95. ■

CLIP AND STRIP



Model CAS-130

\$198

- CUTS AWG 30 WIRE TO DESIRED LENGTH
- STRIPS 1" OF INSULATION

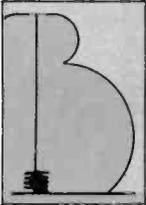
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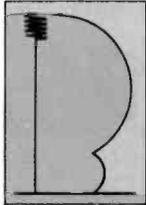
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The Great Breakthru!

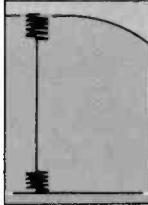
Computer Engineered Duo-Phased Performance!



Powerwave of Base Loaded Antenna



Powerwave of Top Loaded Antenna



Powerwave of Shakespeare's Two Load™ Antenna

NEW LONGER RANGE!
NEW TALKPOWER!
NEW STRENGTH!
NEW MOUNTS!

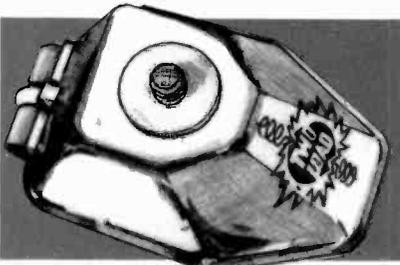
Black or White!

Shakespeare's computer engineered **Two Load™ Antenna** doubles the advantage of both base and top loaded antennas. Base loading means low SWR. Top loading gets the signal out! With loading coils stacked and co-phased in the vertical mode, the Shakespeare Two Load™ multiplies your signal in all directions...**power up** to get out over the top of nearby interference...**power down** to ensure superior performance and low SWR

Big New Bonus in Reach and Range

TIP LOAD...the top loading coil is completely encased in Shakespeare's exclusive fiberglass process. No bulge. No lump. No exposed coil. And the sleek, thin design stays erect at highway speeds.

BASE LOAD...the Shakespeare base loaded coil is your booster...promising extra performance and delivering a true power match.



PLUS...the new sculptured chromed trunk mount that has Detroit cheering. With built-in electronics. A moulded rubber shield to protect your car's finish. And the new **Spin-Off/On Feature** lets you laugh at the guys at the car wash. The stud is stainless...the housing sealed...making the entire unit moisture proof and completely corrosion resistant!



Two Load™ Antenna
 Style 50C0-1B Trunk
 Lid Mount: with
 "Duo-Phased" loading.



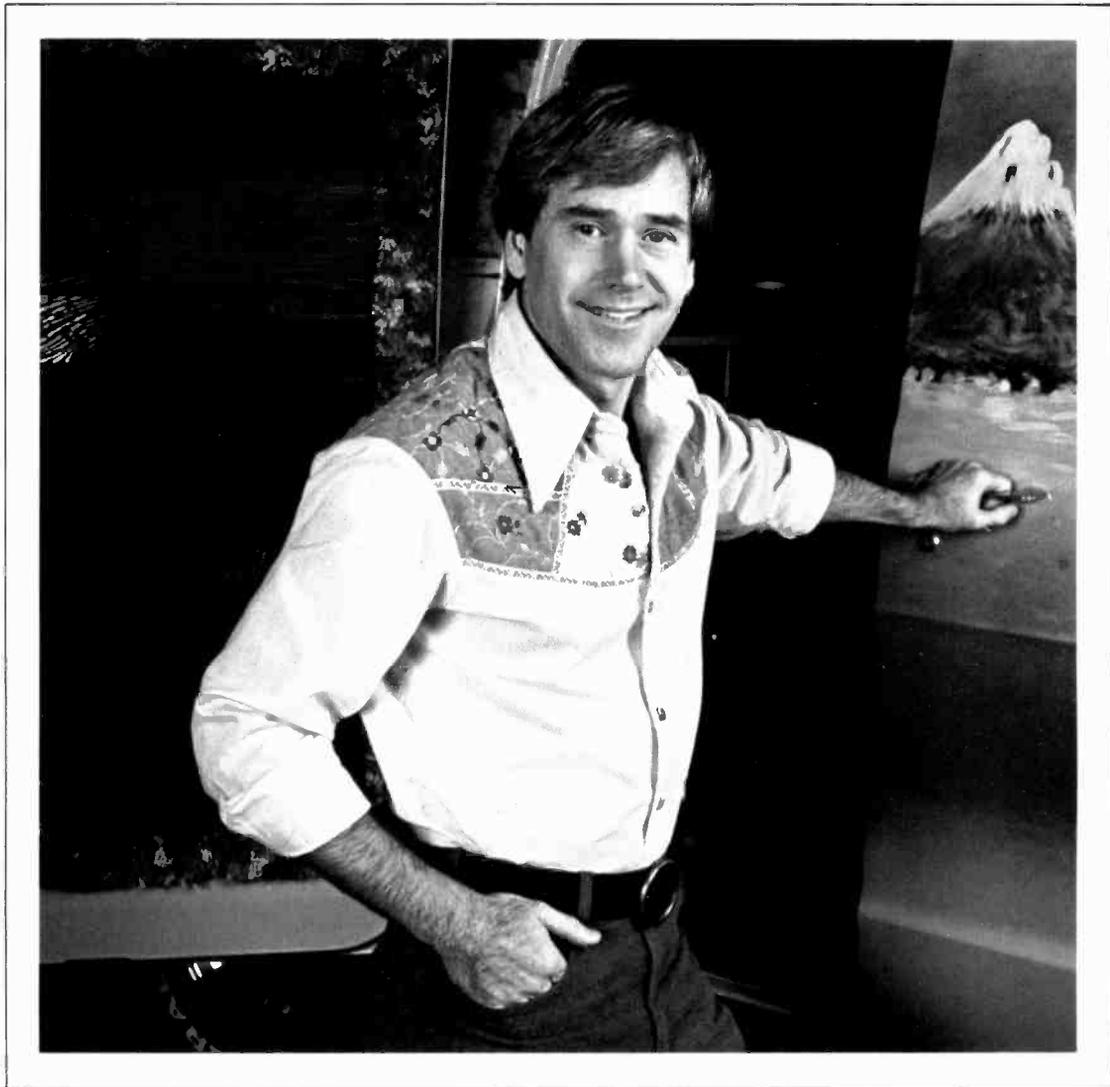
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**When you do, you'll probably pick CIE.
You can't afford to settle for
less when it comes to something like
electronics training that could
affect your whole life.**

When you shop around for tires, you look for a bargain. After all, if it's the same brand, better price — why not save money?

Education's different. There's no such thing as "same brand." No two schools are alike. And, once you've made your choice, the training you get stays with you for the rest of your life.

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* * *

If you talked to some of our graduates, chances are you'd find a lot of them shopped around for their training. They pretty much knew what was available. And they picked CIE as number one.

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We hope you'll shop around. Because, frankly, CIE isn't for everyone.

There are other options for the hobbyist. If you're the ambitious type — with serious career goals in electronics — take a close look at what we've planned for you at CIE.

What you should look for first.

Part of what makes electronics so interesting is it's based on scientific discoveries — on ideas! So the first thing to look for is a program that starts with ideas and builds on them!

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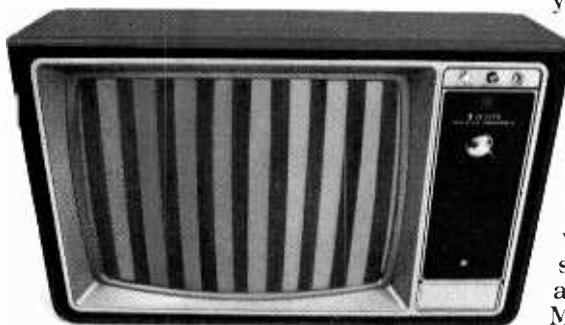


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Electronics in the News!

IBM Detects Forgeries

An experimental signature verification system invented at IBM's Research Division has detected the difference between forged and genuine signatures in realistic field testing. The system may someday be used in controlling access

to sensitive data, devices or locations.

In field trials of the system, held at an IBM facility, 2,907 of 2,958 verification attempts (98.3 percent) were accepted. An even greater proportion of forgery attempts, 490 of 492 (99.6 percent), was rejected. The 2,958 valid signatures were collected from 248 individuals, who volunteered for the field trials. The "forgery" attempts were made by some staff members from the Thomas J. Watson Research Center who tried to fool the machine.

The new system measures data as a signature is actually being written. Small accelerometers and a pressure detector built within the barrel of a pen linked



IBM Research scientists have invented an experimental signature verification system which has detected the difference between forged and genuine signatures in realistic field testing. Two IBM scientists, Nicos J. Anthony (left) and Noel M. Herbst, look on as a third, Chao N. Liu, registers his signature with a special pen.

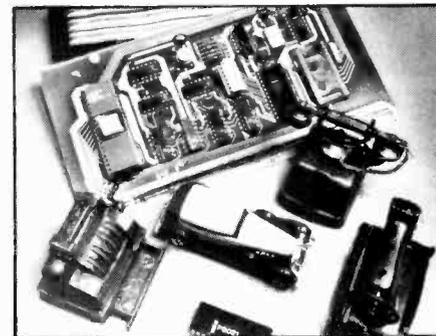
to a computer detect the differences in accelerations and pressure, as well as the revealing hesitations, that can betray attempts to forge a signature.

Cheapie Chip

The 8021 single-chip microcomputer made by Intel is the lowest-priced 8-bit microcomputer ever offered to equipment manufacturers. It's priced at \$3.00 each to large OEM buyers. Moreover, the 8021 is ideal for applications such as home appliances, test and measurement instruments, automotive, sensing/recording instruments and telecommunications.

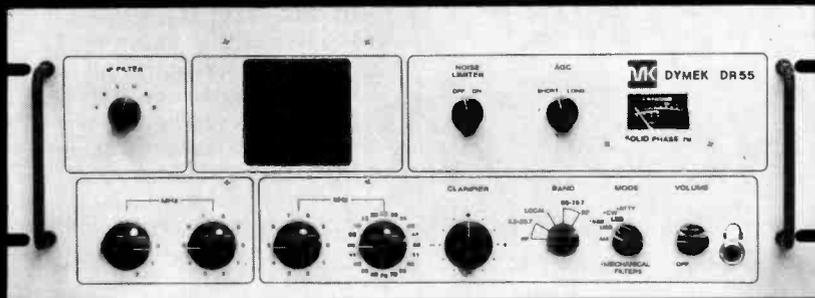
For this low price, the OEM (original equipment manufacturer) can obtain a complete, stand-alone, single-chip system containing an 8-bit central processor, 64 bytes of read/write data memory, 1024 bytes of program memory, 21 input/output lines, and all other generally required functions, including a programmable interval time/event counter, and very cost-effective on-chip system clock and oscillator.

The 8021 will find its way into consumer products eventually. Thermostatic use for heating and cooking applications are obvious. Toys offer unlimited applications.



The lowest cost single-chip microcomputer ever offered, \$3.00 in large OEM quantity, the Intel 8021 microcomputer, shown in foreground, serves a wide range of control applications: telecommunications, automotive, home appliances, and process control are notable examples.

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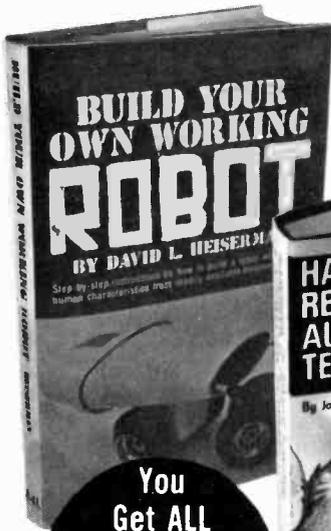


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CIRCLE 36 ON READER SERVICE COUPON

DX central reporting

A world of SWL info!

BY DON JENSEN

□ NORMALLY, IN DX CENTRAL, I don't get involved in radio amateur doings. There are several fine magazines devoted exclusively to ham radio. And, while some of you are amateurs, most readers of this column are into DX listening.

But because so many readers have been asking about DX'ing satellite signals, let's take a look at the amateur radio satellite transmissions of OSCAR 8.

OSCAR 8 uses a shortwave frequency of 29,402 kHz. Transmissions are in code, not voice, but don't let this deter you from trying to tune in this ham band beacon as it passes over your part of the country. OSCAR transmits a half dozen code groups, preceded by the word "HI" (di-di-di-dit, di-dit).

An earlier satellite, OSCAR 7, may also be heard on 29,502 kHz, with a somewhat similar beacon. It transmits 24 code groupings, beginning with the introductory CW (Morse) "HI HI."

OSCAR 8 has an orbit of just over 100 minutes. It usually can be heard during the evening hours, and it can be found by sheer patience, hanging on the frequency for a number of hours until you hear the beacon transmission during OSCAR's passage.

The exact time for an OSCAR 8 reference orbit is broadcast by the station of the American Radio Relay League (ARRL), the national amateur radio organization, located at Newington, CT. The OSCAR data is broadcast by the ARRL station, W1AW on 3,990, 7,290, 14,290 and 21,290 kHz at 0130 GMT.

If you live in the central part of the continent, listen for a later passage of the satellite, approximately an hour and three-quarters later. West Coast DX'ers can try about three and a half hours after the reference orbit time, or check again twelve and three-quarters, fourteen and-a-half, or sixteen hours later. Be patient!

This brief introduction is merely intended as a tip-off to non-hams that amateur radio satellite signals can be heard by DX'ers. If you want more detailed data about times and uses of the OSCAR satellites, I suggest you regularly read the amateur radio magazines or contact ARRL, Newington, CT 06111.

Voyageur's Last Voyage. In DX CENTRAL REPORTING's September-October 1978 column, I mentioned the fact that the European-style "hobby pirates" appeared to be invading North American shores.

Perhaps the most interesting of the recent pirates, because of its fairly long life (about eight months), its regular weekly schedule, its wide reception area (at least coast to coast and perhaps across the Atlantic) and its general wackiness, was the Voice of the Voyageur.

The Voice of the Voyageur, the self-styled "Free Broadcaster from the Mighty North", was heard nearly every Saturday night for at least a half an hour on 5,850 kHz. It called itself the champion of bootleg broadcasting and "voices" identified themselves by various names, including Bobby Bootlegger, A.F. Gain, R.F. Wavelength, Disco Dan, Slow Joe, and others. Its location? According to announcements, "one mile north of nowhere."

The station's first broadcast was on Christmas Day, 1977. Its last was August 20, 1978. Eight days later, the FCC raided and confiscated the Voice of the Voyageur's 100 watt AM transmitter.

During its lifespan, the DX'ing community speculated as to the identity of the operators and the location of the station. Some believed it was located north of the border in Canada, others supposed it was in Michigan or in Minnesota. As it turned out, the latter guess was right. After the federal agents silenced the station, the self-proclaimed "Top Man" of the station identified himself in several DX bulletins as Mike Martin of Crystal, Minnesota.

Apparently no prosecution will follow the raid, although it is possible under federal law. If pirate radio blossoms in the United States, it seems likely that somewhere along the line, the government will feel it necessary to take bootleg broadcasters to court.

Why has the hobby pirate radio movement flourished in Europe? It seems that the governments of the various countries more or less tacitly ignore these various unlicensed broadcasters as long as they stay within their own little self-defined frequency band and as long as they keep their power low. Those that have had illusions of going "big time", with more than 100 watts of power, have been quickly raided and shut down.

In the U.S., the FCC's position seems to be, from its actions, to try to shut off any illicit radio operation.

Any such station that uses much power and has anything like a regular broadcasting schedule (which, frankly, is a requirement if a station wants to attract an SWL audience) will be nailed, sooner or later. ■

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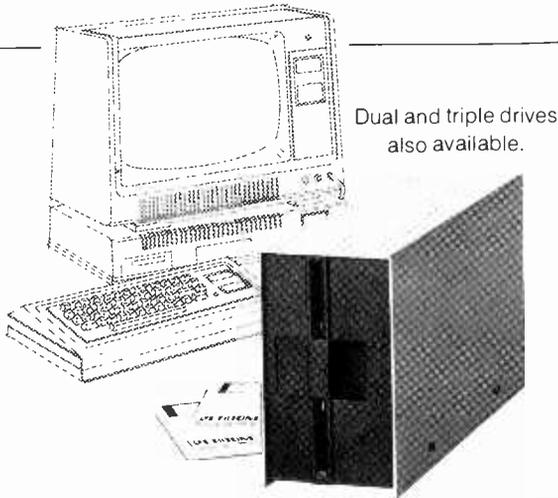
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CIRCLE 102 ON READER SERVICE COUPON

Got a question or a problem with a project—ask Hank! Please remember that Hank's column is limited to answering specific electronic project questions that you send to him. Personal replies cannot be made. Sorry, he isn't offering a circuit design service. Write to:

Ask Hank, He Knows!

**Hank Scott, Workshop Editor
ELEMENTARY ELECTRONICS
380 Lexington Avenue
New York, NY 10017**

Same Old Problem

Hank, my old hound would whine when I sent or received CW. So, I switched to SSB phone. Now the guy next door whines. He's 140 pounds heavier than my dog and we both fear him. What am I doing wrong?

—L. J., Detroit, MI

I knew a Dutchman who always put on an Irish brogue when he transmitted, and spent every Friday night at the local pub saying, "Ya, der Irish are dumbkoff hams!" He got away with it for a long time, but you've been caught early in the game. Understand that your neighbor does not enjoy your voice coming through his FM set and herringboning his TV set. Find the trouble. Start at your end. Check your modulation, any splatter? Keep that SWR down and inspect the antenna. Keep power down during prime TV hours. Install filters. Then visit your neighbor and give him a hand in inspecting his TV antenna. Be a sport, install the TVI filters at your expense. You'll find that both you and your dog will get to like the neighbor. Get him into your shack when you have a pre-arranged DX contact and let your neighbor chat a bit. If he gets involved with ham radio, your troubles are over.

Sounds Good

I hear a hi-fi outfit now makes quality ham gear. Do they have anything for 2 meters?

—L. V., Los Angeles, CA

You're putting me on? You are referring to the Trio-Kenwood people at 116 E. Alondra, Gardena, CA 90248. They make a beauty of an FM transceiver for 2 meters. It's the TR-7400A that sells for about \$400. Whatta rig!

Fails When Cold

Why is it TV antenna troubles always occur in the middle of winter?

—A. S., Lincoln, NE

Because TV antenna inspection and maintenance is never performed in the fall. Would you believe that my TV antenna is over 12 years old, and it is as good today as it was when new. I always replace the coax lead-in every other year. Bolts are checked, corroding rivets and hardware replaced.

Getting BASIC

Why can't the Personal Computer companies get together and come up with one cassette tape for loading BASIC language into any computer?

—D. J., San Diego, CA

Sounds like a good idea, but you need different programs for different chips. The 6800 chip doesn't speak the same machine language as the 8080 chip, so no one cassette tape can do the job. However, the industry should agree on two or three levels of basic: i.e., 4K, 8K, 12K, and put it all on ROMs that interface with CPUs. This way, everyone will start off with a universal BASIC language whereby any BASIC program from one manufacturer will work on another's personal computer, no matter what microprocessor chip is used.

Youngster Goes Antique

I am 14 years old, and I would like to start collecting antique radios. I have repaired and built radios before, it's just that I don't know how to find the old radios. Please help if possible.

—Carey Sartin
306 Radio Road
Sulphur Springs, TX 75482

Advertise, my boy, advertise. First, tell all your friends, relatives, and neighbors about your hobby. Put up a notice in your local supermarket. Your dad can help by putting a notice up in his office or factory bulletin board. Visit flea markets, tag sales, garage sales. Start thinking, you'll find more ways yourself. Good luck.

Listen To Me

Hank, do you have plans for a voice activated switch?

—L. A., Amherst, NH

Sorry, I don't run a design service, so I can't help you with plans, however, do you have 88¢? If you do, then buy the voice activated solid-state switch from EDI, Dept. EE6, 4900 Elstron Avenue, Chicago, IL 60630. Minimum order is \$3.00. Catalog is free. By the way, the 88¢ special is normally open, then locks closed.

Takes Lots of Pics

Hank, I'm a 35 millimeter camera fan, and soon will open my first darkroom. Do you have any plans for a timer? I've built projects before.

—J. D., Greenwich, CT

The Fall-Winter 1978 issue of ELECTRONICS HOBBYIST has plans for a Pro-Timer project you may want to build. Also, there are several other projects that shutterbugs may want to build.

Book Hunter

Hank, can you please provide me with, or refer me to some basic information on AC and DC motors? I need theory as well as applications.

—W. L., Richmond, IN

Look into our *Bookmark* column, and write to the publishers of the reviewed books to send you their latest book catalogs. Also, check your local library.

In the Dark

Where can I find a book on subjects for the darkroom?

—R. E., Sikeston, MO

It may be too late to find a copy on the newsstand, but see if you can get the Fall-Winter 1978 Edition of ELECTRONICS HOBBYIST. Can't find it? Then write to the magazine at 380 Lexington Avenue, New York, NY 10017 and enclose \$1.50 and \$.25 for postage and handling.

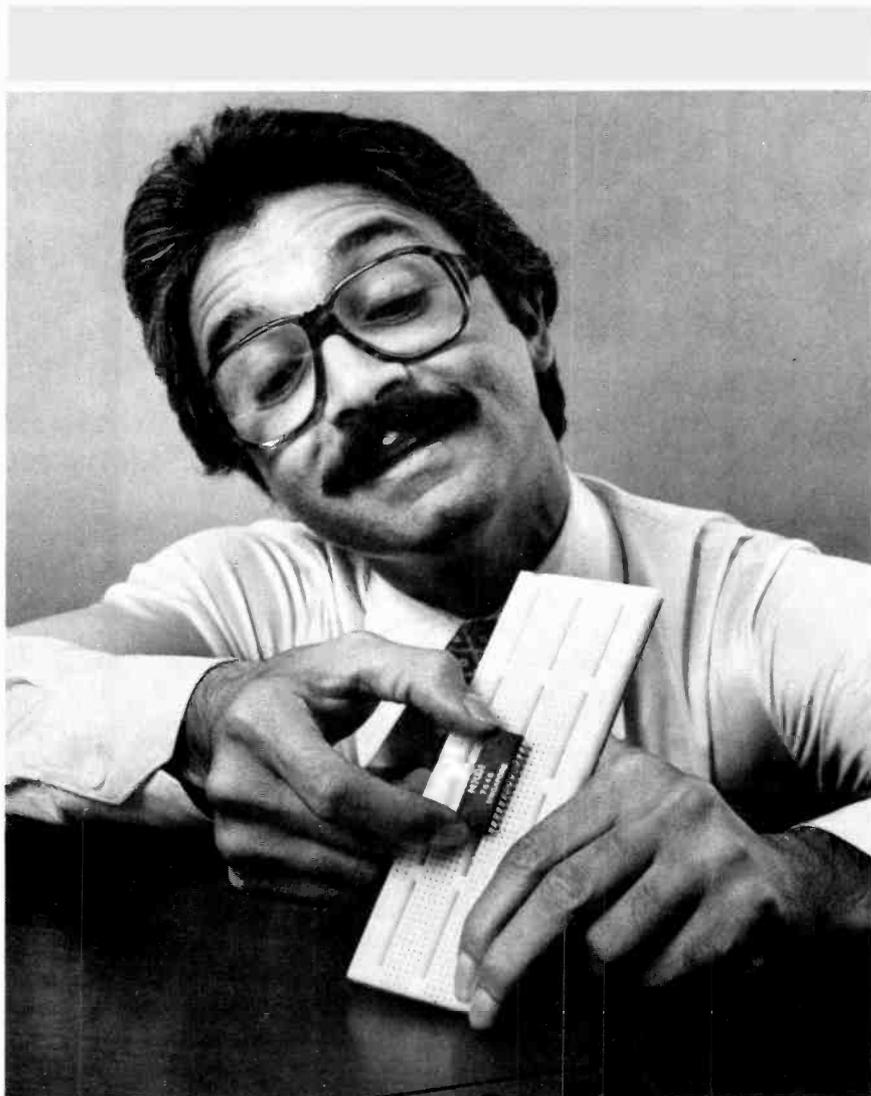
Lend A Hand

△ Our readers ask for help, and only you can do it. Please contact anyone below whom you can help. They thank you and I thank you!

△ Hallicrafters SW Radio, Model S-120, needs info on alignment; Sean A. Devitt, 2237 Wharton Rd., Glenside, PA 19038.

△ CGE Model KL-66 Radio Vintage 1935-36, needs circuit diagram; James D. MacDonald, RR #1, West Bay Road, N.S., Canada BOE 3LO.

△ GE Voice Commander 132-174 MHz FM Transceiver, needs power pack, literature; Alan P. Summerlin, KA4CUF, P.O. Box 183, Broadway, NC 27505. ■

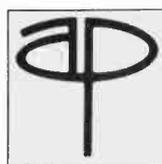


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Growing Demand for Computer Technicians

This is only one of the growth factors influencing the increasing opportunities for qualified computer technicians. The U.S. Department of Labor projects over a 100% increase in job openings for the decade through 1985. Most of them *new* jobs created by the expanding world of the computer.

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Assemble Your Own Microcomputer

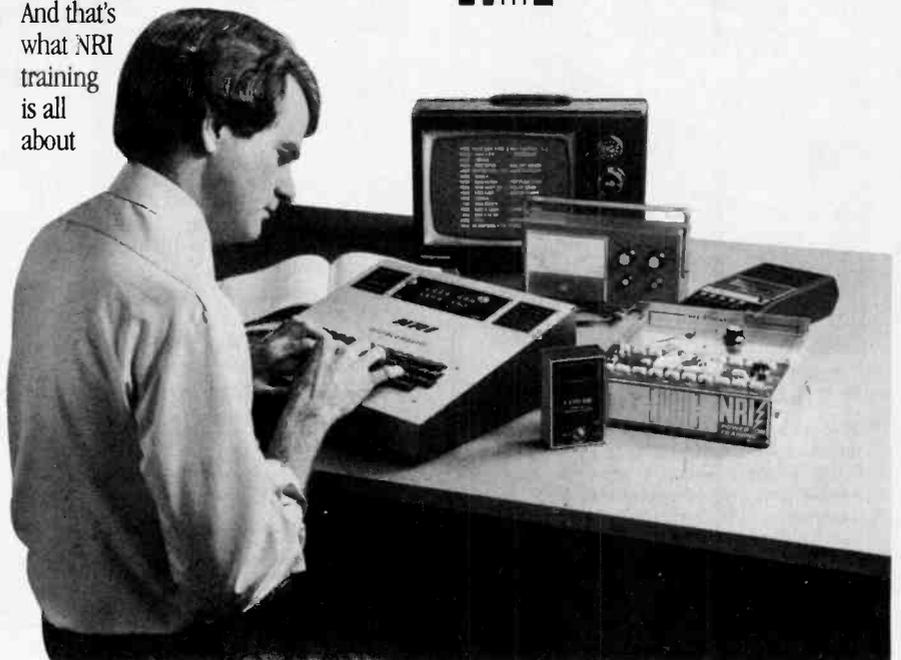
NRI training goes far beyond theory. It includes practical experience, too. As you progress, you perform meaningful experiments building and studying electronic circuits on the NRI Discovery Lab.[®] You assemble test instruments that include a transistorized volt-ohm meter and a CMOS digital frequency counter...instruments you learn on, use later in your work.



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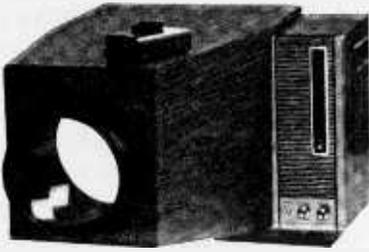
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The LIFESCREEN III projection system gives you all the enjoyment and excitement of the \$4000 systems. Our new injection molded Tron-Ex lens (F/1.9) produces an amazing image that is over 3 times brighter than most nationally marketed big-screen TVs—including Sony. And the Tron-Ex delivers sharper focus to the screen edge for better overall clarity. Our light-enhancing Extron LS-50 screen is 6 times brighter than most movie screens, because the molded parabolic contour rejects extraneous light, concentrating a directionally selective TV image for clear, colorful viewing. The LIFESCREEN III plans provide exact dimensions to fit the 13" Toshiba (model C389), but they can be modified to fit most 12" to 19" portables. Pre-constructed LIFESCREEN III lens housings available for most TVs. Order the components catalog below. **COMPLETE PACKAGE \$319**



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LIFESCREEN I
The original independent projection system from Extron. Works with the Sharp 13" model 13A29 color TV or Sony 15" model KV1541R color TV. Can be used with any size screen. The LIFESCREEN I includes our new Tron-Ex F/1.9 lens, one front surface mirror, building plans for cabinet, and the LS-50 screen, 32" x 40" / 50" diagonal. **COMPLETE PACKAGE \$339**

EXTRON GUARANTEES EVERYTHING: the professional quality, accuracy of description and availability of components described in this ad. After building your LIFESCREEN PROJECTION SYSTEM, if you are not satisfied for any reason, return all components to EXTRON for instant refund.

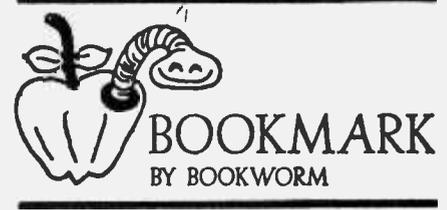
LARGER SCREENS FOR THE LIFESCREEN I AND LIFESCREEN III SYSTEMS CAN BE ORDERED FROM OUR CATALOG.

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probability theory or in programming to learn both. Simple exercises aid the reader in gaining expertise. Published by Dilithium Press, P.O. Box 555, Forest Grove, Oregon 97116.

Everything About Microcomputers. This is the definitive microcomputer book for the hobbyist. *The Scelbi Byte Primer* is the most extensive and well-organized volume we have seen on microcomputers to date. Over 400 pages long, and containing contributions from more than 50 recognized authors, it is the "bible" that your bookshelf needs. The book contains many illustrations and photographs, which can help even the greenest hobbyist make the maximum use of his

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or her home system. The Primer lists ideas for practical, home-use programming, as well as the theory to back them up. For the advanced builder, there are construction plans for 6800 and Z80 computers, just to mention a few. If you are a beginner or an old hand, there is something in here for you. Published by Scelbi Computer Consulting, Inc., P.O. Box 133 PP STN, Department B, Milford, Connecticut 06460.

The world of electronics gee-wizardry

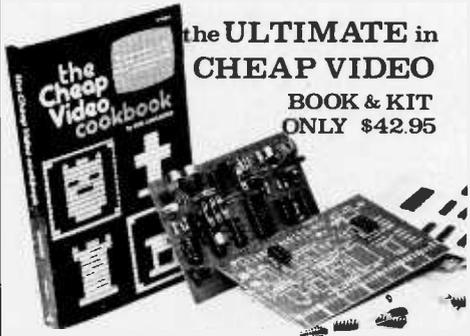


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You will receive training for the Novice, Technician and General Classes of F.C.C. Radio Amateur Licenses. You will build Receiver, Transmitter, Square Wave Generator, Code Oscillator, Signal Tracer and Signal Injector circuits, and learn how to operate them. You will receive an excellent background for television, Hi-Fi and Electronics.

Absolutely no previous knowledge of radio or science is required. The "Edu-Kit" is the product of many years of teaching and engineering experience. The "Edu-Kit" will provide you with a basic education in Electronics and Radio, worth many times the low price you pay. The Signal Tracer alone is worth more than the price of the kit.

THE KIT FOR EVERYONE

You do not need the slightest background in radio or science. Whether you are interested in Radio & Electronics because you want an interesting hobby, a well paying business or a job with a future, you will find the "Edu-Kit" a worth-while investment. Many thousands of individuals of all

ages and backgrounds have successfully used the "Edu-Kit" in more than 79 countries of the world. The "Edu-Kit" has been carefully designed, step by step, so that you cannot make a mistake. The "Edu-Kit" allows you to teach yourself at your own rate. No instructor is necessary.

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The Progressive Radio "Edu-Kit" is the foremost educational radio kit in the world, and is universally accepted as the standard in the field of electronics training. The "Edu-Kit" uses the modern educational principle of "Learn by Doing." Therefore you construct, learn schematics, study theory, practice trouble shooting—all in a closely integrated program designed to provide an easily-earned, thorough and interesting background in radio.

You begin by examining the various radio parts of the "Edu-Kit." You then learn the function, theory and wiring of these parts. Then you build a simple radio. With this first set you will enjoy listening to regular broadcast stations, learn theory, practice testing and trouble-shooting. Then you build a more advanced radio, learn more advanced theory and techniques. Gradually, in a progressive manner, and at your own rate, you will find yourself constructing more advanced multi-tube radio circuits, and doing work like a Professional Radio Technician.

Included in the "Edu-Kit" course are Receiver, Transmitter, Code Oscillator, Signal Tracer, Square Wave Generator and Signal Injector Circuits. These are not unprofessional "breadboard" experiments, but genuine radio circuits, constructed by means of professional wiring and soldering on metal chassis, plus the new method of radio construction known as "Printed Circuitry." These circuits operate on your regular AC or DC house current.

THE "EDU-KIT" IS COMPLETE

You will receive all parts and instructions necessary to build twenty different radio and electronics circuits, each guaranteed to operate. Our Kits contain tubes, tube sockets, variable, electrolytic, mica, ceramic and paper dielectric condensers, resistors, tie strips, hardware, tubing, punched metal chassis, Instruction Manuals, hook-up wire, solder, selenium rectifiers, coils, volume controls, switches, solid state devices, etc.

In addition, you receive Printed Circuit materials, including Printed Circuit chassis, special tube sockets, hardware and instructions. You also receive a useful set of tools, a professional electric soldering iron, and a self-powered Dynamic Radio and Electronics Tester. The "Edu-Kit" also includes Code Instructions and the Progressive Code Oscillator, in addition to F.C.C. Radio Amateur License training. You will also receive lessons for servicing with the Progressive Signal Tracer and the Progressive Signal Injector, a High Fidelity Guide and a Quiz book. You receive Membership in Radio-TV Club, Free Consultation Service, Certificate of Merit and Discount Privileges. You receive all parts, tools, instructions, etc. Everything is yours to keep.



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- CONSULTATION SERVICE • FCC
- AMATEUR LICENSE TRAINING
- PRINTED CIRCUITRY

SERVICING LESSONS

You will learn trouble-shooting and servicing in a progressive manner. You will practice repairs on the sets that you construct. You will learn symptoms and causes of trouble in home, portable and car radios. You will learn how to use the professional Signal Tracer, the unique Signal Injector and the dynamic Radio & Electronics Tester. While you are learning in this practical way, you will be able to do many a repair job for your friends and neighbors, and charge fees which will far exceed the price of the "Edu-Kit." Our Consultation Service will help you with any technical problems you may have.

FROM OUR MAIL BAG

Ben Valerio, P. O. Box 21, Magna, Utah: "The Edu-Kits are wonderful. Here I am sending you the questions and also the answers for them. I have been in Radio for the last seven years, but like to work with Radio Kits, and like to build Radio Testing Equipment. I enjoyed every minute I worked with the different kits; the Signal Tracer works fine. Also like to let you know that I feel proud of becoming a member of Your Radio-TV Club."

Robert L. Shuff, 1534 Monroe Ave., Huntington, W. Va.: "Thought I would drop you a few lines to say that I received my Edu-Kit, and was really amazed that such a bargain can be had at such a low price. I have already started repairing radios and phonographs. My friends were really surprised to see me get into the swing of it so quickly. The Trouble-shooting Tester that comes with the Kit is really swell, and finds the trouble, if there is any to be found."

SOLID STATE

Today an electronics technician or hobbyist requires a knowledge of solid state, as well as vacuum tube circuitry. The "Edu-Kit" course teaches both. You will build vacuum tube, 100% solid state and combination ("hybrid") circuits.

PRINTED CIRCUITRY

At no increase in price, the "Edu-Kit" now includes Printed Circuitry. You build a Printed Circuit Signal Injector, a unique servicing instrument that can detect many Radio and TV troubles. This revolutionary new technique of radio construction is now becoming popular in commercial radio and TV sets.

A Printed Circuit is a special insulated chassis on which has been deposited a conducting material which takes the place of wiring. The various parts are merely plugged in and soldered to terminals.

Printed Circuitry is the basis of modern Automation Electronics. A knowledge of this subject is a necessity today for anyone interested in Electronics.

Progressive "Edu-Kits" Inc., 1189 Broadway, Dept. 595-DJ Hewlett, N.Y. 11557

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CIRCLE 13 ON READER SERVICE COUPON

HI-FI REPORTS

Spruce up your sounds without spending a fist-full of dollars. By Gordon Sell

□ AFTER YEARS OF CAREFUL STUDY I have come to the conclusion that there are two distinct types of audiophiles—the single-play turntable type and the automatic turntable type. The extreme single play'er, as I call him, handles his LPs only when wearing white, lint-free gloves while the extreme automatic'er shuffles records like a poker player on a winning streak. Most of us are no where near these extremes but we do tend to belong to one group or the other.

No matter what group you are in you either want to, or need to take better care of your hi-fi records and equipment, and there is no shortage of gadgets to help you do this. Record cleaners, dust removers, anti-static guns, stylus gauges and cleaners, tape-head cleaners, head demagnetizers, and all kinds of record and tape storage systems. In this issue's Hi-Fi Report I'll tell you about what's available.

Record Whatsits. One of the more interesting new approaches to record care is Empire Scientific's Disco Film. Just spread the film over your LP.



CIRCLE 50 ON READER SERVICE COUPON

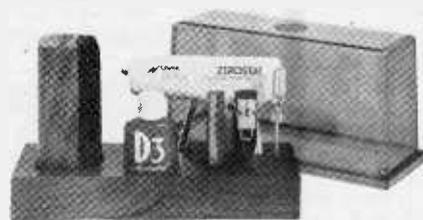
Empire Scientific Disco Film

When it dries you peel off the film and it takes all the dust and grit with it. One \$29.95 applicator will take care of 70 LPs.

Discwasher, the General Motors of record care, has a very complete line of products. A good cross section is

shown here in their DiscKit set. It has an antistatic pistol (you hold the muzzle over the surface of the record and give it four or five good shots), an

CIRCLE 55 ON READER SERVICE COUPON



Discwasher DiscKit

SC-1 stylus cleaner, a special record cleaning squeegee, and D-3 cleaning fluid. All this plus the walnut storage tray which has storage space for tools and extra cartridges retails for \$46.00.

When cleaning records it is very important to have the proper work surface—you could be cleaning one side while scratching or linting up the other.

CIRCLE 60 ON READER SERVICE COUPON

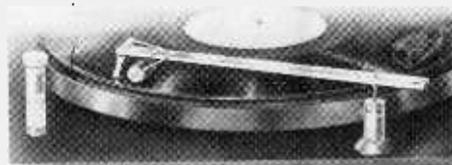


Sound Guard Work Pad

Sound Guard makes its non-slip, lint-free Record Care Work Pad to prevent such occurrences. Retails for \$7.95.

There are a lot of self tracking record cleaners on the market. A popular one is TDB (The Dust Bug) by Watts which can be mounted in a convenient spot on your turntable. The combined action of a cleaning-fluid-soaked roller

CIRCLE 65 ON READER SERVICE COUPON



Watts TDB (The Dust Bug)

and a brush does the job. TDB retails for \$8.99 including cleaning fluid.

Many turntable problems can be traced to vibration in the base. To help

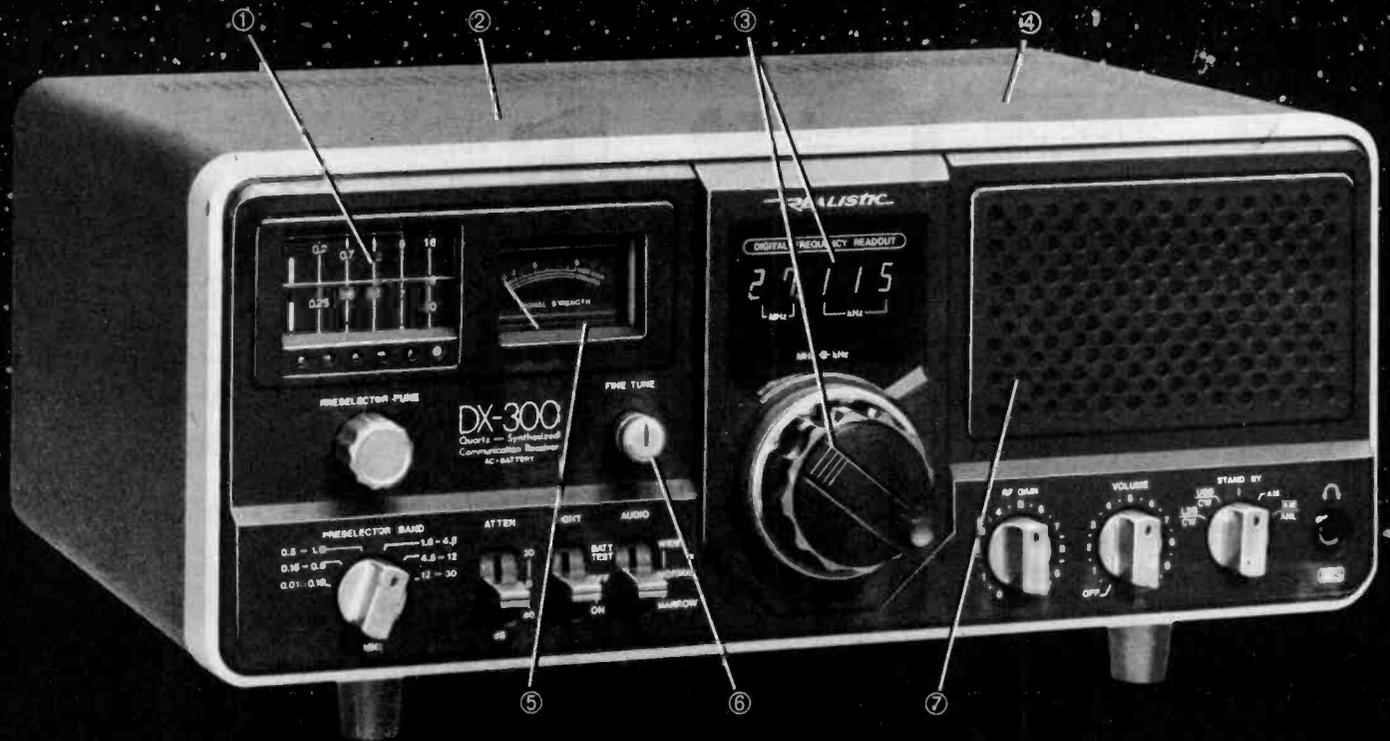
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cure such problems Audio Technica manufactures a set of vibration insula-

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\$5.50 ea.

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CIRCLE 17 ON READER SERVICE COUPON

tors on which you can mount your turntable. These are also adjustable for height and Audio Technica provides a compact bubble level so that you can make your installation perfectly level. Retails for \$24.95. Circle number 57 for information about this and the rest of Audio Technica's extensive line of audio accessories.

Tape Tricks. For the tape recording fan preventive maintenance basically comes down to two things, head cleaning and head demagnetizing. The best thing I've seen for the later, if you have a cassette deck, is TDK's battery-powered head demagnetizer, model

CIRCLE 67 ON READER SERVICE COUPON



TDK Head Demagnetizer

HD-1. It looks just like a normal cassette cartridge and it is inserted in the same way. Just turn it on for a few seconds and the job is done. Reel-to-reel head demagnetizers are available from many tape and tape recorder manufacturers.

Head cleaning is a real trouble spot for the tape recordist. Heads are often buried away in the machine and you need to be some sort of magician to get

CIRCLE 72 ON READER SERVICE COUPON



Maxell Tape Head Care Kit

at them. Maxell has brought out a super tape recorder care kit that not only has tape cleaning pads and cleaning solution but contains a set of specially shaped applicators that make cleaning a snap. The kit also has a booklet on tape recorder care that's well worth the entire kit's \$8.95 suggested retail price.

Just remember that the secret to keeping records in tip-top condition is a combination of maintenance and storage—keep them away from direct sunlight, heat and free from dirt and dust.

NOW! GET A BIG \$20 REBATE ON THESE BEST-SELLING NO-CRYSTAL BEARCAT® SCANNERS.

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BC 210



BC 211



BC 250

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ELEMENTARY ELECTRONICS/March-April 1979 CIRCLE 110 ON READER SERVICE COUPON

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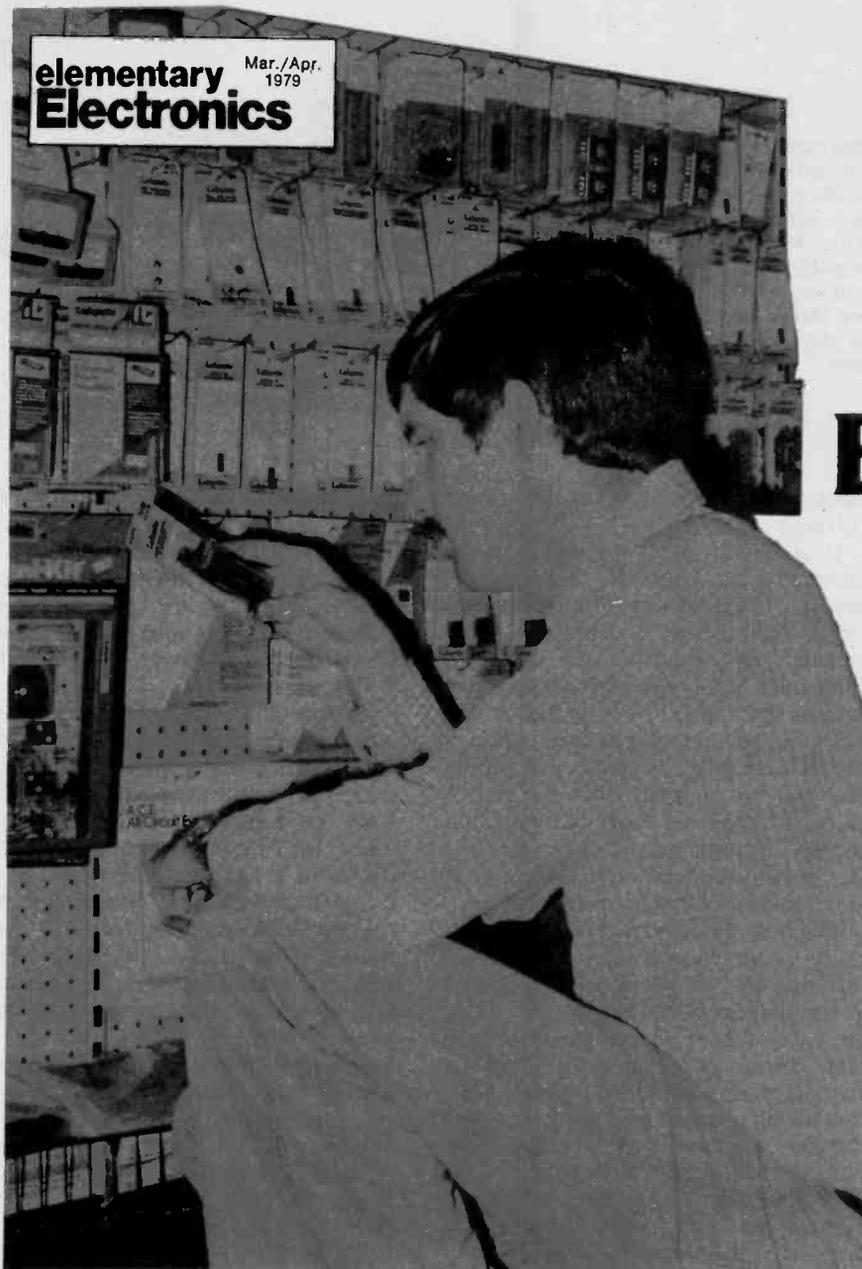
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6460 W. Cortland Street, Chicago, IL 60635 312/889-9087

In Canada: Atlas Electronics, Ontario

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The Fine Art of Buying Electronic Parts

by Walter Sikonowiz

**An inflation fighter's
guide to buying components**

Who are these specialists? They are the mail-order businesses that advertise in the back pages of **ELEMENTARY ELECTRONICS** (as well as other publications). Some of these companies restrict themselves to new merchandise, which they sell at very agreeable rates because of low overhead. Others sell only surplus, that is, unused components obtained from manufacturers willing to sacrifice some inventory for ready cash. A component's appearance on the surplus market can be caused by a multitude of economic factors which are unfortunate for the manufacturer, but a windfall for you, the sharp-eyed and observant buyer.

New or Surplus? How can you tell whether merchandise is brand new or unused surplus? In many instances, the catalog will tell you. If not, there is one sure indication: If the merchandise is being sold for a fraction of the retail price you would expect to pay, it's surplus. Three firms that deal exclusively in surplus are Delta Electronics (PO Box 2, 7 Oakland St., Amesbury, Massachusetts, 01913), B&F Enterprises (119 Foster St., Peabody, Massachusetts, 01960), and John Meshna Inc. (PO Box 62, E. Lynn, Massachusetts, 01904). Others, like Poly Paks (PO Box 942, South Lynnfield, Mass., 01940), or Herbach & Rademan (401 E. Erie Ave., Philadelphia, Penn., 19134), offer a mixture of surplus and brand new stock. Regardless of whether the merchandise is new or surplus, all

ASK A GROUP of electronics enthusiasts what the single most difficult part of project building is, and more often than not the reply will be, "Buying the #\$\$%&* parts." Such an attitude is not unwarranted because, try as you may, you will never find one distributor capable of supplying all the parts you need. Even so, there is no reason for the incredible amount of difficulty experienced by some people. Once you understand what's available, and who's selling, shopping for parts becomes downright easy.

The Big Four. You start by collecting catalogs; the more the better. Ten will get you by, but twenty is not too large a figure. Begin with the Big 4: Burstein-Applebee (3199 Mercier St., Kansas City, Missouri, 64111), Radio Shack (everywhere), Allied (401 E.

8th St., Fort Worth, Texas, 76102), and Lafayette Electronics (PO Box 428, Syosset, New York, 11791). These are the general practitioners of electronics; they dispense a little of just about everything a hobbyist could need.

The Specialists. Once Ohm's Syndrome takes hold, however, and your sales resistance rises in the face of inflation (and limited selection), it's time to see a specialist. This might be any one of several firms selling certain products, such as integrated circuits, and little else. Because of specialization, these companies can afford to have very complete inventories of selected merchandise. Furthermore, although you might expect a specialist to slap you with a fat fee, in most cases just the opposite will happen; you'll save money, and that makes it worthwhile.

e/e PARTS BUYING

firms offer some guarantee of satisfaction or they list the percentage yield.

In order to get better acquainted with the various suppliers, let's survey the market item-by-item. In the following paragraphs, whenever a specific company is mentioned in connection with a component, it is only because that firm is particularly strong in a certain area. Some degree of overlapping does exist among all firms, however, so don't assume that any one supplier is being recommended to the exclusion of all others.

Integrated Circuits. Although human life is based on the chemistry of carbon, it is the chemistry of silicon that now forms the basis for our business and industry, thanks to the integrated circuit. Because of their tremendous importance, integrated circuits are sold by almost every electronics supplier, big or small. You'll find that the Big 4 have quite respectable IC inventories, but prices are relatively high, and selection is not complete. Jameco Electronics (1021 Howard St., San Carlos, Calif., 94070), and Ancrona Corp. (PO Box 2208, Culver City, Calif., 90230) feature perhaps the widest selections of ICs: linear, TTL, CMOS, DTL, ECL, LSI and so forth. Jade Computer Products also offers a very good selection of integrated circuits in their comprehensive catalog.

Circuit Specialists (PO Box 3047, Scottsdale, Ariz., 85257) is a nice company to do business with, since they require no minimum-size order. In addition to a wide range of the standard ICs, Circuit Specialists carries special numbers from RCA, Motorola, and Mostek. Digi-Key (PO Box 677, Thief River Falls, Minn., 56701) also features a wide assortment, including some circuits difficult to find elsewhere. Last, but not least, there is Solid State Sales (PO Box 74A, Somerville, Mass., 02143). Although this company's selection may be a trifle smaller than

You can buy bulk components at next-to-nothing prices if you buy untested, surplus parts. Poly Paks is a popular bulk supplier and two of their packs are shown here. Most of the parts are useable.



some, its service is like the fabled "greased lightning."

Occasionally, you are going to receive a dud. When this happens, it's best not to go berserk. A calm request for a replacement is usually accommodated very quickly. After all, these companies want your continued business in the future. As a precautionary measure, you might consider ordering two of each IC. The chances of getting one dud are so small that the probability of receiving two duds simultaneously is infinitesimal. You can use the extra integrated circuit chip, if it is a good one, in a future project.

Discrete Semiconductors. This category is an exceptionally broad one. Included are: bipolar transistors, FETs, SCRs, diodes, UJTs and so on. As in the case of ICs, almost everyone sells some discrete semiconductors, but few vendors stock each part number. Before giving up an elusive part, try either Hanifin Electronics (PO Box 188, Philadelphia, Penn., 19405), or the Ancrona Corp. These two firms have perhaps the most extensive listings of discrete semiconductors available.

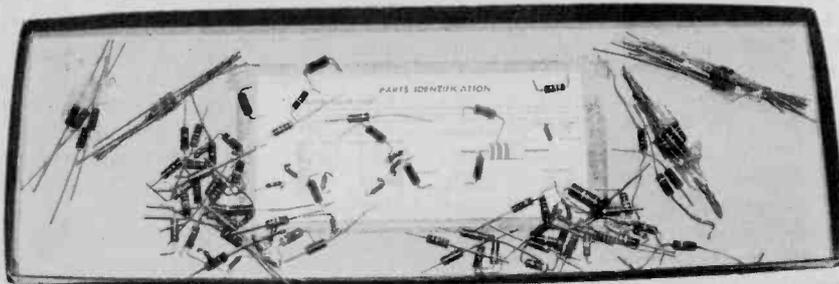
Most suppliers offer special discounts to encourage volume buying of parts. This appeals directly to the squirrelish instincts of the electronics hobbyist, but be careful. Just like that greedy little tree-dweller, you will probably hoard more than you can ever use. If you must stockpile parts, do it sensibly. Choose those discrete components

that are most frequently used: 2N3906 PNPs, 2N3904 NPNs, 1N914 switching diodes, 1N4003 rectifiers and so forth. Avoid the high-wattage zener diodes now appearing in surplus. Today, integrated circuits have supplanted zeners as regulators at all but the lowest power levels.

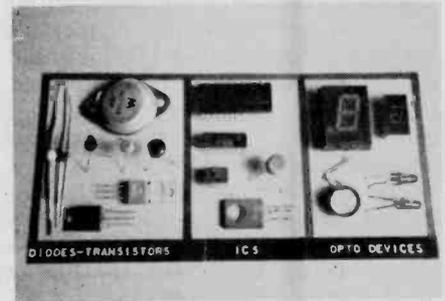
Resistors. Buying from one of the larger retailers, you can expect to pay around 10 cents a piece for carbon-composition resistors. Compare that with the typical 4-cent selling price from the specialist firms, and the choice of a supplier is obvious. Resistors are one class of component that can be sensibly stockpiled. Buy half-wattors with a 5% tolerance. They cost only a bit more than 10% resistors and save you the trouble of stocking two tolerances.

Power resistors, with ratings from 5 to 100 watts, are available from the surplus dealers at incredible prices. Buy a small assortment. Power supplies and audio amps often need dummy loads during checkout, and for such purposes these high-power resistors are ideal. If you do not have exactly the right resistance at hand, use serial and parallel combinations whose net resistance is the desired value.

Don't forget those high-class resistors, the metal-film precision units with tolerances of 1% or better. You can get these from the larger retailers, but at 60 cents to one dollar apiece (often with a ten-piece minimum order) who



Since a great many people have trouble remembering the color code, a useful aid to sorting surplus resistors is an old tie box with the color code marked inside the lid.



Try to build up a supply of transistors, diodes, ICs and electro-optical devices.

ADDRESSES OF PARTS SUPPLIERS:

Ace Electronics
5400 Mitchelldale
Houston, TX 77092

Active Electronics Sales Corp.
12 Merser Rd., Natick, MA 01701

ALdelco, 228 E. Babylon Tpk.
Merrick, N.Y. 11566

Allied Electronics, 401 E. 8th St.
Fort Worth, TX 76102

Ancrona Corp., P.O. Box 2208
Culver City, CA 90230

B&F Enterprises, 119 Foster St.
Peabody, MA 01960

Bullet Electronics, P.O. Box 1944
Dallas, TX 75219

Burstein-Applebee, 3199 Merceir St.
Kansas City, MO 64111

Chaney Electronics, P.O. Box 27038
Denver, CO 80227

Circuit Specialists, P.O. Box 3047
Scottsdale, AZ 85257

Delta Electronics, P.O. Box 2
7 Oakland St., Amesbury, MA 01913

Diamondback Electronics Co.
P.O. Box 194, Spring Valley, IL 61362

Digi-Key, P.O. Box 677
Theif River Falls, MN 56701

Digital Research Corp.
P.O. Box 401247B, Garland, TX 75010

Electronics Distributors, Inc.
4900 N. Elston
Chicago, IL 60630

ETCO Electronics, 521 Fifth Ave.
New York, NY 10017

Formula International, Inc.
12603 Crenshaw Blvd.
Hawthorne, CA 90250

Fuji-Svea, P.O. Box 3375
Torrance, CA 90510

Herbach and Rademan, 401 E. Erie Ave.
Philadelphia, PA 19134

HobbyWorld, 19355 Business
Center Dr., Northridge, CA 19324

Integrated Electronics
540 Weddell Dr., Sunnyvale, CA 94086

International Electronics Unlimited
Village Square P.O. Box 449
Carmel Valley, CA 93924

Jade Computer Products
5351 W. 144th St.
Lawndale, CA 90260

Jameco Electronics, 1021 Howard St.
San Carlos, CA 94070

John Meshna, Inc., P.O. Box 62
East Lynn, MA 01904

Lafayette Electronics, P.O. Box 428
Syosset, NY 11791

Mouser Electronics,
11511 Woodside Ave.
Lakeside, CA 92040

New Tone Electronics, P.O. Box 1738
Bloomfield, NJ 07003

Olson Electronics
260 S. Forge St.
Akron, OH 44327

Optoelectronics
5821 N.E. 14th Avenue
Fort Lauderdale, FL 33334

Poly Paks, P.O. Box 942
South Lynnfield, MA 01904

Quest, P.O. Box 4430
Santa Clara, CA 95054

Radio Hut
P.O. Box 401247
Dallas, TX 75238

Radio Shack, Consult your local
phone book

Ramsey Electronics
Box 4072
Rochester, NY 14610

Signal Transformer Co.,
500 Bayview Ave.
Inwood, NY 11696

Solid State Sales, P.O. Box 74A
Somerville, MA 02143

Steven Products, P.O. Box 698
Melville, NY 11746

Surplus Electronics Corp.
7294 N.W. 54th St., Miami, FL 33166

needs them? Actually, for certain ultra-stable or low-noise circuits, precision resistors are mandatory. Active filters, accurate voltage dividers, and analog-computer circuits are but a few examples. When you really need precision resistors, Hanifin Electronics can supply them at about 15 cents each. But because Hanifin is an industrial supplier, do not send in a 75¢ order; fifteen dollars worth is a realistic minimum. Since Hanifin offers lots of goodies besides resistors, you should have no trouble putting together a good-sized, worthwhile order of resistors. **Capacitors.** The best all-around ca-

pacitor that money can buy is the polystyrene type. It also happens to be one of the cheapest, a fortunate coincidence. Polystyrenes are available in the range from 5 pF to 0.5-uF, but above .01-uF, they begin to get bulky and expensive. Your best and most complete sources for these capacitors are Burstein-Applebee and Allied (addresses supplied previously). Standard tolerances are 5% (super for a capacitor), with 2.5% and 1% available at higher prices.

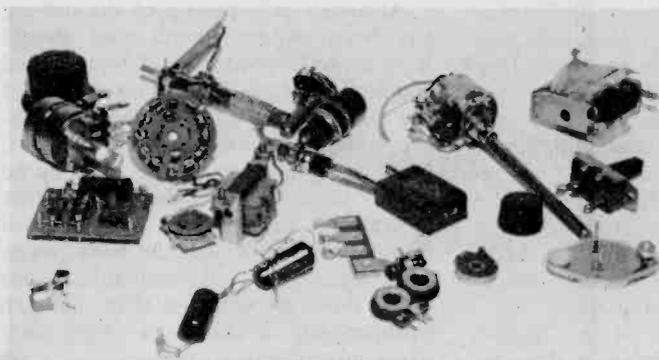
In the range from 0.01-uF to 1-uF, you are best off with mylar (polyester) capacitors. (Mylars are available out-

side this range, too.) Standard tolerances are 20% and 10%. A great many firms carry mylar capacitors.

Above 1-uF, most capacitors are aluminum electrolytics, which are polarized devices. One of their most important functions is filtering, particularly in AC power supplies. Tolerances tend to be relatively loose since applications rarely call for very precise electrolytic capacitors. Capacitances as high as 40,000-uF and beyond are available to the adventuresome hobbyist.

The aluminum electrolytic has a more sophisticated cousin, the tantalum capacitor, which is commonly available in capacitances as high as several hundred microfarads. Relative to the aluminum electrolytic, the tantalum features tighter tolerances (10% typically), lower leakage, and smaller size for equivalent capacitance. As a result, tantalums are preferred over aluminum electrolytics in timing applications. Both electrolytic types are stocked by many distributors.

Surplus capacitors are available, with perhaps the best source being Poly Paks (see above), at least in terms of variety. If you do buy surplus capaci-



The best way to build up your parts inventory is to salvage useable components from junked pieces of electronics gear. Transformers, switches, potentiometers, crystals and coils are always handy to have.

tors, play it safe and check each one on a capacitance meter. Ceramic bypass capacitors for digital logic are available very cheaply as surplus, and so too are mylars. On the other hand, be very cautious when buying surplus aluminum electrolytic capacitors. They have a limited shelf life, and once they dry out, they are useless. Most dealers are scrupulous enough not to do this to you, but you can end up with a relic of the 1950's that looks more like an artillery shell than a capacitor. Choose these components very carefully.

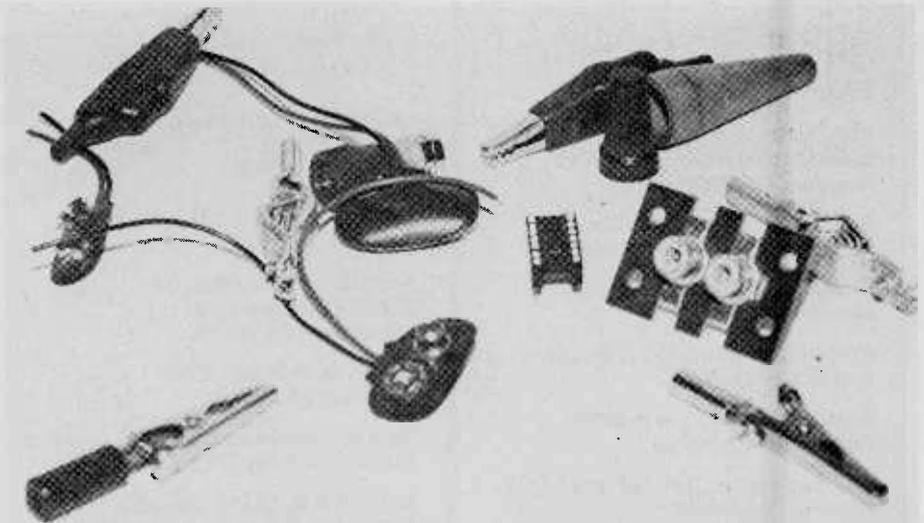
Potentiometers. New pots cost about the same no matter where you buy them. Imported units may sell for less, but cheap materials yield an inferior device, one that is often difficult to turn because of high-friction bearings. While imports are excellent for experimenting, it always pays in the long run to use only top-quality potentiometers in your construction projects.

Surplus pots can save you a lot of money, but read the fine print closely. Pay attention to shaft length. Some units are intended for screwdriver adjustment and have short, slotted shafts which cannot accept a knob. In addition, watch out for strange tapers, such as "reverse logarithmic." Pots specified as having either "linear" or "audio" tapers are the ones most usually called for in projects.

For some reason, wirewound pots seem to abound in surplus. These are fine for low-frequency work, often at high power. But wirewounds have poor resolution and should never be used in a circuit where very precise adjustments must be made. For the bulk of your experimenting, standard carbon-composition pots are your best choice.

Slide pots are a great convenience in audio work, especially if you are building a mixer or music synthesizer. Many outlets carry them, but most units have too short a path of travel (1¼ inches) to be really useful. Slide pots with twice the adjustment range are preferable, and they can be purchased at reasonable cost from Mouser Electronics (11511 Woodside Ave., Lakeside, Calif., 92040).

Relays. These may well share the fate of the dodo, thanks to fast and reliable solid-state switchers like triacs, SCRs and transistors. Industrial control systems that once bristled with relays and cam-actuated microswitches now rely on digital logic and thyristors. Even Ma Bell, at one time the patron saint of relay manufacturers, now uses elec-



Plugs, jacks, alligator clips, battery clips terminal lugs and IC transistor holders are always missing just when you need them. They can often be purchased in bulk for a large savings. They are found on parts store display boards and in parts salvage bins.

tronic switching to route calls. The result of all this phasing-out is a surplus market chock full of relays at bargain prices.

Despite the decline in its commercial popularity, the relay still possesses some admirable qualities, such as excellent driver/load isolation and minimal temperature sensitivity. Furthermore, it happens to be one of the easiest devices for the beginner to understand and use. All things considered, it makes sense to take advantage of the surplus bargains now, while they last.

Power Transformers. Here is another item carried by almost every supplier, but inventories are generally limited in scope. When your application demands just the right transformer, it pays to be able to order directly from the manufacturer. Signal Transformer Co. (500 Bayview Ave., Inwood, N.Y., 11696) offers a wide array of transformers, from tiny, PC-mount devices to mammoth, kilowatt isolation transformers. Other makers also offer diverse selections, but some may not encourage direct mail ordering.

Undoubtedly the most economical way of securing a transformer is through a surplus dealer like Delta. Many kinds of transformers end up as surplus, and with just a little luck you can find one to suit your purposes. Discounts greater than 75% off list are common, so the money you save may be substantial. This is especially true if you are planning to construct something big such as a high-powered audio amplifier. Transformers from some of the best amps ever to shake a loudspeaker end up as surplus, victims of design changes and competition.

PC Supplies. There is no surplus material worth mentioning in this cat-

egory, so let's focus on new merchandise. The simplest PC methods involve placement of a pattern directly on copper-clad board. These are fine in the beginning, but for serious experimenters, photographic techniques are a must. Not only do photographic methods yield neater copper traces and a greater density of components on your board, they also allow any number of boards to be produced from a single piece of artwork.

Photographic PC processing can best be learned from one of the kits offered by various manufacturers. You do not need expensive equipment like a camera or enlarger. All necessary materials and instructions come in the kit. These PC kits may employ either negative or positive photographic processes, which differ from one another principally in the method used to prepare a board's artwork. Positive methods are perhaps easier for a beginner to visualize, but negative kits seem to be equally popular. Most suppliers carry at least one brand of PC kit, if not more. Choose one that fits your needs and budget. You'll find the professional-looking results to be well worth the extra effort it takes to do it right.

Although only the tip of the iceberg has been exposed here, you should have a pretty good idea of how to find supplies by now. To obtain copies of the catalogs you want, write directly to the companies mentioned in the text. Note that our coverage has been by no means exhaustive. Undoubtedly other worthwhile catalogs are available, so hunt carefully through the back pages, too. Remember, all companies stock much more merchandise than they can economically include in a single magazine advertisement. ■



CYCLOPS

Sleep for 1001 peaceful nights
with this electronic genie standing faithful guard

by Anthony J. Caristi

BUILD CYCLOPS. With his space age magic eye he will stand guard over your house or property and sound a musical alarm if an intrusion should occur. He does this without the use of any special light source by monitoring the ambient light intensity falling on his eye. Cyclops performs his guard duty with a very meager appetite for power, consuming only $\frac{1}{2}$ watt while he is on duty. If an intrusion should occur, Cyclops responds by sounding an attention getting alarm, and automatically resets himself after a specified time delay selected by you.

You can also take advantage of Cyclops' unflinching eye by using him as an automatic doorbell. When someone approaches the door of your house and casts a shadow, the resulting change in light intensity falling upon Cyclops will cause him to sound a short and pleasant series of musical notes. You can extend his detection range by placing him in your driveway or garage to announce the arrival of an automobile at night, when he sees the headlights of a car.

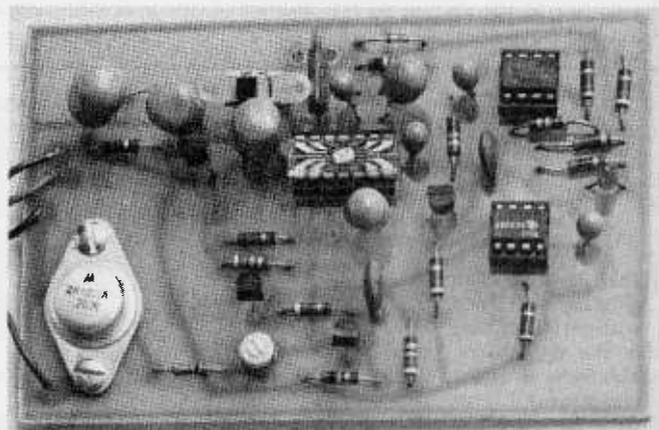
Versatility. Cyclops is quite versatile and can be used for purposes other than an intrusion alarm or automatic doorbell. For example, you can construct an electronic rifle range by placing Cyclops' eye at the center of a bull's eye and shooting with a beam of light from a home-made ray gun. Each time the bull's eye is hit, a series of musical tones will sound. An electronic ray gun or rifle can be constructed by modifying a small flashlight which emits a narrow beam so that the light rays are concentrated. In order to produce a "shot," the circuit shown can be used. This will drive the light bulb from a charged capacitor and result in a pulse of light. Use a spring loaded SPDT switch.

Cyclops' built-in musical ability can be used as the basis for a "Close Encounters" sound generator accompa-

nied by a flashing light, or you can even place Cyclops in your car and have an unique musical horn. This and all the other features of Cyclops can be performed by a single electronic assembly which can be constructed at low cost. Simple modifications of the circuit will permit you to use Cyclops for whatever purpose you desire.

About the Circuit. The eye and heart of Cyclops is a specialized integrated circuit which is the result of a marriage between a photodiode and a digital and linear circuit on a single chip. Such a device is called an Optolinear and is available to you from the source specified in the parts list for Cyclops. This is the 14-pin IC chip shown in the photograph of the Cyclops PC board.

The Optolinear IC chip is the eye of Cyclops. This nifty little package detects small changes in the ambient lighting conditions and triggers the alarm. You can use this handy device as a burglar alarm or as a household remote controller.



IC1 is an integrated circuit motion detector which monitors the ambient light intensity falling on the built-in photodiode. When a change in light intensity occurs, a circuit is triggered which produces a series of pulses of varying frequency in the audio range. A digital counter within the chip permits a specified number of pulses to be generated, and then resets the circuit back to a standby mode to await the next change in light intensity falling upon the photodiode. The series of

audio pulses produced, when amplified and fed to a loudspeaker, is a simulation of the familiar whooping sound which is characteristic of some alarms. C4 determines the rate at which the circuit changes from one tone to the next, and can be changed to suit individual tastes. IC1 has an additional digital circuit which produces a second set of random musical tones which might be described as "Close Encounters" music. When the chip is in this mode of operation, it is also capable of flashing a 6 volt light bulb in time with the music.

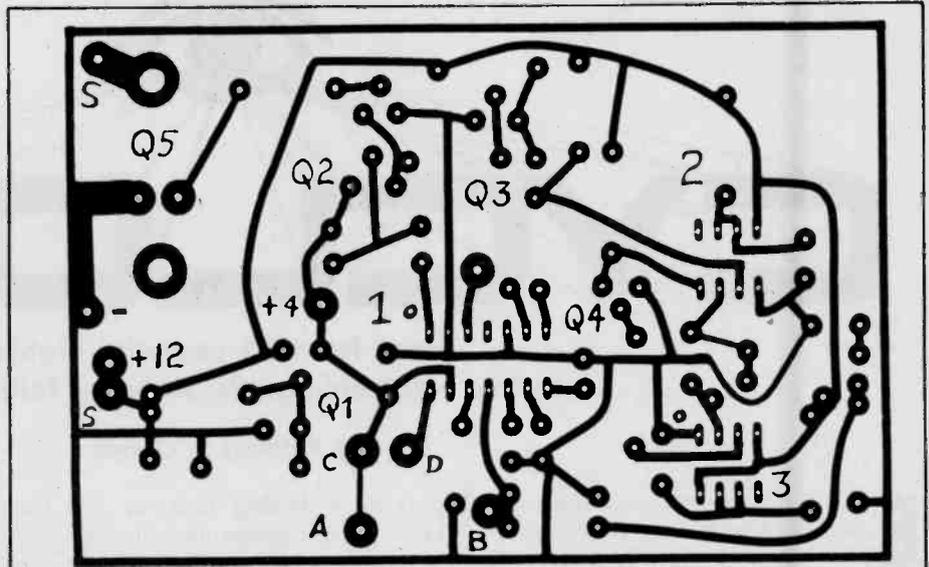
Control of the operation of IC1 is accomplished by feeding a positive voltage to either or both control input terminals, pins 11 and 14. When ter-

minals C and D of the printed circuit are connected together and terminals A and B are open, the circuit is set to perform as an intrusion alarm. Opening the circuit between terminals C and D, and A and B, programs the circuit for "Close Encounters" music. Automatic control of terminals A and B of the circuit is provided by IC2 and IC3, and manual control of terminals C and D is provided by a single pole slide switch mounted directly on the printed circuit board.

e/e CYCLOPS

Power to drive a loudspeaker is provided by Q2 and Q5 which amplify the low voltage output pulses of IC1 and deliver peak currents of up to 1 ampere into the speaker. When IC1 is in standby mode, the voltage at the output terminal, pin 1, is about 4 volts. This cuts off both Q2 and Q5 so that current in the loudspeaker is zero. When IC1 is activated, Q2 conducts current and provides base drive to Q5 through R3 which acts as a volume control. When the circuit is set for maximum volume, Q5 acts as a switching transistor, driving the loudspeaker with pulses of about 12 volts. The circuit will drive loudspeakers of any impedance. Greatest volume will be obtained with a 3.2 ohm speaker, since this will draw the highest load current from Q5. Peak power delivered to a 3.2 ohm speaker can be as high as 40 watts when the volume control is set to maximum. Average power will be much less than this since the circuit delivers pulses with a duty cycle of less than 50%.

Construction. Cyclops can be constructed on a single sided printed circuit board measuring 2 7/8 by 4 1/4 inches. This includes all the necessary circuitry with the exception of the 12 volt power source. If an AC operated power supply is desired, it can be added to the circuit at the option of the builder. A typical power supply circuit is shown



Use this full-sized printed circuit board template to make your own Cyclops. You might try out one of the new PC kits from Vector that lifts the pattern from a magazine page.

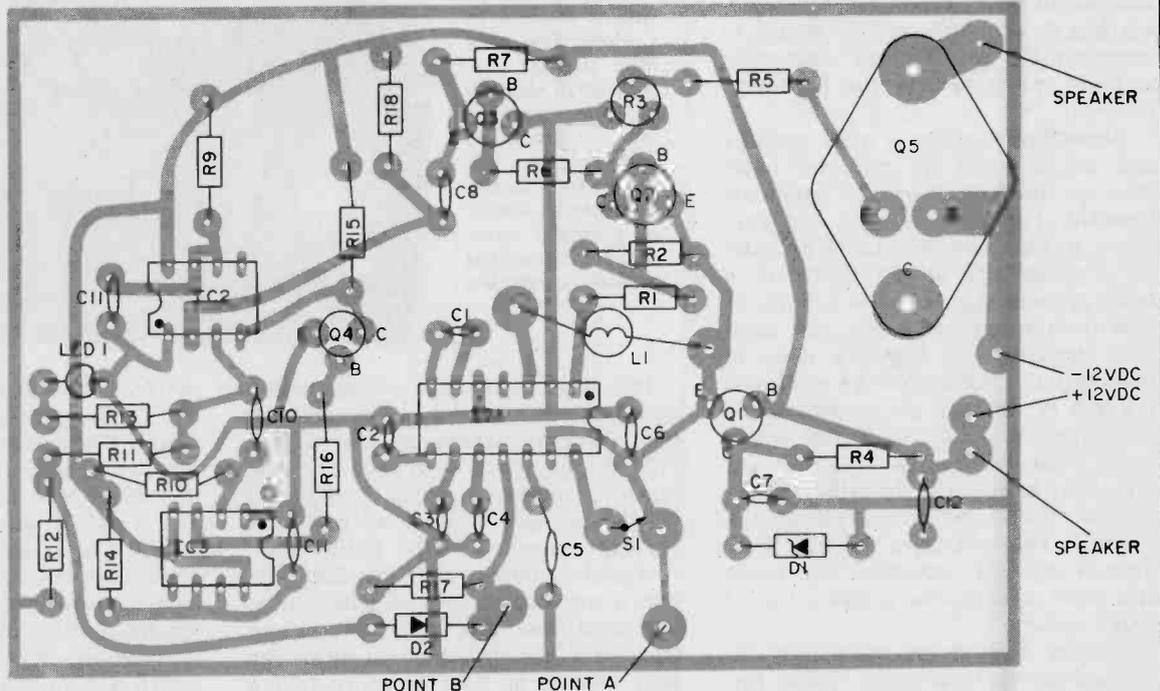
with the schematic on the next page.

The printed circuit layout in this article is shown full size as seen from the copper side of the printed circuit board. The component layout is also shown. If possible, make photocopies of the printed circuit, component layout, and schematic diagram and work from these copies. This will avoid wear and tear on the originals which you will want to keep in good condition for future reference.

After etching the printed circuit, go over it with a magnifying glass to pick up any shorts or opens which may ex-

ist. This will help avoid problems when the circuit is first placed in operation. For a slight additional cost, it is strongly recommended that sockets be used for the integrated circuits. Their value in a printed circuit assembly cannot be overemphasized. The use of sockets give you the ability to troubleshoot the circuit, should a problem exist, in much less time than if the IC's were soldered in place. It is extremely difficult to remove a multi-pin IC which has been soldered into a printed circuit without destroying the IC or printed circuit. Do not mount the integrated

This parts location diagram will help you get everything in the right place. This view is of the component side with the parts facing up. The foil PC pattern is on the underside. Building this project is a snap even if you are a beginner.



circuits until instructed to do so in the checkout procedure.

The component layout shows control switch S1 and volume control R3 mounted directly to the printed circuit board. You may want to mount the printed circuit board in a small cabinet with these components accessible from the outside. If you are going to use the lamp with the circuit, be sure to place it so that its light will not fall upon IC1. Should this happen, the additional feedback signal from the lamp may cause a circuit malfunction, although no damage will occur.

You will note that the power output transistor, Q5, is mounted to the printed circuit board with no heat sink. None is required since this transistor operates as a switch at high current levels, and therefore dissipates very

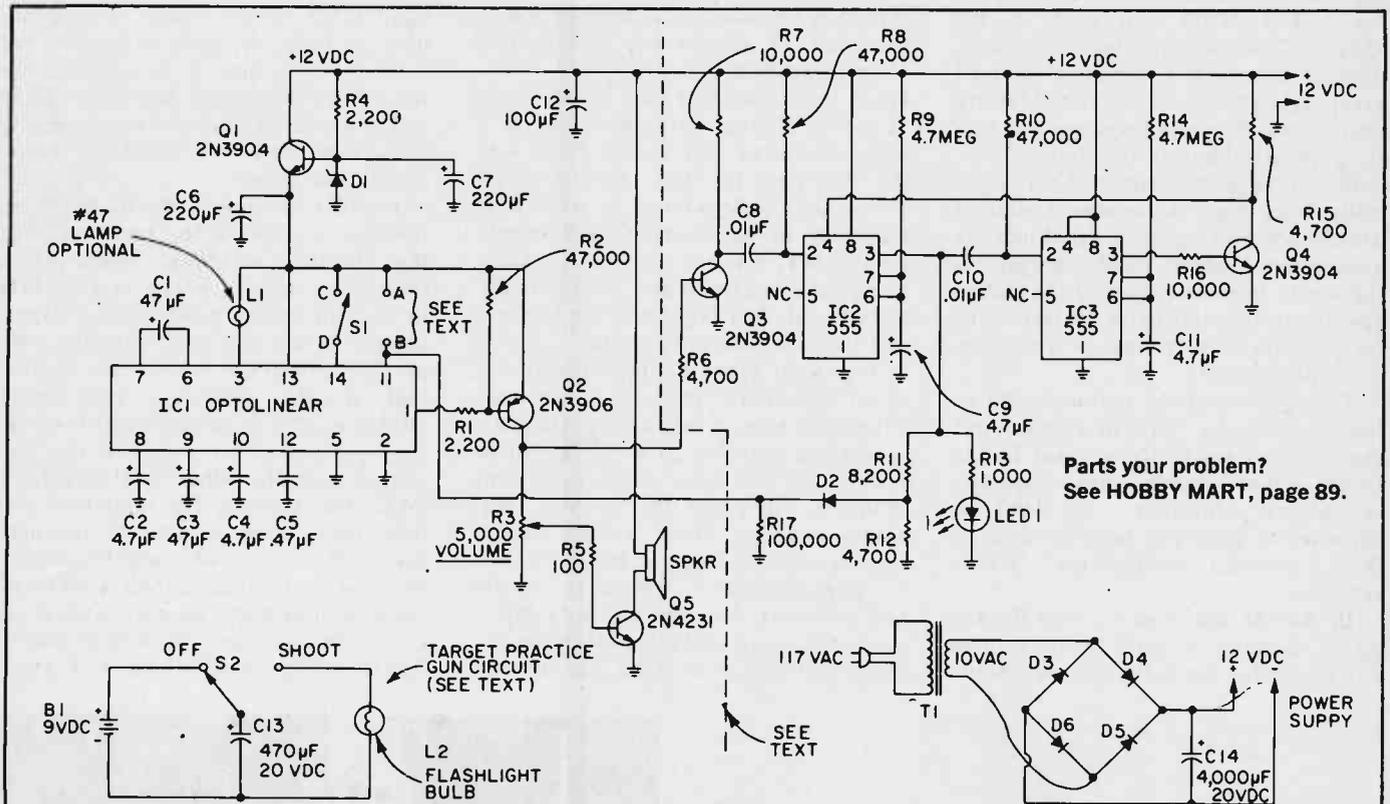
little heat. Mount Q5 to the printed circuit board with two 4-40 screws and nuts. Make them tight but not overtight.

Checkout Procedure. The printed circuit assembly should be checked with power applied before installing any of the integrated circuits in place. This will avoid damaged components in the event of possible short circuits or miswiring. Apply 12 VDC power to the circuit using a battery or AC operated power supply, observing correct polarity. Measure the voltage at pin 13 of IC1 using the negative side of the DC power supply as the meter reference. This should be between +3.5 and +4.5 volts DC. If the voltage is not within this range, check zener diode D1 for a voltage drop of 4.2 to 5.2 volts. Check also that D1 is mounted

(Continued on page 85)



If Cyclops really appeals to you as a useful gadget, but you don't have the time or experience to put it together, then you might consider ordering Delta Electronics' Motion Detector. It uses the same IC as Cyclops. It sells for \$24.50 in kit form or \$69.50 fully assembled with NiCad batteries and charger. Delta's address is in the parts list of this article.



Parts your problem?
See HOBBY MART, page 89.

PARTS LIST FOR CYCLOPS

- B1—9-volt battery
- C1, C3—47-uF electrolytic capacitor, 10 VDC
- C2, C4—4.7-uF electrolytic capacitor, 10 VDC
- C5—0.47-uF ceramic disc capacitor, 10 VDC
- C6, C7—220-uF electrolytic capacitor, 20 VDC
- C8, C10—0.01-uF ceramic capacitor, 10 VDC
- C9, C11—4.7-uF electrolytic capacitor, 20 VDC
- C12—100-uF electrolytic capacitor, 20 VDC
- C13—470-uF electrolytic capacitor, 20 VDC
- C14—4,000-uF electrolytic capacitor, 20 VDC
- D1—1N5230 4.7 volt zener diode
- D2—1N4148 silicon diode
- D3, D4, D5, D6—1N2069 silicon diode
- IC1—Optolinear IC (see text for explanation)
- IC2—555 timer
- IC3—555 timer

- L1—#47 lamp
- L2—flashlight bulb
- LED1—light emitting diode
- Q1, Q3, Q4—2N3904 NPN silicon transistor
- Q2—2N3906 PNP silicon transistor
- Q5—2N4231 NPN silicon transistor
- R1, R4—2,200-ohm, 1/4-watt resistor
- R2, R8, R10—47,000-ohm, 1/4-watt resistor
- R3—5,000-ohm trimmer potentiometer (PC board mounting type)
- R5—100-ohm, 1/4-watt resistor
- R6, R12, R15—4,700-ohm, 1/4-watt resistor
- R7, R16—10,000-ohm, 1/4-watt resistor
- R9, R14—4,700-ohm, 1/4-watt resistor
- R11—8,200-ohm, 1/4-watt resistor
- R13—1,000-ohm, 1/4-watt resistor

- R17—100,000-ohm, 1/4-watt resistor
- SPKR—3.2-ohm PM type speaker
- S1—SPST miniature slide switch
- S2—SPDT momentary-on switch
- T1—10-volt, 1.2 amp transformer
- Misc.—large plastic cabinet (8 in. by 4 in. by 4 in.) screws, spacers, wire, AC plug and zip cord, etc.

Note: IC1 is available from:
Delta Electronics
7 Oakland St.
P.O. Box 2
Amesbury, Mass. 01913
Catalog #1072W
Price: \$8.95

TROPICAL DX

Tune the lands of the ancient Mayan Empire!

Ralph Perry

NOT FAR SOUTH of the border, there lies a land of smoking volcanoes, of steaming jungles alive with panthers and tropical birds, and of mysterious stone pyramids.

That land is Guatemala and the adjoining Yucatan Peninsula of Mexico, the home of primitive Indians descended from the famous Mayans. To experience a direct link with the past, the with-it DXer can tune in the "Mayan Connection," a handful of low-wattage shortwave outlets run by these great-great-grandsons of the Mayans, some using the same language and music popular with their forefathers!

How do you get started? Easy, especially since these flea-powered stations usually poke a king-sized signal into the atmosphere. Added to the bargain is the highly friendly nature of the station operators (this translates to fast QSLs for permanent mementos of your tuning experiences!).

The majority of the stations you'll be tuning along the "Mayan Connection" are intended solely for a rural Indian audience that is catching up on spelling or cultural education... so don't be surprised at what you hear on some of these "escuelas radiofonicas" (radio schools).

Up And At 'Em! You can scan the airwaves morning or night to hear these but we prefer the early morning hours

because the low frequency "tropical bands" where the TG (Guatemala) call signs appear are quieter around dawn. But, if you feel a little static is a small price to pay for a few more Zzzz's, sleep away! They're there at night, too.

Step number one is to educate those old "oidos" as the Spanish-speakers say it (that's ears, chum!). A painless way to do that is to tune in on the flagship station of the Mayan Connection, Radio Nacional of Guatemala, transmitting from downtown Guatemala City, capital of the nation that likes to call itself "Land of Eternal Spring," thanks to a pleasant climate that usually keeps it in the 70s. Tune in *TGW, La Voz (The Voice) de Guatemala* on its 6180 kHz frequency in the 49 meter band around 1200 GMT, when it signs on. Its king-sized signal is easy to find without really trying hard. Just pop up to the top end and listen for marimba music.

Marimba? Why, it's the national music of Guatemala! It's kind of a bouncy xylophone-type of instrument. There's a saying the marimba is a "smile put to music" and one taste of the catchy instrument will prove that to you. Marimba melodies cover a wide range, from traditional songs to popular tunes, to "pure marimba" (which the experts will tell you is the most authentic type) made of gourd sounding-tubes, to orchestrated selections using marimba as

a lead instrument. It's a happy, rollicking sort of sound: Try it, you'll like it!

Now that you have the hang of the rhythm of the country, it's time to head upcountry from modern Guatemala City, buzzing west to world-famous Lake Atitlan. Lake Atitlan, ringed by three volcanoes, features deep blue waters that constantly change ever-so-slightly in hue, and a dozen Indian villages named for the Apostles perched on its shores. For DX purposes, the important one is Santiago (St. James).

La Voz de Atitlan, station TGDS, presents a good challenge with its 120 meter band frequency of 2390 kHz. However, this little outlet run by Juan Tiney Mendoza, which pumps out a variety of marimba and other indigenous tunes, along with educational programming (in Spanish and Indian dialects), is sometimes well heard around 0230 GMT in the winter. From January to June, the main course on the radio menu is spelling lessons. But the rest of the year, Senor Mendoza said in a friendly letter, cultural programming is the rule. Be sure to write the station if you hear them!

Another favorite of North American listeners is perhaps the top station of the Mayan Connection: *Radio Maya (natch!) de Barillas*, noted on 3325 kHz in the 90 meter band. Radio Maya, located in the pleasant mountain town of Huehuetenango (the locals shorten that to the nickname pronounced "WAY-way"), is under English-speaking operations, but some of the languages used are rather wild! Try Kanjobal, for instance. No matter—if you hear them, drop a note to manager Loran W. Veithe, who will be pleased to know you've heard their 1,000-watt Gates transmitter. The station offers an eye-catching white card with a Mayan Indian warrior outlined on it in green



The lands of the ancient Mayan Empire still hold some of the most attractive scenery in the world, and some of the best DX programs.



Listen for the catchy beat of the native marimba bands, played on authentic gourd instruments to help you find the stations.

for correct reception reports. (Oh yes. If you are *really* after the big game, shoot for Radio Maya's 120-meter frequency of 2360 kHz. And, good luck!)

One of the most easily-logged Guatemalan stations—but by no means dull—is *La Voz de Nahuala*, station TGVN, which bills itself as the "Friend of the Maya-Quiche Culture" broadcasting from the village of Nahuala, not far from our previous acquaintance, "Huehue." Try for TGVN on 3360 kHz about 1200 GMT.

You might think the next station honors that lovely lady who fries eggs for you in the morning, Mom, because that's how you pronounce this outlet located in Cabrican-Huitan: *Radio Mam!* Actually, the Mam Indians are the inspiration for the name of station TBMN, a 1,000-watter that is a relative newcomer to the airwaves, making its debut on Jan. 11, 1975. Gladys Maria Landia, the director, says Cabrican is "a pretty town about 10,000 feet above sea level." You can usually hear this station catering to these direct descendents of the Mayas, broadcasting in the unique Mam language, around 0600-0200 GMT sign-off time on 4825 kHz. And you have to know that any station with a slogan of "Love, Peace and Justice" is going to give DXers their due... and they do! QSLs are quick coming in, usually with a lovely lime-on-white pennant.

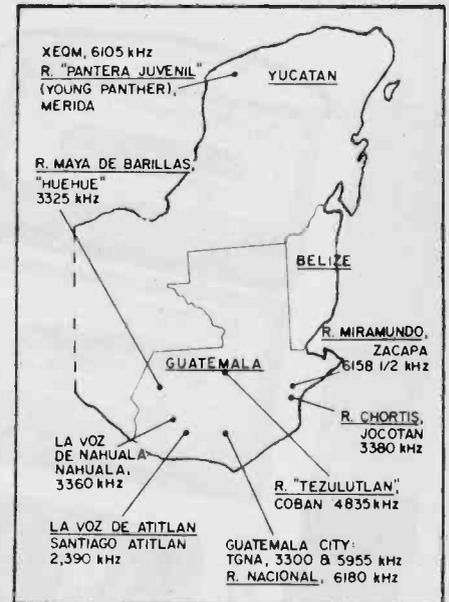
It's Coffee Time! The capital city of the "Department" (like a state) of Alta Verapaz is Coban, a rich coffee-producing district. The residents of Coban most likely enjoy their evening mug of brew while catching the news and marimba offerings of *Radio "Tezulutlan"* on 4835 kHz. Try TGTZ with your morning coffee, though, because it's best around 1200 GMT. The slogan is "Culture and Education," and in case

you wish to write, the honcho is Padre Bernadino Ness, director. But don't be surprised if your full-data reply, complete with pennant, comes from Alberto Pa Macz, an enterprising individual who is announcer, programmer and correspondent for Radio Tezulutlan.

On our way back to eastern Guatemala, and the lowlands, we must first check back in at the capital city to make note of the best-known of broadcasters from this country: *Radio Cultural, TGNA* ("Transmitting the Good News Abroad"), a missionary station heard on 3300 kHz and 5955 kHz, with English at 0300-0400 G.M.T., and Spanish and local languages from 1100 sign-on. TGNA may not exactly fit on the Mayan Connection, but it does send out a dandy QSL card depicting the national symbol of Mayaland: the Quetzal bird. The Quetzal bird, which sports a long (as in l-o-n-g!) green tail feather, romps around in the deep recesses of Guatemala's jungles. It cannot live in a cage and usually dies within a day in captivity. The freedom-loving descendents of the Mayas so admired the creature that their unit of currency is called a "quetzal." It's worth about a buck.

Far in the east of the country, near Honduras and the Caribbean coast, are two unusual stations: Radio Chortis and Radio Miramundo.

Radio Chortis, TGCH, a 1,000-watter entering its twelfth year on 3380 kHz in the 90 meter band, is frequently heard "like a local" stateside. Affiliated with Radio Schools of Jocotan, the village location, the station teaches Indians such tricks as mixing and molding a good adobe brick along with the usual spelling and history. For a good reception report, Padre Juan, the boss, may send you the fascinating local magazine of Radio Chortis, which contains



the station schedule. Try at 1100 GMT, when the "Country Dawn" program features regional music and "saludos"—which are "hello's" to listeners. At 1200 GMT, it's time for the general cultural program, "School For All." Of course, it's in Spanish. The transmitter is a good ol' American-built Collins.

Radio Miramundo, La Voz del Ejercito (The Voice of the Army), located in Zacapa, is one station that's created quite a stir among US DXers. Up to recently, no one was even sure it really was a shortwave station. But Miramundo slipped out from underneath a big bopper of a Colombian station and now is heard nearly daily with a hotshot marimba program around 1215 sign-on time on 6158½ kHz. Good news, too, is that QSLs are starting to come in. Try hearing Hugo Echeverria's show, "The Miramundo Festival." Drop him a line, too, if you do!

(Continued on page 86)



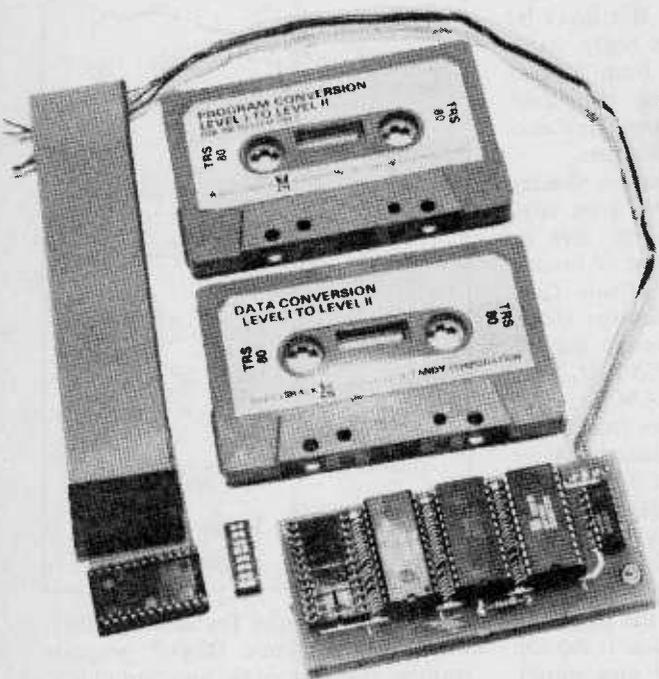
The Mayans ruled their part of the world for many years, and they built an impressive civilization, awesome ruins of which remain.



Many of the present day inhabitants of the region live a simple, peaceful life reminiscent of the long ago, Imperial ancestors.

UPGRADING THE TRS-80 COMPUTER

Convert your Level I Radio Shack TRS-80 computer to full Level II specs for just \$99



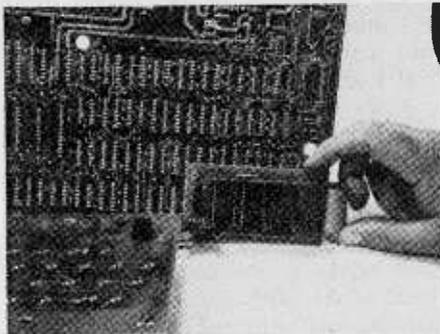
CIRCLE 32 ON READER SERVICE COUPON

□ It's SAFE TO SAY that the Radio Shack TRS-80 with Level II BASIC is twice the computer it was with the old Level I BASIC, and when this fact became apparent to the early purchasers of the TRS-80, which was then available with Level I only, some were pretty burned up that their machine was reduced to second-class status after only a few months. It is rumored that some owners were making voodoo dolls shaped like Radio Shack Level II ROM chips and pinning them so that one input line was open.

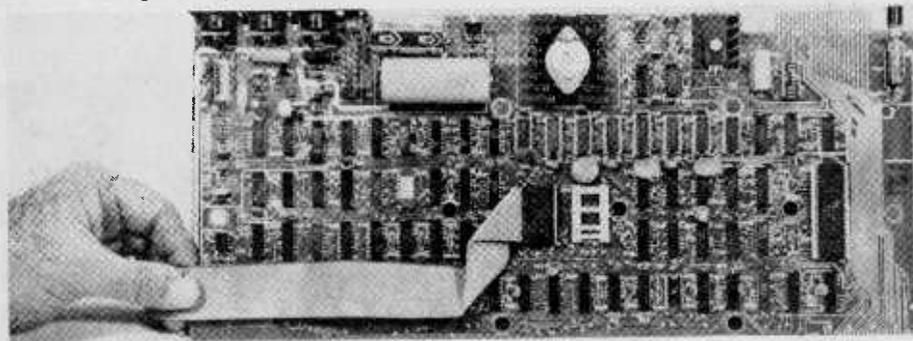
Add On Level II. To Radio Shack's credit, however, such drastic steps are no longer needed. For \$99 (the difference in cost between Level I and Level II computers) you can have your Level I TRS-80 factory modified to full Level II specifications. Radio Shack does all the work for you.

Of course, if you, like thousands of others, are perfectly happy with the

TRS-80 Level I system there is no need to change. Last year when we first reviewed this computer we were, like everyone else, impressed by how much



On the flip side of the computer board the free ribbon connector plugs into one of the original ROM sockets. A jumper, resistor installation, and a cut foil complete the Level II conversion. It couldn't be easier, yet it works, and without major modifications to the original computer.



The 12K module has adhesive strips on the bottom. You position the module over the edge of the main computer board and press down; voila, the module is secured to the computer. The ribbon connector plugs into the empty right hand socket, as shown. Four wires from the module are tack-soldered to foils on the computer printed circuit board.

was delivered for so little. For only \$599 you got a computer with a TV terminal and a cassette bulk-data storage recorder.

On the surface the TRS-80 appeared to be a formidable computer value, but, as we were to discover and point out in our review, the Level I BASIC was sharply limited in terms of effective use for hobbyists and students above the grade-school level. Among other things, the Level I version of BASIC has only two string variables, and lacks the "transcendental package" which provides trigonometric and math functions required for effective use by students in junior and senior high school, and college.

Boosting the BASIC. Level II BASIC, which came along later, corrected all the defects inherent in Level I. Essentially, it is the 12K Microsoft Extended BASIC, which is one of the most powerful BASICs available to hobbyists. You name it, and it's probably in Level II. Even *named* files are included—which is the next best thing to a disc system, along with specific error codes (23 of them), program trace, and well, there's little that's not there. 12K provides a lot of room for "extension," and Radio Shack has packed it with everything, even an *edit* mode that allows you to correct bits and pieces of programs. For example, you can correct parts of a multiple statement line without retyping the entire line.

Finally, the Level II speeds up data handling. The Level I BASIC cassette baud rate was only 250. The Level II

(Continued on page 95)

We all know how annoying TV commercials (and some programs) can be. Some times you would love to be able to flick off their loud, abrasive chatter until the show comes back on, but you are watching TV to relax not to jump up and down every ten minutes. With this simple remote control unit you can turn the sound on and off with the blink of a flashlight.

All you do is aim a flashlight at a small box sitting on top of the TV. When the unit receives the first flash of light the sound is turned off and an indicator light comes on (verifying your signal). When you want the sound back another flash of the light and the sound is restored.

There are a number of good reasons for using a flashlight as the transmitter. First, of course, it is simple and inexpensive. Also it allows the receiver to be simple, and hence easy to build and trouble-shoot. Naturally this system requires the operator to have a free line-of-sight to the TV, but a viewer always has that. Further the unit responds to any number of flashlights.

How It Works. The circuit operates as follows. The signal light is received by a photo-transistor (P1) recessed behind the front panel. A photo-transistor is a transistor where the base signal is effectively provided by a light source, the brighter the light the more it turns on. In this circuit, the photo-transistor is used as one leg of a voltage divider. When the light strikes P1 the voltage across it drops. This "falling edge" is amplified by Q1 and then used to trigger the monostable multivibrator (IC1).

This device (IC1) is often called a "one shot" because it outputs one pulse of uniform width each time the input goes high or low (depending on how it's connected up). The length of this pulse is set by C2 and R5, in this case about .5 sec. The "one shot" here is acting as a buffer, taking the rough signal from the flashlight and converting it into a nice, clean, clock pulse for the flip-flop (IC2).

The flip-flop is used here as a memory to keep track of whether the TV sound is on or off. One property of the J-K flip-flop is that if both J and K inputs are held high (5v), the output will "toggle" with each clock pulse. In other words if the output is low, it will go high with the first clock pulse and then low again with the next clock etc. This is just the kind of action we need. When the output of IC2 goes high it will turn the sound off and hold it off until it gets another clock pulse. To accomplish this the output of the flip-flop is used to drive the relay con-

REMOTE CONTROL

Kill your TV's sound with the blink of a flashlight

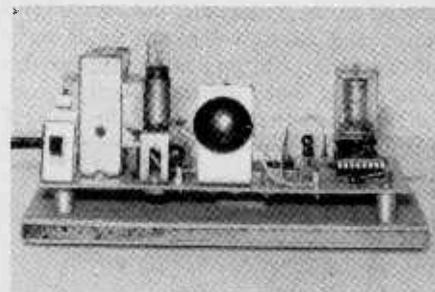


by Christopher Kilian

trol transistor Q2. When IC2 goes high, the transistor turns on providing a path for the relay coil current to ground, thus energizing the relay.

Note the diode D3 across the relay coil. This is necessary as it provides a safe path for the built-up energy in the coil to dissipate when the relay is de-energized. Without the diode high voltage spikes occur which quite probably would cause false triggering in other parts of the circuit. The relay performs two functions. The first set of contacts (normally closed) controls the sound by opening the TV speaker circuit. The other set of contacts (normally open) controls the indicator light which is powered by the 12.6 VAC from the transformer. The function of this light is more important than you might think as it gives the operator a positive indication of what state the unit is in. (It's not always obvious from program material.)

The power supply is simple and straightforward. The 110 VAC is run thru a power switch into a 12.6 fila-



Install a light shield over the photo-transistor so that the unit will not be triggered by anything other than the flashlight beam. Installing the project inside a light proof case with only a small hole in front of the photo-transistor will make the unit even more effective. With a little bit of imagination this controller could be adapted to almost any device you can think of

ment transformer. The 12.6 VAC is rectified by a full-wave rectifier using the center tap with D1 and D2, then smoothed by C1. This unregulated voltage is adequate for the relay coil, but not for the ICs, so the 6-V zener

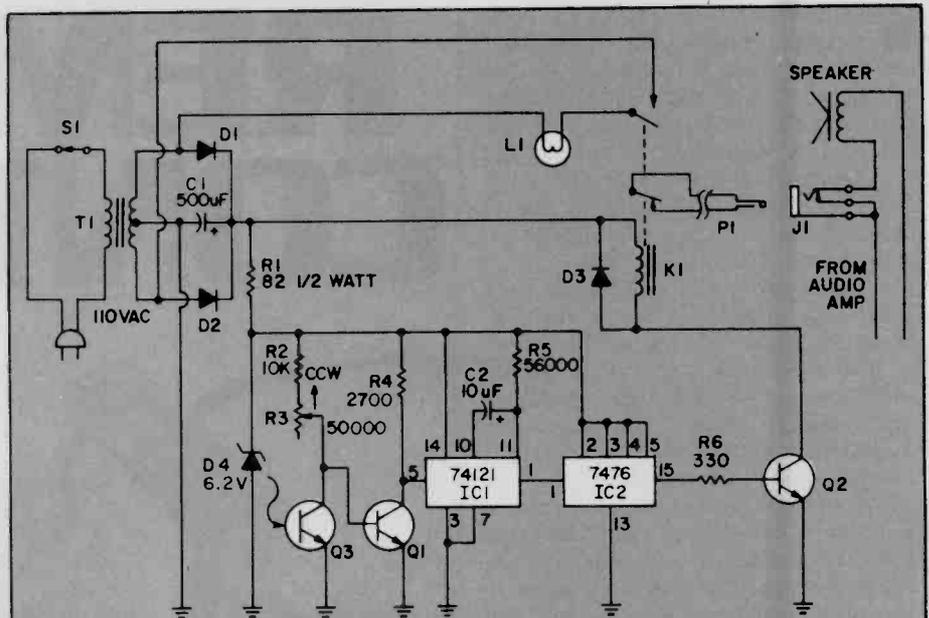
e/e REMOTE CONTROLLER

is employed to provide a regulated 6-V for these components.

Construction. Probably the easiest way to construct the circuit is on a 4½-in. by 6-in. perforated circuit board using push-in terminals for connection points. Start by laying in the transformer, relay and IC sockets. If you use a board with 0.1 in. centers the IC socket pins should stick right through and can be secured with two small screws. Mounting the transformer and relay will, of course, require enlarging some holes. Next, the push-in terminals may be inserted and the components soldered into place. Note that the photo-transistor is mounted directly on top of Q1, facing the front. It should be as far above Q1 as its leads will allow. For a professional looking job turn the board over and solder the interconnecting wires on the backplane.

The circuit can now be mounted in a case using stand-offs. Mount the power switch, potentiometer, and indicator on the front panel. Cut a one-inch hole directly in front of the photo-transistor to allow the flashlight beam in. Finally, it is best to enclose the whole unit to keep ambient light from activating the circuit.

Installation and Checkout. To complete the system a simple modification to the TV is required. Unplug the set, remove the back cover, and locate the two wires going to the speaker. As shown in the schematic, cut one of the wires and connect the two leads to a phone jack, which you mount in the side of the case. When the jack is correctly wired the sound will be normal



PARTS LIST FOR REMOTE CONTROLLER

Need parts?
Hobby Mart, page 89.

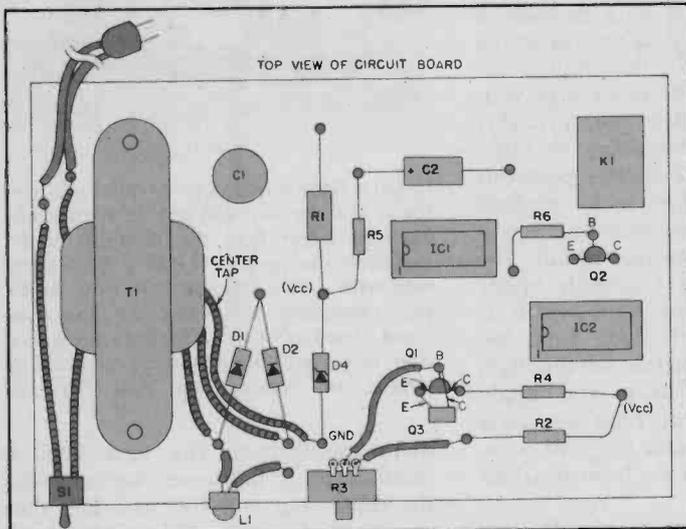
- C1—500-µF, 35-volt electrolytic capacitor
- C2—10-µF, 35-volt electrolytic capacitor
- D1, D2, D3—1N4003 diode
- D4—1N4735, 6.2-volt zener diode
- IC1—74121 monostable multivibrator
- IC2—7476 dual JK master/slave flip-flop
- J1—closed circuit jack (Radio Shack 274-292, or equiv.)
- K1—12-volt DPDT relay
- L1—lamp assembly and 12-volt bulb
- P1—matching plug for jack J1 (Radio Shack 274-289 or equiv.)
- Q1, Q2—2N3904 transistor
- Q3—photo-transistor (Radio Shack 276-130

- or equiv.)
- R1—82-ohm, ½-watt, 10% resistor
- R2—10,000, ¼-watt, 10% resistor
- R3—50,000-ohm, potentiometer
- R4—2,700-ohm, ¼-watt, 10% resistor
- R5—56,000-ohm, ¼-watt, 10% resistor
- R6—330-ohm, ¼-watt, 10% resistor
- S1—SPST switch
- T1—12.6-volt center tap filament transformer
- Misc.—one 16-pin and one 14 pin IC socket, 4½-in. by 6-in. perfboard, cabinet, nuts, bolts, spacers, perfboard push-in terminals, sheet metal, knob, power cord, etc.

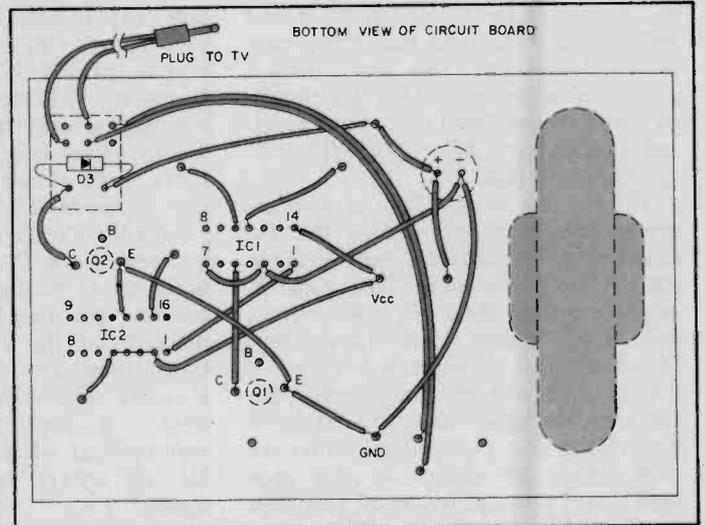
when the control unit is not plugged in. But when it is plugged in the relay must be closed to complete the sound circuit.

Once the system is operational, some adjustment of the sensitivity potentiometer is necessary. Have someone op-

erate the flashlight from the viewing area while you adjust the pot. Find the point where the unit responds to the flashlight but not to room lights etc. Now sit back, knowing you have at least some power over Madison Avenue. ■



This top view of the circuit board shows how the photo transistor is mounted directly on transistor Q1's base and emitter leads.



Point to point wiring and perfboard construction make this project a snap to put together. Take care hooking up the relay.



e/e checks out the...



CIRCLE 74 ON
READER SERVICE COUPON

This ultrasonic servant turns appliances
off and on at your whim

Universal WhistleSwitch

☐ JUST GIVE A WHISTLE . . . and your cassette deck will start or stop, your video cassette recorder (VCR) will pause for commercials, or your photo studio modeling and work lights will turn on and off. Fact is, just about anything you can control with a switch can also be controlled without ever leaving your chair by simply giving a whistle, or to be more precise, an "ultrasonic whistle." Your only problem will be to decide whether you need to control 120 VAC, or some other voltage or signal source.

The device that makes it all possible is the "Whistleswitch," made by Universal Controls Corp., and sold by many parts distributors and hobbyist suppliers.

The "Whistleswitch" really consists of two assemblies: a receiver and transmitter. The transmitter, or "whistler," is simply a dog whistle mounted in a small squeeze bag made of plastic, much like the air control device used by photographers for remote control of camera shutters. Squeeze the whistler and air is forced through the whistle, producing an ultrasonic sound which barely is discernable by the user.

The ultrasound is picked up by the receiver, a small plastic box measuring 2½-in. by 4½-in. by 1½-in. On one side of the box are terminals that plug directly into an AC outlet. On the op-

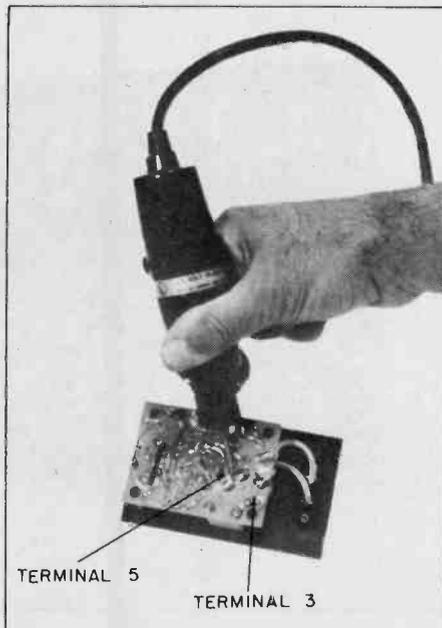
posite side is a relay-controlled AC outlet. When the receiver senses the ultrasound signal from the whistler it applies power to the outlet. Another burst of ultrasound removes power from the outlet. Each subsequent burst

of ultrasound causes the outlet to "flip."

Range. The system has a working range of up to 30 feet, the exact value depending on the surrounding furnishings. A sensitivity control on the bottom of the box allows the device to be adjusted for the minimum signal from the whistler that will trip the relay, thereby reducing the possibility of false tripping by random noise.

If all you need to do is control AC power, such as turning a TV or lamp on and off, the system as supplied is all that's needed. However, if you need to control a low voltage circuit, such as a VCR's pause, or a reel-to-reel recorder's remote start, or an audio circuit, the AC outlet is of no use unless you want to use an external control relay. However, since the AC outlet is controlled by an internal relay in the receiver, a few simple modifications are all that's needed to provide an ordinary set of switching contacts, making the device a universal whistle switch.

Modification. The first step is to open the box, whose cover is cemented rather than secured with screws. Simply force the tip of a pocket knife against the cemented joint between the front and back of the receiver and draw the knife around the four sides. Don't press too hard or the blade might slip into your thumb. Repeat the draw until



The foil on both sides of relay terminal number 5 must be cut away. Although the job can be done with a knife or an ice pick, a neater cut is done by using a rotary grinder bit in a small, hand-held drill.

e/e WHISTLE SWITCH

you have cut through the joint. Carefully remove the cover, taking care not to damage the sensitivity control, whose shaft, which cannot be removed, extends through the cabinet.

Using diagonal or side cutters, clip both wires running to the AC receptacle at the printed circuit board. Next, locate the relay, which is in a small plastic housing on the PC board. If you flip the board over, you'll find that directly below the relay is the printed circuit wiring shown in the diagram. The relay has five terminals (the numbering shown is ours), with a foil connection between terminals 4 and 5 which extends on to other circuits. This is the only important foil; forget about all others.

Using a knife or rotary grinder, cut through the foil on both sides of terminal 5, as indicated by the arrows marked CUT. When you're finished, terminal 5 should have no connection. It is the wiper contact for the relay. Terminals 2 and 3 are the stationary contacts. Set the assembly aside for the moment.

Using a drill or other suitable tool, remove the AC outlet from the cover and replace the outlet with a plastic or Bakelite strip. Secure any type of "control" jack to the strip before installing the strip in the cover. (A small section of ordinary perf-board will be fine.) There isn't too much room behind the strip because the AC plug terminals share the same space, so a small jack such as the phono type, or mini-jack used on portable recorders, is recommended.

Solder short lengths of #20 or #22 insulated stranded wire to relay PC board terminals 3 and 5, and to the control jack. Polarity is not important because all relay terminals are now isolated.

Finally, reassemble the box. Press the front and rear sections together, draw a bead of fast-drying plastic cement around the joint, and hold the parts together until the cement sets. Perhaps the fastest method of assembly is to feed some plastic solvent, such as that supplied in the "G. C. Plastic Repair Kit," around the joint. The solvent actually "welds" the plastic together in seconds. The way to do this is to fill a needle injector with a small amount of solvent and inject a drop or two into the joint. The solvent runs the length of one side of the joint and al-



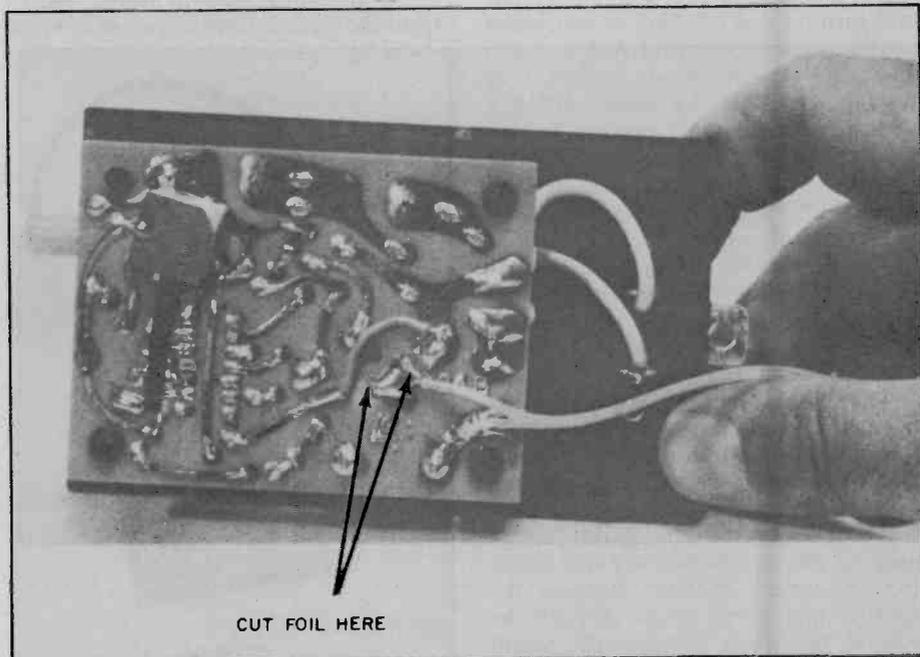
Here, the new control jack is shown installed in place of the original AC outlet. We strongly suggest the use of a miniature jack, as clearance under the cover is severely limited. Use a thin flexible wire to connect the jack to the PC board.

most instantly welds the two pieces by dissolving some plastic from both sections of the box. In a few seconds the solvent evaporates, leaving the sections permanently "welded" together.

Using The Whistle Switch. Install the receiver on an AC outlet near the equipment to be controlled and connect a control cord from the receiver's jack to the equipment. You will probably have to make up a patch cord with the correct connectors. Since the whistle switch requires insignificant power it can be left plugged in at all times.

When first plugged in, the whistle switch's control contacts are open. The first "whistle" closes the contacts. Aim the *whistler* at the receiver and squeeze. If the relay fails to trip, advance the receiver's sensitivity control, always using the minimum amount of sensitivity required for reliable operation.

Unless the room has uncovered floors and ceilings, the whistler's signal probably won't bounce or reflect around objects, so try not to conceal the receiver behind the controlled equipment. Keep in mind the system will be certain to work if there is nothing between the whistler and the receiver. ■



The finished cuts around terminal number 5 are shown here, with the new leads to the control jack soldered into position. Use a magnifying glass to be certain that you have removed all of the copper foil, and that no fragments remain on the board which might cause a short circuit. Allow for sufficient length in the wiring from the printed circuit board to the control jack, so that when the cover is closed, no strain will be placed on new connections. The WhistleSwitch is ready for duty, at your command.

e/e checks out the...



CIRCLE 40 ON READER SERVICE COUPON



Regency Flight Scanner

Fasten your seatbelt and you'll be clear for takeoff into a new realm of radio listening

□ WHILE A VHF-UHF SCANNER puts you where the action is, it doesn't give you *all* the action. Specifically, it leaves out the 108-138 MHz, amplitude modulated, aircraft band. If you want to hear what's going on at the local airports, or ride along in the cockpit of an airliner, you'll need a scanner specifically designed for these frequencies and AM modulation.

While there are many crystal controlled aircraft scanners available, finding the right frequencies and crystals for your area can prove expensive unless you know someone at the airport who can give you a list of the air and ground frequencies. A much easier way to get on the aircraft band is with a programmable scanner, one that searches out the frequencies in use and

then let's you program them into a channel.

Tower Finder. The Regency ACT-T-720A Digital Flight Scan is just such an aircraft band scanner. Using an on-board microprocessor—in reality a small computer—the ACT-T-720A can actually search a user-selected range of frequencies between 108 and 136 MHz, and then program any of the “discovered” frequencies into one of 16 channels. Of course, if you know the local aircraft frequencies you can program them in directly without searching them out.

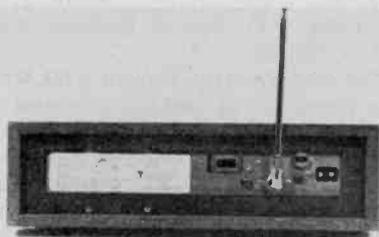
Because the scanner is digitally programmed there is never a need to purchase crystals as you discover new frequencies or move from area to area. To change frequency you simply punch the new one in through a keyboard (more on this later).

The Digital Flight Scan has 16 programmable channels, a battery maintained non-volatile memory (in the event of power failure you don't lose programming), a volume control, squelch control, and a seven-digit LED display used to indicate the frequency programmed into a channel, the frequency scheduled to be programmed into a channel, d (delay before resuming scan), and L (channel locked out of scan). In addition, there is a search mode that scans between user-selected frequency limits, stopping on active frequencies and indicating the frequency on the LED display. The frequency can be logged or instantly programmed into one of the channels.

A bank of 16 LEDs (light emitting diodes) indicates whether a channel is on or off. The diodes used as channel 1 and channel 2 indicators also serve as the programming indicators for the search: when the channel 1 indicator is lit the lower search limit is entered; when the channel 2 indicator is lit the upper search limit is entered. Search limit programming, however, does not affect the frequencies programmed into channels 1 and 2. A 17th LED is used to indicate scanner is in the search mode.

Three “keyboards” determine the specific type of operation. The keyboards are similar to those found on electronic scales used by food stores. The keyboard itself is a flexible plastic sheet with alpha-numeric symbols. Be-

(Continued on page 87)



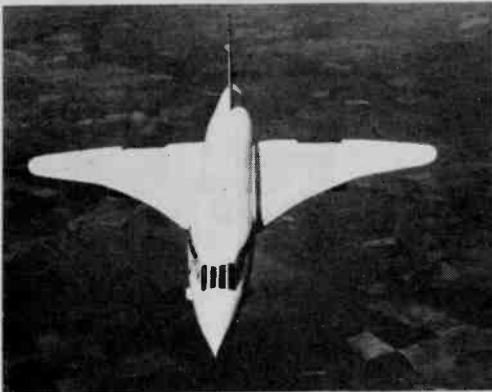
The rear apron has sockets for the AC and DC power cords, and jacks for a remote speaker and the antenna. The supplied telescopic whip antenna plugs directly into the antenna jack as shown; it is simply unplugged if you want to use an outdoor antenna. The 9-volt battery for the channel memory protection slides into a small compartment that is normally protected by a metal plate; we have removed the plate so you can see how the battery slides.



The L.E.D. frequency readout indicates the channel or received (searched) frequency. The letter “P” following the frequency indicates it is one of two user-programmed priority channels. An “L” following the frequency indicates the user has locked that channel out of the SCAN, though it can be manually selected. A letter “d” following the frequency indicates that a 2-second delay has been programmed before scanning resumes after the station carrier goes off.

DXing at the Speed of Sound

by Harry Helms Jr.



Tune in on the high-flying excitement of aircraft radio

A MOVING TARGET may be harder to hit, but not for DX, even when the target is moving at 1200 miles per hour at an altitude of 29,000 feet! SWLs can "reach for the sky" by tuning in the international aeronautical frequencies, receiving many fine catches and QSLs for their efforts. Both aircraft aloft and airports can be tuned in, with transmissions ranging from routine weather broadcasts all the way up to top-secret, coded instructions for nuclear bombers of the Strategic Air Command!

While over land, most air traffic is confined to the 108-136 MHz aeronautical band. However, this band has limited range and is not useful when aircraft must travel far away from land (such as on trans-oceanic flights) or where aircraft are frequently operating far away from their home base (such as in the military). For such situations, certain frequency ranges have been set aside in the shortwave spectrum to handle communications to and from aircraft. Our chart gives these frequency ranges. Almost all air traffic today is in the single sideband (SSB) mode, usually upper sideband, although aeronautical weather transmissions are still largely in the AM mode.

Aviation Weather. The simplest aero-

nautical stations to hear are known as the *VOLMET* stations. These stations transmit weather information to aircraft operating on various international routes. One of the best-heard stations is operated from New York's Kennedy International Airport, giving weather

Major Aeronautical Bands All Frequencies in kiloHertz	
2144-2170	10005-10100
2850-3155	11175-11400
3400-3500	13200-13360
4650-4750	15010-15100
5480-5730	17900-18030
6525-6765	21850-22000
8815-9040	23200-23350

The above list is of the major aero bands. Pilots will switch from frequency to frequency according to propagation and need.

information for cities located in the eastern half of the United States. Transmissions last for twenty minutes, beginning on the hour and half-hour. During the twenty minutes of each hour that this station is silent, another *VOLMET* station located at Gander, Newfoundland is on the air on the same frequencies giving weather information for various Canadian cities. Together, New York and Gander serve what is known as the "Atlantic area

route." Another group of five *VOLMET* stations serve the Pacific area route.

Our chart shows the times and frequencies that easily-heard *VOLMET* stations use. Station identification is often simply the name of the city where the *VOLMET* is located, such as "New York Radio" or "Gander Aeradio." There are many other *VOLMET* stations around the world, and most are very good verifiers of DX reports. Lists of *VOLMET* stations, along with their addresses, can be found in the *SPEEDX Utility Guide*, available from *SPEEDX*, P.O. Box E, Elsinore, California, 92330.

Old Sod DX. One foreign *VOLMET* that should be of particular interest to North American SWLs is "Shannon Aeradio," located at Shannon Airport in Ireland. This *VOLMET* is the only chance most DXers have to log and verify this rare country! Tune for it on 8833 kHz from 2200-0700 GMT. If you hear it, you can send your report to Shannon Aeradio—EIP, Ballygirrein, Newmarket-on-Fergus, County Clare, Ireland.

Commercial Flights. Commercial airliners traveling along international routes keep in touch by using several assigned frequencies. Frequencies used depend on which route the airliner is

taking. Flights in the Caribbean area use 8959 kHz for example, while those in the Far East use 8868 kHz. Transmissions are in the upper sideband (USB) mode and you'll find English to be the most widely used language on international flights.

Airplanes will identify by the name of the airline and the flight number, such as "Air France 102" while airports will simply use the name of their city, such as "Miami." However, all British Airways (formerly BOAC) flights are identified as "Speedbird." Similar, all Lufthansa aircraft identify themselves as "Bluebird."

Our chart will show you where to tune to hear commercial air traffic. Of particular interest to East Coast listeners should be 11367 and 13328 kHz, which are often used by the supersonic Concorde. Most commercial aeronautical stations will QSL, although a prepared card is usually necessary. Transmissions from airports can be reported to the Communications Officer-in-Charge of the airport heard; transmission from airplanes can be reported to the Flight Communications Manager of the airline operating the aircraft heard.

Uncle Sam's Planes. The United States Air Force maintains perhaps the most extensive and sophisticated air communications system in existence. Some of the most fascinating listening available to the SWL can be found here.

Our chart lists some of the more commonly heard frequencies used by various Air Force bases. All transmissions are in USB and are identified by the name of the air base. DX'ers should pay particular attention to the frequencies used by Albrook Air Force Base (AFB) and Elmendorf AFB, as these two targets are among the easiest ways to hear and verify, respectively, the

If you live along the Atlantic, Gulf or Pacific coasts you might chance to tune in some naval air action such as this McDonnald Douglas A-4E Skyhawk close-support and attack plane. Watch your newspapers for reports of training exercises.



Commercial Airliner Channels and Routes

freq. kHz	Routes:
5589	North Pacific
5610	North Atlantic
5638	Pacific and Atlantic
5673	Atlantic, Caribbean, Southeast Asia
6540	Caribbean (very busy channel)
8868	Far East
8889	North and South Atlantic
8931	North Pacific
8959	Caribbean
10049	South Atlantic
11343	Caribbean
11367	North Atlantic (used by the Concorde.)
13205	Soviet flights to Cuba
13288	Central Atlantic
13328	North and South Atlantic (Concorde channel)
13344	South Atlantic

This chart shows the frequencies commonly used on various international air routes. Listen up for the Concorde (the plane shown at the beginning of this article) on the frequencies indicated. The British Airways flights identify as 'Speedbird.'

Panama Canal Zone and Alaska! Most Air Force bases will verify correct reports by QSL card, and you can send your reports to the Chief Radio Officer at each air base.

Ordinary Air Force flights will identify themselves simply by aircraft numbers, such as "Air Force 27856." How-

ever, stations of the Strategic Air Command (SAC) often use tactical call signs to disguise the location of their ground stations and planes aloft. These tactical calls are changed frequently, but among those used in the past have been "Bagman," "Aerosol," "Dog-
(Continued on page 86)

While it's doubtful you'll ever catch a U-2 spyplane like the one shown here, you might DX these Air Force bases, and S.A.C. intercontinental bomber frequencies.

Strategic Air Command Frequencies

4725, 6761, 9027, 15041 kHz



U.S. Air Force Bases and Frequencies

freq. kHz	Base and Location	freq.	Base and Location
6727	Scott AFB, Illinois	8995	Albrook AFB, Panama Canal Zone
6738	Elmendorf AFB, Alaska	9017	Andrews AFB, Maryland
6750	MacDill AFB, Florida	9023	Scott AFB, Illinois
8964	Hickam AFB, Hawaii	11176	Albrook AFB, Panama Canal Zone
8967	Andrews AFB, Maryland	13201	Andrews AFB, Maryland
8989	McClellan AFB, California	13201	McClellan AFB, California
8989	Elmendorf AFB, Alaska	13244	Loring AFB, Maine
		15015	Loring AFB, Maine

e/e installs the...

VIGILITE ELECTRONIC HOME SECURITY TIMER



CIRCLE 70 ON READER
SERVICE COUPON

**Microprocessor timer gives your home
that lived in look while you're away**

□ VIGILITE IS A NEW microprocessor-based, pre-programmed light control unit that permits unusually efficient automatic control of home lighting to make would-be intruders think your unoccupied home is inhabited. It does away with all those plug-in clocks that clutter tables and floors, and that require dangling power cords that your dog or cat runs into constantly, or that your two-year-old uses as a teething device. Vigilite (made by Hutech Corp. in California) installs neatly and permanently as a replacement for any conventional single-pole wall switch.

When automatic lighting control is not required, the unit functions exactly like a normal on/off switch, except that it also constantly shows the correct time of day by means of a digital readout. When you intend to leave your home unoccupied, simply press a "room" button to activate the automatic timing system. The unit will then turn any 40- to 300-watt lighting fixture on the circuit on and off according to a pre-programmed schedule.

Five Patterns. Five different timing patterns are factory pre-programmed into each Vigilite (see chart) to simulate typical use of lights in key home locations, a bedroom, outside, kitchen and family/living room. You can quickly and easily select the appropriate timing sequence by means of a pushbutton. Obviously, for maximum protection, you need two or more Vigilites in your home so that an ob-

server on the outside thinks people are moving about in the house. Since there is no installation cost (you can install the Vigilites yourself), the total cost of your lighting security system is calculated by multiplying the unit cost of \$39.95 by the number of locations you wish to control.

Note that a Vigilite can control built-in overhead lights, as well as table lamps plugged into a switch-controlled wall receptacle, which is something that a conventional clock control cannot do. Just understand that the device must *not* be used to control such things as a TV set, appliances, or any other motor-driven equipment.



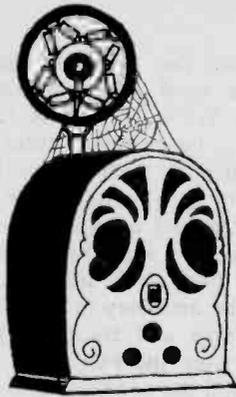
After cutting off power at the fuse box, remove the light switch and install Vigilite in its place. The whole job takes five minutes.

How it Works. Before discussing the very simple installation procedure, let's see exactly how this ingenious invention works. First you press and hold down a "Time" switch. After one second, the digital readout will count minutes from 1 to 60. Continue pressing until the minute is on the correct number, then release the "Time" switch. Next repeat the same procedure to set hours. Note that P.M. time is indicated by two lighted dots that appear between the hours and minutes displays. You have now quickly and easily set the clock to indicate the correct time of day or night.

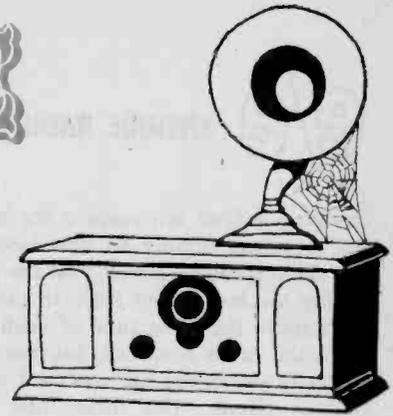
To select the desired automatic on/off switching pattern, push and hold down the "Room" button until the display indicates symbolically the room-pattern of your choice. For example, when symbol "F" appears, release the "Room" button if you want the family/living room program. When this is done, the correct time of day again reappears on the digital display.

Activation of the program-selected mode is done by depressing the "Room" button for *less than 1 second*. Pressing longer would start changing the programming again. After this fraction-of-a-second activation procedure, the digital display alternately shows the correct time and the selected room pattern symbol. To deactivate the system, simply once again press the "Room" button for less than 1 second.

(Continued on page 88)



ANTIQUE RADIO CORNER



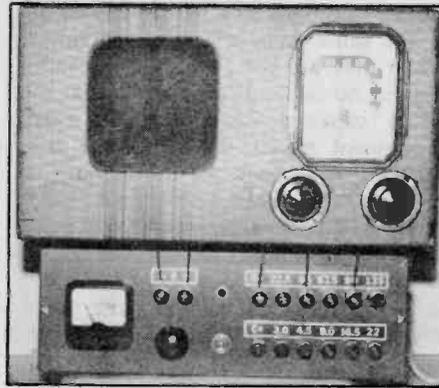
by James A. Fred

Troubleshooting Antique Circuits

□ MANY ANTIQUE RADIO collectors are older men who started radio repairing in the 1920's. They remember the magnetic speakers, WD-11 tubes, TRF and Neutrodyne receivers, catwhiskers, etc. But what about the younger collectors who were trained on transistors, diodes, phase-locked loops, emitters, collectors, etc? I hear from this group of collectors, who are usually between 20 and 35 years old, quite often. Many have taken up collecting so they will have a hobby to turn to at home. They tell me that it is very satisfying to restore a 1920's radio with its superior hand-made construction, large, easy-to-see and repair components, and fine wooden cabinets. There is nothing to compare with the thrill of turning on the power and tuning in a station on a set you have brought to life with your own hands.

Simplicity. The old sets were so sim-

ple that the only test instrument needed to troubleshoot most radios was a volt-ohmmeter. Of course it would be helpful to have a simple tube tester capable of testing the real old tubes,

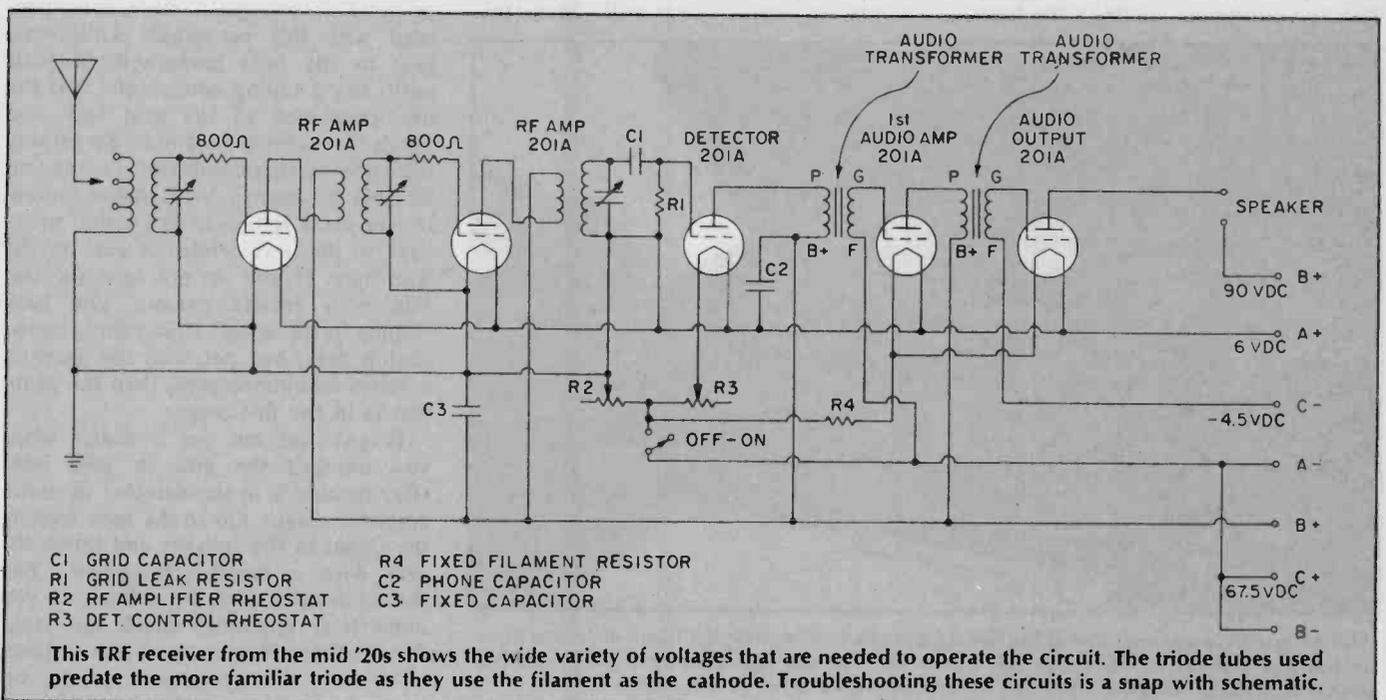


Using special batteries for old radios is expensive. I use this special power supply which is described in detail in the text.

and a signal generator. Since troubleshooting of solid state devices is usually done with an oscilloscope, the modern technician may not have simple test equipment or know where to buy it. It is fine to own and use a digital VTVM, an oscilloscope, and a function generator, but look at the fun he is missing by not troubleshooting his 1920's radio with 1920's test equipment.

Since we have already discussed an ohmmeter and the voltmeter, we will tell you how to troubleshoot a 1924, 3 dial, TRF radio receiver. To troubleshoot this set, the only instrument you will need to perform all the necessary tests, is an ohmmeter, unless the set still doesn't play after you have resistance checked it and turned it on. If it still doesn't play, you will need the voltmeter and perhaps a tube tester.

Troubleshooting. To start trouble-



e/e ANTIQUE RADIO

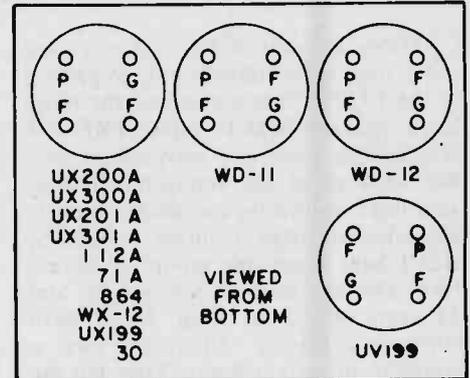
shooting a dead set, remove the batteries or power supply so you have just the radio standing alone. Pull the tubes, *noting the location of each*, in case you have more than one tube of each type. With the tubes removed, use the ohmmeter to check the filaments for a continuous circuit. The three tube bases you will find, with the pin locations indicated, are illustrated. Before checking the WD-11, WX-12, or 864/VT24 tube filaments, be sure your ohmmeter does not apply more than 1.5 volts to the tube filaments. Either open up your meter and visually check its battery voltage, or use another voltmeter to measure the voltage across the test prods. The reason for this is because the above listed tubes only require 1.1 volts on their filaments and a voltage higher than 1.5 could burn them out. After you are sure that your tube filaments are OK, lay them aside until later. Take your ohmmeter and check all coils, (those connected to turning condensers) rheostats, and audio transformer windings for continuity. The resistance of the tuning coils will be very low, between 2 and 20 ohms. Visually check the tuning condensers at this time to be sure that the movable plates do not touch the stationary plates as you turn the tuning knob. The primary of the audio transformer will measure around 1000 ohms, while the secondary will measure 5000 or more ohms. If either of these windings are open (no resistance reading) the trans-

former will not operate properly, if at all. Repairing transformers is a difficult task, with most needing to be rewound or replaced. Repairing and rewinding will be the topic of a future article.

The filament rheostats will measure from 6 to 30 ohms. Grid leaks are resistors too, but will vary in resistance from 100,000 ohms to 10 million ohms. Most inexpensive volt-ohmmeters will not measure the value of a grid leak. Fixed capacitors (called condensers from 1920 to 1940) should show an open circuit when measured with an ohmmeter. If they show any resistance at all, they should be replaced. Use only mica, ceramic, or dipped mylar capacitors in the old battery radios. If the capacitors are sealed into metal boxes or plastic containers, (Philco has these) you can melt out the tar and put new small capacitors of the same value into the containers. When they are remounted in the radio chassis, no one will ever know that the inside capacitors are new. If every component passes the ohmmeter test, you can now check the headphones or speaker. Old headphones and loudspeakers will have from 2000 to 5000 ohms of impedance. Do not use crystal or dynamic earphones with these old radios because they will not work properly, if at all, due to the impedance mismatch.

Firing Up. Now you are ready to put good tubes into the radio, connect up the headphones or speaker, power supply or batteries, and antenna and ground. Turn on the power and the radio, and watch for the tube filaments to light. You will have no

trouble seeing the filaments light in 71As, 112As, most 201As and 200As. The WD-11, WD-12, and WX-12 filaments have to be viewed in total darkness to see them. If there are no lighted filaments, turn the rheostat knobs. With the rheostat turned to minimum resistance the filaments should glow at their brightest. If there is still no light in the tube, it will be necessary to measure the filament voltage and trace the circuit all the way from the battery or power supply through the connecting wires, or cable, to the tube socket. There is the possibility of a bad solder joint or cor-



You can use this guide to find out the pin locations of some of the popular old tubes.

roded tube socket contacts. Be sure your battery is good, or that your power supply is furnishing the correct voltages for the tubes you are using.

With the filaments lighted, you should begin to hear noise in the headphones or speaker. Touch the grid leak or the grid terminal of the detector tube and you should get a loud hum or howl. If you get a noise here, proceed with this paragraph. Otherwise, skip to the next paragraph. If your radio has 3 tuning condensers, find the one connected to the grid leak and touch the antenna lead to it. By turning the knob on that condenser, you should be able to hear a local radio station. If you get a station at this point, move back to the next condenser and try the lead here. If you do not hear the station with greater volume, you have trouble in this stage. If you do hear the station here, but not with the antenna wire on its binding post, then the problem is in the first stage.

If you did not get a sound when you touched the grid or grid leak, your trouble is in the detector or audio amplifier stages. Go to the tube feeding the signal to the speaker and touch the grid with a metal screwdriver. You should hear a click or a hum. If you don't hear anything, check this stage for trouble. If you do hear a noise.

(Continued on page 84)



This Metrodyne receiver is one of the first AC operated radios with the filament connections at the top ends of the tubes. In this photo you can see the filament harness running across the tops of the tubes. The lack of batteries was a boon to radio sales.

GETTING YOUR BNEE FOURTH SEMESTER

□ Now that your station is assembled, let's make a contact. To do this, we'll first talk about "why morse code?" and then get into some operating procedures. In the meantime, get your rig warmed up!

The Morse Code. The code may seem senseless to bother with for you at first, but it is the most efficient use of radio spectrum space there is, due to its small bandwidth. Once you build some speed and become somewhat relaxed when conversing with other stations, it is fun. The necessity to concentrate on the code forces you to forget about the problems of the job or other worries and, in that way, it can be a welcome change.

Code is a great equalizer of amateur radio stations. Modest antennas, longwires, dipoles, and ground planes, and low power (less than 300 watts input) can and do work around the world. Virtually all of the European and Russian stations that I've worked on all bands are running 100 or 200 watts input. An exception is to find someone on 10, 15 or 20 meters CW using a 3-element beam.

An example of how-not-to operate, using high power and high-gain antennas, to create a morass of bad operating habits, rudeness, interference, and malfunctioning, splattering equipment can be found on the bottom end of the 20 meter SSB phone band (14,200 kHz and up).

It's a very pleasant change to move to the peace and quiet of the CW band. There's plenty of room, and even the pileup of stateside operators chasing a rare foreign station is less chaotic.

Once you upgrade, you'll see what I



**Basic operating procedures—
how to make a contact**

Thomas R. Sundstrom W2XQ

deciphered. Examples include: your = UR; receiver = RCVR; weather = WX; antenna = ANT; longwire = LW; etc. One of the best lists of common abbreviations I've seen is in the *Radio Amateurs' DX Guide*, published by Radio Amateur Callbook, Inc.

Let's construct a QSO as an example. A QSO can be initiated by calling CQ, or replying to someone else calling CQ. If you call CQ:

CQ CQ CQ DE W2XQ W2XQ W2XQ
K

"Calling any station, from W2XQ, go ahead." This is a 3 by 3 call (3 CQs and the call 3 times); in an inactive band, something up to a 10 by 3

This is the last of our series Getting Your BNEE (Bachelor of Novicetry from ELEMENTARY ELECTRONICS). If you want to go beyond this course then pick up a copy of our sister publication AMATEUR RADIO TODAY, available on newsstands everywhere. It is jam-packed with information about amateur radio and radio equipment.

mean. Using an old 50-watt output transmitter and an end-fed 135-foot longwire antenna, I just collected a WAC (Worked All Continents) Certificate on 40 meters CW. It can be done.

The QSO. Over the years, telegraphers and amateur radio operators have developed a "shorthand" known as the "Q" signals. An example of these is the QSO, short for two-way conversation.

QSOs normally follow a standard format. Usually the first exchange consists of: An RST report, the location of the station, and the first name, in that order.

An RST report consists of three numbers reporting on readability, strength, and tone of the received signal. If you get back anything less than a T of 8 or 9, you should check your equipment.

Procedural signals and Q-signals that you are likely to encounter are also detailed in many listings. Other words are abbreviated, but are easily

(10 CQs) would be OK, but don't call CQ 50 times, as I've heard some stations do, without signing a call or pausing to listen for a reply.

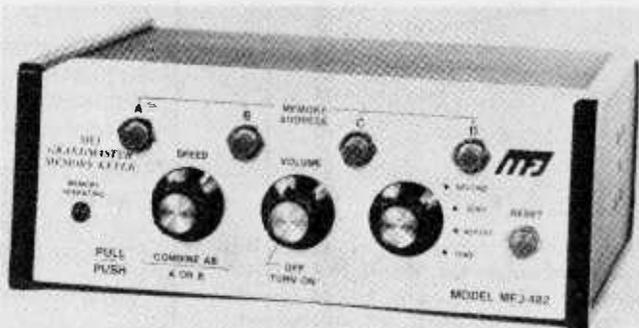
W2XQ W2XQ DE WB2AYA
WB2AYA K

"W2XQ, from WB2AYA, go ahead." A 2 by 2 call should be sufficient unless the band is extremely crowded or signals are weak. Once the contact is established, send the calls only once (since you know the call, there is no need to repeat it):

WB2AYA DE W2XQ BT TNX FER
CALL ES GM BT
UR RST 599 ES QTH WILLING-
BORO, NJ BT NAME
TOM BT HW CPY? AR BK (or
WB2AYA DE W2XQ)

"WB2AYA from W2XQ . . . thanks

With an automatic keyer such as this MFJ model, you can send a "CQ" or a pre-recorded message with just the touch of a button. It makes operating easier and a lot more interesting.



CIRCLE 69 ON READER SERVICE COUPON



BNEE SEMESTER IV

for the call and good morning . . . your signal report is: perfectly readable with very strong strength and perfect tone . . . my location is Willingboro, NJ . . . name is Tom . . . how do you copy? . . . end of message . . . break (or WB2AYA from W2XQ).” Actually, operators tend to repeat the critical data, RST, QTH, and name, twice. You should not be sending any faster than you wish to receive. The overslash (—) means the letters are sent in one continuous motion. The RST-QTH-name is a standard opening format; you may find an abbreviated version coming back to you. As it is not necessary to identify but every ten minutes, the use of BK speeds up the QSO. Unfortunately, not everyone recognizes it for the useful procedural signal it is. Note that the “Q” signals are complete statements in themselves; they can be turned into questions by adding a question mark (or example, QTH? means “what is your location?”).

BK NAME? BK

“break . . . your name is ? . . .

RST System

R=Readability

- 1—unreadable
- 2—barely readable, occasional words distinguishable
- 3—readable with considerable difficulty
- 4—readable with practically no difficulty
- 5—perfectly readable

S=Signal Strength

- 1—faint signals, barely perceptible
- 2—very weak signals
- 3—weak signals
- 4—fair signals
- 5—fairly good signals
- 6—good signals
- 7—moderately strong signals
- 8—strong signals
- 9—extremely strong signals

T=Tone

- 1—60 Hz AC or less, very rough and broad
- 2—very rough AC, very harsh and broad
- 3—rough AC tone, rectified but not filtered
- 4—rough note, some trace of filtering
- 5—filtered, rectified AC, but strongly ripple-modulated
- 6—filtered tone, definite trace of ripple modulation
- 7—near pure tone, trace of ripple modulation
- 8—near perfect tone, slight trace of modulation
- 9—perfect tone, no trace of ripple or modulation of any kind

Q=Signals & Procedural Signals

In transmitting and receiving morse code, a “shorthand” has been developed that is universally understood; the incomplete list that follows covers almost all of the Q-signals and procedural signals that you are likely to encounter.

- AR—end of message
- AS—wait
- BK—break (interrupt transmission)
- BT—separation between thoughts/sentences
- CQ—general call to any station that will reply
- CUL—see you later
- DE—from
- DX—distant/rare station (if CQ DX is sent by a US or Canadian station, no stateside station should answer)
- GA—good afternoon

- GE—good evening
- GM—good morning
- GN—good night
- HI—laughter (in morse code)
- K—go ahead (invitation to transmit)
- KN—go ahead to specific station (all others keep out)
- QRM—I have interference (from other stations) on your signal
- QRN—I have atmospheric static on your signal
- QSB—I have signal fading on your signal
- QSO—two-way contact
- QRT—stop sending (closing down station)
- QSL—I will send a verification card
- QTH—my location is . . .
- R—roger; all understood
- SK—signing clear
- 73—best wishes
- 88—love and kisses

break.” WB2AYA missed my name and has quickly asked for a repeat. Don’t waste motion and send something like: WB2AYA DE W2XQ BT SRI QRM ES MISSED UR NAME BT PSE SEND AGN TNX AR WB2AYA DE W2XQ K. What a waste of time! Simply repeat your name, and then break back to him or her.

R BK OK ES RIG HR IS . . .

“Roger (everything received) and the rig here is . . .” Only send R if everything was copied for complete understanding. If you have to ask for a “fill” on something missed, don’t send the R. To continue the QSO, you might tell the other station about the weather (WX), your age, what you do for a living, how long you’ve been licensed, etc., and conclude by asking a question (other than “how copy?”). Conclude a QSO by sending something like: TNX FER FB QSO ES CUL BT 73

SK WB2AYA DE W2XQ SK

“ . . . thanks for a fine business QSO and see you again . . . best wishes . . . signing clear . . . WB2AYA from W2XQ . . . signing clear.” Make the closings reasonable in length; I’ve

heard some that were longer than the original QSO. If you are shutting down the station, send QRT after the second SK.

One very useful procedural signal hasn’t been mentioned yet. It means “wait”, while you answer the door or the telephone, and can be sent anytime

(Continued on page 95)

Manufacturers’ Addresses*

Autek Research
Box 5127B
Sherman Oaks, CA 91403
(active audio filter)

Hy-Gain Electronics Corporation
8601 Northeast Highway Six
Lincoln, NE 68505
(antennas)

Gotham, Inc.
2051 N.W. 2nd Avenue
Miami, FL 33127
(antennas)

MFJ Enterprises
P.O. Box 494
Mississippi State, MS 39762
(active audio filter(s))

Mini-Products, Inc.
1001 West 18th St.
Eire, PA 16502
(antennas)

Telex Communications, Inc.
9600 Aldrich Avenue South
Minneapolis, MN 55420
(headphones)

Wilson Electronics Corp.
P.O. Box 19000
Las Vegas, NV 89119
(antennas)

*partial listing



There are many different types of logs. This is an award log for the “Heard All Counties” award by “CQ” magazine. As you can see it represents an awful lot of contacts.



**Charles D. Tandy
1918-1978**

WHEN CHARLES D. TANDY, founder and boss of the corporation that bears his name, died on November 4, 1978, the electronics hobbyist lost a fabulous friend—probably without even knowing of his existence, much less his connection with the industry and his enormous contribution to its do-it-yourself fraternity.

Among the many paradoxes involving this man's spectacular career, perhaps the most curious is that Charles Tandy, having entered the business in 1963 by acquiring an elderly, failing New England company called Radio Shack, knew absolutely nothing about hobby electronics. What he *did* know, perhaps better than any man who ever lived, was the art of serving special-interest hobbyists via systems of small stores managed by highly motivated salespersons, and the art of making profits consistent with good business

King of the Hobbyists

Charles D. Tandy, the man who put a Radio Shack in almost every town and village

by Lewis Kornfeld

practice, profits which could be immediately redeployed into the creation of still more stores, and eventually, the setting up of factories, R&D facilities, giant warehouses and transportation complexes.

A New Concept. He defied the conventional wisdom of the consumer electronics world of the early 1960s by deciding to quit the mail order business at the very time when Radio Shack's larger competitors were secure in their opinion that mail order was the best way to sell electronics in quantity, particularly its "parts and pieces" merchandise. His theory was deceptively simple: "We'll put a store everywhere mail orders originate, and then we'll see how many people will want to mail their money into Chicago, New York and Boston . . . and wait."

In the 15 years during which he piloted Radio Shack from a \$12-million weakling into a \$1-billion colossus, he opened an average of over 470 stores and authorized dealers per year! Midway in his efforts at placing a 'Shack' in every corner of the United States, he did the same thing in Canada. And to cap it all off, he decided to expand abroad, setting up chains in Australia, England, Belgium, Holland, France, Germany, and Japan, adding 500 overseas places where Radio Shack goods could be sold. At his death, the company total stood at a staggering 7100 outlets, only nine of which were in existence in 1963!

The net effect of this extraordinary

activity was to bring electronics parts and equipment from the big cities and the occasional town, right down to the grass roots and neighborhood level where surely—without the foresight, compulsion and daring of this one man—they might never have come.

Although the typical post-war electronics shop offered a range of 10,000 to as many as 30,000 items, Radio Shack, in order to make its Tandy-size expansion affordable, cut back to 2400 items. In Mr. Tandy's experience, gleaned from years of operating his Tandy Leather Company chain, 2400 was "just about the right number." While it might deprive the customer from being able to find exactly the desired size, value and type of component, he would find enough to satisfy his basic needs.

Dynamic Inventory. Additionally, the sale of each part would be carefully monitored, to allow for weeding out slow movers and replacing them with more current and fast moving stock-keeping units, thus maintaining Tandy's magic 2400-item assortment, a number known to be affordable and consistent with his ambition to open pay-as-you-grow stores in hitherto inconceivable numbers. Needless to say, the competition thought his tiny assortment laughable. But Charles David Tandy, the innocent newcomer from Texas, thought he "just might laugh all the way to the bank."

In the beginning, he ran into problems he'd never encountered in the



When Charles D. Tandy took over Radio Shack in 1963 the stores were typical electronics supply houses with tens of thousands of items. Hardly a place for an electronics hobbyist to browse.



The typical modern Radio Shack store is designed to meet the needs of electronics hobbyist with a well-planned inventory of components, not to mention a full line of consumer electronics.

e/e KING OF THE HOBBYISTS

leather business—repairs and mail-order returns. The latter he eliminated by the simple means of discontinuing all solicitation of mail orders, terminating the many costly clerical systems associated with filling orders by mail, and handling lost orders and disgruntled customers. The worst offender was the mail order credit department where Radio Shack—and later Allied Radio—were to meet their Waterloo. “I pay cash, I’ll sell for cash,” Tandy vowed, possibly echoing the sentiments of James Cash Penney, one of his early idols and father of J. C. Penney.

Repairs, however, were another matter. Much to Mr. Tandy’s surprise and indignation, electronics merchandise did not always work or retain its original functional ability. There was nothing to do but to face the music: buy or manufacture more reliable goods, and set up yet another profit (or loss) center to keep the goods sold and to satisfy the customer even if it meant “walking an extra mile.” Radio Shack, in the USA alone, now has 55 strategically located service centers plus another 50 being put on stream to handle its personal microcomputer business.

To his dying day, Tandy was never too proud to personally answer his own telephone, handling complaints with booming good nature and leaving the offended customer absolutely certain his problem would be solved “that day,

and I don’t mean tomorrow,” as he so often told employees, with his own special brand of conviction laced with laughter and motivational hustle.

In Tandy’s mind, the hobbyist was the key ingredient in Radio Shack’s program for success. His proudest achievements, aside from Radio Shack, were in building such other strong leisure-related companies as Tandy Leather Company and Color-Tile, leading divisions of what is now known as TandyCrafts, Inc. Like Tandy Corporation—which is now entirely an electronics enterprise—TandyCrafts is listed on the New York Stock Exchange.

Do It Yourself. He reasoned that the person who did things with his hands was not only influential in his community but also was a likely candidate for buying finished equipment such as radios, tape recorders, audio systems, and even costly and complex things like the company’s famous TRS-80 computer. “If I can make him happy at my parts counter, why should he go next door for something already built and finished?”

Nothing made Charles Tandy angrier (or more contemplative) than empty hooks in the parts department. He spent millions developing computerized restocking and inventory control systems. He poured over “out reports,” querying merchandisers and inventory controllers as to why they could have even a single out-of-stock item “when, damnit, I’ve made your life simple by eliminating thousands of slow movers and keep-



The author, Lewis Kornfeld, is a longtime friend and associate of Charles D. Tandy. He is also the president of Radio Shack.

ing only the 2400 best sellers.” Excuses, such as their concern with the several hundred new stores they were in the process of supplying, were dismissed with a wave of his cigar-holder and a stern but jovial warning: “Just tell me you’re not going to keep us 100 percent in stock,” he’d roar, “and I’ll do it myself, because I know how to get it done!”

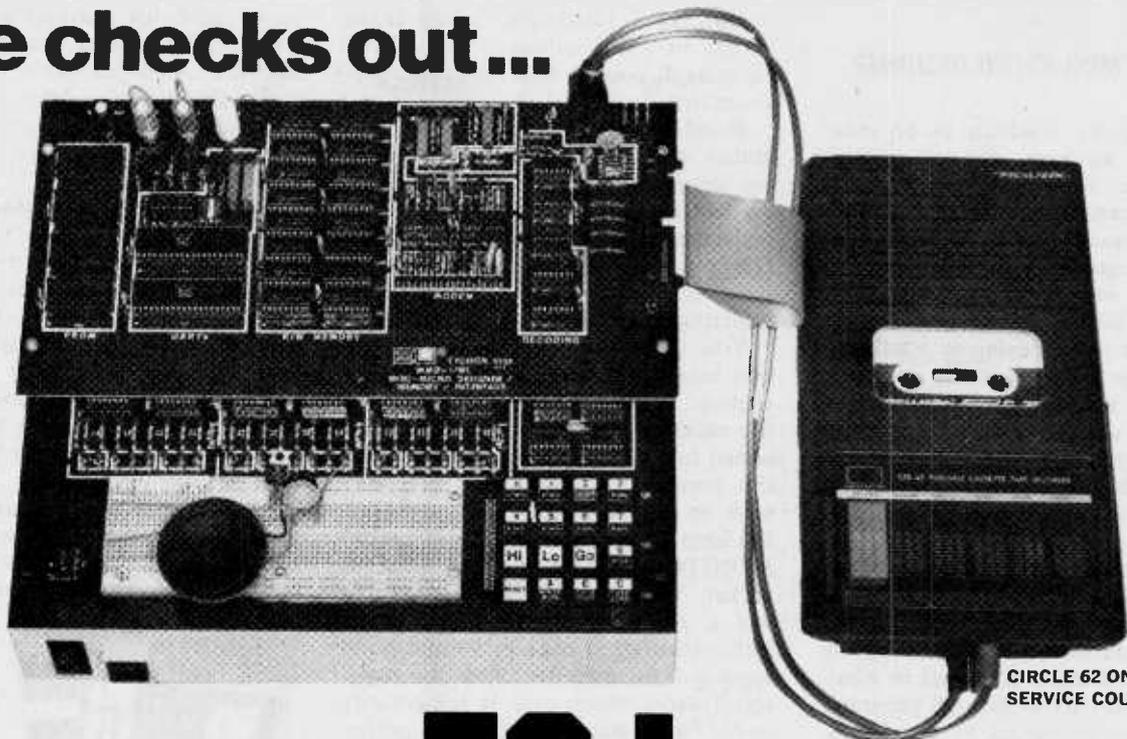
It mattered little to him that he didn’t understand an IC, an RF circuit, a crystal, or even a DPDT switch. It was all merchandise, wasn’t it? He under-

(Continued on page 84)



The first Radio Shack store (left) is contrasted to a modern store (above). There are now more than 7,000 stores worldwide, with many more opening every day of the year.

e/e checks out...



CIRCLE 62 ON READER SERVICE COUPON

□ YOU COULD RENAME this Mini-Micro Designer (MMD-1) computer a "Designer's Dream Machine" or "Student's Salvation", depending on whether you are a digital design engineer or a befuddled student still laboring to understand what really makes a computer tick. It may be hard to believe, but this relatively low cost computer from E & L Instruments is at once a remarkably effective self-teaching aid, and a tool that any advanced computer experimenter would soon hold virtually indispensable.

The MMD-1 was created not for Star Trek and ping pong fanatics, but for experimenters. If you know little or nothing about how computers really work, but want such understanding without plodding through endless technical jabberwocky, take a look at the MMD-1. If you want a computer that can lead you to automating a robot or running your household from a keyboard, take a look at MMD-1. If you want a machine that can quickly test your electronic inventions, without the need to risk burning expensive ICs with a hot soldering iron, take a look at MMD-1. And if none of these situations apply, take a look anyway; the odds are that you'll think of more than one good reason to send for manufacturer literature.

Features. Before examining the MMD-1 hardware, and the truly complete line of supporting software, let's pause for an overview of this 8080A-based computer for training and hardware development.

E&L INSTRUMENTS

The key word is flexibility
for this miniature marvel

MMD-1 COMPUTER

The first thing you notice about the MMD-1 is that most of the components are out in plain sight, not buried inside a plastic or metal box. Admittedly this makes the components somewhat more vulnerable to damage if you are careless; on the other hand, the vulnerability makes you treat the machine more respectfully than you might otherwise. More importantly, you sense a psychological rapport with the machine that becomes stronger as your understanding of the machine grows. You are able to put a finger on specific ICs and say, "that's where it happens" or, "that's where the programmed data is now".

However, most of the time, your attention is directed to the octal-style keyboard and to the row of 24 red indicator lights that light or extinguish as you tap in data or watch a program run.

As you may already know, the octal counting system has digits only from 0 through 7, which is why you see only these eight numbers on the keyboard. The H and L keys tell the computer when you are interested in either the "Hi" or "Lo" half of a memory address (location); each memory location is divided into two parts to facilitate processing. The G key is for "Go" and is used to start a program running. The S key is for both "See" and "Store" since it is used for the dual functions of depositing data into memory and examining data already stored. The Reset key, as the word implies, resets the computer to the start of the program being run. The A, B and C keys are for optional applications and need not concern us now.

The readout of the MMD-1 consists of 24 red LED (light-emitting diode) indicator lights. The 24 LEDs are separated into three groups of eight, each group comprising a "port" with the left and middle ports used to indicate addresses in the Hi and Lo memory locations and the right hand port used to reveal data in memory.

The eight LEDs in each port are sub-grouped into 2-3-3 patterns to make interpretation of their numerical octal values easier. You might wonder why the MMD-1 does not utilize more

e/e MINI MICRO DESIGNER

familiar numeric readouts as do other computers. Because, for an experimenter, the binary type readout is faster and easier when there is a need to know exactly what is happening during programming and running. There is no need to convert a numeric readout to binary to find out, for example, what is happening to a particular low order bit because the answer is right there before you. If all this is not entirely clear, be assured that it will be before you get very far into the Bugbooks that explain how the MMD-1 (and other microcomputer systems) work.

Operation. To run a program on the MMD-1, just punch in the starting address (hitting the reset key usually does this automatically) followed by the run key. Data is displayed in whatever port you choose through programming, and is evidenced by the LEDs, through breadboard terminals, or through any interfaced peripheral equipment you may have added.

The HALT light, a very convenient feature, simply tells when the computer has encountered a halt statement in the program. It is extremely handy for debugging any program. Just insert a halt instruction anywhere in the program, run the program and see if the HALT light comes on. If it does, the computer made its way to that particular part of the program. If it doesn't light, your program has gone off into Gonzo Land during some earlier step. This highly desirable feature is lacking in many other training machines.

The built-in breadboard, next to the keyboard, permits interfacing all kinds of peripheral equipment to MMD-1 ports *without soldering*. Just poke the bared ends of leads and components into the breadboard holes; to disconnect, pull out the wires. It's all very fast and easy. There's a connecting pin in front of each of the 24 indicator LEDs through which you can interface your breadboarded gizmo with the computer. In practice, for heavy experimentation, it is advisable to use a separate "outboard" breadboard to save wear and tear on the built-in board which would be difficult to remove and replace, because of the many solder connections.

On the breadboards you can assemble all kinds of gadgets and interconnect them to do whatever you have in mind—including ICs, switches, LEDs, pots, and more complex outboards consisting of specialized circuits on PC

boards. E & L Instruments sells a broad variety of such outboards as optional equipment, both as kits and in factory-assembled form.

Monitor Option. Most of the integrated circuit chips on the MMD-1 are installed in sockets, instead of being hardwired to the circuitry, to make replacement and alteration of chips fast and easy without risking heat or static electricity damage caused by a soldering iron.

You should start your experimentation using the standard Keyboard Executive (KEX) PROM chip because the excellent training instructions contained in Bugbooks V and VI relate to this particular PROM. Later you may wish to replace KEX with a KEX/LD chip so that you can add a special MONITOR PROM to an adjacent socket. The Monitor enables you to run a program one step at a time, rather than all at once in normal rapid sequence, in order to check the registers (places where data is temporarily stored and manipulated) for proper contents. It's important to understand that *running* a program one step at a time is not the same as simply stepping through a memory to check its contents. You can do that much even with the standard KEX. The Monitor enables you to determine much more quickly at what step your program has gone off into the wild blue yonder instead of staying on track, hence "debugging" a program is considerably simplified.

Incidentally, also available is a DBUG 1K program, in PROM or on

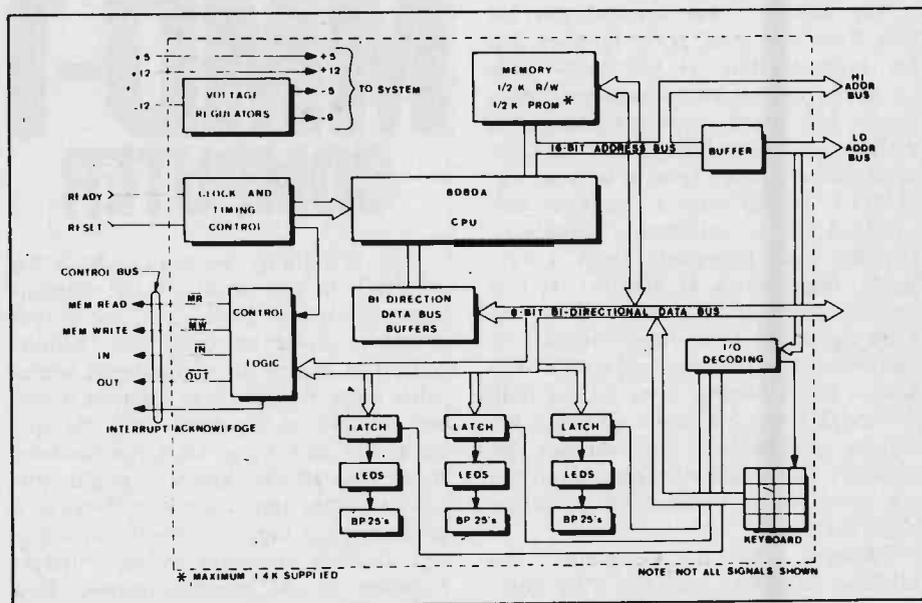
paper tape, that provides advanced debugging and editing procedures for a software developer. This program requires the use of a Memory Interface Board (about which more later) and an ASCII device such as a teleprinter or CRT terminal.

Incomparable Bugbooks. E & L's Bugbooks V and VI are indispensable guides to learning with the MMD-1. Each volume contains almost 500 pages of text written, not by electrical engineers, but by professional educators who obviously not only understand computers, but also know what confuses students and how to lead learners through difficult concepts in the most painless way possible.

The texts provide detailed explanations of all computer components and systems, from simple gates to complex interfacing circuits. Most chapters have



The two operating manuals, one for basic and one for expanded equipment, as well as the Bugbooks, are learning tools also.



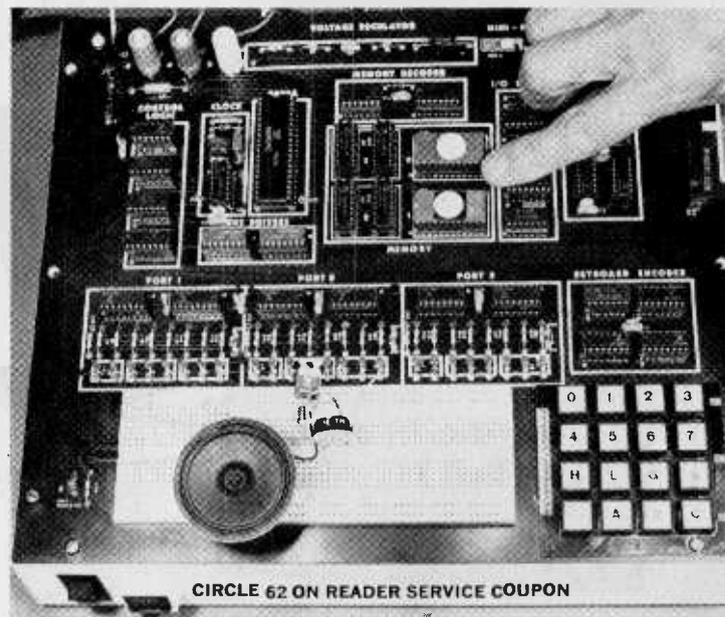
The MMD-1 features the popular 8080 microprocessor system in a self-contained structure which includes octal keyboard, LED displays, and access to the full bus structure. The flow chart shows some of the signal paths within the computer. With the flow chart and Bugbooks, you can literally put your finger on "where it's happening" in the unit.

actual programs that illustrate the concepts discussed in the chapters, plus a series of related experiments (about 60 in all) you can perform on the MMD-1, plus review questions and answers. Each experiment asks you to compare the results you obtain with results the writers of the Bugbooks obtained when they ran the same experiments. Thus there's never any question about whether your computer readouts are right or wrong. You should note the index for both Bugbooks V and VI is at the end of Bugbook VI.

You don't really need Bugbooks I through IV because the essential material contained in these earlier volumes has been consolidated into Bugbooks V and VI for more convenient use with the MMD-1. Even if you can't afford the MMD-1 now, these Bugbooks can teach you much about the way microcomputers work. Also now available is Bugbook VII which deals with advanced techniques related to analog converter software and hardware interfacing. It too contains many interesting and illuminating experiments.

Cassette storage of program material is fast and easy, provided you have the Memory Interface Board which comprises the upper deck of the unit shown in this article. A Radio Shack CTR-43 portable Cassette tape recorder is shown, but is not available from E & L. You can use your own comparable recorder just by interfacing the

The two indicated chips on the lower deck are the standard KEX (keyboard executive) and L/D optional memory. These can be replaced with KEX/LD and "Monitor" PROMs to permit single instruction execution of programs in the MMD-1 memory.



recorder's earphone and auxiliary jacks to the MMD-1 CAS interface using two connecting cables.

Options. Many options are offered so that you can tailor your learning and experimenting computer to your personal needs and budget. If funds are limited, you can obtain the basics and add to it more equipment as you go along.

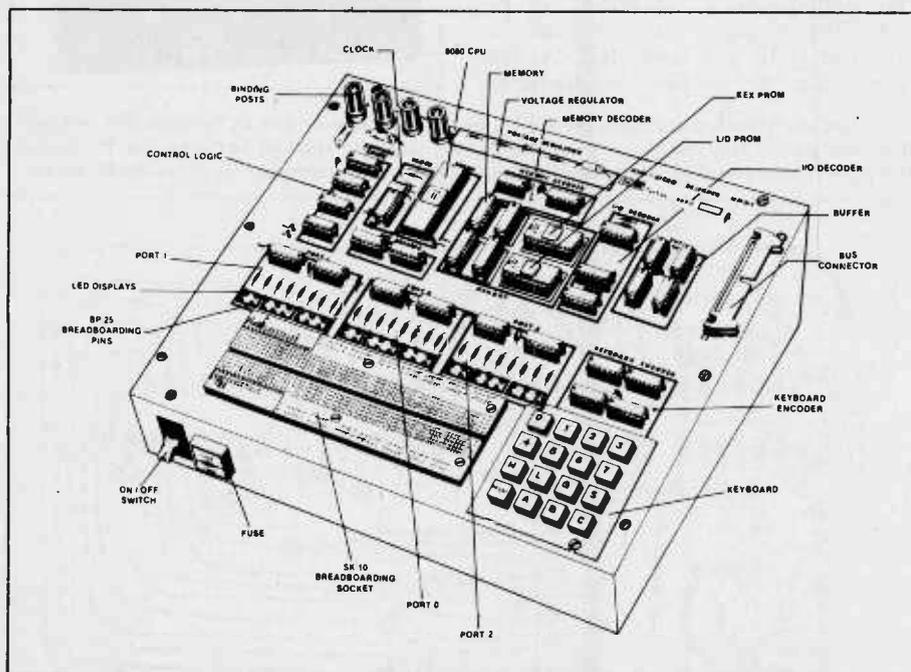
The MMD-1 is a lower cost, simplified version of the original Micro Designer (MD-1) now widely used in vocational schools, colleges and indus-

trial laboratories. Thus the computer, through its predecessors, has been extensively field tested under the most demanding applications conditions. A completely assembled and tested MMD-1 costs \$525, down from its original \$600 cost. In kit form, with all parts ready for assembly plus all instructional materials, the price is \$350.

The basic MMD-1 computer provides the following hardware: a complete 8080A microprocessor set including read-write and read-only memory; direct keyboard entry of data and instructions in machine language (no data entry terminal is needed); light-emitting diode status and data indicators; an integral solderless breadboarding and interfacing socket with direct buffered access to the microprocessor set; a complete, self-contained power supply.

The MMD-1 is designed around the following integrated circuits: One 8080A 8-bit single chip central processor; one 8224 clock generator and driver; four 811-2 1024-bit (256 x 4) static MOS Random Access (read-write) memory (RAM); two 8216 4-bit parallel bi-directional bus drivers; and, a choice of two 1702 2048-bit (256 x 8) electrically programmable read-only memory chips (PROMs). You can obtain either a KEX (Keyboard Executive) and a separate L/D (Load/Dump program) PROM or you can opt for the upgraded version which has the KEX/LD combination on one chip and a Monitor PROM on the second chip. However, if you obtain the Monitor with KEX/LD, you won't have the convenience of the reset feature that is coordinated with the Bug-

(Continued on page 98)



As indicated by the drawing above, and the other photos, the wide-open construction of the MMD-1 not only makes for use as a teaching tool, but obviously makes it easy to troubleshoot circuit paths and individual components. If you desire to experiment with modifications to the circuit paths, all you need do is reach right in!



STOPPIT!

Are your reflexes faster than a speeding LED?

by James J. Barbarello

HOW FAST CAN YOU REACT? One way to find out is by playing our LED game, named *Stoppit*. Start by pressing and holding the *ready* button. The ready LED will light and remain on for an unspecified time. Then the light will begin "falling" at a speed determined by the *skill* control (the illuminated light will extinguish and the one below it will go on, and so forth). If the zero position is reached, this light will remain on until the game is reset by pressing the *ready* button.

The object of the game is to stop the action as quickly as possible (thus earning a high score) by momentarily depressing the *stop* button. Since the *ready* button must be held down until the action starts, you must be quick to reach the *stop* button and obtain a high score.

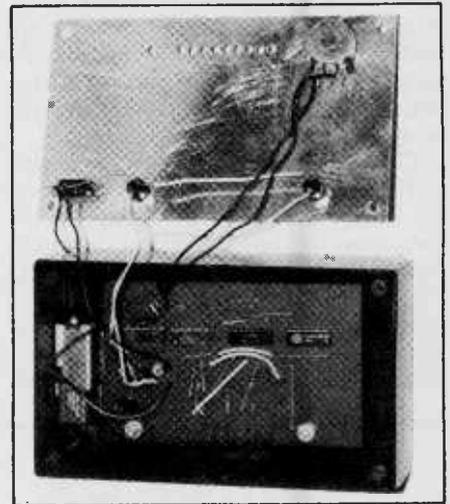
Stoppit uses readily available CMOS devices, is powered by a single 9 volt battery and can be built for between \$15 and \$20.

How It Works. The "heart" of Stoppit is a 4017 CMOS Decade Counter with decoded outputs. It contains 10 output pins that are sequentially energized (count from 1 to 10) with each input clock pulse. Only one output at a time is high. A high input to reset pin 15 will set the count to 1. A high input to enable pin 13 will stop the counting.

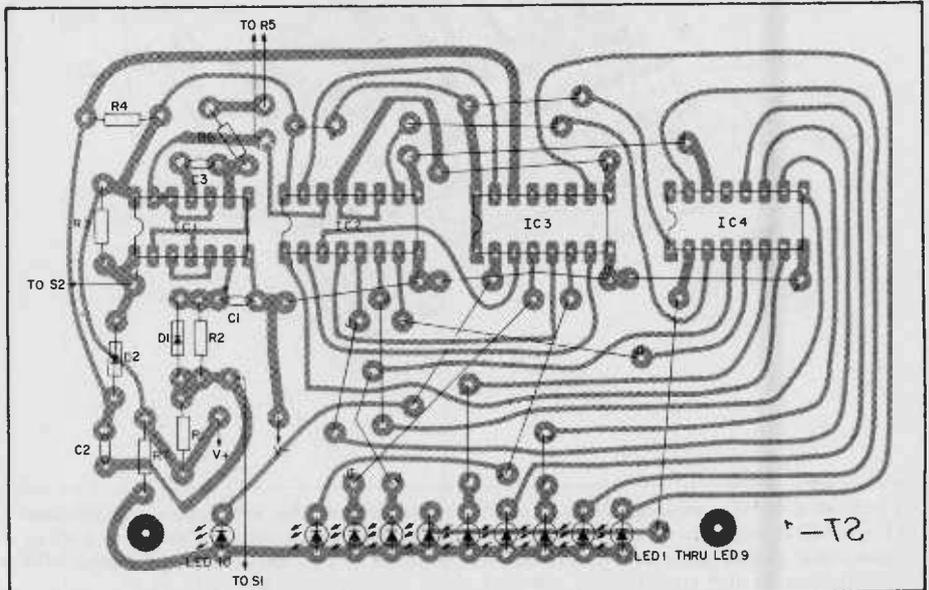
As seen in the schematic diagram, the decade counter's (IC2) outputs drive 10 inverting buffers. When any one of the counter outputs goes high, the corresponding buffer output goes low and sinks sufficient current to allow the associated LED to light. R7 limits the current drawn by the LED. The last output (pin 11) is also connected to the *enable* pin. This output

is low until the last count, allowing IC2 to sequence. At the last count, pin 11 goes high, energizing L1 and disabling IC2.

Another way of stopping the count is by stopping the input clock signals. IC1, a Quad 2-input NAND gate serves two purposes. It is used to form a gated clock oscillator (IC1C and D) and an R/S (Reset/Set) Flip Flop (IC1A and B). When S1 is closed, a negative pulse is transmitted through C2 which resets the R/S Flip Flop through D2. This causes the "Q" output (Pin 4 of IC1B) to go low and the "Q" output (Pin 3 of IC1A) to go high. The negative pulse is also inverted in IC3F and resets IC2. At the same time, C1 begins to discharge



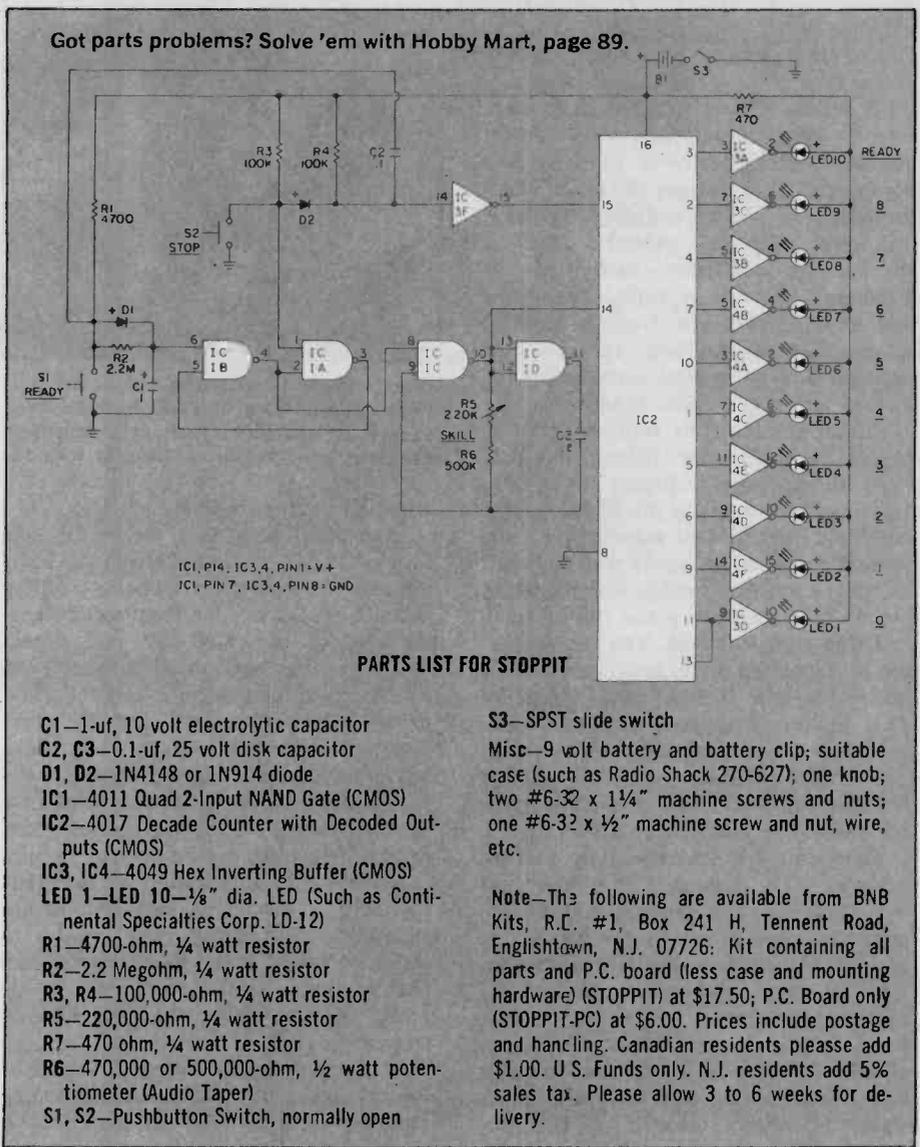
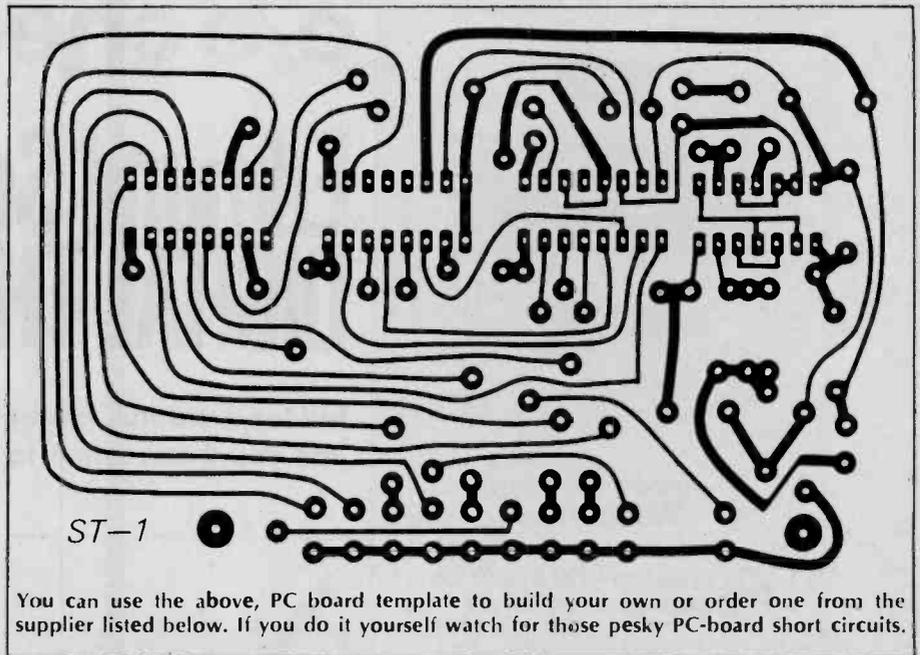
The LEDs are mounted carefully on the PC board so that they just fit through the holes in the front panel. You may have to fiddle around with the spacing between the PC board and project box. The diagram below shows how the various components fit on the PC board.



through R2 and S1 to ground. When the voltage across C1 decays to the CMOS low level ($\frac{1}{2}V^+$), the R/S Flip Flop is set, forcing the "Q" output high and the "Q" output low. The high "Q" output enables the clock oscillator and allows IC2 to begin counting at a rate determined by R5 (Skill), R6 and C3. R6 limits the upper frequency of the clock oscillator. Closing S2 (Stop) resets the R/S Flip Flop, disabling the clock and stopping the count. Since the set pin of the Flip Flop must be high before it can be reset, S1 must be released to allow C1 to recharge through R1 and D1 before S2 has any affect. Since R1 is relatively small, C1 recharges "instantaneously." Thus, in operation, S1 is depressed until the counting begins. S1 is then released and S2 is quickly closed to stop the count. Power is supplied by a 9 volt battery.

Construction. Stoppit can most easily be assembled using our PC Board layout and components placement. In this way, all components except for the switches and *skill* control are mounted directly on the board. Note that there are 18 jumpers, 3 of which are insulated. Standard handling precautions should be observed for the CMOS devices and I.C. sockets may be used. To be compatible with the PC Board layout, $\frac{1}{8}$ " diameter LEDs should be used. The leads should be long enough so that, when mounted, the top of the LED is at least $\frac{3}{4}$ " above the PC Board. Mount the LEDs so that they form a straight line and are of uniform height. The finished unit can be mounted in any convenient case. A simple battery holder can be made from a $\frac{3}{4}$ " x $1\frac{3}{4}$ " piece of aluminum stock by forming it into a "Z," the vertical portion of the "Z" being the dimension of the wider side of the battery. A hole can then be drilled in the lower horizontal portion of the "Z" so that it can be anchored to the bottom of the case with a machine screw and nut.

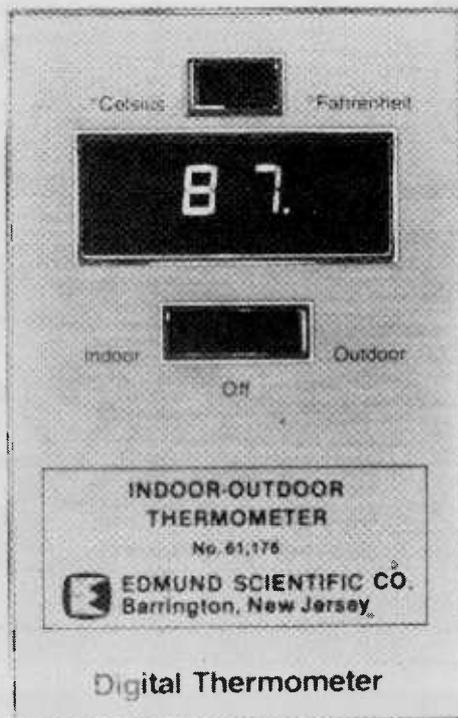
Playing The Game. When the unit is first turned on, the lights will sequence and stop on the *zero* position. Place the *skill* control near the *amateur* position. Depress and hold the *ready* button. After a few seconds, the *ready* LED will extinguish and the numbered LEDs begin to sequence. As soon as this happens, release the *ready* button and momentarily depress the *stop* button. Repeat this process five times, noting your score each time. Your total score is then the sum of the five individual scores. As your proficiency increases (as noted by an increased total score), advance the *skill* control. You may wish to challenge your family or friends in a test of quick reactions. ■



e/e checks out...

Edmund Scientific's DIGITAL THERMOMETER

Indoor/outdoor, fahrenheit/celsius thermometer lets you know when to button up your overcoat



CIRCLE 52 ON READER SERVICE COUPON

□ THE ONLY PRACTICAL way to ease into the forthcoming metric age—if you are not there already—is to daily use equipment and devices that are calibrated in the metric system. Your new car, for example, probably has a speedometer/odometer calibrated in kilometers as well as miles. Now you can enjoy and learn from a digital-readout indoor/outdoor thermometer that permits immediate comparison of Fahrenheit and Celsius readings.

Edmund Scientific's Indoor/Outdoor Digital Thermometer (Stock No. 61, 176) shown here is priced at \$49.95. It is ready to use after the addition of a nine-volt battery. Just mount in a convenient place on an inside wall and run the thin connecting cable with attached sensor to a suitable place outdoors.

Three-digit Readout. The thermometer is contained in a grey plastic box measuring 4½ inches by 3 inches by 1¼ inches, and has a gold-colored faceplate with two switches and a three-digit LED (Light Emitting Diode) readout window. The faceplate pops off easily for battery replacements.

Range of the thermometer is from -31 to 122 degrees Fahrenheit and -35 to 50 degrees Celsius, with an accuracy of plus or minus one digit. You can test the instrument, before installation, by placing the outdoor sensor next to the thermometer box in which case both "outdoor" and "indoor" readings should be the same. If the readings agree within one degree, the unit is operating within the specified accuracy range. The unit shown here met this



Tiny outdoor temperature sensor is only about 3/8-inch long and barely more than 1/8-inch in diameter. It is inconspicuous wherever you decide to have it located.

one-digit maximum deviation test.

In normal use, you move the top slide switch to either Celsius or Fahrenheit, and the lower switch to either Indoor or Outdoor setting. The temperature is indicated by red digits, about 3/8-inch high, that flash on and off at about one second intervals. To conserve battery power, keep the thermometer switch off except when making readings. You know when the 9-volt battery needs replacement because a weak battery shows only a series of decimals instead of the digits.

Installation. Installation of the thermometer is quick and easy, but to ensure accurate readings you should select locations for the thermometer and the outdoor sensor with reasonable care. Do not place the thermometer too close to a source of heat, in particular a radiator, or where it would be unduly cooled by air conditioning equipment. Also avoid a wall that is warmed by the direct rays of sunlight

coming through a window.

You can in fact place the thermometer just about anywhere that it would provide the most accurate average room temperature because the wire leading to the sensor is 12 feet long and can be extended to as much as 100 feet without adversely affecting accuracy of temperature readings. When a suitable location is found, mount it with two small screws provided with the thermometer.

Locate the outside sensor on the north side of the house, in the shade. Hardware is provided for mounting the sensor in an upright position. It will be inconspicuous anywhere because it is only 5/8-inch long. Again, keep the sensor well away from such possible sources of heat or cold as outdoor lighting fixtures, kitchen and bathroom ventilator outlets, clothes dryer vent or air conditioning equipment.

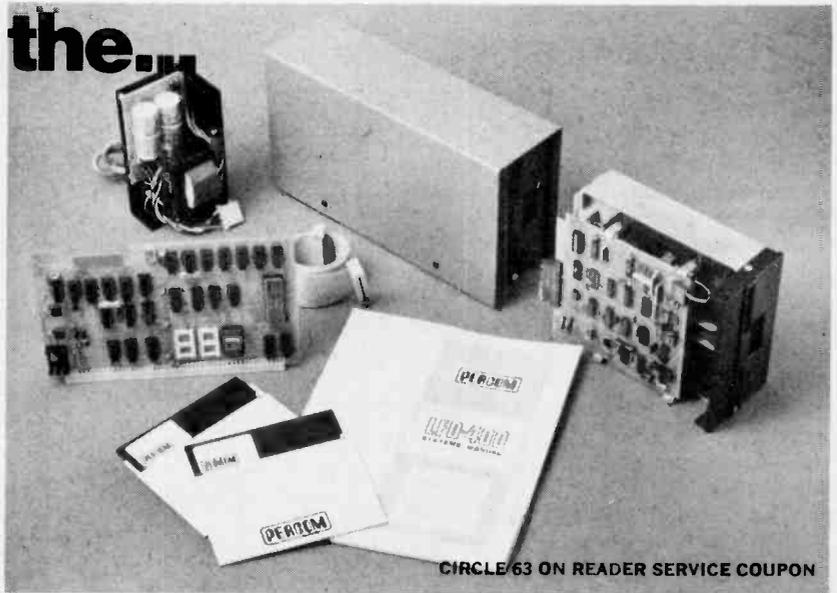
There's no need to drill holes through the house wall to pass the sensor wire outside. Just run it out near one corner of a window. Chances are that there's enough space for the thin wire without the need of any cutting or drilling. At worst, all you need do is cut a small channel with a sharp knife in which to place the wire so that it will not be damaged by window movements.

In addition to having accurate information about inside and outside temperatures, you benefit additionally in having a means of teaching yourself, and others in your family, Fahrenheit-Celsius equivalents. Make a practice of *predicting* what the Celsius reading will be after first observing the Fahrenheit reading. Or if the initial reading is on the Celsius scale, predict the Fahrenheit equivalent before checking: with just a flick of the switch. Your kids will enjoy playing the game, and will soon become very expert at making mental temperature conversions. ■

e/e checks out the...

PERCOM LFD-400 Minifloppy Disc System

Compact disc system adds kilobytes of brain power to your SWTP-6800



CIRCLE 63 ON READER SERVICE COUPON

□ ONCE YOU GET OVER the initial thrill of getting a computer system up and running, and you've gotten the most complex software debugged and ready for use, there comes the time when you realize it is often more trouble to use the computer than to crawl along with pencil, paper, and pocket calculator.

Storage. The problem lies in something called "storage," usually a punched paper tape or a cassette recording. For example, assume that you want to run the program *Electro* we featured in an earlier issue of *e/e*. First you have to load BASIC, which could take from 1.5 to 17 minutes depending on whether you are loading from a 300 or 1200 baud cassette, or teletype punched tape. Then you have to locate the cassette or tape with *Electro* and take another 1 to 5 minutes to load the program. If something goes wrong along the line, like a dropped bit due to humidity effects on the tape player, you might have to reload, and a full 20 minutes might pass before you could use the computer to solve a simple series of calculations. Basically, it comes down to the fact that simple storage systems are inconvenient, often making use of the computer more trouble than it's worth.

For maximum utilization of a personal computer, your storage system must be extremely fast, extremely convenient, and of course, reasonably priced. One of the best systems we've run across in terms of speed, convenience and price is the Percom LFD-400, a minifloppy system specifically designed for the SWTP 6800 computer.

Convenience. Perhaps the most convenient feature of the Percom LFD-400 disk system is that it doesn't require rewriting all the software in order to use the disk storage. You can use all

your existing SWTP 6800 software as is. For example, let's assume you have the program *Electro* on cassette and you have the Percom LFD-400 disk system connected. You simply load the cassette just as you did before, using a cassette interface. Then you dump the program to the disk with the simple command `SAVE 1xxx`. The numeral 1 means drive unit #1 (you could use a #2 or #3 drive) and xxx is the disk's sector number. We'll explain sectors later.

That's all there is to it. The program *Electro* is now on the disc. To load *Electro* at a future time you would simply enter the command `LOAD 1xxx`. If the starting sector was #10, the commands would be "`SAVE 1010` and `LOAD 1010`."

In this manner you can transfer all your present software to disk without a major, or even minor, rewrite.

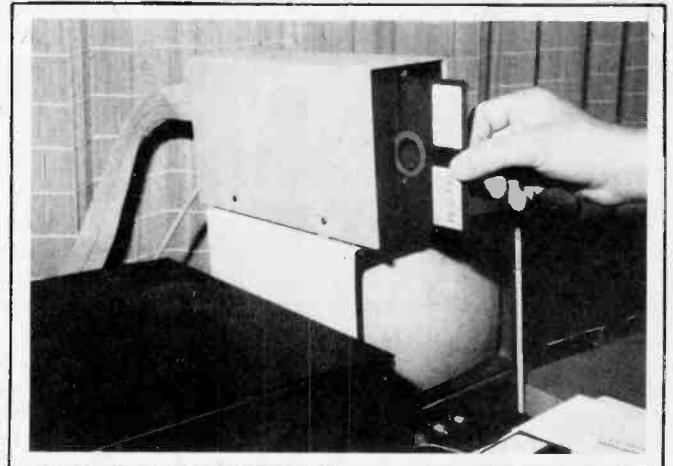
Each disk is electrically divided by a disk operating system into 350 sectors, and each sector can accommodate 256 bytes of storage, providing a total of 89.6k bytes of storage per diskette.

When you `SAVE` a program, the terminal indicates the last sector used for storage. For example, if a program is saved at sector 045 and uses up two sectors, the terminal will indicate `LAST SECTOR-047`. You now know your next program `SAVE` must start at sector 048.

"Aha!" You say, "The Percom does not file by name, it requires sector numbers for identification of software." Yes. It's true, sector numbers are required in the basic no-fuss, budget version. You can update to numbered or even name files later, but what you get for a basic price of \$599.95 fits most all requirements for speed, convenience, and price.

As far as loading speed is concerned, SWTP's version of 2.0 BASIC loads in under 10 seconds. The program *Electro* loads in the time it takes to look up from your keyboard to the CRT screen or printer. Need a different program? No need to search for cassettes or punch tapes and then cue them to the beginning of the new program. Just type `LOAD 1xxx` and in the time of a blink to a few seconds, the

To load or save software simply install a diskette in the drive, close the door, and set the computer's stack pointer, address A048, to C000. That's the address of the ROM operating system.



e/e PERCOM FLOPPY DISC

program is loaded.

The next logical question is, how much extra memory does your computer need to use the Percom LFD-400 disk system? The answer is . . . none. Unlike most disk systems that require at least 4K of rather expensive memory just to run the disk operating system, the Percom has its system, called miniDOS, in a ROM that's supplied with the LFD-400. If your computer has, say, 12K of memory handling an 8K BASIC, the Percom runs in the same 12K. At the time of loading BASIC from disk, only 114 bytes for the disk system are added to your "normal" BASIC.

How it works. The disk system requires a PATCH to your BASIC. PATCH is simply a buzzword (or computerese) meaning modification. In this instance, it's the addition of instructions from address 1EFO to 1F6F. Percom supplies a listing and a diskette for this PATCH. You first load your BASIC in the usual way, then enter the patch through MIKBUG, and then dump the BASIC with the PATCH to a disk. Next time you want to load BASIC, you simply load the disk, and in a few seconds you have your new, patched BASIC loaded.

For those who want to use the disk system with the 6800 mnemonic assembler or the TDC text editor, Percom will supply the necessary patches in technical memos at very nominal cost (ask Percom for a technical memo catalog).

The LFD-400 system, priced at \$599.95 with one disk drive, is supplied completely wired and tested. It is not a kit. All the user need do is install the disk drive in its cabinet (two screws), fit two connectors, and install a con-

The controller PC board can be installed in any motherboard slot. For convenience, the best location is in the last slot, the one at the rear, so the connecting cable can run out the back without crossing any of the memory or the CPU board. Space the boards to attain maximum ventilation between circuit boards.



troller board on the mother board of the SWTP 6800. That's the whole bit.

The controller board has three sockets for the 2708 type PROM. One is used for the miniDOS ROM supplied with the system. The other two sockets can be utilized for user-programmed PROMs, or for upgrading to a named file system, available in ROM from Percom. The miniDOS ROM provided with the basic system is already programmed to handle expansion. It looks over at the next socket; if the socket is empty it simply provides basic storage and retrieval. If the socket is fitted with a PROM or ROM it follows the programmed instructions.

The LFD-400 system uses a 5/4-inch minifloppy disk of the 10 sector "hard-sectored" type. We don't have to get into the nitty-gritty of what hard-sectored means, just be certain you get the right type of mini-disk, or diskette as it's also called.

To get the system up and running you just plug in the controller board to your computer, connect the cable from the controller to the disk drive, turn on the power, and set address A048 (the pointer) to C000, the address of the ROM miniDOS. Type "G", and the DOS (disc operating system) is ready for any loading or storing operations. You can save or load the entire core (memory), part of a core, a program, or whatever.

Several low cost options are available for the Percom system. The basic miniDOS can be upgraded to miniDOS+ with an optional PROM (for the #2 socket) that supports up to 32 named files per diskette. Then there's the FMS-6800 full blown file management system, but it requires 4K to 8K of additional RAM just to support the

disk operating system. (If you require anything more than the basic miniDOS supplied with the LFD-400, be sure you obtain the technical memos to be certain you know what you're getting and how it can be of service to you.)

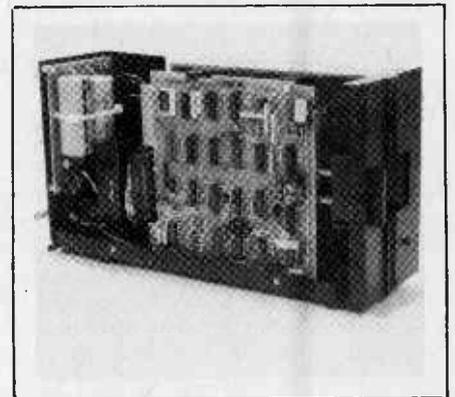
If you don't want too great an expansion but could use a data file system that permits up to four data files to be open at the same time, a PATCH for SWTP BASIC is available on "Software Diskette #2" for \$10. ("Software Diskette #1," which contains the basic patches for SWTP BASIC, is supplied with the LFD-400 system. If you need another one, it's also \$10.)

Using The system. Typical of everything we've received from Percom, the LFD-400 system worked instantly, with no debugging hassles. Also typical of Percom, the instructions are notably clear. A small glitch with plug polarity we uncovered has been resolved by Percom in all shipments to users, so there's no need to go into a

(Continued on page 85)



The controller printed circuit board has three sockets (on the bottom to the right of center) for EROMs (erasable read only memories) and PROMs (Programmable ROM). The #1 socket is used for the miniDOS ROM supplied with the disk system.



The disk drive and all its electronics are supplied completely assembled and tested as a factory unit, in factory shipping cartons.



Kathi's CB Carousel

by Kathi Martin, KGK 3916

President's Thomas J. is destined to go down in CB history

□ TO MEET THE NEEDS readers who have taken the time to write and ask what's available in a good reliable rig, I went back over my notes and test reports and checked the 1979 CB YEARBOOK (chock full of test reports on all types of CB rigs), and found there are still good buys available. Not many, but enough to give you a decent selection. One of my favorites is President's Thomas J., a 40-channel AM transceiver with a list price of only \$159.95, the last time I looked.

Performance-wise, it's similar to a few other rigs in the same general price range, but it has some specialty features I'm attracted to; features that, in my opinion, make it an excellent value.

Starting off, the President Thomas J. is housed in a cabinet 2 $\frac{3}{16}$ -in. high by 7 $\frac{15}{16}$ -in. wide by 8 $\frac{3}{8}$ -in. deep. It's supplied with the usual mobile mounting bracket, a plug-in power cable for 13.8-VDC with positive or negative ground, and a plug-in microphone. It has the usual LED digital 40-channel indicator, volume and squelch controls, an RF gain control, both a noise blanker and ANL, a PA/CB selector switch, and outputs for external and P.A. speakers: all features more or less common to the better quality transceivers.

The Frosting. The extras, which I find are a decided convenience even for routine CB communications, are a microphone gain control, a tone control (actually a treble cut), a built in VSWR meter, a panel lamp dimmer, and modulation metering. Actually, all the meter functions are provided by a single meter that is switched by a front panel selector to indicate the usual S/RF-output, and modulation and VSWR.

The microphone gain control provides sensitivity adjustment from full off to about -38 dB, meaning it can fully modulate the rig with little more than a whisper. The problem with high mike sensitivity is the distortion if you speak in a normal voice. Almost all

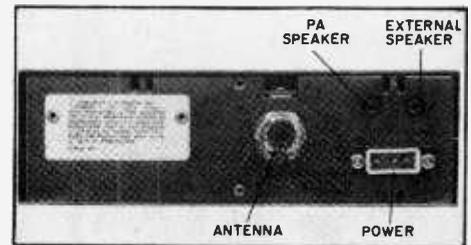


The front panel of the President Thomas J. doesn't look too much different because the mike/RF gain and volume/squelch controls are concentric, cutting down on the overall total number of controls and switches. One selector switch is used for the single meter that indicates received signal strength (S-units), RF-output, modulation, and antenna system VSWR. The black space to the right of the meter is the blacked-out LED digital channel indicator. If you push the extreme left hand switch under the channel indicator the receiver and transmitter instantly switches to channel 9. For more info. circle number 46.

high mike sensitivity rigs with 100% modulation limiting suffer from high level distortion. With the Thomas J., however, you simply back off on the mike gain control until the modulation meter *occasionally* peaks at the "100%" scale calibration. (It's really better to start with the mike gain at full off and advance the control until the meter just peaks at 100% as you modulate.) The end result of setting proper mike gain using the modulation meter is some of the cleanest, most crisp modulation to be heard on the band. Fact is, because the signal is so free of distortion many stations claim my signal's undermodulated, but they somehow seem to receive every word, even when there's severe adjacent-channel bleedover.

Speaking of bleedover, there's little of it in the Thomas J. The receiver section, whose sensitivity I measured at 0.4 μ V. for 10 dB S+N/N ratio, has 62 dB adjacent channel rejection, and a Delta tune covering ± 1.5 kHz helps you tune in stations which might be out at the limits of permitted tolerance. (It's hard to tune a station out at the tolerance limits when your rig has high selectivity if you don't have some form of Delta or fine tuning.)

The only complaint I have with the



The rear apron is strictly standard: minijacks for the P.A. and external speaker; a positive/negative ground power connection; and an antenna receptacle. Easy to hookup.

receiver is the AGC action. An input signal range of 2 to 10,000 μ V, representing very weak and very strong signals, produced an AGC action of 10 dB; adequate but not great. In plain terms, it means that if you have the volume cranked open to work a weak station a strong signal coming on the channel is going to come in a bit on the loud side.

Calibration. One the flip side of the coin, however, there's a calibrated S-meter. S9 represents 100 μ V, and each S-unit is 5 dB. If you're helping someone make antenna system adjustments you can give a reliable measurement that means something, not some

(Continued on page 88)

IT'S SIMPLY BASIC

Keep Your Mailing List Up To Date and Sort It Any Way You Wish With This Amazing Program!

by Larry Friedman, WB2AHN

□ WHILE MASS DATA STORAGE is easily accomplished using a cassette recorder, it often takes so long to find and/or load a program or data that the whole thing isn't worth the effort. A set of index cards can often be handled faster than a personal computer with a cassette storage system.

For fast mass data handling a disc system is an absolute *must have*. Problem is, a disc system generally chews up a lot of memory just to operate the disc; usually about \$250 worth of memory in addition to the cost of the disc system. But a disc system such as the PerCom LFD-400 (for the SWTP 6800 computer) requires no extra memory

assigned exclusively for the disc, and is an ideal low-cost means for the hobbyist to attain mass storage at reasonable cost.

A Disc Delight. To show the convenience of a budget disc system, this issue's program, *Inventory*, was designed especially for a SWTP 6800 with the basic PerCom LFD-400, using the optional PerCom patch for numbered files. The BASIC used was SWTP Version 2.0.

Inventory will keep track of up to 75 items per file. Simply use additional files for additional items. The functions given in lines 0008 to 0018 are self-explanatory. If you don't understand some of them simply load the pro-

gram, put about five items into the inventory, and then experiment with the different commands.

Take care that you use a reverse slash in line 0140; don't substitute a division symbol ("/"). The reverse slash is PerCom's command to send the program to the specified line after the data is read/written. Also, make certain you use a sector number that hasn't been used (line 0110).

Note. This program handles up to 75 items because we assume a hobbyist's computer with a disc system will have 20K of memory. If you have more memory you can increase the number of items per file.

If we had two disc systems with random files we could easily handle hundreds of items, but another disc and support memory for random files is very expensive. The basic PerCom LFD-400 disc system with single drive, and 20k memory in the computer, requires specific files per 75 items.

Inventory can be easily modified to serve specific needs. For example, you can have it store four, five, or more entries per catalog item. Essentially, it is a "universal program" for a budget disc system such as the PerCom LFD-400, one that does not require additional memory solely for the DOS (disc operating system).

Just fifteen years old, Larry Friedman, who set up this program, is an old hand with computers. He has built his own computer system using an SWTP 6800 as the base. The computer gets such diverse uses as processing complex electronic equipment test reports and keeping the statistics for Larry's baseball and bowling teams. Larry is also a consultant on programs for electronics experimenters, and a real whiz as an amateur radio operator and as a beginning pilot.



INVENTORY

```
0001 REM "INVENTORY" BY LARRY FRIEDMAN
0002 REM PROGRAM USES SWTP 6800 BASIC VERSION 2.0 AND
0003 REM PERCOM SINGLE-DRIVE LFD-400 DISK SYSTEM
0004 REM
0005 INPUT "DO YOU WANT A LIST OF COMMANDS (Y/N)";A$
0006 IF A$="N" THEN 100
0007 PRINT
0008 PRINT
0009 PRINT "UPDATE
0010 PRINT "SEARCH
0011 PRINT "CATALOG
0012 PRINT "DELETE LINES
0013 PRINT "QUANTITY
0014 PRINT "DELETE
0015 PRINT "LOCATION CHANGE
0016 PRINT "QUANTITY CHANGE
TO ENTER INITIAL ITEM ENTRIES"
TO UPDATE THE FILE WITH NEW ITEMS"
TO FIND AN ITEM IN THE FILE"
PRINTS ENTIRE CONTENTS OF FILE"
FOR MULTIPLE DELETIONS OF ITEMS"
FOR FINDING QUANTITY OF AN ITEM"
FOR DELETION OF A PARTICULAR ITEM"
TO CHANGE THE LOCATION OF AN ITEM"
TO CHANGE THE QUANTITY OF AN ITEM"
```

```
5040 PRINT I$(X);
5050 INPUT A$
5060 IF A$="T" THEN 190
5070 IF A$=" " THEN 5120
5080 IF A$="D" THEN 5110
5090 PRINT "ENTER D,T, OR HIT RETURN"
5100 GOTO 5050
5110 I$(X)="";I$(X)="";Q(X)=0
5120 NEXT X
5130 GOTO 190
6000 INPUT "ITEM>";I$
6010 FOR X=1 TO 75
6020 IF I$(X)=I$ THEN 6060
6030 NEXT X
6040 PRINT "ITEM NOT FOUND IN LIST"
6050 GOTO 190
6060 PRINT "ITEM ";I$;" QUANTITY: ";Q(X)
6070 GOTO 190
7000 INPUT "ITEM>";I$
7010 FOR X=1 TO 75
7020 IF I$(X)=I$ THEN 7060
```

```

0017 PRINT "LOCATION FIND - LISTS ITEMS IN SPECIFIED LOCATION"
0018 PRINT "END
0100 DIM I$(75),S$(75),Q(75)
0110 INPUT "SECTOR START",A
0120 OPEN #10,A
0130 FOR N=1 TO 75
0140 READ #10,I$(N),S$(N),Q(N)\160
0150 NEXT N
0160 PRINT
0170 DATA START,UPDATE,SEARCH,CATALOG,DELETE LINES,QUANTITY
0180 DATA DELETE,LOCATION CHANGE,LOCATION FIND,QUANTITY CHANGE,END
0190 PRINT :PRINT :INPUT "COMMAND>";C$
0195 PRINT
0200 RESTORE
0210 FOR X=1 TO 11
0220 READ DS
0230 IF DS=C$ THEN 270
0240 NEXT X
0250 PRINT "SORRY, ";C$;" ISN'T A VALID COMMAND."
0260 GOTO 190
0270 ON X GOTO 1000,2000,3000,4000,5000,6000,7000,8000,9000,9250,9500
1000 PRINT "START FILE ENTRIES"
1010 PRINT "ENTER ITEM, LOCATION, & QUANTITY (SEPARATED BY COMMAS)"
1020 PRINT
1030 V=1
1040 FOR X=V TO 75
1045 PRINT "# ";X;
1047 INPUT I$(X),S$(X),Q(X)
1050 IF I$(X)="STOP" THEN 190
1070 NEXT X
1080 GOTO 190
2000 PRINT "UPDATE FILE ENTRIES"
2010 FOR X=1 TO 75
2020 IF I$(X)="STOP" THEN 2060
2030 NEXT X
2040 PRINT "SORRY, FILE IS FULL"
2050 GOTO 190
2060 V=V+1
2070 GOTO 1040
3000 INPUT "ITEM>";I$
3010 FOR X=1 TO 75
3020 IF I$(X) THEN 3060
3030 NEXT X
3040 PRINT "ITEM NOT FOUND IN FILE"
3050 GOTO 190
3060 PRINT "ITEM ";I$(X);" FOUND IN LOCATION: ";S$(X)
3070 GOTO 190
4000 IF I$(1)="" PRINT "NO ITEMS IN LIST.":GOTO 190
4001 Q=0
4005 PRINT "ITEM";TAB(20);"LOCATION";TAB(40);"QUANTITY"
4010 FOR X=1 TO 75
4015 Q=Q+1
4020 IF I$(X)="STOP" THEN 4050
4025 IF I$(X)="" Q=Q-1 :GOTO 4040
4030 PRINT I$(X);TAB(20);S$(X);TAB(40);Q(X)
4040 NEXT X
4050 PRINT :PRINT TAB(20);Q-1;" ITEMS IN CATALOG"
4060 GOTO 190
5000 PRINT "HIT RETURN TO ADVANCE ITEM, D TO DELETE ITEM"
5010 PRINT "OR T TO TERMINATE DELETE LINE FUNCTION"
5020 PRINT
5030 FOR X=1 TO 75
5035 IF I$(X)="" THEN 5120
5036 IF I$(X)="STOP" THEN 190

```

```

7030 NEXT X
7040 PRINT "ITEM NOT FOUND IN LIST"
7050 GOTO 190
7060 I$(X)="" :S$(X)="" :Q(X)=0
7070 GOTO 190
8000 INPUT "ITEM>";I$
8010 FOR X=1 TO 75
8020 IF I$(X) THEN 8060
8030 NEXT X
8040 PRINT "ITEM NOT FOUND IN LIST"
8050 GOTO 190
8060 PRINT S$(X)
8070 INPUT "NEW LOCATION>";S$(X)
8080 GOTO 190
9000 INPUT "LOCATION>";S$
9005 Z=0
9010 FOR X=1 TO 75
9020 IF S$(X) PRINT I$(X);Z=Z+1
9030 NEXT X
9040 IF Z=0 PRINT "NO ITEMS IN THAT LOCATION."
9050 GOTO 190
9250 INPUT "ITEM>";I$
9260 FOR X=1 TO 75
9270 IF I$(X) THEN 9310
9280 NEXT X
9290 PRINT "ITEM NOT FOUND IN LIST"
9300 GOTO 190
9310 PRINT "QUANTITY = ";Q(X)
9320 INPUT "CHANGE>";C
9340 Q(X)=Q(X)+C
9350 GOTO 190
9500 INPUT "ENTER SECTOR FOR DUMP",A
9501 CLOSE #10
9502 OPEN #10,A
9503 FOR X=1 TO 75
9510 IF I$(X)="" THEN 9700
9520 PRINT #10,I$(X);S$(X);Q(X)
9530 NEXT X
9700 CLOSE #10
9710 PRINT "NEXT AVAILABLE SECTOR = ";SCTR
9999 END

```

SAMPLE RUN CF "INVENTORY"

```

READY
#RUN
DC YCU WANT A LIST OF COMMANDS (Y/N)? Y

```

```

START      TO ENTER INITIAL ITEM ENTRIES
UPDATE     TO UPDATE THE FILE WITH NEW ITEMS
SEARCH     TO FIND AN ITEM IN THE FILE
CATALOG    PRINTS ENTIRE CONTENTS OF FILE
DELETE LINES FOR MULTIPLE DELETIONS OF ITEMS
QUANTITY   FOR FINDING QUANTITY OF AN ITEM

```

(Continued on page 94)

Programs are written in SWTP type 2.0 8K basic, and might require some modification for use with other BASIC interpreters. Programs for this column are checked and debugged using a SWTP 6800 computer with 12K memory, a Micro-Term ACT-1 CRT terminal, an ASR 33 TTY, and a National Multiplex CC8 recorder. Printout will fit single line TTY or two lines on most CRT terminals.

CB XCVR CHECKOUT



- CRAIG L-131
- MIDLAND 78-999
- PANASONIC RJ-3600
- ROYCE 582

• **CRAIG L131**

\$299.95 (Craig Corp.)

General Description: A 40-channel AM/SSB transceiver for mobile and P.A. operation. Fine tuning ± 800 Hz is provided. Power supply is 12 to 13.8 VDC with negative or positive ground. Overall dimensions are



CIRCLE 42 ON READER SERVICE COUPON

2¼-in. H x 8½-in. W x 10¼-in. D. There are front panel controls for: channel selection, volume, squelch, clarifier, SWR Cal/local-distance sensitivity. Switches for: CB/PA/ Panel lamp dimmer, noise blanker/ANL, AM/SSB mode, S/RF/SWR/ Cal. meter function. Standard accessories include a microphone, DC power cable, quick-release mobile bracket.

Receiver Section Test:

Input sensitivity	0.3 μ V
Adjacent channel rejection	77 dB
AGC action	13 dB
SSB opposite sideband rejection	50 dB
Input level for S9 meter indication	1000 μ V

Transmitter Section Test:

AM RF output	3.7 watts
SSB RF output	11 watts P.E.P.
Modulation to 85%	yes
Relative sensitivity for 85% mod.	-32 dB
Modulation limited to 100%	yes

Editorial Remarks: The L131 has a relative reading S-meter, double conversion, jacks for P.A. and remote speakers, incandescent digital chan-

nel indicator, S/RF-output/SWR meter. Mobile bracket automatically disconnects antenna and speaker connections when transceiver is removed from the car. ■

• **MIDLAND 78-999**

\$699.95 (Midland International)

General Description: A 40-channel AM/SSB transceiver for mobile, P.A., base operation. Fine tuning ± 800 Hz is provided. Power supply is 12 to 13.8 VDC with negative ground and 120 VAC. Overall dimensions are 6-in. H x 14-27/32-in. W x 11-13/16-in. D. There are front panel controls for: channel selection, volume, squelch, clarifier, RF gain, MIC gain, tone, P.A. gain, SWR CAL. Switches for: Antenna A/B, SWR CAL, noise blanker, ANL, AM/SSB modes, CB/PA, high Audio



CIRCLE 48 ON READER SERVICE COUPON

frequency filter, channel lamp dimmer. Standard accessories include a microphone, DC power cable, A.C. power cord.

Receiver Section Test:

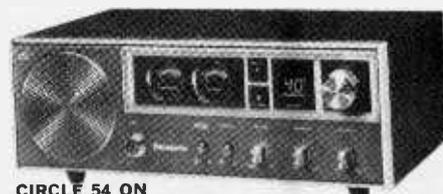
Input sensitivity	0.6 μ V
Adjacent channel rejection	52 dB
AGC action	13 dB
SSB opposite sideband rejection	50 dB
Input level for S9 meter indication	150 μ V

Transmitter Section Test:

AM RF output	3.8 watts
SSB RF output	11 watts P.E.P.
Modulation to 85%	yes
Relative sensitivity for 85% mod.	-40 to -12 dB

Modulation limited to 100%yes

Editorial Remarks: The 78-999 has a 5 dB per unit S-meter, double conversion, jacks for P.A., remote speakers and headphones, L.E.D. digital channel indicator, separate meters for percent modulation, RF-output/SWR, and S-unit. ■



CIRCLE 54 ON READER SERVICE COUPON

• **PANASONIC RJ-3600**

\$299.95 (Panasonic)

General Description: A 40-channel AM transceiver for mobile or base operation. Power supply is 12 to 13.8 VDC with negative or positive ground and 120 VAC. Overall dimensions are 5-3/16-in. H x 13-9/16-in. W x 8¾-in. D. There are front panel controls for: channel selection, volume, squelch, and RF gain. Switches for: noise blanker/ANL, and preset channel selector. Standard accessories include a microphone, mobile mount and DC power cable.

Receiver Section Test:

Input sensitivity	0.3 μ V
Adjacent channel rejection	64 dB
AGC action	13 dB
Input level for S9 meter indication	60 μ V

Transmitter Section Test:

AM RF output	3.5 watts
Modulation to 85%	No 75% Max.
Relative sensitivity for 85% mod.	-39 dB
Modulation limited to 100%	yes

Editorial Remarks: The RJ-3600 has a relative reading S-meter, jack for
(Continued on page 98)



CONTROL THAT TAPE

Keep in charge of your computer with this one-evening project.
by Herb Friedman

THROUGH THE COMMON CASSETTE recorder, used as the data storage system for many hobby and personal computers, is both inexpensive and reliable, it is also a pain-in-the-RAM. Most computers control the starting and stopping of a recorder's motor via a control cable and plug from the computer's recorder interface to a jack on the side of the recorder. It is impossible to run the recorder manually. You must pull out the remote control plug if you want to rewind the tape, or do anything else to the tape, such as skipping forward to other data, or to a "clear" section of tape for additional data recording. Then you must reinstall the remote control to return the recorders' on-off operation back to computer control.

Another problem with most cassette installations is that you can't hear what's going on. Is the tape really feeding data to the computer? Is the computer really feeding data to the cassette? If we had a dollar for the times many of us hit the **LOAD** key—only to realize minutes later there was no feed to the computer—we could probably afford a disk system! Surely, we could afford a disk if we also had a buck for every time we dumped from the computer only to discover too late the recorder wasn't in the record mode, or there was no dump when we thought there was.

Though many personal computers provide some form of bell, whistle, or terminal indication that the computer is loading or dumping, it's most convenient to hear what's going on.

For something like ten dollars and a short evening's work you can build a *Personal Computer Tape Controller* that allows you to manually control the recorder's motor and functions even when the computer's remote control

cable is plugged in, and to also monitor loads and dumps.

The monitor hookup depends on the particular model cassette recorder you use. The audio feed from the recorder to the computer is generally taken from the monitor jack of the recorder, which is an output for an external speaker or earphone that disconnects the recorder's internal speaker when a patch cord is plugged in. Most inexpensive recorders also provide a monitor jack output for the record signal even though the speaker is turned off. By bridging a small speaker across the connection to the monitor jack it's possible to hear the signal feed to and from the computer. You might have other problems with load and dump, but by hearing the signals you'll at least know there actually is a computer signal going in and out of

the recorder.

The complete controller is amazing: No power supply. ICs, transistors, batteries, or LEDs! A few jacks, switches, a small speaker and some patch cords are all that's needed. (We could have done it the hard way with a few ICs and transistors, but why waste money on unnecessary parts.)

The only critical area is the cabinet, or the front panel on which the jacks are installed. It must be made of plastic or some other insulator. Many computers are sensitive to ground loops between a recorder's input and output jacks, and for this reason there must be no common connection between the two in the controller. Similarly, the remote motor control jack (J3) must also often be electrically insulated from J1 and J2's common connection. By mounting



The Tape Controller connects between the computer's record interface and the cassette recorder, allowing monitoring of both the record and playback signal(s), as well as providing forward and reverse control without pulling the remote control patch cord.

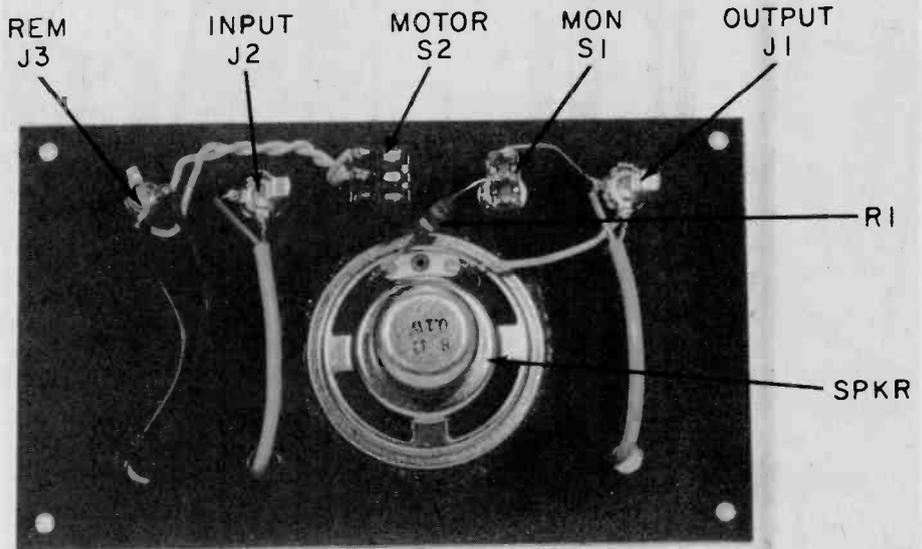
e/e TAPE CONTROLLER

all three jacks on a plastic panel or cabinet the whole ground loop problem is avoided and the controller is truly universal.

The speaker can generally be any 8 or 16-ohm miniature type 1.5 inches or larger. It is cemented with "airplane" or "model" cement directly to the panel—its muffled sound will be adequate for monitoring.

Resistor R1 is used only if you want to lower the speaker volume (which is often unnecessary because of the muffling). Experiment with 1/2-watt values from about 15-ohms upwards until you get the desired sound level. While you could install a potentiometer (about 50 or 100-ohms) to provide a variable volume adjustment, such is not an easy value to locate at your local parts distributor, and the slight extra convenience isn't worth the extra cost.

Jacks J1, J2 and J3 match the existing plugs on the connections from your computer's recorder interface, and plugs P1, P2, and P3 should be identical with the interface plugs. As a general rule, J1, J2, P1, and P2 carry the audio signals and are the miniature type. J3, and P3, which are the recorder's remote



Construction of this tape controller couldn't be more straight-forward. There's no power supply, ICs, transistors, batteries or LEDs! However, there is one critical area—the front panel. The jacks installed thereon must be electrically isolated from each other. This is because many computers are sensitive to ground loops between a recorder's input and output jacks so the controller must not make a connection between the two. The best bet is to just avoid the entire problem from the beginning. Use a plastic panel/cabinet!

control, are the sub-miniature type.

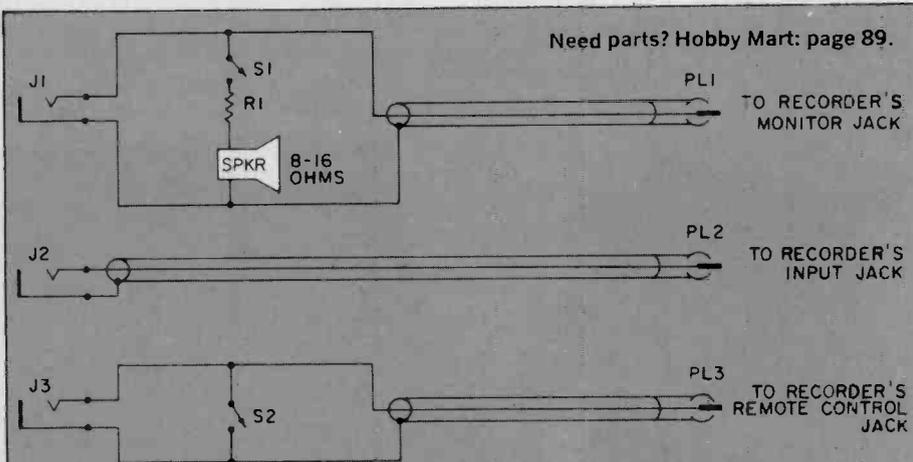
Using The Controller. Connect the wires from your computer or computer interface to J1, J2, and J3. Connect P1, P2 and P3 to your cassette recorder. To operate the cassette recorder manu-

ally, set S2 to *manual* (closed), thereby shorting the recorder's remote control circuit. When you want the computer to start and/or stop the recorder, set S2 to the *open* position. (When S2 is closed it's the same as if you had pulled out the remote control plug from the recorder's *remote* jack.)

To monitor either the output from, or input to, the recorder, close S1. If you find the monitor sound disturbing after the load or dump starts simply open S1; it has no effect on the load or dump. If your computer requires the load start on the recording's *marking tone* to avoid a "garbage" entry at the point where the marking tone commences, close S1 so you can monitor the recorder output, close S2 so you can operate the recorder manually and play the tape until you hear the start of the marking tone, then open S2 as soon as you hear the tone. This returns cassette control back to the computer. You can now commence the load without fear of "garbage" caused by the start of the marking tone.

(Note. This controller is intended for recording systems that utilize audio tones to represent data, such as the so-called Kansas City, or Byte/Manchester systems. It is not intended for recording magnetic impulses, such as NRZ, which generally provide an input/output monitor as part of the recorder.)

Be in control of your computer by building this little device. We think you'll agree it will be one of your most useful computer accessories. ■



Need parts? Hobby Mart: page 89.

PARTS LIST FOR TAPE CONTROLLER

J1, J2—Miniature jack, see text.
J3—Sub-miniature jack, see text.
P1, P2, P3—Plugs to mate with J1, J2, J3. See text.
SPKR—8 or 16-ohm miniature speaker, see text.

S1, S2—SPST switch.
R1—50 to 100-ohm resistor, 1/2-watt, see text.
Misc.—Cabinet or panel made of plastic or other insulator; wire; etc.

Speaker SPKR 1 can be anything from 1.5-inches and larger. It can even be smaller if you happen to stumble across one of those surplus mini-speakers that still sell for about 50-cents. The speaker is cemented to the front panel with silicon rubber (RTV) adhesive, or "airplane" or model cement. Do not try to use one of the new instant-drying cements such as Krazy-glue—they won't stick to the speaker's fiber "front." The switches shown have more terminals than needed for SPST. They are "surplus," selling for much less than a "new" SPST switch. Use whatever you can get most cheaply.

□ WHETHER YOU SERVICE your own color and/or black-and-white television equipment because you truly enjoy electronic troubleshooting, or because you are primarily interested in holding down spiraling professional TV repair costs, you need more sophisticated test equipment than your battered, but faithful old VOM. Basically, you must have a generator capable of producing a broad variety of test signals to reveal what's right or wrong in complicated TV circuitry. One of the most versatile instruments you are likely to find for either home or pro-shop TV repair is Heath's model IO-4101 Vectorscope. Not the least remarkable feature is the modest price of \$169.95.

First, a word of caution. Although you should have no difficulty assembling the kit if you follow Heath's typically excellent assembly instructions to the letter, give a thought to how ready you are to actually use the instrument. The Vectorscope is *not* a magic solution to all TV problems in the hands of one whose only acquaintance with TV equipment is through channel-selector buttons. To use the Vectorscope, you must already know a fair amount about the inner workings of a TV set, or be prepared to spend much time and effort educating yourself in such knowledge.

Super Test Set. This all-solid-state instrument generates all the stable crystal-controlled test signals needed to produce color and convergence patterns required to adjust color circuitry and tri-gun convergence systems. Twelve patterns, including dots, crosshatch, horizontal and vertical lines, gray scale, and color bars are available in either the standard 9 by 9 display or an exclusive Heath 3 by 3 format. A clear raster for purity adjustments can also be produced.

The Vectorscope is much more than a typical pattern generator because it includes its own cathode-ray-tube display that shows a characteristic waveform for each type of color TV receiver. The petal-pattern or "Daisy" display waveform is a voltage representation of all ten color bars, an exact representation of the chroma signal being fed to the guns of the CRT in the TV receiver. It can reveal a missing, or weak color, and show the correct setting of the burst phase transformer, reactance coil, oscillator coil and band-pass controls. The color demodulation angle may also be checked."

Crystal-controlled horizontal and vertical sync pulses are incorporated into the Vectorscope output signals to provide necessary blanking and to lock the various patterns firmly on the TV

screen. Sync signals are also available at a front panel jack, for servicing sync circuits without video, or sets having separate video and sync demodulator phase adjustments. There's RF output for channels 2 through 6, and an RF level control varies the RF output for checking relative sensitivity and to prevent overloading the RF and IF circuits of the receiver. A switched, crystal-controlled 4.5 MHz sound carrier aids in fine tuning the Vectorscope to the receiver channel frequency.

A video signal is available for

the 3.56 MHz oscillator. Be sure that any TV receiver you use as monitor during these adjustments is in good working condition because a malfunctioning set can lead to endless confusion.

Two methods are provided for checking the video output signals. The first method utilizes an oscilloscope. The clarity and details of the patterns are directly related to the bandwidth and triggering of the oscilloscope used. This is the procedure to use if you have a scope. A chart shows how to set os-

e/e assembles the...



CIRCLE 1 ON READER SERVICE COUPON

Heath VECTORSCOPE

Budget TV tester does almost everything but change tubes

troubleshooting video circuits; it's adjustable with a level control. The chroma signal is also adjustable for amplitude and is used to check color hue and sync with different signal levels. Front panel switches are provided to turn the individual red, blue, and/or green beam currents on or off during convergence checks.

Generator Tests and Adjustments are needed, after assembly, to put the Vectorscope itself into proper operating condition. A black-and-white TV receiver may be used for all adjustments except for the color bar displays, the vector displays, and the adjustment of

illoscope controls and what waveform characteristics to expect for various display settings such as purity, dots, crosshatch, horizontal and vertical lines.

If an oscilloscope is not available, you'll have to connect the Vectorscope to the video detector and sync detector output of a TV receiver. Heath doesn't hold your hand at this point, or attempt to tell you where to find these detectors in your TV set; it's assumed that you already know your way around inside a TV set. Instead of observing waveforms, as with the oscilloscope, you now compare TV screen patterns with a set of drawings of normal patterns.

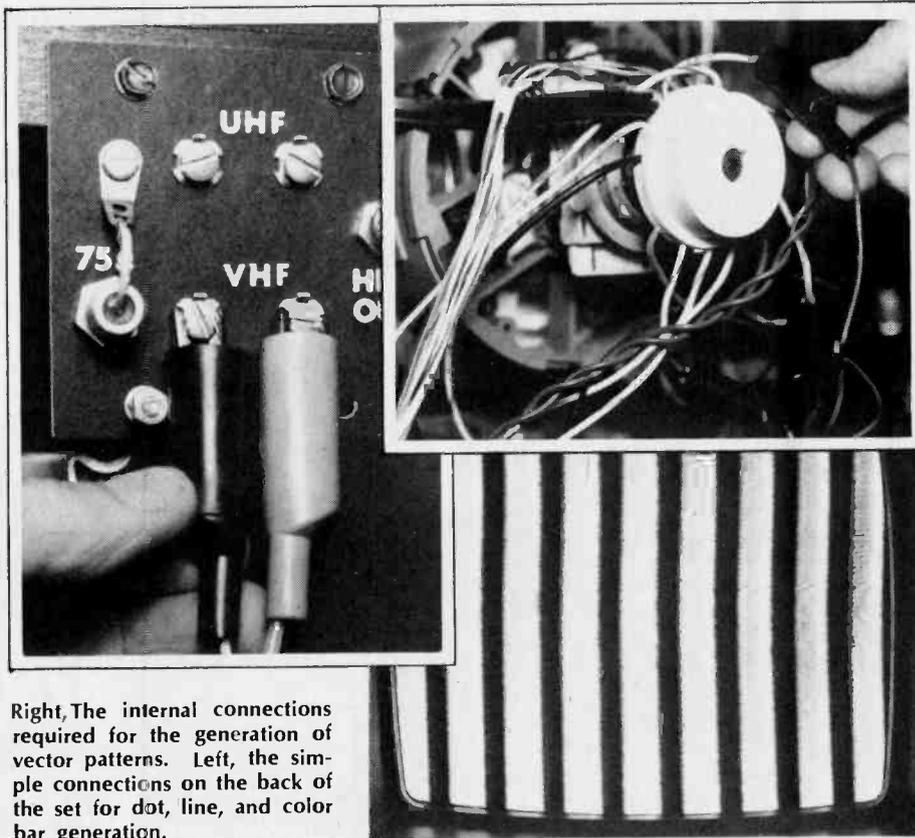
e/e VECTORSCOPE

Vector Display Adjustment. A four-wire cable coming from the Vectorscope terminates in four alligator clips. Three have insulation-piercing needles built into the jaws which make quick and easy connections to chroma leads going to your TV receiver's picture tube. You have to know how to identify these normally color-coded chroma leads. The fourth alligator clip, without needles, goes to chassis ground.

You also need to know whether the chroma signal in your TV receiver is fed to the cathodes or grids of the CRT, and then set a switch at the rear of the Vectorscope to either "Cath" or "Grid," as the case may be. The luminance (black-and-white) signal must be bypassed to ground on receivers that have their chroma signals applied to the cathodes of the picture tube. If there is no service switch in the receiver that grounds the luminance signal, the signal must be bypassed by insertion of an electrolytic capacitor between the center lug of the contrast control and chassis ground.

The channel, chroma and RF controls on the Vectorscope are used to create the proper petal ("Daisy") pattern as shown in photographs in the Heath manual; the shape depends on whether the receiver is grid-fed or cathode-fed, and on whether you are using the 9 by 9 or 3 by 3 format. Don't overlook the important fact that the size and shape of the petal pattern is also influenced by the color, tint and horizontal hold controls of the TV receiver. Although you will have pre-set the focus and astigmatism, pull off the knobs on the Vectorscope's horizontal and vertical position controls to get at the hollow shafts, and use a small screwdriver to touch up the petal pattern if it seems too fuzzy. However, don't expect to get razor-sharp edges on the petals.

To further emphasize the fact that



Right, The internal connections required for the generation of vector patterns. Left, the simple connections on the back of the set for dot, line, and color bar generation.

you must have basic knowledge about TV circuitry, we mention in passing that adjustment of the vector display also calls for disabling the burst amplifier by removal of a transistor or tube, depending on the type of TV receiver used. And you must know how to adjust the reactance coil for the most stable color picture.

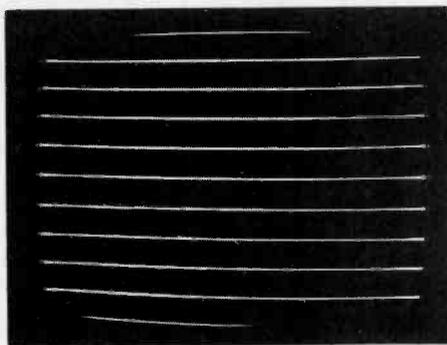
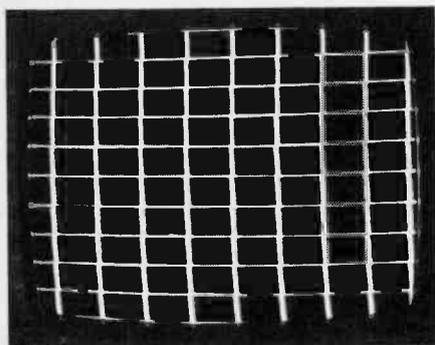
Using the Vectorscope. To effectively and properly use the Vectorscope, you must know the correct pattern display of an aligned TV receiver. Use manufacturer specifications if they are available. Otherwise hook the Vectorscope to a properly functioning receiver, and misadjust each coil carefully as you observe its effects on the pattern on the TV screen or Vectorscope CRT. Attach a "tape flag" to the alignment tool so that you can return the coil to its

proper setting before going on to the next one. If you have more than one TV receiver available, try the tests on all of them and note any small differences in the displays.

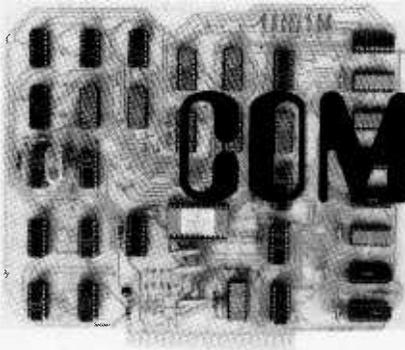
Color guns in TV receivers that apply chroma signals to the grids can be turned on or off with the gun switches on the front panel of the Vectorscope. If the chroma signals are applied to the cathodes, the guns can be turned off by turning down the screen (drive) controls, using the actual procedure that pertains to the type of TV receiver under test.

The Heath manual tells how to use the Vectorscope to perform standard adjustments of TV receivers, but you may wish to obtain a good color TV servicing book for additional information, especially to understand how to judge receiver performance by observations of variations in the color bars of your particular set.

Summing Up. Clearly, the Heath Vectorscope is an extremely versatile tool that can help squeeze out every last bit of performance inherent in the design and construction of your color or black-and-white TV receiver. But it can do that only if the instrument is used knowledgeably. If you take time to become truly familiar with your Vectorscope's Daisy and other patterns, you'll be in clover for the rest of your TV troubleshooting days. ■



The lefthand TV screen shows the pattern used for convergence and linearity adjustments. The right screen is for vertical linearity and pincushion adjustment. Both use a 9-by-9 setting.



COMPUTER READOUT

by Tom Williams

How computers communicate with the real world

□ MOST PEOPLE WHO HAVE begun investigating the world of computers are probably familiar with the most common means of communicating with the machine—the keyboard terminal. This type of input/output, or I/O, device reads the different keystrokes typed by the operator and converts each into a distinct pattern of 1's and 0's which are then transmitted to the computer through one of its I/O ports. A port is simply a location (sometimes a memory address) where the CPU looks for incoming information from the terminal and to which it transfers data to be read by the terminal.

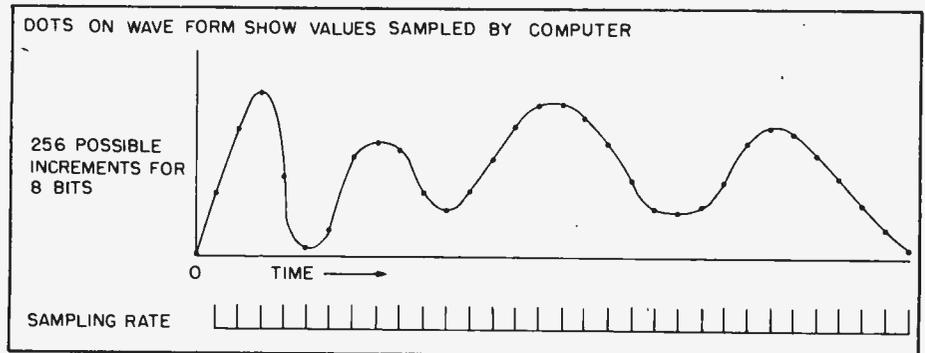
For the computer to receive meaningful data from a keyboard terminal, the operator must first formulate it in terms of the alphanumeric characters available on the keyboard and the computer must be programmed to interpret the symbols sent to it. This works quite well for a great many applications, but what if we want the computer to do something that requires so much constant input that the task of formulating it and typing it in all the time would be too dull and repetitive for a human to put up with all the time?

Computer Control. Let us take for an example, the task of reading—and later controlling—the temperature in some device. While that job could be done by a simple thermostat, we will see that using a computer will enable us to expand incredibly the possibilities for using the temperature data it reads.

The first problem is to get the information into the machine. We could have an operator read a thermometer and type the readings in via the keyboard, but he would soon get frustrated, especially if we wanted readings every half second or so. With the computer, we can do it automatically. This whole subject of automatic data gathering and external control is called *process control*. It is simply obtaining information from the real world, processing that information according to a program in the computer's memory and performing actual operations based on that information.

This means that an incredible variety of specialized I/O devices and programs must be devised and tailored to the specific application. These can range from sensors of all kinds to stepper motors, valves and electric trains. We will now look at some of the general methods that are used to interface a computer to the outside world.

Each sample that is read by the computer represents the value of the analog signal at a given point of time. For an eight-bit A/D converter, this value can be resolved into 256 increments ($2^8 = 256$). For example, it would be possible for such a device to measure a range of temperatures from 0 degrees to 100 degrees Celsius to an accuracy



A computer can represent a wave form by sampling the level of the wave at a given point in time. The computer can interpolate the wave in between the points. The audio industry is just starting to use this same technique to make master recordings at the studio. The record albums that are produced are clearer and have more range than analog recordings.

Analog to Digital. Since the real world does not normally present convenient digital data, some method must be found to translate *analog* signals into digital data. The general device for doing this is called an analog to digital, or A/D converter. An analog signal such as an audio wave, has constantly changing values so the best a digital device can hope to do is to *sample* positions of the wave and to approximate its shape in the form of digital information. Given the speeds at which computers operate, this can be done with surprising accuracy.

Let us look at the wave form shown here. It is applied as a continuously varying voltage to the input of the A/D converter which is at one of the computer's input ports. The computer then reads the instantaneous value at regular intervals and accepts the digital value through its port. It can thus form an approximation of the wave form. The greater the frequency of this *sampling rate*, the more accurate the digital approximation will be.

of better than 0.4 degrees Celsius! This accuracy can be enhanced by more complex (and more expensive) 10- or 16-bit converters.

The opposite of A/D conversion, digital to analog conversion, is also done, often on the same circuit board known, naturally, as an ADAC. Here, the digital information is output at a specific rate to a network of resistors, filters and op amps to produce an analog signal. The most sophisticated D/A converters are used in computer music applications where the highest quality complex waveforms are essential.

One inexpensive example of these principles, now available to hobbyists, is the Data-Bag™ speech processor made by Mimic Electronics (P.O. Box 921, Acton, MA 01720). This device allows the user to digitally record his voice in the computer's memory and then play it back by having the computer output those memory contents through the D/A section of the Data-Bag to a speaker. In all this there is a tradeoff the user must be aware of. The

e/e COMPUTER READOUT

faster the sampling rate, and hence the more accurate the representation of the wave form, the more information must be stored—and the more memory must be taken up with stored data.

Of course, most real world applications are concerned with more than just inputting and outputting the same information. The real power of the computer, after all, is to process the information and make decisions based on it. And the true purpose of real-world connections is to enable the computer to act independently on those decisions. In this context, then, they are merely the things which implement the end results of the processing which is the computer's main task.

Control. By outputting analog signals, the machine could be used to control conventional analog devices. Let us take a look at our example of temperature control. The A/D converter, under software control, samples and presents temperature readings to the computer which reads and compares this data with its program information. If the temperature is outside the specified parameters, the computer outputs a digital value to the D/A converter which applies the proper analog voltage to the motorized temperature control until the readings again satisfy the limits in the program.

Well, we certainly don't have to invest in a computer simply to use it as a thermostat! As I said and will emphasize again, the power of the computer lies in its speed and its ability to analyze large amounts of data and make decisions based upon it. So let us set our machine a somewhat more challenging task.

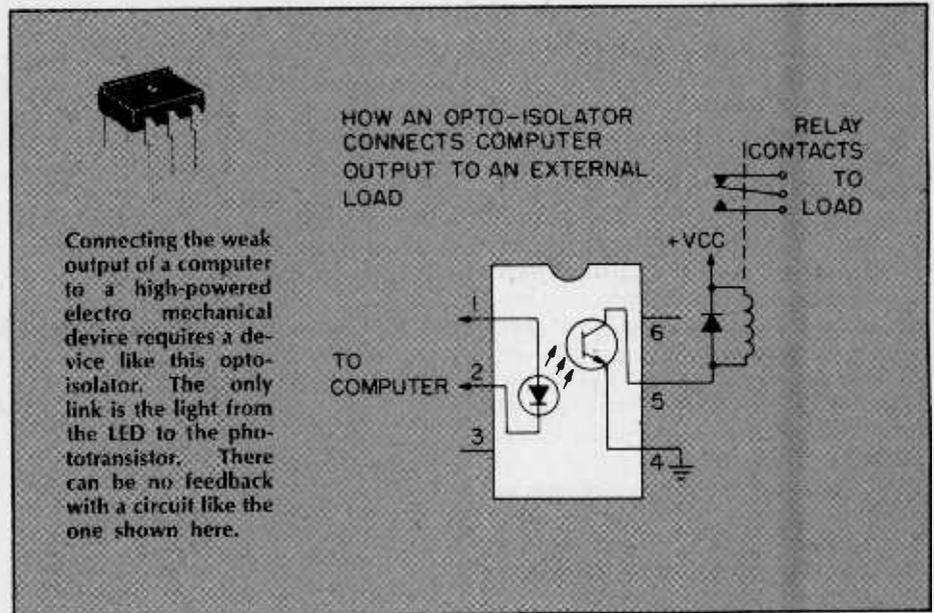
Multiple Data. We have a chemical process in which the computer must simultaneously monitor several thermometers, flow meters and pH meters, control various valves and temperature controls, and, in addition, prepare a human-report on materials used, temperature variations and the like. In addition, it must be alert for critical conditions (or combinations of conditions) and sound an alarm, and shut down operations if necessary. It should be apparent that the main problem here is not so much in the various on-off or analog devices at the machine's ports, but more in the considerations put into the software program.

Having the computer monitor many different inputs simultaneously is accomplished with an analog multiplexer.

A typical such device can monitor 16 channels by rapidly scanning the inputs. In much the same way, an automobile distributor can service 8 different spark plugs seemingly at the same time.

Parts of the computer's program can then store the different values in memory locations allotted to the different input channels. This information can then be manipulated analysed and output in whatever manner the programmer thinks best.

and destroying components. The solution for simple on-off functions is to isolate the voltage with an *opto-isolator*. As the diagram shows, this is a device consisting of a photo transistor and an LED. The LED is connected to the computer output and is totally electrically isolated from the phototransistor. The phototransistor is turned on by the light emitted when the LED is on. It can thus be used to turn on any type of relay or other device while protect-



There are two more devices that are very important in process control applications. The first is the *real time clock*. Since all computer functions are controlled by various timing circuits in "clocked logic" there is a central timing reference in the form of a crystal oscillator known as the system clock. It's typical frequencies in home computers are between 2 and 4 MHz. Since a crystal controlled clock is extremely accurate, divider circuits can be added to give the system an internal source of time reference calibrated in hours, minutes, seconds and fractions of seconds. The computer can then be programmed to refer to this time standard in order to time and delay the external processes it is controlling.

The other important device is one which enables the computer to turn on and off high voltage or high power devices safely. Obviously, the low voltage levels present at a computer's output port are not capable of controlling large devices by themselves. One solution is to use them to turn relays on and off which in turn controls the devices that do the actual work. The problem with relays and transistor switches is that there is danger of high voltage getting back into the computer

ing the computer circuits from dangerous voltage.

This is the type of device we would use to sound alarms and activate sprinkler systems if our computer detected dangerous conditions, in our chemical process. Of course, with the computer in charge of things that should not happen.

If it did, the operators could use the computer to analyse the recorded data and the records of its control functions to generate a report on the entire process. This report could then be printed out in an orderly format for the chemists to look at and make decisions as to what program changes would be necessary in the process control to make sure such a disaster did not reoccur.

And that brings us back to the point I have been emphasizing. The program control and analysis of the data are the crucial aspects. The external devices must sense accurately and carry out the machine's orders exactly. But the whole system is still merely a tool which is used to extend the power of the human mind in the same way the lever extends the power of the human muscle. Whether we use it properly is still up to us. ■

e/e BASIC COURSE IN ELECTRICITY & ELECTRONICS



ELEMENTARY ELECTRONICS takes a look at the diode—the electronic one-way street. By its ability to pass current in only one direction it allows us to change alternating current into direct current. Try to imagine what electronics would be like without these dynamic little devices.

This series is based on material appearing in Vol. 1 of the 5-volume set, **BASIC ELECTRICITY/ELECTRONICS** published by Howard W. Sams & Co., Inc. @ \$25.50. For information on the complete set, write the publisher at 4300 West 62nd St., Indianapolis, Ind. 36268.

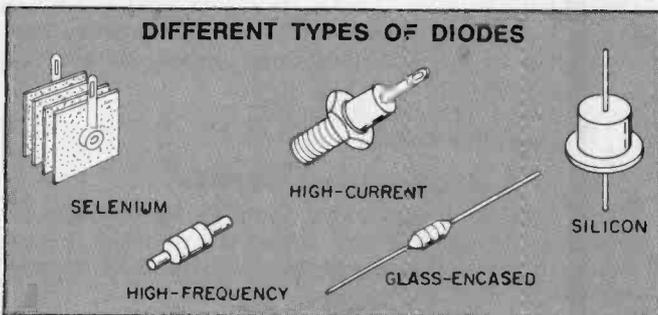
UNDERSTANDING DIODES

What you will learn. Diodes are used in virtually all electronic circuits. They are simpler than, but similar to transistors. When you understand simple diode action you are halfway to understanding transistors. The diode is a device through which current passes easily in one direction, but very little or not at all in the other direction. In this article you will learn of the common uses of diodes, and how they work in circuits.

WHAT IS A DIODE?

A diode is an electrically operated device which has two elements (or terminals). If a voltage source is applied to these elements in the correct polarity, current flows through the diode. However, if the polarity is reversed, very little (if any) current passes through.

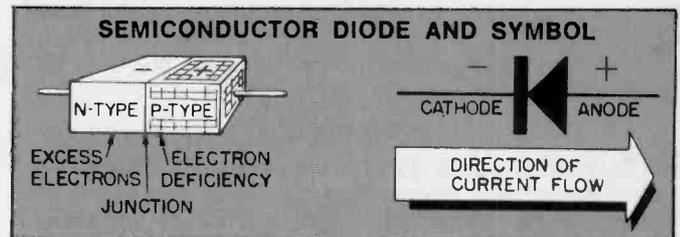
A solid-state diode contains two dissimilar metals or two different types of semiconductor materials. Current flows across the junction formed between the differing materials.



Semiconductor Diodes—A semi-conductor diode is made of the same materials as those used in transistors, usually **germanium** or **silicon**. The silicon diode is more expensive than the germanium diode, but is able to handle a greater amount of current.

During manufacture, a tiny block, identified as **P-type**, is treated in such a way as to have a deficiency of electrons. Another block is identified as **N-type**, and is treated to have an excess of electrons. Such a diode is often called a **PN junction**.

When joined, a voltage barrier forms at the junction,



preventing the electrons in the N material from moving over to the P material. However, when a voltage is applied (as shown in the drawing) the barrier is overcome and electrons flow from N to P. The schematic symbol used for all solid-state diodes is also shown.

Voltage polarities necessary for current to flow are labeled on the symbol. Current flows through the diode toward the arrowhead.

QUESTIONS

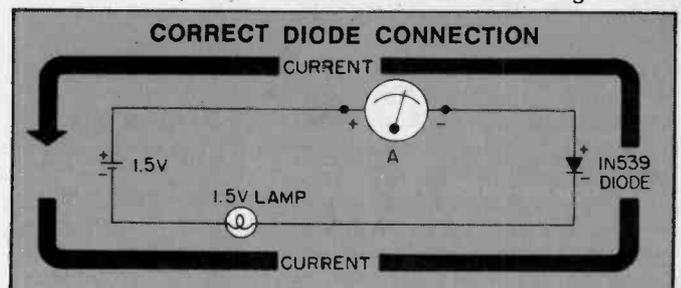
- Q1. N-type germanium has an (excess, deficiency) of electrons.
- Q2. From anode to cathode in a diode is a direction of _____ resistance.
- Q3. The identifying symbol for the anode is a +.

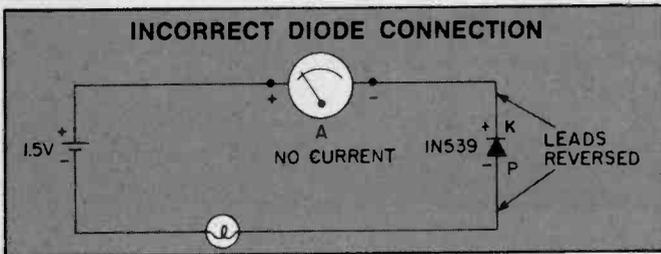
ANSWERS

- A1. N-type germanium has an **excess** of electrons.
- A2. From plate to cathode in a diode is a direction of **high** resistance.
- A3. The symbol for the anode is +.

DIODE REACTION TO AC AND DC

It can be easily shown that a diode allows current to flow in one direction and not in the other by constructing the circuit below. A 1.5-volt lamp, an ammeter, and a diode are connected in series across a 1.5-volt cell. (Semiconductor diodes are distinguished



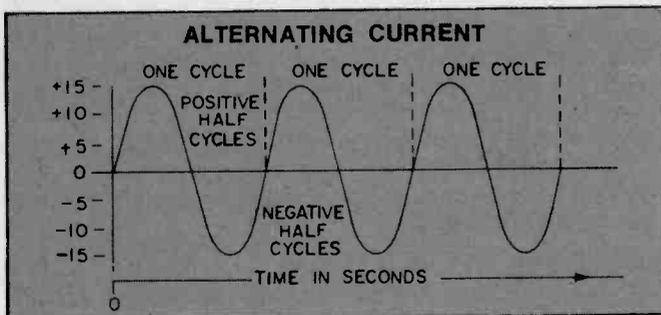


from each other by a number-letter designation. The diode recommended for this circuit is a 1N34).

With the connections made as shown, current will flow and the lamp will light. The ammeter will record very close to 200 milliamps. Now reverse the connections of the diode. Will the lamp light? No. And, as indicated in the next drawing, the meter pointer will remain on zero. The anode-to-cathode resistance of the diode is sufficiently high to prevent a flow of current. A small amount may leak through, but it is not enough to record on the meter.

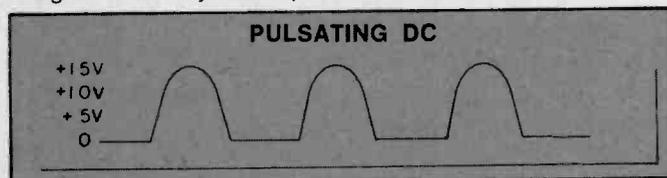
RECTIFYING AC

To **rectify** means to convert AC to DC. a **rectifier** is a device that accomplishes this, and a **rectifying** circuit is one in which it is done. A **diode** is a **rectifier**.



You know that an alternating voltage increases and decreases in positive voltage during a half cycle and in the next half cycle makes the same changes in negative voltage.

As long as the voltage is generated, the positive and negative half cycles repeat themselves alternately.



DIODE REACTION TO AC

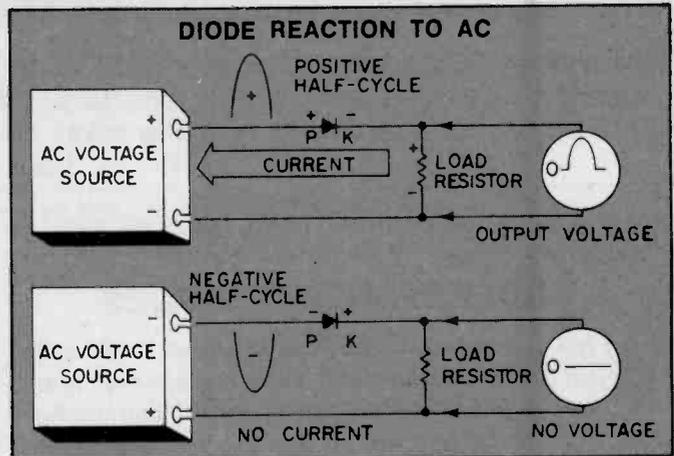
How does current flow in a diode circuit with AC voltage applied? Remember, current flows in one direction through a diode only when the anode is more positive than the cathode.

How does current flow in a diode circuit with AC voltage applied? Remember, current flows in one direction through a diode only when the anode is more positive than the cathode.

During a positive half cycle, the upper terminal of the source is positive with respect to the lower terminal. This means the lower terminal may be at zero volts, but it is negative when compared to the positive

upper terminal. Therefore, the anode of the diode is positive with respect to the cathode. A changing half cycle of current flows.

If an **oscilloscope** is connected across the load resistor, an exact picture of the changing voltage drop will be shown. This changing voltage will look exactly like the waveform at the voltage source.



During the next half cycle, the upper terminal voltage becomes negative with respect to the lower, and the diode anode is negative with respect to the cathode. As you know, current will not flow under these conditions. Since the diode presents a very high resistance in the circuit, all of the source voltage will be dropped across it. No voltage will be displayed across the load resistor.

QUESTIONS

- Q4. As the circuit is connected above, only the _____ half cycles of the AC voltage will appear across the load resistor.
- Q5. A rectifier converts _____ to _____.
- Q6. Draw a diagram showing the waveforms that will appear across R in the above circuit.

ANSWERS

- A4. As the circuit is connected, only the **positive** half cycles of the AC voltage will appear across the load resistor.
- A5. A rectifier converts **AC** to **DC**.
- A6. See diagram below.

A DC POWER SUPPLY

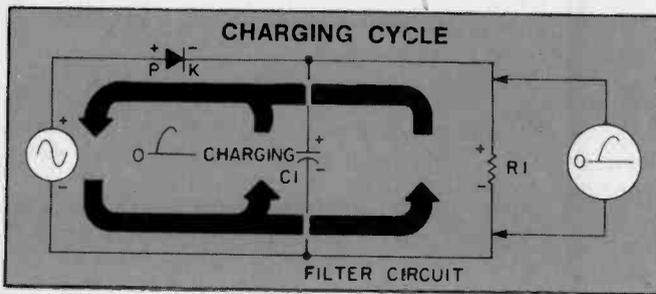
Most electronic equipment requires DC voltage to operate its circuits. Since alternating current is the normal supply, a **power-supply** circuit is used to provide the required DC voltage.

FILTER CIRCUIT

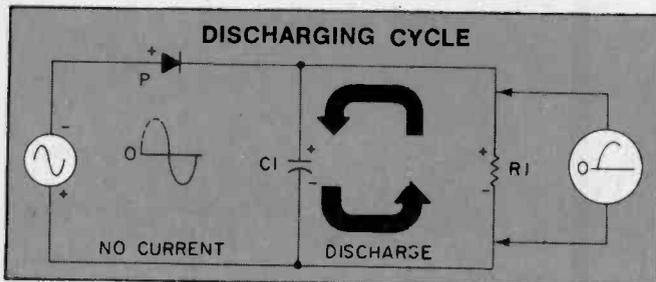
The diagram shows the output voltage obtained from the rectifier circuit is DC—current flows in only one direction—but it is not smooth, nonvarying DC. In fact, it is called a **pulsating DC**. The waveform is a series of pulses.

Filtering Action—The peaks and valleys of the pulsating waveform can be smoothed out by a **filter circuit**. A capacitor can be used to filter (smooth) out some of the changes.

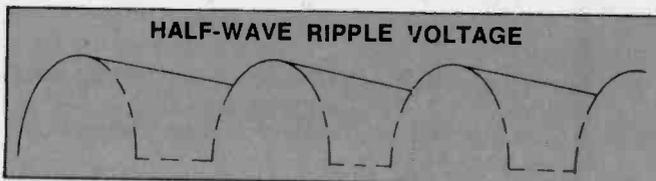
As the source voltage rises to maximum positive,



current flows through R1 and the rectifier. Some of the current also charges the capacitor to the value of the source voltage.



At the instant the applied voltage begins to decrease, C1 starts discharging, trying to maintain the same voltage level. The discharge path of C1, however, is through R1. The current from C1 cannot flow backward through the rectifier. Since resistance regulates the time of discharge (10 RC time constants to discharge completely), the discharge time is slow. As shown in the diagram below, the output waveform does not follow the descending curve of the input. It decreases at a much slower rate.



During the negative input half cycle, the rectifier does not allow current to flow, but the capacitor continues to discharge. The discharge current decreases as the capacitor charge grows less. On the next positive swing, the rectifier does not conduct current until after the input voltage has increased to an amount equal to the charge on C1 at that instant. The anode must be more positive than the cathode for the rectifier to conduct. The sequence continues. The resulting output waveshape (in solid lines) is shown below. Such an output is called **DC ripple voltage**.

QUESTIONS

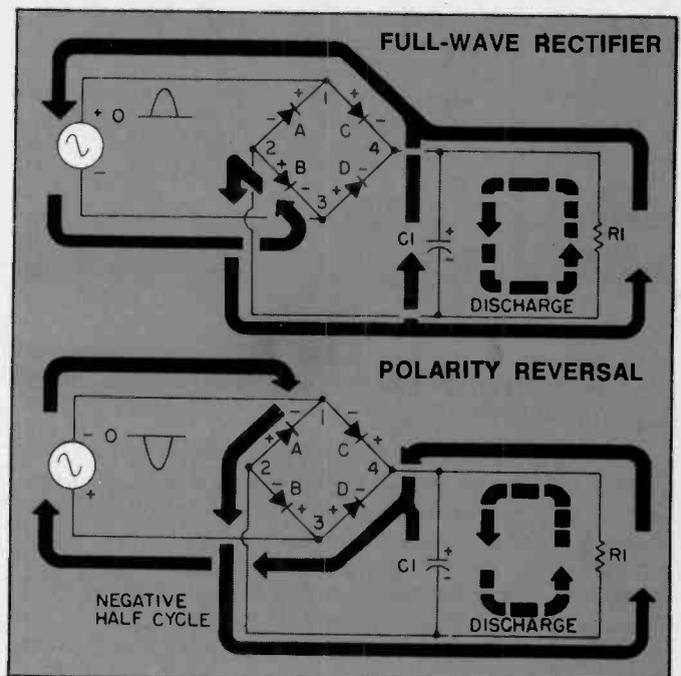
- Q7. The pulse-like waveform developed by a rectifier circuit is called _____.
- Q8. The changing voltage pattern made by these pulses can be smoothed out by a _____ circuit.
- Q9. The filter capacitor begins to _____ as soon as the positive voltage input begins to decrease.
- Q10. The filtered output is called a _____.

ANSWERS

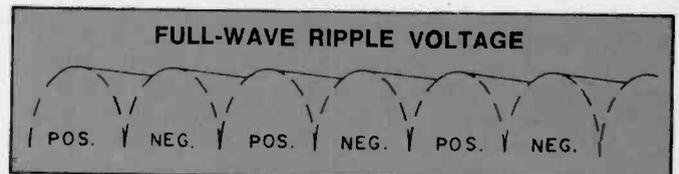
- A7. The pulse-like waveform developed by a rectifier circuit is called **pulsating DC**.
- A8. The changing voltage pattern made by these pulses can be smoothed out by a **filter circuit**.
- A9. The filter capacitor begins to **discharge** as soon as the positive voltage input begins to decrease.
- A10. The filtered output is called a **DC ripple**.

FULL-WAVE POWER SUPPLY

The preceding circuit is a **half-wave** rectifier. It allows only half the AC wave (positive half cycles) to appear across the load resistor. **Full-wave** (both positive and negative half cycles) rectification can be obtained with the switching action of the diodes in the circuit below.



On the positive half cycle, current leaves the lower terminal of the AC voltage source and enters terminal 3 of the 4-diode network (called a **bridge**). The bridge is positive to negative from top to bottom because of the source polarity. Diode B has a negative cathode and a positive anode, but diode D has reverse polarity across it. Current must therefore flow through diode B to terminal 2. This current charges C1 and flows through R to terminal 4. Because of polarities, this current must flow through diode C. Diodes D and A are of the wrong polarity.



C1 charges as the voltage increases and discharges during the voltage decrease, just as in the half-wave circuit.

During the negative half cycle, the polarities of the voltages on the four diodes are reversed. Current leav-



ing the upper end of the source arrives at terminal 1. The voltage on diode C is of the wrong polarity, but diode A will conduct. Current leaves terminal 2, and then follows the same path as the positive half-cycle current. C1 has just begun to discharge; the rising current restores the charge to full voltage. The remainder of the current flows through R1 in the same direction as the positive half-cycle current did. At terminal 4, only diode D has the correct voltage polarity to conduct. Current flows through diode D to terminal 3 and the AC source.

QUESTIONS

- Q11. A (an) _____ rectifier provides better filtering action than a (full-wave, half-wave).
- Q12. In the diagram at the top of this page, current at terminal 1 will not flow through diode C because current will not pass from _____ to _____.
- Q13. Current at terminal 4 will not go through diode C because its cathode is _____ and its plate is _____.

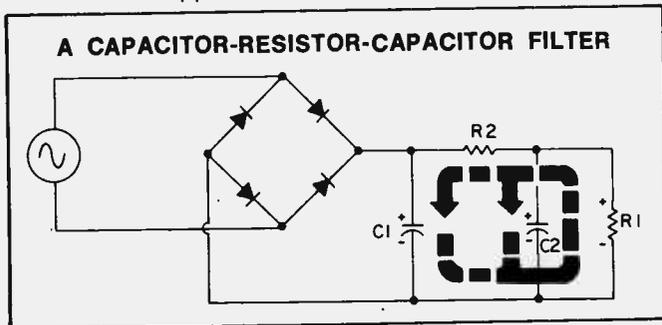
ANSWERS

- A11. A **full-wave** rectifier provides better filtering than a **half-wave**.
- A12. Current at terminal 1 will not pass through diode C because current will not pass from **plate** to **cathode**.
- A13. Current at terminal 4 will not go through diode C because its cathode is **positive** and its plate is **negative**.

IMPROVING THE POWER SUPPLY

The DC ripple remaining on the full-wave rectifier output may be smooth enough voltage for some equipment but not for others. The output can be made still smoother by improving the filtering action.

By adding another capacitor in parallel with the load resistor and another current-limiting resistor in series with the discharge path, the filter network can reduce more of the ripple.



Both capacitors are charged and recharged by the positive and negative currents switched into the filter by the bridge. Both capacitors discharge together through load resistor R1 as C1 did previously. R2 aids by limiting the flow of current through the filter.

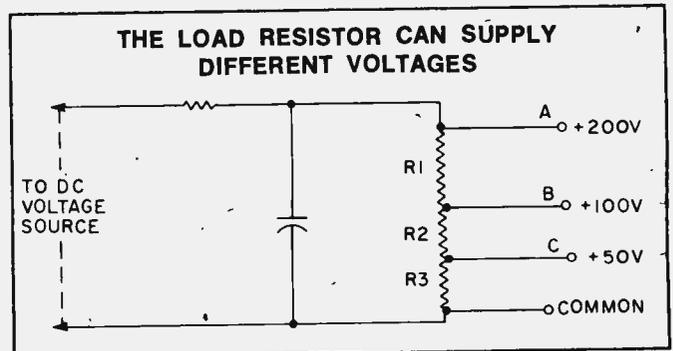
Further improvement to the filtering action can be made by replacing R2 with an **iron-core coil called a choke**. Such a coil is wound on a bar of iron. The reaction of a coil (inductor) to AC is, as you recall, one of opposing changes in current. Magnetic fields, reinforced by the iron core, smooth out the ripple by pre-

venting the changes from occurring. The iron core inductor is called a **choke coil**.

LOAD RESISTORS

Some electronic equipment requires two or more values of DC voltage for proper operation. These voltages can be selected from the load resistor.

Suppose that the DC requirements of the rest of the equipment were +200, +100, and +50 volts. A power supply can be selected or designed to produce a current large enough to cause a drop of at least 175 volts across R1.



Either three series resistors of the correct values, or a bleeder resistor capable of being tapped at the desired values, can be used. The drawing above shows a bleeder resistor symbol.

By making connections to terminals A and Common, 200 volts will be available. To obtain 100 volts, the bleeder is tapped at the halfway point to obtain half the total voltage. For 50 volts, the resistance is tapped halfway between the 100-volt point and the common terminal.

QUESTIONS

- Q14. A capacitor opposes changes in current by storing a _____ on its plates.
- Q15. A coil opposes a change in current by developing a changing _____.
- Q16. Assume in the above figure that the bleeder must be replaced with three separate resistors. If you know that 0.1 amp flows through the bleeder to produce a total of 200 volts, what is the value of R₁, R₂, and R₃?

ANSWERS

- A14. A capacitor opposes changes in current by storing a **charge** on its plates.
- A15. A coil opposes a change in current by developing a changing **magnetic field**.
- A16. **R₁ = 1,000 ohms; R₂ = 500 ohms; R₃ = 500 ohms.** If 0.1 amp developed 200 volts across the total resistance, the bleeder would have to be 2,000 ohms. ($R = E/I$). There would have to be 1,000 ohms on either side of the 100-volt tap, B. And the two resistors from B to Common must be 500 ohms each.

WHAT YOU HAVE LEARNED

1. Solid-state diodes allow current to flow in one direction under conditions of proper polarity because

(Continued on page 94)

LITERATURE LIBRARY

381. *Fordham Radio's* handy catalog covers test instruments, tools, parts, home and car audio products, scanners and lots more. Get your free copy today!
373. 48-page "Electronic Things and Ideas Book" from ETCO has the gadgets and goodies not found in stores and elsewhere.
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372. Just what the experimenter needs can be found in *Olson's* bargain flyer—parts, assemblies, semiconductors, components, and more. Even more interesting are the prices.
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302. Big catalogs are coming back. *Burstein-Applebee* will send you theirs. It's a parts bonanza every experimenter would want to see. Latest catalog is over 200 pages.
303. *Graymark's* catalog reveals a host of products and kits every experimenter would like to have. Unusual binary clock is a winner. A *must* catalog for the beginner.
305. A new 4-page directional beam CB antenna brochure is available from *Shakespeare*. Gives complete specs and polarization radiation patterns for their new fiberglass directional antennas.
306. *Antenna Specialists* has a new 32-page CE and monitor antenna catalog, a new amateur antenna catalog, and a complete accessory catalog.
307. *Atlas* calls their 210X and 215X the perfect amateur mobile rigs. Their 6-page, full-color detailed spec sheet tells all. Yours for the asking.
330. There are nearly 400 electronics kits in *Heath's* new catalog. Virtually every do-it-yourself interest is included—TV, radios, stereo and 4-channel, hi-fi, hobby computers, etc.
308. Your guide to equipment for radio communication is an informative product booklet offered by *R. L. Drake Co.* Hams and SWLers alike should scan this 20-page shopper's guide.
310. New and used personal computer machines, and peripherals you never dreamed existed, or were available are in the *Newman Computer Exchange* catalog. Get yours today.
311. *Midland Communications'* line of base, mobile and hand-held CB equipment, marine transceivers, scanning monitors, plus a sampling of accessories are covered in a colorful 18-page brochure.
312. *E.D.I. (Electronic Distributors, Inc.)* carries everything from semi-conductors to transformer/relays to video cameras. In prices ranging from 19¢ to \$500, products appear from over 125 electronic parts manufacturers. The catalog is updated 3 times a year.
313. Get all the facts on *Progressive Edu-Kits* Home Radio Course. Build 20 radios and electronic circuits; parts, tools, and instructions included.
314. Cover the Ham bands from 80 to 10-meters with one classy rig—*Swan Electronics'* 100-W 100 MX mobile transceiver. Get the details direct from *Swan*.
316. Get the *Hustler* brochure illustrating their complete line of CB and monitor radio antennas.
318. *GC Electronics* offers an "Electronic Chemical Handbook" for engineers and technicians. It is a "problem solver" with detailed descriptions, uses and applications of 160 chemicals compiled for electronic production and packaging. They are used for all types of electronic equipment.
320. *Edmund Scientific's* new catalog contains over 4500 products that embrace many sciences and fields.
321. *Cornell Electronics'* "Imperial Thrift Tag Sale" Catalog features TV and radio tubes. You can also find almost anything in electronics.
322. *Radio Shack's* 1979 catalog colorfully illustrates their complete range of kit and wired products for electronics enthusiasts—CB, ham, SWL, hi-fi, experimenter kits, batteries, tools, tubes, wire, cable, etc.
323. *Lafayette Radio's* 1979 catalog offers almost everything in hi-fi, CB, ham and many electronic parts. A product index will help you find anything from auto equipment accessories to wire wrapping tools.
327. *Avanti's* new brochure compares the quality difference between an Avanti Racer 27 base loaded mobile antenna and a typical imported base loaded antenna.
328. If you are into audio, ham radio, project building, telephones, CB or any electronics hobby you'll want *McGee's* latest catalog of parts and gadgets. Hard to find parts fill each page, so get a copy of the catalog from *McGee* today!
329. *Semiconductor Supermart* is a new 1979 catalog listing project builders' parts, popular CB gear, and test equipment. It features semiconductors—all from *Circuit Specialists*.
332. If you want courses in assembling your own TV kits, *National Schools* has 10 from which to choose. There is a plan for GIs.
333. Get the new free catalog from *Howard W. Sams*. It describes 100's of books for hobbyists and technicians—books on projects, basic electronics and related subjects.
335. The latest edition of the *TAB BOOKS* catalog describes over 450 books on CB, electronics, broadcasting, do-it-yourself, hobby, radio, TV, hi-fi, and CB and TV servicing.
338. "Break Break," a booklet which came into existence at the request of hundreds of CBERs, contains real life stories of incidents taking place on America's highways and byways. Compiled by the *Shakespeare Company*, it is available on a first come, first serve basis.
345. For CBERs from *Hy-Gain Electronics Corp.* there is a 50-page, 4-color catalog (base, mobile and marine transceivers, antennas, and accessories). Colorful literature illustrating two models of monitor-scanners is also available.
354. A government FCC License can help you qualify for a career in electronics. Send for Information from *Cleveland Institute of Electronics*.
355. New for CBERs from *Anixter-Mark* is a colorful 4-page brochure detailing their line of base station and mobile antennas, including 6 models of the famous Mark Heliwhip.
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366. How about a hybrid 13-watt audio module for \$8.88? Or ultrasonic transducer for \$1.49? You find these and other exotic parts and products aplenty in *Poly Paks* flyer. Get your copy now!
371. Your computer system needn't cost a fortune. *Southwest Technical Products* offers their 6800 computer complete at \$395 with features that cost you extra with many other systems. Peripheral bargains are included here.
374. *Radatron's* Catalog 1006 lists many projects from a self-contained portable lab station for an electricity-electronics course to many texts, lab manuals, and applied activities.
375. *Compucolor Corp.* has a personal computer system with an 8-color integral display, a typewriter-like keyboard, and a mass storage device. Programs are ideal for checkbook and income tax figuring.
376. *Sparkomatic* offers all the car sounds for the "travelin' man"—speakers, amplification systems, radios, speaker accessories along with CB antennas, all presented in 4-color pics with descriptions.
377. We can't enumerate all the products in *John Meshna, Jr.'s* catalog of surplus electronic parts: power supplies; computer keyboards; kits for alarms, clocks, speakers; and more.
378. *Delta Electronics* is a complete parts source for electronics experimenters. Discrete parts, modules, boards, subassemblies and complete gadgets. Get *Delta's* 120-page catalog today.
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King of the Hobbyists

(Continued from page 58)

stood the sort of buyer commonly known as a hobbyist. How to cater to his needs without losing money. How to attract him by store location, service, price and advertising. Especially advertising. "If you want to catch a mouse you've got to make a noise like a cheese," was one of the dandiest Tandyisms on record.

All through 1961 and 1962, Tandy fretted over his urge to get into a business with a bigger horizon than leathercraft. He'd already mastered the latter, garnering a reputed 80 to 90 percent of the market. Somehow he arrived at the conclusion that electronics was right up his alley; exciting merchandise, constant growth, scads of hobbyists, great tie-ins to leisure time and education. He started knocking on doors, but as a buyer, not as a salesman. After making the rounds of all the consumer electronics catalog houses—not once, but several times—he finally consummated a deal with Radio Shack and its major lending institutions.

Then there was the matter of the Tandy Corporation Board of Directors. It vetoed the deal on the basis of The Shack's financial condition and its ap-

parent inability to achieve a decent gross margin. "Okay," Tandy said, "you guys buy out my position in Tandy and I'll take on Radio Shack myself—without you." To its ultimate credit, the Board capitulated. Charles Tandy came to Boston in April, 1963, and took charge personally. He had no team. He'd create a team out of the employees who would be left after his first clean sweep of the overhead.

"Don't fire anybody," was his first instruction, "without first offering them a job as Manager of a new store." That, there were no new stores in the works was irrelevant to Radio Shack's new leader. There would be stores—soon. One of the company's top chieftans was offered "the entire city of Philadelphia." At that time there were zero stores in or planned for Philadelphia. But 15 years later there would be 80!

The Salesman. "Charles Tandy Keeps on Selling," was the title of a recent Fortune article about the chairman. But Chancellor J. M. Moudy of Texas Christian University observed that "Charles was more than the sum of his family and TCU and Harvard and Navy experiences. More came from the man than went into him for he had

some great and unique spark within him."

And in a moving eulogy in the New York Post, financial writer Irwin Lainoff put it all into perspective: "Charles Tandy used to swing through Wall Street with a warmth that set him apart from most businessmen who like to fashion themselves in granite." He'd tell anyone who listened about "how many Radio Shacks he was opening this year, store sales, margins, and advertising outlays. Late in the night, though, the man from Texas would sit quietly and explain how Tandy (Radio Shack) had filled the vacuum as a retailer of consumer electronic products. Before long, you'd realize that here was one of the true marketing giants of our age."

Radio Shack's 20,000 employees, and 25,000,000 customers—including those to whom electronics is a vocation or an avocation—might be surprised that a man who didn't know a resistor from a transistor could be so important to the recent past and present of electronics for the masses. But to Charles Tandy, who explained and practiced his business theory in the full glare of the public spotlight, "they'll say it was easy . . . after we've done it."

Antique Radio Corner

(Continued from page 54)

hum, etc., your set will play.

It is quite expensive to buy all the batteries necessary to make your radios play. Most collectors have one or more AC operated power supplies for their old radios. The ideal power supply should furnish the necessary "A" voltage for the filaments at a current adequate for a 6 tube radio. It should supply up to 6 different "B" voltages to cover all types of sets, and it should supply several different "C" minus voltages for sets that require them. There are several manufacturers of power supplies for the old battery radios. The one I use is manufactured by a radio collector who knows exactly what a power supply should do. I've found this power supply to be rugged, well built, conservatively rated and hum free. I have operated several sets from a Philco portable to a Silvertone console radio. It is reasonable in price and contains solid state rectifiers and voltage regulators. You can get a brochure containing complete information about this power supply by writing to: Gary Schneider, 6848 Commonwealth Blvd., Parma Heights, Ohio 44130. You will be glad you did.

I recently ran across another supplier of old radio and TV tubes who may be able to supply that tube you

are missing for one of your radios. He has no 200As, 201As, 199s, WD-11s, or WD-12s, but he does have most any other number you might need. Write for his tube list, with prices to: Steinmetz Electronics, Dept. ARP, 7519 Maplewood Ave., Hammond, IN 46324.

Several years ago, I bought a radio and tube collection from the widow of a deceased owner of 6 radio parts stores in the Washington, DC area. Among the tubes were two spherical glass bulb types. One of the tubes had a double contact bayonet base for the filament leads, similar to an automobile lamp bulb. The exhaust tip was broken, but the filament was still OK. The tube was a duo-diode; it had two plates and a filament. I was never able to find out definitely who made it, but an educated guess was that it was a Fleming valve. Recently I sent it to Sam Diaz, Pine Grove Mills, PA 16868 and he pumped it, de-gassed it and resealed it. I am looking forward to building some type of radio receiver with that tube.

Sam Diaz is a glass blower, and has the pumps and other necessary equipment to repair receiving and small transmitting tubes of the filament type. He tells me that he is making replicas of some 1917-model tubes which were originated in France by the Methal Co. If you have any rare tubes that need to be restored, I would advise you to contact Sam Diaz and ask for help. Tell him I sent you.

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ELEMENTARY ELECTRONICS/March-April 1979

Percom Floppy Disc

(Continued from page 68)

minor problem that no longer exists.

As with all minidisk drives we have seen and used, a small red lamp on the front of the drive indicates when it's operating. To extend life of the drive, Percom has built in a timing circuit that turns off the drive motor after 3 seconds of non-use.

The miniDOS has its own error messages independent of BASIC's errors. For example, if you get the special disc error symbol and a "O" you have been told you're trying to run the system without a disk, or with the disk gate open. If the error is a "3", you've tried to load a blank sector. There are five disk system errors, ranging from the *disk missing-gate open to read error*, meaning the sector was tried nine times without success.

High humidity is the curse of virtually all media computer storage sys-

tems. And, while the Percom chugs away without errors under humid conditions that knock out our data cassette recorders, at the point where the humidity starts to separate wallpaper from the wall, the Percom has failed to load once or twice. But normally, air circulation generated by the internal motor flushes out the drive and we have never experienced a third failure.

Summing Up. Overall, from virtually every viewpoint, the Percom LFD-400 is an excellent value for the personal computer user or hobbyist with an SWTP 6800 computer. With it, you actually get all the advantages and services of a "full blown computer," and it meets our requirements of reasonable price, speed, and convenience.

All the possible uses of the LFD-400 system are too great to cover in an article, so we suggest you write for additional information to Percom Data Company, 318 Barnes, Garland, Texas 75042, or circle number 63 on reader service coupon. ■

Cyclops

(Continued from page 39)

so that the cathode side is connected to the base of Q1. Do not proceed further until the voltage at pin 13 of IC1 is within the range of +3.5 to 4.5 volts.

Measure the voltage at pins 2, 5, 6, 7, 8, 9, 10, and 12 of IC1. This voltage should be zero. Measure the voltage at pin 8 of IC2 and IC3. This voltage should be about +12 volts. Measure the voltage at pin 1 of IC2 and IC3. This voltage should be zero.

Disconnect the power from the circuit. Very carefully insert the integrated circuits in their sockets, paying strict attention to the proper orientation for pin 1 as shown in the component layout. Pin 1 of the Optolinear IC is indicated by a red dot or "U"-shaped indentation molded into the top of the plastic case at one end.

Be sure the speaker is properly connected to the circuit between the +12 volt bus and the collector of Q5. Set S1 to the ON or closed position. Adjust the volume control about halfway and apply 12 volts of power to the circuit, observing correct polarity. You should hear the whooping sound generated by the circuit, and the LED should light. The LED should remain lit for about 30 seconds, and when it goes out, the sound should continue for a few seconds more. Once the sound stops, you can wave your hand over IC1 and cause the sound to start again. This time the circuit will reset itself after a few seconds, since IC2 is being inhibited by the timed cycle of IC3. After another 30 seconds has passed,

the cycle can be repeated.

To generate the "Close Encounters" music sound, throw S1 to the OFF or open position. When you apply power to the circuit, Cyclops will generate the whooping sound for 30 seconds, and then will switch to the "Close Encounters" music for another 30 seconds as IC2 and IC3 switch on and off. This sequence will repeat indefinitely. If you wish to generate only the "Close Encounters" sound, remove IC2.

Applications. Cyclops can be used in many applications depending upon the connections between terminals A, B, C, and D of the circuit and whether or not the timing circuitry of IC2 and IC3 is included in the assembly.

For a short timing interval, such as would be needed for an automatic doorbell or light operated rifle range, the circuit shown on the right of the dotted line of the schematic can be deleted. S1 should be set to the ON or closed position and terminals A and B of the printed circuit board should be connected together. For these applications, as well as using Cyclops for a musical automobile horn, you may want to slow the whooping rate for a more pleasant sound. This can be easily accomplished by changing the value of C4 to 10 microfarads or more.

The circuit can be used as an intrusion alarm with a long timing interval by building the complete circuit as shown in the schematic. Set S1 to the ON or closed position and short terminals A and B.

A combination whooping sound and "Close Encounters" music can be produced by building the entire circuit and setting S1 to the OFF or open position. Delete the timing circuit for continuous "Close Encounters" music. ■

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Tropical DX

(Continued from page 41)

Toward the end of what historians call the Mayan "Classic Era," around 900 A.D., they all inexplicably migrated northward, up the Yucatan Peninsula. So to round out this guide to the Mayan Connection, we'll do likewise. Onward, to Merida, at the very peak of Yucatan!

Merida, at the edge of the "thumb" of the Yucatan (which is actually Mexico) is a pastel and chattering little town of well-manicured green parks, horse-drawn carriages and an epic past. At one time, Merida was a boom town as the center of a hemp industry, thanks to the sisal plant which flourishes on the Yucatan scrub land. That has died down now, but a growing industry is the tourist trade Merida has, thanks to the famous pyramid ruins of Chichen Itza and Uxmal, both nearby.

At the Speed of Sound

(Continued from page 51)

pound," and even "Ouch!" Of course, these humorous calls do have the serious purpose of attempting to confuse the enemy in the event of actual conflict. Our list of SAC frequencies will indicate where to tune for such tactical stations.

Sometimes, on Air Force channels, you will hear the word "foxtrot" followed by coded groups. These are coded instructions to aircraft aloft. You may also hear the term "skyking" used, which is a general term for any SAC aircraft.

Alert SWLs should keep a check on the frequencies used by Andrews AFB whenever the President or Vice-President is scheduled to leave or arrive in Washington. Both Air Force One and Two communicate through Andrews, and some SWLs have even been lucky enough to hear telephone calls placed through Andrews AFB by members of the Presidential party!

Wrapping It Up. One very important

Commonly Heard VOLMET Broadcasts

Times of operation are given as minutes past each hour.

Atlantic Area broadcasts on 3001, 5652, 8869, 13272 kHz.

New York: 00-20 and 30-50
Gander, Newfoundland: 20-30 and 50-60
Pacific Area broadcasts on 2980, 5519, 8903, 13344 kHz.

Oakland, California: 05-10 and 35-40
Tokyo, Japan: 10-15 and 40-45
Hong Kong: 15-20 and 45-50
Honolulu, Hawaii: 20-25 and 50-55
Anchorage, Alaska: 25-30 and 55-60

Those Mayan outposts make Merida the last stop on the Mayan Connection. Broadcasting from a second-story walk-up a block off the downtown square in Merida is the only shortwave station in Yucatan, "Young Panther Radio," *Pantera Juvenil*, on 6105 kHz, 49 meter band. "Su Pantera" Radio is a far cry from the rural stuff your ears have been drinking in elsewhere on the Mayan Connection! The programming, starting around 1100 GMT, is young, jazzy and modern! About that morning show, manager Mario Gonzales Peraza says, "In 'The Early Morning Riser' show, we transmit some of the best music and send greetings to the 'radio sentries' who phone us." EQM only pumps out 250 watts, but Peraza says they get reports from Europe, S. America and Asia... so why not you? Every so often, they really pound through in the morning hours. QSLs? Of course!

So there you have the Maya Connection. And "maya" your listening be muy bueno!

thing which must be kept in mind when DX'ing the aeronautical channels is that it is a federal offense, punishable by a fine of \$10,000 and a jail term of one year, to reveal the contents of any transmissions you may intercept on the aeronautical channels (or any other non-broadcast stations, except amateurs, for that matter). You may report the time, date, frequency, and call signs of other stations contacted in your reports for a QSL card, but you may not quote any of the message itself. Even if you escape prosecution for quoting any of the received transmission, the station heard will likely refuse a QSL if you quote any of what you heard in your reception report! The one exception to this rule is a VOLMET transmission, which is considered as a broadcast for general reception.

As mentioned earlier, the *SPEEDX Utility Guide* is a big help in determining frequencies of aeronautical stations and addresses for QSLs. Another valuable reference is the *Confidential Frequency List*, available from Gilfer Associates, Box 239, Park Ridge, NJ 07656.

It also pays to join an SWL club which features coverage of aeronautical DX. SPEEDX (Society to Preserve the Engrossing Enjoyment of DXing) has the largest such coverage. Good coverage is also offered by the American Shortwave Listeners Club, 16182 Ballard Lane, Huntington Beach, Calif., 92649. Both clubs will send sample bulletins for \$1.00.

As you can see, there's no need to restrict your DX'ing to earth-bound stations. The sky can be the limit for SWLing!

Regency Scanner

(Continued from page 49)

hind each symbol is a mechanical switch. Pushing on the plastic directly over the symbol causes the associated switch to be activated.

One keyboard is labeled 1 through 16, and these are the channel selectors. An LED directly adjacent to each number indicates whether channel is turned on or off, or is active (on for active).

A second keyboard is labeled 0 through 9, *manual*, *scan*, *priority*, *delay*, and *enter*. It is used to select the *manual* or *scan* mode, and for programming the frequency limits of a search, or the frequency to be programmed into a channel. The *delay* changes the "normal" *scan* delay from 0.2 to approximately 2-seconds, holding the *scan* through the pause in a two-way contact.

Priority refers to channel 1 and any other channel the user selects as the second priority channel. Whenever either priority channel alone is programmed *on* and the scanner is stopped on an active channel the priority channel will be sampled approximately once a second for activity, and the scanner will switch to the priority channel the instant activity is perceived.

When both priority channels are programmed *on* and the scanner is stopped on another active channel the priority channels will be sampled alternately for activity. Regardless what channel the scanner stops on, even the second priority channel, the scanner will always switch to priority channel 1 if it becomes active. When the scanner stops on either priority channel the frequency readout will display the frequency followed by a letter "P."

Searching. A third keyboard has but two switches, labeled *search program*, and *search scan*. *Search program* is used when the user enters the upper and lower search frequency limits. *Search scan* starts the search. Once the search finds an active frequency it locks to that frequency, which is displayed on the readout, until the frequency goes "dead," or the search is once again resumed by pressing *search scan*. A "found" frequency can be entered into a channel by simply pressing the *enter* switch followed by the channel selector number. You can switch to *manual*, or *scan*, or *search* by simply pressing the appropriate keyboard entry. The only limitation on *search* is that the range is split into two increments: From 108 to 118 MHz a 50 kHz increment is utilized; from 118 to 135.975 the increment is 25 kHz. Any increment that is keyed in that does not match either specified range will be automatically corrected by the computer.

Permanent Memory. Though the power switch turns the receiver off in the usual sense (all lights off, etc.), power is still maintained to the channel memories so the programmed frequencies are remembered. In the event the AC mains (powerline) should fail the memory programming would crash because there would be no power whatsoever to keep them alive. To handle this type of emergency there is a compartment on the rear apron for a 9-volt "transistor radio" battery that serves to keep the memories alive even if the main power is removed.

The Digital Flight Scan is housed in an attractive wood cabinet 12½-in. wide by 3¾-in. high by 9¾-in. deep. Weight is 9 lbs. The scanner can be powered either by 120 VAC, or 11.5 to 15 VDC. Both the AC and DC power cords plug in. In addition to the AC and DC. power connectors, the rear apron has jacks for the antenna and a remote speaker.

A telescopic antenna that plugs into the antenna jack is supplied with the scanner. The 9-volt battery required for the non-volatile memory is optional and is supplied by the user.

Overall Performance. Rattling off a stream of specifications is useless, as we've well learned from testing VHF receivers; for under crowded band conditions what appears good in print might not work out so well when actually monitoring. In the area of sensitivity the Digital Flight Scan is rated at 1 μ V and that's just about what we measured using a signal generator. In comparison to other high quality flight receivers the sensitivity appeared about the same.

As for selectivity. We ran across no condition where there was splash from one utilized frequency to another, so we must assume the 55 dB adjacent channel rejection specification is adequate for the Aircraft Band.

Overall sound quality is very good. When there is distortion it's the fault of the transmitting station, either ground or airborne. When the transmitting station's modulation is clean and crisp it is received the same way by the ACT-T-720A.

Summing Up. Overall, the Regency Digital Flight Scan is an admirable performer. Of noteworthy merit is the fact that though computer controlled, the overall operation isn't so complicated it takes a read-thru of the instruction manual anytime you want to change functions or programming.

The Regency ACT-T-720A Digital Flight Scan complete with AC and DC power cords and telescopic antenna is priced at \$349.00. For additional information circle No. 40 on the Reader's Service Coupon.

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Vigilite Timer

(Continued from page 52)

The only time you will ever need to go through the program-selection procedure is when you have a power failure or when a burned-out bulb must be replaced. When changing bulbs, you push a master switch just above the digital display to turn all power off the lighting fixture, for safety reasons.

Installation. The Vigilite system installs in minutes as easily as a dimmer switch. Just remember that it must be used only on a single-switch branch circuit, not on a circuit having switches

at more than one location. Only a screwdriver is needed for the installation.

First, turn power off the branch circuit at your fuse panel or circuit breaker board, and check the existing wall switch to be sure you flicked the right circuit breaker. Remove the wall plate and old switch. After pushing the master switch at the top of the Vigilite unit to its "Off" position, connect the two wires in the wall switch box to the two Vigilite wires using wire nuts. Be sure that no bare wire is visible outside of either wire connector.

Mount the Vigilite unit into the switch box using the same screws that

formerly held the old switch in place. Then add a cover ("flash") plate and a small spacer to keep the plate the proper distance from the Vigilite. Finally peel protective paper from the back of the outer front panel and press the panel onto the flash plate. All that remains is to restore power to the branch circuit and pull the master switch to power the Vigilite unit. The LED display comes on to show that you are ready to go through the program-selection procedure and start using this space-age crook-foiler. ■

Kathi's Carousel

(Continued from page 69)

vague relative value which might represent a very large change, or a very small variation. (An early model of the Thomas J. that I saw had a relative reading S-meter.)

One feature I find has no value is instant Channel 9 selection. Simply press a button and both the receiver and transmitter instantly shift to channel 9, the regular LED channel indicator blanks out, and a small LED indicates that the instant channel 9 switch is on. As I have often said, in my travels I have never gotten a single response to an emergency call on channel 9. As far as I'm concerned channel 9 emergency monitoring is a myth. From the rock-bound coast of Maine to the sunny skies of California, I call for assistance on channel 19, or whatever is used as the local highway/trucker channel.

The tone control is no earthshaking feature except for the times when a constant background noise—which can't be suppressed by either the noise blanker or ANL—starts to grind me down. It's nice to be able to tune down the high frequencies, which is the most annoying noise component; it's like having a third type of noise limiting.

Of course, the built in VSWR meter is a big plus when installing a new antenna or testing the old one. I usually keep the meter set so it continuously indicates the antenna system VSWR. In the winter, with the salt used for melting road ice constantly eating away at a bumper mounted antenna, it happens—once or twice each year—that a connection corrodes or opens. The VSWR meter instantly tells me something's wrong.

Summing Up. Other than the instant channel 9 selection, the President Thomas J. is a heavyweight in features and performance, particularly in view of its modest price. You'd be hard pressed to find its equal in wall to wall modulation and high receiver selectivity for about \$160. For additional information circle No. 46 on the readers service coupon. ■

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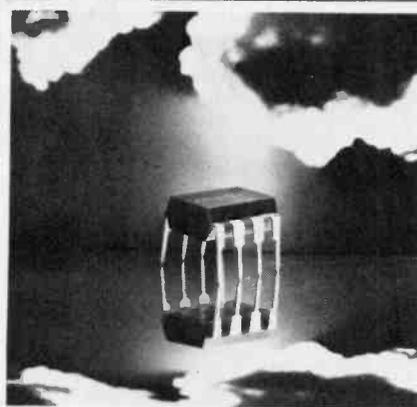
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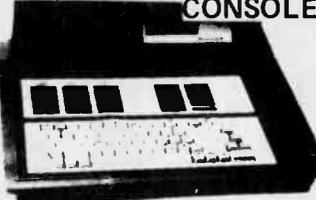
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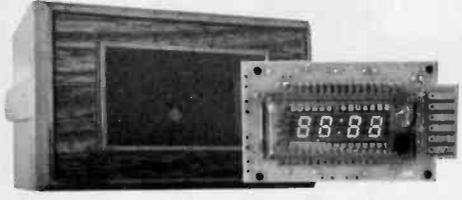
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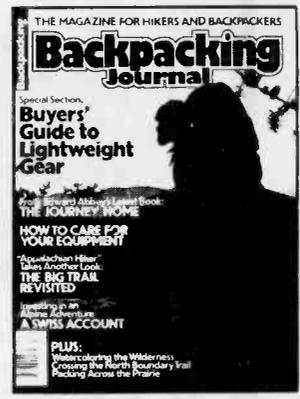
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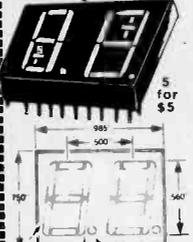
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1.9Million	1N4004	400V .049			
9Million	1N4005	600V .055			
4Million	1N4006	800V .065			
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Simply Basic

(Continued from page 71)

DELETE FOR DELETION OF A PARTICULAR ITEM
 LOCATION CHANGE TO CHANGE THE LOCATION OF AN ITEM
 QUANTITY CHANGE TO CHANGE THE QUANTITY OF AN ITEM
 LOCATION FIND LISTS ITEMS IN SPECIFIED LOCATION
 END TO CLOSE FILE AND EXIT FROM PROGRAM
 SECTOR START? 1109

CMMAND>? START

START FILE ENTRIES
 ENTER ITEM, LOCATION, & QUANTITY (SEPARATED BY COMMAS)

```
# 1 ? RESISTORS,BOX 8,56
# 2 ? CAPACITORS,UNDER BENCH,82
# 3 ? SCREWS,BOX 11,200
# 4 ? TRANSISTORS,BOX 8,11
# 5 ? ROUND STAPLE GUN,GARAGE,1
# 6 ? DIODES,BOX 11,32
# 7 ? STOP,,0
```

CMMAND>? CATALOG

ITEM	LOCATION	QUANTITY
RESISTORS	BOX 8	56
CAPACITORS	UNDER BENCH	82
SCREWS	BOX 11	200
TRANSISTORS	BOX 8	11
ROUND STAPLE GUN	GARAGE	1
DIODES	BOX 11	32
6 ITEMS IN CATALOG		

CMMAND>? UPDATE

UPDATE FILE ENTRIES
 # 7 ? NAILS,BOX 4,60
 # 8 ? SOLDERING IRON,ON TOP OF WORKBENCH,1
 # 9 ? STOP,,0

CMMAND>? SEARCH

ITEM>? TRANSISTORS
 ITEM TRANSISTORS FOUND IN LOCATION: BOX 8

CMMAND>? QUANTITY

ITEM>? RESISTORS
 ITEM RESISTORS QUANTITY: 56

CMMAND>? DELETE

ITEM>? SCREWS

CMMAND>? DELETE LINES

HIT RETURN TO ADVANCE ITEM, D TO DELETE ITEM
 CR T TO TERMINATE DELETE LINE FUNCTION

```
RESISTORS?
CAPACITORS?
TRANSISTORS? D
ROUND STAPLE GUN?
DIODES? D
NAILS?
SOLDERING IRON? T
```

CMMAND>? CATALOG

ITEM	LOCATION	QUANTITY
RESISTORS	BOX 8	56
CAPACITORS	UNDER BENCH	82
ROUND STAPLE GUN	GARAGE	1
NAILS	BOX 4	60
SOLDERING IRON	ON TOP OF WORKBENCH	1
5 ITEMS IN CATALOG		

CMMAND>? END

ENTER SECTOR FOR DUMP? 1125
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Understanding Diodes

(Continued from page 82)

- of the materials from which they are made.
2. A diode converts AC to DC because it forms a one-way street for current. A device that does this is called a rectifier.
3. Output from a rectifier is pulsating DC. To smooth out the pulsations, a full-wave rectifier can be used. By adding a filter circuit—capacitors and resistors, or capacitors and a coil—the ripple can be made relatively smooth.
4. The smooth DC voltage can be taken from the power supply in desired values by tapping a bleeder resistor. ■



TRS-80 Update

(Continued from page 42)

BASIC actually runs at 500 baud, meaning everything loads and dumps in at least half the time.

How to Order. Here's how the modification works. You order the Level II modification kit at your local store. When it arrives you give your computer to the manager. He sends your computer and mod kit to the local service center. They do the installation, check it out, and return a tested, *up-graded* computer to your store. A fairer deal you're not likely to find anywhere.

But what goes into the mod kit? Like every hobbyist we had the itch to know not only what went into the mod kit, but how it was installed.

Since the service manual is available only to Radio Shack service centers, we had to make special arrangements to get the mod kit and the manual into order to show our readers how the "magic" of upgrading was done by Radio Shack for no more than the basic cost of the Level II BASIC.

But before we get into the actual conversion let's take time out to see what we're upgrading. The TRS-80 Level I model has the 4K BASIC in one or two ROMs, depending on which one of two models you have.

The 12K Level II BASIC is in three 4K ROMs; obviously, we can't force three ICs into two sockets, so that's where the main conversion must take place.

Three Into Two. The Level II mod kit consists of a small printed circuit board with the three ROMs for the 12K BASIC and an empty socket, a ribbon connector set, a DIP jumper, a small resistor, and three cassettes, two of which are shown. The two cassettes provide conversion programs so data and programs originally recorded in 250 baud Level I BASIC can be run, and rerecorded in 500 baud Level II BASIC. The third cassette has the freebie games of *blackjack* and *backgammon* Radio Shack gives with all their computers; it has nothing to do with the conversion. Not shown is a rather extensive, advanced, Level II BASIC Programming Manual. This manual is not like the beginner's Level I manual which teaches programming to people who never heard the word "BASIC" before. Level II assumes you now have learned how to program. (Yes. The Level I book is available for beginners.)

No Do-It-Yourself? You might ask why the user can't do the job himself. Well, firstly, to protect the CMOS ICs the installer must wear a "ground bracelet" to avoid zapping the ICs with a high static voltage. Then there's the DIP jumper. (Aha! Thought we forgot, eh?) The jumper must be programmed for the amount of RAM. Make an error and everything gets fouled up. It's a simple thing to cut the appropriate jumper, but if you make an error a service technician could spend hours searching for an unsuspected problem with memory addressing. This way Radio Shack avoids disgruntled foul-it-

up-yourselfers by providing free installation.

With Level II BASIC the TRS-80 becomes a really powerful, and more important, *useful* computer for the hobbyist and student. It's only limitation remains lack of a *hard copy* permanent record, but that's taken care of with Radio Shack's optional "Screen Printer," a relatively low-cost, unusual device we hope to bring you a report on in the coming months.

One note of caution. The Level II 500 baud cassette interface is a rather finicky device, and is extremely sensitive to input level and "tone" from the cassette recorder. It works fine with the low cost Radio Shack CTR-41 cassette recorder, but requires hours of experimentation to get the correct adjustment with other recorders, particularly those not sold by Radio Shack. Don't think you can improve performance by using a more expensive, or "better" recorder. Do it the way Radio Shack says, with the equipment Radio Shack specifies, and you'll have no problems with data handling.

If you already have the TRS-80 Level I you owe it to yourself to get the upgrading to Level II as soon as possible; it virtually gives you a whole new computer. If you haven't made up your mind between Level I and Level II, go Level II for it's well worth the extra \$99. As for those afraid to let their "baby" out for upgrading to Level II, Radio Shack guarantees you get back a fully working and checked out Level II. Have no fear; it's the only way to go. ■

BNEE Semester IV

(Continued from page 56)

that you have a momentary interruption. It is not necessary to follow it by call signs or an explanation. For example, if I were interrupted in signing off:

TNX FER FB AS

WB2AYA should recognize this and just sit tight. Perhaps he'll send an R acknowledging my request to "wait." I'll be back to finish the thought.

Logging your QSOs. FCC rules have been relaxed over the years on what must be retained as operating records, but I would recommend a formal log of your QSOs be retained. One of the best logbooks (and certainly the mostly widely known) is the one published by the American Radio Relay League. Follow the directions in filling out the pages.

Upgrading your code speed. Although the code is a barrier for many amateurs, it is possible to solve the psychological plateaus that crop up around

10-to-12 words per minute and 20-to-25 words per minute.

The secret is to copy code at speeds significantly over your present, comfortable level. Assuming that you have moved to something around 10 words per minute with solid copy, make a jump to 18 words a minute. Do *not* attempt to build your speed incrementally; at 13, then 15, then 18 w.p.m.

Where do you get this high speed code practice? Code tapes are one answer, but they tend to be incremental in speed or they can be memorized. The best code tapes, in my opinion, come from 73, *Peterborough, NH 03048* (\$4.95 plus 25¢ postage). The 14 w.p.m. tape is an hour's worth of cipher groups (5 characters per group) that is impossible to memorize. I found I could copy 18 to 20 w.p.m. straight text after getting sixty percent of the 14 w.p.m. tape.

An alternative is the on-the-air code practice stations (see the list on form CD-139 published by the American Radio Relay League) or, preferably, the 18 w.p.m. news bulletins aired on the ARRL's station, W1AW (see the

Operating Aid CD-5/9 W1AW Schedule).

Among other times, W1AW airs the code bulletins nightly at 8 p.m. Eastern time on 1835, 3580, 7080, 14080, 21080, and 28080 kHz. You can check your copy by listening to the phone bulletins at 9 p.m. Eastern on 1835, 3990, 7290, 14290, 21390, and 28590 kHz.

The Code Exam. What should you expect when you take the code test for the General (or Advanced) class license? You'll take the exam with other persons. After filling out the applications, the code test is the first piece administered.

You'll copy a mock QSO (at 13 w.p.m.) and then you must answer a minimum of 8 (out of 10) multiple choice questions based upon the messages sent. This new test, in some ways, is easier than the old-style test wherein at least 1 minute out of 5 had to be error free copy.

The second part of the examination is the writing. If you pass the code and fail the written, you can retain credit for the code for up to a year. ■

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(Continued from page 72)

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for 85% mod. -31 dB
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Editorial Remarks: The 582 has a relative reading S-meter, double conversion, connectors for P.A. and remote speakers, L.E.D. digital channel indicator, and 5-step L.E.D. S/RF-output meter. Can utilize auto stereo speakers for CB monitor when listening to auto radio. "Memory control" returns tuning to the channel selected when transceiver was turned off. ■

Mini Micro Designer

(Continued from page 61)

book experiments. Either choice brings fully 512 words RAM and 512 words PROM.

Versatility. For a truly versatile unit, you should also go for the accessory Memory-Interface Board which mounts directly over the main unit as shown here. The MMD-1/MI board, completely assembled and tested, sells for \$250. In kit form, including all parts for assembly, the price is \$194.50.

The MMD-1/MI offers the following features: 2K RAM memory capability, with 1K supplied; teletype interface (20 MA current loop); paper tape reader control for ASR33 teletypewriters; audio cassette interface; sockets to accept up to 1K PROM or ROM. Addition of the MMD-1/MI board to the basic MMD-1 Microcomputer increases the on-board memory capacity to 2.5K RAM and 1.5K PROM or ROM.

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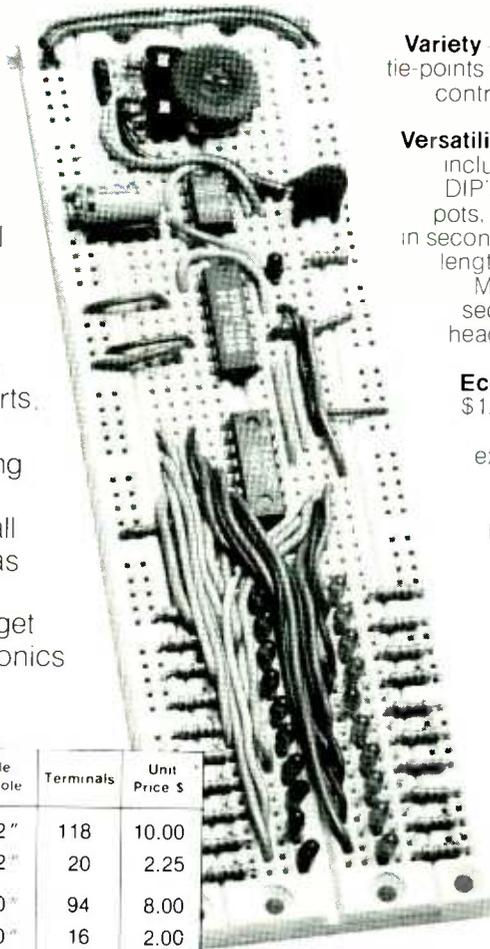
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Durability – Higher-temperature sockets with abrasion-resistant, glass-filled plastic, rated better than 100°C. Screw-down-and-interlocked design provides high mechanical strength.

Reliability – Ruggedly designed to professional engineering standards, for heavy day-in, day-out use. Non-corrosive prestressed nickel-silver contacts insure more secure mechanical and electrical connections. Vinyl backing prevents shorting when mounted on conductive surfaces.

Length Hole-to-Hole	QT Model	Length	Hole to-Hole	Terminals	Unit Price \$
	QT-59S	6.5"	6.2"	118	10.00
	QT-59B	6.5"	6.2"	20	2.25
	QT-47S	5.3"	5.0"	94	8.00
	QT-47B	5.3"	5.0"	16	2.00
	QT-35S	4.1"	3.8"	70	6.00
	QT-35B	4.1"	3.8"	12	1.75
	QT-18S	2.4"	2.1"	36	4.00
	QT-12S	1.8"	1.5"	24	3.00
	QT-8S	1.4"	1.1"	16	2.50
	QT-7S	1.3"	1.0"	14	2.25

All QT units are .33" thick

NEED MORE INFORMATION? CALL TOLL-FREE: 800-243-6077 to order, or for the name of your local distributor. Prices slightly higher outside U.S.A.

*Manufacturer's suggested list • Prices and specifications subject to change without notice
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CONTINENTAL SPECIALTIES CORPORATION



Corporate Headquarters: Continental Specialties Corporation
70 Fulton Terrace, Box 1942, New Haven, CT 06509
351 California St., San Francisco, CA 94104
(415) 421-8872, TWX 910-372-7992
Europe, Africa, Mid-East: CSC UK LTD,
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