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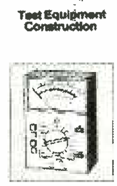

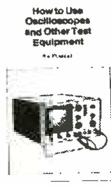

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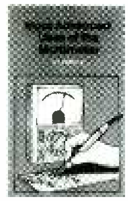

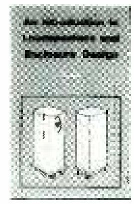

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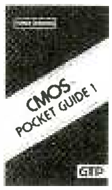

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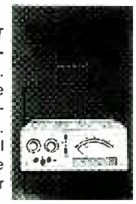

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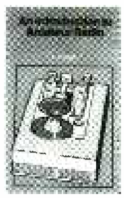

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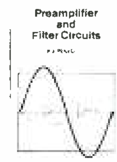

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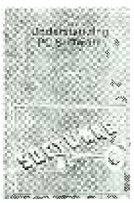

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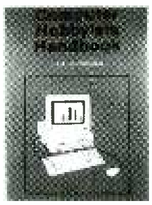

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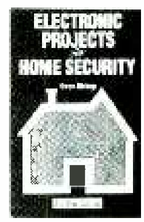

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EDITORIAL

THE IMPORTANCE OF PERSPECTIVE

When it comes to evaluating a technology, time offers an invaluable perspective. Two articles in this issue highlight that fact.

The first is "Electricity and Medicine in the 19th Century," which looks at some of the popular medical practices of the late 1800's that made use of the wonder of that age: electricity. Looking back, it seems hard to believe that the educated physicians of that day could advocate such dubious and dangerous practices. Yet, while some of the procedures were clearly quackery, many respected doctors regularly prescribed electric treatments of some type for everything from gout to cancer. Only the perspective of time eventually convinced them that the technology was worthless.

The second article is "TV Answer: What's the Question?" For those of you unfamiliar with it, *TV Answer* was unveiled last spring, amidst much ballyhoo in the general press. It is an over-the-air, interactive system that allows consumers to do such things as participate in instant polls, play along with studio contestants in game shows, and order products, all using their TV set and a set-top converter.

The system has potential, and a similar, cable-based system has met with some success in Canada. But the Canadian system does more than is promised by *TV Answer*, and is relatively inexpensive. *TV Answer* will cost around $700 initially, and it is doubtful that many Americans, especially in these tough economic times, will be willing to fork over that kind of cash to do things that they can, for the large part, already do for free.

Still, some major companies are getting involved with *TV Answer*. Those include Hughes, Hewlett-Packard, J.C. Penney, and others. And the concept of interactive TV is intriguing, especially when you consider some of its less trivial applications such as education.

Once again, only the perspective afforded by time will tell whether *TV Answer* will succeed, is premature, or is a technology that nobody wants or needs.

Carl Laron
Editor

LETTERS

QUIT BEEFING

I would like to express a "counter" opinion to a letter titled "Where's the Beef" that appeared in the June issue of **Popular Electronics**. Like W.T.R., I also live in Seattle and know very well the availability of special parts: They *are* available! Unlike W.T.R., I am glad to see more specialized circuits represented in **Popular Electronics**.

No one ever has to buy part "X" exclusively from company "Z." Part of the fun in assembling home-brewed circuits is shopping around! I personally don't use a junk "box;" I use four multi-drawer cabinets (like everybody else), in which I keep a stock of parts, new and used. Nor is it always necessary to buy large quantities from chip manufacturers, as the Editor's response stated. So griping about the "outlay of cold cash" isn't worthy of an experimenter these days. Actually, things have never been this good!

Keep up the good magazine!
B.B.
Seattle, WA

TAKING CONTROL

Larry Antonuk's article, "A PC-Based Stepper-Motor Controller" (**Popular Electronics**, June 1992) was a very interesting circuit. I was amazed at how easy it was to write my own programs to control the outside world.

At the time I received the magazine, I did not have available the specific parts to build the stepper-motor controller. But with a little imagination and some modifications I was able to come up with a working circuit. Instead of using the NTE3400 Darlington optoisolator, I substituted a 4N25 optoisolator. For the transistors, I substituted a 2N2222 and tied all the outputs together. I also tied each transistor's emitter to a different value resistor to limit current to give the stepping effect. In addition, I tied the LED's to the computer side of the optoisolators, so even with a load the LED's will stay on. As for the motor, I used a permanent-magnet DC motor.

Once the hardware was complete, I began writing the program. The finished circuit worked to perfection. With this kind of power, I am going to develop a circuit using a stepper motor to control model railroads.

Thanks again for a great article.
R.H.
Widham, ME

ANOTHER POSITION

I read Carl Laron's editorial, "Positioning Ourselves" (**Popular Electronics**, July 1992), with utter amazement.

For years, I have been a senior corporate executive of one of the largest multinational companies with minimal military business, and I am also active in international trade organizations at the Vice-Chairman level. One of my hobbies is electronics.

Where in the world are the facts to justify the statement, "Our military-first legacy has left us with decaying plants and factories, a crumbling infrastructure, disappearing jobs, and a trade deficit..."?

The above problems have nothing to do with military-first legacy but rather with the way government and Congress have handled tax legislation, welfare, and foreign trade. We have passed moronic laws that have killed individual incentives, we have spent over a trillion dollars on welfare programs that don't work (and, in fact, are counterproductive), and we have let some foreign countries get away with murder in their trade dealings with us.

No one denies that a lot of companies are inefficient and have bloated staffs. But that is being taken care of by competition. To suggest that we need more government interference with business is absurd. Tax incentives, yes. Vastly better education, yes. More government direction for industry, heaven forbid. Where did Mr. Laron get the idea that the bureaucrats in Washington have the intelligence and vision, let alone the experience, to give industry "proper perspective or direction"? Has he ever dealt with them? Look at their track record. Most of them have never met a payroll, and wouldn't know how.

It always amazes me that while the socialist countries are getting away from the notion that the government knows best, we have intelligent people in this country who have learned nothing from history and constantly advocate more big government.

Let the free market decide our priorities, Mr. Laron, not some faceless bureaucrat in Washington. In spite of what the media says, this is a mild recession; 93% of the people are working, and given a choice, half the people in the world would come here. Because, unlike Mr. Laron, they do not see us "positioning ourselves for disaster." Where Mr. Laron sees disaster, they see opportunity. And they are right, as history has demonstrated.

I enjoy **Popular Electronics**, but I suggest you stay in areas where you have some experience.
I.V.de C.
New York, NY

I, too, must express utter amazement. I never suggested that the government has vision or intelligence; in fact I feel that the opposite is true—that's why we are in the mess we are in. And I fully agree that the government should not dictate the direction that industry takes. However, if our consumer industries are to effectively compete with those of the rest of the world, our government must support them with the zeal that previously has been reserved for our defense industries.

I respectfully suggest you go back an re-read my comments, and try to do so without any political or nationalistic bias. I think you will find that though our perspectives differ greatly, our positions are not all that far apart.—Carl Laron, Editor.

STACKING UP

I would like to put in a very good word on behalf of Jeff Holtzman concerning his *Computer Bits* column in the June issue of **Popular Electronics**.

I am quite an avid reader of **Popular Electronics**, even though I did not discover it until a few years ago. Although I am somewhat of an "idiot" version of an electronics wizard—I think my type is referred to as a "Samurai technician"—I am capable of handling the innards of a computer as well as the important aspect concerning computer programming. The latter is my real love and, incidentally, has been my business for the past 20 years. I was therefore very interested in Mr. Holtzman's review of the Stacker program.

I am very wary of all the hype surrounding that type of program. All the glowing articles in the computer magazines leave me completely indifferent to their claims. That's not so with Mr. Holtzman's article. It was written in a no-nonsense vein and so impressed me that I actually called the software company for detailed information. STAC Electronics was nice enough to let me know that I could probably get the program at least 50% cheaper by contacting a discount house. That type of helpful information completely shook me! I ended up ordering the program (still based on the description in *Computer Bits*).

The program arrived, and I must say that Mr. Holtzman was 100% accurate in every detail! His review style, at least in this instance, was absolutely perfect, as well as factual. Please pass along my thanks for his guidance.
R.M.H.
St. Croix, VI ■

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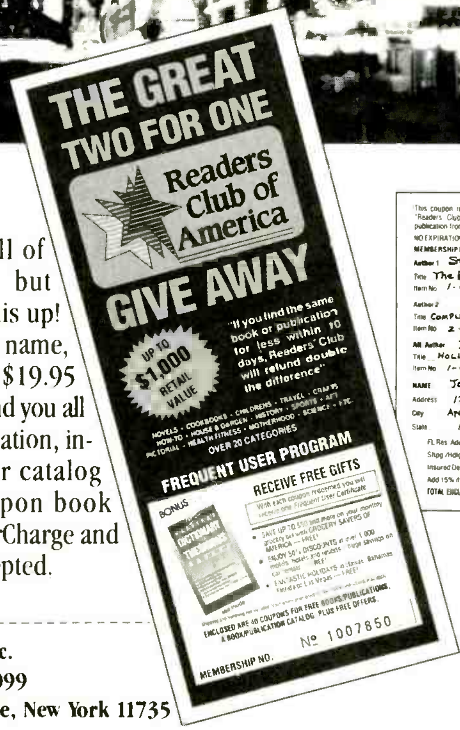

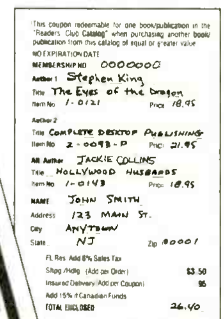
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SEPTEMBER 1992

VOLUME 5, NUMBER 9

A CHRONICLE OF CONSUMER ELECTRONICS

Sports Car Sound Room

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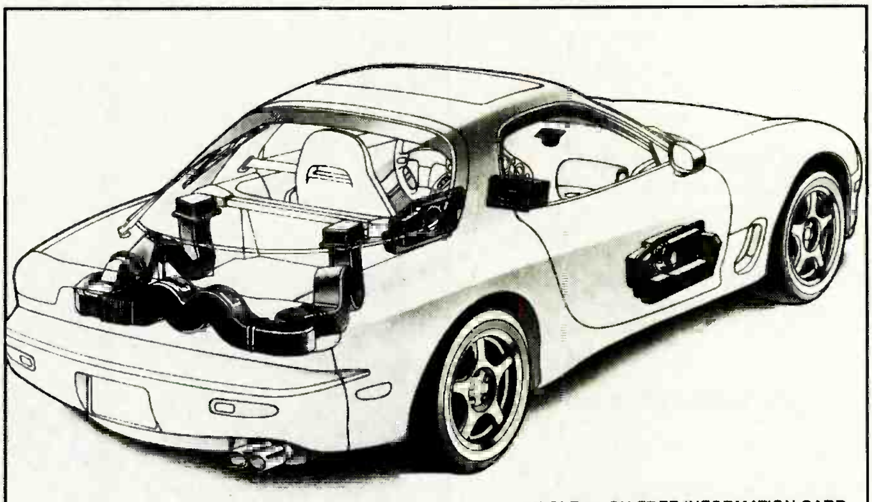

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We don't pretend to be experts when it comes to cars. Far from it, especially when it comes to late-model sports cars. Whether from a strained wallet or from an ingrained sense of practicality, four-door, four-cylinder cars are more our speed—the type in which you can eat a meal and not worry about staining the upholstery, or take the dog down to the beach and not worry about sand on the seats on the way home, or haul home flowers and shrubs from the nursery without worrying about spilling soil on the floor. Our cars are the type that are not likely to get stolen even when parked on the streets of New York, nor stopped when skirting the speed limit. In other words, our cars are a means of transportation, not an image or ego enhancer. No heads turn when we drive by.

That doesn't mean that we were at all adverse to driving a 1993 Mazda RX-7 around town for a long weekend. (Yes, reviewing electronics does have some *very* nice perks on occasion!) Actually, we were to review the car's sound system, a *Bose Acoustic Wave* system designed and built specifically for the RX-7. But you can't drive a car like this Mazda and not have something to say about it—and heads *did* turn when we drove by.

We've seen older model RX-7's, and always thought they were nice, sporty-looking little cars. We'd never seen anything quite like the newly redesigned 1993 model, which took second place in *Car and Driver's* recent sports-car test, beating out the Corvette and the Lotus Elan. Descriptive comments from our friends and family (and everyone had *something* to say about it) ranged from "It looks like a submarine," to "It reminds me of that little car Suzanne Sommers drove in *American Grafitti*" (a T-bird), to "Remember those 1960's drawings of the city of the future when they had those elevated highways with little spacy cars speeding along ..." Actually, the car does have a retro look to it, all sleek curves. As *Road & Track* puts it, the 1993 RX-7 has "... a skin pulled taut over mechanical componentry, yet still fetchingly curvaceous in the way of an AC Cobra or a Sixties' Ferrari." Even the passenger-side window controls were neat, set into the door handle like the trigger on an Air Force fighter plane's gun.

Driving the car was also like nothing we've experienced before—and we have had other opportunities to test drive new, expensive cars with custom sound systems. The pickup was amazing. Forget zero to 60—before we knew it, we were doing 80 mph! The rotary engine was surprisingly quiet, and even the road noises weren't as loud as we expected from a small, lightweight sports car built for speed. This car isn't just a means of getting from point A to point B—you just might have more fun driving it than you will when you get to your destination.

As much fun as it was to drive the high-performance RX-7, our main interest was in the sound system. In short, we found the performance of the customized Bose system to be a perfect match for what's under the hood.

The idea of customized, high-end automotive audio systems isn't new. Back a decade ago, Bose and General Motors introduced the Delco-Bose Music System, and started a trend that was followed by other U.S. and foreign car manufacturers. Bose is currently designing automotive audio systems for Acura, Audi, Honda, Infiniti, Mercedes, and Nissan as well as GM and Mazda.

A customized sound system can mean tremendous quality in a car, which is typically a difficult place for sound reproduction thanks to the reflective surfaces (such as windshields) and non-optimum speaker placement. While a good component system can provide good results in one car, it might sound awful when installed in a different model.

But an audio manufacturer who knows precisely where the system is going to be installed can design around all of the car's

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This month in GIZMO

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limitations. If he knows where the speakers are going to be installed—and even has some control over where they'll be placed—he can design the optimum speakers. He can use, for example, the reflection of the windshield as part of the design. It's almost like having an equipment manufacturer come into your home, measure the parameters of your living room, and then design the speakers and amplifiers specifically for the room.

The Mazda/Bose system consists of four major sections: A waveguide enclosure with two woofers, door-mounted front speaker/amplifiers, a centerfill speaker, and an AM/FM tuner with cassette and CD player.

Bose's Acoustic Wave speaker technology is what makes this system different from any other automotive audio system. A 110-inch folded waveguide is wrapped around the rear hatch area. It does reduce the luggage area considerably, but we

The head unit features easy-to-use controls. That's important in a car with the performance the RX-7 can deliver.

doubt that many potential RX-7 buyers are too concerned about such real-world practicalities—even if it means having to remove the waveguide assembly to get to the spare tire. Two 6½-inch woofers are mounted inside the waveguide, as are two amplifiers with custom-tuned active equalization networks (which change the equalization with changing volume settings) and compression circuitry.

The front speakers are mounted in two door enclosures. Each contains a 4½-inch full-range driver and another amplifier, also with custom-tuned active equalization network and compression circuitry. The enclosures are tuned and ported specifically for the configuration of the Mazda RX-7.

A final, centerfill speaker is mounted on the top surface of the dash. The 2½-inch "Twiddler" tweeter/midrange speaker is mounted with its amplifier and equalization network aimed at the windshield to provide reflected sound.

The head unit is mounted in the dash in a conventional location. Like the RX-7's clean instrument panel, the head unit features well-designed controls. The single-disc CD player and its controls are on the

(Continued on page 23)

J.ust V.ery C.ompact

JVC GR-AX50U COMPACT VHS CAMCORDER. From: JVC Company of America, 41 Slater Drive, Elmwood Park, NJ 07407. Price: $1499.95.

After years of unhampered growth, camcorder sales actually dipped slightly last year. The sluggish economy got most of the blame, however, and there is the potential for increased growth this year. In fact, 1992 might prove to be the best year ever for the camcorder, with 3.1 million sales expected. It was the full-size VHS camcorders that took the strongest beating last year. Even though they've slimmed down considerably (put Sharp's Slimcam on your shoulder if you don't believe us), they can't compete with the smaller 8mm and VHS-C (or Compact VHS) formats. Compact camcorders now make up almost 70% of all sales; 8mm units account for better than 45% of total camcorder sales, VHS, 30%, and VHS-C 25%. As consumers opt for smaller camcorders, the stakes have gone up in the war between 8mm and VHS-C.

How do you choose the right compact format? It's not easy. VHS-C has some disadvantages when compared to 8mm. Each VHS-C tape can hold only up to 30 minutes (90 minutes using the slow speed) as compared to two hours for 8mm. Sound is not as good as 8mm, and in our experience, cassettes can be more difficult to find. The big advantage? As driven home in recent advertising campaigns, the tapes *will* play back on your standard VHS VCR. You never have to hook up your camcorder to your TV or VCR if you don't want to, and you can save some wear and tear on your expensive camcorder.

How do today's Compact VHS camcorders stack up? To find out, we examined the *GR-AX50U* from *JVC*. As you might expect, the camcorder is light, weighing 2½ pounds with the battery and cassette. We found it comfortable to hold, although people with very small hands will have a little trouble reaching the zoom controls. The camcorder is small, but it's somewhat stout, making it difficult to carry in a purse or briefcase. That shape, however, does help to make the GR-AX50UU well balanced. The camcorder wasn't fatiguing, even when it was used for long periods of time.

The GR-AX50U offers a sensible mix of features. It's not a stripped-down camcorder, nor does it offer a host of little-used functions. The feature most worthy of note is the color LCD viewfinder. If you've ever lost track of your subject while looking through a standard black-and-white view-

CIRCLE 51 ON FREE INFORMATION CARD

LAB TEST GLOSSARY

Minimum Illumination: The lowest light level at which a camcorder can produce a viewable picture. Measured in lux (lumens per square meter). The lower the number, the better.
White Balance: The amount of unwanted color that shows up on a neutral object. Measured in IRE. The lower the number, the better.
IRE: Unit of luminance. 1 volt peak-to-peak is divided up into 140 IRE units.
Color Contamination: The amount of unwanted color detected between closely set lines in a video picture. Results from incomplete separation of the red, green, and blue signals. The lower the number, the better.
Video Signal-to-Noise Ratio: Indicates the amount of noise on a fixed video signal. Chroma AM measurements indicate the saturation and strength of the color signal. Luminance measurements indicate the brightness of the video signals. The higher the numbers, the better. ■

LAB TEST RESULTS
JVC GR-AX50U COMPACT VHS CAMCORDER

VIDEO SECTION

Minimum Illumination:	2.5 Lux (0.97 lux with gain up)
White Balance:	4 IRE
Color Contamination:	4 IRE
Resolution (Lines)	
Camera Mode	340 (SP), 340 (EP)
Rec/play video out	240 (SP), 240 (EP)
Rec/play RF out	N/A
Minimum Focus Distance:	40 inches (full zoom), 0.25 inch (macro)

Signal-to-Noise Ratio (dB)

	Optimum Illumination	Minimum Illumination
Camera		
Chroma AM	46.7	41.6
Luminance	41.0	34.7
Rec/Pl Video Out		
Chroma Am	44.1 (SP) 38.5 (EP)	42.8 (SP) 38.9 (EP)
Luminance	41.7 (SP) 39.6 (EP)	38.3 (SP) 36.5 (EP)
Rec/Pl RF Out		
Chroma AM	N/A	N/A
Luminance	N/A	N/A

AUDIO SECTION

Maximum Microphone Output:	0.49 volts
External Mike Input Sens:	3.0 mV
Signal-to-Noise Ratio:	59.1 dB

MISCELLANEOUS DATA

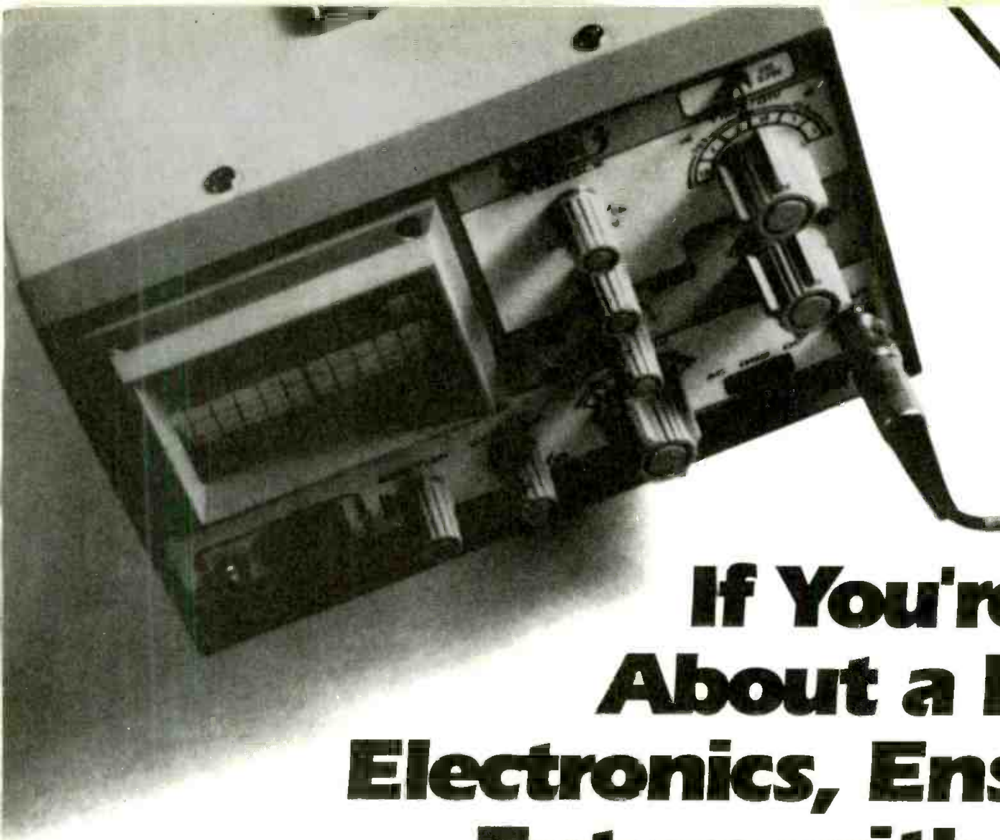
Weight	2½ pounds (including battery and tape)
Dimensions (H × W × D)	4⅝ × 4¼ × 9⅛ inches
Power Requirement	11.5 watts (video lamp adds 5 watts)

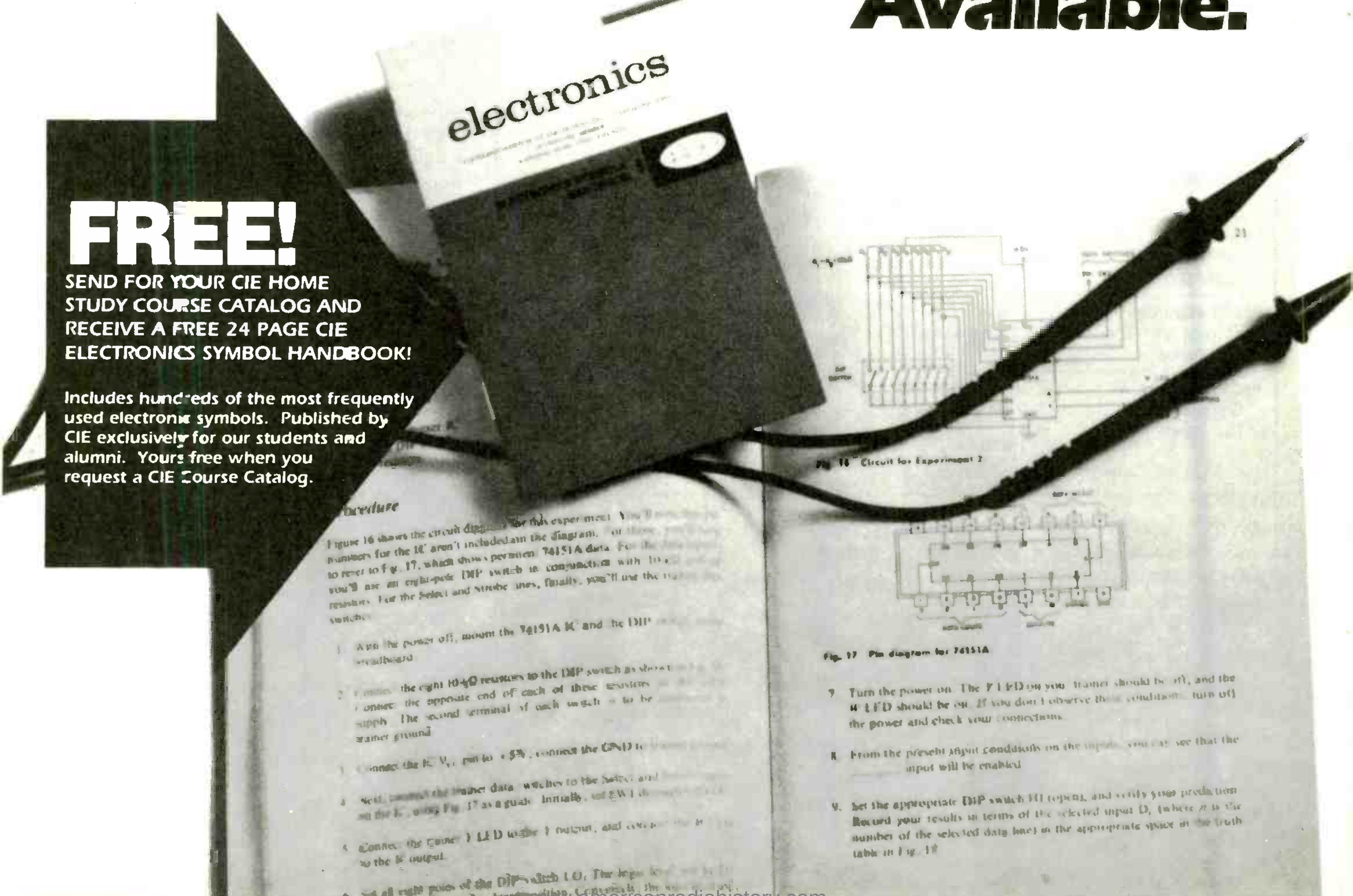
finder, you know that a color one is not just a gimmick. Even though the resolution and brightness of the color viewfinder doesn't match that of a black-and-white CRT found in most camcorders, the color LCD does help you locate your subject in low-contrast situations. To find out how well it worked, we took the camcorder on a short whale-watching expedition off the coast of Cape Cod. Finding black whales in a deep blue ocean is difficult enough with the naked eye. Finding them through a standard camcorder viewfinder is next to impossible. Through the GR-AX50U's color viewfinder, the job was considerably easier.

Another advantage of the color viewfinder comes into play when you use titles. Will that cyan title hold up against the background scene you're shooting? Since titles are shown in their actual colors, you'll know for sure.

The camcorder offers an 8× power zoom lens and a multiple-speed shutter (six speeds, from 1/60 second to 1/4000 second). Auto focus can be switched off, if desired. A nice feature is JVC's auto macro capability—you need not make any manual adjustments to go into macro mode. If necessary, the lens will automatically zoom out to achieve correct focus. That's true point-and-shoot capability!

Although the camcorder doesn't offer any character-generator for titling (something we did miss), it can display the date and time, and also the age of your subject. For children under seven years old, the display will indicate the age in years and months, 6Y11M, for example. Older ages are represented without the month. (You

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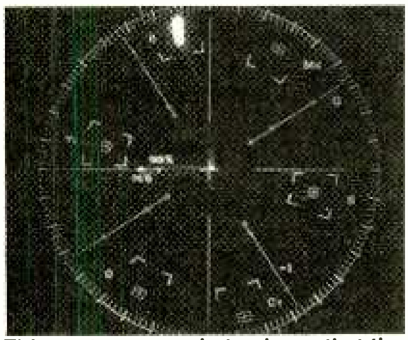
might want to ask permission before you use that feature on anyone over 21!) Fortunately, you don't have to calculate the age—you enter the birthdate, and the camcorder calculates the age for you.

Other sensible features include audio/video fade-in and fade out, automatic tracking, "encore playback" (which lets you view about the last ten seconds recorded), an automatic tape-head cleaner, a detachable video light, and a "gain-up" mode that sacrifices picture quality for low-light capability.

A "cinema mode" is also offered by the GR-AX50U—we presume because JVC had some processing power left over and wanted to use it. We doubt that many users would miss the feature, which adds black bars at the top and bottom of the screen to produce a type of letter-box effect.

The controls on the camcorder are sensibly laid out. A sliding cover hides the



This vectorscope photo shows that the phase accuracy and color saturation were excellent.

playback controls and also acts as the switch that shifts the camcorder between its camera and playback modes. (It covers the encore playback and auto/manual focus switch in the playback mode.) The most infrequently used controls—time and date set—are hidden inside the cassette compartment. Two pause/record controls are provided: One is by the thumb as with most camcorders; the other is located on the eyepiece arm, which swivels 180 degrees.

Manual focus is achieved with a rocker control on the top, left-hand side of the camcorder. On the left side panel are controls for the fader, title display, shutter speed, gain up, and a "full-auto" button, which returns the camcorder to automatic control. Small, hard-to-use buttons on the top right side handle manual tracking, tape speed, and tape-counter operation.

Input/output jacks (for microphone, headphone, remote, and A/V out) are located below the viewfinder. Unfortunately, a special connector is needed for the audio and video outputs. Since most people will not want to play back tapes through the camcorder, it's not a serious problem, but

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You Can Judge a Video by its Titles

VIDEO TITLEMAKER. Manufactured by Videonics, 1370 Dell Avenue, Campbell, CA 95008. Price: $499.

How do you turn ordinary camcorder footage into something that anyone—even someone who isn't on the tape—is willing to watch? One way is by editing out the most boring scenes. Another way is to add excitement, humor, and life to the scenes that are left. That's not as difficult as you might think thanks to *Videonics*, makers of post-production products for amateur, semi-pro, and professional videographers. Their *Video TitleMaker* lets you add colorful titles and other special effects to any video.

You probably already use titles in your videos—most modern camcorders let you add the time, date, and maybe a two-line title using any alpha-numeric characters. Handwritten title cards are another option available to anyone, and some camcorders let you store the image of a hand-written title in memory. The problem with such titling methods is that they require advance planning. It's difficult to do anything creative quickly on the fly.

The Video TitleMaker is meant for post-production work. After you get home from a vacation, wedding, or party, you get to work. Although the TitleMaker doesn't offer any editing functions *per se*, it can be used in combination with video editing equipment (such as Videonic's DirectED) and with other external processors (such as Videonics' Video Equalizer or Boing Box sound-effects mixer, which share the same cabinet styling).

In its simplest setup, the TitleMaker sits between your camcorder (which acts as the video source) and your VCR (which acts as the video recorder). Although audio connectors are provided, they are only for convenience—audio is passed straight through the titler. The titler can be left permanently in-line; when the power is turned off, all signals are passed directly through. The TitleMaker supports S-video, so it can be used with all videotape formats. It has a horizontal resolution of 480 lines, with 720 pixels per line, so its titles are broadcast-quality.

Titles are created as a series of "pages." Each page is defined by the text on it, how the text is aligned, what effect will be used to introduce the page, how long the page will play, and what effect will be used to end the page. Within each page, you have control over how the text looks—you can select the color, size, type style, and outlines for your text. You can change the color and patterns of your backgrounds, or wash color over video, or use video as the background. You can add borders to your titles, and manipulate text using standard word-processing features such as block move and block copy. Text can be centered, or aligned left or right. International characters, such as accents and currency symbols, are also available.

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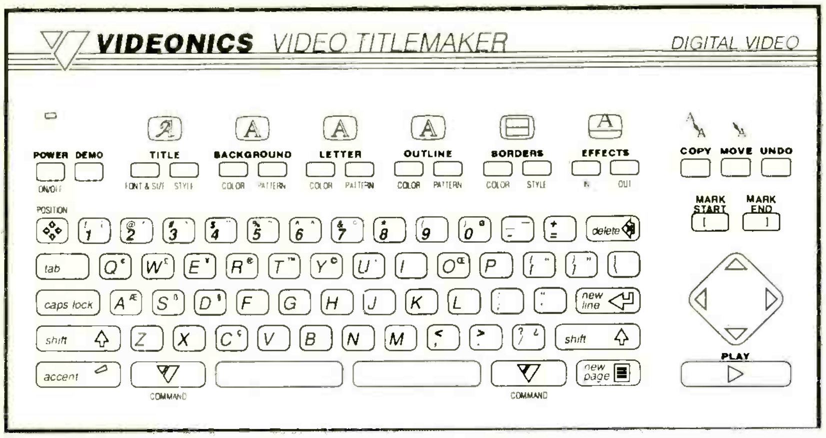


The Video TitleMaker keyboard is easy to use because of its well-labeled keys. Unfortunately, the rubber keys are not meant for touch typing. We would have preferred to have a keyboard that would beep with each keypress. That would have helped us cut down on the typos caused by poor key contacts and poor tactile feedback.

To introduce the page, you can select a number of effects. You can do a direct cut into the page, fade in gradually, or "wipe" across the screen in one of 18 ways (including left to right, right to left, diagonally, edges to center, or center to the edges)

You can play back the titles you create either one page at a time under manual control (either via the keyboard or an external jack) or automatically (where each page plays for the amount of time you selected when you created it).

It's not possible to describe every possible way to use the TitleMaker in a short article. The 36-page instruction manual does a good job describing the mechanics of using the titler, without giving too many practical suggestions for how to use it creatively. But a built-in demonstration program, which runs for over seven minutes, does an excellent job of showing just what the titler can do. Even better, the demo can be copied into the titling area so that you can study the commands used to create the effects, and modify them to create your own titles. If you really want to get a good idea of what the TitleMaker can do, head for your local video-equipment store and take a look at the demo.

What the titler can do is turn out some rather professional-looking effects. It can, of course, superimpose text on top of your video, as any titler can be expected to do. But it can also be used to add subtle touches that make things look far more interesting. For example, you can have titles scroll up the screen at one of eight different speeds. Better yet, you can have your titles scroll *across* the screen, as you might commonly see on TV to announce a news emergency. As with any special effect, overusing the crawling message can get tiresome. But used properly, it's an effective, elegant way to get a lot of text on the screen relatively unobtrusively.

How can you use titles effectively? The most common reason for a camcorder purchase is to videotape a new baby. Every year, of course, that baby has a birthday celebration—another favorite camcorder subject. Most people we know keep all those birthdays on a single tape, either saving the tape and recording on it only on that special day, or by copying and editing the material from a second tape. With the TitleMaker, you could put large, bold letters on a solid background to begin each year's celebration: "Peter's Fifth Birthday." You could then scroll across the bottom something such as "Billy Johnson, Ray Fellowes, and Toni Vames join Peter in an exciting dance contest." (If you've ever discovered a box of old photos of people you no longer recognize, you can appreciate how important it can be to identify the people in your videos.)

Because of the capabilities of the TitleMaker, it's important to show some restraint when using it—it's very easy to over-do some of the effects. There are, for example, "over a million colors" available, according to Videonics. When you first power-up the unit and go to one of the four color menus (background, letter, outline, and border), you are presented with a palette of 34 choices, some of which are duplicates. Above the palette are three "control bars" that give you control over the hue, saturation, and "lightness" of the color (how much white is added to it). Each bar lets you scroll through values from zero to 200. (That yields, theoretically, $200 \times 200 \times 200 = 8$ million different colors. We could not distinguish each color, however.) In addition to solid colors, you can also apply interesting patterns to letters, backgrounds, or even outlines or shadows. You can even mix video into the pattern so that you end up with an

(Continued on page 22)

Let Your Interpreter Do the Talking

INTERPRETER II TP9002 FIVE-LANGUAGE TALKING TRANSLATOR. Manufactured by The British Boston Company, 41 Vreeland Avenue, Totowa, NJ 07512; Tel: 201-890-5883. Suggested retail price: $249.95.

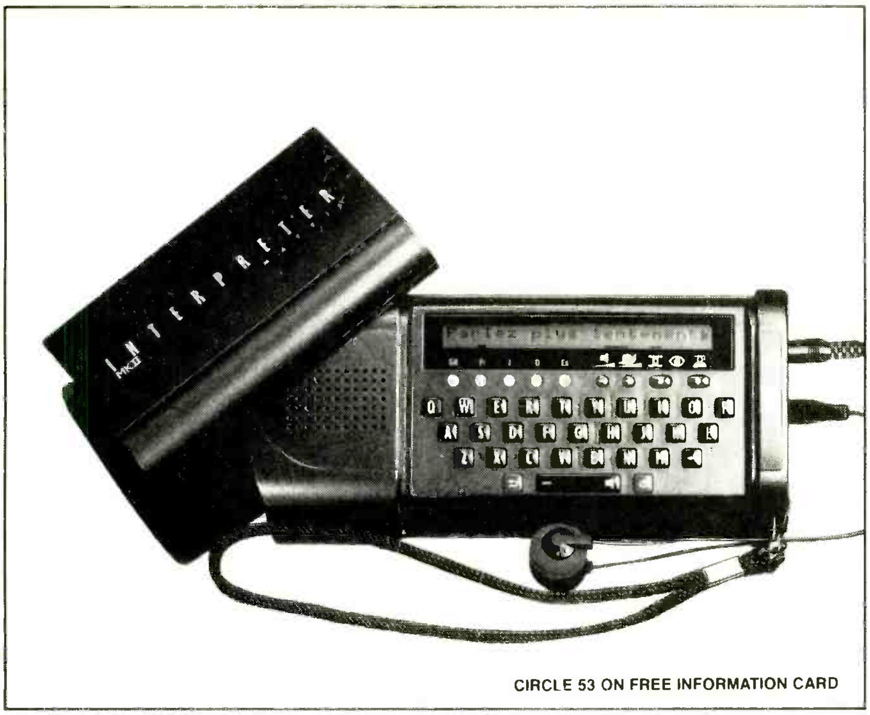
As we write this, spring is in the air: The baseball season is in full swing, birds are nesting, tulips are blooming, and the "Travel" section in each Sunday's newspaper is filled with tempting summer-vacation ideas. One of our favorite "if-we-had-the-time/money" fantasy trips would include using those train passes that offer unlimited rail travel through Europe for a set period of time. Yet while we're intrigued with the idea of a trek through several foreign countries, we're a bit put off at the thought of trying to communicate in foreign languages. About all we can remember from a few years of high-school French (studied more years ago than we care to admit), is "*Bon jour. Comment-allez vous?*" ("Hello. How are you?"). Living in New York, we've picked up a few phrases in street Spanish, but not anything we'd want to use in polite company. Our Italian is limited to menu items, and our German is virtually non-existent.

On previous trips abroad, we've relied upon foreign-language dictionaries and phrase books, without much luck. It was frustrating to try to quickly locate the precise word or sentence needed, and difficult to interpret the pronunciation guides. We gave it our best shot, but much of what we said was unintelligible. Of course, being confirmed *Gizmologists*, we've also tried using electronic translators. Although they made it faster and easier to find the right words, we still were not always sure how to pronounce those words.

As annoying as the language barrier can be for tourists, for business travelers—who can't afford to miss important meetings because they can't ask (or understand) directions, or misunderstood the scheduled time—it can be disastrous. Some executives have resorted to hiring multilingual interpreters to avoid such troublesome problems.

These days, however, business and pleasure travelers alike can actually *buy* a translator that's fluent in five languages. It's called the *Interpreter II TP8002*, and besides being cheaper than a human translator, it has the advantage of fitting in your briefcase or purse.

The Interpreter II looks like a standard



electronic translator. It has a "QWERTY"-style keypad, an LCD readout, and five buttons used to select between English, French, Italian, German, and Spanish. But looks can be deceiving. Hidden behind its ordinary facade is a digitized voice that boasts a vocabulary of more than 60,000 phrases and 13,500 individual words. You can opt to use any of the five languages as the base language and, working from there, immediately obtain written translations in each of the other four languages, and then hear those translations by pressing the speech bar. What's more, the digital voice actually uses the proper inflection when pronouncing the translated word in each language.

When you turn on the Interpreter II and select the base language (your native tongue) by pressing the corresponding language key—gb (Great Britain) for English, FR (*Francais*) for French; I for *Italiano*; D (*Deutch*) for German, or es (*Espanol*) for Spanish—you are automatically greeted by a voice saying "hello" (for simplicity's sake, we'll stick with English in most of our examples). That is the only time, however, that you'll hear an unsolicited word. The Interpreter II acts as a standard, silent translator, displaying words on the LCD readout, until you decide to press the speech bar to hear a word or phrase spoken aloud. A volume-control key allows you to adjust the speech to a comfortable level, and a pronunciation-speed key lets you hear a word or phrase spoken at normal speed, or at two slower speeds so that you can more readily grasp the proper pronunciation.

We tried keying in the word "water." Pressing the FR, D, I and ES keys brought up on the display the French, Italian, German, and Spanish translations—*eau*, *acqua*, *wasser*, and *agua*—respectively. Pressing the speech bar resulted in spoken translations of the word. That's a step beyond most electronic translators—at least, if you want a glass of water, you know how to pronounce the word as you mime drinking. But the Interpreter II won't leave you in that awkward position.

By pressing the "*" key once the word has been translated, you enter the "phrase building" mode. The Interpreter II will then display a series of phrases using that word. In this case, we could use "the water," "I do not like water," "Can I have some water?," "Would you like some water?," "Have you got some water?," "How much is the water?," "I would like some water," "I like water," "I need some water," and "Please bring me some water." Similarly, when translating the word "dog," the Interpreter II supplies the phrases "the dog," "There is no dog here," "Can I have a dog?," "Which dog do you recommend?," "How much is the dog?," "I would like to see a dog," "Show me the dog," and "Someone has stolen my dog." Generally speaking, the supplied phrases are intended to help travelers alert others to some problem ("I need . . . .," "I have lost . . . .," "I would like . . . .,"), or to transact business ("Do you have . . . .," "How much is . . . .," "Which . . . would you recommend?").

Some words have no accompanying phrases, and others might not have the ones you'd like. For instance, the only phrase associated with "ski" was "I cannot ski." That's not going to help you find a good ski resort in the Italian Alps. Keying in "skiing," however, brought up such phrases as: "How far is the skiing?," "How much is the skiing?," and "I would like some skiing." Granted, each of those is a bit stilted, but by using them, you should be able to get your point across. If a phrase cannot be translated exactly in all five languages, the displayed phrase will flash, indicating that although the phrase will be understood, it might sound somewhat strange.

You needn't be at a loss for easily understandable phrases, however. The Interpreter II offers "get you out of trouble sentences" in 14 categories: assistance, conversation, socializing, eating, money and shopping, emergency, travel, accommodation, health and doctor, business, sightseeing, complaints, cars, and chemist/pharmacy. You needn't even remember those precise category headings. A press of the "*" button immediately after turning on the Interpreter puts you into the common-phrase mode, and you can scroll through the categories with subsequent presses of that button. Pressing the "#" key allows you to scroll through the phrases under each heading. The phrases in each category are succinct and easily understood in each language, whether you're navigating a singles bar in a foreign city (Socializing: "What's your name?," "Would you like a drink?," "Are you alone?," "Are you married?," "Would you like to come out with me?"); conducting business ("I have an appointment with . . . .," "Can I send a fax from here?," "Can I leave a message with your secretary?"); or experiencing any traveler's nightmares ("I have been robbed" "Get the police/fire department/ambulance!," "My child is missing!").

If you're the type who gets tongue-tied even in your own language, the Interpreter II can help you find the exact word you need through its "word review" function. If you type in the word "food," for instance, and then enter the word-review mode, each subsequent press of the "*" key will bring up a food-related word, from "biscuit" through "yoghurt." In between are types of foods (from hot dog to pate), cooking styles (boil, fry), meals (breakfast, dinner), and dietary descriptions (salty, spicy) and restrictions (kosher, low-fat).

As you might have guessed from the Interpreter's use of "biscuit" (instead of "cookie") and spelling of "yoghurt" (instead of "yogurt")—the device has a decidedly English accent. (We suppose that's to be expected from a product from The British Boston Company.) Not only does the talking translator speak with an upper-crust British accent, but if you want to translate such words as "color," "flavor," or "theater," the Interpreter expects

(Continued on page 23)

Instant Axxess-ibility

AXXESS TOUCH-SCREEN PERSONAL ORGANIZER. Manufactured by Oregon Scientific Inc., 18383 S.W. Boones Ferry Road, Portland, OR 97224; Tel: 800-869-7779. Suggested retail price: $599.

CIRCLE 54 ON FREE INFORMATION CARD

Can you remember your first home phone number, the one they repeatedly drilled you on back in kindergarten (along with your full name and your address)? How about the phone number of your best friend from grade school or high school? Or your first girlfriend's number?

We wouldn't be surprised if one or more of those had stuck in your brain over the years. Not only were they used quite frequently, but back in the days when you were dialing those numbers, they were among a select few seven-digit numbers that you had committed to memory—your own, those of a few close friends, and perhaps one or two for use in emergencies. No, we're not surprised that they were easy to remember.

These days, we know quite a few people who, based on their inability to remember telephone numbers, have begun to suspect that their advanced years have begun to adversely affect their memories—even if their years haven't advanced much past 25. In fact, the culprit is much more likely to be overload than premature senility. As adults in a complex modern world, we are simply confronted with too many phone numbers to be able to easily recall them all. There are dozens of work-related numbers to remember, and things at home are likely to be worse, with friends, relatives, doctors, dentists, babysitters, the kids' friends, neighbors, the scout leader, and other various groups and organizations frequently called. Making matters worse (in terms of memorizing, at least) is a convenience upon which many of us have come to rely: speed dialing. Just program in a number once, and then you never need dial it again. No wonder we can't remember phone numbers!

And no wonder that our telephone directories—both personal and business—have become vital tools. We'd certainly be lost without ours. And we're always on the lookout for new, high-tech versions that might make it easier to keep track of all the people we call.

Axxess is one such device. The standalone, desktop unit stores more than 1000 records, each including name, company, address, phone, and fax numbers, and a two-line memo. An instant search feature lets you find the record you need by company name, contact name, or memo. A 100-year calendar allows you to schedule appointments for tomorrow or far into the future, and an alarm provides an audible reminder of each appointment. Axxess' auto-dialer will even dial up to 10 telephone numbers of your choice for you. A time log keeps track of the amount of time you spend on phone calls or on projects. And, with an optional cable and software package, you can upload or download data from your PC or Macintosh to the Axxess. You can enter data using your own computer's keyboard, or print out hard copies on your computer's printer.

All of those features are convenient, but they aren't unique to Axxess. What sets Axxess apart from the personal-organizer crowd is its touch screen. Instead of resembling a computer keyboard with a small readout running across the top, like most personal organizers, Axxess looks like a small computer monitor—with no keyboard. Instead of painstakingly pressing the usual array of tiny buttons, all of Axxess' functions are accessed by touching menu options on the screen. When it comes time to type in data, a QWERTY-style keyboard image appears on the screen (or you can select an alphabetically-arranged on-screen keyboard). Typing is accomplished by simply touching the on-screen buttons. If you prefer, you can simply connect an IBM-PC/AT compatible keyboard to a port on the back of the unit (or a Mac keyboard, using a special, optional adaptor cable).

When you swing open or lift off the unit's protective cover, Axxess' front panel features only a 7-inch (diagonal) LCD screen and a small speaker. No buttons, no knobs. Turn it over, examine all four sides and the back, and there's still not much to see other than a rectangular, box-like protrusion on the back. Actually, it is two boxes. The upper one contains jacks for plugging in phone cords and the AC power-adapter/battery charger, a combination serial and parallel port for connecting a computer or printer, and a connector for hooking up a full-size PC-type keyboard. The bottom one contains the unit's rechargeable batteries. Axxess can run for 3½ hours on its batteries; they automatically recharge when the unit is plugged in. A message appears on the screen to let you know if the batteries are running low. In that case, you must plug Axxess in again as soon as possible or risk losing the stored data (unless, of course, you've downloaded that data to a hard or floppy disk for back up, which we'll discuss later).

The unit's smooth facade and lack of tiny buttons with confusing icons is indicative of *Oregon Scientific's* intention to keep its operation as simple and intuitive as possible. And—at least with the basic functions—they seem to have succeeded.

When you turn Axxess on for the first time, you're greeted with the message: "What may I call you?" By entering your first name (or any moniker you like to go by), each subsequent time that you turn on Axxess, it will greet you by name (followed by a quotation). Next, the time and date are set by directly touching words and numbers on the screen. When the preliminaries are finished, the main menu appears, providing the selections: enter data, search, quick dial, utilities, time log, cal-

(Continued on page 22)

Only NRI assures your today's best-paying

Success comes to those who know how to get the most from today's electronics. And the best-paying electronics jobs go to people who have the hands-on skills to install, troubleshoot, diagnose, service, and maintain high-tech products and systems.

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Jobs for computer service technicians will almost double in the next 10 years, according to Department of Labor statistics, making computer service one of the fastest-growing fields in the nation. Now with NRI, you can cash in on this opportunity — either as a full-time industry technician or in a computer service business of your own.

Get inside a powerful 386sx/20 MHz mini-tower computer system!

NRI gives you practical, real-world experience with the latest in electronics and computer technology. Today, that means you get inside the powerful new West Coast 386sx computer system, the centerpiece of your hands-on training. As you actually assemble this 1 meg RAM, 32-bit CPU computer from the keyboard up, you perform hands-on experiments and demonstrations that make theory come alive!

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Your NRI training now also includes a remarkable diagnostic package that allows you to quickly locate and correct defects in IBM XT, AT, 80286/80386, and compatible computers. Using your QuickTech diagnostic software and R.A.C.E.R. plug-in diagnostic card, you master today's high-tech computer troubleshooting skills.

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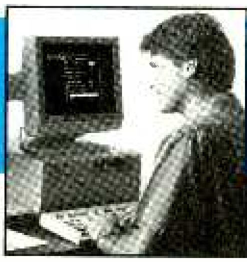
success in five of electronics careers

3. Prepare for a career in telecommunications



Some of today's hottest jobs in electronics are in telecommunications, where an explosion of new technologies is creating unlimited opportunities for the trained technician.

Now with NRI hands-on training, you can get a fast start in this exciting field...as you explore everything from satellite and cellular technologies to analog and digital switching systems, local area networks, fiber optics, modems, multiplexers, and more.

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NRI prepares you thoroughly for today's telecommunications opportunities by giving you practical experience with real-world equipment you keep.

You actually assemble your own data communications system, featuring an IBM PC/AT-compatible computer, 2400 baud fax modem, diagnostic breakout board, communications software, 40 meg IDE hard disk drive, near-letter-quality printer, and access to NRI's exclusive communications network.

4. Build your own computer-controlled music center!

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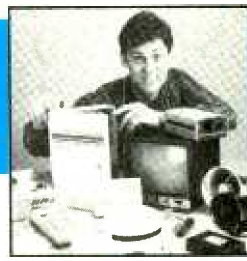
Enthusiasts everywhere are discovering the excitement of today's electronic music technology. At the heart of the excitement is MIDI (Musical Instrument Digital Interface), an innovation that's transformed musical instruments into the ultimate computer peripherals.

Now you can get in on the ground floor of this multibillion-dollar industry with NRI training in Electronic Music Technology.

Get to the heart of today's MIDI technology

Only NRI gives you hands-on experience with the equipment that's revolutionizing the music industry — an Atari 1040ST computer with built-in MIDI ports, Casio synthesizer with advanced MIDI operations, and ingenious MIDI software that links computer keyboard to synthesizer keyboard. Best of all, NRI gives you the knowledge and skills to use, program, and service this extraordinary equipment!

5. Make good money in security electronics



Last year, Americans spent over $17 billion on security services and equipment. For you, this new consumer demand means a breakthrough opportunity to start a high-paying career — even a business of your own — installing, servicing, and maintaining residential and commercial security systems.

Hands-on equipment for training and for use in your own home and auto

You train with and keep a closed-circuit TV system, fire/intrusion alarm, remote entry keypad, remote control auto alarm, and much more. Best of all, you actually safeguard your own property while gaining the expertise you need to make money as today's expert security electronics technician.

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18-092

Just A Heartbeat Away

DYNAPULSE 200M COMPUTERIZED BLOOD-PRESSURE AND PULSE MONITOR. Manufactured by: Pulse Metric, Inc., 10225 Barnes Canyon Rd., Suite A100, San Diego, CA 92121. Price: $179.00.

It's estimated that about 60 million people—one out of four—in this country suffer from high blood pressure, or hypertension. That condition, in which the heart is beating harder than it should have to, is a precursor for such killers as heart disease, strokes, and kidney disease. Fortunately, early detection and treatment can and does make a drastic difference, significantly decreasing the likelihood of death from those diseases. Unfortunately, given the state of health care in America today—where many people have no health insurance at all, and many others are insured by companies that do not cover preventative medicine—half of those 60 million people are unaware that they have high blood pressure. And high blood pressure doesn't have any obvious symptoms. That's why it's often called "the silent killer."

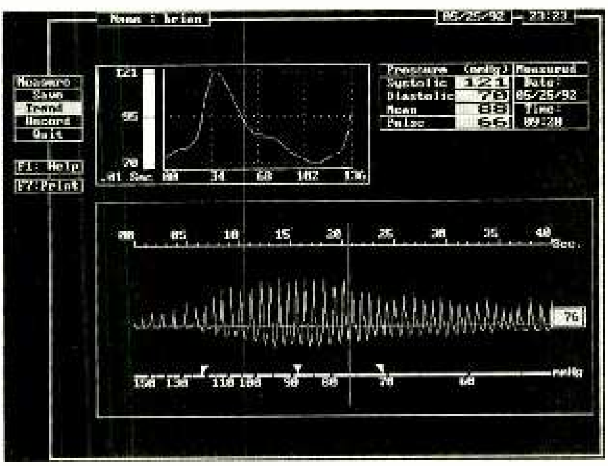
The test for high blood pressure is simple, and familiar to virtually anyone who's ever visited a doctor's office. Generally performed by a nurse, the professional test involves slipping an inflatable cuff over the upper arm, pumping it up to act as a temporary tourniquet that cuts off the circulation to the lower arm, and then allowing it to gradually deflate while listening to the arm's main artery with a stethoscope and watching the mercury column rise in a sphygmomanometer. That instrument measures the number of millimeters that the arterial pressure can push the mercury up a vertical tube; the unit of measurement for millimeters of mercury is abbreviated as "mmHg." The test involves two actual measurements. When the cuff is sufficiently deflated, blood flows back into the lower arm. The nurse can then hear a rhythmic thumping, known as Korotkoff sounds, and the height reached by the mercury column at that moment indicates the pressure exerted by the heart as it beats, or the systolic pressure. As the unrestricted blood flow returns to normal, another reading is taken during the resting period between heart beats, as the Korotkoff sounds vanish. That is called the diastolic pressure.

A blood pressure reading is represented by the systolic pressure over the diastolic pressure, with 120/80 mmHg considered to be normal. In determining if a person has hypertension, the diastolic pressure takes precedence. By current standards, diastolic pressure between 90 and 94 mmHg is considered to indicate mild hypertension, between 105 and 115 indicates moderate hypertension, and above 155 indicates severe hypertension.

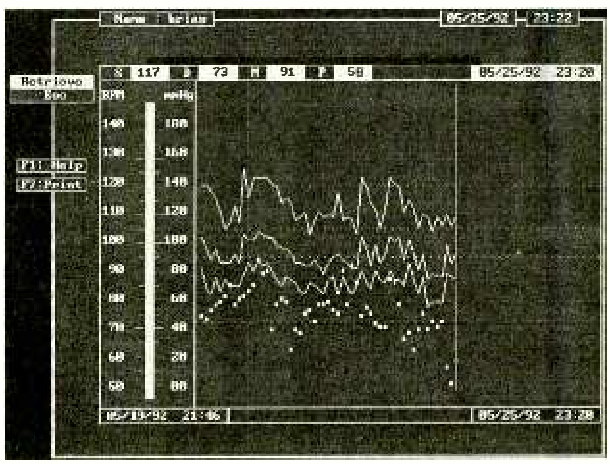
About 70% of those suffering from hypertension fall into the mild category. Mild cases can often be treated by making lifestyle changes that have been proven to reduce blood pressure, including weight loss, exercise, and reducing the intake of salt and alcohol. For more severe cases of high blood pressure, there are several types of treatments available. Sometimes its possible to battle high blood pressure with a combination of lifestyle changes and low doses of drugs. Continual monitoring of a person's blood pressure allows a doctor to determine the effectiveness of various courses of treatment and, when drugs are called for, to determine the lowest effective dosage needed to bring a patient's blood pressure back to the normal range.

Actually, "normal" readings vary somewhat according to age and other factors, including whether the person being tested has just consumed caffeine or experienced a stressful situation. In fact, for many people simply going to the doctor causes enough stress to alter their blood pressure test results; in fact, a name has been coined for those people's "conditions"—white-coat hypertension. Because so many factors influence blood-pressure readings, to obtain an accurate result two or three tests should be administered each time, with the average used as the true reading. That's rarely done in a busy doctor's office. Furthermore, blood pressure can vary at different times of the day and after various physical exertions. For that reason, a full, accurate picture of a person's blood pressure would require multiple tests, perhaps three a day, performed over a period of time, with the results charted to depict trends and averages. Even if you visit your doctor religiously for 6-month check-ups, you won't receive that type of testing. And plenty of people rarely see a doctor unless they are already sick.

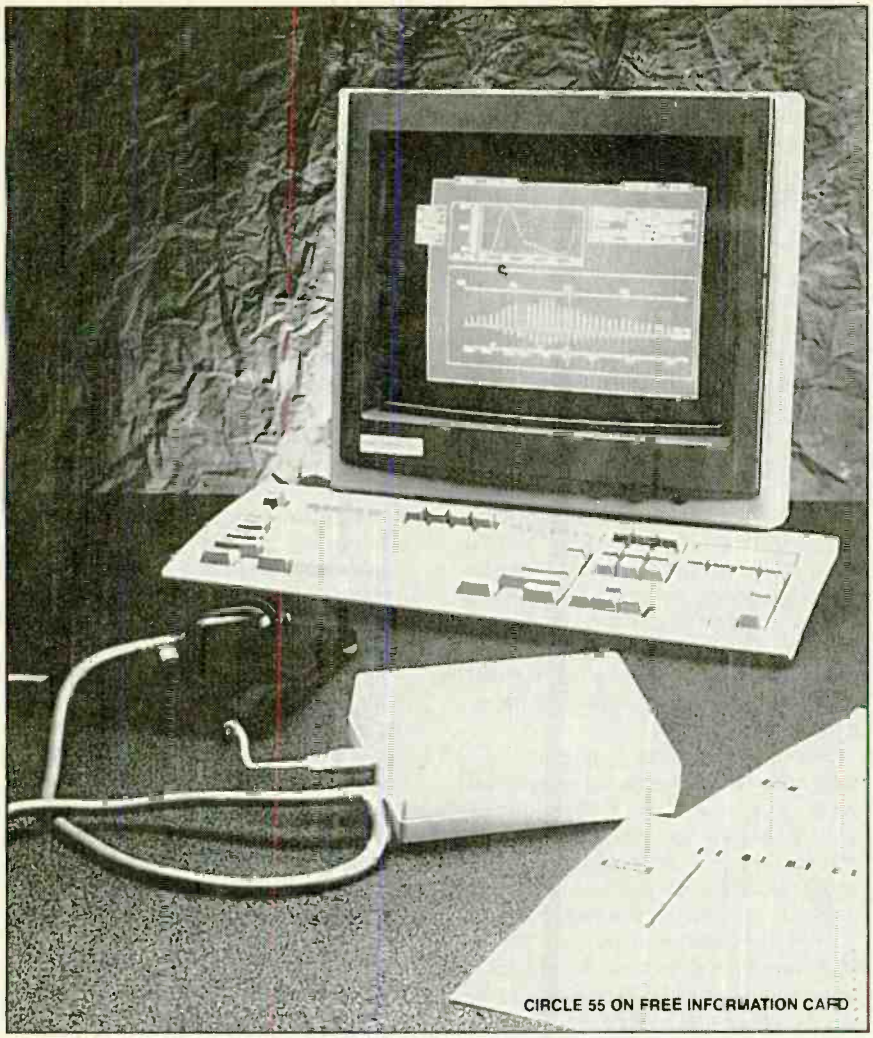
That's why there is a whole range of do-it-yourself blood-pressure testers available commercially. Those range from tricky-to-use index-finger cuffs, to manual models that require the user to develop the skill of listening for crucial sounds through a stethoscope practiced by a trained nurse, to electronic models that automatically



After a blood-pressure measurement is complete, the on-screen graph shows the "pulsation stream" on the bottom, which shows the pulse signal taken during the total measurement. The top graph is a waveform of the single pulse pointed to by the cursor of the lower graph.



The "Trend" display shows how much blood pressure can vary. These measurements, taken over the course of one week at different times of day show normal fluctuations—something your doctor's measurement ignores—and can be a help to someone trying to combat hypertension.


CIRCLE 55 ON FREE INFORMATION CARD

calculate the data and display the results on a digital readout. We found a blood-pressure monitor that goes a few steps further. The *DynaPulse 200M*, which connects to the serial port of a PC, measures not only your systolic and diastolic rates, but also measures your mean arterial pressure (MAP), the average pressure used to pump blood through the circulatory system. The MAP results can be used to detect such cardiovascular complications as artery blockage. The computer-based device charts blood-pressure trends and displays them graphically, providing the date and time of each reading. Up to six different people can record, store, and display their individual trends and records.

Like the manual and electronic blood-pressure devices, the DynaPulse 200M uses an inflatable cuff and a pump. Those are attached to a small unit in which the actual measurements are done. That battery-powered (4 "AAA" cells) unit connects to your computer's serial port via a supplied 9-pin RS232 cable. (A 9-to-25-pin adaptor is also supplied.) Because no add-on boards are used in the system, installation should prove to be easy for most computer users—you just have to know where your serial-port connector is. The DynaPulse software that completes the system is supplied on both 3½- and a 5¼-inch diskettes.

Although we didn't measure our blood pressure before we installed the DynaPulse 200M, we doubt that the installation process caused it to increase any! Once the software is copied from the diskette to a directory on your hard drive (it will also run on a single diskette), you simply tell the setup program what type of display adapter and printer you are using (either Epson or HP LaserJet compatibles are supported), and which COM port you have the unit attached to. The only other requirements is that your PC has at least 256K of memory and DOS 2.1 or later.

Up to six regular users and one guest can be supported by the software, whose use we found to be intuitive. Once you've entered your name in the User menu, you're ready to proceed to the Measurement screen, where you are presented with five choices: Measure, Save, Trend, Record, and Quit.

When you select "Measure," and then "Start," a small graphic instructs you to "Put cuff on arm." When you're done with that, a second graphic instructs you to "Close relief valve." Then you are instructed to pump the pressure bulb. When you've pumped the cuff sufficiently the PC beeps to let you know you should stop pumping. When the measurement is complete, the PC beeps again, and tells you to open the release valve to release the cuff pressure, and your measurement is displayed graphically and numerically on-screen. If there were no anomalies in the reading (from movement, a phone call, cough, etc.) you might want to save the reading as part of your blood-pressure history. You can view your history at any time, or print it if you choose.

There are many advantages to keeping track of your blood pressure. The primary one is simply to determine whether or not you have hypertension—a disease that has no discernible physical symptoms but that can have devastating effects on your life. Second, by charting your blood pressure, you can visually check how well your prescribed treatment is working. The DynaPulse 200M makes it extremely easy to do both of those things, quickly and accurately. Moreover, it lets each member of the family do the same. Pulse Metric claims that unlike most home units, the DynaPulse 200M offers "clinical grade" accuracy. Although we don't dispute that, we are concerned that there is no test for low batteries, which can cause inaccurate readings.

We have just one other misgiving: While there's no chance of getting false readings due to "white-coat hypertension" we wonder if severe computerphobes (and we all know at least one!) might experience false-high readings that could be dubbed "PC hypertension!" ■

JVC CAMCORDER

(Continued from page 12)

we'd prefer to see standard phono jacks instead.

Accessories supplied with the camcorder include the special A/V cable, a cassette adapter (which allows you to play back a VHS-C tape in a standard VHS machine), and a battery charger/AC adapter. Interestingly, no RF modulator is provided. Perhaps it's to drive home the point that you don't have to hook up the camcorder to your TV because you can use a full-size machine to play back the tape. We think it should be included, however, if only to help travelers who want to play back the day's shooting in their hotel room.

All in all, JVC's GR-AX50U is a good example of why the Compact VHS format is still a strong contender. The camcorder performs very well overall, and it's a breeze to use. And, yes, its tapes *will* play back on your VCR. ■

PERSONAL ORGANIZER

(Continued from page 15)

endar, secure menu, and off. Up to this point, everything is completely intuitive.

Entering data is also simple. When you select that menu option, Axxess presents you with the instruction "Enter company name" at the top of the on-screen keyboard. If there's no company, pressing enter brings up the next category, "contact name." We didn't have to open the manual until we realized we'd keyed in the wrong zip code and had to use the edit function. That one wasn't completely intuitive, but was simple enough once we scanned the instructions in the manual. For those times when it is necessary, the manual is clearly written and easy to follow.

We didn't mind typing on the touch screen, particularly when we compared its performance to various tiny-keyed units we've used in the past. It does take a bit of getting used to, and we had quite a few typos until we got our finger spacing right. The area usually occupied on a standard keyboard by the space bar here contains the MENU, LAST SCREEN, BACKSPACE, ENTER, and SAVE commands as well as SPACE. We frequently found ourselves saving an incomplete field or record by hitting ENTER or SAVE when we were aiming for SPACE. Of course, like all touch screens, it is subject to dirt and smudges. And, quoting directly from the manual, "As funny as this may sound, don't let the mustard from your sandwich get onto the Axxess screen. It will stain beyond repair!" We try not to eat messy stuff at our desks, so that didn't faze us.

When first setting up Axxess for use—copying all the names and numbers in your Rolodex (and on all those business cards stuffed into your top desk drawer), you'd probably find it easier to use a standard computer keyboard. Under the "Utilities" heading on the main menu, the "set features" option brings up another menu that allows you to set some basic parameters, including the type of keyboard you prefer: touch screen, PC/AT, or Macintosh. It takes just a touch on your choice to switch Axxess to that mode. Then all you need do is plug in your computer keyboard and type away.

Once you have all the names and numbers input, it's quite easy to search for a particular entry. Axxess allows you to search by company, first name, last name, or memo. (That last one can come in handy if you use the memo line to note people's birthdays. Then you can search every day for any memo with that date, and never forget to call a friend or relative on their birthday.) The flexibility also helps when you're not very good at remembering names—at least you have a better chance of remembering either first, last, or company name than just one of those!

We also liked being able to type contact names first name first, particularly because it's possible to output each record to a printer. That way you can print address labels that don't have last name first.

You can select ten of your most-often-called telephone numbers for auto-speed-dialing by choosing "quick dial" on the main menu. Quick dial works in two ways. In most cases, Axxess can be interfaced directly to an analog phone system using the supplied modular phone cable. Or you can use the audio-dial (DTMF) feature by holding the phone's handset next to the small speaker on the front panel as the number is dialed. Both methods worked fine with our office phone system. Digital phone systems, however, might cause some problems, and the manual suggests contacting the phone system's supplier for further information before attempting hook-up. The audio-dial feature is said to work with most digital systems, however, as long as you first dial the number required to get an outside line.

Selecting the calendar function automatically calls up the current month's calendar, with today's date flashing. Touching that screen will cause the days on which you have scheduled appointments to be highlighted. (If you have no appointments, Axxess will let you know by saying "No appointments scheduled.") You can press PREVIOUS or NEXT to scroll back or ahead on the calendar. Appointments are entered either with a single date and time, or under daily, weekly, monthly, or yearly categories. It is possible to clear all previous appointments from memory, or to delete individual appointments.

Another business-related function is the time log. It can be used to keep track of the time you spend on outgoing phone calls. By setting the "phone log" function on, each time you make a call Axxess will ask if you want to log it. If you do, you must remember to stop the phone tracking log when you hang up, as Axxess doesn't recognize that the call is completed. You can also use the time log to keep track of the time you spend working on various projects. There is space for 24 different listings. Touching one of those references is like punching a time clock; again, you must remember to turn off the log when you've finished. For billing purposes, you can even print out all or part of your time log. Unfortunately, when it comes to deleting time logs it's all or nothing—it is impossible to delete single time logs when you finish a project.

Besides printing out time logs, appointment schedules, and phone-number records, you can also download the information to a computer (either a PC or Macintosh) or to another Axxess. You can transfer the entire database stored in your Axxess, or a single record. One thing to remember: You must be sure to use the "Append" command or you'll overwrite all your data!

For most people, we'd imagine that PC transfer would come in most handy for data backup and restoring. But if you already keep a name-and-address database on your PC, you might be able to download the appropriate information to your Axxess, and keep your PC file up-to-date with new information entered into Axxess while you're away from your PC. All you need to be compatible with Axxess is an ASCII data file, with the entries delimited by commas. We won't get into the specifics here, but most database programs will be able to give you appropriately formatted information. (If the previous sentence doesn't make sense to you, there's a good chance you'll have trouble with anything other than backup and restore functions anyway.)

Otherwise, Axxess is easy to use—considerably easier than remembering all those addresses and phone numbers! While it performed all its intended functions admirably well and with little effort on the user's part, and while the touch-screen is an innovative feature, we're not sure that the almost-$600 price tag is justified. We hope to see future Axxess models at more axxess-ible prices. ■

VIDEO TITLEMAKER

(Continued from page 13)

interesting effect and even more choices.

The working memory of the titler is 8K. That may not sound like a lot to people used to running short on memory in their 640K PC's, but for titling it's a lot of space. The seven-minute demo was written in about 7K. The memory is non-volatile; that is, it retains its contents even when power is disconnected from the unit.

The Video TitleMaker was designed primarily for improving home videos. But that certainly isn't the only application that comes to mind. The excellent continuous-play demo made us realize that the TitleMaker could be used as a "video billboard" for point-of-purchase advertising or in a hotel lobby to announce the day's special events. A sports bar could use it to run a continuous crawler message that could announce scores of out-of-town games or, perhaps, drink specials.

For anyone who is serious about home videos, but who can't justify the expense of a full-blown video-editing system, the Video TitleMaker is a sensible alternative. It should give the skilled videographer a new outlet for his creative energies and a new way to make his good videos even better. ■

SPORTS CAR

(Continued from page 6)

top half of the double-DIN chassis. The cassette, tuner, and volume and tone controls are on the bottom.

The CD player offers forward and backward track skip, fast-forward and reverse, random-track selection, and track intro-scan. The cassette-player section offers a standard array of features, plus both Dolby B and DNR noise reduction. APC, or automatic program control, lets you automatically find next or previous tracks.

The tuner features twelve station-presets, and five tuning methods: manual, seek, scan preset, and auto memory tuning, which stores the six strongest stations in a separate memory. The latter is especially useful when driving in areas where you are not familiar with the local stations. We were very impressed with the radio's *diversity reception* in which two antennas are used. One is a rear mounted power telescoping antenna that receives both AM and FM signals. Another antenna, mounted on the rear window, receives only FM. The antenna providing the best FM reception is selected. It helps to eliminate or reduce some kinds of reception problems common to cars, especially "picket fencing."

The Mazda/Bose sound system does provide remarkable performance. The bass is clean and natural. The stereo imaging is superb. Although the acoustic waveguide, from which most of the bass frequencies emanate, is in the rear, you can't localize the bass in most instances. Thus the sound seems to come from in front of you. The centerfill "Twiddler" enhances the stereo image tremendously, providing a very natural soundfield without holes, and one where it is not possible to localize the speakers. It is, perhaps, the best car audio system we've ever heard in that respect.

Occasionally, a product that we review does exactly what it was designed to do. The Mazda RX-7 with its Bose Acoustic Wave audio system is such a product. We were truly surprised to find such a fine audio system in a car built primarily for sports-car performance. We're going to have a hard time getting back into our four-door sedans. ■

INTERPRETER

(Continued from page 14)

to see them spelled "colour," "flavour," and "theatre." Fortunately, when misspelled (or Americanized) words are keyed in, the Interpreter offers other, similarly spelled possibilities, so you can usually get the word you want without too much trouble.

We managed to stump it a few times, however. If your travel plans include any illicit activities, forget about getting any help from the Interpreter II. Such terms as prostitute, marijuana, and heroin are not included in its vocabulary. For some reason, neither are several less provocative words, including helicopter, cemetery, submarine, camcorder, videotape, racetrack, or balloon.

While we're complaining, we might as well mention that, at times, the digitized voice is somewhat difficult to understand, particularly when it's played at the slowest speed, which tends to distort it. We can only judge the English-speaking voice, since we're not familiar with the other four languages. We also noticed—and now we're getting really picky—that "You're welcome" is misspelled as "your welcome."

On the plus side, it is quite easy to get your message across in four foreign languages when using the Interpreter II. The common-phrase mode is particularly impressive, offering sentences that you are sure to use, and making it easy to find those phrases quickly when you need them. If, on the one hand, you'd like to really get to know a language, you can spend time in the interactive "teach" mode, in which random words are called up and spoken first in English and then displayed and repeated aloud twice in the language of your choice, with a pause between the spoken words to allow you to repeat the word yourself. You can also pick up some basic sentence structure clues from calling up and listening to phrases. If, on the other hand, you're shy or simply want to be sure to be understood, you can even let the Interpreter II do your talking for you. ■

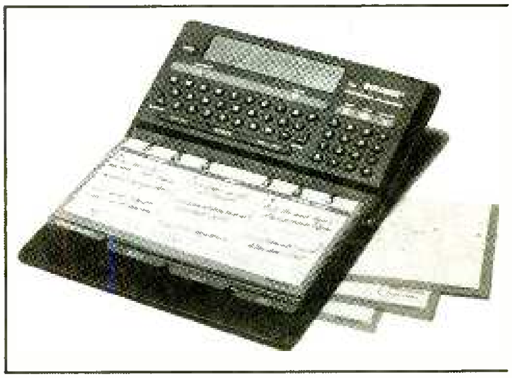
For more information on any product in this section, circle the appropriate number on the Free Information Card.

ELECTRONICS WISH LIST

Paper/Electronic Planner

Electronic personal planners have their advantages, but sometimes it's just easier to jot yourself a quick note with pen and paper. That's why *Rolodex* (245 Secaucus Rd., Secaucus, NJ 07094) has come up with a bridge between paper and electronic planners. The compact *Rolodex Personal Planner* combines the practicality of paper with the power of electronics. Its electronic section contains only those functions that are most frequently used: A contact file with 48K memory holds up to 400 names, numbers, and addresses; electronic notes can be retrieved numerically, alphabetically, or by date; and calendar, clock, and calculator functions are provided. A QWERTY-style keyboard and clearly mapped icons make the unit easy to use. The paper section consists of a six-ring binder that comes with various forms, including dated weekly schedules, call sheets, task checklists, expense-account envelopes, and credit-card holders. The Personal Planner is about the size of a checkbook. Suggested retail price: $129.99.

CIRCLE 56 ON FREE INFORMATION CARD



Rolodex Personal Planner

ELECTRONICS WISH LIST

For more information on any product in this section, circle the appropriate number on the Free Information Card.

Passport 100 Laser Detector

Laser Radar Detector

In the escalating war between radar-detector users and highway-patrol officers, the laser gun is among the latest weapons used to trap speeders. To counterattack that innovation, the *Escort Division of Cincinatti Microwave Inc.* (5200 Field-Ertel Rd., Cincinatti, OH 45249) has introduced the first traffic laser detector for consumer use. The *Passport 100 Laser Detector* monitors LIDAR (laser detection and ranging) beams from laser guns. It features a test/dark mode, a three-LED meter, an alert light, and a pilot LED. Its audible alarm is adjustable. Suggested retail price: $99.

CIRCLE 57 ON FREE INFORMATION CARD

Nakamichi CD/Receiver System

Distinctive CD/Receiver System

Instead of an assortment of stackable components, *Nakamichi America Corporation's* (Specialty Audio, 19701 South Vermont Avenue, Torrance, CA 90502) *SoundSpace7* features a single system unit and a pair of matching speakers designed with an emphasis on ergonomics and aesthetic appeal. The SoundSpace7 incorporates Nakamichi's MusicBank system, which features an internal "1 + 6" stacker mechanism that combines the convenience of a CD changer with the performance advantages of a single-disc player, and provides access to a total of seven discs for sequential, programmed, or random play. No cartridges are required, and 3-inch CD's can be played without an adaptor in the single-disc mode. The receiver section of the system features "Harmonic Time Alignment" amplifier circuitry, which based on the principle that the timing of an amplifier's harmonic-distortion components is essential for sound quality. Designed in accordance with that principle, the amplifier is said to provide pure sound reproduction free of "harshness or graininess." The receiver section has an AM/FM quartz-lock frequency-synthesis tuner with ten AM/FM station presets, auto seek, and manual-tuning capabilities. The two-way speakers use a one-inch soft-dome tweeter and a 6¼-inch woofer. Other features include a loudness compensation switch, bass and treble controls, preamp outputs, video and tape inputs, and a wireless remote control. Suggested retail price: $2200.

CIRCLE 58 ON FREE INFORMATION CARD

29-Inch Sony Trinitron

29-Inch Television Set

No stranger to innovations, *Sony* (Sony Drive, Park Ridge, NJ 07656) has introduced the industry's first 29-inch TV, the *KV-29XBR85 Trinitron*. According to Sony, discriminating viewers are sure to appreciate not only the 15.4% more viewing area that the set offers over a 27-inch set, but its array of high-performance features as well. Those include a Trinitron Microblack picture tube with oxide-titanium coating; "Digital/Intelligent Color Pure" comb-filter circuitry to separate luminance and chrominance signals for enhanced edge sharpness; "Improved Velocity Modulation" scanning circuitry for a crisper image; a "Digital Bus Control Chassis" that enables more accurate signal processing; and "Active Signal Correction" circuitry that automatically monitors and adjusts brightness, sharpness, picture, and color by sampling 248 reference points 60 times every second. On the audio side, the KV-29XBR85 features an active subwoofer speaker driven by its own 40-watt amplifier mounted in a ported enclosure, along with built-in main stereo speakers. The television is also equipped with the SRS Sound Retrieval System. The programmable/universal remote control lets the viewer control every television feature and function, including favorite-channel scan, picture-in-picture, and split-screen displays. Maybe they're the solution for our Gizmo offices. Suggested retail price: $2099.99.

CIRCLE 59 ON FREE INFORMATION CARD

A Hands-on Electronics REPORT

AMERICA POWER CONVERSION BACK-UPS 250

You need not allow hours of work to simply disappear when a power-failure occurs.

Despite advances in the capabilities of modern personal computers, a momentary power outage is still all it takes to lose the data or file you're working with. More traumatic is the loss of previously written files, or even an entire hard disk, which can occur should a power problem strike while your computer is saving a file.

Other power disturbances, such as sags (or brownouts), blackouts, surges, and spikes, can also affect the operation of your computer. While devices such as surge suppressors or voltage regulators can protect equipment from some of those irregularities, a modern backup power supply can protect against them all.

Actually, there are many different approaches to the design of backup power supplies, from "uninterruptible power supplies" that use on-line inverters backed up by a battery, to "standby power supplies" that switch to a battery-powered inverter only when required, and hybrids of both. To confuse the issue, the terms "uninterruptible" and "standby" are frequently used interchangeably by both users and manufacturers. Apparently for marketing reasons, manufacturers more and more are using the term UPS (uninterruptible power supply) to describe units that are really standby power supplies.

Enter the Back-UPS 250. To make selecting a back-up power system more straightforward, American Power Conversion (132 Fairgrounds Road, West Kingston, RI 02892; Tel. 800-541-8896) offers a complete line of backup power units of various types. This report is about the smallest and least expensive unit (only $169), the Back-UPS 250, which can provide standby power for most common microcomputer systems. The unit is rated at 250 "volt-amperes" (or VA).

You can convert between the VA rating and wattage if you know the "power factor" of the load you'll need to plug into the UPS. You just multiply the power factor (typically 0.6 to 0.7 for computers) by the VA rating. American Power Conversion uses just under .7 for their calculations. So the UPS 250 is capable of providing about 170 watts.

The amount of time that the Back-UPS 250 can provide power will vary with the connected load. As examples, the unit can provide 29 minutes of operation for a Macintosh SE/30 (75 VA), 23 minutes for an IBM PS/2 with monochrome monitor (100 VA), 14 minutes for an IBM PS/2 30 with a 14-inch VGA monitor (150 VA), 8 minutes for an IBM PS/2 55SX with 14-inch VGA (200 VA), or 5 minutes for a Compaq 386/25e with 14-inch VGA (250 VA). In each case, you would have ample time to shut down your system in an orderly fashion.

If your configuration differs, you can estimate the operating time of your setup based on the times given above. Simply add the VA ratings of your monitor and computer and compare. The VA ratings can be found in devices' manuals or taken from the back of the units. If your units' ratings are specified in amperes, multiply by voltage to get VA. If the ratings are given in watts, multiply by 1.4 to get VA.

The Unit's Operation. The Back-UPS 250 has a storage battery, monitoring and control electronics, a solid-state inverter, and a step-up transformer all in one case. If present, regular household power runs through the unit to power sockets on the back, into which you plug your computer or whatever. As long as AC line current is present, everything operates just as if there were no standby power supply present.

However, if the line voltage drops

(Continued on page 87)

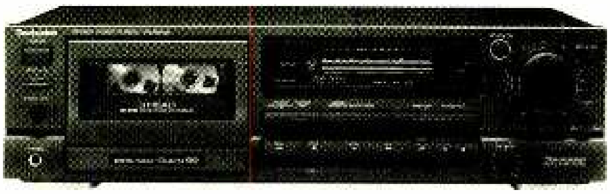
PRODUCT TEST REPORTS

By Len Feldman

Technics RS-BX606 Stereo Cassette Deck

For all the talk about present and future digital audio-recording technology such as DAT (Digital Audio Tape), DCC (Digital Compact Cassette), CD-R (Recordable Compact Discs), and MD (Mini-Discs), most audio enthusiasts are quite content with a high-quality analog cassette deck that delivers wide dynamic range, low background noise, and low distortion. The Technics RS-BX606 is just such a unit.

That tape deck is loaded with features that will appeal to the serious recordist. The RS-BX606 uses advanced three-head construction that enables you to monitor recorded results right off the tape, in real time, a fraction of a second after the recording is made. Further, the recorder incorporates dual, digital-servo, direct-drive motors, with tape speed precisely controlled and adjusted against a referenced quartz oscillator. Each motor's flywheel is individually balanced. A full-logic feather-touch transport, controlled by a microprocessor, coordinates all tape-transport functions.



CIRCLE 120 ON FREE INFORMATION CARD

The Technics RS-BX606 Stereo Cassette Deck

In terms of electronic features, the RS-BX606 offers both Dolby B and C noise reduction, as well as Dolby HX-Pro, which extends a tape's headroom for recording higher frequencies with less distortion. The tape deck also offers a "Bias Fine Adjustment" feature that allows bias levels to be easily fine-tuned using a front-panel control. That feature allows the user to optimize the performance of normal, high-bias, or metal-particle tapes. There's also an electronic tape counter that can display real elapsed time in minutes and seconds. Dual-range fluorescent peak-hold meters are incorporated for setting accurate recording levels.

Other features found on this deck include a switchable MPX filter (useful when recording FM-stereo programs), an auto record-mute that inserts silent pauses between recorded segments, auto tape-select that automatically adjusts to the type of tape used, a timer for recording and playback, and large, easy-to-read master record and balance controls.

CONTROL LAYOUT

At the left end of the front panel are a power switch, a cassette-eject button, and a stereo-headphone jack and its associated rotary level control. Further to the right is the cassette compartment, while still further to the right is a large display area that incorporates the fluorescent level-metering system, the tape-counter display, and various other status symbols and words. A row of buttons below the display area takes care of the timer functions, counter-reset and mode selection, repeat and memory rewind (to the 0000 point on the counter), meter-sensitivity selection, activation of the MPX filter, and selection of Dolby B or C noise reduction.

Major transport controls take the form of larger pushbuttons arranged along the bottom edge of the front panel. These include the usual rewind, stop, play, fast-forward, pause, and record buttons as well as the previously described auto record-mute button. At the extreme right of the panel are a small bias-adjustment knob; a balance control; the monitor switch (that switches between source and tape); and a large, rotary, master recording-level control. The rear panel of the RS-BX606 houses a pair of line-input jacks and a pair of line-output jacks. The power cord for this tape deck is supplied separately and must be plugged into the socket labeled "AC In."

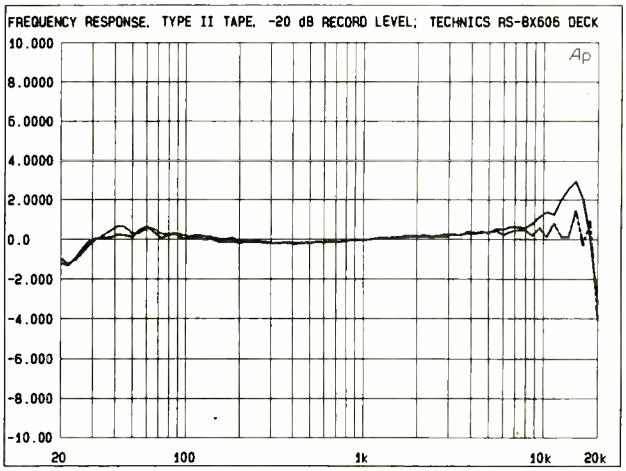
TEST RESULTS

We measured the performance of this tape deck using all three of the popular types of cassette tapes. For test samples we used Maxell XL-I for normal-bias (Type-I) tape, Sony ES-II for high-bias (Type-II) tape, and

TEST RESULTS—TECHNICS RS-BX606 CASSETTE DECK

Specification	Mfr's Claim	PE Measured
Frequency response (±3dB)		
Normal tape	30 Hz to 17 kHz	20 Hz to 20 kHz
High-bias tape	30 Hz to 18 kHz	20 Hz to 20 kHz
Metal tape	30 Hz to 19 kHz	20 Hz to 20 kHz
Signal-to-noise (Type II tape)		
Dolby off	57 dB*	57.8 dB**
Dolby B	66 dB*	66.9 dB**
Dolby C	74 dB*	73.3 dB**
Harmonic distortion, 1 kHz		
Normal tape (0 dB)	N/A	1.1%
High-bias tape (0 dB)	N/A	1.1%
Metal Tape (0 dB)	N/A	0.9%
Wow-and-flutter (WRMS)	0.05%	0.025%
Fast forward/rewind (C-60)	100 seconds	97 seconds
Input sensitivity	60 mV	Confirmed
Output level		
Line out	400 mV	450 mV
Headphones	125 mV/8 ohms	Confirmed
Power requirements	120V AC, 50/60Hz, 20W	Confirmed
Dimensions (W × H × D, inches)	$16\frac{15}{16} \times 4\frac{15}{16} \times 11\frac{13}{16}$	
Weight	9.46 lbs. (4.3 kg)	
Suggested price:	$279.95	

*Measured with respect to maximum recorded level
**Measured with respect to 0-dB indication on deck's meters



The record/playback frequency response of each sample was examined using recordings made at a nominal –20-dB level, referred to a standard Dolby level of 200 nanowebers/meter. The plot shown here is for the Sony ES-II (high-bias) sample.

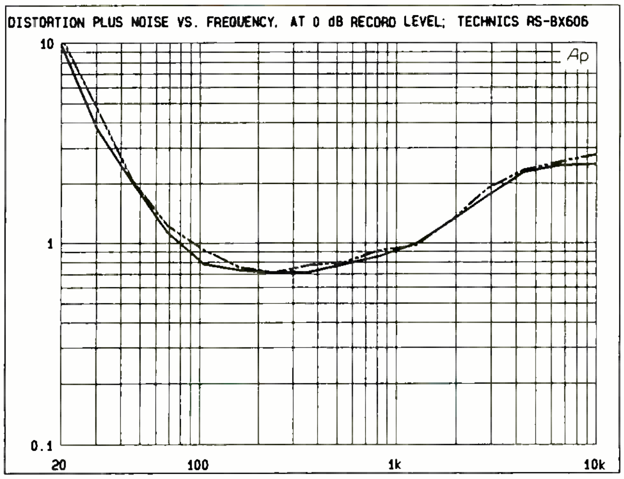
Maxell Metal tape for metal-particle (Type-IV) tape. The record/playback frequency response of each sample was examined using recordings made at a nominal –20-dB level, referred to the standard Dolby level of 200 nanowebers/meter. In each case, recording bias was fine-tuned or optimized for the tape used. In all cases, response extended to at least 20 kHz, and down to 20 Hz, with never more than a ±3-dB tolerance.

We also used a frequency-response measurement (using the high-bias tape sample) to examine the action of the MPX filter. As expected, with the filter switched on response drops off sharply above 15 kHz or so in order to attenuate response at 19 kHz (the pilot-carrier frequency used in transmitting stereo FM). The MPX filter should be used if your tuner or receiver does not adequately attenuate this non-audio pilot tone. If the FM-stereo pilot signal is not adequately attenuated, it might upset the tracking of the Dolby circuitry and, in extreme cases, it could add distortion to your recordings of FM programs.

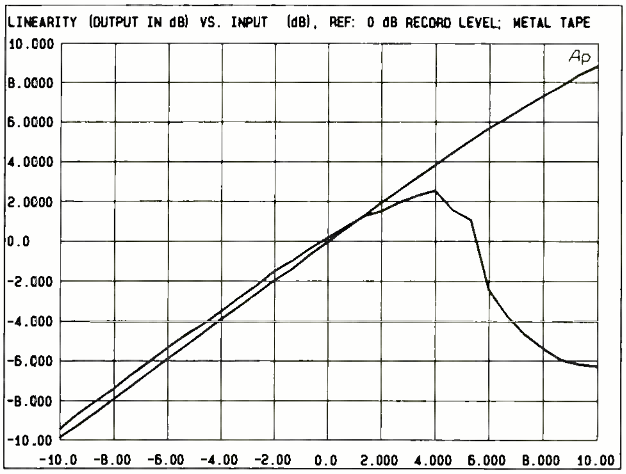
We next turned our attention to distortion levels as a function of frequency. To do the test, a constant 0-dB signal, as indicated on the deck's own metering system, was recorded on all three tape samples. It should be noted that, when recording music, such high signal levels would rarely be recorded at those frequency extremes. At the upper-bass and mid-range frequencies where such levels might be commonly recorded, harmonic distortion remained at or below the 1% mark, with the metal-tape sample exhibiting the lowest distortion of the three types at a 1-kHz test frequency.

Using high-bias (Type-II) and metal-particle (Type-IV) tape, we next recorded and played back a 1-kHz test signal, varying its amplitude from −6 dB to +10 dB, as indicated on the tape deck's own metering system. The headroom advantage of metal tape is clearly evident from these tests: While the high-bias tape showed increasing distortion with increasing recording level (reaching around 3% at +10 dB), the metal tape's distortion readings remained nearly constant, barely exceeding 1% at the over-recorded level of +10 dB.

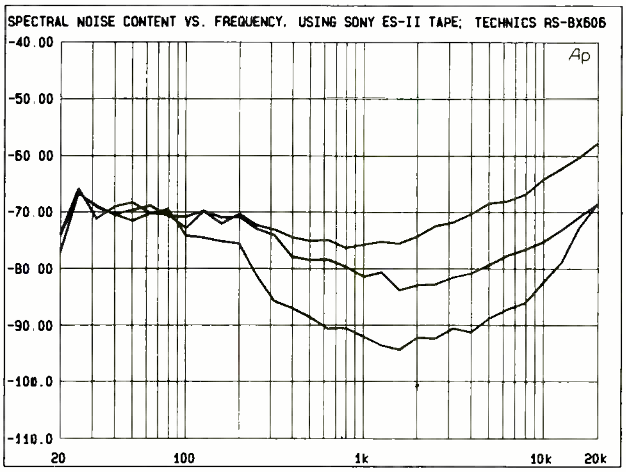
Next, we conducted an MOL (or Maximum Output Level) test. That test is done to determine the linearity (or more correctly, the deviation from linearity) of the unit. To conduct the test,



Using Type-IV (metal) tape and a nominal 0-dB recording level, distortion plus noise was below 1% at the upper-bass and mid-range frequencies where such signals most commonly would be recorded.



Using metal tape with this recorder, the maximum output level for the 10-kHz recorded test signal (lower trace) was +2.3 dB, and the drop-off in 10-kHz level only begins to occur above an input recording level of +4 dB.



This plot of tape hiss as a function of frequency shows the advantages of Dolby noise reduction. The top trace was obtained with no noise reduction, the middle trace with Dolby B, and the lower trace with Dolby C.

signals of 1 kHz and 10 kHz at levels ranging from −10 dB to +10 dB were recorded on the three tape samples. For the 1-kHz test signal, linearity for all samples was virtually perfect up to and even beyond 0 dB (output levels are equal to input levels over that range). However, as higher and higher recording levels were used, the superiority of metal tape, even at the mid-frequency of 1 kHz, became evident.

When the test was repeated using a 10-kHz test signal, more significant differences between the tape types were noted. For normal-bias tape, the maximum output level at 10 kHz was approximately −1.5 dB. Beyond a recording level of +2.0 dB or so, recorded output at 10 kHz actually dropped instead of rising. For high-bias tape, the maximum output level for the 10-kHz recorded test signal was around −2.0 dB. By contrast, using metal tape with this recorder, the maximum output level for the 10-kHz recorded test signal was an impressively high +2.3 dB, and the drop-off in the 10-kHz signal only began to occur above an input recording level of +4 dB. These tests clearly illustrate the advantage of using metal tape for wide dynamic-range recording on a high-quality tape deck such as this Technics model.

Next, we measured the noise characteristics of the Technics RS-BX606 recorder using Type-II (high-bias) tape—the type of tape most often used by home-recording enthusiasts. With no audio test signal applied, recordings were made first with no Dolby noise reduction switched in, then with Dolby B, and finally with Dolby C. When

(Continued on page 94)

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Build a HIGH-ENERGY IGNITION SYSTEM for your Car

Get the most from your automobile with this electronic ignition system

BY CHARLES R. BALL

Most new automobiles, whether domestic or imported, have some form of electronic ignition. Electronic ignitions aid in combustion, which improves mileage and reduces harmful emissions. But, most of them are incapable of producing sufficient spark energy to achieve maximum MPG while maintaining minimum-emission levels. In addition, there are still many older vehicles and some newer ones, on the road that do not have electronic-ignition systems. Often, the owners of those non-electronic ignition vehicles simply can't afford the new breed of computerized cars. Then there are the old diehards who don't particularly care for the new breed of cars, but who nonetheless desire maximum performance from their vehicles.

Regardless of the category that you fall into, the *CD4-MX Capacitive Discharge Ignition* described in this article—which can provide 50 to 70 kV to the spark plugs—may be just what the "MPG Doc" ordered. The higher spark energy provided by the CD4-MX allows the plugs to be gapped wider. Wider gapping allows an increased flame front and that translates into more complete combustion, more power, greater fuel economy, and a reduction in exhaust emissions.

The CD4-MX is compatible with standard (Kettering) ignitions, as well as GM-HEI, Ford, Chrysler, Bosch, and other systems. For Kettering (breaker-point) ignitions, installation is a breeze. Due to the numerous variations in non-Kettering (electronic pickup) ignitions (GM-HEI has more than three variations in the Cadillac system alone), reference to the manufacturers shop manual is required for cars with those ignitions. Based on the information in the manual, some modifications to the generic construction and installation procedures may be required, depending on the vehicle.

Kettering Ignitions. Prior to the Kettering ignition system, automobiles used magneto-type ignitions similar to those used in most lawn mowers. However, the Kettering ignition (a coil/point system, which produced a superior spark) soon changed all of that.

Figure 1 shows a typical implementation of a Kettering ignition system. As shown, the system is comprised of an input from the points that feed a detached ignition coil, which in turn delivers sufficient voltage to the spark plugs to ignite the fuel/air mixture within the engine. The CD4-MX allows the spark-plug gap to be increased over manufacturer's recommendations, thereby providing a wider flame front, affecting more complete combustion. Depending upon the plug and wiring, the spark-plug gap can often be increased to as much as 0.080.

More recently, Hall-effect devices and optical pick-ups became more reliable and practical for automotive use, and have all but replaced mechanical points. However, both the Hall-effect and optical pick-up systems are based on the basic Kettering principle. They have merely eliminated the breaker points.

WARNING!! This article deals with and involves subject matter and the use of materials and substances that may be hazardous to health and life. Do not attempt to implement or use the information contained herin unless you are experienced and skilled with respect to such subject matter, materials and substances. Neither the publisher nor the author make any representations as for the completeness or the accuracy of the information contained herein and disclaim any liability for damages or injuries, whether caused by or arising from the lack of completeness, inaccuracies of the information, misinterpretations of the directions, misapplication of the information or otherwise.

The Circuit. The following circuit explanation refers to using the CD4-MX in conjunction with a Kettering-type ignition. A schematic diagram of the CD4-MX is shown in Fig. 2. The circuit is essentially a DC-to-DC converter that is capable of producing an output of 400 to 700 volts DC from a 12–14-volt DC source. The DC-to-DC converter consists of a cross-coupled (astable) multivibrator (built around Q1, Q2, R1, R2, R4, and R5), and T1, a 24-volt center-tapped input, 450-volt output (at 160 Hz), 10-watt step-up transformer. Such a unit may be difficult to locate, but a suitable one is available from the source given in the Parts List. The operating frequency of the multivibrator is determined by T1's primary inductance, the characteristics of Q1 and Q2, and the values of R4, R5, C6 and C7. Resistors R1 and R2 provide a slight reverse bias to ensure proper start-up of the DC–DC converter.

The multivibrator's operation depends on the inherent gain mismatch in any two similarly rated semiconductors coupled with the inductance mismatch between the two halves of T1's center-tapped primary. Those factors combine to cause one transistor to turn on before the other.

At turn on, battery power is fed through D1 (which is used to prevent reverse-polarity damage to the circuit) and across C1 to the emitter junction of Q1 and Q2 (two high-power, wide-temperature-range, PNP silicon transistors). Capacitor C1 is a low ESD, high-capacitance electrolytic unit that is used to filter out power-line noise (caused by switching transients within the CD4-MX) that might otherwise affect the CD4-MX or the vehicle's other electronics.

The first transistor to turn on applies a voltage across its associated half of T1's primary winding. That voltage is also applied to the base of the second transistor (through either R4 or R5, depending on which transistor is conducting), turning on the second transistor, while turning off the first. The output of the second transistor, like the first, is applied across its respective half of T1's primary and is also fed to the base of the first transistor. That causes the first transistor to again turn on and the second to turn off.

The voltage alternately applied to the two halves of T1's primary winding induces a higher voltage in T1's secondary winding. The output of T1 is applied to a fullwave-bridge rectifier, comprised of D3–D6, which provides a pulsating DC output. Resistor R8 and neon lamp NE1 are series connected from the output of the bridge rectifier to ground. Together those components provide a visual indication of the performance of the DC–DC converter and of spark activity, while also providing a discharge path for C4 when the ignition is turned off.

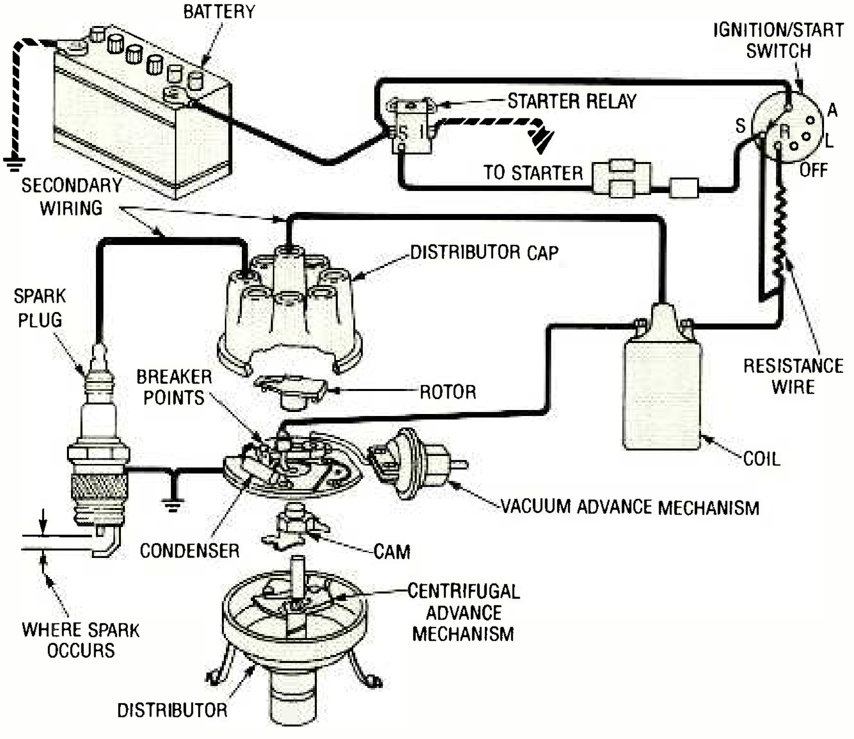


Fig. 1. In the basic Kettering ignition system, a signal from a set of points is fed to a detached ignition coil.

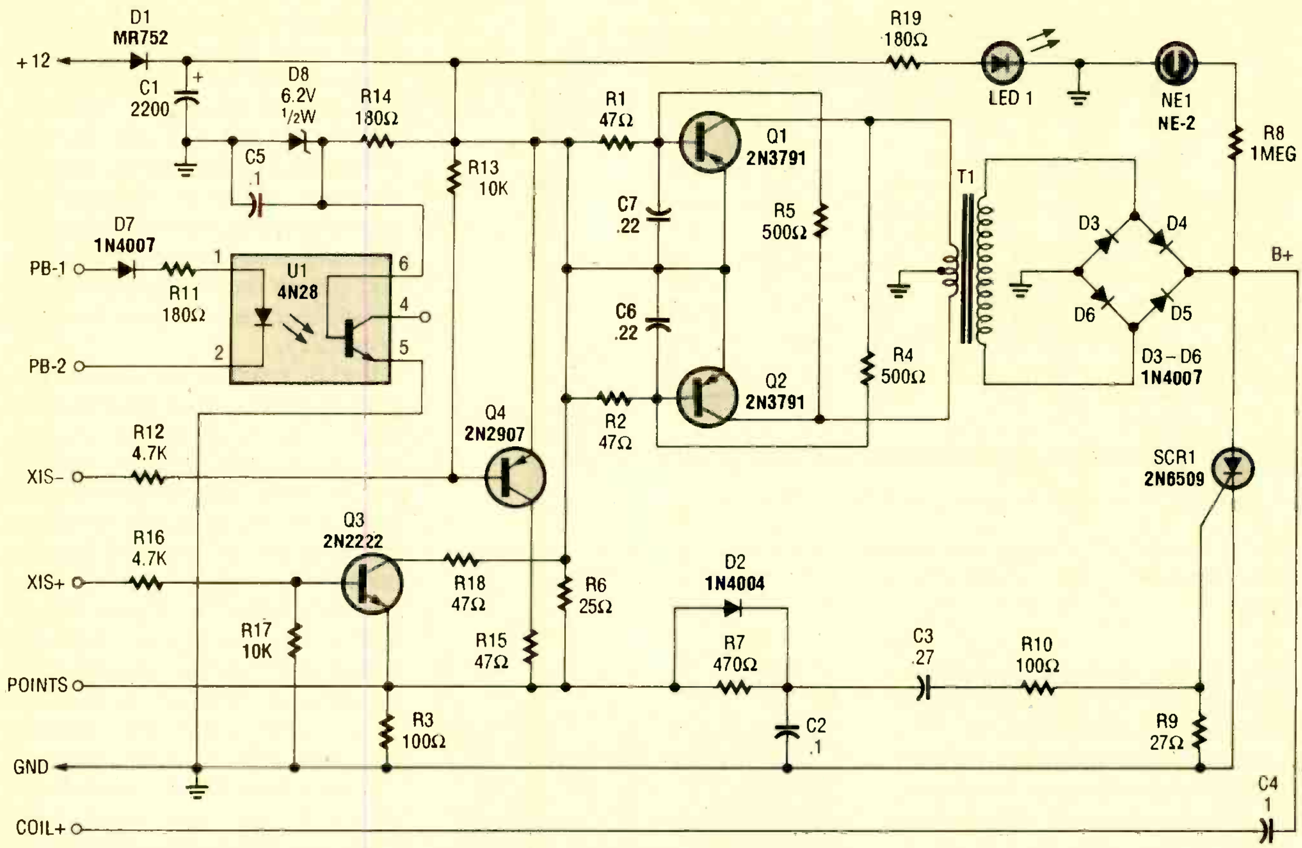


Fig. 2. At the heart of the CD4-MX is an astable multivibrator, built around Q1 and Q2, that feeds step-up transformer T1. The output of T1 is rectified by D3–D6 and used to charge capacitor C4. When the points close, a small voltage is fed to the gate of SCR1, causing it to fire, dumpimg the charge of C4 to the vehicle's ignition coil. The circuit also contains optional sub-circuits to accommodate different types of auto ignitions. See text for more information.

The output of the bridge rectifier causes C4 to charge to between 400 and 700 volts. When the points fire, a small voltage is delivered to the gate of SCR1 through the D1/R7 parallel combination, C3, and a voltage divider network consisting of R9 and R10. Diode D2 ensures that the trigger voltage delivered to the gate of the SCR is of the proper polarity, while providing a low forward drop to a noise-reduction network, consisting of C2 and C3. Resistor R7 provides a discharge path for C2 and C3. Resistors R9 and R10 ensure the proper trigger voltage for the SCR.

The voltage derived from the points triggers SCR1, causing the multivibrator to stop oscillating. At the same time, the energy stored in C4 (approximately 400–700 volts) is dumped to the primary of the ignition coil. The ignition coil (essentially a step-up transformer), in turn, generates a spark of between 40,000 and 70,000 volts in the ignition-coil secondary. That voltage is routed to the appropriate plug via the distributor.

Once the points open, SCR1 turns off, the oscillator is restarted, C4 begins to recharge, and the process begins anew.

Non-Kettering Configurations. The CD4-MX contains provisions for a number of different circuit variations to accommodate different vehicle/boat ignition systems. In unusual situations, the vehicle/boat shop manual should be consulted to ensure proper configuration.

There are three alternative configurations included in the CD4-MX. For all non-point/breaker (*i.e.* non-Kettering) ignition systems, R6 is not used and must be omitted for proper operation. Other configurations require the use of positive (using Q3) or negative (using Q4) logic trigger circuits. These are accessed via the XIS+ and XIS– inputs, respectively.

Grounding XIS– allows SCR1 to be triggered via Q4. When the ground is removed, the trigger circuit is reset. Applying +12 volts DC to XIS+ triggers SCR1 via Q3. When the positive voltage is removed, the trigger circuit resets.

Transistor Q3 or Q4 can be used alone or in conjunction with optoisolator/coupler U1, with D7 oriented as shown in the schematic and parts-placement diagram. If U1 is used in conjunction with either transistor, its output at pin 4 should be connected to XIS+ or XIS–, depending on the polarity of the output from the sensor.

When the sensor output is positive, connect the positive output to PB-1and the ground (or negative sensor output) to PB-2. For negative sensor outputs, PB-1 should be connected to ground (or the more positive source), with the negative sensor output connected to PB-2; *e.g.,* the PB-1 terminal must always be positive with respect to PB-2. Then it is a simple matter of connecting the output of U1 to either

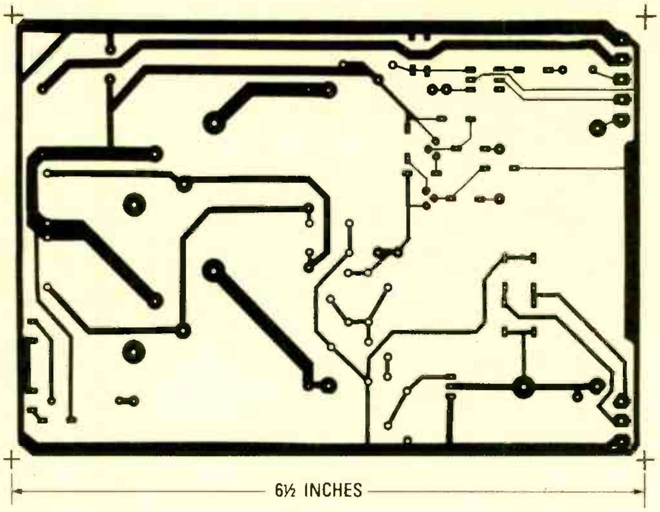


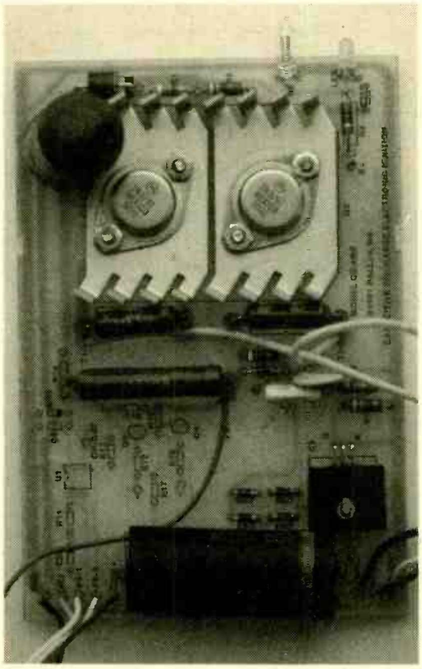
Fig. 3. The CD4-MX prototype was assembled on printed-circuit board. The layout for that board is shown here half size. Note that the outer perimeter of the board is ground.

Q3 or Q4 by installing a jumper from U1 pin 4 to XIS– for a negative trigger or XIS+ for a positive trigger.

If a DC offset (a standing voltage across the pick-up sensor) is present, use U1 but replace D7 with a Zener diode that has a voltage rating equalling the offset voltage, plus 2 volts; the extra 2 volts provides a safety margin. And, again, configure the board appropriately. Typically, without a DC offset present, a Hall-effect device will trigger Q3, Q4, or U1 directly using the component values shown.

In any event, whenever U1 is included in the circuit, D7 (or a Zener diode with appropriately specifications) should be in the circuit to provide reversed-polarity protection. Resistor R11 provides current limiting. Resistor R14 and Zener diode D8 form a voltage regulator for U1, while capacitor C5 provides additional filtering.

For all non-Kettering ignitions, the manufacturer's literature for the type of ignition and pickup device currently installed will dictate the ultimate configuration of the CD4-MX, whether it is to be used for automotive, marine, farm-implement, or another application.



Here is a view of an assembled CD4-MX board prior to installation in its enclosure. Note that the circuit board does not contain all of the components that are shown in the schematic diagram or the parts-placement diagram. That's because not all of the components are required for every installation. The version pictured here is intended for Kettering-type ignition systems.

Construction. The author's prototype of the CD4-MX was built on a printed-circuit board, measuring about 4½ by 6½ inches. Figure 3 shows a half-size (50%) template of the author's printed-circuit pattern. When assembling the circuit, all connections to and from the circuit board must be well insulated to prevent accidental shock and electrical breakdown due to moisture.

A parts-placement diagram for the project's printed-circuit board is shown in Fig. 4. That diagram gives the locations of all the components shown the schematic diagram, but not all of the components are required for all installations. For example, U1, D7, D8, Q3, Q4, R6, and R11–R18 are not required for standard Kettering installations. Therefore it will be necessary to consult the manufacturer's literature for the type of ignition and pickup device installed in your vehicle and then configure the circuit accordingly.

Start by installing the passive components (resistors and capacitors) first, followed by the semiconductors (diodes, transistors, SCR, LED, IC, etc.). Ferrite beads should be placed on both leads of R4 and R5 before installation. The ferrite beads help to reduce the effects transients, while providing adequate ventilation around the resistors. Resistor R6 (for standard Kettering installation only), if used, should be mounted with ¼-inch phenolic or ceramic spacers to elevate it above the printed-circuit board.

When mounting C1, apply silicone rubber to the base, avoiding the leads. Use the silicone rubber sparingly because if it seeps through the circuit-board holes soldering may be difficult. Then mount the unit with the proper orientation and solder in place. Capacitor C4 (an axial-lead unit) should be similarly mounted by applying a small bead of silicone rubber to the underside (the portion facing the circuit board) of its body.

Once all of the passive components have been installed, go to work on the semiconductors. Like R4 and R5, diode D1 should be mounted so that it is slightly elevated off the board for ventilation. The SCR should be mounted to the circuit board on a heat sink. When installing the SCR, first slide the heat sink under the device (silicone grease is preferred, but not required). Bend and align the leads of the SCR with the holes in the circuit board, insert and solder. Secure the SCR and heat sink with a #4-40 × ⅜-inch screw, nut and an internal-tooth lock washer. The lock washer is very important because of automotive vibration.

Now mount Q1 and Q2. Small heat sinks may or may not be required but are recommended for high-temperature environments (you never know where life may lead you!). Silicon grease may be used to increase ther-

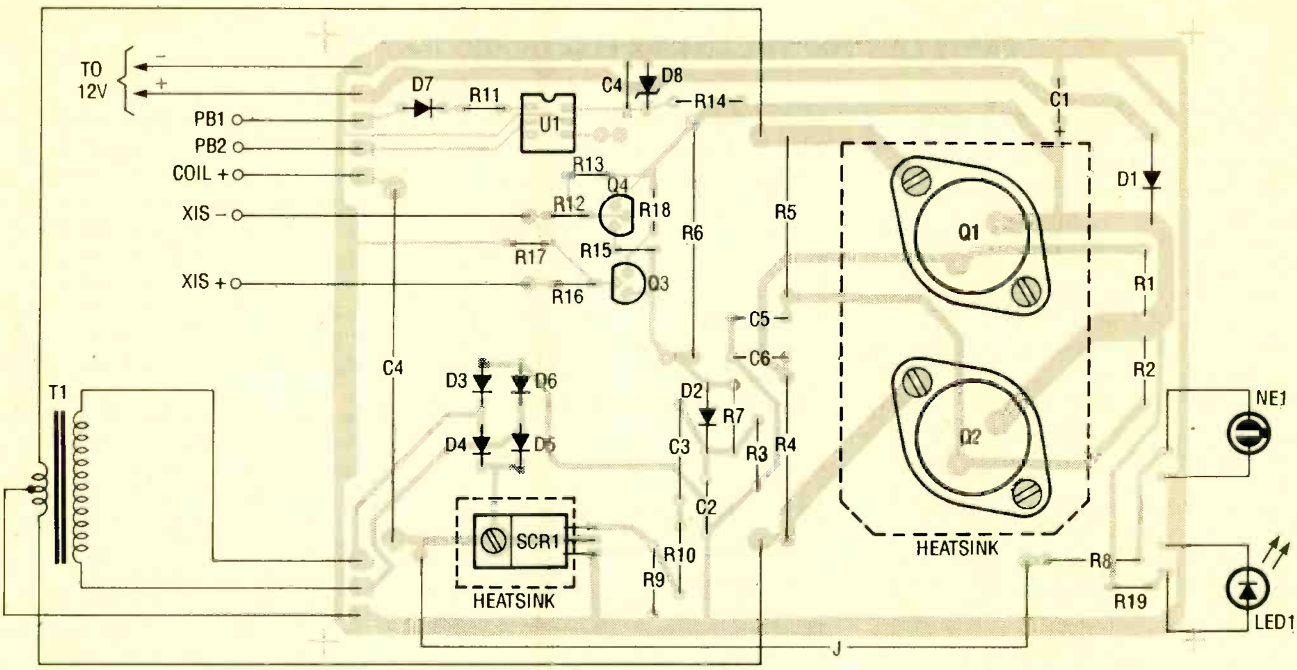


Fig. 4. Assemble the CD4-MX circuit board according to this parts-placement diagram. Note that all components outlined may not be required, depending upon your configuration (see text for more information).

mal conductivity. Properly orient the devices and heat sinks on the circuit board. Secure each with two 6-32 × ⅜-inch screws, nuts, and lock washers.

The neon lamp (NE1) and LED1 should be carefully aligned and secured with silicone rubber after soldering to prevent vibration from breaking the component leads when the CD4-MX is placed in use.

Transformer T1's primary is center-tapped. Connect and solder the center tap (the odd color from the three-wire side of the transformer) to the circuit board. Connect and solder the other primary wires from the transformer (both are the same color) to the circuit board points (either lead is okay for either point). Connect the secondary leads (from the other side of the transformer) to the board as shown in Fig. 4.

The author's prototype was housed in an aluminum enclosure measuring about 10 by 4¾ by 2¼ inches. Transformer T1 was mounted to the enclosure, with adequate lead length to allow for connection to the circuit board. Cut a piece of single or double-sided 1/16-inch or thicker printed-circuit material to about the size of the rear of the enclosure. (For grounding purposes, the copper surface must be in contact with the aluminum housing.) Then prepare a piece of printed-

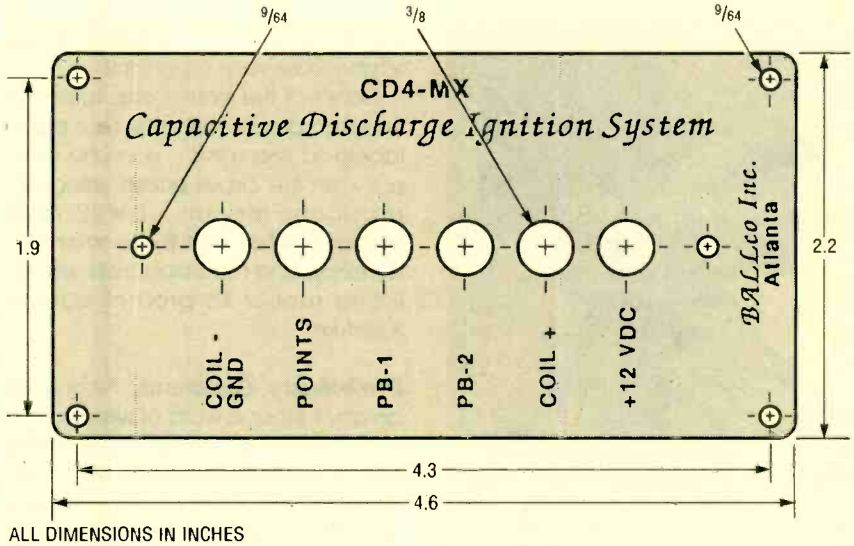


Fig. 5. The rear panel for the enclosure can be fabricated from single- or double-sided printed-circuit material. Drill holes in the rear panel for the barrier strip and for mounting the rear panel to the enclosure according to this diagram. Then label the rear panel as shown. Note that if the board material is single sided, the copper side must be in contact with the enclosure.

circuit material, which will serve as a rear panel, in accordance with the drawing in Fig. 5. Drill the printed-circuit material as shown to accept a 5-terminal barrier strip. A total of 7 holes are needed; 5 to allow access to the terminals of the barrier strip from the inside surface of the rear panel and 2 for mounting the barrier strip. Debur the holes to avoid shorts.

Before mounting the 5-terminal barrier strip, label the rear panel of the enclosure as shown to indicate the terminal functions. Then spray the labels with a plastic spray or cover with clear packaging tape to protect them from the weather. Mount the 5-terminal barrier strip to the rear panel of the enclosure using #6-32 × ¾-inch screws, nuts, and lock washers.

PARTS LIST FOR THE CD4-MX ELECTRONIC IGNITION

SEMICONDUCTORS

U1—4N28 or similar transistor-output optoisolator/coupler
Q1, Q2—2N3791 PNP silicon power transistor
Q3—2N2222, general-purpose NPN silicon transistor
Q4—2N2907, general-purpose PNP silicon transistor
SCR1—2N6509, silicon-controlled rectifier
D1—MR752 200-PIV, 6-amp, fast-recovery rectifier diode
D2—1N4004 400-PIV, 1-amp rectifier diode
D3–D7—1N4007 1000-PIV, 1-amp rectifier diode
D8—6.2-volt, ½-watt Zener diode
LED1—Light-emitting diode

RESISTORS

R1, R2—47-ohm, ½-watt, 5%
R3, R10—100-ohm, ½-watt, 5%
R4, R5—500-ohm, 5-watt, 5%
R6—25-ohm, 10-watt, 5%
R7—470-ohm, ½-watt, 5%
R8—1-megohm, ½-watt, 5%
R9—27-ohm, ½-watt, 5%
R11, R14, R19—180-ohm, ¼-watt, 5%
R12, R16—4700-ohm, ¼-watt, 5%
R13, R17—10,000-ohm, ¼-watt, 5%
R15, R18—47-ohm, ¼-watt, 5%

CAPACITORS

C1—2200-µF, 25-WVDC electrolytic
C2, C5—0.1-µF, ceramic-disc
C3—0.27-µF, 50–100-WVDC, polycarbonate
C4—1.0-µF, 800-WVDC, metallized Mylar
C6, C7—0.22-µF, ceramic-disc

ADDITIONAL PARTS AND MATERIALS

NE1—NE-2 neon lamp
T1—See text
Printed-circuit board materials, aluminum enclosure (see text), Ferrite beads (Mouser Electronics #542-FB73-085), CO2 Flux Remover/Conformal Coating (Miller Stephenson Chemical Co. MS195/CO2), 1 × 1 × 1/16-inch aluminum angle brackets, silicon rubber, silicone grease, 4- or 6-conductor shielded cable, printed-circuit coil standoffs (Kettering only), screws, nuts, lock washers, barrier-terminal strip, terminal lugs, plexiglass barrier-block shield, wire, solder, hardware, etc.

Note: The following parts are available from BALLco, Inc., P. O. Box 1078, Snellville, GA 30278-1078; Tel. 404-979-5900. Printed-circuit board (part number 820-491) for $21.95; transformer T1 (part number 150-901) for $24.95; aluminum enclosure for $15.95; printed-circuit ignition-coil stand-offs (less screws) $2.00/pair (postage paid). Add $4.00 per order for shipping and handling (USA). GA residents must add appropriate sales tax.

This is what the fully assembled project looks like. It is shown here with the cable assembly attached to an ignition coil. The CD4-MX is compatible with most vehicle ignitions, but due to the infinite variations in automotive-electronic infrastructures, it is beyond the scope of this article to describe all connection/construction/installation scenarios.

Insert the screws from the inside of the rear panel and place a ground lug on the screw adjacent to the GND terminal (inside) and bend over to the GND terminal for soldering when the wires from the circuit board are connected and soldered. Use lock washers and nuts on the outside. The lock washers are very important!

Connect the barrier-strip terminals (in accordance with the rear-panel labels) to GND, POINTS, +12, PB1, PB2 and COIL+ on the circuit board, using appropriate lengths of #20 AWG stranded wire. Seal the barrier-strip terminals and mounting bolts with silicone rubber to protect against moisture.

Preliminary Checkout. Before we go any further, a word of warning is in order: **Remember you are dealing with a potentially lethal high voltage that is likely to arc to any close object, including *yourself!*** Before installing the CD4-MX circuit board in its enclosure, some preliminary checks should be made.

First make sure that the circuit board has been thoroughly cleaned and that all flux has been removed. Then check to see that all diodes and electrolytic capacitors are properly oriented. If all is well, connect a 25-ohm, 10-watt resistor from the COIL+ terminal to ground. Connect the +12 and GND terminals to a regulated-DC power supply capable of delivering at least 2-amps DC at 12 to 15 volts. The LED and neon lamp will light, and the transformer will make a slight humming sound. With a suitable meter, check the voltage across C4; it should read between 400 and 700 volts DC, depending upon the transformer used and the input voltage to the CD4-MX.

If any discrepancies exist, disconnect power and check for cold solder joints, solder bridges, and resin left on the board. Also check for proper connection to the barrier strip. Make any necessary changes and reinstate the test.

Final Assembly. If the recommended enclosure is used, drill two holes in each side of the enclosure at the circuit board track and tap each hole for a 6-32 screw. Drill two 9/64-inch holes at the bottom rear of the enclosure to mount the transformer. If an enclosure other than the one recommended is used, ensure that the barrier strip and the transformer clear each other. **Remember, up to 700 volts DC may be present at the COIL+ terminal!**

Before mounting the circuit board in its enclosure, spray the board (top and bottom) with a conformal coating to protect it from moisture and to prevent accidental shorts and arcing. After the coating dries, slide the circuit-board assembly into the en-

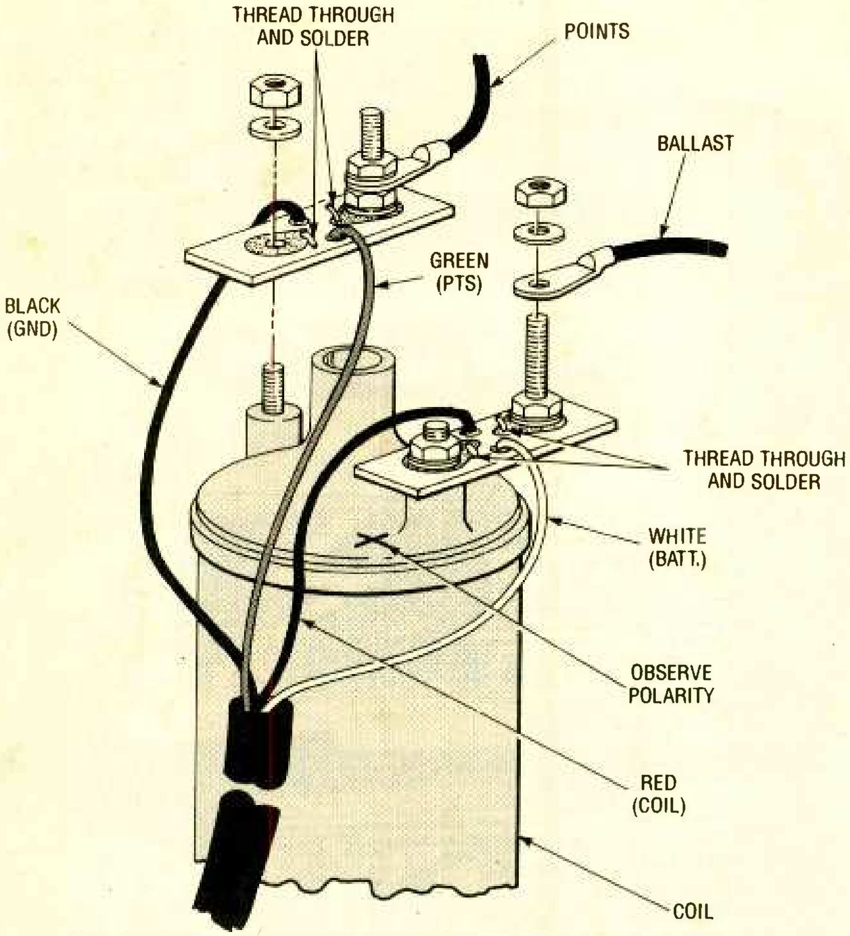


Fig. 6. Connecting the CD4-MX to a Kettering system can be done manually, but standoffs made from printed-circuit material are recommended. The wires from the cable are routed through the standoffs, looped back, and soldered to the standoffs, thereby providing a strain relief. The cable to coil assembly mounting can be easily achieved using the existing coil hardware and the addition of #10-32 hardware. Make sure the proper polarity is observed.

closure so that the LED and the neon lamp appear through the holes in the front panel of the enclosure. After installing the board, insert the four 6-32 × 3/8-inch screws into the previously drilled and tapped holes. Use 1/16-inch aluminum angle brackets under the screws to provide mounting for the CD4-MX.

After the circuit board is secured in the enclosure, mount the transformer to the rear of the circuit board and adjacent to the rear panel. Secure with 6-32 × ½ inch screws, nuts, and lock washers. Attach the rear panel with #6 self-tapping screws. Attach the cable-assembly lugs to the barrier strip and tighten securely. Install a ¼-inch spacer over each of the barrier strip's mounting screws and then assemble a plexiglass safety cover over the screw terminals. Use two additional #6 lock washers and nuts to secure the cover.

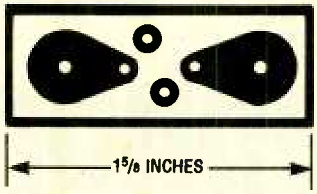


Fig. 7. This is an actual-size layout for the coil standoffs. Connect the cable assembly to the coil as shown in Fig. 6. Remember the lock washers! Connect the end of the cable assembly with lugs to the GND, COIL+, POINTS and +12 terminals of the barrier strip.

Final Checkout. If a Kettering ignition is the intended application of this project, the following checkout will do. If another arrangement is required for different sensors or other physical/electrical arrangements, the checkout, although basically similar, is pretty much up to the builder, as the current capability and voltage output of the sensor must be determined and the proper circuitry implemented. As described earlier, there are infinite variations to the established norm—far too many to cover in a short article.

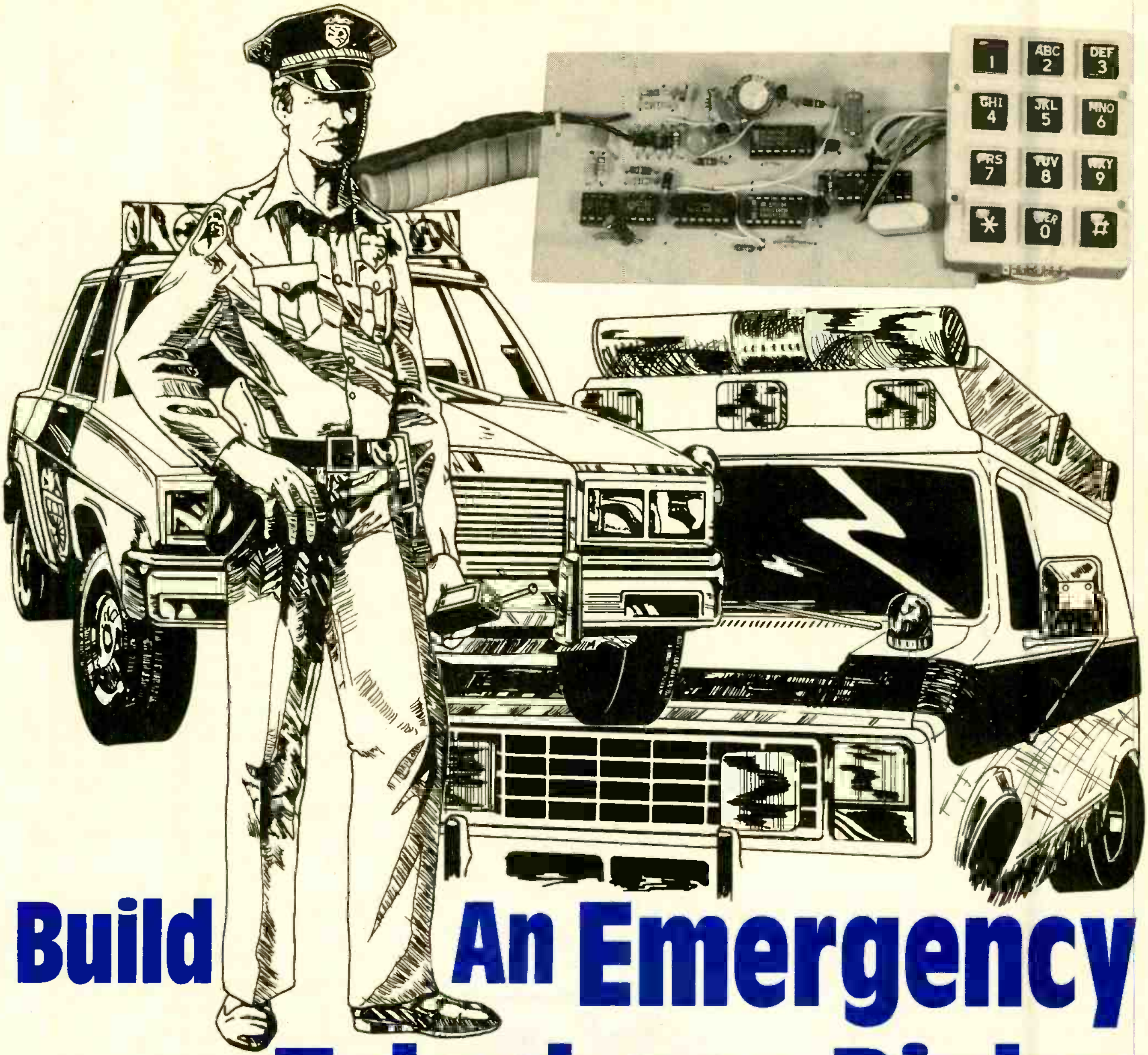
For a Kettering ignition, connect the circuit as described in Preliminary Checkout or if you have an ignition coil handy, connect it in place of the 25 ohm resistor. **WARNING: If a coil is used in the test, keep your distance. A 60 to 70 kV arc will emanate from the center of the coil to the nearest ground—and this could be *you!***

If a function generator that can provide a 0.5-amp, 15-volt peak-to-peak, 60-Hz, squarewave output is available, it can be used to simulate the breaker points (or other trigger source). If everything has been assembled according to plan, the sparks "will be 'a jumping." If a function generator is not available, use a clip lead to simulate the points. Connect one end of the clip lead to ground and briefly touch the other end to the POINTS terminal on the barrier strip. For each touch and release, a spark will emanate. If a load resistor is used instead of a coil, monitor the output of the CD4-MX with an oscilloscope connected across the resistor.

Installation. Once the unit is all checked out, select a mounting location, preferably near the front of the vehicle's engine compartment. The fender well is usually a good choice. Use the holes in the angle brackets to mark and drill at the selected mounting location.

WARNING: Unlike typical ignitions, the CD4-MX is potentially lethal if plug or coil wires are disconnected while the engine is in operation. Touching the COIL+ terminal is also potentially lethal.

For a Kettering ignition, prepare the cable assembly shown in Fig. 6. Standoffs made from printed-circuit material are recommended to connect the CD4-MX to the ignition coil. Figure 7 shows the actual-size layout for the coil standoffs. The cabling that connects the CD4-MX should be the stranded type. Solid wire tends to stress and break—not something you want to have happen in a critical part of your automobile. For other ignition arrangements, the assembly will be up to the builder/installer. ■



Build An Emergency Telephone Dialer

BY

ANTHONY J. CARISTI

Safeguard your home or office with a security system that calls you when there is a problem.

Imagine having an electronic device that would guard your home or office while you're away, and automatically alert you by phone if there is a break-in or some other problem requiring your immediate attention. Well, imagine no longer; for *Teleguard,* which we'll show you how to build, will do just that. Teleguard accomplishes that task by monitoring an open-loop or closed-loop sensor switch located in the protected area. When the sensor detects a problem—such as a break-in, fire, heating-system failure, flood, etc.—Teleguard dials whatever telephone number has been programmed into its memory. When the phone is taken off hook, Teleguard emits an unusual tone to alert the party on the receiving end that something is amiss.

The circuit is not hampered by busy signals when a call is placed; it automatically redials the number again and again (about once a minute) until it gets through. In addition, Teleguard can also automatically dial a number in the event of a medical emergency; for instance, where a mobility-impaired person is unable to dial the telephone. That can be accomplished by adding a "panic" switch to the circuit.

Programming the telephone number to be called is quick and easy, and the pre-programmed telephone number remains in the circuit's memory as long as it is connected to the telephone line. In spite of its ability to retain its programming, the number to be called can easily be changed whenever desired. Another feature of

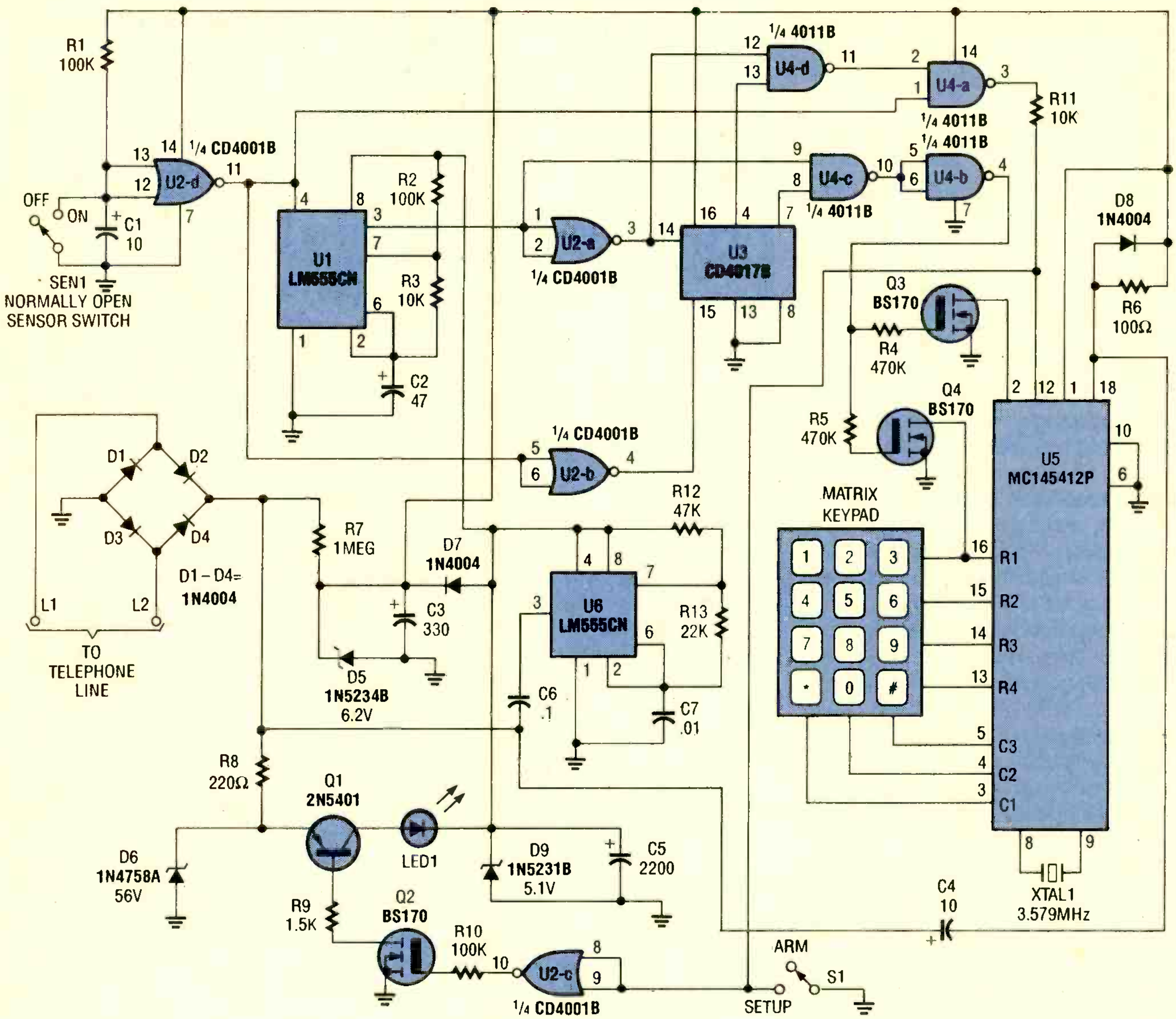


Fig. 1. The main component in Teleguard is an MC145412P pulse/tone repertory dialer (U5), which has a built-in, last-number-redial function. The last-number-redial function is used to initiate a call whenever the circuit detects a problem.

Teleguard is that it does not require an internal power supply; but instead derives its operating power directly from the telephone line. And the circuit, although telephone-line powered, won't interfere with normal telephone use, so it can be left activated at all times. Imagine the secure feeling you will have with Teleguard at your service!

About the Circuit. A schematic diagram of the Teleguard circuit is shown in Fig. 1. At the heart of the circuit is an MC145412P pulse/tone repertory dialer (U5), which has built-in, last-number-redial function. Integrated circuit U5, which generates dual-tone multi-frequency (DTMF) signals, is controlled by a common 3 × 4 matrix-type telephone keypad. When ever a telephone number is keyed in, U5 retains that number in memory as long as power is uninterrupted.

The circuit is connected to the telephone line through a fullwave-bridge rectifier, composed of D1–D4, making the circuit insensitive to telephone-line polarity. The output of the bridge rectifier is applied to R7, D5, and C3, which form a network that supplies power to the rest of the circuit as well as providing a memory-retention voltage to U5, ensuring that it will retain the programmed telephone number. That voltage is also used to maintain the logic levels of U2, U3, and U4 when the circuit is in the standby mode.

Sensor switch SEN1 is an open-loop sensor switch that is used to monitor the protected area. The sensor switch is selected to suit your application. When the circuit is in the standby mode (has not been triggered), the output of U2-d is low. That low travels along two paths. In one path, that low is applied to U1 (a 555 oscillator/timer) at pin 4, keeping it off, and to pin 1 of U4-a. The output of U4-a is applied to pin 12 of U5.

In the other path, the low output of U2-d is inverted by U2-b and applied to pin 15 of U3 (a 4017 decade counter/divider with 10 decoded outputs), causing U3's 0 output at pin 3 to go high. Because there is nothing connected to that output, it has no affect on the circuit.

When SEN1 is closed (by an intruder entering a protected area, for example), pins 12 and 13 of U2-d are pulled low, forcing its output to go high, enabling U1, while pin 12 of U5 goes low, placing U5 in the off-hook condition. At the same time, the output of U2-c is driven high. That high is applied to Q2, causing it to conduct. With Q2 conducting, Q1 is forward biased, causing it to conduct too. That causes LED1 to light, providing a visual indication that Teleguard has seized the telephone line.

As U1 oscillates, U3 begins to count upward, and continues to count (repeating its 0–9 count) as long as SEN1 remains closed. The logic levels generated by U1 at pin 3 and U3 pins 4 and 7 pass through U4 (a–d), producing two output pulse trains; the on-hook/off-hook pulse train that is applied to pin 12 of U5, followed by a redial pulse train that is applied pin 2. The redial pulse occurs about a second after U5 goes off hook, to allow time for the telephone network to respond to Teleguard's connection and establish a dial tone.

When pin 4 of U4-b goes high, Q3 and Q4 are forward biased, pulling pins 2 and 16 of U5 low. That's the redial logic required for U5 to output its stored telephone number. The circuit then remains dormant until the next on-hook/off-hook pulse is applied to pin 12 of U5. The cycle repeats (dialing the stored number) about once a minute. During the time between dialing, the called party has time to answer the telephone. Whether or not the call is answered, Teleguard will continue to redial the number about once a minute as long as SEN1 remains closed. That ensures that the call will eventually get through should the called number be busy, or if no one is immediately available to answer the call.

Integrated circuit U6 (another 555 oscillator/timer), configured as an astable multivibrator operating at about 1 kHz, is active only when Teleguard has made connection to the telephone line. The output of U6 is capacitively coupled to the phone line, alerting the called party that Teleguard has made its emergency call.

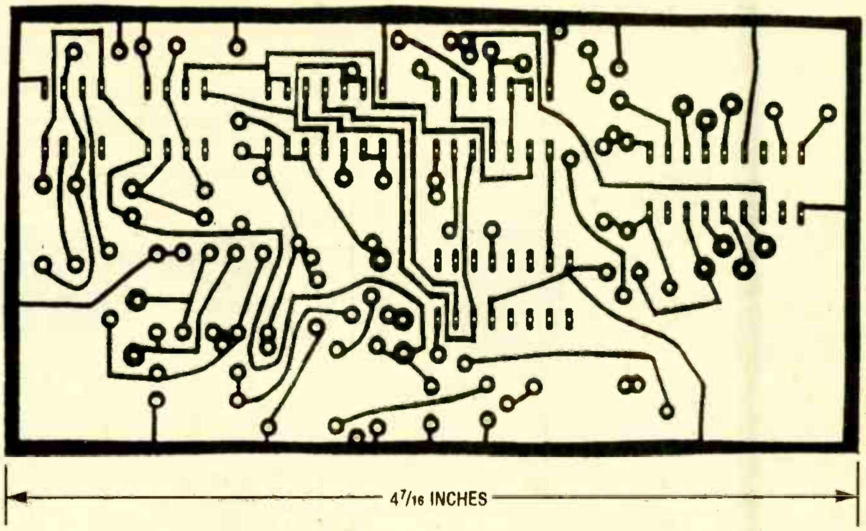


Fig. 2. Here is a full-sized template of the project's printed-circuit board.

Switch S1 is used to initialize the circuit with the preprogrammed emergency telephone number. When S1 is placed in the setup position, pin 12 of U5 is pulled low. That forces U5 to go off hook, and activates Q1 to seize the telephone line. The desired telephone number (including a "1" and area code if necessary) is then manually entered via the keypad. After entering the number, S1 is set to the arm position to deactivate the circuit while retaining the preprogrammed telephone number.

Construction. The majority of Teleguard was assembled on a printed-circuit board, measuring 2 by 4 7/16 inches, with the remainder of the circuit (the keypad and two switches) connected to the circuit board through lengths of insulated wire. A full-size template of the project's printed-circuit board is shown in Fig. 2.

Once you've gathered the parts listed in the Parts List and prepared your circuit board, construction can begin. When assembling the circuit, it is recommended that sockets be provided for all of the IC's. Begin assembling the circuit by installing sockets where IC's are indicated in the parts-placement diagram, which is shown Fig. 3, but, do not install any IC's until instructed to do so. Once the sockets are in place, install the jumper connections. Be careful during this operation; one misconnected jumper can render your circuit inoperative.

After that, install the passive components (resistors, capacitors, etc.) followed by the active components (transistors and diodes), making sure that all polarized components (diodes, transistors, and electrolytic capacitors) are properly oriented. If a polarized component is installed backwards, the circuit will be inoperative and could possibly self-destruct, taking several other components along with it.

Once all of the on-board components have been installed, connect a length of quad telephone line cord to the circuit board. For the line cord, you can use either a commercially available modular plug-to-plug telephone cord, or make your own. If you make your own you'll have to connect a modular plug to one end of the cord. If the commercial unit is used, cut it in half and strip the insulation from the free end of one piece. Then carefully tin the red and green wires of the cord and solder them to the points indicated in Fig. 3 (L1 and L2 on the circuit board).

Next connect the keypad—a standard telephone 3-by-4 matrix type—to the board. The keypad can be salvaged from one of the many low-cost telephones that are available, or it can be purchased from one of the mail-order houses. In any event, the keypad has 4 row connections (identified as R1, R2, R3, and R4) and 3 column terminals (identified as C1, C2, and C3). Simply connect the row and column terminals of the keypad to like terminals on the circuit board; *i.e.*, C1 to C1, R1 to R1, and so on as shown in Fig. 3.

After completing that task, check the wiring very carefully, especially

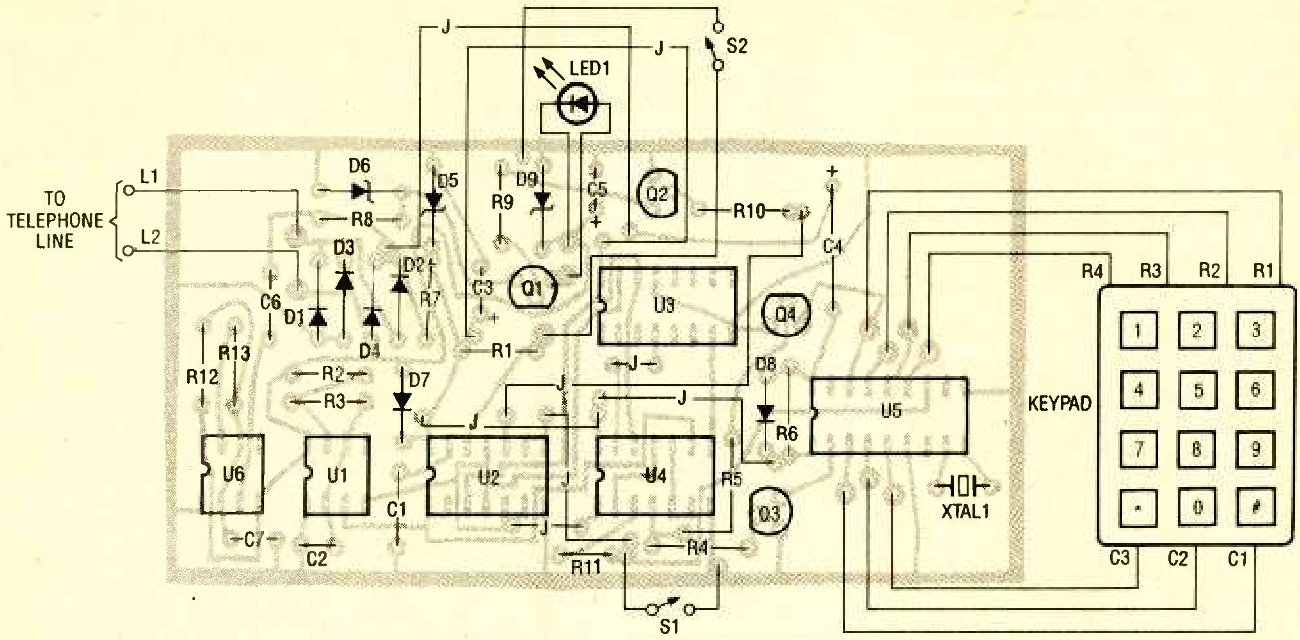


Fig. 3. Once you've gathered the parts and prepared your circuit board, begin the circuit by installing sockets where IC's are indicated in this parts-placement diagram.

between the keypad the circuit board. An error in wiring the keypad to the circuit will cause misdialed numbers! While you are at it, inspect the circuit carefully for the proper placement of all parts, cold solder joints (which appear as dull blobs of solder), and shorted or opened circuits. It is far easier to correct a problem at this stage of the game than to attempt to locate and correct a problem later.

The circuit can be housed in any enclosure of suitable size. The keypad, S1, and LED1 should be mounted to the side of the enclosure for easy accessibility. Prepare the enclosure to accept the off-board components, but do not mount the circuit in its enclosure yet. You must first find out if the circuit is functioning properly.

Test Setup. The operation of the circuit can be tested by connecting Teleguard to telephone line, or using a well-filtered 40- to 50-volt DC power supply to simulate the power that would otherwise be derived from the telephone line. Figure 4 shows the setup for using an external power supply for testing. The power supply is simply connected to your Teleguard with a 1k, 2-watt resistor connected in series with the positive output of the DC supply. The positive output of the power supply (with its series resistor) is then connected to the L1 terminal of the Teleguard circuit board. The negative

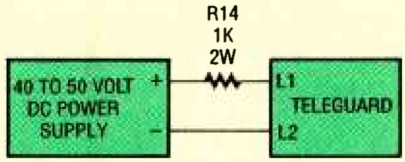


Fig. 4. The circuit can be tested without the aid of the telephone line using a 40- to 50-volt DC power supply to simulate the power that would otherwise be derived from the telephone line.

power supply output is then connected to the L2 terminal. If the telephone line is used for test purposes, a resistor is unnecessary, and polarity is not important; simply connect the project's modular plug to the telephone line.

A digital voltmeter or VOM with an input impedance of at least 10 megohms will be needed to measure voltage levels within the circuit. A telephone and modular duplex adapter—which allows both Teleguard and the telephone to be plugged into the telephone line simultaneously—are also required for testing. The adapter allows the telephone to be used to verify that U5 generates a DTMF signal in response to each number keyed via Teleguard's keypad.

At this point, all IC sockets should be empty; if not, remove all IC's from the board. Set S1 to the arm position and connect the project to the DC supply or telephone line. The LED should be unlit. Allow a minute or so for C3 to charge, then measure the voltage across that unit. You should get a reading of about 5 to 6 volts DC. If you reading is somewhere out in left field, find and correct the problem before proceeding.

If the voltage is within specifications, disconnect power and discharge C3. Then insert all IC's into their respective sockets, being very careful to properly orient and seat them in their sockets. Set S1 to the arm position. Apply power to the circuit, again allowing a minute or so for C3 to charge. Set S1 to the setup position; LED1 should light. Do not proceed with the final test if LED1 does not light when S1 is placed in the setup position.

Continue the checkout by double-checking the orientation of LED1, Q1, Q2, D6, D7, and C5. Measure the voltage across C3, making sure that the voltage across it is at least 5 volts. Set S1 to the arm position for a minute or so. Flip S1 to the setup position and press each key of the keypad (one at a time) while examining the waveforms generated at pin 18 of U5 using an oscilloscope. Each time a key is depressed, a DTMF signal (about 1 volt peak-to-peak) should be generated.

Next test Teleguard's programmability and operation under program control. Program the circuit by momentarily setting S1 to the arm position, and then return it to setup. Key in any telephone number using the keypad. Then set S1 to the arm position. Simulate a problem situation by shorting pins 12 and 13 of U2 to ground. Maintain the short while monitoring pin 18 of U5 with the oscilloscope. A few seconds after pins 12 and 13 are grounded, a series of DTMF bursts should appear at pin 18 of U5 in rapid succession.

Allow the circuit to remain dormant for about a minute. The series of DTMF bursts should reappear. The cycle should repeat about once a minute as long as pins 12 and 13 of U2-d remain grounded. If Teleguard performs as described, proceed to the final phase of testing; otherwise troubleshoot the circuit to locate and repair the fault.

If U5 fails to generate DTMF signals in response to the keypad entry, carefully check the wiring between U5 and the keypad. Closure of any keypad switch must short one row wire to one column wire in accordance with the keypad matrix. If in doubt, disconnect power to the circuit, remove U5 from its socket, and use an ohmmeter to verify that each keypad button shorts the correct terminals of U5, as outlined in Fig. 5.

If the keypad has been properly connected, verify that U5's crystal oscillator is functioning properly by holding down any key while examining the waveform at pins 8 and 9 of U5. You should get a 2- or 3-volt peak-to-peak, 3.58-MHz waveform only when a keypad key is depressed. If no oscillation is present, verify the presence of 5 volts at pin 1 (the supply input) of U5. Try a new IC and crystal if possible.

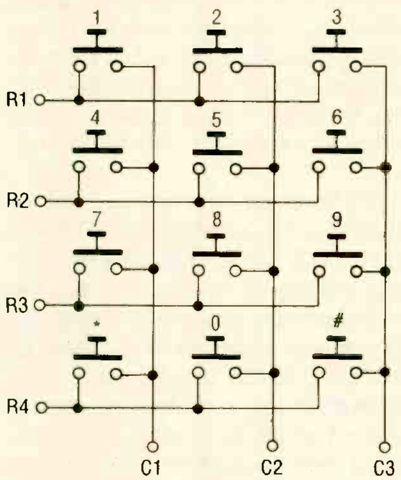


Fig. 5. This illustration outlines the row/column connections that occur as a result of depressing any one of keypad switches. For instance, if the 8 key is depressed, row 3 is shorted to column 2; if the asterisk key is depressed, row 4 is shorted to column 1, and so forth.

PARTS LIST FOR THE TELEGUARD

SEMICONDUCTORS

U1, U6—LM555CN CMOS oscillator/timer, integrated circuit
U2—CD4001B quad 2-input NOR gate, integrated circuit
U3—CD4017BE decade counter/divider, integrated circuit
U4—CD4011B quad 2-input NAND gate, integrated circuit
U5—MC145412P pulse/tone repertory dialer, integrated circuit
U7—CD4001B or CD4011B quad 2-input NAND gate (optional see text), integrated circuit
Q1—2N5401 PNP silicon transistor
Q2–Q4—BS170 or equivalent enhancement FET
D1–D4, D7, D8—1N4004 1-amp, 400-PIV (or similar) silicon rectifier diode
D5—1N5234B 6.2-volt, 0.5-watt Zener diode
D6—1N4758A 56-volt, 1-watt Zener diode
D9—1N5231B 5.1 volt, 0.5-watt, Zener diode
LED1—2-volt, 20-mA, red Light-emitting diode

RESISTORS

(All resistors are ¼-watt, 5% units, unless otherwise noted.)
R1, R2, R10—100,000-ohm
R3, R11—10,000-ohm
R4, R5—470,000-ohm
R6—100-ohm
R7—1-megohm
R8—220-ohm
R9—1500-ohm
R12—47,000-ohm
R13—22,000-ohm
R14—1000-ohm, 2-watt (used in testing only)
R15—2.2-megohm (optional, see text)

CAPACITORS

C1—10-µF, 10-WVDC, electrolytic
C2—47-µF, 10-WVDC, electrolytic
C3—330-µF, 10-WVDC, low-leakage electrolytic
C4—10-µF, 50-WVDC, electrolytic
C5—2200-µF, 6.3-WVDC, electrolytic
C6—0.1-µF, ceramic-disc
C7—0.01-µF, ceramic-disc
C8—0.1-µF, ceramic-disc (optional, see text)

ADDITIONAL PARTS AND MATERIALS

S1—SPST toggle or slide switch
SEN1—Normally open or normally closed sensor switch (see text)
SEN2-SEN5—Sensor switch (optional, see text)
XTAL1—3.578-MHz, color-burst crystal
Printed-circuit materials, enclosure, telephone-type 3 × 4 matrix keypad (see text), telephone line cord with modular plug, IC sockets, wire, solder, hardware, etc.

Note: The following parts are available from A. Caristi, 69 White Pond Road, Waldwick, NJ 07463. Etched and drilled PC board, $14.95; U5, $14.95; all other IC's, $2.00 each; Q1, $1.75; Q2, Q3, and Q4, $1.95 each. Please add $3.00 postage/handling. New Jersey residents, please add appropriate sales tax.

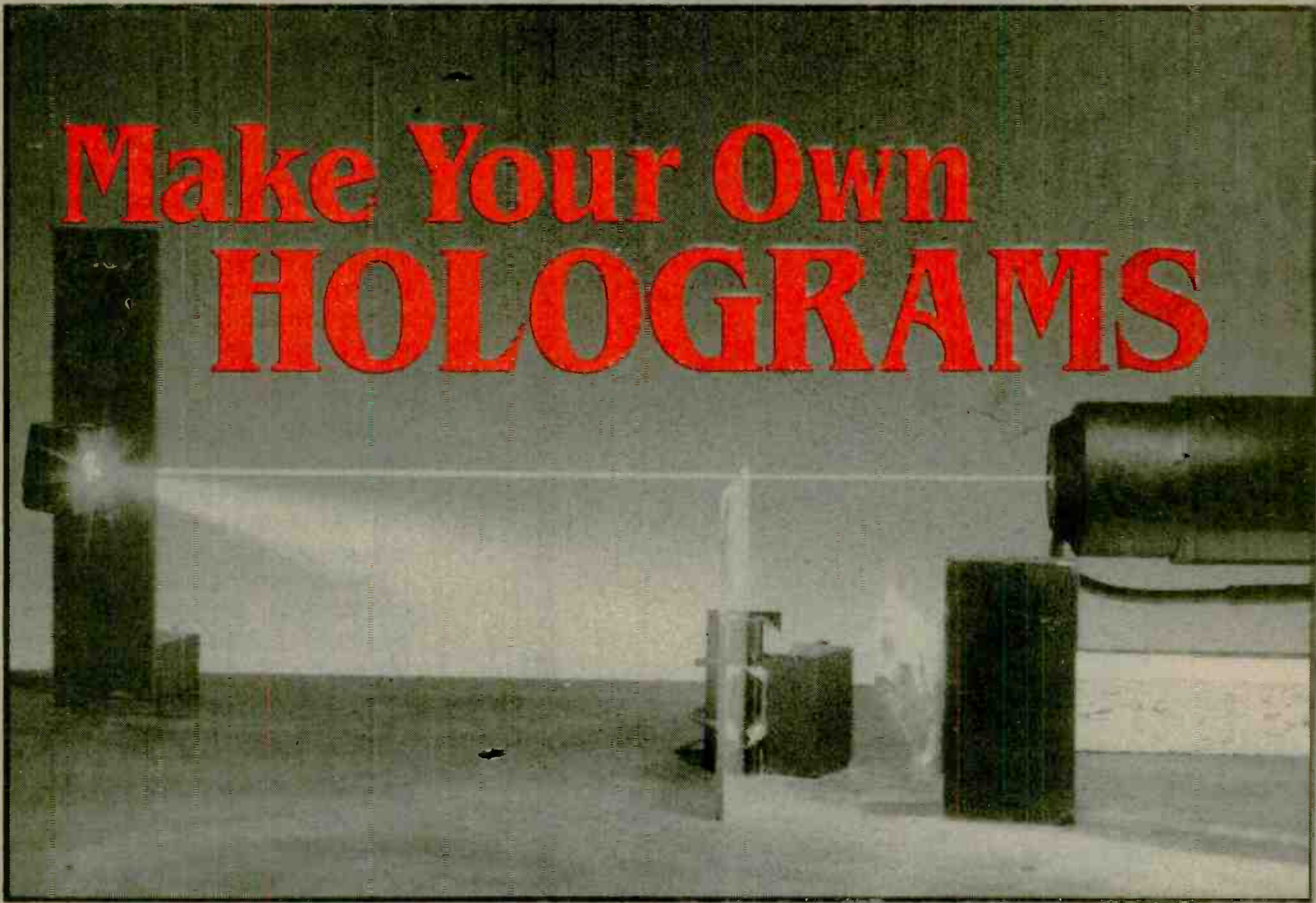
Final Test. Temporarily remove U6 from its socket to disable the 1-kHz oscillator. Using the duplex adapter, connect both Teleguard and a telephone to the telephone line. Leave the handset on hook, set S1 to arm, and allow a minute for C3 to charge. The LED should be unlit. Set S1 to setup; LED1 should light, indicating connection to the telephone line.

Pick up the telephone handset and listen as you key in a number via the project's keypad; DTMF tones should be heard in the handset in response to the keystrokes.

Place the telephone handset on hook, momentarily place S1 in the arm position, and then switch it back to setup. Then, with the telephone handset on hook, key in (via the Teleguard keypad) any telephone number. If possible key in the telephone number of an associate who can then verify that the circuit is operating properly. Once Teleguard has dialed out, you can then use the telephone to engage in normal conversation. If that checks out, remove power from the circuit and reinstall U6 in its socket. Apply power to the circuit and reprogram Teleguard, as before, by switching S1 from arm to setup, key-

(Continued on page 90)

Make Your Own HOLOGRAMS



If you have a suitable source of laser light, you can make your own holograms by following the simple procedure outlined here.

BY JOHN IOVINE

Last month we showed you how to build a HeNe laser. This month, we will show you how to build the other components needed to shoot holograms. We will also describe how to shoot a hologram that is viewable in white light.

However even before you acquire any of the parts, you will need to decide where you can set up your equipment. The area must be quiet (no vibrations) and dark (no light); you can use safe-lites (which we will discuss later) so you do not have to work in complete darkness. I usually set up my holographic equipment on the floor to reduce vibration, a concrete floor in your basement is perfect, but even a bathroom or bedroom may be good enough.

Isolation Table. Holograms are very sensitive to vibration. Vibrations so subtle that you cannot feel them can prevent the hologram from forming. Because of that, holographers use an "isolation table." An isolation table is a base designed to dampen as much vibration as possible. The table we will use is simple and portable, it can be set up or stored in less than a minute.

The table (shown in Fig. 1) consists of three components: a small piece of carpet, a small 12–18-inch diameter inner tube, and a metal plate. The carpet should be large enough so that the inner tube can lay on it without hanging over the edge. The inner tube should have just enough air for it to be filled, but still remain very soft. In other words, you should be able to squeeze the sides of it together easily. The top metal plate is our working area and should be about the same size as the carpet. The metal should be thick enough so that it doesn't flex when objects are placed on it. The plate I use is 3/16-inch thick. If you cannot get a metal plate, you can use 3/4-inch, or thicker, plywood, with sheet metal adhered to one side.

Optical Components and Such. Steel plates that measure 1 × 4-1/4 × 1/16-inch will be used to form mounts for the optical components. The

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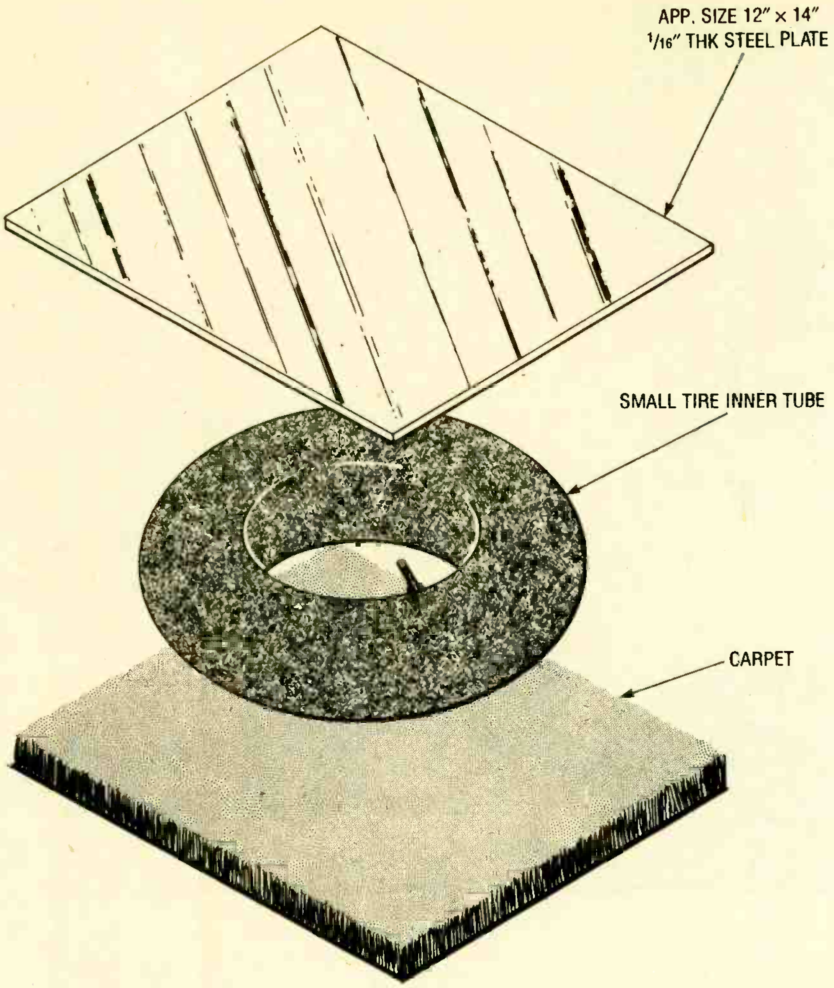


Fig. 1. Since even slight vibrations can ruin a hologram, this light table is specifically designed to prevent vibration.

plates can be assembled in a variety of useful configurations using small bar magnets (see Fig. 2). Putting the plates together is simple and the set ups are more stable than it might appear. I advise buying a minimum of 4 plates and magnets to ensure moderate versatility.

We will only use one mirror lens to keep our optical components to the bare minimum. The mirror lens is a spherical front-surface mirror attached to a bar magnet using epoxy glue as shown in Fig. 3. Be careful not to get any glue on the front surface.

With the component mounted on a magnet, it easily attaches to the side of an inverted T mount, and is adjustable through a full range of motion. That makes aligning and directing the laser light easy.

The spherical mirror has a short (2.5 to 3.5 mm depending on the mirror) focal length (see Fig. 4). For that reason, when the laser passes the focal point, it spreads rapidly, allowing you to illuminate the entire photographic plate with laser light.

In addition to the materials already mentioned, you will need a white cardboard card that is the same size as a film plate (which we'll discuss shortly) and a black card. By attaching two binding clips to the black card (see Fig. 5), it will be used to block and unblock (shutter) the laser beam.

The last item to mount is the film. There are many kinds of film you can use to shoot your holograms. My recommendation is to start with 2.5-in. square 8E75 glass plates (see the suppliers listed in the Parts List), so we'll discuss how to work with that film. Using glass film plates simplifies the set-up, procedure, and the design of the film holder itself.

The film holder consists of two office binder clips with a magnet glued to each one. The binder clips are available from any office-supply store.

The last item you will need is a safelight. A safelight provides sufficient illumination when working in a darkened room for setting up the table and/or during film processing without exposing or fogging the film. The 8E75 holographic film is least sensitive around 500 nanometers (nm) wavelength (green light). I recommend buying a safelight specifically designed for holography to ensure it produces that wavelength (see the Parts List).

Setting-Up a Hologram. For the first step, turn on your laser. The laser must be given ample time—20–30 minutes—to warm up and stabilize, before you shoot.

The first object you select to holograph should be smaller than the plate and preferably a light color; white, off-white, silver, or have a metallic finish. You can shoot larger and darker items after you gain some experience, but to start with, holograph something that will show up brightly. The object should also be rigid, something that won't flex, bend, or move during the exposure. For my first object I chose a small white sea shell.

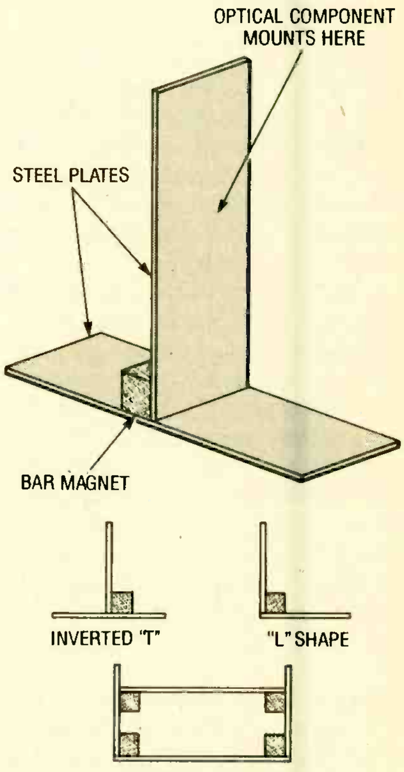


Fig. 2. Building versatile optical mounts is easy. All you need are some magnets and metal plates.

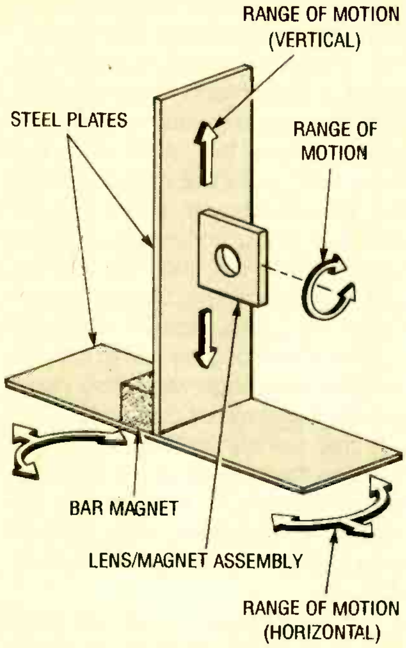


Fig. 3. The optical mount for the mirror lens allows you to position the mirror with complete freedom.

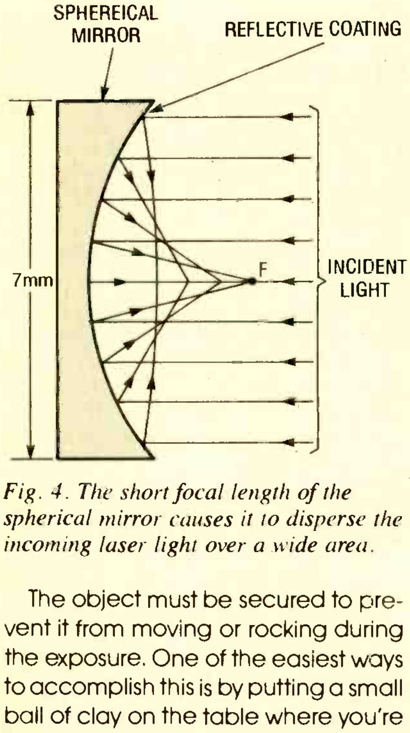


Fig. 4. The short focal length of the spherical mirror causes it to disperse the incoming laser light over a wide area.

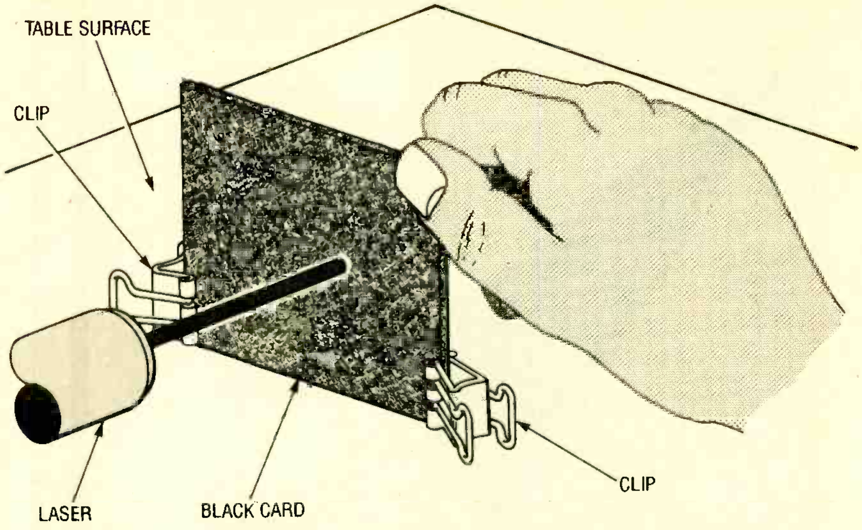


Fig. 5. A black card must be used as a shutter. It will keep laser light from the film until the film is in position and ready.

The object must be secured to prevent it from moving or rocking during the exposure. One of the easiest ways to accomplish this is by putting a small ball of clay on the table where you're placing the object. Push the object into the clay. Instead of clay, you could also use Fun-Tak—a blue-colored adhesive material with the consistency of clay; it is available from art-supply or craft stores. It can be pulled apart and pushed together again, rolled into balls, whatever. The material is reusable, and because of its strong adhesive properties, is worthwhile to purchase. Another way to secure objects is to glue the object to a magnet and position them where you must on the sheet-metal base.

Set up the holography table as illustrated in Fig. 6. Note that the laser tube is placed on the table without its power supply. You should never place the power supply on the isolation table as the 60-Hz hum from the step-down transformer may cause the table to vibrate, making it impossible to produce a hologram.

Position the white card, using the film holder clip or clips, where the film plate will be located. Adjust the mirror so that the beam reflected from the mirror is spread evenly on the white card. Remove the white card, leaving the binding clip(s) in position. Position the object close to where the film plate will be. The laser should now illuminate the object you are shooting. Look at the object from the laser side, this is what your finished hologram will look like. Make any adjustments you want to the object to holograph it in the best position possible. Now block the laser beam with the black shutter card (look back at Fig. 5 if you need to see how that should be done).

With all the lights off, remove a film plate from its light-tight box. Try to hold the plate by its edges. Close the box and turn on your safelight. The film plate will appear transparent, but there is an emulsion on one side. We want to place the plate's emulsion side toward the object as that will yield a better hologram. Touch the plate with a moist finger on each side at the corner. The emulsion side is sticky. Don't worry if you can't identify the emulsion side when you first start out, you can produce a hologram with the emulsion faced either way.

Put the plate in the binding clip(s) that were holding the white card. Leave the set-up alone for a minute. This will allow any vibrations to die down.

Exposure and Developing. The exact exposure time varies with the intensity of the laser light and the sensitivity of the film. You can experiment with the exposure time using these values as starting points: for a 1-milliwatt laser try 20 seconds, for a 1.5-milliwatt laser start with 15 seconds, and for a 2 milliwatt unit try 10 seconds.

To make the exposure, lift the shutter card off the isolation table, but keep it in a position that still blocks the laser beam. Hold the card in this position for 30–60 seconds to let any vibration caused by lifting the card off the table to die down. Then lift the card completely, allowing the laser to expose the plate. After the exposure time has elapsed, place the card back down blocking the laser beam. The plate is ready to be developed.

Although developing holograms is simple, the chemicals are poisonous and can be absorbed through the skin. Since I use my hands to move the plate from tray to tray, I always wear rubber (Playtex) gloves when developing holograms—you should too. By the way, developing should be

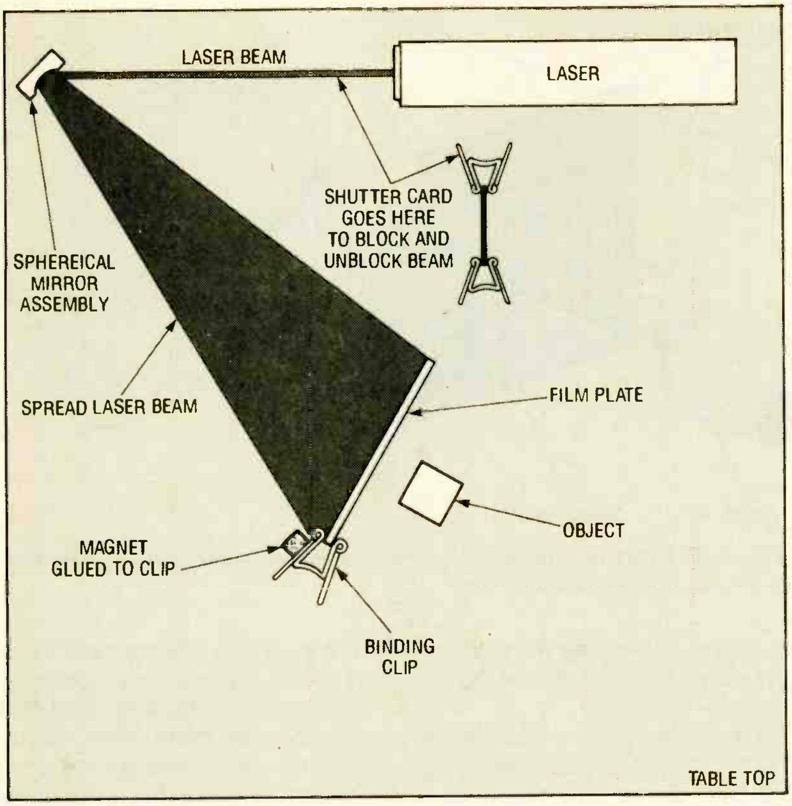


Fig. 6. This is a view of the light table from above. Note that the shutter card has been moved out of the way so the film receives laser light.

done only with the safelight on.

You need three plastic trays large enough to hold a film plate. The trays should be arranged as shown in Fig. 7. The first tray holds the developer, the second tray contains water, and the third tray contains bleach. A holography kit available from Images Company (see Parts List) includes pre-measured packets of chemicals that you just dump into a liter of distilled or de-ionized water to make the solutions.

The developer is made from equal parts of two stock solutions (labeled A and B in the kit). Mix equal portions of the solutions in the tray, just enough to

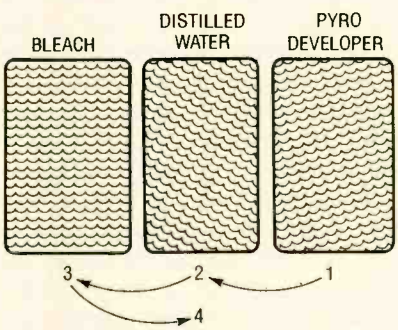


Fig. 7. If you set your developing trays in a row as shown here, developing your holograms is as easy as 1-2-3-4.

cover the plate when you're ready to place it in the tray. The developing solution has a short lifetime, so mix it just before you're ready to develop holograms. After you successfully produced a few holograms you may want to try "batch processing." In batch processing you expose a few plates, (storing them in a lite-safe box) and develop them all at once or one after another in the same developer solution. I don't advise batch processing before you successfully produce a single hologram as it will waste film and chemicals if there is something wrong with your set-up.

The plate should be placed in the developer emulsion-side up for two minutes. Gently rock the tray back and forth to keep fresh solution in contact with the plate. The plate will gather density and may appear to turn completely black. Don't worry, that's normal.

Remove the plate from the developer and place it in the water. This step isn't mandatory, but it will extend the life of the bleach so that you can reuse it.

After 30 seconds have elapsed, place the plate in the bleach. Rock the tray gently back and forth as before. Keep the plate in the bleach until it becomes completely clear again. That usually takes about one minute. After the plate clears, the emulsion is light-safe, so you can turn on the room light. Remove the plate from the bleach and put it back into the water tray. Bring the tray to a sink, run tap water at about room temperature and place the tray under the running water for five minutes. Afterwards, remove the plate, stand it vertically against a wall and allow it to dry. The holographic image will not be visible until the hologram is completely dry.

Plates sometimes dry with water spots on them. You can dip the plate in Kodak Photo-flo solution (mix according to directions) after the final rinse to prevent water spots from forming.

Some holographers wipe the plate with a squeegee to remove excess water and thereby speed up drying. Others use a hair dryer to shorten the drying time. If you use a hair dryer, set

PARTS AND MATERIALS LIST FOR THE OPTICAL BENCH

12 × 14 × 1/16-inch steel plate
1 × 4¼ × 1/16-inch steel plates (4)
Inner tube
Carpet
Spherical mirror with 2.5 to 3.5 mm focal length
Bar magnets
Agfa 8E75-HD-NAH 2.5-inch glass holographic plates
Green safelight
Hologram-developing chemicals kit
Laser tube and power supply (see last month's issue)

The following are available from Images Company (P.O. Box 140742 Staten Island, NY 10314; Tel. 1-718-698-8305): 1 × 4 × 1/16-inch steel plate (part number IM-ST) for $1.50 each; spherical mirror (part number IM-SP) for $12.00; small bar magnets (part number IM-M2) for $1.50 each; large bar magnet (part number IM-M3) for $2.00; 30 pcs Agfa 8E75-HD-NAH 2.5-inch glass holographic plates for $46.00; green safelight (part number IM-LT) for $25.00; Hologram-developing chemicals kit (part number JD-2) for $12.00. Please add $3.00 for shipping and handling of all orders. NY resisdents add appropiate sales tax.

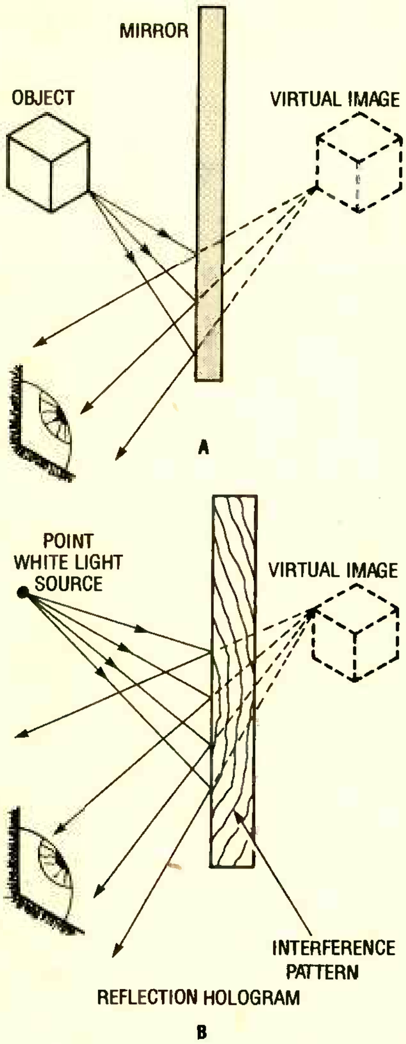


Fig. 8. One type of image that can be viewed from a white-light reflection hologram is a virtual image, like those seen reflected from a mirror (A).

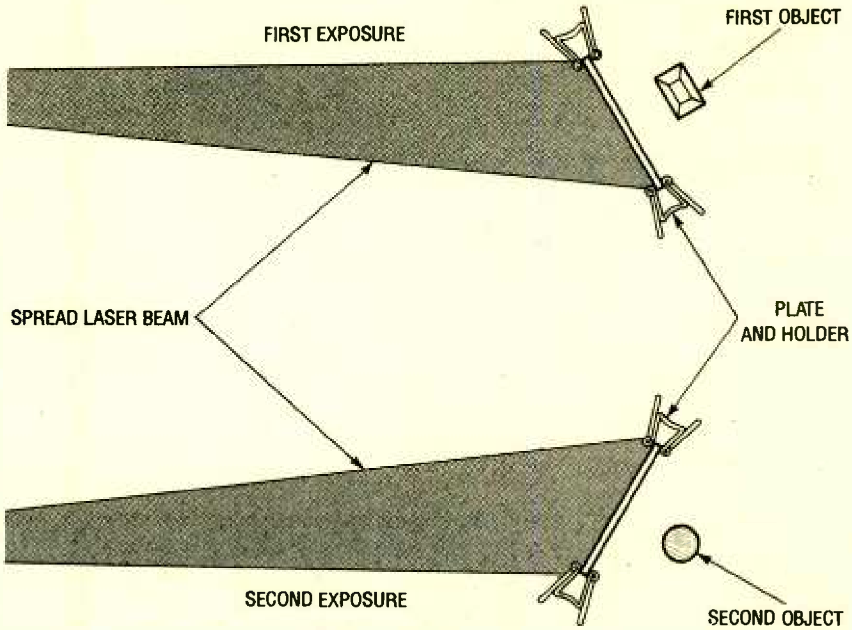


Fig. 9. To apply multiple images to a single piece of film start by making a normal hologram of one object (using only half your usual exposure time). Then block the beam, reorient the film, and make a hologram of the second object (again only using half the normal exposure time).

it on warm or low, or you may damage the hologram from excessive heat.

Viewing Your Hologram. After you have exposed and processed your holographic plate, it's time to take a look at your hologram. First, let the plate dry because if it's still wet, you probably won't see anything.

The hologram we made is a white-light reflection type. As the name implies, it is viewable in white light. The best type of illumination for this hologram is a point light source. The sun is a perfect example of such a source.

Tungsten Halogen lamps are also an excellent light source. Incandescent lamps can be used, but the image quality isn't as good. When using an incandescent lamp, notice that if you increase the distance of the hologram from the bulb, the image appears sharper. This happens because the lamp becomes more like an ideal point light source as the distance increases.

To improve the appearance of the image, put a black sheet of paper behind the hologram. Alternatively, you can spray-paint the back of the hologram black. Do this only with reflection holograms you want to display, because once it's painted, you can't use it to make copy holograms.

Images. There are two types of images you can view from a white-light reflection hologram: real and virtual. The most common example of a virtual image is the image that is reflected in a mirror (see Fig. 8A). To the observer, the light rays that appear to come through the mirror are actually reflected off its surface. For that reason, the image is said to be virtual.

The parallax and perspective of the virtual image in a hologram is observed to be correct. As you move your head from side to side or up and down, the three dimensional scene changes in proper perspective as if you were observing the real physical scene (see Fig 8B). The virtual image is said to be an orthoscopic image, meaning true image.

In contrast to the virtual image is the real image. The real image in our reflection hologram can be observed simply by flipping the hologram around. The real image has some peculiar properties. For one, the perspective is reversed. Parts of the image that should appear in the rear are instead in the front and vice versa. If you move your head to the right, the image appears to rotate in proportion to your movement and you see more of the left side, not the right side. The brain perceives this paradoxical visual information causing the image to appear to swing around. The real image is said to be pseudoscopic, meaning a false image.

Troubleshooting. Not all the holograms you shoot will be perfect. The following will help locate a problem when you encounter some fault with the holographic image:

No image—Correcting for a hologram without any image can be very frustrating. Even though it might seem as if you don't have a starting point to begin evaluating the problem, you do: During development, did the hologram go black or did it gain some density? In the latter case, the most probable cause is that the film plate or model moved during exposure.

Parts of Hologram Missing—This relates to the first problem. If you are

(Continued on page 92)

A "QUICK & DIRTY" QUAD

BY MIKE DEUPREE

If you're a student of antenna design, or the kind of person who insists on precision and good technique no matter what, well, good for you, but you'd better stop reading at this point. You aren't going to like what follows.

On the other hand, if you're a CB operator or a ham who wants to take advantage of the current hotspots on the 10- or 12-meter bands, and all you care about is getting a good signal on the air quickly and cheaply, the QuAD Special may be just the ticket.

We call it a QuAD not just because it's a full-wave loop antenna, but because its " *Quick And Dirty*," too. As the name might suggest, this antenna won't win any beauty or efficiency contests, but it should cost less than $15 even with all new parts, and you can have it on the air in a couple of hours with the most basic tools. Plus, it can be erected just about anywhere you could install a vertical, but it requires no ground plane, puts out twice the signal, and is directional.

If you want to get an antenna up quickly, then our design is what you're looking for.

Gathering Parts. Sound like it's worth a try? Then start by surveying your garage to see how many "antenna components" you have on hand. For the frame you'll need two 1-inch radiator-hose clamps, four U-bolts, a scrap piece of plywood about nine-inches square, and three 10-foot lengths of PVC water pipe, each a different diameter. I suggest 1-inch, ¾-inch and ½-inch sizes, but it depends on the pipe stock you buy. The important thing is that the smallest pipe must slide snugly into the next-largest; check for a good fit before you buy. As for the 1-inch section, which will be the vertical member, the thin-wall type isn't as strong, but it slips neatly over the tapered end of a standard Radio Shack antenna mast, which can be important for mounting purposes.

For the antenna itself you'll need about 40 feet of wire. I used No. 14 stranded electrical wire with polyvinyl insulation because it's cheap, strong, and easily available. The exact length of the wire depends upon the frequency design of the antenna. The formula for the wire length is 1005 divided by the frequency in megahertz.

You will also need a short length of 75-ohm coax to match the antenna to a 52-ohm feedline. The matching-section length should be 246 divided by the frequency in megahertz, multiplied by the velocity factor of the coax you use. If the antenna is for a CB base station and you are using standard Radio Shack RG59U coax, you'll need 37 feet, 2 inches of antenna wire and 6 feet, 10 inches of coax.

(Continued on page 93)

BUILD THE IDIOT BOX

BY RUSS HEAD

If your living room has a spot open for a fascinating conversation piece, this may be your next project.

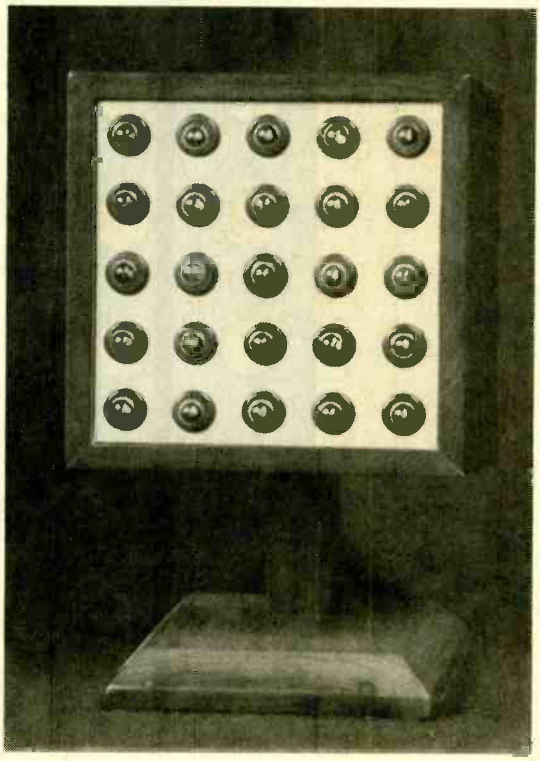
Turned on by light displays? Want a simple, reliable and attractive conversation piece? Then the *Idiot Box* is something you should look into. It produces an endlessly changing pattern of soft orange light, which will cause your guests to stare at its neon face, and inevitably ask, "What is that?" And then the conversation begins . . . .

The name is derived from the irresistible urge most people have to mindlessly observe its performance at length. From time to time, the display will momentarily form a letter or number and then resume its random behavior. Perhaps that's one of the reasons it seems so distracting. No matter how abstract the reason for its appeal, the circuit works on the very sound principles of electronics, which we'll explore now.

How It Works. The circuit is composed of twenty-five repetitions of the circuit shown in Fig. 1. As shown, in each of those "sub-circuits" there is an NE-51 neon bulb connected to a timing circuit, consisting of a 10-megohm resistor and a 0.1-µF, 100-WVDC capacitor. Each capacitor simply charges through its resistor until the bulb's firing point is reached; then the capacitor discharges somewhat as the bulb flashes. The cycle repeats at a nominal rate of once per second for each bulb.

All of these sub-circuits are connected together at points "A" and "B," which are also connected to the power supply. You can make a suitable power supply in two different ways: You can wire ten 9-volt batteries in series to provide the required 90 volts at an average current of less than 48µA. Or, for those willing to sacrifice portability, Fig. 2 shows an optional AC-line power supply. The value of the potentiometer in that circuit has been selected to produce a comfortable range of flash rates.

Even though the sub-circuits are more or less the same and receive power from the same source, normal variation in the component values ensures a slightly different flash rate for each sub-circuit, thus producing random patterns. However, while the patterns produced will be random, to ensure the most interesting display the bulbs should be selected so they flash with more or less the same frequency. We'll discuss an appropriate bulb-selection procedure later on. For now let's deal with the cabinetry.



Metal Work. Nothing is particularly critical about the construction of the circuit or enclosure. In fact, for non-carpenters, the enclosure—a wood case with a metal front panel—may be the only challenge. Let's start by discussing the preparation of the front panel.

The front panel in the prototype was made from a 5 × 5 × 1⁄16-inch piece of aluminum (see Fig. 3A), which is easy enough to work with, but you can substitute another material if you wish. Assuming you'll use aluminum, you should metal-punch the holes in the panel as it will yield a cleaner cut and more regular spacing. A scrap of pegboard with 1-inch apart hole centers may be used as a helpful guide for this procedure. Use a light lubricant (such as WD-40) on the punch and die to facilitate withdrawal of the punch without bending the panel.

If you choose to drill instead, you should test the accuracy of the hole diameter on a scrap piece of aluminum first, and use a piece of pegboard as a drilling guide when the test is over. Start each hole with a bit no larger than a pegboard hole then enlarge it to 15⁄32-inch. If you don't mind adding a step, using an intermediate drill size might keep the bit from wandering. Install a grommet in the test hole and insert a bulb up to its metal base (see Fig. 3B). It should fit quite snugly, which is necessary to keep little fingers from poking the bulbs into the box's innards. Once you have determined the optimum bit sizes to use, drill the front panel using the peg board and/or Fig. 3A as a guide.

Straighten the panel if necessary and remove any sharp edges from the holes and sides. Thoroughly clean and finish the front panel. You may use a metal primer and paint (flat or gloss black is nice) or, for nicer results, prepare the surface with 220-grit

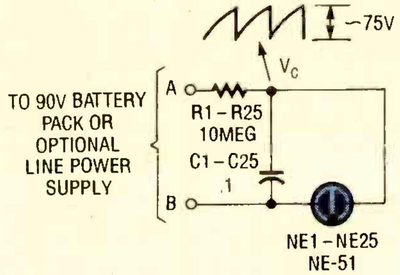


Fig. 1. The idiot box circuit is composed of 25 repetitions of this "sub-circuit." They are all tied together at the power-supply points "A" and "B."

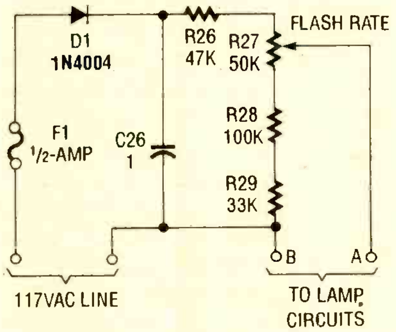


Fig. 2. If you don't want to use batteries to power the circuit, you can build and use this AC power supply instead.

sandpaper followed by 400-grit sandpaper and apply a satin finish. Use a clear spray lacquer or varnish over the satin finish to protect it. The front-panel finish is important to the unit's overall appearance, so take your time with it. Once the front panel drys, install the grommets.

You must also fashion a special clamp (shown in Fig. 4) out of aluminum, so you should do that at this time. The clamp will be used to secure the batteries or the AC supply inside the cabinet. Simply use Fig. 4 as a guide for making the clamp.

The Cabinet Body. Now let's cover the wooden enclosure's construction as its dimensions will help you determine how large you should make the circuitry. To start, make the 4 sides and 4 corner braces using the dimensions given in Figs. 5A and 5B, respectively. The length of the corner braces will determine the position (or depth) of the front and rear panels, so cut them as uniformly as possible.

Determine which side panel has the poorest exterior surface. That panel will be used as the bottom of the completed box. Drill a clearance hole for a No. 8 screw, centered and one inch from one of the un-beveled edges of that panel. A screw passing through that hole will attach the panel to the unit's pedestal, as you'll soon see.

Now cut a piece of plywood to form a 5 × 5 × ¼-inch section and smooth the edges with sandpaper. That will be used as the rear panel. Compare the size of the battery clamp and the rear panel to be sure the clamp's mounting ears won't extend beyond the rear panel's edges. The battery clamp's hole centers should be positioned 2¼ inches from the bottom of the panel. File the ears back as necessary and use the clamp to mark the inside of the rear panel for the clamp's mounting screws. At the marked points drill very shallow pilot holes for No. 4 × ¼-inch screws, using caution to avoid penetrating the wood (an awl may be better than a drill for this procedure). Do not attach the clamp at this time.

To assemble the box, lay the rear panel on a flat surface, interior side up, and smear a little Vaseline at the corners to prevent glue from sticking to it. Position the decorative panel's rear-edges-down around the outside of the rear panel—a rubber band will help hold them erect and together. Position the corner braces with just enough glue to keep them in place while you check the fit of the box edges and front panel, making any necessary adjustments. Then, disassemble the box, apply glue to the edges of the decorative panels and corner braces, and re-assemble the unit, making sure the braces are laid firmly in place and that no glue comes in contact with the front panel. Use rubber bands to maintain light

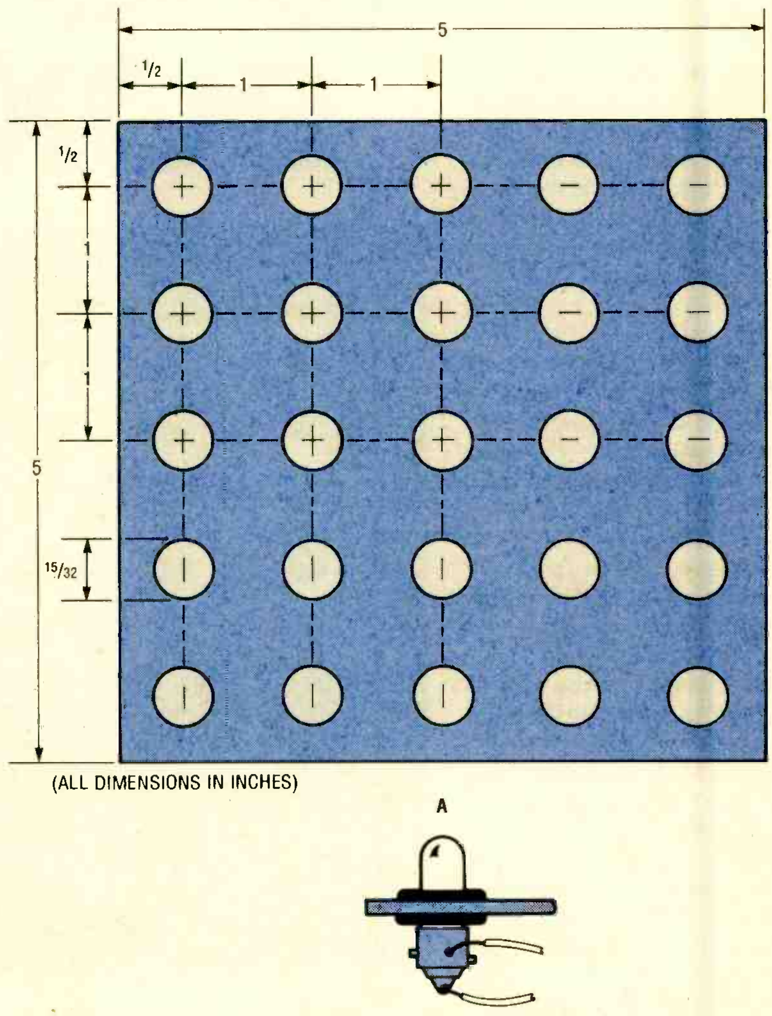


Fig. 3. The front panel (A) should be drilled with care to produce uniform holes. Test-fitting a grommet and bulb in a drilled piece of scrap metal (B) will allow you to determine if you are using the right drill bits.

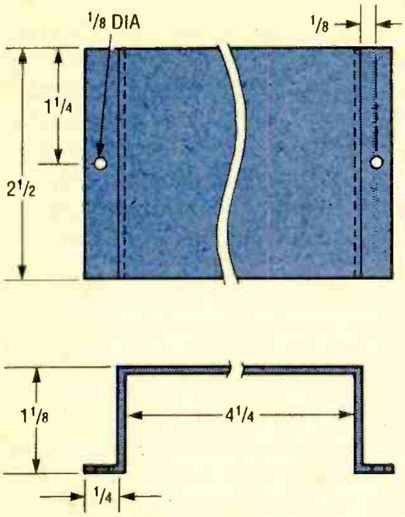


Fig. 4. The battery clamp can be fashioned of aluminum using this as a guide. After bending the strip, drill the holes indicated.

pressure until the glue sets.

Make the pedestal base and the post (both shown in Fig. 6) from ¾-inch thick and 1-inch square material, respectively. The flatness of the post ends are critical to the appearance of the completed assembly, so proceed carefully. If necessary, sand the post ends until you're sure the box will sit properly on the post.

Drill holes in the base and post to accept the screws as shown, and countersink the hole in the bottom of the base. Lightly sand both pieces and apply glue to the surfaces where they'll touch before securing them with a 1½-inch flat-head wood screw. Once the glue sets, finish the assembly. When the finish is dry, glue a thin piece of felt to the underside of the base and set it aside to dry again.

Next, drill a No. 4 clearance hole at each corner of the rear panel about ⅛ inch from the edges so the panel can be mounted to the corner braces. Carefully countersink the holes so the screw heads will rest flush with the surface of the rear panel. Then, temporarily set the rear panel in place against the corner braces so that the battery clamp will be parallel to the bottom panel once in place. Drill pilot holes into the braces for the No. 4 screws using the back panel as a guide.

The box can now be secured to the pedestal post (see Fig. 7). Apply some glue to this contact area before securing with a No. 8 × 1-inch screw and flat washer as shown. Do any alignment necessary at this time—it's your last chance.

Making the Battery Supply. We can now turn our attention to the electronics, starting with the batteries. If you plan to build the AC supply, skip to the next section.

The batteries should be assembled in two groups of five. Lay the first battery flat and stack four on top, all pointing the same way. Wrap with electrical tape to hold the stack together. Attach battery clips to the batteries (don't let any of the leads touch) and wire and solder the leads of the batteries in series—red-to-black, etc. Use spaghetti or tape to insulate each soldered connection. Make the second stack of five in the same fashion. Each group should now have a red and a black wire. Make a quick check to verify the safety of the connections in each stack. Do not solder the two stacks in series yet.

Check to see that the two battery stacks—positioned with the two sets of terminals facing outward—fit into the clamp and that the clamp will hold them firmly against the rear panel. The batteries need to clear, or may rest on, the pedestal mounting screw, so position the battery stacks accordingly. Secure the battery packs with the clamp using No. 4 wood screws, tightening carefully to avoid stripping the wood. The clamp's flanges don't have to lay flat against the rear panel—just tighten enough to keep the batteries from sliding around. You can skip the next section if you will be using the battery pack for power.

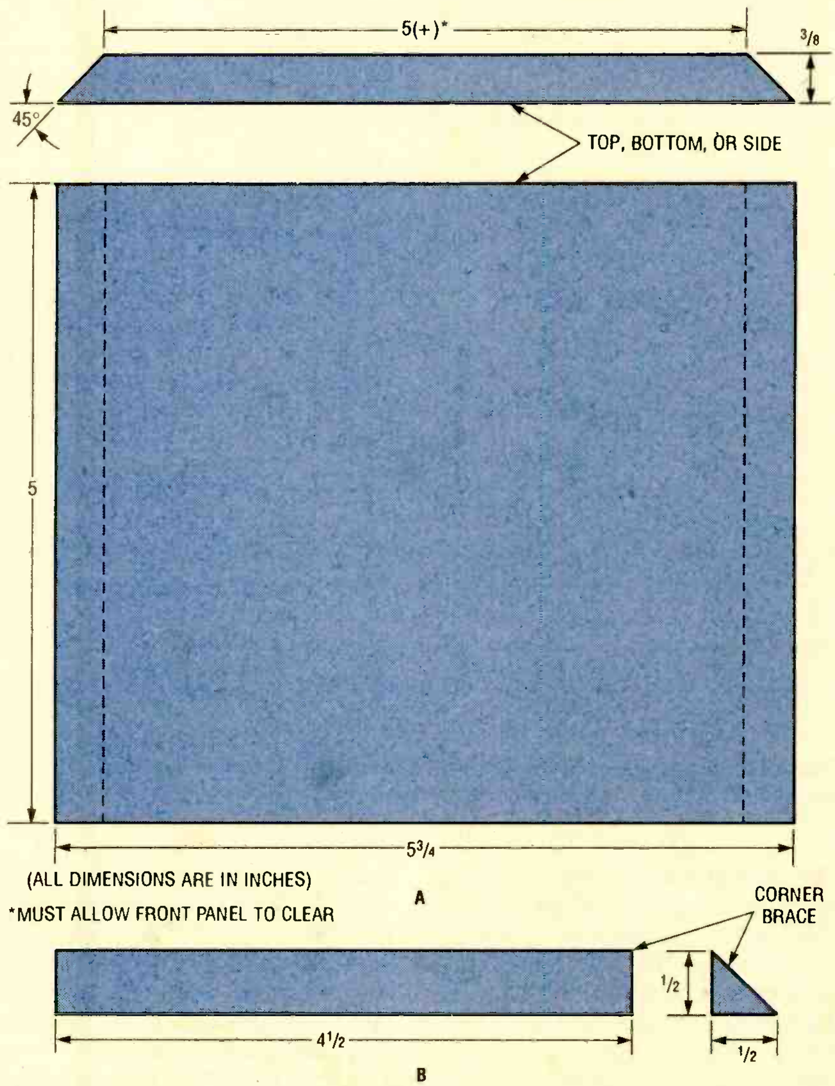


Fig. 5. You will need to cut four side panels (A) for the enclosure and four corner braces (B) to strengthen their joints. Note the bevel of the two edges of each panel.

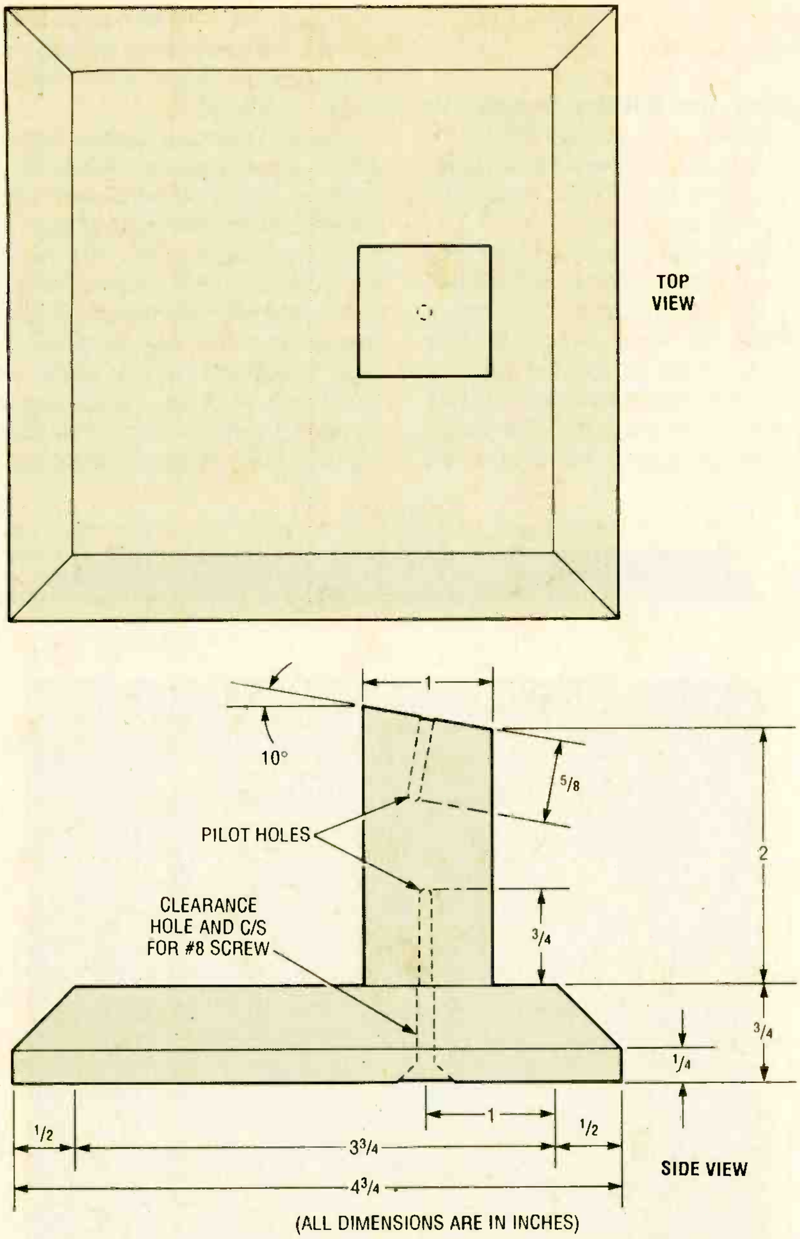


Fig. 6. Use this as a guide to cutting and assembling the pedestal base and post. When assembled, felt can be applied to the bottom as a finishing touch.

the enclosure allowing the potentiometer to protrude through its hole. Secure the potentiometer with its nut.

Before you install the power supply and clamp, you must modify the rear panel to permit the line cord and the potentiometer shaft to pass through. Do this by drilling two ¼-inch holes—the one for the line cord should be near the bottom edge of the rear panel and the one for the potentiometer shaft should allow the small enclosure to be mounted vertically so that the screws for its aluminum lid are visible above and below the battery clamp. The holes should be countersunk (or counterbored) on the inside of the panel to clear the pot-mounting hardware and a 9/16-inch (outer-diameter) grommet used to protect the AC line cord. Put the grommet in place and pass the line cord through it and through the grommet on the small enclosure. You can connect the line cord to the power supply now.

Adjust the position of the power supply if necessary and secure it to the rear panel with the battery clamp and two No. 4 wood screws being careful not to strip the wood. Attach a knob to the potentiometer shaft.

Check the operation of the supply by measuring its unloaded output. It should fall between 92 and 123 VDC. If the reading is not even close, check and correct the circuit before proceeding. One last comment is in order: fuse F1 is *only* in the circuit in case capacitor C26 shorts; If the output is shorted, the fuse will not protect R26, which will overheat. So if the display does not come to life when you plug-in the power supply (which will come later), quickly unplug it and look for errors.

The Optional AC Supply. You can build the AC supply using any suitable construction method and Fig. 2 (presented earlier) as a guide. All the components, with the exception of the fuse and the potentiometer, can be mounted on a five-position terminal strip for a compact assembly. Nothing is too critical about its assembly, but remember you're dealing with 117-VAC, so use sound and safe construction techniques. Also keep in mind that you'll need to pass the line cord through the rear panel, so don't connect it to the circuit just yet.

You'll need to acquire a small project box to act as an enclosure for the supply. Get the one suggested in the Parts List (or a case with roughly the same dimensions) as the depth of the recommended case ensures that it can be secured to the inside of the rear panel by the clamp.

To prepare the little case drill a hole in its largest plastic surface to accommodate the potentiometer. Drill additional holes to mount the circuitry (the fuse holder, terminal strip, etc.) and to mount two grommets for the AC line cord and power supply leads. Mount the grommets and install the nearly completed power-supply circuit in

Building the Main Circuit. You can build the main circuit on perfboard or experimenter's board (perfboard with some generic traces already in place). Size the board to fit within the cabinet before you begin wiring the circuit. With the size worked out, just make twenty-five repetitions of the circuit shown back in Fig. 1 (without the neon bulbs). Now connect the sub-circuits together so they all share the same power-supply lines, which should be brought off the board by a pair of wires.

You will also need to attach twenty-five pairs of wires to the board to sup-

PARTS AND MATERIALS LIST FOR THE IDIOT BOX

RESISTORS

(All fixed resistors are ¼-watt, 5% units.)
R1–R25—10-megohm
R26—47,000-ohm (for AC supply, see text)
R27—50,000-ohm, linear-taper potentiometer (for AC supply, see text)
R28—100,000-ohm (for AC supply, see text)
R29—33,000-ohm (for AC supply, see text)

CAPACITORS

C1–C25—0.1-µF, 100-WVDC, plastic, ceramic-disc, or metal-film capacitor
C26—1-µF, 200-WVDC, metal-film (for AC supply, see text)

ADDITIONAL PARTS AND MATERIALS

D1—1N4004, 1-amp, 400-PIV rectifier diodes (for AC supply, see text)
NE1–NE25—NE-51 neon bulb
F1—½-amp, slow-blow fuse (for AC supply, see text)
10 heavy-duty 9-volt batteries (for battery supply, see text)
10 9-volt battery clips (for battery supply, see text)
5 × 5 × 1/16-inch aluminum panel
2½ × 7¼-inch piece of thin aluminum
5 × 5 × ¼-inch plywood (lumberyard scrap)
19-inch length of ½-inch tall triangular pine
5 × 24 × ⅜-inch hardwood
4¾ × 4¾ × ¾-inch hardwood
2 3/16-inch long, 1-inch square hardwood
4¾ × 4¾-inch piece of felt
No. 8 large-pattern flat washer
4 No. 4 × ⅝-inch, flat-head wood screws
2 No. 4 × ¼-inch round-head wood screws
No. 8 × 1½-inch flat-head wood screw
No. 8 x 1-inch round-head wood screw
25 ⅜-inch I.D., ⅝-inch O.D., ¼-inch thick rubber grommets
3 ¼-inch I.D., 9/16-inch O.D., ¼-inch thick rubber grommets (for AC supply, see text)
Paints and finishes, readers choice (see text)
Furniture glue
Small project enclosure (Radio Shack 270-739, see text)
Fuse clip (for AC supply, see text)
5-position terminal strip (for AC supply, see text)
AC line cord and plug (for AC supply, see text)
Control knob (for AC supply, see text)
No. 24 hook-up wire, small wire nuts, perfboard, solder, etc.

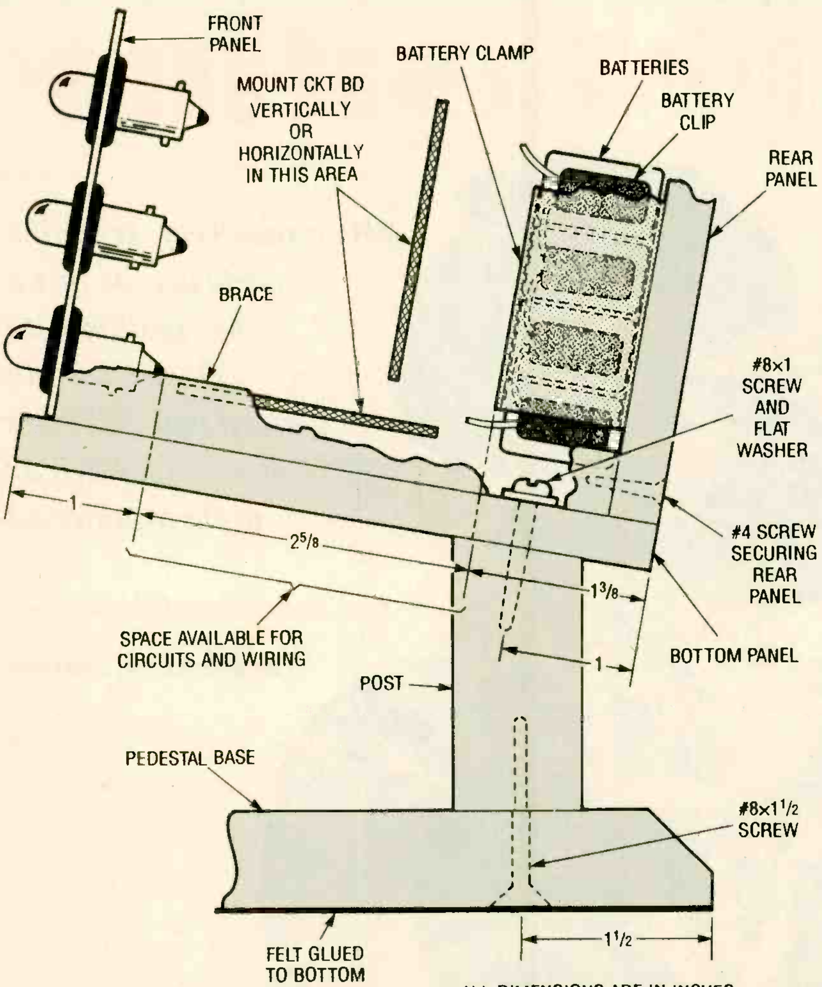


Fig. 7. This cut-away view of a battery-powered unit should give you an idea of how the sub-assemblies come together during the final-assembly procedure.

ply power to the bulbs. In order to mount the circuit board horizontally to the bottom of the case, cut the wires so that ten pairs (for the bottom two rows of bulbs) are 2½ inches long, five pairs (for the next row up) are 4 inches long, another five pairs (for the row above that) are 5-inches long, and another five pairs (for the top row) are 6-inches long. Strip and tin the wires, and attach them to the circuit board at the appropriate points.

Make sure the circuit-board bulb leads aren't touching each other and check the resistance between the two power leads to ascertain whether there are any shorts on the board. Your ohmmeter should read more than 400k. If necessary, correct any errors you discover in your work before proceeding.

If you will be using battery power, connect the red lead from one battery pack to one of the power-supply leads from the board. Connect the black lead from the other battery pack to the remaining power supply lead from the main circuit board.

If you will be using the AC supply, check to make sure it is not plugged in. Then connect the supply leads from the main circuit board to the appropriate points of the AC-supply circuit.

Connect a voltmeter across the

(Continued on page 90)

Electricity and Medicine in the 19th Century

Was it quackery, scientific curiosity, or just a fascination with electricity that goaded many doctors to give doses of electricity to their patients?

BY STANLEY A. CZARNIK

By the end of the third quarter of the 19th century, the medical application of electricity to cure ailments was a fairly well-established practice. Wherever physicians had access to static machines, induction coils, or even a row of simple cells connected in series, the temptation to dabble with the effects of electrical therapy often proved impossible to resist.

Furthermore, some of the old stigma had been removed. In 1872, for example, electrotherapist G.D. Powell wrote: "There is nothing more striking in recent therapeutics than the change which [sic] has come over the attitude of the profession with regard to the employment of electricity in medicine." "Only ten years ago," he adds, "to announce oneself a believer in electricity as a remedy of positive value was a hazardous thing." So, the pendulum of opinion was moving in a more open-minded direction, and the risk of being labeled a fraud, or a fool, had been noticeably reduced. But still, the potential popularity of electrical medication was some twenty or thirty years away.

Popular Philosophy. By about 1900, electrotherapeutic notions had taken

clear possession of the public mind. Electrotherapy became a fad, an instance of bandwagon psychology coupled with a large measure of collective self-delusion, all fueled and inspired by the notable progress of 19th century science and technology.

What really might seem amazing is how anybody could take such things seriously. That, at least, is the natural reaction from our vantage point in the final decade of the 20th century. The strangely naive quality of all such old ideas is unequivocal.

However, let's keep in mind that we are dealing here with a very different cultural situation. Not only was electrical energy the wonder of the age (according to the ideology of the mid- to late 19th century, but all other natural forces were, one by one, being reduced to various forms of electric force. James Clerk Maxwell's theory of the electromagnetic nature of light is probably the best example. Some must have reasoned if so much of the world is, in fact, electricity, then perhaps the same can be said for the vital stuff of life itself.

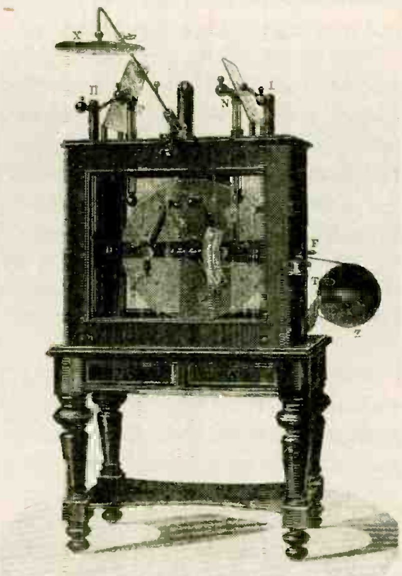
Furthermore, the transformative powers of electricity were well-known, as in the phenomenon of electrolysis for instance. If an electric current could be made to change water into a couple of invisible gases, then, surely, it could be made to alter any number of organic situations within a living body. The following appeared in an 1898 issue of the *Journal of the American Medical Association*: "A force that can propel cars, run the heaviest machinery, light a city, enable us to talk across miles of space, or break up molecules into their ultimate atoms, must have some effect when properly used upon the metabolism of the human organism."

The Power of Therapy. Prior to the early 1890's, there were four different types of electrical energy available for therapeutic purposes. They were called "galvanic" (low- to moderate-voltage continuous DC), "faradic" (high voltage interrupted DC), "static" (from a Wimshurst machine, for example), and "sinusoidal" (low-frequency AC) following the development of the alternator. Compared with the other methods, sinusoidal therapy was used relatively little so it will not be discussed further.

What was to become "the 5th medical current" and perhaps the most widely used type of electrotherapeutic energy was termed "high frequency" (from a Tesla coil or similar device). As it turns out, there are strong historical connections between electrotherapy at its peak and the invention of Tesla's famous transformer; but, more on that later.

The Static Cure. The oldest known sources of electrical power for medical purposes are the various types of electric fish: the electric eel, ray, and catfish. In fact, one of the earliest written references to electric fish appears in the *Hippocratic Corpus*. However, the first man-made electrotherapeutic power supply was one or another form of static generator or charged Leyden jar.

After the middle of the 19th century, new and improved static devices were developed, like the Wimshurst and Holtz machines. Many of the generators were bigger than the ill people connected to them. The sheer size of such machines, as well as the elegant wooden cabinets into which they were often built, must certainly have provided many a nervous patient with a certain confidence in the procedure they were about to undergo. The histrionic effect of the apparatus should not be underestimated. The brass and iron hardware, the spinning glass plates, the stately Victorian craftsmanship: who could help but be impressed?


Many 19th-century medical generators were large, impressive-looking devices built into elegant wooden cabinets. This German-made static machine features a special "umbrella electrode" (at X) for the stimulation of the head. The machine was activated by hand with a crank (at Z).

Characteristically American was the wish to have the biggest device in existence. Proud possession of "the largest machine in the world" was claimed by one Dr. Garner of Washington. It was at least eight feet tall and each of the rotating glass plates was at least five feet in diameter. The dimensions were published in the *Archives of Electric Medicine* in 1898.

For the typical static treatment to work, the patient had to be properly insulated. That was often accomplished by placing the person on a wooden platform raised up off the floor with a number of glass columns. The simpler alternative was an ordinary wooden chair.

The Electric Breeze. One strange yet fairly common form of static therapy was known to the French as "*le souffle electrique*" (the electric breeze). Such treatments were thought to have a kind of "decongestant" effect.

There were various methods of application, but a special kind of electrode system was necessary if the purpose of the breeze was the stimulation of the head. It was called an "umbrella electrode," little more than a metallic plate dangling from a support rod connected to the top of the static machine. The lower surface of the plate was equipped with a collection of small metal points or spikes. The patient was seated on an insulated platform with his head directly under, but not touching, the metal umbrella. The remaining pole of the generator was connected to the platform.

When the machine was activated with the turn of a crank, the electric field between the patient and the plate would create a tingling sensation, presumably conducive to good health. To modify the effect, the umbrella might be replaced with grounded metal tuft or tassel. There were many other variations as well.

The Medical Battery. Perhaps the simplest type of 19th-century electrotherapeutic technology was the galvanic-current generator, nothing more than a collection of electrochemical wet cells connected in series. The applicator electrodes were either metallic contrivances of various shapes and sizes or moist fabric pads. Different levels of voltage were normally obtained by moving a couple of spring clips from cell to cell, thereby adding to or subtracting from the strength of the battery.

The galvanic medical battery lent itself naturally to localized physical disorders believed to require contact with a specific electric pole: positive or negative. Contact with the wrong pole would not cure anything; it might even make the situation worse. Such an electrotherapeutic theory of treatment was taken just about as far as it would go by a certain A.W. Tipton of Jacksonville, Illinois. Dr. Tipton's ideas appeared in *Electrical Medication*, first published in 1882.

Perhaps the simplest type of electrotherapeutic power source was a collection of voltaic wet cells of the 1880's or earlier. The output of the battery could be varied by moving a couple of spring clips (at A and B) from one cell to another.

Tipton's therapeutics were determined by what he liked to call the "electrical classification of disease." He claimed there were "only two" types of disease: those in which the "electro-vital force" is abnormally positive and those in which it is abnormally negative. Too much positive force may generate inflammation; too much negative force may create a paralytic condition. Also, a body area that ought to be positive may become negative; or, a negative may become positive. Such "polar derangements" were liable to occur anywhere in the body.

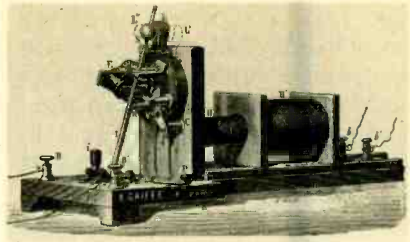
Of course, the only sure cure for those unfortunate physical confusions was a properly administered dose of old-fashioned electrical medicine. Suppose, for example, that the problem was a "morbidly positive" (that is, inflamed) kidney. To reduce the inflammation, set up the galvanic battery and place the positive electrode over the kidney and the negative electrode somewhere near the opposite side of the body. Since like poles repel and opposite poles attract, the inflammation will be driven away from the sick kidney and towards the other electrode. In that way, all the "improper excitement" could be eliminated.

So, being sick was a little like having the wrong battery, a dead battery, or the right battery backward. And being treated by Dr. Tipton was like having your polarity fixed. The entire notion is unbelievable and simple-minded but, as the doctor points out: "Simplicity is complexity! How amazing!"

The Medical Coil. Following the discovery of electromagnetic induction by Michael Faraday in 1831 and the American experimenter Joseph Henry at about the same time, the evolution of the high voltage induction transformer proceeded rapidly on both sides of the Atlantic. Indeed, so many people were working on the device that it is difficult to say exactly when the induction coil was invented and just who was responsible. What is certain is that one of the very first uses to which those early spark coils were put was high voltage electrotherapy.

That, in a nutshell, accounts for the appearance of what is now generally known as the "medical coil." The early terminology, however, was more complicated. One fairly common description was faradic battery; other terms included galvano-faradic or volta-faradic apparatus (if powered by electrochemical wet cells) and magneto-faradic (if powered by a hand-cranked magneto).

Sometimes, practitioners found it necessary to raise or lower the strength of the electrotherapeutic impulses. That requirement led to a number of interesting technical changes; one such modification was known as the "sledge." The sledge was a movable secondary coil mounted on horizontal tracks or rails that allowed the user to move it back and forth over the primary. That changed the level of inductive action between the two windings, thereby altering the intensity of the high voltage output.

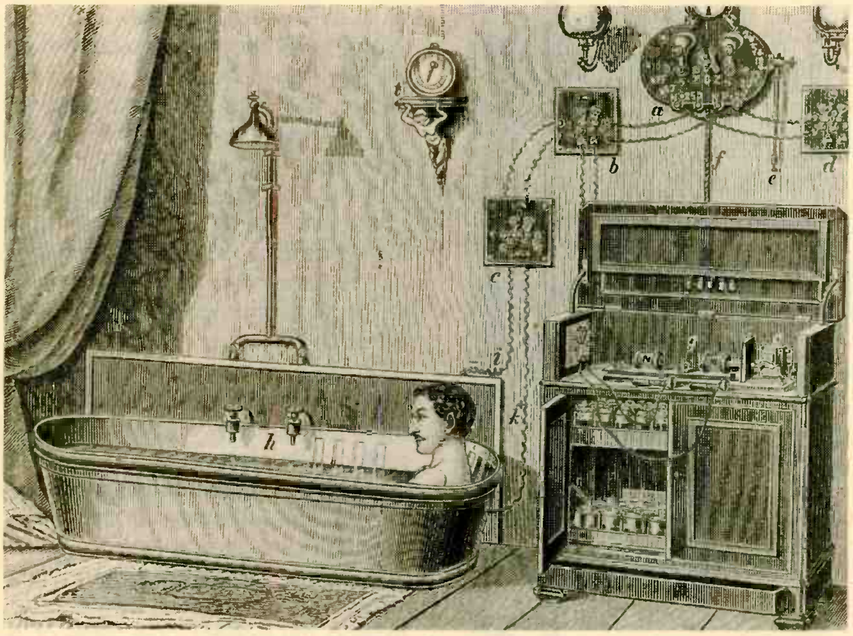


19th-century medical coils were often provided with a means of varying the strength of the high voltage impulses. One such system was known as the sledge: a secondary winding mounted on tracks or rails (at H') that allowed the user to move it back and forth over the primary (at H). This model was also equipped with a sophisticated vibrator mechanism (at L) allowing the output to be set to anywhere from 1 to 60 interruptions per second.

Along with the static machines and the medical battery packs, induction-coil equipment became part of the general proliferation of electrotherapeutic technology—a technology used, and used widely, on real people suffering from real physical and emotional problems. In 1884, Henry Bigelow estimated that—within the borders of the United States alone—10,000 physicians were using therapeutic electricity every single day. Most doctors had no trouble at all finding patients, since, as J.M. Scudder observed in 1895, the average non-professional becomes "fascinated with the buzz of a battery" and then proceeds to make himself part of the magical medical circuit. Such people are "captivated by the marvelous and disposed to accept as true the shallowest pretension, especially if it be clothed in the semblance of science."

The Electric Bath. There were two ways of applying the high voltage, induction-coil current, a form of therapy often called "faradisation" (applied to a specific body part) and general (to the entire body at once). The former method of application was introduced and discussed by G.B. Duchenne in a famous book entitled *A Treatise on Localized Electrization* (1855), the latter a couple of years later by a certain J. Dropsy in his *Electrotherapy*.

According to some commentary first published in 1859, Dropsy's original reasoning was so unusual that it provoked more mockery and ridicule



One way of getting uniform distribution of therapeutic current was known as the electric bath. This German example dates from the early 1890's. Note the sledge-type induction-coil system in the cabinet on the right.

than serious attention. But, as the 19th century drew to a close, generalized applications of electricity became more and more popular. One way of getting a uniform distribution of therapeutic current was known as the "electric bath," a method so frightfully dangerous that it is difficult to believe anybody ever even thought of it. Yet, such systems were actually built and harnessed to the purpose of physical stimulation and maintaining good health.

One of the first institutions to install electric baths was St. Bartholomew's Hospital in London. The baths were in place by the end of 1882. Typically, the tubs were made of a non-conductive material like earthenware, porcelain, or wood. The London baths had two copper-plate electrodes, one at each end of the unit; often, the plates would be enclosed in a lattice work of fabric or china to prevent direct contact with the patient. Here again, there were many variations on the basic idea; but all such systems required a lot of electrical hardware, most of which was either mounted on the wall or kept in a nearby cabinet. The average electric bath was designed for use with a number of different medical currents, and the interrupted induction current was always an alternative, especially where "simple nutritive effects" were required.

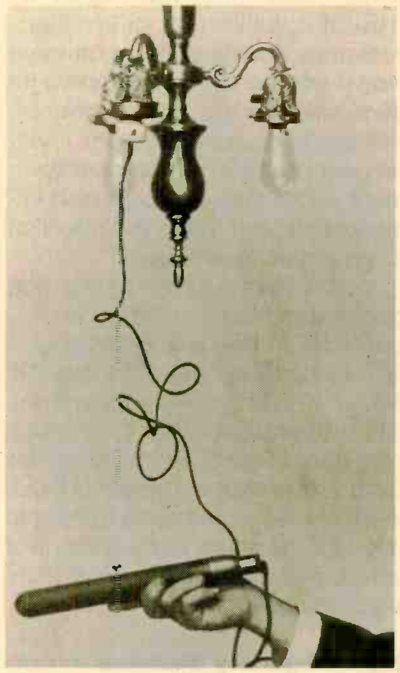
Beyond a few general recommendations, only a little serious thought was given to special safety precautions, and evidence of such consideration can be hard to find. A few words of pertinent advice were recorded by H. Lewis Jones, author of *Medical Electricity* (1900) and several other books on electrotherapy. One suggestion was that the professional therapist should always supervise the treatments since insufficient preparation and attention to the security of electrical contacts can lead to the "annoyance and loss of patients." Elsewhere, he says simply that "anything unexpected in the flow of current" should be avoided because a "disagreeable shock" may prevent the patient from coming back for another treatment. What our authority really seems to be interested in is unnecessary reductions in the size of his clientele!

The Tesla Coil. The life of Nicola Tesla and the technical history of the Tesla coil are subjects that continue to arouse the curiosity of a great many people. However, limitations of time and space prevent discussing anything other than how his work affected the "development" of electrotherapy.

The high voltage, high frequency transformer system of Tesla was made public on May 20, 1891, in a lecture at Columbia College in New York before the American Institute of Electrical Engineers. Tesla's talk created an international sensation, and, in 1892, he appeared before enthusiastic audiences in France and England. The following year, further lectures were given in St. Louis and Philadelphia. And the year after that, the entire body of information was published in book form with commentary by Thomas Commerford Martin.

Clearly, the news spread rapidly and Tesla became one of best-known scientists of the period. Regardless of how people first heard of Tesla's wonderful experiments, the unique physiological effects of high frequency currents were hard to miss: Tesla miraculously illuminated gaseous tubes while holding them in his hand and showed how sparks could be made to fly from the tips of his fingers—all without much discomfort apart from a slight burning or tingling sensation. At about the same time, in Paris, Jacques d'Arsonval was also exploring the reaction of the human organism to high frequency oscillations.

With the intense interest in electrical medicine already in the air, the therapeutic possibilities of Tesla's novel in-



The invention of the Tesla coil opened the way for a whole new wave of electrotherapeutic devices. This portable "pocket Tesla" was small enough to be held in one hand and activated with a thumb switch. The unit dates from the first decade of the 20th century.

vention were quickly appreciated and, since small Tesla systems were not hard to build, everybody everywhere started working with their own equipment. Sometime later, Tesla himself wrote that, following his original announcement of high frequency diathermy (localized heating), "experiments were undertaken by a host of experts here and in other countries." The information, he added, "spread like fire."

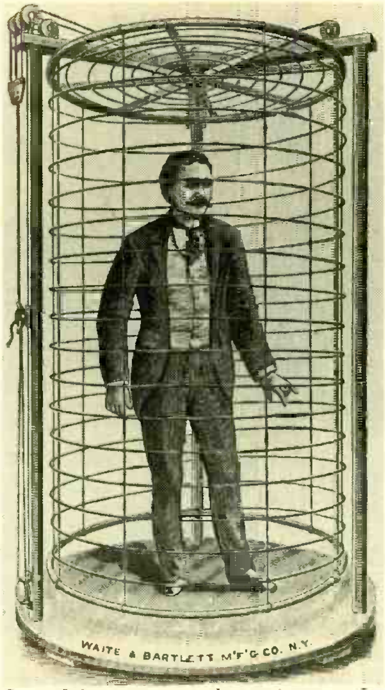
Respect. Easy-to-make, simple-to-use, high frequency medical machinery became enormously popular. According to one journalist, no drugs, no surgery, no pain seemed to be, "the rational trend of modern medicine."

As it turned out, the timing was perfect. Tesla's technology became mainstream just when electrotherapy was receiving a certain measure of professional respect. In 1890, Dr. George Bretton Massey, of Philadelphia, suggested the formation of an electrotherapy society. The first meeting, with twelve participants, was held at the New York Academy of Medicine in January, 1891.

A few years later, the annual meeting of the American Electro-Therapeutic Association was hosted by President William McKinley. Electrotherapy had become much more than a sideline clinical alternative for small town doctors and practitioners with less honorable intentions. It was an accepted form of physical treatment with a following large and important enough to win the attention of the American president.

Then, in the middle of all that burgeoning activity, the Tesla coil appeared and became, according to Dr. S.H. Monell, founder of the New York School of Special Electro-Therapeutics, "a new weapon for the healing art." But, there is something else beyond even that. As a medical instrument, the Tesla transformer grew into a symbol, a singular representation of electrotherapeutic theory and technology in general.

High Frequency Madness. In both Europe and America, the years just before and just after 1900 saw some of the most bizarre medical contraptions and outrageous clinical procedures ever. Many of these involved the use of Tesla-type oscillators, and there is room here for only a few of many possible examples.



One of the strangest electrotherapeutic devices was the so-called "auto-conduction cage," generally attributed to the French experimenter Jacques d'Arsonval. The cage was little more than a large wire solenoid meant for connection to a high frequency generator circuit. Note the ropes and pulleys for raising and lowering the conductive spiral.

The French experimenter d'Arsonval came up with what was called the "auto-conduction cage." The cage was a large wire solenoid mounted on a cylindrical wooden frame in which the patient would usually sit or stand. The entire cage was connected to a high frequency generator, the purpose being an even distribution of electrical stimulation. Some of the cages were collapsible, some were fitted with a door, and some had a big round lid on hinges, "like the cover of a basket." Such electric cages were manufactured in the United States.

An alternative to auto-conduction was auto-condensation. For treatment the patient would sit on a specially constructed couch made with a large flat metal electrode beneath the cushion. The other electrode was connected to the patient. The idea was, again, general high frequency stimulation, but this time by means of making the patient one plate of a giant human capacitor. The couch was considered preferable to the cage. That was because there seemed to be "an inherent objection on the part of the human race to being incarcerated in a cage."

Such large pieces of high frequency equipment were complimented by much smaller portable units meant for local electrification. One of the first was the so-called "pocket Tesla." The pocket device was really small, not much bigger than a large tube of toothpaste, and easily held in one hand. Such units contained a charg-

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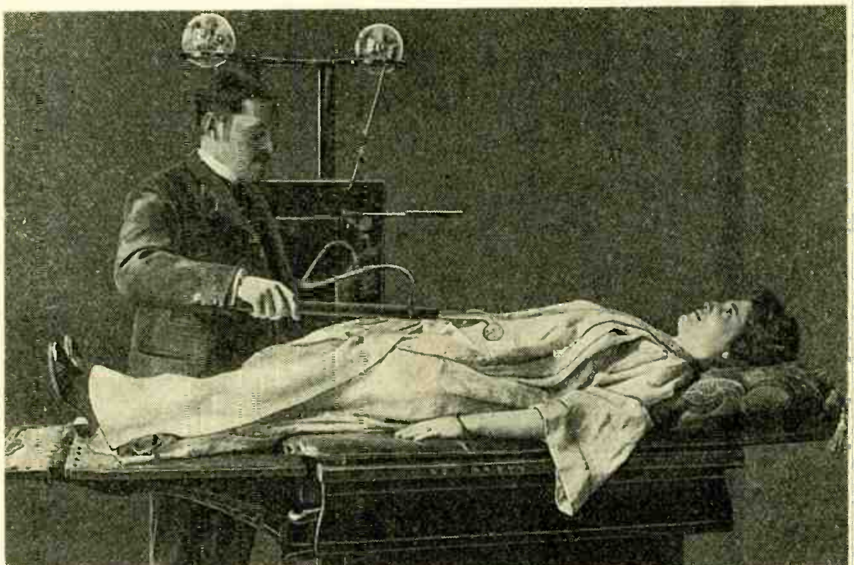
As electrotherapy approached its peak of popularity, electrical medication was used for almost everything. Here, a woman receives a high frequency treatment for diabetes. Note the removable glass vacuum electrode and long insulated receptacle.

A Super-Simple NiCd-Battery Rejuvenator

Don't throw away those seemingly unchargeable, rechargeable batteries; they could very well be brought back to life with the aid of this simple circuit.

BY FRED BLECHMAN

It is a well known fact that rechargeable nickel-cadmium batteries have a tendency to "play possum," appearing to be dead, while merely napping instead. It is also a known fact that such batteries can be awakened from their *siesta* by giving them the proper "wake-up call." The *Zap-Adapter* described in this article is designed to arouse most of those batteries from their seemingly endless slumber.

Nickel-cadmium batteries have a tendency to grow internal "whiskers"—fine web-like shorting paths between the internal battery elements—when not used for prolonged periods of time. Those whiskers eventually discharge the cell completely. When attempting to charge such a battery, the internal whiskers short out the relatively small charging current (which is usually only about 1⁄10 of the cell's ampere rating), preventing the battery from being recharged.

Awakening a nickel-cadmium cell (assuming that it can be aroused) requires that a high current be applied to the battery for a few seconds to blast away the whiskers. Once the whiskers are gone, you can charge the battery in the normal manner.

The Zap-Adapter that we'll describe is intended for use with AA rechargeable nickel-cadmium batteries, which seem to be the most popular size. The same design, with proper battery holders, can also be used for AAA, C, or D cells, all of which are single-cell types.

About the Circuit. Figure 1 shows a schematic diagram of a simple circuit that can be used to desolve the whisker formation that prevents nickel-cadmium batteries from receiving a charge. The circuit consist of nothing more than two fully charged, series-connected nickel-cadmium batteries (B1 and B2) and a switch (S1). Nickel-cadmium batteries were used for the source because they can deliver lots of current. For example, AA-size cells can deliver a continuous current of 0.5 amperes. Switch S1 allows you to control the amount of time that rejuvenating power is applied to the sleepy battery.

When S1 is closed, a jolt current of sufficient magnitude is sent through the battery so as to cause the tiny whiskers (shorts) within to open. Also, if the dead battery has become reverse-polarized, the polarity is also corrected by the harsh treatment.

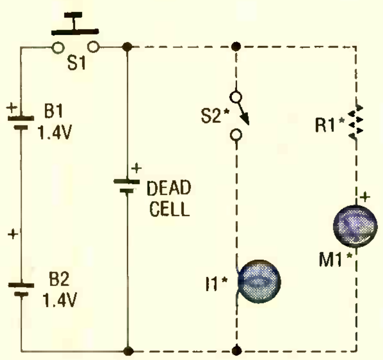

Fig. 1. This simple circuit can save some of your old nickel-cadmium batteries from the trash heap.

The dashed portion of the circuit in Fig. 1 is optional and can be included to allow you to monitor/test the circuit's operation. Including the resistor (R1) and meter (M1) in the circuit eliminates the need for an external meter. Adding a second switch (S2 in Fig. 1) and a flashlight lamp (I1) enables you to monitor the battery's voltage under load. By removing the dead battery and closing S1 and S2 at the same time, you can test the live batteries under load.

Construction. The Zap-Adapter was assembled on a small section of perfboard, just large enough to hold the circuit components. Three inexpensive AA battery holders (like those available from Radio Shack and other electronics distributors) were mounted to the board; two battery holders, connected in series, for the source current and the third for the battery that is to be awakened. A pushbutton switch was used for S1. The battery holders and switch can be mounted to the board using double-sided tape.

It is a good idea to put the single holder to one side of the board and the double holder (or two holder combination) to the other side to separate the good cells from the bad. If you intend to include the meter and/or lamp circuit in your project, be sure to leave room for them.

If you don't have a small DC milliammeter in your junkbox, look for one at swap meets, surplus outlets, or mail-order catalogs. The meter should have a full-scale current rating of from 50 μA to 1 mA. If you intend to include a meter in your circuit, it will be necessary to determine the appropriate value for R1. That can easily be done by placing a 50k potentiometer in series with the meter, and connecting

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TV Answer:

What's the Question?

Does TV Answer signal the birth of over-the-air interactive television, or is it just the latest piece of vaporware to come down the pike?

BY ROBERT ANGUS

If you read USA Today or watch CNN, you can hardly have missed it: a black box that lets you talk back to your TV set called "TV Answer." With it, you can order a pizza with anchovies, get literature on a new car, or purchase Smoky Stover's Greatest Hits. It'll let you take part in polls, compete with game-show contestants for prizes, and even call the plays in minor-league sports events. According to its developers, it's the dawning of interactive video in America.

According to Hewlett-Packard—the home-computer behemoth that's supplying the hardware—by the end of the year, you should be able to purchase TV Answer boxes with their pistol-shaped remote controls from consumer-electronics stores and other retail outlets for under $700. Founded in 1986 as a technology-development company, TV Answer doesn't actually make anything itself. Nor will it provide any of the programs or services needed to make the system run. It licenses the technology to companies (such as HP) and to would-be program users. In addition, the company hopes to turn a pretty penny by franchising the local cells—satellite uplink/downlink facilities comparable to those used by cellular phones—that allow the system to work.

How Does it Work? Sometime before the end of the year you'll begin seeing commercials for various products and services that contain a blinking box. By aiming the remote at the box and pressing the appropriate button, you can request more information on the product or order the item, which will be delivered direct to your home. At some future date, you'll be able to play video games offered by some as-yet-unnamed provider, participate in surveys, or compete with game-show contestants for prizes. In fact, according to TVA, you'll be able to order flowers from 800 Flowers, booze from 800 spirits, discs and tapes from Bose Express Music, a variety of catalogue items from J.C. Penney, and other items from CUC Inc.

There are two communication loops in the TV Answer system (see Fig. 1). The first carries data between the company headquarters and individual cell sites via a satellite network. The second loop is between each cell site and the 2800 homes it can serve.

Each cell site is a two-way satellite-communication station, uplinking responses from various TVA homes to Hughes communication satellites and downloading TV program listings, interactive commercials, order forms for goods and services, news about TV Answer, updated memory card information (more on that later), and order confirmations. A very-small-aperture Earth terminal (VSAT) and radio transmitter/receiver at the cell site form the cell satellite-communications link.

Data received in digital form from a satellite is transformed into a radio signal in the 218–219 MHz range. That signal carries data between the cell site and the TV Answer "black box" in the home.

The TV Answer box also uses signals in that range to talk to the cell site. The

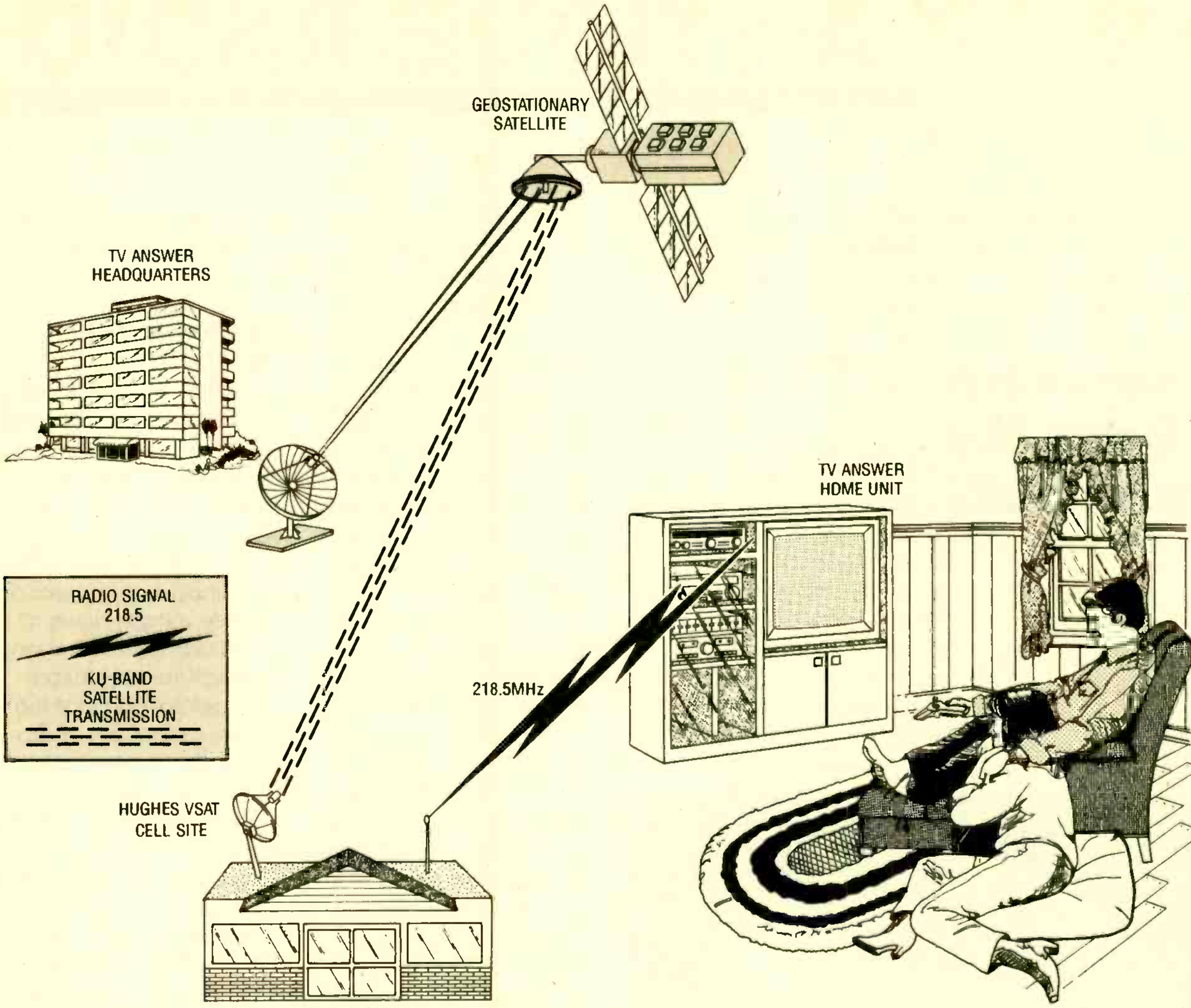

Fig. 1. In the TV Answer system, the black boxes of up to 2800 homes communicate with a cell site which up-loads and downloads satellite-relayed information to and from the TVA headquarters.

black box contains all the necessary viewer identification information, including your address. All you have to do to place an order is to press the right button on the remote. TVA headquarters collects all of the incoming information from the cells (via the satellite link), they are processed, the order is placed, the viewer is billed, and the information is passed on to other parties (such as vendors) needing the viewer's responses. In fact, by using their own VSAT Earth stations, interactive service providers can receive viewer responses at the same time as does the TVA headquarters.

To increase viewer control, the system has the ability to memorize passwords for channels or credit cards, and to lock out access to certain channels. Thus parents will be able to prevent their offspring or their babysitters from unauthorized ordering of cubic zirconium baubles or marital aids.

Interactive TV History. Although TV Answer claims to be the first "wireless" interactive video system, it is not the first interactive video system. The first system was used in Columbus, Ohio back in 1977 when Warner Brothers cable inaugurated a system called QUBE, which would have allowed viewers to vote electronically in town meetings as well as choosing premium movies. However, according to Warner officials QUBE died because it was premature, and because there weren't the number of channels needed to fill up its then-enormous capacity. Most of what it did then seems pretty tame when judged by the capability of today's cable. Nevertheless, it showed what interactivity could achieve.

A better example of interactivity via cable is Videoway, available to cable subscribers in Montreal, Quebec city, and several other areas in Canada. For about what you'd pay for a premium cable channel, you get a system that includes not only your choice of four premium movies (two current, a golden oldie, and a fourth featuring the star or director of one of the first two), but also the chance to pick your choice of camera angle on a hockey or baseball game, order the week's groceries from your choice of local supermarkets, play one of several video games, compete against contestants on game shows, and record

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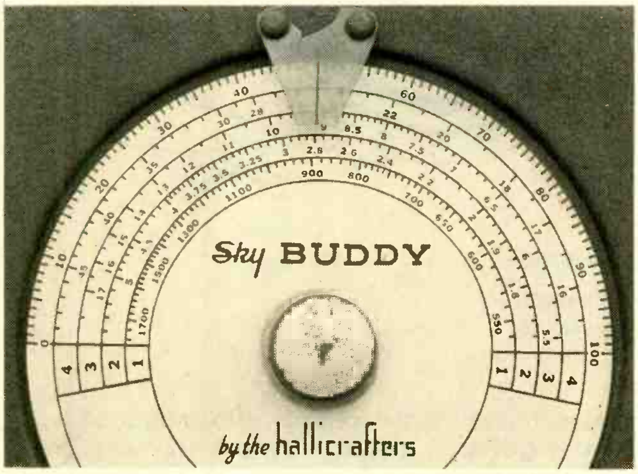
ANTIQUE RADIO

By Marc Ellis

Housekeep Before You Troubleshoot!

Back in the June issue, I reported on the initial steps in our latest restoration project—an intact, but very tired-looking, *Hallicrafters Sky Buddy (Model S-19R)*. The S-19R, for those who may have just joined us, was introduced in 1939. As the bottom-of-the-line model, it was a popular starter set for teenage hams and shortwave listeners during the late pre-World-War-II era. And, in spite of its low ($29.50) price, the sturdy little radio offered professional features, wide coverage, and good performance.



This close-up of the Sky Buddy's *"German Silver" dial shows a cracked dial cursor.*

During the last couple of columns, we had to put the Hallicrafters project on hold in order to discuss the final group of entrants in the "With the Collectors" contest and handle other accumulated mail. Now we can get back to the restoration. But first, here are some that letters I saved to kick off this column.

SKY BUDDY MEMORIES

Paul Daulton (Jacksonville, AR) still has the Sky Buddy he purchased at age 12 in the mid 1950's. He bought it from a man who had served as a Coast Guard radio operator during World War II and had used the set for code practice. After moving on to bigger and better equipment, Paul retired the Sky Buddy—but it still occupies the place of honor in his radio collection.

Norman Wehrli (Athens, TX) has had his Sky Buddy since the late 1930's, when he presumably bought it new. Norm SWL'd with the set until receiving his ham license in 1940, then used it as his station receiver. After his stint in the armed forces, he acquired more sophisticated equipment for the ham shack. But the S-19R stayed in the family, serving for many years as a broadcast receiver.

For two other readers who didn't happen to own Sky Buddy's, our new restoration project is bringing back pleasant memories of other Hallicrafters sets. *Wally Forsland* (Clearlake, CA), for example, used an Echophone during World War II. He graduated to an S-38 after the war and subsequently upgraded to an SX-28A followed by an SX101.

Robert C. Hopkins (Orangevale, CA) purchased an SX-18 Sky Challenger II in the mid 1950's and still uses it several times a week. The Sky Challenger II sets—designated SX-18 (with crystal filter) and S-18 (without crystal filter)—are "big brothers" to the Sky Buddy. Their series number is lower than the Sky Buddy's (18 as opposed to 19) because they were released the prior year (1938).

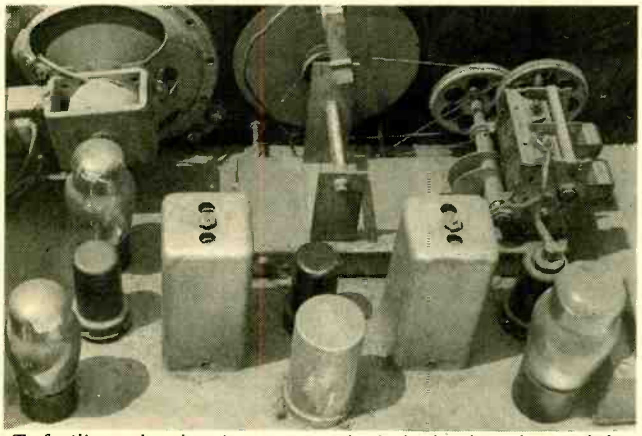
BEGINNING THE RESTORATION

The last time we worked on the Sky Buddy, an initial assessment was made of the set's condition. We opened it up and found no signs of tampering or serious electronic failure. Then we turned it on (increasing the line voltage slowly to avoid damage to the long-unused filter capacitors) and determined that the power supply was operational. So was the audio section, as evidenced by static heard when adjusting the volume control, and even a bit of music coming from a strong local station.

But except for the local music, which eventually faded out and could not be heard again, the S-19R was essentially dead. It was evidently not a tube problem, since all tubes tested okay on my reasonably sophisticated Navy-surplus checker.

As I've said in the past, I've learned from experience that it doesn't pay to troubleshoot a long-neglected set like this one without first taking care of some basic housekeeping issues. It's not only unpleasant to work on such a radio without getting rid of the dust, rust, and grime, but any dirt and corrosion on the switch, tube, and volume-control contacts can cause intermittent malfunctions that make it difficult to uncover the real problems.

Cleanup of the S-19R, which came into my possession laden with plenty of deep-seated crud, would be somewhat complicated by its unusual mechanical construction. Although the radio's removable top and bottom panels give good access to components above and below the chassis, the chassis itself is non-removable—being permanently attached to the wrap-around, one-piece, cabinet/front panel.



To facilitate the cleaning process, both the loudspeaker and the tuning capacitor/bandspread drive subchassis to the right of it would be removed.

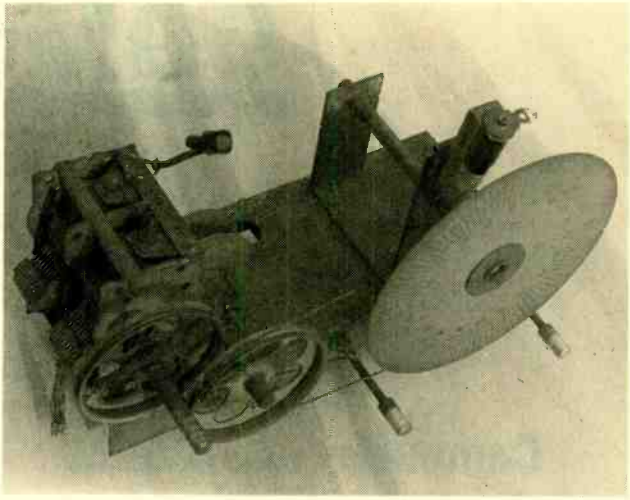
In order to facilitate cleaning above the chassis, I decided to remove two of the bulkier components: the loudspeaker, which was dirty enough to require a separate housekeeping project of its own, and a large subchassis containing the tuning capacitor, with its main tuning- and band-spread- dial drive systems. Removal of the latter would require taking off the two tuning knobs and the main tuning dial. And while I was at it, I decided to remove all other control knobs, as well as the bandspread-dial bezel, to make cleaning the front panel as easy as possible.

TUNING DIAL REMOVAL

The celluloid dial cursor mounted over the top of the main tuning dial appeared to be a problem. A piece of it had already cracked off, and it looked as if the cursor might be further damaged by pulling the dial out from under.

The cursor assembly was held in place by a couple of small slotless screws tapped into the front panel. There was no way to remove them with a screwdriver, and I couldn't even imagine what kind of tool had been used to install them in the first place. But as luck would have it, there was no problem at all. The screws were easily turned by pressing and twisting with the thumb.

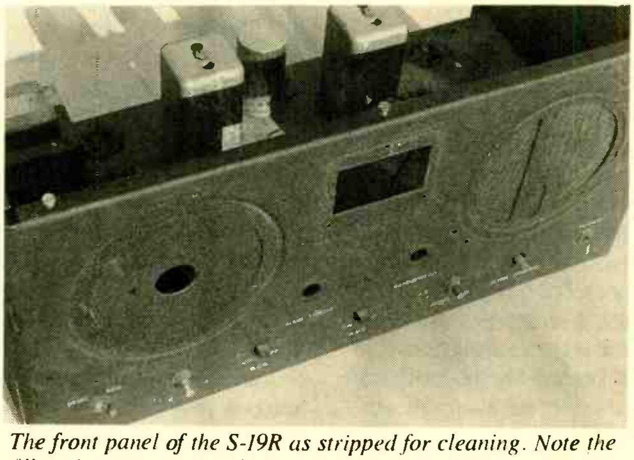
With the cursor removed, taking off the main tuning dial was a matter of releasing its set screw, and then twisting and pulling with one hand while preventing the tuning capacitor from turning with the other. The control knobs were no problem either, although in some cases I had to twist the screwdriver with pliers to loosen frozen threads.



With the tuning capacitor/bandspread drive subchassis out of the set, it will now be possible to restring the dial cords.

I was really puzzled by the area of the front panel that was revealed by removing the tuning dial. Originally, there had been a circular opening whose diameter was about an inch less than that of the dial. But this opening had been filled with a round metal plate (attached by spot-welding) with a hole at the center just a little bit larger than necessary to accommodate the dial drive shaft.

Why was the opening made so large in the first place? Maybe to give access to the dial-drive pulleys for facilitation of restringing—a job that is now virtually impossible without removing the tuning capacitor/bandspread dial subchassis. Maybe the large hole was necessary so that the front-panel recess for the tuning dial could be formed without wrinkling the metal. Or maybe the hole was somehow necessary in the original S19 (which had an almost identical front panel but a different bandspread arrangement), but became obsolete when the set was revised to become the S-19R.



The front panel of the S-19R as stripped for cleaning. Note the filler plate (see text) reducing the diameter of the round dial opening at left.

Even more curious, why was the hole, once made, so carefully filled—presumably at some expense? I can't even venture a guess about that. I doubt that it would have been necessary to keep dust out, since the round dial plate fits very nicely into its circular recess, making a reasonably effective seal even with a large central opening. And, in any case, there is no sign that the *back* of the S-19R's cabinet was ever closed in at all! Maybe somebody out there in reader-land

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COMPUTER BITS

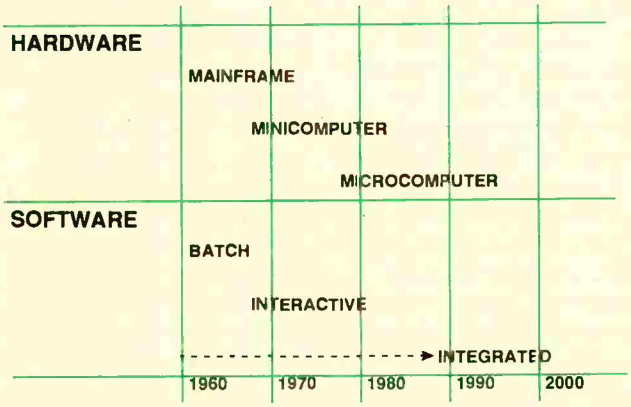
By Jeff Holtzman

Computer Evolution

Why do we have PC's? What will we be using them for? How are our usage patterns changing? This month, we will use this space to attempt to answer those questions.

MAINFRAME, MINI, MICRO

The 1960's and 70's saw the rapid development and proliferation of increasingly dense integrated circuitry. First there was small-scale integration, which put a few gates composed of a few dozen transistors on a single chip. Next came medium-scale integration, which combined hundreds of transistors to form moderately complex functions such as arithmetic-logic units. Then came large-scale integration, and the first microprocessors.



In the history of the computer industry, software has always lagged hardware. However, dramatic increases in CPU speed and memory capacity are now paving the way for fantastic new software that will finally make the phrase "user friendly" meaningful.

Paralleling the evolution of integrated circuits was the evolution of computers. The computer industry started off on a "bigger is better" kick. Mainframe designers focused on the idea of putting all the processing power in a single box, and only allowing access to that power through a centrally controlled means. You submitted a "job" on punched cards, and when the "high priesthood" gave its blessing, your job ran.

The minicomputer industry grew up as the initial attempt to wrest control from central authority and put it back in the hands of users. Researchers at Bell Labs invented the UNIX operating system with just that thought in mind. However, minis still concentrated most power centrally, leaving users with dumb CRT's, alphanumeric keyboards, and no local intelligence to speak of as a way of accessing that power. But most users still were not satisfied with that situation.

In the early 70's, the microprocessor was invented as a way of combining all the necessary logic and control functions on a single chip. There were several reasons for doing so. One was to be able to build effective machine controllers. The other was to provide end users with local power that they could control themselves. *Voila*, the Apple II, the Commodore 64, and the 8080- and Z80-based CP/M machines. Not to mention IBM's 1981 contribution, the PC.

BATCH, INTERACTIVE, INTEGRATED

The evolution of hardware architectures from mainframe to mini to micro was driven by an even more important, yet parallel, evolution in software architecture, from batch, to interactive, to today's emerging paradigm, integrated. Batch-mode software has no user interface, and executes according to schedules defined by other people or the system itself. Interactive software has a constrained user interface that attempts to maintain a simplified one-to-one correspondence between particular real-world entities and the computer-based representation of them. Thus, the first generation of spreadsheets looked like accounting books, the first generation of word processors emulated typewriters, etc.

The underlying goal of those products was simply to do the same things that people did manually, albeit faster and more efficiently. Current leading-edge products extend their uses in ways that have no manual or mechanical analogs. For example, imagine linking a spreadsheet to a communications package to update stock prices or manufacturing data in real time. And that brings us to the third generation.

The third generation of computer software, which is just now beginning to emerge. This generation takes a different point of view, one that encompasses prior generations but extends them in new ways without analogs; it is based on capabilities offered solely by computers. It is possible to recognize such software by its ability to read and write multiple file formats, to share data in real time with other applications running on the same machine, and to share data in real time with applications running on other machines. Thus, the key feature of this new design and usage paradigm is integration.

There were various attempts at building "integrated" applications throughout the 80's, but typically they were Frankensteins built by bolting existing applications together, but providing little consistency in user interface, not to mention data sharing among modules. I would rank Borland's SideKick (1984) as the seminal multifaceted "integrated" program (in the sense discussed here) for personal computers.

SideKick was the first non-DOS TSR (DOS's own Print and Mode commands always had memory-resident components), which gave it the ability to coexist with other arbitrary programs. It also contained several modules (scheduler, calculator, notepad) that shared a common user interface, although it didn't really offer data integration among the modules.

DESKTOP PUBLISHING

After the Macintosh and Windows were released, desktop publishing hit the scene, and the industry learned about integrating disparate file formats. DTP program designers recognized that the industry was too immature for real standards to take effect, so from the beginning, the programs accepted text and graphics files in a variety of formats.

Early versions of PageMaker brought everything into one huge file. Ventura, on the other hand, kept only a central list of files comprising a publication, thus providing the capability for multiple persons to work on different parts of a publication simultaneously. Ventura's implementation was dangerous in that it didn't protect users from each other, but it proved both that the concept worked and that users really wanted it. Current versions of PageMaker support a similar capability. Network support is the hottest area of development in DTP right now, particularly on the Mac.

DTP has proven important in another way: It has not only popularized, but has also legitimized the graphical user interface and the concept of multitasking (having the computer perform two or more tasks simultaneously). Desktop publishing was important for a third reason as well. It was the first major applications category that had no analog in "real life." The first word processors were better typewriters. Desktop publishing software, on the other hand, created a new use for computers, and in the process brought powerful new capabilities—and responsibilities—to end users.

For a while, industry analysts went looking vainly for "the next killer application." (Lotus 1-2-3 was the prototypical killer application because it defined a new market category and immediately dominated that market.) Spreadsheets and word processors are by far the largest application categories, followed at a distance by databases, desktop publishing, and telecommunications. That's because those tools correspond to what people do. The hottest area now is not in developing new types of applications, but in integrating (there's that word again) the applications that we already have.

TODAY AND TOMORROW

Evolution of the computer industry has occurred in waves. Mainframe, mini, micro. Batch, interactive, integrated. The current wave does not attempt to render past accomplishments or technologies obsolete. Rather, it is building toward a world where micros, minis, and mainframes can all communicate and contribute in appropriate ways. In the early 80's, mainframe bigots ignored the PC and ultimately became frightened by it, as it started encroaching on mainframe turf. PC bigots likewise rebelled against centralized control.

Today there is growing recognition that all three hardware architectures have their uses, and that software must provide the glue to maintain communications among them. There is also growing recognition that applications as we know them—specific programs that do only one thing—must be replaced by integrated tool sets.

In the old days, we had separate word processors, spreadsheets, and databases because computer hardware that could run several major applications simultaneously was too expensive for widespread use. Now that's no longer the case. Now the pressure is on software designers to build multi-tool applications that simply let users do their jobs.

Recent strides in programs like Microsoft's Excel 4.0, Visual BASIC, and (to a lesser extent) Word for Windows 2.0 provide an inkling of how things are evolving. Get a taste. Drink deeply. The future is here today. ■

CIRCUIT CIRCUS

By Charles D. Rakes

Electronics Potpourri

This month the Circus is taking us on a circuit merry-go-round featuring as many circuits as our allotted space will allow. You might think our first entry is too obvious and simple to appear here, but I've had quite a few people ask the question: "How do you wire a two-way light switch circuit?"

A two-way switching circuit can be a handy arrangement to have at the bottom and top of the stairs, or at two doors going into the same room, or at any two locations where it would be convenient to turn an AC-operated device on or off from more than one location.

TWO-WAY AC SWITCH

The switching arrangement shown in Fig. 1 is the type of circuit used in both domestic and industrial environments to allow a light or other AC-operated device to be controlled from more than one location. As

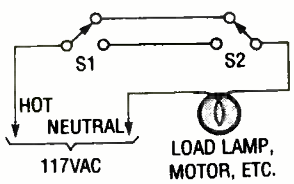


Fig. 1. The switching arrangement shown here is the type of arrangement used in both domestic and industrial environments to allow a light or other AC-operated device to be controlled from more than one location.

shown, the hot AC lead (black wire) is connected to the wiper of S1. The neutral (white wire) goes to one side of the load with the other load connection going to the wiper of the second switch completing the circuit and lighting the lamp.

Switching either switch to its other position turns off the lamp. The lamp can then be turned on by switching either switch to its other position.

VOLTAGE PROBE

Our next entry (see Fig. 2) turns a couple of dollars worth of parts and a few minutes into a handy little voltage-testing probe that can be helpful in checking and troubleshooting solid-state circuitry. The simple voltage probe lights a red LED when connected to 1.25-volts or more, and turns a green LED on with inputs of less than 1-volt. Low-frequency pulses with an amplitude of 1.5 volts or greater will cause both LED's to light.

Transistors Q1 and Q2 are connected in a Darlington configuration that offers a high input impedance and a minimum load to the circuit under test. When the probe's input goes above 1.25 volts, the combined collector currents of Q1 and Q2 lights LED1. With an input of less than 1 volt, Q1 and Q2 turn off allowing their collector voltage to go positive to supply base current through R2 to Q3. Transistor Q3's collector current turns on LED2. The 680-pF capacitor (C1) helps to bypass any RF at the probe's input to ground.

VOLTAGE-LEVEL INDICATOR

Next up is a circuit (see Fig. 3) that will indicate three different pre-set input voltages. The circuit can be used to check or troubleshoot TTL or CMOS circuitry, or to monitor battery voltage during charging, while at rest, and during discharge. Also the three preset voltages can be adjusted to monitor the output voltage of a DC power supply.

The voltage-level indicator is built around an LM324 quad op-amp. The first op-amp, U1-a, is configured as a high input impedance voltage follower with a voltage gain of 1. The output of U1-a at pin 1 drives the positive inputs of the three remaining op-amps (U1-b–U1-d). Resistors R3–R6 comprise a voltage divider that sets each of the three monitoring voltage levels. The divider current is 1 mA making it very easy to figure resistor values for other voltage settings. Since 1 mA flows through the voltage divider, it provides a voltage drop of 1-volt per kilohm (*i.e.*, $1000 \times .001 = 1$). So 2k = 2 volts, 3k = 3 volts, etc. The total voltage drop across the divider (including R3) should add up to 9 volts; if not re-check your math.

The negative inputs of U1-B through U1-d are connected at various points in the voltage-divider network: That configures the circuit to indicate 1-, 3-, and 5-volt input levels. Op-amp U1-b is connected at the junction formed by R3 and R4; U1-c at the junction formed by R4 and R5; and U1-d at the junction of R5 and R6.

Op-amp U1-d's output goes positive, lighting LED3, with an input of 1 volt or more. With an input of 3 volts or more, the outputs of

PARTS LIST FOR THE TWO-WAY AC SWITCH

S1, S2—SPDT light switch
I1—Incandescent lamp or other AC-operated device

PARTS LIST FOR THE VOLTAGE PROBE

SEMICONDUCTORS
Q1–Q3—2N3904 general-purpose NPN silicon transistor
LED1—Red light-emitting diode
LED2—Green light-emitting diode

RESISTORS
(All resistors are ¼-watt, 5% units.)
R1—470,000-ohm
R2—47,000-ohm
R3, R4—470-ohm

ADDITIONAL PARTS AND MATERIALS
C1—680-pF, ceramic-disc capacitor
Perfboard materials, 6–9-volt power source, wire, solder, hardware, etc.

PARTS LIST FOR THE VOLTAGE LEVEL MONITOR

RESISTORS
(All resistors are ¼-watt, 5% units.)
R1—220,000-ohm
R2—10-megohm
R3—4000-ohm
R4, R5—2000-ohm
R6–R9—1000-ohm

ADDITIONAL PARTS AND MATERIALS
U1—LM324 quad op-amp, integrated circuit
C1—680-pF, ceramic-disc capacitor
LED1–LED3—Light-emitting diode, any color
Perfboard materials, IC socket, two 9-volt batteries and connectors, wire, solder, hardware, etc.

PARTS LIST FOR THE VARIABLE VOLTAGE DIVIDER

R3—3000-ohm, ¼-watt, 5% resistor
R4–R6—2000-ohm potentometer
Perfboard materials, wire, solder, hardware, etc.

both U1-d and U1-c go high, lighting LED2 and LED3. When the input to the circuit reaches 5 volts or more, the outputs of all three op-amps go high, lighting all three LED's.

The variable voltage divider shown in Fig. 4 can be used with the circuit in Fig. 3 to allow a wide range of input voltage settings. Each potentiometer in the divider offers a 2-volt adjustment for each of the three op-amps.

ADJUSTABLE VOLTAGE MONITOR

Our next circuit (see Fig. 5) uses the LM324 in an adjustable voltage monitoring and alarm circuit that offers a variable window

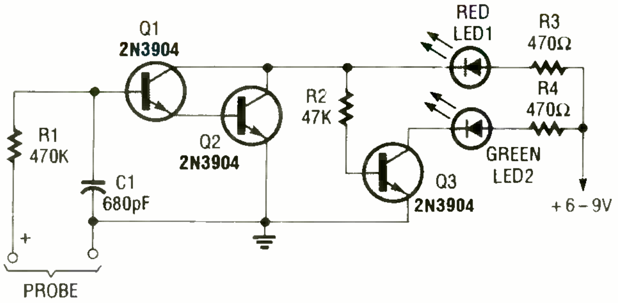


Fig. 2. This simple voltage probe can be helpful in checking and troubleshooting solid-state circuitry.

that can be used to check whether the voltage in a circuit remains within a given range. The window is adjustable from just a few millivolts to over ½ volt with the component values given.

In that circuit, U1-a is configured as a voltage follower, which gives the circuit a very high input impedance, while providing a voltage gain of one. The output of U1-a feeds the negative input of U1-b and the positive input of U1-c. The other inputs of the two op-amps are connected across the window-adjustment potentiometer, R4. Potentiometer R4 can be adjusted to monitor voltages from near 0 to about 8 volts.

Two LED's (connected in parallel and oppositely polarized) are connected

PARTS LIST FOR THE ADJUSTABLE VOLTAGE MONITOR

SEMICONDUCTORS
LED1, LED2—Light-emitting diode
U1—LM324 quad op-amp, integrated circuit

RESISTORS
(All fixed resistors are ¼-watt, 5% units.)
R1—100,000-ohm
R2—1000-ohm
R3—2200-ohm
R4—250-ohm potentiometer
R5—10,000-ohm potentiometer

ADDITIONAL PARTS AND MATERIALS
C1—680-pF, ceramic-disc capacitor
Perfboard materials, enclosure, two 9-volt batteries and connectors, IC socket, knobs, wire, solder, hardware, etc.

PARTS LIST FOR THE AUDIBLE MEMO ALERT

U1—4011 or 4093 quad 2-input NAND gate, integrated circuit
R1—10-megohm ¼-watt, 5% resistor
R2—1-megohm ¼-watt, 5% resistor
C1—680-pF, ceramic-disc capacitor
C2—0.1-µF, ceramic-disc capacitor
BZ1—Piezo buzzer
S1—Switch, see text

ADDITIONAL PARTS AND MATERIALS
Perfboard materials, enclosure, clothes pin, 9-volt battery and connector, IC socket, wire, solder, hardware, etc.

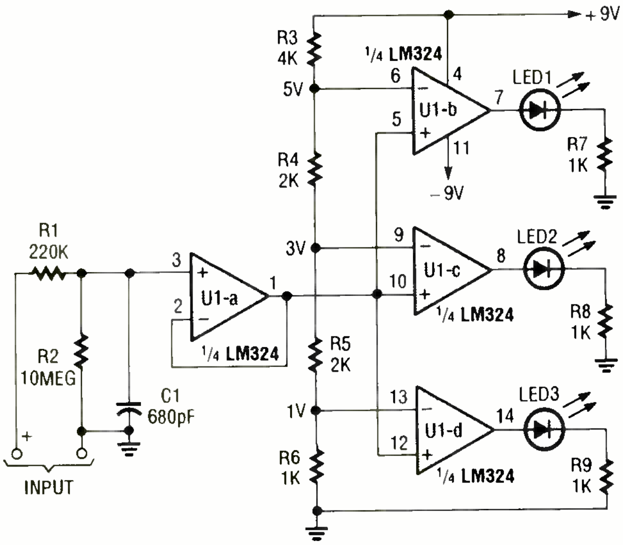


Fig. 3. The voltage-level indicator will indicate three different pre-set input voltage levels.

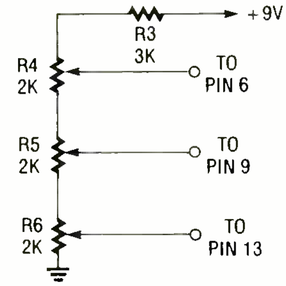


Fig. 4. The variable voltage divider shown here can be used with the circuit in Fig. 3 to allow a wide range of input voltage settings.

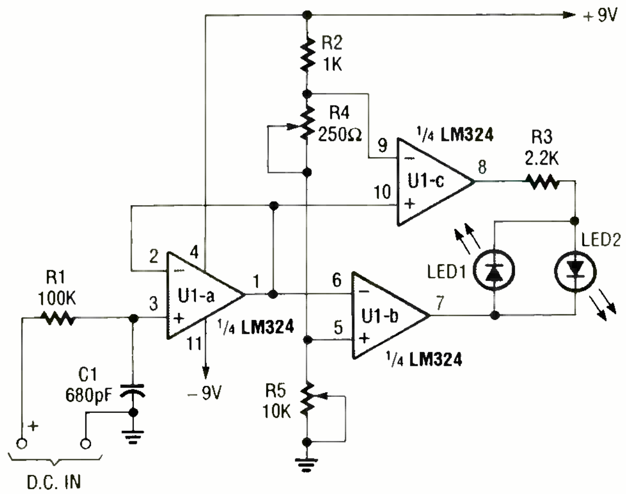


Fig. 5. The adjustable voltage monitor can be used to check whether the voltage in a circuit remains within a given range.

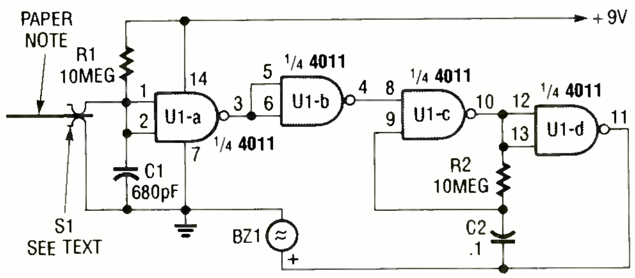


Fig. 6. The audible memo alert is designed to draw attention to memos or notes the might otherwise go unnoticed.

between the outputs of U1-b and U1-c, and are used to indicate the input voltage status. When the input voltage is within the pre-set voltage limit, both LED's remain dark. If the voltage goes up and out of the window range, LED1 lights as a warning of an over-voltage condition. On the other hand, if LED2 turns on, the input voltage has dropped below the window's lower voltage limit.

The voltage range of the window is at its maximum when R4 is set to its maximum-resistance setting and *vice versa* for the minimum-resistance setting.

AUDIBLE MEMO ALERT

Our last circuit this time around is an audible memo alert. A single quad 2-input CMOS NAND gate, a 9-volt battery, two resistors, two capacitors and a piezo buzzer connected as shown in Fig. 6 can make your next note or memo really stand out.

The first gate (U1-a) is connected to a normally closed switch made from a clothes pin and two thumb tacks. The switch is in its normally closed position when no memo is clipped between the the thumbtack contacts. When a paper note (or other non-conductive material) is placed between the two contacts of the switch, the input of U1-a is pulled high through R1. That triggers a low-frequency oscillator, comprised of U1-c and U1-d, whose output feeds pulses to a piezo sounder (BZ1) as long as the note remains in place. ■

THINK TANK

By John J. Yacono

The 558 Timer

As you might already know, I'm a pretty big fan of the 555 oscillator/timer. However, there is a timer circuit on the market that is actually more versatile than the 555 and just about as easy to use—the 558 quad monostable timer. A 558 provides as many monostable-timer spring boards in one package as four 555's or two 556's. Furthermore, the 558 monostable timer sections can be chained together (without additional support components) to produce time delays much longer than is reasonably possible with 555's or 556's (unless you use a few 555's or 556's and some additional support components).

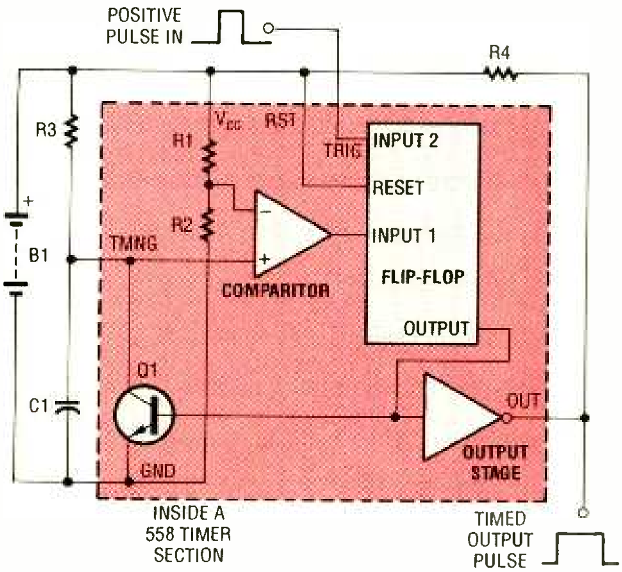


Fig. 1. In this cut-away view of a 558 timer, we show one of the four monostable circuits. Each such section requires two resistors and a capacitor to make it functional.

Two sections in a 558 can also be wired to form two astable timers that are superior to similar timers made from the 555. For example, the parts in a 558 astable circuit can be selected to provide a duty cycle from almost 0% to almost 100% (quite impossible with a straightforward astable oscillator made from a single 555 timer). The astable configuration also permits you to vary the frequency of the unit—via its control-voltage pin—without altering its duty cycle (sadly impossible with a lone 555 timer)! Also, the control voltage of a 558 timer can be varied over a wider range than possible with a 555 timer. For that reason the timing period of a 558 section can be varied over a 50-to-1 range.

The drawbacks of the chip are surprisingly few. Its timing accuracy is slightly dependent on the supply voltage, but that drawback can be overcome by using a steady supply voltage when accuracy is important. It has open-collector outputs, which are useful if you wish to connect several open-collector outputs together, but the outputs require an external pull-up resistor to produce a true high.

This month, I'll describe how the 558 functions. Next month, I'll go over some basic 558 circuits. Let's hurry up and get to the theory now and move on to some letters afterward.

THE 558 MONOSTABLE TIMER

In electronics, it is often necessary to build a circuit that will produce a high pulse that lasts for a known amount of time when triggered by a signal from some other circuit. As you probably know, such a circuit is called a "monostable timer." As mentioned, the 558 contains four such monostable-timer circuits. Since the four circuits within the chip are identical, we only need to discuss how one operates to understand the operation of the other three.

Each monostable circuit in a 558 requires two external resistors and one external capacitor in order to function. In Fig. 1, we show a cut-away view of one monostable section of the 558 chip. It is shown connected to four other components (a battery, two resistors, and a capacitor) that help it produce a pulse when triggered.

Let's discuss the parts inside the chip first. The simplest part of the chip is the resistor network composed of two resistors, R1 and R2. The network is connected between the terminals of the battery, so current flows from the battery, through both of the resistors, and back to the battery again. Almost no current "escapes" from the resistor network (almost none flows into the comparator). That means that the current flowing though R1 flows through R2 as well. Remember that when a current flows through a resistor, a voltage develops across it. The values of R1 and R2 determine the voltage that develops across R2. The values used in the chip were selected so that the voltage across R2 is about ⅔ of the voltage across both resistors (in this case, the battery voltage). That voltage is used as a reference voltage.

The reference voltage is sensed by the comparator. As many of you know, a comparator is a device that compares one voltage to another. If the voltage at its positive input is greater than the voltage at its negative input, a positive voltage will appear at its output (the pointed end). If the voltage at its positive input is less than the voltage at its negative input, zero volts will appear at its output. So the comparator compares the voltage across the capacitor (C1) with ⅔ of the battery voltage. The comparator sends the result of its test to a flip-flop circuit.

The flip-flop in the 558 is designed so that its output goes high if the output of the comparator generates a high pulse. If the trigger input connected to the flip-flop is pulsed high, the output of the flip-flop will go low once the trigger input goes low again.

The output of the flip-flop is sent to the two remaining sections of the chip: an output stage and a transistor (Q1). The output stage inverts the output of the flip-flop and presents the inverted output to the outside world, while the transistor performs a function that would be best explained by looking at the whole circuit.

When the battery is first connected to the circuit, the chip is designed so that the flip-flop output is initially high. The output stage converts that high to a low and presents that low to the outside world. The high at the flip-flop output also turns on the internal transistor. Since the transistor provides an easy path for electrons to find their way to the positive side of the battery (through R3), they don't flow into the capacitor (C1), so the capacitor doesn't charge.

If a pulse is sent to the trigger input, the flip-flop output switches from high to low. So the output stage goes high and the transistor turns off. With the transistor off, electrons start to flow through C1 and the voltage across the capacitor rises as it charges up. When the capacitor's voltage rises a little higher than the reference voltage, the comparator sends a high pulse to the flip-flop. The flip-flop output goes high, turning the transistor back on, and forcing the output stage to go low. The charge is quickly drained from the capacitor by the transistor, which once again keeps the capacitor from charging.

Notice that the current through the capacitor is limited by R3. That limits the rate at which the capacitor charges. By properly selecting the values of R3 and C1, we can set how long it will take for the capacitor to charge to the reference voltage. That means that we can set how long the output stage will be high. That time period (denoted T) is given by:

$$T = R3 \times C1$$

As mentioned before, the output of the monostable (labeled "out" in the drawing) is actually incapable of going high on its own. It can go low or just turn off (disconnect itself from the world). However, external resistor R4 provides a path to a higher potential for electrons when the output turns off, thus simulating a high output. Since R4 brings the output high when the output stage is off, it is called a "pull-up resistor."

With that out of the way we can get to the letters. Let's start off with a couple of letters left over from last month's topic (telephone circuits) before proceeding with a letter for our new topic: alarm circuits.

PHONE-LINE INTERFACE

If you wish to design phone circuits to perform various jobs, you should isolate the circuits from the phone line to avoid damage to either the phone line or your project. Figure 2 shows a phone-line interface circuit that will not only isolate your phone projects, but provide some basic phone-line handshaking as well. The ringer circuit is formed by components C3, D3, R2, and the piezo buzzer. When there is an incoming call, the AC ring signal from the phone line will appear at the tip and ring terminals and drive the piezoelectric element (BZ1). Closing switch S1 activates the relay, K1, which completes the circuit to the external phone line. The input impedance of the telephone-coupling transformer, T1, and its associated components cause the DC phone-line voltage (nominally 48 volts) to drop, so that the telephone-company equipment knows that the call is being answered. A metal-oxide varistor (MOV1), rated at 130 volts rms, is used to protect the phone circuit from damage by lightning.

Audio signals are coupled through the T1 and then C2. From there, your own custom circuits can be connected at point A and ground to do their assigned jobs. For example, you could connect the input of a speaker-driver circuit at point A to form a speaker phone. If you'd like, a DTMF dialing circuit may be con-

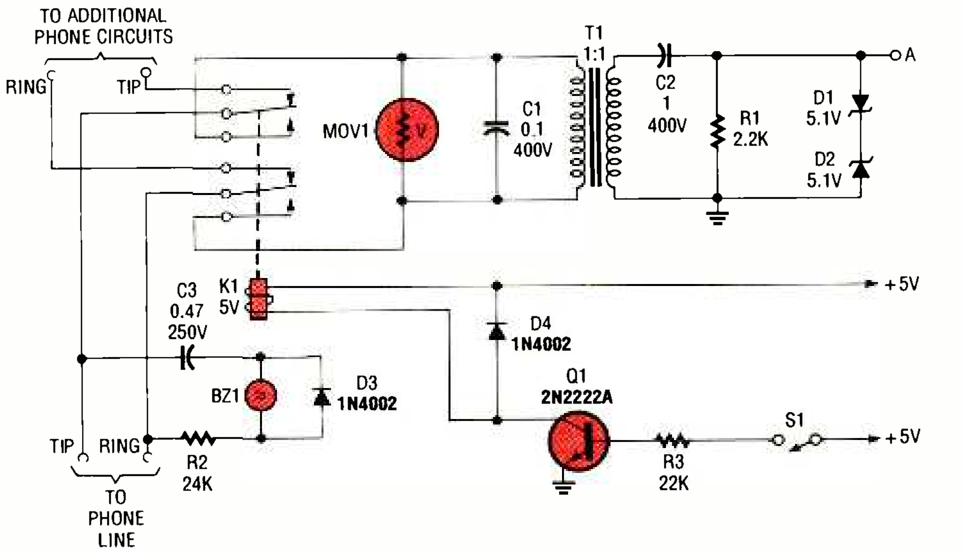


Fig. 2. If you're looking for a good telephone-project front-end, you might want to give this circuit a try. It can "ring," interrupt the telephone wiring, and isolate a project from the phone line.

nected to provide a dial-out feature, as well.

If you wish to connect more than one custom circuit to point A, keep in mind that each circuit that you add will reduce the overall impedance presented to the phone line. So be careful not to load the line down too much.

—Tony K.P. Wong, Robinson Heights, Hong Kong

That's a very nice front-end circuit. Definitely a good start for building your own feature-filled phone. If anyone builds upon this circuit please write-in; I'd like to know where it leads. Perhaps you can combine it with this next circuit:

PHONE-USE INDICATOR

Think Tank is one of my favorite columns in **Popular Electronics** because of the many different simple-to-relatively complex circuits that pop up. I have built a simple circuit that will indicate if the phone line is in use. I built it because all the phones in my house are locked out if I use the phone or modem in my computer/electronics workshop. If someone is using one of the other phones when I pick up the phone, they are cut off.

The basic circuit (shown in Fig. 3) is an LED in series with a transistor, which is used as a switch. Phone lines normally have about

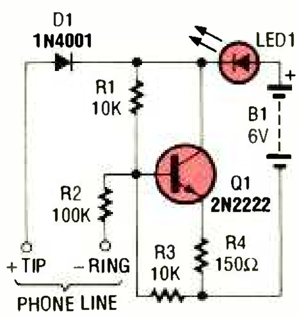


Fig. 3. This phone-in use indicator also indicates the presence of a ring signal. Just the thing for the hearing impaired.

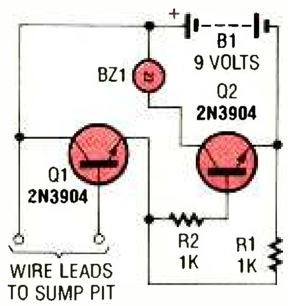


Fig. 4. You'll never be caught "all wet" after a basement flood if you use this flood alarm to give you an early warning.

51 volts DC present between the ring (red) and tip (green) wires with all the phones on hook. If a phone is picked up, the voltage drops to about 10 volts DC. If the voltage drops that low, resistors R1 and R3 bias the transistor into conduction, lighting the LED. When all the phones are on hook the current through D1, R1, and R2 is sufficient to bias the transistor into non-conduction, turning off the LED.

The load on the phone line is minimal and when the LED is off, the current drawn from the battery is essentially zero. With the LED on, the circuit draws about 7 mA. You can change the current by varying R4. Unless you talk or use your modem a lot, the batteries should last a long time. Diode D1 rectifies the 90-volt AC ring signal so that the LED will flash when the telephone rings. This could make the circuit useful to someone who is hearing impaired.

—Richard W. Washburn, Naguabo, PR

I particularly like circuits that can help the physically challenged. If I receive enough such circuits, I would like to devote a column to them. Would anyone care to contribute some circuits to help me? Now we have just enough room for one letter devoted to our new topic—alarms.

SUMP ALARM

When my sump pump failed the other day, my newly carpeted basement became the first carpeted indoor pool. Frustration from the notion that my basement flooded while I was but a few floors away motivated me to design a circuit that I call "The High Water-Level Alarm."

The circuit consists of two transistor-based subcircuits. One subcircuit (containing Q2) acts as an electronic switch and the other subcircuit acts an interface between the switch and any water that may be present in the sump pit. When water is present, it acts as a 150k path to conduct current to the base of Q1. Transistor Q1, in turn, provides bias current to Q2, which grounds and activates the buzzer.

Well Mr. Yacono, I hope my circuit is worthy of your column. I cannot wait to get "The Book."

—Mario Bonsignore, Baltimore, MD

I think it is very worthy. In fact, I have only one problem with your letter. This is an informal column, so everyone can just call me John.

For anyone interested, the circuit is a limited-gain Darlington configuration. If you were to short out the two resistors, the circuit's gain would be equal to the gains of the transistors multiplied by one another.

Well, until next time, please send your circuit creations to Think Tank, **Popular Electronics**, 500-B Bi-County Blvd., Farmingdale, NY 11735. ■

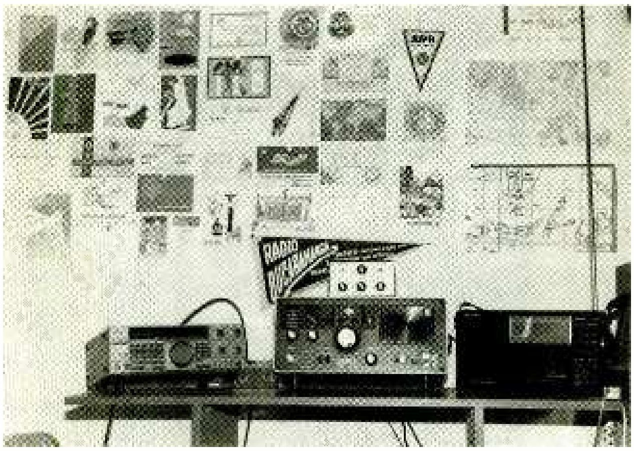
DX LISTENING

BY Don Jensen

Into the Mailbag

Every once in a while, someone asks me what's the best part of your job. The answer is easy. The best part of writing this column is reading the mail! And there's more than one good reason for that.

First, your letters to *DX Listening* tell me what I'm doing right, and, more important, what I am doing wrong. That helps me to do more of the former and less of the latter in future columns. Second, it gives me the opportunity to help some of you who have questions about some of the things I've learned over the years. But finally, I find the mail fascinating because of the things I learn from you.



Clifford Nadiger copies shortwave fax transmissions using the setup shown here. His RadFax decoder sits atop an aging Yaesu FRG-7 receiver (center). They are flanked by a Kenwood R-500 at the left and a Radio Shack DX-440 at the right.

For instance, here's a letter I got recently from Clifford A. Nadiger of Copperas Cove, TX telling about his interest in copying facsimile—or simply fax—on shortwave. Almost everyone today is familiar with the typical office fax machine, sending graphic messages across the miles by ordinary telephone links. Not surprisingly, the same sort of signals can be sent via radio. Here's what Cliff has to say about that:

"I have spent the last 35 years employed in the electronics field. I have built many electronic projects. Over a year ago, following plans in the November, 1990 issue of **Popular Electronics**, I built the RadFax, an RTTY (radioteletype) and radio-facsimile decoder.

"The unit will work with a computer through the printer port or the RS232 port. I'm using the latter, with a Scott 80286 computer, and the results are excellent! The software, RadFax 2, is from Australia and works great. I am able to copy RTTY, CW (code), and fax signals. Fax, however, is my favorite, particularly the meteorological information that goes out on the shortwave frequencies. I've copied weather maps from most everywhere in the world. It's nice to see projects like the RadFax decoder; I hope they continue!"

Cliff sent along examples of weather maps and test charts he's copied on shortwave with his fax-receiving setup. Thanks!

MORE LETTERS

Since the mailbox is bulging, lets get to some more of your letters, as space permits.

"Just a note to let you know how much I enjoy the column in **Popular Electronics**," writes Don Fredrickson of Cedar Rapids, IA. I've been hearing a station on 11,855 kHz, weekdays between 2300 and 0400 UTC. It identifies itself as *Radio Slaboda*. The language is foreign to me. Is this a new station somewhere?"

It would seem that what you are hearing is the U.S. sponsored *Radio Liberty*, the sister station to *Radio Free Europe*, which broadcasts from Germany to Russia and the other Commonwealth nations that made up the former U.S.S.R. It identifies in Russian as *Goverit Radio Svodoba*, in Belorussian as *Hawortys Radyio Svodoba*, and in Ukrainian as *Hovoryit Radio Svoboda*. *Radio Free Europe*, which beams programs to other eastern European countries, calls itself *Radio Svobodna Evropa* in Bulgarian, and *Radio Wolna Evropa* in Polish.

Next, here's a note from Edwin Gardiner of Warwick, RI. Edwin writes: "I have just bought a receiver and enjoy it very much. But since I only speak English, I often don't know what a program is about or where it is coming from. "Can you tell me of any DX listening clubs in the East Coast area so I can keep up on the world broadcasts in English? I'm sure you can help me in some way. Keep up the good work and I look forward to more of your columns in **Popular Electronics**."

You've got this one figured out, Edwin. Joining a good shortwave listening club is a great way to keep current on English-language programming schedules, as well as picking up hints and tips on SWL'ing in general.

Two clubs, one headquartered in Pennsylvania, the other in Ontario, Canada (whose bulletins I read without fail each month) are the North American Shortwave Association (NASWA) and the Ontario DX Association (ODXA). Regular readers of this column will note that I frequently pass along information originating with and credited to those clubs.

A one-year membership to NASWA costs $25. Their address is 45 Wildflower Rd., Levittown, PA 19057. ODXA's annual membership for Canadian residents is $30.76 in Canadian funds, or $26 in U.S. dollars for those living in the United States. Their address is P.O. Box 161, Station A, Willowdale, Ontario, Canada M2N 5S8. You can get a sample copy of NASWA's *Journal* or ODXA's *DX Ontario*, both hefty, monthly news magazines for $2 (U.S.) each.

HELPING HANDS

Who can offer a bit of help to these readers with receiver-related questions?

Wesley Dempsey (P.O. Box 50019, Philadelphia, PA 19132) says he has a Sangean ATS-803A that his girlfriend gave him for his birthday. He'd like to hear from others using this receiver, especially in conjunction with an active or trapped dipole antenna.

Clarence E. Spragg (6801 37th Ave., Sacramento, CA 95824) would like a photocopy of a schematic for a vintage receiver he found at a local flea market: The Allied Radio SX-190.

Your letters with questions or comments about shortwave listening, your recent receptions, and photos of your listening "shack" are always welcome. Send them to me at *DX Listening*, **Popular Electronics**, 500-B Bi-County Blvd., Farmingdale, NY 11735.

BITS AND PIECES

Here are some bits and pieces of shortwave news:

Radio Kuwait, silenced when Iraq invaded that tiny sheikdom in 1990, finally returned to the air and is heard with strong signals from a 500-kilowatt shortwave transmitter on 15,505 kHz. It is programming to Europe and North America from 1800 to 2300 UTC.

Also in the wake of the Gulf War, U.S. and Canadian SWL's again can hear Iraq's foreign service on shortwave. *Radio Iraq International's* North American service has been noted at 2315 to 0115 UTC. There is an English segment, but its timing has been irregular within this two-hour block.

Friends of Ian McFarland, former producer and presenter of the long popular but now defunct *SWL Digest* program on *Radio Canada International*, can hear his mellow voice on *Radio Japan*. Ian turns up on the *NewsRound* program during the station's 1100 UTC North American transmission on 6,120 kHz. Ironically, this signal is being relayed by Canadian transmitters.

Radio Prague International, one of the most stable shortwave operations in eastern Europe, changed its name recently to the more appropriate *Radio Czechoslovakia*.

DOWN THE DIAL

Here are some stations, times, and frequencies to keep you tuning:

ABU DHABI—*Radio Abu Dhabi*, broadcasting from the Persian Gulf region, can be heard opening in English at 2200 UTC on 11,965 kHz. The station is reported to operate in parallel on 7,215 and 9,600 kHz.

AFGHANISTAN—Once a rather common shortwave logging in North America, *Radio Afghanistan's* transmitting equipment has reportedly badly deteriorated since the departure of Soviet military forces. But a tentative west-coast logging of that station, broadcasting in one of the Afghan languages, was recently reported on 4,740 kHz at 1340 UTC.

BOUGAINVILLE—The conflict between the insurgent Bougainville Revolutionary Army and the government of Papua New Guinea on that Pacific isle has got to be the least known civil war going on in the World today. The rebels are on the air on 3,880 kHz with *Radio Free Bougainville*, a station logged in Australia. Other reported frequencies, which might be audible in North America, are 21,450 and 21,500 kHz. Among the broadcast times mentioned are 0100, 0400, 1300, 1600, and 2300 UTC.

BULGARIA—*Radio Sofia* broadcasts in English from 0400 to 0615 UTC on 11,720 and 11,765 kHz. Two other possible frequencies are 7,670 and 11,660 kHz.

MEXICO—You can find *XEUW*, in Vera Cruz on 6,020 kHz at around 0400 UTC. Though the programming is all in Spanish, it's a good bet for some great Mexican music.

UKRAINE—Unlike the schedule chaos with other broadcasters within the Commonwealth of Independent States, *Radio Kiev's* English-language service to North America thankfully seems stable during the 0100 to 0200 UTC hour. Frequencies? They're not so dependable; some to try include 7,240, 9,800, 9,860, 15,180, 17,605, and 17,690 kHz. ■

Credits: Arthur Cushen, New Zealand; Jim Renfrew, NY; Mikew Fern, CA; Dan Ferguson, VA; North American SW Association, 45 Wildflower Rd., Levittown, PA 19057; World DX Club, c/o Richard D'Angelo, 2216 Burkey Drive, Wyomissing, PA 19610

By Joseph J. Carr, K4IPV

Tools For Elmers and Elmees

Megacool radio weasel, and fellow technical writer, Harry Helms (AA6FW) has committed heresy, but like Galileo and Copernicus will eventually be proven right. Unlike those other luminaries, Harry will probably live to see his own vindication. Why? After reading Harry's new book, *All About Ham Radio* (DX/SWL Press, HighText Publications, Inc., 7128 Miramar Road, #15, San Diego, CA 92121), you'll know why. The book, as its title suggests, is a much needed addition to ham-radio literature.

All About Ham Radio deals with a lot of technical, regulatory, and operating matters. The book appeals to both the old timer and the newcomer because it covers the subjects in appropriate depth, without the technical pompousness seen in a lot of ham books. Overall, it's a minimalist approach to the subject: It's just plain talk, that's all—and all useful with no fluff and no fat. As a reader of this column, you undoubtedly know that I disdain the solemn, nearly somber, tone of many technical articles and books. So Harry's style of writing appeals to me, as it should also appeal to you.

The Harry Helms (AA6FW) book, All About Ham Radio *(DX/SWL Press, HighText Publications, Inc., 7128 Miramar Road, #15, San Diego, CA 92121), is a much needed addition to ham-radio literature, dealing with technical, regulatory, and operating matters.*

Helms knows when to be serious, and when to inject a little humor into the technical subjects he writes about. While too much humor is sometimes out of place (like when being attacked by a pack of Rotweilers or Pit Bulls, one should not be tempted to see the humor inherent in the situation), it is used subtly, and in a refreshing manner.

All About Ham Radio is a useful—dare we call it evangelism—tool for introducing ham radio to people who have more than a casual interest. The ham-radio hobby grows when each ham-operator "Elmers" (ham jargon for "mentor") others. Most ham operators got into the hobby because of someone else, and it is a role that we should all perform from time to time. I recommend Harry Helms' book to people who want to either use it themselves, or pass it on as a gift to people being Elmered (are they "Elmees?").

So how did Harry Helms commit heresy in his book? It's really simple. Harry, like myself, shares the view that the no-code technician's license is a good thing for amateur radio as a whole. And, of course, it is a darn good thing for those who don't want to learn the Morse code required by the other classes of ham license. It is heresy because some of the old timers in the hobby, and even some of those in positions of leadership, are frothing at the mouth over the fact that some newcomers don't have to learn code like we did.

That is Dark Ages thinking. Harry's big sin, with a capital S, is that he expresses the heretical idea that you can be happy as an electronic clam getting a no-code ham license and chatting away on 2-meters FM for the rest of your natural life . . . rather than upgrading, via Morse code, to other privileges. Horrors!

Why is Helms right in his heresy? Why will he eventually be vindicated? Look at the Japanese experience. Although our F.C.C. was recently reported as being unable to tell for sure how many ham licenses are still out here, it's becoming obvious that there are more ham operators in Japan than in the USA—1,000,000 by some counts—and the number is climbing faster than our own numbers. It seems that a lot of the Japanese increase has been due to their own no-code license.

The Japanese no-code license is structured similar to our own (after all, both have to comply with the ITU treaties), so it is quite possible to obtain a no-code equivalent to our own Technician-Class license . . . and stay there until it blizzards in Tripoli. But the Japanese no-coders are upgrading of their own volition to higher (code) classes because they want to obtain the higher privileges. No pressure, no fuss, no muss.

Harry's right: Those that want to upgrade will do so in large numbers (probably more than our pre-no-code rates), and some won't, and that's okay.

CODE HELPS

Okay, so you believe that hams *should* know Morse code and go for a General, Advanced, or Extra Class ham ticket. So how does one do it? Having taught code in several classes over the years, I am convinced that anyone can do it. There are a number of practice aids that you can use to build speed.

First, listen to the ARRL station, W1AW, which transmits Morse-code practice every evening. Write to ARRL headquarters (225 Main Street, Newington, CT 06111) for details of the W1AW schedule (which changes slightly over the year). Second, there are code-practice tapes. ARRL makes some, as do numerous vendors. Nearly all ham dealers sell such tapes. They are really great and low cost. But all contain a hidden trap.

When I was working toward a General-class license, they didn't have code tapes; however, there were code-practice phonograph records, which had the same defect. Using those records, my speed built, and built, and built. Wow, did I think I knew Morse code. But when I got different records, or tuned into W1AW, my speed dropped tremendously. It seems that I'd memorized the recordings. My apparent speed was really a measure of my recall and not code proficiency. Use the tapes, but watch out for that trap.

Third, there are a number of Morse-code computer programs available. Most of them seem to run on Commodore-64 machines (which sort of became the *de facto* ham standard), but an increasing number of Morse-code computer programs are available for MS-DOS and Apple II machines. Try GGTE Morse Tutor (GGTE, P.O. Box 3405, Newport Beach, CA 92659).

A more comprehensive product is QSO Tutor (available for both MS-DOS and Macintosh machines). It not only has a code-tutor function, but also drills the user on the entire question set for the class of license being sought. QSO Tutor is available from QSO Software (208 Patridge Way, Kennett Square, PA 19348).

And don't forget the "sending" end of Morse-code instruction. Part of code is the key, whose use is probably one of the big mysteries of ham radio (judging from the number of bad "fists" on the bands). A straight key and buzzer is a reasonably low-cost, code-practice device, and a "code-practice oscillator" (CPO)—with a purer tone—and straight key won't exactly break the bank. Of course, once you get on the air, if you elect to use CW, then it's likely that you'll want to upgrade to an electronic keyer and paddle key. ■

SCANNER SCENE

By Marc Saxon

Tuning in the GMRS

Often overlooked in the shuffle of things to monitor on a scanner is the General Mobile Radio Service (GMRS). We were reminded of it when we got a look at a neat little handheld that operates in that band. It occurred to us that our county fire service even makes use of GMRS. You might want to monitor there, or even think about obtaining an FCC license for GMRS operation and using it yourself.

The band runs from 462.55 to 462.725 MHz, with channels spaced at 12.5-kHz steps. (Forget all that cockeyed information in the 1992 *Police Call* that shows 25-kHz GMRS spacing!) Repeaters are allowed in that band, with the inputs from 467.55 to 467.725 MHz.

We have noted that some frequencies appear to be more heavily used than others. The most likely reason for this is that those popular frequencies correspond to channels that are supplied in the more popular transceivers. For instance, the Fanon Courier Procom handhelds can be obtained with the following simplex frequencies factory-installed: 462.5625, 462.6125, or 462.6375 MHz. The following repeater channels also can be factory installed: 462.575, 462.625, and 462.675 MHz. Note that 462.675 MHz is used by many REACT teams for their operational communications.

Two popular Business Radio Service low-power simplex channels are also available in the Fanon Courier Procom units. Those are 464.50 and 464.55 MHz.

Qualifying for an FCC GMRS license is easy, and so is obtaining one. About all you need is to be a U.S. citizen capable of filling out an application form that consists of a couple of questions. Then you have to get the equipment. Since it is UHF-FM gear, it's pricier than CB, but you get to use repeaters and the quality is better than on 27 MHz. Take a listen on the GMRS band and you just might find it to your liking.

For more information on the 2-watt, 2-channel Fanon Courier GMRS handheld units, contact the company at 14811 Myford Road, Tustin, CA 92680.

The 2-watt, two-channel Courier Procom UHF-FM transceiver is ideal for use on the General Mobile Radio Service (GMRS).

MARINE BAND CHANGES

In a few major port areas, the U.S. Coast Guard has established what it defines as Vessel Traffic Services (VTS) areas. A VTS system is used as an advisory service to coordinate vessel movement and prevent ship collisions and groundings in busy harbors. The Coast Guard has been conducting a voluntary VTS in San Francisco on VHF-FM Channel 13 (156.65 MHz). Now the USCG is changing that from a voluntary system to one in which participation is mandatory. It appears that when the San Francisco VTS goes mandatory, that harbor's VTS will switch over from VHF-FM Channel 13 to Channel 14 (156.70 MHz).

Nationally, VHF-FM Channel 16 has long been designated for calling and distress purposes. The problem has been that the channel is being misused by too many recreational boaters who think that "calling" includes the right to hold conversations on the channel. That abuse has tied up the channel in local areas to the point where, at times, it would be impossible to use it for a distress call.

The Coast Guard now wants VHF-FM designated exclusively for distress calls. Vessels calling the USCG on that channel make their initial contact there, and then switch over to Channel 22 (157.10 MHz) to explain the problem. Vessels with non-distress traffic that are simply seeking to call another vessel are now asked to stay off Channel 16. Such calls are now supposed to be made on VHF-FM Channel 9 (156.45 MHz), with the vessels switching to one of the several available working channels once the contact has been established on Channel 9.

HOORAY FOR HOLLYWOOD!

We received a letter from Larry Rasmussen of California, who is star struck. Better than that, Larry is a *paparazzi*, a freelance photographer who takes celebrity snapshots and sells them to the media. Larry tells us that when he shows up at major gatherings in Tinsel Town, there usually are very efficient private plain-clothes security people on duty. Their job is to keep the public away from the celebrities. Several times he has noted vehicles with the markings "West Coast Detectives" near those events, so he assumes that is one of the security companies on the job. Since the security people use two-way radios, Larry thought it would be interesting to listen in with his portable scanner while he attempts to get shots ahead of the other *paparazzi*. Larry asked if we knew what frequency to monitor.

From what our sources tell us, "West Coast Detectives" is a top Los Angeles-area company in the celebrity-protection business. We understand that their security people use hand-helds that operate on 464.45 and 464.70 MHz.

A GOOD IDEA, AFTER ALL

Last February, we mentioned the idea of using a vertically mounted UHF-TV yagi for long-range scanner reception. We pointed out that readers should be aware that TV antennas are made for use with 300-ohm twinlead. Even when used with a standard TV 300-to-75-ohm matching transformer, there would still be a (1:5:1) impedance mismatch between the transformer output and the 50-ohm scanner input.

That brought an informative letter from Allan H. Kaplan, W1AEL, of Ashburn, VA. Allan is an electronic engineer and engineering consultant. He basically said that we were theoretically correct in mentioning that to satisfy any purists among our readers who otherwise might have pointed out the mismatch.

On the other hand, from a strictly practical standpoint, in a receive-only application (such as for the typical commercially manufactured scanner), that mismatch is "absolutely negligible," Allan wrote. He thought that anyone who generally liked the UHF-TV antenna idea for a scanner shouldn't be dissuaded from using it for fear that the mismatch might detract from the benefits of the antenna in a scanner application. He suggests that if there is a long run between the antenna and the scanner, 300-ohm twinlead should be used from the antenna, with the matching transformer installed right at the antenna input of the scanner.

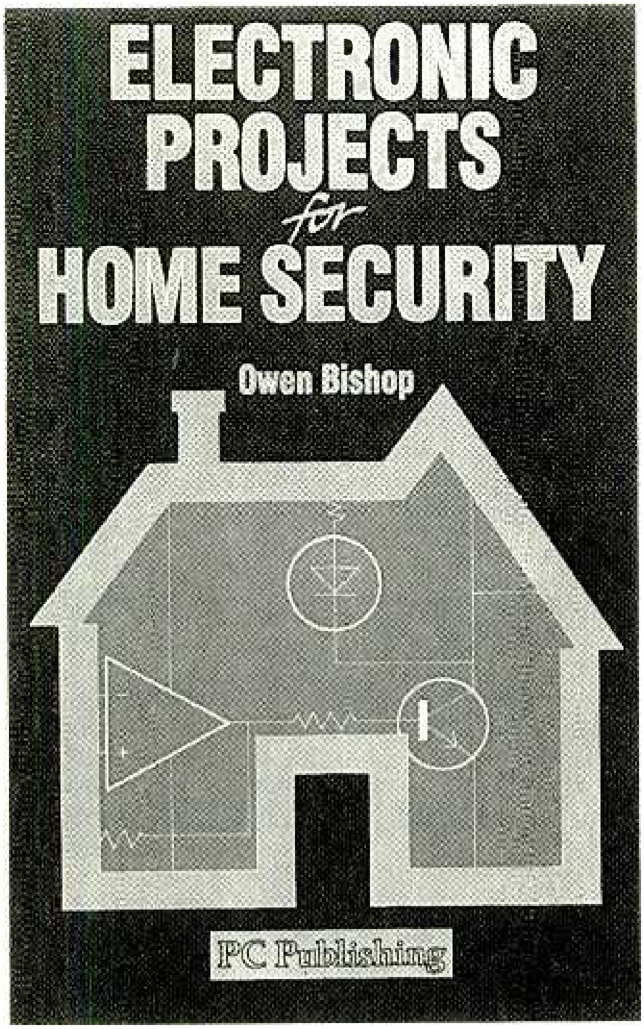
Thanks, Allan, for your thoughts and guidance in this matter! ■

ELECTRONICS LIBRARY

Electronic Projects for Home Security

by Owen Bishop

A house, to many people, represents not only comfort and shelter, but also their largest financial investment. So it's no wonder that home security systems are becoming increasingly important. This book deals with several aspects of home security—intruder, fire, and flood protection—with the emphasis on how to make the best use of home-brewed electronic devices. The book presents 25 construction projects to help the reader secure his home. Those projects range in complexity from a single-door protection circuit that can be built in an hour or two to a sophisticated multi-channel security system. For each project, the principles of operation are explained and construction details, including circuit diagrams and complete building and troubleshooting instructions are provided for each project. In some cases, suggestions for adapting a project to special requirements are included as well. The projects are suitable for beginners. Even the multi-channel system starts at a simple level and can be expanded later as the builder's experience grows. Because all of the projects are powered by battery or from a ready-made mains adapter, they are entirely safe. The index includes tips about construction techniques and tool use.



Electronics Projects for Home Security (order number PCP115) costs $10.00 plus $2.50 shipping and handling and is sold by Electronics Technology Today Inc., P.O. Box 240, Massapequa Park, NY 11762-0240.

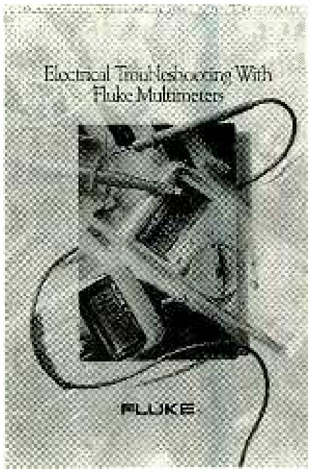
CIRCLE 97 ON FREE INFORMATION CARD

ELECTRICAL TROUBLESHOOTING WITH FLUKE MULTIMETERS

from John Fluke Mfg. Co., Inc.

Several test techniques for troubleshooting electrical systems using Fluke digital multimeters are outlined in this 20-page booklet. It includes sections on DMM safety and protection, basic electrical measurements, troubleshooting with min/max recording, power measurements and power factor, wiring and grounding, engine-driven generators, motors, and harmonics. Each section contains clearly written explanations and helpful illustrations.

Products used in the examples include the Fluke 70 and 20 Series II, the new Series 10, and the Series 80 digital multimeters, all of which offer AC and DC volts, ohms, diode test, continuity beeper, and auto-range with user-selectable manual range. Accessories used in the examples include



current/power probes, test lead sets, and current probes.

Electrical Troubleshooting with Fluke Multimeters is free upon request from John Fluke Mfg. Co., Inc., Service Equipment Group, P.O. Box 9090, Everett, WA 98206; Tel: 800-87-FLUKE.

CIRCLE 93 ON FREE INFORMATION CARD

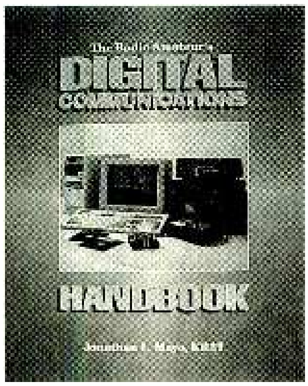
THE RADIO AMATEUR'S DIGITAL COMMUNICATIONS HANDBOOK

by Jonathan L. Mayo, KR3T

The diversity that makes the world of amateur-radio digital communications so interesting also makes it difficult to understand all of the wide variety of

modes that exist for almost any operating situation. Today's multimode digital controllers, which contain several digital modes in one unit, require users to have knowledge of several modes—their strengths, weaknesses, and comparative value. This book is intended to provide a one-stop source of such information. In its ten chapters and several appendices, all the major digital modes—CW, Baudot RTTY, ASCII RTTY, AMTOR, packet, SSTV, and fax—are introduced and explained.

Before getting into the specifics of each major mode, the book offers an introduction to the basic concepts of digital communications and a history of the various modes. Later chapters cover how to set up a digital station, provide reviews



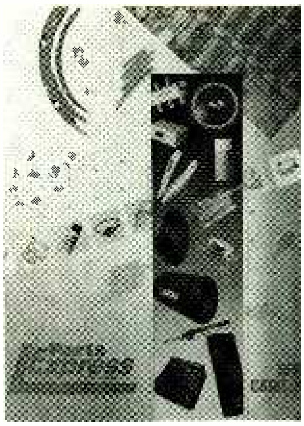
of various available digital interfaces and accessories, and explore future developments in amateur digital communications. Seven appendices provide a variety of related information, from code charts to operating frequencies, and sources of additional information are outlined in a bibliography.

The Radio Amateur's Digital Communications Handbook costs $14.95 and is published by TAB Books, Division of McGraw-Hill Inc., Blue Ridge Summit, PA 17294-0850; Tel. 1-800-822-8138.

CIRCLE 98 ON FREE INFORMATION CARD

1992 CATALOG
from Parts Express International Inc.

Geared toward professionals in the electronics industry as well as technical hobbyists, this 148-



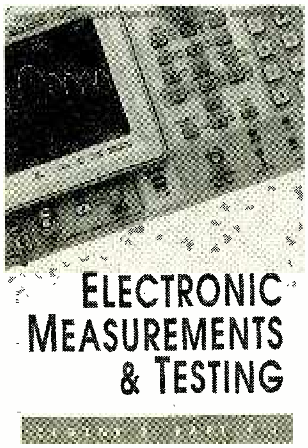
page catalog contains a wealth of electronic parts and accessories. Featured are speakers and audio accessories for home and car, CATV- and VCR-repair parts and accessories, semiconductors, tools and technical aids, computer accessories, chemicals and solvents, telephone products, wire, connectors, instructional books and videotapes, and arcade-game parts.

The 1992 Catalog is free upon request from Parts Express, 340 East First Street, Dayton, OH 45402; Tel: 1-800-338-0531.

CIRCLE 92 ON FREE INFORMATION CARD

ELECTRONIC MEASUREMENTS AND TESTING
by Eugene R. Bartlett

With an emphasis on the practical use of today's test instruments, this book provides practicing professionals and advanced hobbyists with sound guidance on measuring the parameters and performance of



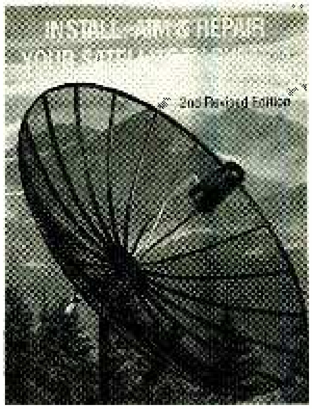
electronic components and systems. It examines the various types of analog and digital test instruments, including their development to present-day standards and configuration for a variety of uses. Readers are lead step-by-step through test procedures, system tests, and performance verification for different types of systems, including audio-frequency, radio-frequency, television, microwave, satellite, radar, fiber-optic, and cable-communication systems. Also covered are digital systems, computers, and microprocessors. All of the test procedures are clearly outlined, fully diagrammed, and supplemented by tips and techniques that can improve the speed and reliability of operations. The hands-on desktop reference addresses the special problems that might arise from the testing of specific systems and introduces proven methods for checking and calibrating test instruments to ensure more consistent and accurate results using those instruments.

Electronic Measurements & Testing costs $39.95 in hardcover and $27.95 in paperback and is published by McGraw-Hill, Inc., 1221 Avenue of the Americas, New York, NY 10020; Tel: 1-800-2-MCGRAW.

CIRCLE 96 ON FREE INFORMATION CARD

INSTALL, AIM & REPAIR YOUR SATELLITE TV SYSTEM: 2nd Revised Edition
by Frank Baylin with Brent Gale

Written specifically for home satellite-TV system owners who have curious natures and some basic "do-it-yourself" abilities, this book sets out to prove that it is not difficult for such individuals to install, repair, and maintain their own systems. The book is divided into three general sections. The first explains how a satellite-reception, or TVRO (television receive-only) system works. In the second section, the general methods that can be used to install a satellite-TV system are outlined. When necessary, the



background theory needed to understand how each component works is included. The third section presents a general and powerful method for troubleshooting and repairing any type of satellite-TV system. Satellite systems, like automobiles, require regular tune-ups and routine maintenance, and those procedures can be performed even by a non-technical person. The book also provides a reference section in which books recommended for further reading are described for the interested reader.

Install, Aim & Repair Your Satellite TV System costs $10 plus $3 shipping and handling and is published by Baylin Publications, 1905 Mariposa, Boulder, CO 80302; Tel: 303-449-4551; Fax: 303-939-8720.

CIRCLE 91 ON FREE INFORMATION CARD

1992 SHORT-FORM CATALOG
from Protek, Inc.

More than 55 advanced-design, money-saving test instruments are featured in this six-page, condensed short-form catalog. The easy-to-use booklet provides detailed explanations of product functions, features, and specifications in such categories as oscilloscopes, multimeters, panel meters, portable and bench DC power supplies, etc.

The 1992 Short-Form Catalog is free upon request from Protek, Inc., P.O. Box 59, Norwood, NJ 07648; Tel: 201-767-7242; Fax: 201-767-7343. ■

CIRCLE 90 ON FREE INFORMATION CARD

BACK-UPS 250

(Continued from page 26)

significantly or quits altogether, the sensing circuitry in the Back-UPS 250 instantly fires up the inverter and activates a relay. The inverter produces 120 VAC at 60 Hz, (although a 220–240-VAC 50-Hz version is also available), which is supplied to the sockets via the relay. Since a typical computer power supply will continue to provide current for 8 to 20 milliseconds after an outage, and the relay switching takes place in just a few milliseconds, the computer will keep on operating as if nothing happened.

Features. The Back-UPS 250 has a beige-colored case that measures 3.4 inches wide, 6 inches high, and 13.1 inches deep, and it weighs only 10 pounds. It comes with a 32-page detailed and well-illustrated Owner's Manual.

The front of the unit has an on-off switch that glows red when the unit is on and AC line voltage is present. The back panel has two standard 3-prong 120-volt sockets, a "Site Wiring Fault" LED, a push-to-reset circuit breaker, and four tiny switches. The sockets are marked "For Computer Use Only," but more on that later.

The fault LED will light if your source power is wired incorrectly, such as no ground, or reversed hot and neutral wires. If the power requirements of your equipment are much greater than the Back-UPS 250 capacity, the circuit breaker trips and the unit switches to inverter operation for a short time; if the overload is severe, the UPS emits a loud tone and shuts down to prevent its destruction.

The four rear switches can be set to prevent changeover to the internal inverter during chronically low power-line times. The specifications indicate the unit can be set to trip over a range of 88 to 103 VAC. If short power interruptions are common in your area, one of the switches can be used to defeat the normal 5-second-interval beeps that notify the user when the unit transfers to internal power.

Significant surge and spike protection is provided, as well as full-time suppression of EMI/RFI (electromagnetic interference/radio-frequency interference). The battery is a maintenance-free lead-acid, sealed, leakproof type with a typical service life of 3-6 years, and a recharge time of 6 to 10 hours. The Back-UPS 250 has a 2-year warranty, including the battery.

Setup and Use. Using the Back-UPS 250 is easy. Simply plug your computer and monitor power cords into the back of the Back-UPS 250, then plug the 250 into a wall receptacle that is **not** switched. Turn on both the computer and monitor and then turn on the Back-UPS 250; that way the 250 can be used as an on/off switch for both. Incidentally, your printer should **not** be plugged into the Back-UPS 250, since some printers (especially laser printers) can draw a lot of power for short periods.

For more information on the Back-UPS 250 or other APC units, contact the manufacturer directly, or circle number 119 on the Free Information Card. ■

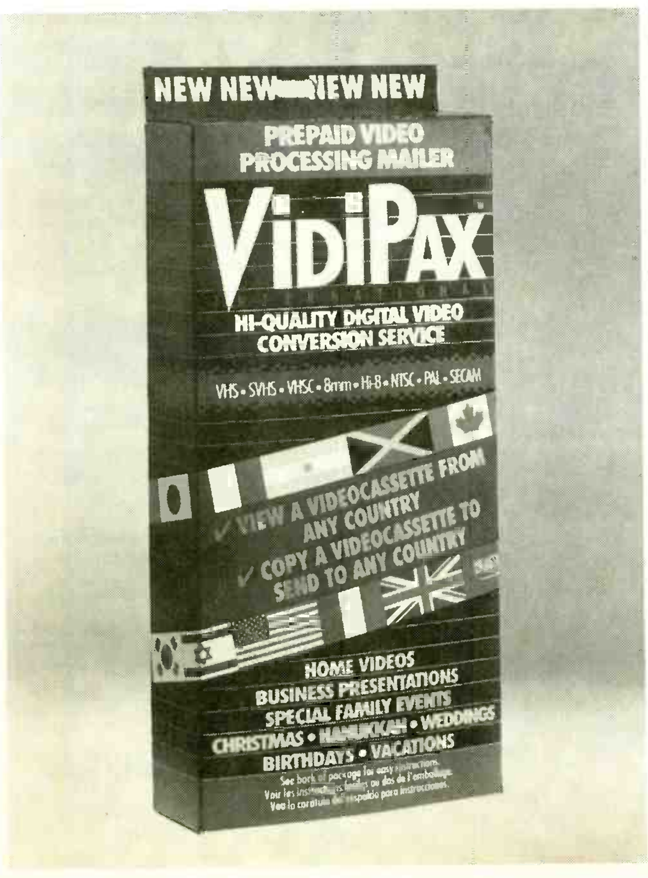
NEW PRODUCTS

NTSC/PAL/ SECAM Video-Conversion Mailers

With three different color-television standards in use in various parts of the world, videotapes made in the United States (using the NTSC standard system) must be converted before they can be replayed on PAL or SECAM VCR's in foreign countries, and *vice versa*. Consumers generally had to search for professional video service bureaus that typically charged between $70 and $100 per hour for conversions. The *VidiPax International Mailer* videotape processing service simplifies matters by allowing consumers to mail in their tapes for conversion. The mailer's basic cost covers a one-hour conversion as well as return shipment of both the original and the converted tape. Consumers can also opt to convert between different types of tape—for instance, standard VHS videotape to 8mm tape—for no additional charge. The consumer doesn't even need to know the type of system used in the country to which they are sending the tapes; by noting the country on the order form, VidiPax will determine the proper standard to use in transferring the tape. Using the enclosed order form, which is printed in English, Spanish, and French, additional time and duplicate tapes can be ordered.

The VidiPax International prepaid mailer costs $39.95, additional conversion time costs $7.50 per hour, and duplicate tapes cost $15 apiece. For additional information, contact VidiPax, P.O. Box 2, Eldred, NY 12732; Tel: 914-557-3600.

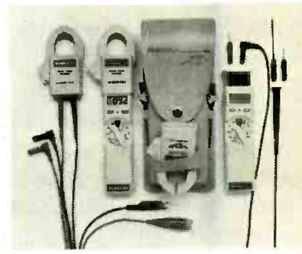
CIRCLE 101 ON FREE INFORMATION CARD



HIGH-RESOLUTION DIGITAL MULTIMETER

Developed in direct response to needs expressed by field-service technicians, the *HS24 "Stick"* digital multimeter from *Fieldpiece* adds ranges needed to allow the DMM to display resolution to 0.1 amps AC and 0.1° using AC current clamps and temperature converters. That additional resolution can be important for any technician who measures current on equipment consuming less than a few kilowatts or who needs to measure temperatures within a hundred degrees of zero.

The small (7¼ × 2 × 1-inch), rugged instrument combines the functions of a digital multimeter, a voltage checker, a capacitance meter, a continuity checker, and a current-clamp meter in a fully sealed, drop-proof, contamination-resistant housing. Besides the 200-mVAC and 200-mVDC ranges added for high resolution, the HS24 measures AC voltage to 750 volts, DC voltage to 200 volts DC, capacitance to 200 μF, and resistance to 2000 ohms. Also included are a continuity beeper, a hi-voltage indicator, and a HOLD button to freeze the reading. Unlike other DMM's, the jacks come out of the HS24's top to accept probe



tips, test leads, alligator clips, or an accessory current clamp head.

The HS24 is also available in a kit (*HS24K11*) that contains everything needed for quick and easy measurements in the field: the HS24 meter; a leather case; deluxe test leads with removable probe tips and probe handles that contain a female banana jack; long, insulated probe tips that plug directly into the meter or into the test-lead probe handles; one large and one small alligator clip, connected to a 90° sleeved banana plug, that plug into the test leads for a 4-foot ground lead; and a 300-AC amp ACH current clamp head that fits directly on the DMM, so that the unit can be used as a one-piece clamp meter.

The HS24 "Stick" digital multimeter and the HS24K11 kit cost $99 and $159, respectively. For more information, contact Fieldpiece Instruments, Inc., 8322B Artesia Blvd., Buena Park, CA 90621; Tel: 714-992-1239; Fax: 714-992-1239.

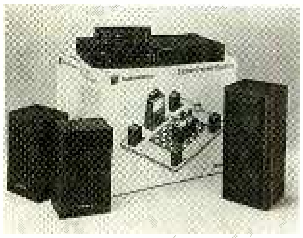
CIRCLE 102 ON FREE INFORMATION CARD

SURROUND-SOUND PACKAGES

Two pre-packaged surround-sound systems from *AudioSource* each provide everything needed to enjoy surround sound at home, within minutes of opening the box. The top-of-the-line *SS 3001* features the SS Three/II surround-sound processor with built-in 30 × 30-watt center- and rear-channel amplifiers and a full-function wireless remote control.

The processor uses Analog Device's new-generation Dolby Pro Logic chip with bipolar CMOS logic, which provides wide dynamic range and low harmonic distortion and background noise and is the only Pro Logic IC made with an auto-balance function. The *SS 4001* surround-sound system features the remote-controlled SS Four processor, which also features the Pro Logic IC, and boasts two built-in 24-watt amplifiers for the rear and center channels. Both processors feature various operating modes, including Dolby, Hall, and Matrix; an adjustable digital time-delay circuit; and a subwoofer output with variable level control and adjustable crossover. The SS Three/II features Dolby 3 for use when only the three front channels are needed.

Each system also includes the VS-One video-shielded center-channel speaker, which places the dialog into the center sound stage. To make the most of the rear-channel sound effect, a pair of LS Ten/A acoustic suspension speakers is also included. Rounding out the package are RCA interconnect cables, 100 feet of 18-gauge speaker wire, and complete instructions.

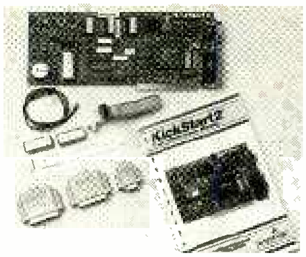


The SS 3001 and SS 4001 surround-sound systems have suggested retail prices of $579.95 and $499.95, respectively. For more information, contact AudioSource, 1327 North Carolan Avenue, Burlingame, CA 94010; Tel: 415-348-8114; Fax: 415-348-8083.

CIRCLE 103 ON FREE INFORMATION CARD

PC DIAGNOSTIC TOOL

A cost-effective, multi-function diagnostic tool designed for use with any PC, *Jensen's KickStart*



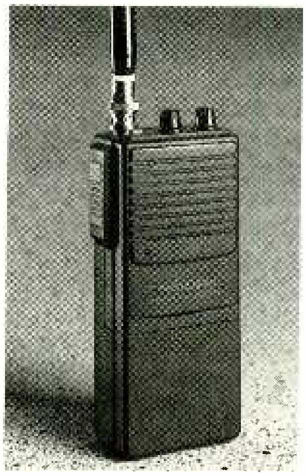
2 diagnostic card is especially effective for troubleshooting PC's that will not run diskette-based diagnostics, or that seem "dead." It can also be used to troubleshoot a personal computer from a remote terminal, reducing critical down time and travel time. By using special jumpstart ROM's to replace the BIOS ROM's on the PC system board, KickStart 2 takes over the execution of the Power-On Self-Test (POST) that every viable PC performs (unless system-board and memory problems cause the PC to appear dead). After running POST, the diagnostic tool goes on to conduct advanced diagnostics of the CPU and MPU, real and extended memory, interrupt controller (which is responsible for many strange failures), DMA controller, clocks and timers, and the CMOS setup RAM. KickStart 2 tests serial, parallel, Ethernet, floppy and hard drives, keyboards, and video (through VGA) for proper operation. A battery-backed clock logs the exact time of each error, and errors can be read from the board LED's or a remote terminal, or sent to a disk file or a printer. KickStart 2 comes with JumpStart ROM's; the KickStart board; DB9, DB25, DB25-parallel, and Ethernet BNC loopbacks.

The KickStart 2 PC diagnostic tool costs $599. For additional information, contact Jensen Tools, Inc., 7815 South 46th Street, Phoenix, AZ 85044; Tel: 602-968-6231.

CIRCLE 104 ON FREE INFORMATION CARD

TWO-WAY BUSINESS-BAND TRANSCEIVER

Radio Shack's first two-way business radio-service transceiver, the two-channel, VHF-FM, handheld *Realistic BTX-120*, is designed specifically for business use at construction sites, factories, warehouses, school campuses, hospitals, entertainment complexes, and anywhere that dependable short-range business communication is required. The compact radio weighs less than 15 ounces and comes ready to operate on the 151.625-MHz business channel. Optional plug-in crystals allow the addition of a second channel if desired. To ensure clear transmissions, a built-in circuit



automatically adjusts for a wide variety of voice levels. The adjustable squelch control eliminates background noise between transmissions. The BTX-120 operates at 1-watt power with an effective range of up to one mile. A three-way indicator lights when transmitting, receiving, or when the battery is low. A removable, rechargeable nickel-cadmium battery pack and a UL-listed AC charger are included, along with a 150-mm detachable antenna, a belt clip, and a vinyl carrying case. Also included is an application form for the required FCC license.

The Realistic BTX-120 business-band transceiver (cat. no. 19-1201) sells for $149.95 at Radio Shack stores nationwide. For further information, contact Radio Shack, 700 One Tandy Center, Fort Worth, TX 76102.

CIRCLE 105 ON FREE INFORMATION CARD

VIDEO EDITOR

In response to the requirements of amateur videographers in the 1990's, *Videonics* has introduced the *Video EditMaker*, an updated version of its predecessor, the DirectEd series of multifunction universal edit controllers. The Video EditMaker combines the functions of a video editor, titler, and graphics and special-effects generator, with increased speed, accuracy, and flexibility.

The device is designed to take advantage of the editing-control features found in sophisticated camcorders and VCR's, yet it maintains the ability to function as an edit controller when used with conventional equipment. It automatically selects the proper operating mode based on the equipment to which it's connected, and it uses wireless infrared commands to control the destination (record) deck.

The Video EditMaker is easy to use, with all functions accomplished by following on-screen menus and all commands issued via a handheld remote control. Several automatic edit-

ing modes are available. For instance, if a user is working with a conventional camcorder and a VCR with a wireless remote control, the Video EditMaker switches into its "universal" mode. If both the playback and record decks have wireless remote controls, the EditMaker takes advantage of that, using two supplied infrared "wands" to automate rewinds in the final assembly process. And if the source tape was recorded with a VITC time-code-equipped camcorder, the EditMaker uses the frame-accurate track time to increase the accuracy of the final edits.

The Video EditMaker has a suggested retail price of $699. For further information, contact Videonics, 1370 Dell Avenue, Campbell, CA 95008-6604; Tel: 408-866-8300; Fax: 408-866-4859. ■

CIRCLE 106 ON FREE INFORMATION CARD

IDIOT BOX

(Continued from page 57)

supply lines to the main circuit board. Now plug in the AC supply or connect the remaining leads of the two battery packs together (being careful not to complete the circuit with your body). If the voltmeter doesn't show a little more than 90 volts, disconnect power immediately and look for solder bridges and wiring errors.

You should check each sub-circuit using a bulb. To do that, wrap a few turns of bare wire on one of the jaws of a wooden clothespin and connect the windings to one of the common bulb leads on the circuit board. Grasp a bulb's brass body in the jaws so it makes contact with the windings. Then, for each of the 25 sub-circuits, touch the bulb's end terminal to each "output" lead to verify that each circuit causes the bulb to flash repeatedly. (You may have to try both leads of each twisted lead pair to find the one that isn't common). Trace and correct any defective circuits that you may find.

Bulb Selection. As mentioned earlier the bulbs will have to be selected to flash at about the same rate, so let's deal with that now. Pick one of the 25 sub-circuit bulb-wire pairs and, using clip leads and a clothespin (set-up as mentioned earlier), check the flash rate of each bulb. Save the bulbs that flash at approximately once per second for use in the Idiot Box. Reject any that depart markedly (say, by a factor of two) from this rate. They don't have to be identical, but the closer they are, the smoother the display will be. You may have to examine 30 bulbs or more, but the end result is well worth it. After the selection process is complete, disconnect power from the circuit.

Front-Panel Assembly. The panel's finish should be thoroughly set before installing grommets and bulbs, since considerable handling is required. Since you've already installed a grommet and bulb while testing the fit afforded by your drill bits, we'll just mention a few tips to help you install them in the front panel.

First, when installing the grommets check their fit before installing the bulbs. Properly installed grommets will be rotatible with thumb and forefinger.

Second, it's a good idea to wear light cotton gloves when installing the bulbs, as the procedure will be hard on your fingers after about the tenth bulb. You'll find placing a little water on the bulbs will allow them to slide into the grommets easier.

Once all the bulbs are in place, sight along panel edge and adjust them for a uniform appearance at the depth shown in Fig. 7. Now recheck the fit between the box and the panel in case the panel bent at some point along the way.

Now, wire the circuits to the bulbs (nothing is yet installed in the box), considering the following:

- Some wiring "order" will be helpful for any subsequent repair.
- Be brief with the soldering iron; the "end-beads" are just made of solder and could otherwise melt.
- Solder the wires to the brass bodies as far away from the bulbs as possible to avoid loosening the bulb-to-brass adhesive.

Finally, check for sound bulb connections by temporarily re-connecting the battery pack to the circuit board and making sure all the bulbs function. Disconnect power when satisfied.

Final Assembly. Lower the circuit-assembly—dangling from the front panel—into the box from the front. Form the wiring so that (however the circuit board is mounted) it won't act as a spring, pushing the front panel away from its mounting surfaces. Secure the front panel with a drop of glue on each front face of the corner braces. Set the box on its rear edges (the pedestal will need room to hang over the edges of your work surface) and apply light pressure to the front panel until the glue sets up. That can easily be done by placing 4 toilet-paper tubes, deformed into ellipses to clear the grommets, on the panel; and placing a small book on top of the tubes.

Use small wire nuts to connect the power source to the circuit board, and mount the rear panel to the box with No. 4 wood screws.

Your project is now complete. Make one final check for proper operation, then you can sit back and enjoy! ■

TELEGUARD

(Continued from page 42)

ing in the desired telephone number, and then switching back to arm.

The automatic redial function can be checked by shorting pins 12 and 13 of U2-d to ground to simulate an emergency condition. After a few seconds, the programmed number will be dialed. That can be verified by listening to the earpiece of the telephone handset. If an associate answers the call, he or she should hear the 1-kHz tone.

If no DTMF signal is generated by the circuit, review the troubleshooting procedure to locate and repair the fault. If the automatic-redial feature is not functioning, carefully check U1–U4, Q3, Q4, and their associated components. If the 1-kHz tone is absent, check U6 and its associated components.

Using Teleguard. Teleguard may be connected to any available telephone jack. A pair of wires must be run from the circuit to the sensor(s) at the protected door, window, etc. If you will be using the circuit to detect fire, flooding, or other emergencies, use appropriate sensors in your sensor loop. For normally open sensor loops,

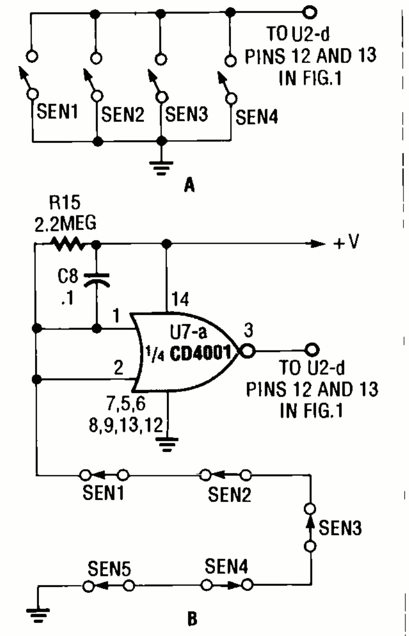


Fig. 6. Teleguard can be used with both open- and closed-circuit sensor loops. The setup for an open-circuit loop is shown in A; while the closed-circuit loop configuration is shown in B.

multiple sensors can be connected in parallel (as shown in Fig. 6A) and tied to the circuit to allow detection of a breach at any number of entry points.

If normally closed sensor switches are used, multiple sensors can be series connected (as shown in Fig. 6B) to the circuit through an inverter (in our illustration, a NOR gate configured as an inverter) to monitor several different areas. It is important that no part of the sensor loop be allowed to make contact with ground though pipes, electrical appliances, etc. The sensor-loop ground is derived from Teleguard's circuit board, so use insulated wire to connect the sensor loop to the board.

A phone is not required for use with Teleguard. The circuit can be left connected to the telephone, without having any adverse affects on the normal operation of the phone system. Note that anytime the unit is disconnected from the line, the number programmed into U5 will be lost.

Programming Teleguard. With the sensor loop in the safe or dormant condition—normally open sensor switches open or normally closed sensor switches closed—and connected to the circuit, set S1 to the arm position and connect Teleguard to the telephone line. Allow about 1 minute charging time. Place S1 to the setup position. The LED should light, indicating connection to the telephone company central office. Key in the desired telephone number (including a 1 and area code if necessary).

After keying the number, immediately set S1 to the arm position. The LED should go out. This completes the setup procedure and arming of the circuit. To change the telephone number at any time, simply repeat the programming sequence.

If a sensor is triggered after the circuit is armed, Teleguard will immediately go off-hook and call the programmed number. It will continue to do so, about once a minute, until the protective circuit is restored. When the call is answered, the 1-kHz tone will be heard in the handset at the receiving end, alerting the called party to a problem condition at the protected area. Of course, be sure to alert others who may pick up the phone about the special tone should Teleguard call. ■

TV ANSWER

(Continued from page 65)

your opinion on questions of the day. The system has the potential to customize newscasts to match your interests, provide a TV-program listing that also automatically programs your VCR, and perform most of the tricks that TVA claims.

The problem with Videoway until recently was that it requires four television or cable channels to handle all that interactivity; and few cable systems wish to devote that much space to it. Its real secret lies in the remote control, which actually switches seamlessly back and fourth among the four channels without the viewer's notice. The imminence of digital signal compression, in which four, six, or eight video channels can be squeezed into the space now occupied by a single TV signal makes it a natural for the cable systems of tomorrow—and perhaps for over-the-air use as well. Its first workout will be during 1992 Summer Olympics, where it will allow subscribers to some cable systems to pick their sport or event.

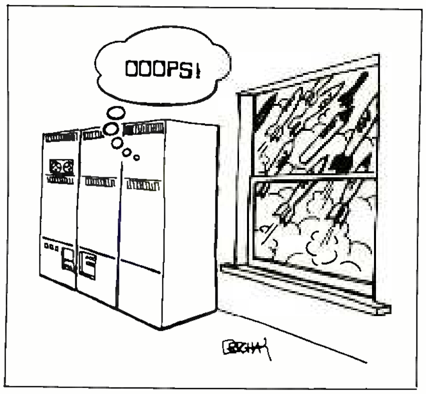
Practicality or Pipedream. One question Wall Street is asking is whether people really need, want, or are willing to pay for interactivity, wireless or otherwise. The people of Columbus said no to enough of those questions that the system fell into disuse. Montrealers, on the other hand, have been signing up for Videoway in significant numbers since its introduction just over two years ago "because it is cheap and because it is something new," according to Jean Paul Galarneau, a spokesperson for the cable operator.

Galarneau admits that his company is just scratching the surface of interactivity's potential; it hopes to have dramatic shows in which the viewer can determine the plotline (the *Young Indiana Jones* TV series is seen as a distinct possibility for interactive treatment, if it stays alive long enough) and to take the technology into the classroom with instructional programming. TVA also talks about the instructional possibilities of its system; the difference at the moment is that the Videoway viewer has the ability to change the program he's watching as well as merely respond to questions. TVA simply handles the latter.

Will Americans spend $700 to avoid the bother of dialling an 800 number to order booze or records? "It won't stay at $700 for long," a spokesperson for Hewlett Packard says. HP is making and marketing the hardware, at least initially.

TVA's president Morales says that the remote control, which can also be used for just about any other infrared-controllable product in the house, is worth at least $100 in its own right when compared to the prices charged for other universal remotes. He also cites the growing need for an electronic program guide as the number of program channels available in the average household balloons. Not only can an electronic program guide keep track of all the broadcast, cable, premium, and pay-per-view channels available, he says, but it's more up-to-date than the one appearing in your morning newspaper. And unlike it, the electronic variety can even program your VCR when you point the remote control at the listing of a program you'd like to tape and zap the appropriate button. Similar electronic program guides could cost $90 per month or more. Morales doesn't say how much his will cost, who will provide it, whether it will be advertiser-supported, or when it'll be available.

Because it is wireless, Morales stresses, it is independent of the program-reception system in the home. For example a commercial for Bose Express Music aired over a local TV station and containing the blinking TVA signal would permit a viewer with a rooftop antenna, cable service, or a satellite dish to place his order. The theory seems sound, we will have to see what the future has in store. ■



HOLOGRAPHY

(Continued from page 47)

shooting a hologram that contains more than one object, each object must be secure. If an object moves even slightly during exposure, it will not develop a holographic image.

Dark Spots—This is also caused by slight movement.

Image has Bands of Light and Dark—The object moved slightly during exposure.

Faint Image—A faint image can be caused by either overexposing or underexposing the film. If the plate went black almost immediately after being placed in the developer, it is overexposed. If the plate is still light after two minutes of development, it is underexposed. Another possible cause is the tap water used in making your stock solutions contained chlorides. Again, use only distilled or de-ionized water.

Image is Weak and Fades—This is a problem I encountered when I used green plastic filters for my homemade safelight. The safelight was fogging my film.

One More for the Road. There are many types of holograms—for example transmission, copy, transmission in reflection, pseudo-color reflection, and stereograms—that you can make using the equipment you have acquired. Unfortunately, we don't have the space to discuss all of them.

However, let's try one more set-up that shows how powerful holography can be. It is called a "dual-channel" or "multiplex" hologram. To make one, you holograph two different objects on one plate. In the finished hologram the image will change from one object to the other as your viewing angle changes. As an example, exposure one could be an unopened jewelry box, and the second exposure could show the box opened, revealing an engagement ring.

One method of recording multiple images is to change the angle of the light exposing the plate (see Fig. 9). Between exposures you just move the holographic plate as shown. The rest of the set-up is the same as we used in the reflection hologram. The exposure time for each exposure should be about half the time used to record a single hologram. ■

ELECTRICITY AND MEDICINE

(Continued from page 62)

ing transformer, interrupter, capacitor, and a tiny Tesla coil. The device could be screwed into an ordinary electric-light outlet and used at home. An external thumb control activated the coil. With proper dosage and careful manipulation, a most "comforting and agreeable" physical effect could be guaranteed.

What Dr. Fredrich Finch Strong, an instructor at Tuft's College Medical School, called "the undoubted therapeutic value" of high frequency treatments was taken very seriously by a great many people. It got to the point where high frequency jolts were prescribed in situations that would otherwise require no medical attention at all. And since the small portable units were available, why not just keep one with you, like a comb or lipstick. In one almost unbelievable passage, Dr. Monell recommends replacing the traditional evening coffee or cocktail with "a little bit of after-dinner high frequency tonic" to "banish stuffiness, lighten weight, clear the mind." So much better than caffeine or alcohol, high voltage refreshment, he says, "is a boon to the bon vivant and diner out." That is not, and never was, any kind of medical advice; that is, in fact, completely ridiculous.

Discredit and Disgrace. Accounting for the fall of classical 19th century electrotherapy is a difficult and complicated matter. The main reason is that there are many relevant historical elements falling outside the sphere of electrical medicine proper. For instance, one important factor, especially in America, was the reform of medicine in general. Today, a typical medical education follows a largely predetermined course. The situation in the 1800's could not have been more different. Whether or not a doctor had been to medical school, what had been studied, and whether or not the degree granted (if any) really meant anything were all variable.

Closer to our topic is the fact that, after about 1900, the number and nature of useless devices, fraudulent procedures, and unscrupulous quack practitioners became intolerable. One woman, for example, told her New York physician about a certain electrical clinic in Atlantic City that sold tickets, each good for two minutes worth of sparks from "a man with a stick standing on a platform." A similar institution appeared in Philadelphia where "sparks, baths, and shocks" were "dealt out indiscriminately to old and young alike irrespective of condition."

There is a note of irony here. Electrotherapy reached its highest peak of popularity just as professional skepticism began to bubble up after years of poor results, equivocal results, or no results at all. One doctor, following a long period of careful record-keeping, became convinced that he was just wasting his time. "My battery is now in my cellar," he said, and "anyone can have it who will take it away." Another physician claimed that some electrotherapeutic applications can have a certain "moral effect," but then there is this: "it will have just as much effect if the electrodes are not connected to the battery." The same doctor also offered to give his equipment away to anyone who promised "not to use it on a human being." As cool-headed criticism degenerated to the level of sarcasm and ridicule, the death of 19th-century electrotherapy became inevitable.

A Movement of Thought. Looking back, much of what the electro-medical specialists did, said, built, and believed seems downright silly. The reaction is understandable; but, the sheer magnitude of the electrotherapeutic movement calls for serious historical attention. In one way or another, electrotherapy affected the lives of thousands upon thousands of people. When the end finally came, it was much more than some disgruntled doctors letting their faradic batteries go rusty in the basement. It was the end of a phase in the general history of collective thought and popular self-deception: it was the end of a craze—a craze in every sense of the word. As Charles Mackay put it in 1852: "We find that whole communities suddenly fix their minds upon one object, and go mad in its pursuit; that millions of people become simultaneously impressed with one delusion, and run after it, till their attention is caught by some new folly more captivating than the first." ■

QUICK & DIRTY QUAD

(Continued from page 48)

The Assembly. With a hacksaw, cut two slots in a cross configuration (as viewed from the end) at each end of the ¾-inch pipe, which will allow it to be "squeezed" a bit. Cut the ½-inch pipe into two 5-foot lengths. Insert one length about halfway into each end of the ¾-inch pipe, slip a hose clamp over each junction and tighten them enough to keep the inner pipes from slipping.

You have just completed the horizontal frame member. You will be joining it to the vertical frame member by using the plywood as a hub, so drill four pairs of holes in the plywood, configured as shown in Fig. 1, each large enough to permit a leg of a U-bolt to pass through. Using two U-bolts, attach the plywood to the center of the horizontal member. Tighten the U-bolts until they're good and snug but aren't deforming the pipe.

Attach the vertical member (the largest pipe), to the plywood in a similar manner, but on the other side of the board at a 90-degree angle to the ¾-inch pipe. Fasten it a couple of feet from one end of the pipe, instead of at the center as you did with the horizontal member, and leave these U-bolts loose enough to allow the pipe to slide easily through them.

Feed the antenna wire through the length of the horizontal member. Drill holes through opposite walls of the vertical member about a quarter-inch from the top end. Strip a couple of inches of insulation (if there is any) off one end of the antenna wire, run it through one hole and twist it around itself. Do the same with the other end of the wire in the opposing hole. Strip one end of the 75-ohm coax and fasten the center conductor to one end of the antenna wire and the braid to the other.

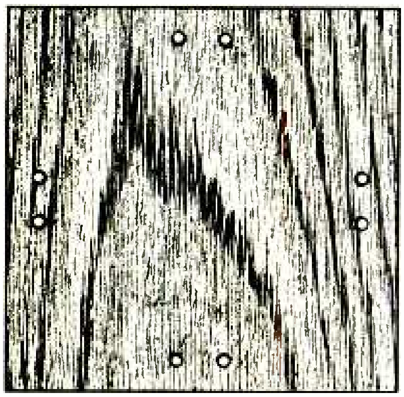


Fig. 1. The 10-Meter version of the Quick And Dirty Quad should be mounted on a TV-antenna rotator and tripod. Four pairs of holes should be drilled in the plywood in this configuration. The spacing and diameter of each pair of holes depends upon the U-bolt chosen to pass through them.

You must now secure the connections. That can be done with with automotive-type crimp connectors. If you choose to solder them instead, **be extremely careful not to transfer too much heat to the PVC pipe. The material burns readily, and the fumes are toxic.**

Attach an RF connector to the other end of the coax, and fasten the coax to the vertical member. Use with electrical tape, spaced every foot or 18 inches, for that.

Mounting. Your antenna is finished and needs to be mounted. Ideally you might have an old TV-antenna tripod and rotator left up on the roof from the "Dark Ages" before cable TV. If you aren't that lucky, secure the base of the vertical member to the best anchor you can find, the higher the better. If you aren't using a rotator, orient the antenna so it presents its largest area in the direction favored for reception. Attach the feedline to the matching coax.

Now slide the plywood and horizontal member down the vertical member as far as you can without running into your mounting apparatus, and tighten the U-bolts to keep it there. Slide the inner sections of the horizontal member out by the same distance on each side until the antenna wire is taut.

As you do that, the bottom member will bend upward like a bow, which is not only okay, but is one of the reasons (there were others) we used PVC pipe. The flexibility of the bottom member, and the ability to change its length by telescoping the end sections, allows you to adjust the tension and, to a certain degree, the shape of the antenna to fit your particular circumstance. You want sufficient tension to retain the shape and keep the wire from tangling or going slack, but not so much that it puts a serious strain on any of the components.

When you get it the way you want it, tighten the hose clamps and that's it, you're done.

There isn't much troubleshooting advice we can give because if you did it right, your rig should be looking at an acceptable SWR reading. If that isn't the case, recheck the lengths of antenna wire and coax, as well as the connections.

Incidentally, by its nature few mechanical aspects of the "QuAD" are inviolable. You could feed it from the bottom or from a corner, turn it upside down, or even feed it to an antenna tuner with open-wire line instead of using coax.

One final note to fans of portable or field-day operations: Once built, this antenna quickly breaks down into a small, light, easily transportable bundle. When you get where you're going, tie a length of line (I favor nylon seine cord) to the top, throw the line over something high, and pull'er up. Attach other lines to each end of the horizontal member to anchor or "steer" it. ■

ANTIQUE RADIO
(Continued from page 67)

knows the answer and will write to advise us.

REMOVAL OF CHASSIS-MOUNTED COMPONENTS

The loudspeaker was very readily removed, requiring only desoldering of its six under-chassis connections and removal of the four screws holding it to the panel. The metal-mesh speaker grille had to remain because it was riveted in place.

In a letter quoted earlier, reader Paul Daulton mentioned that his grille originally had some type of now-disintegrated flocking, and he was wondering how to replace it. My grille doesn't even show the signs of previous flocking. Perhaps someone can tell us what it looked like and suggest how it can be restored.

Removal of the tuning capacitor/bandspread dial can best be described as an aggravating task. It's not for the fainthearted, being difficult to accomplish without damage to the set. To avoid giving up, I had to keep telling myself how necessary this step was to a good restoration.

First of all, access to the chassis for deep cleaning would be very much improved by its removal. Second, I'd be able to replace the four rubber shock-mount gaskets, which were meant to insulate the subchassis from vibration and which were now petrified to a rock-like consistency. Finally, and perhaps most important, it would give me access to the drive-pulley system, making it possible for me to replace the bandspread- and main tuning-dial cords. From sad experience, I've learned that these cords are very likely to break soon after a long-unused set is put back into service.

To get the subchassis out, the two tuning-capacitor stator connections had to be removed by desoldering them via access holes buried deep under the main chassis wiring. The wiring in that area is associated with the RF circuits and, as such, is very sensitive to changes in position. Modification of lead dress could cause dead spots, oscillations, and/or "birdies" that might be very difficult to eliminate later.

I was able to remove the stator connections with only a little difficulty, but the real problem was the heavy copper braid grounding the tuning capacitor rotors to a solder lug mounted under the chassis. Since that lug is in physical contact with the chassis, which serves as a very large heat sink, and since the heavy braid and other connections made to the lug also tended to funnel heat away, it was almost impossible for me to melt the solder on that joint.

My 40-watt Radio Shack iron would hardly touch it. I even tried a 60-watt iron of traditional design without much better results. I eventually gave up and released the subchassis by snipping the braid; I'll worry about how to reattach it later.

With the stage set for the cleaning, corrosion removal, and restringing process, I stopped work on the radio to take a breather. It's a good place for us to stop, too. We'll get back to the project next month. In the meantime, let me hear from you! You can write c/o *Antique Radio*, **Popular Electronics**, 500-B Bi-County Blvd., Farmingdale, NY 11735. ■

TEST REPORT
(Continued from page 29)

residual tape noise (hiss) was plotted as a function of frequency, the advantages of Dolby were clearly evident, as was the improvement of Dolby C compared with Dolby B. Single-value measurements of signal-to-noise ratios were also made at this time, and the A-weighted results were 57.8 dB without Dolby, 66.9 dB using Dolby B, and 73.3 dB using Dolby C. These results are somewhat conservative, however, since they are referenced to a 0-dB recording level. Normally, S/N figures are quoted with respect to the 3% distortion level, so, in the case of the Type-II tape used in these tests, you could add nearly 10 dB to each of the figures just quoted.

Our last bench test involved a measurement of wow-and-flutter. We measured it using two types of weighting curves. When the WRMS (weighted root-mean-square) method of measurement was used, wow-and-flutter averaged about 0.025% over a test period of 25 seconds. Using the more conservative IEC peak-weighting method, wow-and-flutter hovered between around 0.05% and 0.08%. In either case, these results are excellent for a cassette deck in this price category.

COMMENTS

In our hands-on experiments, we transcribed several of our favorite CD's to cassette tape. Surprisingly, in all but a few instances, once we carefully set recording levels (after auditioning the CD to find its loudest peaks) we were able to capture the full dynamic range of the CD on tape, without audible increases in distortion.

We used Dolby C noise reduction to make these recordings and would advise readers to do the same if they purchase or own this deck. That, combined with the extra headroom afforded by Dolby HX-Pro, is largely responsible for the distortion-free wide dynamic range that we were able to obtain. Of course, the electronics of the Technics RS-BX606 and its fine transport mechanism with its low wow-and-flutter also contributed greatly to the fidelity of the recordings that we were able to make using this machine.

For more information on the RS-BX606, contact the manufacturer (Technics, One Panasonic Way, Secaucus, NJ 07094) directly, or circle No. 120 on the Free Information Card. ■

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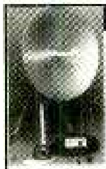

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BATTERY REJUVENATOR

(Continued from page 63)

that branch circuit in parallel with the main circuit, as shown in Fig. 1. Press S1, and adjust the potentiometer for a full-scale meter deflection. Once a full-scale deflection is obtained, measure the resistance of the potentiometer, and replace the potentiometer with an equal-value fixed resistor.

If the lamp circuit is included in the project, be aware that different lamps draw different currents, and some may not light with only 1.3 volts. The important thing though is not how bright the bulb glows (if at all), but how the meter reacts.

Although the Zap-Adapter described in this article was designed for AA-size batteries, the circuit can easily be made to accommodate other single-cell batteries; AAA, C, and D (see text for details).

PARTS LIST FOR THE ZAP-ADAPTER

B1, B2—AA nickel-cadmium battery
S1—Normally-open momentary pushbutton switch
R1—50,000-ohm potentiometer (optional, see text)
M1—50-µA to 1 mA meter (optional, see text)
S2—SPST slide or toggle switch
I1—3-volt flashlight lamp (optional, see text)
Perfboard materials, enclosure, 3 AA battery holders, double sided tape, wire, solder, hardware, etc.

Use. Place two fully charged, nickel-cadmium batteries in the source battery holders. The meter should give a 0-volt reading since S1 (which is connected between the batteries and the meter) is open. When the switch is closed, the meter reading should jump to about 2.8 volts. Next put a dead cell in the holder provided. If the battery has whiskers, there will be no meter reading (due to severe loading). If the battery has become reverse-polarized, the meter will show a negative reading.

If the meter reading is between 1.3 and 1.4 volts, the battery can be recharged in the normal manner. Since there is no load on the dead battery, even a weak battery must show a normal reading. What you're looking for is an apparently dead battery.

Assuming that the meter shows the battery to be dead, press S1; the meter reading should rise rather quickly. Continue to hold the switch closed for about three seconds; the meter should go to around 1.4 volts. If the meter reads nothing, your battery is too far gone to revive. If the meter reading does not go all the way to 1.4 volts, try pressing S1 again to see if you can get it up to 1.4 volts. A couple of deep-discharge/full-recharge cycles should rejuvenate the battery. ■

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Countersurveillance

Never before has so much professional information on the art of detecting and eliminating electronic snooping devices—and how to defend against experienced information thieves—been placed in one VHS video. If you are a Fortune 500 CEO, an executive in any hi-tech industry, or a novice seeking entry into an honorable, rewarding field of work in countersurveillance, you must view this video presentation again and again.

CALL NOW!

1-516-293-3751

HAVE YOUR VISA or MC CARD AVAILABLE

Wake up! You may be the victim of stolen words—precious ideas that would have made you very wealthy! Yes, professionals, even rank amateurs, may be listening to your most private conversations.

Wake up! If you are not the victim, then you are surrounded by countless victims who need your help if you know how to discover telephone taps, locate bugs, or "sweep" a room clean.

There is a thriving professional service steeped in high-tech techniques that you can become a part of! But first, you must know and understand Countersurveilance Technology. Your very first insight into this highly rewarding field is made possible by a video VHS presentation that you cannot view on broadcast television, satellite, or cable. It presents an informative program prepared by professionals in the field who know their industry, its techniques, kinks and loopholes. Men who can tell you more in 45 minutes in a straightforward, exclusive talk than was ever attempted before.

Foiling Information Thieves

Discover the targets professional snoopers seek out! The prey are stock brokers, arbitrage firms, manufacturers, high-tech companies, any competitive industry, or even small businnesses in the same community. The valuable information they filch may be marketing strategies, customer lists, product formulas, manufacturing techniques, even advertising plans. Information thieves eavesdrop on court decisions, bidding information, financial data. The list is unlimited in the mind of man—especially if he is a thief!

You know that the Russians secretly installed countless microphones in the concrete work of the American Embassy building in Moscow. They converted what was to be an embassy and private residence into the most sophisticated recording studio the world had ever known. The building had to be torn down in order to remove all the bugs.

Stolen Information

The open taps from where the information pours out may be from FAX's, computer communications, telephone calls, and everyday business meetings and lunchtime encounters. Businessmen need counselling on how to eliminate this information drain. Basic telephone use coupled with the user's understanding that someone may be listening or recording vital data and information greatly reduces the opportunity for others to purloin meaningful information.

CLAGGK INC. PE
P.O. Box 4099 • Farmingdale, NY 11735

Please rush my copy of the Countersurveillance Techniques Video VHS Cassette for a total cost of $53.95 each (which includes $4.00 postage and handling)

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All payments in U.S.A. funds. Canadians add $4.00 per VHS cassette. No foreign orders.

The professional discussions seen on the TV screen in your home reveals how to detect and disable wiretaps, midget radio-frequency transmitters, and other bugs, plus when to use disinformation to confuse the unwanted listener, and the technique of voice scrambling telephone communications. In fact, do you know how to look for a bug, where to look for a bug, and what to do when you find it?

Bugs of a very small size are easy to build and they can be placed quickly in a matter of seconds, in any object or room. Today you may have used a telephone handset that was bugged. It probably contained three bugs. One was a phony bug to fool you into believing you found a bug and secured the telephone. The second bug placates the investigator when he finds the real thing! And the third bug is found only by the professional, who continued to search just in case there were more bugs.

The professional is not without his tools. Special equipment has been designed so that the professional can sweep a room so that he can detect voice-activated (VOX) and remote-activated bugs. Some of this equipment can be operated by novices, others require a trained countersurveillance professional.

The professionals viewed on your television screen reveal information on the latest technological advances like laser-beam snoopers that are installed hundreds of feet away from the room they snoop on. The professionals disclose that computers yield information too easily.

This advertisement was not written by a countersurveillance professional, but by a beginner whose only experience came from viewing the video tape in the privacy of his home. After you review the video carefully and understand its contents, you have taken the first important step in either acquiring professional help with your surveillance problems, or you may very well consider a career as a countersurveillance professional.

The Dollars You Save

To obtain the information contained in the video VHS cassette, you would attend a professional seminar costing $350-750 and possibly pay hundreds of dollars more if you had to travel to a distant city to attend. Now, for only $49.95 (plus $4.00 P&H) you can view ***Countersurveillance Techniques*** at home and take refresher views often. To obtain your copy, complete the coupon or call.