CB Power Mikes - Punching Your Message Through

Elementary Electronics

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SEPTEMBER-OCTOBER
1977
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FOR BEGINNERS

HOW TELEVISION IS TRANSMITTED AND RECEIVED

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SPECIAL HOME COMPUTER ISSUE

- How to Run a Computer Terminal in Your Home
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SIX GOOD JOBS FOR

Read what the U.S. Dept. of Labor* says about these growing career fields:

1. **Electricians (Construction and Maintenance)** In selecting apprentice applicants or trainees, employers look for young people who have manual dexterity and are interested in learning how electrical equipment functions. Applicants also need good color vision because electrical wires are frequently identified by color. Although physical strength is not essential, agility and good health are important. Employment of construction electricians is expected to increase rapidly through the mid-1980's. Employment of maintenance electricians is expected to increase moderately through the mid-1980's because of the growing amount of electrical and electronic equipment used in industry.

2. **Auto Mechanics.** For entry jobs, employers look for young persons with mechanical aptitude, and a knowledge of automobiles. Generally, a driver's license is required. Courses in automobile repair offered by many high schools, vocational schools, and private trade schools are helpful. Courses in science and mathematics help a person better understand how an automobile operates. Employment is expected to increase because expansion of the driving age population, consumer purchasing power, and multicar ownership will increase the number of automobiles.

3. **Accountants.** Greater use of accounting information in business management, changing tax systems, and growth of large corporations all point to excellent opportunities for accountants. People planning a career in accounting should have an aptitude for mathematics. Neatness and accuracy also are necessary. Employers seek applicants who handle responsibility and work with little supervision. Employment of accountants is expected to increase rapidly through the mid-1980's as businesses and government agencies continue to expand in size and complexity.

4. **Engineering and Science Technicians.** Industrial expansion and increasing complexity of modern technology underlie the anticipated increase in demand for technicians. Those interested in a career as a technician should have an aptitude for mathematics and science, and enjoy technical work. An ability to do detailed work with a high degree of accuracy is necessary: for design work, creative talent also is desirable. Employment opportunities are expected to be favorable through the mid-1980's.

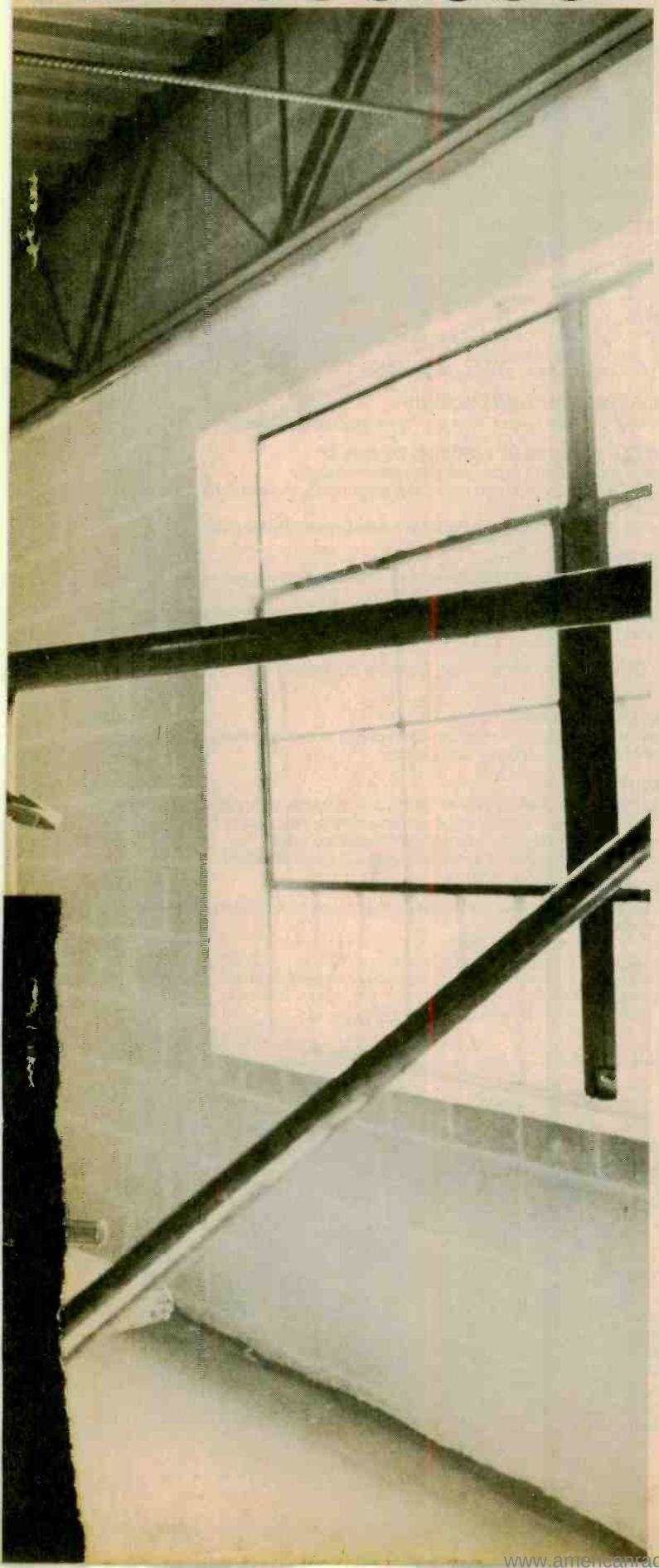
5. **Air-Conditioning, Refrigeration, and Heating Mechanics.** Increases in household formations and rising personal incomes should result in a very rapid increase in the number of air conditioned homes. Air-conditioning in offices, stores, hospitals, schools, and other buildings also is expected to increase. Employers prefer high school graduates who have had courses in mathematics, physics, and blueprint reading. Mechanical aptitude and an interest in electricity are important qualifications. Good physical condition helps in lifting and moving heavy equipment. Employment is expected to increase very rapidly through the mid-1980's.

6. **Draftsmen.** Those planning careers in drafting should: be able to do detailed work requiring a high degree of accuracy; have good eyesight and eye-hand coordination because most of their work is done at the drawing board; be able to function as part of a team since they work directly with engineers, architects, and skilled workers; and be able to do free-hand drawings of three dimensional objects. Employment of draftsmen is expected to rise rapidly as a result of the increasingly complex design problems of modern products and processes. Prospects will be best for those having post-high school drafting training.

*Bureau of Labor Statistics, *Occupational Outlook Handbook*, 1974-75 edition.

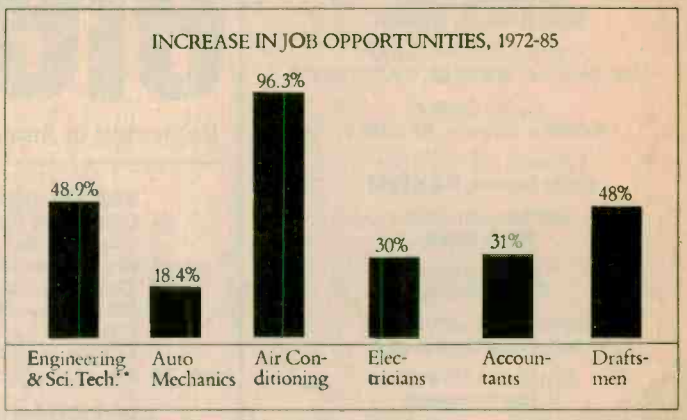

Electrician

THE 70's & 80's



If you're looking for a new career, you should keep in mind that some job fields will grow faster than others over the next ten years. (Some, such as barbers, railroad workers, meat-cutters, etc., will actually decline.)

Why do we tell you this? We're ICS—International Correspondence Schools—and we offer career training in fields the government experts say are likely to increase over the next decade.



Source: U.S. Dept. of Labor, Bureau of Labor Statistics, *Occupational Manpower and Training Needs*, Revised 1974.
**This category includes electronics and a variety of engineering fields available through ICS, as well as some technical fields which ICS does not offer.

Of course, we can't guarantee you a job—no school can do that. But we can give you the first-rate training you need, especially if you're interested in one of the growing career fields where ICS concentrates its training.

You could even earn a college degree without going to college. The ICS Center for Degree Studies is authorized by the Pennsylvania Department of Education to grant the Associate in Specialized Business degree in Accounting and Business Management, and the Associate in Specialized Technology degree in Civil, Mechanical, Electrical, and Chemical Engineering Technologies.

These degree programs are not mere stepping-stones to higher education nor are they primarily intended for transfer toward more advanced degrees. They are practical, career-oriented programs designed to help you reach your objectives without further academic training.

As an ICS student, you study at home, at your own pace. But you're never alone. If you ever want to talk to an instructor, you can call ICS from anywhere in the continental United States or Canada, using our toll-free Dial-a-Question® service.

Since 1890, millions of men and women around the world have turned to ICS for career training. More than 70 of America's largest 100 corporations (including Bethlehem Steel, 3M, Union Carbide, Weyerhaeuser, International Paper) use ICS training for their own employees.

No one can promise success, but if you *want* more—more money, more security, more day-to-day satisfaction and more future—our free Career Booklet and free Demonstration Lesson can help you get started in the right direction. Just check the box next to the field that interests you most and mail the card or coupon today. There's no obligation.

ICS International Correspondence Schools, Scranton, Pa. 18515

Please mail me the Free Career Booklet and Free Demonstration Lesson for the field I have checked below. I understand I am under no obligation.

- ☐ Electrician
- ☐ Engineering
- ☐ Accounting
- ☐ Drafting
- ☐ Electronics Technician
- ☐ TV Service & Repair
- ☐ Surveying & Mapping
- ☐ Construction Electrician
- ☐ Diesel Mechanics
- ☐ Air Conditioning & Refrig.
- ☐ Automotive Mechanics
- ☐ Business Management
- ☐ Airline/Travel
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- ☐ Income Tax
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- ☐ Appliance Servicing & Repair
- ☐ High School

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Veterans: Taken for career purposes. ICS Programs qualify for VA Benefits.

XA104H

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In Hawaii: 931 University Ave., Honolulu, Hawaii 96814.

elementary electronics

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Dedicated to America's Electronics Hobbyists—Including Electronics Digest®

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- ★ CODE OSCILLATOR

- ★ No Knowledge of Radio Necessary
- ★ No Additional Parts or Tools Needed
- ★ Solid State Circuits
- ★ Vacuum Tube Circuits

YOU DON'T HAVE TO SPEND
HUNDREDS OF DOLLARS FOR A RADIO COURSE

The "Edu-Kit" offers you an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. Our Kit is designed to train Radio & Electronics Technicians, making use of the most modern methods of home training. You will learn radio theory, construction practice and servicing. THIS IS A COMPLETE RADIO COURSE IN EVERY DETAIL.

You will learn how to build radios, using regular schematics; how to wire and solder in a professional manner; how to service radios. You will work with the standard type of punched metal chassis as well as the latest development of Printed Circuit chassis.

You will learn the basic principles of radio. You will construct, study and work with RF and AF amplifiers and oscillators, detectors, rectifiers, test equipment. You will learn and practice code, using the Progressive Code Oscillator. You will learn and practice trouble-shooting, using the Progressive Signal Tracer, Progressive Signal Injector, Progressive Dynamic Radio & Electronics Tester, Square Wave Generator and the accompanying instructional material.

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.

PROGRESSIVE TEACHING METHOD

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-learned, 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.

FREE EXTRAS
• SET OF TOOLS

- SOLDERING IRON
- ELECTRONICS TESTER
- PLIERS-CUTTERS
- VALUABLE DISCOUNT CARD
- CERTIFICATE OF MERIT
- TESTER INSTRUCTION MANUAL
- HIGH FIDELITY GUIDE • QUIZZES
- TELEVISION BOOK • RADIO TROUBLE-SHOOTING BOOK
- MEMBERSHIP IN RADIO-TV CLUB: 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

J. Stataitis, of 25 Poplar Pl., Waterbury, Conn., writes: "I have repaired several sets for my friends, and made money. The "Edu-Kit" paid for itself. I was ready to spend $240 for a Course, but I found your ad and sent for your Kit."

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."

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. 586 DJ Hewlett, N.Y. 11557

Please rush me free literature describing the Progressive Radio-TV Course with Edu-Kits. No Salesman will call.

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ADDRESS.....

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PROGRESSIVE "EDU-KITS" INC.

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CIRCLE 15 ON READER SERVICE COUPON

Hey, look me over

Showcase of New Products

Electroplating System

A new, low-cost portable electroplating system, specifically designed for plating craft and hobby projects, has been introduced by Micro Materials. Designated the Ranco EP-1, the advanced unit provides complete electroplating capability and can be used in total safety. Unlike conventional methods that require a series of expensive and toxic plating baths, the Ranco EP-1 uses patented felt-tip pens. Advantages of the Ranco EP-1 system include: complete portability, no special skills required, total plating capability, non-polluting, completely non-toxic, no baths or solutions, disposable plating pens for 10 different metals, and low cost. Completely contained in its own case, the EP-1 allows anyone to produce professional quality electroplating the very first time. The Ranco EP-1 Portable Electroplating System is available at $410. Non-toxic, disposable plating pens are available in 24K gold, silver, nickel, chrome-color, rhodium, black nickel, copper, tin, and zinc. A pure chromium pen is available on special order only, since it contains toxic chromic acid. Each pen will produce more than 10 square feet of electroplating. Additional pens are currently under development. For more information, write to Micro Materials Corporation, 100 Grand Street, Westbury, NY 11590.

CIRCLE 62 ON READER SERVICE COUPON

Two in One for Lab

The Logiklab Model 151 by Integral Electronics features the innovative combination of a digital signal source together with a logic power supply. The supply is highly regulated, short-circuit proof and capable of delivering 1 A at 5 VDC. The signal source, in the Astable Mode, simultaneously provides true and complementary TTL compatible square waves and pulses over the frequency range from 10 Hz to 100 KHz. Manual and remote gating of the oscillator is available. In the Monostable Mode, single pulses, continuously variable from 5 microseconds to 50 millseconds are produced, either by manual or remote trigger. Fail-safe design procedures and full power burn-in guarantee a highly reliable and versatile instrument at a moderate unit price of $79.50. For further information, write to Integral Electronics Corp., P.O. Box 286, Commack, NY 11725.

CIRCLE 58 ON READER SERVICE COUPON

Budget Speaker

The SSU-1050 is Sony's new budget priced speaker delivering clean, low-distortion sound over a wide frequency range. The two-way acoustic suspension design features an 8-in. woofer and 2¼-in. tweeter positioned in high-density, thick chipboard enclosure which is sealed and lined with fiberglass to prevent unwanted vibration and resonance. Amplifiers supplying between 10 and 50 watts

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Enjoy clearest, brightest, most spectacular wide-angle views of stars, moon, comets with our unique, easy-to-use, portable 4¼"; f/4 Newtonian reflector. Top quality optics provide fine resolution. Only 17", 10 lbs.!
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Top-quality Spy Scope, a $30 value, now $14.95! Special purchase saves you 50%. 100% coated optics; 393 ft. field of view. Only 2 oz.—stores in pocket, purse, glove box.
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Parabolic mike w/ 18¾" transparent reflecting shield & 2 I.C.'s in amplifier magnifies signals 100X over omni-direction mikes. Catch sounds never before heard; highest signal to noise ratio poss. 5½ lb.
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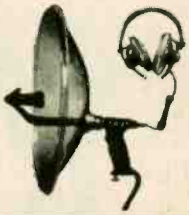

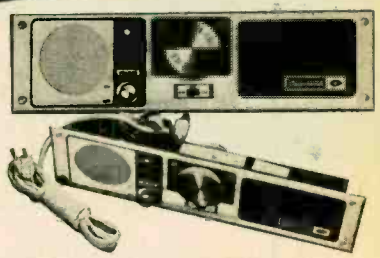

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Great surplus buy saves you 50% on brand new AM/FM Deluxe Wall Radio w/ handsome silver/black control panel. Mount anywhere den, kitchen, bedroom, office, workshop. Self-cont. Philco-Ford radio chassis (14¼ x 3 13/16 x 3½") w/ 11 transistors, vol. control, AM/FM hi-sensitivity tuner, AFC 2¾" dia. speaker, 7½" 110V AC cord. Orig. cost $30 ea. in 3000 quant. for nat'l, motel chain. Retail value over $40! Buy several now.
No. 72,275 (READY TO PLAY!) . . **$19.95** Ppd.
SAVE! buy 3 or more @$17.95 EA.

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3-Channel Color Organ lets you modulate 3 independ. strings of colored lamps w/ intensity of your music. "Audio light show" flashes, responds to rhythm, pitch!

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CIRCLE 39 ON READER SERVICE COUPON

HEY, LOOK ME OVER

CIRCLE 54 ON READER SERVICE COUPON

of power are recommended to drive the SSU-1050. Nominal impedance is 8 ohms. The unit's frequency response measures from 50 Hz to 20 kHz with a crossover frequency at 1 kHz. Designed to be placed vertically or horizontally, the unit features removable grilles. The units are finished in Summertime Teak vinyl, weighs 18 lbs. and sells for $130.00 a pair. Get all the facts direct from your local Sony audio dealer or write to Sony Corp. of America, 9 West 57th St., New York, NY 10019.

Programmable Scanner

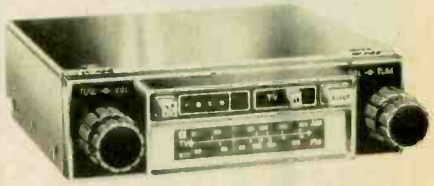
As a hobby, shortwave listening has kept pace with the boom in CB. One of the problems of the SWL in the past has been the need for manual tuning, a difficulty that is completely eliminated in Surveyor's new Model 10P, three-band, VHF hi/lo UHF scanner. The Surveyor 10P Scanner, in addition to its numerous other featuers, has two facilities with great appeal to SW listeners. The 10P has a top level programmable switch, letting the listeners program easily and quickly to any and all bands. There is also a priority switch that is the listener's assurance of hearing transmission on

CIRCLE 63 ON READER SERVICE COUPON

channel 1, even though a signal is being received on another channel at the same time. And, of course, a fully tunable squelch for complete noise control. Completely solid state throughout, the 10P can be used at home or mobile with a power converter. Its dual conversion circuit is an assurance of high selectivity, working against spillover from one channel to the next, and it has a 10-channel capacity. The 10P comes equipped with an AC and DC power cord, mounting bracket, hardware and an antenna for indoor use. The 10P Scanner sells for $189.00. For further information, please write to Surveyor Manufacturing Corporation, 7 Electronics Court, Madison Heights, MI 48071.

TV Audio When Traveling

Have you missed many televised sports events or specials during the holidays because you were enroute to your favorite relative's home for dinner? Did you fail to see your favorite game show or soap opera because you had errands to run? Boman has the answer! Now, with the BM-1126 you can drive and listen to your favorite TV show, and then when you arrive at your destination, continue to watch your show. When the show no



CIRCLE 56 ON READER SERVICE COUPON

longer interests you, slip in an 8-track stereo tape or switch to a local AM or FM station. The versatile BM-1126 has a multitude of unique features including pushbutton eject, a cartridge compartment tape head and antenna trimmer adjustment, a slimline chassis with fully adjustable shafts, and multi-colored indicator lights. Priced to sell at $179.95.

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take any **3** of these unique electronics books (value to $51.75) for only **99¢** each

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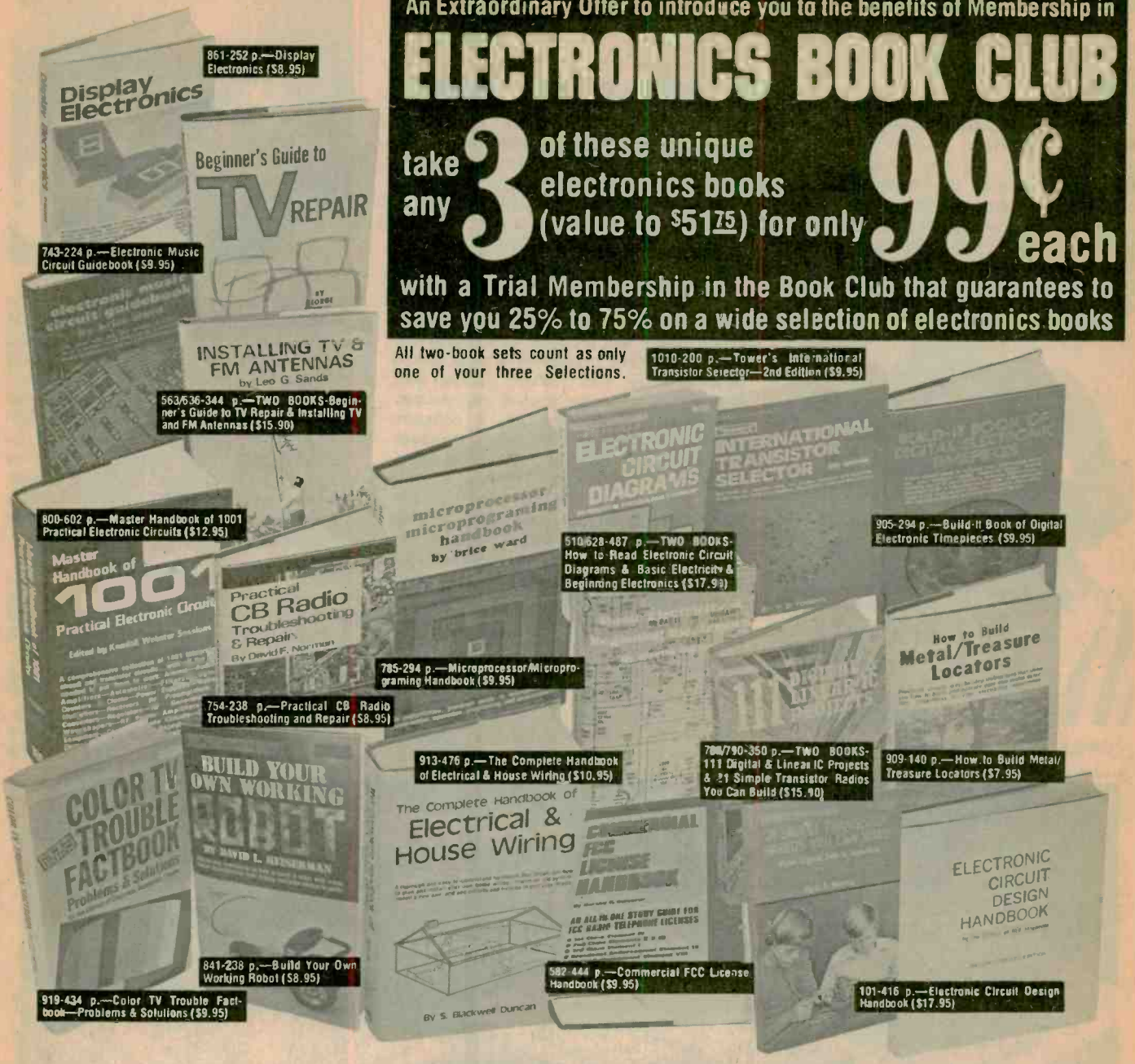

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To start your Membership on these attractive terms, simply fill out and mail the coupon today. You will receive the 3 books of your choice for 10-day inspection. YOU NEED SEND NO MONEY! If you are not delighted, return the books within 10 days and your Trial Membership will be cancelled without cost or obligation.

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Facts About Club Membership

- The 3 introductory books of your choice carry publishers retail prices of up to $51.75. They are yours for only 99¢ each (plus postage and handling) with your Trial Membership.
- You will receive the Club News, describing the current Selection, Alternates and other offerings, every 4 weeks (13 times a year).
- If you want the Selection, do nothing: it will be sent to you automatically. If you do not wish to receive the Selection, or if you want to order one of the many Alternates offered, you simply give instructions on the reply form (and in the envelope) provided, and return it to us by the date specified. This date allows you at least 10 days in which to return the form. If, because of late mail delivery, you do not have 10 days to make a decision and so receive an unwanted Selection, you may return it at Club expense.
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For more information, write to Boman Industries, 9300 Ha-1 Road, Downey, CA 90241.

Siren-Equipped Weather Radio

Weatheralert offers 24-hour protection against loss of life and property from tornados, severe thunderstorms and other weather emergencies. The receiver sounds a siren—triggered by a signal from the local U.S. Weather Service Transmitter—whenever dangerous conditions threaten. A complete report on the emergency is broadcast directly after, and the warning sequence is repeated. During normal conditions, the unit picks up the weather station's continuous report. Operates within 40 to 50 miles of a transmitter. Optional Antenna Kit extends range up to 80 miles. AC-powered, with battery back-up feature. Should an electrical failure result from a weather emergency, unit automatically becomes powered by an internal 30-hour battery. Sells for $39.95. Write or phone Weatheralert Co., 639 South Dearborn Street, Chicago, IL 60605. Enclose $2.50 additional for shipping and handling.

CIRCLE 51 ON READER SERVICE COUPON

At Right Angles

Here's a new product that looks like someone read the blueprints with double vision when the product was made. No matter, the final product is a great aid to people using flat ribbon cables and standard double-row socket connectors. Called, the Intra-Connector, it consists of a standard female double row socket connector and two sets of mating male contact pins, at right angles to each other. Thus, Intra-Connector can be used as a through-line connector, either straight or at right angles, with a redundant set of male pins to facilitate signal tracing and measurement at various points throughout flat cable systems—wherever, in fact, a connector is now installed. In this application, Intra-Connector is a valuable testing tool. Intra-Connector can also be used to expand upon existing systems by residing as a line "tap," the full cable wide. Thus daisy chains can be built into existing systems quickly and easily. Here, Intra-

CIRCLE 64 ON READER SERVICE COUPON

Connector performs as an equivalent to the cube tap. Intra-Connector is available in the five most popular flat ribbon cable line widths to work immediately with the bulk of all of today's systems: 20, 26, 34, 40 and 50 contacts (lines) wide. Intra-Connector is available from A P Products distributors, who can be located through the company's toll-free Faster And Easier Line, (800) 321-9668. Prices range from $6.00 to $10.50. Write A P Products, Box 110, 72 Corwin Drive, Painesville, OH 44077.

Hole Cutting Kit

Drill burr-free holes for easy mobile CB antenna installation or for electrical and hobby uses with the unique Conecut Kit from GC Electronics. The kit (3420) contains two drill bits (No. 1 drills holes from ¼-in. to 13/16-in; No. 2 from ⅝-in. to 1-3/16-in.), cutting compound and assortment of fiber hole gauges, all in a convenient vinyl pouch. Holes can be

Introducing the mobile that can move you out of the world of the ordinary and into the world of the serious CB'er. The Cobra 138XLR Single Sideband. Sidebanding puts you in your own private world. A world where there's less congestion. More privacy. More time to talk.

It's all possible because instead of 40 channels you get your choice of 120 channels. Both AM and SSB. And instead of 4 watts of legal power you get 12 watts of legal power. So you get almost double the range of AM.

With the 138XLR Single Sideband there's less background noise and less interference. So there's cleaner, clearer reception. Because like all Cobras, the 138XLR SSB is engineered to punch through loud and clear. Even in crowded metropolitan areas.

And like all Cobras it comes equipped with such standard features as an easy-to-read LED channel indicator. Switchable noise blanking and limiting. An RF/signal strength meter. And Cobra's exclusive DynaMike gain control.

You'll find the 138XLR SSB wherever Cobras are sold. Which is almost everywhere. Because Cobra's got a nationwide network of dealers and Authorized Service Centers offering sales, installation, service and advice. So come on in. And move on up.

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drilled in almost any thin material with the Conecut drill bits—steel, sheet metal, tubing, conduit, plastic or formica. Pilot holes or center punch marks are unnecessary, even on curved surfaces. Sells for $34.95. For more information, write to GC Electronics, 400 South Wyman, Rockford, IL 61101.

Amateur Desk Clock

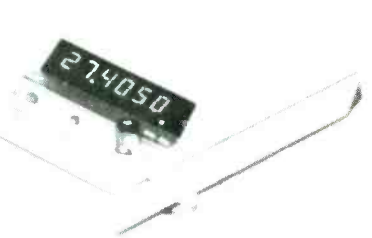
CIRCLE 68 ON READER SERVICE COUPON

The QTR-24 Yaesu World Clock is one of the newest additions to the Yaesu line of amateur equipment. It is a 12-hour/24-hour clock which indicates the daylight/dark hours around the world. The clock is run by a single size C drycell which will last a year. It is 5¾-in. in diameter x 2½-in. deep, and sits on the desk or it can be mounted on the wall. Price is $30.00. For more information, write to Yaesu Musen USA, Inc., 7625 East Rosecrans Ave., Unit #29, Paramount, CA 90723.

30 MHz Portable Frequency Counter

30 MHz portable frequency counter by B&K-Precision is not much larger than a pocket calculator. The new Model 1827 offers full six-digit LED display and operation to 30 MHz. The B&K-Precision 1827 features 1 ppm resolution on a six-digit scale with ±.25 ppm stability. The input circuitry is sensitive enough to display a 100 mV sinewave signal, but is protected against an input signal of up to 200 volts (peak AC & DC). An optional signal tap allows the 1827 to continually monitor the output frequency of a 23- or 40-channel CB transceiver without affecting normal set operation. The 1827 is designed to provide fully

CIRCLE 66 ON READER SERVICE COUPON



autoranging operation, or can be switched to a 1 second position for 1 Hz resolution—even while measuring CB radio frequencies. Decimal point position is automatic, as is a MHz/kHz indication. An exclusive battery saver feature electronically shuts off power to the LED display after 15 seconds of operation, making the 1827 ideal for field service. A touch of the display button restores the display for another 15 seconds. When operated by an external power source, DC or AC, the display remains on continuously. Price is $120.00. For additional information, write to B&K-Precision, Dynascan Corporation, 6460 West Cortland Avenue, Chicago, IL 60635.

Magnetic Mount for 140 MPH

The Channel Master Mag-Ne-Tenna is a full-size, base loaded mobile antenna, providing high performance with 23 and 40 channel sets, AM and single sideband. The antenna has a 6-pole, 8-ounce magnet, and was successfully tested on the surface of an airplane flying at 140 miles per hour. Its exceptional holding power means it is particularly effective

CIRCLE 34 ON READER SERVICE COUPON

Shakespeare's Big Stick™ Antenna. World famous performance. And right in your own backyard

Punch out the big signal from 60 feet up with Shakespeare's Big Stick. The omnidirectional fiberglass base station antenna that outperforms anything on the 40 channel band. Illuminating 12 times more capture area. And sending the signal energy out to the horizon in a unique, low angle radiation pattern.

This half-wave coaxial sleeve antenna incorporates exclusive Shakespeare engineering in fiberglass to outrange taller, heavier metal antennas under all conditions. Withstanding ice and winds up to 125 MPH with no damage to reception. And pretuned to a low SWR over the 40 channel band

Move up for the big gain with Shakespeare's Big Stick. Pretested. No ground radials. Works anywhere with any length of cable. Also available in a low cost, 2-piece model, Big Stick II.

Shakespeare

The best antenna going. And coming.

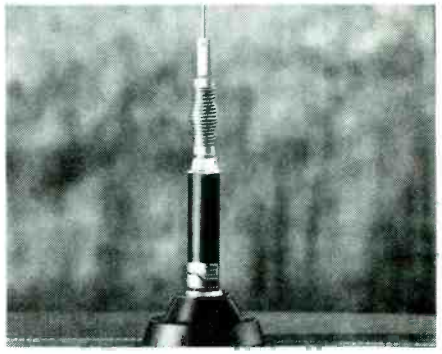
CIRCLE 17 ON READER SERVICE COUPON

Big Stick, Style 176
Used as part of this country's DEW line defense system. Less than $45.

Shakespeare Company/Antenna Group, P.O. Box 246, Columbia, S.C. 29202
In Canada:
Len Finkler, Ltd., Ontario.

HEY, LOOK ME OVER

on vinyl surfaces—even padded vinyl surfaces. Electrically, the Channel Master Mag-Ne-Tenna is a superb performer because it features an in-line, ferrite bead RF choke, a must for vinyl top cars. The choke maintains stable SWR, aids in tuning, eliminates background noise, and



CIRCLE 75 ON READER SERVICE COUPON

generally enhances performance. Drift and RF interference are eliminated. The antenna is fully-weather-protected; A 24 foot length of coaxial cable is furnished for simplified installation. When not in use, the Mag-Ne-Tenna is easily removed from the surface of the vehicle, leaving no tell-tale signs for CB thieves. Model 5029; list price, $34.95. For further information, contact Channel Master, Ellenville, NY 12428.

Rapid Hide-Away Antenna

The Hustler "Hustloff" instant removal, store-in-the-trunk, instant remount antenna has performance equal to most permanently mounted mobile installations! The special design trunk lip mount firmly clamps to any trunk lid with the twist of a knob. Operation is

CIRCLE 72 ON READER SERVICE COUPON

instant and easy. Positive grounding is assured with the heavy duty, case-hardened clamp assembly. Mounted antenna cannot be removed when trunk is closed. Deluxe features include a 180 degree swivel for positioning antenna to optimum vertical location, 17-ft. coax with all connectors factory attached. The Hustloff antenna is available with 48-in. standard and 55-in. heavy duty stainless steel antennas. Price is $28.95 for the HT-27 and $31.25 for the HHt-27. Additional information may be obtained from New-Tronics Corporation, 15800 Commerce Park Drive, Brookpark,OH. ■

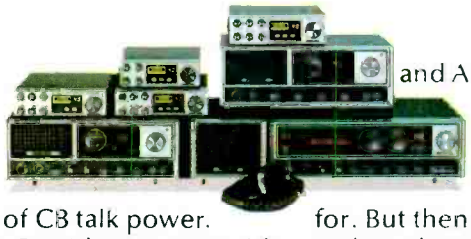
President. A whole new class of CB radio.

First class.

With 40 channels and all the power the law will allow.

Every single President radio is thoroughly tested to make sure it works perfectly before it ever gets out of the factory.

Every President model is engineered with quality features like variable mike gain and our sophisticated compression circuit for a new standard of CB talk power.



And every President comes with a little something extra for its price. Like 100 mm digital channel readout and ANL on our *least* expensive units.

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In Canada: Lectron Radio Sales Ltd., Ontario

CIRCLE 14 ON READER SERVICE COUPON

BOOKMARK
BY BOOKWORM

Math Unraveled. For those people baffled by math, here is the book that takes math out of the twilight zone and into the sunlight of everyday use. *Mathematics Unraveled—A 'New Commonsense Approach* by James Kyle tells the how and why of mathematics, and best of all, how to really enjoy mastering math. It's written in an easy-to-read style, and it's backed up by nearly 100 practical illustrations. Here's what Kyle says in his Preface: "Since first becoming interested in electronics, I have been forcibly reminded (every time I have to calculate a voltage, current, or power level) of the importance of mathematics to today's technology."

Soft cover
280 pages
$6.95

Kyle presents the subject in a logical, progressive, building-block way that lets the reader assimilate knowledge as he reads. It's a fact-packed, entertaining history of the development of the art. Also, it's right into that controversial New Math. The reader will be surprised to find that he knows most of it already. And what he doesn't know is explained simply with words and illustrations. Then the relationships of numbers, equations, and mathematics are explained. There is much more. Write to the publisher for the book catalog. Published by Tab Books, Blue Ridge Summit, PA 17214.

Substitution Guide. Here is a supercolossal six-in-one guidebook with a one-stop cross reference list for the simplified replacing of over 80,000 transistors and integrated circuits labeled with manufacturer's parts numbers. It's *Master Transistor/IC Substitution Handbook*. Now virtually *any* part number can quickly be looked up—be it American, European, Japanese, Taiwanese, or whatever—and immediately referenced to which of the six major manufacturers of general replacement parts makes it. And even more than that, the user can also check out the basing diagrams for all listed units. So now the needless running around, the headscratching, the costly guesswork can all be eliminated; at least one of these replacements is carried by every parts jobber in the country. And all their parts are cross-referenced in the same easy-to-use master guide! Published by Tab Books, Blue Ridge Summit, PA 17214.

Soft cover
518 pages
$7.95

Old But Good. Here is the fourth edition of an old favorite, *Tape Recording for the Hobbyist* by Art Zuckerman. His text is written especially for the hobbyist, not the professional. In non-technical language, it discusses numerous types of recordings and explains the method used to make each of them. The author shares his knowledge of tape recorders, helping the reader to choose the recorder and techniques best suited to a particular purpose. Practical situations are covered—field recording, using the recorder at a party, editing and producing tapes, producing special effects, making movie and slide show tracks and maintenance tips. Published by Howard W. Sams and Co., Inc., 4300 West 62nd St., Indianapolis, IN 46268

Soft cover
160 pages
$4.95

8080 Designer's Guide. A new designer's guide covering the applications of programmed logic and featuring specific uses of 8080 type microprocessors deals primarily with design and documentation of 8080 microprocessor subsystems. Illustrated with drawings and tables, the guide contains numerous sample programs and experiments, demonstrating programming and program/hardware integration. Titled *The Designer's Guide to Programmed Logic featuring the 8080 Microprocessor*, it covers desgin and engineering approaches to microprocessors as developed by Pro-Log and used to design its own MPS 880 product line. Discussed in the Implement-

Soft cover
148 pages
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(Continued on page 19)

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"HOMING PIGEON"™

the first all-indoor CB base antenna with all-out performance.

Model HP-27

THIS HUSTLER COVERS 40+ CHANNELS

The "Homing Pigeon" is your antenna answer to operating CB from any location, condominium, office, home, apartment, motel etc. No installation required; antenna is supported between floor and ceiling like a pole lamp. Communications range is equal or superior to better mobile installations. The "Homing Pigeon" incorporates a unique method of easily and quickly adjusting SWR. One setting covers all channels for outstanding performance with any 23 or 40 channel CB radio, AM or SSB. Antenna is supplied complete with 17′ coax, connectors attached, ready to use. Model HP-27.

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Patent for "Homing Pigeon" applied for by New-Tronics. Other Hustler antennas are protected by one or more New-Tronics patents: 3287732, 3513472, 3327311, 3419869, 3599214, 3873985, 3582951.

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CIRCLE 12 ON READER SERVICE COUPON

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It's a fact that the people who first put radio on wheels also made the first radio on wheels on the moon.

But it's not surprising.

Because Motorola® makes more radios for police, firemen, taxis, and lunar rovers.

And now Motorola makes a 40-Channel CB radio that shares much more than a name with our professional 2-way radios.

The clean, uncluttered lines of the Motorola CB, for instance.

Features that many manufacturers leave on the outside of their sets (or don't offer at all) are built into a Motorola CB.

Gain control, noise limiting, audio compression, even a TV interference filter are built-in, fully automatic circuits that actually make communication better.

And operation easier.

A digital phase lock loop synthesizer provides precise tuning (automatically, of course).

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The Motorola 40-Channel CB radio.

We believe it's the most sensibly engineered CB radio on the market. We believe it will deliver years of service at a level of performance few could match.

Put a Motorola CB radio under your dash and you'll believe, too.

Motorola CB

From the voice of experience in 2-way radio.

To find the dealer nearest you, write: Customer Relations Manager, Motorola Inc., Automotive Products Division, 1299 East Algonquin Rd., Schaumburg, Illinois 60196.
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CIRCLE 23 ON READER SERVICE COUPON

BOOKMARK

(Continued from page 16)

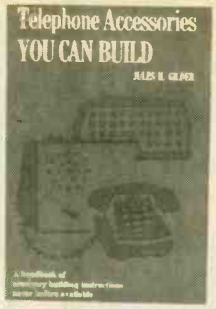
ing Programmed Logic section are: the scientific approach to problem solving; both system design and modular approaches to microprocessor use: how to use multi-level modules; and program listing, labels and patching. An extensive section is devoted to programming applications that includes detailed examination of the use of sub-routines and different addressing modes available in the 8080 micro-processor. Also covered are timing, counting, compare, logical operations, and arithmetic applications. Contact Pro-Log Corp., 2411 Garden Road, Monterey, CA 93940.

More Than Pot Luck. Now you can cook up delectable programs with this mouth-watering gourmet's delight of all new "6800" software. *Scelbi "6800" Software Gourmet Guide and Cook Book* is now available and tells how to use the original manufacturer's recommended mnemonics and assembly formats, with hexadecimal notations. General purpose routines for multiple precision operation. Programming time delays for real time applications.

Soft cover
200 pages
$9.95

Random number generators. Completely assembled relocatable floating point arithmetic program, with 23 bit signed mantissa and 7 bit signed exponent. Input/output processing for basic 1/0 programming. Interrupt processing. Code, numeric conversion routines. Real-time programming. Search and sort routines. And too many more goodies to mention here. Published by Scelbi Computer Consulting Inc., 1322 Rear Boston Post Road, Milford, CT 06460.

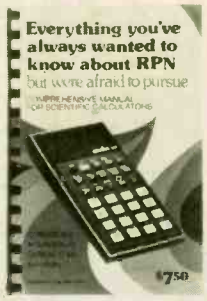
Adding on to Ma Bell. Already one of the most common and useful of all home appliances, the telephone has the potential of being much more than simply a communicative device. It can remotely control other appliances, automatically dial any number (police, fire department) when triggered by an alarm, code phone conversations to insure privacy, even act as a burglar alarm when equipped with the proper accessories. But up to now, these accessories have had to be purchased at prices ranging from $30 to $200. Jules H. Gilder, in the first guidebook of its kind, now shows how to build these accessories, and at a small fraction of their retail cost —many for less than $5. *Telephone Accessories You Can Build* includes the basics of telephony and pertinent telephone regulations. The easy-to-follow plans it provides are all geared to practical application. Containing useful schematics, basic building tips, and printed circuit layouts, *Telephone Accessories You Can*



Soft cover
84 pages
$3.95

Build opens the door to a world of telephone electronics for hobbyist and technician alike. Published by Hayden Book Company, Inc., 50 Essex St., Rochelle Park, NJ 07662.

Manual For Scientific Calculators. Do you want to get the most out of your scientific calculator? Well, now you can with help from a new manual just published by TK Enterprises. *Everything You've Always Wanted to Know About RPN But Were Afraid to Pursue* is a compact manual that devotes an entire section to Reverse Polish Notation (RPN), the most efficient technique for expressing complex calculations. Divided into two parts, this comprehensve text first describes the basic operations of the Corvus 500 calculator, which is also functionally iden-



Soft cover
118 pages
$7.50

tical to the APF Mark 55 and OMRON 12SR calcualtors. The second part of the manual presents a selection of application problems and their accompanying solution programs. Typical problems are demonstrated in financial, statistical and simple algebraic calculations. Problems illustrated should prove useful to all who use a scientific calculator. The manual is available directly from the Publisher, TK Enterprises, 16611 Hawthorne Boulevard, Lawndale, CA 90260. ■

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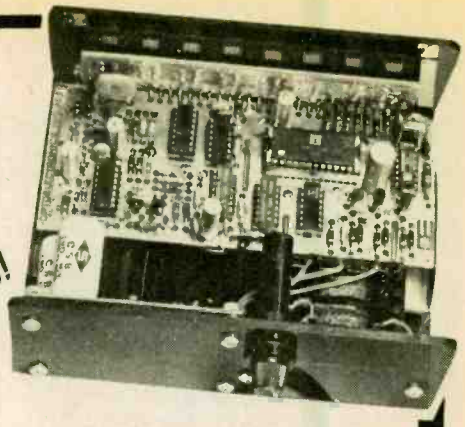

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SIZE:
3" High
6" Wide
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KIT #FC-50C IS COMPLETE WITH PREDRILLED CHASSIS ALL HARDWARE AND STEP-BY-STEP INSTRUCTIONS. WIRED & TESTED UNITS ARE CALIBRATED AND GUARANTEED. PRESCALERS WILL FIT INSIDE COUNTER CABINET.

FEATURES AND SPECIFICATIONS:

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GATE TIMES: 1 SECOND AND 1/10 SECOND
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RESOLUTION: 1 HZ AT 1 SECOND. 10 HZ AT 1/10 SECOND.
FREQUENCY RANGE: 10 HZ TO 60 MHZ. [65 MHZ TYPICAL].
SENSITIVITY: 10 MV RMS TO 50 MHZ. 20 MV RMS TO 60 MHZ TYP.
INPUT IMPEDANCE: 1 MEGOHM AND 20 PF.
[DIODE PROTECTED INPUT FOR OVER VOLTAGE PROTECTION.]
ACCURACY: ± 1 PPM [± .0001%]: AFTER CALIBRATION TYPICAL.
STABILITY: WITHIN 1 PPM PER HOUR AFTER WARM UP [.001% XTAL]
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POWER CONSUMPTION: 4 WATTS
INPUT CONNECTOR: BNC TYPE

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Great for Clocks or any LED Digital project. Clear-Red Chassis serves as Bezel to increase contrast of digital displays.

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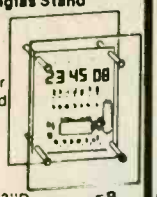
SEE THE WORKS Clock Kit Clear Plexiglas Stand



- 6 Big .4" digits
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- 3 set switches
- Plug transformer
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Plexiglas is Pre-cut & drilled
Kit #850-4CP
Size: 6"H,4½"W,3"D

$23.50 ea. 2/$45. A SUPER CLOCK!

60 HZ. XTAL TIME BASE

Will enable Digital Clock Kits or Clock-Calendar Kits to operate from 12V DC.
1"x2" PC Board
Power Req.: 5-15V (2.5 MA. TYP.)
Easy 3 wire hookup
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Complete Kit $4.95
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PRIME - HIGH SPEED RAM

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LOW POWER - FACTORY FRESH

1-24	$1.95 ea	100-199	$1.60 ea
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OVER 500 PCS. $1.39 ea.

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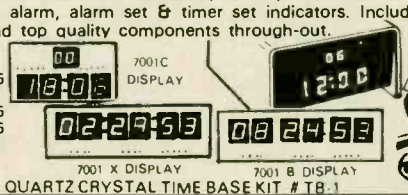
DATE-TIME-SNOOZE ALARM & MORE... KIT 7001

FOR THE BUILDER THAT WANTS THE BEST. FEATURING 12 OR 24 HOUR TIME — 29-30-31 DAY CALENDAR. ALARM, SNOOZE AND AUX. TIMER CIRCUITS

Will alternate time (8 seconds) and date (2 seconds) or may be wired for time or date display only, with other functions on demand. Has built-in oscillator for battery back-up. A loud 24 hour alarm with a repeatable 10 minute snooze alarm, alarm set & timer set indicators. Includes 110 VAC/60Hz power pack with cord and top quality components through-out.



KIT - 7001B WITH 6 - .5" DIGITS $39.95
KIT - 7001C WITH 4 - .6" DIGITS & 2 - .3" DIGITS FOR SECONDS $42.95
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KITS ARE COMPLETE (LESS CABINET)
ALL 7001 KITS FIT CABINET I AND ACCEPT QUARTZ CRYSTAL TIME BASE KIT # TB-1

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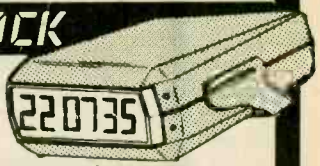

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CIRCLE 21 ON READER SERVICE COUPON

DX central reporting

A world of SWL info!

BY DON JENSEN

☐ Direct satellite to home television broadcasting is technically possible now, although just when this technology actually will be put to use for more than experimentation remains to be seen.

Tests and demonstrations conducted at the Montreal headquarters of the Canadian Broadcasting Corporation (CBC) have shown that excellent color television reception is possible directly from satellites using a small dish type antenna, about two feet across. The CBC has conducted its tests using its communications technology satellite Hermes, which for the past year-and-a-half has been hovering in a geostationary orbit 22,300 miles out in space.

Hermes and two other communications satellites are featured on a brand new QSL card now being issued by the CBC's Radio Canada International. One of these featured satellites is Alouette I, the first of four Canadian satellites designed to carry out ionospheric studies. It was launched from Vandenberg AFB, Calfiornia, back in 1962. Its primary purpose was to measure the earth's ionosphere from above. It was called, therefore, a "topside sounder." The signals sent back from this satellite produced a sort of radar map of the ionosphere. The ionosphere, by the way, is that region beyond the atmosphere from which shortwave signals are bounced back to earth, thousands of miles away from the transmitting antenna. Alouette I—named after a high flying Canadian song bird of the lark family—is expected to orbit the earth, some 625 miles out, for another 2,000 years.

Brotherly Satellite. Also pictured on *Radio Canada International's* new QSL is Anik I, a third communications satellite launched in November, 1972. It was the world's first domestic geostationary communications satellite, providing television, telephone and data transmssion links to all parts of Canada. It offered, for the first time, live television service (rather than videotaped programs run days later) to the TV stations in the larger communities of the Canadian North.

Anik is parked over the equator, south of Calgary, Alberta. Its parabolic antenna can "see" all of Canada.

The attractive blue and white satellite QSL card is now available to those SWLs who tune *Radio Canada International* shortwave programs. Under the QSL policy begun last year by *Radio Canada International,* the listener may receive one QSL card per year. The blank QSL card is mailed out with the *Radio Canada International* summer-fall 1977 program schedule. When a listener tunes a *Radio Canada International* program, he fills in the card with date, hour of reception and frequency in kilohertz. He should also include some brief details about the content of the program heard. The card is then mailed to the CBC's *Radio Canada International* headquarters in Montreal.

If the details on the card are correct, the reception will be verified and the card will be returned to you as your QSL. Cards with incorrect reception details will not be returned. If you have not received a *Radio International* program schedule and blank 1977 satellite QSL card, you can get one by writing to *Radio Canada International,* Post Office Box 6000, Montreal, H3C 3A8.

Radio Canada International has a full shortwave schedule, but, for starters you can look for half-hour English language programs at 0100 (9,535 kHz), 0200 (9,605, 0,655 kHz), 0300 (6,000, 9,605 and 9,655 kHz) and 0400 (5,960 and 9,655 kHz), and 0400 (5,960 and 9,655 kHz), GMT.

The new QSL card is very attractive and a fine addition to any SWL's collection!

End of a Clandestine. Forty years after it first began broadcasting—though with two breaks in those four decades—the *Voice of the Basque Resistance, Radio Euzkadi,* ceased operations on April 30, according to an official European source.

In 1937, *Radio Euzkadi* (pronounced ooze-kahdi) went on the air from Bilbao in the Basque region of northern Spain. In a bid for Basque loyalty in the civil strife, Madrid's Republican government granted the Basques semi-autonomy. But ten months later the Basque republic had crumbled before the armies of Francisco

DX CENTRAL

Franco and his German and Italian allies. *Radio Euzkadi* was silenced.

A Basque government in exile was formed in Paris. When World War II began and the Nazis took the City of Lights, the Basques fled again, this time to the U.S. After the war, the exiled Basque leaders set up shop in France.

Radio Euzkadi was born in December, 1946. From that time until mid 1954, the station operated from on board an old fishing trawler in the harbor at Bayonne, France. Transmitters were low powered and the station was not audible in the U.S., although European SWLs logged it on either 6,300 or 7,000 kHz on occasions. When the Basque struggle against the Franco regime began to heat up, the Spanish government applied political pressure on France, which had until then, closed its eyes to the clandestine broadcasts coming from its territory. The French were pressured into silencing *Radio Euzkadi*.

A reborn *Radio Euzkadi* returned to the air a third time, probably in 1965, with a shortwave transmitter on about 13,250 kHz, a frequency it used right up to the end. Later a second transmitter was added, which used several frequencies, but wound up on about 12,105 kHz. The stations claimed to be using transmitters running 80 kilowatts.

This time the station appeared to be transmitting from the northern coast of South America, almost certainly Venezuela, although its location was never officially disclosed. Instead, the station maintained the fiction that it somehow operated secretly from the Pyrenees Mountains in northern Spain. Apparently the Venezuelan government also chose to look the other way and spokesmen denied any knowledge of the station or its whereabouts.

Radio Canada's new satellite QSL card. Three of Canada's satellites are featured on the card, and the back contains space for verification information.

And so *Radio Euzkadi* operated until the end of April. Apparently with the Basques winning some concessions from the new regime in Madrid it was time to take a lower profile.

In its closing announcement, *Radio Euzkadi* said it was ending its operations "to prepare for our appearance on the soil of our own land in freedom. . . . Since the Basque national flag is once again flying proudly from all mastheads in the Basque country, *Radio Euzkadi* can withdraw from the air with honor.

Thus ended one of the most interesting clandestine broadcasters of the past 40 years.

Trans World Radio, Guam. Scheduled to begin in June or July, so probably on the air by the time you read this, is the fourth and newest of the *Trans World Radio* stations on shortwave.

SWLs are, no doubt, familiar with *Trans World Radio* stations at Monte Carlo, Monaco; Bonaire in the Netherlands Antilles, and in Swaziland in southern Africa. The latest addition to the family of religious-oriented shortwave stations is KTWR on the island of Guam in the

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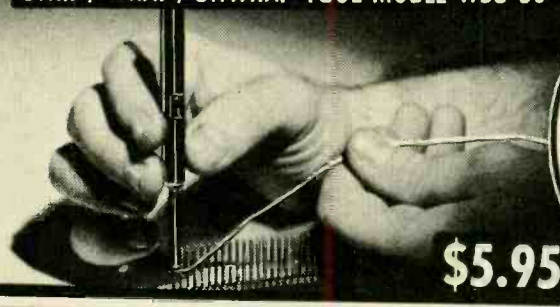

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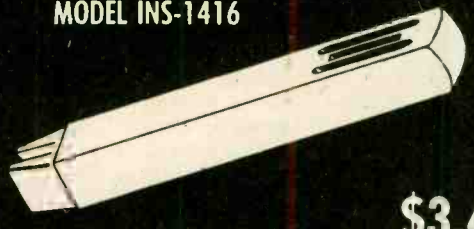

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DX CENTRAL

Pacific.

At this writing the tentative fall schedule of broadcasts is 1100 to 1500 GMT on 9,575 and 11,705 kHz; 2100 to 2200 GMT on 15,155 kHz; 2200 to 2300 GMT on 15,155 kHz; 2300 to 000 GMT on 11,705 and 15,155 kHz; 0000 to 0120 GMT on 15,155 kHz; 0900 to 1100 GMT on 11,780 kHz; 1015 to 1100 GMT on 11,705 kHz; and 2200 to 2245 GMT on 15,155 kHz.

Target areas for broadcasts are China, the USSR and South Asia, but the 100 kilowatt transmitters should be easily heard in North America.

Reader Feedback. 'I've lost HCJB, my favorite radio station," writes Steven Shaffer. "I've lost it in a sea of German and Spanish stations. I think it's the wind currents or something is wrong with HCJB's transmitter. My mother thinks it's my set because all I have is a whip. My father thinks like I do. The 49 meter band is the only place I could hear them and now I'm sunk. Could you please help me?"

Okay, Steven. First, I have to agree with your mother that you'd do far better with more than just a whip antenna. You don't have to have a fancy antenna. For starters try a 20 to 30 foot length of wire antenna—too much antenna on a portable rig like yours could tend to overload it. Then try HCJB on one of its other frequencies, like, say, 9,560 kHz during the evening hours in North America.

This well-equipped SWL listening post belongs to Bart Tammaro Jr., of West Haven, Conn. Not all of it is visible in this shot, but Bart lists the following receivers: Drake SPR4 and 2C; Halicrafters SX122A, SX133 and SX100; and a Hammarlund SP600.

Bill Bergadano of Staten Island, N.Y., observes that during 1976 he had some occassions when he logged stations not heard before or since on 41 and 49 meter bands at 11 a.m. to 1 p.m. local time. Bill notes that reception on the lower bands is usually strictly "local" in nature during the midday period. "What I'd like to know," Bill asks, "is if we can expect another phenomenon like that soon, and if in the near future, how many months, years from now?"

Some other DX listeners also reported unusual 49 meter band reception when the sun was high in the sky last year.

As to your question, if I knew when conditions like that will occur again, I'd use that sort of prognostication talent instead to pick race horse winners or Wall Street stocks!

"Dear Don," writes Mark Vincent of Lockney, Texas, "In an earlier column you mentioned that *Radio Canada International* had discontinued its DX show. Well, *Radio Canada International*, starting June 4, has a new DX show entitled, 'DX Corner' on Sundays."

That is good news, Mark, and thanks for passing the word along to DX Central readers.

A medium wave question from George Rogers of Chickamauga, Georgia.

"Will you please tell me where in Cuba the *Radio Progreso* relay on 880 kHz and the *Radio Caribe* relay on 1040 kHz are located and what are the powers of these stations."

The former, George, is located at Pinar del Rio and runs 10 kw of power. The *Radio Caribe* outlet on 1040 kHz is on the Islande la Juventud. It has a power of only 1,000 watts.

Up the Dial. (Times in GMT, frequencies in kHz) **3,385**—One of the more unusual catches from South America is *France Regions III*, a shortwave outlet at Cayenne, French Guiana. Look for this one very early, say around 0930 . . . **6,130**—CHNX, Halifax, Nova Scotia, Canada, is one of the handful of private, non-CBC stations on shortwave in Canada. It had been missing from the air for perhaps a year. Now it is back. Listen about 1200 . . . **9,770**—There are unconfirmed reports that a new station called *Radio Nationale* is due to come on the air on shortwave from Haiti For now, though, the best—and perhaps the only—way to hear this Voodoo island in the West Indies is via 4VEH, Cape Haitien. In Spanish it can be heard around 2300 . . . **11,920**—*Radiodiffusion Television Ivorienne* at Abidjan, Ivory Coast, West Africa, can be heard around 2130 after *Radio Nacional Espana* signs off. Programs are in an African vernacular language.

(Credits: Leon Tannenwald, NY; Michael Delman, NY; Derek Davey, OH; Kenneth Earhart, PA; American SWL Club, 16182 Ballad Lane, Huntington Beach, CA 92649) ■

GLOSSARY OF DX TERMS

CBC—The Canadian Broadcasting Corporation, the government radio and television organization of our northern neighbor.

GMT—Greenwich Mean Time, or Universal Time. This widely used standard time reference is equivalent to EDT + 4, EST or CDT plus five hours, CST or MDT plus 6 hours; MST or PDT plus 7 hours; and PST + 8 hours.

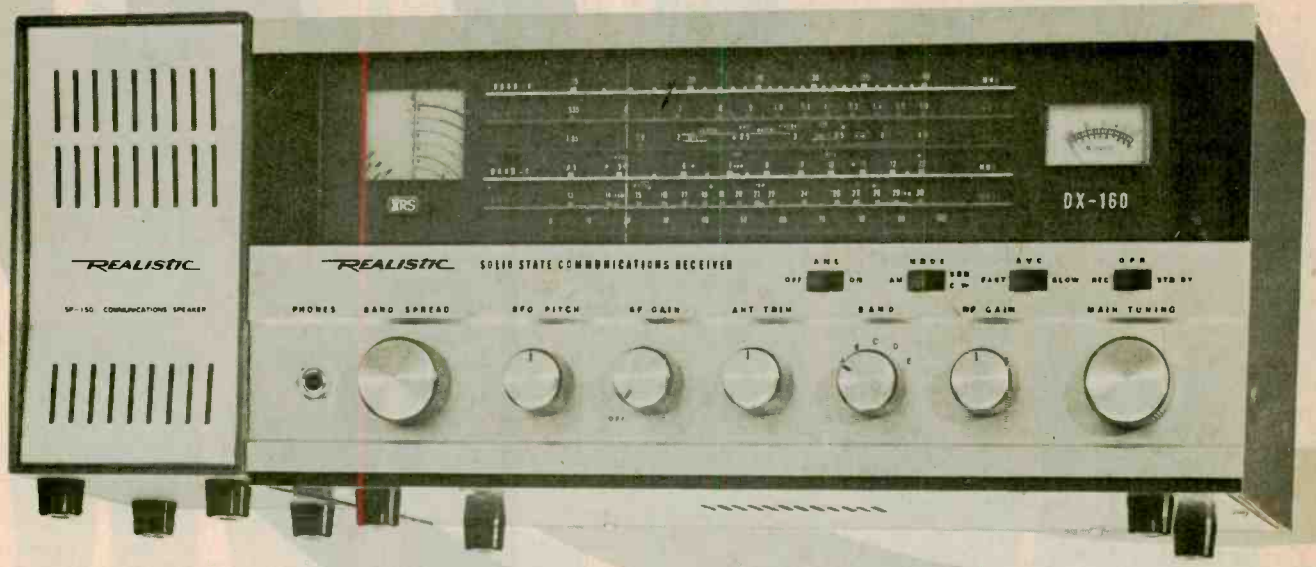
kHz—Abbreviation for kilohertz, a standard unit of radio frequency measurement signifying a thousand cycles per second. Typical shortwave frequencies might be 6,075 kHz, 9,500 kHz, 11,135 kHz, etc.

kw—Abbreviation for kilowatt, a unit of power measurement. A kilowatt equals 1,000 watts.

QSL—A reply from a station, in response to a listener's report of reception. A QSL, or verification, confirms that the SWL's report was correct. Often a colorful, well designed postcard, such as the one from Radio Canada International illustrated.

SWL—Shortwave listener; one who tunes the shortwave bands as a hobby.

When the world talks, you can listen...



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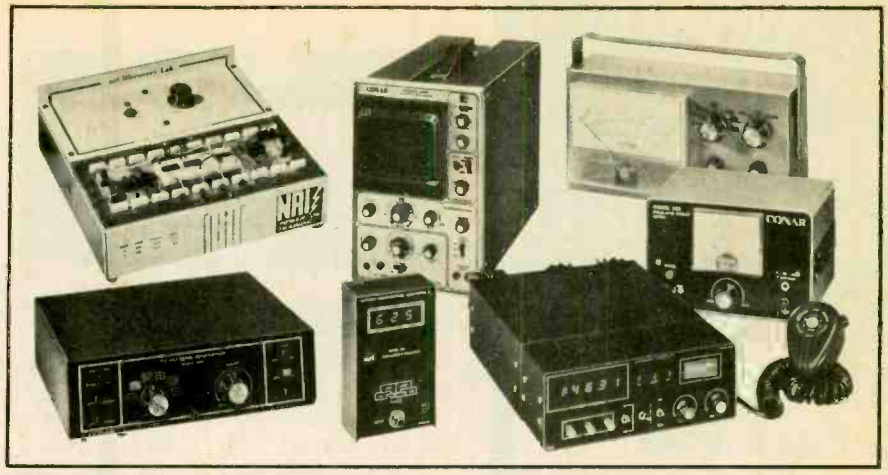

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Electronics in the News!

Computer-Graphics For Rent

Lockheed-California Company's high-speed computer graphics system has remote terminals which offer immediate display, change, and recall of pictures and drawings to users in product design and manufacturing. Called Computer-Graphics Augmented Design and Manufacturing (CADAM), it is the first system of its kind with the capability of being operated simultaneously from computer terminals anywhere in the world.

The CADAM system, which has been in commercial use in 12 locations throughout Europe and the United States for two years as a single centralized unit, now enables designers and engineers to look instantly at the same picture from separate locations in order to analyze preliminary drawings, detect errors without waiting for printing drawings and to make necessary design changes.

The added remote capability of the CADAM system gives rise to a host of new applications in small businesses and industries. It can be used extensively in

Each remote CADAM display unit is connected to a central computer. Here, the operator makes changes in design of a truck. She uses an electronic pen and a keyboard, instead of the traditional draftsman's tools, to alter the drawing.

electronics, automotive design and manufacturing, general mechanical manufacturing, architecture, engineering, shipbuilding and aerospace.

The software program, which is based on simple descriptive geometry, operates on standard IBM 360, 370 or equivalent hardware. It makes computer-aided design and manufacture using a common data base accessible to smaller companies, because the system can be supported from service bureaus operating the mainframe computer.

The new distributed version of CADAM, which is available as a commercial product under license from Lockheed-Calfiornia, is a complete modular software system accurate to six significant digits. Presently being used by one U.S. company in facilities which are remote from the host computer, the new distributed CADAM permits engineering and manufacturing data bases to be shared without regard to their geographic separation. Design changes can be incorporated in thousands of drawings overnight.

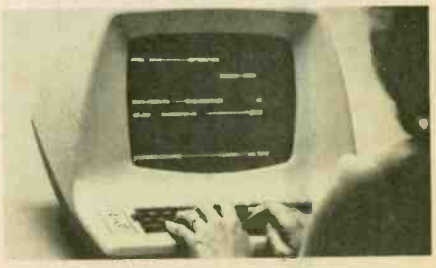
In advanced applications, one section of a complex design can be displayed and immediately changed from any of the terminals and composite drawings can be displayed to present the total picture. Through interaction with the computer, animation, rotation, image-zooming and stacking can be achieved to show the operation of complex designs without production drawings. The host computer can then permanently store all input for further recall.

Dumb is Beautiful

While the rest of the world concentrates on so-called "intelligent terminals," Lear Siegler appears to have taken a step in the other direction by introducing a low-cost terminal—but only because it's smart to be dumb.

Unlike most manufacturers whose video terminals have been getting "smarter" and more expensive, Lear Siegler has introduced a new 12-inch, bare-bones video terminal, which is dumb only in the sense it is a simple input/output device that the user gets to tailor to his specific application.

The ADM-3LC video terminal offers a standard 960-character display in 12 lines of 80 upper and lower-case characters. In applications now using teletypewriters, the ADM-3LC is software



It works like a typewriter, which most people already have been trained at. The Lear Siegler "dumb" terminal is not so dumb, since it works in most applications at moderate cost.

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NEWSCAN

and hardware compatible, and it can be used for direct replacement of the teletypewriter. The ADM-3LC is ideal for inquiry response applications; in fact, nearly 90 percent of the applications for video terminals require no more than a dumb terminal.

The standard 59-key office-type keyboard, with upper and lower-case shift, permits generation of the complete USASCII set. The ADM-3LC displays upper and lower case in high contrast characters in a standard 5x7 dot matrix.

Data entry is at the bottom line of the ADM-3LC screen. Advancing to a new line causes the entire data page to scroll upward, typewriter style. Full control of the display is provided by Clear Screen, Carriage Return, Line Feed, and Space Bar keys. Backspace and character overwrite capability allow display editing. End of line is announced by an audible tone to alert the operator to go to the next line manually.

The ADM-3LC contains both a 20 mA current loop interface and the EIA standard RS232C interface for direct or data communication connection to any standard computer port.

An EIA RS232C extension connector, included at no extra charge, permits easy interfacing with most asynchronous serial printers for hard copy recording of the video display information. This bidirectional extension port may also be used to daisy chain multiple data terminals, or to interface a magnetic recorder for storing larger messages.

A switch panel next to the keyboard allows operator selection of the ADM-3LC operating mode, either full or half duplex. The transmit and receive speed is selectable from 75, 110, 150, 300, 600, 1200, 1800, 2400, 9600 to 19200 bauds.

Word format is also tailored to the application with a choice of standard 9, 10, or 11 bit words with odd, even or no parity, plus one or two stop bits.

Being dumb has other advantages—the ADM-3LC requires almost no operator training, because it's so easy to use. It has higher inherent reliability, because it takes fewer components to be dumb. However, hobbyists will have to wait for surplus units in a few years, unless they can afford the $1095 price.

The world's largest liquid crystal display system is shown in operation at the offices of Hitachi, Ltd., one of the three Japanese-based companies who have been engaged since 1972 in a joint research project to develop a large-area liquid crystal display.

Getting Bigger Displays

The largest liquid crystal display system ever developed, capable of selectively displaying more than six-hundred alphanumeric symbols, has a display area of 0.4 meters (16 inches) by 0.5 meters (20 inches). The successful development of this experimental model represents a major step toward the use of large-area liquid crystal display systems in computer terminals, airport and railway arrival and departure information panels, electronic blackboards and other educational aids. The result of research carried out since 1972, the liquid crystal display system was subsidized by a grant from the Japanese Ministry of International Trade and Industry.

Liquid crystal is an organic compound having the fluidity of a liquid, which undergoes a change in transparency when voltage is applied. This change in transparency can be clearly seen even in bright daylight. The power necessary to activate the change is almost negligible; only a few microwatts (one microwatt = one-millionth of a watt).

For this reason, liquid crystal displays have found wide acceptance in devices such as pocket calculators, wrist watches and clocks, in which small display areas are sufficient.

The development of large-area liquid crystal display systems had heretofore been unsuccessful, primarily because of the long time-lag that occurred between the application of the voltage and the change in transparency of the liquid crystal material.

The Japanese research team overcame this obstacle by improving the liquid crystal material, designing new methods of panel fabrication and driving technique, and employing a "dynamic scattering mode." With the dynamic scattering mode, the panel indicates characters by a whitening of the liquid crystal material when voltage is applied. Further research is continuing toward the simplification of production processes, and application of LSI in the dimming circuit. ■

NEW!

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Fantastic new design uses CMOS I.C. and a total of 39 semi-conductors to give a touch control keyboard, all the electronic parts in one PC Board. This organ is easy to build, yet has features like a full two-octave range touch keyboard, variable tremolo; two voices; built-in I.C. amplifier with volume control, complete with speaker and a specially designed plexi-glass case.

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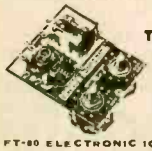

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Ideal to be used as time delay unit for burglar alarm, photo service, and other purposes. Max. loading 110V, 2 AMP. Supply voltage 12-18V D.C.
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POLICE ALARM UNIT
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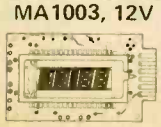

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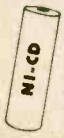

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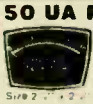

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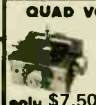

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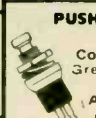

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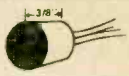

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CIRCLE 30 ON READER SERVICE COUPON

Beep the Metal Dish

My husband says that you cannot use a metal dish in a radar oven. I do, and it works OK. Where do people get the idea that you can't use metal dishes?
—Y. G., Bronx, NY

Metal dishes reflect radar waves without converting any of them to heat. Radar waves bounce from all directions inside the oven cavity and through the food. A glass shelf, which freely passes radar waves, supports the food above the bottom of the oven, thus waves enter the food from below. Prevent the radar waves from entering the food from the bottom, and you have reduced the efficiency of your oven 25-50%. By the way, let's call it a microwave oven and microwaves, and leave radar to the navigators. No, you will not damage your microwave oven with the metal dish, but since it must run for a long time for each meal, the overall effective life of the unit is reduced and electricity bills increase.

Long Life to You

Hank, I predict Citizens Band radio will die. What I mean is that interest in the band will diminish and instead of 10,000,000 CBers, we'll have 100,000 or so. What do you thnk?
—F. Y., Drain, OR

I'll believe it when they take the squelch control out of the CB transceiver. We are entering an era of personalized two-way radio communications which will be as big as the land-line telephone. Both communication forms will be with us for a long, long time, until someone develops ESP with a private channel for everyone.

Radio Contact

What is the best time to pick up Radio Nigeria? My son is working there for the next year.
—D. J., Cumberland, OH

The best time for picking up Radio Nigeria is around 0430-0455 GMT. At 0455 GMT, they sign off. Look for them on 7255 kHz in the 41-meter band. No, I didn't hear Radio Nigeria! A local SWLer filled me in. Listening to broadcasts from your son's part of the world will make letter writing easier and more interesting.

Playing With Matches

What is the difference between an antenna match box made for a base station and one made for an automobile?
—R. T., Pine Bush, NY

There should be none provided they are

both rated for the same power. Base units are made fancier, some are made with desk-top finishings, etc. Hams should watch maximum ratings carefully. CBers need not. Just about every match box made can handle the power.

Fix the Trouble

Would a shortwave radio receive CB signals better than a CB could? My rig gets a lot of cross-channel and sideband interference.

—J. T., Montreal, Canada

By cross-channel, I assume you mean adjacent channel reception. If this were the case, the receiver section of your CB is out of alignment. Most modern day CB rigs have an adjacent channel rejection of 45 dB. I don't know whether your shortwave receiver can do better. As for SSB interference, if it's on your channel, your rig, or any other receiver cannot eliminate the trouble. I'd suggest you have a pro tune-up the receiver section of your CB rig and check out the antenna system carefully.

Old and Delicate

I am restoring a pre-WW portable receiver and I can't find a 1F3. What can I do?

—F. S., Fargo, ND

The 1F3 vacuum tube can be replaced by the 1T4 type. I owned an old Philco portable using tubes of this type and they popped everytime I pulled a tube from the set and replaced it. Be sure the battery supply is disconnected and the electrolytic capacitors are discharged before removing and replacing tubes.

Bigger Spread

Hank, is it true that Cadmium Sulfide photocells see better than the human eye? My teacher says so, and I think he is wrong.

—D. G., Boulder, CO

The human eye has an approximate range of 500 to 600 microns for the wavelength of light it sees. The cadmium sulfide uses about 500 to 700 microns. So you see, your teacher is correct, provided you are talking about the light spectrum.

Too Many Thumbs

Every time I have to replace a phone cartridge, I am all thumbs. I break leads, lose screws and spacers, etc.; it's a disaster! Why don't they make snap-in units for guys like me?

—M. P., Gillette, WY

They do make snap-in units, but only on cheaper cartridge models. Weight is very important, the lighter the mass on the tonearm, the better is the sound reproduction. Thus, convenient mounting systems which are heavy cannot be used. But that doesn't help you. Do what I do, when installing a phono cartridge. When inserting screws, put a bit of bees wax on the screwdriver blade so that the screw will afix to it. It helps to hold it, and the bees wax is non-corrosive. Also, use tweezers to handle the delicate clips and fine wire that attach to the phono cartridge. And use a magnifying glass attached to your glasses or one that comes on a headband. Be sure not to rush, your fingers can't move as fast as your eyes.

The Folks Don't Like It

I have terrible TVI from my CB rig. I tried filters on the output, including a dummy load—no help! What can I do?

—E. B., Kearny, NJ

Try an AC line filter. You may be pumping RF into the AC line. Also, ground the case of the CB rig to a good electrical ground. And, if you changed the microphone, go back to the original—you never can tell!

Simple-Syn Erratta. A few errors crept into last issue's schematic diagram of our Simple-Syn Music Machine. Please make the following corrections:

C8 is shown with reversed polarity. Be certain the negative side goes to ground.

R4 is mistakenly shown on the schematic as 3.3K but it should be 330K (330,000). R5 is shown as 1200, but should be 12,000. R10 is shown as 220K, but should be 270K (270,000). All the values are correct as listed in the parts list, only wrong in the schematic.

Lend A Hand

Here are the requests from a few readers. If you can assist, please write directly to the person in need, do not send to me. Sending help via my office will only delay the mail.

Δ C. A. D'Andrea needs service and instructional manual for the Lafayette Radio TE-19CRT rejuvenator-tester, Knight 83Y145J RF generator, and Knight 834135J signal tracer. Send whatever you have to 414 West 35th Street, Lorain, OH 44055.

Δ Schematic diagram and info on a five-inch reel-to-reel Shinagawa SSS-501 tape recorder is needed by George Poitras, 91 Boucher St., Edmundston, N.B., Canada E3V-1P8.

Δ If you know Basic, can you tell Carl Rosen how to plot points on a graph, while following an equation. It's a Hewlett-Packard computer. Write to Carl at 174-A Boney La., Nissequoque, NY 11780.

Δ Paul Crowson, 529 Witsell Rd., Jackson, Miss. 39206 would like to get the manuals and schematic diagram of a Philco Model 60 cathedral radio and a Zenith Model 10A± radio/phono.

Δ Dr. S. G. Hueston, 97 Edward St., London, Ont., Canada N6C-3H6 would like to have the schematic diagram and operating manual for Signal Corp. receiver R274-FRR made by Hallicrafters. ■

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:

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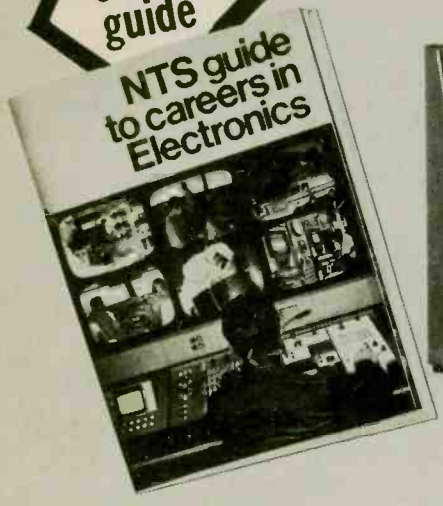

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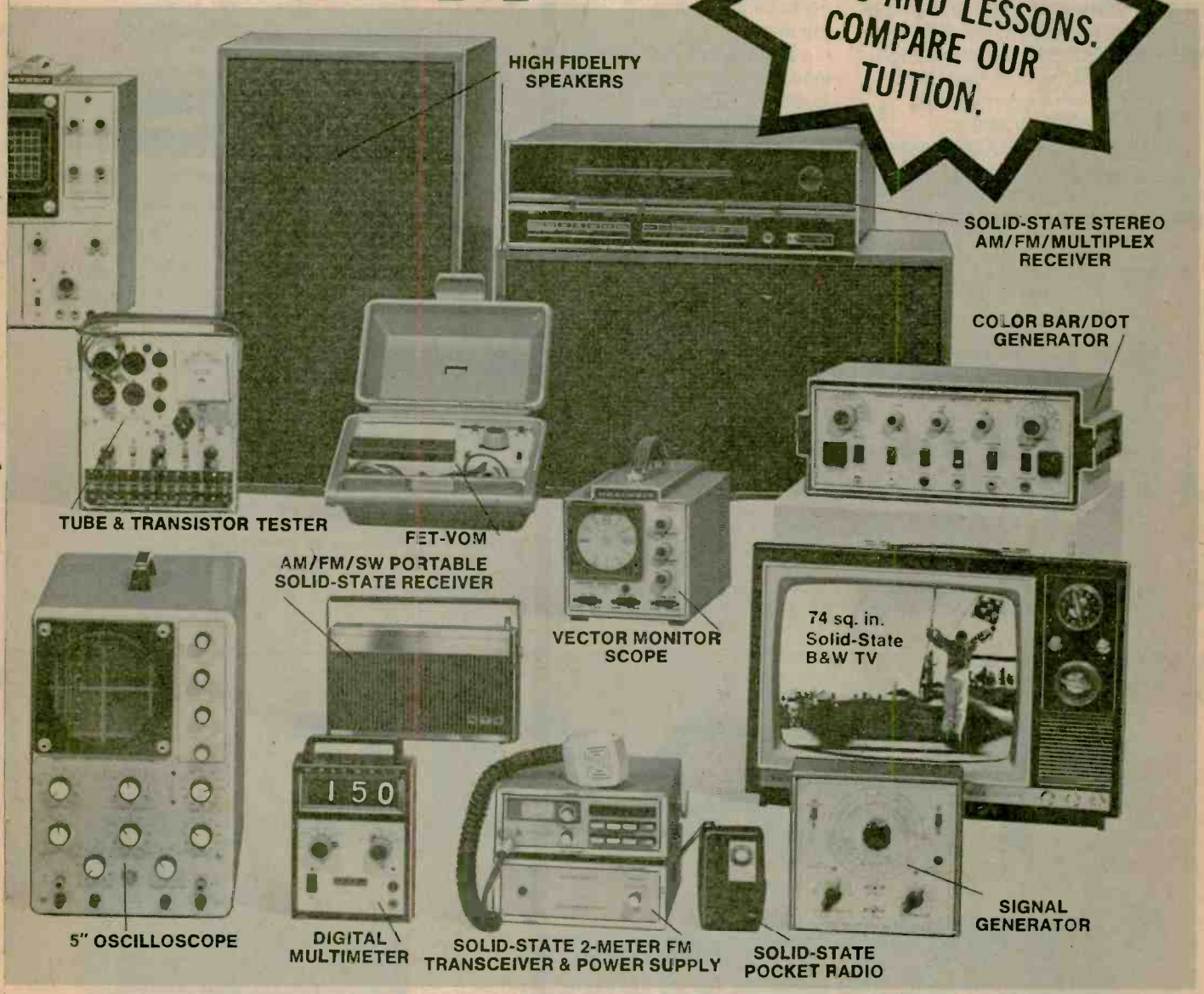

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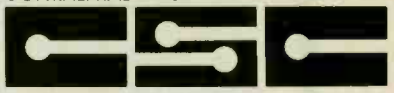

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Internal Time Base Characteristics Frequency: 3.579545 MHz crystal oscillator. Setability: ± 3 ppm @ 25°C. Trimmer Adjustment: ± 4 ppm. Temperature Stability: Better than 0.2 ppm/°C, 0 to 50° C. Maximum Aging Rate: 10 ppm/year.

Display Characteristics Display: Eight .6" high LED digits, with anti-glare window. Lead-zero blanking: decimal point automatically appears between sixth and seventh digit when input frequency exceeds 1 MHz. Overflow: When input signal exceeds 99,999,999 Hz, the most significant (left hand) digit flashes, allowing user to read in excess of 100 MHz. Display update: Fixed 1/6-second plus 1 second gate time. Low Battery Indicator: When batteries or power supply falls below 6.6 VDC, all eight display digits flash at a one-Hz/second rate. During battery operation, flashing display extends operating time of unit.

GENERAL Power Requirements: 6 AA Alkaline or NiCad batteries (internal battery compartment); External: 110-220/AC Battery Eliminator charger; Automobile cigarette lighter adapter for both charging and operating: 7.2 to 10 VDC external power supply; Battery Life: Alkaline, 3 hrs., cont. use; 8 hrs. intermittent use. NiCad, 3 hrs., cont. use, 6 hrs. intermittent use. Battery Charging: 12-14 hours required for full charge. Size (HWD): 1.75" × 5.63" × 7.75" (4.45 × 14.30 × 19.69 cm). Weight: Less than 1.5 lb. (0.68 kg) with batteries. Accessories Included: 100-IPC clip-lead input cable; detailed applications/instruction manual.

FREQ. OUT.

*Manufacturer's suggested retail

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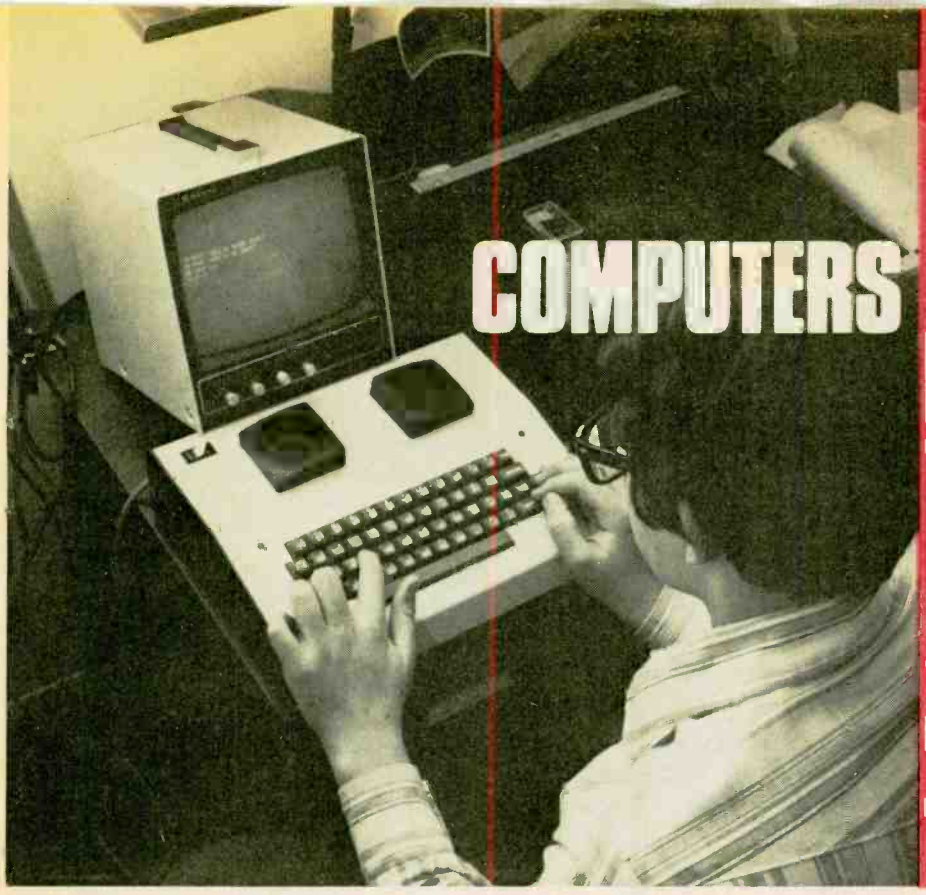


elementary Electronics Sept./Oct. 1977

COMPUTERS

PHONE THE FUTURE

How to link your home to today's new, computerized nerve-centers.

by Herb and Lawrence Friedman

EVEN IF YOU NOW haven't the vaguest interest in personal computers, within a year or two you will likely be up to your neck in personal computing whether you like it or not; and by *personal computers* we don't mean a Hewlett-Packard or TI programmable calculator—though they are, in fact, personal computers.

Personal computer means a full blown computer you can use to keep and process business and family records; one your children can, and probably will, use for their math, science and social studies—at all levels from grade school up; a computer your preschool children might use to play games such as *Star Trek* and *Klingon Capture;* a computer you could use for adult education courses taken in the comfort of your own home.

For less than the cost of a decent hi-fi system, or a console color TV with remote control, you can have a computer in your own home as powerful as some of the big IBM jobbies, and the whole computer won't take up much more space than a couple of shoeboxes. If you don't have room for two shoeboxes worth of electronic hardware you can rent computer time from regional and national companies. For example, did you ever wish you had an hour or so of computer time to finish a school problem? *Call Data* will charge you as low as $6 per hour (educational rate) for using their computer. If all you need is a couple of hours on their computer per month the bill could be less than your phone company charges you for the privilege of having a telephone.

Whether you opt for a personal computer in your own home, or a connection through your telephone to a time-share computer service you are going to need a *terminal,* the device that lets you communicate with the computer.

Trouble is, the surplus market is loaded with *computer terminals* that are really worthless for general use, so this article is going to serve as both an introduction to computer terminals and a guide as to what's available and really worthwhile.

Because of space limitations we cannot cover every type of terminal used to communicate with computers. Since the average reader will have access to a time-share dial-up computer, (via the telephone) or a personal computer in the home, we are going to cover only the terminals that work with both systems. There is no reason to spend several hundred dollars for a terminal that works with a personal computer only to find that if someone offers you free time on a giant time-share system your terminal can't be used

By simply feeding punched tape through the reader, as shown, a computer will accept a program at the maximum TTY speed of 110 words per minute. This particular program will require a full thirty minutes of computer time and will check every single bit of memory in an 8K word memory board.

Two Piece Terminals. At the very minimum a computer terminal consists of two separate devices: a typewriter style keyboard that transmits information to the computer, and a display device that "prints" the information coming from the computer. The display can either be some form of printer that "types" a written record—called "hard copy"—on paper; or a CRT, which can be a TV monitor, a modified TV receiver, or anything else using a CRT.

As a general rule the two sections—keyboard and printer—are totally independent even though you might have used, or observed, a working computer and seen that whatever was typed on the keyboard was printed out on the display. The keyboard transmits information to the computer, which then *echoes* back to the display so the user can check the entry. If the user types the word *ready* the computer echoes back the word and the display shows the word *ready*. Without the echo the user would have no idea whether he was transmitting correct data into the computer. The condition of separate

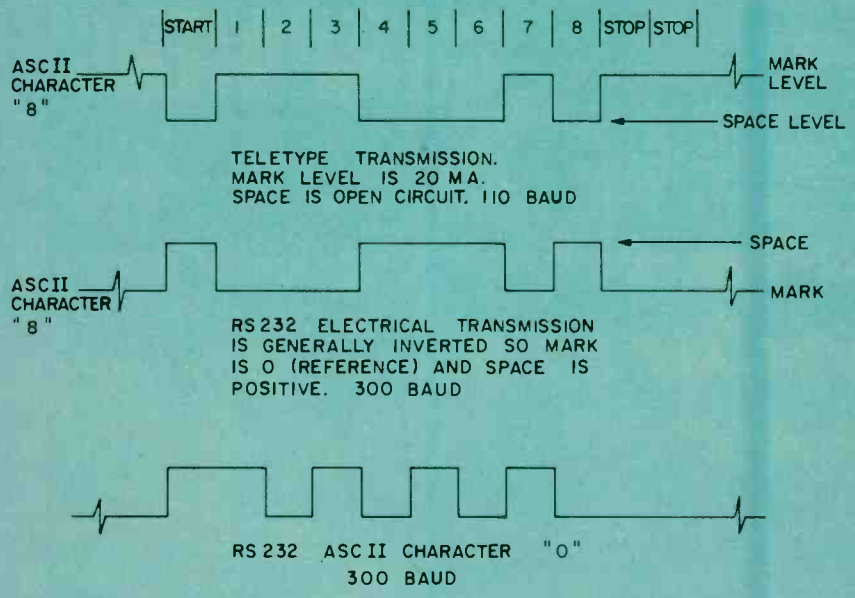
keyboard and display is termed *full-duplex*, meaning two things can occur at the same time—you can transmit and receive simultaneously.

Another condition is termed *half-duplex*, and there appears to be several versions of what is meant by half-duplex. The most common use feeds the keyboard character to the display and the computer. When the computer echoes back, the display shows both the original keyboard entry and the echo. In full-duplex, a keyboard entry of ABCD is displayed via the echo as ABCD. In half-duplex the display shows AABB CCDD. In full-duplex the word *ready* is displayed as READY; in half-duplex it appears as RREEAADDYY Half-duplex transmission is commonly used when time cannot be allowed for the computer to echo back. There are certain conditions when this is necessary, and the half-duplex mode, at the least, allows the user to check *spelling* and codes as they are entered into the computer.

Local is a term meaning the keyboard is connected directly to the printer so that keyboard entries are fed only to the display and any recording device attached to the display. In this manner a tape can be prepared for transmission to the computer at a later time.

If the terminal is in the vicinity of a computer it can be connected directly to the computer via multiple wires—this is termed *hard wired*. On the other hand, it is possible to use the telephone to "converse" with a computer on the other end of town, or even the country. The terminal is connected to a device called a *modem*, an acronym for *Mod*ulator-*Dem*odulator. Some modems can be hard wired directly to the telephone line; others can be acoustically coupled by simply placing the telephone's handset into a built-in receptacle. The modem takes the signal from the keyboard and converts it into audio tones which are fed to the computer through the telephone line. At the receiving end, a different type of modem converts the audio tones back to an electrical signal for the computer. Each modem is a two-way device. The modem at the computer takes the computer's output electrical signal and converts it into audio tones for transmission to the terminal. At the terminal the modem converts the audio tones back into electrical signals needed to drive (produce) the display. To avoid a mix-up on the telephone line the audio tones from the

TECHNIQUES OF ASCII INTERFACING



All time-share and most of the larger personal computers use an electrical character code termed ASCII, short for American Standard for Communications Interchange of Information, and pronounced "as-key."

The 8-level ASCII code presently in use was designed for teletype so the associated terminology refers to TTY operation even if the entire communications system is electronic with a CRT for the display.

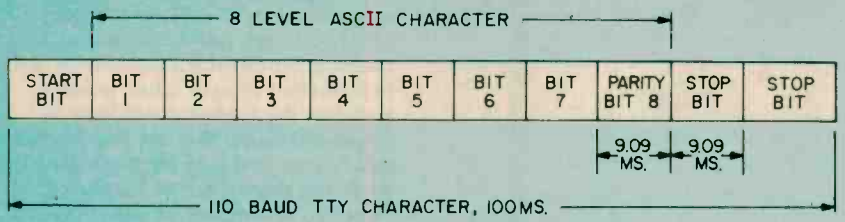
The TTY terminology in turn goes back to the days of the telegraph when one or a series of magnetic sounders was connected in a battery powered loop through the telegraph keys. Since everything was in series, the normal *off* condition was for current to flow in the loop and this condition was called *mark*. When the key was open to send a character the current loop was broken, the sounders made a "click" and the open current loop condition was called *space*. We still use the terms *mark* and *space* today. When a computer's TTY is connected to its associated equipment and it is not receiving a character signal it is fed 20 mA of current for the printer—the *mark* condition. To send characters the current is interrupted—the *space* condition. (You might have to read this over a few times to get the sense because it appears to be the opposite of what's needed. As we'll show, in electronic systems we invert the signal so *mark* is generally zero current or voltage and *space* is some amount of current or voltage.)

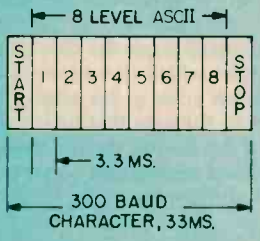
On to the next confusion. The 8-level ASCII character code really uses only seven *bits* to transmit the character; the eighth bit is for something termed *parity*, and even here we don't stop because there must be signals to synchronize the sending and receiving equipment. After all, something has to tell the printer that the electrical pulses to follow are a character and not line noises. So we add a *start* bit in front of the character. Now we must turn off the printer so it doesn't generate "garbage" sensing line noises as character bits. For this we follow the parity, or eighth bit, with two stop bits. Now we have a total of 11-bits making up the 8-level ASCII TTY character, as shown in our earlier diagram.

Note that each bit is 9.09 msec wide, making a total character length of 100 msec. The start bit turns on the printer, the first seven bits represent the character—either letter, numeral, control function, etc.—and the stop bits insure the printer stops and resets for the next character.

The parity, or eighth bit, is used to "test" the transmission when there is the possibility noise can obliterate, or add, a bit. The keyboard can be programmed so the parity bit is added to provide odd or even parity; that is, the *total number of character bits* from one to eight is even or odd.

Assume the keyboard is programmed for even parity and the letter Q is transmitted. The letter Q uses three bits—Numbers 1, 5 and 7. Three is an odd number so the eighth bit is automatically added, making the





total number of bits transmittted four, an even number. At the receiving end only the first seven bits are processed, giving the character Q. A *parity* detector, however, counts all the bits; if it's not an even result the printer might indicate an incorrect character has been received, or the parity detector might light a lamp or sound a bell to indicate something is wrong with the transmission. If the character originally had an even number of bits, such as the letter V which uses bits Numbers 2, 3, 5 and 7, the eighth parity bit is not added since the transmission has an even number of bits for the character, and the parity detector "sees" an even count. Both the keyboard and parity detector can be programmed for even or odd parity. Where there is a direct connection to the computer, or a circuit with little likelihood of noise, the parity detector is usually disabled or simply not used.

Though a TTY requires a bit length of 9.09 msec. the resultant 110 words per minute printer speed is too slow for most users. 300 WPM is the standard for electronic terminals used by time-share (with echo) and personal computers. We get the higher speed by simply reducing the time of each bit to 3.3 msec., and by eliminating the second stop bit.

The actual TTY transmission of the No. 8 is shown in the topmost figure. Note that the reference is *mark*, and the transmitted bits are *start*, 4-5-6, stop-stop. The middle figure shows the electrical equivalent as would be transmitted by an electronic keyboard using the EIA's RS-232 standard. Note that *mark* is now "O" (zero) and the waveform appears as a conventional waveform with the bits positive-going. (Yes, RS-232 provides for a negative-going waveform resembling the TTY waveform shown in the topmost figure). Note that the RS-232 character shown is 300 *baud* so the second stop bit is eliminated.

In both the top and middle figures bit number 1 is not used so the start bit stands alone. The bottom figure shows what occurs when bit 1 is part of the character. The letter "U" has alternating bits starting at bit 1, so bit 1 combines with the start bit to form a "pulse" double the reference bit length of 3.3 msec. The receiving device senses the leading edge of the start bit, times out for 3.3 msec. and since it "sees" a signal at the start of the next 3.3 msec. interval it "counts" bit 1. It is through the timing that the receiver counts bits. For example, in the top figure bits 4, 5 and 6 run together and "appear" as part of a square waveform. In actual fact the TTY doesn't recognize a square wave; its timing mechanism simply counts three contiguous bits followed by a space.

In both TTY, modem, and most personal computer use each ASCII character is transmitted *serially*, meaning one bit follows the other. There are special circuits, however, that require a *parallel* transmission, that is, all bits are transmitted through at least seven wires at the same time (eight wires if parity is used). This is generally done electronically with each bit represented by a *high* (logic 1).

The subject of the ASCII code and its transmission is rather extensive. We have featured the general highlights you'll need to know as you get started in using computers. A more complete explanation geared for hobbyist use can be found in the Sam's publication **TV Typewriter Cookbook** by Don Lancaster. If possibe, avoid the TTY service manuals and handbooks; you need a whole set to find out what's going on and the Cookbook is faster and more easily understood.

terminal are at a different frequency than those from the computer.

The basic input/output device for both time-share and most personal computer systems is the model 33 teletype, and the terminology for the model 33 has become, more or less, the accepted terminology for all I/Os. A model 33 printer (no keyboard) is called an RO for *R*ead *O*nly. CRT displays, or any other type of printer without an associated keyboard are usually termed ROs.

A model 33 teletype which consists of a printer and keyboard is termed a KSR for *K*eyboard *S*end and *R*eceive. Any other type of TTY or CRT terminals with a keyboard and display is termed a KSR.

Then there is ASR for *A*utomatic *S*end and *R*eceive. This is a model 33 TTY with an attached paper tape punch and a reader to read back the paper tape. The tape can be punched either from the keyboard in the *local* operating mode, or by the computer via the echo. The punch is mechanically attached to the printer so whatever the printer receives (with some exceptions programmed through a "stunt box") gets punched out on the tape. The reader feeds out as does the keyboard. If the tape is played (or *read*) by the reader, the output from the TTY is just as if it was sent from the keyboard. Both the punch and reader can be controlled from the computer by special signals, hence, this type of TTY is termed Automatic Send and Receive, or ASR Any similar terminal device is known as an ASR.

Though the model 33 TTY, and its designations such as RO and KRS, is the common standard of reference for most hobby and time-share computer systems there are other keyboard-printer devices that provide similar functions. Other straight TTY equipments are available as ASR and KSR equivalents of the model 33; and there are special *line printers* that print an entire line of copy at high speed, in contrast to the TTY's one-letter-at-a-time printout.

Smart and Dumb. Another variation is the "dumb" CRT terminal. This is a keyboard and CRT display made to function exactly as a KSR TTY. Though all-electronic, it puts out exactly the same type of signal as a TTY and responds to the same input signal, printing one letter at a time at TTY speed on the CRT. A slightly different version of the KSR electronic TTY puts out something called an RS-232 signal, an industry-wide TTL (transistor-transistor logic) compatible signal used for direct connection to computers and some modems; but it's still a "dumb" terminal.

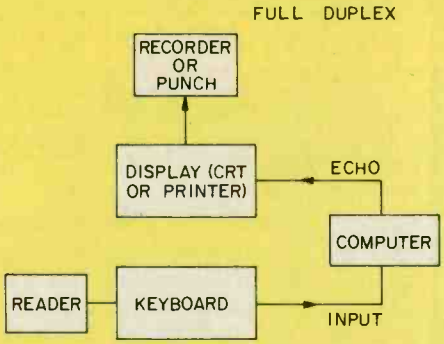
e/e PHONING THE FUTURE

What's a "smart" terminal? An electronic terminal with a built in minicomputer. A smart terminal allows the user to type a full page into storage, examine the page for errors, make corrections, and then transmit the signal. In some smart terminals additional information can be typed into storage as the previously entered information is sent out. On the receiving end, a smart terminal can often store several pages of transmission, allowing the user to electronically roll back to previous pages. (A full screen is usually a page.) Some smart terminals are actually full computers with built in KSR and can store thousands of words, but this is esoteric equipment. The typical hobbyist and time-share user is more likely to use an inexpensive, dumb KSR electronic terminal such as the highly rated Micro-Term ACT-1, which has 300 *baud* (we'll explain *baud* later) RS-232 output that can be fed directly to a hobby computer or into a modem such as the Omnitech 701A (the industry "work horse" available used for about $150) that has both a TTY and RS-232 connection.

For those who need both a direct RS-232 output and a modem, but who don't want the modem as an extra piece of gear with its required wiring there is the ACT-2 terminal shown in the photographs. The one shown is a prototype sent to ELEMENTARY ELECTRONICS for test and evaluation. It is essentially the ACT-1 with a built in modem.

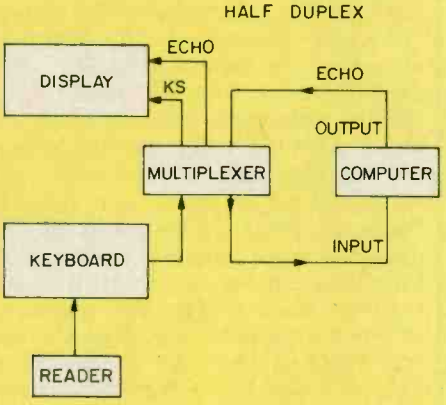
Baud. Whether you go into personal or timeshare computer systems you're going to hear and read much about something termed *baud* or *baud rate*. Very simply, *baud* is expertese for something we used to term *pulse width*, or *time;* it's sort of like when the experts decided to upgrade electronics by deciding we must all call cycle-per-second *hertz*.

Here it is—the standard of reference for many time-share and personal computer installations. This model 33 teletype is used whenever hard copy, a written record, is required. The model pictured is an ASR—Automatic Send and Receive. Visible to the left is the paper tape punch and reader.



For computer use a terminal—whether TTY or electronic with CRT—is generally arranged in the full-duplex mode, meaning the keyboard and display are independent of each other. In some instances the keyboard will have an associated reader that can provide output from a punched tape (or other player), while the display has an associated recorder, or a punch for paper tape. If there is an associated reader and punch the complete terminal is an ASR (Automatic Send and Receive).

The keyboard sends the characters to the computer which in turn sends back an instantaneous echo to the printer/display. It appears to the user that he is typing directly to the display though there is, in fact, no direct connection between the keyboard and display.

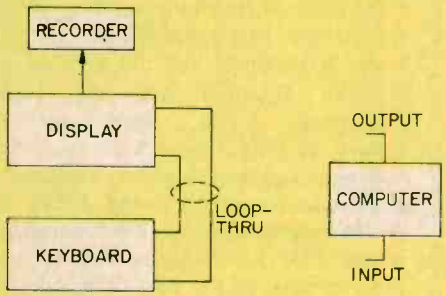


In the half-duplex mode a form of multiplex device somewhere in the overall system—it can be a simple wire from the keyboard—sends the keyboard signal to the display even if the computer's echo is turned off. If the echo is left on the display will show each character twice, once from the direct connection from the keyboard followed by the echo. Half-duplex is generally used when the terminal operates at baud rates too fast for the printer to follow the echo, or too fast for the computer to handle the incoming character plus the echo. In time-share and hobby personal computer systems the echo is usually turned off at baud rates higher than 300.

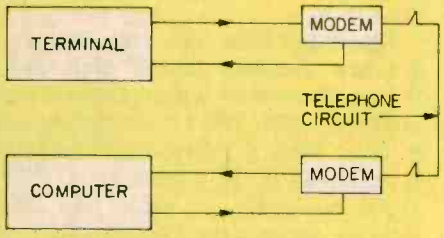
In order for electronic systems to communicate there must be some form of synchronization; each character or command must be transmitted and received in a specific time interval. If a printer was programmed to receive a character in say, 100 milliseconds (msec.), and it received one and a half characters in 100 msec., obviously it would be confused and display incorrect information, just as it would if it received only half the character information in 100 msec.

As you might have guessed, we achieve synchronization by transmitting any character in a specific time interval. If you refer to the illustration of an ASCII TTY signal you'll note it consists of 11 bits—the start bit, 7 character bits, parity, and two stop bits—with each bit being precisely 9.09 msec. in width for a total of 100 msec. Now *baud*, or *baud rate* is very simply the reciprocal of the pulse width of each bit. Since the pulse width of each ASCII TTY bit is 9.09 msec the *baud rate* is 1/.00909, or 110. That's all there is to it. We could just as easily

Nothing could be simpler than using the ACT-2's coupler. Just place the telephone handset in its niche and have full access to such systems as Call Data which accommodate virtually all programming languages. Call Data, for instance, can do such things as feed back a cross assembler for your personal computer, or provide access to the Dartmouth University program library.



When a terminal is switched to the local mode the keyboard is connected directly to the display via a loop, and the computer is disconnected. In this way the keyboard entries are fed directly to the printer and tape punch of an ASR TTY, and tapes can be prepared for feed to the computer at a later time. It also permits characters such as control functions to be added to a punched tape that has been previously made from a feed by the computer using the full or half duplex modes. (In half-duplex the computer can feed the display if the keyboard is not in use. This is usually accomplished by sending special control signals to the computer.) In electronic terminal systems with CRT display the recorder might well be a digital tape recorder rather than a TTY-type tape punch.



A terminal can be connected to a computer through voice-grade telephone circuits using a device termed a modem, an acronym for modulator-demodulator. The modem converts the terminal's electrical pulses to tones in the approximate 1000 to 2000 Hz range. When the tones are received by the computer's modem they are converted back to electrical signals. Each modem is a two-way device: the computer's modem converts the computer's signal to audio tones and feeds it to the terminal's modem where it is converted back to an electrical signal for the printer or display. To avoid confusion between the terminal and computer the tones from the terminal are completely different from the tones generated by the computer's modem.

Here we have both the accepted standard of the industry and a promising newcomer. The modem on the left is the Omnitec 701A and originally cost more than $400. It handles both TTY and RS-232 inputs and can be directly connected (hard wired) to the phone line; it also provides half and full duplex switching. Used ones can be had for about $150. On its right is the new Omnitec 501A—specifically made for the model 33 TTY. It is available fully assembled for $150, and as a semi-kit for $100—all PC board wiring complete, it just needs to be placed in its cabinet. It too provides both half and full duplex. Avoid hobby-type modems which do not have a duplex switching option directly available on the front or rear.

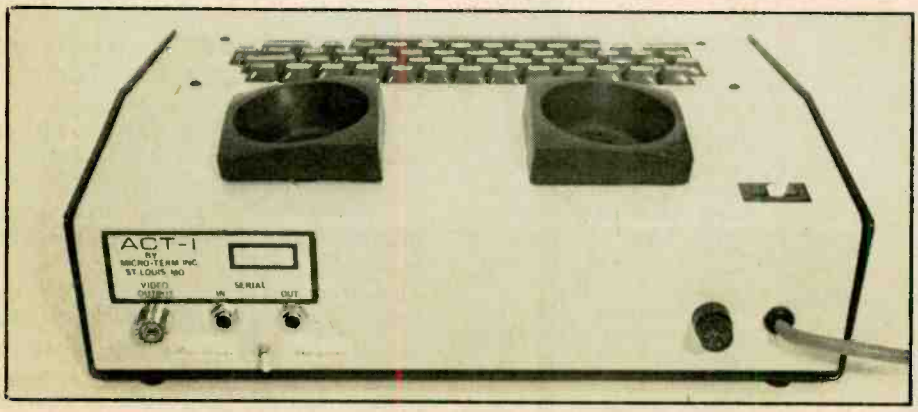
have called it the "Irving rate," the "Gloria rate," or the "9.09 rate." We call it *baud rate*, and a 110 baud rate is always 8-level TTY speed.

Trouble is, the TTY is capable of printing a maximum of 100 words per minute typing rate, which is fine for someone typing away, but slow when getting information back from a computer.

Though there are printers capable of displaying more than 100 words per minute they cannot print faster than the information is transmitted, and the limitation remains the speed at which the ASCII characters are transmitted. But, the ASCII format applies to the sequence of the eight bits making up the character and parity (a self-checking feature). If each bit were shortened each character would take less time to transmit, and that's exactly what is done. By general convention, for most personal and time-share *high speed* terminals the character bit rate is shortened from 9.09 msec to 3.3 msec., Almost three times as much information may be transmitted within a given time interval as compared to a 110 baud TTY. If we find the reciprocal of 3.3 msec (1/.0033) we get an answer of 300, meaning a 300 *baud* rate. You will find most hobby CRT terminals such as the ACT-1 and ACT-2 to be 300 baud.

The fact that 110 baud means 100 words per minute and 300 baud means 300 words per minute doesn't mean there is a direct relationship between baud rate and words per minute. The close relationship is purely accidental. (If you get out the calculator and start multiplying you'll probably claim a 300 baud rate should produce less than 300 words per minute. The "error" comes in because the TTY signal has two stop bits which take up a total of 18.18 msec. The complete TTY signal is 11 bits; start, 8 characters with parity, 2 stops. The 300 baud system has only one stop bit—ten bits total for the character—so the stop is 3.3 msec,

(Continued on page 104)



This actual prototype of an ACT-2 uses an older ACT-1 (hence the label) with a built-in modem for interfacing to the telephone lines. The video output feeds a TV monitor (CRT) and the two pieces make up a complete terminal. Inputs and outputs are RS-232 and when phone plugs are inserted the modem is automatically disconnected. A switch for full duplex or half duplex is located directly under the phone jacks. Using the modem is just a matter of pulling the plugs and then placing the handset in the coupler.

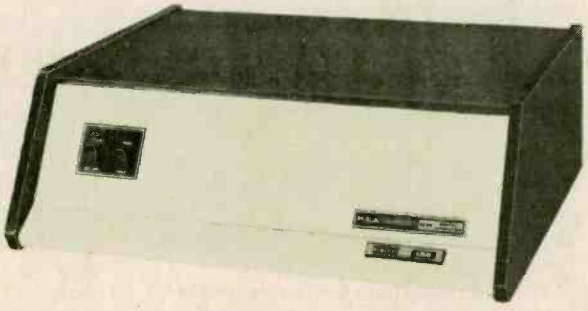
E/E PREVIEWS...

The Heath Home Computer Systems

Flexibility is the keynote as these new kits can be scaled from home and hobby to industrial use.

Heath's H8 computer has been designed with the hobbyist in mind. It is built around the hobby's most popular microprocessor, the 8-bit 8080A. The H8 also features a built-in 1K x 8 ROM which contains a monitor program. The front of the H8's panel contains a 9 digit, 7 segment octal display.

Heath's top of the line H11 is a 16-bit digital computer. The H11 utilizes a 16-bit central processing unit (fully wired and tested) with 4K x 16 dynamic RAM; the memory expandable to a full 20K. Remember, this is a 16-bit system—so the basic memory is equivalent to 8K in an 8-bit memory board.



Heath is now making the LA36 DEC Writer II available for use with their new computer systems. The LA36 features an ASCII encoded upper/lower case keyboard with 95 printable characters. The terminal can operate on either full or half-duplex, and has a parity check on output.

CIRCLE 31 ON READER SERVICE COUPON

On a warm spring day a few months ago we packed off the ELEMENTARY ELECTRONICS staff to a wedding at Benton Harbor, Michigan. Right! That's the home of Heathkit, and the wedding was between Heathkit and the Digital Equipment Corp., more generally known as DEC. Now when you have two giants getting together, Heathkit of electronic kit renown and DEC, one of the biggest names in microcomputers whose PDP-11 is considered by even the Pentagon as the best designed computer system, we're entitled to expect some new and impressive breakthroughs in personal computer kits.

Well, we got more than we ever expected, or dreamed was possible in kits. Basically, Heathit and DEC have come up with a system concept that can be scaled to accommodate any needs, from hobby/personal computing to educational, small business or industrial use.

Top of the Line. The Rolls-Royce of the new Heathkit line is their H-11 Digital Computer which features the prewired DEC LSI-11 microcomputer module. With a teletype interface the Heathkit H-11 is essentially a PDP-11/03 minicomputer, which uses DEC software such as the DEC BASIC and FOCAL languages, PAL-11 assembler, on-line debug, etc. This all might sound at the present time like a lot of gobbly-gook, but those who have any background in using minicomputers realize that we are talking about the general availability of software (programs) from DECUS, the DEC user's organization. In fact, Heathkit makes a whole new ballgame out of personal computing because the hobbyist no longer ends up with a "black box" for which he must now locate software. The H-11 comes complete with the BASIC and FOCAL higher languages, editor, etc. Just this package alone will give you computer facilities exceeding those of many schools with extensive computer programs. Fact is, the average hobbyist will probably end up with a lot better computer installation than his son uses in school.

Heath Support. Just as Heathkit supports the builder with software at the time of construction, so too will they support the user in the future through self-instructional programming courses and a Heath User's Group (HUG) which will share new programs among users of the H-11.

The mail-order price of the H11 with

its software package is $1295. Accessories include a serial interface ($95), parallel interface ($295) and a 4K x 16 static RAM (Random Access Memory) ($275). Keep in mind the H11 is a 16 bit system, so 4K memory really is equal to 8K in the typical hobby/personal computer.

A Computer for Everyone. For those who find the H-11 somewhat expensive Heathkit also showed their 8-bit digital computer called the H8. The H8 is built around the 8080A microprocessor and is configured for 32K of memory with a total capacity of 65K addressable memory. Unlike most other 8080A personal computers which are "black boxes" with front panel consoles that require initial keying by hand of the loading program, the Heathkit H8 computer has a built-in monitor program in ROM (Read Only Memory) for controlling the front panel and load-dump operations.

Speaking of the front panel, it's like nothing we've seen before on a hobby/personal computer using the 8080A. Firstly, the H8 has a 16-digit keyboard for entry of data and control functions. A 9-digit, 7-segment octal display can show the register and memory contents, while a built-in speaker and LED status lights permits the user to monitor machine states. Again, Heathkit doesn't leave you stranded with a "black box."

The H8 kit sells mail order for $375 and includes a fully wired CPU (central processing unit), assembly and operations documentation, and all systems software on audio cassette. Accessories —which many of you must use—include an 8K memory board with 4K of static RAM (Random Access Memory) for $140, a 4K expansion chip set for $95, a serial interface board with 1200 baud (very fast) audio cassette interface for $110, and a three port parallel interface for $150.

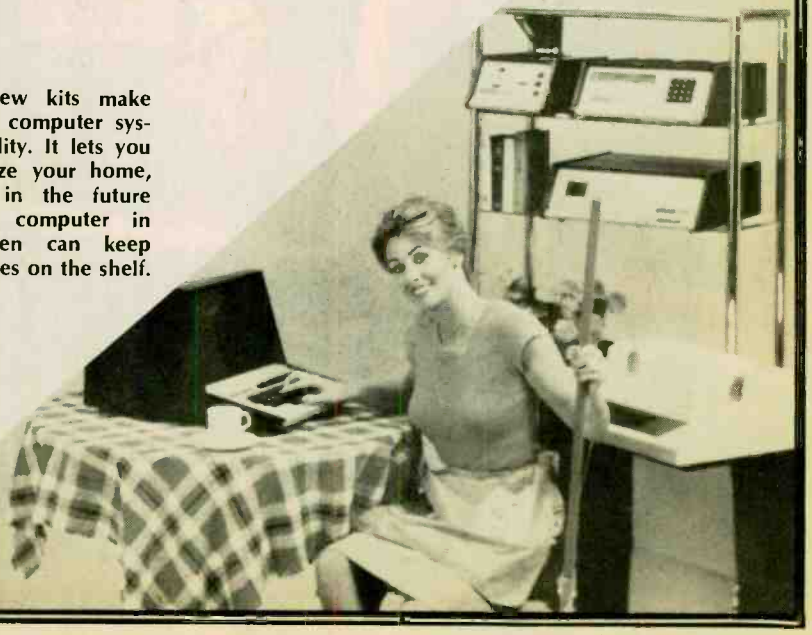
Talking To Your Computer. Okay, you've got a computer, now how do you talk to it? If you still want to take the kit route Heathkit has a 12-inch CRT terminal called the H9 which sells mail order for $530 including the cabinet. The H9 utilizes the full 67 character ASCII keyboard with a 12-line 80-character format, cursor control, batch transmit and a plot mode.

The standard serial interface (connection to the computer) includes EIA, TTL, and 20 mA loop (for teletype). The Baud rate is selectable from 110

(Continued on page 100)

The H9 alphanumeric video terminal is designed to accompany the H8 and H11 computers, but will work with any digital computer. The H9 features a full 67 key ASCII keyboard with a 12-line, 80-character format on a 12-inch CRT. It also features: an option of four columns of twelve lines—20 characters wide, a cursor control, batch transmit, and plotting ability.

The H10 Paper Tape Reader/Punch Unit is intended for use with the H8 and H11 computers. The H10 is a mass storage peripheral unit that will also function with all other digital computers. It uses the standard size roll or fan folded tape. The reader section reads tape at 50 characters per second (cps).



Heath's new kits make the home computer system a reality. It lets you computerize your home, and live in the future today. A computer in the kitchen can keep your worries on the shelf.

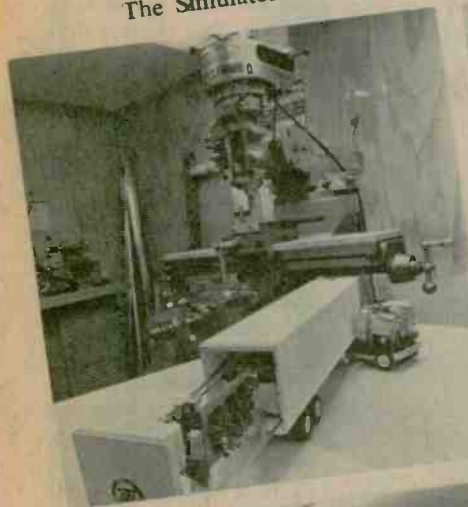
Master Truckers Learn On Mini-Trucks

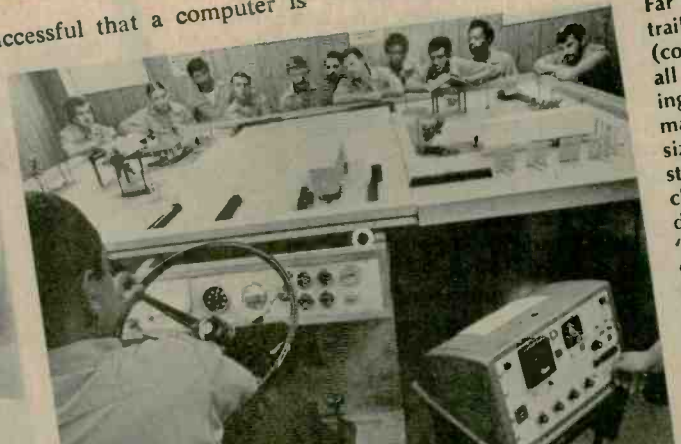
Electronic tiny trucks teach beginning drivers, saving time and money.

☐ Student truck drivers at the Driver Training Institute, Brooklyn, New York, learn how to drive the big rigs using a radio-controlled truck simulator. The student drivers operate full-size controls, which send signals to the tiny radio-controlled trucks which operate on table-top roads, parking lots and highways. Herb Gruen, director of the Driver Training Institute says that four days on a Simulator equals more than two weeks of actual practice driving a full-size truck. "And it saves costly mistakes." Gruen adds. "The real trucks cost $25,000 and up."

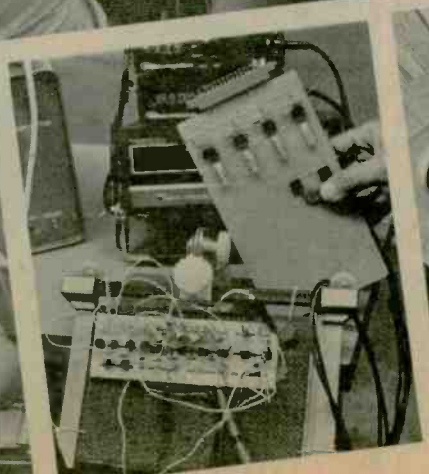
The Simulator has been so successful that a computer is being added to the system which will check the student's driving, making typewritten printouts of bad driving habits which must be cured, such as riding the clutch, driving in the wrong gear (big trucks have 13 to 30 different clutch. ratios—"speeds"), double-clutching, and so on.

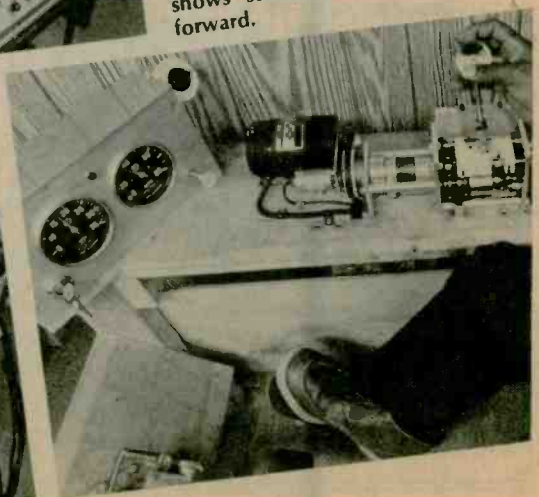
While the student "drives" using a full-sized wheel, accelerator, multi-speed clutch, and brakes, the tiny radio-controlled truck exactly duplicates his maneuvers, including his mistakes. Other students observe, along with the instructor, who can introduce vehicle failures which could actually occur on the road, oil-pressure loss, air-brake failure, etc. ■





Far left, minature tractor-trailer's body and cab (cover removed) carries all electronics for receiving and executing commands from student's full-sized driving controls: steering wheel, brakes, clutch, and gas pedal. Student at lower left is "backing" while watching toy truck action via rear-view mirror. Middle photo (below) show electronics. Lower right is the mock-up for multi-speed clutch practice. Picture at left shows student "driving" forward.





Las Vegas LED

Always win on the red with electronic roulette

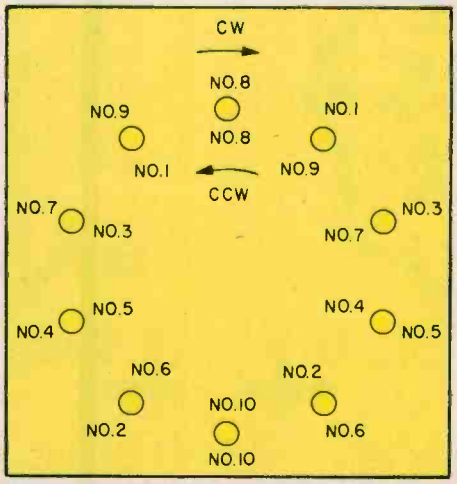
by Walter Sikonwiz

PEOPLE HAVE ALWAYS BEEN fascinated by games of chance, as diversions and obsessions. Inveterate gambler or not, chances are you'll really like *Las Vegas LED*, our version of that old favorite, Roulette. Here's more good news—you won't have to drop a bundle to cash in on the fun.

Las Vegas LED's spinning wheel of fate is a revolving dot of light, provided by a ring of ten LEDs. A glance at the photographs will show you that play is governed by three controls: *Accelerate, brake,* and *decay*. You start by pressing the *accelerate* button, which causes a red dot of light to revolve at an ever-increasing rate until a terminal velocity is reached. If you release *accelerate,* the spinning light will gradually coast to a standstill. The rate of deceleration is determined by the *decay* control. Pressing *brake* while the light is coasting causes a more rapid, but not instantaneous, halt to the spinning.

At least two games are possible, with this control format. Using a little imagination, you can probably devise more. The first possibility is similar to standard Roulette. A player presses *accelerate,* then releases it, and hopes that the number he has predicted beforehand will be the one at which the light ultimately comes to rest. Alternatively, the player starts the light into motion; then, upon the release of *accelerate,* he tries to stop the light on a number designated by his opponent, using only one pulse of the *brake* switch for this purpose. This second variation is quite a frustrating game; particularly so if various decay times are used. Decay times from about 1.5 to 15 seconds can be selected via the *decay* potentiometer.

How It Works. Before discussing construction, let's delve into the theory behind our Roulette game. We start with a very simple voltage-controlled oscillator. We then devise some means for converting the oscillation of our VCO into the apparent revolution of a spot of light (this might seem hard, but we'll see how simple it is later); the velocity of the light will be directly proportional to the VCO's frequency. The VCO's frequency, however, is proportional to the control voltage applied to it. We can produce acceleration of the revolving light if we cause the VCO's control voltage to gradually rise while the *accelerate* button is depressed. Conversely, deceleration of the light is synonymous with a gradual reduction in control voltage. How do we produce a control voltage that behaves in such a manner? We can charge and discharge a capacitor through resistors, and use the voltage across the capacitor as our control voltage.



Mount the LEDs in one of the two orders shown here, which one depending on whether you wish your wheel to "rotate" clock-wise (cw) or counter-clockwise (ccw).

Take a look at the schematic diagram. The voltage across capacitor C3 is our control voltage, and you can see how pressing S2, the *accelerate* button, charges the capacitor through R13. Once S2 is released, charge accumulated on C3 drains away through R13, R11, and *decay* control R12. Setting R12 to its maximum resistance produces the slowest rate of capacitor discharge; hence, as we'll see later, the revolving light will take a maximum amount of time to come to rest.

Brake switch S3 also discharges C3, this time through R14. Since the resistance of R14 is set to a relatively small value, the rate of discharge is quite rapid, and produces a quick cut in the speed of the light. It is the voltage on C3 that is to be our control voltage. Transistor Q11, functioning here as an emitter follower, reads C3's voltage; and because the emitter follower configuration is used, Q11 will not significantly contribute to the discharge of capacitor C3. At Q11's emitter we now have a voltage proportional to that on C3, which is used to drive our VCO.

Unijunction transistor Q13, along with R16, R17, R18, R19, and C4, comprise a relaxation oscillator, the frequency of which is proportional to the input voltage present on the left-hand end of R16. We don't have the nice, linear, voltage-to-frequency conversion of fancier VCOs, but what we have serves our purpose well enough. The output signal of our VCO appears across R19, and is a series of short-duration spikes with an amplitude of a volt or two. Such a signal won't be acceptable to the circuitry that follows, so we first feed it to transistor Q12, set up so that only a small input signal saturates it fully. The resultant output signal, available at Q12's collector, is a well-defined series of negative-going pulses, approximately 9 volts in amplitude.

Now we convert the variable-frequency pulses from Q12 into the ap-

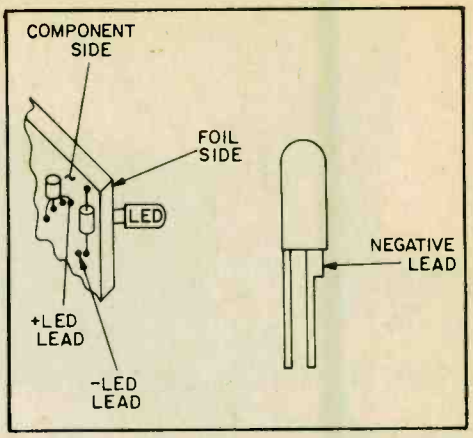
parent revolution of a dot of light by using an integrated circuit known as a decade counter. One essential characteristic of such an IC is that it has ten outputs, and at any given instant of time, nine of these outputs will be at a low potential, while the tenth will be high. The second important feature of the decade counter is that whenever its input, (pin #14 in this case), senses a specific change in potential (high-to-low in this case), the lone high signal advances serially along the outputs. Specifically, successive input pulses to IC1 will cause the high signal to advance from output #1 all the way to output #10, and then back to output #1 again. You might logically assume output #1 to be available at pin #1, and so on; however, this is not the case. We won't discuss the actual location of the individual outputs, because this information is available on the data sheet that accompanies this Radio Shack IC.

From the schematic, we see how Q12's output feeds IC1's input, pin 14. The outputs of IC1 (pins 1 through 7, plus pins 9, 10, and 11) connect to ten LEDs through buffer transistors Q1 through Q10. These buffers are emitter followers; they're necessary because the IC alone cannot supply sufficient current to illuminate an LED. Whenever a particular output is high, its associated driver transistor will supply current to a LED, and light it.

We arrange these LED's in a circle so that as we progress in a clockwise direction, starting at the LED associated with output #1, we encounter, *in proper consecutive order,* those LEDs associated with output #2 through output #10. When we feed an input signal to our IC, we see the LEDs fire sequentially so that a spot of light appears to be revolving in a counter-clockwise direction. One full revolution of the light requires ten input pulses, and the rate of revolution is in direct proportion to the input frequency.

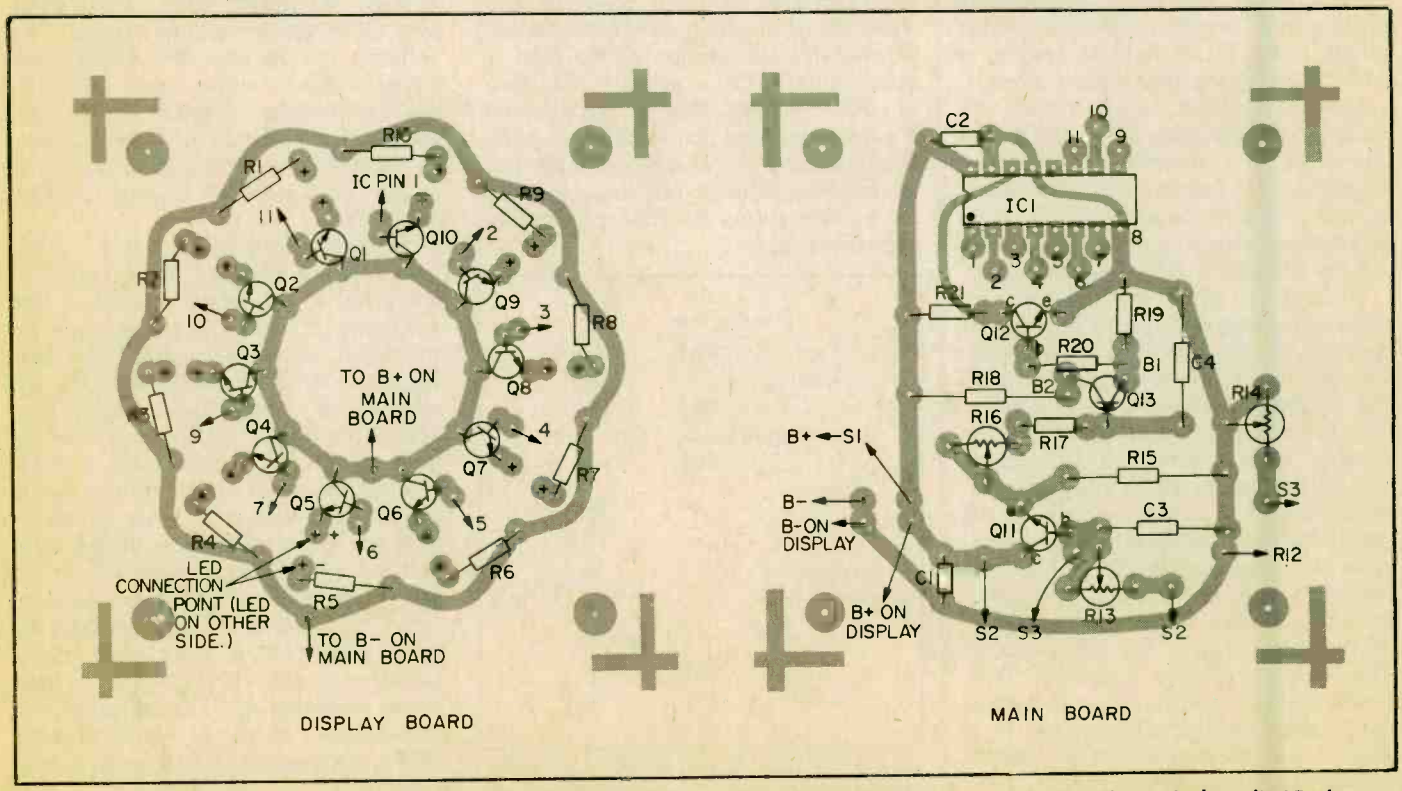
Let's review what we have: 1) the frequency of our VCO is controlled by the gradual charge and discharge of a capacitor; 2) the variable-frequency signal from the VCO feeds a decade counter, which drives ten LEDs; and 3) proper LED arrangement results in the apparent revolution of a single dot of light, with a velocity proportional to the frequency of the VCO. That's all there is to it.

Wiring. Since nothing about the circuit is critical, you may build it any way you wish. Perfboard construction is good. Alternatively, you might want to copy the PC layouts provided; the choice is up to you. A good place to begin construction is by drilling your-



LEDs are to be wired to the foil side, with their leads left long enough that their heads poke through the front cabinet (see text). Observe polarity; the negative leads of the LEDs are notched, as shown, and should be connected as both the pictorials and the schematic indicate.

cabinet to accept the ten LEDs. With a compass, lay out a small circle on a sheet of paper. If you intend copying the PC layout provided, the circle's radius should be exactly .9 inch. With a protractor centered at the circle's center, divide the circle into arcs at 36-degree intervals. Trim away any excess paper, leaving just the circle and a small border around it. Position the circle conveniently on your cabinet, and tape it down. With a fine, sharp awl make



The component sides of the main and display boards are shown in this pictorial view. Make certain that the main board's IC pins are all interconnected properly to the solder-points on the display board, as labeled. Connect, for example, IC pin 1 to Q10. Don't forget about R11 which is not shown and is wired point-to-point between R12 and S2.

slight indentations in the cabinet at the points where the circle is subdivided into arcs. Remove the circle, and at each indentation drill holes through which the LEDs can protrude.

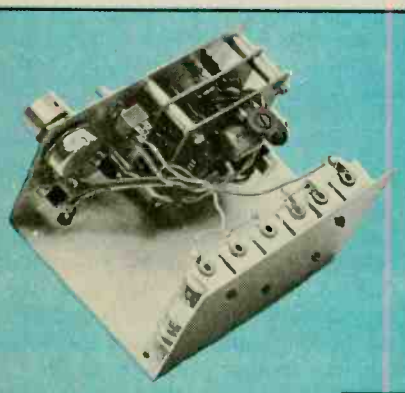
The drawing given shows the order of mounting of LEDs for both clockwise and counterclockwise revolution. The PC layout supplied for the display board provides counterclockwise revolution of the light.

The majority of the components mount on two circuit boards—either the main board or the display board. Even if you decide not to use a PC board, the PC layout provided for the display board may be helpful to you. Note that the arrangement is particularly simple, even though a good many parts are involved, because a radially symmetric pattern is employed instead of the usual rectilinear layout.

When installing components on the display board, follow the dimensional details in the accompanying drawings. Note that Q1 through Q10, and R1 through R10 mount on the component side of the board. LED1 through LED10 mount on the opposite foil side, with leads of such a length that the tops of the LEDs extend beyond the spacers and through the cabinet's panel. The semiconductors that mount on the display board are not especially fragile, but as is the case with all solid-state devices, excess heat can be damaging. Solder all connections quickly, using a 25-watt iron and fine, rosin-core solder. Twelve wires will run between the display board and the main board; ground, +, and the ten counter output leads.

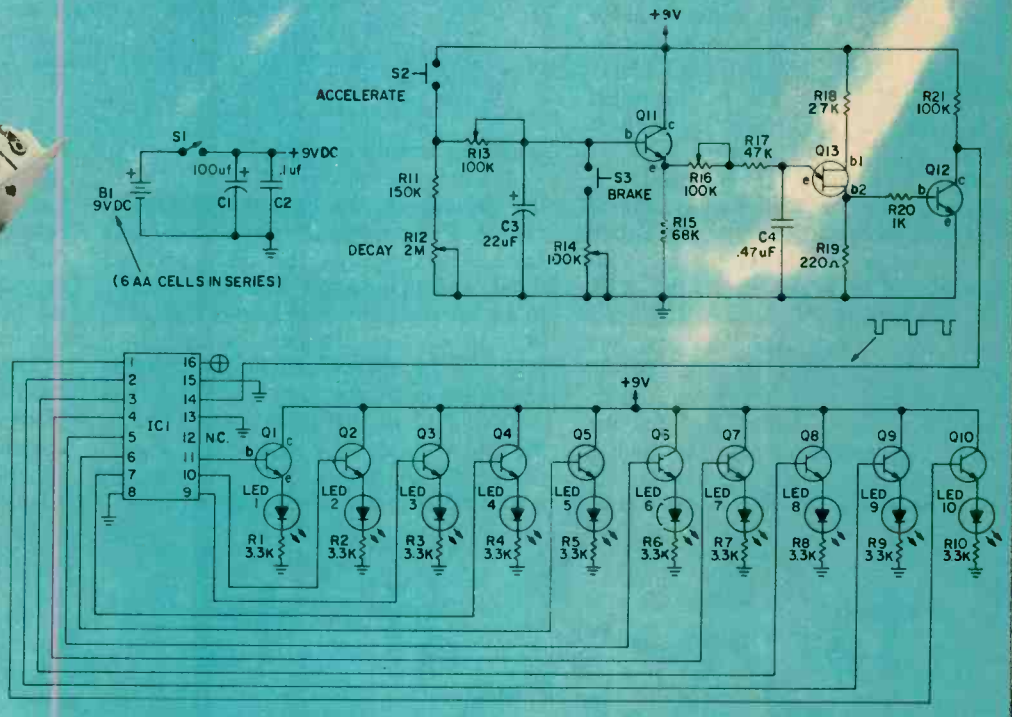
The main board contains the rest of the components. Note that if the PC patterns supplied are copied, the main board may be stacked right behind the display board. This makes for a very dense packing arrangement, but if you have ample space, the boards may be mounted in any manner you like. R11 does not appear on either circuit board; instead, it is wired point-to-point between R12 and S2. Be sure to use a 16-pin socket for IC1. This IC is a CMOS unit, and should be inserted into its socket only after all soldering is finished. If, in checking out your unit, you should find an error that requires re-wiring, remove IC1 before applying a soldering iron to the board.

In assembling the circuit, pay atten-



Inside view of Vegas LED showing stacking of PC boards.

Completed Vegas shown fully assembled, and installed in case.



PARTS LIST FOR LAS VEGAS LED

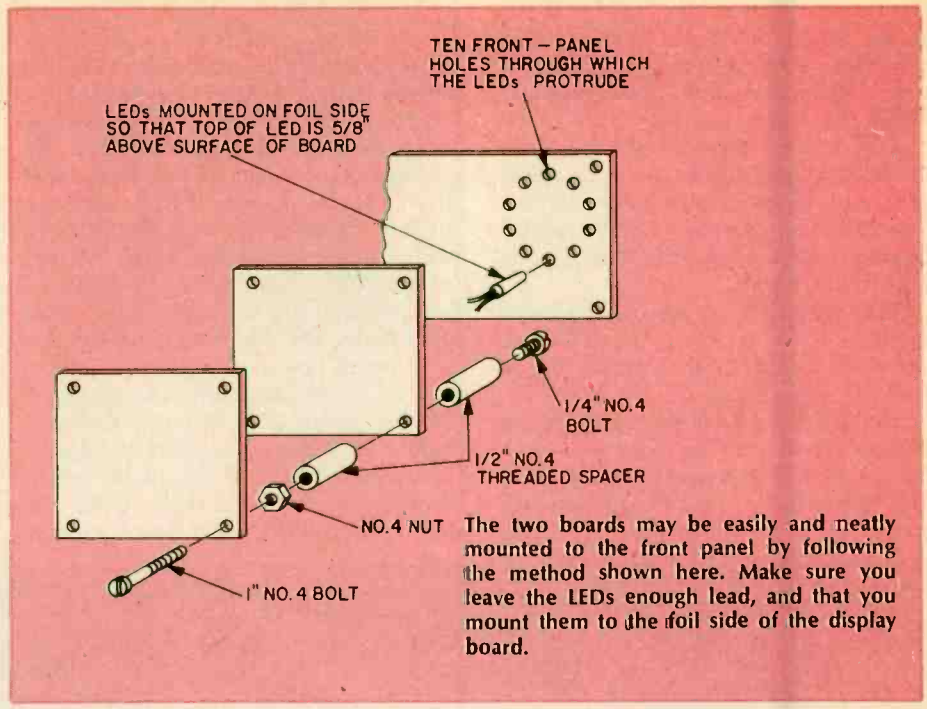
B1—Six AA (penlight cells) 1.5 VDC (Radio Shack 23-552 or equiv.)
C1—100-uF, 16-VDC capacitor (Radio Shack 272-955 or equiv.)
C2—.1-uF capacitor (Radio Shack 272-135 or equiv.)
C3—22-uF, 16-VDC tantalum capacitor (Radio Shack 272-1412 or equiv.)
C4—.47-uF, capacitor (Radio Shack 272-1071 or 272-1404 or equiv.)
IC1—Decade Counter/Divider CD4017 (Radio Shack 276-2417 or equiv.)
LED1-LED10—Light Emitting Diodes (Radio Shack 276-026 or equiv.)
Q1-Q12—2N3904 transistors (Radio Shack 276-1603 or equiv.)
Q13—Unijunction transistor (Radio Shack 276-2029 or equiv.)
R1-R10—3300-ohm resistor (Radio Shack 271-000 or equiv.)
R11—150,000-ohm resistor (Radio Shack 271-000 or equiv.)
R12—2-Megohm potentiometer (Radio Shack 271-093 or equiv.)
R13, R14, R16—100,000-ohm trimmer (Radio Shack 271-220 or equiv.)
R15—68,000-ohm resistor (Radio Shack 271-000 or equiv.)
R17—47,000-ohm resistor (Radio Shack 271-000 or equiv.)
R18—2700-ohm resistor (Radio Shack 271-000 or equiv.)
R19—220-ohm resistor (Radio Shack 271-000 or equiv.)
R20—1000-ohm resistor (Radio Shack 271-000 or equiv.)
R21—100,000-ohm resistor (Radio Shack 271-000 or equiv.)
S1—SPST toggle switch (Radio Shack 275-612 or equiv.)
S2, S3—SPST pushbutton switches, normally open (Radio Shack 275-1547 or equiv.)

Misc.—Battery clips (Radio Shack 270-325 or equiv.), IC socket (Radio Shack 276-1998 or equiv.), aluminum spacers, wire, solder, hardware, etc.

tion to the orientation of C3 and C1. Likewise, make sure the transistors and IC are correctly positioned. The LEDs must also be properly oriented. The leads of all these devices are identified on the packages in which they are sold. Because of the circuit's low power consumption, six 1.5-volt penlite cells in series will power it for a long, long time. A single 9-volt transistor battery could also be used.

Because this is not a finicky circuit, the operating controls and circuit boards can be mounted in any convenient way inside your cabinet, but be certain to allow sufficient room to accommodate the batteries. When you've completed cutting and drilling the cabinet, finish off the front panel with press-on decals. As shown in the photographs, LED1 through LED10 should be identified with numerals applied in a random order.

Final Calibration. After assembly is complete, only a few simple adjustments are necessary to put the circuit into operation. Turn R12 so that its resistance is at a minimum. Set R13, R14, and R16 to the midpoints of their ranges of rotation. Apply power, and depress the *accelerate* button. Within several seconds you should see a spinning dot of light. Adjust R16 for the desired maximum velocity. Too high a maximum speed blurs the image and spoils the effect, whereas a slow-poke display is equally undesirable.

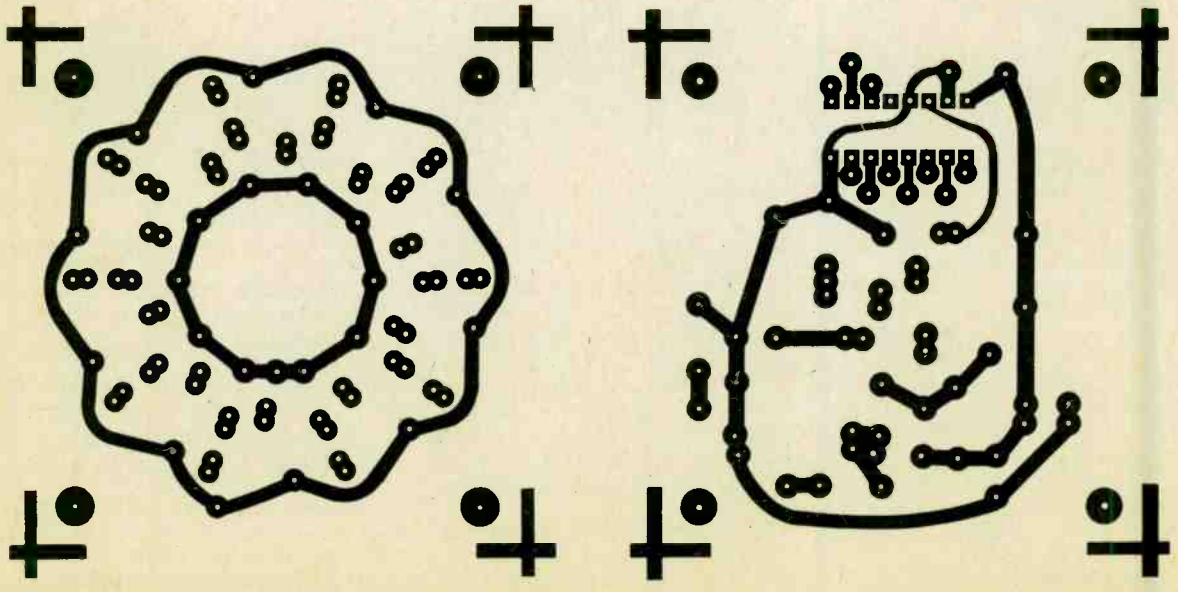


The two boards may be easily and neatly mounted to the front panel by following the method shown here. Make sure you leave the LEDs enough lead, and that you mount them to the foil side of the display board.

Release the *accelerate* button, and the velocity of the light will diminish rapidly. Press *accelerate* again, and then release it, repeating the cycle several times, and at the same time adjust R13 to get an acceleration response that you like. In general, the best position for R13 will be somewhere in the middle of its range of rotation.

Turn R12 so that its resistance (and the decay time) is a maximum. Press the *accelerate* button until the display reaches maximum velocity, then release it, and press *brake*. Note the rate at which the display is slowed down. Adjust R14 while alternately pressing *accelerate* and *brake* until you obtain a rate of deceleration that you like. A very rapid braking action is undesirable; the brake should diminish the velocity, not halt motion instantaneously.

The game may be used as already described in the opening paragraphs. However, just as dice can be found as constituent parts of many other games, so too can Las Vegas LED be adapted to games of your design. ■



Las Vegas LED uses two compact PC boards to keep its "wheel" spinning. The display board, on the left, takes advantage of a repetitious circuit to achieve a neat, clean symmetry of design. The main board, on the right, is also simple to etch and wire. Use these two full-size patterns as templates for your own Las Vegas LED.

CB XCVR CHECKOUT

- COBRA 138 XLR
- PEARCE-SIMPSON LION 40
- PRESIDENT JOHN Q.
- MIDLAND 77-882

☐ ELEMENTARY ELECTRONICS has been able to obtain more of the new 40-channel CB transceivers for review, and presents the test reports here. These units are not prototypes, but are "stock standard," the same as the transceivers that you can buy over the counter. If you don't find the particular unit you are interested in reported on here, check the newsstands for the 1977 edition of the CB BUYERS GUIDE.

• COBRA 138 XLR

$349.95 (Dynascan Corp.)

General Description: A 40-channel AM/SSB transceiver for mobile and PA operation. Fine tuning ± 1.5 kHz is provided. Power supply is 12 to 13.8 VDC with negative or positive ground. Overall dimensions are 2⅜-in. h x 7⅞-in. w x 10½-in. d. There are front panel controls for Channel Selection, Volume, Squelch, AM/LSB/USB, RF Gain, Voice Lock, Dynamike, Tone, LED Dimmer, and switches for ANL/Noise Blanker, PA/CB.

Receiver Section Test:

Input Sensitivity	0.3 μV AM
Adjacent Channel Rejection	67 dB

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AGC Action	8 dB
SSB Opposite Sideband Rejection	50+ dB
Input Level for S9	20 μV

Transmitter Section Test:

AM RF Output	4 watts
SSB RF Output	11 Watts P.E.P.
Modulation to 85%	yes
Relative Sensitivity for 85% Modulation	—39 dB max.
Modulation Limited to 100%	yes

Editorial Remarks: A double conversion receiver with jacks for external and P.A. speakers, LED digital channel indicator, S/RF-output meter. ■

• PEARCE-SIMPSON LION 40

$249.95 (Pearce-Simpson, Inc.)

General Description: A 40-channel AM transceiver for mobile, PA, base operation. Delta tuning ± 1.5 kHz is provided. Power supply 12 VDC to 13.8 VDC with negative or positive ground. Overall dimensions are 2½-in. h x 7⅛-in. w x 9½-in. d. Front

CIRCLE 69 ON READER SERVICE COUPON

panel controls and switches for Channel Selector, Volume, Squelch, RF Gain, Tone, SWR Calibrate, S/RF/SWR Meter, ANL, Noise Blanker, PA/CB, CB thru PA Speaker, and Delta Tune. Standard accessories are microphone, mobile mount, DC power cable.

Receiver Section Test:

Input Sensitivity	0.6 μV
Adjacent Channel Rejection	62 dB
AGC Action	9 dB
Input Level for S9	300 μV

Transmitter Section Test:

RF Output	3.7 watts
Modulation to 85%	yes
Relative Sensitivity for 85% Modulation	—32 dB
Modulation Limited to 100%	yes

Editorial Remarks: The Pearce-Simpson Lion 40 has a relative reading S-meter, double conversion receiver, external and PA speaker jacks, and S/RF output meter. ■

• PRESIDENT JOHN Q.

$169.95 (President Electronics, Inc.)

General Description: A 40-channel AM transceiver for mobile, PA operation. Power supply 12 to 13.8 VDC with negative or positive ground. Overall dimensions are 2⅛-in. h x 6¼-in. w x 9⅜-in. d. Front panel controls and switches for Channel Selector, Volume, Squelch, Microphone Gain, Panel Light Dimmer, PA/CB, ANL, Local/Distance Sensitivity. Standard accessories are microphone, mobile mount, DC power cable.

Receiver Section Test:

Input Sensitivity	0.4 μV
Adjacent Channel Rejection	51 dB
AGC Action	11 dB
Input Level for S9	40 μV

Transmitter Section Test:

RF Output	3.8 watts
Modulation to 85%	yes
Relative Sensitivity for 85% Modulation	—35 dB
Modulation Limited to 100%	yes

CIRCLE 71 ON READER SERVICE COUPON

Editorial Remarks: The President John Q. has a relative reading S-meter, double conversion receiver, external and PA speaker jacks, LED digital channel indicator, and S/RF output meter. ■

• MIDLAND 77-882

$199.95 (Midland Communications Co.)

General Description: A 40-channel AM transceiver for mobile, PA oper-

(Continued on page 101)

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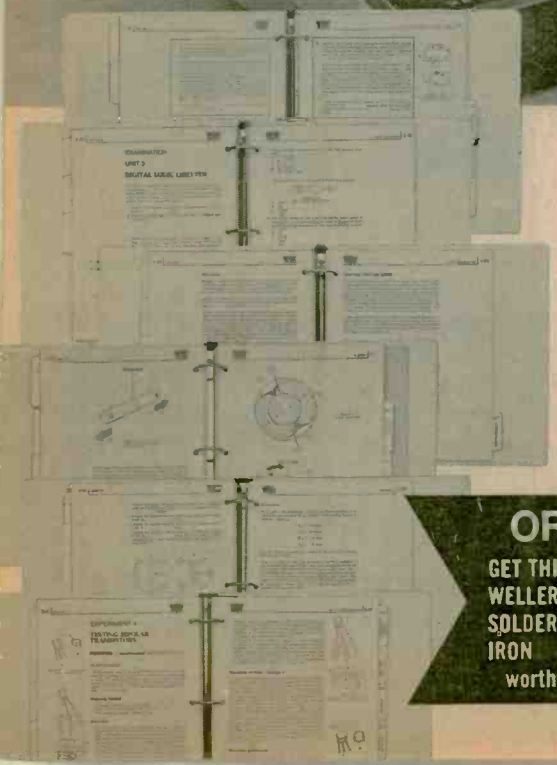

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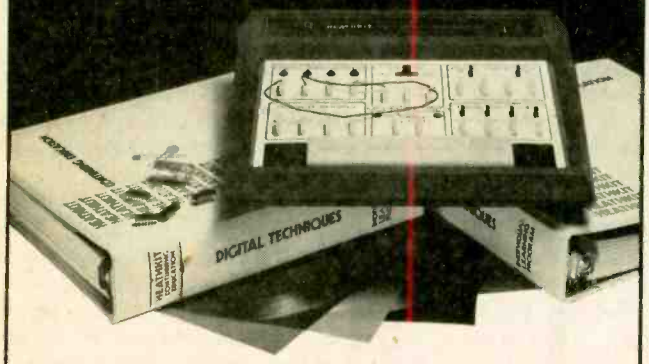

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ED-105A

FLASHMATE– THE PHOTOGRAPHER'S DREAM

Photoflash problems vanish with this easy-readout solid-state meter.

Frank I. Gilpin

☐ Any photographer, amateur or pro, will tell you the biggest bane of his life is figuring exposures for electronic flash photography. *If* you know the manufacturer's guide number for your flash unit, and *if* that number is close enough to being accurate for your production line unit, and *if* you can remember it from one shooting session to another, and *if* you remember how to use it, and *if* your flash is fully charged, and *if* you use straight, harsh flash instead of bouncing it, and *if*. . . . Well, flash photography is very often *iffy*.

Theoretically, you divide the guide number by the number of feet between the flash and subject, and the answer you get is the f-stop. This has to be figured for every shot, if you move between shots and this guide number is only good for one film type. Again, it gets pretty iffy. There are, to be sure, flash meters on the market, but the least expensive one I know of costs nearly $100, and they are all rather bulky.

The answer to these problems is Flash-Mate. It's smaller than an Instamatic camera, inexpensive to build, reliable and accurate, and easy to build, with readily-available parts. It takes all the IF variables in stride, and gives you the right f-stop for *any* flash at *any* distance and for *any* film type from ASA 10 to ASA 400. Flash-mate can be either of two basic types of meters. One, called an *ambient* light meter, measures the light output of your flash, aimed right at it. The other type, for measuring *reflected* light, is aimed at the subject and reads the light reflected by the subject. Your Flash-Mate can be calibrated for either type, as you choose.

How Circuit Works. The silicon phototransistor used as the light-sensing element in Flash-Mate has a very high resistance to ambient light, therefore the unit will work effectively under a wide range of lighting conditions, even including sunlight. The *sudden* light provided by the electronic flash causes a sudden drop in the phototransistor's resistance. This sudden drop in resistance pulses the trigger circuit of Q2-Q3. This pulse allows Q3 to charge capacitor C2 to a value proportionate to the intensity of the energy-producing light striking Q1. The value of this charge on C2 is then measured by FET Q4, and indicated on the meter. Because of the high input resistance of the FET, C2 does not discharge for several minutes and you have plenty of time to take a reading.

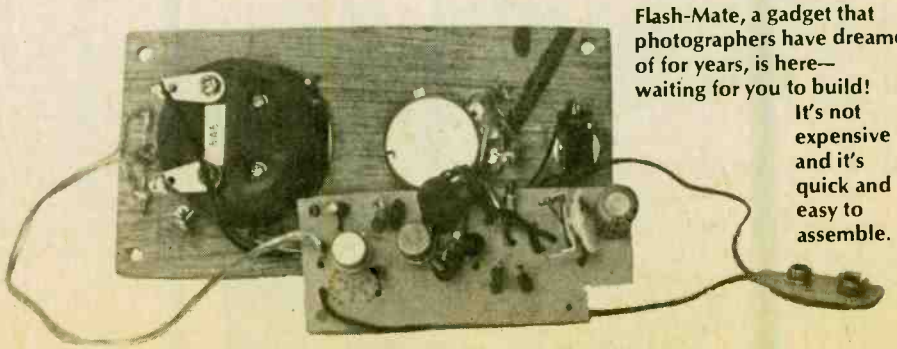
A discharge path for the meter and C2 is provided by R4 and S1. The switch turns the unit off and simultaneously discharges C2, leaving it ready for another reading, in about two seconds.

Sensitivity adjustments for various film types are effected by adjusting R8. A rotary switch could be used to connect a different trimmer resistor to the meter for each ASA number, but that would boost the cost, increase the size of the unit and limit the number of ASA numbers for which Flash-Mate can be calibrated.

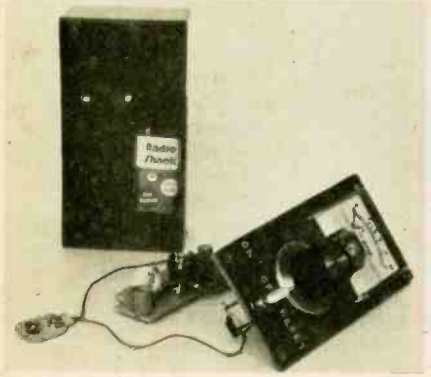
Potentiometer R8 can be calibrated for any ASA value, and as many as you want. You can even add more calibrations later. The only drawback to this compromise is that you must take care to set the pot directly on the reference marks before taking readings for a given ASA. If you exercise care and patience when calibrating the unit, this will present no problems in later use.

The two PNP transistors Q2 and Q3 are audio signal types and almost any high gain experimenter grade units will do. There are, however, few substitutes for Q1. It has a very high resistance to ambient light, has a reaction time on the order of 2.8 microseconds and has a wide range of illumination sensitivity. You can use a HEP-312, or a Clairex CL902, which also have the necessary reaction times and ambient light resistances required to keep the trigger circuit biased off until a bright, sudden light is sensed. The FET, Q4, is a P-channel, small signal unit and there are a number of substitutions possible, such as 2N5461 through 2N5465.

Assembly Options. You have a choice of assembly methods. Your Flash-Mate can be assembled on a perforated board using point-to-point wiring, or on a printed circuit board, for which the foil pattern is shown. Layout is not overly critical and you can vary the arrangement. Q1 is made with a clear epoxy lens which is quite durable, but an extra measure of protection can be provided by covering it

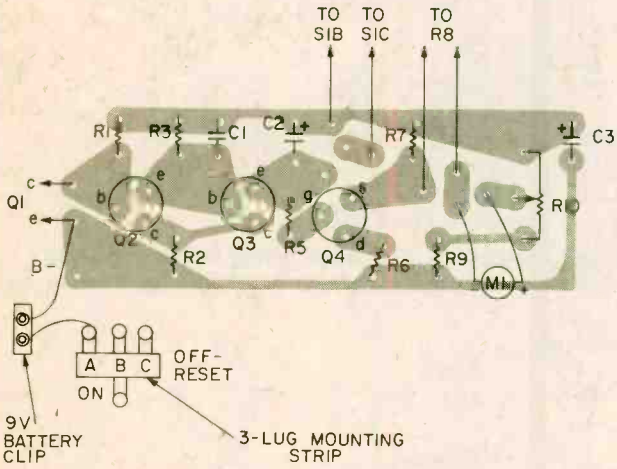


Flash-Mate, a gadget that photographers have dreamed of for years, is here—waiting for you to build! It's not expensive and it's quick and easy to assemble.



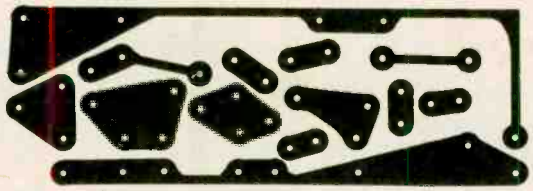
The layout of Flash-Mate's perf (or PC) board is uncritical and the arrangements of the components may vary. The roominess of the box allows for a clean layout

To calibrate Flash-Mate you will need an accurate electronic flash with an f-stop computer disc. Calibration can be done either for ambient light or bounce flash.



Here's the component side of Flash-Mate's PC board. The layout is simple and straightforward, which helps keep assembly time to a minimum. Flash-Mate is a great weekend project; accurate, unique, and goes together easily.

The foil side of Flash-Mate's board is quickly etched, especially if you use this full-size pattern. You could reduce or enlarge this as size and layout are not critical in this circuit.



with a clear pilot light lens or other clear plastic dome. The phototransistor can be mounted in several ways. You can press-fit it through a rubber grommet in the front panel of the cabinet, epoxy it through a hole, or it can be mounted on the chassis board so that it is rigidly suspended behind a hole in the front panel.

After all components are mounted and wired to the chassis board and connected to M1, R8, Q1 and S1 on the front panel, check to make sure all polarities are correct. Remember that when the chassis board is mounted in the cabinet, you have to be able to reach R10 to make adjustments. If the shaft is slotted you can drill a small hole in the cabinet facing the adjustment slot in the trimmer.

Some potentiometers have a knurled plastic wheel for adjustment which can be manually roated regardless of its mounting position.

When you are sure all is in order and you have double checked your wiring, apply power to the unit with S1. Turn R8 fully clockwise for least resistance and adjust R10 until the meter needle rests on zero. After this one internal adjustment, you can close the cabinet, screw down the front panel and prepare for the calibration procedure. You'll need a tape measure, a tripod and a flash unit.

To calibrate Flash-Mate either for ambient readings, or the reflected light reading mode, you will need a reliable electronic flash with an f-stop computer disc. You should also be sure the unit is charged fully, or has fresh batteries.

Ambient Light Reading Calibration. Set the flash computer to ASA 400. Determine the distance-from-subject necessary for an f-stop of f22. For instance, if your computer says a distance of three feet for f11, two and a half feet for f16 and 18 inches for f22, place the meter on a table and the flash mounted on a tripod exactly 18 inches in front of it. Carefully remove the clear plastic meter cover. Turn on the meter and set R8 fully clockwise and after a few seconds to stabilize, fire the flash. The meter needle should travel all the way upscale. Adjust R8 until the needle rests exactly on the uppermost reference mark of the meter scale. Label this spot "f22." Reset the meter with S1 and consult your flash computer once more to determine the distance for f16. Measure off this distance, set the flash at that spot and fire it at the flash meter. The needle should rest at a spot lower than the first. Mark this spot on the meter scale "f16." Take care not to disturb the setting of R8 during this calibration step.

Follow this procedure all the way through the scale to f2, remembering to reset the meter after each reading. When you've finished this step, replace the cover on the meter face and label the panel adjacent to R8's indicator knob "400."

This completes the calibration of the meter scale for all ASA values and the calibration of R8 for ASA 400. Select the next highest ASA on the computer and find the distance for an aperture of f16. Set the flash that distance from the meter and fire it. Adjust R8 until the needle rests exactly on the previously established mark for f16. Now mark the panel adjacent to R8's indicator knob and label it for the ASA number used to determine the distance. The meter is now calibrated for that ASA. Repeat this step for each ASA value desired. I have my meter calibrated for 25, 64, 80, 125 and 400, the five films I use most, but I can easily add more at some later date by using a reliable flash and the above procedure.

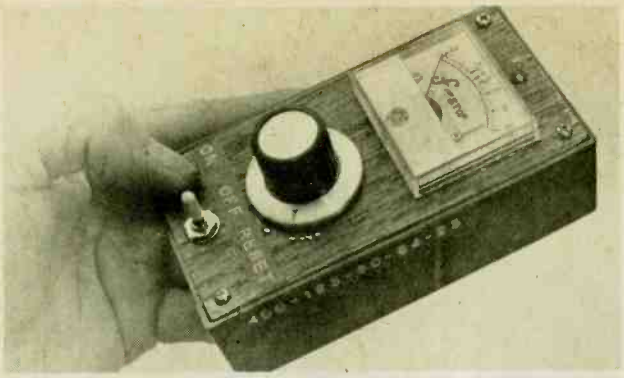
Reflected Light Calibration. The best situation is to find any wall which is an 18 percent gray, but any neutral color wall, or off-white bedsheet will do. In this procedure, the wall (or a sheet tacked up on a wall) becomes your "subject." Using the reference flash

unit's computer to determine the first distance for f22 at ASA 400, place the meter and flash this distance from the wall. Both the flash and meter are aimed at the same spot on the wall. Fire the flash from just above and a few inches behind the meter to avoid "blinding" it with a strong sidelight from the flash. Mark the meter face for f22 and continue moving the meter and flash farther from the wall until f2 is calibrated. Repeat for other ASAs as in the previous step.

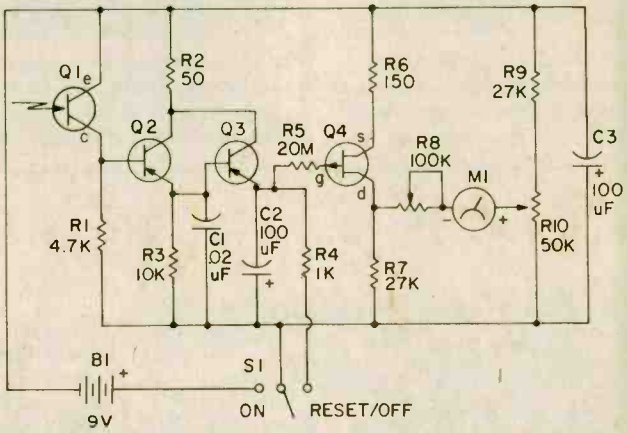
Using Flash-Mate. For the ambient light reading model, the procedure for taking a reading is as follows: Place Flash-Mate at the same location as the subject, facing the flash, and set R8 for the ASA of the film you're using and turn it on. Place the flash where you want it and fire it using the open flash button. Read the f-stop from Flash-Mate and set your camera to that f-stop.

To use Flash-Mate calibrated for reflected light readings, place it facing the subject in the same position as the flash. Fire the flash, take the reading from Flash-Mate and set your lens to that f-stop.

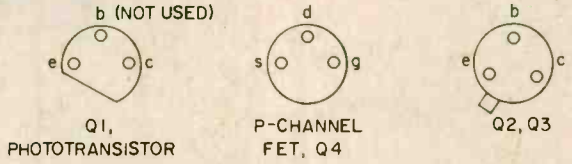
Personally, I prefer the direct, or ambient reading mode of calibration. For me, it offers more versatility. For example, your model need not be present to take a reading in advance. If you were going to shoot portraits using direct flash, bounce flash, or the popular umbrella reflector technique, you need only set up the flash and select where the model will sit or stand for the picture. Place Flash-Mate at that position, take a reading and set your camera lens. When the model arrives, all you need do is focus and shoot with no wasted time and wow, will you appear professional with no fumbling over f-stop computations or camera fiddling. If you plan to shoot from several positions during the session, these spots and their readings can be determined beforehand and noted. A piece of masking tape on the floor with the appropriate f-stop marked on it will remind you of the correct setting for that position. This technique is also handy for those special awards luncheons, handshakes, weddings, graduations, or any other planned events. You can go a little early before the event and take your readings and pick your spots from which to shoot and when that once-in-a-lifetime event occurs, you'll have a perfect exposure of it. ■



Flash-Mate is one useful gadget-bag stuffer. Forget about computing f-stops and concentrate on composing those pictures. The photo-sensitive transistor (above the meter) measures the light, and the meter reads directly in f-stops. The unit can be calibrated to read either ambient light or for bounce flash photography, depending on your own artistic preferences.



Schematic for Flashmate circuitry. Be sure when wiring in the transistors that you carefully observe lead keying, and always avoid allowing them to heat too much.



PARTS LIST FOR FLASH MATE

C1—.02-uF capacitor (Radio Shack 272-1066 or equiv.)
C2, 3—100-uF, 16-VDC electrolytic capacitor (Radio Shack 272-955 or equiv.)
M1—0-50 microampere DC panel meter (Radio Shack 22-017 or equiv.)
Q1—Photo-sensitive transistor HEP-312 or Clairex CL902 (Radio Shack 276-130 or equiv.)
Q2, 3—General-purpose PNP silicon transistor, 2N5139 or HEP-51 (Radio Shack 276-2034 or equiv.)
Q4—Field-effect transistor, P-channel, 2N-5460 or 2N5461 (Radio Shack 276-2037 or equiv.)
R1—4700-ohm, ¼-watt resistor (Radio Shack 271-000 or equiv.)
R2—47 or 50-ohm, ¼-watt resistor (Radio Shack 271-000 or equiv.)
R3—10,000-ohm, ¼-watt resistor (Radio Shack 271-000 or equiv.)
R4—1000-ohm, ¼-watt resistor (Radio Shack 271-000 or equiv.)
R5—20-megohm, ¼-watt resistor (if not available, use two 10-megohm, Radio Shack 271-000 in series)
R6—150-ohm, ¼-watt resistor (Radio Shack 271-000 or equiv.)
R7, 9—27,000-ohm, ¼-watt resistor (Radio Shack 271-000 or equiv.)
R8—100,00-ohm printed circuit board-mounting potentiometer (Radio Shack 272-220 or equiv.)
R10—50,000-ohm printed circuit board-mounting potentiometer (Radio Shack 271-219 or equiv.)
S1—Single-pole, double-throw switch (Radio Shack 275-613 or equiv.)

Misc.—Printed-circuit board kit (Radio Shack 276-1576 or equiv.); cabinet 6¼-in. x 3¾-in. x 2-in. or larger (Radio Shack 270-627 or equiv.); knob; hookup wire, hardware, solder, etc.

Note: Radio Shack part numbers above are for capacitors intended for printed circuit board mounting. If you use other type of construction such as perf board, axial-lead capacitors will be more convenient to mount.

COMPUTER READOUT

by Norman Myers, Computers Editor

☐Is a pocket calculator a kind of microcomputer? What can a microcomputer do that a programmable calculator cannot? Which should I buy? These are some of the questions you've mailed me. This month we will look at calculators, especially the programmable type. We will begin with an overview of calculators and recent electronic developments, then we will discuss details of what calculators can do by concentrating on the Hewlett-Packard HP-65, and finally we will make some observations about how microcomputers and calculators differ.

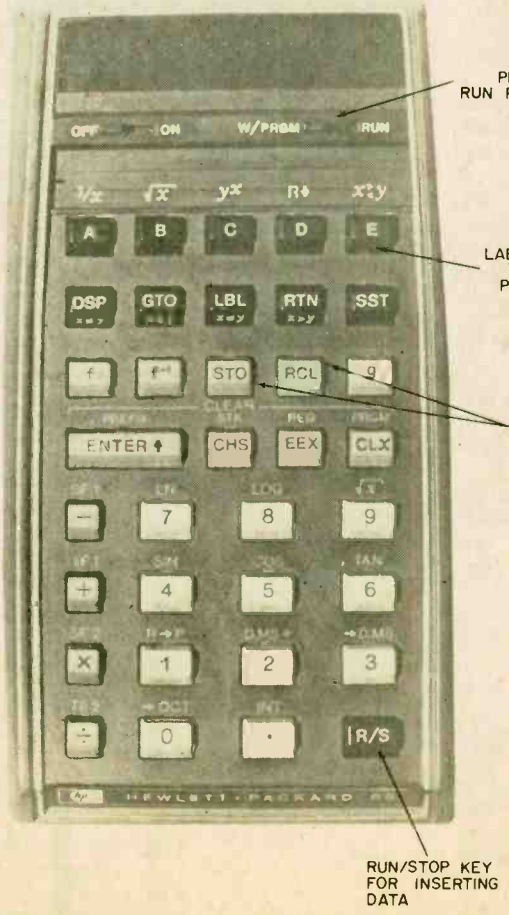
Scientific calculators contain various functions, such as squares and square roots, and are distinguished from business calculators which are generally simpler and have fewer functions. Scientific units have become very popular in the last two years for two reasons. Hand-held units have decreased to a fraction of their original price while their mathematical powers have increased. Power of these hand-held units has increased in spite of the cost cuts. The credit for increased power at less cost goes to microelectronics—the microscopic transistors and resistors packed by the hundreds on quarter-inch square chips. Lower power consumption and higher density of components on chips has made more storage available in random access memories (RAMs) and more computing power available in arithmetic units. Fabrication methods have been improved while sales volumes have increased, both of which allow prices to drop.

If all this can happen to hand-held calculators, we can imagine what may happen to microcomputers. We have reviewed several computers in this column that are no bigger than a book and contain readout digits and a keyboard. I expect the microcomputer market to become especially popular as microelectronics reduces computer sizes even more (probably to the size of hand-held calculators) and allows more and more storage. Prices may well drop and microcomputers may become $100 tools required by some high school and college courses.

By looking at what has happened to calculators, we can guess what will happen to microcomputers.

Pick-A-Peck. There are dozens of hand-held calculators on the store shelves. Among the best known are the Hewlett-Packard (HP) and Texas Instrument (TI) calculators. Texas Instrument's SR-56 ($100) has been a popular basic unit with most of the scientific functions you could want and it is programmable. By programmable we mean that a sequence of key strokes can be stored in the calculator and used repeatedly to solve problems. More on this later. The Hewlett-Packard HP-25 ($175) is another popular key-programmable calculator but both the SR-56 and the HP-25 cannot store programs after the unit is turned off. The storage medium is called "volatile" as opposed to "non-volatile." The HP-25C, however, keeps the program stored with microwatts of power from the batteries after the unit is switched off. A company called Casio has a similar battery supported non-volatile memory approach with their 101 calculator.

Non-volatile program storage is a most desirable feature to have in calculators; once you write and test a program you can use it many times over with confidence. Writing a program one day, then re-entering it a keystroke at a time into the calculator weeks later, leads to errors, besides being a bother. The classic calculator for program storage is the HP-65 which shook the world just three years ago by offering magnetic strips as the storage medium for programs. You write a program, enter a tape in a side slot of the HP-65, a motor pulls it through and out the other side. Your program is invisibly written on the magnetic strip like voice patterns are stored on a magnetc tape. The HP-65 allows programs to be stored for long periods and read back into the calculator for replay at any time. Engi-



The HP-65 is one mean, programmable machine from Hewlett-Packard. It was the first hand-held to offer magnetic-strip cards for memory storage and is truly a classic calculator. Programs may be stored on the cards and played back at any time in the future. Cards are simply entered into the slot on the side of the HP-65, and an internal motor pulls the card through and out the other side. This brought the ease, reliability and accuracy of programmability into the price range of many workers in science and industry. The calculator has 35 multiple function keys, a few of which are labeled in this photo. Each key is marked with its basic function, and with two others which can be chosen by the user. Add to this the programmable capability and you have great versatility. Once programmed, the HP-65 can run through complex number manipulations over and over again.

CIRCLE 57 ON READER SERVICE COUPON

neers, technicians, businessmen, and hobbyists all had versatility they had never thought possible. Today, a new calculator called the HP-67 ($450) offers over twice the storage (224 storage locations versus 100) and computing power of the HP-65 at about one-half what the HP-65 cost two years ago! Texas Instrument's SR-52 ($250) and the HP-67 both use magnetic cards for program storage and are thought by most to be the most powerful units available today. National Semiconductor's 7100 ($400) is expected to be on the market soon and will offer program storage of 4096 locations on read only memory (ROM) cartridges instead of cards. The cartridges will reportedly plug into the 7100 calculator. The user will, for example, be able to store about 40 programs of about 100 steps on each cartridge.

Printers Too. Printers are also becoming available for use with calculators. The HP-97 has essentially the same functions and storage capacity as the HP-67 but the 97 is a bit larger and includes a printer which records data and programs on a strip of paper. Likewise, Texas Instruments has a printer (the PC-100) to which their programmables can be conneected.

In summary, the input to calculators is through the keyboard, and the output is through the familiar LED displays or through printers, or both simultaneously. Now let's look closer at the classic, programmable, magnetic card calculator—the HP-65.

Classic HP-65. The HP-65 has 35 buttons or keys and most of the keys perform multiple functions. The basic function for each key is marked in black on the top of the key itself; but other functions are marked near the key in yellow and in blue. The key with the number four on it, for example, also has a blue 1/x and a yellow SIN associated with it. To make the key calculate a reciprocal, press the blue "g" function key followed by the blue 1/x. To get a sine function, press the yellow "f" key followed by the yellow SIN key. To get the inverse sine function, that is to "undo" the sine, press f^{-1} then SIN. More on functions later.

Numbers are stored and maniplated in the HP-65 in registers. Each number takes up one entire register and a number can be as large as 9.9999999×10^{99}. (Remember, 10^{99} is scientific notation which simply means the decimal point is moved 99 places to the right. 100 is 1.0×10^2.)

The register containing the number on the display is called the X register. It is one of four registers in an "operational stack," but only the X-register contents are displayed on the LED readout. The four registers are called X, Y, Z, and T, but could be called anything you like. The value of a stack is that it aids in solving equations by reducing the need to store intermediate results. This stack is used with the "enter" key. Suppose, for example, we want to calculate $(5 + 3) \times (7 + 9)$. The steps would be

Press	
5	5 put into X register and displayed
enter	5 bumped up to Y register
3	3 put into X register and displayed
+	X + Y = 8 put into X register and displayed
7	7 put into X, 8 bumped to Y
enter	7 bumped to Y, 8 bumped to Z
9	9 put into X
+	X + Y = 16 put in X and displayed, 8 drops down to Y
X (times sign)	X x Y = 128 put in X and displayed.

The calculation has been done in one smooth set of operations without having to think of storing and recalling intermediate results. Results can be displayed in "fixed" or scientific format. To get fixed format, for example, press "DSP . 3" (DSP is one key) to get three decimal places (10.234) on the display. For scientific notation, press "DSP 3" to get 1.023×10^1 on the display.

The HP-65 has nine addressable registers called R1 through R9 which can be used to store data. They are usually used to store constants or intermediate results from the X stack register. To store a number appearing on the display (and therefore in the X stack register) one presses the STO key then any number 1 through 9. The data will be stored in the selected register until over-written by another entry or until you turn off the calculator. To recover and use the stored digits, press the RCL (recall) key and the appropriate register number, 1 through 9. Recalling a number does not erase it from the register—a copy of that number is simply transferred to the X register. The HP-65 can also do a passel of fancy functions, like sine, cosine, logarithms, square roots, factorials, and more. These functions are needed in all types of engineering and design fields such as electronics, civil engineering, and architecture. The calculator with these functions allows the student, layman, and curious hobbyist to invent, experiment, and learn what can be done. Suppose, for example, that a designer says adding more sound absorbing items to your room cuts the noise by 20

The HP-65 and its supporting software. Packaged with the calculator are user aids such as reference booklets, instruction manual, pre-written programs—and a selection of pre-recorded, magnetic card programs.

SOME OF THE HP-65 KEYS AND THEIR USES

Keys	
+, −, ×, ÷	Arithmetic functions.
0 through 9	Used for entering data and with STO/RCL.
enter	Causes data to move up in stack registers as a computation aid.
DSP	Selection of number of decimal places.
CHS	Change sign.
STO, RCL	For storing and recalling data from any one of nine registers.
GTO	"Go to" key tells calculator where to start in a program.
LBL, A—E	Used to give names or "labels" to sections of a program.
RTN	Instructs calculator to return to start of program.
SST	Used to single step through a program.
R/S	Run/Stop used to stop program temporarily.
f, g	There are "f functions" marked in yellow on many keys, and "g functions" marked in blue on the same keys. Hitting f then a key is one function. Hitting g then a key is another. This gives many functions with few keys.

dB—what does that mean? Well, 20 dB just means 20 = 10 log R where R is the ratio of the new sound level to the old and "log" is the logarithm function. To find R, place 20 in the X register, divide by 10, press the yellow "f^{-1}" key, then the "log" key to get antilog (2) = R or R = 100. So the noise will be cut by 100 times.

Mathematics. The trigonometric functions in the HP-65 are sine, cosine, and tangent. These allow you to figure out the length of sides of triangles when the angles and one side are known. If, for example, the shadow of a tree is 40 feet long and the sun rays make an angle of 30° with the ground, the HP-65 will show you that the tree is 20 feet tall. There is a function that converts from octal code—the very numbering system many microcomputers use (remember, in octal, 07 is 7 in decimal, 10 is 8 in decimal, and 11 is 9)—to decimal code or vice-versa. This conversion function is made to aid computer programmers. The square (x^2) function on the HP-65 is useful in many equations but if some other power is needed besides 2, the calculator has a "y to the x power" function, where you specify any y and any x. There is also a factorial function, which sounds fancy but is easy to understand. If there are four horses in a race, it turns out there are 24 different ways they can be lined up crossing the finish line, where, for example, 2 – 1 – 3 – 4 is one way. The number 24 comes from 1 X 2 X 3 X 4 = 24 and the expression 4! (called four factorial) is just an abbreviation for 1 X 2 X 3 X 4. The HP-65 calculates factorials. Just put your number (4, 8, whatever) in the X register and press the "n!" key. How long would it take you to calculate 69! ? A calculator does it in about two seconds.

Both the HP-65 and HP-67 accept prerecorded programs via magnetic cards. The cards are fed into a slot on the side of the calculator and are pulled through by a motor. The user may also record his own programs onto blank tapes. This system allows programs to be saved and filed for later use so the calculator doesn't have to be programmed over and over again.

Texas Instruments announced a new line of programmable calculators just as this issue went to press. Above is the TI 57 ($79.95). This is a new, scientific programmable designed with the student user in mind. Rather than a simple instruction manual, which can be confusing to many first-time users of programmables, the 57 is complete with the book "Making Tracks."

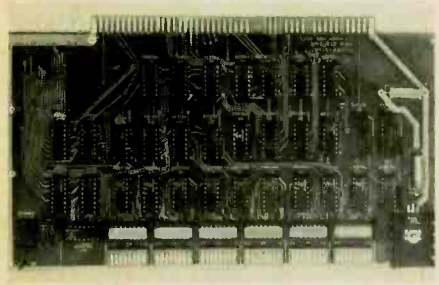
Programs. Programming a pocket calculator basically means one thing—a sequence of key stroke instructions are stored in the calculator's memory. When you want to run the program, you press the start key and the calculator runs through its memory of key strokes performing each function as it goes. You can imagine the stored program causing an invisible hand to be working the calculator keys in exactly the proper order to perform the calculation you need. Why have a programmable calculator? Because by putting the program in the calculator once, you can use it again and again with different numbers as inputs. Suppose, for example, you want to manufacture electronic games by special order and you have worked out a formula to give the prices you must charge your clients based on the number of integrated circuits in the game he wants built, the size of the order, the delivery date, etc. By programming the equation into the calculator, a price quote can be given to the client without having to go through the long formula each time. With the HP-65 (or HP-76, or SR 52) the program can be stored on a magnetic strip for use at any later time. Hewlett-Packard and Texas Instrument have written many useful and fun programs onto magnetic strips you can buy from their program library. One typical fun program is the game of NIM wherein you play against the calculator. After inserting the program via the magnetic strip, a number appears on the display. You subtract either 1, 2, or 3 from the number. The calculator then selects (via its program) whether to subtract 1, 2, or 3, then executes that subtraction as the display changes automatically. Then it is your turn again. The player (you or the calculator) reaching zero first loses. If the computer wins, it writes 55178 ("BLISS" upsidedown); and if it loses it writes 3507.1 ("I LOSE").

From all of the above discussion you must have rightly gathered one main point—programmable calculators can do a lot. Now answer this question: Which, in general, is more powerful and more flexible—a calculator or a microcomputer? The answer is a microcomputer. In fact, a calculator is really a specialized microcomputer where the various functions like sines and logarithms have been written as equations and pre-programmed onto ROMs inside the calculator. If a microcomputer has sufficient memory, you can program it to do anything a scientific calculator can do and more, but you cannot get a calculator to do all that a microcomputer can do. A microcomputer can be made to accept input data lines and to pulse data out to a teletype or to a control device; it can control your model railroad; keep inventory of your supplies and automatically write orders; play complex games like chess; and even generate sounds or tones through a speaker. A pocket calculator cannot do those things simply because it is not designed to. Convenience is the keyword. A press of a key gives a preprogrammed function, whereas with a microcomputer you have to write that program into memory and then you can use a single key to access it. With a microcomputer you have essentially unlimited potential but you have to build all the programs into it. Tune in next month for more micro mania. ■

The TI 59 ($299.95) represents a new advance in hand-held programmability, due to what Texas Instruments terms a "library module." A library module is a plug-in IC chip which can contain up to 5,000 programmed steps—more information than can be recorded onto 25 magnetic cards.

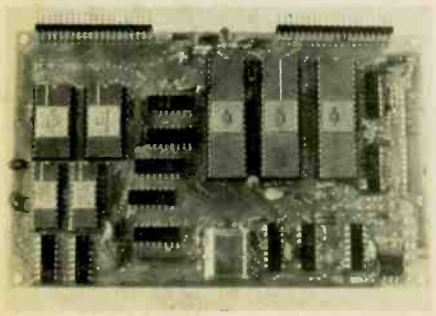
COMPUTER NEW PRODUCTS

Here in one place each issue of e/e you will find product information on the newest hobby computers and accessories.

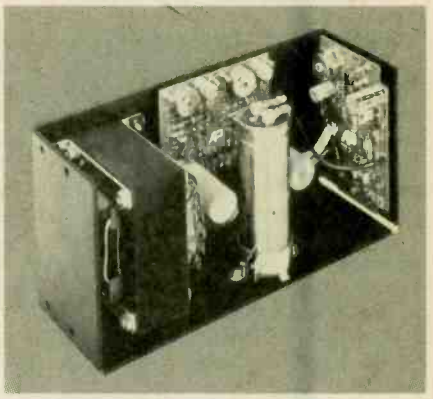


Auto-Boot Loader—RMQ Systems says the company's Power-Start auto-boot loader frees you from ever keying in a bootstrap program again. The simple action of pressing RESET on the front panel automatically loads your computer from your loading device—disc, cassette, paper tape or other medium. The device is compatible with the Altair 8800, and allows it to be run without the front panel. All that is needed is an ON/OFF switch and a RESET button. Power-Start is available as a complete auto-load board, with its own ROM, or it can be purchased without the ROM and used with your own ROM or PROM memory. It can be configured to execute a loading program located anywhere in your memory address space. Rewiring of your computer is not required; just plug into the backplane, like any other board. An on-board switch permits disabling of the board. Power-Start is available in two kit forms and two assembled versions: Model PS-1K is priced at $195; model PS-2K, the kit without ROM, is $165. Assembled model PS-1A costs $295; model PS-2A, also assembled but without ROM, is price-tagged at $265. RMQ Systems, 1044 University Ave., Berkeley, CA 94710. Circle 50.

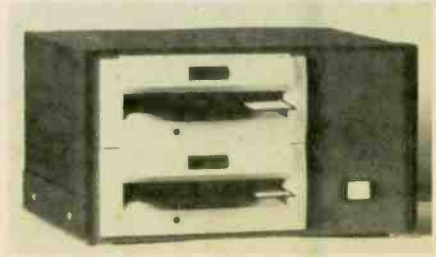
Keyboard Encoder—Radio Shack now stocks an ASCII Keyboard Encoder that utilizes the Shack's exclusive "Project-Board" concept. You purchase the printed circuit board with a complete, step-by-step assembly instruction manual and parts list. All necessary parts for assembly of the encoder, including a 63-key computer control keyboard, are available from Radio Shack. Or you may use parts from your own "junkbox" collection. The encoder can be used with TV typewriters, minicomputers, microprocessors, electric typewriters, or any other devices requiring positive or negative ASCII encoded alpha-numerical characters. Features include: repeat key to control all characters and symbols; negative-going or positive-going data valid strobe; latch outputs (stores last key code); shift and shift lock capability; true or false ASCII outputs; six extra control keys. The encoder handles an output of 833 characters per minute and has a repeat key rate of 208 CPM. An external power source of 5 VDC at about 500 ma is required. The project board with complete assembly and parts manual costs $14.95. All parts needed to assemble the encoder, including the circuit board, manual and keyboard, but excluding hardware and case, are available from Radio Shack for $57.80. Radio Shack, 2617 West 7th Street, Fort Worth, TX 76107: Circle 32 on Reader Service Coupon.



Super-Compact Computer — Microcomputer Associates' Super Jolt is one of the most compact single board computers available. It measures 4¼" x 7" and contains an 8 bit 6502 microprocessor, 1,024 bytes static RAM, 32 bidirectional and programmable I/O lines, a 1 megahertz crystal controlled clock, an interval timer, 4 interrupts including a timer interrupt and a non-maskable interrupt, three serial interfaces. The system includes a 20 ma current loop, RS232 and TTL, as well as 5,120 bytes of resident ROM program memory that includes a complete single pass Resident Assembler Program called RAP, a resident TINY BASIC interpretive language designed especially for JOLT systems and the 1,024 byte DEMON DEbug MONitor program. Super Jolt can function as a single card development system permitting assemblies to be made with only a single pass of a source program from a terminal or via a TTY paper tape reader. Programs can be debugged, and higher level language can be used. Single unit pricing for the Super Jolt card, fully assembled and tested is $375 without RAP and TINY BASIC ROMs, and $575 with the ROMs. Microcomputer Associates, 2589 Scott Blvd., Santa Clara, CA 95050. Circle 55.



DC Power Supplies—Adtech Power offers four TAPS Series triple output DC power supplies for microprocessor and other multiple DC power applications. All three outputs are isolated from each other so that either positive or negative can be grounded on any output. Adjustment of output voltages is accomplished by means of screwdriver adjust isolated wire-wound potentiometers. The units are constructed on an aluminum chassis with approximately 20% more heat sink area than on competitive units, according to Adtech. All units may be mounted in various orientations with various optional fasteners. Overvoltage is included in all units on the 5V outputs, and foldback current limiting is standard for all three outputs. Remote sense is also provided on the 5V output. DC outputs specs and prices: TAPS 1, 5V @ 4A, ± 12-15 @ 0.5A, $94.15; TAPS 2, 5V @ 6A, ± 12-15 @ 1.0A, $107; TAPS 3, 5V @ 9A, ± 12-15 @ 1.5A, $137; TAPS 4, 5V @ 12A, ± 12-15 @ 3.0A, $163. Units are also available ± 9-12V as an option. Other specs: regulation, ±0.1% for line and load with universal input of 115/230V ± 10%, 47-62 Hz; ripple, 5mV peak to peak maximum (typically 1mV); stability, ±0.2%; transient response, less than 50 microseconds. Adtech Power, Inc., 1621 South Sinclair Street, Anaheim, CA 92896. Circle 60 on Reader Service Coupon.



Floppy Disk—OSI's 470B floppy disk, an upgrade of the company's popular 470 model, features a GSI model 110 disk drive for 240K bytes single density storage. There's also a head load indicator and a

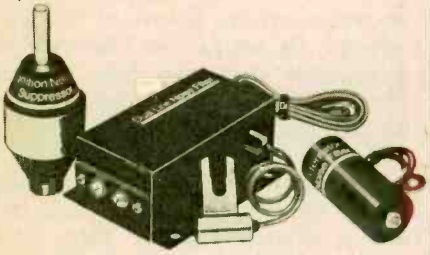
(Continued on page 101)

CB NEW PRODUCTS

e/e puts together in one neat package some of the newest CB rigs, antennas and accessories for you to use in CB contacts this year!

CB Filter System

The NFS-1000 Noise Filter System from Sparkomatic for use with CB transceivers and AM and FM radios, is a unique combination of filters designed to eliminate interfering noises from all vehicular sources including ignition spark, alternator/generator, other accessories, metal to metal contact. The unit effectively reduces noise levels without impairing engine performance or power. NFS-1000's special features are the dual line noise



CIRCLE 74 ON READER SERVICE COUPON

filter designed to filter the power line and eliminate residual noises. Accessories such as mechanical voltage regulators and electric fuel pumps produce interference in the form of an irregular "frying" sound. The filter contains both low and high frequency filtering circuits and is generally effective at these and all other disturbing frequencies. Also included are: an ignition noise suppressor, alternator noise filter, and generator noise filter. The NFS-1000 sells for $15.95. Get all the facts from Sparkomatic Corporation, Milford, PA 18337.

Twin Scale CB Meter

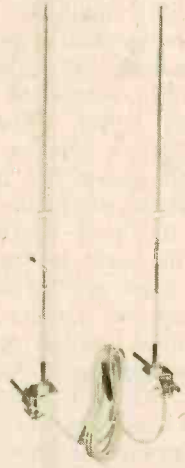
Here comes Mura's Model CBM-30 meter. A twin meter unit, there are separate power and SWR scales permitting simultaneous monitoring of RF output power and VSWR. The meters are sensitive d'Arsonval types with an SWR scale that has a range extending from 1:1 to 10:1 and can measure up to 100 watts with a plus-minus accuracy of 20%. The CBM-30 has an input and output impedance of 52 ohms and so does not disturb the impedance of the connecting coaxial cable. The unit can

CIRCLE 49 ON READER SERVICE COUPON

be permanently installed between the cable and the input to the transceiver with minimum insertion loss. By having a permanent installation the CBer can constantly monitor power and SWR to make sure that the transceiver/antenna combination always supplies optimum RF power output. No switching is required and both meter pointers are controlled by a continuously variable knob on the front panel. Calibration marks permit the user to return to any previously determined setting. Priced at $46.50. For further information, write to Mura Corporation, Westbury, NY -1590.

Co-Phased Antenna System

Designed especially for trucks. motor homes and recreational vehicles, and operable on all 40 channels, Avanti's AV-529 CB Antenna system consists of two 4-ft. fiberglass Avanti Racer antennas in a co-phased arrangement. This arrangement increases performance approximately 25% over a single roof-mounted antenna, and minimizes the problem of a



CIRCLE 73 ON READER SERVICE COUPON

skewed or shifted radiation pattern. The mounting assembly fits most mirror bracket arrangements including west coast types. It is readly removable for easy transfer to another vehicle if desired. The co-phasing harness, completely factory tested to assure maximum performance, connects quickly and easily to the mirror mounts. Priced at $53.95. For more info, write to Avanti Research & Development, Inc., 340 Stewart Ave., Addison, IL 60101.

CB Noise Suppression Filter

The EMI-TVW2 is an improved twelve-element low-pass TVI filter for CB base stations. In practice, the harmonics of a 1-kW, 28-MHz ham transmitter are held to 20 dB below the

CIRCLE 46 ON READER SERVICE COUPON

minimum useable TV signal. Even better performance is realized in the CB band. Insertion loss is under 0.4 dB below 30 MHz. Sells for $16.95. For more facts, write to Marine Technology, 2780 Temple Avenue, Long Beach, CA 90806.

CB Mobile Converter

Car radios can easily be converted into CB receivers with the CB/AM Converter by GC Electronics. Tune in any of the 40 CB channels with an ordinary car radio. The CB/AM Converter works from any car antenna, including windshield types. It's an ideal way to be advised of road and weather conditions. No license is required to operate the converter. The AM radio reception is unaffected

CIRCLE 65 ON READER SERVICE COUPON

when the converter is switched to the Off position. When in the On position, the red LED indicator light goes on. Hardware and complete instructions are supplied. Installation is simple. Sells for $19.95. GC Electronics, a division of Hydrometals, Inc., offers a complete line of CB radios, antennas and accessories. Get all the facts, by writing to GC Electronics, 400 South Wyman, Rockford, IL 61101.

New Hide Away Antenna

The Hustler Hustloff Instant-Removal, store-in-the-trunk, instant-remount antenna has performance equal to any permanently mounted mobile installation! The special design trunk lip mount firmly clamps to any trunk lid with the twist of a knob. Operation is instant and easy. Positive grounding is assured with the heavy duty, case-hardened clamp assembly. Mounted antenna cannot be removed when

CIRCLE 72 ON READER SERVICE COUPON

trunk is closed. Deluxe features include a 180-degree swivel for positioning antenna to optimum vertical location, 17-ft. coax with connector factory attached. The Hustloff is available with 48-in. standard and 55-in. heavy duty stainless steel antennas for 40-channel coverage. Priced at $28.95 for the HT-27 and $31.25 for the HHT-27. Additional information may be obtained by writing to New-Tronics Corporation, 1580 Commerce Park Drive, Brookpark, OH 44142. ■

Kathi's CB Carousel

by Kathi Martin, KGK3916

Kathi—now a TV star—checks out the E. F. Johnson Messenger 92

☐ Ah yes! I remember them well. CB walkie-talkies I could actually push down in the pocket of my jeans and still slide into the seat of a 'vette. Only problem with the pocket-sized hand-helds was the under-100 mW input power barely got the signal down the block, let alone to the next campsite; but for short-range communications they were great—as long as you took care not to spear someone's eye with the extended antenna.

To push the signal out farther hand-held power was increased to 1-watt, 2-watts, 3-watts, and would you believe, even 5-watts. The package got bigger and bigger, the spear when fully extended got longer and longer, and the Nicad batteries usually needed for extended-time full-performance made the hand-helds heavier than an SSB mobile rig.

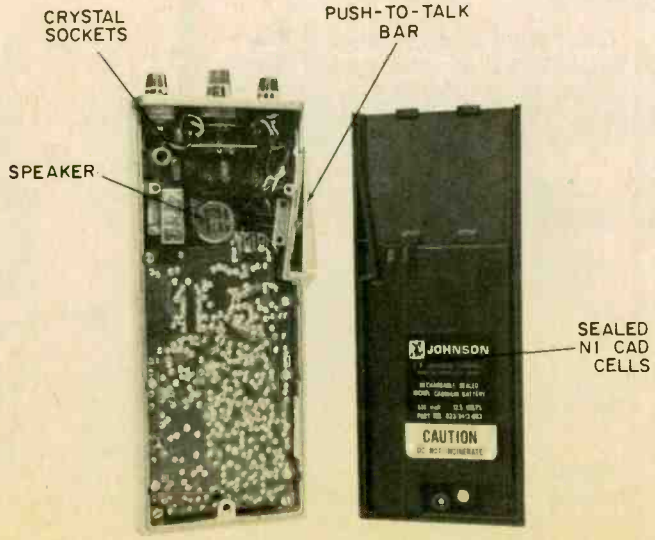
As long as there was nothing better we had to put up with the oversize and overweight hand-held because that was the only way we were going to get high-performance in a mini-package. But now as they say in the TV commercials, I've found the better way. Specifically, the E. F. Johnson Messenger 92 hand-held.

Pocket Power. Look at the photo of the Messenger 92. Anything look strange? Right! The antenna is only a bit longer than the case—9¾-inches to be exact. It's really a rubberized flexible antenna—often called a rubber ducky—the same type of antenna used on the over-$1,000 police/fire hand-helds. Now look at the size of the case in proportion to the hand—which belongs to one of the techs in the test lab. Note how the Messenger 92 actually fits the hand, just like a police fire/unit. Aha! You think Kathi is pulling a fast one and the Messenger 92 isn't a CB transceiver. Wrongo! The Messenger 92 is a CB hand-held, but it has the convenience features of police/fire models.

To start, the Messenger 92 is about the size of the hand-helds you see tucked into the hip pocket of your local beat cop. Similarly, instead of being loaded with ten or twelve Nicad AA penlight batteries the 92 has a specially shaped Nicad that occupies most of the rear cover, as shown in the photographs. In normal use this type of rechargeable pack can take between 500 and 1000 charge-discharge cycles. Because there's no wasted space between cells the 92's battey contains a lot of energy in a relatively compact case, so the overall weight of the hand-held is sharply reduced. Note, also, there's no connecting wires between the battery section and the transceiver itself. Two pressure contacts at the top of the battery automatically make connection to the transceiver when the cover is secured with a single captive mounting screw.

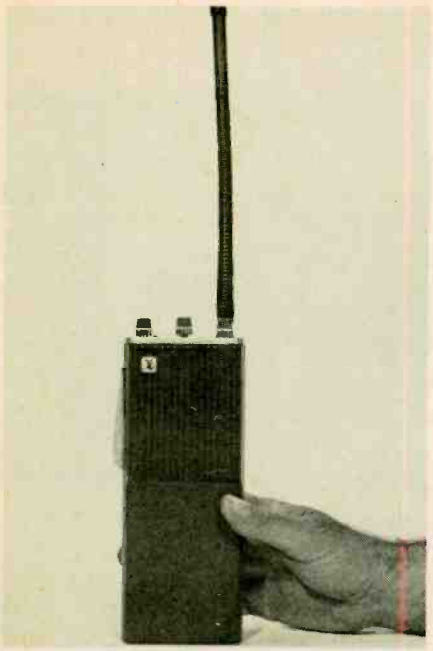
User-Programmed. As for features, the Messenger 92 is user-programmed for up to five channels using separate, and inexpensive (standard) transmit and receive crystals. The crystals plug into the small strip holder near the top that's exposed when the battery cover is removed. An aluminum write-on label on the back of the battery cover allows you to indicate what selector position is which channel.

The channel selector is located with the volume and squelch controls on the top, along with a screw-jack for the rubber ducky, micro-mini jacks for an external antenna and remote speaker, and a battery-saving LED battery condition indicator. Under normal conditions—when the battery charge is up—the LED is off, so no extra current is being used telling the user the battery is okay. When the battery charge is reduced through use to the point where you had better recharge soon or you'll be talking to yourself then the LED lights. Unlike the mini-mini LEDs used on some rigs which can barely be seen at night let alone in daylight, the LED

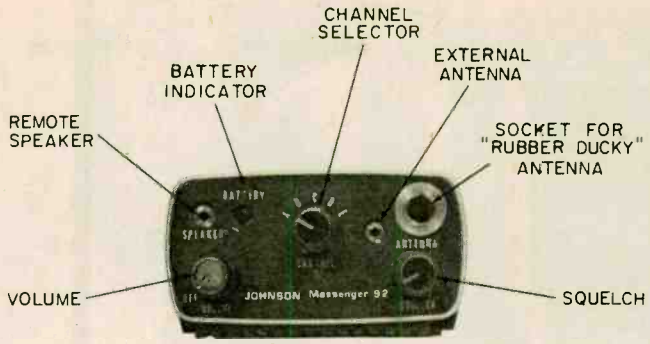


Unlike the typical CB hand-held that uses ten or twelve penlight Nicad batteries the Messenger 92 has a special Nicad shaped to fit the cover, thereby providing the most power in the smallest possible space at a sharp reduction in overall weight. The crystals—which are user selected—plug into a strip near the top of the main section.

The supplied battery charger plugs into a charging jack in the bottom of the case. It is a trickle charge, taking 10 to 16 hours for a complete recharge, but the low rate allows the charger to be left connected without worry about damage to the battery. ▶



No, that's not a police/fire hand-held, it's Johnson's new CB Messenger 92 which comes complete with a short rubber ducky antenna. The thing really does fit inside a pants pocket.



The three controls mounted on top are for volume, squelch and channel selection. (The 92 handles up to five channels.) The rubber ducky antenna screws into the antenna socket. Micro-mini jacks are provided for an external antenna and remote speaker. An LED battery condition indicator lights only when the battery is starting to run down; it is off when the battery has a substantial charge.

indicator on the Messenger 92 is rather large and can be seen under typical sunny skies.

Because separate crystals are used for transmit and receive the circuit is about as straightforward as you're likely to find anywhere: something I like in portable equipment because the fewer the number of circuits and parts the less likelihood there is something will break down when least expected.

The Crucial Figures. The transmitter uses but three transistors to produce 1.9 watts output at the antenna jack into 50 ohms. Modulation is limited to 100% and the microphone sensitivity is −21 dB—exactly average.

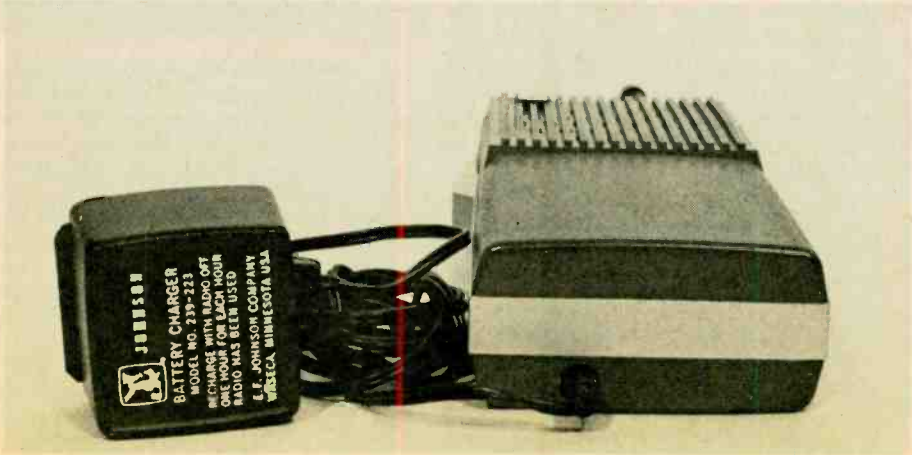
The receiver is single conversion with a bandpass filter providing a measured adjacent channel rejection of 58 dB. This is good even when compared to many high-priced double conversion models and is more than adequate for hand-held use. Overall sensitivity with the signal generator connected to the antenna input jack measured a *hot* 0.3 uV for 10 dB S+N/N (signal plus noise to noise) ratio.

In Actual Operation. The Messenger 92 proved to be a real winner. The receive and transmit sound quality is exceptionally good, very crisp and clean —a signal easily heard over ambient noise. Naturally, the short *rubber ducky* antenna does not radiate as efficiently as the longer spear type telescopic whips, but if you're not trying for five miles range from a hand-held the Messenger 92 holds up well. The nice part is if you tuck the 92 in your jeans or clip it to a belt the antenna doesn't jab you in the ribs, it simply bends out of the way and then snaps back. It also doesn't stick in someone's eye.

Overall, I'm much impressed by the Messenger 92. My only gripe is the micro-mini jacks for the remote speaker and particularly the remote antenna. It's very hard to locate a micro-mini to UHF adaptor plug, and the micro-mini plug is a bit small for most coax cable. I hope Johnson changes to mini-jacks in the next production run. Otherwise you'll be totally impressed with the 92.

The Messenger 92, supplied complete with Nicad battery and external charger is priced at $169.95. Crystals are optional.

For additional information circle No. 47 on the reader's service coupon. ■

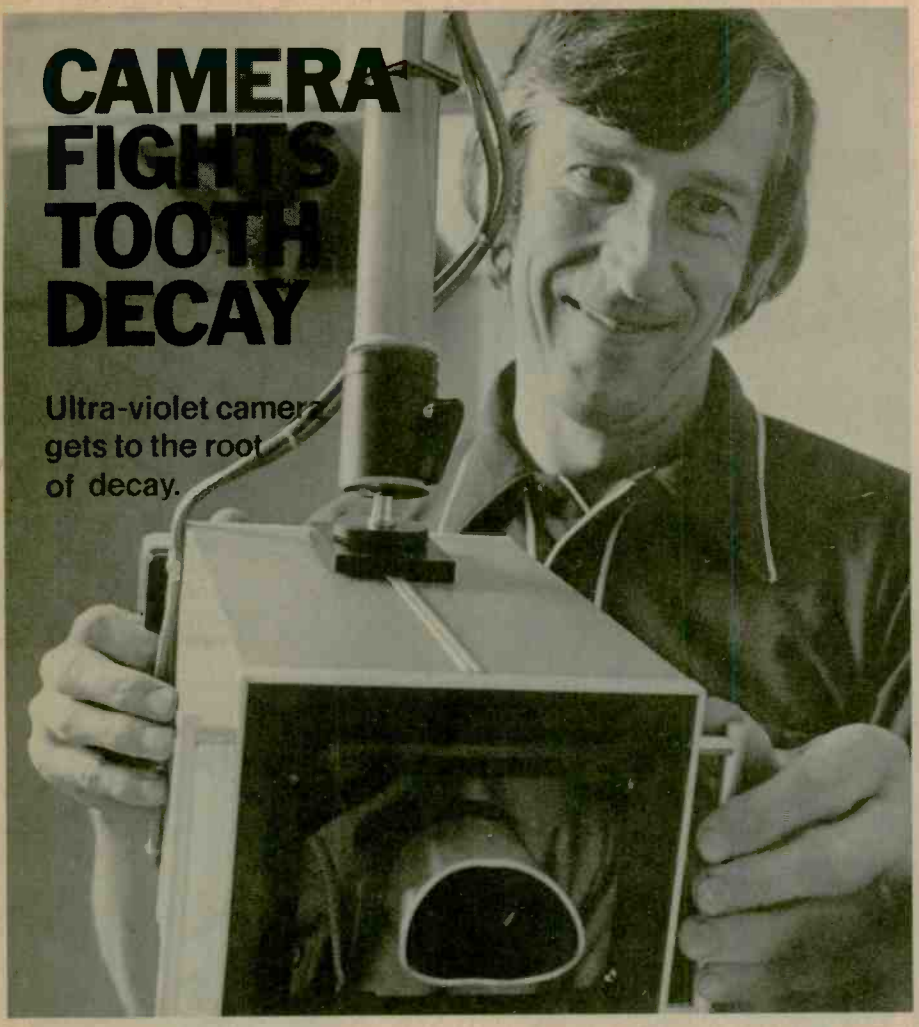


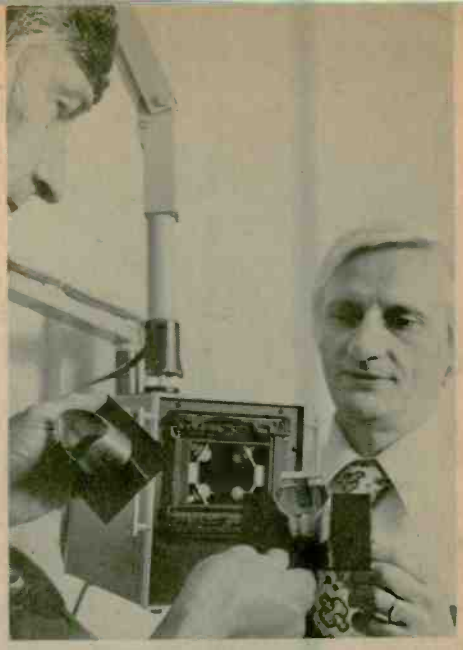
Kathi Martin, along with other notables in the CB field such as Jon Gallo, Phyle Horne, Leo Sands and others, took part in the filming of an NBC Knowledge Series on Citizens Band Radio. Unfortunately, when you read this notice, the first airing would have taken place, August 1 through August 5 on KNBC in Los Angeles. Programming information for the Chicago, Cleveland, New York and Washington (D.C.) areas are planned but not firmed up at this time. Also, almost all NBC affiliates will repeat these TV-casts. We suggest you call your local TV station that carries NBC programming to obtain dates and times of the Knowledge Series on Citizen's Band Radio.

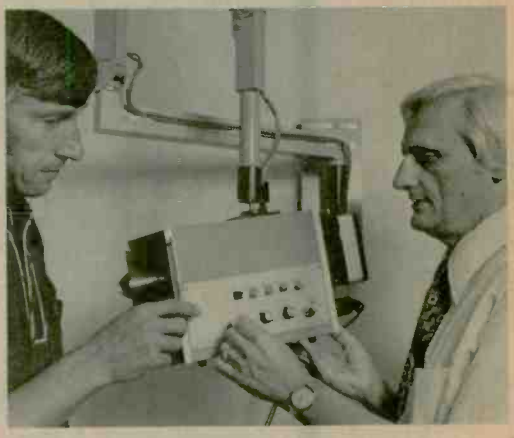
—The Editor

CAMERA FIGHTS TOOTH DECAY

Ultra-violet camera gets to the root of decay.







At top right the camera's developer, Dr. Gwinnette, changes the front lens attachment, which varies according to the shape of the patient's mouth. The front lenses are completely interchangeable, and attach to the main unit by means of an internal clamp. Dr. Isreal Kleinberg (at right) assists in the process. In the middle right photograph, the side view of the camera is shown as the two doctors discuss its operation. At the rear of the camera the polaroid film attachment, which allows instant development of the photographs, can be seen. Bottom right shows the plaque camera as it is directed toward the mouth of a patient.

☐ "An ounce of prevention is worth a pound of cure." This age-old adage seems to be the personal motto of Dr. Israel Kleinberg, the chairman of the dental research team at the State University of New York—Stonybrook. Dr. Kleinberg has been developing ways of preventing tooth decay since 1955. In hopes that eventually drilling & filling teeth will rarely be necessary.

Dr. Kleinberg's decay prevention system is based on the fact that 90 percent or more of all tooth decay is the result of "plaque." Plaque is a protein film that builds up around the teeth. Plaque harbors bacteria which eat into the tooth enamel and causes cavities. Thus, keeping teeth plaque-free would prevent decay from setting in.

There was one crucial problem which Dr. Kleinberg had to solve: under normal conditions plaque is not easily detected by the human eye. Under ultraviolet light however, plaque is easily visible as a darkened area which stands out from the rest of the plaque-free enamel. After making this discovery, Dr. Kleinberg & his research team set out to build a camera which could take instant photographs of a patient's teeth, so that the areas of plaque would be highlighted for the dentist's use.

Now, a camera of this sort has been perfected and has been in use for one year at Stonybrook University. A small tube at one end of the camera houses a lens. After an initial thorough cleaning of the teeth, the camera is used to check for persistent areas of plaque. A patient's lips fit around the tube and a picture is taken of the patient's clenched teeth. The instant picture shows the plaque areas which are then treated and cleaned again. A second picture would hopefully reveal that all the plaque has been removed. Any remaining stains would indicate that a cavity had begun to form.

Dr. Kleinberg and his research team feel that in the future this sort of equipment will be used widely to prevent tooth decay from occurring in the first place. Under other circumstances his work might be recognized with an honorary plaque, but since he's dedicated to plaque-prevention, some other sort of trophy would probably be more appropriate. ■

LOUD AND CLEAR, GOOD BUDDY!

CIRCLE 48 ON READER SERVICE COUPON

Superpunch! That's Shure's name for this handsome microphone. It includes such features as a "million cycle" leaf-type, press-to-talk switch and the capability of being used with Voice Operated Relay (VOX) transceivers. $42.

CIRCLE 32 ON READER SERVICE COUPON

This Realistic 21-1171 mobile preamplifying mike offers variable gain to 25 dB; a sensitivity of —42 dB; and comes with a four-conductor cable. $19.95.

CIRCLE 59 ON READER SERVICE COUPON

Keep your hands free for better things than holding a microphone, but still keep in touch with your CB Buddies using the CB-88 from Telex. This headset can be worn from a headband or can be clipped onto the user's eyeglass frames. It weighs less than three ounces and comes in different versions to match all CB transceivers. $69.95.

CIRCLE 44 ON READER SERVICE COUPON

Turner's Expander 500 mirophone would be at home on the bridge of the starship Enterprise, or next to your favorite CB transceiver. This futuristic design includes separate volume and tone controls, and a meter which measures both audio input and battery strength. $65.

CIRCLE 49 ON READER SERVICE COUPON

Mura's PRX-300 offers their PRM (Peak Redistribution Modulation) feature, a "distortion-limiting" extra. The futuristic design houses a mike of 28 dB gain, variable impedance and —36 dB sensitivity. It requires a 9-volt battery. $60.

e/e looks and listens to CB power mikes

by Jorma Hyypia

☐"Come back?"

If you keep hearing that request from your modulatin' Good Buddies, although you talk as clearly as a Shakespearean actor, it can mean but one thing; your CB rig just isn't putting out as clearly as you are putting in.

But, forsooth, don't make haste to junk your transceiver, which might be perfectly good; the varlet garbling your speech may only be the original equipment microphone that came with your CB set. Replace it with a *power* mike and you will start hearing bounteous praise for the quality of your audio, instead of those wearisome "Come back *again*" pleadings.

A power mike will not (and should not) actually boost the RF signal put out by your CB set; but it can load your carrier wave with more audio information, and do it with less distortion, than is possible with the cheapy mike that came with your CB set. As much as 35% of the potential information-carrying capacity of your carrier wave may now be wasted. By packing more audio into it, your speech will sound clearer—albeit *not* louder—even to those reading your mail out at the fringes of your CB range. The end result: it *seems* that you are getting better distance. Certainly, improving your reach by clarifying your speech makes more sense than adding an illegal linear amplifier just to splatter unintelligible audio further around the landscape.

How does a power mike work such miracles? A tiny battery-powered amplifier built into the mike strengthens the audio signal before sending it to your CB transceiver. Thus, the transmitter has more to work with and can more easily put out a fully modulated carrier wave. This can be overdone. Overloading results in distortion, which is why the better power mikes have a volume control that permits you to adjust the carrier loading right up to 100%, but no more.

The following market survey will get you started on your hunt for just the right power mike. Your local dealer can provide more detailed specs. If possible, test several power mikes on your own rig while a friend modulates with you from the other side of town. Pick

the one that makes your speech easiest to understand.

We'll consider three different categories of power microphones: (1) *Base* mikes that have integrated stands to hold them upright on a table, (2) hand-held *Mobile* mikes and (3) *Hands-Free* mobile jobs. Let's take them in that order.

Incidentally, manufacturers of communications mikes often stress the relatively limited frequency ranges of their microphones. This might seem puzzling to hi-fi audio fans until it is remembered that these mikes are intended for *voice* reproduction. Suppression of frequencies outside the normal voice range can be desirable in order to minimize background noises.

Base Mikes. Mura offers two base station power microphones that have housings of decidedly "modern" styling. The Model PRX-300 retails for $60, and the DX-2000 for $50. The specs on both microphones are: Sensitivity, −36 dB; gain, 28 dB max.; impedance, variable to 2500 ohms; switching, relay or electronic; color-coded, 5-conductor cable. They both feature slide-type gain control, push-to-talk and lock switches, and a dynamic amplifier powered by a 9-volt battery. The PRX-300 adds Mura's PRM feature. The letters stand for Peak Redistirbution Modulation, and Mura maintains that this patented circuit results in less distorted modulation.

Radio Shack offers their Realistic brand 21-1173 base station microphone ($29.95). The maximum variable output of the mike is 25 dB; sensitivity, −42 dB; impedance of 3300 ohms; and switchable for electronic or relay operation. It requires two AA batteries.

Primo offers a model DM-1524A1 base station mike retailing for $55. It has a transistorized preamp, gain control lever, switch locking lever and push-to-talk switch. Inside the case there's a changeable switch for relay and electronic switch wiring; either a 3-conductor or 5-conductor cable may be used. This dynamic cardioid job has au output level of −40 dB and an output impedance of 100 ohms.

The Shure Model 526T Super Punch base station mike ($42) has a lockable "Million Cycle" leaf-type press-to-talk switch, a modulation level volume control, and a *Normal/Vox* selector switch for press-to-talk or for use with VOX-operated transceivers in which the sound of the operator's voice triggers the transmit circuit. Sounds picked up by an omnidirectional dynamic element are amplified to provide adjustable output levels from 0.63 to 14mV for 1 microbar input. Other specifications are: Frequency response, 200 to 6000 Hz; output impedance, 5000 ohms; load impedance, 500 ohms; cable type, 3-conductor shielded; power source, 9-volt battery.

Shure's Model 444T preamplified base station mike ($37.50) has a volume control, and a push-to-talk bar with an optional lock. The height of the pickup head is adjustable. Specs: Frequency response, 200 to 6000 Hz; impedance, less than 1000 ohms; output level, adjustable from 2 mv to 45 mv for 1 microbar input; comes with a 4-conductor cable.

The Superex model M-607 ($45) is an electret condenser type base station microphone with a preamp powered by one AA battery. The mike features an adjustable gooseneck support, variable gain control, interlocking push-to-talk switch and 500 ohms impedance. Model M-606 ($35) is similar to the M-607 but lacks the variable gain control. Superex also offers a VOX-type base station microphone, model M-606VX, selling for $110 complete with "Vox-Box" control.

Turner is out to tempt you with a broad selection of base station mikes, including the Expander 500 which retails for $65. This really jazzy-looking job sports separate volume and tone controls, an audio input indicator meter as well as a battery strength meter, press-to-test button to check the battery, adjustable tilt head and a press-to-talk switch with slide lock for extended transmissions. The Expander 500 utilizes a dynamic cartridge and is powered by a 9-volt battery; maximum output level is −30 dB, and the output impedance is 5000 ohms; comes with a 5-conductor cable.

Turner's model CS-1 base station mike, listed at $85, was designed for transceivers requiring 6-conductor cables and special switching. The ceram-

CIRCLE 44 ON READER SERVICE COUPON

Every Good Buddy wants a sidekick—and maybe the Super Sidekick will do. An adjustment in the base allows for its impedance to be matched to either tube-type (high-impedance) or transistorized (low impedance) sets. The neck and base are jet black, the head is chrome. $58.

CIRCLE 48 ON READER SERVICE COUPON

Shure's Model 524C Ranger 2 is a cute little handful. It features a transistorized amplifier claimed to have enough oomph to permit use of a 100 feet of unshielded cable. It requires 2.5 to 35 VDC and uses a 4-conductor cable. $66.

CIRCLE 45 ON READER SERVICE COUPON

RMS Electronic's CMB-5006 is powered from a 9-volt battery. It has a two-position gain control and 20 dB gain. $29.95.

CIRCLE 59 ON READER SERVICE COUPON

Telex's CB-73 is a power and noise-canceling mike all in one. It features "aviation" styling and an unspecified amount of variable gain. $39.95.

ic generating element is unaffected by temperature or humidity. The 9-volt battery usually lasts about 6 months. Specs: Sensitivity, –23 dB; output impedance, 5000 ohms; amplifier voltage gain, 0 to 33 dB adjustable; Frequency range, 300 to 3500 Hz. Model +3B is identical to the CS-1 except that it has a black finish instead of a gold housing.

Turner's model +2 is a ceramic mike with battery-powered preamp, a volume selector controlling 0 to 30 dB gain, and a slide switch to adapt the unit to relay or electronic switching. Uses a 9-volt battery and 3-conductor cable. Price: $48.

Other Turner base station microphones you may want to check out include Model +3 ($55) which has a maximum adjustable output level of –23 dB; also the Super Sidekick ($58) which offers up to –25 dB gain plus a setting in the bottom of the base to adjust the mike to requirements of both tube-type (high impedance) and transistorized (low impedance) sets.

Mobile Microphones. The hand-held microphones discussed in this section can be used with base station equipment if you do not dig the larger stand-up models. However, we list them under "mobile" equipment because most CBers will buy them for that purpose.

Mura's model PRX-100 ($40) offers variable gain controlled by a slide switch. The maximum gain is 16 dB, and other specs include: Sensitivity, –50 dB; impedance variable to 2500 ohms. The PRX-100 is powered with a 9-volt battery, uses a 5-conductor cable, and has provision for relay or electronic switching.

By sacrificing variable gain, you can get model PRX-200 for the more modest price of $29.95. It has –58 dB sensitivity, 7 dB gain, and a nominal 2000-ohm impedance.

Two other Mura mobile power mikes worth investigating are the DX-116 and the DX-120, priced at $29.95 and $18.95 respectively. The DX-116 offers variable gain whereas the DX-120 has three separate levels that are user adjustable. Both use a 9-volt battery, a 5-conductor cable, and have relay or electronic switching capability. The DX-116 specs include: Sensitivity, –42 dB max.; gain, 20 dB max.; variable impedance to 2500 ohms. The DX-120 specs: Sensitivity levels, –54 dB, –45 dB and –43 dB; gain settings, 23 dB, 21 dB and 12 dB; nominal impedance, 2000 ohms.

The Primo model DM-1618 mobile mike ($40) features a gain control lever, slide switch to adapt for relay or electronic switching, and handy battery holders inside the battery compartment lid. The DM-1618 is available with either a 3-conductor or 5-conductor cable and has the following general specs: Type, dynamic omnidirectional; output level, –40 dB; output impedance, 100 ohms.

Realistic from Radio Shack prices their 21-1171 mobile preamplifying mike at $19.95. The 300 ohm mike has a variable gain of 25 dB maximum, a sensitivity of –42 dB and uses a four-conductor cable.

RMS Electronics offers an amplified mobile microphone, model CMB-5006, selling for $29.95. It operates on a 9-volt battery, has a two-position slide gain control, and provides "20 dB more gain than conventional microphones."

A Shure model 524C Ranger 2 ($66) features a transistorized amplifier claimed to provide enough output signal to permit use of up to 100 feet of unshielded cable. This dynamic type microphone has the following specs: Frequency response, 300 to 5000 Hz; output level, –44 dB; load impedance range, 250 to 2200 ohms; maximum signal, 118 dB SPL at 1000 Hz produces 0 dBV (1.0V) at 10% THD. The DC supply voltage range is 2.5 to 35 VDC, and a 4-conductor cable is used.

Superex pegs the price of its M-508 mike at $25, for which you get automatic gain control for signal equalization, and compression amplification to prevent overloading. It uses one 7-volt mercury battery and has an impedance of 500 ohms.

Sylvania offers two power mikes with variable gain control, relay or electronic switching capability, 5-conductor cables, and operation on 9-volt batteries. Model SDX-100 ($40) has the following specs: Sensitivity, –50 dB max.; gain, 40 dB max.; impedance, 0 to 2500 ohms. Model SPM-70's ($30) specs: Sensitivity, –42 dB max.; gain, 16 dB max.; impedance range is variable to 2500 ohms.

Telex says that its CB-73 mobile power mike is designed for "aviation standards performance" so it makes

CIRCLE 44 ON READER SERVICE COUPON

The Turner Expander 400 lights up to let you know when its battery is low (a small light is recessed above the grille). Complete with variable gain, the mike comes with a 6-conductor cable. $45.

CIRCLE 44 ON READER SERVICE COUPON

The Road King 77 combines preamplification with noise canceling versatility. Turner calls it "the perfect truck microphone." The mike is complete with a black mesh screen and rubber lip guard. $44.

CIRCLE 44 ON READER SERVICE COUPON

The Turner Road King 66 is a variable volume mobile mike with a gain of 0 to 15 dB. It can be yours for $42.

CIRCLE 48 ON READER SERVICE COUPON

Shure's HF 52 Mobile Communications Microphone is a hands-free job. The dynamic mike can be mounted on the dashboard, the sun visor or the steering column. Also supplied is a footswitch. The system can be operated from any 12 VDC negative-ground vehicle battery. $99.60.

sense to package it in an "aviation type acoustic housing." For the list price of $39.95 you get a dynamic type, noise-canceling mike with −43 dB sensitivity, 200 to 6000 Hz frequency response, and an unspecified amount of variable gain.

Heading the numerically generous selection of mobile power mikes offered by Turner is the Expander 400 which retails for $45. A unique feature is the battery light above the grille which automatically lights during transmission when the battery needs replacing. The Expander 400 also offers a fine-tuning volume control, relay or electronic switching capability, and a 6-wire (5-conductor, one shield) cable. Expander 400NC ($47) is a noise-cancelling version of the 400 model.

Space does not permit detailed description of the many other amplified mobile mikes by Turner. But here are some model numbers worth checking out at your local dealer. Model M+3 ($42) is a ceramic job powered by a 7-volt mercury battery. Model M+3B ($42) offers amplifier voltage gain from 0 to 15 dB, and an adjustable output level of −42 dB maximum. Model RK-66 (Road-King 66) sells for $42 for which you get an adjustable output level to −42 dB maximum, amplifier voltage gain of 0 to 15 dB. Model RK-77 ($44) offers an adjustable output to −49 dB, and a sturdy wire mesh front screen complete with a rubber lip guard to help position the mike for best noise-cancelling. Model M+2 ($38) has a rated output level of −40 dB adjustable. Most of these microphones are available in other versions, under different model numbers, for such applications as electronic switching.

Hands-Free Mikes. These usually consist of *headsets* that include one earphone, but also have the option of a no-hands unit with a mike clipped to the sun visor of the car.

The top-of-the-line headset unit offered by Electro-Voice is model RE51 which lists for $138 or $139.80, depending on your shipping zone. A very light microphone assembly mounts to eyeglass frames or to a lightweight headband which is supplied. A small tube, which conducts sound from your mouth to the microphone element, is positioned close to your mouth. A supple, lightweight cable connects the mike to a separate, small, preamplifier box which also houses a muting button (cough button) for momentarily turning the mike off without noise on the audio line. Specs for the RE51 include: Frequency response, 60 to 10,000 Hz; impedance, 50 to 250 ohms; output level (total including preamp), −54 dB; power source, two AA batteries; type, omnidirectional dynamic.

If you are turned on by such miniature dynamic headsets, also check out the Electro-Voice 967 series. Model 967M, listing for about $93, comes with one connecting plug for the microphone; model 967ME (about $126) uses two connecting plugs—one for the microphone and the other to fit the earphone jack used in standard private aircraft.

Shure offers a somewhat different type of "hands free" communications system. The HF52 Mobile Communications Microphone consists of a tiny dynamic mike that can be mounted on a car's sun visor, dashboard or steering wheel column; an amplifier with adjustable gain; and a heavy-duty corrosion-proof footswitch. The system operates from any 12 VDC negative-ground vehicle battery system. The footswitch keys the transmitter without disturbing the operator's driving; the transmitter remains on until the switch is relased. The frequency range is 200 to 5000 Hz. When the mike is 18 inches from the voice source it provides the same output as a "close-talked" hand-held job, according to Shure. User net price of the HF52: $99.60.

Superex offers a preamplified headset microphone system for $55. Model

(Continued on page 101)

CIRCLE 48 ON READER SERVICE COUPON

Shure's Model 444T has its ups and downs, due to its variable volume control and an adjustable height feature. Push to talk, with an optional locking switch, the microphone comes complete with a 4-conductor cable. $37.50.

CIRCLE 44 ON READER SERVICE COUPON

If your transceiver requires a 6-cable power mike, the Turner CS-1 fills the need. Powered by a 9-volt battery, the mike features a separate locking control and a ceramic generating element impervious to temperature and humidity. $85.

CIRCLE 32 ON READER SERVICE COUPON

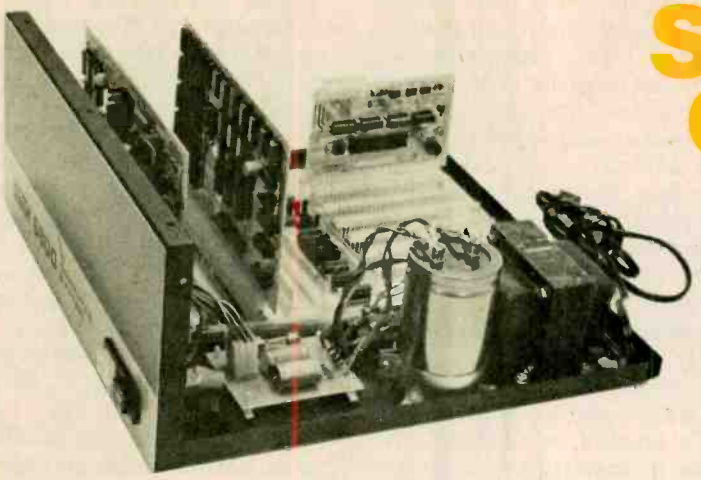
Here's the Realistic 21-1173 base station mike, with "Glide-Path" gain control. The mike has a push-to-talk switch, a locking switch, and a tiltable head. It requires two AA batteries for operation. $29.95.

CIRCLE 44 ON READER SERVICE COUPON

The Turner +2 has a light blue finish and a chrome grill ring. It can be adapted to relay or electronic switching via a slide switch in the base. The push-to-talk bar may be locked for long transmissions. $48.

e/e checks out the...

SWTP 6800 Computer



When the computer bug *bytes*, this new unit is the right Rx.

CIRCLE 53 ON READER SERVICE COUPON

☐ It seems so easy. Just send for a box of parts. Spend a few evenings putting everything together, and when you're all done you have a real computer; a computer powerful enough to equal many time-sharing systems owned by some small school districts and colleges. The price? Less than that of a decent—not great—high fidelity system. Anywhere in the range of less than $400 to under $1000.

Only problem is, a computer by itself can do absolutely nothing. It just sits there on the table. Possibly, it might have a row of switches, and lights that wink and blink depending on the operation sequence of the switches, but for the average electronic hobbyist it's useless. There must be some way to talk to the computer, and for that we need a terminal, an input/output device—or I/O as it's more commonly termed. Cheapest I/O is a CRT video display terminal for about $400 in kit form, $550 wired. Now we're up to at least $1000, but all we have is a system that could be used only by someone with considerable training in *machine language*, generally college level work.

SWTP's table-top "black box" microprocessor computer and a terminal are all that's needed for a personal computing system. Simply press the white reset button on the front panel and you can program directly from the terminal—in this instance a model ASR 33 TTY.

Of course, most computer advertisements make it look easy: "Own your personal computer. Play *Star-Trek*, Tic-Tac-Toe, etc." If you believe a few games are worth $1000 or more then latch onto any personal computer kit.

But, if you want to be able to use a computer for serious work without a degree in computer science, then you need one easily and inexpensively programmed in a "higher language." BASIC is such a program. A BASIC-equipped computer and terminal reads out READY when it wants you to enter information. BASIC allows even children to build simple programs such as A + B = C. It allows the electronic hobbyist to program for reactive inductance—$X_L=6.28(f)(L)$, and then runs a hundred or so values of f or L in a minute. In fact, BASIC is the beginner's language, the one you see people using that asks: "What is your name?" The language that *talks* to the user.

Since we at e/e figure our readers will join the personal computing explosion—which many expect to be as big as CB in the next few years—we surveyed the marketplace for a computer system suitable for the typical hobbyist and student, something that could be used for general experimentation, or for school or business problems other than electronic. First thing we discovered, is that a lot of money buys little in the way of easy operation. One computer kit has a $200 charge just for the BASIC interpreter (the computer language program). Another kit priced in excess of $500 has no higher language available. Yet another $500 kit has a "Tiny BASIC" good for a few small problems and games (games again).

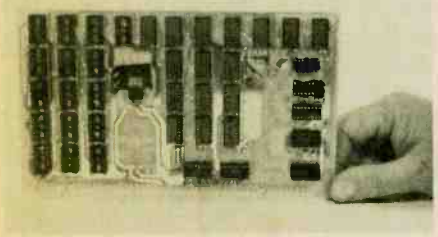
Our Choice. When we were all done we came up with one computer system (kit) we presently consider a "best buy" for the average hobbyist, the Southwest Technical Products Corp.'s Model 6800 Computer System.

The reason we've selected the SWTP 6800 is twofold. Firstly, it has a built in *resident monitor* that eliminates the need for panel swtiches and lights. You don't need to know machine language to use the 6800; because of the monitor you can enter data in hexadecimal form directly from the terminal. But even more important, SWTP has a really excellent 4K BASIC interpreter that includes multiplication and scientific notation (a rarity in 4K interpreters) and an outstanding 8K BASIC—one of the very finest with exponentiation, direct peripheral equipment address, patching, etc. The 8K program contains a whole slew of operations and commands not

The "mother board" and the power supply are mounted on the cabinet's base. All other circuits plug into the mother board, with wiring automatically completed by the mother board's PC foils.

found on some slightly older time-share BASIC systems. The 4K and 8K BASIC interpreters for the SWTP 6800 computer are available on TTY tape and cassette from about $5 to $20 depending on the program and its base (paper tape or cassette). Though there are other 6800 type computer kits available, it's SWTP's BASIC programs that makes the SWTP computer our "best buy."

Before going further, let's explain the whole bit about 4K and 8K memory systems: The "K" stands for a thousand *bytes*–eight bit "words." A computer with 4K memory RAM (random access memory) can be programmed up to, or has the capacity for, 4000 bytes. An 8K memory means 8000 bytes Theoretically, 4K BASIC should fit into a



This is what a 4K memory board looks like with only the ICs for 2K of memory. We've left the other 2K of memory chips out so you can see the extensive use of sockets. Contrary to what SWTP says, if you don't want heartaches, use sockets for all ICs. Only the voltage regulator, which must be secured to a heat sink, does not have a socket.

4K memory. Unfortunately, it doesn't. 4K BASIC actually needs about 4.5K of memory; so a computer must have about 6K of memory in order to program using 4K BASIC. On the other hand, 8K BASIC needs only 6.5K for the interpreter; so 8K of memory handles 8K BASIC very well. Since 4K of memory cannot handle 4K BASIC, most users of personal computers with 4K memory use a smaller version of BASIC known as "Tiny BASIC," which is good for little more than playing games.

For the average hobbyist, we don't believe a computer system should be limited primarily to games. We strongly suggest the SWTP 6800 computer system should be obtained with at least 6K of memory.

The stripped down SWTP 6800 computer kit consists of a "black box" ($395) with just an illuminated power switch, a reset switch, a mother board, a microprocessor/system board, a 4K memory board, and a serial control interface board that can be programmed for either a 110 *baud* TTY or a 300 *baud* CRT terminal. The power supply components mount directly on the base of the "black box" cabinet. As assembled by the user, the mother board can accommodate five additional 4K memory boards (under $100 each) for a total of 24K of memory, and seven more interface boards for a total of eight peripheral I/O devices such as line printers, recorders, etc. You simply plug in the optional memory or interface boards

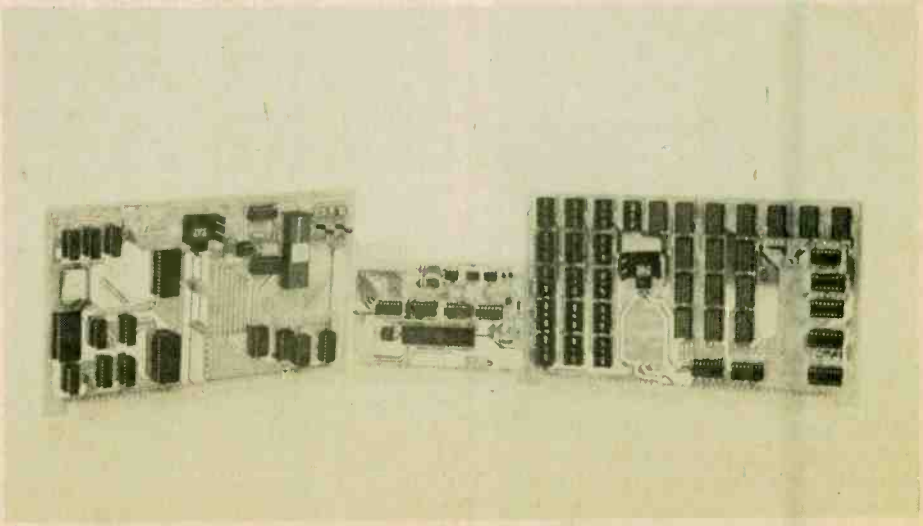
Construction. The PC boards are first quality, and the ICs had a notably excellent failure rate–only one was defective. This, considering the large number of ICs supplied, is excellent. (We have come to expect up to a 10 percent IC failure rate in kits.) To successfully build this kit you *must* use a needle pointed soldering iron rated about 25 watts. Anything larger will result in solder bridges–the printed foils are unusually close compared to the usual hobbyist kit's printed circuit board(s). Also, you must have someone well skilled in computer technology willing to help you debug the system; we'll explain the need for this later.

Unlike a Heathkit, SWTP's instructions don't spell out every step. You get a rather good pictorial (two color) for each board, a separate parts list, a set of general instructions, and you use all three to determine what part goes where, and when. The component packaging is unusually good. As a general rule the components are packaged for a small number of steps; when you complete one package you (generally) move on to another package. (All the components are not jumbled together–a welcome variation on the kit packaging we've been getting from the "biggies" the past few years.)

Warning. SWTP does not supply sockets for the ICs; they specify the ICs should be soldered to the PC boards. Whatever you do, don't make this foolish mistake. USE SOCKETS FOR EVERY IC. If you wind up with a defective IC (as we did), or intáll an IC backwards (which is very easy to do) you'll make hash out of the board trying to remove the defective or reversed IC. A complete set of sockets for the basic 6800 computer kit is available from the Computer Mart of New York, 118 Madison Ave., N.Y., N.Y. 10016, for $23 postpaid. They also have socket sets for the optional SWTP computer boards (such as additional 4K memory boards).

Do not handle any IC unless you're grounded just as specified by SWTP. They even provide a 1-megohm resistor so you can "safety-ground" from your wrist to the electrical ground. A wire to the ground bus or chassis of the computer is not a ground. *You must be grounded to the electrical ground.* Any tool or knife used near the ICs must be grounded. While not all the ICs are prone to damage by static electricity, the C-MOS types are, and it takes just a flick of the finger to zap an IC. So don't open any IC packages until told to do so, and don't open or handle the ICs until you're properly grounded. If your soldering iron doesn't have a three-wire (grounded) power cord never apply the iron to the PC board(s) once the ICs are installed.

Testing. If you're extra careful, and



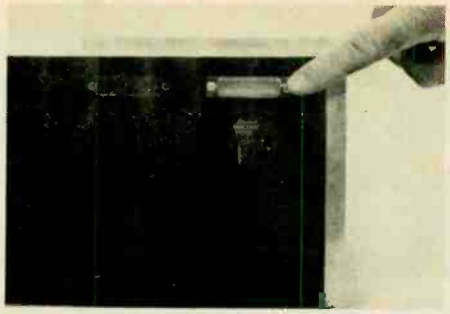
These three boards, which plug into the mother board, make up the basic computer. The central processing board is on the left, the 4K memory board on the right, and the serial input/control interface is in the center. Additional memory and interface boards can be plugged into the mother board.

double-check every step, the computer kit should take a couple of long evenings, maybe ten hours. To check out the computer you will need some form of terminal. Many of you will not understand one word of the rather extensive check out and programming instructions, that's where someone who has taken a computer science course comes in. He can run the diagnostic programs specified in the instruction manual. These diagnostics can pinpoint almost any defect, whether a defective component or a wiring error If you have purchased the kit from a computer specialty store, such as one of the Computer Marts, they might check out your boards in their own system; it depends on the particular store and the guy running it. If you make a botch of the assembly, some computer specialty shops will do the service for you at a modest fee. A friend who has studied computer science, or the specialty shop, are your two best bets if you have problems. SWTP tries hard but they're just not geared for extensive service. They will supply parts by mail rather quickly, and try to answer your letters. But, getting them on the phone can be rather expensive at long distance rates. That's why we suggest you latch on to a college student before you tackle a computer kit, or deal with one of SWTP's major dealers (the price is the same from SWTP or a dealer).

The only problem we had with the basic computer kit was a defective IC—thank heaven we used sockets!

When completed, the computer kit had 4K of memory, which could do very little other than run the diagnostics and a few simple programs and games (those games again). So, we purchased an optional 4K memory board, giving us a total of 8K memory, and we loaded in a 4K BASIC tape, and found we had no multiplication—the tape was defective. After getting a good 4K tape we had a flexible language suitable for high school level math, and many electronic programs. After a long wait, because the demand exceeded the supply at the time, we got our 8K BASIC tape which opened up a whole new world. The SWTP 8K BASIC is a powerful interpreter allowing such things as trancendental functions character strings, and user defined functions. Fact is, the SWTP BASIC is much more powerful than the BASIC in the time-share system of our local central high school district, and they have a notably good computer system and course.

The SWTP 6800 computer is our present choice for a personal computer because of its relatively low cost in relation to other computer kits, its built in monitor system (Motorola's MIKBUG) and a notably excellent BASIC interpreter. The system's only problem is common to all presently available personal computers: you lose the programs when the power is turned off. Either SWTP or an accessory supplier will eventually come out with a non-volatile extended BASIC (8K or greater) in PROM, ROM, or EPROM; and, there is word that someone is working on a FORTRAN compiler for the 6800 system.



Connections, from the terminals and other peripheral equipment, are normally made through grommeted holes in the rear of the cabinet. We have installed a Type-D connector so with proper jumpers in the associated plugs the single serial/control interface can be used for 110 or 300 baud, and TTY or RS-232 input/output.

Getting Started. As you have surmised by now, you need a lot more equipment than "just a computer" in order to have a computer system. For starters, you must have an Automatic Send and Receive Teletype (ASR TTY) so you can feed in program tapes: if you can't feed in long programs by tape you're back to games. Alternately, you might prefer a CRT TV terminal, in which case you will need either an optional, punched tape reader, (a reasonably priced accessory), or a cassette recorder and an interface between the recorder and computer (cost slightly greater than a paper tape reader, and you must build the interface. Programs are available on cassette tape for slightly less than the cost of the same program on punched paper tape).

You need the 6800 base computer, an additional 4K of memory, a terminal, some form of paper or cassette tape reader, and a BASIC interpreter program if you plan on anything more than playing games or writing simple programs.

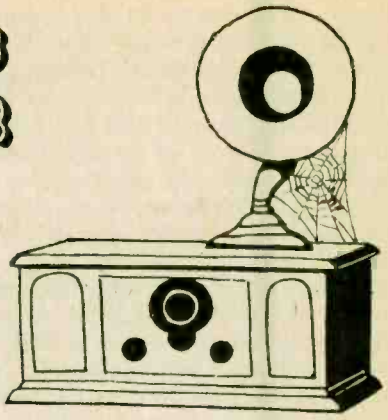
Often, if you make arrangements to get all your equipment from one source in a package deal, some items will be thrown in at a "discount" or "free." At the time this article was being prepared, the Computer Mart of New York had a special package price on the SWTP computer with an additional 4K of memory and the 8K BASIC.

We suggest you purchase your computer hardware from a local dealer because he will give you some degree of free or low cost assistance if you have problems. While our problem was only a single defective IC in the kit, it might have been a real hassle to handle it by mail or phone. Further, when we found we had a defective 4K tape our local dealer swapped the tape on the spot.

Would We Do It Again? The answer is yes. Looking back at our problem(s), the actual construction of the kit, and the final result in respect to the 8K BASIC available from SWTP, we would start out in personal computing exactly the same way, with a SWTP 6800 computer kit. The only change we would make in our system would be to save space by using a CRT TV terminal instead of a model 33 TTY, and we would use an inexpensive optical reader to feed the 8K BASIC tape into the computer. We would sacrifice the "hard copy" of the TTY for the compact size of a CRT terminal, adding a line printer for hard copy at a later time. But, all in all, we find we are using the SWTP 6800 computer in preference to our time-share system; in the long run it will work out less expensive than paying hourly charges for time-share computing. ■

Our college computer technology student was Morris Balamut, who is also the manager of the Computer Mart of New York. This is our memory board he's plugging in to the store's own SWTP 6800 to check for proper operation one board at a time). Turned out we had a defective IC. We strongly urge you do not tackle a computer kit unless you have a college level computer technology student and/or a local authorized kit dealer to back you up if you have problems. In many instances you'll find that store personnel and college level assistance are one and the same. If you must get service direct from a computer manufacturer you might be in for a long wait. When the price direct or from an authorized dealer is the same (don't forget to allow for shipping charges) get your computer kit from a local dealer.

ANTIQUE RADIO CORNER



by James A. Fred

☐ Hello, out there in Radioland! Your cards and letters have been most helpful in telling me what collectors want to know about their old radios. Keep writing to me because this is the only way I can help you find greater enjoyment and satisfaction in your collection of old radio equipment.

Arthur Williams, an antique radio collector from New Zealand, is going to tour England, Canada, and the United States during 1977 and 1978. He wants to visit as many radio collectors as his schedule will allow. If you would like to visit with him drop me a line in care of this magazine and I'll turn your name and address over to him. He will then see if he can fit you into his schedule.

The Indiana Historical Radio Society held a very successful meeting in conjunction with the Antique Wireless Association at the Auburn-Cord-Dusenberg Museum in Auburn, Indiana the middle of April. Two radio auctions were held, there was a display of old radio equipment, a flea market, and an old radio equipment contest which entertained the members. An evening banquet brought an end to this very enjoyable Antique Radio day.

This Radiola 25 came complete with antenna, and was entered by Lionel Haid, of Richmond, Indiana. As you can imagine, this set is as rare as it is good-looking.

In the last issue of ELEMENTARY ELECTRONICS I wrote about substituting tubes in AC-operated radios. There are many tubes that were made in the 30s still around so you should have no trouble finding the ones you need. However what to do with radios that use the WD11, WX12, UV199, UX199, 201A, etc. is becoming a major problem to collectors. Some collectors have decided to wire transistors underneath the tube sockets and leave dummy tubes in the sockets. Now that may be fine for the collector who doesn't care about retaining the integrity of an old radio. I am opposed to this practice as is every other serious minded collector who is trying to preserve his old radios for posterity.

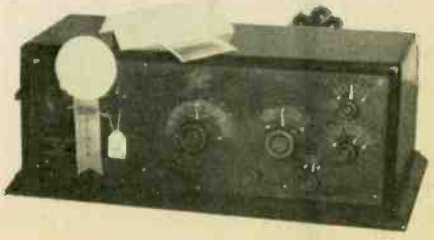
Some Good Tube Substitutions. This column will deal with several methods of providing substitute tubes to make some of the older radios (1920-1924) operate in their original way. That is to say I won't suggest changing tube sockets or mutilating the radio in any way, but will tell you how to alter tube bases or suggest tubes that can be plugged in and give results equal to the original set of tubes.

To begin our discussion an easy conversion is to use a type 40 in place of a 200A or a 201A. There are a few differences in the characteristic of the 40 and the 201A. These aren't serious to the collector, but I would not recommend using the 40 in the last audio stage to drive a speaker. The 40 requires 5 VDC at .25 amps, just as the 201A does. The amplification factor of the 40 tube is 30, while the 201A's is 8. The plate current of the 40 is .2 mA while the 201A draws 3 mA. The 40 will tolerate a higher plate voltage because its plate resistance is higher.

Another substitution is the type 112A or 71A in place of the 201A in the audio output stage of a 5-tube battery radio. Since the 71A was used in many of the early AC receivers there seems to be a good supply available. Usually a C-bias battery is recommended when using the 112A or 71A.

Of course we shouldn't forget the type 30 tube which is a 2 VDC filament triode. If you want to replace all the 201As in a set and have a 3-volt battery to supply the filaments you can plug in type 30s and get good results. Just be sure the radio has the right sockets to accept the 30. You can also replace the WX12, and UX199 with a type 30 if you use the proper filament voltage.

Some Tougher Tube Substitutions. Now that we have discussed the simple plug-in replacements let's get to the more difficult UV199 for the UX199. The UV199 has a different base pin arrangement from the UX199, which has the normal pin size and location. The tube pins are small nubs that only extend about ⅛ inch from the tube base and the filament pins are 180 degrees apart rather than side by side. Here's a sketch of the tube pins as viewed from the bottom of the tube. Note that the UX199 has two larger-diameter filament pins which makes it difficult to insert it improperly into the socket. Back in the 20s adapters were made so you could use a UV199 in the UX199 socket, or even use it in place of a WX12 or 201A. The 99s required only 3.0 to 3.3 volts DC on the filament which meant that you could use 2 No. 6 dry cells in series for the filament supply. In remote areas this was more convenient than using a storage battery that had to be recharged every few



Beautifully restored and working perfectly, this Zenith 3R receiver was a winner in the restoration contest at the Indiana Historical Radio Society meeting, in Auburn, Indiana.

weeks. You can make an adapter by mounting a socket which will hold the UV199 on top of a 4-pin tube base and wiring the socket lugs to the proper base pins. Likewise you can make an adapter for the UX199 tube to be used in a set intended for 201As. The photo shows one such adapter. A long screw can be used to hold the socket and base together.

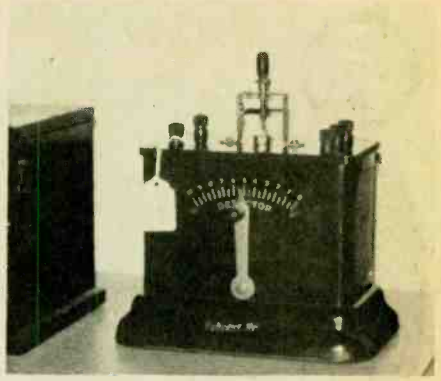
I have saved the most difficult substitution for the last. This is the substitution of an 864/VT24, a type 30, or a 1H4G for a WD11. It is nearly impossible to find a WD11, which many collectors need for the Radiola III, the Balanced Amplifier, Radiola IIIA, and the Radiola Grand as well as other radio sets. Nearly every collector has one of these Radiolas, but very few have working tubes in them. The 864/VT24 is a non-microphonic version of the WD11 developed by the Army Signal Corps, except that it has the small, regular, 4-pin base with two large and two small pins. The large pins are for the 1.1 VDC filament which is the same as the WD11 requires. This makes the 864/VT24 compatible with the WD11 except for the base pin locations. There have been many methods used to adapt the 864 to the WD11 configuration. You can remove the base from a defunct WD11 and by grinding out the base, force an 864 into it. The main trouble with this idea is that you have made the WD11 unfit for use as a non-working display tube. A better way is to leave the WD11 as is and use it for display only. Some collectors have no desire for their sets to play, but only want them to look like new.

Preferred Method. The method I prefer is to remove the glass bulb from the base (either the 864/VT24, type 30, or the newer 1H4G), remove the two larger pins from the base, make a new large pin (plate) and stake it in the proper position along with a new small pin for the other filament lead. Now this isn't at all difficult if you have patience, and are reasonably handy with tools, and have a source for the pins needed.

The first thing you must do is to obtain a supply of 864s, 30s, or 1H4Gs. Check with your friends, old radio repair shops, war surplus electronic part stores, or look in a copy of BUDGET ELECTRONICS for a list of suppliers of old vacuum tubes. The type 30 was made in two bulb shapes. One is tubular about the same diameter as a small 4-pin base, the other has the small dome shaped bulb. The 864/VT24 has a tubular bulb 1-3/16-inch in diameter which is nearly the same as the WD11. The 1H4G is an octal tube with a tubular glass bulb 1-9/16-inch in diameter. This diameter may be too large for some of the older radios. The 1H4G tube has the same characteristics as 30.

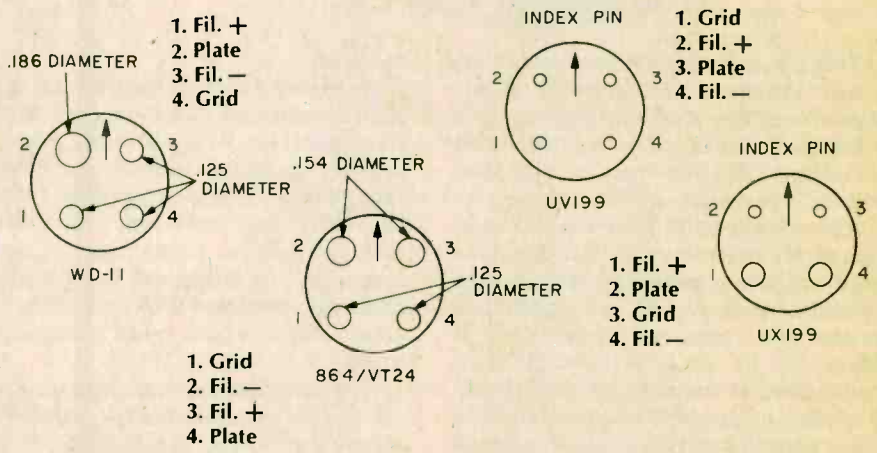
The next step is to remove the glass bulb from the base. The wires soldered into the tube pins help hold the base to the bulb plus there is cement holding the base to the bulb. Over the years much of the cement will have dried out and left the base loose on the glass. Put on a pair of leather gloves and grasp the bulb in one hand and the base in your other hand and twist Some bulbs will come loose this way and others won't. If the bulb doesn't come loose place the tube in the

(Continued on page 99)



A real find! This rare and beautifully restored Federal Jr. crystal receiver was seen on display at the Indiana Histoical Radio Society meeting in Auburn, Indiana held recently.

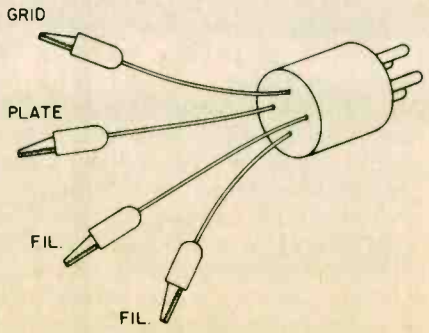
TUBE ADAPTATIONS FOR ANTIQUE RADIOS



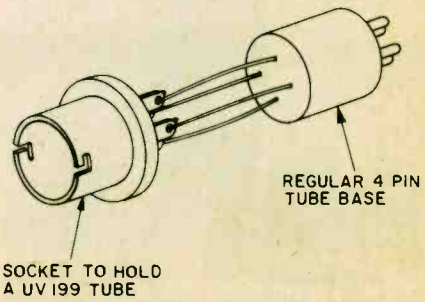
Here shown are the differences in pin size and placement for the four old-time tubes discussed in the text. The pins are viewed here looking from the bottom of the base.

Note carefully the differences as to which pin is connected to Fil.+, Plate, Grid and to Fil.—. It's hard to go wrong if you follow these diagrams. Your antique radio will soon be as good as new—and even work in the same way!

One of the main problems to be faced when adapting old-time tube sockets is figuring out just what each of the pins is connected to. There has never been any sort of standardization. In fact, even the diameters of the pins aren't constant.



Here's an arrangement that allows you to test old-style, four pin tubes in modern four pin sockets such as those on most of today's tube testers.



It's easy to make an adapter to use a UV199 tube in place of the older UX199. (See text for details).

Power Up With An "AEROGENERATOR"

Your energy troubles may be gone with the wind!

☐ Tilting at a windmill in Boroughbridge, England might prove a shocking experience to a latter-day Don Quixote. This windmill, situated on the country estate of a North Yorkshireman, is more than a scenic eyecatcher—30 Kw. more.

The traditional, centuries-old technology of harnessing the wind has been reworked and modernized with a view towards solving one of mankind's newest, and urgent, problems. Where is the power to run civilization going to come from in the next decades? Fossil fuels are being depleted, nuclear technology seems caught in an environmental bind, solar energy is not yet reliable on a large scale—perhaps we should look to the wind.

The aerogenerator uses standard components such as fixed blades instead of variable-pitch ones. Even though it rotates, due to the fixed blades, at a constantly varying speed, a complex hydraulic system ensures the generators turn steadily.

Sir Henry Lawson Tancred, an engineer, aviator and owner-designer of the Boroughbridge windmill takes pride in pointing out that his is the largest, private venture into windpower since the 1950's. Sir Henry, both nobleman and technocrat, refers to his creation as an "aerogenerator," to distinguish her from her more plebian sisters who do nothing but grind flour and look good amongst the tulips.

The aerogenerator can produce up to 30 Kw. of useable, electric power. Sir Henry's prototype presently drives a 5 Kw. generator that, even at low wind speeds, can produce grid-synchronous power which can be fed to the grid network and from there into homes. When the wind rises, the aerogenerator can produce on a second generator another 25 Kw. of non-synchronous power to be used for many heating purposes.

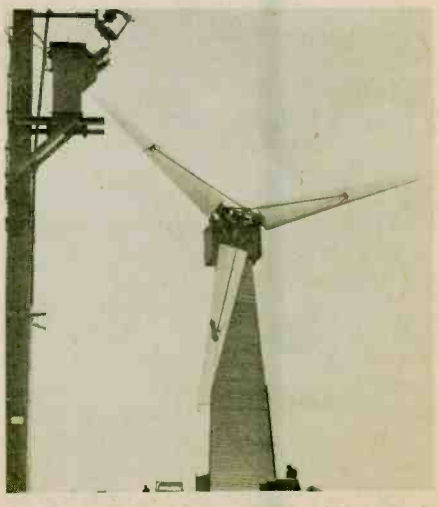
The windmill (pardon us, Sir Henry), could easily produce all 30 Kw. as grid-synchronous but, as Sir Henry said, that "would have been too much for the little single-phase grid line" which runs through Sir Henry's estate of Aldborough Manor.

Though the windmill uses standard components, which helps to keep its cost at a reasonable level, the technological problems involved in its design were nothing to be sneezed at. Americans at the Lewis Research Center in Sandusky, Ohio found that out when they tried to build a power-generating windmill. Their version cost much more than Sir Henry's aerogenerator and, due to blade whiplash and tower oscillations, it never operated above 50 per cent efficiency.

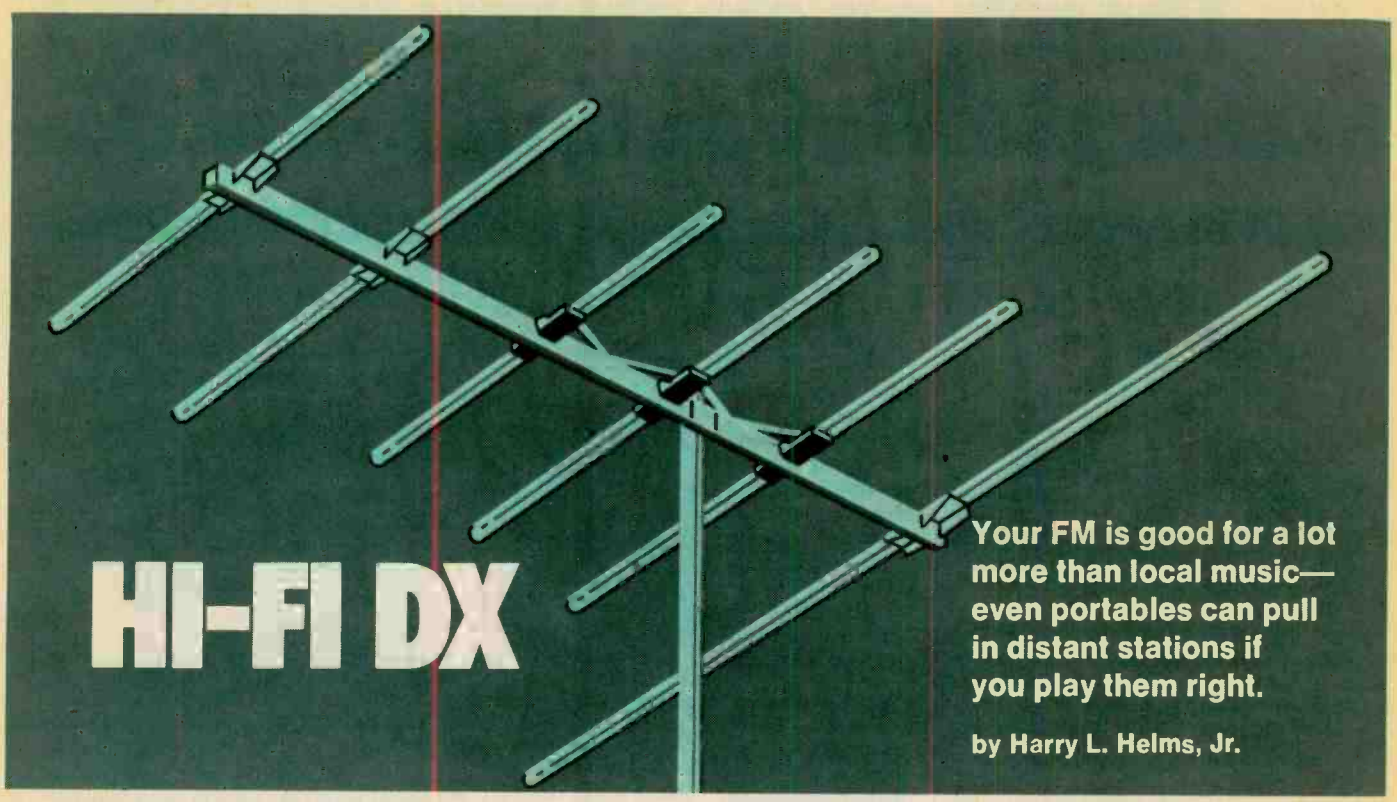
Sir Henry drew on both his engineering and aviation backgrounds and came up with an idea to link the blades together like the spokes of a wheel. This did damp out the oscillations. He then used fixed-blades rather than ones with variable pitch in an effort to keep costs down. He solved the resultant problem of variable rotational speed with a system of hydraulic pumps that ensure a steady pressure runs the generators.

According to the aerogenerationists, windmills are the coming thing. Even now, Sir Henry envisions a "100 meter in diameter wind-wheel rated at about two megawatts and costing a mere fraction of the US designs."

Windmills may be a part of the solution to the energy crisis and, one thing for certain, Sir Henry's ideas aren't going to blow away! ■



On the pole to the upper left of the windmill you can see the special installation which receives the grid-synchronous portion of the generated power. Once into the main power-network it can be directed to wherever it may be needed.



HI-FI DX

Your FM is good for a lot more than local music—even portables can pull in distant stations if you play them right.

by Harry L. Helms, Jr.

☐ You say you have a problem? Feeling low over Radio Moscow? The standard AM band getting pretty bland? Ah yes, you have a case of the "DX blahs," which is the result of getting into a rut with your SWL activities. The only cure, my friend, is to try the "higher Hertz"–88 to 108 MHz to be specific, the home of FM broadcasting and FM DXing!

FM DXing is now *the* "in thing" among DXers in the know. You can't tune the world anytime you want, like on shortwave, nor can you easily tune in distant stations like on the AM broadcast band–but where else can you DX in stereo or quadraphonic sound? And FM DXing is trailblazing–we are still unraveling the mysteries of long-distance reception at FM frequencies. Finally, you can DX without a kilo-dollar receiver or monster antenna system. If you have an ordinary portable or table radio that covers the FM band you have all you need to start FM DXing today.

As one example, on a July afternoon in 1975 your author heard FM stations from New Hampshire to North Dakota on a simple $30 AM-FM portable using only its built-in whip antenna. Such an experience is actually *common* in FM DXing. The secret lies not in your equipment or in an extensive knowledge of radio. Rather, FM DXing depends upon being in the right place at the right time!

Propagation Possibilities. There are four main ways in which FM signals are propagated, or reach the receiver from the transmitter. *Meteors* provide one way, as the ionized trails left by meteors entering the Earth's atmosphere can actually reflect FM signals over great distances. *Auroral reflection* is another method, and is associated with the Northern Lights. FM signals are actually reflected off the auroral curtain.

The simplest type of FM antenna, the old "rabbit ears." It can get some amount of directivity by the easy technique of just rotating the two elements by hand. When conditions are right, it will give surprisingly good results. Just remember, if you want this type of antenna, don't go for elaborate knobs and slides. They don't do anything at all to help reception.

Both of these methods, however, involve techniques and methods of interest to advanced DXers. Fortunately, most FM DX is the result of propagation modes that are easier to use.

Sporadic-E is by far the most spectacular method of FM DX reception that the beginner will encounter. Sporadic-E takes place in the E layer of the Earth's atmosphere approximately 50 miles above sea level. For reasons not yet completely understood, scattered patches of intense ionization form in the E layer of sufficient intensity to reflect FM signals over long distances. A typical range for sporadic-E skip is between 40 to 1200 miles. Sometimes the FM signals will reflect off more than one cloud, resulting in reception at distances of 2500 miles! Sporadic-E skip is also one of the kindest DX methods for the FM newcomer, for it is often just as good (and sometimes even better) on portables and table radios as it is on expensive receivers and fancy antenna systems. When sporadic-E is taking place, stations over 1000 miles away blast through at local levels, even overpowering semi-local stations!

A more subtle method of propagation is *tropospheric bending*. Tropo, as it is called, takes place when two differing air masses meet. A typical case is where cool Pacific air from the West encounters warm, moist air from the Gulf of Mexico. At the boundry point where the two air masses meet, a "duct" is formed that traps FM signals and

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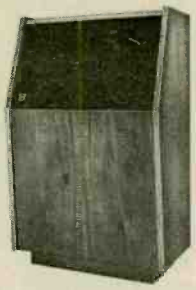

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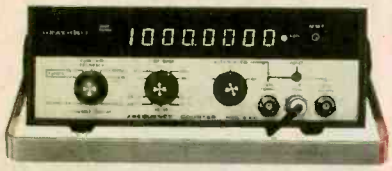

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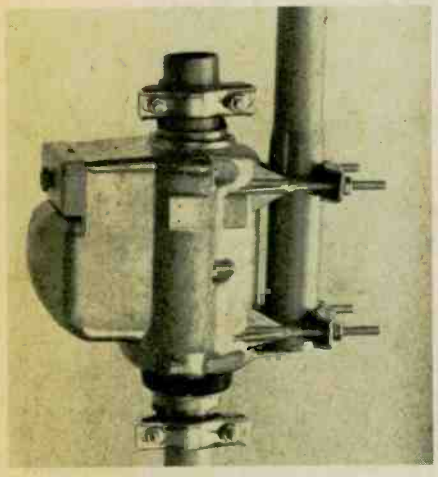
bends them over the horizon along the length of the boundry. The FM signals are trapped in the troposphere, the layer of our atmosphere that extends from sea level to about six miles. Ranges for tropo DX are not ordinarily as long as for sporadic-E, usually only a few hundred miles, but tropo charting has produced reception of FM stations from Houston in New York.

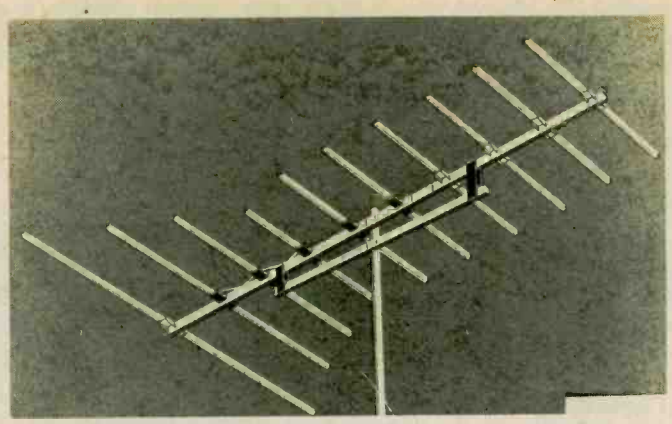
When to DX. Sporadic-E is highly unpredictable, and may take place any time of year. However, peak activity is



The servo-rotor unit for an outdoor antenna rotator. This control, mounted indoors, determines the direction to which the rotator will point the antenna.

from early May to early August, with a lesser period of activity from late December to early January. Daylight hours are best, with mornings and early evenings at your DX site usually best. However, most top FM DXers make it a point to check the band every chance they get during the busy summer FM DX season.

Sporadic-E starts on lower frequencies and works its way up the frequency spectrum into the FM band. Smart FM DXers keep a check on television channels 2 through 6 for signs of sporadic-E activity on television. Sporadic-E on the TV channels can be identified by rolling



A ten element yagi FM antenna. This design is able to receive very distant signals because virtually all of its sensitivity is concentrated along the axis.

black bars across the TV picture, garbled audio, ghost pictures on local TV stations, and the appearance of TV signals on channels normally empty. When sporadic-E becomes noticeable on channels 5 and 6, it is a sign that sporadic-E is about to reach the FM band.

Generally, sporadic-E does not cover the entire FM band. It reaches a certain frequency, called the *maximum usable frequency* (MUF), the highest frequency on which sporadic-E can produce long distance reception. Sporadic-E skip is generally first noticed in the 88-92 MHz educational portion of the band. This is where to start DXing if sporadic-E is present. Many DXers work their way up the band, logging new stations as they go, and follow the sporadic-E until it reaches the MUF.

Changes of direction are frequent in sporadic-E, with DX signals first coming from the north and then abruptly swinging toward the west, for example. This is due to the fact that the sporadic-E clouds themselves are in motion. Your author has heard sporadic-E skip swing all the way from New England to the Plains states in a single opening. Also, signals via sporadic-E skip are often loud but quite variable in strength. Rapid fades and audio distortion are common. It is highly erratic but superb fun while it lasts!

Tropo is less spectacular but more predictable than sporadic-E. Tropo is virtually a daily happening during periods of fair weather because of sunrise tropo. When the sun rises, it heats the cool dawn air and causes atmospheric inversions. Such conditions last until approximately 9:00-10:00 a.m. local time and enable listeners to log stations within a two hundred mile radius or less.

Long-haul tropo of several hundred miles is most common in autumn. A check of your newspaper's weather maps can provide important tips as to when tropo might be present. A key

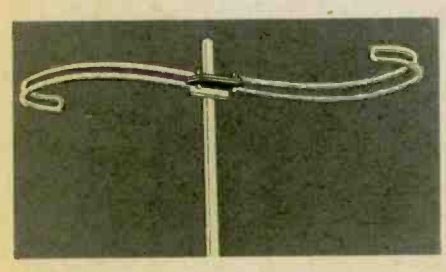
The motor and gear assembly for an outdoor antenna rotator. The unit must be sturdy enough to withstand strong winds, and to be able to swing the long beam of the FM antenna around. It also must not be affected by weather extremes.

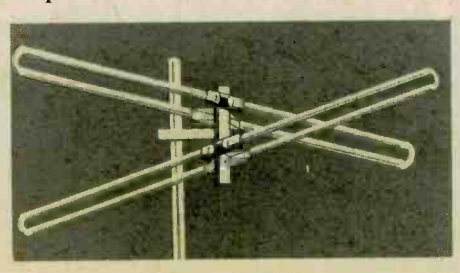
clue is a slow moving high pressure system followed by a cold front. Ducting which permits long-distance FM reception will exist where the cold front and high pressure area meet, and the duct will run the entire length of the boundry line between the two air masses.

Tropo is also common in coastal areas. Listeners along both the Atlantic and Pacific coasts will note enhanced reception of stations up and down both coasts during summer evenings. Tropo openings are also frequent between the coastal areas of the Gulf of Mexico.

Tropo is fairly common in the eastern two-thirds of the United States, but is rare in the more arid and mountainous areas of the West. Tropo is excellent, however, up and down the Pacific coastline west of the mountains.

(Continued on page 102)





Two different types of omnidirectional antennas. Each one provides a pattern of sensitivity that is as nearly circular as possible. With these units an antenna rotator is unnecessary since nothing is gained by turning them, although the lack of a reception pattern concentrated in one direction means that a lot of sensitvity is lost.

SUPER SCA SOOTHER

There are more possibilities for music than you thought in your FM tuner. e/e shows you how to make them real.

by Herb Friedman

YOU CAN LISTEN TO SCA BROADCASTS at far greater distances with this SCA (Subsidiary Communications Authorization) adapter for your FM receiver or tuner than with previous designs, even those costing many times more. The secret lies in a new integrated circuit now available at very low prices which decodes the ultrasonic frequency the SCA signal is on. This IC is a PLL (Phase-Locked Loop) which acts as the detector of the 67 kHz SCA carrier wave which the subsidiary signals are transmitted on.

Although most people are unaware of it, many FM stations transmit not just the two signals of a stereo program, but one, two, or even three other programs, usually music, which cannot be heard by the owners of normal FM tuners or receivers. These programs can be heard only if you have a special SCA receiver, or if you have an SCA adapter, similar to the one described in this article.

Our SCA Super-Soother is so-called because the most common use for SCA is to transmit Muzak-like background music into stores and factories. It uses two ICs which cost $6.00 (total, including postage) plus a handful of resistors and capacitors. Because of the advanced design made possible by the PLL IC, Super-Soother can grab SCA signals which ordinary SCA adapters would lose completely, or at best receive with lots of hash and/or distortion—and who needs that with soothing background music, music to lull you by . . . or whatever?

Using a two IC circuit in an amplifier / (PLL)-detector configuration Super-Soother will actually permit you to DX your FM-SCA programs. No longer will your SCA listening be restricted to local FM stations. You can now monitor *fringe reception* FM stations with SCA programming.

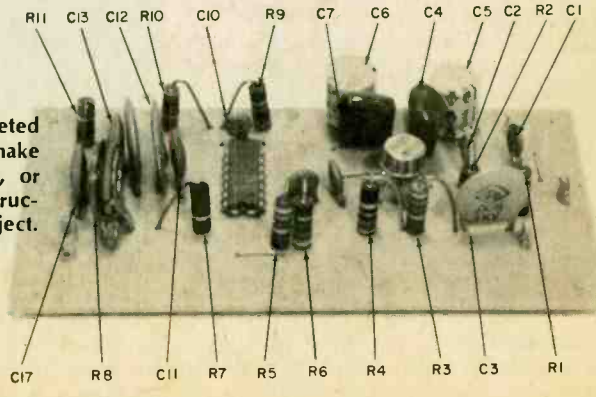
But before going further let's take a look at what SCA is all about. When a *Subsidiary Communications Authorization* is granted to an FM station by the FCC the station is permitted to transmit up to *three more programs* in addition to its regular program (called the main channel program) by a special method of modulation. A standard FM radio—either mono or stereo—cannot detect the SCA programs. The regular listening audience hears only the main channel programming. In fact, there is no way a listener with a standard FM radio can tell the station is transmitting an SCA program(s). Only listeners with FM radios equipped with an SCA adaptor can hear the SCA program.

If you would like to tune in to these "phantom broadcasts" you can do so with Super-Soother SCA Adapter. It's super because its extra-high sensitivity permits reception of SCA programs that other low cost SCA adaptors can't detect.

What You Can Hear. For many years SCA has been used to transmit educational programs and weather reports to specialized audiences; it has been used for reading to the blind, and even for broadcasting some school tests. The most common use of SCA, however, is the transmission of background music —the type heard in restaurants and shopping centers—and ethnic music. For example, in the New York City area there are FM stations with SCA programs of the music of China, Greece, Ireland, and many others.

Best of all, this pleasant, interesting music is rarely, if ever, interrupted by an endless barrage of commercials or the patter of an announcer in love with his or her own voice.

How It Works. SCA programming is transmitted by a 67 kHz FM subcarrier (or sometimes 65 kHz impressed on the main FM carrier). When a station broadcasting SCA is received



Here's the way the completed board looks. You can make your own circuit board, or order it. Perf board construction won't do in this project.

by a standard FM radio or tuner the SCA subcarrier is simply wiped out in the radio's detector and the listener has no idea it exists.

To receive SCA the regular FM detector output must be fed into a 67 kHz detector before the 67 kHz subcarrier is eliminated by the standard FM detector's de-emphasis network.

Until recently it took a lot of expensive hardware to receive SCA programs: a very sensitive receiver and a rock-steady detector. (A good receiver is needed because the SCA subcarrier is usually only 10% of the total FM signal.) Though many low-cost SCA adaptors have been available in projects, or in wired form, most had a tendency to burp, gargle or distort on weak SCA levels.

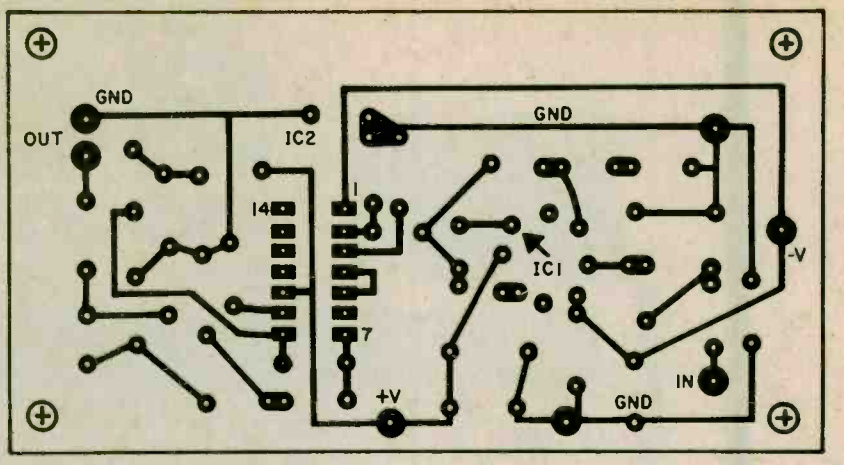
While the radio astronomy crowd had a great weak-signal detector known as the *phase-locked loop* or PLL, it was also true that the astronomical-use PLL was astronomical in price. Thanks to modern solid-state techniques, however, the Signetics Corp. has come up with a PLL specifically intended for SCA detection that's priced well under $5.

Available in both the standard 8-pin round and the 14-pin DIP IC packages the Signetics SE/NE565 requires virtually no external hardware for SCA detection. Most important, since the PLL automatically locks onto the incoming SCA subcarrier frequency the SE/NE565 will demodulate subcarriers of either 67 or 65 kHz without need for individual adjustment.

Combination Gets Results. Unfortunately, the phase-locked SCA detector requires at least 80 mV input from the FM detector for good reception, and this usually means that only one or two very strong, or local SCA stations can be received. To make our Super-Soother the best there is we have combined the PLL with a high gain operational amplifier. The result is the Super-Soother which can receive SCA programs even using a cheapie FM radio and an indoor (rabbit-ears) antenna.

Another plus feature of Super-Soother is that no large filter coils are needed to suppress the main channel program. Even SCA programs on stereo stations are received cleanly, with no trace of *stereo hash*. And because large coils aren't need the entire adaptor can be assembled on a 2¼-in. x 4¼-in. printed circuit board which you can purchase, or make, as you wish.

Because the gain of the adaptor is unusually high it must be assembled on the circuit board exactly as described to insure stability. You can't build this project on perfboard.



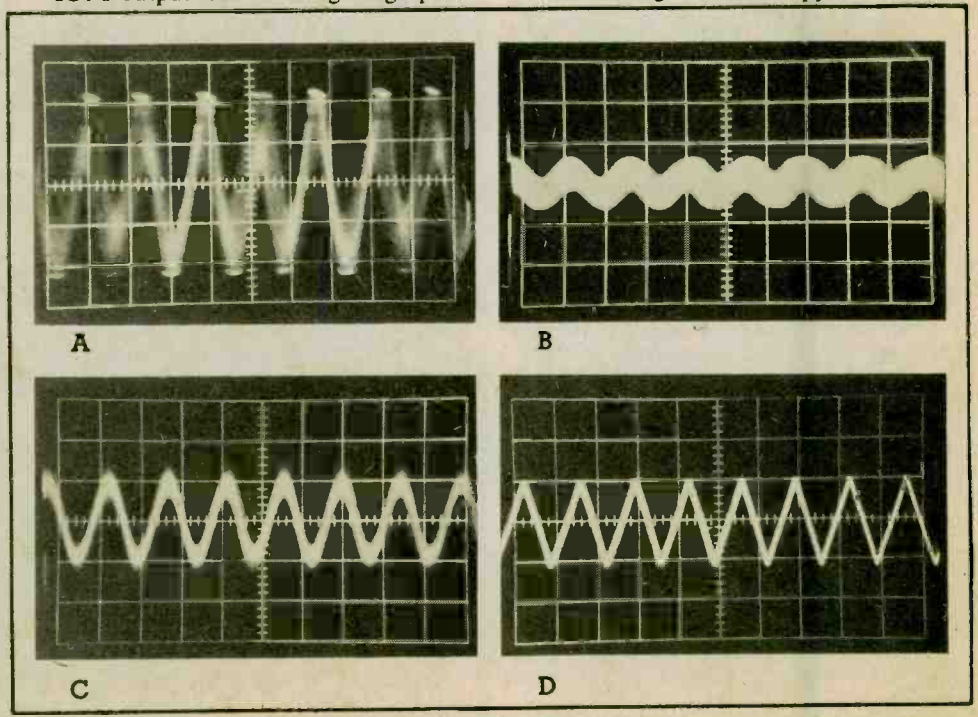
Exact-size printed circuit board layout is shown here. Transfer the image to copper clad board using carbon paper. This is the bottom (copper) side.

How The Circuit Works. The signal from your FM tuner's detector, before de-emphasis, is applied to operational amplifier IC1 through a high-pass filter consisting of C2, R1 and R2. The filter's effective frequency is 60 kHz, which removes just about all of the main-channel information. The frequency response of the amplifier is tailored by the feedback loop through R3 and C3 to further suppress main-channel information.

IC1's output is fed through high-pass filter C9 and R5 to IC2, the PLL detector. IC2's output is passed through a low-pass filter consisting of C12, C13, C14, R9, R10 and R11 which provides SCA de-emphasis and noise suppression. The output level at C15 is about 50 to 100 mV depending on the particular signal, and can then be fed to your hi-fi amplifier.

Since SCA audio response is limited to a maximum of 7 kHz just about any amplifier can be used.

Note that Super-Soother requires a bipolar power supply in the range of ±6 to ±9 VDC. The supply can be either batteries or a power-line bridge rectifier using a center-tapped 12-volt



Oscilloscope patterns will pinpoint any possible difficulty. You can use a general purpose scope since the signals are under 100 kHz. With "triggered" scopes, set the time base to u sec/cm. Photos B and C are input and output of IC1, the 67 kHz amplifier. If signal is clipped as in A, main channel program may break through—see text for curves. Normal IC2 pin 9 waveform is shown in the waveform of D. Vertical sensitivity B, 20mmV/cm; C, IV/cm.

filament transformer as shown on the schematic. Since the SCA adaptor requires only about 10 mA of current any small power transformer can be used.

Assembly. If you cannot make your own circuit board, you can purchase a drilled and plated board. See the parts list for information.

If you make your own board use a #56 bit to drill the holes for the push-in connecting terminals and trimmer potentiometer R8. Drill the corner mounting holes to clear a #4 screw. Drill the component holes with a #58, #59, or #60 bit.

Install IC1 and IC2 before any other components. Note that the IC1 lead opposite the case tab is #8. Insert the leads—beginning with #8 and push IC1 within ¼ to ⅜-inch of the board. Solder the leads and cut off the excess.

If this is your first IC project it would be wise to use IC sockets.

Hold the board so you are looking at the top, with IC1 to your left. Hold IC2 so the notch is away from you and insert IC2's leads into the matching holes. *Doublecheck the notch before soldering.*

Install trimmer potentiometer R8 and solder. Then install the three wire jumpers, and finally, the remaining components, taking extreme care the polarity of capacitors C5 and C6 is correct. Note that C5 has the positive lead connected to ground.

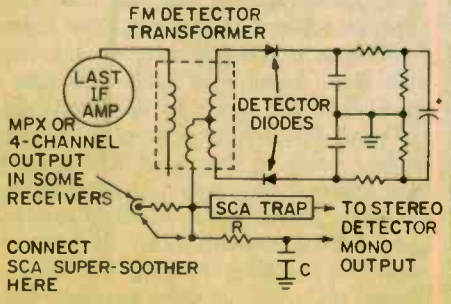
While capacitors C12 and C14 are indicated as 0.02 uF they aren't the easiest to obtain in miniature size. You can substitute two parallel-wired 0.01 uF capacitors.

The three oscillosope traces show what you can expect to get if you are tuned to an SCA station. Photo B is the input, IC1 pin 2; note the presence of a 67 kHz carrier. Photo C is IC1 pin 6; note the very strong 67 kHz carrier. Photo D is IC2 pin 9, the phase lock detector's voltage controlled oscillator triangular wave output.

If you don't get photo B, the trouble is the connection between the tuner and the adaptor. If you get photo B but not photo C, the trouble is in the IC1 circuit. If you get photo C but not photo D, the trouble is in IC2.

If you don't get photos C and D, there is most likely a major fault in the assembly; we have specifically designed the adaptor so one defective IC cannot disable another IC.

Setup And Checkout. Either a bipolar battery power source or an AC supply can be used. Since there is no difference (in this case) in performance between a ±6 and ±9 VDC supply use whatever you have available. For long-term battery life Burgess Z4 6-volt batteries are suggested. However regular (or long-life) 9-V transistor batteries will work fine.



The Super-Soother (or any other SCA adaptor) is connected after the FM detector, but before the deemphasis network, as here.

PARTS LIST FOR SUPER-SOOTHER

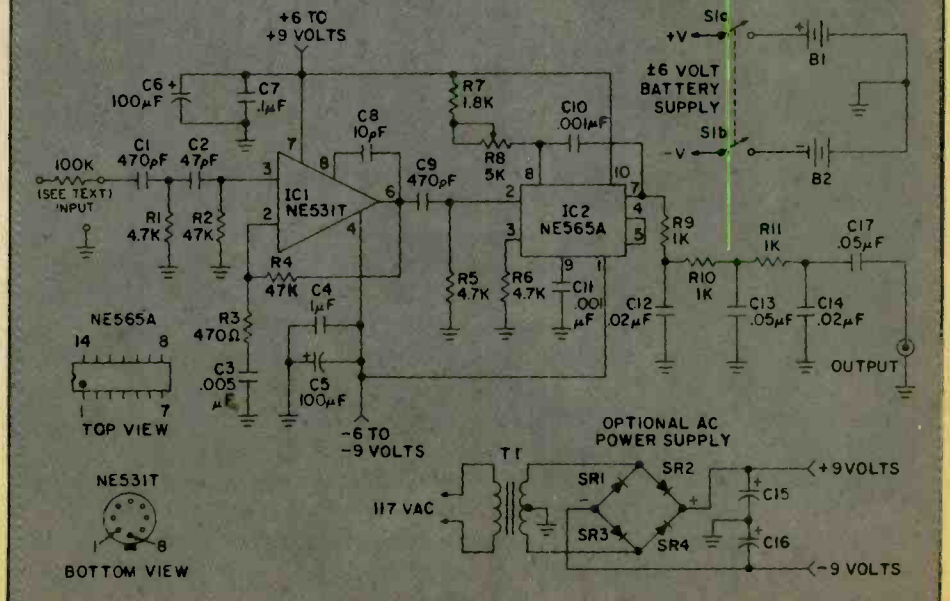
C1,9—470-pF capacitor (Radio Shack 272-125 or equiv.)
C2—47 or 50-pF capacitor (Radio Shack 272-121 or equiv.)
C3—.005-uF capacitor (Radio Shack 272-130 or equiv.)
C4,7—.1-uF capacitor (Radio Shack 272-135 or equiv.)
C5,6—100-uF, 16-VDC or better electrolytic capacitor (Radio Shack 272-1005 or equiv.)
C8—7 or 10-pF capacitor (or use two Radio Shack 272-120 capacitors wired in parallel)
C10,11—.001-uF capacitor (Radio Shack 272-126 or equiv.)
C12,14—.02-uF capacitor (use two Radio Shack 272-1065 in parallel)
C13,17—.05-uF capacitor (Radio Shack 272-134 or equiv.)
IC1—op amp integrated circuit Signetics NE 531T (available from supplier listed below)
IC2—phase-locked-loop SCA detector integrated circuit Signetics NE 565A (available from supplier listed below)
R1,5,6—4700-ohm, ½-watt resistor (Radio Shack 271-000 or equiv.)
R2,4—47,000-ohm, ½-watt resistor (Radio Shack 271-000 or equiv.)
R3—470-ohm, ½-watt resistor (Radio Shack 271-000 or equiv.)
R7—1800-ohm, ½-watt resistor (Radio Shack 271-000 or equiv.)
R8—5000-ohm potentiometer, circuit-board mounting (Radio Shack 271-217 or equiv.)
R9,10,11—1000-ohm, ½-watt resistor (Radio Shack 271-000 or equiv.)
S1—SPST switch (Radio Shack 275-602 or equiv.
Misc.—Cabinet 6-in. x 4-in. x 2⅜-in. or larger (Radio Shack 270-252), two batteries 9-VDC or 6-VDC unless power supply is used, battery connecting clips, phone jacks, wire, solder, etc.

An etched, drilled, printed circuit board for the Super-Soother SCA Adapter is available from Electronic Hobby Shop, Box 192, Brooklyn, NY 11235 for $6.95. US orders add $1.50 for postage and handling; Canadian orders add $3.00. No foreign orders, please. Postal money orders will speed delivery; otherwise allow 6-8 weeks for delivery. NY state residents must add sales tax.

The two ICs for this project are available from Circuit Specialists Co., Box 3047, Scottsdale, Ariz. 85257 for $6.00 which includes shipping and postage.

PARTS LIST FOR POWER SUPPLY FOR SUPER-SOOTHER

C15, 16—2000 or 2200-uF, 20 VDC or better electrolytic capacitors (Radio Shack 272-1020 or equiv.)
SR1-4—Bridge rectifier or separate diode rectifiers—anything over about 15 mA will do (Radio Shack 276-1151 is an inexpensive bridge rectifier rated more than enough.)
T1—Small 12.6-VAC filament transformer (Radio Shack 273-1385 is more than adequate.)



e/e SUPER SOOTHER

Super-Soother connects to your radio or tuner between its FM detector and de-emphasis filter. If you connect after the de-emphasis filter you will find the 67 kHz subcarrier has been filtered from the detector's output signal and you will get nothing but noise from the Super-Soother. The drawing shows a typical FM detector output, the de-emphasis network, and the correct connecting point for the adaptor. Since it is possible the Super-Soother will load down the detector for normal FM reception I suggest a switch be installed so it can be removed from the circuit when not being used for SCA listening.

Super-Soother is most conveniently connected through a phono jack installed on the rear apron of the tuner or radio, though you can use a direct wire connection.

If you have one of the older FM tuners with an *MPX* output you already have the correct connection because the MPX output *is* the *non*-deemphasized detector output. Similarly, if you have a modern FM tuner with an *FM detector, 4-channel, or FM Quadrasound* output jack you also have the correct connection as they are all FM detector outputs from *before* the de-emphasis network.

Connect the tuner's detector output to the Super-Soother with the shortest possible length of shielded cable, or install it directly inside the tuner or receiver if there is sufficient room. Connect Super-Soother's output to any high-gain amplifier such as the microphone input of a hi-fi or general-purpose amplifier.

Locking The Loop. Tune in a station you know (or believe) is transmitting an SCA program (a call to the station should get you the info) and adjust trimmer potentiometer R8 for best SCA sound quality. Normally, the reception will be almost completely garbled and then fade into a clean signal as R8 is adjusted. As R8 is adjusted further the sound will again garble. Set R8 so it is approximately midway between the two settings that produced garbled sound. Usually, the adjustment is quite broad so don't be too fussy.

If you don't know which stations are transmitting SCA set R8 to its mid-position and tune the station very carefully and very, very slowly. When you hear anything that sounds like distorted music try adjusting R8—if it's real SCA it will turn into clean sound as R8 is adjusted. Note that some stereo stations can cause sound bursts that appear to be SCA. If adjusting R8 doesn't clean up the bursts it's not SCA. Note that once R8 is properly adjusted there is no stereo hash interference with SCA signals; hash will only be heard from non-SCA signals.

Problems? The high sensitivity of this system may require that the overall gain be reduced. In the event you cannot receive *any* SCA stations you either have none in your area or you have made a construction error. Here are some hints to help.

1) If your problem is a weak signal resulting in high frequency noise try changing C12 and C14 to 0.05 uF.

2) If your problem is background breaking through from the main channel the problem is probably caused by adaptor overload (clipping). Simply change C1 and C9 to approximately 300 pF. This will attenuate the subcarrier and clean up the breakthrough on very strong signals, though very weak signal might get lost (you can't grab, or hear, them all). A second, simple corrective procedure is to install a 100k ohm resistor in series with the input from the radio or tuner's detector. This effectively cuts down the input signal and eliminates overload. ■

NOT ACCORDING TO HOYLE

A tricky computer can stop you from trumping a partner's ace.

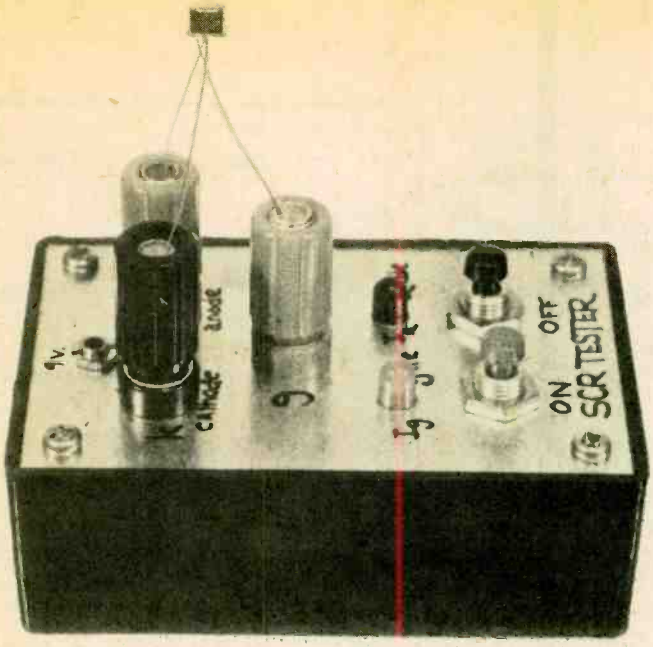
Each opponent has his own display before him. The light-emitting-diodes (LEDs) show each card in the player's own hand; then, with a touch of the light-sensitive pen to the recall diode the LEDs change to show the cards already played during the game. This feature frees the player's minds from having to recall cards.

☐ Since long before **2001—A Space Odyssey's** Hal, the smarter-than-human computer was born, bridge players have dreamed of a machine they could play on which would do their remembering for them. And now it's here, called Bridgemaster and it works using a light pen to play the cards.

The four-hand electronic game board uses light-emitting diodes (LEDs) and light-sensing pens instead of cards. It allows the players, at the touch of the diode with the pen, to deal hands in split seconds—electronically selected at random by the board—store or recall from the memory bank every card, trick and play of the game. Bidding is simplified with the aid of the memory.

In front of each player is a display board consisting of the four card suits, Spades, Hearts, Diamonds and Clubs, with each card shown from One through the Ace. Along with each card sign is a diode which lights up when that card is used. The central area of the display board contains the panel which shows the state of play and the reset diodes.

Each player holds his light-sensitive pen to the chosen diode in order to activate his play. Playing the conventional way, with an open partner's hand is easy, too. It's just a matter of turning the display board around 180 degrees after the bidding. ■



"Bad SCR" LEDIT Said It

Here's a device to check those cheap, surplus bargains.

by David R. Corbin

☐ Everyone loves a bargain, and bargain bags of semiconductors often yield great buys in the form of perfectly good, but unmarked and untested diodes, transistors, and silicon-controlled rectifiers (SCRs). The trouble is, how do you go about identifying the leads and testing these semiconductors?

A simple, one-evening project using light-emitting diodes (LED) both as indicators and as functional circuit parts in the testing process can now be built for less than five dollars. This LED-indicating tester (LEDIT) will check out diodes and SCRs, and to some will even identify leads of and test many transistors for opens and shorts.

While transistors are actually quite easy to check on a standard ohmmeter, using the lower voltage, middle-range scales to prevent excessive voltage or current through the transistor, an SCR is a bit more difficult. As shown in the drawing, an SCR contains the equivalent of two transistors connected in a closed feedback loop. One lead is the *anode*, the other the *cathode*. A third lead is called the *gate*.

How SCRs Work. Whenever the gate is brought close enough to the voltage on the anode to cause a specified minimum current to flow in through the cathode and out of the gate, the SCR will suddenly turn *On* and exhibit a "short," similar to the action of a conducting diode, provided current is permitted to flow in the cathode-to-anode circuit. It will stay in this mode even if the positive voltage is removed from the gate. Only by reducing the anode current below a specified minimum level can the SCR be turned *Off* again.

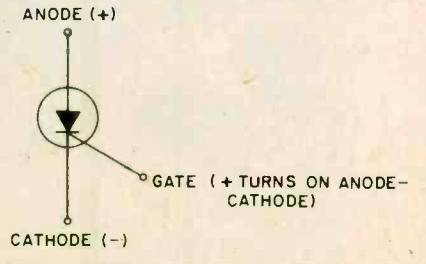
The problem with trying to check most common, small-size SCRs with an ohmmeter is that the minimum gate current and minimum holding current are naturally provided by the ohmmeter. All but the cathode-to-gate path may check "open," making it impossible to identify the leads on an unmarked SCR. What LEDIT does is to provide a quick and low-cost way of putting a safe current through the SCR gate and anode circuits, while providing enough current to turn on and latch virtually all small SCRs found in grab-bag assortments.

By placing an adjustable resistance and a current meter in series with the anode and gate, you could obtain the specified current levels, but for most quick testing of SCRs (open, shorted, or perhaps not even an SCR after all) LEDIT will provide all the information needed.

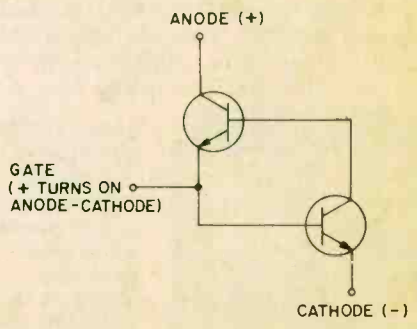
Checking SCRs. There are five ways to misconnect an SCR to the three posts, and one correct way. None of the incorrect ways will damage a good SCR among the vast majority of those around today. The correct connection, when identified, provides for short tests between gate and cathode, cathode and anode, and anode to gate. It also provides for open tests between cathode and anode, and cathode to gate, and turn-on/turn-off functions.

Here's How It Works. Light emitting diodes D2 and D3 have a current rating of about 10 milliamps, with between 1.5 and 1.8 volts across them. This is normally enough current to turn on any common SCR connected to terminals J2, J3 and J4, and to keep the SCR conducting after the gate voltage is removed. With the SCR turned on, current will flow through D3 in the anode circuit until the current is interrupted. Then the SCR will turn off again, and power can be reapplied to the circuit without illuminating D2 or D3.

As the schematic shows, voltage is supplied through J1, or from a 9-volt battery if you prefer. A 9-volt DC transistor radio or tape player AC sup-



Silicon-controlled rectifier (SCR) is really a diode which conducts only when a third element, the gate, lets it. Circuit between anode (+) and cathode (—) is normally open, until the voltage on the gate approaches the anode. When that happens electrons flow from cathode to anode almost as though the diode were a "short."



Equivalent circuit of an SCR looks like this—two NPN transistors connected. Gate is same as base of lower. It can turn On the lower transistor, which turns On the base of the upper.

ly is a very convenient way to power small projects like LEDIT which have very low current requirements. More importantly, if LEDIT is used only occasionally a battery may tend to run down, leak, and become a nuisance when left on the shelf too long. One 9-volt DC supply can power any number of projects simply by plugging it in, if you use an external supply jack as shown here.

A negative 9 volt potential is applied through diode D1 to the rest of the circuit as a precaution against applying reverse power. Resistor R1 is a 1000-ohm cathode-to-gate resistor which shunts the flow of current rushing into the internal capacitance of the anode-to-gate junction whenever voltage is first put across an SCR under test. If it were not for R1, the SCR would turn on every time it was connected, even without a gate signal voltage, an effect called *dv/dt* and meaning "change in voltage with a change in time." The rapidly-applied anode voltage causes a small current to flow which charges the junction capacitance, and it flows through the cathode-to-gate circuit unless shunted by R1. Since cathode-to-gate current is what normally turns on an SCR, there is nothing very mysterious about this dv/dt effect.

More on LEDIT's Action. Two push-button switches control the gate and anode currents of the SCR under test. Switch S1 is in series with R2 and D2 and is normally open. This is the gate signal voltage. Since "ground" is positive in this design, pressing S1 lets cathode-to-gate voltage flow through D2 and R2. R2 limits the current to a safe value for both the SCR and D2.

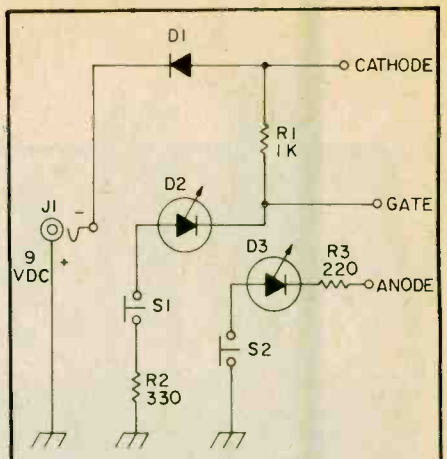
If the gate is either normal or shorted, D2 will emit red light. But only if the gate is normal will D3, the anode current indicator, come on with a clear light. Letting up on S1 should let D2 go out and leave D3 on. If it does not, then the SCR either cannot remain on with a 10 mA anode current (which is not too likely, but possible) or it is defective.

Pushing normally-closed switch S2 interrupts the anode current. The clear light will go out. When that switch is released, the light should not come on again. If it does, there is likely a problem with the SCR, or possibly R1 is not small enough for that particular device. This is not very likely since 1000 ohms is getting near the minimum value used with most SCRs.

If S1 is pressed and D2 (red) does not light, then the gate is open. Actually, D2 will light very weakly through the 1000-ohm shunting resistor even without an SCR in the tester, but it is easy to tell the difference between a good light-up and this weak glow.

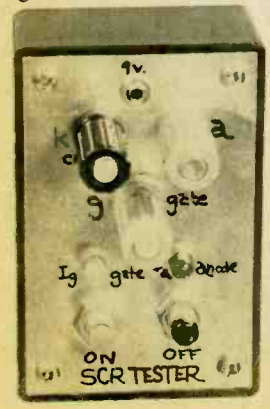
Put It Together. None of LEDIT part values are critical, and any convenient "next-size" part can be used with reasonable results. Resistors R2 and R3 are necessary to limit the current to D2 and D3 (LED indicators), and shouldn't be much smaller than indicated in value. If anything, use slightly larger values. The gate turn-on current is rather stiff for small devices so don't hold them "on" with the turn-on button any longer than necessary. I've tested innumerable smal devices and none were damaged by LEDIT but when dealing with unknown parts, it's

(Continued on page 100)

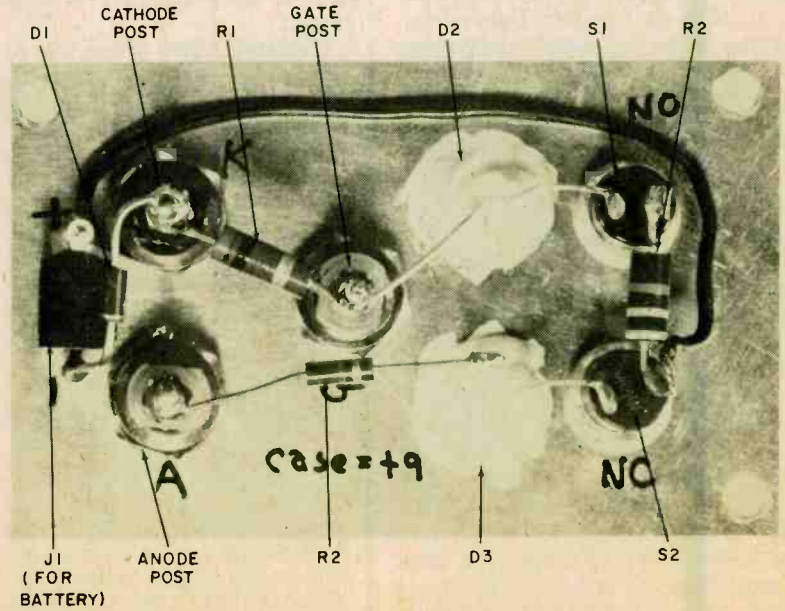


PARTS LIST FOR LEDIT SCR TESTER

D1—1000-PIV, 2.5-A rectifier, HEP R0170 Radio Shack 276-1114 or equiv.)
D2—Red LED (Radio Shack 276-041 or equiv.)
D3—Clear LED (Radio Shack 276-047 or equiv.)
R1—1000-ohm, ½-watt resistor (Radio Shack 271-000 or equiv.)
R2—330-ohm, ½-watt resistor (Radio Shack 271-000 or equiv.)
R3—220-ohm, ½-watt resistor (Radio Shack 271-000 or equiv.)
S1—SPST normally-open pushbutton switch (Radio Shack 275-1547 or equiv.)
S2—SPST normally-closed pushbutton switch (Radio Shack 275-1548 or equiv.)
Misc.—Cabinet 4-in. x 2½-in. x 2½-in., approx. (Radio Shack 270-231 or equiv.), jack for battery connection (any convenient type), 5-way binding posts (Radio Shack 274-661 or equiv.), wire, solder, etc.



Author's LEDIT is finished and ready to test unknown SCRs as well as units which have their leads identified. The LEDIT is an easy project for a weekend builder. Find out the truth about those SCRs and diodes!



Here we have a view of LEDIT's interior, specifically the reverse side of the front panel. No PC board is necessary or recommended, just follow the author's design of direct point-to-point wiring for neat and easy assembly.

e/e BASIC COURSE IN ELECTRICITY & ELECTRONICS

RECOMMENDED THEORY FOR ALL CB OPERATORS

This series is based on BASIC ELECTRICITY/ELECTRONICS, Vol. 4, published by HOWARD W. SAMS & CO., INC.

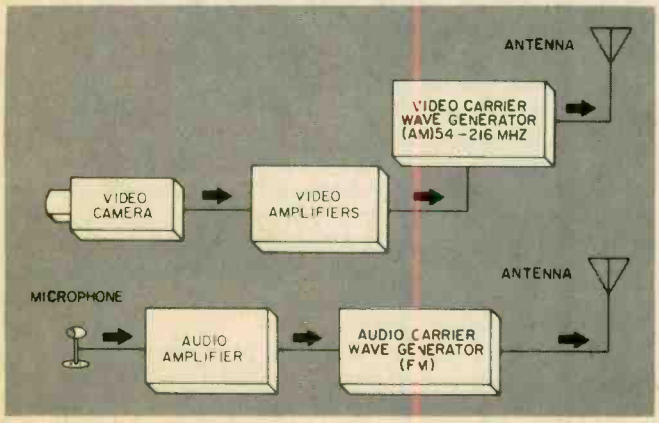
WHAT YOU WILL LEARN. You will learn how the picture is picked up by the TV camera at the broadcast station, and how the picture and the sound are transmitted by the TV station. You will learn how the TV signals are received and converted into sound and pictures in your TV set.

You will also learn that the same basics are used in transmitting TV pictures and sound as are employed in FM and AM broadcast radio receivers. The basic electronic principles are the same.

TV Transmission

The AM or FM radio transmitter has only the single task of putting sound on a carrier. The TV transmitter must modulate two carriers, one with sound and the other with video (picture). The audio section is in a separate channel of its own. Shown in the TV block diagram here is a camera which sends a weak picture signal to the video amplifier to be strengthened. The output of this section is a video frequency used to modulate a very high frequency (VHF) carrier

TV Transmitter Block Diagram



generated in the transmitter block. Superimposing the video (picture) on the carrier is done by amplitude modulation, the method used in an AM broadcast radio transmitter. The audio is frequency-modulated, just as in your FM radio.

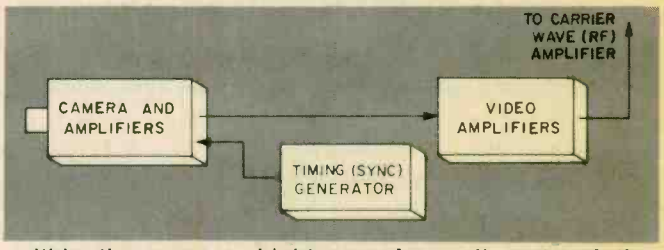
TV Video Transmitter

In the video section, video signals from the camera are amplified and fed to a power amplifier in the carrier generator section. Here, the carrier is amplitude-modulated by the video signal.

There are several different types of TV cameras. The **vidicon, plumbicon,** and **image orthicon** are examples. The latter is the type most frequently used. Although the manner in which they accomplish their purposes differ, their basic operating principles are the same.

The video camera, much like its photographic counterpart, deposits a scene through a lens on the target

Sync (Scanning) Injection



within the camera. Light rays from all parts of the scene are focused through the lens, reproducing the image on the target. If the target were a photographic negative, the light rays would excite deposits of light-sensitive materials in proportion to the intensity of light, varying from white through shades of gray to black.

A similar process occurs in a TV camera. The light-sensitive target receives a picture of the scene. Tiny areas on the chemically treated target are thereby electrically charged in proportion to the light intensity of that part of the scene.

Scanning

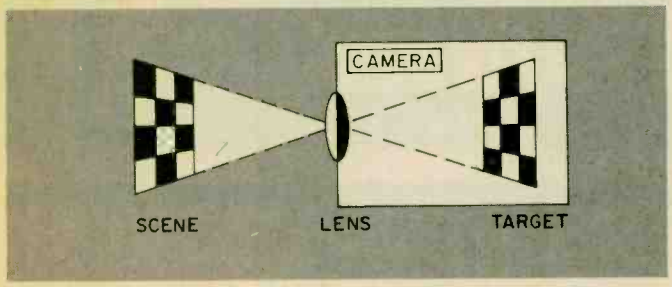
A very narrow beam of electrons is moved back and forth across the target from top to bottom. The beam samples the intensity of the charge in each of the tiny areas. The amount of each charge indicates whether that portion of the scene is black, white, or some shade of gray.

As the diagram shows, the target is scanned in a sequence of 525 lines from top to bottom. A complete scan of the target is made 30 times each second. The same procedure is duplicated on the screen of your receiver. In a TV receiver with a 17-inch screen, the electron beam in the picture tube travels across the screen at the rate of approximately 13,000 miles per hour.

A following diagram shows how this is accomplished. The beam moves across the target in the camera from left to right, sampling the intensity of each tiny area

it passes. At the end of the line the beam is blanked (shut off) and returned to the left side of the target to start the next line. The beam is turned on again and

Video Camera



samples the second line. This process is continued until the bottom of the target is reached. The beam is blanked and returned to the upper left-hand corner to start scanning again. When the beam is on and moving from left to right sampling the intensity on the target, it is said to be scanning. When it is shut off and being returned to a new starting point, it is retracing.

QUESTIONS

Q1. The video camera target is ..... by an electronic beam.
Q2. How many lines does the beam trace each second?

ANSWERS

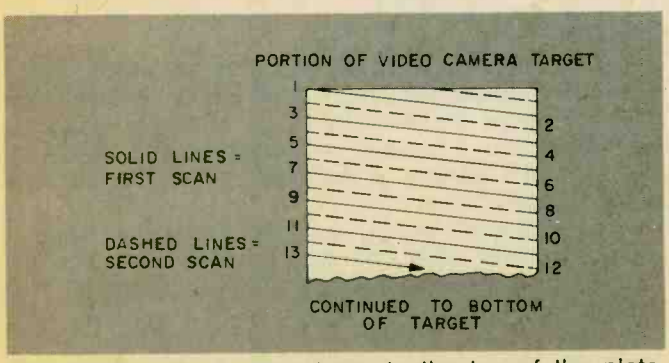
A1. The video camera target is **scanned** by an electron beam.
A2. 15,750 lines per second (525 x 30).

Interlaced Scanning

Because of problems in controlling the beam and of noticeable flicker to the viewer when **line-by-line scanning** is performed, the beam is caused to scan every other line.

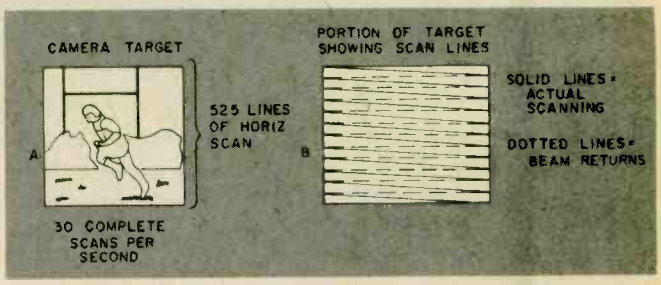
As the illustration shows, the first scan starts at line 1, samples the charged areas, and is retraced to line 3. This action continues to the bottom of the target, scanning the odd-numbered lines. When it reaches

Electron Beam Scanning



the bottom, the beam returns to the top of the plate and scans the even-numbered lines. Full scan, top to bottom, requires 1/60 of a second. To scan the entire plate, the beam requires two passes, which takes a total time of 1/30 of a second. On the receiver screen a new image is being presented on every other line 60 times a second, a line-tracing frequency that cannot be noticed by the eye. If it were being done at the rate of 30 times a second, the eye might be able to see the changes, which would be recognized as a flicker. This process of scanning every other line is called **interlaced scanning.** The camera thus identifies the light and dark areas of a scene and converts this information to currents and voltages that change in proportion to the light intensity.

Interlaced Scanning



Sync Generator

The timing of the scanning events is very critical. The beam of electrons must begin at a precise point near the top of the camera target and scan every odd-numbered line in 1/60 of a second. The electron beam must be blanked out precisely at the end of every line and at the end of the **field.** A complete scan of all all odd-numbered lines (or even-numbered lines) is called a field.

When the odd-numbered field has been completed, the blanked beam must be returned to a new position at a precise time to begin scanning the even-numbered field. Each action and position of the camera beam must be followed precisely by similar action in your TV receiver at home. The stage in the TV transmitter that establishes this precise timing is known as the **Synchronizing generator,** or sync generator.

The sync generator in the preceding illustration feeds pulse waveforms to the camera. The amplitude and timing of the pulses are such that they **synchronize** (cause all events to take place at precise time intervals) scanning, blanking, retracing, and positioning of the electron beam. The same sync pulses (for synchonizing the same events in the receiver) are fed, with the amplified video, to another stage of video amplifiers. From this point the entire signal—video and sync pulses—is passed to the final amplifier of the carrier for modulation purposes.

As you have learned from the preceding discussion, the composite video signal contains a great deal of information. A series of video waveforms is shown. Remember that a waveform is a graph of amplitude and time.

QUESTIONS

Q3. ..... scanning skips every other line.
Q4. Scanning is synchronized by a .....
Q5. What information is carried in the composite video output signal?

ANSWERS

A3. Interlace scanning skips every other line.

A4. Scanning is synchronized by the **sync generator.**
A5. Video signals and sync timing pulses.

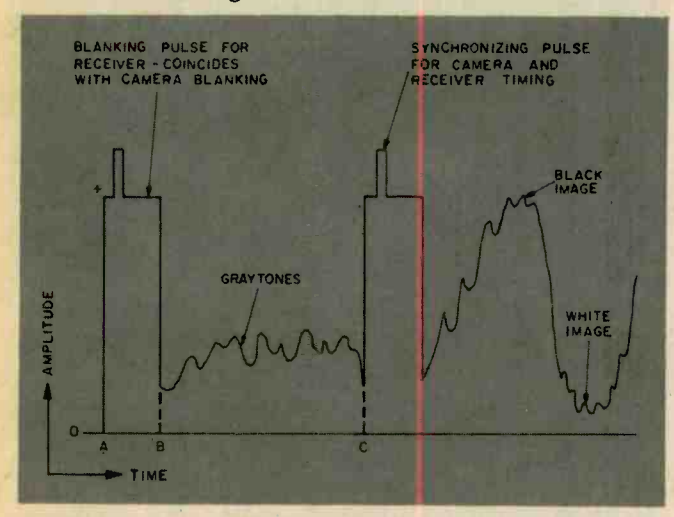
Video Modulation

The video and timing pulses are placed on the carrier frequency by amplitude modulation.

The carrier-frequency section is similar to the same circuits in a broadcast radio transmitter.

The oscillator generates a continuous and constant frequency. The output of the oscillator is increased in

Video Signal For Two Scanned Lines



frequency and amplitude by the multiplier and amplifier sections. In the power amplifier, the carrier is raised to the desired power level required by the station, and is amplitude-modulated by the video signal. **Linear** amplifiers are used to boost power output beyond that provided by the modulated stage.

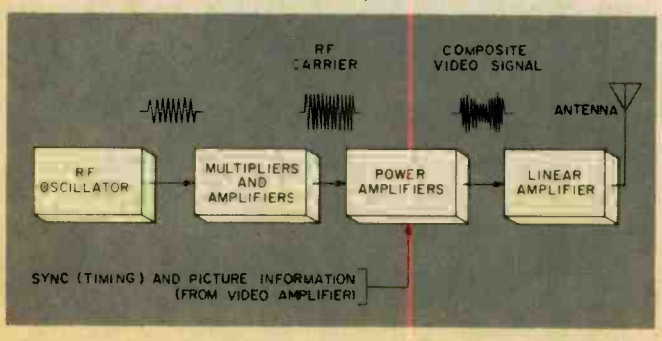
QUESTIONS

Q6. A video signal has ..... and .....dimensions.
Q7. VHF has (shorter, longer) wave-lengths than UHF.
Q8. A TV video signal is ..... modulated.

ANSWERS

Q6. A video signal has **amplitude** and **time** dimensions.
Q7. VHF has **longer** wavelengths than UHF.
Q8. A TV video signal is **amplitude** modulated.

TV Carrier (RF) Wave

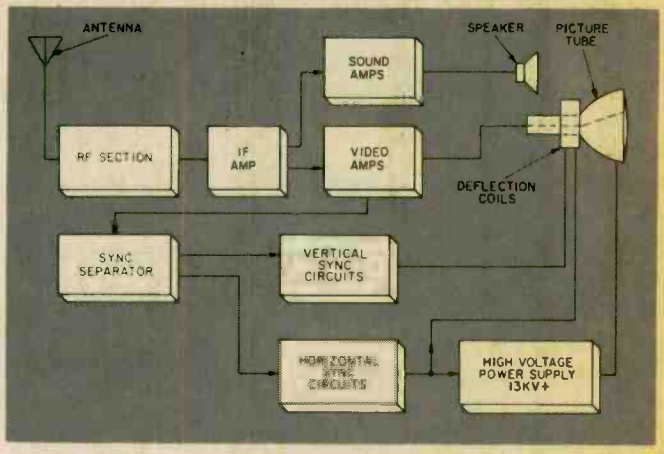


HOW THE RECEIVER WORKS

A single antenna brings both the FM sound carrier and the AM video (picture) carrier to the TV set. This is satisfactory since the sound and video carrier frequencies are quite close together (the sound carrier is 4.5 megahertz higher).

Both carriers are amplified and converted to an intermediate frequency (IF). The two signals are amplified and sent to separate audio and video detectors. In the sound section, the audio component of the frequency-modulated wave is detected, amplified and sent to the speaker, In the video section, the picture signals and blanking pulses are taken from the amplitude-modulated wave and sent to the cathode-ray (picture) tube.

TV Receiver Block Diagram



Synchronizing (sync) pulses also present in the video signal control the frequency of oscillators in the vertical and horizontal circuits. The outputs of these stages cause the image to appear properly synchronized on the screen of the cathode-ray (picture) tube.

Scanning

There are 525 horizontal lines in a complete picture on a TV screen. Each line represents an image line scanned by the TV camera. The entire 525 lines are called a *frame*.

In the discussion thus far, video signals and blanking pulses have been fed to the cathode ray tube for each scanned line of the picture waveform entering the set. The video portion of the waveform controls the intensity of the electron beam, while the periodically appearing blanking pulses shut the beam off at proper intervals called the retrace period.

A system is needed to move the beam on the receiver screen from side to side and top to bottom in synchronization (in step) with the action that takes place in the camera. Each of the video waveforms (two are shown in the diagram) represents one particular scan line among the 525 lines that appear on the screen of a complete picture.

The camera scans every other line (interlaced scanning) for viewing ease (eliminates flicker). The receiver beam must do likewise, sweeping every other line precisely in sequence with the camera. In the first pass, the beam must start In the upper left-hand corner and trace every odd line, ending at the middle of the bottom line for a total of 262½ lines called a field (½ of 525). The beam must then return to the top center

of the screen and sweep each even line in sequence, completing 262½ lines of the field at the right end of the bottom line.

In the process, the beam must excite the phosphorescent screen with the corerct intensity indicated by the corresponding portions of the video waveforms. At the end of each line, the beam is blanked and must be rapidly returned to the left to start the next line of the picture. When the beam reaches the bottom of the screen, it must be blanked again and rapidly returned to the correct position (left or middle) at the top to sweep the next field. It must complete a **field** (262½ lines) in precisely 1/60 of a seocnd and a full **frame** (complete picture) in 1/30 of a second.

QUESTIONS

Q9. The start and the position of each scan line on on the CRT screen are controlled by the .....

Q10. There are ... lines to a field and ... fields to a frame.

ANSWERS

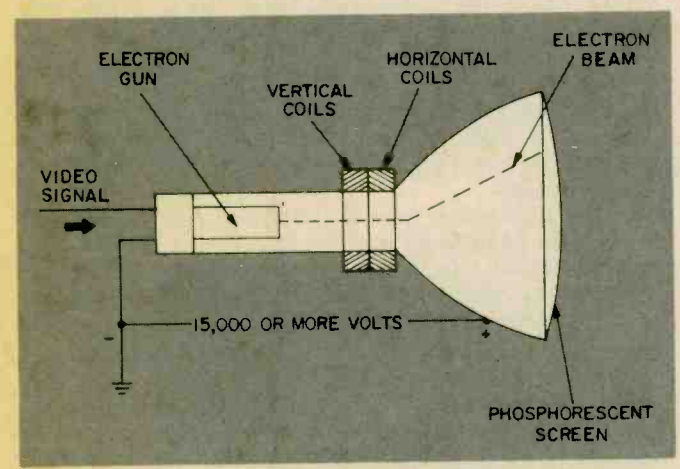
A9. The start and the position of each scan line on the CRT screen are controlled by the **sync pulses.**

A10. There are **262½** lines to a field and **two** fields to a frame.

Moving the Electron Beam

We know that a negative voltage repels and a positive voltage attracts electrons. The cathode-ray tube (CRT) uses this effect to send an electron beam to the screen and control its movement.

Cathode Ray (Picture) Tube

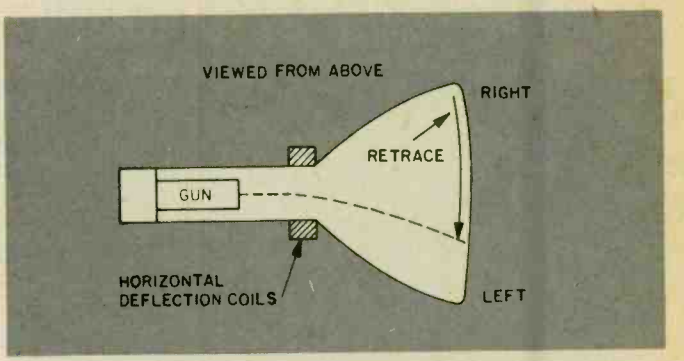


The basic construction and connections of a magnetically deflected CRT are shown. At the left end an electron gun shoots a narrow stream of electrons toward the screen. To speed the electrons on their way, the inner surface of the flared portion of the tube has a conductive coating energized with a voltage that is several thousand volts positive with respect to the electron source.

The CRT is connected to the output of the last video amplifier from which it receives the video and blanking signals. The CRT control grid, which controls the number of electrons, responds to the varying amplitude of the video and releases the required quantity of electrons. The control grid also **stops** the flow of electrons when the blanking pulse appears.

During the time a video signal is present, the beam must be moved from left to right across the screen. When the beam reaches the right side, the blanking pulse shuts off the electrons and the beam moves back to start the next line.

Moving The Beam Across The Screen



A **horizontal-deflection** coil through which the neck of the tube is inserted moves the beam from side to side. Current moving through the coil sets up a magnetic field which has an attracting and a repelling effect on electrons.

The stronger the field, the greater is its effect on the beam. To increase the strength of the field requires an increase in current through the coil. The illustration shows the beam during retrace.

The change in strength of the magnetic field during a sweep must coincide with the time duration of the scanned line. A gradual rise of current within the coil during this time period accomplishes this. The starting time is triggered by the sync pulses that ride on the blanking pulses. If the current decreases rapidly at the end of each line (during the blanking pulse), the sudden drop in magnetic field strength returns the beam to the left very quickly.

A similar magnetic field is set up by a second coil (the **vertical-deflection** coil) which controls the movement of the beam line by line from the top of the screen to the bottom. On completion of a field (262½ lines), the beam quickly retraces to the top.

QUESTIONS

Q11. The sweep of the receiver beam must be ..... with the camera beam.

Q12. The electron beam in the CRT is generated by an .....

Q13. Electrons are drawn to the screen of the CRT by a .....

Q14. ..... move the CRT beam.

Q15. An increase in current through a deflection coil (increases, decreases) the magnetic field.

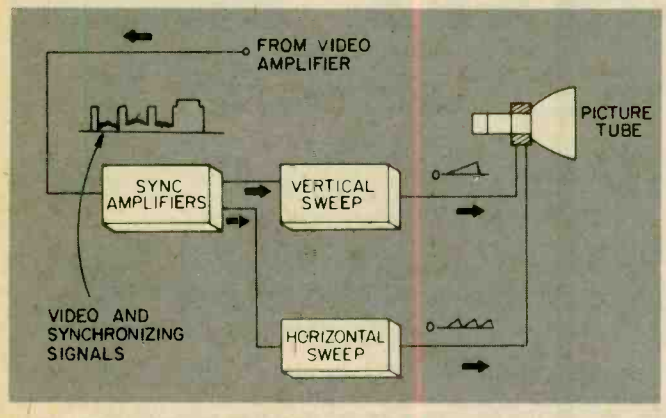
ANSWERS

A11. The sweep of the receiver beam must be **synchronized** with the camera beam.

A12. The electron beam in the CRT is generated by an **electron gun.**

A13. Electrons are drawn to the screen of the CRT by **a positive voltage of thousands of volts.**

Sync Control



A14. **Magnetic fields** move the CRT beam.

A15. An increase in current through a deflection coil **increases** the magnetic field.

Sync Control Circuits

The beam movement is accomplished by steadily increasing the current flow in each of the deflection coils during precise time intervals. The starting times for these intervals are controlled by the sync pulses.

Video waveforms arrive at the sync separator from the video amplifier. There is one narrow sync pulse for each line of scan. This pulse is intended to control the starting time of each horizontal sweep across the screen. When one field of 262½ lines has been completed, the video waveforms are followed by a sync pulse many times wider than the horizontal sync pulses.

This wide pulse is the trigger that develops a verti- sweep to move the beam from line to line down the face of the screen. Every other vertical sync pulse starts in the middle of a video waveform, accounting for 262½ lines in each field of interlace scanning.

The illustration shows the comparative widths of the horizontal and vertical sync pulses and the relative starting times of the second and third fields. The sync pulses are removed from the complete video waveform by a sync separator.

The narrow and wide pulses are distributed to the appropriate sweep circuits (horizontal and vertical) after sync separation accomplished by capacitor and resistor combinations which can distinguish between voltage waveforms with short time durations and those with long durations. The short sync pulses are sent to the **horizontal** sweep circuit and the long pulses to the **vertical** sweep circuit.

QUESTIONS

Q16. **Timing of the magnetic field developed in the ..... and ..... deflection coils is controlled by .... pulses extracted from the video waveform.**

Q17. **The sync separator separates the narrow and wide timing pulses from the video waveform. The narrow pulses control ..... deflection and the wide pulses control ..... deflection.**

Q18. **Horizontal sync pulses occur during the horizontal ..... portion of the video waveform.**

ANSWERS

A16. Timing of the magnetic field developed in the **horizontal** and **vertical** deflection coils is controlled by **sync** pulses extracted from the video waveform.

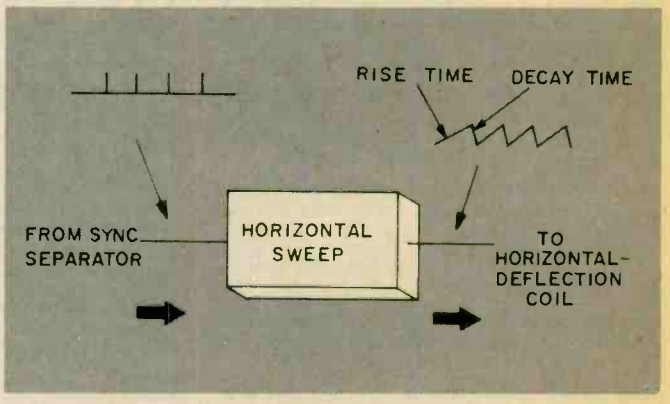
A17. The sync separator separator separates the narrow and wide timing pulses from the video waveform. The narrow pulses control **horizontal** deflection and the wide pulses control **vertical** deflection.

A18. Horizontal-sync pulses occur during the horizontal **blanking** portion of the video waveform.

Sweep Circuits

The two sweep circuits (horizontal and vertical) generate a linear rising voltage each time they receive a sync pulse. The horizontal-sweep circuit is triggered 262½ times during the same time the **vertical-sweep circuit** is triggered once. Horizontal sweep is produced by an oscillator which generates a slowly rising and rapidly decaying sawtooth waveform, whether the set is tuned to a transmitting station or not. This accounts for the **raster** (lines on the screen when the TV receiver is on but no signal is being received.

Horizontal Sweep Circuit



The purpose of sync pulses is to trigger oscillators to start at the same time as the line scan in the camera. Capacitor and resistor combinations convert the oscillations to the sawtooth waveshapes shown in the diagram above. Rise time of the sawtooth causes the current in the horizontal-deflection coil to increase gradually, moving the beam across the screen in step with the line scan in the camera. At the end of the line, coil current decreases rapidly, returning the beam (which is now blanked) to the left of the screen. There are 525 lines to each frame, so the frequency of the horizontal oscillator must be 15,750 cycles per second (525 x 30).

The vertical sweep oscillator and amplifier are almost identical to those in the horizontal sweep section. The main difference is that the frequency of oscillation is much lower—60 times a second, to match the frequency at which each field is swept. The rise time (plus a short decay time) of the vertical sawtooth lasts for 1/60 of a second before another vertical sync pulse arrives to start the next waveform. Gradual increase in current in the vertical deflection coil moves

(Continued on page 104)

LITERATURE LIBRARY

301. Get acquainted with the new *EICO* products, designed for the professional technician and electronics hobbyist. Included in brochure are 7 IC project kits, *EICO's* "Fonealds," security products and many varied kits.

302. *International crystal* has illustrated folders containing product information on radio communications kits for experimenters (PC boards; crystals; transistor RF mixers & amplifiers; etc.).

303. *Regency* has a new low cost/high performance UHF/FM repeater. Also in the low price is their 10-channel monitoradio scanner that offers 5-band performance.

304. *Dynascan's* new *B & K* catalog features test eequipment for industrial labs, schools, and TV servicing.

305. Before you build from scratch, check the *Fair Radio Sales* latest catalog for surplus gear.

306. Get *Antenna Specialists'* catalog of latest mobile antennas, test equipment, wattmeters, accessories.

307. Want a deluxe CB base station? Then get the specs on *Tram's* super CB rigs.

308. Compact is the word for *Xcelite's* 9 different sets of midget screwdrivers and nutdrivers with "piggyback" handle to increase length and torque. A handy show case serves as a bench stand also.

310. *Turner* has two booklets on their Signal Kicker antennas. They give specifications and prices on their variety of CB base and mobile line. Construction details help in your choice.

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. *The EDI (Electronic Distributors, Inc.)* catalog is updated 5 times a year. It has an index of manufacturers literally from A to X (ADC to Xcelite). Whether you want to spend 29 cents for a pilot-light socket or $699.95 for a stereo AM/FM receiver, you'll find it here.

313. Get all the facts on *Progressive Edu-Kits* Home Radio Course. Build 20 radios and electronic circuits; parts, tools, and instructions included.

316. Get the *Hustler* brochure illustrating their complete line of CB and monitor radio antennas.

317. *Teaberry's* new brochure presents their complete lines of CB and marine transceivers and scanners for monitoring police, fire and other public service frequencies.

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 typas of electronic equipment.

319. *Browning's* mobiles and its famous Golden Eagle base station, are illustrated in detail in the new 1977 catalog. It has full-color photos and specification data on Golden Eagle, LTD and SST models, and on "Brownie," a dramatic new mini-mobile.

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 1977* 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. Get *Lafayette Radio's* "new look" 1977 catalog with 260 pages of complete electronics equipment. It has larger pictures and easy-to-read type. Over 18,000 items cover hi-fi, CB, ham rigs, accessories, test equipment and 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. A new free catalog is available from *McGee Radio.* It contains electronic product bargains.

329. Semiconductor Supermart is a new 1977 catalog listing project builders' parts, popular CB gear, and test equipment. It features semiconductors—all from *Circuit Specialists.*

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, etc.

331. *E. F. Johnson* offers their CB 2-way radio catalog to help you when you make the American vacation scene. A selection guide to the features of the various messenger models will aid you as you go through the book.

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.

334. *Sprague Products* has L.E.D. readouts for those who want to build electronic clocks, calculators, etc. Parts lists and helpful schematics are included.

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.

337. *Pace* communications equipment covers 2-way radios for business, industrial and CB operations. Marine radiotelephones and scanning receivers are also in this 18-p. book.

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.

342. *Royce Electronics* has a new 1977 full line product catalog. The 40-page, full-color catalog contains their entire new line of 40-channel AM and SSB CB transceivers, hand-helds, marine communications equipment, and antennas and accessories.

344. For a packetful of material, send for SBE's material on UHF and VHF scanners, CB mobile transceivers, walkie-talkies, slow-scan TV systems, marine-radios, two-way radios, and accessories.

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.

350. Send for the free *NRI/McGraw Hill* 100-page color catalog detailing over 15 electronics courses. Courses cover TV-audio servicing, industrial and digital computer electronics, CB communications servicing, among others G.I. Bill approved, courses are sold by mail.

352. Send for the free descriptive bulletin from *Finney Co.* It tells all about their new auto FM radio signal booster (eliminates signal fading).

353. *MFJ* offers a free catalog of amateur radio equipment—CW and SSB audio filters, electronic components, etc. Other lit. is free.

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.

356. Send for *Continental Specialties* new breadboarding prototest devices. They vary in prices from a mini-budget kit at $19.95. Featured is the new logic monitor, giving information on what it does, how it works, and how to use it.

357. *Dage Scientific Instruments* offers a 16-page booklet on how to build an electronic thermometer with control. Included is an introductory course on thermocouples, schematics and many applications.

358. *PixTronics* announces its new Model 200 Super Sensitive Electronic Darkroom Exposure Meter, used to determine the correct exposures of all black-and-white and color negatives. Useable with any enlarger.

359. *Electronics Book Club* has literature on how to get up to 3 electronics books (retailing at $58.70) for only 99 cents each . . . plus a sample Club News package.

360. *Cornell-Dubilier* has a 4-color, 4-page, brochure on its Ham II, CD-44, and Big Talk rotor communication systems. Exploded half tones detail interior rotor construction, and tables list specs.

ELEMENTARY ELECTRONICS
Box 1849, G.P.O.
New York, NY 10001

September/October 1977
Void After February 16, 1978

Please arrange to have the literature whose numbers I have circled below sent to me as soon as possible. I am enclosing 50¢ for each group of 10 to cover handling. (No stamps, please.) Allow 4-6 weeks for delivery.

301	302	303	304	305	306	307	308	310	311	312	313
316	317	318	319	320	321	322	323	327	328	329	330
331	332	333	334	335	337	338	342	344	345	350	352
353	354	355	356	357	358	359	360				

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Antique Radio

(Continued from page 79)

coldest part of your freezer for several hours then remove it and push the base only down into some boiling water. The uneven coefficient of expansion will sometimes break the cement loose. I usually have success this way, but as a last resort you could use a solvent.

Next take a double-cut file and file away the solder from the ends of the pins. With a soldering iron or gun heat the pin tip and flip the tube to throw the melted solder out of the pin. You should now be able to see the lead wires through the holes in the ends of the pins. When all four wires are unsoldered you will be able to pull the bulb loose from the base. Whatever you do, don't forget which wires go to the plate, grid, and filaments. You can identify the filament wires with a low-range, low-current ohmmeter, but if you loose the grid and plate wires you will have to look inside the bulb to trace the wires to their respective tube elements. The 864 will have two grid leads inserted into one pin. You will find the lead wires are an alloy that bonds readily to glass, but is difficult to solder to. Tin the leads for at least a half inch when you reassemble the bulb to the base. You may need to polish the leads with sandpaper and use a flux when tinning the leads.

You are now ready to remove the two larger filament pins from the tube base. If you have access to a drill press this will be easy. Otherwise use a hand-held electric drill. Use a no. 28 drill bit and carefully drill out (from the inside of the base) most of the staked portion of the brass pin. With a sharp pick remove the remaining parts of the staking, grasp the pin with a pair of pliers gently pull and twist until the pin comes out. If you have a lathe you can make the new pins that you need or you can purchase them from the source named at the end of this article. Now that you have removed the pins you are ready to reassemble the tube. Insert the large pin into its hole in the base, and using a punch with a 90-degree point carefully flare the pin until it fits tightly. Do the same with the smaller pin. Be sure you stake them tightly into the proper holes. The drawing shows the base with the pins up. Run a bead of cement around the glass bulb and insert the previously-tinned leads into the proper pins. Remember the plate pin is the large pin, across from it is the grid pin. The other two pins are for the filament. Use masking tape to hold the bulb and base together for 24 hours while the cement dries. Solder the ends of the tube pins, being sure to heat the pins hot enough that the solder will flow down into the pins. Do not use excessive solder, for it may run down inside the base and short the wires together. Use a small file to dress the ends of the pins to a round surface so the pins will go into a socket easily.

Now We Test It. To test the converted 864/WD11 in a regular four-pin tube socket you must make an adapter. The easiest way to do this is to remove a four-pin base from an old tube. Solder pieces of flexible wire about 6-inches long into the tube pins. Solder clips with insulators to the opposite ends of the wires. Identify each clip as to grid, plate, and filaments. Connect the clips to the proper pins, set the tube tester filament selector switch to 1.1 volts, and set the other knobs just the same as you would for a 30, and test in the usual manner. If the lowest filament voltage on your tube tester is 1.5 volts solder a 1.5 ohm, ½-watt or larger in series with one filament lead. This will reduce the voltage to 1.1 volts.

If you decide to convert a 30 or 1H4G to a WD11 replacement follow the same general directions, only use the correct wiring and filament voltage for the tube you are converting.

If You Need Help. For those of you who are "all thumbs" or do not have the proper tools you can buy the pins already made or buy a tube base with the pins already staked into the proper holes. Write to Antique Radio Parts, P.O. Box 42, Rossville, IN 46065 for a brochure showing the necessary parts with prices. If you need 30s or a 864/VT24 tube write to George Haymans, Box 468, Gainesville, GA 30501 for his list of tubes and parts. Be sure and send an SASE to either of these sources or you may not get a reply.

So long for now! I hope I have given you some useful information on replacing those nearly impossible tube types. Believe me, it is well worth the not inconsiderable effort. The thrill of receiving modern-day broadcasts on an antique receiver—and a receiver which is operating exactly as it did in the old days—is something you have to experience to truly understand. Somehow, receiving broadcasts on the newer, state-of-the-art sets cannot compare to reliving the old days when it was a DX catch just to hear your home-town station, though many antiques are capable of surprisingly sensitive and selective operation. All in all, this is a hobby which has appeal for young and old alike.

See you next time with more antique radio news and views. ■

LEDIT—checks your SCRs and diodes

(Continued from page 92)

LEDIT READOUT TABLE

TERMINAL POST Anode	Cath.	Gate	BUTTON PRESSED None	On	Off	LED ON Red	Clear	None	INDICATES
a	c	g	x					x	a-c not shorted
a	c	g		x		x			g-c short or a-c open
a	c	g	x				x		a-c short or possible dt/dv
a	c	g		x				x	g-c open
a	c	g		x		x	x		normal turn-on
a	c	g			x			x	normal turn-off
			MISCONNECTIONS						
g	c	a	x				x		
g	c	a		x		x	x		
c	a	g	x					x	
c	a	g		x				x	
a	g	c	x					x	
a	g	c		x				x	
c	g	a	x					x	
c	g	a		x				x	
g	a	c	x					x	Clear LED may be on weak
g	a	c		x				x	Clear LED goes out
			DIODES						
a	c		x				x		normal
a	c		x					x	open
c	a		x				x		shorted
c	a		x					x	normal

Use the above table to interpret LEDIT's displays. For further discussion of the way by which LEDIT reads out, see pages 91 and 92.

better to be safe than sorry.

In thousands of parts tested I've never had a false indication except in the case of a few rare *dv/dt* turn-ons. When this happens, here's what to do. Just interrupt the power with S2 several times and see if the indicator D3 lights every time, or just part of the time. Part-time turn-on indicates a definite *dv/dt* situation. Full-time turn-on usually indicates a short. Thats all there is to it! ■

New Heath Computers

(Continued from page 47)

(teletype) to 9600.

If you need hard copy—a printed record—here's the *biggie*: Heathkit will sell the DEC Writer II Keyboard Printer Terminal. For those of you who don't know why we call it the *biggie*; the DEC Writer II is the Cadillac of teletype-style terminals. It is probably the most desired peripheral in any computer installation. (*Peripheral* is an accessory input or output, or input/output device for a computer.)

Finally, for those who want a quick, convenient way to save programs for future use Heathkit also introduced their model H10 Papertape Reader/Punch. This device punches standard 1-inch teletype tape at the standard TTY speed of 10 characters per second, but unlike standard TTY readers which read back at 10 cps the H10 reads at 50 cps; you can load programs into your Heathkit computer at five times the punching speed. The punch and reader operate independently and can be used simultaneously. A *copy mode* for tape duplication is standard parallel TTL. The mail order price in

kit form is $350.

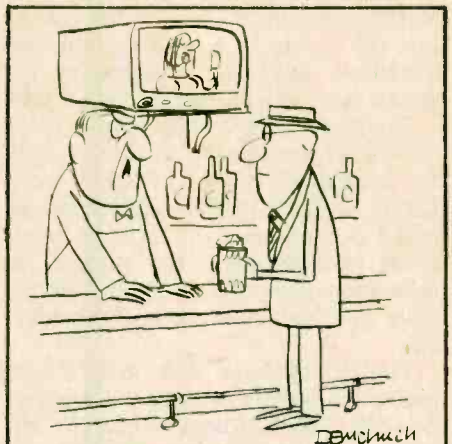
Summing Up. Overall, the wedding of Heathkit and DEC has been bold, dramatic, and exciting. It has completely changed the development and marketing of personal and small-systems computing equipment in that small systems will no longer be scaled-down versions of commercial computers. In particular, having a PDP-11 in your home or office isn't a compromise between commercial and personal computers: most consider it among the very finest in minicomputers. And the Heathkit-DEC peripherals are in the same class.

For additional information circle No. 31 on the reader's service coupon. ■

Computer New Products

(Continued from page 64)

prefabricated fifty line interconnecting cable. An introductory special consisting of a fully assembled drive and cable harness, 6502 disk operating system, and a controller board in kit form costs $599. The drive is also available fully assembled for use with OSI Challengers, including matching case and power supplies, for $990. OSI's floppy disk bootstrap prom allows the owner of any OSI system to use his floppy disk immediately on power up and is available for $29 with either version of the 470B. Ohio Scientific Instrument, 11679 Hayden Street, Hiram, Ohio 44234. Circle 52 on Reader Service Coupon for more information about this product. ■



"For a lousy 25 cent beer? No, I won't change the channel!"

CB XCVR Checkout

(Continued from page 53)

CIRCLE 70 ON READER SERVICE COUPON

ation. Delta tune ±1.2 kHz provided. Power supply 12 to 13.8 VDC with positive or negative ground. Overall dimensions are 2¼-in. h x 6⅜-in. w x 7⅞-in. d. Front panel controls and switches for Channel Selector, Volume, Squelch/PA, Noise Blanker, ANL, External CB (CB signal to PA speaker). Standard accessories are microphone, mobile mount, DC power cable.

Receiver Section Test:

Relative Sensitivity for 85%	
Input Sensitivity	0.6 μV
Adjacent Channel Rejection	62 dB
AGC Action	9 dB
Input Level for S9	70 μV

Transmitter Section Test:

AM RF Output	3.9 watts
Modulation to 85%	yes
Modulation	—36 dB
Modulation Limited to 100%	yes

Editorial Remarks: The Midland 77-882 has a relative reading S-meter, double conversion receiver, external and PA speaker jacks, and S/RF output meter. ■

Loud and Clear, GB

(Continued from page 74)

CB-SMC features a push-to-talk switch which mounts onto the auto turn signal or gear shift. The mike is powered by an AA battery, and the earphone is equipped with an anti-blast circuit. The CB-SMC can be used with either relay or electronic switching radios.

The Telex CB-88 ($69.95) is a lightweight headset that can be worn by means of a headband or by clipping to eyeglasses with an adapter. The headset weighs less than 3 ounces. The single magnetic receiver is claimed to mask external noise; and the voice signal is amplified by a small, in-line variable amplifier. Specs for the magnetic microphone: Sensitivity, −48 dB; frequency response, 100 to 4000 Hz. Specs for the single magnetic driver: Impedance, 8 ohms; sensitivity, 103 dB; frequency response, 200 to 8000 Hz.

Another headset by Telex that includes a full-size, cushioned earphone is model CB-1200 ($59.95). Specs for the ceramic mike: Sensitivity, −66 dB; frequency response, 100 to 5000 Hz. Specs for the single dynamic driver: Impedance, 8 ohms; sensitivity, 103 dB; frequency response, 100 to 8000 Hz. ■

ELEMENTARY ELECTRONICS INDEX TO ADVERTISERS

Hi-Fi DX

(Continued from page 86)

Foreign DX Too! While most FM DX is restricted to the United States and Canada, some foreign DX is possible. DXers within 1000 miles of the Mexican border have a shot at logging Mexican stations. DXers in the Southeast can expect to hear stations in the Caribbean. Bermuda is frequently reported from states on the Atlantic coast.

Equipment and Such. Any radio capable of receiving FM can be used for sporadic-E work. In fact, many DXers actually prefer portables and rabbit ears antennas due to their directional characteristics. The strength of most sporadic-E skip makes high sensitivity and high-gain antennas unnecessary.

For serious tropo work most DXers prefer an outside antenna as high as possible. The aim here is that the antenna reach into the tropospheric duct.

DX Strategies. Since FM DX openings do not last as long as those on medium or short wave, a strategy for DXing must be devised. For sporadic-E, it is wise to listen only long enough to get sufficient material for a verifiable report. Once this is done, tune to another frequency. You may like to send hour-long reports to shortwave broadcasters, but that's a luxury that you cannot afford on FM.

Tropo DX openings often last for several hours or even days. Also, tropo affects the entire 88 to 108 MHz equally, in contrast to sporadic-E and its maximum usable frequency. In addition, if tropo is in from a certain area on one frequency, all other stations in the same general area should also be heard, unless you have locals on their frequency. Therefore, if you have the relatively stable tropo signal of a station a few hundred miles away, check the latest edition of White's Radio Log (an exclusive feature of our sister publication, COMMUNICATIONS WORLD) for other stations in the same general area. Tune to their frequencies and odds are they'll be heard!

Sure They QSL! FM broadcasters are excellent verifiers. In fact, your author has found that they are generally better verifiers than standard AM broadcasters.

Forget all about SINPO, QSL, QRM, 73, and all the rest of that SWL lingo. FM broadcasters have no idea what it means, so write your report in plain English. Reports should be addressed to the chief engineer, and always include return postage if you want a QSL.

Record titles may be good material for reports to shortwave stations, but American FM stations don't keep lists of songs played. Include music played anyway, for it can't hurt. The best material is commercials and public service announcements you heard and the time when you heard them. Commercial broadcasters must keep lists of these and the time at which they are aired. Other good items are announcer's name, that station's record survey, and anything that seems to be unique to that station. Keep your reports concise and to the point.

Include details on your listening gear. If other stations were audible from the same general area, you might want to mention that fact. Be sure to ask if they have received any reports more distant than yours, for quite often you will find yourself the most distant reporter to a station!

Is there anyone who doesn't have a radio capable of receiving FM somewhere in their home? There's no reason then not to start FM DXing, so begin today. Discover what DXing's in crowd has found out! ■

FM DX REPORTING DO'S AND DONT'S

DO enclose return postage with each report.

DO address your report to the Chief Engineer.

DO use plenty of readily verifiable material in your reports, such as names of announcers, commercials and public service announcements, station slogans, song ratings on record surveys, and any other item that seems to be unique to that station.

DO describe reception quality in plain English.

DO politely request a verification.

DO ask if any reports more distant than yours have been received.

DON'T use any SWL jargon as "QSL," "QRM," or the SINPO code.

DON'T rely solely on song titles or a list of records played to prove your reception.

DON'T demand a verification—ask for one!

DON'T report a station unless you are absolutely certain that you indeed heard it! If you can't be certain, report it as a tentative reception.

FOREIGN FM DX TARGETS

BERMUDA
ZBM-FM, Hamilton, 89.1
ZFB-FM, Hamilton, 94.9

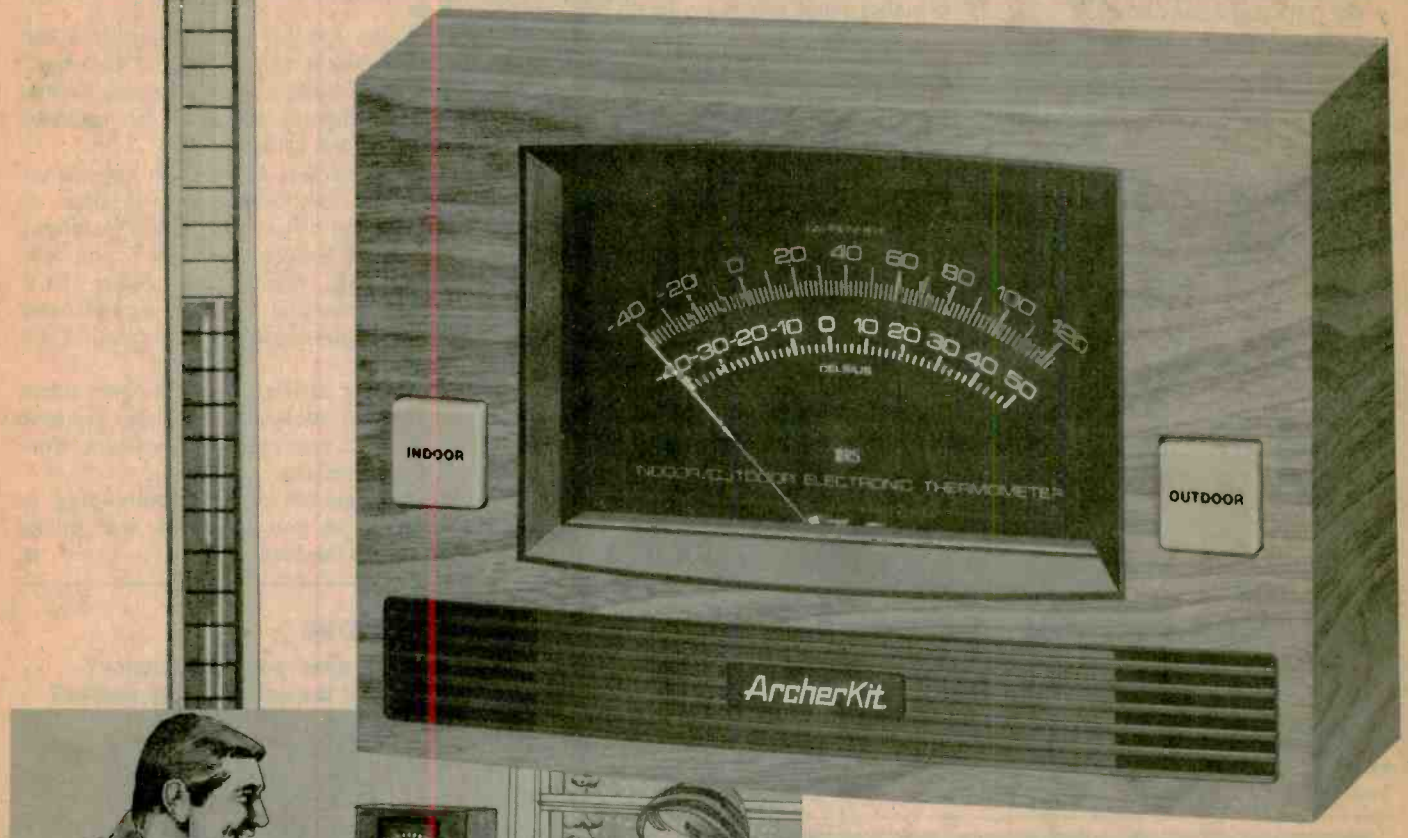
CUBA
CMQ-FM, Havana, 90.5
CMHW-FM, Santa Clara, 90.5

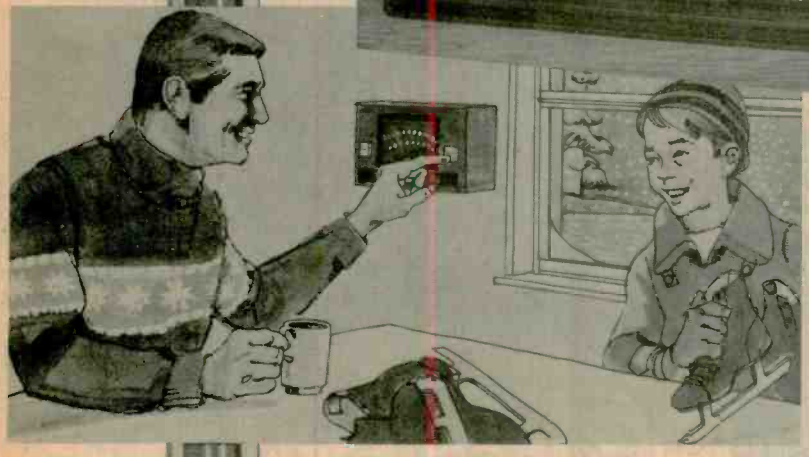
DOMINICAN REPUBLIC
HIZ-FM, Santo Domingo, 89.1
HION-FM, Santo Domingo, 92.5
HIJP-FM, Santo Domingo, 94.9
HIJB, Santo Domingo, 95.7

HAITI
4VUE-FM, Port Au Prince, 88.1

JAMAICA
Radio Jamacia, Spur Tree, 90.5
Jamaica Broadcasting Corp., Coopers Hill, 91.1
Jamaica Broadcasting Corp., Montego Bay, 92.1
Radio Jamaica, Coopers Hill, 92.7

The ArcherKit Thermo Meter





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Phoning the Future

(Continued from page 45)

which is less than one-third the time of the 110 baud stop bits.)

Baud rates can be intermixed for storage. Assume you have a Southwest Technical Products MC6800 personal computer such as the one E/E will use for our personal computing series. You might type in your program using a 110 baud model 33 teletype. Allow for corrections, proofing and changes and assume you have worked one hour loading the program. The final program–error free–if punched out on paper tape through the TTY might take 10 or 15 minutes to load it back in the next time you want to use it. But you can have a "hobby standard" 300 baud recorder connected to the computer, and instead of dumping the program out to the TTY you dump to the recorder at three times the TTY speed. The recording will take only some 3 or 4 minutes to save and reload into the computer. Some personal computing hobby recorders run 1200 baud, and that 10 or 15 minute program can be saved and loaded in a few seconds. (There are even higher baud rate recorders.)

Summing Up. Your first requirement for both personal and time-share computers is the terminal. With the personal computing marketplace growing at a rate exceeding Jack's beanstalk there are more and more ads from more and more companies offering surplus TTYs and CRT terminals, both kit and wired. Like the early days of anything, many won't be around tomorrow when you need service or parts, and some of what will be sold won't work too well. In selecting a terminal, stick to the well-known brands from companies that have deserved reputations. For example, you can always get parts and service for a model 33 TTY at reasonable prices. This is not necessarily true of any other TTY. If you're purchasing a used model 33 (which is about the only way to get one, because the waiting list for a new one dircet from Teletype is months and months) make certain you get it from a company specializing in rebuilt models, such as National Teletype.

If you opt for a CRT terminal the proven one is the ACT-1; if you want to go the build-it-yourself route Southwest Technical Products is probably your best bet at this time.

For modems, Omnitec is considered by many the industry's workhorse. A used model 701A is available for about $150 and handles both TTY and RS-232 inputs. They have newer TTY models available in both semi-kit and wired versions for prices between $100 and $160.

In later articles we will cover other equipment such as TTY tape readers, high baud rate recorders, splicers, storage systems, etc.

The age of personal computing is upon us so you might as well climb aboard at the beginning. ■

Basic Course–Transmitting and Receiving TV

(Continued from page 97)

the beam from the top to the bottom of the screen. The decay of the vertical sawtooth waveform brings the beam back to the top in time for the next sync pulse.

QUESTIONS

Q19. What is the horizontal sync pulse frequency?
Q20. What is the frequency of the vertical sync pulses?

ANSWERS

A19. The horizontal sync frequency is **15,750 Hz.**
A20. The vertical sync frequency is **60Hz.**

WHAT HAVE YOU LEARNED

1. A television transmitter actually consists of two separate transmitters. One section uses a camera to scan a scene, and a group of circuits to modulate an AM carrier wave with the image. The other section takes the output from a microphone and uses it to modulate an FM carrier wave.
2. Video information is obtained from the camera as it scans a scene with an electron beam, one line at a time. The video signal, with the addition of blanking and synchronizing pulses, is amplified and then used to modulate the picture carrier wave. This amplitude-modulated carrier is raised to a specified power level with linear amplifiers and then fed to the antenna.
3. A TV receiver contains many circuits that can be grouped into a few electronic functions. These include the RF section (front-end), IF section, sound section, video section, vertical-sync control, horizontal-sync control, cathode-ray tube, and low- and high-voltage power supplies. Many of the functions are similar to those found in a radio receiver.
4. The RF amplifier, mixer, and oscillator select the desired channel among the many appearing at the antenna and convert the sound and video-carrier frequencies to appropriate intermediate frequencies.
5. The video section contains circuits to extract the video signal and amplify it to a level required for operating the beam-control portion of the CRT. ■

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. 46268.

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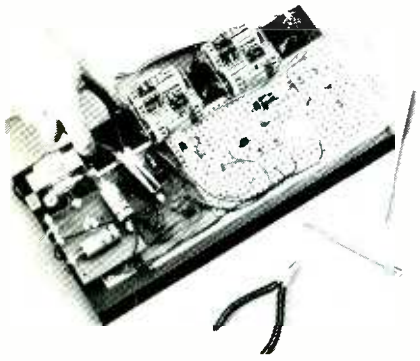

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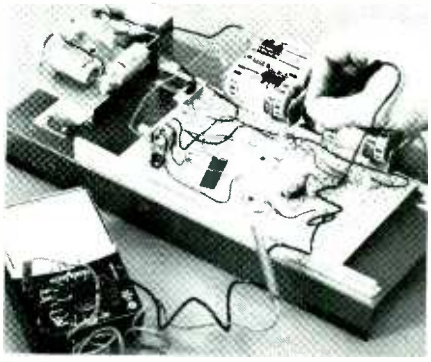

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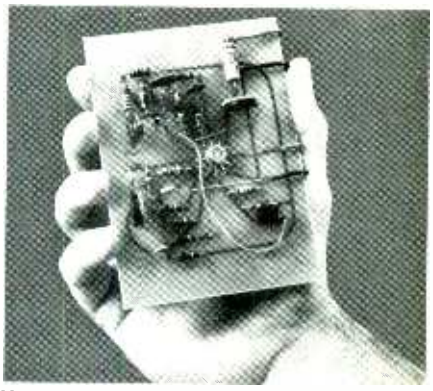

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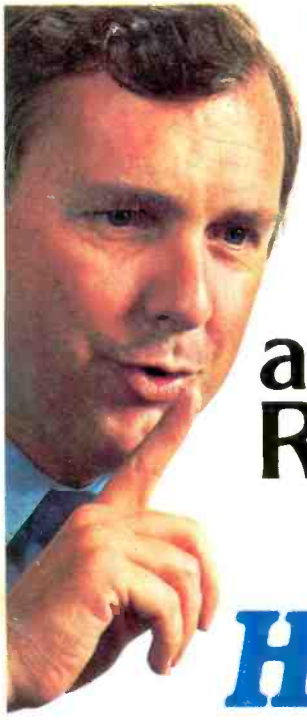

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