

KANSAS CITY TALKS IN TONES TO YOUR COMPUTER

elementary
Electronics

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Electronics**

MARCH-
APRIL
1978
\$1.25

FOR BEGINNERS

How to assign values to variables in BASIC.
How to write simple computer programs.

OUR BASIC COURSE

**MAKE YOUR TELEPHONE
WORK FOR YOU!**

Start home appliances while you're away
Build a ringer Ma Bell can't hear
Check on taps, record your talks,
pushbutton dial

**FIND KILLER FUMES
IN HOME AND CAR
WITH SUPER
SENSOR**

Take to the Sky with
☆ Galaxy Computer Game
☆ High-flying CB

**SHORTWAVE RADIO LETS
YOU SNOOP ON SPIES**



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DAVIS PUBLICATION



**A President Mobile for your wife?
Your friends will think you're crazy.**

The lowest priced President CB costs a lot more than the bargain basement boxes you see huckstered throughout the land.

But then Old Hickory is a lot more radio.

The electronic wizardry of the thing is impressive. The mike feeds directly into a variable pre-amp that has a front panel control... then feeds into a compressor that squeezes modulation peaks exceeding 100% back into the envelope. A clipper finishes the job and a low pass filter removes any distortion.

The result is a new standard of talkpower for CB... consistent 100% modulation.

Despite the mystical complexities of its innards, Old Hickory is as simple to use as a telephone. And loaded with

premium features like a digital display with a dimmer switch, full size meter, ANL override switch and LED transmit indicator.

To make sure every President Mobile does the wonderful things the specs say it will, we quality test every single radio we build. Not just a spot check of one in twenty. Every single radio.

Now your friends might think you're crazy to buy all that quality and reliability for your wife.

But if she ever really had to depend on the CB just once in her life, which would you rather she had?

A toy?
Or a President Mobile?



PRESIDENT
Engineered to be the very best.

President Electronics, Inc. 16691 Hale Avenue - Irvine, CA 92714 - (714) 556-7355
In Canada: Lectron Radio Sales Ltd., Ontario

CIRCLE 28 ON READER SERVICE COUPON

Burglar Alarm Breakthrough



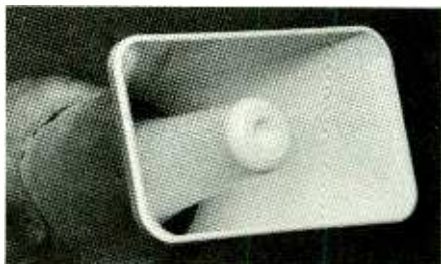
A new computerized burglar alarm requires no installation and protects your home or business like a thousand dollar professional system.

The Midex security computer looks like a handsome stereo system component and measures only 4"x 10½"x 7."

It's a security system computer. You can now protect everything—windows, doors, walls, ceilings and floors with a near fail-safe system so advanced that it doesn't require installation.

The Midex 55 is a new motion-sensing computer. Switch it on and you place a harmless invisible energy beam through more than 5,000 cubic feet in your home. Whenever this beam detects motion, it sends a signal to the computer which interprets the cause of the motion and triggers an extremely loud alarm.

The system's alarm is so loud that it can cause pain—loud enough to drive an intruder out of your home before anything is stolen or destroyed and loud enough to alert neighbors to call the police.



The powerful optional blast horns can also be placed outside your home or office to warn your neighbors.

Unlike the complex and expensive commercial alarms that require sensors wired into every door or window, the Midex requires no sensors nor any other additional equipment other than your stereo speakers or an optional pair of blast horns. Its beam actually penetrates walls to set up an electronic barrier against intrusion.

NO MORE FALSE ALARMS

The Midex is not triggered by noise, sound, temperature or humidity—just motion—and since a computer interprets the nature of the motion, the chances of a false alarm are very remote.

An experienced burglar can disarm an expensive security system or break into a home or office through a wall. Using a Midex system there is no way a burglar can penetrate the protection beam without triggering the loud alarm. Even if the burglar cuts off your power, the four-hour rechargeable battery pack will keep your unit triggered, ready to sense motion and sound an alarm.

DEFENSE AGAINST PEEPING TOMS

By pointing your unit towards the outdoors from your bedroom and installing an outside speaker, light, or alarm, your unit can sense a peeping Tom and frighten him off. Pets are no problem for the Midex. Simply put them in one section of the house and concentrate the beam in another.

When the Midex senses an intruder, it remains silent for 20 seconds. It then sounds the alarm until the burglar leaves. One minute

after the burglar leaves, the alarm shuts off and resets, once again ready to do its job. This shut-off feature, not found on many expensive systems, means that your alarm won't go warning all night long while you're away. When your neighbors hear it, they'll know positively that there's trouble.

PROFESSIONAL SYSTEM

Midex is portable so it can be placed anywhere in your home. You simply connect it to your stereo speakers or attach the two optional blast horns.

Operating the Midex is as easy as its installation. To arm the unit, you remove a specially coded key. You now have 30 seconds to leave your premises. When you return, you enter and insert your key to disarm the unit. You have 20 seconds to do that. Each key is registered with Midex, and that number is kept in their vault should you ever need a duplicate. Three keys are supplied with each unit.

As an extra security measure, you can leave your unit on at night and place an optional panic button by your bed. But with all its optional features, the Midex system is complete, designed to protect you, your home and property just as it arrives in its wellprotected carton.

The Midex 55 system is the latest electronic breakthrough by Solfan Systems, Inc.—a company that specializes in sophisticated professional security systems for banks and high security areas. JS&A first became acquainted with Midex after we were burglarized. At the time we owned an excellent security system, but the burglars went through a wall that could not have been protected by sensors. We then installed over \$5,000 worth of the Midex commercial equipment in our warehouse. When Solfan Systems announced their intentions to market their units to consumers, we immediately offered our services.

COMPARED AGAINST OTHERS

In a recent issue of a leading consumer publication, there was a complete article written on the tests given security devices which were purchased in New York. The Midex 55 is not available in New York stores, but had it been compared, it would have been rated tops in space protection and protection against false alarms—two of the top criteria used to evaluate these systems. Don't be confused. There is no system under \$1,000 that provides you with the same protection.

YOU JUDGE THE QUALITY

Will the Midex system ever fail? No product is perfect, but judge for yourself. All components used in the Midex system are of aerospace quality and of such high reliability that they pass the military standard 883 for thermal shock and burn-in. In short, they go through the same rugged tests and controls used on components in manned spaceships.

Each component is first tested at extreme

tolerances and then retested after assembly. The entire system is then put under full electrical loads at 150 degrees Fahrenheit for an entire week. If there is a defect, these tests will cause it to surface.

PEOPLE LIKE THE SYSTEM

Wally Schirra, a scientist and former astronaut, says this about the Midex 55. "I know of no system that is as easy to use and provides such solid protection to the homeowner as the Midex. I would strongly recommend it to anyone. I am more than pleased with my unit."

Many more people can attest to the quality of this system, but the true test is how it performs in your home or office. That is why we provide a one month trial period. We give you the opportunity to see how fail-safe and easy to operate the Midex system is and how thoroughly it protects you and your loved ones.

Use the Midex for protection while you sleep and to protect your home while you're away or on vacation. Then after 30 days, if you're not convinced that the Midex is nearly fail-safe, easy to use, and can provide you with a security system that you can trust, return your unit and we'll be happy to send you a prompt and courteous refund. There is absolutely no obligation. JS&A has been serving the consumer for over a decade—further assurance that your investment is well protected.

To order your system, simply send your check in the amount of **\$199.95** (Illinois residents add 5% sales tax) to the address shown below. Credit card buyers may call our toll-free number below. There are no postage and handling charges. By return mail you will receive your system complete with all connections, easy to understand instructions and a one year limited warranty. If you do not have stereo speakers, you may order the optional blast horns at **\$39.95** each, and we recommend the purchase of two.

With the Midex 55, JS&A brings you: 1) A system built with such high quality that it complies with the same strict government standards used in the space program, 2) A system so advanced that it uses a computer to determine unauthorized entry, and 3) A way to buy the system, in complete confidence, without even being penalized for postage and handling charges if it's not exactly what you want. We couldn't provide you with a better opportunity to own a security system than right now.

Space-age technology has produced the ultimate personal security computer. Order your Midex 55 at no obligation, today.

JS&A NATIONAL SALES GROUP

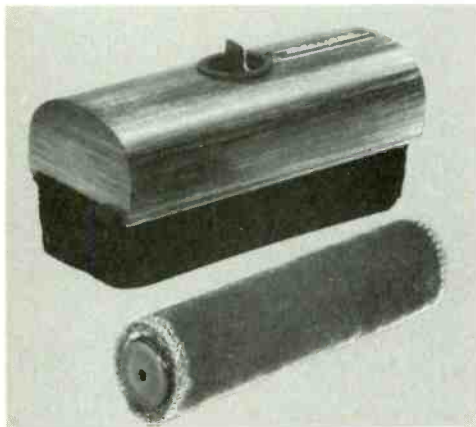
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Next best thing to a vault for protecting your records:



Discostat Static Reducer gives you continuous, two-way cleaning action. Grounded, ultra-fine copper brush cuts annoying clicks and pops, while the plush roller brush collects dust and dirt — all as record plays! Just **19.95***.



Exclusive Hydro-Stor® Disc Cleaners — the most convenient manual system ever! Stores fluid for weeks, keeps correct moisture on cover for clean sweep every time. "Pro" model with stand, rosewood handle, **9.95***. Cylinder, **4.95***.

Realistic record care accessories

Realistic® makes it easy to keep your discs clean and free of electrostatic charges, so those silent passages stay silent a lot longer. Whether you're looking for a low-cost cleaner for casual use or a sophisticated system for critical applications, you'll find it in the Realistic line. Compare our prices with what you'd have to pay for the other big-name brands. Then take the money we save you and . . . put *that* in a vault!



Discoclean is the economical way to keep your records clean. Tracks automatically, while record plays. Special dual bristle system collects even the finest particles. Weighted base for instant installation. Only **9.95***.



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ELEMENTARY ELECTRONICS/March-April 1978

BUILD 20 RADIO and Electronics Circuits

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Training Electronics Technicians Since 1946

PROGRESSIVE HOME RADIO-T.V. COURSE

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- ★ SIGNAL TRACER
- ★ AMPLIFIER
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- ★ 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 easy-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 learn how to tune 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.

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.

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

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

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

SOLID STATE

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

Progressive "Edu-Kits" Inc., 1189 Broadway, Dept. 589 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

CITY & STATEZIP

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elementary electronics

March/April 1978
Volume 18, No. 2

UPDATE YOUR OLD TELEPHONE WITH THESE PROJECTS AND PRODUCTS

- ☆ 33 Trigger—*build it and make a personal robot out of your telephone*
- ☆ 45 Telephone Gizmos—*protect your privacy, record your calls, and much more*
- ☆ 53 e/e checks out the—*Soft-Touch, so you can add your own touch tone*
- ☆ 65 Ring-A-Thing—*makes every room go ding-a-ling*

TEST AND MEASURE WITH THESE CONSTRUCTION SNAPS

- ☆ 49 Super Sensor—*search out leaks in home and car with this solid state project*
- ☆ 55 Clip-Chip—*makes testing suspicious ICs a real snap*
- ☆ 67 Antique Radio Corner—*find out how your electrolytics have weathered the years*

KEEP UP WITH THE HOME COMPUTER BOOM

- ☆ 42 Kansas City—*talk in tones with your computer*
- ☆ 51 Space: 1978—*protect your galaxy, or conquer one, from your livingroom*
- ☆ 60 Simply Basic—*our Whiz Kid shows you how to solve anything electronic*
- ☆ 62 Supermarket Stripes—*computers keep down the gripes*
- ☆ 70 Computer New Products—*more and more computers and accessories for your home and office*
- ☆ 74 Computer Readout—*Norm takes a look at the new ways computers are altering your everyday life*
- ☆ 79 Our Basic Course—*programming with BASIC language*

e/e CHECKS OUT THE NEWEST PROGRAMMABLE PRODUCTS

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- ☆ 63 PAIA Programmable Drum Kit

COMMUNICATIONS COVER THE GLOBE

- ☆ 54 Sky-High CB—*all you need is a plane to triple your range*
- ☆ 57 Morse Code—*the oldest way of transmitting is still the best*
- ☆ 76 DXing International Intrigue—*shortwave snoops on the superspies*

OUR REGULAR DEPARTMENTS

- 8 Hey, Look Me Over—*keep up with the classiest, newest products*
- 18 Bookmark—*by Bookworm*
- 20 DX Central—*watch the swift-moving changes in Shortwave listening*
- 24 Ask Hank, He Knows—*let Hank straighten out your shack*
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☆ Cover Stories



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Cover Illustration by Len Goldberg

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.



Punches through loud and clear.

Cobra Communications Products
DYNASCAN CORPORATION
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Write for color brochure
EXPORTERS: Empire • Plainview, N.Y. • CANADA: Atlas Electronics • Toronto

CIRCLE 36 ON READER SERVICE COUPON

UPWARD MOBILITY.



Hey, look me over

Showcase of New Products

Versatile Antenna Matcher

SST Electronics has introduced their newest model antenna tuner, the T-2 Ultra Tuner. To be used with either Amateur Radio or CB transceivers, this tuner will assure that your transmitter output is properly matched to your antenna load qualities. Matching antenna load with transmitter output stages lets all of your output power reach the antenna, where it is radiated. A mismatched system can waste a lot of your power. This new unit



CIRCLE 57 ON READER SERVICE COUPON

is one of the most versatile available, allowing you to match your rig to a wide variety of antennas, from random length

long wires, to verticles, beams, quad antennas and mobile whips. Price is an unusually low \$49.95. Manufacturer's address is SST Electronics, P.O. Box 1, Lawndale, CA 90260.

Stereo Console

One of three new vertically styled consoles, the Imperial Model D-604R by Superscope features an AM/FM stereo re-



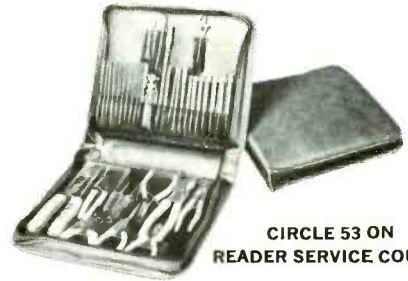
CIRCLE 69 ON READER SERVICE COUPON

ceiver, stereo eight-track tape recorder and a BSR three-speed Deluxe Automatic record changer. The receiver section includes phase-locked loop (PLL) circuitry for improved stereo separation and low distortion; built-in AFC; pushbuttons for Tape, Phono, FM, MPX and AM; and an LED tuning indicator. The eight-track re-

ceiver has automatic, record-level circuitry and pushbutton channel selectors. On the BSR turntable there are controls for tracking force, stylus set-down and cueing. The two-way speaker system has a mechanical crossover network. The whole system weighs 85 pounds and fits into a cabinet that is 25¼-in. wide, 18-in. deep and 30-in. high. The suggested retail price is \$219.95. For more information write to Superscope, Inc., 20525 Nordhoff St., Chatsworth, CA 91311.

Under-The-Arm Workshop

Vaco's Super Zip is a go anywhere, do anything tool case. This compact assortment holds Vaco professional tools in a zippered vinyl case. Lightweight enough to tuck under your arm—yet with 36 popular tools, it's a selection for most any job. Included are interchangeable screwdriver, nutdriver and hex driver blades and handle, pliers, crimping tool,



CIRCLE 53 ON READER SERVICE COUPON

offset screwdrivers, Phillips, slotted and screw holding drivers. Super Zip has the 90-series interchangeable blade tools
(Continued on page 14)

At last...DIP Jumpers for Faster & Easier connections.

AP DIP Jumpers are the low cost high quality solution to bussing between PC boards, mother boards, backplanes and more. Available in 14, 16, 24 and 40 pin single ended or double ended assemblies, in standard lengths of 6, 12, 24 and 36 inches. Each assembly has molded-on strain relief and line-by-line probeability. Contact material is non-corrosive nickel silver. Dielectric is 94 V-O rated. Cable options include stranded electric pink, rainbow or with ground plane.

Order from your AP distributor today. Our distributor list is growing daily. For the name of the distributor nearest you call Toll Free 800-321-9668.

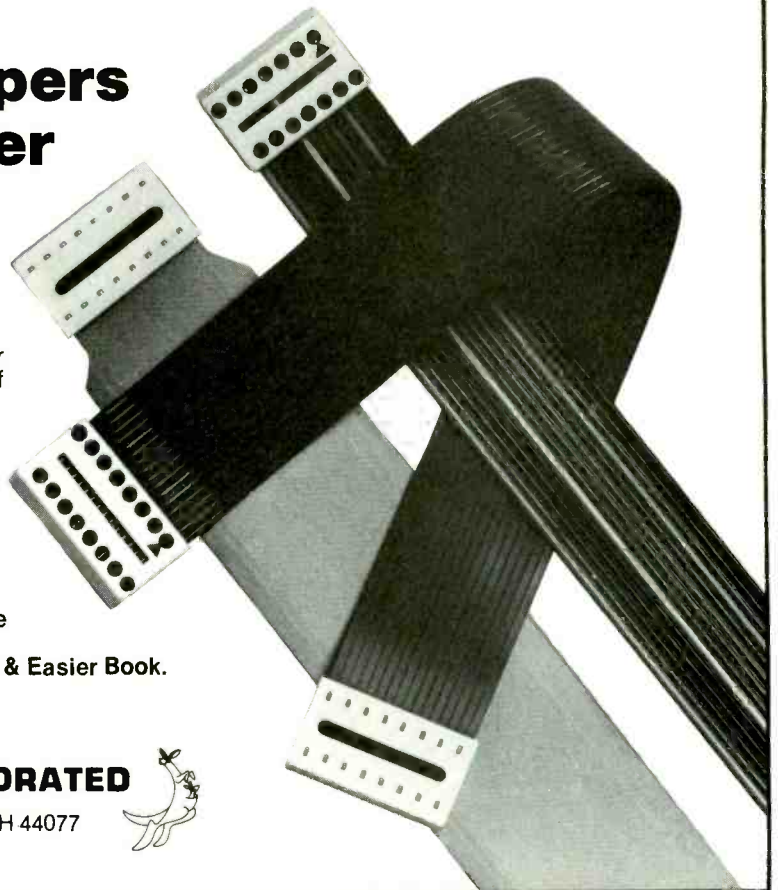
Send for our complete AP catalog The Faster & Easier Book.

Faster & Easier is what we're all about.



AP PRODUCTS INCORPORATED

Box 110 • 72 Corwin Drive, Painesville OH 44077
(216) 354-2101 TWX: 810-425-2250



CIRCLE 6 ON READER SERVICE COUPON

6800/2 IS HERE



The 6800/2 uses our new A2 processor board with socket space for 8K bytes of ROM/PROM. This makes it possible to use the 6800 in applications where ROM programs are useful without purchasing an expensive PROM accessory board. The A2 board has a DIP switch selector that allows you to replace any 8K block of memory above the RAM memory that extends to 32K with memory external to the processor board itself. This lets you develop special programs that will later be put in PROM in a normal RAM memory card where it can be modified and debugged. The A2 board has a crystal controlled baud rate oscillator and a separate clock driver oscillator whose frequency may be changed with a programming resistor. The A2 processor board gives you the maximum possible flexibility in setting up a computer system.

SWTBUG® Monitor—

The 6800/2 is supplied with our new SWTBUG® monitor. This new monitor is software compatible with the earlier Mikbug® monitor used in the 6800. All major subroutine entry points are identical. SWTBUG® features a resident MF-68 Minifloppy disk boot, single level breakpoints, vectored software interrupt, generation of punch end of tape formatting and automatic interface configuring for either the MP-C control interface or MP-S serial interface.

ACIA Type Interface—

The 6800/2 uses our MP-S serial interface. This RS-232 and

20 Ma. TTY compatible interface may be configured to operate serially at the following baud rates: 110, 150, 300, 600, 1200, 2400, 4800 and 9600. Complete interrupt control is available through the user's software.

4K Static MEMORY—

The 6800/2 comes with 4K of static RAM memory on our MP-8M board. The memory may be expanded to 8K by the addition of eight more memory chips. No additional parts are needed. Full buffering of all data, address and control lines is a standard feature. Memory expansion to 32K of continuous RAM memory and up to a 48K mixture of ROM/RAM is possible with this system.

ACCESSORY BOARDS—

Do you have a special job? Our accessory boards make it possible to use the 6800/2 for almost any type of computer application. We have our MP-T interrupt timer with software interrupt selectable output. Our MP-N calculator interface that allows you to do arithmetic functions in hardware. Our MP-R EPROM programmer that programs and verifies EPROMs right in the machine—and more coming.

6800/2 Kit \$439.00 ppd Cont. U.S.
6800/2 Assembled \$495.00 ppd Cont. U.S.

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CIRCLE 42 ON READER SERVICE COUPON

Learn to service Communications /CB equipment at home...with NRI'S COMPLETE COMMUNICATIONS COURSE

Learn design, installation and maintenance of commercial, amateur, or CB communications equipment.

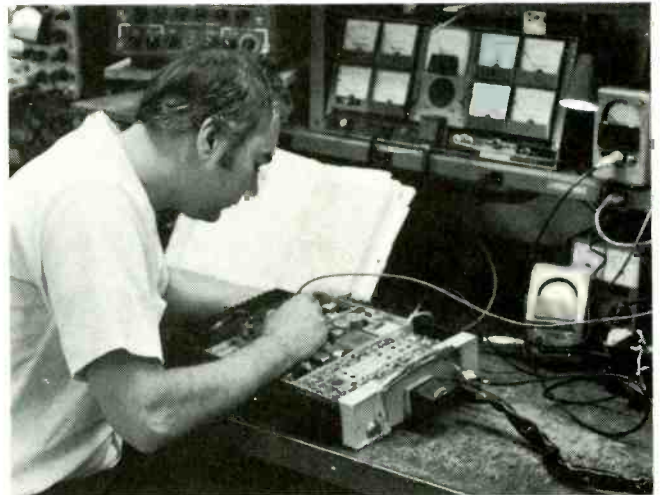
The field of communications is bursting out all over. In Citizens Band alone, class D licenses grew from 1 to over 2.6 million in 1975, and the FCC projects about 15 million CB'ers in the U.S. by 1979. That means a lot of service and maintenance jobs . . . and NRI can train you at home to fill one of those openings. NRI's Complete Communications Course covers all types of two-way radio equipment (including CB), AM and FM



Transmission and Reception, Television Broadcasting, Microwave Systems, Radar Principles, Marine Electronics, Mobile Communications, and Aircraft Electronics. The course will also qualify you for a First Class Radio Telephone Commercial FCC License or you get your tuition back.

Learn on your own 400-channel digitally-synthesized VHF transceiver.

You will learn to service all types of communication equipment, with the one unit that is designed mechanically and electronically to train you for CB, Commercial and Amateur communications: a digitally-synthesized 400-channel VHF transceiver and AC power supply. This 2-meter unit gives you "Power-On" training. Then we help you get your FCC Amateur License with



special instruction so you can go on the air.

The complete course includes 48 lessons, 9 special reference texts, and 10 training kits. Included are: your own electronics Discovery Lab, Antenna Applications Lab, CMOS Frequency Counter, and an Optical Transmission System. You'll learn at home, progressing at your own speed, to your FCC license and into the communications field of your choice.

NEW CB SPECIALIST COURSE NOW OFFERED



NRI now offers a special course in CB Servicing. You get 37 lessons, 8 reference texts, your own CB Transceiver, AC power supply and multimeter . . . for hands-on training. Also included are 14 coaching units to make it easy to get your commercial radio telephone FCC license—enabling you to test, install, and service communications equipment.

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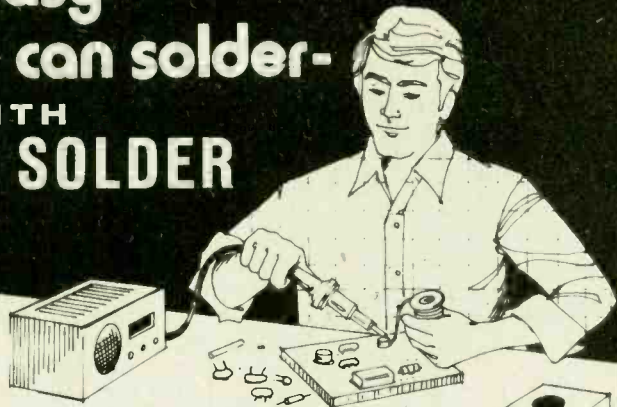
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HEY, LOOK ME OVER

(Continued from page 8)

plus pliers, wrench, offset and screw holding drivers, wire stripper and crimping tool. Its small size and light weight make it easy to tuck under the arm, or slip in a drawer. Super Zip is tough, rugged simulated leather vinyl case. Heavy gauge all metal zipper is snag free. Included in the Super Zip are 4 slotted and Phillips screwdriver blades, 6 hollow shaft nutdriver blades with 3/8-in. to 1/2-in. sockets, 9 hex shaft driver blades for .050-in. to 3/16-in. screw heads and a full-size handle for all blades. Also provided are 6 professional, electronic and snap ring pliers, adjustable wrench, adjustable wire stripper, crimping tool with bolt slicer, Phillips and slotted screw holding drivers and offset drivers for both Phillips and slotted type screws. Sells for \$155. Write to Vaco Products Company, 1510 Skokie Blvd. Northbrook, IL 60062. for information on Super Zip and other tool products.

AM/FM/MPX/8T in Dash

Medallion's Model 65-564 in-dash AM/FM/MPX radio and 8-track tape deck is a complete car sound system. The compact design of the Model 65-564 allows the backlighted radio tuning dial to fold back for insertion of 8-track cartridges. AM/FM radio automatically shuts off when an 8-track tape is inserted in cartridge door. The Model 65-



CIRCLE 65 ON READER SERVICE COUPON

564 has 4-way speaker controls with side-to-side balance located inside the cartridge door and front-to-rear fader located on the shaft. The on/off/volume/tone shaft depresses for pushbutton AM/FM channel selection. The 8-track tape player features both automatic and pushbutton channel select, channel indicator lights and pushbutton tape eject. Medallion's Model 65-564 has fully adjustable shafts, custom trim plates and both Ford and GM type knobs for easy and professional installation. Suggested retail price is \$179.95. Complete details from Medallion Division, Midland, P.O. Box 1903, Kansas City, MO 64141.

Programmable Scanner

There are no extra crystals to buy with Radio Shack's new five-band, 16-channel programmable scanning monitor receiver. The Realistic COMP-100 Programmable Memory Scanning Receiver provides access to over 20,000 frequencies used by police, fire and emergency services, utilities, business, weather, ra-

(Continued on page 16)

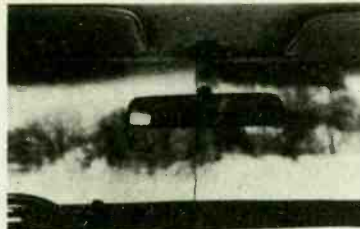
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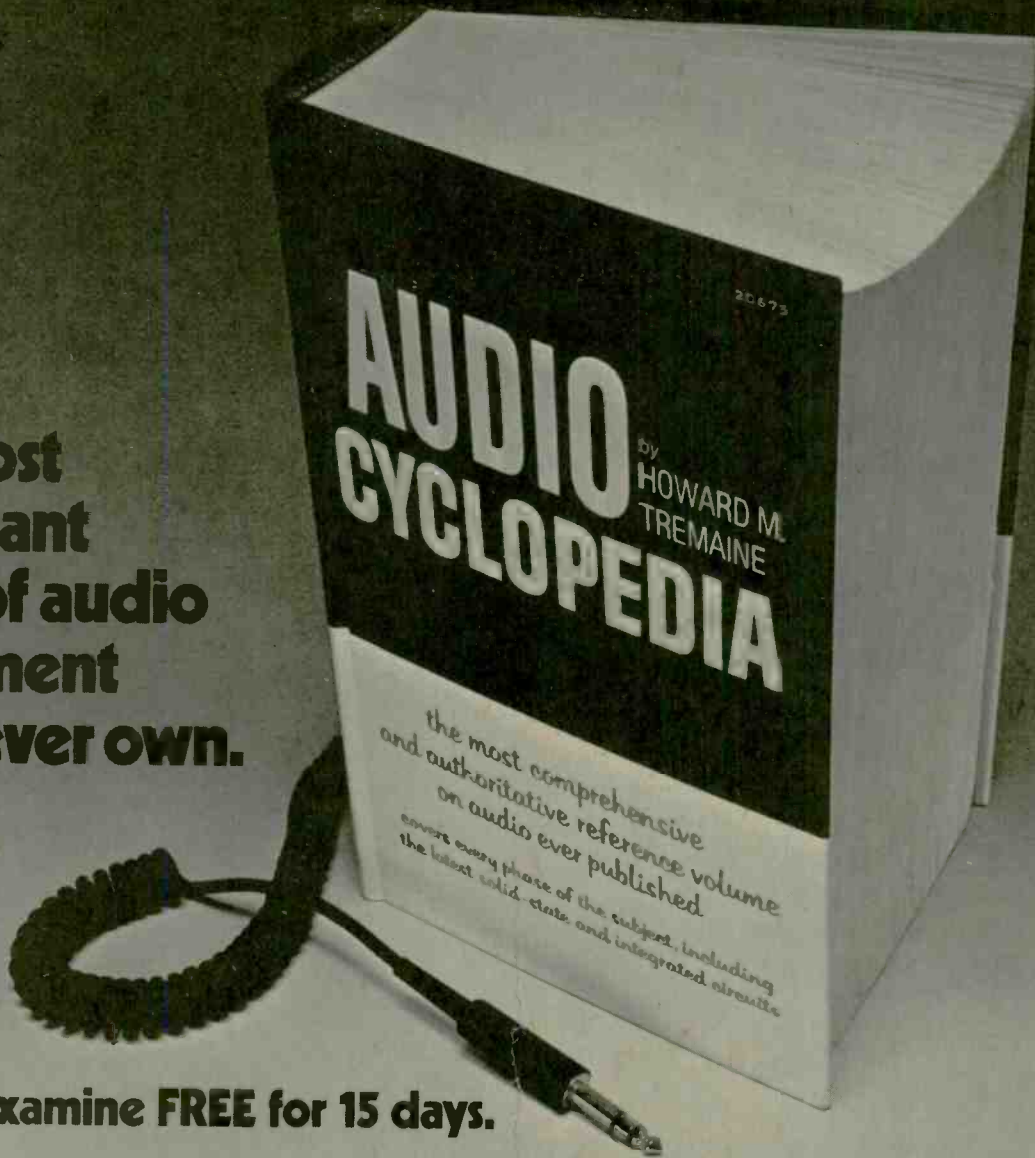
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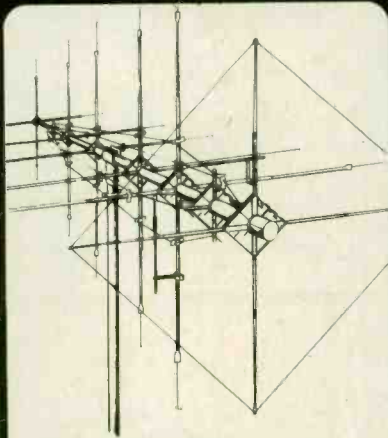
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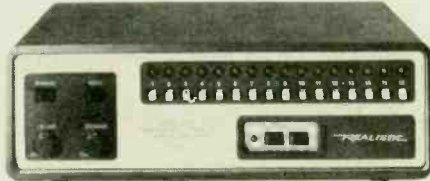
MOONRAKER

CIRCLE 8 ON READER SERVICE COUPON

HEY, LOOK ME OVER

(Continued from page 14)

dio telephone and other communication users. Two keys, Program and Enter, control the programming function. In the program mode, the 16 LED channel indicators and lockout buttons let you change or check stored frequencies. A code book is included with the scanner



CIRCLE 32 ON READER SERVICE COUPON

that shows how to program the desired frequencies. The programmed memory is maintained with a 9-volt battery in the event of a power failure, or if the COMP-100 is unplugged. Coverage includes: VHF-Lo (30-50 MHz), VHF-Hi (150-172 MHz), UHF-Lo (450-470 MHz), UHF-Mid (470-490 MHz) and UHF-Hi (490-512 MHz). Other features include: built-in scan delay to catch callbacks, individual channel lockout buttons with skipper circuit, automatic and manual scan, built-in speaker, jacks for external speaker or headphone and tape recorder, and separate VHF and UHF antenna inputs. The Realistic COMP-100 Programmable Memory Scanning Receiver, complete with code book, mobile mounting bracket and power cables for 120 VAC and 12 VDC negative ground, is priced at \$349.95. Available at Radio Shack stores across the nation.

Hand-Size 3½ Digit Portable DVOM

A single selector switch provides five functions and 22 ranges on a highly compact, hand-size battery operated 3½ Digit Model 3000 Digital VOM made by



CIRCLE 66 ON READER SERVICE COUPON

Triplet. The 3½ Digit display features high intensity LED's with blinking over-range indication, auto-zeroing and auto-polarity indication. Also, if a low battery condition exists, all decimal points are simultaneously displayed preventing erroneous readings. Ranges include AC

and DC Volts: 0-2, 2, 20, 200 and 600; AC and DC milliammeters: 0-2, 20, 200; three low-power ohm ranges: 0-200, 20K and 2M for in-circuit semiconductor testing; plus three hi-power ohm ranges: 0-2K, 200K, 20M. Typical DC accuracy is .9% reading. Input resistance on all voltage ranges is 10 Megohms. Overload protection up to 600 Volts is provided on all ranges. Only \$140, the Triplet Model 3000 DVOM including a one year warranty, 48-inch long test leads, insulated alligator clips, rechargeable Ni Cad batteries, AC Adapter/Charger and comprehensive instruction manual is available through Triplet distributors nationwide. For complete information, write to Triplet Corporation, Dept. PR., Bluffton, Ohio 45817.

Programmable Heating Control

Here's a new energy-saving programmable home heating control for central furnace heating systems. The Heath GD-1776 provides two automatic temperature setbacks in any 24-hour period, letting the homeowner automatically reduce temperatures at night, while at work, or when the home is unoccupied. Heat is reduced for the period set by the

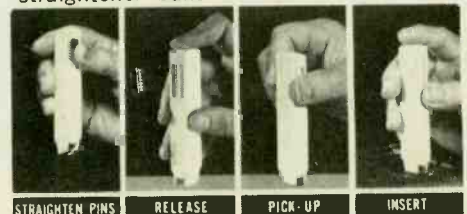


CIRCLE 31 ON READER SERVICE COUPON

timer and returned to normal operation when desired. The GD-1776 installs on any conventional gas, oil or electric central furnace system. A replacement thermostat uses existing two-conductor thermostat wiring. For further information on the GD-1776, which is mail-order priced at \$37.95, write Heath Company, Dept. 350-14, Benton Harbor, MI 49022, for a free catalog.

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O.K.'s Model INS-1416 DIP Insertion Tool inserts both 14 and 16 pin IC packages into sockets or predrilled boards. Durable glass-filled Lexan construction features precision parts for long life and easy one-hand operation. Narrow profile permits tool to work on densely spaced patterns, while unique insertion mechanism assures accuracy as well as excellent "feel." The tool includes a pin straightener built into the handle.



CIRCLE 63 ON READER SERVICE COUPON

Priced at \$3.49 the INS-1416 is available at your local electronics distributor or directly from O.K. Machine and Tool Corporation, 3455 Conner Street, Bronx, NY 10475.

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book and explains the best design of the various types of low-pass, high-pass, band-pass, and notch filters, with many design graphs and tables with illustrative examples worked out. In addition, twenty-six experiments demonstrate the design and characteristics of many of the filters, providing suitable questions and answers for the reader as he performs the experiments. Published by E&L, Derby, CT 06148.

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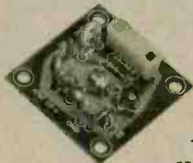
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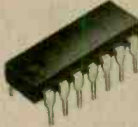
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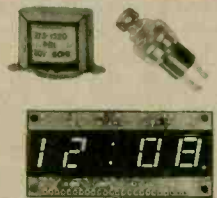
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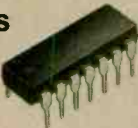
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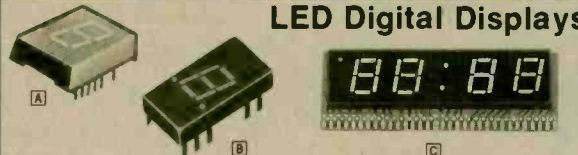
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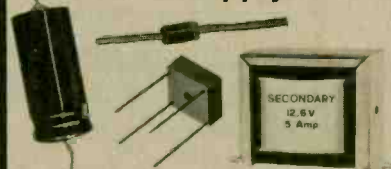
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4049	276-2449	69¢
4050	276-2450	69¢
4511	276-2447	1.69
4518	276-2490	1.49

LED Digital Displays



Digits	Size	Drive	Cat. No.	ONLY	Digits	Size	Drive	Cat. No.	ONLY
1	0.6"	Anod.	276-056	2.99	1	0.3"	Anod.	276-1210	4/6.99
1	0.6"	Cath.	276-066	2.99	1	0.3"	Cath.	276-1211	4/6.99
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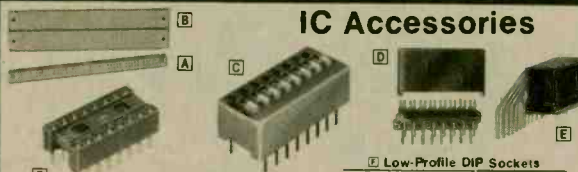
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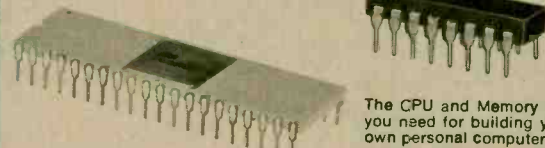
Pins	Cat. No.	Price
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75492	276-1702	99¢
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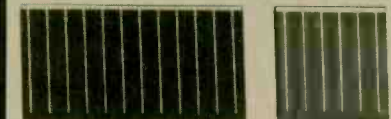
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A world of SWL info!

BY DON JENSEN

□ Shortwave listening, thy name is change!

Few situations change as much as the shortwave broadcasting picture. New stations come on the air, sometimes without any advance warning. Others, once easily heard, seem to vanish not to be logged again. Listeners find that even longtime favorites busily juggle frequencies and broadcasting schedules.

Let's take a look at some of the past, present and proposed changes that may affect your SWLing.

Not too many months ago, one of the more easily heard African shortwave stations was ETLF, the *Radio Voice of the Gospel*, a religious broadcaster in Addis Ababa; Ethiopia. The station, with a pair of powerful shortwave transmitters of 100 kilowatts each, was owned by the Lutheran World Federation.

Then the government of Ethiopia

stepped in. Political changes had occurred in that country. It was a different government, one with a different political philosophy than the one that had originally granted the Lutheran World Federation Broadcasting Service the permission to construct the modern shortwave voice.

The Radio Voice of the Gospel was no more. It became, overnight, the *Radio Voice of Revolutionary Ethiopia*. And that's what the station is today, transmitting on 6,015 and 7,180 kHz, at 0400, 1030 and 1700 GMT in several languages, including English.

Missionary broadcasters operating from other countries do have a precarious situation due to political changes. A fate similar to ETLF's was suffered during the year by a much smaller religious station in Africa.

Radio Cordac in Bujumbura, Burundi had struggled along for years. It had only a fraction of the financial resources of the large *Radio Voice of the Gospel*. But occasionally North American SWLs were able to hear the signals of *Radio Cordac's* two-and-a-half kilowatt transmitter on 4,900 kHz during the late evening. But the Burundi government changed that, ordering the station shut down for good.

If you have been a shortwave listener for more than just a few months, you may remember the English language

programs of *Radio Nacional* in Brasilia, capital of the largest of the South American countries.

More Political Problems. *Radio Nacional*, Brasilia had a foreign service, intended primarily for European listeners, but which was widely heard in the U.S. and Canada as well. There was an English service at 2100 GMT, plus other programs in Portuguese and German.

But then, according to available information, political considerations intervened. Apparently the Brazilian government became concerned about foreign shortwave broadcasts—and you probably can guess the origin of those broadcasts—having an impact on Brazilian listeners in the huge, underdeveloped backcountry of that nation.

So the foreign service was changed. Instead of using the *Radio Nacional* transmitters to reach overseas audiences in English and other languages, the stations focused on Brazilian listeners in the Amazon region and programs in Portuguese.

The station can still be heard—on 11,780 kHz from 1900 to 2300 GMT for instance—but the programs are no longer in English.

Lots of Improvements, Too. Not all shortwave changes are negative. For instance, until very recently it was impossible to hear English language programs from Uruguay, Brazil's South American neighbor.

But that, too, has changed. A new International Service has been initiated by SODRE (which stands for Servicio Oficial Difusion de Radio Electrica), a shortwave station in Montevideo. Reportedly the International Service is aired from 2200 to 0000 GMT, but SWLs report hearing English programming at various times a bit later, between about 0230 and 0330 GMT, mixed with Spanish programming. The SODRE frequencies to tune are 9,515 and 11,885 kHz.

A Real Shocker. Many SWLs are upset by reports from Great Britain that suggests that perhaps even Auntie BBC, the respected and venerated old British Broadcasting Corporation, may be subject to change.

The shock waves were set off by a report that suggested, for economy reasons mostly, some drastic cutbacks in BBC broadcasting.

The proposals include these stunners!

- The famous and, yes, beloved English language World Service would no longer be transmitted to North America, Australia, New Zealand or non-communist Europe.

- Many language services would cease to be, including programs in French, German, Italian, Portuguese, Greek, Finnish and Spanish (for

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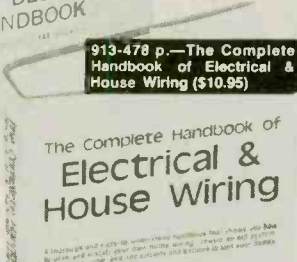
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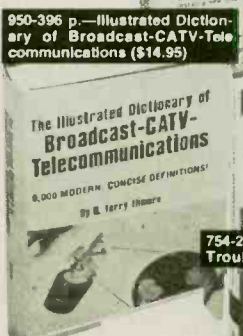
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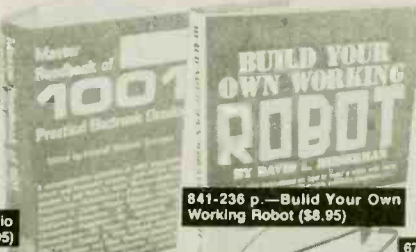
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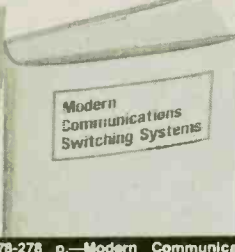
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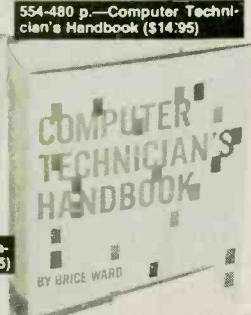
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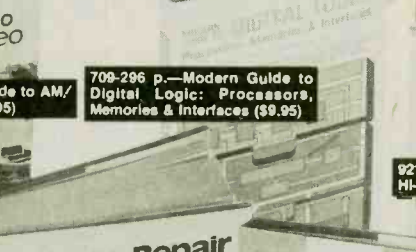
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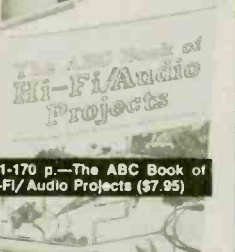
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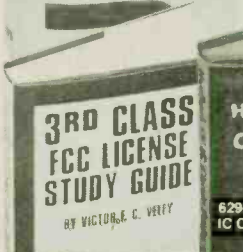
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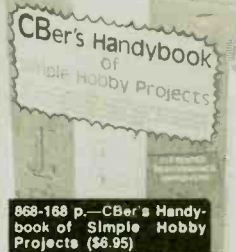
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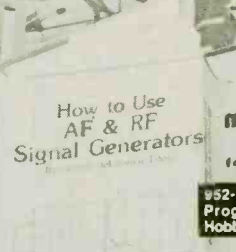
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Spain).

• That the 2000 to 0400 GMT shift transmissions be cut out.

North American SWLs, who probably are less concerned about the foreign language programs and who might be able to hear World Service programs when beamed to other parts of the world, are most concerned about the proposed loss of BBC programming during the 2000-0400 GMT "prime time" listening.

Frankly, our correspondent in the United Kingdom, an ace Dxer named Roger Bowen reports that these "think tank" proposals are not at all likely to be adopted. Still, sometimes trial balloons are sent aloft simply to find out if anyone cares. So SWLs might be wise to fire off protest letters to either the BBC in London (Broadcasting House, London W1A 1AA, England) or to the British Embassy in Washington, DC.

Changes, Changes. Programming changes have been announced by Holland's *Radio Nederland*, a very popular station with SWLs.

The changes are not prompted by political or financial considerations. These changes, which were to go into effect in November, result from a changing technology, and the use by Radio Nederland of relay stations on Madagascar and on the island of Bonaire in the Netherlands Antilles.

In the past, Radio Nederland feature programs have been tape recorded and shipped by air to the distant relay transmitters for broadcasting. With the change, however, the programs will be fed to the relay stations by satellite from Holland.

The only problem involved here is that only one satellite circuit will be in use, meaning that it will not be possible to broadcast more than one language at a time. For instance, the Bonaire relay formerly had simultaneous English and Spanish transmissions on different frequencies.

The answer chosen by Radio Nederland has been to shorten each of the programs and to repeat these shortened versions—by then taped—several more times. The program cuts announced involved a decrease from 80 minutes to 50 minute programs.

Good or bad? There are SWLs on both sides of the question. There are those who will lose some favorite programming in the cutback. But, on the other hand, it is expected that newspapers will be strengthened. And a number of SWLs have expressed the view that 50 minutes is a more reasonable listening time for the average listener than is 80 minutes duration.

And so they go on, for whatever

reason, for good or bad, the changes that are such a major factor in SWLing today.

In the Mail. A question from Terry Concannon of Seattle, WA, is at the top of the mailbox this month.

"I read in a SWL book that a number of years ago there was a shortwave station called the *Voice of the Prairies* in Calgary, Alberta, Canada. Could you tell me a little bit about it and what happened to it?"

Interesting question, Terry, about an interesting station.

To understand CFVP, the shortwave *Voice of the Prairies*, it is necessary to know a bit about Canadian private broadcasting. Going back a good many years, it seems, some Canadian AM broadcasters felt that with the vast reaches of the northland it was worthwhile relaying their medium wave programs on shortwave to reach these more distant listeners then beyond the range of the AM signal.

And there still are today a number of such shortwave relays of AM stations. The best known are probably CFRX, 6,070 kHz, relaying the programs of CFRB, Toronto, and CFCX, 6,005 kHz, which relays MW outlet CFCF in Montreal.

Down the dial. (Times in GMT, frequencies in kHz): 700—If you live on the West Coast of North America you may find Australian stations coming through on the AM medium wave band. One California listener pulled in 2NR in Grafton, Australia at about 1345 GMT . . . 1529—And a listener on the Eastern Seaboard reports logging *Vatican Radio* on this frequency at 2335 with light music with some interference from WCKY . . . 6,025—*Radio Portugal* in Lisbon can be heard broadcasting in English at around 0300 . . . 6,195 —In addition to it's *Radio Canada International* foreign service, the Canadian Broadcasting Corporation has a home service network for listeners in northern Canada. This is the Northern Service broadcast. You can hear this one in English, perhaps with some native Indian music and some broadcasts in Eskimo as well, at many times during the day. Try this frequency between 0200 and 0300 . . . 9,605—If you have no success with hearing *Vatican Radio* on 1529 mediumwave, try this frequency on shortwave at 0100 . . . 15,325 —Uganda Broadcasting Corp. operates on this frequency in English from 1800 to 1830. (Credits: Randy Tomer, CA; Richard Eckman, PA; Bill Bogel, CA; Glenn Thompson, NM; Bill McMillan, MI; Sydney Osterman, Ontario, Canada; National Radio Club, P.O. Box 118, Poquonock, CT 06064; North American Short Wave Association, P. O. Box 13, Liberty, IN 47353). ■



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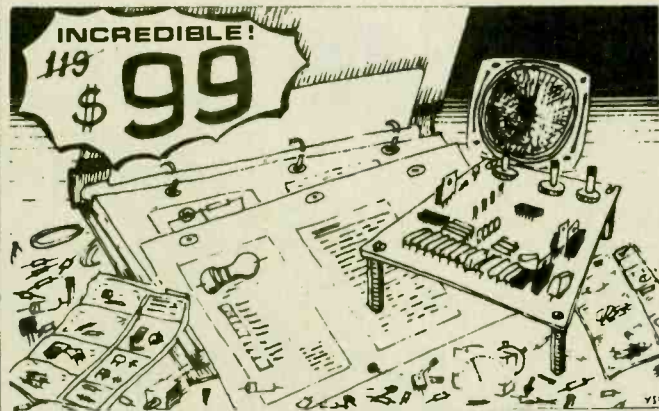
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Sounds Good

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

—L. V., Los Angeles, CA

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

Fails When Cold

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

—A. S., Lincoln, NE

Because TV antenna inspection and maintenance is never performed in the fall. Would you believe that my TV antenna is over 12 years old, and it is as good today as it was when new. I always replace the coax lead-in every other year. Bolts are checked, corroding rivets and hardware replaced. In fact, everytime an element is bent by birds, I replace it with a solid rod as opposed to seamed tubing. When I move, my antenna goes with me.

Antenna Blues

I have a Kenwood KR-77 with quite a few years on it. We have cable TV here and I am not too thrilled with their choice of FM stations. So, I put an omnidirectional antenna up on the roof—the best I could find. I still have difficulty "bringing in" some of the few stations I think worth listening to. Can I piggy-back an additional FM directional antenna on the omni I now have and direct the new antenna toward the few stations I think are super up here in the mountains of western North Carolina? Will this improve either or both? Should I go the whole way and get a rotor?

—J. C., Hendersonville, NC

You can piggy-back an FM directional antenna, but use an antenna switch to reduce the multipath reception the omni would be adding to the signal. A rotator? I would prefer it, but before you try it, install an MATV system (it works for FM signals, too!). Maybe your directional antenna is broad beam enough to be pulling those hill signals and get signal boosting by the MATV amplifier. If not, go rotator. I suggest you write to The Finney Company, 34 West Interstate Street, Bedford, OH 44146. They're hotshots in MATV and their literature may offer a better solution to your problem. As for that Kenwood KR-77, it's a good unit, but have it checked out for it may need a front end alignment. And if you like Kenwood products, the latest receivers are real good buys. I suggest that you check our sister publication, Hi-Fi Stereo Buyers Guide, for specifications on Kenwood equipment.

Looking for Help

Schematic diagrams and service information on specific radio and TV sets are available at a nominal charge. Supreme Publications is offering to mail promptly service material on almost any television, radio, or stereo. It is able to supply such information from its own service manuals, from its extensive files of factory data going back to the 1920's, and from manuals of other publishers. The charge is \$1.50 and up, and the usual charge is \$2.50. "Each request for material is a challenge to us," James Lynch, manager of Supreme Publications said to me, "And while most items can be easily and quickly filled, at times our Mr. Beitman (who has been connected with diagrams and servicing for 40 years) spends an hour to find a hard one. It's fun, so he says." It is good to know that there is a large organization ready to supply service material on a radio or a TV set you may find hard to repair and for which you do not have a diagram and other helpful service data. Write Supreme Publications, 1760 Balsam Road, Highland Park, IL 60035 and tell them Hank Scott sent you. They'll be very glad to hear from you, and you'll hear from them before you know it!

(Continued on page 26)

ELEMENTARY ELECTRONICS/March-April 1978

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CIRCLE 22 ON READER SERVICE COUPON

ASK HANK, HE KNOWS

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In reference to your column in **ELEMENTARY ELECTRONICS** (Sept./Oct. 1977) entitled "Radio Contact", I have listened to Voice of Nigeria for quite sometime. Granted, VON does broadcast in English at 0425 GMT in the 41-meter band and in the afternoon until 1755 GMT. Also try the 25-meter band at these times. But it's all in vain—these times and frequencies are only good in our winter season. Have D.J. of Cumberland, Ohio try 0555 GMT on 7255 kHz. He'll be surprised to find that VON is one of the strongest, if not the strongest signal in the 41-meter band.

—K. T., Bing, NY

Thanks for your help!!

Where to Receiver Shop

I read about the Barlow-Wadley XCR-30, Mark III receiver in an old issue of **ELEMENTARY ELECTRONICS** a while back and would like to buy one now. Who do I write to because I can't seem to buy one locally?

—Y. L., Tucson, AZ

Write to Gilfer Associates, Box 239, Park Ridge, NJ 07656. They sell Barlow-Wadley and R.L. Drake receivers besides other goodies for the shortwave listener.

4-1-1 Service

Hank, Ma Bell has gone bezerk! The prices they ask for are unbelievable. I want touch-tone dialing in my house and refused to be ripped off. What do I do? By the way, my phone exchange is equipped for touch-tone service.

—L. F., Hollis, NY

Rest easy! Just look into our May/June 1977 issue of **ELEMENTARY ELECTRONICS** and read the story entitled, "Add Tone to Your Phone." Also, watch the surplus ads because the touch-tone phones should be popping up in the marketplace.

Computers Catching On

Hank, I can't read "computerese"! Where can I get beginner's information so a beginner can understand it? I read **ELEMENTARY ELECTRONICS**, but it has been very limited on computer coverage.

—D. L., Chicago, IL

Stay with **ELEMENTARY ELECTRONICS**. Your letter came about the same time as the Sept./Oct. 1977 issue was released. This issue was jammed packed with computer stories you can understand. The Nov./Dec. 1977 issue is packed also, and I'm told that the first half of 1977 will find lots of computer stories in it.

Read Closer

Where can I get IC sockets really cheap?

—D. M., Tucumcari, NM

You've got to be kidding? First ad I turn to in **ELEMENTARY ELECTRONICS** sells 14-pin IC sockets for 25¢ each, 22¢ each for 25, and 20¢ each for lots of 100. Look for the Optoelectronics ad in your issue.

News from Tonto

Hank, your editors are the greatest! I

built the Lone Ranger Light Meter and it worked right off. Calibration was perfect. I shot several rolls of film on vacations and both black-and-white and color snaps came out perfect. Good job!

—S. T., Prairie de Sac, WI

Why a Kit?

What is the advantage of wiring your own color TV set from scratch?

—A. M., Little Rock, Ark.

Each person has their own set of reasons. I know one experimenter who enjoys soldering parts together. There is, also, the thrill of seeing your kit work. I take the hard cash position. If you build and adjust a color TV set, you will repair it saving cash each time. When the convergence or purity fall off, you'll bring it back to superb color and not put up with poor color to avoid a TV service call.

Help Wanted

Here are some readers who need your help. Lend a hand, boys!

Δ Blank or pre-recorded cartridges for Bell-O-Matic stereo tape recorder, Model 603: Send info to Andrew Cuneo, 157 W. Albemarle Avenue, Lansdown, PA 19050.

Δ Salvage cover and main circuit board from J.C. Penney, SSB Model 981-6240 CB transceiver: Write to Pat Chapman, P.O. Box 7674, Ketchikan, AK 99901 and give post-paid price.

Δ Service info for a Carnegie AM/FM/8-track console, Model V6S039-R made by Carnegie Electronics, Inc.: Write to Marvin Kosmal, 1931 Palmgrove Avenue, Pamona, CA 91767 who needs help in servicing the radio section.

Δ National NC-90 LW and SW receiver instruction book and circuit diagrams: Write to Jose Pevez Muros, 882 Valero St., (Delicias), Rio Piedras, San Juan, Puerto Rico 00924. Jose would like to correspond with pen pals.

Δ Hallicrafters Model S-38C receiver in need of repair: please send schematic diagram and data to Herminio Rodriguez, General Contreros #20, Santa Isabel, Puerto Rico 00757.

Δ Hallicrafters SX-11 and S-108 receivers and HT-40 transmitter instruction manuals and schematic diagrams: Keith J. Thibodeaux, P.O. Box 476, Baton Rouge, LA 70821.

Δ Hallicrafters HQ-110C receiver owners manual and schematic diagram: Frederick J. Onucki, 63 Highland Ave., Metuchen, NJ 08840.

Δ Juliette stereo phonograph, Model ACH-195SA schematic diagram: Russ Johnson, 4122 Harbrook Sq., Navarre, OH 44662.

Δ Tube chart and manual for Superior Model MOD-1240 tube tester: Robert Wm. Gag, Sr., Box 386, R.D. #4, Kerbytown Rd., Middletown, NY 10946.

Δ Gonset transceiver Model G76 schematic diagram and owner's manual: C. C. Brown, P.O. Box 14, Revenna, KY 40472.

Δ Wants to rebuild Stromberg-Carlson receiver, Model 633W: send data and history of unit to John Steven Leonard, 207 3rd Avenue, Red Oak, IA 51566.

Δ Pacco Speed-Check tube tester Model T-61 operating instructions: Nana Kwamina Sam, 1424 W. 105th Pl., Chicago, IL 60643. ■

ELEMENTARY ELECTRONICS/March-April 1978

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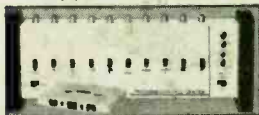
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Electronics in the News!

Disco Riddle Solved in Milwaukee

A discotheque riddle from Milwaukee: What do smoke, energy-saving and dancing have in common? "Air", says Zoy Maholias, owner of The Attic night club. But he didn't know the answer or the riddle until Lee Curtis of Auer Steel Heating Supply Co. helped analyze a problem of haze over the dance floor from tobacco smokers.

"It became really evident when the spotlight came on over the dance floor," Maholias said, "The excitement of disco dancing is the flashing, multi-colored spotlights as well as the solid, rhythmic beat of the music. But the lights on the ceiling had trouble penetrating the haze. And the dancers had trouble breathing—you need clean fresh air when you're exercising to disco music." The Attic needed clean air.

Curtis saw a solution to the problem that would save Maholias enough money in electrical energy costs to pay for the equipment he needed to clean the air. The answer was not more ventilation air, the answer was cleaning the already conditioned (either heated or cooled depending on the season) air

and using outside air for ventilation when the outside air was at a temperature you needed inside.

Cleaning the inside air, instead of dumping it out the ventilation system and having to heat or cool new air that was brought in, meant saving a lot of heating and air conditioning dollars. "Canes Heating & Cooling Co., installed 10 electronic air cleaners which Honeywell says removes more than 90 per cent of airborne smoke particles," Curtis said. "This saved money on heating and air conditioning and also cleaned the air," he said.

Then Canes installed damper controls and outside air sensors that sensed when outside air in the evening was cool enough to bring in fresh air for ventilation without using the air conditioning systems. This saves a bundle in energy. In the case of The Attic, it started saving about 30 per cent on its energy bills. That means The Attic will pay for the new equipment in less than two and a half years, and save more then on plus getting a hedge against any energy price increases.

Increase in Solar Cell Efficiency

A major increase in the efficiency of solar cells—which convert sunlight directly into electricity—has been achieved by scientists of the IBM Corporation. The high efficiency solar cells, made of the semiconductor material gallium arsenide coated with a thin layer of gallium aluminum arsenide, convert 22 per cent of the sunlight falling on them at the earth's surface into electricity.

Only six years ago, the best efficiency



Dancers bump to live bands and eight-track music but never choke to tobacco smoke. Ten electronic air cleaners like this one are installed over the dance floor. Honeywell engineers said they remove more than 90 per cent of airborne smoke particles which reduces ventilation air requirements and saves electrical energy.



Jerry M. Woodall, left, and Harold J. Hovel of IBM Research prepare to test an experimental solar cell in a "solar simulator." The simulator measures the cell's response at various wavelengths of light. The cells developed by Woodall and Hovel have an energy conversion efficiency of 22 per cent.

attained with gallium arsenide solar cells was 11 per cent. The best solar cells made of silicon, widely used to power space vehicles, are now 18 per cent efficiency for terrestrial use.

The 22 per cent efficiency of the IBM solar cells is close to the theoretical maximum of 27 per cent expected for gallium arsenide, and represents a considerable increase over the previous highest efficiency reported for gallium arsenide solar cells—18 per cent—attained by researchers at IBM in 1972.

Although gallium arsenide solar cells are now substantially more expensive to make than silicon cells, they have two advantages that may make them competitive. First, they are more efficient in converting sunlight into electricity at the earth's surface. Second, they function well at high temperatures, allowing them to be used at high levels of sunlight concentration.

Concentration of sunlight using expensive mirrors or lenses may well be a key to making solar electricity economical, since solar cells themselves may always be relatively expensive. Gallium arsenide cells can operate at sunlight concentration levels as high as 1,000 to one. In contrast, silicon solar cells are limited to concentration levels of no more than several hundred, because the efficiency of silicon cells decreases rapidly with rising temperature. Moreover, silicon requires more expensive cooling procedures than does gallium arsenide for the same efficiency.

The critical processing technique used in making the new cells is quite simple, requiring only one step to form the active region of the device. Other techniques for making high-efficiency gallium arsenide cells generally involve a more complex sequence of processes. The overall fabrication process of course involves many steps including making gallium arsenide wafers of the necessary quality, applying metal electrodes to collect the electric power, and packaging the devices.

Long Beach Grand Prix Goes CB

The Long Beach Grand Prix Association added yet another first to its list of unique accomplishments in holding America's through-the-streets Formula One race in downtown Long Beach, California—the use of CB radios in track communication.

In 1976 the Long Beach Grand Prix Association won the award for the best organized Formula One race in the world, quite an accomplishment for its first Formula One race. In 1977 they improved their organization by using CB radios around the circuit for communications. The new 40-channel mobile units were used before the weekend and during the race weekend for



The Tram CB firm's DN-4B racing car, which was one of the entries in the Long Beach, California, Grand Prix auto race.

vehicle traffic and ticket control. 40-channel units were at key points around the circuit and in officials' cars who kept in touch with each other and with the Base Station at the Long Beach Grand Prix office.

Comments by Mr. Pete Biro, Vice President of the Long Beach Grand Prix, were more specific: "Our circuit, as you know, is unique in that we have a completely portable safety system consisting of over 1,700, 8,000 pound concrete blocks and over five miles of fencing which are installed on a 2.02 mile race course, using the city streets of downtown Long Beach. This year, the entire operation of installation and tear-down was coordinated through constant communication with our fence crews, barrier crews, security personnel through the use of CB radios. The equipment performed flawlessly throughout and we feel that without the equipment, it would have been impossible to meet our schedule and have the circuit built in time to run the event."

News for Home Entertainment

Predicting a Billion-Dollar industry within three years, RCA began selling the electronics industry's first four-hour video cassette recorder/player, which is optionally priced at \$1,000. The RCA "SelectaVision" Video Cassette Recorder unit is priced some \$300 below the current leading competitive VCR instrument.

The Japanese-made RCA unit offers the homeowner the choice of recording either two hours or four hours of program material, either live or off-the-air, on a single cassette. Competing units currently on the market offer only two-hour recording capability.

Roy H. Pollack, Vice President and General Manager of RCA Consumer Electronics, said RCA believes the home video cassette recorder market "is a promising new business that will reach the billion-dollar sales level within three years."

By contrast, he noted that it took the color television industry 10 years to

reach the same sales plateau.

"The advent of VCR marks a major milestone in the history of the consumer electronics industry. In the past century, consumers have seen the birth and development of the phonograph, audio recording, radio, television, video games and now sight and sound recording in the home," Mr. Pollack said.

The RCA "SelectaVision" VCR attaches to any brand of TV receiver and allows the user to record up to four hours of television in color for viewing at a later time. By using the built-in electronic digital clock/timer, programs can be recorded automatically if the viewer is away from home. "SelectaVision" will also record the program being viewed or another program on a different channel at the same time.



Cheryl Enright selects her own TV program with a new four-hour video cassette recorder system just introduced by RCA. The "SelectaVision" system allows the user to store up to four hours of favorite television material in color for playback at a later time. A built-in digital electronic clock/timer and remote pause control makes everyone a TV producer.

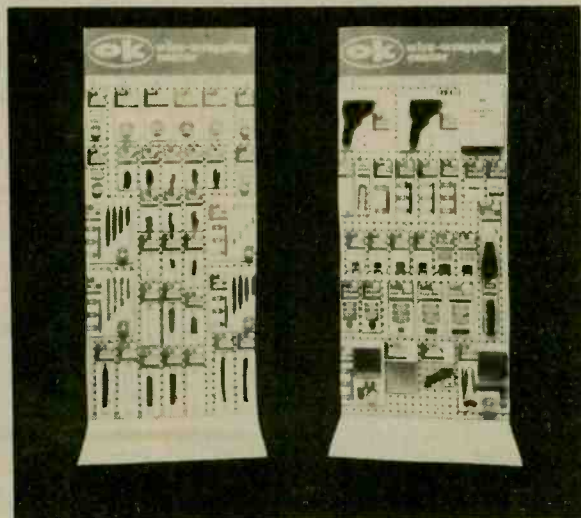
Optional accessories complement the RCA VCR, including a choice of two monochrome TV cameras with built-in microphone for "instant home movies," a microphone and two cassettes with up to two or four-hour recording capacity.

Mr. Pollack noted that RCA's first participation in videotape recording began in 1951, with a research program for a broadcast-quality machine that resulted in the Quadruplex video tape recorder now in wide use in the broadcasting industry.

Following the introduction of consumer VCR instruments that were capable of one hour recording, later increased to two hour capabilities, RCA earlier this year selected the new four-hour VCR system—designated VHS which is supplied to RCA by the Matsushita Electric Industrial Company, Ltd. Several other brands names will be selling similar Matsushita VCR systems, and the various systems are expected to be compatible with the two hour tapes. At present, the four hour tapes are only compatible with the machine that records them. ■



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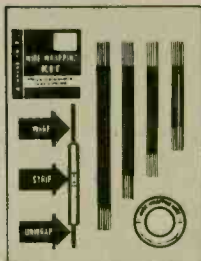
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Bit for AWG 26-28	BT-2628	\$7.95

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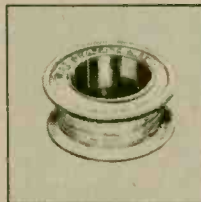
WIRE-WRAPPING KITS



Contains: Hobby Wrap Tool WSU-30, (50 ft.) Roll of wire Prestripped wire 1" to 4" lengths (50 wires per package) stripped 1" both ends.

Wire Wrapping Kit (Blue)	WK 2 B	\$12.95
Wire Wrapping Kit (Yellow)	WK 2 Y	\$12.95
Wire Wrapping Kit (White)	WK 2 W	\$12.95
Wire Wrapping Kit (Red)	WK 2 R	\$12.95

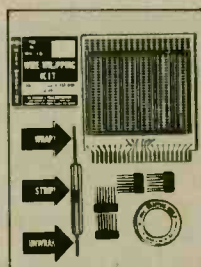
ROLLS OF WIRE



Wire for wire-wrapping AWG-30 (0.25mm) KYNAR® wire, 50 ft. roll, silver plated, solid conductor, easy stripping.

30 AWG Blue Wire 50ft Roll	R 30B 0050	\$1.98
30 AWG Yellow Wire 50ft Roll	R 30Y 0050	\$1.98
30 AWG White Wire 50ft Roll	R 30W 0050	\$1.98
30 AWG Red Wire 50ft Roll	R 30R 0050	\$1.98

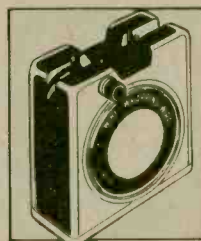
WIRE-WRAPPING KIT



Contains: Hobby Wrap Tool WSU-30, Roll of wire R-30B-0050, (2) 14 DIP's, (2) 16 DIP's and Hobby Board H-PCB-1.

Wire-Wrapping Kit	WK-3B (Blue)	\$16.95
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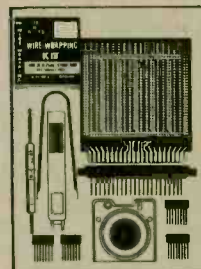
WIRE DISPENSER



- With 50 ft. Roll of AWG 30 KYNAR® wire-wrapping wire.
- Cuts the wire to length.
- Strips 1" of insulation.
- Refillable (For refills, see above)

Blue Wire	WD-30-B	\$3.95
Yellow Wire	WD-30-Y	\$3.95
White Wire	WD-30-W	\$3.95
Red Wire	WD-30-R	\$3.95

WIRE-WRAPPING KIT



Contains: Hobby Wrap Tool WSU-30 M, Wire Dispenser WD-30-B, (2) 14 DIP's, (2) 16 DIP's, Hobby Board H-PCB-1, DIP/IC Insertion Tool INS-1416 and DIP/IC Extractor Tool EX-1

Wire-Wrapping Kit	WK-4B (Blue)	\$25.99
-------------------	--------------	---------

PRE CUT PRE STRIPPED WIRE

Wire for wire wrapping, AWG-30 (0.25mm) KYNAR® wire, 50 wires per package stripped 1" both ends.



30 AWG blue Wire 1" Long	30 B 50 010	\$.99
30 AWG Yellow Wire 1" Long	30 Y 50 010	\$.99
30 AWG White Wire 1" Long	30 W 50 010	\$.99
30 AWG Red Wire 1" Long	30 R 50 010	\$.99
30 AWG Blue Wire 2" Long	30 B 50 020	\$ 1.07
30 AWG Yellow Wire 2" Long	30 Y 50 020	\$ 1.07
30 AWG White Wire 2" Long	30 W 50 020	\$ 1.07
30 AWG Red Wire 2" Long	30 R 50 020	\$ 1.07
30 AWG Blue Wire 3" Long	30 B 50 030	\$ 1.16
30 AWG Yellow Wire 3" Long	30 Y 50 030	\$ 1.16
30 AWG White Wire 3" Long	30 W 50 030	\$ 1.16
30 AWG Red Wire 3" Long	30 R 50 030	\$ 1.16
30 AWG Blue Wire 4" Long	30 B 50 040	\$ 1.23
30 AWG Yellow Wire 4" Long	30 Y 50 040	\$ 1.23
30 AWG White Wire 4" Long	30 W 50 040	\$ 1.23
30 AWG Red Wire 4" Long	30 R 50 040	\$ 1.23
30 AWG Blue Wire 5" Long	30 B 50 050	\$ 1.30
30 AWG Yellow Wire 5" Long	30 Y 50 050	\$ 1.30
30 AWG White Wire 5" Long	30 W 50 050	\$ 1.30
30 AWG Red Wire 5" Long	30 R 50 050	\$ 1.30
30 AWG Blue Wire 6" Long	30 B 50 060	\$ 1.38
30 AWG Yellow Wire 6" Long	30 Y 50 060	\$ 1.38
30 AWG White Wire 6" Long	30 W 50 060	\$ 1.38
30 AWG Red Wire 6" Long	30 R 50 060	\$ 1.38

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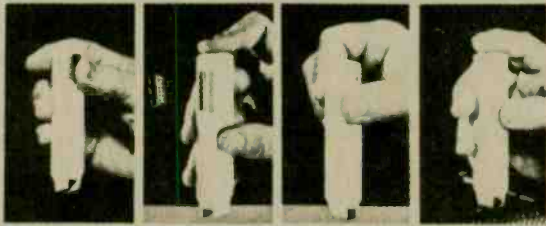
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CIRCLE 24 ON READER SERVICE COUPON

ELEMENTARY ELECTRONICS/March-April 1978



DIP/IC INSERTION TOOL WITH PIN STRAIGHTENER



STRAIGHTEN PINS RELEASE PICK UP INSERT

14-16 Pin Dip IC Inserter INS-1416 \$3.49



DIP/IC-EXTRACTOR TOOL

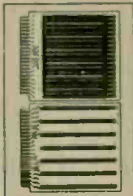
Extractor Tool EX-1 \$1.49

P.C. BOARD

The 4 x 4.5 x 1/16 inch board is made of glass coated EPOXY Laminata and features solder coated 1 oz. copper pads. The board has provision for a 22/44 two sided edge connector, with contacts on standard .156 spacing. Edge contacts are non-dedicated for maximum flexibility.

The board contains a matrix of .040 in. diameter holes on .100 inch centers. The component side contains 76 two-hole pads that can accommodate any DIP size from 6-40 pins, as well as discrete components. Typical density is 16 of 14-Pin or 16-Pin DIP's. Components may be soldered directly to the board or intermediate sockets may be used for soldering or wire-wrapping.

Two independent bus systems are provided for voltage and ground on both sides of the board. In addition, the component side contains 14 individual busses running the full length of the board for complete wiring flexibility. These busses enable access from edge contacts to distant components. These busses can also serve to augment the voltage or ground busses, and may be cut to length for particular applications.



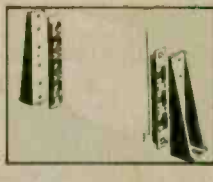
Hobby Board H PCB-1 \$4.99



PC CARD GUIDES

Card Guides TR-1 \$1.89

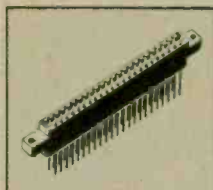
QUANTITY - ONE PAIR (2 pcs.)



PC CARD GUIDES & BRACKETS

Guides & Brackets TRS-2 \$3.79

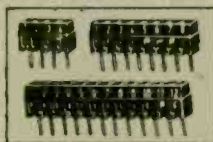
QUANTITY - ONE SET (4 pcs.)



PC EDGE CONNECTOR

44 Pin, dual read out, .156" (3,96 mm) Contact Spacing, .025" (0,63 mm) square wire-wrapping pins.

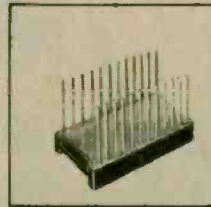
P.C. Edge Connector CON-1 \$3.49



P.C.B. TERMINAL STRIPS

The TS strips provide positive screw activated clamping action, accommodate wire sizes 14-30 AWG (1,8-0,25mm). Pins are solder plated copper, .042 inch (1mm) diameter, on .200 inch (5mm) centers.

4-Pole	TS- 4	\$1.39
8-Pole	TS- 8	\$1.89
12-Pole	TS-12	\$2.59



DIP SOCKET

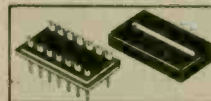
Dual-in-line package, 3 level wire-wrapping, phosphor bronze contact, gold plated pins .025 (0,63mm) sq., .100 (2,54mm) center spacing.

14 Pin Dip Socket	14 Dip	\$0.79
16 Pin Dip Socket	16 Dip	\$0.89



RIBBON CABLE ASSEMBLY SINGLE ENDED

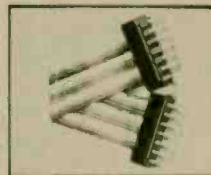
With 14 Pin Dip Plug 24" Long (609mm)	SE14-24	\$3.55
With 16 Pin Dip Plug 24" Long (609mm)	SE16-24	\$3.75



DIP PLUG WITH COVER FOR USE WITH RIBBON CABLE

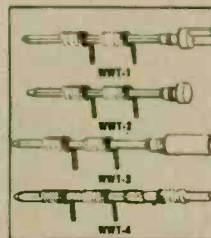
14 Pin Plug & Cover	14-PLG	\$1.45
16 Pin Plug & Cover	16-PLG	\$1.59

QUANTITY: 2 PLUGS, 2 COVERS



RIBBON CABLE ASSEMBLY DOUBLE ENDED

With 14 Pin Dip Plug - 2" Long	DE 14-2	\$3.75
With 14 Pin Dip Plug - 4" Long	DE 14-4	\$3.85
With 14 Pin Dip Plug - 8" Long	DE 14-8	\$3.95
With 16 Pin Dip Plug - 2" Long	DE 16-2	\$4.15
With 16 Pin Dip Plug - 4" Long	DE 16-4	\$4.25
With 16 Pin Dip Plug - 8" Long	DE 16-8	\$4.35

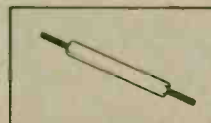


TERMINALS

- .025 (0,63mm) Square Post
- 3 Level Wire-Wrapping
- Gold Plated

Slotted Terminal	WWT-1	\$2.98
Single Sided Terminal	WWT-2	\$2.98
IC Socket Terminal	WWT-3	\$3.98
Double Sided Terminal	WWT-4	\$1.98

25 PER PACKAGE



TERMINAL INSERTING TOOL

For inserting WWT-1, WWT-2, WWT-3, and WWT-4 Terminals into .040 (1,01mm) Dia. Holes.

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Strip length easily adjustable for your applications.

DESCRIPTION	MODEL NUMBER	ADJUSTABLE "SHINER" LENGTH OF STRIPPED WIRE		Price
		INCHES	TO INCHES	
24 ga. Wire Cut and Strip Tool	ST-100-24	1 1/4"	1 1/4"	\$ 8.75
26 ga. Wire Cut and Strip Tool	ST-100-26	1 3/4"	1 3/4"	\$ 8.75
26 ga. Wire Cut and Strip Tool	ST-100-26-875	7/8"	1 1/2"	\$ 8.75
28 ga. Wire Cut and Strip Tool	ST-100-28	7/8"	1 1/2"	\$11.50
30 ga. Wire Cut and Strip Tool	ST-100-30	7/8"	1 1/2"	\$11.50

THE ABOVE LIST OF CUT AND STRIP TOOLS ARE NOT APPLICABLE FOR NYLON OR TEFLON INSULATION

MINIMUM ORDER \$25.00. SHIPPING CHARGE \$1.00. N.Y. CITY AND STATE RESIDENTS ADD TAX

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MODEL	NO. OF TIE-POINTS	14-PIN DIP CAPACITY	SUGG. LIST *	OTHER FEATURES
PB-6	630	6	\$15.95	Kit — 10-minute assembly
PB-100	760	10	19.95	Kit — with larger capacity
PB-101	940	10	29.95	8 distribution buses, higher capacity
PB-102	1240	12	39.95	Large capacity, moderate price
PB-103	2250	24	59.95	Even larger capacity, only 2.7¢ per tie-point
PB-104	3060	32	79.95	Largest capacity, lowest price per tie-point
PB-203	2250	24	80.00	Built-in 1% regulated 5V, 1A low-ripple power supply
PB-203A	2250	24	129.95	As above plus separate ½-amp +15V and -15V internally adjustable regulated outputs

*Manufacturer's suggested list
Prices and specifications subject to change without notice.

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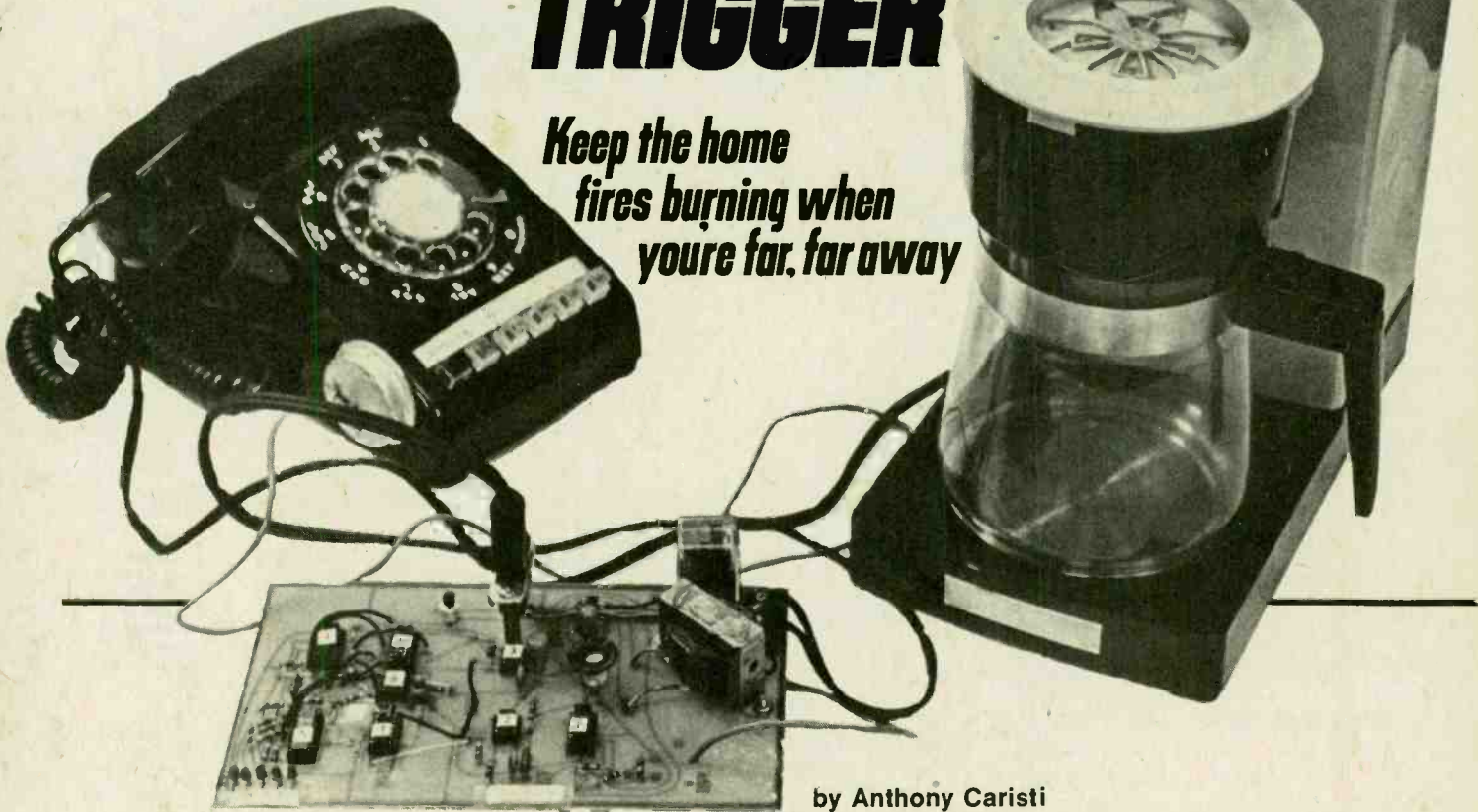
CIRCLE 30 ON READER SERVICE COUPON

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TELEPHONE TRIGGER

*Keep the home
fires burning when
you're far, far away*



by Anthony Caristi

HOW WOULD YOU LIKE to be able to energize any electrical device in your home, from anywhere in the country, and do it without paying for a phone call? You can do it, and it's perfectly legal. The remote control described in this article is a simple digital circuit which responds to the sound of the telephone bell. There is no need to make any hard wire connections to the telephone line, and it is this feature which permits you to build and use this device without any permission from Ma Bell. You can't even be charged any tariff for using it.

The remote control circuit is protected against accidental operation through normal telephone calls by means of an automatic reset feature which cancels out the effects of any telephone calls made by others. This is accomplished by incorporating a time delay circuit which allows the circuit to receive a valid code for a

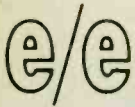
period of ninety seconds. When the ninety second period is completed, the circuit resets itself and waits for the next telephone call.

The proper code to activate the circuit consists of 2 rings of the telephone, a 25 to 40 second delay, and 2 more rings. If, and only if this code is received before the 90 second delay is terminated will the device be activated. Any other combination of rings will not operate the circuit. Since it is very unlikely that anyone would ring your telephone with such a sequence, accidental operation is virtually eliminated. Included in the circuit is a group of LED indicators which monitor the control pulses and indicate the status of the circuit at all times.

How It Works. The best way to understand circuit operation is to refer to the illustration of several pertinent waveshapes in the circuit, and to the schematic. A crystal or ceramic micro-

phone is used as the sensing element which detects the sound of the telephone bell. The output of the microphone is fed to the negative input of a comparator, IC 1. The positive input of the comparator is set to a positive DC voltage by means of a potentiometer which acts as a sensitivity control. This forces the output of IC 1 to +5 volts. During periods of silence there is insufficient output from the microphone to exceed the voltage setting of the sensitivity control, and the output of the comparator remains at 5 volts. When the telephone rings, the increase in sound energy causes the output of the microphone to exceed the setting of the sensitivity control. The output of the comparator oscillates between zero and 5 volts as the bell continues to ring. This is shown in the illustration as waveform A.

The output of IC 1 is fed to the trigger input terminals of IC 2 and IC



TELEPHONE TRIGGER

3, pin 2. Each of these IC's is a 555 timer connected to operate as a monostable or one shot multivibrator. IC 2 produces an output pulse of about 3 seconds duration, and IC 3 produces an output pulse of about 90 seconds duration. These output pulses are illustrated as waveforms B and C.

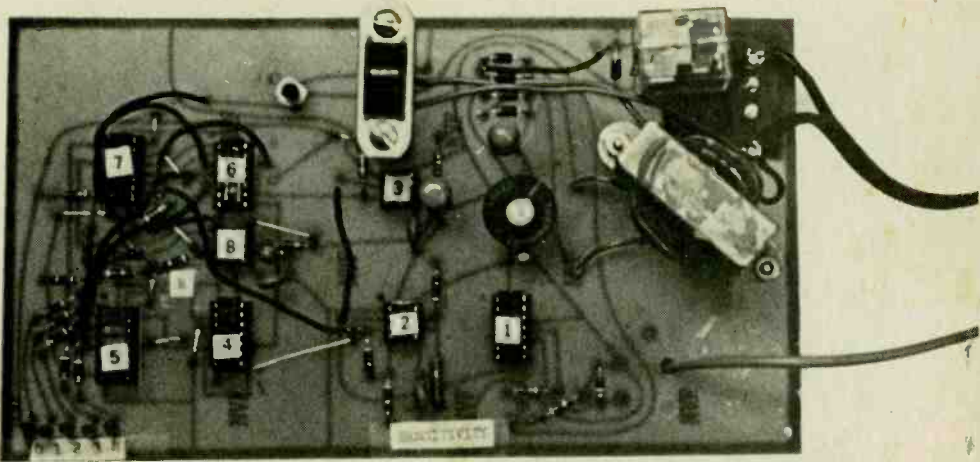
The purpose of IC 2 is to convert the rapidly oscillating output of IC 1 to a rectangular pulse of known duration, about 3 seconds. Note that the pulse time of IC 2 is greater than that of one ring, but stops before the start of the next ring. IC 2 provides an accurate waveform which can be counted by IC 4.

The output of IC 2 is inverted by IC 7D, which in turn drives LED "R." This provides a visual indication of the circuit response to the sound of the telephone.

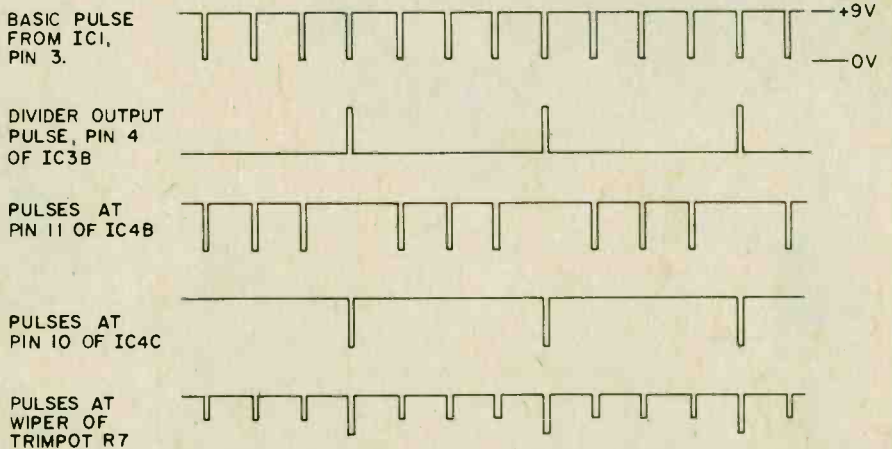
IC 3 is used as the control of the binary counter IC 4. When the circuit is in a standby condition the output of IC 3 is at a logic level of zero. This is fed to IC 4 reset terminals 2 and 3 through NAND gate IC 6C and forces IC 4 to be set to a count of zero. When the first telephone ring is received, the output of IC 3 goes to a logic one state, thus allowing IC 4 to count for a period of 90 seconds.

The output of IC 2 feeds the clock input, pin 14, of IC 4 which clocks on the trailing or falling edge of the pulses. IC 5 is a 4 bit decoder which provides a zero logic level at any one of its output terminals as determined by the binary information fed from IC 4 to its input terminals. The output of IC 5 is used to drive a set of LED's and also to control a 25 second timer, IC 8.

This is a 555 timer chip which operates as a one shot multivibrator in a similar manner as IC 2 and IC 3, except that its period of operation is 25 seconds. The purpose of IC 8 is to provide a 25 second time interval, starting after the second ring, which will cause the circuit to reset itself should a third ring be received before IC 8 resets itself. IC 8 is also retriggered after the fourth ring to prevent the appliance from being turned on if a fifth telephone ring is received. When IC 4 reaches a count of 2, the 25 second time is activated. This is shown in the figure as waveform D. If IC 4 receives a third clock pulse from IC 2 during this interval, it is reset to zero through inverter IC 7A and NAND gates IC 6D and IC 6C. Once IC 8 re-



Here's a close-up of a prototype board for Telephone Trigger. The placement of the major components is the same, though your editors eliminated the jumper wires in the final version. However, this should give you a fairly accurate idea of how the final version will appear. Keep in mind that there will be slight differences from this.



Here's the best way to understand the operation of a circuit such as Telephone Trigger, by studying these waveshapes in conjunction with the schematic and the lucid explanation presented in the text. Read the explanation over a few times, referring to the diagram and schematic as you do. Soon you'll be a logic-circuit, solid-state "maven."

turns to its normal state after the period of 25 seconds, IC 4 is ready to receive additional clock pulses without being reset to zero.

When IC 4 reaches a count of 4, the 25 second timer is reactivated as shown in waveform D. The output of IC 5, pin 5, is prevented from reaching Q1 base until the 25 second period is over. Should IC 4 receive any more input pulses Q1 would not be activated at the end of the 25 second period, since the counter would then be at a count of 5 or more.

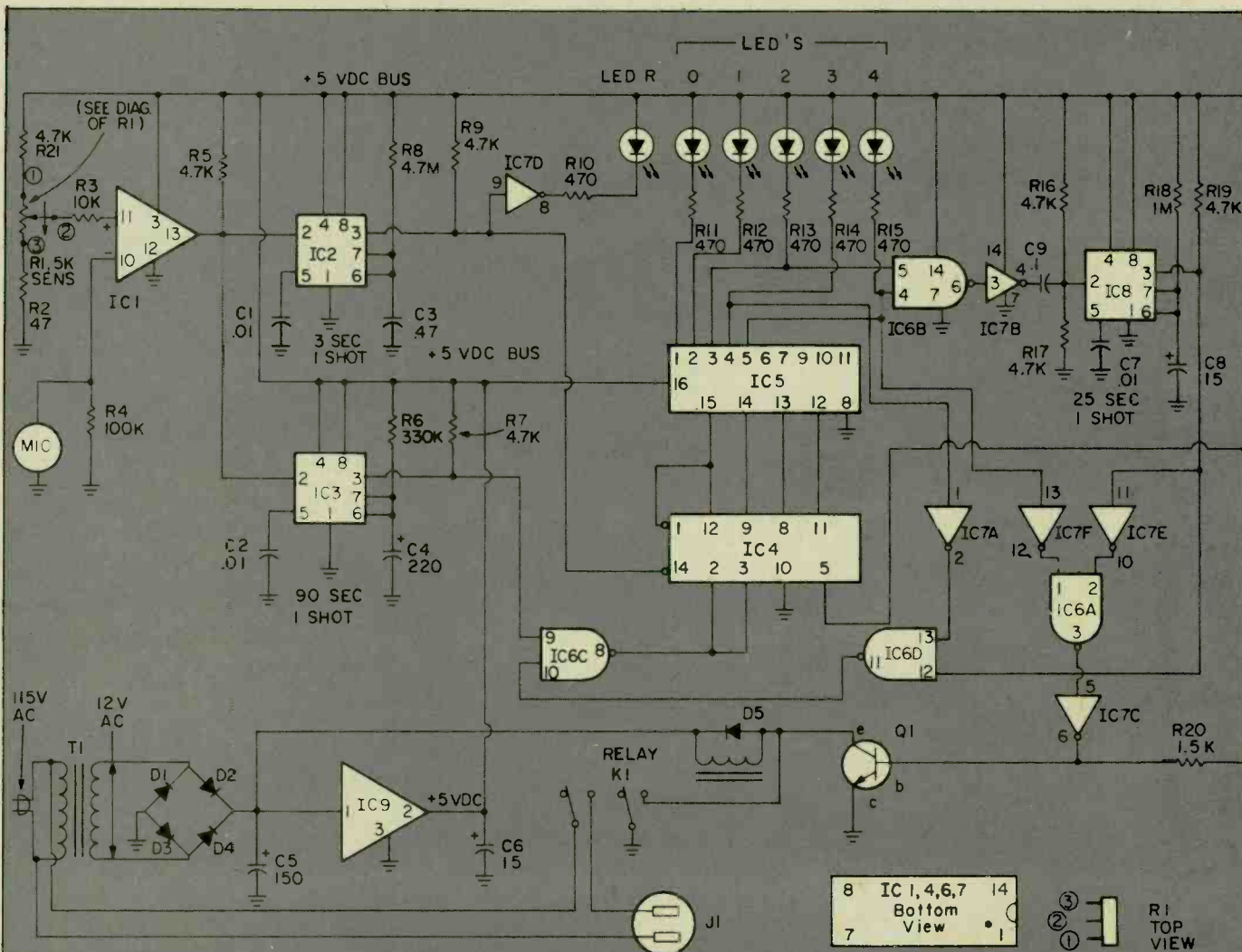
The outputs of IC 5 are shown in figure one as waveforms E. When IC 5 is fed a binary number from 0 to 9, the corresponding output terminal assumes a logic level of zero. All other output terminals remain at a logic level of one. By connecting LED's to outputs 0, 1, 2, 3, and 4, (pins 1, 2, 3, 4,

and 5) the status of binary counter IC 5 is visually indicated.

The coil of a 12 volt relay is connected in the collector circuit of Q1 so that it is activated whenever Q1 conducts current in response to the zero logic level of IC 5, pin 5. Since the output of IC 5 is not permanent, one section of the relay contacts is connected to the coil circuit so that the relay latches and remains activated even though IC 4 is reset to zero at the end of the 90 second pulse time of IC 3. The other set of contacts of the relay is used as a single pole switch.

Power to operate the circuit is obtained through a 12 volt transformer feeding a full wave bridge rectifier. The output of the rectifier is fed to IC 9 which is a fixed 5 volt regulator. The entire circuit, with the exception of the

(Continued on page 40)



The schematic diagram for Trigger, the automatic telephone relay tripping circuit. As you see, there are plenty of components in the circuit, so exercise a reasonable amount of care as you assemble them and build this exciting project.

PARTS LIST FOR TELEPHONE TRIGGER

- C1, C2, C7—.01-uf capacitors (Radio Shack 272-131 or equiv.)
- C3—.47-uf capacitor (Radio Shack 272-1071 or equiv.)
- C4—220-uf, 10-Volt, tantalum electrolytic capacitor (Allied 852-4166 or equiv.)
- C5—150-uf, 15-Volt, tantalum electrolytic capacitor (Allied 852-735 or equiv.)
- C6, C8—15-uf, 10-Volt, tantalum electrolytic capacitor (Allied 852-4400 or equiv.)
- C9—.1-uf capacitor (Radio Shack 272-135 or equiv.)
- D1-D5—1N2069-type silicon diodes (Radio Shack 276-1139 or equiv.)
- IC1—LM339-type (Radio Shack 276-1712 or equiv.)
- IC2, IC3, IC8—555 timers (Radio Shack 276-1723 or equiv.)
- IC4—SN7493N-type (Allied 570-7227 or equiv.)
- IC5—SN7442N-type (Allied 570-7199 or equiv.)

- IC6—SN7400N-type (Radio Shack 276-1801 or equiv.)
- IC7—SN7404N-type (Radio Shack 276-1802 or equiv.)
- IC9—LM309H-type (Allied 569R1278 or equiv.)
- K1—SPDT relay (Radio Shack 275-206 or 275-208 or equiv.)
- LEDs 0-4, R—Light emitting diodes (Radio Shack 276-1622 or equiv.)
- Mic—microphone (Radio Shack 270-095 or equiv.)
- Q1—2N3904-type (Radio Shack 276-2030 or equiv.)
- R1—5000-ohm PC-type potentiometer (Radio Shack 271-0217 or equiv.)
- R2—47-ohm resistor (Radio Shack 271-1307 or equiv.)
- R3—10,000-ohm resistor (Radio Shack 271-1335 or equiv.)
- R4—100,000-ohm resistor (Radio Shack 271-1347 or equiv.)

- R5, R7, R9, R16, R17, R19, R21—4700-ohm resistor (Radio Shack 271-1330 or equiv.)
- R6—330,000-ohm resistor (Allied RD¼S796 or equiv.)
- R8—4.7-megohm resistor (Radio Shack 271-1360 or equiv.)
- R10—R15—470-ohm resistors (Radio Shack 271-1317 or equiv.)
- R18—1-megohm resistor (Radio Shack 271-1356 or equiv.)
- R20—1500-ohm resistor (Radio Shack 271-1357 or equiv.)
- T1—115 to 12-volt transformer (Radio Shack 273-1385 or equiv.)

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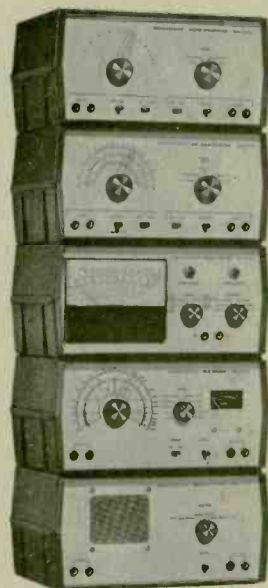
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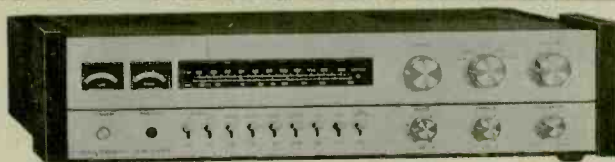
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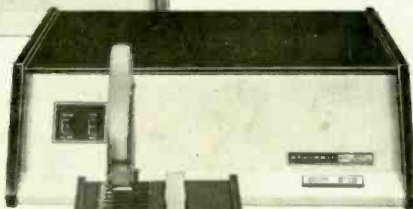
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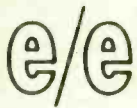
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CIRCLE 1 ON READER SERVICE COUPON



TELEPHONE TRIGGER

(Continued from page 35)

relay is returned to the unregulated output of the bridge rectifier, 12 volts.

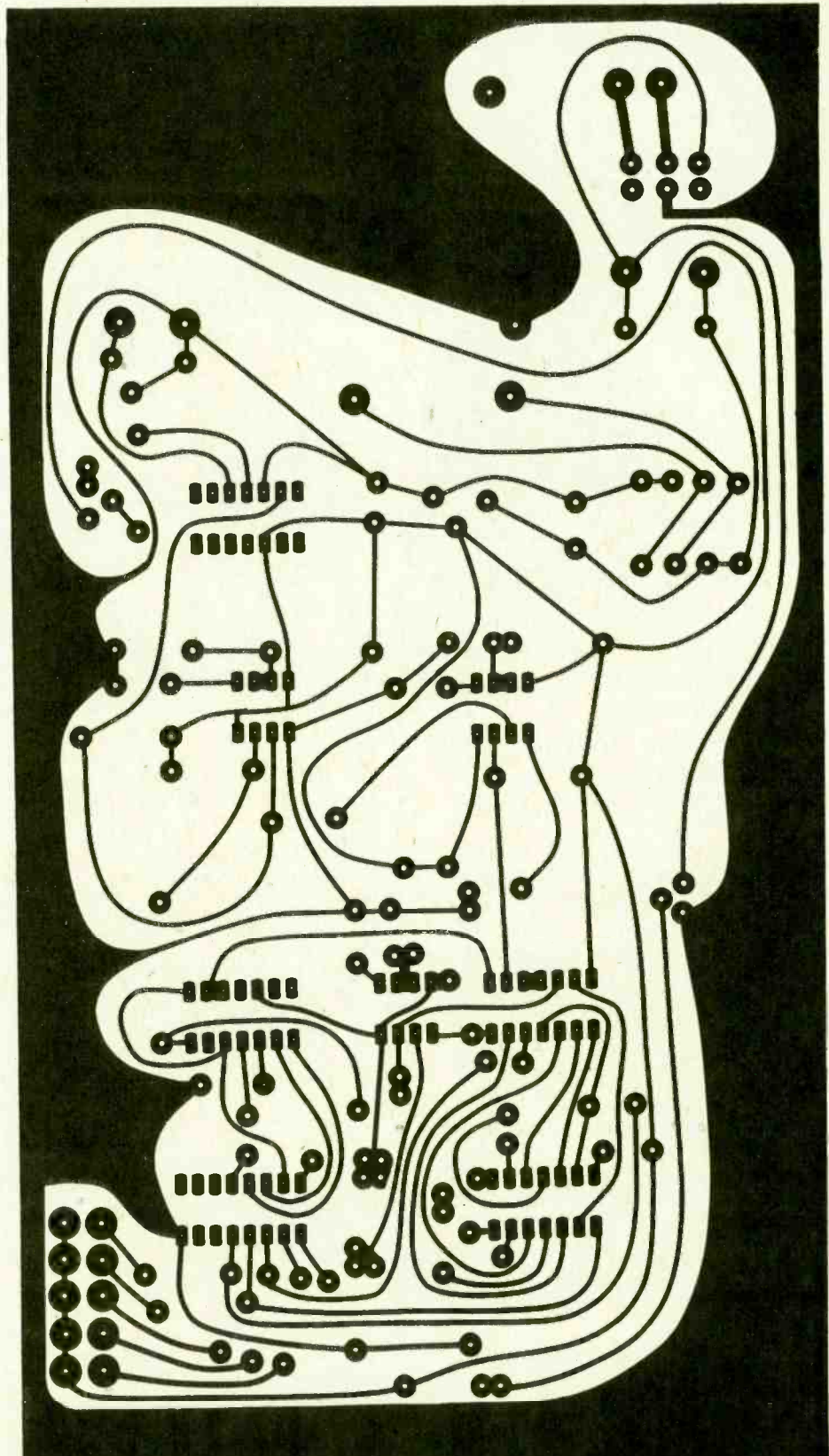
Construction. The entire circuit is constructed on a printed circuit board. The crystal microphone cartridge was mounted directly on the board with adhesive, but also may be connected by means of a shielded wire to some remote location by the telephone bell. The foil pattern of the printed circuit board is shown full size, as is the component layout. Although this is a relatively simple digital circuit, it is recommended that sockets be used for the IC's and Q1. The initial checkout of the circuit will be simplified if IC 3 can be temporarily removed from the circuit. In the event that the unit ever requires service you will find that it is well worth the added cost of sockets. It is extremely difficult to remove a multi-pin IC which has been soldered directly into a printed circuit board without destroying the IC. When mounting the electrolytic capacitors, diodes and LED indicators, be sure to observe the correct polarity as shown in the schematic.

Mount and solder all parts to the printed circuit board as shown in figure 3. After this is done you will be able to locate and insert the proper jumpers into the printed circuit board.

Be sure to use a relay which is capable of carrying the current of the appliance which is to be turned on. The parts list shows a choice of two relays. Part number 275-206 has a current rating of 10 amperes. You will have to use the higher current relay if you plan to operate a high current appliance such as an air conditioner or coffee-maker. If the remote control is to be used to operate a heating system, relay contacts can be connected into the thermostat circuit. Such a connection permits the use of the lighter duty relay. The relay coil driver transistor, Q1, can safely carry up to 150 milliamperes to drive the relay coil.

A receptacle for plug-in appliances is mounted on the circuit board and is wired directly to the line cord and relay as shown in the schematic. Be sure to use a line cord and wire which will safely carry the desired current. For 10 ampere operation use at least a #16 gauge wire.

Testing And Adjusting. Checks are made with only the built-in LED indicators and a DC voltmeter. The first check is on the timing of IC 2. It will be helpful if you temporarily remove



Here's an exact-size PC board layout to make your own Telephone Trigger. If this is your first time etching out a complex board, avail yourself of some of the excellent layout aids which are available at many large electronic supply houses. You might also investigate some of the photographic kits used to make boards by copying images such as this right off the magazine page, a definite help to those of us who have trouble drawing a straight line with a ruler. One thing, you will find that in a project such as this one doing your own PC board is an additional part of the enjoyment.

IC 3 from the circuit to prevent it from resetting the counter while you perform the first part of the check.

Apply power to the unit and measure the voltage at pin 1 and pin 2 of IC 9. The voltage at pin 1 should be about 12 volts and the voltage at pin 2 should be 5 ± 0.25 volts, measured with respect to ground. Set the sensitivity control about $\frac{3}{4}$ maximum clockwise. Gently tap the microphone while watching LED R. It should light when the microphone is tapped, and remain lit for about 3 seconds. Each time the microphone is tapped LED R should light for at least 2 seconds and not more than 4 seconds. It is important that the timing of IC 2 falls into this range so that it will be able to sense each telephone ring separately. You may change the value of R 8, if necessary, to bring the timing of IC 2 within the range of 2 to 4 seconds.

To check the operation of IC 4 and IC 5 momentarily short pin 9 of IC 6 to ground to clear the counter and set it to zero. LED 0 should be lit. Gently tap the microphone and wait for LED R to be extinguished. When this occurs, LED 1 should light, indicating that the counter has advanced one count. Connect a voltmeter to pin 3 of IC 8. Tap the microphone while watching the voltmeter. At the end of the 3

seconds the counter should advance to a count of 2, and the voltage at pin 3 of IC 8 should rise from zero to about 5 volts. This voltage should hold for at least 25 and not more than 30 seconds. You may adjust R 18 to bring the timing of IC 8 into this range, if necessary.

After IC 8 has completed its operation, tap the microphone 2 more times to advance the counter to 4. At this time IC 8 should again be activated. When IC 8 completes its second cycle, the relay should be activated.

You may check the operation of the reset circuitry by tapping the microphone three times to simulate three telephone rings without the required 25 second delay. When this is done the counter should not advance to a count of 3, but should reset to zero after a count of 2.

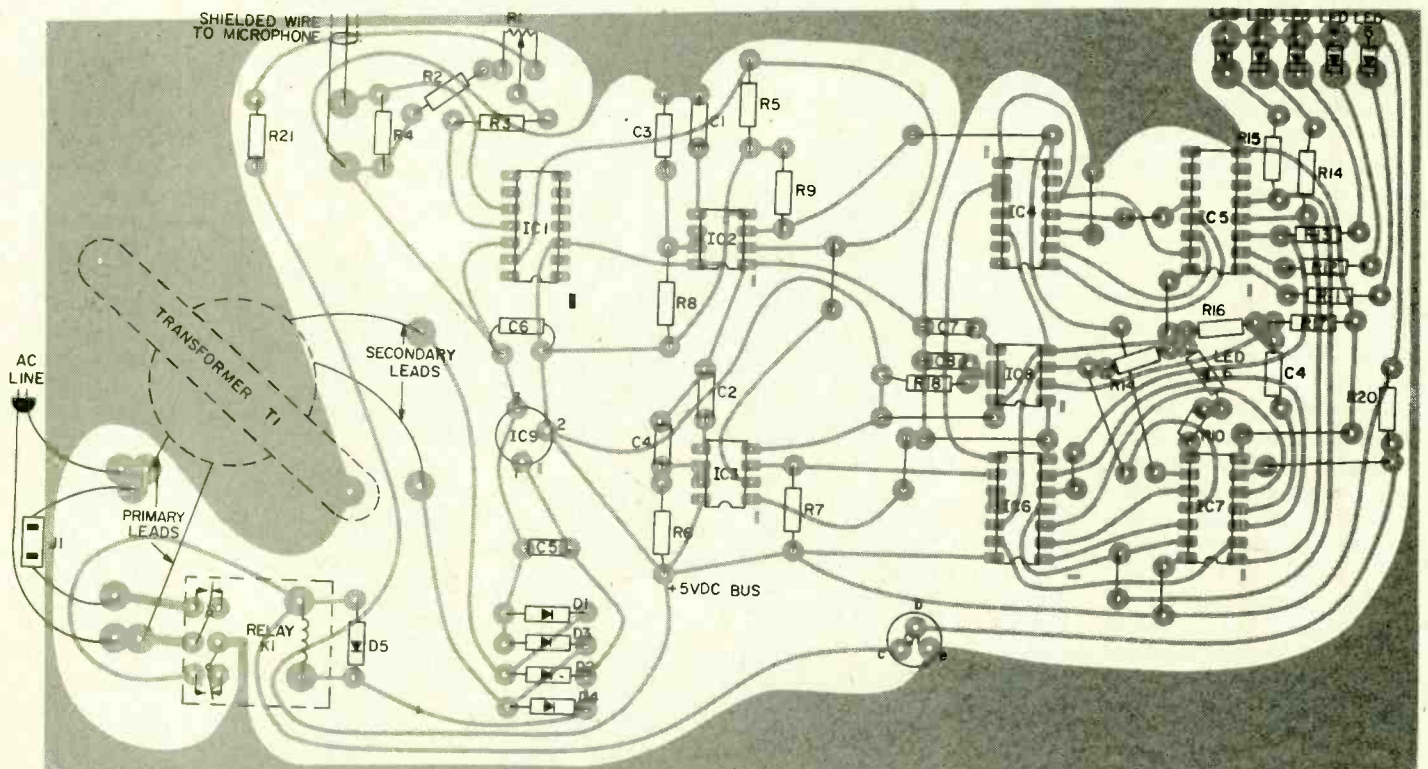
Replace IC 3 in its socket. Check the timing of IC 3 by connecting a voltmeter to pin 3. The voltage should be zero before the circuit is triggered by tapping the microphone, and should rise to about 5 volts and hold for at least 80 and not more than 95 seconds. You may adjust R6, if necessary, to bring the timing into this range. The operation of IC 3 may be visually checked by advancing the counter to a count of 1 and watching the LED indi-

cators. After IC 3 completes its 90 second time, the counter should be reset to zero.

The final adjustment is the sensitivity control. If possible have a friend call you up and let the telephone ring for about a minute. Locate the remote control microphone as close to the telephone bell as possible. Set the sensitivity control the maximum counterclockwise (least sensitivity) position. Slowly turn the sensitivity control while watching LED R, and leave it set to the least sensitive position which gives a reliable detection of the sound. It is best to avoid excessive sensitivity so that the circuit does not respond to random noises in the house.

The remote control is now ready to be placed in operation by connecting the appliance to the receptacle on the circuit board and turning its power switch on. Once the hookup is made the appliance will automatically be turned on when you call your own telephone number with the the proper code. The 25 second delay time between the 2nd and 3rd rings is not critical, but should not be less than 25 seconds and not more than 40 seconds. The circuit will operate properly if you happen to get a partial ring when you call, but if there is any doubt that the

(Continued on page 90)



Following this full-size component layout will help to make construction of your Telephone Trigger as simple as dialing a phone. Make certain to observe the polarity of diodes and LEDs; the LEDs will have a notch on the negative lead to help you distinguish which is which. Some of the foil runs are close together so, if this is one of your first projects, or even if you're a seasoned construction veteran, check after building for any solder bridges. If you find one repair it carefully with a sharp knife blade.

YOU'VE JUST SPENT a couple of hours loading your personal computer with a long, complex program such as Lunar Lander, Wumpus, or Ham-murabi, or maybe a school project; you have spent perhaps another hour debugging the program to get the so-called "universal BASIC" into your computer. Your fingers are sore from typing on the terminal, and all that effort can be wiped out by a sudden powerline interruption. Similarly, if you turn the power off after a computer session, the program is cleared and that requires another long session of typing and debugging the next time you need to run the program.

The plain truth is, after you've typed out a small twenty line program for the fourth time you have probably *had it up to here* with personal computers. Imagine what it's like reloading a hundred, two hundred, or 500-plus step program!

Fact is, anyone who wants to use a personal computer for more than a toy must have some means of recording and reloading programs. The problem with recording, however, is that the marketplace is jam-packed with personal computer recording equipment. Few of these are compatible with each other, or different hobby computers. The prices for the hobby-quality recorders range from budget to astronomical, with price not necessarily reflecting either reliability or ease of use.

Since your selection of personal computer recording equipment can make or break your bank account, as well as your interest in hobby computers, we're going to describe a few of the moderately priced equipment that provide a good balance between price, performance, and, most important, convenience. Keep in mind we will be covering only hobby-grade personal computing accessories. Please don't write in that we overlooked an IBM Selectric terminal with computer interface, or surplus magnetic tape or disc devices from a discarded commercial system. We will be talking only about equipment specifically made for what is essentially the *entry-level* to hobby or personal computing.

A warning before we get started: Take notice that virtually all of the personal computing recording equipment we've used have come with instructions setting a new low for clarity. They barely suffice for getting power into the equipment; they are worse than useless if you run into problems, so be certain you can get assistance from someone who knows or has used the equipment you're planning to pur-

chase. If you're a college level technology student or a flaming technical genius you can probably go it alone. (Don't forget, when it comes to computers proper grammar is not a substitute for the ability to express an idea or instruction clearly. Do not be fooled by slick, well edited instructions: they are probably beyond intelligent comprehension. Get some skilled backup before you tackle a recording system.)

Paper Tape. The basic recording medium is *paper tape*, the type with up to eight holes representing each character and parity—called 8-level ASCII (see ELEMENTARY ELECTRONICS Sept.-Oct. 1977). It can be punched and read under computer control by an ASR 33 teletype or similar equipment being used as a computer terminal. The chief advantage of paper tape is that, unlike magnetic storage systems which are subject to accidental erasure by strong magnetic fields, paper tape is virtually destruction-proof. Short of setting fire to the tape, the recording will last for years and years. Should the tape be damaged it can be easily repaired by a Mylar patch similar to a movie film splice, which is applied by an editing/

splicing device also similar to a movie film editor.

You can even use the editor/splicer to remove sections of the recorded programs, or splice in new additions.

Many of the personal computer BASIC interpreters (compilers) are available on TTY paper tape, as are core-sident assembler/editors and some game programs. Naturally, it might not be worth several hundred dollars for a tape reader you might only use a few times, so you can consider a manual tape reader that sells for less than \$80. You simply pull the tape through the reader by hand, or jury-rig some form of winder. (Check your local computer store for an Oliver tape reader.)

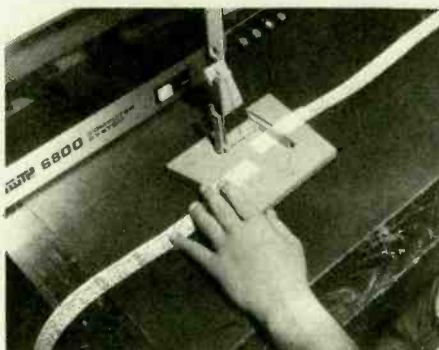
If you're thinking of swapping programs with friends or using them on a school or time-share computer system, paper tape is the easiest way to get a reliable, essentially universal format.

Kansas City Computing

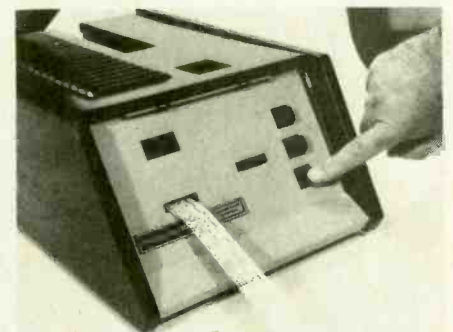


The punch/reader of an ASR-type teletype writer is one of the more common systems. It's very easy to use; just push a button to transmit a signal from the computer and it will punch or read a tape or do both.

CIRCLE 31 ON READER SERVICE COUPON



Damage a paper tape? Or, do you want to splice two program parts together? Never fear, it's as easy as splicing film.



Need paper tape equipment without a TTY? The H-10 from Heathkit is an economical punch/reader. The punched tape comes out one of the front panel slots.

To make tapes you'll need a punch. A combination punch and reader used to run many hundreds of dollars; now you can build one yourself for a moderate price. The Heathkit H10, priced at \$350 in kit form, can be easily adapted to most personal computers having a standard parallel I/O port.

Though the H10 is somewhat more inconvenient to load and operate than some other punch/read devices, it has several advantages for the hobbyist. Firstly, there's reader speed. Paper tape is punched at the standard rate of 10 characters per second, which represents a theoretical maximum of 110 wpm (words per minute) at the TTY standard 9.09 mSec character rate. Now this might look fast on paper, but when being read into a computer it's a crawl; some 8K BASIC programs take as long as 18 minutes to load at 110 wpm. But the Heathkit reader operates at five

times the punch speed, and the tape is read in 20% of the normal time. The same tape that would take 18 minutes to read at 110 wpm takes only 3.6 minutes with the H10 reader.

The H10 will also directly copy a paper tape, and it's punch and reader can operate independently under computer control if needed.

In combination punch/readers the H10 is about the best buy, even though it can be a little troublesome to load, or reload if you want to pick up from a stop.

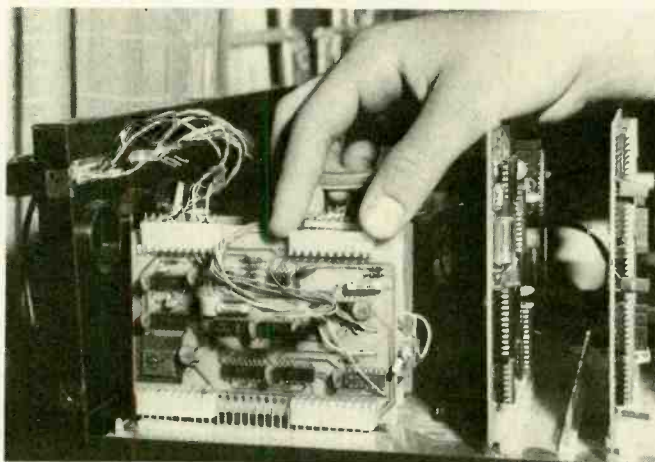
Kansas City. Though paper tape is essentially indestructible, under normal handling it is prone to spill, leaving yards and yards of curling, twisting ribbon on the floor. Besides, until the Heathkit H10 came along, hobbyists had to put up with a slow read of 110 wpm, or an ASR TTY terminal. At a computer fair in Kansas City several

years ago, *Byte* magazine proposed a tape recording system operating at 300 baud (about three times TTY paper tape speed) using audio tones of 1200 and 2400 Hz on standard Philips cassettes. The system came to be known as the "Kansas City" standard. It's primary advantage is that an ordinary, inexpensive cassette recorder can be used to record the audio tones which result from conversion of the computer's digital data.

Unfortunately, the originators were "digital designers", and there probably wasn't an audio engineer in the room. No self-respecting audio engineer would ever use two harmonically related frequencies for information storage. How the Kansas City proponents ever got tangled with what we will show is the weakness of harmonic relationships we'll never know, because the telephone Touch-Tone frequencies, which

Keep your computer loaded with these up-to-the-minute techniques.

by Herb Friedman



It couldn't be easier to install Personal Computing's Model 33. Line up the pins, and just press down! This Kansas City interface also includes a big plus—a level adjust indicator to reduce some of the overload problems.

◀ CIRCLE 73 ON READER SERVICE COUPON

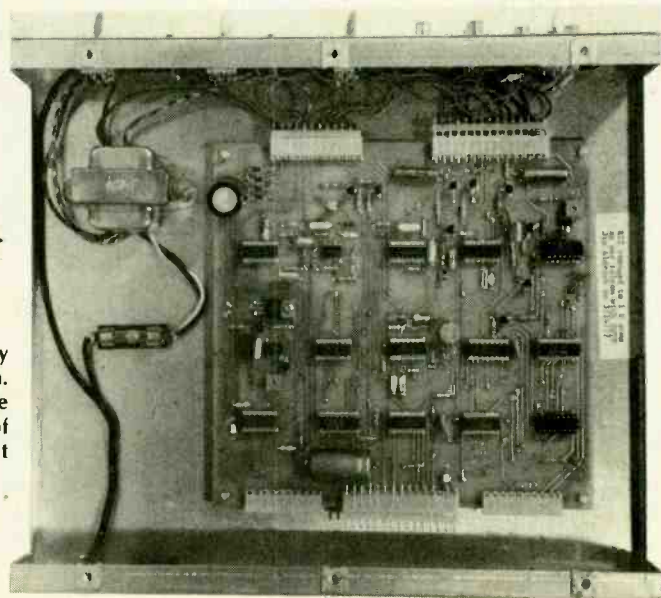


You don't need a special interface for the CC8 "Computer Aid" recorder.

▶ CIRCLE 62 ON READER SERVICE COUPON

▶ CIRCLE 65 ON READER SERVICE COUPON

The AC-30 is only available in kit form. But, the board is large and there's a lot of room for assembly. It goes together.



Magnetic recording is the speediest method of mass data storage. Many hobbyists use either Philips-type cassettes or the mini-floppy disc, known as a diskette. Specially tested and certified cassettes such as the Maxell on the right cost more than usual audio cassettes but are needed for high computer speeds. The diskette on the left is permanently housed in a protective sleeve. The entire unit, sleeve and all, is placed into the disc drive system.

e/e KANSAS CITY UPDATE

are non-harmonic, have been around for many years, and just about everyone but the Kansas City designers use Touch-Tone frequencies for encoding, signaling, etc.

To use Kansas City you need an interface such as the SWTP AC-30, which also uses computer signals to control up to two associated recorders. We spent four weeks trying to "repair" a working AC-30. The problem was that the distortion in the tape recorder was providing sufficient harmonic energy from the 1200 Hz signal to interfere at 2400 Hz. It is somewhat *tricky* to get the recorder's output level and tone control properly set for reading. It is one hell of a job to get the record level correct with some small recorders; too much signal and the distortion confuses the read of the tape. Too little level and the inherent tape/electronic noise confuses the read of the tape.

For those with SWTP 6800 computers there is a small Kansas City interface that plugs right into the computer—taking up an I/O port simply for power—that provides for easy level adjustments. This device, the Personal Computing Company's model 33, is the easiest-to-use Kansas City interface we have yet to see. It becomes part of the computer, doesn't require a separate power cord, is easy to set up because of an L.E.D. level indicator, and best of all, the PCC Model 33 is sold com-

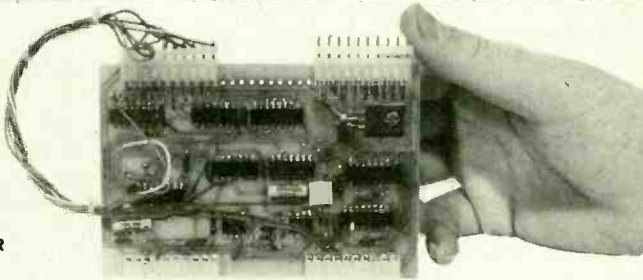
(Continued on page 93)

Where to Find More Info

Info on the products shown in this article is available from: H10 paper tape punch/reader from Heathkit, Benton Harbor, MI 49022; AC-30 cassette interface from Southwest Technical Products, Inc., 219 W. Rhapsody, San Antonio, TX 78216; PCC Model 33 cassette interface from Personal Computing Company, 3321 Towerwood Drive, Dallas, TX 75234. CC8 Cassette Data Recorder from National Multiplex, Corp., 3474 Rand Ave., South Plainfield, NJ 07080; BFD-68 Floppy Disc System from Smoke Signal Broadcasting, Box 2017, Hollywood, CA 90028.

Personal Computing's Model 33 Kansas City interface for the SWTP 6800 computers is supplied factory-assembled. It plugs directly into the computer's motherboard.

CIRCLE 73 ON READER SERVICE COUPON



National Multiplex's CC8 digital data recorder may resemble an ordinary cassette recorder, but inside it's another story. It can reliably record up to 1200 baud with any good, audio cassette and up to 4600 baud with a high-quality, data cassette.

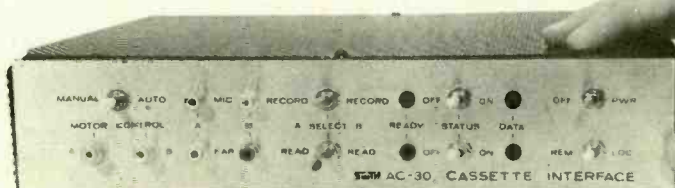
CIRCLE 68 ON READER SERVICE COUPON



Smoke Signal's mini-floppy disc system can be connected to a SWTP 6800 computer just by plugging one board into the computer's motherboard. There are no adjustments. For more information about this product circle number 63.

CIRCLE 67 ON READER SERVICE COUPON

The AC-30 from SWTP is a cassette interface using the Kansas City system which is capable of controlling two audio recorders. Output is self-clocking, and this interface works with RS-232 systems.



FOR ALMOST THE ENTIRE modern history of the telephone the telephone companies, led by Ma Bell, held the public in an iron monopolistic grip. With the assistance of easily influenced and cooperative state regulatory agencies the telephone subscriber had absolutely no control or rights where his phone was concerned. Legally, a Ma Bell subscriber could not even attach a shoulder rest to a handset, or apply felt to the bottom of a phone to prevent worn "feet" from scratching the furniture. In short, if there was any telephone device the phone company could not charge you for, or didn't supply because there was not enough profit in it for them, you couldn't use it.

In what was to become a landmark court decision always referred to as "The Carterphone Decision", the death-grip monopoly of the telephone companies was broken, and typical of American business freed from the heavy hand of state-supported monopolies, businesses rushed into the marketplace with telephone accessories that not only competed in quality with standard telephone company equipment, but were generally better, priced at a fraction of the usual rental price, and often delivered a service Ma Bell claimed "couldn't be done."

For example, consider the message repeater. Back in the days of Ma Bell's monopoly your local theater might have used a Ma Bell message repeater to announce the movies and their showtimes. If you remember, these announcements were often garbled, with more wow and flutter than a \$15 cassette deck with worn out batteries. Often, you had to call back two or three times to get the message, and of course, each call was another 5-cents for Ma Bell. The theater couldn't get a better machine because it wasn't allowed.

Today, you can walk into a Radio Shack, Olsen, or other electronics supply store and for well under \$100, less than a few months rental for Ma Bell's old voice garbler, buy your own complete message repeater and recorder with performance as good as any general purpose cassette deck. Fact is, the free marketplace so far outclassed Ma Bell's repeater she discontinued the service in many areas. Fact is, you can probably find just about any specialized telephone accessory you need, everything from a low cost speakerphone to a gadget that instantly tells you if someone is listening in on an extension phone or has tapped your line with a monitor headset.

Lots of New Tele-Services. The photograph shows some of the most popular telephone accessories other



TELEPHONE GIZMOS

Make your ringer do things you never thought possible.

By Herb Friedman

than "decorator" extensions, or surplus Western Electric, Stromberg Carlson, and Northern Electric telephone sets.

In the photograph we show Radio Shack's \$80 telephone answering system, a battery powered device that plays a 15-second message, and can record 30-second messages. There is also the famed Record-A-Call, a telephone answering machine that records as long as the user talks up to the full length of a cassette; a machine that can be keyed by the user from a remote location to play back all messages received, and then rewind and reset to the beginning of a cassette for more messages. There are two "conference" speakerphones, the \$30 Radio Shack and the

\$70 Heathkit. Simply press a button and you talk into, and listen to the phone without lifting the handset, just like "Mr. Big" in the movies. The major difference between the Radio Shack and Heathkit types is the built-in dial on the Heathkit. To dial a number when using a low cost "basic" speakerphone such as the Radio Shack model you must place the call with a regular phone, then switch on the speakerphone and hang up the telephone handset. To place a call with the speakerphone having a built-in dial you simply press the *on* button and dial with the built-in dialing mechanism.

The other gadgets in the photo are a sample of the devices made by an out-



This Record-A-Call machine plays your message through an endless cassette on the left, and records incoming messages on the right hand cassette. You can record on either cassette, allowing you to prepare different messages which are easily snapped into place.

e/e TELE-GADGETS AND GIZMOS

fit known as Telco, who also packages under many private and "house" labels. These gizmos usually sell for under \$30 and include a device that shows when a second telephone on your line has been lifted, or when someone has placed a headset across your phone line. About the only tap it can't spot is a high impedance bridge such as used by sophisticated eavesdroppers. (No way you can beat these boys. They can even unscramble a scrambler as easy as losing a slug in a coin telephone.) For \$20 or less you can get a conference connector. If you have two telephone lines coming into your home this device will connect them together so you can make conference calls. (Ask your local telephone company how much this service will cost you—if they give it to you.)

In states where they are allowed you can use a device that will automatically start recorder when a phone is lifted, and stop the recorder when the call is completed.

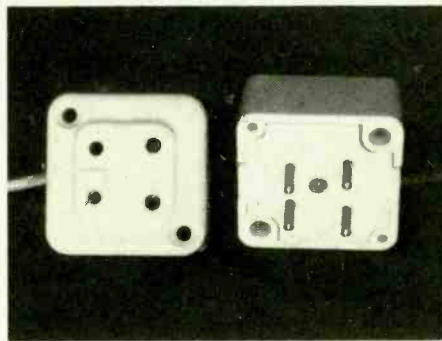
If you need a device that will simply play a message like "Due to rain all Little League games are canceled" and you can't get a sponsor to spring for a full telephone answering machine Telco has an inexpensive gadget that let's you use your own cassette recorder for giving the message.

More Telephone Technology. If you're fortunate enough to live in an area where the phone company has kept up with modern technology you can arrange for a call diverter service. By simply dialing a special number on your phone incoming calls are diverted to another number. A great service when you're out for the evening? Sure! But this service isn't available in all localities. However, you can purchase your own call diverter (you will need two telephone lines but it's worth the peace of mind when the children are home alone) when your friendly telephone company won't provide the service. What's that? You used to read about such a device used by gamblers called a "cheesebox." Right you are! When the police bust a bookie the newspaper talks about the infamous "cheesebox", when the phone company rents you a "call diverter" they brag about their state of the art central switching system. Well, even if you're not a bookie, and your local phone company hasn't caught up with modern technology, you can arrange for your own call diverter.

(Continued on page 88)



A few of the most popular telephone accessories. A—The Heathkit speakerphone or "hands-free telephone" with built in dialer. B—the Record-A-Call remote control telephone answering machine that can be keyed from a remote location to play messages back over the telephone lines. C—Radio Shack's budget telephone answering machine. D—Radio Shack's low cost speakerphone (no built in dialer). E—An assortment of Telco devices to indicate if your phone is being tapped, to start a recorder each time your phone is used, to provide conference-connection between two telephone lines.



The big breakthrough—the stackable phone plug (two are used to illustrate the construction). One side has the four standard prongs. The rear, instead of having a cover, has sockets allowing another plug to be stacked on top. A virtual endless stack of accessories can therefore be added.



No larger than a pack of cigarettes this tone generator can signal a Record-A-Call to playback all received messages when you phone in. You reset the Record-A-Call with a second tone burst.



A favorite with the paranoid set. The small lamp indicated by the finger lights if any other telephone or headset is tapped across the line used by the telephone to which the "snitch" has been calibrated. Instantly shows if someone is listening in on an extension phone, even if they have equipped the phone with a cut-off switch.



To prevent others from raiding your message machine, the tone generators provide a specific frequency output to which the machine responds

e/e checks the... RADIO SHACK TRS-80 COMPUTER



This system brings the Computer Age into your livingroom.

□ Though there has been much talk of personal computers in the sense of two cars in every garage and a computer in the den, until the Radio Shack TRS-80 there was nothing that could be used by someone totally unfamiliar with electronics. If you couldn't tell a Molex socket from a D-connector there wasn't much chance you'd be able to *interface* (fancy term for interconnecting) the components that go into making up a basic computer system.

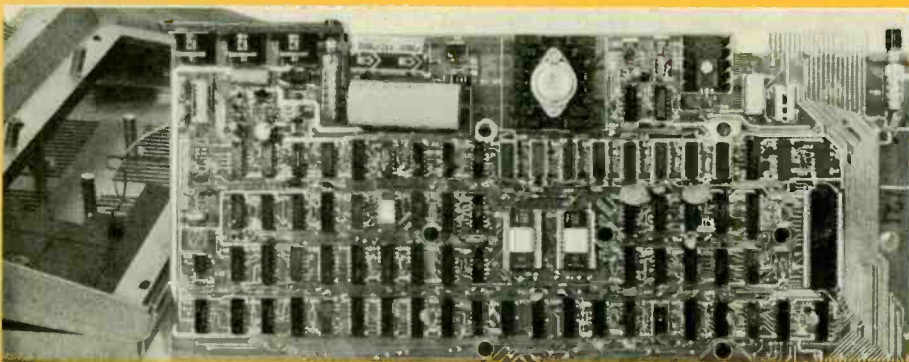
The TRS-80, however, is a whole different idea in personal computing. Just push together three common DIN connectors such as you might find in a typical hi-fi system and you have an instant computer system pre-programmed with BASIC. Press the power switch and your computer system is up and running.

The TRS-80 consists of three independent equipments. First, there's the computer itself with its associated plug-in power supply. Housed in a cabinet approximately 16½-in. wide x 3½-in. high x 8-in. deep, with an integral keyboard, the computer has a resident 4K basic, graphics, and 4K RAM (random access memory) which can be expanded to 16K on-board, or 62K with a planned outboard accessory. The back of the computer has DIN connectors for its power supply, the video output (for CRT display), and a tape recorder. The main power on-off switch is located adjacent to the connectors. On the rear left is a cover plate for an

expansion port (fancy term for printed circuit connector), and the *reset switch* that bails you out if your program *bombs* and locks the computer into a loop.

The basic computer and its plug-in power supply is priced at \$399.95 (assuming it ever becomes available as a separate item).

The second equipment in the system is a 12-inch video display monitor priced at \$199.95. Front panel operator controls are the on-off switch, and brightness and contrast adjustments. Unlike the usual video monitor which has a UHF or BNC connector input—and you provide the matching cable and connectors—the Radio Shack video display has a permanently attached input cable with a DIN connector that plugs into the computer.



This is the actual computer, just one IC after another. The two large chips in the middle, with the white centers, are plug-in ROMs (Read Only Memories). These are the chips which contain BASIC. Circle No. 32 on the Readers Service Card for information.

The final equipment in the package is a Realistic CTR-41 cassette recorder usually priced at \$49.95. It is supplied with signal and control cables that plug directly into the computer. The recorder is used for storing user-programs, or for loading the computer with a program from several program packages available from Radio Shack—among them a payroll program for up to twelve employees, a personal finance program, and a special math education program.

Though the three items individually represent a cost of \$649.95, the package price, including a 300 page instruction / programming manual, is \$599.95.

How It Works. Let's start with the manual. The final version was not available when this article was prepared. Instead, an abbreviated user's manual, sufficient to get anyone started, was supplied with the first systems. It is literally a work of art. The quality of *documentation* (another fancy word, meaning instructions and technical information) usually supplied with personal computing equipment is "the pits"—*abysmal* is too good a description. The preliminary instruction manual for the TRS-80, however, is outstanding by any consumer standards. We can only hope the same person prepared the final 300 page manual. The only problem with the manual is that the demonstration "multiplication tables" program has two typographical errors and the program won't run. This is a fun program and will probably be the one you'll try at a Radio Shack store so make the following changes: statement #70 should read ". GOTO 130"; statement #110 should read ". GOTO 20". (As we said, this is a preliminary manual.)

To use the computer, just press the power switch. If the screen fills with scrambled alpha- numerics simply press the power switch again and you'll see the word READY. The computer is

e/e RADIO SHACK COMPUTER

now ready for use.

If you want to save a program you need only install a good quality audio cassette in the recorder, preset the recorder's controls to record, and enter CSAVE on the terminal. The computer automatically starts the recorder and feeds the program to the tape. Taped programs can be loaded into the computer by entering CLOAD on the terminal. (The computer automatically converts the digital pulses to audio signals for recording and vice versa for loading.)

Radio Shack has announced intentions to make available, at a later time, peripherals for "hard copy" (a printer) and a disc system. By the time you are reading this one or more accessories might already be available.

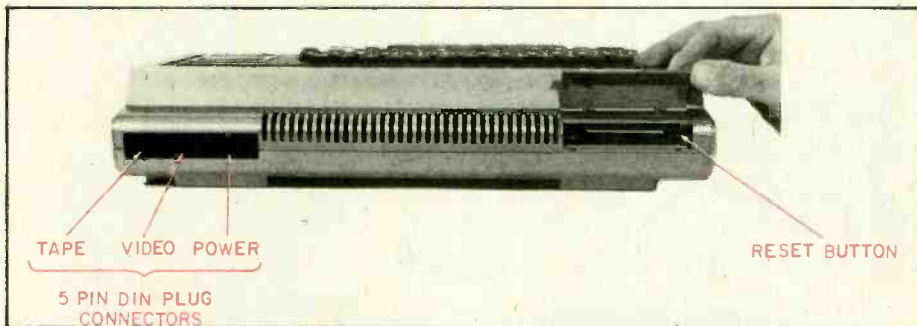
Though the overall concept for the TRS-80 personal computer is good, the 4K BASIC leaves a bit to be desired. It somewhat limits the potential, primary consumer use of a computer—that of an educational aid. The 4K BASIC lacks trigonometric and transcendental functions, limiting its math level to elementary grades. Junior High and High School would require, at the very least, the trigonometric functions. Radio Shack has announced a Level-II BASIC will be made available—which we assume will be essentially some form of 8K BASIC with the trig and transcendental functions.

The BASIC is in plug-in ROM (read only memories) so we assume Level-II BASIC would be installed by simply exchanging one or two ICs. (The computer easily comes apart by removing a few screws.)

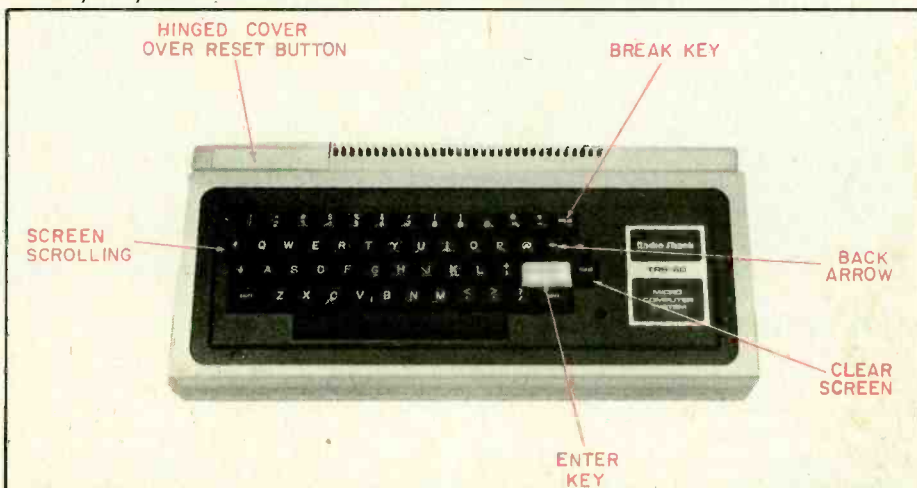
The recorder runs at 300 baud, so saving and loading a user program can take considerable time. One of our programs took almost 8 minutes to save, and 8 minutes to load. Radio Shack undoubtedly used 300 baud in order to utilize an inexpensive audio recorder, but a high speed digital recorder would be preferable. There are indications from Radio Shack that they are planning for high speed mass-data recorders in the near future.

Why For Me? Perhaps you're impressed by the specifications of a computer such as the TRS-80, but you're still hesitant about letting the "computer age" right into your living-room. You may be wondering: isn't a home computer mostly for an engineer or accountant?

Right now, the field of Hobby Computing is expanding at a truly amazing



The TRS-80 microcomputer from Radio Shack can be the first step in bringing the Computer Age into your own home! It's available in a complete system, fully assembled, and you can be programming in just a few hours after you take a TRS-80 home. Already, thousands of people are involved in the new Personal Computing hobby. A system such as the TRS-80 can be a fantastic introduction to it.



The three DIN connectors on the rear are for the video terminal, the power supply, and an audio cassette recorder. A cover, shown lifted, conceals an expansion port which will be used for optional accessories in the future—things such as magnetic and disc recorders, hard-copy printers and a variety of memory expansion boards.

rate and encompasses people from every walk of life and of a myriad of varying interests. A typical computer user can be a High-School student running a few amazingly realistic games in his spare time; a housewife using her own computer system to help plan a big dinner from recipes designed for a much smaller crowd; to a small businessman doing the payroll and invoicing, which used to take his secretary days, in just a matter of minutes.

Computers are no longer in the future. Computers are here, right now, ready to change your life for the better.

Radio Shack has recognized the needs of the home computerist and has supplied taped programs which will help you get started on using the TRS-80 on a day-to-day basis. The "Games" tape which comes with the TRS-80 introduces you to the fun aspects of computing. More tapes are available from Radio Shack which include such things as programs to help you run your kitchen and housekeeping more economically and efficiently; tapes that program the computer to be your private,

business secretary ready at any time to do your books and payroll perhaps more accurately—and certainly quicker—than ever before.

Once you get started, you won't be able to stop. Courses, such as our introduction to the BASIC Language which has been running in this magazine, will enable you to plan your own programs and to solve your own, special problems without having to depend on taped cassettes. In fact, one of the most exciting aspects of this new hobby is the programming. It is a real thrill to set yourself and your computer the goal of solving some problem or other, to program the computer, and watch that problem melt away.

For the past few years, thousands of people have been introduced to the Hobby Computing field. With the introduction of the TRS-80 (and other computers like it) into the marketplace there will soon be millions of people, just like yourself, using computers in their everyday lives.

For more information circle No. 32 on the reader's service card. ■

SUPER SENSOR

Sniff out those gas leaks before they get you with this nose that knows.

by Cass Lewart

IS YOUR FURNACE generating carbon monoxide in addition to heat? Does your car deliver exhaust fumes straight into the passenger compartment? Our *Super Sensor* will warn you of these and other hazards of modern living before it is too late for action. This sensitive instrument will also help you in locating gas leaks in your kitchen or basement, or gasoline leaks in your car or boat. You may also use Super Sensor as a "breathometer," as even small amounts of alcohol on one's breath will give an indication on the built-in meter.

The instrument is based on a newly developed and recently improved, inexpensive, solid-state gas sensor responding to combustible and oxygen reducing gases or vapors. Carbon monoxide, natural gas, methane, propane, hydrogen, cigarette smoke, gasoline or alcohol vapors, and other hydrocarbons are detected in concentrations as low as 10-50 parts per million.

The sensor consists of a pellet of semiconductor material, mainly tin oxide, molded around a small 5-volt filament heater. The resistance of the semiconductor pellet decreases in the presence of deoxidizing gases or vapors.

The sensor element is enclosed in a plastic cylinder covered with a fine mesh and its six pins fit into a standard 7-pin vacuum tube socket.

The sensor used in our project, though similar in function to earlier models (e.g. in DC Powered Gas Alarm in Nov.-Dec. 1974 issue of this magazine), provides several new and important features. It is more stable with a shorter warm-up time requiring less heater current than the previous model, and also provides electrical insulation between the heater and the sensor element. The new features made it possible to design this unique Super Sensor.

What's the Inside Story? The schematic of the Super Sensor shows the circuit is powered by six D-cell batteries in series. The power drain is approximately 150 mA.

IC1 provides a regulated 5 Volt supply for the filament heater of the sensor. The gas sensitive element is connected as one arm of a resistance bridge consisting of R4, R7, R8 and the meter M1 with its associated resistors R5 and R6. The bridge can be balanced by adjusting R8 so that no current flows through the meter.

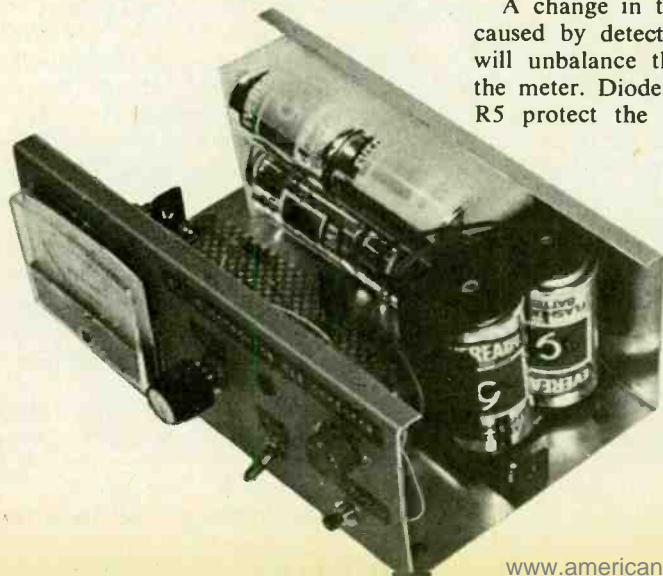
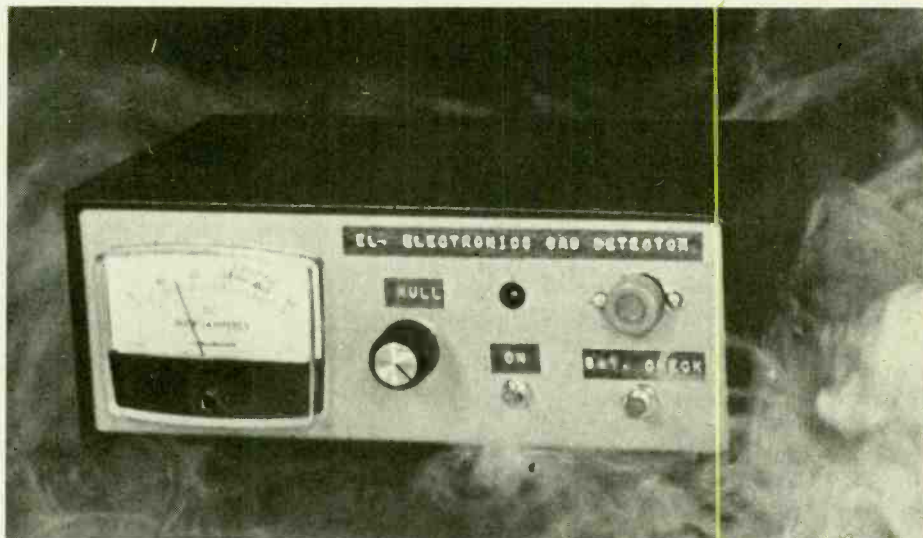
A change in the sensor's resistance, caused by detection of noxious gases, will unbalance the circuit and deflect the meter. Diodes D1, D2 and resistor R5 protect the meter from overload

while R6 determines Super Sensor's overall sensitivity. R2 limits the current through the sensor; R1 and LED1 indicate that the circuit is working, so that you do not drain batteries by leaving the unit on inadvertently; R3 and S2 give you a battery check so you know when to replace the batteries.

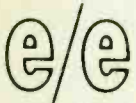
Making It Happen. As shown in the photographs, the sensor circuit fits snugly into a metal cabinet of approximately 8-in. W x 3-in. H x 5-in. D. Most of the space is taken by the six D-cells. If you decide to substitute C-cells, which would limit you to about 5 hour operation instead of 20 hours with D-cells, you may fit the sensor in a smaller cabinet. All controls, meter and the sensor are mounted on the front panel of the cabinet.

Sometimes it may be more convenient to mount the sensor element separately and to connect it with a cable to the main unit. As this is a purely DC project no special wiring precautions are required.

Setting It Up. Turn Super Sensor on with S1 and let the unit warm up for two minutes. The needle on the meter will rise quickly and then, slowly, settle down. Turn potentiometer R8 for maximum meter deflection and press S2. If the reading is between 35 and 50 microamperes, mark the reading on the meter with a magic marker. If you find this reading decreases by more than 10% it is time to change batteries. If the initial reading is not within 35-50 μ A range change R5. A typical range for R5 is between 1 and 5 kilohm depending on the meter. Resistor R6 controls the circuit's overall sensitivity to gas concentration. Maximum sensitivity is achieved when R6 is completely removed from the circuit. Even a small amount of impurities will then fully deflect the meter. We found that

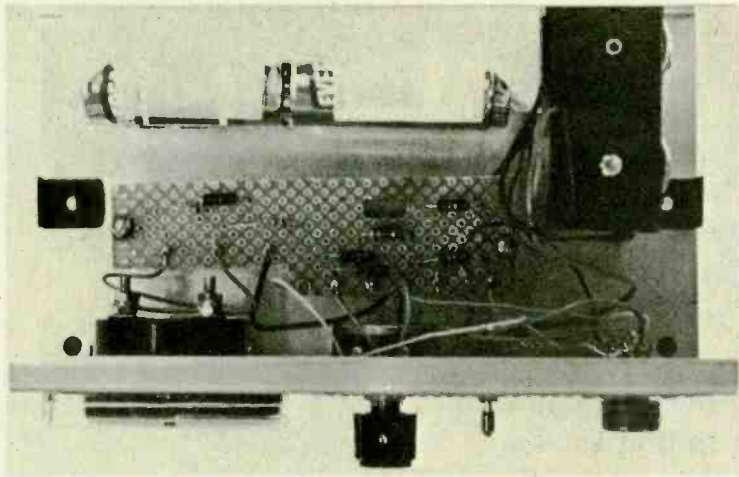


This will give you an idea of the way the six "D" cells are mounted. That many batteries are heavy, so be sure that they are securely fastened to the back and the bottom of the cabinet.



SUPER SENSOR

View from the top of Super Sensor with the cabinet removed. You can see the format by which the "D" cells are laid out. Also, check the size and shape of the perf board on which most of the components are mounted for clearance.



the value of 2200-ohms was about the best for general purpose measurements. Change of R6 may also require a change of R5 as these two resistors are interacting with each other. R6 could also be replaced with a two-position switch for High and Low sensitivity.

If you are planning to use rechargeable batteries or a 12 Volt car battery the only change in the circuit is that IC1 should be mounted on a heat sink (e.g. cabinet wall).

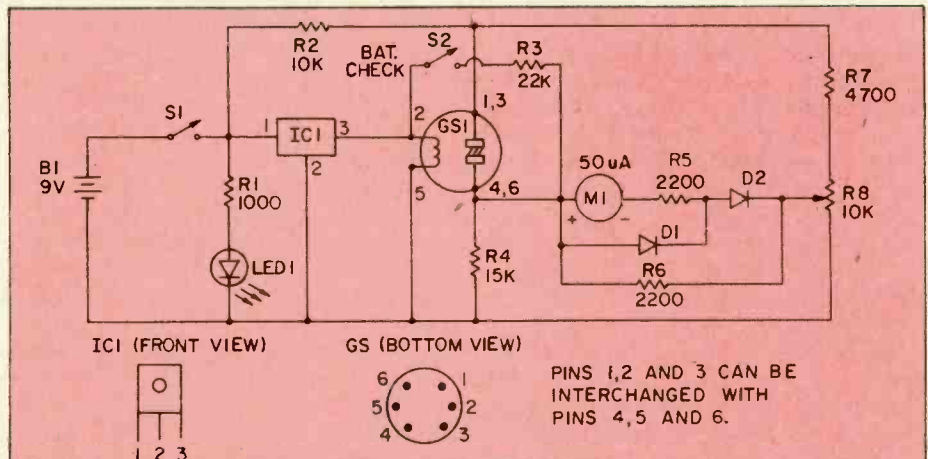
Sensiting the Changes. Always warm up Super Sensor by turning it on for two minutes before using. Then set the meter for maximum reading with R8 and test batteries with S2. Turn R8 slowly to null the meter and you are ready to go. After a few minutes repeat the nulling procedure. Presence of detectable gases or vapors (you may test it with a puff of cigarette smoke) will deflect the meter needle nearly instantaneously. It may take the air inside the sensor element a minute or two to clear and return to a normal, fresh air reading.

Life-saving Uses. Your Super Sensor can be one of the most important additions to your household. With it you can search out potentially dangerous leaks in your household natural gas supply, around your oil-burner, and among storage cans which may contain gasoline or other inflammables about which you may have forgotten. For some uses you may want to make an extended sensor head, which since the circuitry is not critical, involves simply attaching carefully insulated wires to the sensor.

Your car, too, may be the source of undetected leaks. Use Super Sensor to search out gas leaks around the engine, fuel line, and gas tank. Also, exhaust leaks can be found by—carefully—letting the engine run for a few minutes with the car up on a rack. Bring the sensor into close proximity with the exhaust pipe and muffler, especially in those areas where there are joints or couplings, or where rust looks suspicious. When you do this particular test, always be sure that there is plenty of ventilation. ■

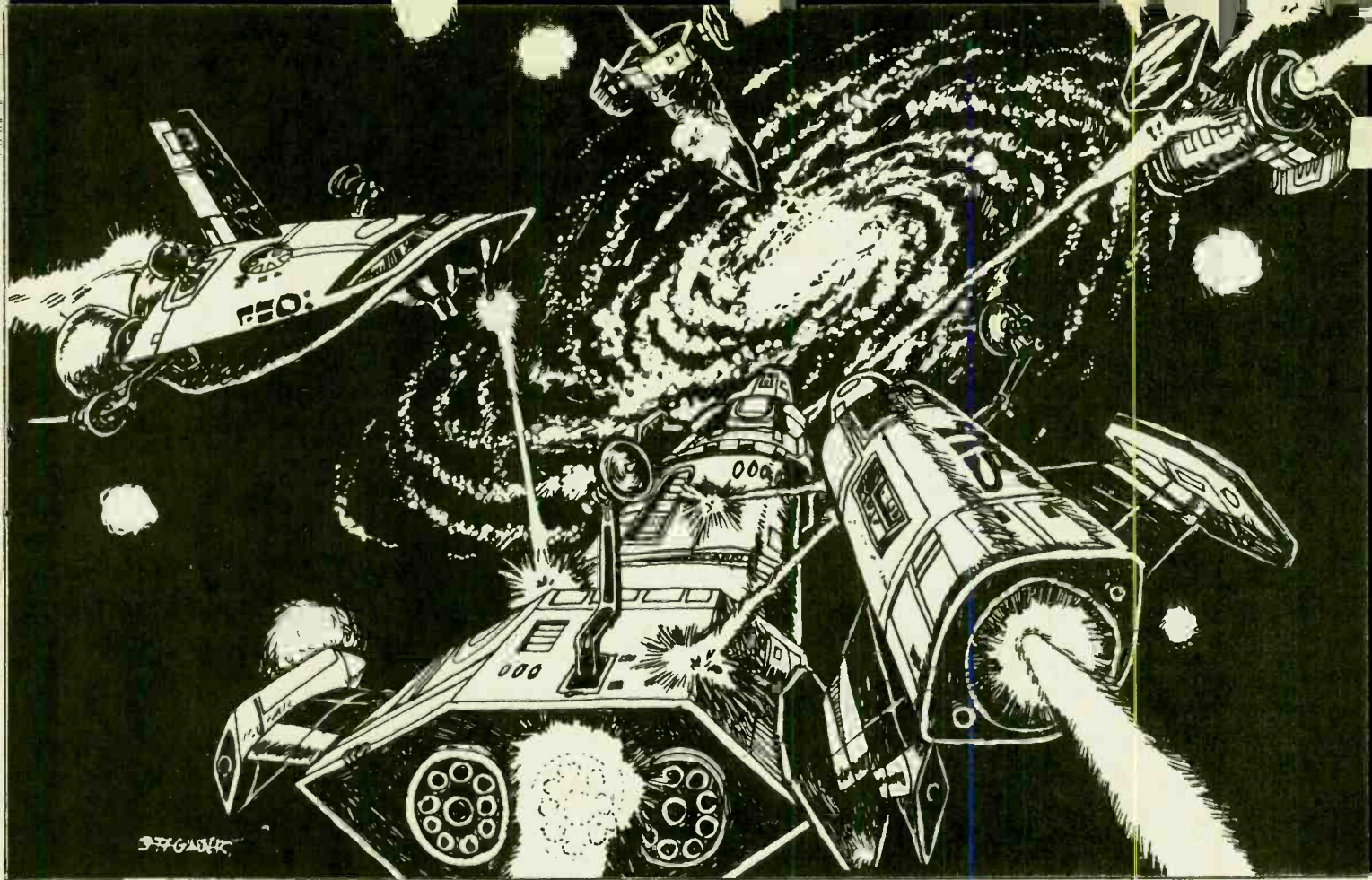


Front view of the Super Sensor shows the positioning of the meter, the null control, and the battery check and off-on switches, as well as the gas detector itself.



PARTS LIST FOR SUPER SENSOR

- B1—Six, D-cell batteries wired in series. (Radio Shack 23-508 or equiv.)
- D1, D2—Germanium diodes IN34 (Radio Shack 276-1123 or equiv.)
- GS1—Gas Sensor, Model 812 (Order directly from Southwest Technical Products, Dept. EE2, 219 West Rhapsody, San Antonio, TX 78216, \$7.50 ppd.)
- IC1—5-volt regulator (Radio Shack 276-1770 or equiv.)
- LED1—Light-emitting diode (Radio Shack 276-041 or equiv.)
- M1—50-uA panel meter (Radio Shack 22-051 or equiv.)
- R1—1000-ohm resistor (Radio Shack 271-0023 or equiv.)
- R2—10,000-ohm resistor (Radio Shack 271-0034 or equiv.)
- R3—22,000-ohm resistor (Radio Shack 271-0038 or equiv.)
- R4—15,000-ohm resistor (Radio Shack 271-0036 or equiv.)
- R5, R6—2200-ohm resistor (Radio Shack 271-0027 or equiv.) (see text)
- R7—4700-ohm resistor (Radio Shack 271-0030 or equiv.)
- R8—10,000-ohm potentiometer, linear taper (Radio Shack 271-1715 or equiv.)
- S1—SPST toggle switch (Radio Shack 275-602 or equiv.)
- S2—SPST pushbutton switch (Radio Shack 275-609 or equiv.)
- Misc.—Metal cabinet, Battery holders, 7-pin miniature tube socket, Solder, Wire, etc.



SPACE: 1978

Fight the Star Wars with a play-by-mail computer.
By Neil Shapiro WB2KQI

Look up past the treetops, further still, beyond the clouds and the familiar blue sky into the black velvet of Space. Height no longer has meaning, and the stars are sprinkled like a diamond cutter's dust and scattered to the farthest edges of Infinity. In the silence of that void, like technological phantoms, interstellar ships of competing galactic empires move at unimaginable speeds through uncharted dimensions. The ships fly on their missions of power and conquest, linking together the blue and habitable worlds which circle yellow stars, and often these ships clash terribly in that night, temporarily bringing light to an emptiness never lit before.

In a way, all of this is fantasy—but on the other hand, it seems quite real to the hundreds of people who play GALAXY II each month by mail. Once every turn a prospective Galactic Emperor must make hard and fast decisions on how to run his own segment of the galaxy. Everything, from building ships and naming their captains to

founding colonies, fighting battles, collecting and disbursing taxes, and much more, is all figured into each turn. There are more than forty players in each game who send in monthly moves. The moves are then collated, followed through, and any player interactions decided, all by computer.

Of course, it's not just any computer which can handle the complexity of a game such as GALAXY II. The game is run on two System 370 model 168's from IBM. These are huge computers with over seven megabytes of real core storage. In fact, these computers use something termed "virtual storage" which, as the name implies, means that the available memory space is virtually unlimited depending on how the system is configured.

Does this mean that only computer programmers and high-level scientists are among those playing GALAXY II? Well, many of the players (all of whom hope to become a Galactic Emperor) come from backgrounds widely divorced from the sciences and research.

Brett Tondreau, GALAXY II's designer, states, "We're looking for overworked, highly educated people who are jaded with the cursory forms of entertainment currently so common in the TV and movie theatres. We need people who are conscious of what they like and have a very high respect for both their own creative energies and those of others."

So, if you're tired of watching *Star Trek* re-runs on the tube, here's your chance to set out on your own mission and go 'where no man has gone before.' All it takes is the creative energy to be able to envision what it would be like to run your own galactic empire, and the desire to give it a try. The rules are complex in their entirety, but each part of the whole can be readily enough comprehended with just a little effort. Once you know what you're doing, you would be hard put to swear that all those spaceships, planets and colonies *don't* exist. It is simply amazing how receiving personal reports of a mission accomplished from one of your favor-

e/e GALAXY COMPUTER GAME

ite starship captains tends to make you believe in everything that's going on.

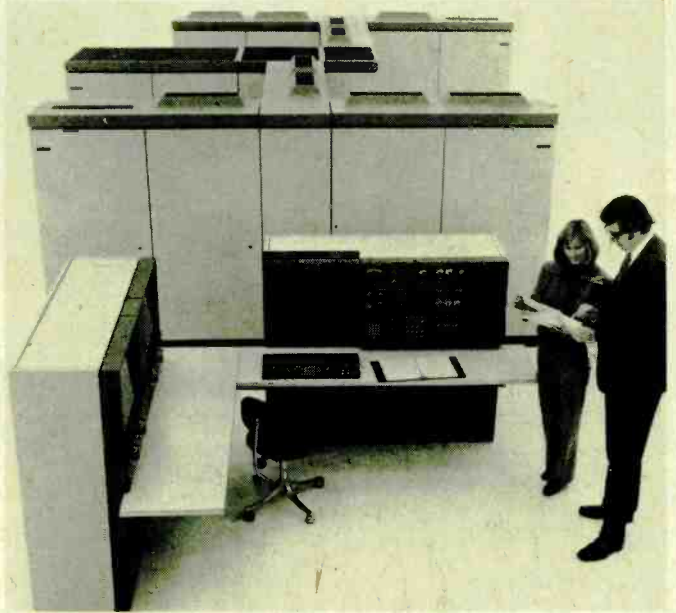
Because of the wealth of detail involved in GALAXY II, there is really no such thing as a typical turn. There are, however, typical parts to most turns, operations which are done again and again but put together in varying ways for different goals.

For instance, let's say you're ready to launch a new spaceship. Your first act is to see that the planet launching that ship has enough Matter-Antimatter-Drive units (MADs) to contribute to a vessel of the size you plan on designing. If not, you'll have to decide how much of that planet's industrial capabilities to assign to producing those MADs, and then you'll have to begin juggling priorities. To make it easy, we will assume that the planet has already stockpiled 8 MADs, which is enough to fashion a Lance-Class vessel.

So, you have the eight MADs. Now, each MAD has to be contained within a hull unit (HU). You will then have to assign at least 8 HUs to the ship. Again, you have to decide to either build new HUs or to use any stockpiled.

Let's not forget the fact that the ship has to be crewed. You may want to also assign it a goodly number of colonists in "cold sleep," along with maybe one or two high-level passengers. All of these people breathe, and so you will

GALAXY II is run on an IBM-370 model 168 like the one shown here. The computer offers seven megabytes of real core storage along with virtual storage systems which give an almost unlimited storage capability. The game makes use of the system's peripherals which are configured to include such things as: 32 disk drives, three banks of tape drives and IBM's fastest printer terminal. Right now, GALAXY II is using only 500K of memory so there is plenty of room for future Empires to expand and war into.



have to assign a value of Life Support (LS) that will last at least as long as the mission you plan. To get those people where you want to send them will require you to assign Power Support (PS).

Unfortunately (though it's a lot of fun!), everyone "out there" isn't going to be friendly. It would be a good idea to assign that Lance-class ship a certain number of Beams (BEs) for offense and a goodly number of Shields (SHs) for defense. Combat will be decided using these variables along with how experienced your ship's captain is from previous battles or missions.

Further, you may want to assign each ship a number of Probes (PBs) so that it may gather intelligence for you. Of course, don't forget the Screens (SCs) which can shield that ship from an enemy's probe and mask its identity.

Figure on having only a small fleet in the beginning of the game. Sooner or later, once you figure out which stars hide your opponents' own degenerate races as opposed to your own race of superbeings, you'll have to build a bigger fleet to root the blighters out.

Be sure you don't forget your planetary development. This is one of the

(Continued on page 90)

WHAT FOLLOWS IS AN ACCOUNT OF THE ACTIONS ON THE PLANET AVALON										GALACTIC COORDINATES 14-14-3 IN THE POST FLIGHT PHASE			
COLONY	LOCATION	GOVERNOR	BEAMS	SHIELDS	PROBES	SCREENS	MADS	HULLS	ECONOMIC	MINERAL-II	INDUSTRIAL UNITS	CAPACITY	
AVALON	14-14-3	GAWAIN	18	20	20	20	1	0	RESOURCES	466	2817	13.32	
		EXPERIENCE			DESIGNATION				MINERAL-I	522	MINERAL-III	293	
		1			AH				UNIVERSAL UNITS		-21988	EFFICIENCY	
												3.97	

Each month the GALAXY II computer tells you how your dreams of Empire are being made into reality—either that or how you're gradually being wiped from the map by your opponents. Here we see a typical report on a planet by the name of Avalon, which is governed by a gentleman named Gawain. The planet is in fairly good shape mineral-wise, and is just beginning to show signs of economic expansion. Obviously the treasury has been depleted, as shown by the -21988 Universal Unit figure. Hopefully, this money has been invested soundly and new factories (Industrial Units) have been planned as well as investing in the indexes of Capacity and Efficiency. If this plan of deficit financing succeeds then Gawain will wind up governor of a rip-roaring planet.

SHIPS LOG OF THE VESSEL IGRAYNE CLASS: MSH FIRST FLIGHT PHASE												
FLIGHT EXECUTED. PRESENT LOCATION OF IGRAYNE IS 14-14-2.												
CAPTAIN BLAMOR REPORTING A SUCCESSFUL FOUNDATION OF COLONY CORNWALL AT 14-14-2 WITH 30 INDUSTRIAL UNITS.												
COLONY CORNWALL REPORTS SUCCESSFUL ADAPTATION. INITIAL CONDITIONS INDICATE THE CAPACITY OF PLANET AS 0.33. -CAPT. BLAMOR												
WE HAVE TRANSFERRED 12 SCs TO THE COLONY CORNWALL												
VESSEL	LOCATION	CAPTAIN	BEAMS	SHIELDS	PROBES	SCREENS	MADS	SECURITY	TRIBUTE	POWER SUPPORT	MINERAL CARGO	MINERAL-II
IGRAYNE	14-14-2	BLAMOR	20	20	0	0	6	(S)	0	25.1999	0	0
		EXPERIENCE						DESIGNATION	INDUNITS	LIFE SUPPORT	MINERAL-I	MINERAL-III
		20						AH	0	79.9951	0	0

SOLAR SYSTEM REPORT AT 14-14 (RACE, DG, CGND, COLONY): (NO RACE UN NAMED) (LOGRES AH CORNWALL) (LOGRES AH AVALON) AND 2 VESSELS (BY ORB, HULL, DG, C, & RACE): ORBIT 0: ORBIT 1: ORBIT 2: IGRAYNE AH MSH LOGRES ORBIT 3: YSOLDE AH MSL LOGRES

The computer also reports on each and every one of your starships; tells you where they've been, what they've seen and what actions they've taken. Here we see the log of the Igrayne, under the command of the noble Captain Blamor. The good Captain is able to report to his Leader that the colony of Cornwall was successfully founded and the colonists transported safely there. His ship is now empty of cargo (INDUNITS) as all the colonists have been dropped off. The Igrayne's armament, while not too very formidable, consists of a good selection of beams, shields, screens and MAD. The Igrayne under Blamor's command would be a tough nut to crack

e/e checks out the...



SOFT-TOUCH TELEPHONE DIALER

Add the convenience of touch-tone dialing, and prepare for computer shopping with this little accessory.

AS MOST ELECTRONIC hobbyists have learned, the Touch-Tone dual-frequency signals used by telephone companies for quick dialing have now become standards for many other applications. Salesmen out in the field can phone to a central computer and enter their orders by keying the appropriate keys on a Touch-Tone phone; standard computer systems can be accessed by Touch-Tones; even some amateur repeaters are accessed via a touch-tone pad, particularly if the repeater uses an *autopatch* for connecting the amateur radio operator's transceiver to the telephone system. There are even devices that divert a telephone call to another number when accessed through touch-tones.

Problem is, how do you utilize touch-tone if all you have is the standard rotary dial type of telephone? The type where you stick a finger or pencil in the appropriate hole, pull the dial around, and then let go. The answer is: With a *Soft-Touch* Touch-Tone converter, a device that's a touch-tone dial and microphone replacement in a standard mouthpiece. To install the device you simply unscrew the telephone's mouthpiece and microphone (the mike falls out when the mouthpiece is removed) and substitute the *Soft-Touch*.

In seconds any modern-type rotary dial (or even no-dial) telephone is converted to a Touch-Tone phone, and either the rotary dial or the touch-tones can be used for dialing.

The *Soft-Touch* is powered through the telephone, power being automatically supplied through two internal handset connections after the *Soft-Touch* is screwed into place. The tone generator circuits are crystal controlled so there's no chance of frequency drift under normal, even extreme variations in ambient temperature. Dialing, (transmitting tones) is accomplished by simply pressing a fingertip against a

pressure-sensitive membrane switch, which has the standard calibrations of 1 to 9, 0, #, and *. The switch mechanism can be easily rotated through 360° so the user can orient the "dial" calibrations any way that's most convenient.

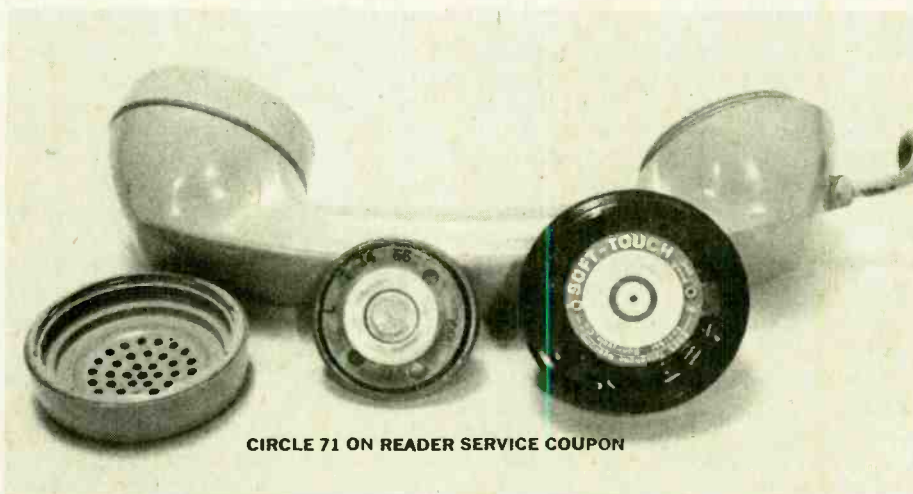
Testing. The *Soft-Touch*, which is priced at \$34.95, worked exactly as claimed, converting modern-type, rotary dial telephones into Touch-Tone operation. As for the voice quality, several tests conducted with different individuals through different telephone circuits showed the voice quality to be about the same as the standard Western Electric T-1 microphone (transmitter). With the volume level of the *Soft-Touch* at its worst it was a *smidgen* lower than that of the T-1 microphone.

Caution. Though the *Soft-Touch* converts a telephone for Touch-Tone that doesn't necessarily mean it will give your particular telephone Touch-Tone dialing. Firstly, Touch-Tone must be available in your *exchange*. Secondly, it

must be available on your particular telephone line. In some communities the entire exchange is touch-tone and any Touch-Tone phone connected to any phone line will work. In other exchanges Ma Bell only turns on the tone control circuits after the subscriber has agreed to a monthly charge for a Touch-Tone phone. Of course, if you already pay for Touch-Tone any additional Touch-Tone phones will work.

Other Applications. Perhaps the best way to handle the *Soft-Touch* in special applications is to treat it as a standard T-1 microphone. And if you plan to use the *Soft-Touch* in a home-brew project, or as a replacement mike for your amateur FM transceiver, keep in mind that the minimum operating power requirements are 3 volts DC at 10 mA.

Circle No. 71 on the Reader's service coupon to get more information about *Soft-Touch* from the manufacturer. Your reply will come as quickly as possible, so write now and get ready for *Soft-Touch* and trouble-free dialing. ■



CIRCLE 71 ON READER SERVICE COUPON

The two circles on the back of *Soft-Touch*'s printed circuit board are the connections to the telephone. Two spring terminals built into the handset which normally make connection to the telephone microphone (transmitter) press against the PC connections when the *Soft-Touch* is screwed down. Installation just couldn't be simpler!



SKY-HIGH CB

All it takes is a plane to triple your range.

by David Vine

Bill checks out the CB antenna mounted on one of his planes, a workhorse World War Two vintage Stinson L-5 high wing monoplane. The antenna, as noted in the article, is a regular unit designed for use in automobiles, which works fine here!



□ BILL DELISLE IS ONE of a growing number of airborne CBers. Citizens Band radio has long been a way of life with ranchers and folks living in the less populous areas of the U.S. Since many ranchers use planes to “check the north 40,” it’s just a natural progression to put CB radios into these planes as CB begins to rival the telephone in popularity. In ranch country, CB is often more convenient than Ma Bell.

“We have a ranch operation in western Nebraska,” says Bill. We use CB radio to check windmills to make sure they’re irrigating the land, and we can quickly notify a neighbor by CB if his windmills are not working. We also count bulls, and any problems we spot from the air can be reported to home by CB radio.”

The ranch houses in Bill’s hometown of Bingham, Nebraska, are spaced six to ten miles apart, but CBs in the airplane have a range of 15 to 25 miles at about 2,000 feet altitude. Bill reports the busier channels such as 19 and 11 are just about impossible to use unless the squelch is set at maximum, since airborne CBs pull in signals from such a long distance.

Planes Pose Problems. Bill explains, “We went to an aviation radio shop to have our CB installed. It worked fine parked on the ramp but as soon as we revved up the engine, we couldn’t hear a thing. The engine noise drowned out the CB audio.” He decided to run the CB audio output through the aircraft radio system, allowing him to hear it through the headset and cabin loudspeaker. “Our call numbers are KGO-

6830,” says Bill. “There are a lot of CBs going into aircraft in our area and the operators sometimes use the aircraft type as a handle. We get called the grasshopper because our plane is small and green but in our area everyone knows each other so we usually use first names.”

On one trip along I-80, motorists called Bill everything from “old army plane” to “spy in the sky” to “bear in the air,” and he says, “We were accused of all kinds of things.”

CB is Everywhere. Bingham is about 40 miles east of Alliance, the nearest “big” city. “We have a population of 21 in Bingham. One family had a couple of kids and that shot our population way up recently,” says Bill, laughing. He adds, “You’ll find an antenna on every pickup out our way. If something goes wrong, if someone gets stuck in the snow, or medical help is needed for a sick cow, or a person just needs to communicate with a neighbor quickly, CB is the answer. We feel CB is a safety factor you just can’t afford to pass up.”

“In our country area, about every third airplane has a CB. We have a unit in our station wagon, another in the pickup, a big base unit, and a portable unit that I carry in the tractor. The tractor got stuck in a vicious snow storm last February. There was just about zero visibility and tremendous winds. The tractor got hung up but I called a neighbor on the CB and he came and got me out. I would have had a long, hard walk of about three miles had it not been for the CB,” says Bill.

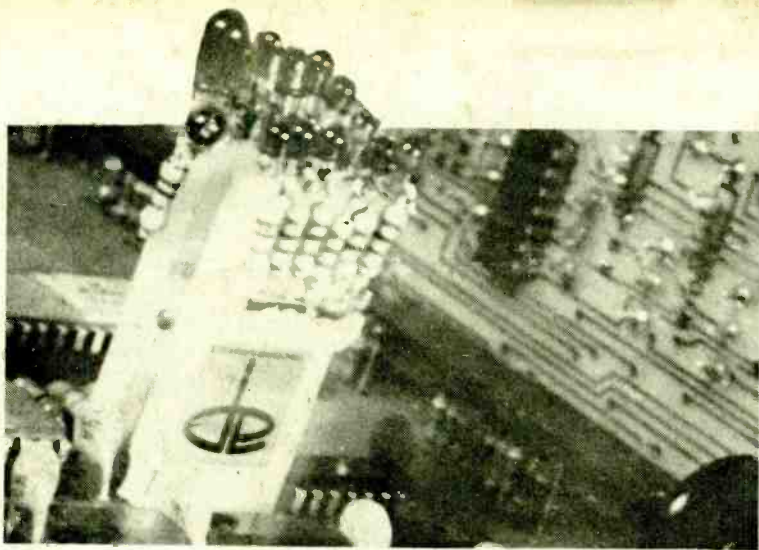
“We got away with a rather cheap

set in our less noisy Cessna Skyplane but when I got the Stinson L-5 (an older army plane) we needed a better unit with microphone gain control to damp out the noise in the cabin,” Bill reports. “You’ll find this control is a big help, even on motorcycles. You can reduce the sensitivity of the mike and you’ll have to scream into it but people don’t hear cockpit noise.”

Snow Storm CB Rescues. Most of the emergency rescues in Bill’s area have been caused by bad storms, so he’s been grounded, unable to join search efforts with his aerial CB station. However, CB has played a key part in saving lives. He recalls two potentially fatal emergencies. “There was an auto broken down during a particularly bad Nebraska snow storm. The person squawked for help on channel 19 and Lord love a duck, everybody came back to him. He was out in the country somewhere and everybody thought they knew where he was. Everybody and his brother jumped into their pickups, trucks, and cars and off they went looking for this poor fellow. The farmers and ranchers in that area took a terrible beating. The fences were cut, knocked down, and run over. It was a disaster because so many people came to help, but the guy was found before he froze.”

In another blizzard situation, CB radio can be credited as a communica-

(Continued on page 90)



chip-clip

IC testing got you flipping? Don't give up, try Chip-Clipping!

by James Gupton

□ The dual-inline-package (DIP) integrated circuit (IC) is not a really new electronics device; it's been around for more than ten years. While it was the microprocessor and mini-computer revolution that focused attention on this device, even those of us not involved in computers use ICs. For example, tape decks, radios, and television receivers now use them. Unfortunately, ICs are not infallible, and do on occasion breakdown. Due to the compact size of the IC, working space between devices is scant, to say the least. The need for an IC tester becomes apparent when one tries to follow a schematic diagram, manhandle two snake-like probes, and keep one eye on a meter and the other on an IC pin at the same time. That's where our deluxe *Chip-Clip* becomes a necessity.

Most frequently, repairmen come across digital ICs. In digital logic circuits there are only two input and output values (called states), low or high, corresponding to off or on. Most digital logic ICs use a voltage of +5 volts DC for the high state and 0 volts for the low state. We use the low or high voltage to turn off or on a light emitting diode (LED) and let a number of LEDs tell us what the present state is at every IC pin simultaneously. *Chip-Clip* will close on the small, tightly spaced IC pins without shorting adjacent pins. Equally important, it can be attached to an IC when there is only a quarter of an inch of space between circuit components.

To further illustrate the utility of our *Chip-Clip*, let's take a look at two types of logic ICs. We have illustrated a 7420, quad input, positive, NAND gate. It actually contains two separate four-input NAND gates, one on each side of the DIP. In either circuit, the output voltage will be high if a low voltage appears on any of the four input pins. When all four input voltages are high, the output voltage goes low. Therefore, to find out why the output

is high on either or both NAND outputs, there are eight close-quarter voltage measurements that you must make. Imagine how difficult it would be to keep your meter probe in the right spot without wandering and shorting between pins! We have also diagrammed the 7404 hex inverter logic IC. Here we have not two logic devices but six independent inverting circuits. In operation, if a high voltage appears on the input pin, the output drops to a low voltage. Should the input go low, the output goes high. By taking advantage of the high and low voltage states, we can observe the on or off condition of the LEDs and see the status of all six inverters simultaneously. Here, too, the *Clip-Chip* will prove an invaluable aid.

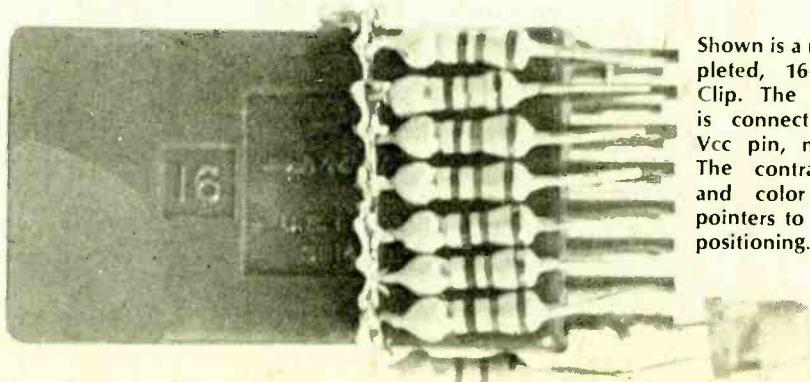
Building the Chip-Clip. The foundation of the *Chip Clip* is the standard 14 pin or 16 pin IC test clip available at any Radio Shack store or from any number of electronic mail order firms. To the IC test clip we add subminiature LEDs and a current limiting resistor between each logic test-clip pin and the IC ground pin. As mentioned previously, when low voltage is present on the IC pin, the LED does not light. When +5 volts appears on the logic input pin, the LED turns on. In addition, *Chip-Clip* has a different color LED on the Vcc connection (pin 14 or 16) to confirm the presence of Vcc

voltage. The contrasting LED color prevents confusing Vcc indication with a logic indication.

The assembly drawing illustrates the necessary connections for the 14 pin *Chip-Clip*. If you are building a 16 pin unit, two additional LEDs and resistors are needed for the two extra test points. The IC ground changes to pin 8 and Vcc input changes to pin 16. The additional LEDs are connected to pins 7 and 15. No other changes are necessary.

The ground pin is connected to a common ground wire loop. It consists of two rectangular loops fashioned from 20 gauge solid wire. One of these loops is placed around each edge of the test clip one-half inch down from the top of the plastic. Four 0.028 holes are drilled to anchor the ground bus to the test clip. Since there is one ground bus loop on each half of the test clip, they must be connected together with a short piece of #20 flexible stranded wire to allow free movement of the test clip's sections and enable the test clip to clamp onto the IC DIP pins.

On the 14 pin test clips, six 150 ohm, quarter watt resistors are soldered to the ground bus loop on each side of the test clip and are positioned vertically. The body of the resistors should not stand above the top of *Chip-Clip*'s frame and the resistor leads should be trimmed to the level of the metering pins. The



Shown is a nearly completed, 16-pin *Chip-Clip*. The green LED is connected to the Vcc pin, number 16. The contrasting size and color serve as pointers to the correct positioning.

e/e CHIP-CLIP TESTER

resistor for the Vcc pin is positioned at the same level as the rest of the resistors but instead of being positioned on the side of the test clip, it is placed at the end of the clip next to the Vcc pin.

Finishing Touches Installing the LEDs is only a matter of soldering the cathode LED lead to a resistor and the anode lead to one of the test clip's metering pins. The cathode lead can be identified by its knotch or flat side. Remember, no LED goes to the test clip's pin 7 on a 14 pin Chip-Clip, or pin 8 on a 16 pin one. All other test clip metering pins have a LED and resistor attached. It should be noted that the specified LEDs have a forward voltage rating of 1.6 volts d.c. and a maximum current rating of 20 mA. For voltages greater than 5 volts at Vcc, a new value of current limiting resistance must be used. (See accompanying box.)

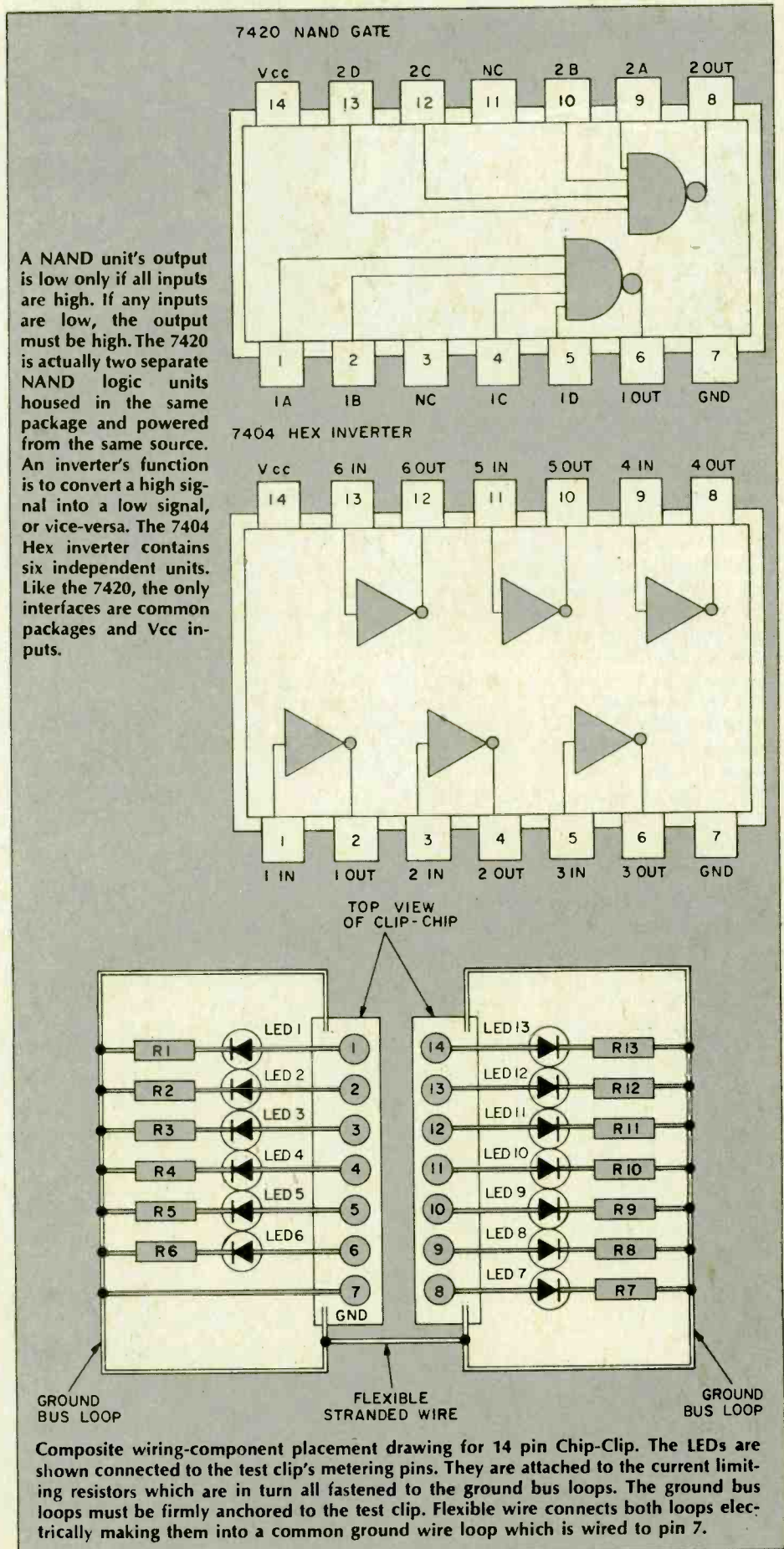
Determining Limiting Resistance
 The simplest way to determine the value of current limiting resistance for any value Vcc is by the formula:

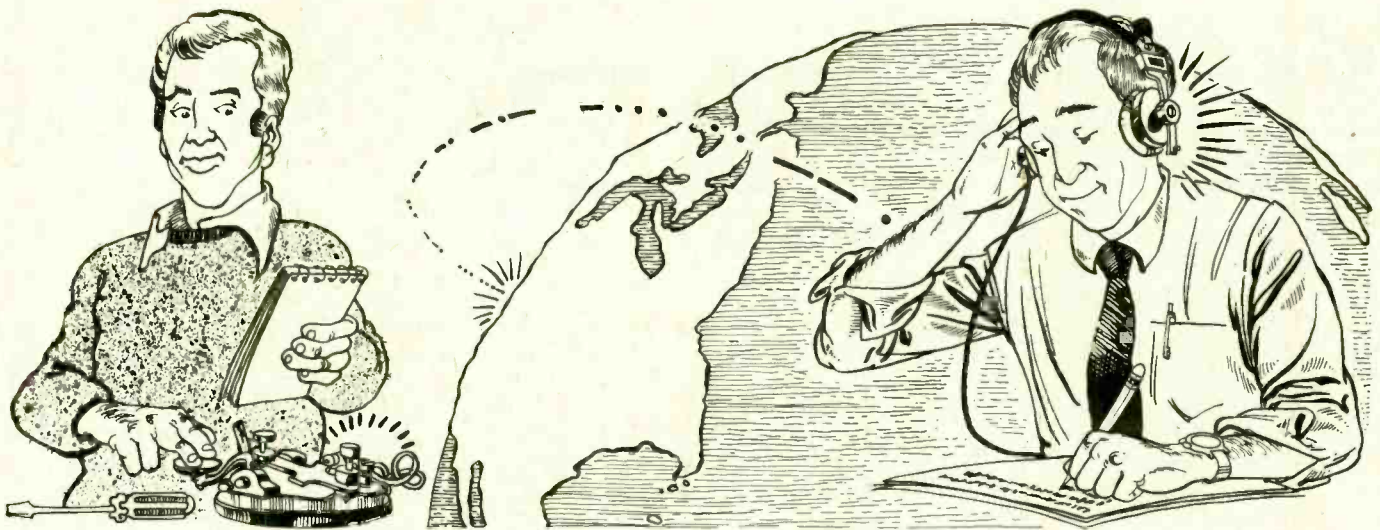
$$R = \frac{V_{cc} - 1.6}{.020}$$

Vcc = voltage greater than + 5 volts.
 1.6 = forward voltage of LED
 .020 = maximum LED current
 R = the new resistance

While almost any size LED can be used, the subminiature LED is recommended because of the limited space across the side of the IC test clip. In the author's model, a green emitting LED, jumbo size, was used to indicate the presence of Vcc voltages. The contrasting color prevents mistaking the lit LED as a logic function and serves as a pointer to the correct positioning of the test clip on the IC under test since the Vcc indicator is on pin 14 or 16.

Final Checkout. There are two things to be sure of. Be certain that the LEDs polarities are observed. Also, identify pins 1 and 14 on the 14 pin test clip or 1 and 16 on the 16 pin test clip and always be sure that these numbers always point towards the IC identifying notch, dot, or indenture on the top of the IC case. Final note, while these logic status test clips have been designed only for logic type ICs, it may be possible to employ them for other 14 or 16 pin ICs providing your schematic diagram confirms pins 7 or 8 as ground and pins 14 or 16 as Vcc. If in doubt, *don't use the Chip-Clip.*





EVEN THOUGH THE STORM had passed, Dave, WA6RGJ, stayed close to his radios. He knew that local flooding can short underground cables, interrupting power and telephone service. If that happened, two-way radio might be the only link to safety. But the bands remain quiet. Just a single carrier on Channel 9, without modulation. Probably some kid playing with the family CB rig. Dave politely asks the station to stop blocking the emergency channel which is continuously monitored by Dave and other REACT volunteers in this coastal town.

Suddenly the carrier flicks on and off rapidly! Always alert, Dave asks, "Are you in trouble? Do you need assistance?"

Again the carrier flicks on and off. "Use one click for no, two clicks for yes. Again, are you in trouble?" Two clicks. "Do you need help?" Two clicks. "Are you in a car?" One click. "A boat?" Two clicks, and another two clicks, faster this time.

Before Dave dials the Coast Guard, he tries a stab in the dark, "Do you know the Morse code?" Two clicks! "Standby while I hook up a system to copy code on this CB rig."

Moments later, Dave has connected a jury-rigged beat frequency oscillator, essential for copying code. "Go ahead. Describe your location and problem. I am a ham radio operator and will copy your code and relay to the Coast Guard."

Soon Dave has the Coast Guard on the line, asking them to go to the rescue of a small yacht a few miles off the coast. Badly battered in the storm, it is leaking, engines out, and microphone smashed.

The Coast Guard dispatcher is skeptical. "How did you find out all this if his microphone is broken?"

MORSE CODE --

Obstacle or Opportunity?

by Charles J. Harris
WB2CHO

Dave quickly explains the makeshift code transmission. Within minutes the Coast Guard cutter is on the way.

Ridiculous? Never happen? What you have just read is a dramatization of a true story. Dave McCollum is a ham who never lost his interest in CB public service work. He regularly monitors both channel 9 and the local amateur radio emergency frequencies. His ability to use Morse code often comes in handy on the ham bands, but this was his first cw contact on the 11-meter Citizen's Band! The skipper of the troubled ship learned code as an Eagle Scout; this was his first opportunity to make a contact in cw! Normally prohibited by FCC rules, cw is allowed under emergency situations to help save a life.

Ham Talk. Morse code, cw, the International code, that dit-dah stuff. By whatever name, the Morse code is an essential and valuable part of every amateur radio operator's training. It is what sets the radio ham apart from other communicators, and is the common bond between amateurs throughout the world.

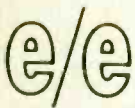
To get a ham radio license in the United States, you have to pass an ex-

amination in sending and receiving code. (A code-free license has been proposed by the Federal Communications Commission, but the increased interest in CB has postponed action on this idea for at least a couple of years.) Meanwhile, a new, easier code examination and improved teaching methods have greatly simplified the once-difficult task of mastering the code. These changes and improvements have put the amateur radio license, with its worldwide range and almost unlimited freedom, within the reach of any interested radio communicator.

Is Morse Obsolete? Why code? The simplest answer is that international agreements require it. Every amateur must possess knowledge of the Morse code. But this does not really answer the question. Why does this requirement exist?

Morse code is still the most efficient method of radio communication known. The equipment needed to send code is far less complex than that needed for voice, and far less expensive. Code can get through interference and noise more effectively than any other mode of communication, which is why it is used to handle most amateur radio messages, and is also used in weak signal work such as bouncing radio signals off the moon. Code is efficient in the use of the radio spectrum: almost 30 code signals can fit into the same band occupied by a single voice station, which helps reduce interference. Finally, code is a universal language. Hams throughout the world, from Russia to Rochester, can communicate with each other with Morse code.

More than 40% of all amateurs in the United States use code as their major amateur radio activity; many more use the code regularly. Every amateur has the ability to communicate in code;



EASY MORSE CODE

it is the common bond which ties together amateurs from all walks of life, in every country and every age bracket. Code and amateur radio have been inseparable more than 60 years. Unless you are willing to wait at least until 1980 to get your code-free ham license, you will have to spend a little time getting to know the code. It's a lot easier than you think!

First Steps. It takes only a few hours of study to reach a code proficiency of five words per minute (5 wpm), needed for the most basic amateur radio licenses: Novice and Technician. Almost everyone can pass the new comprehension-style code exams with less than ten hours of code practice, and many make do with as little as five hours. A mere 15 minutes of practice each day is all you'll need to pass that magic 5 wpm level in a few weeks, and be well on your way to higher code speeds. It really is simple, thanks to some of the new teaching aids now available.

In learning the code, you want to build up a habit, just as in learning to ride a bicycle. You learn a few motions, and pretty soon you are riding—or copying the code—without thinking about it. The trick is to start on the right foot. You can cut your effort in half by using the proper approach.

Many would-be radio amateurs have run into difficulties learning the code because they tried to tackle *two* translations at the same time. They learned it from a piece of paper, with the code written down as either dots and dashes or dits and dahs. Either way, they learned letters as combinations of dits and dahs, not as *sounds*. If you learn this way, you have to translate the sounds you hear into dits and dahs, and then translate *that* into the letters. The double translation is twice as much work and twice as difficult, especially when you are trying to learn both translations at the same time.

The right way to start is to translate the code from sounds to letters directly, skipping the additional step: half as much effort, and twice as fast! All you need is the correct training aids.

To learn the code by this sound-only system, you need someone to speak the letter and send the code. "A—didah, a—didah." Every time you hear the sound, think of the letter, and write it down. The letters should be sent at a fast character speed, with long spaces between them to lower the resultant speed.

Slow Speed Code Practice from W1AW

	UTC	pdst	cdst	edst
Monday, Wednesday and Friday.	1300	6 am	8 am	9 am
	2300	4 pm	6 pm	7 pm
Tuesday, Thursday, Saturday and Sunday	2000	1 pm	3 pm	4 pm
	0200	7 pm	9 pm	10 pm

Frequencies: 1.835, 3.58, 7.08, 14.08, 21.08 and 28.08 MHz

Using this method, you can avoid the temptation to think of code in terms of dots and dashes. A character speed of about 16 words per minute is about right to start, with long spacing between letters to reduce the effective speed down to a couple of words per minute. (A code "word" is five letters long; a speed of 5 words per minute (wpm) is 25 letters per minute, or about one letter every two seconds. Numbers and punctuation each count as two letters.) Finally, avoid learning similar sounding letters at the same time. Before long, you'll be copying code in automobile horns and whistles.

What if you don't have someone to say the letters and send the code? A good recording of an instructor talking, reading the characters and sending the code, is an adequate substitute. The recording in the ARRL *Tune in the World with Ham Radio* package uses two instructors and properly formed characters to lead you quickly through the first steps in code learning. This system has been used by more than 50,000 prospective amateurs during the past few months, with unparalleled success. Heathkit Company offers the same system in their Novice training courses, and even the military training programs now use the *Tune in the World* code.

Practice—the Key to Code. Learning the letters is the first step in building code skill. The next step is practice. There is no substitute for continued, diligent practice in mastering the Morse code. Proper forms of practice, however, can smooth the path to code proficiency just as proper teaching techniques make it easy to learn the letters in the first place.

The three simplest ways to enhance your command of the Morse code are: code practice oscillators, tapes and records, and on-the-air code practice. If you're willing to devote between 15 and 20 minutes each day with one or more of these aids, you'll be on the bands with your own amateur license in weeks.

The most flexible of these is the code practice oscillator, or cpo. Even a buzzer will work for a cpo, but there are many kits and ready-made electronic cpos available from only a few dollars (see table). With the addition of a key, speaker and power supply of some nature (usually an inexpensive battery), any one of these cpos will produce a note very similar to what you will hear on the air.

Sit down with another member of the family or a friend and send to each other for a few minutes. The instructor of your radio class can provide code



Every month, thousands of new Hams take to the airwaves—and it's not as hard to be among them as you might think. The Morse Code (or CW) can be easily mastered by just about everyone. You can learn at one of the thousands of classes throughout the country, as pictured here. Or, you can pick up one of the new study-at-home courses. No matter which method you choose, Ham Radio communication can open the world.

Sources of Code Practice Oscillators

Supplier	part number	cost	address
Radio Shack	20-1155	\$ 1.99	(local store or catalog)
	28-105	4.49	
Heathkit	HD-1416	12.95	Benton Harbor, MI 49002
G. R. Whitehouse		5.95	Newbury Drive, Amherst, NH 03031
MFJ Enterprises	CPO-555	15.95	P.O. Box 494, Mississippi State, MS 39762
Ramsey Elect.	CPO-1	2.50	P.O. Box 4072, Rochester NY 14610

practice material geared to your progress through the letters, or you can use any book or magazine, sending only those letters you have learned. Try sending for about five minutes straight, and then compare what you sent with the text. Then switch roles for another five-minute session.

If you don't have someone working with you on the code, you can still use the readily available tapes and records for additional practice. Just make sure the code is sent at high character speed, with longer spacing between letters. Most of the popular brands use this system today: AMECO, 73, and the new *ARRL Code Kit*. Random letters and numbers, such as found on the *Code Kit* cassettes, make for long-lasting practice, as you cannot anticipate or memorize the code.

Another alternative for additional code practice is listening to contacts or code practice on the air. If you already own an amateur band receiver or transceiver, you can receive a wealth of code practice throughout the ham bands. The Novice bands in particular are filled

Novice Frequencies: Code

3700-3750 KHz 21100-21200 KHz
7100-7150 KHz 28100-28200 KHz

with slow speed contacts, and make good practice for the comprehension

code exam and future on-the-air contacts. The well-known W1AW code practice is also very useful, as many thousands of amateurs have found that its machine-produced code is excellent practice. This station recently changed its code practice schedule to include more practice at slower speeds; check the schedule which accompanies this article.

Whatever method you use to practice the code, you should be conscientious about sticking to a regular schedule. As little as 15 minutes each day will do wonders—but an hour one day in four will leave you frustrated and disappointed. It's *daily* practice that helps the most.

Have your code practice partner send (or listen from tapes or W1AW) at a speed a little faster than you can copy perfectly. Your greatest increase in speed comes when you are pushing a little. If you get almost every letter at 3 words per minute, do most of your practice about 4 to 5 wpm; you'll get fewer letters, but your speed will increase that much faster.

If you want to spend more than 15 minutes per day on the code, break up the practice sessions in blocks of no more than 20 minutes. Do something completely different for a while, and

then go back to the code for a few minutes. Hours and hours of continuous practice can be discouraging, and really isn't necessary although some people have mastered the code in less than a single day of dedicated effort! It can be done.

Off and Running. Receiving is only half of communicating via Morse code; you also must be able to send accurately. It is a lot easier to learn how to send properly than to receive, but you should spend at least a few minutes of each session working on the other half of code communications.

If you are working with someone else, you automatically get your sending practice on a regular basis. Any sending problems such as running letters together or poor character formation will stand out quickly, and be quickly corrected. If you are using a tape for practice, record a few minutes of your own sending on a blank cassette. Listen to it the next day, and see if you can copy it. Again, any slight irregularities will show up rapidly. Finally, W1AW includes some text from recent issues of the monthly ARRL journal, *QST*, every week. You can send along (not on the air!) and compare your "fist" to the code practice machines at W1AW. The booklet in the *ARRL Code Kit* contains additional hints on both sending and receiving.

The Finish Line. If you are like most of us, a few weeks of 15-minute per day, 5-6 day per week practice will bring you to the needed 5 word-per-minute proficiency level. All that remains is to take the code test itself. Any qualified amateur radio operator can give you the test; The ARRL, Newington, CT 06111, has a file of more than 4,000 instructors who regularly give comprehension style code exams.

For the test itself, the examiner will send a standard amateur contact, just like you would hear on the air, or as found on the back of the *Tune in the World* cassette tape. Then he will give you ten multiple choice questions about what was in the contact: the operator's callsign, name, location, etc. Passing grade is eight or more out of ten.

It is impossible to "fail" the code test, as new FCC rules allow you to continue to take it until you pass! It's simply a matter of concentrating on the code for a few minutes.

As thousands of new hams discover every month, the code is *not* designed to keep you from getting an amateur radio license. It's an integral part of amateur radio that opens the door to one of the most exciting avocations in the world: ham radio. ■



Heathkit's study-at-home course includes a Code tape and a second cassette used in conjunction with their specially prepared, loose-leaf course covering everything you will need to pass the Novice exam. The course is also available with a CPO kit. Either option has a unique guarantee—your money back if you don't pass the Novice.



The American Radio Relay League's (ARRL) study course for the Novice includes a CW tape and a hundred-page workbook, to speed you on your way to a Ham 'ticket.' This and any other course can be enriched by listening to W1AW, the ARRL's on-the-air CW practice station. The frequency and time schedule is included in this article. Good Luck!

IT'S SIMPLY BASIC

Solve for Ohm's Law, Reactance and Frequency with this Wizard of a Program!
by Larry Friedman, WB2AHN

Here's a universal program that solves many, if not most, of an experimenter's typical problems in Ohm's Law, reactance, and frequency. The program can be kept loaded in your computer's memory so it will be at your fingertips as you test or develop projects, or work school problems.

Unlike the simplified programs we've used in previous issues, this one is moderately long, somewhat complex, and utilizes a few special tricks you should be familiar with as you get into serious programming. Exponentiation is shown in line 640 by simply multiplying a number by itself (squaring), in line 840

the *up arrow* (on teletypewriters the *shift-N*) is used. The *up arrow* is the common programming symbol for exponentiation and you really should get in the habit of using it at all times, even if you are simply squaring a number or term. (Note: On some computers the *double-asterisk*, or **, is

used in place of the *up arrow*.) This issue's program also illustrates how to get quotation marks to appear in a program's *run*. Normally (there are exceptions), you cannot use quotation marks in a *run* because, in BASIC, they act as *delimiters* for the

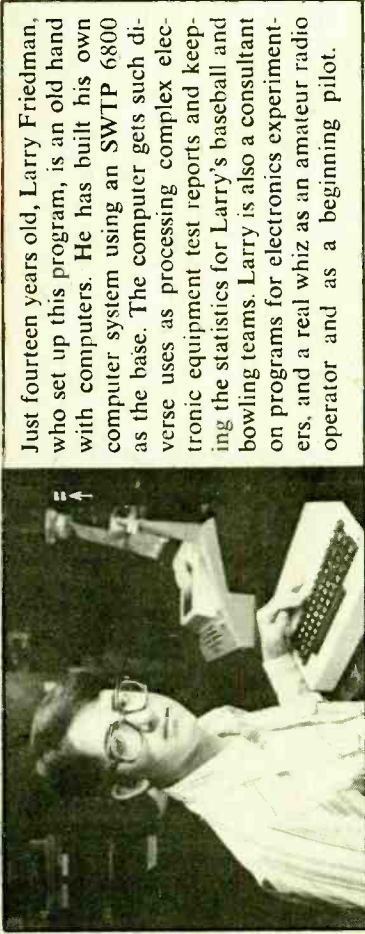
(Continued on page 91)

ELECTRONIC EQUATION CRUNCHER

```

0100 REM "ELECTR" BY LARRY FRIEDMAN
0101 INPUT "DO YOU WANT INSTRUCTIONS";MS
0102 IF MS="N" GOTO 116
0103 PRINT "DIRECTIONS FOR USING THIS PROGRAM:"
0104 PRINT "THE COMPUTER WILL ASK YOU FOR THE VALUES OF "
0105 PRINT "E,I,R,P,L,C,F,TIME (PERIOD),X(C), AND X(L).";
0106 PRINT "ENTER THE KNOWN VALUES. ENTER 0 FOR UNKNOWN VALUES."
0107 PRINT
0108 PRINT "IF YOU MAKE AN ERROR WHEN ENTERING A VALUE,"
0109 PRINT "ENTER -1 FOR THE NEXT VALUE AND THE COMPUTER WILL BACK "
0110 PRINT "UP TO THE VALUE WHERE THE ERROR WAS MADE."
0111 PRINT
0112 PRINT "WHEN THE COMPUTER ASKS YOU IF YOU WISH TO CHANGE ANY ";
0113 PRINT "VALUES, TYPE ";CHR$(34);"NO";CHR$(34);" IF YOU WISH ";
0114 PRINT "TO LEAVE THE PROGRAM, TYPE ";CHR$(34);"YES";CHR$(34);
0115 PRINT
0116 PRINT
0120 DIGITS= 4
0130 PRINT "ENTER THE FOLLOWING DATA. USE 0 FOR UNKNOWN VALUES."
0140 INPUT "ENTER E IN VOLTS";E
0150 INPUT "ENTER I IN AMPERES";I
0160 IF I=0 GOTO 140
0170 INPUT "ENTER R IN OHMS";R
0180 IF R=0 GOTO 150
0190 INPUT "ENTER P IN WATTS";P
0200 IF P=0 GOTO 170
0210 INPUT "ENTER L IN HENRIES";L
0220 IF L=0 GOTO 190
0230 INPUT "ENTER C IN FARADS";C
0240 IF C=0 GOTO 210
0250 INPUT "ENTER F IN HERTZ";F
0260 IF F=0 GOTO 230
0270 INPUT "ENTER TIME (PERIOD) IN SECONDS ";T
0280 IF T=0 GOTO 250
0980 IF C=0 GOTO 1000
0990 X(1)=1/(6.28*F*C)
1000 NEXT N
1010 PRINT
1020 PRINT "E=";E
1030 PRINT "I=";I
1040 PRINT "R=";R
1050 PRINT "P=";P
1060 PRINT "L=";L
1070 PRINT "C=";C
1080 PRINT "F=";F
1090 PRINT "X(C)=";X(1)
1100 PRINT "X(L)=";X(2)
1110 IF F=0 PRINT "TIME (PERIOD) = 0"
1120 IF F<>0 PRINT "TIME (PERIOD) =" ;I / F
1130 PRINT
1140 PRINT
1150 PRINT "DO YOU WANT TO MAKE ANY CHANGES?"
1160 INPUT MS
1170 IF MS="N" GOTO 1410
1171 REM - THE COMPUTER WILL NOW RESET THE VALUES TO 0
1172 E=0
1173 I=0
1174 R=0
1175 P=0
1176 L=0
1177 C=0
1178 F=0
1179 T=0
1180 X(1)=0
1181 X(2)=0
1182 PRINT "HOW MANY CHANGES?"
1190 INPUT A
1200 FOR K=1 TO A

```



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


```

0290 INPUT "ENTER X(C) IN OHMS",X(1)
0300 IF X(1)=1 GOTO 270
0310 INPUT "ENTER X(L) IN OHMS",X(2)
0320 IF X(2)=-1 GOTO 290
0330 PRINT
0340 FOR N=1 TO 2
0350 IF E<>0 GOTO 450
0360 IF I=0 GOTO 390
0370 IF R=0 GOTO 420
0380 E=I/R
0390 IF R=0 GOTO 450
0400 IF P=0 GOTO 600
0410 E=SQR(P/R)
0420 IF I=0 GOTO 450
0430 IF P=0 GOTO 450
0440 E=P/I
0450 IF I<>0 GOTO 550
0460 IF E=0 GOTO 490
0470 IF P=0 GOTO 520
0480 I=P/E
0490 IF R=0 GOTO 550
0500 IF P=0 GOTO 550
0510 I=SQR(P/R)
0520 IF E=0 GOTO 550
0530 IF R=0 GOTO 550
0540 I=E/R
0550 IF R<>0 GOTO 650
0560 IF E=0 GOTO 590
0570 IF I=0 GOTO 620
0580 R=E/I
0590 IF P=0 GOTO 650
0600 IF I=0 GOTO 650
0610 R=P/(I*I)
0620 IF P=0 GOTO 650
0630 IF E=0 GOTO 650
0640 R=(E*E)/P
0650 IF P<>0 GOTO 750
0660 IF E=0 GOTO 690
0670 IF I=0 GOTO 720
0680 P=E*I
0690 IF I=0 GOTO 750
0700 IF R=0 GOTO 750
0710 P=(I*I)/R
0720 IF E=0 GOTO 750
0730 IF R=0 GOTO 750
0740 P=(E*E)/R
0750 IF F=0 GOTO 910
0760 IF C=0 GOTO 830
0765 IF L<>0 GOTO 820
0770 L=((1/(6.28*f))*2)/C)
0780 GOTO 840
0790 INPUT "ENTER X(L)
      (OR 0 IF UNKNOWN VALUE)",X(2)
0800 IF X(2)=0 GOTO 820
0810 L=X(2)/(6.28*f)
0820 IF C<>0 GOTO 900
0830 IF L=0 GOTO 960
0840 C=((1/(6.28*f))*2)/L
0850 GOTO 900
0860 IF X(1)<>0 GOTO 900
0870 INPUT "ENTER X(C)
      (OR 0 IF UNKNOWN VALUE)",X(1)
0880 IF X(1)=0 GOTO 900
0890 C=1/(X(1)*(6.28*f))
0900 IF F<>0 GOTO 940
0910 IF L=0 GOTO 940
0920 IF C=0 GOTO 940
0930 F=1/(6.28*SQR(L*C))
0940 IF L=0 GOTO 970
0950 IF F=0 GOTO 970
0960 X(2)=6.28*f*L
0970 IF F=0 GOTO 1000

```

```

1210 DIGITS= 0
1220 PRINT "WHAT IS CHANGE #";K
1230 INPUT P$
1240 IF P$="E" INPUT "ENTER E IN VOLTS",E
1250 IF P$="I" INPUT "ENTER I IN AMPERES",I
1260 IF P$="R" INPUT "ENTER R IN OHMS",R
1270 IF P$="P" INPUT "ENTER P IN WATTS",P
1280 IF P$="L" INPUT "ENTER L IN HENRIES",L
1290 IF P$="C" INPUT "ENTER C IN FARADS",C
1300 IF P$="F" INPUT "ENTER F IN HERTZ",F
1310 IF P$="X(C)" INPUT "ENTER X(C) IN OHMS",X(1)
1320 IF P$="X(L)" INPUT "ENTER X(L) IN OHMS",X(2)
1330 IF P$="TIME" INPUT "ENTER TIME IN SECONDS",T
1340 IF P$="PERIOD" INPUT "ENTER PERIOD IN SECONDS",T
1350 PRINT
1360 PRINT
1370 NEXT K
1380 PRINT
1390 DIGITS= 4
1400 GOTO 330
1410 END

```

```

RUN
DO YOU WANT INSTRUCTIONS? YES
DIRECTIONS FOR USING THIS PROGRAM:
THE COMPUTER WILL ASK YOU FOR THE VALUES OF
E,I,R,P,L,C,F,TIME (PERIOD),X(C), AND X(L).
ENTER THE KNOWN VALUES. ENTER 0 FOR UNKNOWN VALUES.
IF YOU MAKE AN ERROR WHEN ENTERING A VALUE,
ENTER -1 FOR THE NEXT VALUE AND THE COMPUTER WILL
BACK UP TO THE VALUE WHERE THE ERROR WAS MADE.
WHEN THE COMPUTER ASKS YOU IF YOU WISH TO CHANGE
ANY VALUES, TYPE "NO" IF YOU WISH TO LEAVE THE PROGRAM.
TYPE "YES" IF YOU HAVE TWO OR MORE CHANGES TO MAKE.
ENTER THE FOLLOWING DATA. USE 0 FOR UNKNOWN VALUES.
ENTER E IN VOLTS? 4
ENTER I IN AMPERES? 4
ENTER R IN OHMS? 0
ENTER P IN WATTS? 0
ENTER L IN HENRIES? .001E-6
ENTER C IN FARADS? 0
ENTER F IN HERTZ? 1000000
ENTER TIME (PERIOD) IN SECONDS ? 0
ENTER X(C) IN OHMS? 0
ENTER X(L) IN OHMS? 0

```

```

E=4.0000
I=4.0000
R=1.0000
P=16.0000
L=1.0000E-09
C=2.5356E-07
F=10000000.0000
X(C)=0.0627
X(L)=0.0628
TIME (PERIOD) =1.0000E-07

```

```

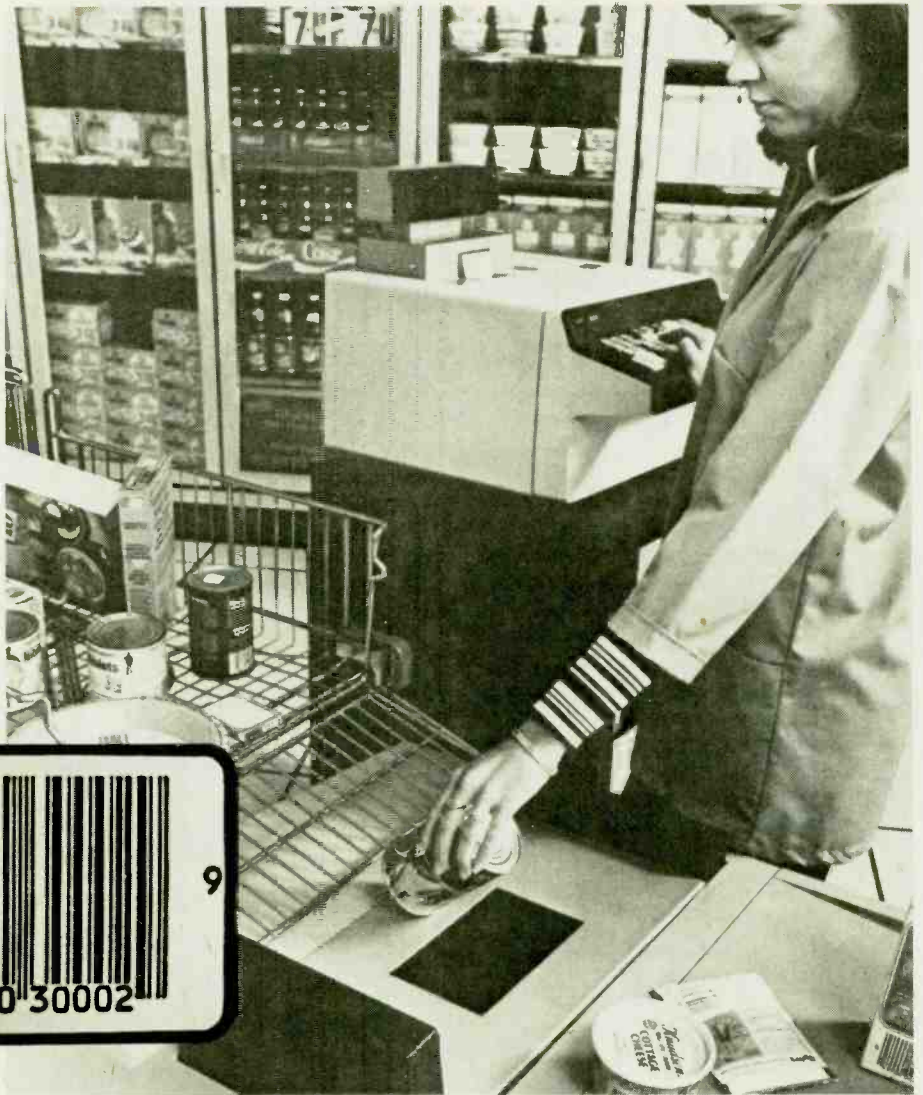
DO YOU WANT TO MAKE ANY CHANGES?
? YES
HOW MANY CHANGES?
? YES
RE-ENTER
? 4
WHAT IS CHANGE #1
? E

```

(Continued on page 91)

MORE STRIPES, LESS GRIPES!

* * *GEMCO -- FOOD* * *			
	MILK		.69
	MILK		.69
	DELI DEPT		1.32
1.38#	SQUASH@	.05	.07
3	CORN		.51
.73#	SQUASH@	.5	
.66#	SQUASH@	.5	
.22#	SQUASH@	.5	
	TAX DUE		
	TOTAL		
	CSH PAID		
	CHG DUE		
11/25/75	10:39	00	
GEMCO THANKS YOU			



Pricing Computers come to the local supermarket by Shane Piroli

□ When next you hand your favorite supermarket cashieress a tin of tuna don't be surprised if, rather than simply ringing it up, she whizzes it over a glass plate set into the top of the check-out counter and then presents you not with a simple register tape but with a completely itemized bill. Yes, computers have come to the local market!

Already, dozens of stores have installed the Universal Product Code System from IBM and it looks as if this is one wave of the future destined sooner or later to engulf us all. What will it all mean? Hopefully, lower prices and faster service at the consumer level and better inventory control and re-ordering procedures for the store manager.

It's all accomplished by a microprocessor computer which uses an optical scanner to "read" those black and white stripes which, by now, everyone and

their Aunt Tillie has already noticed on nearly every package, box or can from even non-computerized stores. The fact of the matter is, manufacturers fully expect that all stores of large enough volume will become computerized, so they've already tooled up to label their products in computer-communicable language.

The optical scanner is beneath a glass-topped slot in the countertop (the slot being about a foot wide and several inches long). The unit can read the stripe-code no matter where it appears on the face of the glass. It can, in fact, read both "forwards" and backwards" so that it makes no difference which direction the product is moved along the scanner's screen. If the cashieress actually misses the oversize screen no code will be read and the computer will thus inform its fallible human to try it again.

Products will, of course, still be labeled with normal prices via shelf-labels so that the consumer will be able to comparison shop and also know when he's reached the end of his wallet. Produce items, too fragile to be UPD

stripe-encoded, will be priced normally and also marked with a code number the register operator can feed manually into the computer.

The computer, being a computer, is quite good at arithmetic and is capable of automatically computing sales tax, coupons, food stamps and both the amount given the cashieress and the change due the customer. Even better, all of this information is printed out on the register receipt and fully itemized; the consumer has a "hard" copy of all the fact which went into computing his bill so he can double-check it all at his leisure.

The even more futuristic possibilities inherent in this development are imagination staggering. Imagine going into a supermarket with no more money than what's in your bank account, and that not on you.

The computer age is still just beginning. Even now our lives are changing at every level in response to high technology moving into ever more and more areas of our lives. Such things as this supermarket computer seem to be one of the more positive results ■

e/e assembles the...

PAiA PROGRAMMABLE DRUM SET

This electronic drum can play
the hottest gigs.



PLUG THIS DRUM-SOUND synthesizer into your audio amplifier to create the sounds of snare, bass, accent bass, tom-tom, conga, wood block and clave drums. This PAIA Programmable Drum Set will provide almost any rhythmic pattern you can dream up and at a wide range of speeds. This tireless, electronic partner can turn your dull practice periods into real jam sessions, or provide the beat for your combo when a drummer is not available.

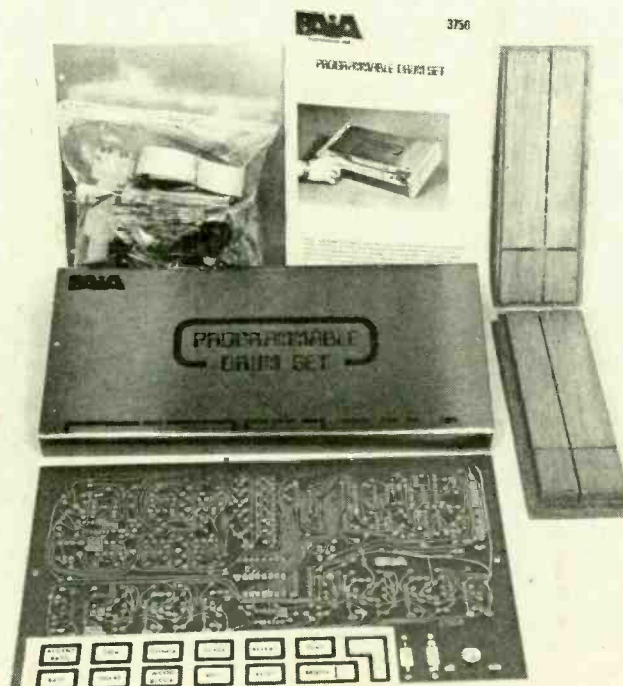
The appropriate capacitance-sensitive touch pads are pressed to enter and store two separate pairs of rhythmic patterns for repeated playback. Each of the two main patterns is paired with a separate bridge pattern which can be automatically switched on at a preprogrammed time. This is handy for introductions and other digressions from the main beat. Playback tempo can be varied by a control knob to obtain a steady beat at any speed; or the pattern can be played manually. Other handy features of the PAIA kit include program editing and external synchronization capabilities.

Construction. This should pose no problems if a few basic precautions are observed. The unit contains about a dozen CMOS (Complementary Metal Oxide Semi-conductor) integrated cir-

cuits which can easily be damaged by static electricity during installation. Each CMOS has an attached piece of conductive foam material to protect it. Do not remove the foam until told to do so, and install these parts only in the order given in the manual. Use a small,

pencil type soldering iron because the transistors and integrated circuits can be damaged by excessive heat. Foil patterns on the printed circuit board are spaced closely, so take care to avoid solder bridges. The instruction manual has other, similar bits of advice you

The PAiA Programmable drum set consists of a PC board, metal chassis, two wooden sides, a bag of components, and an instruction manual. Everything is especially well-designed, and the kit goes together beautifully. With a few hours work you'll soon be programming your favorite tempos. Circle No. 70 on the Readers Service Card.



e/e PROGRAMMABLE DRUM

should heed.

The unit requires a good ground for proper operation. Usually, the ground made through the attached amplifier powerline is sufficient, but an earth ground (water pipe) may be needed if the unit is used with a battery powered amplifier. The drum set itself is battery powered; it uses four penlight cells and one nine volt transistor radio battery. Since the current drain during operation is a significant 100 ma. in full operation, and 30 ma. in *save* mode, keep the unit turned off when you're not actually using it.

Tactics of Percussion. There is a natural tendency on the part of everyone who has ever played with the Programmable Drums to try to enter the patterns "in tempo" by beating out the rhythm on the touch switches. *This is not the way it is done.* Any pattern you enter must have *rest's* entered with the pattern for proper spacing of the drum beats.

A simple foxtrot-shuffle pattern would be entered like this: press *reset* to clear the internal events counter. Press *program* to put the unit into programming mode (the red program indicating LED should come on). Then, in sequence, press *heavy bass / rest / snare / rest / bass / rest / rest / snare*. If you wish the program to repeat over and over, press *repeat* at this point. To play back the program, press *reset*, then *play*. The program should play back at whatever speed the tempo control is set for.

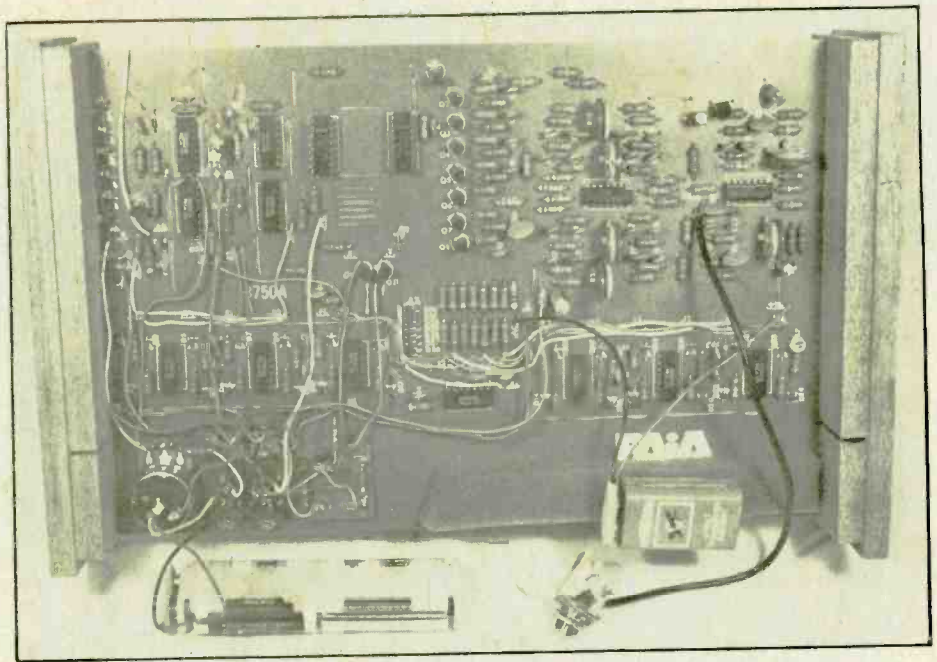
A *score* switch determines which of the two possible programs will be selected. Each program may consist of a main pattern and a bridge pattern.

A *save* switch lets you store a program for a short period of time when the rest of the unit is turned off. Since the integrated circuit memories are volatile (they would lose what is stored when the power is turned off), the *save* mode draws current from the batteries when it is in use.

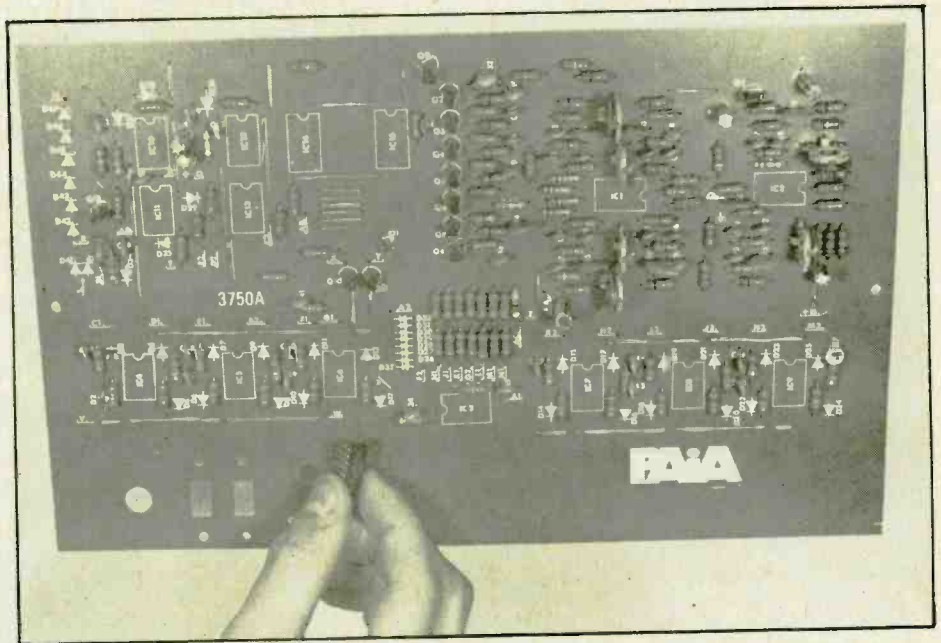
A *tempo* control lets you play back at any desired speed. It is used to program repeating beats; for example, if a drum pad is touched continuously during programming a repeated beat will be heard, and be entered into the memory at whatever rate is chosen by means of the *tempo* control.

The *reset* pad should be touched whenever going from one mode of operation to another to clear the internal events counter.

Use of the *repeat* pad during programming makes the pattern return to



The PAIA drum set is powered by means of the four penlight cells and one 9-volt transistor radio battery visible here. There are no complicated wiring harnesses nor complex jumpering to worry about. After component installation, all goes together quite quickly. After a couple hours you should be able to drum up a storm!



It's easy to install the components on the PC board. PAIA has done a beautiful job of labeling right on the PC board where all the resistors, capacitors, integrated circuits, diodes and transistors go. Follow the map and you can't go wrong.

the beginning and repeat when played back. The *repeat* pad, used during playback (regardless of where you are in the pattern), will cause the pattern to start again at the beginning. This is handy for special effects and introductions.

The *bridge* pad is used to program a secondary rhythmic pattern. To do this, *reset*, then *bridge* and *reset* at the same time, then *program*, after which you enter your pattern. When the bridge

pattern reaches it's point it will automatically return to the main pattern unless the bridge pad is held down.

The *rest* pad can be used as a non-latching play key to play in tempo any programmed sounds for as long as the pad is touched. It can also be used to single step the program to any desired point for editing. When you reach the event to be edited, put the unit into program mode and make whatever

(Continued on page 85)

Ring-A-Thing



**Worried about missing that big call?
Build Ring-A-Thing and hear them all.**

by Anthony Caristi

DID YOU EVER MISS an important telephone call because you were out of range of sound of the telephone bell? It doesn't have to happen again if you build and install this inexpensive remote telephone bell. It is battery operated and can be located anywhere inside or outside your home. Since it is self-powered it requires virtually no energy from the telephone line. The input impedance of the circuit, as seen by the telephone line, is almost 100,000 ohms and the input resistance is infinite. When connected across the telephone line it is undetectable and has no effect on telephone performance.

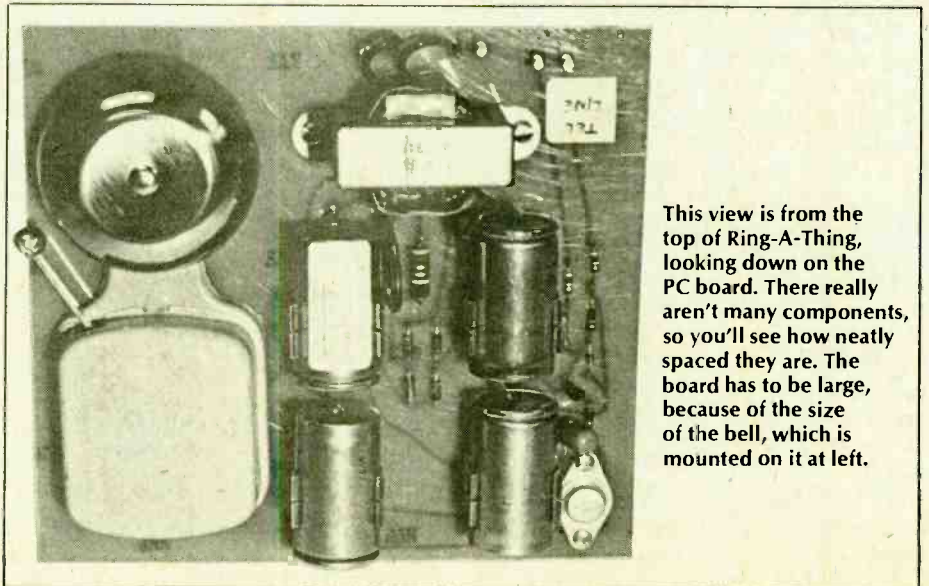
No Power Problems. The circuit derives its power from four rechargeable NiCad cells connected in series which provide 4.8 volts to drive an ordinary doorbell. Since the power demand on these cells occurs only when the telephone rings, the battery will operate the bell over 1000 times on one charge. This should last several months, depending upon how many calls you receive. A built-in battery charger is included in the circuit so that the cells may be conveniently charged from the AC power line at any time. Full recharge takes 14 hours, but the charger may be left in operation indefinitely, if desired, with no damage to the cells due to overcharge. This is possible since the charging circuit has been designed to deliver a limited current to the cells. The NiCad cells used in this circuit are size C, but other sizes may be used. This is possible since the charging circuit has been designed to deliver a limited current to the cells. The NiCad

cells used in this circuit are size C, but other sizes may be used. This will be covered later in this article.

How It Works. When the telephone rings, a 20 Hertz AC voltage of about 220 volts peak to peak is impressed across the telephone line. The series circuit composed of R1, R2, R3, C1, and C2 is connected across the line to provide isolation and act as a voltage divider for Q1. C1 and C2 provide DC isolation, since the line normally has a DC voltage of about 48 volts across it when the telephone is not in use. Q1 responds to the 20 Hertz ringing signal by conducting current during each positive half cycle applied to its base. CR1 prevents Q1 from being reverse biased during the negative half of the ringing

signal. The emitter current of Q1 is applied to the base of Q2 causing it to saturate and act as a switch. This applies full battery voltage to the bell, causing it to ring. The voltage applied to the bell is essentially a 20 Hertz square wave which produces a slightly different sound than that produced by pure DC. CR2 and C3 protects Q2 from any reverse voltage spikes produced by the collapsing magnetic field of the bell.

The battery charger circuit is composed of T1, a 4 diode bridge rectifier, and R5. T1 provides isolation from the AC power line while reducing the voltage to about 6 volts RMS. The output



This view is from the top of Ring-A-Thing, looking down on the PC board. There really aren't many components, so you'll see how neatly spaced they are. The board has to be large, because of the size of the bell, which is mounted on it at left.

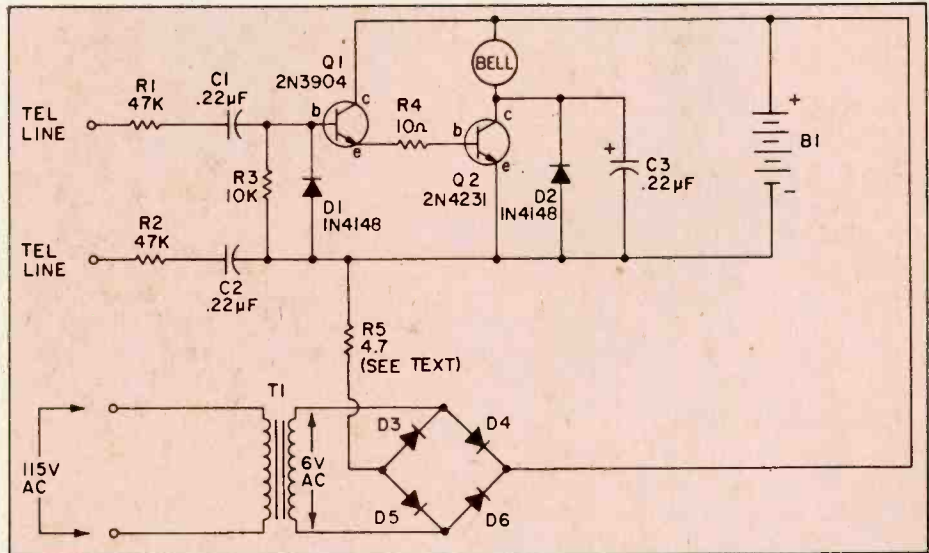
e/e RING-A-THING

of the bridge rectifier, a pulsating DC of about 9 volts peak, is applied to the four cells through a current limiting resistor, R5. This type of circuit is recommended for NiCad cells, and provides essentially a constant charge current regardless of the state of charge of the battery or power line voltage. By limiting the current to not more than one tenth of the ampere hour rating of the cells, the charger may be operated for any length of time without damage to the battery due to overcharge. When the cells attain full charge, the gases produced within the cell are recombined chemically preserving electrolyte.

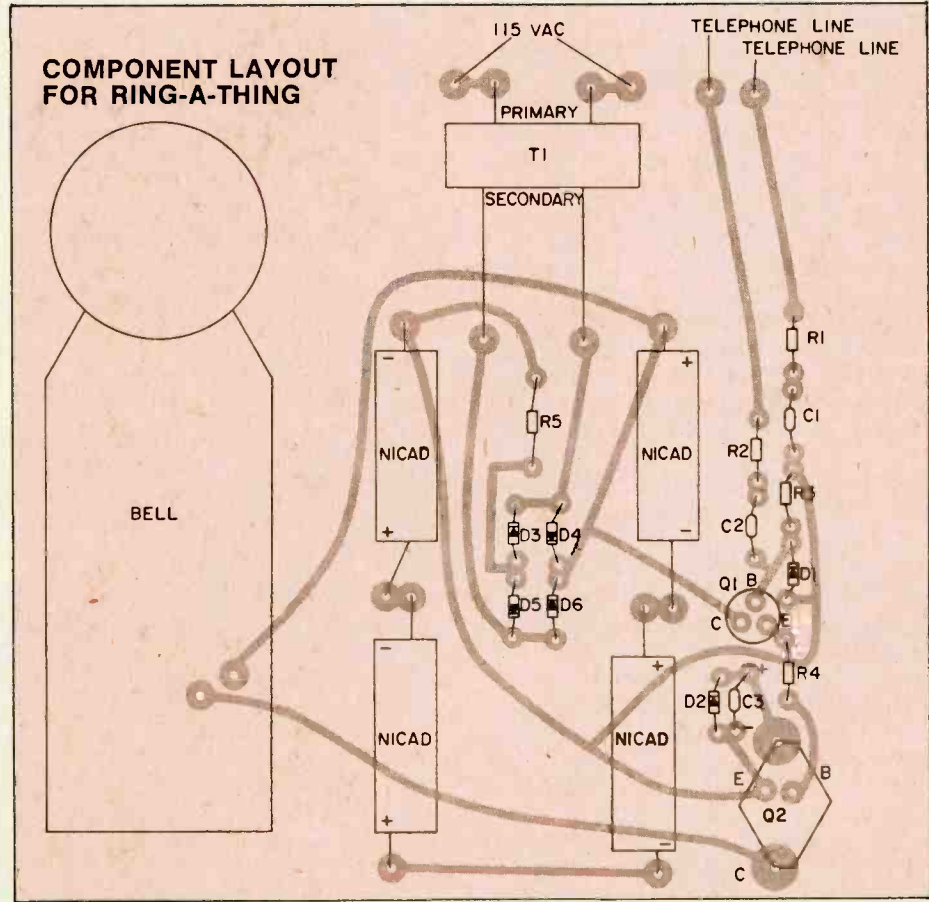
Construction. The entire circuit is built on a 6½-inch x 9½-inch printed circuit board. The foil layout is shown half size in figure one and the component layout is shown in figure two. The cells are securely mounted to the printed circuit board using steel clips. This method of assembly is recommended since it would not be good practice to rely on the connecting wires

of the cells to hold them in place. If the cells you are using do not have solder tabs, the wires can be soldered directly to the positive and negative metal parts of the cell. In this case do not use excessive heat when soldering so that the cells do not become damaged. When mounting the cells be sure to follow the exact polarity as shown in figure two.

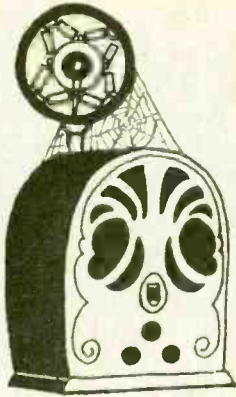
The printed circuit layout for the bell connections may be changed to accommodate the type of bell you are going to use. Be sure to locate the mounting holes for the bell before laying out the printed circuit to avoid a conflict between the copper foil and mounting screws. Do not solder R5 into the printed circuit until instructed to (Continued on page 85)



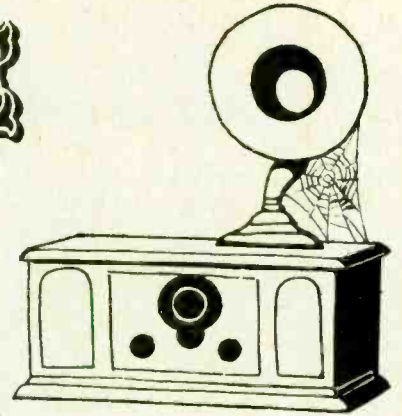
- PARTS LIST FOR RING-A-THING**
- B1—Size "C" NiCad cell (Radio Shack 23-124 or equiv.)
 - C1, 2—0.22µF, 250-volt tubular or ceramic capacitor (Radio Shack 272-1070 or equiv.)
 - C3—22-µF, 16-volt tantalum capacitor (Radio Shack 272-1412 or equiv.)
 - D1, 2—General purpose silicon diode (Radio Shack 276-1103 or equiv.)
 - D2-6—0.5A, 100-volt or greater silicon diode (Radio Shack 276-1102 or equiv.)
 - Q1—NPN silicon transistor, 2N3904 (Radio Shack 276-2030 or equiv.)
 - Q2—NPN Silicon power transistor, 5-A, 2N4321 (Radio Shack 276-2020 or equiv.)
 - R1, 2—4700-ohm, ¼-watt, 10% resistor (Radio Shack 271-1300 or equiv.)
 - R3—10000-ohm, ¼-watt, 10% resistor (Radio Shack 271-1300 or equiv.)
 - R4—10-ohm, ¼-watt, 10% resistor (Radio Shack 271-1300 or equiv.)
 - R5—4.7-ohm, 1-watt, 10% resistor (Allied Electronics—address below—824-5049 or equiv., see text)
 - T1—6.3-volt, 1-A filament transformer (Radio Shack 273-050 or equiv.)
 - Misc.—Bell (Standard 6-volt doorbell), battery clips (Radio Shack 270-1436 or equiv.) wire, solder, etc.
- Allied Electronics' address is 401 E. 8th St., Fort Worth, TX 76102.
- To obtain a printed circuit board template free from ELEMENTARY ELECTRONICS that will speed up your construction of Ring-A-Thing send a stamped, self-addressed number 10 business envelope to The Editor, ELEMENTARY ELECTRONICS, 229 Park Ave. So., New York, NY 10003.



The component layout of Ring-A-Thing, with the foil side down. You'll see, if you look carefully, that the diagram has a few more components than the photograph of the unit has. That is because your editors added a few capacitors, etc.



ANTIQUE RADIO CORNER



by James A. Fred

Keep your power supply from humming with this simple circuit.

□ Hello! out there in Radioland. Winter has rolled around again and it is time to restore all those radios you collected last summer. It was a real pleasure meeting so many of my readers in Dearborn, Michigan, last October at the Antique Wireless Association Annual Conference. For those of you that didn't make it I will just mention a few highlights.

The headquarters for the conference was in the Dearborn Inn. The first day's activities took place there and included the radio equipment auction. The auction lasted over 4 hours and many radios, speakers and miscellaneous items were sold to the highest bidder. A Radiola III that didn't work and had no tubes sold for \$24.00, a Magnavox horn speaker that didn't operate brought \$25.00, an AK model 33 battery set, less tubes went for \$35.00, and a two tube Crosley model 52 with tubes sold for \$50.00.

The usual flea market activity went on in the Parking Lot every time a trunk lid was opened. A cold miserable rain threatened to close down the flea market on Saturday, but it soon stopped raining. On Saturday the meetings were held in the Theatre in the Ford Museum. This was my first trip to the Ford Museum and I really enjoyed seeing all the items, especially the Radio equipment. If you are planning a visit to the Ford Museum don't expect to see many radios for a year or so. The



Parking lot sales were an important part of the AWA meeting in Dearborn, Michigan.

museum is rearranging several of the exhibits and must put the radio equipment in storage. After the new construction is finished the radio equipment will be on display again.

The highlight of the program was a talk by R.H.G. Mathews. Mr. Mathews told the story of the founding of the Zenith Radio Corporation, by himself, Carl Hassler, and Commander Eugene McDonald. The first two men mentioned started the Chicago Radio Laboratories with \$200.00 borrowed from Mr. Mathews' father. After Commander McDonald joined the other two men the Zenith Radio Corp. was founded. Mr. Mathews eventually retired and has been living in Mexico for the last ten years.

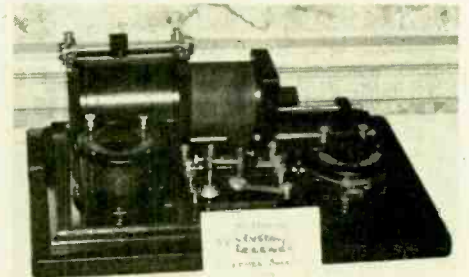
The Earliest Music. Did you know that the first musical program was broadcast by Reginald Fessenden, in 1906? Fessenden, a Canadian born inventor, had sent his voice through the air at Cobb Island, Maryland in 1900. While working for the United States Weather Bureau he had sent his voice through the air between two masts 50 feet high and one mile apart. This was the first time in history man's voice was carried on a wave of electricity.

One of Fessenden's first jobs was working for Thomas Edison and he tried to interest him in voice transmission, but Edison was too deeply involved in his many inventions to listen to him. Still only 26 years old Fessenden became a teacher, first at Purdue University in West Lafayette, Indiana, and then as head of the Electrical Engineering Department at the University of Pittsburgh. In 1900 he decided to become a full time inventor and moved to the U.S. weather Bureau, as mentioned above, for whom he built a wireless telegraph station. Later he left this position and with the backing of two Pittsburgh millionaires he built a wireless station at Brant Rock, near Boston, Mass. and a second station on the coast of Scotland.

By Christmas eve of 1906, Fessenden was ready to make the world's first longwave radio voice broadcast. It was made from Brant Rock, to ships of the United Fruit Company, in the Caribbean Sea which were equipped with his receiving equipment. Fessenden played his violin and sang hymns, while other persons read from the Bible.

If you would like to read the whole story of Fessenden's life send for the book *Radios First Voice* by Ormand Raby. This paperback, 160 page book, plus photographs, is available for \$2.25 postpaid from Antique Radio Press, P.O. Box 42, Rossville, IN 46065.

Measuring Electrolytics. In the Antique Radio Corner in the January-February issue of *ELEMENTARY ELECTRONICS* we told you about replacing electrolytic capacitors and how to measure leakage. There is one other parameter you may wish to measure and that is the actual capacity of an electrolytic capacitor. The test circuit shown is from the book *Modern Radio Servicing* by Alfred Ghirardi and was published in 1935. This circuit is a simple one and can be built quite inexpensively. From the circuit shown you can see that you need a stepdown transformer (a 6.3-volt at 1-ampere filament transformer will work fine), a 100-ohm, 4-watt potentiometer, a 0-5-volt, full scale, AC voltmeter, a 0-1-milliamper AC milliammeter which when provided



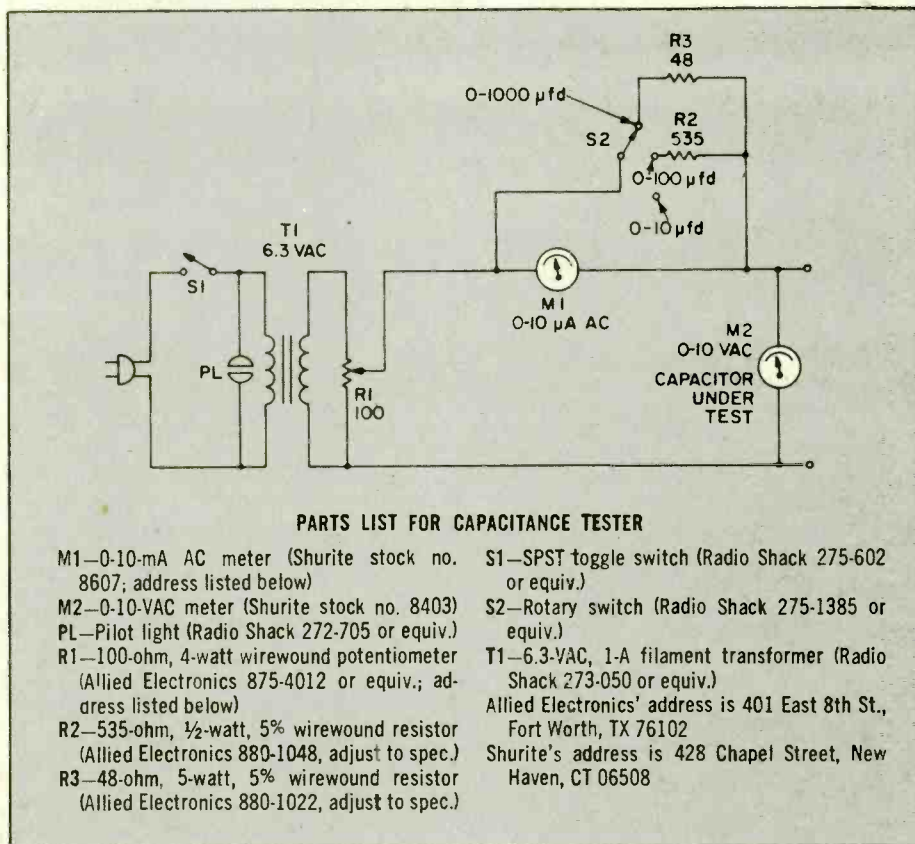
One of the oldest pieces on display at the AWA Annual Conference was this 1912 Murdock Crystal receiver, with a handsome wood base.

e/e ANTIQUE RADIO CORNER

with several shunts will allow you to measure larger values of capacitors. To use the tester connect a capacitor to the binding posts, adjust the potentiometer until the voltmeter reads exactly 2.65-volts. The reading on the milliammeter will then be equal to the capacity in microfarads. That is a reading of 10-milliamperes will equal 10 microfarads.

This simple tester will prove to be very useful when restoring old radios. The most important parts are the shunt resistors used to change the full scale deflection of the AC milliammeter. The circuit diagram shows what current ranges are necessary to measure capacitors from 1 to 100 mfd. These are the size electrolytics you will find in most old radios. Since the tester only applies 2.65 volts AC to the capacitor under test there is no possibility of "blowing" the capacitor. However, there is one thing to remember. Always test for leakage first, and if the leakage exceeds the value allowed in the January-February issue of *ELEMENTARY ELECTRONICS* the capacitor checker just described will not give accurate readings. I breadboarded the circuit shown and found that most of the capacitors I tested measured within 25% of their stamped values. Remember most capacitor catalogs show the tolerance of electrolytic capacitors to be -50% to +100%. This is quite a variation, and in a 10 mfd. capacitor it would mean that the capacitor could measure from 5 to 20 mfd. and still be within limits. When replacing filter capacitors, the ones in the power supply, do not use capacitors that are smaller in capacity than the originals. You can use any voltage rating higher and capacity ratings not more than twice that of the original.

The Parts Crunch. If you want to duplicate this circuit I am sorry to say that you may have trouble finding the parts. I have been building original electronic projects from individual parts for over 40 years. It is becoming very difficult to buy the basic parts for original projects. If you have access to radio books and magazines published in the 1920's you will see what I mean when you read the construction projects published in those magazines. One reason it is hard to buy basic parts is because everything has gone solid state. Semiconductors are small so every assembly using semiconductors has been squeezed until you need a magnifying glass to work on them. Transistors and integrated circuits are cold, impersonal



objects compared to a vacuum tube. Vacuum tubes are warm, easily used items that you can look into and see the lighted filament, plates, grids, etc. This is why I prefer going back into the period between 1920 and 1945 for collecting, repairing, and restoring radios. Enough of my personal feelings and back to the parts problem. I solved this

problem by sending for all the parts catalogs offered by advertisers in *ELEMENTARY ELECTRONICS* magazine. There is no one best catalog, you must have them all. You cannot rely on your local radio parts dealer to supply tube sockets, transformers, meters of all kinds, and other special parts you may need when you build original projects. ■



This is the way the interior of the McGee Radio Company store looked on January 24, 1933. It's full of cathedral radios, and the console radios are a real knockout, too!



Kathi's CB Carousel

by Kathi Martin, KGK3916

Only your Good Buddies will know for sure that you've got this hot rig in your car.

□ My next-door neighbor had her second CB rig ripped off in less than a week. Yes, the car had a burglar alarm, and a locking dashboard mount, but the rig and a good part of the dash was gone before anyone even had a chance to respond to the siren.

It was while looking at the ripped-out dash that I thought about how much more secure an in-dash CB would be when my car is in the city. Naturally, concealing the rig in the trunk is the best protection, but if you've got to have it out at all times an in-dash rig looked like the best bet.

Where to put it? I wasn't about to start doing a body-and-fender job on the dash. Besides, there was no room in the car's dashboard even if I could locate my old metal nibbling tool.

Then came the flash of inspiration. Simply replace the present auto radio with a combination radio/CB! Locked and bolted into the dash itself it was more than likely a fast ripoff artist would look for another car; after all, even a crowbar is useless if the rig is behind the dash.

Shopping Around. A quick survey of the marketplace turned up several forms of combination in-dash radio/transceivers. Some had a built-in cassette player, some a cartridge player, some were AM/FM/CB. After much thinking about all the possible combinations I realized that I would not compromise high CB performance just to get a rig mounted in the dash, and high performance means high selectivity. Around New York City, a transceiver short on selectivity is almost worthless what with activity booming.

Looking over the mountain of spec sheets I've accumulated this year I noted the Realistic TRC-471 was rated for 70 dB adjacent channel rejection—a respectable, if not outstanding value in any CB rig.

Next came the hard part. Would it fit in my car? Since the TRC-471 is

specified for Ford and GM I was reasonably certain it would fit my GM, but having been burned many times in the past I made careful measurements of the unit at the Radio Shack store before going through my purse for my charge card.

Next question. What about the mounting hole(s) already in my dash? No problem there because the TRC-471 has adjustable shaft spacing, is supplied with an adaptor and new trim plate, and a giant size bag of mounting hardware.

The Rig. The unit itself is a combination AM/FM-Stereo/40-Channel CB Transceiver. It is supplied pre-wired with an output plug and jack for stereo front and rear speakers. The radio itself has a left/right balance control and a front/rear balance control in addition to the volume control. Unlike some combination units that share the important circuits for both AM and CB, the TRC-471 has independent AM and CB receiver sections that permit monitoring of CB while listening to AM or FM.

It works this way: When you push in a button marked *MONitor* both the radio and CB are fed to the speakers. You select the desired CB channel—indicated on a digital readout—and then squelch the CB with the squelch control. In short, the CB section is set the same as with any rig.

Then you tune in an AM or FM station using the regular tuning knob or one of five preset station selectors.



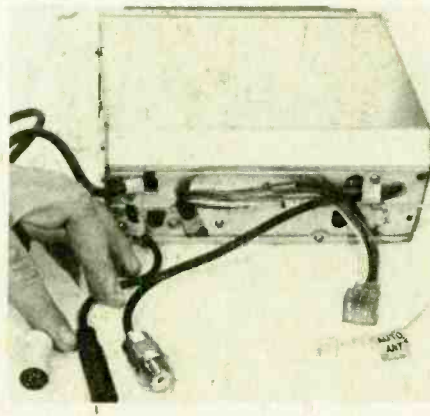
Your car may already have a built-in radio and trim panel, or the dashboard may be predrilled for the main controls.

If a CB station comes on the channel the CB squelch releases and the CB signal is fed to the speakers.

The transmitter does not work in the *MONitor* mode. To transmit the unit must be placed in the CB operating mode by pressing a CB selector. When the CB selector is on both the AM and FM radio are inoperative.

Separate antenna connectors are provided for the AM/FM and CB antennas. However, the TRC-471 has a power convenience feature that makes it attractive to use a combination AM/FM/CB disappearing (motor driven) antenna. A separate wire coming from the rear is connected to the volume control's *on-off* switch. When the radio is turned on power is applied to this wire. If the wire is connected to one of the *automatic* disappearing antenna models the antenna will extend when the radio set is turned on, and collapse when the radio is turned off. (Nice feature!) If you own an older type of disappearing antenna which requires a separate power application to lower the antenna you'll have to install a separate power switch. I suggest you

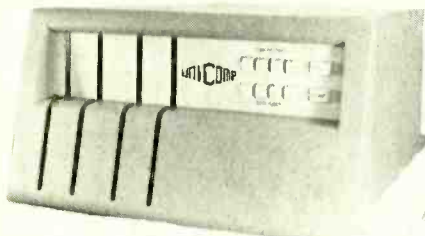
(Continued on page 92)



Here, the hairy paw of an e/e technician holds (from left to right): the microphone connector; AM/FM antenna jack, and a standard UHF-CB antenna connector.

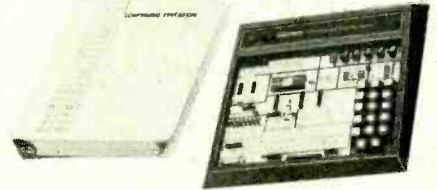
COMPUTER NEW PRODUCTS

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



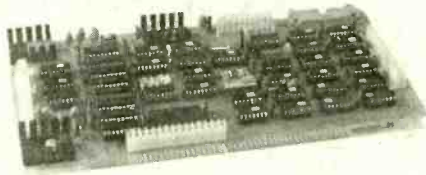
16-Bit Microcomputer System—Uni-comp, Inc., offers a new 16-bit microcomputer system that features a large backplane, dual floppy disc and power supply, all in one package. Model SS-11/15 delivers the full power of DEC's LSI-11 CPU. This "fully integrated" and "cost effective" system is packaged in a single 10½-inch rack or tabletop mounting enclosure. Standard hardware

includes a 15 quad slot backplane, integral switching mode Power Supply, dual or quad Floppy Disk System, CPU with EIS/FIS MICROM, 20-28 KW RAM, console interface, diagnostic bootstrap PROM, bus terminator, console switch register, distributed refresh controller, and complete front panel controls and displays. All unused slots are occupied by bus grant continuity boards allowing development users to separate custom interfaces for ease of testing. User applications benefits from the SS-11/15 compatibility with field-proven operating system software such as RT-11 and RSX-11/S. Programming requirements are fulfilled quickly with an array of source language including Multi-User Basic, Fortran IV and Macro-II. Price: \$3095. Circle 48 on Reader Service Coupon for more information.

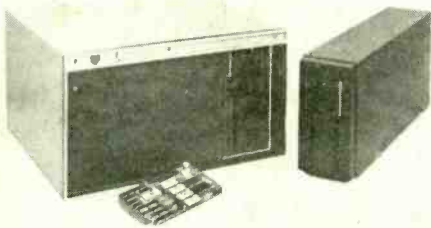


Microprocessor Self-Instruction Course—Heath Company introduces the ET-3400/EE-3401 microprocessor learning system for self-instruction purposes. The EE-3401 course employs Heath's individualized learning techniques to instruct the student in microprocessor operation, interfacing and programming. The accompanying hardware and software experiments provide valuable hands-on experience via the ET-3400 microprocessor trainer. Instructional materials in microprocessor operation and design, applications, machine language programming, hardware, I/O interfacing and much more are all featured. The ET-3400 trainer features the 6800 microprocessor, 256 bytes of RAM (expandable to 512 bytes), a 1K ROM monitor, and 6-digit hexadecimal display and keyboard. Breadboarding sockets permit fast construction of experiments and special prototype circuits. Prices: EE-3401 microprocessor course, \$89.95; ET-3400 microprocessor trainer, \$189.95. Circle 31 on Reader Service Coupon for more information.

Video Display Board—Technical Design Labs claims that this VDB (Video Display Board) that interfaces with the S-100 Bus microcomputers is "low in cost and yet provides the capabilities of video terminals costing thousands of dollars more." The unit consists of two boards mounted piggyback. The VDB contains its own display buffer memory

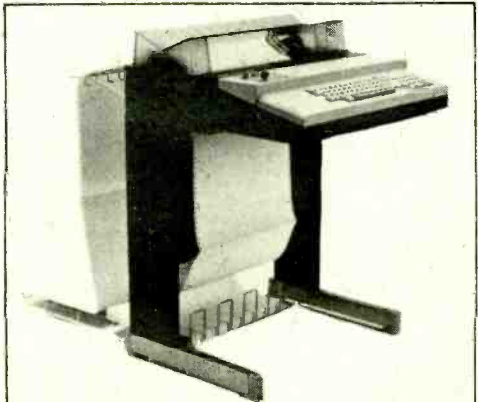


and provides two pages of display, each with 25 rows of 80 characters. The display buffer memory uses no memory address, thus leaving the entire computer memory address intact for user programs. The VDB displays, in addition to the 96 upper and lower case ASCII characters with descenders, 64 unique display symbols to permit a graphic resolution with 160 horizontal elements by 75 vertical elements. The display can accept data at a 400,000 character per second rate. The VDB works with either a modified TV set or monitor and has an on-board 8-bit parallel keyboard port with status strobes. It requires one motherboard socket and occupies two card spaces. Software character and ROMable graphics output drivers are supplied for Z80 and 8080 systems. The VDB is priced at \$349 in kit form and \$449 fully assembled and tested. Circle 52 on Reader Service Coupon for more information.



Mass Storage Systems—PerSci, Inc. introduces a new series of IBM compatible Mass Storage Systems for mini-computer applications. These systems, with data capacities to 1 Mbyte formatted, incorporate PerSci's Model 277 Dual Diskette Drives and are available in several configurations: A one or two drive (two or four spindle) system complete with microprocessor based controller, power supply and cabling enclosed in a 19-inch rack mountable chassis

costs \$3,995 for the two drive system, \$2,895 for the one drive unit; a one or two drive system (\$1,630 and \$2,760 respectively) with power supply and cabinet but without controller; a single drive "slimline" system (\$2,110) that measures only 4½-inches wide when vertically mounted but that incorporates one dual drive (two spindles) and a power supply in a table top chassis. Model 1070 Controller is available separately for \$740. Called an "extremely intelligent" controller, Model 1070 includes an 8030 microprocessor and has an internal disk operating system in firmware. When commanded by the 8080, the 1070 Controller is able to perform all file management functions, including IBM 3740 formatting and initializing. Circle 50 on Reader Service Coupon for more information.



Eight-bit Teleprinter—Olivetti Corp. of America introduces a new 8-bit Teleprinter identified as model TC480 which is available in three versions: receive only (RO), keyboard send/receive (KSR) and automatic send/receive (ASR). Sales are directed mainly to users who require computer hard-copy capability—in particular to retailers, educational institutions, auto dealers, banks. The TC480 key-

(Continued on page 91)



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!

Antenna Swivel Stays Put

The problem with some antenna swivels is that they never stop swiveling. The new MayCom GW-3S Swivel Antenna Holder, designed to mount antennas to slanted surfaces and hatch-back cars, stays adjusted because it has a big



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ON READER
SERVICE COUPON

“star” lock washer and hex-head adjusting screw for positive holding. The chrome-plated MayCom GW-3S swivel has $\frac{3}{8}$ -24 threads to accept mobile antennas and a $\frac{3}{8}$ -24 threaded stud to fit trunk mounts. Retail price is \$3.95. It's another accessory from Maycom Communications Products, 1134 W. John Beers Road, Stevensville, MI 49127.

SSB/AM CB Transceiver

The CP-400, a 40 channel SSB/AM mobile CB transceiver from Communications Power, Inc. is designed for the serious CBer, and includes a high-power JFET mixer that virtually eliminates overloading and intermodulation problems, a built-in logarithmic speech compressor and a power microphone that provide super-strong talk power with no flat-topping, and an eight-pole crystal filter that provides ad-



CIRCLE 56 ON READER SERVICE COUPON

jacent channel rejection of -80 dB on both SSB and AM. With its cadmium plated steel chassis and heavy aluminum case, the CP-400 is a rugged transceiver. The bulk of the vital electronic components are mounted on four computer-grade plug-in printed circuit boards. This modular, solid-state construction makes for simple, easy maintenance. Priced to sell for \$599.00. Further information on the CPI CP-400, and the company's complete line of high technology, American-made communications gear, is available from Communications Power Inc., 2407 Charleston Road, Mountain View, CA 94043.

Good on all 40

Johnson American has announced the availability of the Messenger 92/40, a professional quality 5-channel hand-held CB transceiver, type accepted by the FCC for 40-channel service. The Messenger 92/40 has been completely redesigned to comply with the FCC's specifications for 40-channel service equipment. The new model features low power consumption and superior receiver sensitivity and transmit range. Its cast aluminum alloy



CIRCLE 64
ON
READER
SERVICE
COUPON

frame provides exceptional sturdiness. Johnson's Messenger 92/40 has a nickel-cadmium battery pack that stores enough power for a full day of normal use. Additionally, the charger unit, which is supplied with the radio, permits full recharging overnight. The Messenger 92/40 comes with an LED battery indicator that tells at a glance when charging is required. It is also equipped with a flexible antenna that gives years of trouble-free service in the field. Sells for \$169.95. For further information, contact Johnson American, Inc., Clear Lake IA 50428.

40-Channel CB Base

The Model CBB-1040 has been added to the "Aircommand" line of Citizens Band radios manufactured by Superscope, Inc. The CBB-1040 is a base station version of the CB-640 mobile unit which was selected by the California Highway Patrol for exclusive use in its vehicles. The CBB-1040 comes equipped with a desk type power microphone featuring an adjustable mic & gain switch and providing up



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to 10 times more sensitivity (20 dB) than a conventional microphone. The dual conversion superhetrodyne receiver provides high selectivity and sensitivity. An emergency Channel 9 scanner constantly monitors this nationally recognized emergency channel. A flashing light and audible beep indicate when someone is transmitting on channel 9. A LED digital clock features an automatic power switch which activates the CBB-1040 at a pre-set time. The unit provides a large 3-in. meter for SWR, RF Power, modulation, and receive signal-strength. Automatic noise limiter and noise blanker switches insure the rejection of all unwanted signals. The delta fine tuning control pinpoints signals which are off frequency and helps reject adjacent channel interference. The CBB-1040 sells for \$389.95. For information on this new product and other CB products write to Superscope, Inc., Aircommand, 20525 Nordhoff St., Chatsworth, CA 91311.

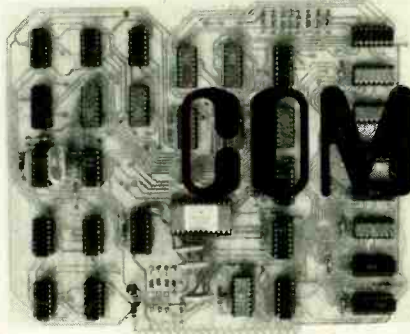
Universal Extension Speaker

The growth of CB communications has created the need for a quality enclosed, extension speaker system. To this end Robins has introduced a deluxe extension/remote loud speaker system that will do this job. Its performance and acoustic design will make it suitable for mobile CB installations, home based CB installations, communications and general audio use. It incorporates a high efficiency 4-in. dynamic in-coupler speaker with an



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ON READER
SERVICE COUPON

extra heavy 3-ounce magnet. The frequency range of 20-13,000 cycles is sufficiently broad to faithfully amplify voice and music, yet retains the ability to reproduce the speech range with a minimum of background hash. A fully adjustable 180° click-set enameled metal mounting bracket enables the user to instantly swing the primary audio direction to any position. Impedance is 8 ohms with 5 watts maximum power to handle high volume without distortion. It includes a long 10-foot cord with 3.5-mm phone plug. Look for Robins catalog No. 48-015 with suggested list price of \$16.00. Get all the facts by writing to Robins Industries Corp., 75 Austin Blvd., Com-mack, NY 11725.



COMPUTER READOUT

by Norman Myers, Computers Editor

The ways microcomputers will touch your everyday life.

□ Our world has already changed because of microcomputers, and it will change much more. In ten to fifteen years, your home will likely have many microprocessors in it. They will be in your kitchen, garage, basement, living room, gameroom, and bedroom. Many people will be using microcomputers without knowing it. Others will be expanding their thinking processes as they pit themselves against complex but fascinating learning machines. Math, science, even history and art will be programmed into shoebox sized computers that you can buy or that you can borrow from a library or school.

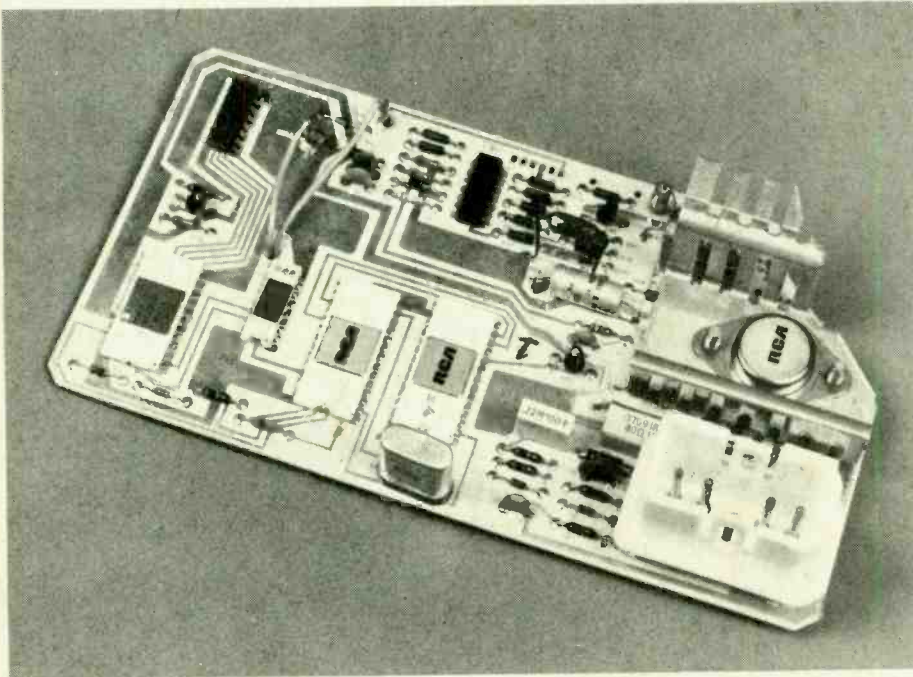
We are talking about a subject as broad as your imagination—the applications of microcomputers. Let's face it, your goal and that of every electronics outfit in this business, is to first understand some principles of microcomputers and then to figure out what to do with them. You may be a hobbyist who is simply curious and trying to ex-

pand his horizons. But, you may be more than that. You may want to start your own business to make and market a product of your own invention. The time has come to understand what is being done with microcomputers, what some companies are thinking about doing, and to pipedream a bit about how we can improve our world with some futuristic inventions.

The whole area of applications is so broad that we need more than one article to begin to cover it. This issue will address microcomputers in business, transportation systems, and the home. But the home applications will only be touched on at this time. The next issue will dive into electronic games for the home—which is a fantastic voyage in itself. So stick with me as we weave our way through.

Computers In The Office. The use of computers in business—a subject many of you have asked me about in your letters—can be broken up into the two

broad areas of inventory and control. Inventory here means keeping track of something. It can be the recordkeeping of a doctor's office or of an accountant for billing purposes, or it can be keeping track of what items are in stock. Let's take a look at some actual cases. There is, of course, the one most of you have seen by now in some of the grocery stores. A light pen reads the international strip code from a label, enters the code into the cashier's terminal which passes it onto the central computer in the back room. For each label code, the computer memory knows the price of the item, how many are in stock, and where to place an order for more. When stock of an item gets too low, the computer writes an order for more. We have here a central computer controlling small microcomputers in the cashiers' terminals. Commands flow back and forth to control the light pen, give pricing, tax computation, *et cetera*. Then there is your local hamburger heaven. Have you noticed the key pad on a Burger King cashier's terminal? Only a microcomputer can provide the kind of flexibility you see there. You say hamburger, for example, and the order taker presses a touch-type key with a picture of a hamburger on it. The price is built into the computer memory. To change prices the store manager calls in the terminal experts to do a simple software change. Hardware does not have to be discarded. After you have placed your large order, this computer provides a listing that is easy for the cooks to follow—how many shakes, how many hot dogs, *et cetera*. Now let's think of how we can improve on this smart terminal. What would you do? Well, the first thing to notice is that the terminal operators have to call the order to the kitchen. We know from our last Computer Readout article that video screens are a blooming output medium. It seems archaic to go from a computer to a person to a microphone to the kitchen. The kitchen should perhaps have a video display that shows the hamburger person how many burgers he has on order of various types (small, large, no pickle, etc.). As the



This PC board assembly is Chrysler's next generation of electronic fuel control, which will serve as an alternative to its present lean-burn system. The four dual-in-line packages on the lower left of the PC board contain the heart of the system, (left to right) the CDP 1833 ROM, the CDP 1824 RAM, a custom-made CPU and a custom input/output port.

outgoing tray is filled, the computer would subtract the items from computer memory card from the screen. Inventory ability could be added by connecting the terminals to a central inventory control computer that ordered food as necessary via a data link to the warehouse computer. Eventually, you could build an entirely automated entry. Drive in, push the key for the food you want, the kitchen would be composed of conveyor belts and ovens—out comes your food.

That is a bit astray from pure inventory control, but that kind of leapfrogging is exactly what is making small computer businesses take off to big things today. Inventory control is very much in demand, and every case has to be nearly custom tailored to the client. Through software control, that customizing is no problem. If you want to imagine how you could get started with an inventory control system, simply imagine getting a small computer that takes BASIC instructions (see our tutorial on BASIC elsewhere in the magazine) via a typewriter keyboard, and next imagine programming a small and simple inventory system to keep track of shoes in a store. You are on your way.

... **And In The Factory.** Computer control in industry is presently widespread, but the potential is really unlimited. The needs are great, and the microcomputers available today literally sit waiting for someone to apply their power to the jobs. Take, for example, the computer-automated control of metal parts. Machines that stamp or bend metal parts are becoming nearly commonplace in industry. The operator

MICRO PROCESSOR USES IN AUTOS

Fuel Economy and Emission Control	Driving Aids	Safety
<ul style="list-style-type: none"> • Firing of plugs • Air/fuel ratio • Rate of deceleration • Speed control for highest m.p.g. • Automatic adjustment for weather conditions 	<ul style="list-style-type: none"> • All electronic instrument panel • Radar with speed control • Computer navigation following road beacons • Computation of best rest stops, expected arrival time, type fuel to use for trip, best tire pressure for load, etc. 	<ul style="list-style-type: none"> • Computer warning of weak spots like tires, battery, brakes, radar, etc. • Anti-skid braking • Anti-theft computer combination locks • Air-bag control

Microprocessors can be especially useful in aiding operators of complex equipment, such as the family car. The auto industry hopes to perfect all the above uses of microprocessors in the coming years. "Dumb" cars will be in museums instead of on freeways!

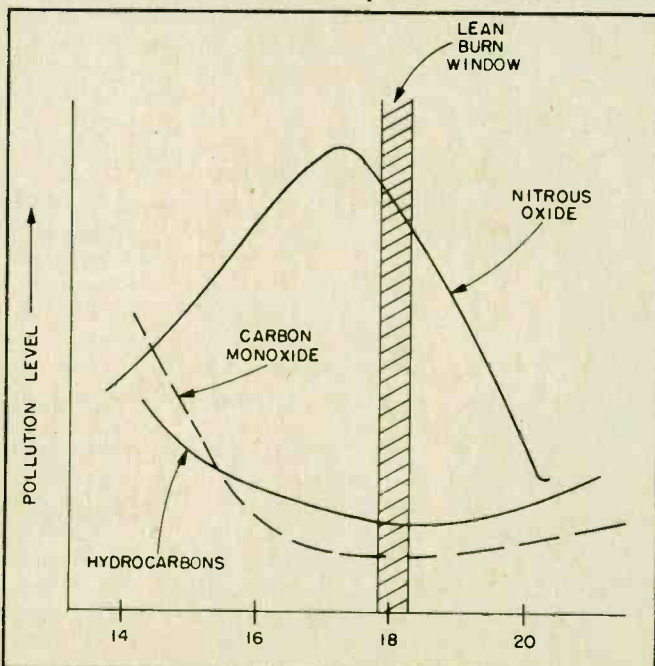
loads a hopper with pipes or other metal pieces, presses the button and the computer controls the machine. Out come car ash trays, hinges, you-name-it. If a new hinge design is to be fabricated, the computer program is simply updated with new holes to drill and bends to make.

The ideas here are not new, and in many cases only the surface is being scratched. Microcomputers of the future will be tied together in an industrial plant. The ordering of raw material to meet schedules on new orders, the actual fabrications, and the shipping and billing would all be computer controlled. And remember, you need not sit by and watch. There is a big market out there and learning about microcomputer operations as a hobby at home will give you a big foot in the door.

The Millers Ferry Hydroelectric Plant in Alabama is controlled by an Interdata 70 that communicates with three IMP microprocessor boards to control water flow and generators at

Jones Bluff Dam that is many miles away. The system is estimated to save tens of thousands of dollars by increasing efficiency of the power plant—so the computers will pay for themselves. Control of open hearth furnace feeding and temperatures, monitor and control of electric power to giant aluminum smelting pots, monitoring of the quantity of ingredients that go into anything from cake mixes to tire rubber—all of these use microcomputers today. The computer acts as a kind of central brain that may have several smaller microprocessors feeding it, which in turn have sensors telling them what is happening. So sensor technology is an area that is absolutely booming as computers push the need for new and cheaper devices. Sensors can smell (such as smoke detectors), feel (like strain gauges), hear (special frequency response transducers), and see (like infra red sensors). Still, there is the need for more. The more intelligence that can be built into the sensors, the less time the central computer has to spend interpreting.

In Your Car, Too! Transportation is an area much in need of microprocessors—and the future will show a fantastic set of changes in this area. The Chrysler Lean-Burn system is one of the popular examples of how people can have a computer in their garage without knowing it. The concept there is to control the spark firing so as to always have the air/fuel ratio equal to 18 to 1. While maximum fuel economy is achieved at a ratio of about 16.5 to 1, a ratio of 18 to 1 leads to minimum levels of carbon monoxide and unburned hydrocarbons. In 1981, nitrous emissions will be tightened from 2 grams per mile to only 1 gram per mile. Several manufacturers plan to use a new type catalytic converter to absorb the bad exhaust, but for that new converter to work well, and for fuel economy to be kept as high as possible, a more elaborate computer control system is being developed.



A lean-burn computer keeps the air/fuel mixture at 18:1 under all driving conditions in order to keep pollution levels low. A new computer system must be devised by 1981—when Congress will cut allowable nitrous oxide levels by fifty percent.

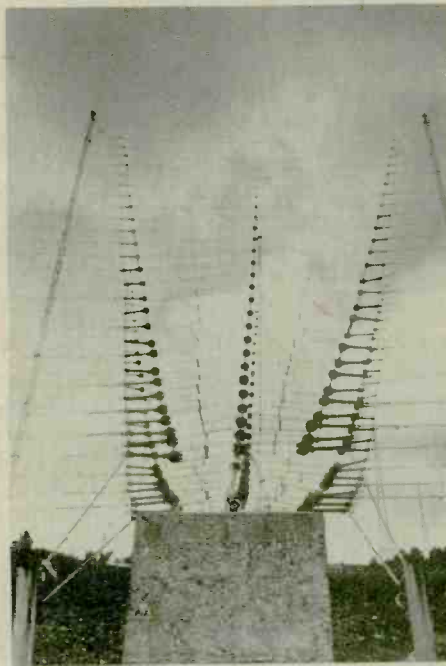
SECRET CODED MESSAGES transmitted to spies in the middle of the night ... a hidden station broadcasting to incite revolution in another nation ... terrorist groups throughout the world linked together by shortwave radio. The elements of a James Bond novel? No, these are actual DX targets for the alert SWL!

It's no secret to any active SWL that much shortwave broadcasting activity is political. But some stations go beyond mere persuasion into outright deception in their activities, often using hidden, extralegal transmitters. These stations are known as the *clandestines*. Not only do they offer some of the most fascinating and exciting listening around, but they often verify listener reports as well! Beyond clandestines lie a group of non-broadcasting stations used to direct spies and terrorist agents in the field. Any SWL, even with simple gear, can listen in on these real life espionage activities!

The one word to describe most clandestine radio activity is *change*. Fixed schedules and frequencies are the exception here rather than the rule. Clandestines also come and go as the world political situation changes. For example, during the 1960's clandestine activity directed against Cuba was heavy, with such stations as Radio Americas and Radio Libertad causing much interest in DX circles. Today, only Radio Cuba Libre, a small operation, remains. More recently, several other clandestines went off the air with the ending of the Vietnam War and the political changes in Spain and Portugal. Yet some clandestine stations have been in operation for over thirty years!

The Spanish Scene. During the 1930s, Spain was rocked by a violent civil war which ended with the triumph of Generalissimo Franco's forces. By 1941, Radio Espana Independiente (Radio Free Spain) came on the air from the Soviet Union as the voice of the defeated Spanish Republican forces. It has continued to operate continuously since then from various transmitters within the Soviet Union and other East European nations. It is currently transmitting from Rumania. This had long been suspected, and was recently confirmed when one day the programs of Radio Bucharest were transmitted at the time and on the frequencies used by Radio Espana Independiente!

Radio Espana Independiente's programming consists of numerous commentaries in Spanish interspersed with musical segments. REI operates on 10110 and 12140 kHz and both frequencies are subject to heavy jamming from transmitters



Complex antenna system at the British Broadcasting Company External Services transmitting station at Crowborough in Southern England. This configuration is a very effective one.



Broadcasting House, the home of the main offices of the British Broadcasting System. From this location in the center of London, the far-flung facilities of the BBC are run.

**DXing
INTERNATIONAL
INTRIGUE**

Snoop on the super spies' adventures.



A scene from "The Spy Who Loved Me," with James Bond (Roger Moore) and Anya Amasova (Barbara Bach) trying to open an escape hatch, in an underwater control center.



The Lotus Esprit which James Bond drives in "The Spy Who Loved Me." Unlike your average Lotus, this car converts into a submarine, with torpedoes and everything!



by Harry L. Helms, Jr.

in Spain. The jamming doesn't seriously affect North American reception, however, and makes REI's frequencies easy to find even on the simplest receivers. Current schedule calls for sign-on at 1800 GMT and sign-off around 2245 GMT. Best North American reception is after 2000 GMT.

Radio Espana Independiente not only verifies reports, its QSL is one that even non-DXers can appreciate. It was designed for the station by none other than Pablo Picasso, and comes in full color. To get it, send your reception reports, preferably with two or more International Reply Coupons (IRCs) for return postage, to Box 359, Prague 1, Czechoslovakia. Despite this address, all QSLs are mailed from Paris.

Spain is also the home of a people known as the Basques. The Basques are concentrated in northeast Spain in the Pyrenees Mountains near the French border. The Basques speak their own language and were an independent nation until their annexation by Spain over 130 years ago. During the Spanish civil war the Basques were aligned with Republican forces against Franco. As such, the Basques were losers along with the Republicans when Franco's forces won. In the aftermath many Basques fled Spain, with many settling in the United States and Venezuela.

From 1947 to 1977 Radio Euzkadi was the voice of those Basques that wished independence from Spain. Euzkadi first came on the air in 1947, but

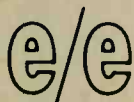
was not widely heard until it began shortwave operations in 1965 from a new transmitter site. Direction-finding techniques indicated that Radio Euzkadi transmitted from a site in Venezuela, probably using existing point-to-point transmitters of around twenty kilowatts power. Several DXers have heard what seem to be phone conversations in the background of Radio Euzkadi, adding strength to the hypothesis that point-to-point transmitters were involved.

On April 30, 1977, Radio Euzkadi left the air. Its announced reason, as monitored in its final broadcast, was "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." Other observers feel that the real reason is the improving state of Spain-Venezuela relations, and that Radio Euzkadi represented a block to any further improvements. Radio Euzkadi has gone off the air three times previously in its thirty years of operation, and many DXers suspect that it will be back as soon as another transmitter site is found.

In the meantime, you can check its old frequency of 13250 kHz to see if Radio Euzkadi makes it back. It was scheduled at 2000, 2130, and 2230 GMT, with programs lasting approximately one half hour, mostly in Spanish. If you do hear them back and want a QSL, or simply want to check on the latest news about Radio Euzkadi, you can write the station at B. P. 59, Poste Centrale, 75790-Paris Cedex 16, France. Be sure to enclose some IRCs with your letter for return postage.

The Last Holdout. Shortly after Fidel Castro came to power in Cuba, that island nation became the target of much clandestine radio activity. Such famous operations as Radio Americas and Radio Libertad have now gone silent, but one mysterious anti-Castro voice remains: Radio Cuba Libre.

Radio Cuba Libre was first reported in September, 1960 on a frequency of 6130 kHz. It is not known if the current operation is still related to the original one. In fact, very little is known at all about Radio Cuba Libre, including the address to send reception reports. It currently operates in the lower end of the 40 meter amateur radio band between 6980-7090 kHz. Programming is in Spanish and consists of political talks and march music. Transmissions last anywhere from fifteen to forty minutes and have no set schedule. Most receptions are reported from 0100 to 0400 GMT. The station is often silent for several months only to come alive with a furious burst of activity for several



DXING INTRIGUE

weeks, and then it goes silent again. Signal strength is highly irregular, ranging from excellent to plain lousy. Obviously, you'll have to tune 6980-7090 kHz carefully for several days—even weeks—to be able to catch this rare DX!

Radio Cuba Libre tries to give the impression that it actually transmits from inside Cuba, as in announcements like "transmite desde las gloriosas montañas del Oriente," referring to the Sierra Maestra range in Cuba. However, it is virtually certain that they operate from somewhere in or near southern Florida, perhaps on a ship.

Asian Action. Clandestine activity in Asia is down from the high levels reached during the Vietnam War. Still, Asia has perhaps more covert activity than any other section of the world. Unfortunately, many of the Asian clandestines are difficult to hear in North America and only operate in Asian languages, making them difficult targets even for experienced DXers. However, two Asian clandestines can be heard reasonably well in North America and they broadcast in English.

In 1972, North Korea and South Korea agreed to stop hostile radio broadcasts to each other as the first step toward eventual reunification of the two nations. The result of the agreement has been that both countries have set up clandestine stations to carry on propaganda activities that are "officially" banned. North Korea's main effort is the Voice of the Revolutionary Party

for Reunification, which claims to be broadcasting from South Korea yet actually is using the same transmitters as Radio Pyomgyang. It has English scheduled from 2230-2300 GMT on 4557 kHz and from 1400-1430 GMT on 4120 and 4557 kHz. The 2230 GMT transmission may just possibly be heard in eastern North America during winter; the 1400 GMT broadcast should be audible in the West during autumn and winter.

China has never accepted the existence of the Federation of Malaysia and thus is home to the Voice of the Malayan Revolution, an organ of the Malayan Communist Party. This clandestine broadcasts in English over Radio Peking's powerful transmitters, making it easier to hear than most clandestines. Tune for it on 9620 and 15790 kHz when English is scheduled at 0930-1000 and 1450-1520 GMT.

Terrorist Transmissions. It is an unfortunate fact of life that terrorist activity over the world has grown by leaps and bounds in recent years. The international character of many terrorist operations means that some form of worldwide communication is needed. Amateur radio equipment and frequencies are a natural due to the availability of gear worldwide, particularly single-sideband (SSB) transceivers.

Terrorist stations have no semblance of a schedule. However, the 20 meter (14000-14350 kHz) amateur band is favored, since it is generally the best amateur band for long-distance work. Single-sideband voice transmission is used. According to Radio Sweden's "Sweden Calling DXers" bulletin,

14338-14348 kHz is often used by Arab terrorist groups, with 14128 kHz another favorite frequency. The infamous Black September group (responsible for the 1972 massacre at the Munich Olympics) uses 14290 kHz for its main channel, using upper sideband (USB). Call signs generally consist of two or three digits and a variety of languages are used.

The Mystery Numbers. Since the mid-1960's numerous DXers have heard a voice, usually a woman's but sometimes a man's, reading groups of numbers in diverse languages on frequencies scattered throughout the shortwave spectrum. The most common languages are Spanish, English, and German, with a few transmissions in Arabic or Czech.

For many years it was believed that the Spanish and English numbers originated from within Cuba, especially since they started after Castro came to power and admittedly started large scale guerrilla activity in Latin America. There have been some reports of the Spanish numbers stations using the same interval signal as Radio Havana Cuba. And in 1975 several SWLs noted audio from Radio Havana Cuba in the background of the numbers transmissions, with the audio in parallel to a frequency in use by Havana. The obvious answer was that both Radio Havana Cuba and the numbers stations used the same transmitter site, and that audio from one was getting mixed in with the other.

As you can see, it's not necessary to join a James Bond-type organization to get involved with cloak-and-dagger adventure. Simply turn on your receiver and start tonight! ■

GUIDE TO FREQUENCIES FOR DXING INTERNATIONAL INTRIGUE

Frequencies (kHz)	Station(s)	Frequencies (kHz)	Station(s)
3000-3500	Numbers stations	9800-10000	Numbers stations
4050-4825	Numbers stations	10110	Radio Espana Independiente (transmits from Romania)
4120	Voice of the Revolutionary Party for Reunification (North Korea)	11500-11700	Numbers stations
4557	Voice of the Revolutionary Party for Reunification	12000-12500	Numbers stations
5000-5250	Numbers stations	12140	Radio Espana Independiente
6700-6850	Numbers stations	13250	Radio Euzkadi (currently inactive, transmitted from Venezuela, often varied frequency 50 kHz up or down)
6980-7090	Radio Cuba Libre (somewhere in the South Florida area)	14000-14350	Terrorist organizations do not confuse with legitimate amateur radio operators in this range)
7300-8150	Numbers stations	15790	Voice of the Malayan Revolution
8800-9200	Numbers stations		
9620	Voice of the Malayan Revolution (broadcasts from China)		



BEGINNING PROGRAMMING WITH BASIC



BASIC is the most popular hobby computer language, and ELEMENTARY ELECTRONICS is going to make it easy for you to learn. This three part series will have you planning and understanding simple computer programs, and leave you with the foundation necessary to set out on your own. The world of computer programming awaits you.

Reprinted, by permission, from pp. 42-61 in BASIC by R. L. Albrecht, L. Finkel and J. R. Brown. Copyright © 1973 by John Wiley and Sons, Inc. One of a series of self-teaching guides.

WHAT you will learn. This is the third in a series of articles designed to introduce you to BASIC which is one of the most popular computer languages. This time around, you will practice writing short programs and also be introduced to the BASIC statements: LET, INPUT and REMARK. You'll also learn the concept of a *variable* and will be able to assign values to those variables using BASIC programs. By the time you finish this installment, and after having read the first two installments before this one, you will be able to: write short programs where values are assigned to variables by means of LET and INPUT statements; construct a combination of statements to identify the value(s) called for by an INPUT statement; write programs where a value calculated by a BASIC statement is assigned to a variable in a LET statement.

To illustrate the concept of *variable* and the function of the LET statement in BASIC, imagine that there are 26 little boxes inside the computer. Each box can contain one number at any one time:

A	7	H		O		V	
B	5	I		P		W	
C		J	4	Q		X	2.5
D		K		R		Y	
E		L		S	-6	Z	
F	2	M		T			
G		N		U			

We have already stored numbers in some of the boxes. For example,

7 is in box A
5 is in box B

- Q1.** (a) What number is in box F?
(b) In box J?
(c) What box is -6 in?
(d) What box contains 2.5?

A1. (a) 2, (b) 4, (c) S, (d) X

Boxes C and N are shown again below. Use a pencil to do the following.

- (a) Put 8 into Box C. In other words, write the numeral "8" in the box labeled "C."
(b) Put 12 into N.
(c) Put 27 into N. But wait! A box can hold only one number at a time. Before you can enter 27 into N, you must first erase the 12 that you previously entered.

When the computer puts a number into a box, it *automatically* erases the previous content of the box, just as you did. In order to put "27" into Box N, you first erased the previous content, "12."

We call A, B, C, . . . , Z *variables*. The number in Box A is the *value of A*; the number in Box B is the *value of B*; the number in C the *value of C* and so on.

Below is a program that uses the LET statement to instruct the computer to "put a number in a box," or more technically to assign a numerical *value* to a *variable*. This program tells the computer to

```

10 LET A=7 ← Put 7 into Box A.
20 PRINT A ← Print the content of Box A
99 END
RUN
7

```

- Q2.** (a) What is the *variable* in Line 10?
(b) What *value* is assigned to that variable?
- A2.** (a) A, (b) 7

Q3. Complete the following program to assign the value



23 to the variable X and then print the value of X.

```

10 .....
20 .....
99 END

```

A3. (Answer is listed below.)

```

10 LET X=23
20 PRINT X
99 END
RUN

23

```

Here is another example. This program adds four numbers, which might be scores of some kind, and computes the mean (average).

```

10 LET A=5
20 LET B=8
30 LET C=3
40 LET D=6
50 PRINT "SCORES: ";A;B;C;D
60 PRINT "MEAN: ";(A+B+C+D)/4
99 END
RUN

SCORES: 5 8 3 6
MEAN: 5.5

```

The LET statements in this program tell the computer to assign numerical values to variable, in this case to put values 5, 8, 3 and 6 into boxes A, B, C, and D. These values are printed (Line 50) and then the computer uses them (Line 60) to compute and print the mean.

Q4. Complete each of the following RUNs as you think the computer would do it. If possible, use a computer to find out if you are correct.

10 LET A=1	10 LET A=7	10 LET A=1
20 LET A=2	20 LET B=A	20 PRINT A
30 PRINT A	30 PRINT B	30 LET A=2
99 END	99 END	40 PRINT A
RUN	RUN	99 END
		RUN

A4. (a) 2

Note that the second value assigned to A in Line 20 replaced the value assigned to A by Line 10.

- (b) 7
- (c) 1
- (c) 2

Look at the preceding programs (a), (b) and (c). In program (b) the value of one variable is used to assign a value to another variable!

So it turns out that one variable can take its value from another variable. Not only that, but a variable can get its value from computations involving one or more other variables whose values have been previously assigned. (That last part is important.)

We can illustrate this with a program that will calculate the grade point average for a student. Assume the student received:

- 4 units of A
- 6 units of B
- 4 units of C
- 2 units of D
- 0 units of F

```

100 REMARK GRADE POINT AVERAGE PROGRAM USING LET STATEMENTS
110 LET A=4
120 LET B=6
130 LET C=4
140 LET D=2
150 LET F=0
160 LET U=A+B+C+D+F
170 LET G=(4*A+3*B+2*C+1*D)/U
180 PRINT "YOUR GRADE POINT AVERAGE IS";G
999 END

RUN

YOUR GRADE POINT AVERAGE IS 2.75

```

Q5. In Line 160, U (for Units) receives its value from the total of each letter grade. What numerical value does U receive when this program is RUN?

A5. U=16

Q6. Which line of the program computes and assigns the computed value to the variable G?

A6. Line 170

LET statements are all fine and good, but what a hassle to change all those LET statements in Lines 110 to 150 everytime you want to calculate the GPA (Grade Point Average) for a different set of grades. Ah, but leave it to BASIC to come up with a clever solution – namely the INPUT statement.

The INPUT statement allows the computer user to assign different values to INPUT variables each time a program is RUN without modifying the program itself. When the computer comes to an INPUT statement in a program, it types a question mark and waits for the user to enter a value for the INPUT variables (or variable). Here is an example.

```

20 INPUT A
30 PRINT "THIS TIME A =";A
99 END

RUN

```

In our example, we typed in 3 as the value to be assigned to A, pressed RETURN, and the computer then continued running the program, using A = 3. Here's the program again with the completed RUN:

```

20 INPUT A
30 PRINT "THIS TIME A =";A
99 END

RUN

?3
THIS TIME A = 3

```

The value of A is printed after the string

After we typed RUN and pressed the RETURN key, the computer typed a question mark. We then typed a 3, which is our value for the INPUT variable A. The computer then printed the string THIS TIME A = followed by the numerical value of A.

Q7. The program could be run again with a different value of A supplied by the user. What would a RUN look like if the user typed 7 as the value of A?

A7. (Answer is listed below.)

```

RUN

?7
THIS TIME A = 7
  
```

Now, in order to make things really clear when dealing with INPUT statements, we need a way of informing the user what the INPUT statement is asking for. Let's add this statement to our example program:

```

10 PRINT "WHAT IS YOUR VALUE FOR A";
  
```

See the semicolon at the end of the PRINT statement? When a semicolon is used at the end of a PRINT statement, the teletype stays on the same line *instead of* performing a "carriage return" and going to the beginning of the next line. Here is our revised program, and the beginning of a RUN.

```

10 PRINT "WHAT IS YOUR VALUE FOR A";
20 INPUT A
30 PRINT "THIS TIME A =";A
99 END

RUN

WHAT IS YOUR VALUE FOR A?
  
```

This much comes from Line 10 ↑ The question mark comes from the INPUT statement in Line 20

Now we know exactly what the computer is waiting for — a value for the variable A. We use 350 as the value, type it in after the question mark, then press RETURN.

```

RUN

WHAT IS YOUR VALUE FOR A?350
THIS TIME A = 350
  
```

Here's another RUN of the program, but now the user has entered 17 as the value of A.

```

RUN

WHAT IS YOUR VALUE FOR A?17
THIS TIME A = 17
  
```

Q8. Now you do one. Write a program, using *two* INPUT statements, that will result in the following printout when RUN.

```

RUN

VALUE OF X?5
VALUE OF Y?10
THEN X + Y = 15
  
```

Values supplied by user
Value computed

A8. Either of these two programs is correct.

```

10 PRINT "VALUE OF X";
20 INPUT X
30 PRINT "VALUE OF Y";
40 INPUT Y
50 PRINT "THEN X + Y =";X + Y
99 END
RUN

VALUE OF X?5
VALUE OF Y?10
THEN X + Y = 15
  
```

```

10 PRINT "VALUE OF X";
20 INPUT X
30 PRINT "VALUE OF Y";
40 INPUT Y
50 LET Z = X + Y
60 PRINT "THEN X + Y =";Z
99 END
RUN

VALUE OF X?5
VALUE OF Y?10
THEN X + Y = 15
  
```

So much for theory. Now let's apply the capabilities of the INPUT statement to the Grade Point Average program.

```

100 REMARK PROGRAM TO COMPUTE GRADE POINT AVERAGE
110 PRINT "HOW MANY UNITS OF A";
120 INPUT A
130 PRINT "HOW MANY UNITS OF B";
140 INPUT B
150 PRINT "HOW MANY UNITS OF C";
160 INPUT C
170 PRINT "HOW MANY UNITS OF D";
180 INPUT D
190 PRINT "HOW MANY UNITS OF F";
200 INPUT F
210 LET U=A+B+D+F
220 LET G=(4*A+3*B+2*C+1*D)/U
230 PRINT
240 PRINT "YOUR GRADE POINT AVERAGE IS";G
999 END
  
```

A PRINT statement with nothing following it causes the teletype to advance to the next line without printing anything, leaving "line spaces" as you'll see in the next RUN.

Here is a RUN of the preceding program featuring values of A, B, C, D and F supplied by the user.

```

RUN

HOW MANY UNITS OF A?4
HOW MANY UNITS OF B?6
HOW MANY UNITS OF C?6
HOW MANY UNITS OF D?0
HOW MANY UNITS OF F?0

YOUR GRADE POINT AVERAGE IS 2.875
  
```

Following each question mark, the user typed the requested value, then pressed the RETURN key
 After all 5 values had been entered, the computer computed the GPA and printed it

Q9. (a) How many units of A did the user enter?
(b) How many units of F?

A9. (a) 4 (b) 0



Let's demonstrate another capability of the INPUT statement. One INPUT statement can be used to assign values of two or more variables:

```

10 PRINT "VALUES OF X AND Y";
20 INPUT X,Y
30 PRINT "THEN X + Y =";X + Y
99 END

RUN

VALUES OF X AND Y?12,6
THEN X + Y = 18

```

There are two things to note:

```

20 INPUT X,Y ← No comma after the last variable
           ↑
No comma here ← Comma separates the variables

RUN

VALUES OF X AND Y?12,6 ← No comma after last value
                    ↑
                    Comma between values

```

Note that 12 is the value assigned to the first INPUT variable X, and 6 will be assigned to the second INPUT variable Y.

Here is the summary

When a program containing an INPUT statement with multiple variables is RUN, the first value typed in by the user after the INPUT question mark will be assigned to the first variable that appears in the INPUT statement; the second value typed in by the user will be assigned to the second variable appearing in the INPUT statement, etc. Both the variables in the INPUT statement in the program, and the values typed in by the user when the program is RUN, must be separated by commas.

Here is another RUN of the program in frame 14. We want to enter 73 as the value of X and 59 as the value of Y.

```

RUN

VALUES OF X AND Y?73
? ←
The computer typed another
question mark. This means
"Didn't you forget something?"

Whoops! We absent-
mindedly hit the
RETURN key.

```

We then completed the RUN by entering the second number, the value of Y. Here is the complete RUN:

```

RUN

VALUES OF X AND Y?73
? 59
THEN X + Y = 132

```

If we don't enter a numerical value for every variable in an INPUT statement, our computer types a question mark.

Q10. Your turn. Write a program to compute and print the value of $A*(B+C)$ for INPUT values of A, B, and C. A RUN should look like the following.

```

RUN

VALUES OF A,B,C?2,3,4
THEN A*(B + C) = 14

```

A10. Here are two ways to do it.

```

10 PRINT "VALUES OF A,B,C";
20 INPUT A,B,C
30 PRINT "THEN A*(B + C) =";A*(B + C)
99 END

10 PRINT "VALUES OF A,B,C";
20 INPUT A,B,C
30 LET D=A*(B + C)
40 PRINT "THEN A*(B + C) =";D
99 END

```

Here's a version of the program to calculate Grade Point Average that uses only one INPUT statement to tell the computer how many units of A, B, C, and F you received (or expect to receive). It uses a PRINT statement before the INPUT statement in order to identify the INPUT values needed.

```

100 REMARK PROGRAM TO COMPUTE GRADE POINT AVERAGE
110 PRINT "UNITS OF A,B,C,D AND F";
120 INPUT A,B,C,D,F
130 LET U=A+B+C+D+F
140 LET G=(4*A+3*B+2*C+1*D)/U
150 PRINT
160 PRINT "YOUR GRADE POINT AVERAGE IS";G
999 END

```

You may have noticed the REMARK statement used as a heading for various example programs. That's what it is, a remark by the programmer to identify what a program or a section of a program does. REMARK statements exist solely for the convenience of a person looking at a program, and (for a change) don't tell the computer to do anything. We will use REMARK to identify most of the programs that follow.

Q11. What will a RUN of the program look like if we enter 2 units of A, 5 units of B, 4 units of C, 3 units of D and 3 units of F?

A11. (Answer is listed below.)

```

RUN

UNITS OF A,B,C,D AND F?2,5,4,3,3

YOUR GRADE POINT AVERAGE IS 2

```

Now, let's consider a problem in the field of population growth.

PROBLEM: In year zero, we start with a population of P people. The population increases by 1% each year. In N years, what will the population be?

P is the initial population.
 R is the growth rate in percent per year.
 N is the number of years.
 Q is the population after N years.

$$Q = P(1 + \frac{1}{100})^N \leftarrow N \text{ years}$$

1% increase per year

↑
Initial population

↓
Population at the end of N years

If the growth rate is 2.5% per year, then

$$Q = P(1 + 2.5/100)^N$$

And, if the growth rate is R% per year, then

$$Q = P(1 + r/100)^N$$

Q12. For review, write this last formula as a LET statement for variable Q using BASIC notation.

170 LET Q =

A12. (Answer is listed below.)

```
170 LET Q=P*(1 + R/100) ^ N
```

NOTE: This formula may actually be used to compute the growth rate for anything that increases by a fixed proportion percentage for a given length of time (e.g., interest on money, bacteria culture growth, etc.).

Here is one version of a population growth program.

```
100 REMARK PROGRAM TO CALCULATE POPULATION GROWTH
110 PRINT "INITIAL POPULATION";
120 INPUT P
130 PRINT "RATE OF GROWTH";
140 INPUT R
150 PRINT "NUMBER OF YEARS";
160 INPUT N
170 LET Q=P*(1+R/100) ^ N
180 PRINT
190 PRINT "POPULATION AFTER";N;"YEARS IS";Q
999 END
```

RUN

```
INITIAL POPULATION?1000
RATE OF GROWTH?1
NUMBER OF YEARS?20

POPULATION AFTER 20 YEARS IS 1220.19
```

Q13. It is now the year 1973. The population of the earth is about 3.6 billion people. The growth rate is about 2% per year. Suppose this growth rate persists until the year 2001. We want to know what the population will be in 2001. Show how this information is entered by completing the blanks in the following part of a RUN.

```
RUN

INITIAL POPULATION?
RATE OF GROWTH?
NUMBER OF YEARS?
```

A13. We think you did it this way.

RUN

```
INITIAL POPULATION?3600000000
RATE OF GROWTH?2
NUMBER OF YEARS?28
```

POPULATION AFTER 28 YEARS IS 6.267686E+09

Or perhaps this way:

RUN

```
INITIAL POPULATION?3.6E9
RATE OF GROWTH?2
NUMBER OF YEARS?28
```

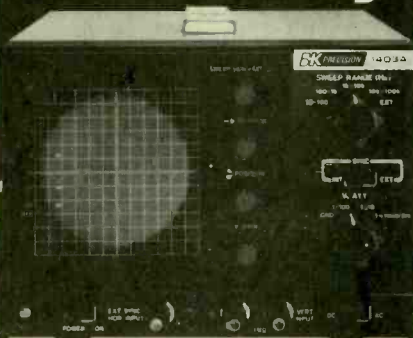
POPULATION AFTER 28 YEARS IS 6.267686E+09

According to our RUN, in the year 2001 the population of the Earth will be 6.267686E+09 people. Here are some other ways to write that number: 6.267686 billion; 6,267,686,000 or 6267686000.

What You Have Learned

1. A computer uses a LET statement to assign a numerical value to a variable. One variable can take its value from another variable. A variable can also get its value from computations involving one or more variables whose values have been previously assigned.
2. The INPUT statement allows the user to assign different values to INPUT variables each time a program is RUN without modifying the program itself. When the computer comes to an INPUT statement in a program, it types a question mark and waits for the user to enter a value for the INPUT variable(s).
3. An INPUT statement allows for multiple variables. The first value the user types after the question mark produced during a RUN will be assigned to the first variable in the INPUT statement; the second to the second variable; and so forth. All values typed in by the user must be separated by commas.
4. REMARK statements exist solely for the convenience of a person examining the program. They do not tell the computer to do anything. They can be used as headings, to label checkpoints, anything the programmer desires.

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301. Get the '78 *Elco* Catalog and see their do-it-yourself kits and factory assembled electronic equipment. Specialties are test equipment, burglar/fire alarms, hobbyist and auto electronics.
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 monitorradio scanner that offers 5-band performance.
304. *Dynascan's* new *B & K* catalog features test equipment for Industrial labs, schools, and TV servicing.
305. Before you build from scratch, check the *Fair Radio Sales* latest catalog for surplus gear.
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 Xcalite). 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.
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* 1978 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.
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 1978 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.
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.
354. A government FCC License can help you qualify for a career in electronics. Send for Information from *Cleveland Institute of Electronics*.
356. *Continental Specialties* has a new catalog featuring breadboard and test equipment for the professional and hobbyist. Descriptions, pictures and specifications aid your making a choice.
361. "Solving CB Noise Problems" is published by *Gold Line* and tells you how to reduce the noise and get a clearer signal. In discussion and diagram you can find out about the kinds of noise, their sources, and the remedies.
362. *B&F Enterprises'* Truckload Sale catalog offers 10% off all merchandise: (military or industrial surplus) speaker kits, TV games, computer terminals, tools, TV components, lenses, and more.
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Ring-A-Thing

(Continued from page 66)

do so in the test procedure outlined below. Q2 is mounted directly to the printed circuit board without a heat sink. None is required since the transistor operates as a switch, resulting in almost no power dissipation.

The method of connecting the telephone line and AC power cord to the printed circuit is left up to the builder. If the unit is to be used at a location not convenient to AC power you may want to use a small terminal strip or connector for the telephone line. This permits easy removal when battery charging is required.

Watch It, Buddy! It is recommended that the cells be handled in a discharged state. NiCad cells are capable of delivering very large short circuit currents (50 amperes or more) even when only partially charged. Once the cells are mounted and wired to the printed circuit any accidental short circuit between the cells or other components on the board may cause a very large current flow. Such currents can easily burn out printed circuit wiring.

Checking the Circuit. After the unit is assembled and wired it is recommended that the charger current be measured so that the proper value of R5 can be placed in the circuit. Since different 6.3-volt filament transformers can vary considerably in output voltage and internal impedance, the current

delivered by the charger should be checked and adjusted if necessary. The best method of measuring charging current is to insert a 0-1 ampere DC meter in series with R5. An alternate method is to measure the resistance of R5, connect it into the circuit, and measure the DC voltage across it. Current can then be calculated by dividing the voltage measurement by the resistance.

The recommended charge current for the C cells specified in the parts list is 120 milliamperes. This will charge the battery in 14 hours, and there would be no danger of overcharge if the line power was connected for several days. If you prefer to leave the charger permanently connected to the AC power line the charge current should be reduced by a factor of three, to 40 milliamperes. This will keep the cells at 100% charge without any danger of cell damage. If NiCad cells of other capacities are used the charge current should be set up to one tenth of the ampere hour rating of the cells, or to 1/30 the rating if the charger is to be operated permanently. For example, if size D cells with a 3.5 ampere hour rating were used, the charge current would be set to 350 milliamperes or 115 milliamperes. The value of R5 should be changed, if necessary, to provide the desired current. Note that it is not necessary to set the current to exactly one tenth of the rating of the cells. Less current can be used with the disadvantage being that it would take longer than 14 hours to fully charge the

battery. Do not use a larger current than specified. To do so will damage the cells on overcharge.

Installing Ring-A-Thing. The unit is connected across the telephone line as shown in the schematic. The only exception to this will be for two party telephones. In this case the telephone ringing signal is impressed between one of the telephone lines and ground. (The other party's ringing signal is impressed across the other line and ground). You will have to experiment to determine which of the two lines has your ringing signal. If you inadvertently connect the circuit to the wrong line, you will be answering the other party's calls! For the ground connection you may use any convenient ground point such as a BX ground.

Before installing the unit you should operate the charger at least 14 hours to fully charge the battery, unless you plan to leave the charger connected permanently to the power line. With a fully charged battery the unit will operate several months before a recharge is necessary. The power demand of the charger is about 2 watts, and will have little effect on your electric bill if left operating. In this case the unit would need no further attention, and you can forget it.

When You Start. You'll need a template to build Ring-A-Thing's printed circuit board. Take a look at the parts list under the schematic diagram to find out how to get it. It's as easy as answering the phone. ■

PAIA Programmable Drum

(Continued from page 64)

changes you wish. The *rest* pad will, during single stepping, play one programmed drum sound with each tap of the pad.

External synchronization can be used by plugging an input line into a pin jack on the back panel. A five volt trigger current from this line steps the internal clock of the drum set. If the trigger pulses are short, they will single step the clock; if long they will run the clock ahead at the rate set by the tempo control. An automatic synchronizing device or foot pedal can be used in this way.

A Peek at the Electronics. The instruction manual which comes with the kit provides a full description, along with circuit schematics, of the way these effects are achieved. Here are some of the more notable aspects:

The drum sounds are built up by means of oscillators using Quad Norton Amp IC's. They have variable sustain controls mounted inside the cabinet for control of the amount of feedback to

each oscillator. The snare sound is made by a noise voicing circuit which avalanches a reverse-bias base-emitter junction of one transistor and feeds it to an IC gating amplifier. This takes the amp out of saturation and lets a signal pass, producing the snare sound. When the activating pulse from the touch pad ends, the amp slowly goes back to a saturated condition to terminate the signal. The total output of all the oscillators is fed to a buffering IC amplifier which drives the output of the unit.

The drum set memory is comprised of two 2112 type memory chips, each 1024 x 1 bit, arranged into 256 x 4 bit words. Together, the two chips represent a 256 x 8 bit memory. Six of the eight bits go to the seven stage IC counter, while the other two select the "page" of memory wanted (one of either the two main or two bridge memories).

The *reset* pad, when touched, causes the read/write memory lines to go into the read state, sets the counter to zero, stops the tempo clock and finally applies a clocking pulse to strobe the current state of the bistable *bridge select* pad.

Play causes the tempo clock to gen-

erate a train of square waves, which in turn advances the counter IC by one count for each cycle. At the same time, a differentiating network produces a pulse making the memory locations specified by the address lines appear at the memory output.

The *program* switch causes the memory to go into the write state. When the touch switches are touched, a signal goes to the clock and advances it. If the touch switches are tapped, the clock will advance by only one cycle. If they are held down, the clock will be repeatedly advanced at a rate determined by the tempo control. Touching the pads will also activate their respective oscillators. The *REST* pads does the same thing without activating any oscillators. The *save* switch supplies a "keep alive" voltage to the memories even when the rest of the circuitry is shut off.

Pay attention to some of the finer details of programming, build carefully, and the beat will go on—and on! The Programmable Drum set is available from PAIA Electronics, Inc., Box 14359, Oklahoma City, Okla., 73114. Price is \$79.95 plus \$3.00 shipping. Circle No. 70 on the readers' service card for more information. ■

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729	74M730	74M731	74M732	74M733	74M734	74M735	74M736	74M737	74M738	74M739	74M740	74M741	74M742	74M743	74M744	74M745	74M746	74M747	74M748	74M749	74M750	74M751	74M752	74M753	74M754	74M755	74M756	74M757	74M758	74M759	74M760	74M761	74M762	74M763	74M764	74M765	74M766	74M767	74M768	74M769	74M770	74M771	74M772	74M773	74M774	74M775	74M776	74M777	74M778	74M779	74M780	74M781	74M782	74M783	74M784	74M785	74M786	74M787	74M788	74M789	74M790	74M791	74M792	74M793	74M794	74M795	74M796	74M797	74M798	74M799	74M800	74M801	74M802	74M803	74M804	74M805	74M806	74M807	74M808	74M809	74M810	74M811	74M812	74M813	74M814	74M815	74M816	74M817	74M818	74M819	74M820	74M821	74M822	74M823	74M824	74M825	74M826	74M827	74M828	74M829	74M830	74M831	74M832	74M833	74M834	74M835	74M836	74M837	74M838	74M839	74M840	74M841	74M842	74M843	74M844	74M845	74M846	74M847	74M848	74M849	74M850	74M851	74M852	74M853	74M854	74M855	74M856	74M857	74M858	74M859	74M860	74M861	74M862	74M863	74M864	74M865	74M866	74M867	74M868	74M869	74M870	74M871	74M872	74M873	74M874	74M875	74M876	74M877	74M878	74M879	74M880	74M881	74M882	74M883	74M884	74M885	74M886	74M887	74M888	74M889	74M890	74M891	74M892	74M893	74M894	74M895	74M896	74M897	74M898	74M899	74M900	74M901	74M902	74M903	74M904	74M905	74M906	74M907	74M908	74M909	74M910	74M911	74M912	74M913	74M914	74M915	74M916	74M917	74M918	74M919	74M920	74M921	74M922	74M923	74M924	74M925	74M926	74M927	74M928	74M929	74M930	74M931	74M932	74M933	74M934	74M935	74M936	74M937	74M938	74M939	74M940	74M941	74M942	74M943	74M944	74M945	74M946	74M947	74M948	74M949	74M950	74M951	74M952	74M953	74M954	74M955	74M956	74M957	74M958	74M959	74M960	74M961	74M962	74M963	74M964	74M965	74M966	74M967	74M968	74M969	74M970	74M971	74M972	74M973	74M974	74M975	74M976	74M977	74M978	74M979	74M980	74M981	74M982	74M983	74M984	74M985	74M986	74M987	74M988	74M989	74M990	74M991	74M992	74M993	74M994	74M995	74M996	74M997	74M998	74M999	74M1000	74M1001	74M1002	74M1003	74M1004	74M1005	74M1006	74M1007	74M1008</
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SN7403	.19	.20	SN7447	1.25	1.28
SN7404	.25	.26	SN7448	1.35	1.36
SN7405	.19	.20	SN7450	.19	.20
SN7406	.19	.20	SN7451	.19	.20
SN7408	.21	.22	SN7453	.19	.20
SN7410	.19	.20	SN7454	.19	.20
SN7413	.39	.40	SN7460	.19	.20
SN7414	.85	.86	SN7462	.19	.20
SN7416	.29	.30	SN7463	.19	.20
SN7417	.35	.36	SN7464	.19	.20
SN7420	.19	.20	SN7468	.19	.20
SN7423	.29	.30	SN7470	.25	.26
SN7426	.25	.26	SN7471	.25	.26
SN7427	.25	.26	SN7472	.25	.26
SN7430	.29	.30	SN7473	.55	.56
SN7432	.25	.26	SN7474	.29	.30
SN7437	.25	.26	SN7475	.79	.80
SN7438	.29	.30	SN7476	.59	.60
SN7440	.19	.20	SN7478	.59	.60
SN7442	.69	.70	SN7479	.39	.40
SN7443	.69	.70	SN7482	.39	.40

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SN7486	.39	.40	SN7414	.25	.26
SN7492	.45	.46	SN7415	.25	.26
SN7490	.69	.70	SN7416	.39	.40
SN7491	.79	.80	SN7417	.125	1.26
SN7492	.45	.46	SN7418	.19	.20
SN7493	.49	.50	SN7419	.25	.26
SN7494	.69	.70	SN7420	.19	.20
SN7495	.69	.70	SN7421	.25	.26
SN7496	.69	.70	SN7422	.69	.70
SN7497	.69	.70	SN7423	.59	.60
SN7498	.69	.70	SN7424	.69	.70
SN7499	.69	.70	SN7425	.69	.70
SN7500	1.49	1.50	SN7426	.69	.70
SN7501	.69	.70	SN7427	.69	.70
SN7502	.69	.70	SN7428	.69	.70
SN7503	.69	.70	SN7429	.69	.70
SN7504	.69	.70	SN7430	.69	.70
SN7505	.69	.70	SN7431	.69	.70
SN7506	.69	.70	SN7432	.69	.70
SN7507	.69	.70	SN7433	.69	.70
SN7508	.69	.70	SN7434	.69	.70
SN7509	.69	.70	SN7435	.69	.70
SN7510	.69	.70	SN7436	.69	.70
SN7511	.69	.70	SN7437	.69	.70
SN7512	.69	.70	SN7438	.69	.70
SN7513	.69	.70	SN7439	.69	.70
SN7514	.69	.70	SN7440	.69	.70
SN7515	.69	.70	SN7441	.69	.70
SN7516	.69	.70	SN7442	.69	.70
SN7517	.69	.70	SN7443	.69	.70
SN7518	.69	.70	SN7444	.69	.70
SN7519	.69	.70	SN7445	.69	.70
SN7520	.69	.70	SN7446	.69	.70
SN7521	.69	.70	SN7447	.69	.70
SN7522	.69	.70	SN7448	.69	.70
SN7523	.69	.70	SN7449	.69	.70
SN7524	.69	.70	SN7450	.69	.70
SN7525	.69	.70	SN7451	.69	.70
SN7526	.69	.70	SN7452	.69	.70
SN7527	.69	.70	SN7453	.69	.70
SN7528	.69	.70	SN7454	.69	.70
SN7529	.69	.70	SN7455	.69	.70
SN7530	.69	.70	SN7456	.69	.70
SN7531	.69	.70	SN7457	.69	.70
SN7532	.69	.70	SN7458	.69	.70
SN7533	.69	.70	SN7459	.69	.70
SN7534	.69	.70	SN7460	.69	.70
SN7535	.69	.70	SN7461	.69	.70
SN7536	.69	.70	SN7462	.69	.70
SN7537	.69	.70	SN7463	.69	.70
SN7538	.69	.70	SN7464	.69	.70
SN7539	.69	.70	SN7465	.69	.70
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SN7543	.69	.70	SN7469	.69	.70
SN7544	.69	.70	SN7470	.69	.70
SN7545	.69	.70	SN7471	.69	.70
SN7546	.69	.70	SN7472	.69	.70
SN7547	.69	.70	SN7473	.69	.70
SN7548	.69	.70	SN7474	.69	.70
SN7549	.69	.70	SN7475	.69	.70
SN7550	.69	.70	SN7476	.69	.70
SN7551	.69	.70	SN7477	.69	.70
SN7552	.69	.70	SN7478	.69	.70
SN7553	.69	.70	SN7479	.69	.70
SN7554	.69	.70	SN7480	.69	.70
SN7555	.69	.70	SN7481	.69	.70
SN7556	.69	.70	SN7482	.69	.70
SN7557	.69	.70	SN7483	.69	.70
SN7558	.69	.70	SN7484	.69	.70
SN7559	.69	.70	SN7485	.69	.70
SN7560	.69	.70	SN7486	.69	.70
SN7561	.69	.70	SN7487	.69	.70
SN7562	.69	.70	SN7488	.69	.70
SN7563	.69	.70	SN7489	.69	.70
SN7564	.69	.70	SN7490	.69	.70
SN7565	.69	.70	SN7491	.69	.70
SN7566	.69	.70	SN7492	.69	.70
SN7567	.69	.70	SN7493	.69	.70
SN7568	.69	.70	SN7494	.69	.70
SN7569	.69	.70	SN7495	.69	.70
SN7570	.69	.70	SN7496	.69	.70
SN7571	.69	.70	SN7497	.69	.70
SN7572	.69	.70	SN7498	.69	.70
SN7573	.69	.70	SN7499	.69	.70
SN7574	.69	.70	SN7500	.69	.70
SN7575	.69	.70	SN7501	.69	.70
SN7576	.69	.70	SN7502	.69	.70
SN7577	.69	.70	SN7503	.69	.70
SN7578	.69	.70	SN7504	.69	.70
SN7579	.69	.70	SN7505	.69	.70
SN7580	.69	.70	SN7506	.69	.70
SN7581	.69	.70	SN7507	.69	.70
SN7582	.69	.70	SN7508	.69	.70
SN7583	.69	.70	SN7509	.69	.70
SN7584	.69	.70	SN7510	.69	.70
SN7585	.69	.70	SN7511	.69	.70
SN7586	.69	.70	SN7512	.69	.70
SN7587	.69	.70	SN7513	.69	.70
SN7588	.69	.70	SN7514	.69	.70
SN7589	.69	.70	SN7515	.69	.70
SN7590	.69	.70	SN7516	.69	.70
SN7591	.69	.70	SN7517	.69	.70
SN7592	.69	.70	SN7518	.69	.70
SN7593	.69	.70	SN7519	.69	.70
SN7594	.69	.70	SN7520	.69	.70
SN7595	.69	.70	SN7521	.69	.70
SN7596	.69	.70	SN7522	.69	.70
SN7597	.69	.70	SN7523	.69	.70
SN7598	.69	.70	SN7524	.69	.70
SN7599	.69	.70	SN7525	.69	.70
SN7600	.69	.70	SN7526	.69	.70
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SN7604	.69	.70	SN7530	.69	.70
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SN7607	.69	.70	SN7533	.69	.70
SN7608	.69	.70	SN7534	.69	.70
SN7609	.69	.70	SN7535	.69	.70
SN7610	.69	.70	SN7536	.69	.70
SN7611	.69	.70	SN7537	.69	.70
SN7612	.69	.70	SN7538	.69	.70
SN7613	.69	.70	SN7539	.69	.70
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SN7615	.69	.70	SN7541	.69	.70
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SN7621	.69	.70	SN7547	.69	.70
SN7622	.69	.70	SN7548	.69	.70
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SN7624	.69	.70	SN7550	.69	.70
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SN7626	.69	.70	SN7552	.69	.70
SN7627	.69	.70	SN7553	.69	.70
SN7628	.69	.70	SN7554	.69	.70
SN7629	.69	.70	SN7555	.69	.70
SN7630	.69	.70	SN7556	.69	.70
SN7631	.69	.70	SN7557	.69	.70
SN7632	.69	.70	SN7558	.69	.70
SN7633	.69	.70	SN7559	.69	.70
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SN7640	.69	.70	SN7566	.69	.70
SN7641	.69	.70	SN7567	.69	.70
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SN7644	.69	.70	SN7570	.69	.70
SN7645	.69	.70	SN7571	.69	.70
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SN7647	.69	.70	SN7573	.69	.70
SN7648	.69	.70	SN7574	.69	.70
SN7649	.69	.70	SN7575	.69	.70
SN7650	.69	.70	SN7576	.69	.70
SN7651	.69	.70	SN7577	.69	.70
SN7652	.69	.70	SN7578	.69	.70
SN7653	.69	.70	SN7579	.69	.70
SN7654	.69	.70	SN7580	.69	.70
SN7655	.69	.70	SN7581	.69	.70
SN7656	.69	.70	SN7582	.69	.70
SN7657	.69	.70	SN7583	.69	.70
SN7658	.69	.70	SN7584	.69	.70
SN7659	.69	.70	SN7585	.69	.70
SN7660	.69	.70	SN7586	.69	.70
SN7661	.69	.70	SN7587	.69	.70
SN7662	.69	.70	SN7588	.69	.70
SN7663	.69	.70	SN7589	.69	.70
SN7664	.69	.70	SN7590	.69	.70
SN7665	.69	.70	SN7591	.69	.70
SN7666	.69	.70	SN7592	.69	.70
SN7667	.69	.70	SN7593	.69	.70
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SN7671	.69	.70	SN7597	.69	.70
SN7672	.69	.70	SN7598	.69	.70
SN7673	.69	.70	SN7599	.69	.70
SN7674	.69	.70	SN7600	.69	.70
SN7675	.69	.70	SN7601	.69	.70
SN7676	.69	.70	SN7602	.69	.70
SN7677	.69	.70	SN7603	.69	.70
SN7678	.69	.70	SN7604	.69	.70
SN7679	.69	.70	SN7605	.69	.70
SN7680	.69	.70	SN7606	.69	.70
SN7681	.69	.70	SN7607	.69	.70
SN7682	.69	.70	SN7608	.69	.70
SN7683	.69	.70	SN7609	.69	.70
SN7684	.69	.70	SN7		

Tele-gadgets and Gizmos

(Continued from page 46)

Talk about gadgets and gizmos you can't get from the phone company, how about the touch-tone telephone. If you simply can't live without dialing by pushing buttons instead of pulling a rotary dial around, you can have it even if your local phone company claims their equipment doesn't handle touch-tone dialing. Telephone specialty shops sell a phone with a touch-tone dial having a built-in digital converter that sends out dial-type pulses. You

might be pressing buttons but the telephone system senses dial pulses.

Another gadget you can't get from the phone company (as far as we know) is the automatic emergency dialer. Some of the automatic models will dial up to three telephone numbers and play recorded messages to the effect your home is being robbed, or there is a fire, or any other message you want. These dialers can be tripped by burglar and fire alarm devices, or any other trip-type mechanism you want.

If you can't fit the cost of one of these rather expensive commercial dialers into your budget, or can't find one

that suits your particular needs (because often the emergency announcement and dialed number(s) must be programmed by the dealer), perhaps the Heathkit GD-1156 is the answer to your needs. The Heathkit dialer can be instantly programmed to dial any number when tripped by any type of security sensor. When you pick up the phone on the other end you can listen to all sounds in your home through a microphone system that is part of the Heathkit dialer.

The Connecting Jack. The gadget that really made sophisticated telephone accessory equipment available to even the non-technical user is the four prong standard telephone jack. (Some parts of the country now use a mini-jack, but mini-to-standard converter patch cords are available.)

Most, not all, telephone accessories and equipments are designed to connect to the telephone circuits through the jack and plug shown in the photographs. Until recently, the user (called "subscriber" by many telephone companies) paid for a single jack. Many telephone companies got smart and increased the cost of a jack installation way beyond its actual value, so an accessory has been designed that connects the ordinary telephone connecting block to a jack.

Naturally, if you have one jack and one plug a single accessory ties up your system. Again it's American know-how to the rescue. Most parts stores that sell telephone accessories also sell a "multiple" or "three way" adaptor. This works just like an electrical "octopus, or "cube tap." Providing three outlets when plugged in. If three outlets aren't enough you can use stacking plugs, such as shown in the photograph. Unlike the standard telephone plug with prongs on one side and a cover for the rear, the stacking plug has prongs on one side and sockets on the rear.

Blood From A Stone. Keep in mind that some states might ban the use of certain accessories, others might permit the phone company to charge for accessories, other accessories are "free" but must be reported (by F.C.C. edict). If the phone company wants to squeeze blood from a stone they will somehow manage to do it, so they can just as easily squeeze money out of you. Before installing any equipment check carefully. If necessary, contact the local phone company to determine what's illegal, and what's free. But never tell them your name, address or phone number. Remember, the phone companies would like to charge for everything, and what's free today they might be able to charge for tomorrow.

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MICROPROCESSORS

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LOGIC DIGITS AND LAMPS

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10111 1.44 10112 1.44 10113 1.44 10114 1.44 10115 1.44 10116 1.44 10117 1.44 10118 1.44 10119 1.44 10120 1.44 10121 1.44 10122 1.44 10123 1.44 10124 1.44 10125 1.44 10126 1.44 10127 1.44 10128 1.44 10129 1.44 10130 1.44 10131 1.44 10132 1.44 10133 1.44 10134 1.44 10135 1.44 10136 1.44 10137 1.44 10138 1.44 10139 1.44 10140 1.44 10141 1.44 10142 1.44 10143 1.44 10144 1.44 10145 1.44 10146 1.44 10147 1.44 10148 1.44 10149 1.44 10150 1.44 10151 1.44 10152 1.44 10153 1.44 10154 1.44 10155 1.44 10156 1.44 10157 1.44 10158 1.44 10159 1.44 10160 1.44 10161 1.44 10162 1.44 10163 1.44 10164 1.44 10165 1.44 10166 1.44 10167 1.44 10168 1.44 10169 1.44 10170 1.44 10171 1.44 10172 1.44 10173 1.44 10174 1.44 10175 1.44 10176 1.44 10177 1.44 10178 1.44 10179 1.44 10180 1.44 10181 1.44 10182 1.44 10183 1.44 10184 1.44 10185 1.44 10186 1.44 10187 1.44 10188 1.44 10189 1.44 10190 1.44 10191 1.44 10192 1.44 10193 1.44 10194 1.44 10195 1.44 10196 1.44 10197 1.44 10198 1.44 10199 1.44 10200 1.44

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Kathi's CB Carousel

(Continued from page 69)

go modern with one of the new automatic antennas. Between the concealed antenna and the in-dash CB rig you sharply reduce the possibility of a passerby knowing your car is CB equipped. (If your disappearing CB antenna isn't already equipped with an AM/FM/CB coupler-matcher you can get one as an accessory for any model.)

No feature and/or convenience is of any value if the CB rig can't deliver all the performance you need when you need it. That's no problem with the

TRC-471 because the CB performance checked out with the best.

Power output into 50 ohms measured 3.7 watts with 85% modulation delivered by a -36 dB microphone input signal (+16 dB more sensitive than average voice level.) Modulation was limited to 100%, and I worked stations who told me the overall modulation sound quality was crisp.

The receiver sensitivity checked out at 0.5 uV for 10 dB S+N/N (signal plus noise to noise). Adjacent channel rejection was an outstanding 70 dB. The AGC action for an input range of 2 to 10,000 uV measured 14 dB, not outstanding by any means. Fact is, if the volume is cranked up to snare a weak signal a strong signal coming on the channel really rattles the windows. Then again, I'd rather have super selectivity than a tight 3 to 7 dB AGC—if I must make a choice between the two. Once the signal level gets over 10 uV the AGC action calms down to a more typical 6 dB.

The rig is equipped with an S/RF-output meter, but it's one of the mini-sized types common to in-dash models.

Installation. I'm not going to say the installation was a snap. While the actual radio/transceiver installation isn't difficult—particularly if the stereo speakers are already in the car from an existing radio—finding out how to take the dash

apart, or how to remove the old radio, can be a two-aspirin headache. Though I knew only a few screws secured the front of the dash I had no idea where they were. Locating someone to tell me how to go about taking the old radio out was the worse part of the job. The regular CB shop where I Koffee-Klatch on weekends was closed for alteration (they are expanding), so I tried other shops. It was always the same story: "We get paid for installation, not free advice. Why don't you just let us do the job honey." (I won't let anyone who calls me honey do any work for me. I have a name and handle.) Finally, I located one of the techs from my favorite CB shop and he told me which four screws held the entire dash trim in place. (Imagine, four screws and not one of those installation creeps would tell me where they were located.)

What with riding around trying to find out how to get the dash trim off and installing a disappearing antenna I spent the good part of a Saturday doing an in-dash installation. But when it was finished—WOW. I can drive into the city and not worry some hoodlum is going to get an easy crack at my CB.

For more information on the Realistic TRC-471 drop in at your local Radio Shack, and circle No. 32 on the Readers' Service Card.

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Wire Kit 1 at \$9.95 = 2.13¢/ft.	

30 Kynar stripped 1" on each end. Lengths are overall
Colors: Red, Blue, Green, Yellow, Black, Orange, White
Wire packaged in plastic bags. Add 25¢/length for tubes.

	100	500	1000	5000
2 1/2 in.	78	240	430/K	3.89/K
3 in.	82	260	471/K	4.22/K
3 1/2 in.	86	280	512/K	4.55/K
4 in.	90	300	552/K	4.88/K
4 1/2 in.	94	321	593/K	5.21/K
5 in.	98	342	634/K	5.52/K
5 1/2 in.	1.02	365	675/K	5.86/K
6 in.	1.06	385	716/K	6.19/K
6 1/2 in.	1.15	405	757/K	6.52/K
7 in.	1.20	425	798/K	6.85/K
7 1/2 in.	1.25	445	839/K	7.18/K
8 in.	1.29	465	880/K	7.53/K
8 1/2 in.	1.32	485	921/K	7.84/K
9 in.	1.36	505	962/K	8.17/K
9 1/2 in.	1.40	525	1003/K	8.50/K
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Add'l. in.	.10	.41	.82/K	.66/K

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18 pin	46	43	39	35	32	30
18 pin	63	58	54	47	44	41
20 pin	84	78	71	63	59	54
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24 pin	91	84	78	68	64	59
28 pin	125	115	108	95	89	82
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12"	1.33	1.44	2.24	2.33	2.55	3.92
24"	1.52	1.65	2.63	2.52	2.76	4.31
48"	1.91	2.06	3.40	2.91	3.17	5.08

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ELEMENTARY ELECTRONICS/March-April 1978

1
out of
2 who
have it
don't
know
it...

Do you?

21 million Americans have high blood pressure. But 50 percent of those who have it, don't know it!

When blood pressure goes higher than it should, and stays high, it sets the stage for heart attack or stroke.

Most cases of high blood pressure can be controlled with drugs and other advances in treatment. That's why you should see your doctor regularly. Only he can tell if you need help.

A public service message from your Heart Association



Continued on the next page

Sky-High CB (Continued from page 54)

ions lifeline. "There was a fellow and a girl who had been at a party drinking. They got into his pickup, took a bottle with them, and went outside of town. Being drunk they got lost and stuck," Bill recalls. "It was snowing and he didn't have any idea where he was. The police did pick up on the call, they were notified by a CBER and they tuned to the channel the guy was using. We were able to get some four wheel drive vehicles out there and we did find them.

This nut was rally buried. He was about three miles off the road, stuck in somebody's wheat field in snowdrifts."

Unless you're an expert in aircraft avionics, Bill suggests having an aircraft radio shop install your CB. If the airplane is new and not too noisy, you might get away without running it through the aircraft radio system. If not, you'll have to pay an aircraft radio shop \$12 to \$24 per hour for installation labor. Though the experts get paid top dollar for their time, it'll usually take them less time to do the job and it'll probably be done right the first time.

Telephone Trigger (Continued from page 41)

phone has rung it is best to hang up, wait 2 minutes, and try again. Also, since it is possible that you may call during a time that the circuit is in an activated state due to any calls made by others, it would be good practice to ring the code two times, spaced several minutes apart.

Galaxy Computer Game (Continued from page 52)

most interesting features of GALAXY II, and is certainly a realistic simulation of economics. Depending on a planet's environment level, and level of development, it has what is termed Indexes of Efficiency and of Capacity. Simply put, the Index of Capacity governs how fast your population can grow and how quickly your planetary colonies can expand.

A player, who is considered his own race's leader, can invest in either of these indexes. This means you can decide, "Well, maybe I won't build that lovely fleet of Destroyer-class ships this turn. If I take the money and invest it in research (i.e. in my Index of Efficiency) then perhaps on the next turn I'll be able to build twice as many ships at only half the cost."

The interesting thing is, you can invest money (UUs—Universal Units) that you have or that you *don't* have. The latter method is known as deficit financing and is done by raising the income taxes of your colony to wartime levels. This is great, but does have certain drawbacks. For instance, after two turns of this, and if your investment has not shown a profit, your own colonists are likely to rebel against you. You can find yourself fighting not only a galactic war, but a few civil ones at the same time!

GALAXY II, which is play-by-mail with monthly turns, allows a person who is interested in computer gaming but who doesn't own a microcomputer to participate in a computer-run simulation.

The cost per turn is based on how many orders a Leader sends to his galactic minions. An average turn should cost in the neighborhood of five to eight dollars, no more than a magazine subscription. Brett Tondreau has a special introductory package available for twenty-five cents to any interested parties who write to: Brett Tondreau, GALAXY II, 20121-5 Leadwell St., Canoga Park, California 91306. Further information may be had by circling No. 72 on the reader service card.

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Sensitivity: less than 10 mv.
Frequency range: 5 Hz to 60 MHz, typically 65 MHz
Gate time: 1 second, 1/10 second, with automatic decimal point positioning on both direct and prescale
Display: 8 digit red LED, 4" height
Accuracy: 2 ppm, internal TCXO standard.
Input: BNC, 1 megohm direct, 50 Ohm with prescale option
Power: 110 V ac 5 Watts or 12 V dc @ 300-400 ma
Size: Approx. 6" x 4" x 2", high quality aluminum case

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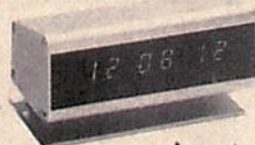
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• 6 jumbo .4" LED readouts
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Computer New Products

(Continued from page 70)

board generates the 128 character ASCII set. An optional numeric pad is available. The device impact prints 7 x 9 dot matrix characters at speeds up to 30 characters per second. Up to 132 characters per line can be printed and up to 64 characters can be stored in memory when the terminal is in receive mode. A horizontal and vertical tab option stores seven tabulation programs in erasable programmable read-only memory (EPROM). Each program contains 16 horizontal and 10 vertical stops. Programs are selected by an operator from the TC480 console. Average price: \$1,750. Circle 51 on Reader Service Coupon for more information.

Simply Basic

(Continued from page 61)

PRINT and (on some computers) the INPUT statement. Lines 113 and 114 show how to obtain quotation marks through the use of the function CHR\$, which calls for the ASCII value. For example, the number 34 is assigned to quotation marks in the ASCII system of alphanumeric encoding. By the statement PRINT CHR\$(34) we tell the computer to print a quotation mark. In effect we fool the computer because it does not see " as the keyboard entry.

Speaking of fooling the computer, to keep the program as short as possible we have not programmed protection against incorrect entries; you can literally fool the computer into outputting incorrect values. Normally, the program will solve all the possible values with only two entries of known values. If you also input a conflicting value—say an incorrect R (resistance) after entering E and I—the computer will output some incorrect information.

Divide By Zero Error Code. In this program a zero ("0") is used for the unknown values. For example, if you enter E and I, and zeroes for R and P, the computer will solve for R and P. The program causes the computer to check to see if a value can be solved before it tries to solve the problem; because of this it is unlikely your computer will output an ATTEMPT TO DIVIDE BY ZERO error code. (However, as with all things, somewhere out there is some form of BASIC that will output DIVIDE/BY 0 ATTEMPTED.)

Error Correction. This program employs ADRS (Automatic Data Recycling Subroutine) for correcting errors. If you make an error when inputting data simply type a -1 for the next value and the program will back up to the place where the error was made. To see how this is done examine lines 140 to 320.

WHAT IS CHANGE #3
? C
ENTER C IN FARADS? 27E-12

WHAT IS CHANGE #4
? L
ENTER L IN HENRIES? .10E-6

ENTER E IN VOLTS? 16

WHAT IS CHANGE #2
? P
ENTER P IN WATTS? 170

E=16.0000
I=10.6250
R=1.5058
P=170.0000
L=1.0000E-07
C=2.7000E-11
F=96907723.0000
X(C)=60.8580
X(L)=60.8580
TIME (PERIOD) =1.0319E-08

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



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 PRESCALER WILL FIT INSIDE COUNTER CABINET
 RESOLUTION: 1 HZ AT 1 SECOND, 10 HZ AT 1/10 SECOND
 FREQUENCY RANGE: 10 HZ TO 80 MHZ, (80 MHZ TYPICAL)
 SENSITIVITY: 10 MV RMS TO 80 MHZ, 20 MV RMS TO 80 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)
 IC PACKAGE COUNT: 8 (ALL SOCKETED)
 INTERNAL POWER SUPPLY: 5 V DC, REGULATED
 INPUT POWER REQUIRED: 8-12 VDC OR 115 VAC AT 50/60 HZ.
 POWER CONSUMPTION: 4 WATTS

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CIRCLE 26 ON READER SERVICE COUPON

Kansas City Update

(Continued from page 44)

pletely wired and tested.

National Multiplex. The name tells you absolutely nothing about this firm's products, which are essentially hobbyist versions of commercial digital tape recorders. Their model CC8 digital cassette recorder is really an ordinary cassette recorder with all new electronics that provides for NRZ (none return to zero) data recording. There are no audio tones to get distorted; the system always works. The only audio is a monitor tone(s) that lets you know a signal is being fed into or out of the recorder. It can operate virtually error-free with a good quality audio cassette tape such as TDK-AD, AUDEX, and Maxell UD up to 1200 baud, and similarly error-free to 4600 baud with data cassettes. In plain terms, 4600 baud means you can load a program that would take 18 minutes with paper tape (at 110 baud) in only 26 seconds. Fact is, we load a SWTP computer with 8K type 2.0 basic in less than 20 seconds using a CC8 recorder at 4600 baud. In months of operation we have had only one error when recording/reading programs.

The CC8 has an RS-232 or TTL I/O—as selected by the user. It is best

READERS SERVICE NO.	COMPANY NAME	PAGE NUMBER
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8	Avanti Research	16
9	B&F Enterprises	89
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—	Powercom	28
28	President	CV2
19	Progressive Edu-Kits	5
—	Quest	86
—	Radio Shack	CV4
—	Radio Shack	4
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—	Radio Shack	25
35	Ramsey Electronics	90
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used on computers with Motorola 6800 CPUs, such as the SWTP 6800 computer. Problem is, it cannot piggyback the control port. You need some program that switches from the control port to a recorder/reader port (we use #3 port) and back to the control port when loading BASIC. We use a *Linzer Loader* program—a short program that permits dumping any section of memory to the recorder, or reading of the recorder's output, and then return to the control port. The *Linzer Loader* checks every bit for parity and indicates a correct load on the control terminal. If the load is defective it is indicated by a special code and a readout of the memory location where the failure took place. If the location remains the same on three successive attempts to load you know you have a defective tape. If the load fails at different locations you know heat and/or humidity has affected the drive speed and you either correct the ambient conditions (not unusual for computer installations) or adjust the recorder's drive speed.

(Note: The *Linzer Loader* for SWTP 6800 computers is available to readers of *e/e* for \$5 from Harry Linzer, 12 Crafton Ct., Malverne, NY 11565. It comes complete with listing for SWTP 8K type 2.0 BASIC in 12K of memory and a TTY tape with the dump and loader programs. In combination with a CC8 recorder it permits loading BASIC in less than 20 seconds.)

The CC8 recorder is the fastest, most reliable we have seen in personal computing cassette recorders. The only problem we have run across is speed drift during very hot and humid weather. At 4600 Baud the speed tolerance is 1%. National Multiplex supplies a speed alignment tape but you'll need a counter. Otherwise, use a *Linzer Loader* program, load BASIC, and slowly change the setting of the speed adjustment so the loading failure occurs at progressively higher memory locations.

Mass Storage and File Handling. When you need to handle mass storage and files, the equipment to use is the floppy disc. These floppy discs are a rather expensive recording medium for the hobbyist. A more practical, certainly less expensive disc system, is the so-called *Mini-Floppy*, or *discette*, such as the Smoke Signal Broadcasting BFD-68 floppy disc system. Though intended for computers with Motorola 6800 CPUs, similar systems are available for the S-100 buss (8080 and Z-80 CPUs).

The Smoke Signal disc system is available fully wired and adjusted with one, two, or three floppy disc drives. It uses the 5-inch mini-floppy (discette) shown in the photographs. Each discette has upwards of 80,000 (80K) bytes of storage (the exact amount depend-

ing on the particular drive system). The primary advantage of the disc system in addition to its mass storage and relatively rapid retrieval is the ability to assign names to files, the renaming of files, the transfer of computer memory to disc and from disc to memory, and a direct jump to the starting location of any location loaded from disc to memory. All operations are under direct software control.

By using a disc system with at least two drives data can be easily and continuously updated. For example, assume you are the secretary of a bowling league. All previous information is on disc storage, along with a program for handling the bowling scores, averages, standings, handicaps, etc. The program is loaded from disc to the computer's memory. It combines previous file data on the league members with input from their latest games and creates a new, updated file. You can either save or erase previous files.

You can even transfer your BASIC interpreter to disc. This way, you simply call for the disc operating system to list the files on the tape, load the file which contains BASIC, usually named "BASIC", and in seconds rather than minutes your computer is loaded. (Fortran is now also available on disc for some S-100 buss computers).

Some disc systems provide the BASIC—usually the 8K extended variety—pre-recorded on disc along with a disc operating system. The Smoke Signal BFD-68 provides no BASIC, you dump your favorite version of BASIC to the disc.

To install a disc system you simply plug the supplied board into your computer, connect the disc unit's line cord to the nearest outlet and press the power switch. Just slip a disc into the drive, *initialize* the computer to the disc system's address and you're up and running.

Similar to audio and data cassettes, a discette (mini-floppy) can be protected against accidental erasure. There is a small notch in the discette, which, when covered by tape, prevents the drive being placed in the record mode.

Summing Up. We have illustrated some of the most common and popular computer storage equipment. Unquestionably you'll find other devices advertised for direct mail sale, or in your local computer store. We will keep you up to date on the equipment most requested by our readers. If there is a particular storage system—generally available from coast to coast—that you believe is suitable for the personal computing hobbyist just call it to our attention. If it appears to have general interest you can be certain it will be considered for a future article. ■

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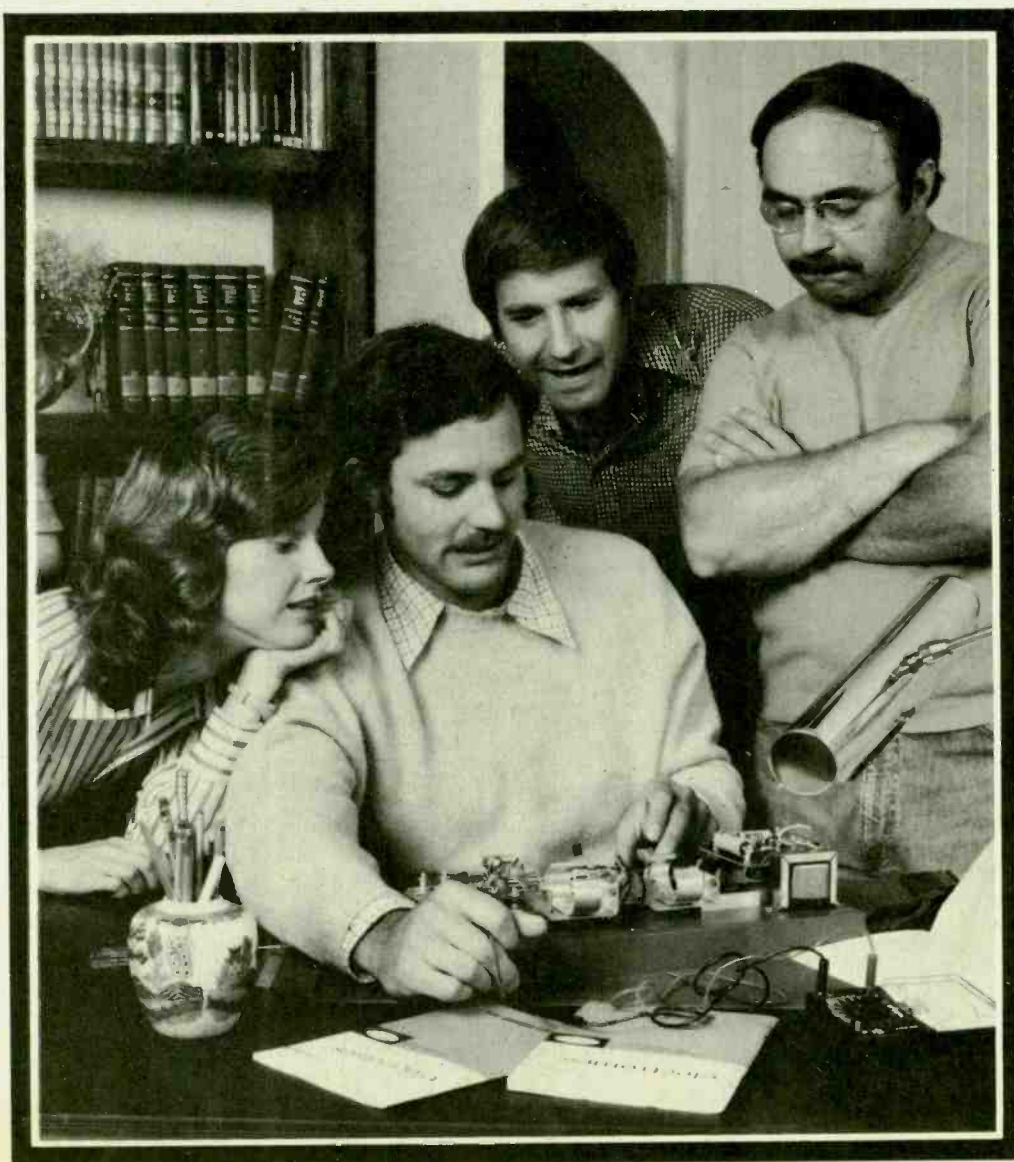
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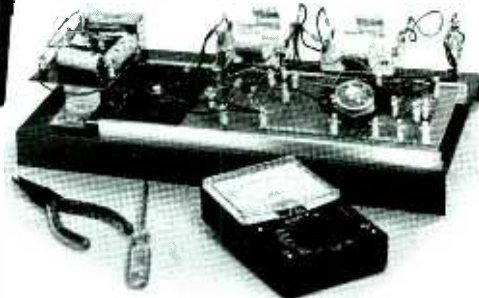
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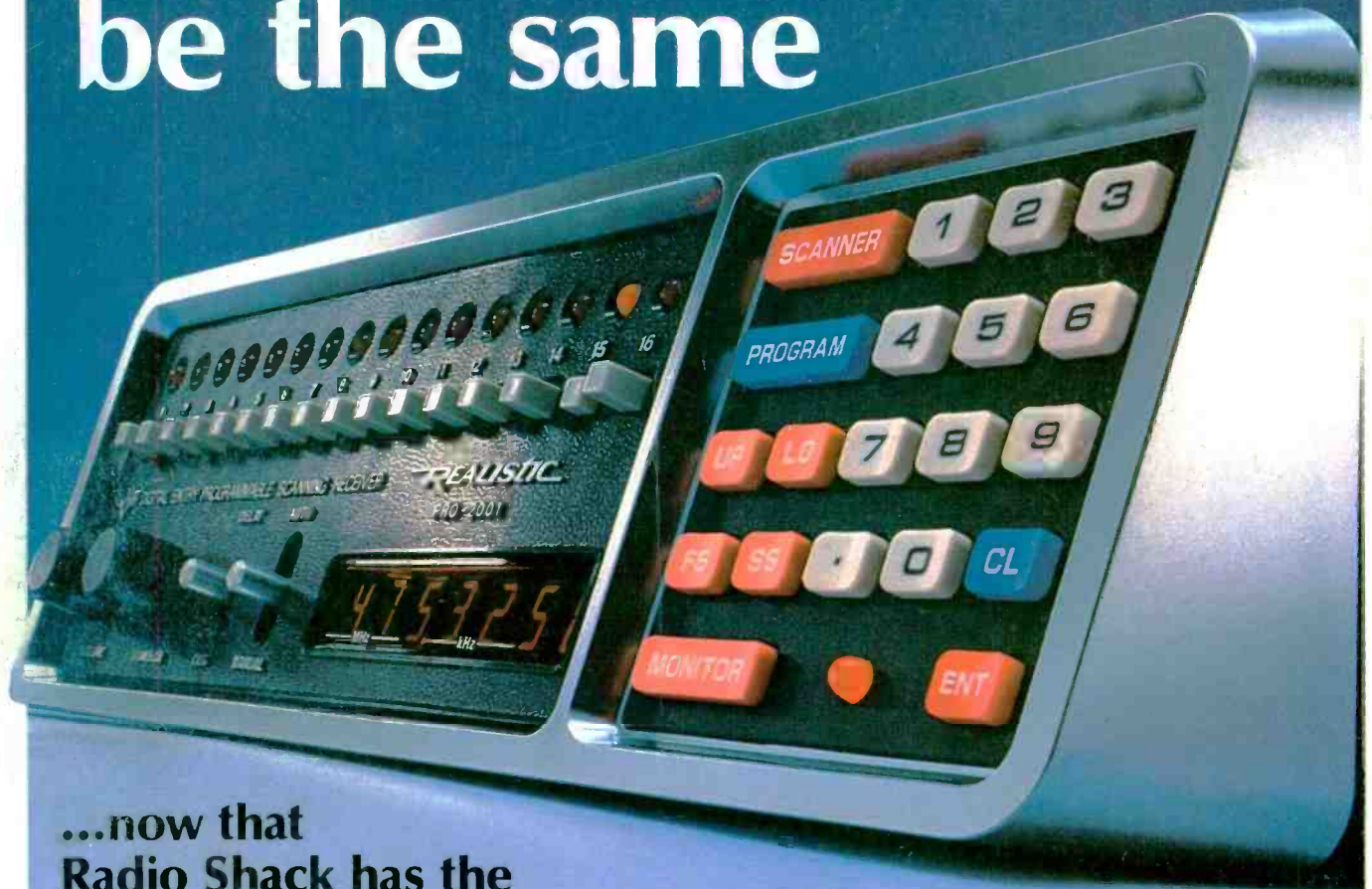
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