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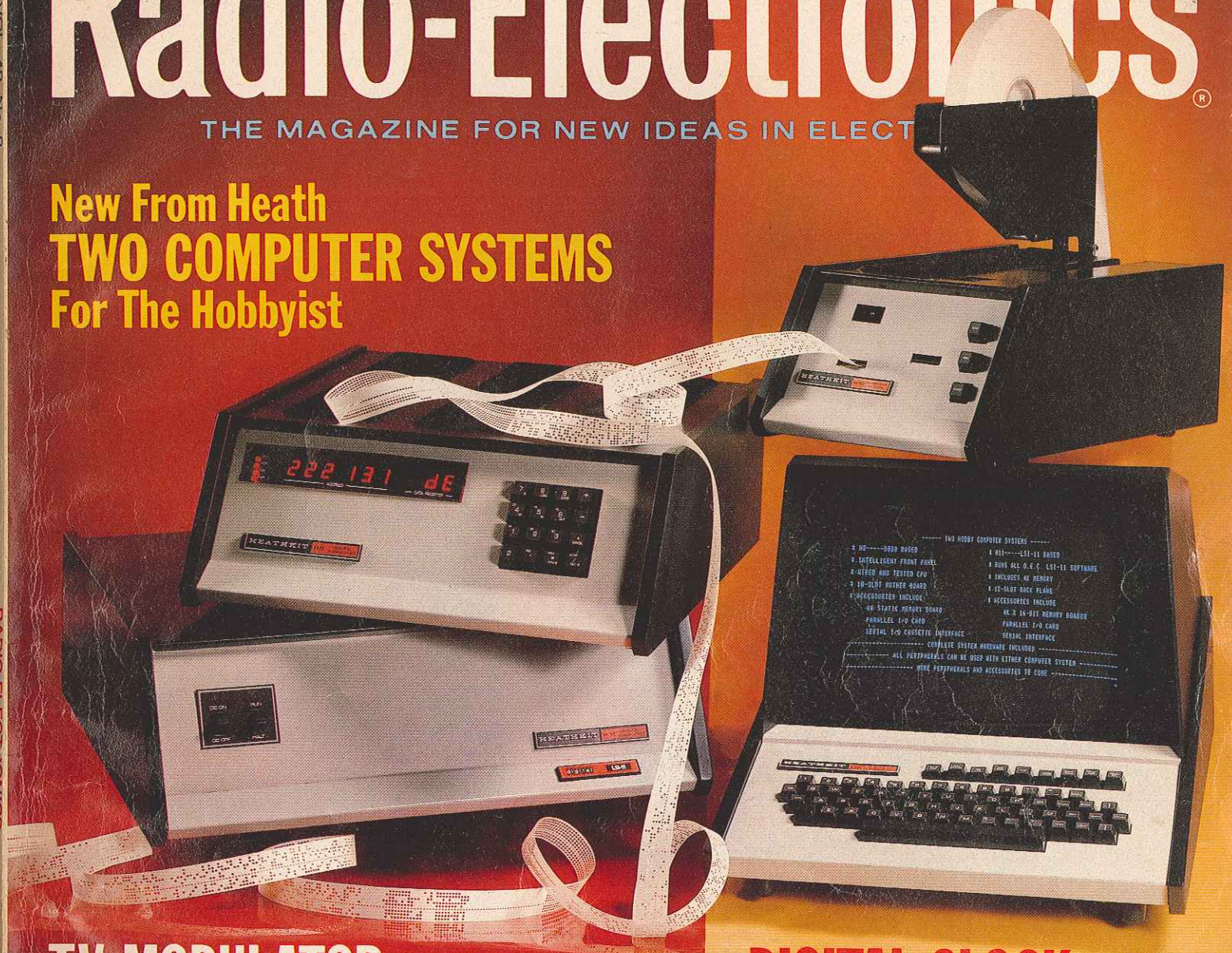

New From Heath
TWO COMPUTER SYSTEMS
For The Hobbyist

TV MODULATOR
Feeds Video Signals
To Your TV's
Antenna Terminals

MAKE PICTURES TALK
How To Turn 8mm Silent
Home

PLUS

A GERNSBACK PUBLICATION

DIGITAL CLOCK
Build 10-Function Unit
Includes Timer And Alarm
Simultaneous Display

Restoring Antique Radios (58)

ANTIQUE RADIOS
Get Started Restoring
And Repairing Today

10 Function Clock CKT (36)
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Anti-Collision Systems For Your Car ★ Movie Sound Synchronization ★
R-E Lab Tests Optonica ST-3535 Tuner & Hitachi SR-903 Receiver ★

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lit to avoid confusion.) On the 10-watt range, the display reads "00.0". On the 100-watt range, the display reads "000." The readout has a resolution of 0.1 watt.

VSWR is displayed with four digits—same reason VSWR's of up to 10:1 can be read. (But if you see a reading of about 5:1, let go of the button, quick. Something definitely needs fixing in the transmitter or antenna. Running a transmitter more than a few seconds with such a high reflected power level can blow up the final RF transistors.)

Modulation percentage is read out on a 3-digit display. This can read from 0 percent to 110 percent. (More than 110 percent indicates trouble, too.) By the way, you must use an undistorted sinewave signal for the modulation. If it is distorted, the harmonics will cause inaccuracies and a bouncing count. A voice signal won't do, of course. In this area, before we go, remember that when you're reading the frequency, the transmitter *must* be unmodulated—with one exception, which we'll get to. If there is modulation, the frequency counter will try to read the sideband frequencies and skip counts. This is normal. These instruments will work with the new 40-channel sets, of course.

All of these goodies are accomplished by state-of-the-art IC technology. They can do some cute tricks. The *model 388* has two coaxial jacks on the back panel; one INPUT, the other OUTPUT. All you need is a short coaxial cable with a PL-259 (sometimes called a UHF plug) on each end, to hook the CB-antenna output to the INPUT connector. An accurate 50-ohm dummy load must be connected to the OUTPUT—the set's own antenna may be used. Do not key the transmitter without one of the loads hooked up. This can damage the transmitter, especially if the transmitter is a solid-state type.

You'll find a BNC jack on the back of the *model 388*, along with a TIMEBASE slide switch. With the switch in the INTERNAL position, it runs on its own built-in timebase. The *model 388X* doesn't have the switch, but does have the jack. The TCXO timebase of the *model 388X* may be used for greater accuracy, by connecting it through a jumper cable to a *model 388* set on *External* timebase. In fact, several *model 388's* may be timed from only one *model 388X*, if desired. You can do a trick with the *model 388*: If you want to hold the display for any reason, just slide the switch to EXTERNAL while the transmitter is keyed. The display will freeze and hold until the instrument is turned off or the switch set back to INTERNAL timebase.

The *model 388's* can be used as a straight frequency meter. There is a BNC jack on the front panel for this, with a high-impedance (1.0 megohm) input and a sensitivity of 100 mV. A push-push selector switch lets you choose front panel operation of the frequency meter or the in-line operation from the back-panel jacks. The modulating signal can be checked on a scope connected to the AM MONITOR jack on the left side. This displays the detected AM modulation and may be used to check for possible clipping, distortion, etc.

The exception we mentioned, about not using modulated signals for frequency readings, is in the testing of single-sideband CB transmitters. These have *no* RF power output at all *without* modulation. Here again, an accurate 1-kHz audio signal is needed. Set the transmitter switch to UPPER SIDEBAND and key it. The display will read out the carrier frequency plus the modulating frequency. Setting to LOWER SIDEBAND reads the carrier minus modulating frequency. VSWR can be read on SSB systems with the same ease. RF power measurements must be corrected by a formula given in the instruction manual, for SSB *only*.

Percentage of modulation is read in somewhat the same way. One circuit reads the peaks and another reads the average value of the modulation envelope after detection in a special two-step circuit. More math, and there you are.

The timebase accuracy of the *model 388* may be checked by comparing it to the 10-MHz signal from WWV or to a frequency standard. If it needs correction, an adjustment is provided to make the display read exactly 10.00000 MHz and there you are. The aging rate of the *model 388* is given as 5 PPM-per-year, and the *model 388X* as 1 PPM-per-year. The "setability" is given as "to ±0.1 ppm," for both units. For this adjustment, the instrument must be warmed up for 30 minutes to allow all parts to reach normal operating temperature, which is 25°C.

Both models are powered from the 120-volt AC line. All of the DC power supplies are stabilized by several solid-state voltage regulators. If you want to use them in cars, etc., it is easy to hook up a connection to the power supply so that they can be used from any 12–14 volt DC-supply. **R-E**

equipment reports

Infinite UC1800 Microcomputer

CIRCLE 78 ON FREE INFORMATION CARD

INFINITE, INC., TAKES TWO DIFFERENT APproaches to the microcomputer learning/development system. First, they produce a training-and-use package that leads the uninitiated unfalteringly into the world of the computer. For example, their *model UC1800* microcomputer is a completely assembled and self-contained microcomputer system. It avoids construction pitfalls and the futile troubleshooting that often follows. To determine whether a problem is in the microprocessor IC or elsewhere can be very difficult without the necessary skill and sophisticated equipment.

On the other hand, Infinite has also developed the *model UC1800HK Hobbyist Kit* for the experienced kit builder. The kit contains only special components that are not widely available.

The *UC1800* is a completely assembled microcomputer system built around the RCA COSMAC *model CDP1802* microprocessor. Four printed-circuit boards are mounted in a console-type cabinet that resembles a desk-type calculator.

The central processor board holds the CPU IC, the CPU control logic, 256 words of NMOS RAM and the 5-volt power supply (except the power transformer mounted separately in the cabinet). The CPU board has a 72-pin gold-plated edge connector for system expansion.

The readout board has four 7-segment LED displays and the associated decoder-driver IC's. Two displays function as the address readout, and the other two as the instruction and input/output readouts. The LED's display the hexadecimal (base 16) representation of the computer's binary numbers. After 0 through 9, A, C, E and F are displayed and "b" and "d", using the available segments. The board contains its own 5-volt regulator IC to supply the substantial 400-mA current drain.

The third board is the switch-control module that interfaces with the six control switches. They are RESET, SINGLE STEP, START/EF1, POWER, MODE and SINGLE STEP/ENTER. The board has outputs that connect to the EF1, CLR, WAIT, and DMA IN terminals on the microprocessor IC.

The keyboard module holds the 16 hexadecimal keys and the necessary debouncing and decoding components. Two LED's indicate whether the most or least significant of the two hex digits in each word is ready for loading.

To load a program, set the MODE switch to LOAD, then RESET, enter the first word, press ENTER and continue. The loading starts at 00 and proceeds sequentially. If you make a mistake along the way, you must either start all over or enter a short program that allows you to change a particular memory location.

After the program is loaded, the MODE switch is then placed in the RUN position and the SINGLE STEP switch can be turned either ON or OFF. With the switch OFF, the computer executes the program automatically. With the switch ON, the computer executes a single instruction for each push of the SINGLE STEP/ENTER button.

The START switch shares the EF1 input function that you can use to interact with your program. Input and output instructions permit you to enter data from the keyboard and readout into the two LED's.

The POWER switch maintains power to the memory only in the STANDBY position to preserve the program with minimum power consumption. You can also purchase a nickel-cadmium battery and charger to keep the memory alive for about four hours after loss of primary AC power.

The DMA (*D*irect *M*emory *A*ccess) design of the *model CDP1802* facilitates program loading without using a ROM utility program. There is an advantage in not requiring this extra component, but it does make the system cumbersome to use.

Infinite addresses this problem by including a listing and instruction for using KEYBUG as part of the *UC1800* package. This program takes one-half of the available 256 memory words, and of course it must be successfully loaded starting at address 00.

KEYBUG has five commands that help in loading, examining and changing memory contents. After the program is loaded, a RESET-START sequence gives control to KEYBUG, which is acknowledged by displaying "db" (debug).

The DC command will display the contents of a single memory location. Press the D and the C followed by EF1, which serves to enter the command. Then key in the address of the location to be displayed and press EF1 again. The program responds by displaying the memory contents. The CC command changes the contents of memory. After the command and

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the memory-location address are entered, the new contents are keyed in and EF1 depressed. Since only a single memory location is accessed by the DC and CC commands, the system can return to KEYBUG automatically and be ready for a new command.

To examine a series of memory locations without entering memory addresses sequentially use the FD (forward display) command. The computer displays the address and its contents; then increments the address and displays its contents each time EF1 is pressed. Similarly, the FC forward change command sequentially loads the memory by pressing the EF1 switch after each data entry. These last two commands are self-looping; the only way to exit the loop so that a new command can be executed is to reset and restart KEYBUG.

The remaining command is EE for execute. The EE command is keyed in, EF1 pressed, the program-starting address entered and EF1 pushed again. Because KEYBUG starts at 00 and a program cannot be written there, EE is the only way to activate a program.

To debug your program, set breakpoints by inserting a branch to 00; this causes a "db" readout when KEYBUG is reached. You can then examine memory to see what has taken place so far. A more sophisticated approach would be to examine the processor registers when the breakpoint is reached, restarting the program and continuing to the next breakpoint.

So far KEYBUG is not available on PROM or ROM and must be loaded manually into RAM. A defective user program may destroy the utility program. This happened several times while I was experimenting with some simple programs. Some wipeouts did not completely annihilate the system, and it was possible to use KEYBUG to find the destroyed memory locations and restore the full capabilities. Some wipeouts were total.

The Infinite computer is available in four versions:

The completely assembled and documented *UC1800* package includes computer, instruction manual, RCA *MPM-201A CDP1802* Users Manual, KEYBUG program and Cardiac. Cardiac (*Card*board *I*llustrative *A*id to *C*omputation) was developed by Bell Telephone Laboratories to simulate the operation of a simple computer. Cardboard slides simulate the instruction decoding, and calculation is done with pencil and paper. The package is priced at $495, plus $8 for shipping and handling. Option 001 is the battery backup and recharger and sells for $22.50. Option 002 enables you to use the microcomputer with either 120 or 230 VAC 50-500-Hz input power and costs $15.

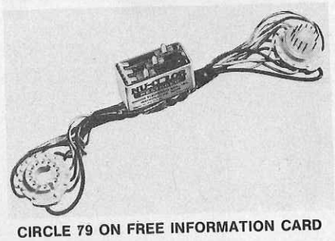
The *UC1800* kit includes everything but the cabinet and power cord. The four modules are factory-assembled and burned-in. This version sells for $389, plus $4 for shipping and handling.

The economy model (*model UC1800HK*) contains four unwired boards, keyboard, 1802 CPU, readouts, cable and Users Manual. It is priced at $129.95, plus $2 for shipping and handling. If you already have a CDP 1802, Option 003 subtracts $18 from the price.

The last version is just the assembled CPU board, which also supplies 500 mA of current for other system components. The *UC30001 OEM UC1800* CPU Module costs $179, plus $2 for shipping and handling.

For additional details write to Infinite Incorporated, 151 Center St., Cape Canaveral, FL 32931. **R-E**

Oneida Model 90A Picture Tube Restorer



CIRCLE 79 ON FREE INFORMATION CARD

ALL THINGS COME TO HIM WHO WAITS. I HAD TO wait for quite a while, but I finally found just the thing I needed: A new device, made by Oneida Electronic Manufacturing Company. This is their *model 90A Nu-Color* picture tube restorer. This device is designed to restore color to old picture tubes with one or more weak guns.

I had a trade-in Wards TV, with a picture tube so bad it had to be seen to be believed. The blue gun read almost normal emission; the

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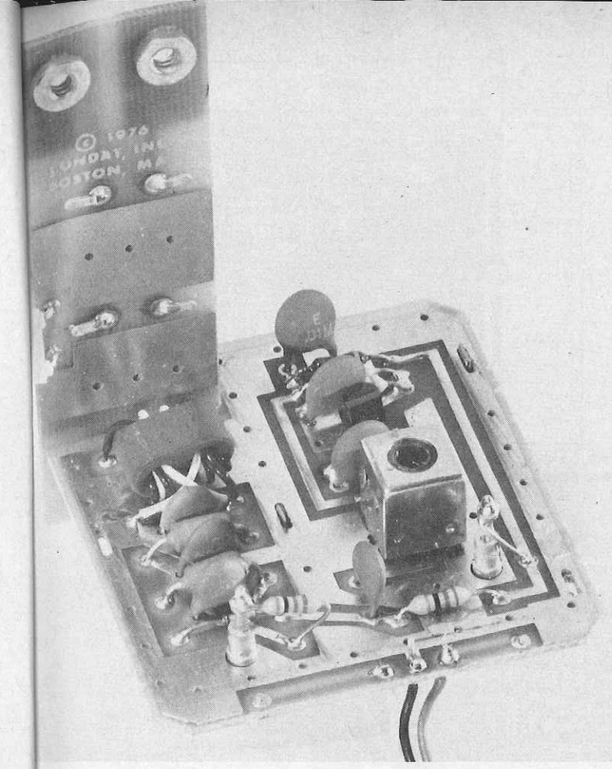

Build this Video Modulator

Permits direct connection of composite video signals from video games and microcomputers to the antenna terminals of your TV set

GLEN DASH

WITH THE ADVENT OF VIDEO GAMES AND the home computer, the ordinary television set is becoming an increasing source of interest for the hobbyist. A TV set can be quickly and safely converted for use as a display monitor using a device known as the Videocube. Basically, the device takes a composite video signal, such as the output of a TV game circuit or the 2650-based microcomputer system (**Radio-Electronics**, April 1977) and feeds a modulated Channel 3 or 4 RF-signal to the antenna terminals of the television receiver.

If we didn't have an RF oscillator/modulator such as the Videocube, the TV set could only be used as a monitor by directly wiring into its video circuit. However, finding the right point to feed in the microcomputer or TV game output often isn't easy, and most TV sets today (especially portables) are not line-isolated, which can lead to safety hazards. Also, poorly designed RF sections will radiate their signal to nearby television receivers and interfere with commercial broadcasts. The Videocube avoids these problems and offers a versatile design that can easily interface to almost any video source.

The Videocube has a 300-ohm output (the type most often used on TV receivers), a selector switch for switching between normal TV viewing and the Videocube's output, and a 3-wire input (5—12-volt power, video input and ground). The Videocube consists of an oscillator that can be tuned to Channel 3 or Channel 4, a modulation section for amplitude modulation of the RF signal from the oscillator, and an output filter for removing spurious harmonics from the signal.

NOTE

The Federal Communications Commission requires that any device to be marketed using a commercial TV receiver as its output must have FCC type approval. Use of the Videocube or other RF device does not automatically entitle a manufacturer to FCC approval.

How it works

The schematic diagram of the Videocube is shown in Fig. 1. Transistor Q1 is used in a Hartley oscillator circuit in which tunable coil L1 and capacitor C4 set the carrier frequency. Feedback to the emitter is provided by capacitor C3. Resistor R3 biases the transistor, as do resistors R1 and R2. The base of the transistor is grounded by C2 for high-frequency signals, making this a grounded base configuration. A filter that prevents RF from getting into the power supply is provided and is comprised of capacitors C1, C5 and resistor R4.

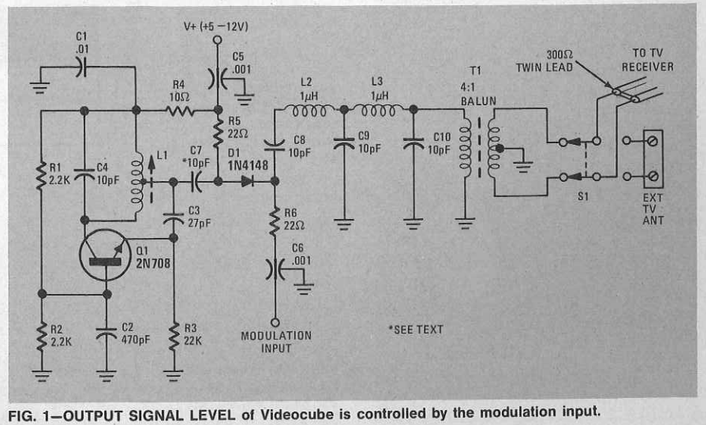

FIG. 1—OUTPUT SIGNAL LEVEL of Videocube is controlled by the modulation input.

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Originally, the large temperature range of the CMOS RCA COSMAC 1802 microprocessor made it a likely candidate. Additional memory, however, can become quite expensive. And because the architecture is nontraditional, it required a ground-up system design.

The very fast 6502 microprocessor has many advantages and only one disadvantage—temperature operating range. This can be solved by placing the entire electronics compartment in a large, thermostatically-controlled "oven." The oven keeps the ambient temperature from falling below 3°C.

OSI (Ohio Scientific Instrument, 11679 Hayden Street, Hiram, OH 44234) offers a rather complete family of microcomputer products with remarkable capabilities at a really low price. Even if you don't plan on using a microprocessor in your collision-avoidance system, I strongly recommend the OSI 440 Video Board as an excellent way of presenting a very flexible, readable display. The 440 is available for $29 unpopulated, plus $4 for shipping and handling. A complete kit, OSI *model 445*, is available for $99, plus $4 for shipping and handling.

System outputs

A passive system can offer a plethora of warnings. These are left to the ingenuity of the designer. Just remember, the time a warning is needed most is the time when attention can least be afforded to it.

Active systems can take over braking, steering, acceleration and more. But the driver proceeds at his own risk. A capacitor shorting out can send a child through a windshield. Double fail-safe and safeguard any system you allow to actively participate in your driving. There hasn't been a system yet intelligent enough to pass a driver's license exam.

One active output you can pursue is the air bag. Many agencies cite the air bag as a positive force in saving lives and reducing injuries. Some foreign cars now offer the air bag. Visit a dealership and talk to the guy at the parts counter about how difficult it is to retrofit one into your vehicle. It shouldn't be too hard. And be on the lookout for a do-it-yourself kit that allows you to install an air bag on your shoulder belt.

An invitation

We have undertaken here to describe some of the elements of a realizable electronic automotive collision-avoidance system you can begin building yourself. Even the individual elements of the system can go a long way toward providing you with the information you need to improve the safety of the driving environment.

We invite your response to the information printed here. Send us your ideas, too. Home computer hobbyists are invited to come up with mathematical models of the driving situation. Then refinements to the system could be plugged in to see what improvements can be made.

Automotive collisions are one of the most costly problems facing us, both in lives and property. Anything we can do to reduce that problem is a step toward making things easier on everybody. **R-E**

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green gun would come up to the bottom end of the BAD sector on the meter; and the red gun just barely wiggled the needle.

The *Nu-Color model 90A* is a plug-in device that is inserted between the picture tube and socket, like a brightener. However, it is *not* a brightener, at least in the usual sense of the word. Between its plug and socket is a little box with three color-coded slide controls, one for each color.

Starting with all controls at the OFF position, I plugged the *Nu-Color* in and turned the set on. As expected, the raster was a bright blue. I adjusted the controls of the *Nu-Color* and came up with a good-looking color-bar pattern. Twiddling the grey scale and the *Nu-Color* controls gave an excellent color picture. Reds saturated normally, with the color control all the way up and all other things looked very good! This device lives up to its claims and its name; it certainly did "restore the color" to this old dog.

As Oneida is careful to explain, the *Nu-Color* is not intended as a "cure-all" for color troubles, but it will help correct problems due to unbalanced picture-tube emission. The device can be installed and adjusted in the home with very little trouble. **R-E**