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A HOWARD W. SAM'S PUBLICATION

Electronic Servicing[®]



**INTRODUCTION
TO SECURITY
SYSTEMS**

A strange case of vertical roll
Closeups are sharp, but.....
Taming color rainbows, part 2



\$975

TUNER SERVICE CORPORATION

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WATCH US GROW

For More Details Circle (1) on Reply Card

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This price buys you a complete new tuner built specifically by SARKES TARZIAN INC. for this purpose.

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Specify heater type parallel and series 450mA or 600mA.

CUSTOMIZE

Customized tuners are available at a cost of only \$15.95.

Send in your original tuner for comparison purposes to:

Introducing the expensive digital multimeter that doesn't cost a lot.

The B&K Precision Model 281. A solid-state, lab-quality portable instrument that measures AC/DC voltage, current and resistance.

The state-of-the-art Model 281 shows readings on a large, clear, 2½-digit numeric display. It also has positive over-range and reverse-polarity indication. There's no need to switch leads. You can reverse polarity at the flick of a switch.

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Featured are 26 ranges: five DC voltage, 100mV to 1000V, with 1% accuracy and 10 megohms input impedance; five AC voltage, 100mV to 1000V RMS, five DC current, 100 μ A to 1A; five AC current, 100 μ A to 1A; and six resistance, 10 ohms to 10 megohms.

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Everything about the 281 says expensive—except the price.

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Very good equipment
at a very good price. **B&K**

\$169⁹⁵



Product of Dynascan Corporation, 1801 West Belle Plaine Avenue, Chicago, Illinois 60613

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January 1973 □ Volume 23, No. 1

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Second class postage paid at Kansas City, Mo. and additional mailing offices. Published monthly by INTERTEC PUBLISHING CORP., 1014 Wyandotte St., Kansas City, Mo. 64105. Vol. 23, No. 1. Subscription rate \$6 per year in U.S., its possessions and Canada; other countries \$7 per year.

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EDITORIAL
RONALD N. MERRELL, Director
CARL H. BABCOKE, Managing Editor
DIANE M. KELLEY, Editorial Assistant
WEBB G. STREIT, Graphic Designer

CONTRIBUTING AUTHORS
Bruce Anderson
Joseph J. Carr
Wayne Lemons
Robert G. Amick

TECHNICAL CONSULTANT
JOE A. GROVES

EDITORIAL ADVISORY BOARD
LES NELSON, Chairman
Howard W. Sams & Co., Indianapolis

CIRCULATION
EVELYN ROGERS, Manager

ADVERTISING SALES
Kansas City, Missouri 64105
Tele: 913/888 4664
E.P. LANGAN, Director
R. JACK HANCOCK, Manager
JAKE STOCKWELL
MIKE KREITER
AIDA CASANOVA, Production

REGIONAL ADVERTISING SALES OFFICES
Indianapolis, Indiana 46280
ROY HENRY
2469 E. 98th St.
Tele: 317/846-7026

New York, New York 10017
George W. Fleck
Room 1227
60 E. 42nd St.
Tele: 212/687-7240

Los Angeles, California 90005
RICHARD BOHEN
3600 Wilshire Blvd., Suite 1510
Tele: 213/383-1552

London W. C. 2, England
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12 Bear Street
Leicester Square
Tele: 930-0525

Amsterdam C. Holland
JOHN ASHCRAFT & CO.
W. J. M. Sanders, Mgr.
for Benelux & Germany
Herengracht 365
Tele: 020-240908

Tokyo, Japan
INTERNATIONAL MEDIA REPRESENTATIVES LTD.
1, Shiba-Kotohiracho, Minatoku
Tele: 502-0656



ELECTRONIC SERVICING (with which is combined PF Reporter) is published monthly by Intertec Publishing Corp., 1014 Wyandotte Street, Kansas City, Missouri 64105.

Subscription Prices: 1 year—\$6.00, 2 years—\$10.00, 3 years—\$13.00, in the U.S.A., its possessions and Canada.

All other foreign countries: 1 year—\$7.00, 2 years—\$12.00, 3 years—\$16.00. Single copy 75c; back copies \$1.

Adjustment necessitated by subscription termination at single copy rate.



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**Now—2 year inboarded warranty
on RCA all-new
Hi-Lite Color picture tubes**

with an optional third year if your customers want it

It's another profit-making reason to sell Hi-Lite color replacement tubes—a 2 year inboarded warranty from the date of installation, plus an optional third year at modest additional charge.

This warranty will help you sell customers on replacing the tube instead of the set. It will help keep them coming back for service on their TV sets and other equipment. And it's further proof of the quality we

build into this top performance line of tubes.

You can sell with extra confidence, maintain your own professional reputation, when you sell Hi-Lite. Get full details from your local RCA distributor. RCA/Electronic Components/Harrison/N.J. 07029

RCA

electronic scanner

news of the industry

Stereo sound for the AM broadcast band might be a possibility, if the FCC approves a request from the Kahn Research Laboratories for a test of AM stereo over station WWDJ of Hackensack, New Jersey. Kahn Research Laboratories (according to **Merchandising Week**) holds patents for a fully-compatible AM-stereo system which allows broadcasting over conventional stations, and for a one-knob AM-stereo receiver. Experimentally, stereo reception can be obtained by using two AM receivers, one tuned slightly above the carrier and one slightly below. Several manufacturers have expressed interest in the system, and it is anticipated that AM-stereo car radios would be the first application, if the system were successfully tested and adopted.

Toshiba plans to market in the U.S.A. picture tubes called Black-Stripe System CRT which are said to have 60 percent more brightness, as reported by **Home Furnishings Daily**. These color picture tubes will have horizontally-in-line guns, a slit-type spherical mask, oblong-shaped color dots, stripes of black to absorb reflected light, and were developed to avoid the basic black-matrix patents held by Zenith.

A hi-fi speaker less than 3 inches thick is being offered by Fisher Radio. As described in **Home Furnishings Daily**, these speakers do not have a conventional cone, but the voice coil is attached to a flat polyurethane disc (or hammer) which is pressed against the polymer plastic panel. The specifications call for dimensions of 29 3/4 inches X 23 3/4 inches X 2 7/8 inches, impedance of 8 ohms, frequency response from 40 Hz to 18,000 Hz and RMS power handling of 25 watts.

Magnavox has introduced a 6.5-pound, hand-held color TV camera, according to the **Wall Street Journal**, designed for video-tape and industrial applications at a selling price of \$2,500. The Chromavue-400 camera has an electronic viewfinder, a self-contained microphone, a four-to-one lens, and operates in normal room lighting.

An atomic-powered nine-pound refrigerator, reported in **Home Furnishings Daily**, has been developed by the Hughes Aircraft Company for the Atomic Energy Commission. Spot cooling as low as -320 degrees Fahrenheit can be obtained by using heat as a source in a method similar to that used in gas refrigerators. The atomic-powered refrigerator is to be used in space and instrumentation applications.

Revolutionary new cooking surfaces should be available in the near future. Several separate articles in **Home Furnishings Daily** tell the facts and guesses about several different cooking systems. Westinghouse, first to develop a "cool top" unit, has a range using reactance heating of ferrous utensils that sells for \$1,500. Pulsonix, Inc. is said to be working on a cooltop unit using reactance heating which heats from the inside out, does not require ferrous cookware, and is supposed to be incorporated into Tappan ranges

(Continued on page 6)

GTE Sylvania has the lines that lay it on the line.

Only GTE Sylvania gives you a choice of three different price lines in color picture tubes.

And GTE Sylvania tells you and your customer exactly what you are getting in each line.

That makes Sylvania tubes easier to sell.

You can tell your customers the advantages of the top-line *color bright 85[®] XR*. You can show them where the savings come from in the economy *color screen 85* line. And you can tell them exactly what they're getting for their money in the middle-line *color bright 85[®] RE*.

The way we see it, if we lay it on the line with you, you can lay it on the line with your customers.

Instead of just handing them a line.



GTE SYLVANIA

	color bright 85 [®] XR	color bright 85 [®] RE	color screen 85
Sylvania rare earth red phosphors	yes	yes	yes
Other manufactured rare earth phosphors	no	no	yes
All sulfide phosphors	no	no	no
X-ray inhibiting glass	yes	no	no
New glass	yes	some	some
Reused glass	no	some	some
Regunned	no	no	some
Screen blemish specs	OEM	OEM	slightly wider than OEM
White field uniformity	OEM	slightly wider than OEM	slightly wider than "RE"
Cut off; purity currents; beam shield leakage	OEM	OEM	slightly wider than OEM

For More Details Circle (5) on Reply Card

January, 1973/ELECTRONIC SERVICING 5

after perfection. No prices have been estimated, but it is rumored the Pulsonix/Tappan might retail for under \$400. Also, Mitsubishi Electric Corporation of Japan (MGA trademark in the U.S.A.) has a cooking unit selling for about \$325 in Japan. In addition, GE has announced it is introducing a "smoothtop" range with a top made of glass and plastic, but heating by means of conventional elements.

A solid-state TV camera without an imaging tube has been developed by NASA. The mosaic receiving the light from a lens is made up of about 200,000 photo-transistors on a single silicon wafer about 2.5 cm square. Resolution is said to be 400 lines vertical. High voltage is not required, and there are no errors from beam deflection because no yoke is used.

Gimbels department store in New York City has started displaying unique electronic prototypes, according to **Home Furnishings Daily**. These displays are intended to be attractive to the shoppers and give them information about the future trends of electronics. The first one shown is called the "Silent Typewriter", and was invented by a Zenith scientist. When connected to the United Press International newswires, it prints words on a phosphor drum. A laser beam fanned into character-generating beams is modulated by high-frequency sounds. After the equipment is developed further, it is estimated that a whole volume of the Encyclopedia Britannica could be sent from London to New York in about 18 seconds. Other possible future applications might be electronic typesetting, microfilm storage and high-speed transmission of pictures.

Lithium batteries using a non-aqueous organic electrolyte are supplied by Chromalloy Electronics to commercial airlines and various branches of our military services. The manufacturer claims very long shelf life, 60 percent power capacity down to -40 degrees F, and a power capacity nearly three times that of magnesium or mercury batteries.

Something new in video-tape players from Matsushita Electric Industrial Company is a system which, as reported in **Home Furnishings Daily**, shows still color pictures on the screens of television receivers by using ordinary cassette tapes. The player is designed primarily for sales and service training, to teach languages, and for other educational uses. □

TO A PRO, TIME IS MONEY

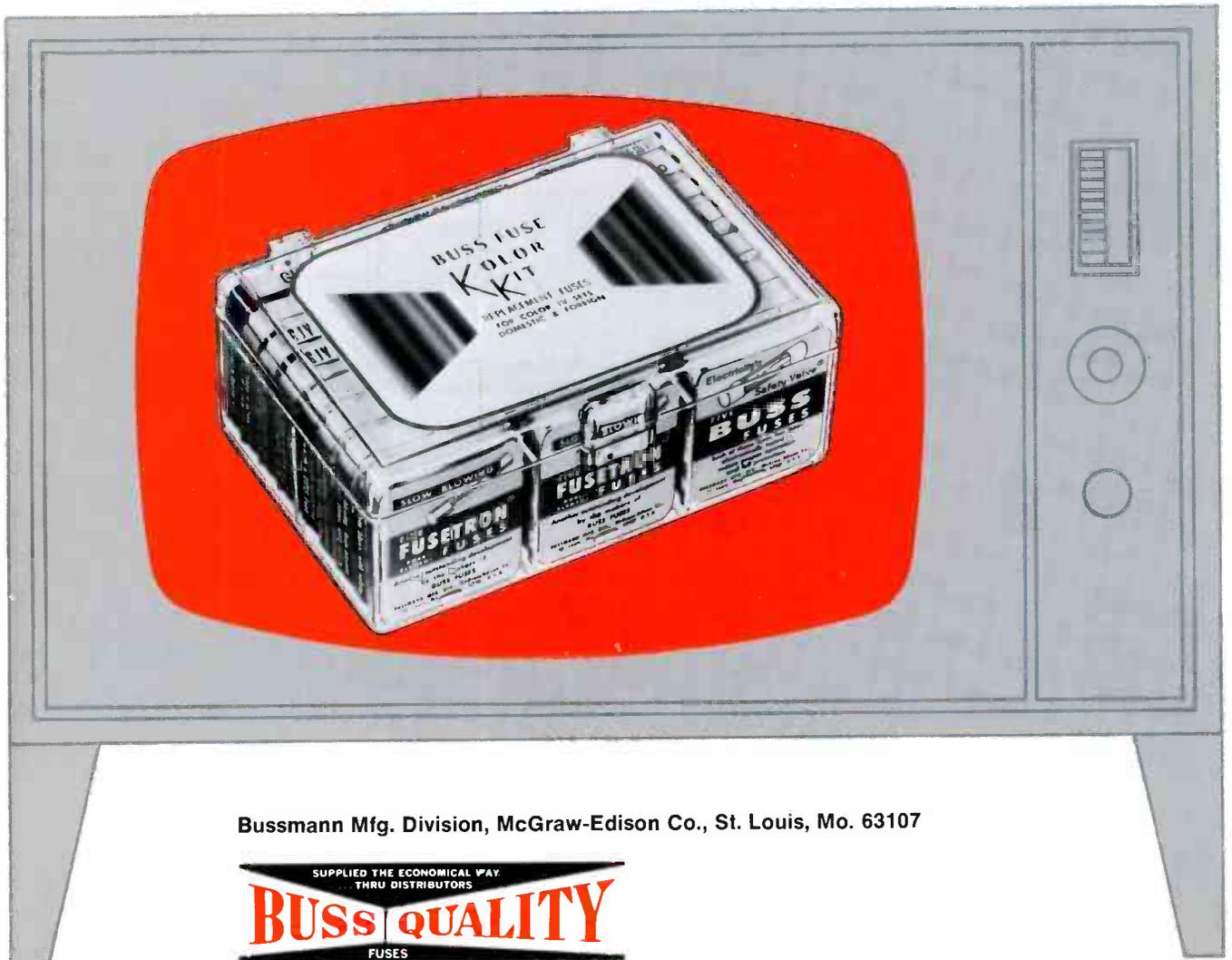
So take time to read about the **BUSS® Kolor Kit** of replacement fuses

The mark of a professional Certified Electronic Technician is efficiency. He's got the ability to locate a problem quickly, repair it quickly, and get on to the next job.

One of his secrets is that he always has the part he needs when he needs it. That's where the BUSS Kolor Kit of replacement fuses for domestic and foreign TVs comes in.

The Kolor Kit comes in two sizes, the No. 140 Kolor Kit containing 120 fuses, and the No. 240 Deluxe Kolor Kit containing 240 fuses plus four sets of twin clips. With a BUSS Kolor Kit in your tube caddy, you'll always have the fuse you need when you need it. Ideal for servicing both color and black and white TV's.

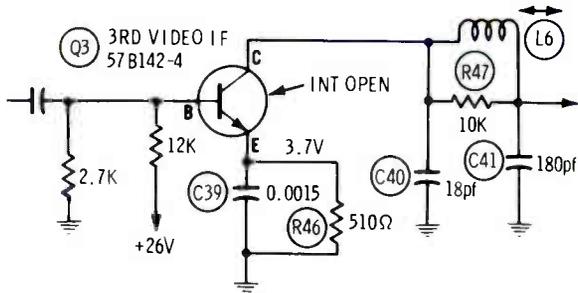
BUSS Kolor Kits are available from your local BUSS Distributor.



Bussmann Mfg. Division, McGraw-Edison Co., St. Louis, Mo. 63107

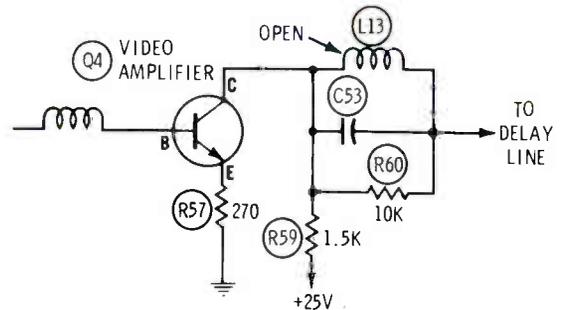
SUPPLIED THE ECONOMICAL WAY
THRU DISTRIBUTORS
BUSS QUALITY
FUSES

Chassis—Admiral 1K10-1A
PHOTOFACT—1083-1



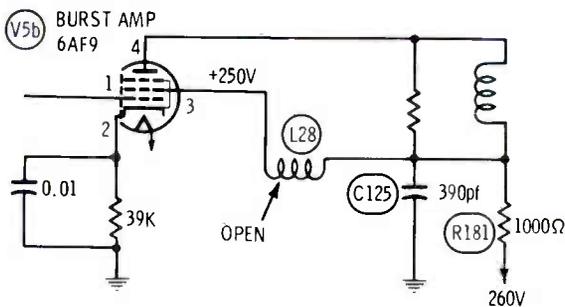
Symptom—Intermittently-weak picture and sound
Cure—If emitter voltage of Q3 is near zero when picture is weak, replace transistor Q3

Chassis—Admiral 1K10-1A
PHOTOFACT—1083-1



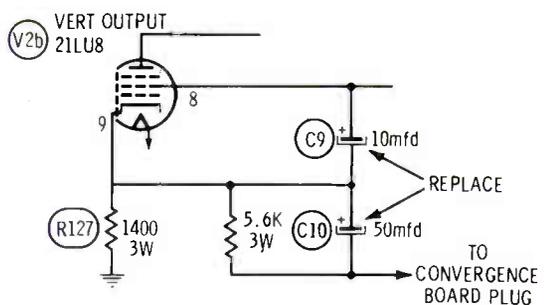
Symptom—Excessive brightness; weak and distorted video
Cure—Short across L13. If trouble clears, replace L13

Chassis—Admiral 3H10
PHOTOFACT—920-1



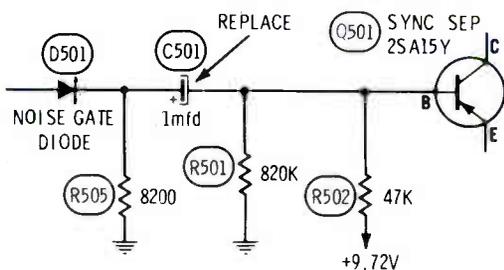
Symptom—Color cannot be locked
Cure—Check screen voltage of the burst tube and continuity of L28. Replace L28, if is open

Chassis—Admiral K10-2A
PHOTOFACT—1022-1



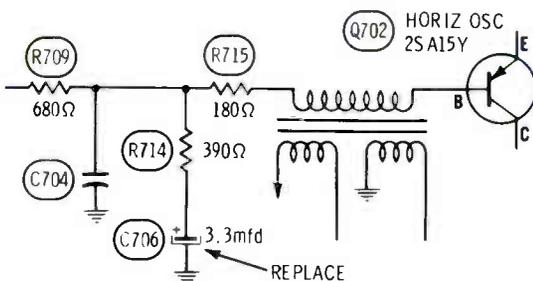
Symptom—Insufficient height; hold control at one end
Cure—Check C9 and C10; replace both, if either is open

Chassis—Wards GEN-11960A
PHOTOFACT—1097-2



Symptom—No vertical or horizontal locking
Cure—Check C501, and replace if open

Chassis—Wards GEN-11960A
PHOTOFACT—1097-2



Symptom—Picture bending and horizontal instability
Cure—Check C706, and replace if defective

Channel Master's new Spartan Amplifier.

It knows how to say "NO!"

Antenna amplifiers don't have a good reputation. They just seem to sit up there and attract all kinds of trouble. Channel Master knows that even one callback is too many. And, frankly, we felt that if the industry gave you a more reliable, trouble-free, high-performance amplifier, you'd put up a lot more. That's why we've just engineered a brand new one--the Spartan. It doesn't make problems. It solves them.

"No" to signal overloading. The Spartan uses new high-capacity semiconductors that can handle up to 200,000 microvolts of signal without distortion or cross-modulation. No amplifier can beat it.

"No" to lightning damage. Lightning surges are the #1 cause of amplifier failure. But now you've got the Spartan. Thanks to advanced new energy-absorbing circuits and components, it takes charge after charge--and still keeps working.

"No" to FM interference. It's the only amplifier with 2 built-in FM traps: a switchable filter that attenuates signals 25 dB across the FM band, plus a tunable trap--only 1 MHz wide--that gives you an extra knockout punch exactly where you need it.

"No" to tropical heat, sub-zero cold, and pouring rain. Exceptional stability and reliability in any kind of weather. And it maintains its flat gain, with no oscillation or hum, even when line voltages fluctuate.

CHANNEL MASTER
SPARTAN SERIES
ANTENNA AMPLIFIERS
...for guys who
can't afford trouble!

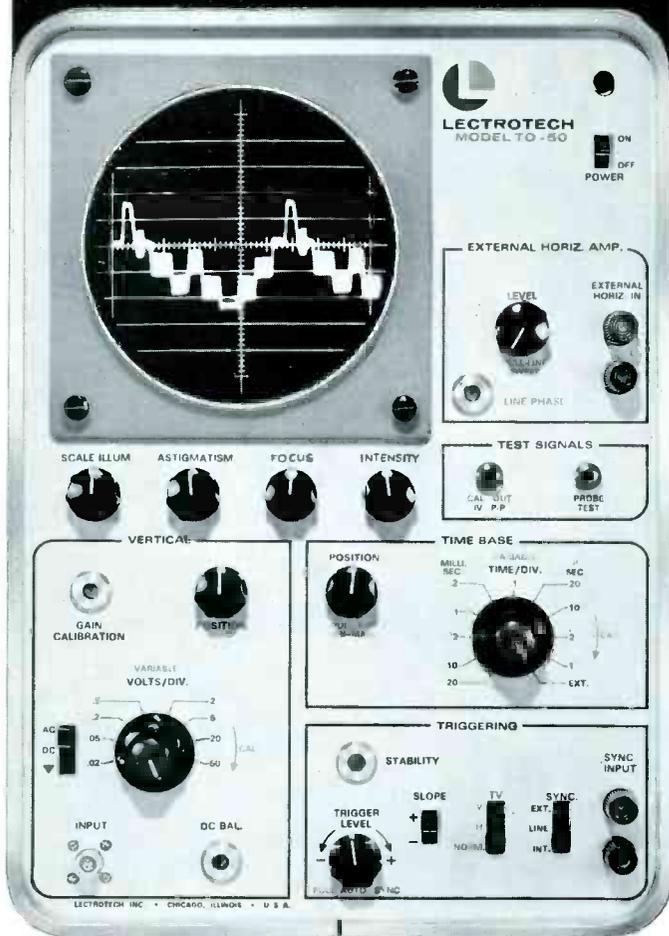
75 and 300 ohm models for every reception area. Write for technical literature.

CHANNEL MASTER
DIV. of AVNET, INC.
Ellenville, N.Y. 12428



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**AT LAST . . . solid state
triggered sweep, wide-band
at a price you can afford!**



Made in U.S.A.

5" oscilloscope/vectorscope

Triggered Sweep: Easy to use. Positive sync results in absolute stability of patterns.

Solid State: For reliability and performance.

Wide Band: 10 MHz—for increased use in all servicing, industrial and educational applications.

D.C. Amplifiers: Eliminates pattern bounce. Permits viewing A.C. signals and D.C. level simultaneously. Use as a sensitive D.C. voltmeter.

plus . . . Calibrated vertical attenuator. • Calibrated horizontal time base. • Automatic sync mode. • TV sync selector. • Vector-scope input for color TV servicing. • External horizontal amplifier. • 60 cycle horizontal sweep (sine wave) with phasing control. Compatible with all sweep generators. • Edge lit calibrated scale. • All solid state (tube protected input).

ONE YEAR WARRANTY

TO-50—oscilloscope/vectorscope Net 339⁵⁰

See your distributor or write Dept.

LECTROTECH, INC.

5810 N. Western Avenue • Chicago, Illinois 60659

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reader's exchange

Needed: A schematic or service information for a very old Majestic radio model No. 70, manufactured by Grigsby-Grunow Co.

Alfred B. Witzl
1645 Campbell Ave.
Des Plaines, Ill. 60016

Needed: Schematic for a Curtis Mathes radio-phono combo model 40M614.

Bradshaw TV Radio Service
2411 Leffingwell St.
Houston, Texas 77026

Needed: Schematic for a Mercury VOM model 1800.

Bill Brett
P. O. Box 562
Leesburg, Florida 32748

Needed: Operating manual for Solar Cap-exameter, Model I-60, 2U or CF.

Harold Bell Wright
1811 Oxford Ct.
Roseville, Calif. 95678

Needed: Service data and voltage readings for a Lambda CI580M power supply.

Edwin G. Hansen, Jr.
1468 Harmony Rd.
Akron, Ohio 44313

Needed: Speaker for old Atwater Kent radio. Might trade an Atwater Kent radio for it.

AEC H. Adams
209 W. Shadywood Dr.
Midwest City, Okla. 73110

Needed: A schematic and operating instructions for a Radio City Products Co. Model 668 multitester.

Leo J. Benedetti
RFD 4
Salem, Ohio 44460

Needed: Schematic and operating instructions for Precision Series E-400 Sweep Generator. I will gladly pay for any cost incurred in reproduction or send to me and I will reproduce and return as soon as possible.

Barrie L. Schartz
RD 2 Box 146
Havre De Grace, Maryland 21078

Needed: A new tube chart for a Jackson model 648A tube tester. My letter to Jackson Electrical Instrument Co., 124 McDonough, Dayton, Ohio was returned as addressee unknown.

Jacob Cihak
730 Buttonwood Avenue
Pennel, Pa. 19047



These solid state color systems are the most serviceable we've ever built. Because independent servicers helped us design them.

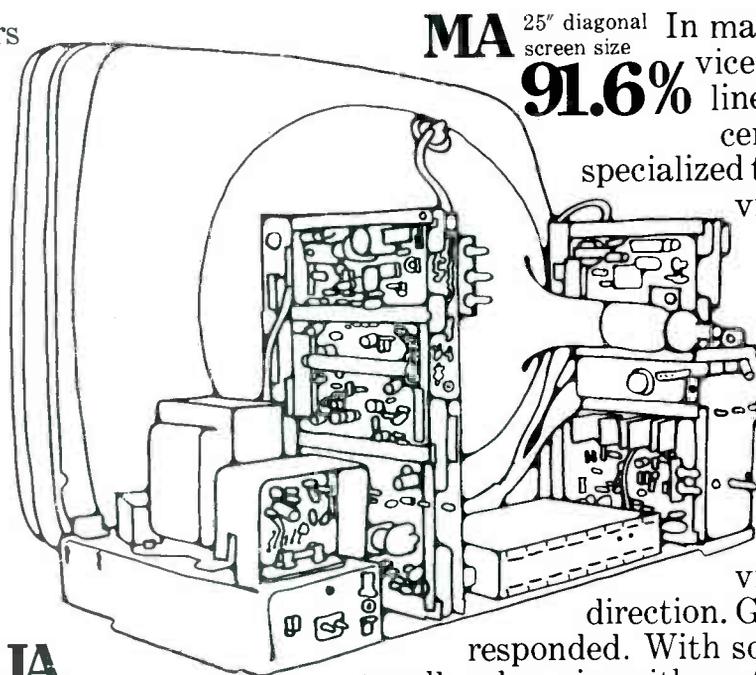
Independent servicers awarded us these serviceability ratings. Proof that foresight pays. The foresight of the television service industry in developing specific serviceability guidelines and urging TV manufacturers to use them. The foresight of General Electric in working side by side with independent servicers to create 100% solid state sets that are easy to service.

GE's new solid state sets are designed for maximum accessibility. With extensive use of visual aids. And plug-in modules and components. Example: 95% of the total components in GE's new solid state modular color console models can be removed for servicing without using a soldering iron. Solid state Porta Color® II models open like a book for ease of service.

Impressed? That's only half the story. To improve local parts availability we are expanding parts distribution through independent parts distributors.

We build every television as if we were going to use it ourselves.

GENERAL  ELECTRIC



MA 25" diagonal screen size

91.6%

In many states, TV servicers use direct phone lines to regional parts centers. We provide specialized training. Our Television Service News provides advance information servicers need to more easily service GE monochrome and color models.

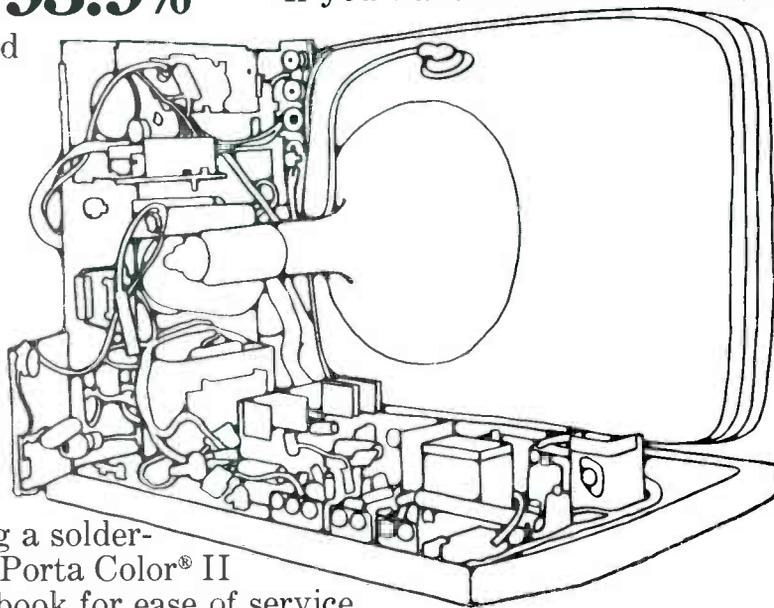
The service industry has provided foresight and direction. General Electric has responded. With solid state products to sell and service with confidence. To achieve our mutual goal of customer satisfaction.

JA

19" diagonal screen size

93.9%

If you want to know more about GE service, call collect or write "Dutch" Meyer, Television Receiver Products Department, Portsmouth, Virginia 23705. Phone (703) 484-3521.



servicebulletin

a digest of info from manufacturers

Distorted Sound On CATV

General Electric C1/L1 and C2/L2 Color Chassis

Distorted sound and critical fine tuning to obtain normal sound, when a cable (CATV) system supplies the signals, probably is caused by the amplitude of the sound carrier being attenuated excessively in the cable system.

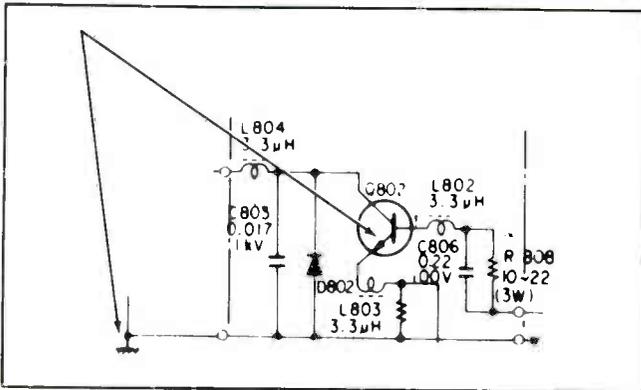
Sensitivity of the sound channel in the receiver can be increased by installation of a GE EP50X6 sound kit, obtainable from GE parts distributors.

Included in the kit are a double-tuned interstage transformer, two resistors, one capacitor, one RF choke, one diode and full instructions for installation and adjustment.

Black Vertical Line In Picture

Sony KV1710 and KV1720

A black vertical line near the left edge of the picture might be caused by radiation from the horizontal output transistor which is picked up by the antenna or tuner leads.



Courtesy of the Sony Corp.

Minimize or eliminate the line by adding a 470-pf capacitor between ground and the emitter of Q802, the HV converter, as shown in the schematic.

Bright Horizontal Line Moving Upward

Magnavox T979 Color TV Chassis

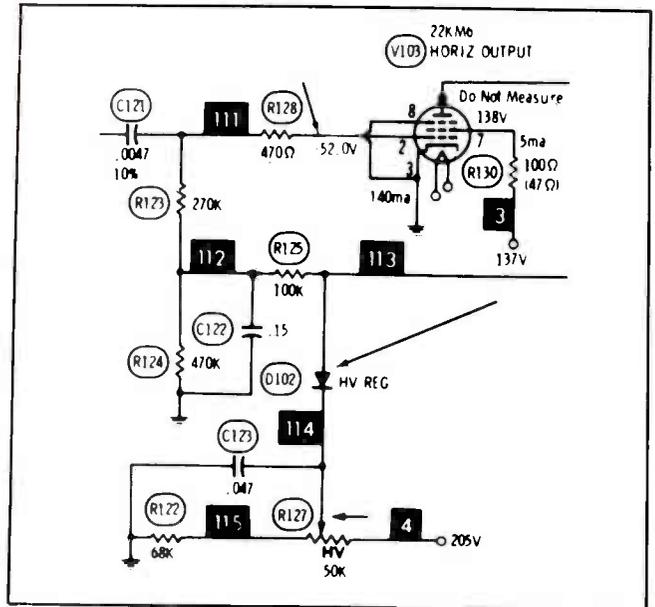
An intermittent bright horizontal line that moves up through the lower third of the raster, or occasional cases of vertical jitter might appear to be corrected by tapping components on the "D" panel.

Usually these symptoms are caused by corroded connectors to the panel. Both the male connector pins on the chassis and the female connectors on the panel should be cleaned using Chloro-Kleen or Dry-Kleen (both are General Cement products). A toothpick could be used to insert the cleaner inside the female connectors.

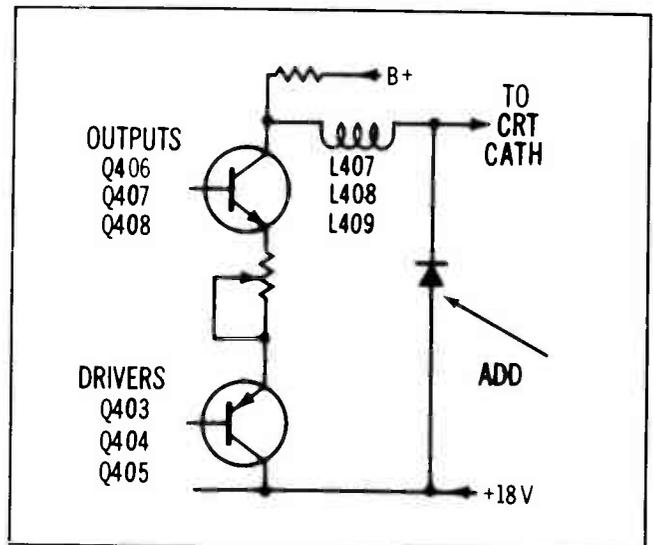
Black Vertical Line In Picture

Magnavox T936, T056, or T957 Color TV Chassis

A black vertical line resembling a snivet or Barkhausen on the left edge of the picture might be caused by leakage or an arc in diode, D102.



This diode is the rectifier for the high-voltage regulation circuit and is connected to the center terminal of the HV control. Replace the diode with Magnavox part number 530088-1004.



Red Smear On B-W

Sony KV-1510

Red smears to the right of extremely white objects in a b-w picture might be caused by saturation of the collector current of the video-output transistors.

Correct the problem by adding Sony part number UFSD-1A diodes from L407, L408 and L409 to the 18-volt supply, as shown in the schematic.

Late production chassis have had this modification made at the factory. □

An introduction to security systems

By John E. Cunningham

The following information has been reprinted from the Howard W. Sams Co., Inc. book number 20767 entitled "SECURITY ELECTRONICS".

In the past, the word "electronics" had an almost magic connotation. The mere fact that a store or other business was protected by an "electronic" system was enough to discourage all but the most intrepid burglar. Unfortunately, this desirable situation did not continue.

Many small businessmen took advantage of this fear of electronic systems and, without bothering to invest in the actual systems merely displayed signs or window decals that indicated an electronic intrusion alarm was in use. Dummy systems such as imitation closed-circuit TV cameras, complete with lenses and flashing lights, are still to be found in some establishments. These devices are just empty boxes. Such schemes might frighten away an amateur, but to the skilled burglar of today they are nothing but an invitation to break in safely.

There is a tendency for the average, law-abiding citizen to think of a burglar, holdup man, or vandal as a rather stupid person. This simply is not true. The burglar today is a skilled craftsman, equipped with up-to-the-minute tools for his trade. His stock in trade often includes a detailed knowledge of the principles of intrusion alarms and techniques that can be used to foil them. This has led to a striking difference between electronic intrusion alarms and other types of electronic equipment. Whereas most commercial electronic equipment must work as reliably as possible with the help of skilled electronic technicians, an intrusion alarm must operate reliably, even with a technician doing his best to keep it from working.

TYPES OF ALARM SYSTEMS

Various types of intrusion alarms, which use different operating principles, are available. Each type has its own advantages and limitations. The philosophy of selecting an alarm for a particular installation is based on the following considerations:

1. If possible, burglaries, holdups, and acts of vandalism should be prevented from happening. The presence of an effective alarm system is definitely a deterrent to would-be burglars and vandals. No one wants to break into a home or establishment where all previous intruders have been caught and sent to jail.
2. The presence of an intruder must be detected as early as possible. There is a saying in the security field to the effect that a burglar can open *any* safe or vault if he is given enough time.
3. The alarm must bring a quick response. An alarm is useless unless action is taken.

Intrusion alarm systems are usually classified in one of three general categories:

1. Centralized Protection Systems
2. Remote Alarm Systems
3. Local Alarm Systems

The principal features of each of these systems are described in the following paragraphs.

Centralized Protection Systems

A centralized system is one in which the presence of an intruder in any protected area of a facility is indicated at some central location such as the headquarters of the security guard. This type of installation is widely used in industries and in institutions such as schools and manufacturing plants that have their own security police forces. The facility may include many different buildings that require different degrees of protection. Each area is equipped with the type of alarm system best suited to the application. The signal outputs from the individual areas are then connected by wires to a control panel at the central location. A typical central station console is shown in Fig. 1.

With a properly designed installation of this type, one man can monitor the

security status of an entire industrial plant. When an intruder enters any of the protected areas, a signal is flashed to the central console. One or more security guards can be immediately dispatched to the scene.

Remote Alarm Systems

Facilities that have limited or no security forces of their own may use remote alarm systems. In this system, each of the areas to be protected has its own intrusion detector. The outputs of the systems are wired to some remote location—usually a police station or the headquarters of a private security company.

The connection to the remote location may be by a radio link, leased wires, or regular telephone lines. In the latter case, electronic devices are used that automatically dial the number of the police station or security service (see Fig. 2).

The effectiveness of this type of system depends on how long it takes the police or the security service to respond and get to the scene of the crime. Many burglaries netting large sums have been performed in a period of a few minutes.

Remote alarm systems are often used as a back-up to the centralized systems previously described. With this arrangement, the local security guards will respond immediately to any intrusion, and the police will arrive soon afterward.

Local Alarm Systems

Local alarm systems, as the name implies, sound a bell or siren on the premises whenever an intruder trips the alarm. These systems are usually used where the other systems are not practical. For example, a local alarm would be used in a remotely located facility where the time required for the police or representatives of a security service to arrive would be so long that they would invariably reach the scene after the burglar had gone.

One disadvantage of the local alarm

is that the burglar knows when his presence has been detected. He can then stay only one or two minutes longer, then leave. Many local alarms bring a response only after the intruder has gone.

In spite of this limitation, the local alarm has its applications. For example, a homeowner may not be willing to pay for a large system that will bring the police, but may feel that he can adequately defend his family and possessions if he is merely alerted to the presence of an intruder. A well-designed local alarm will detect an intruder when he starts to enter, and will alert the resident. In many neighborhoods, people have a great enough sense of responsibility that they will call the police if they hear a burglar alarm in the area.

One factor that should not be ignored in applying the local alarm is that it is capable of producing a strong psychological effect. For example, if an intrusion alarm is arranged so that it will activate a siren that will emit ear-splitting wails, it will have an unnerving effect on most intruders. In addition to the disturbance, it will make it impossible for an intruder to hear the approach of a police cruiser. This alone might force a burglar to leave before he has finished his planned activities. The psychological effect can be enhanced considerably by adding flashing, blinding lights to the audible alarm.

TYPES OF PROTECTION

Most of the chapters of this book describe the detailed principles of operation of different types of intrusion alarms. The type of alarm that is best suited to a particular installation depends to a great extent on the exact type of protection that is required and the extent of protection that is economically feasible. The action taken by a prospective intruder usually depends on his expected reward. If the prize is great enough, he will resort to any plan that seems to have a chance of success, no matter how elaborate the plan may be. He will make any possible attempt to frustrate any detection system and will take great risks. On the other hand, if the maximum possible return from breaking



Fig. 1 A typical centralized-protection control console.

into a place of business is probably small, he will not be willing to take such great risks, and a comparatively simple system might be an adequate deterrent.

Three general categories of protection are available:

1. Perimeter, or point-of-entry protection
2. Specific-area protection
3. Spot protection

One or more types should be considered for every installation.

Point-of-Entry Protection

Where practical, it is usually advisable to detect an intruder as early as possible. This is usually accomplished by installing detectors on doors, windows, gates, and fences. The system is designed to initiate an alarm as early as possible, before the intruder has a chance to accomplish anything. Stores and other places of business that are closed during the night usually require this type of protection.

The principal limitation of this arrangement is that it is rarely practical to provide complete protection. Even if all of the doors, windows, and even the walls of an area are protected, it is still possible and not at all uncommon for burglars to enter an area by cutting through the floor or ceiling.

There are also facilities where perimeter protection is not practical. It might not be desirable, for example, for an alarm to sound every time an intruder passes through a freight yard.

Similarly, a facility that is open for business twenty four hours a day would have no use for perimeter protection.

Another limitation of perimeter protection is that it is useless against the "stay-behind." The "stay-behind" is a burglar who enters a place of business during normal business hours. He then finds a hiding place and remains hidden until after the place is closed and all employees have gone. When he feels that it is safe, he comes out of hiding and helps himself to the merchandise. Then he breaks out of the store, tripping the perimeter alarm on his way out. By the time the police or security guard arrives, he is well on his way.

Specific-Area Protection

Specific-area protection uses systems that detect the presence or movement of an intruder in an area. This type of protection is an excellent addition to a perimeter system. It will pick up the "stay-behind" quickly as soon as he decides that all is clear and starts to move around.

Specific-area-protection systems are frequently used where a particularly sensitive area needs extra protection and where perimeter systems are not practical. For example, part of a factory may operate twenty four hours a day while other parts are only open during the daytime. A perimeter system would be useless because it would be tripped whenever a legitimate

worker entered the plant. In such a case, the areas that are not normally occupied at night can be equipped with a specific-area-protection system. Thus, if anyone attempts to enter a closed area such as an office or stock-room, an alarm will be actuated.

Spot Protection

A spot-protection system is usually associated with one or more specific objects, such as a safe or a jewelry case. It trips an alarm whenever anyone touches, or in some cases even comes near, the protected object. This type of system is used to back up other systems to provide maximum protection for highly sensitive objects. File cabinets containing secret data, safes, and cases containing valuables are often protected in this manner.

Spot-protection systems are often used as annunciator systems during normal business hours. For example, the proprietor of a store may be happy for customers to browse through his store, but would want to know if they attempted to open a show case containing valuables. A system that is connected to a regular system during the night can be connected to a small bell or buzzer during the day. In this way, there would be a warning whenever anyone tried to open the protected case. Similar systems can be used to protect file cabinets containing government or business secrets.

FALSE ALARMS

The requirement for extreme reliability in the face of attempts to sabotage the system has led to the design and installation of systems that are "fail safe." In such a system, the alarm will sound whenever the power or any of the components in the system fail. On the surface, this appears to be an advantage, but if the number of false alarms is high, it can actually be a disadvantage because it will destroy confidence in the system.

There are cases on record where store managers have been called out of bed late at night so often by false alarms that they no longer use the alarm system at all. Nobody has confidence in a system that is often wrong. It is like the old story of the shepherd boy who cried "wolf" too often.

There are also cases on record where burglars have used false alarms to foil an otherwise foolproof alarm system. In this scheme, the burglar regularly trips the alarm and leaves immediately. The police or guards arrive only to find no trouble. After he has done this

long enough to completely undermine everyone's confidence in the system, he breaks in and helps himself. For this reason, well-designed systems differentiate as much as possible between an actual intrusion and a component failure. □

Burglary today is a big business. Losses nationwide are greatly over 1-billion dollars a year. Many stores have been driven out of business by repeated losses from thefts or burglaries; others have been judged a poor risk by their insurance company, who cancelled the policy. Burglary and vandalism in homes are bringing worry and doubt to ordinary people living in quiet residential sections. Nearly everyone needs protection from these dangers.

Appliance sales and service stores are among the prime targets for these sneak thieves, because small radios and TV's rank only behind jewelry and cameras in ease of "fencing" following theft.

We, in the home-entertainment electronics field, should be vitally interested in protection by security systems for these two general reasons:

- To protect your own shop or home from losses; and
- To provide you with additional profit from installing security systems in homes, offices, shops and stores.

The editors of ELECTRONIC SERVICING strongly believe that the installation and servicing of security systems is OUR business. We have the technical knowledge (or easily can acquire it), the same tools and test equipment are required, and many security components are available from the same wholesale distributors from whom we regularly obtain parts.

LET'S CLAIM THIS ADDITIONAL BUSINESS, AND NOT ALLOW OTHERS TO TAKE IT BY DEFAULT!

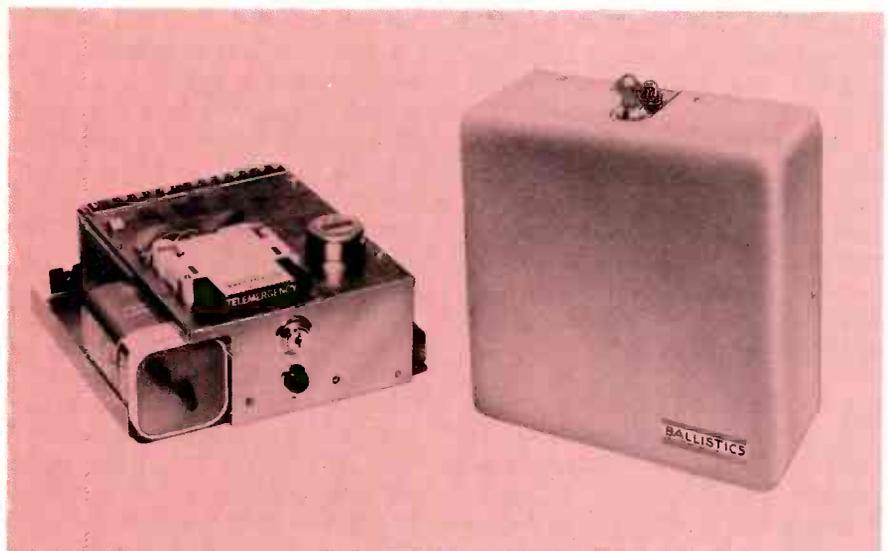


Fig. 2 One type of automatic-dialing device which can call the police.

Inventory control for the small shop

By Robert G. Amick

Have you hesitated about starting an inventory control system for your parts because you were concerned it might make a paper-shuffler out of you? The truth is that increased efficiency usually compensates for the few extra hours spent on paper work. No shop is too small to benefit from a simple inventory-control system.

Is your parts inventory organized and controlled? Do you keep complete stock records and purchasing records? Do you keep a close check on slow-moving or high-cost items, or on those nearing obsolescence?

Your answers to all those questions should be "yes", because inventory control is vital to good business management.

Inventory control often is thought to be something for the "big boys" rather than for small shops. Not so! Perhaps inventory control seems easier for a large staff where responsibilities can be shared. But it's just as important to the man who wears all the hats of purchasing agent, stock man, technician and owner or manager.

The nature of the business of repairing home-entertainment products creates extra inventory problems because of the many makes and models requiring non-interchangeable parts. Perhaps this is the reason so little is written about inventory systems for small shops.

However, many important characteristics are common to the inventory-control systems for different types of businesses. By using them as a starting point, we can discuss what benefits inventory control should bring you. Then later, we will design a simple system to meet your needs.

Goals of Effective Inventory Control

Any good inventory-control system must do these things:

- Assure you of adequate supplies at all times;
- Provide an organized storage plan

which saves the technician's time and prevents overstocks;

- Furnish purchasing guidance about which item to stock, and how many. Also, at what point of depletion you should reorder;
- Prevent over-investment in parts, and reduce over-investment in obsolete parts, rarely-used or high-cost parts;
- It should back up your financial record-keeping, so the "Parts Inventory" entry in your financial statement is meaningful; and
- It should accomplish all of these objectives with a minimum of paperwork and wasted motion.

Control And Information

Control is the heart of good management, and information is essential to effective control.

Figure 1 illustrates the chain of control, beginning with arrival of your parts order. Your receiving clerk opens the shipment, inspects for damage, counts and checks against your purchase order, and transfers the components to the parts department. This is the beginning of control: You make sure you get what you pay for, and pay only for what you get that is in usable condition. Any shortages, breakages and errors are caught early so they can be adjusted promptly with the supplier.

Only those items transferred to stock become entries in your control records. You might have received 36 6JE6A tubes, but 6 were broken. You send 30 to stock, you had 8 on hand making a total of 38 ready for sale. A month later you're down to 6. That tells you how fast you used your stock, which gives you an idea of how many to buy, and how many to keep as a minimum to cover any delays following new orders.

In the parts department, make sure the parts are stored according to a plan. This means they should always go to the same bin. These bins should be checked periodically to see if the stock is declining too rapidly. Order more parts when the count drops to

the reorder level you have predetermined.

Haphazard Storage Causes Overstocking

A logical storage plan doesn't merely save time, it also prevents overstocks. For example, you're out of 1000-ohm 1-watt resistors. Three weeks ago you had 2 dozen. It appears you are using 8 a week. So, you rush-order 30. After they are delivered, you discover most of the missing 2 dozen hidden in a corner. Now you have 45 resistors, and as your weekly-use rate is actually 3, you have an excessive 15-week supply.

Bin Counts

It is necessary to know how many parts are in each of the bins. In large-volume operations, especially those using Electronic Data Processing (EDP), this is done by marking all incoming and outgoing units on the stock cards for a perpetual inventory.

But if your parts business is small, a weekly check of the bins is sufficient.

Watch Those Minimum Orders

Some wholesale suppliers have minimum-price orders. Others require cash with a small order, or set a service charge on orders under a certain amount. You should plan your purchases to avoid these penalties, and to take advantage of any special discounts or larger orders.

Stock Cards

Stock cards (see Figure 2) are required for any system of inventory control. On each card is the identification of the part, its storage bin number, normal reorder quantity, reserve-stock level, supplier, cost and selling prices and the purchase date. Also, lines are provided for reorders.

Keep these cards in the bins as identification, and to provide prices for the technicians who remove parts for servicing.

Also, a card can be removed and turned over to purchasing when more parts should be ordered. It serves as a

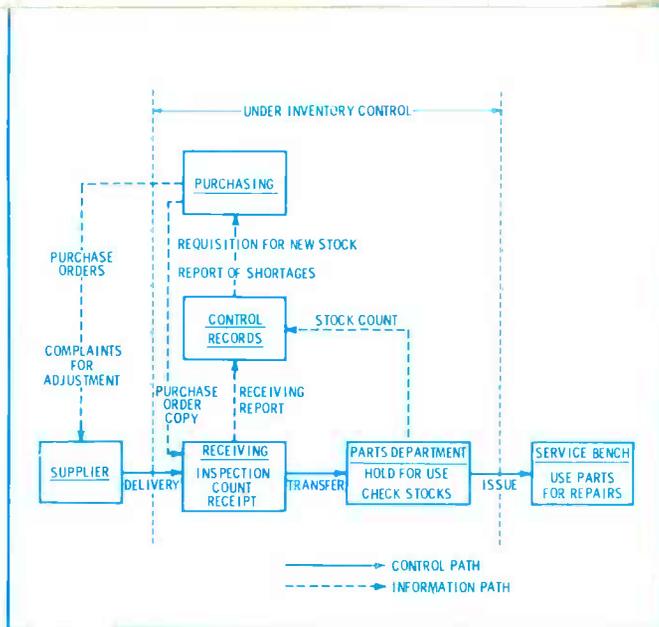


Fig. 1 Flow chart of an inventory-control system.

16 50 3
10 2 0 0
5 3

Part No.	Part Name	Storage Bin No.	Order Quantity	
Supplier Name		Reserve Quantity		
Supplier Address		Net Price		
Supplier Phone No.		Selling Price		

Date	No. Ordered	Rec. Date	No. Rec.	Inventory	Remarks

Fig. 2 Sample stock card for inventory control.

requisition. In some extremely simple systems, these cards are the only items used for inventory control.

Advantages

The system we're discussing fulfills several important objectives. Parts orders are systematic. Quantities are determined by past records (not by guesswork or from possibly-faulty recollections).

Also, storage is organized, which saves time, prevents hidden overstocks and makes efficient use of your storage space. The results are fewer "Out of Stock" notations on your service orders, fewer missed deliveries to customers caused by parts delays, fewer parts-chasing trips that shouldn't have been necessary.

Ideally, you can keep track of items which don't move fast enough to justify tying up money in them. Or those items that once were fast-moving but are slowing down and in danger of becoming obsolete. You can see whether those expensive parts move fast enough that they should be stocked.

The system can give you efficiency by doing the greatest possible business on the least possible investment in parts, by saving time, and by reducing waste and loss in your parts business.

Parts Turnover

In an earlier discussion of Operating Ratios (August, 1971), there was one item called Inventory Turnover; that is, the ratio of cost of the parts sold to the average parts inventory. A minimum of 2.5 to 3 turnovers a year should be maintained, although 4 turn-

overs would be more desirable. That means the cost of parts sold should be about 4 times your average investment in them.

It is not economical to stock a part you might only use once or twice a year. You must balance the expense of keeping the part in stock plus the interest you lose in not investing a like amount of money in a savings account against the extra expense of obtaining the part after it is needed.

Also, it is not generally advisable to stock extra parts as an investment. If the price or demand goes down, you can lose. And even if the price goes up, inflation and loss of interest can cancel most of the paper profit.

Information

In addition to the data obtained from the parts cards, you need information from outside sources to help determine additions to your inventory. It pays to consult with the distributors of new receivers and study schematics of new products for tips about items to stock in the future.

Paper Work

Perhaps this all sounds as though an inventory-control system might turn you into a paper-shuffler. Yes, it might slightly increase the amount of paper you're handling. But maybe you haven't been shuffling enough paper for your own good! If it pays you—in increased parts business per dollar invested, or in money saved—then shuffling papers is good business.

Suppose you now take in \$6,000 per year in parts sales on a \$4,000 inventory. You're doing just 1.5 turns per

year. By doing the extra paper work, you might get the same \$6,000 from parts sales but with an investment of only \$3,000. If so, you've increased your inventory turns to 2; the same sales for less money invested.

Increasing your inventory turns has another advantage. The faster you're turning, the less chance there'll be of obsolete "roosters" on your shelves. Most of your money should be invested where you get prompt returns.

When Do You Need Inventory Control?

Every shop owner or manager needs a good inventory-control system. But you need it especially if:

- Your investment in inventory is increasing without an equal rise in parts sales to keep the turns even;
- You have to "hunt" parts in your stockroom;
- You're overstocked on any but inexpensive parts;
- You've been stuck with some real "oldies" that were obsolete when you bought the last batch;
- You rarely take advantage of quantity or large-order discounts, or if you often pay extra for under-the-minimum orders; or if
- You must make frequent runs to pickup a few parts, or require frequent rush orders for just one or two parts.

These conditions are danger signals indicating that unsystematic buying and helter-skelter storage are eating away at your profit.

Next Month

Next month, we will describe a model inventory-control system.

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GENERAL  ELECTRIC



by Wayne Lemons

A strange case of vertical roll

Sometimes those helpful "quick and dirty" fast tests backfire and cause some of the same symptoms as the defect.

When you repair all brands of TVs of all ages and conditions, as I do, it's not unusual to find one that's a stumper. So I don't feel too badly about the one that defied my favorite shortcuts and destroyed my sense of humor for a time. As I tell about it, second-guess me, and see if you could have solved the problem in less time.

An RCA B&W TV That Rolled

The two owners of a radio-TV servicing business located across town were having trouble diagnosing an RCA which had no vertical sync. Together and separately they had spent several hours on it, but it still rolled. They asked if I would come over and help them.

"I'm pretty busy," I said, "turning out an article on how to fix vertical troubles."

"Fine," they said, "you can add this one to your list."

"Okay, I might be able to spare 15 minutes." I said in my best holier-than-thou voice.

"If you can fix the vertical roll in this set in 15 minutes, we'll buy you the best steak in town, and pay your regular fee," they said.

It was exactly 2 PM when I arrived at their shop, and I am forced to say it was past 5 PM when I left. No steak for this consultation.

Taking The History

As they had said, the picture rolled. There was no tendency to lock either at the top or bottom of the raster. But the horizontal locking was very tight. When I turned the AGC control for a dim picture,

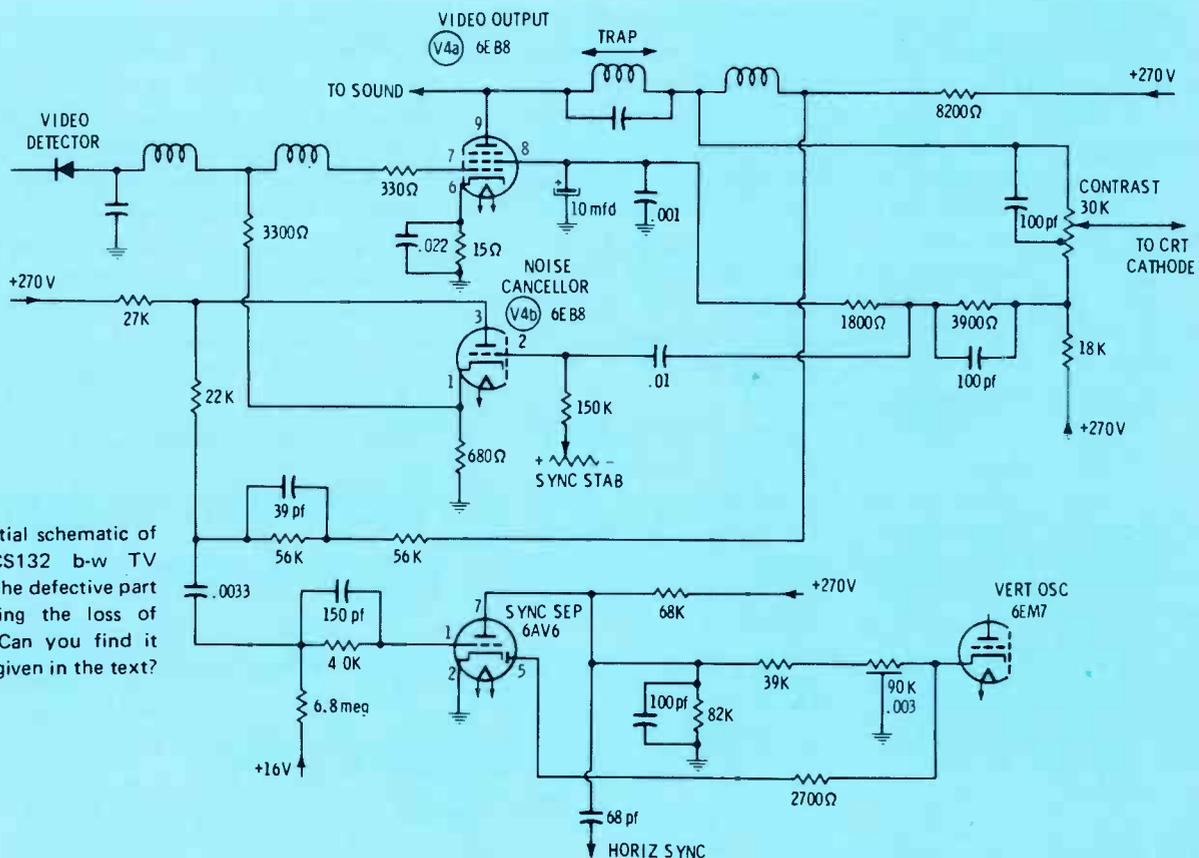


Fig. 1 This partial schematic of the RCA KCS132 b-w TV receiver shows the defective part that was causing the loss of vertical sync. Can you find it from the clues given in the text?

there was a hint of locking.

"What have you tried?" I asked.

"We've replaced the sync, vertical and AGC tubes, and the 2nd IF tube which checked a little gassy. We checked all the capacitors in the vertical sweep and sync circuits for leakage, and even replaced the vertical integrator circuit."

"Have you tested the rest of the AGC circuit?" I asked.

"A bias box didn't help."

"What about the waveforms in the video and sync circuits, did you check them?"

"No, we didn't check them," they admitted. "We work on all brands of sets and find that what is a good waveform in one might not be satisfactory in another. We spent so much time getting fooled by the scope, we finally decided to do everything else first."

"Well, sometimes it is difficult to diagnose with a scope," I agreed. "Usually, it's because we are not familiar with the TV set, or with the scope we're using." If my words had a prophetic ring, I was not aware of it at the time.

They handed me the schematic (part of it shown in Figure 1). "You've already used up 10 minutes talking. You have just 5 minutes to win that steak."

Preliminary Troubleshooting

First, I carefully examined the circuit, mentally following the path of the signal. According to the polarity of the detector diode, the video at the detector was negative-going. That meant the video at the plate of the video amplifier must be positive-going, and part of it was fed to the grid of the sync separator tube. And a positive-going grid signal produces a negative-going output at the plate. Therefore, there should be negative-going sync pulses at the plate.

I touched the low-capacitance scope probe to the plate of the 6AV6, adjusted the sweep rate to

horizontal, and found normal horizontal sync pulses there.

Next, I switched the scope to vertical sweep rate, and found the "grass" from the horizontal pulses was okay, but the shape of the vertical area was not quite right. It was more of a rounded hole than a sawtooth pulse.

At the junction between the 39K resistor and the vertical integrator appeared the normal strong positive-going pulse coming from the vertical sweep stages. There also should be a much smaller negative-going sync pulse which can be seen when the vertical is rolling.

Then I finally woke up. The vertical was rolling, but not enough sync could be seen. Using more scope gain, I could see a small sync pulse, but it was rounded and positive-going. It should be negative-going! Certainly, this was all wrong.

Was the pulse spurious? To find out, I grounded the grid of the vertical output tube to stop the vertical sweep. The large sweep pulses disappeared, but the smaller wrong ones remained. Then I grounded the plate of the sync separator tube. The small pulses were gone. It was plain the wrong pulses were coming from the sync tube.

"How can the vertical sync be positive and the horizontal sync negative?" I mumbled to myself.

By now the partners couldn't conceal their amusement. "You're still paying by the hourly rate." I growled. In answer, they laughed out loud.

Video Diagnosis

Next, I scoped (at vertical rate) the signal at the plate of the video amplifier tube. The vertical blanking-and-sync portion was not flat, but had a pulse shape. In fact, it looked very much as it might if an AGC filter was open. I overrode the AGC with an AGC bias sup-

ply. It didn't help. Reluctantly, I concluded the AGC was not at fault.

Panic and pressure can cause a person to grasp at straws, or even can force you into using cut-and-try methods, so I tried to calm down and think clearly. Although the smug chatter in the background didn't help my nerves one bit.

So, I examined the schematic again, and found the noise canceller. Now, I don't like to service noise cancellers. A small misadjustment and some of them clip the sync as well as the noise. I found the noise-canceller adjustment (RCA calls it "sync stabilizer") and turned it from end to end, but noticed no change in the rolling.

Voltages at the pins of the noise-canceller tube were within tolerance. In fact, the grid was slightly more negative, indicating it was more than cut-off and the stage effectively out of the circuit.

Just to be doubly certain, I tried another of my shortcuts. A clip lead from ground to the plate of the noise-canceller tube gave a slight tendency towards locking, but not enough to be called a cure. This, I thought, cleared the noise-canceller from suspicion.

At this point, I panicked and lost more time than I'm going to admit, replacing tubes and repeating many of the tests.

But something happened that proves no matter how stupidly we are acting, if we keep trying eventually we'll get a lucky break. For the umpteenth time I was looking at the video waveform at the plate (pin 9) of the video amplifier, and when I withdrew the probe it accidentally touched pin 8, the screen grid. There was a large video waveform there where none should have been if correctly bypassed by a 10-mfd capacitor.

Further tests seemed unnecessary; I soldered in a new capacitor

and found the vertical locking to be normal.

Understanding What Happened

Even after the defective part was known and the TV working okay, it was not too easy to understand why the various tests had not located the trouble much sooner. For one thing, all quick tests have limitations we must know about and compensate for. Also, two actions which reduced the vertical sync were at work simultaneously.

The grid of the noise canceller tube should receive a small amount of positive-going video. It should

be overbiased so the tube can't amplify any portion of the signal except noise that is stronger than the sync pulses. However, the open 10-mfd screen bypass changed the ratio of the AC-signal divider consisting of the 3900 and 1800 ohm resistors between the bottom of the contrast control and the screen-grid of the video-amplifier. This permitted an excessive amplitude of video at the grid of the noise-canceller, and the bias was not sufficiently negative to keep the tube from amplifying part of the sync pulses. The signal developed at the cathode of the noise canceller was applied to the video-detect-

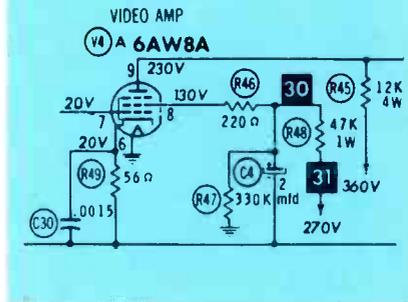


Fig. 2 Many of the older color receivers included an electrolytic wired between screen grid and cathode of the 1st video amplifier tube.

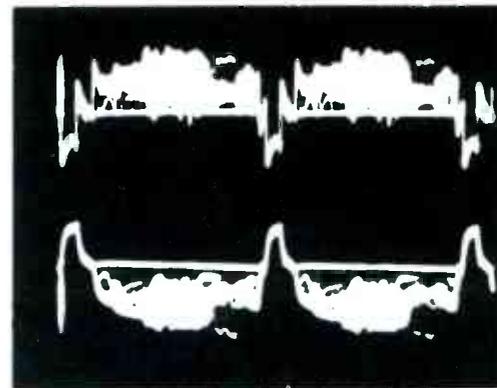


Fig. 3 The 30-volt p-p positive-going video waveform (bottom trace) found at the screen grid of the 1st-video amplifier tube indicates the electrolytic is open. The top trace shows the normal cathode signal.

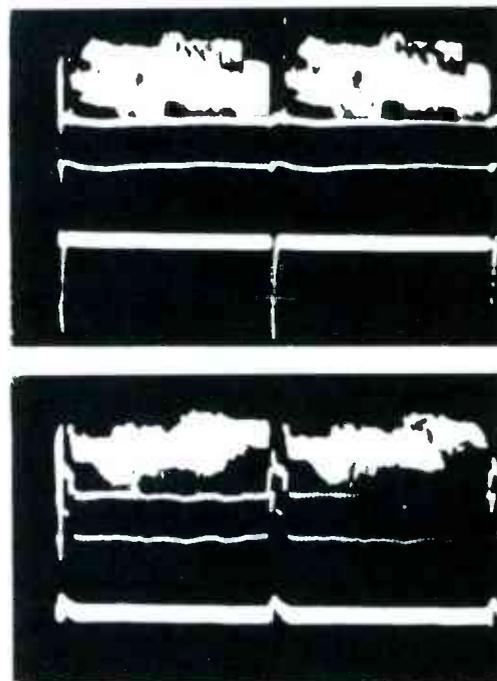


Fig. 4 Normal video (top) and vertical-sync pulses (bottom) are shown in the top picture. When a "dummy" capacitor was substituted, the abnormal video and vertical sync pulses of the bottom picture were produced.

How Video Electrolytics Cancel Vertical Sync

By Carl Babcoke

Defective electrolytic capacitors are well known as a cause of weak vertical sync. Seldom does anyone attempt to explain how a bad capacitor can eliminate the vertical sync and not affect horizontal sync.

Consider the cases of defective screen-bypass electrolytics in circuits similar to the one shown in Figure 2 (typical of RCA, CTC9, CTC10, and CTC11 chassis).

We would presume such capacitors to be open when a large waveform (of polarity opposite to that at the cathode) appears at the screen grid (Figure 3). Unfortunately, it is apparent that more than capacitance must be considered, for we find that disconnecting the old capacitor and operating the receiver without one permits it to operate with normal vertical locking.

Apparently, some type of phase shift is at work here. After unsuccessful attempts

at simulating the defect by adding resistances in parallel or in series with a non-defective capacitor of the correct capacitance, I finally was able to eliminate most of the vertical sync by replacing the electrolytic with a dummy made by paralleling a .047 capacitor and a resistance of approximately 1 megohm. Such specifications might reasonably be obtained from a dried-up capacitor.

Figure 4 shows both normal and abnormal video waveforms at the cathode of the tube, and normal and abnormal vertical sync pulses. The abnormal ones resulted from use of the "dummy" capacitor.

After expansion by the scope (Figure 5), the abnormal sync pulse (bottom trace) shows by comparison with the normal one (top trace) the amplitude limiting that takes place only during the vertical-sync interval. A similar effect can be found in the video waveform. □

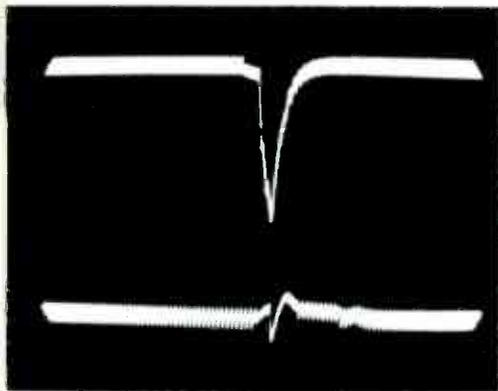


Fig. 5 Normal (top) and abnormal (bottom) vertical-sync pulses that have been widened by the 5X feature of the dual-trace scope.

tor signal and partially removed the sync there. In addition, the signal from the plate was added to the video signal at the grid of the sync separator and partially cancelled the sync.

Two questions arise, how could the vertical sync be cancelled and not the horizontal? The answer is: the 10-mfd screen bypass was not completely open, so the vertical sync was not bypassed as efficiently as was the horizontal.

Why, when I grounded the plate of the noise canceller, did the locking improve slightly, but not enough to be considered a fix? One reason it did not help more is that this short lowered the amount of signal fed to the grid of the sync separator tube.

Summary

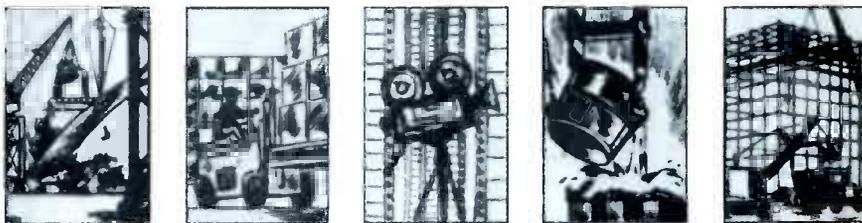
Looking back over the facts of the case, it seems I should have realized the video waveform was not normal. But the combination of an old-model TV receiver and a strange scope was enough to throw me off the trail.

Anyway, that night I had "crow" and "humble pie" for dinner. But the things I learned might in the future bring me more than one steak.

Editor's Note: Because Wayne Lemons has a good sense of humor, and an excellent electronic reputation that needs no defense, I want to rib him by reminding that on page 45 of the February, 1972 issue of ELECTRONIC SERVICING he warned everyone that electrolytics in video circuits can cause a loss of vertical sync. □

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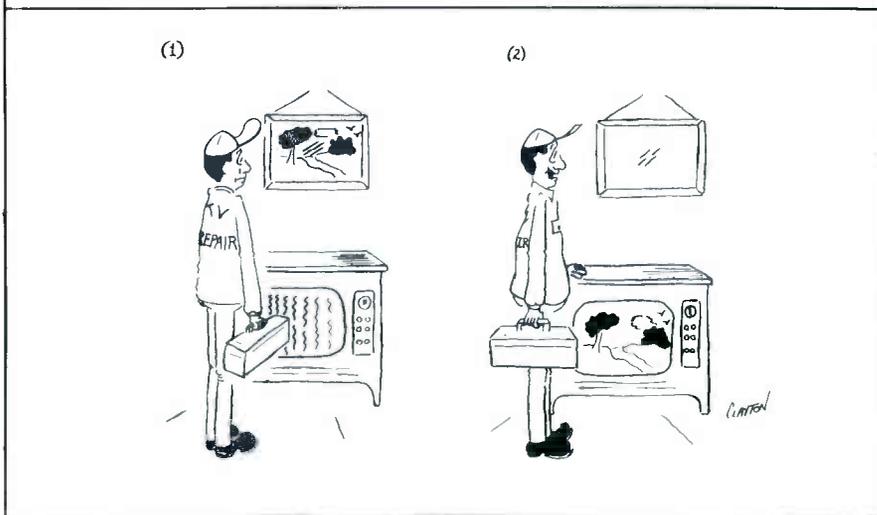
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Taming color rainbows part 2

by Carl Babcoke

The theory and practical adjustments of color locking by direct injection of burst are explained in part 2.

Direct injection of burst (color sync) is the second basic method of locking color oscillators. Locking by means of phase detectors and reactance stages was described in Part 1.

All vertical-sweep circuits are locked by the direct injection of sync pulses. The same basic principle is used in locking color oscillators by the direct injection of burst. There is one minor difference: the burst is so powerful relative to the oscillator signal that locking is very tight, and a customer-operated color-locking control is not needed.

A 3.58-MHz Oscillator

A typical color oscillator is shown by the simplified schematic in Figure 1. Superficially, the stage appears to be an amplifier, because there is no visible way for the signal to move from the plate to the grid. To change an amplifier into an oscillator, a signal from the plate must be applied in-phase (360 degrees) to the grid.

In this case, the signal from plate-to-grid travels through the internal tube capacitance between those two elements. Such a signal, in an amplifier, would be 180-degrees out-of-phase because of the normal inversion in the tube, resulting in negative feedback and a loss of gain. Oscillation could not take place. However, if the phases of signals at the plate and grid are shifted 90 degrees in opposite directions, the total phase shift is 360 degrees and the stage can oscillate.

Phasing of the plate circuit is determined by the tuned circuit, and the quartz crystal (M6) determines the phase of the signal at the grid. Because both grid and plate circuits are tuned, this oscillator could be called a tuned-grid tuned-plate type.

Quartz crystals resonate mechanically; they vibrate physically at the resonant frequency. Electrically, quartz crystals act as a series-tuned circuit

having a tremendously-high "Q".

Although crystal-controlled oscillators are very stable in frequency, the frequency can be changed slightly when desired. In the circuit of Figure 1, C1 is included for adjusting the frequency to zero beat. In addition, adjustment of the tuned circuit at the plate also has a small effect on the frequency. This is a side-effect, but it must be allowed for in the adjustment procedure.

The main task, though, of the tuned circuit at the plate is to control the amplitude of the signal there. Indirectly, this controls the strength of oscillation.

In the circuit we shall analyze shortly, the negative DC voltage at the grid of the tube (developed by oscillation) is used to control both the ACC and color-killer circuits. Therefore, part of the series of adjustments is made to obtain a certain DC grid voltage when there is no signal coming through the burst amplifier. Otherwise, this grid voltage would not be a critical factor.

Double Duty For The Crystal

In addition to the main job of determining the free-running oscillator frequency, the quartz crystal also has another important function. The sync signal is injected from a low-impedance source (step-down winding of the burst transformer) into the oscillator circuit by traveling **through** the crystal. This greatly improves the immunity against noise.

Signals other than the color burst also try to go through the crystal. Mostly, they are harmonics of the video waveforms or part of the frequency content of the snow, which is nearly "white noise". Because the crystal is extremely sharp in its tuning, only those frequencies exactly on 3.58 MHz can pass through to the oscillator grid circuit. That filtering action eliminates most of the noise and video harmonics. At least, the amplitude is decreased below the point where such disturbances could change the phase or frequency of the oscillator.

In addition, this rejection of everything except burst permits the DC

voltage at the grid to change according to the amplitude of the burst, and not be affected much by other signals. Therefore, the negative DC voltage can be used to control accurately the color killer and the ACC action.

Practical AFPC Adjustments

To show how the Automatic Frequency and Phase Control (AFPC) adjustments should be made, we will discuss the RCA CTC38A chassis (Figure 2).

First we must know that all of the normal adjustments, (A19, A20, A21 and A22) have some effect on the frequency. Any good sequence of adjustments must take this into consideration.

A larger problem is how to determine the correct tuning of the burst transformer (L34, adjustment A19). Connecting a scope to the point between L34 and M6 shows little of value. Some of the oscillator signal also appears there, and separating the two is difficult. Another possibility is to adjust L34 for maximum negative grid voltage at the oscillator. However, in practice we find the maximum point is much too broad for any accuracy.

But there is a method which gives high accuracy, is easy to do, and also provides an adjustment of the DC voltage of the oscillator in one simple series of adjustments.

Merely eliminate completely any burst at the plate circuit of the burst amplifier, then adjust L34 for **minimum** DC voltage at the oscillator grid. When L34 is tuned properly, the impedance of the winding feeding M6 is the highest. Therefore, the winding acts as a higher-value resistor in series with the crystal, reducing the efficiency of the oscillator.

However, there are some important conditions to be fulfilled. The oscillator must be precisely on frequency, which means we should be able to see the TV screen and know when the bars or colorcast are in zero beat.

Some technicians ground the grid of the burst amplifier to eliminate the burst. Unfortunately, it's very difficult

to remove all of the signal. A clip lead from grid to ground merely attenuates the signal. Better grounding is obtained by leaning a screwdriver blade between the grid pin and the shield on a coil.

Also, when the burst is eliminated by grounding the grid, the result of the short circuit (back through C141 to the chroma IF) is to greatly weaken the color. This makes it difficult to see the stripes of color bars or the color-cast.

A better system is to bias the burst amplifier tube to cutoff. Simply connect a resistor (of the same value as the cathode resistor) between the screen grid (source of +260 volts) and the cathode. The result is a cathode bias of +130 volts, which is too high to be cancelled by the pulse at the grid, so the tube is thoroughly cutoff and without gain.

While the tube is cutoff in this fashion, preset the tint control and L36

(adjustment A22), then alternate adjust A21 and A20 for zero beat (bars upright, but not necessarily motionless) with an oscillator grid voltage of -3.5 volts measured with a VTVM connected to R234.

The reason R234 is included is worthy of mention. Even the probe of a VTVM or FET-meter has a 1-megohm isolation resistor, when connected to the oscillator grid, will seriously detune the oscillator to a different frequency. If the adjustments are made with the meter probe touching the grid pin directly, the frequency will be wrong when the probe is removed following the adjustments. Always measure the grid voltage using this resistor. Install one and leave it there, if the chassis does not originally have one.

By following the adjustment sequence to be given next, near-perfect accuracy of the AFPC adjustments can be obtained with a minimum of effort.

Adjusting AFPC

Use this method of adjusting the AFPC of the circuit shown in Figure 2:

- Tune in a color bar pattern,
- disable the color killer (usually turning the killer control fully CCW is sufficient),
- connect a 27-K 2-watt resistor from the screen grid (pin 6) to the cathode (pin 2) of the 6CB6 burst-amplifier tube. Lengths of the connecting leads are not important,
- adjust the tint control to the center of its range,
- connect a VTVM set to the -5 volt range to the open end of R234,
- connect a scope with a lo-cap probe to R240, and adjust L36 (A22) for maximum amplitude of signal (it is not necessary to sync the scope),
- alternately adjust C157 (A20) and L35 (A21) for zero beat on the screen and -3.5 volts measured by the VTVM,
- adjust L34 (A19) for the minimum

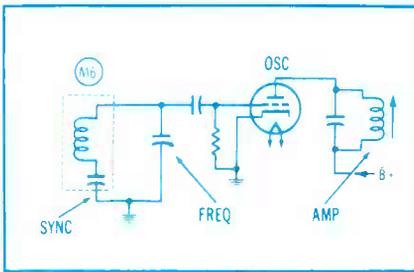


Fig. 1 This simplified color-oscillator circuit appears to be an amplifier. However, the feedback signal passes through the plate-grid capacitance. Burst is applied from a low-impedance source to a point between the quartz crystal (M6) and ground. Frequency is zeroed by the variable capacitor in the crystal circuit, and the strength of oscillation is determined by adjustment of the coil in the plate circuit.

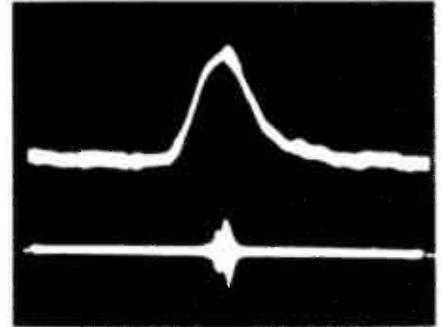
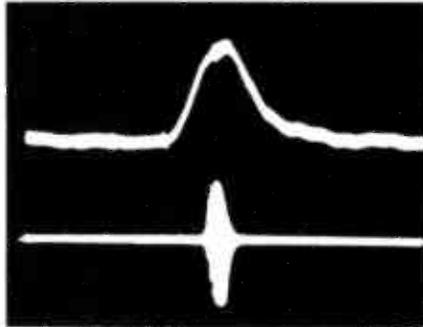


Fig. 3 When the tips of the keying pulses do not arrive at the precise time of burst, the envelope of burst at the plate of the keyer tube will be weak or missing.

Left Normal grid waveform at the top with the burst riding on the tip of the keying pulse produces normal width and amplitude of the envelope of burst at the plate (bottom waveform).

Right Insufficient delay of the keying pulse moves the burst to the right side of the pulse top (top waveform), and causes a weak and narrowed envelope of burst at the plate of the burst amplifier tube. Maximum gain of the tube occurs only at the start of the burst.

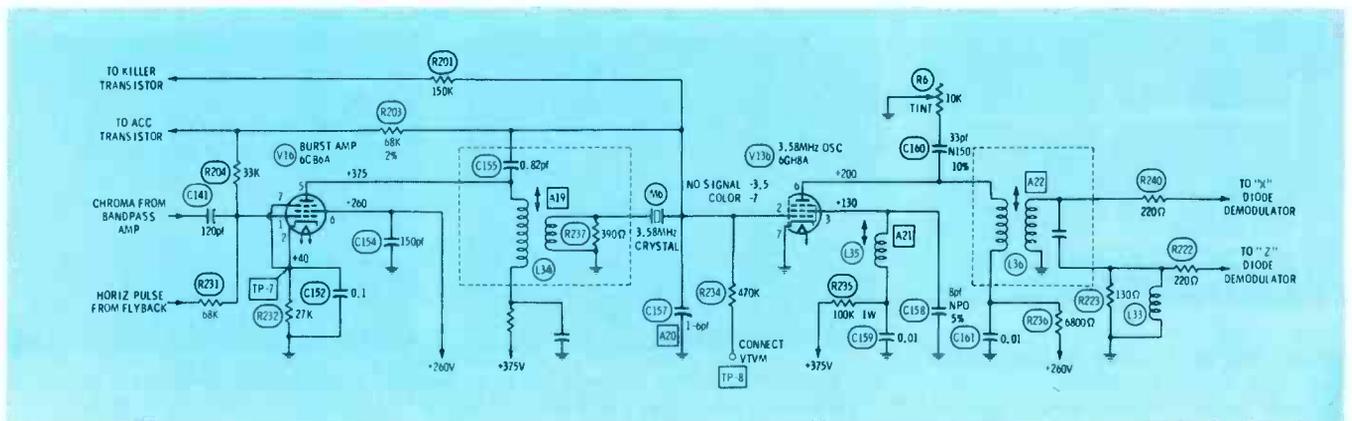


Fig. 2 A complete schematic of the burst-amplifier and color-oscillator stages of the RCA CTC38A chassis.

negative voltage at R234,

- touchup C157 and L35 for zero beat and -3.5 volts again,
- reset the color killer to barely remove the color snow from a blank channel.

That's all. Remove the test equipment, the 27-K resistor, and try the performance. Occasionally, L36 (A22) will need a slight touchup to center good skin color in the middle of the tint control range. Slight adjustments do not necessitate repeating the other AFPC steps.

When the set is tuned to a normal colorcast, the DC voltage at the grid of the color oscillator (measured through R234) should be around -7 volts. If it should measure much higher, a non-functioning ACC circuit must be suspected. Snow, when the set is tuned to a blank channel, usually will cause the voltage at R234 to measure about -5 volts.

Troubleshooting The Burst Amplifier

Any chroma circuit which permits the AFPC to be adjusted correctly and also measures -7 volts at R234 is very unlikely to have any locking problems. However, if the color jumps out of lock when the tint control is varied and the voltage at R234 is not sufficiently negative, you should suspect a loss of burst in the burst-amplifier stage.

First, measure the DC voltages at the plate, screen grid, cathode and grid. The need for plate and screen-grid voltages is clear enough; the tube will not operate without them.

At the grid, the usual reading is zero or very slightly negative. In normal operation, the grid should never draw grid current, so no negative voltage

should be caused by grid rectification. But there is a connection through R204 to the ACC transistor control voltage. Therefore, the grid might measure a few tenths of a volt negative. Incidentally, R204 was not in earlier models, and evidently was added to help the ACC action.

If R204 should open, some burst would still be amplified by V16, but the amplitude probably would be low because the phasing of the enabling pulse at the grid would be lagging excessively. In this case, (see Figure 3), maximum tube gain would not occur during the center of the wavetrain of burst.

A high negative grid voltage of about -20 volts would indicate the cathode circuit was shorted to ground. A cathode-to-heater short in V16, or a shorted C152 would be possibilities.

Measure that cathode voltage

Most critical and significant of all the burst-amplifier tube voltages is the cathode voltage. Without large positive-going horizontal pulses at the grid, the 27-K cathode resistor would bias the tube to cutoff and there would be no gain or plate conduction.

Surprisingly, without grid pulses there would be a very low cathode voltage relative to the usual reading of about +40 volts. About +6 volts is sufficient to cutoff the tube, when there are no pulses at the grid.

A reading of +6 volts at the cathode also might only mean the tube was very weak or C152 was leaking badly. But the most likely cause would be the loss of the horizontal pulses.

What would the cathode voltage measure if R232 opened? There would be very little change from the usual +40 volts, but the tube would have no gain.

Waveform Analysis

Waveforms at the grid of the burst-amplifier tube are useful in showing the relative amplitudes of the pulses and the burst. However, the output waveforms from the stage can be very deceptive.

For example, the waveform at the plate of the burst-amplifier tube looks much the same when a b-w picture is tuned in, when the set is tuned to a blank channel and there is nothing but snow, or when the receiver is operating normally with a color picture. Figure 4 shows how near identical the waveforms can be. It is not enough to have envelopes of **something**.

When those envelopes of output signal are widened by use of a triggered-sweep scope, we find (see Figure 5) they are far from the same. Separate sine waves can be seen in the burst signal, while just a blur makes up the envelope of noise.

Incidentally, it is best to measure burst by connecting the lo-cap probe of the scope to the winding of L34 which feeds M6. That winding is lower impedance than the primary and less subject to loading by the probe. In fact, often the amplitudes of the burst envelopes will be nearly equal both at the primary and the secondary of the transformer.

Adjusting Other Models

Although we have confined our discussion to just one model of chassis, the basic principles are the same for many models having variations of this circuit.

Most other models do not have the coil that determines the amplitude of oscillation.

Adapt the sequence of adjustments to other similar models by eliminating any steps which do not apply. □

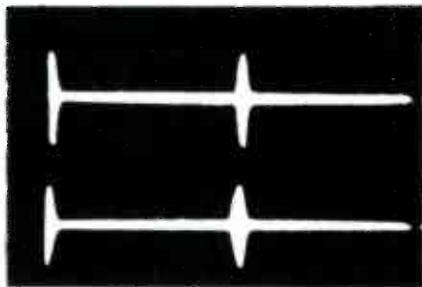


Fig. 4 Burst and "false" burst appear similar. (A) As normally viewed, normal burst (top waveform) appears to be nearly identical with "false" burst (bottom waveform) produced by snow without a station.

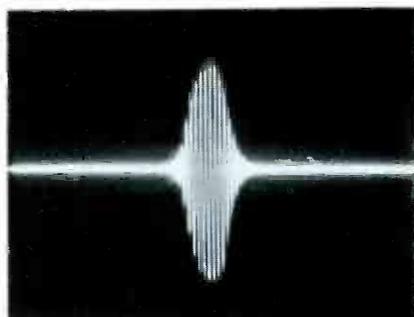
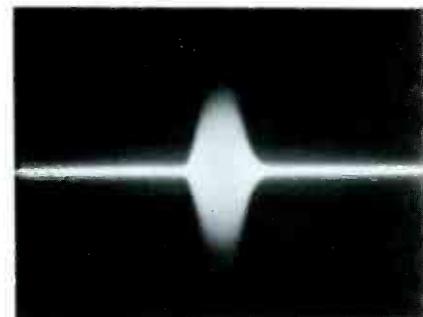


Fig. 5 When the normal and false bursts are widened and locked solidly by use of a triggered scope, we find they are very different.

Left Normal burst shows the sine waves of a 3.58-MHz frequency.

Right False burst from snow is just a blur.



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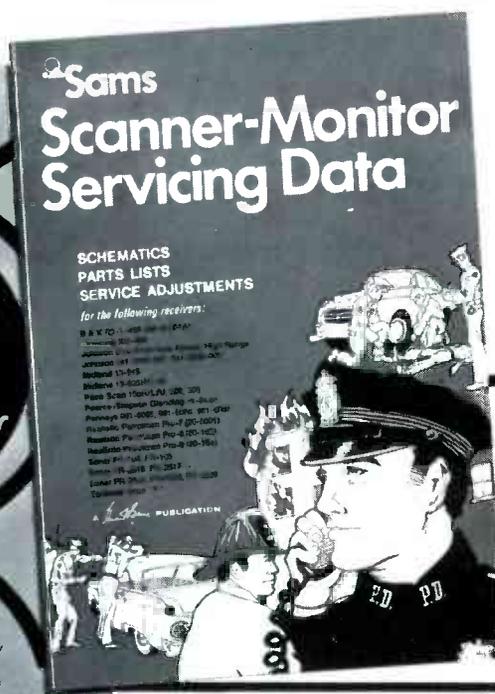
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Understanding a signal-seeking UHF tuner

By Bruce Anderson

Signal-seeking is one solution to the remote control and detenting problems inherent with many types of UHF tuners.

About two years ago, the big news in color television was the introduction of the RCA CTC47 chassis. This was a limited production, prestige receiver with many innovations in circuitry, including diode switching of VHF channels and completely electronic VHF tuning.

Because other circuits seemed more important and UHF not very popular, we bypassed coverage of the UHF tuning system. Now that more UHF stations are coming on the air, and the government is insisting on UHF tuning systems of tuning convenience equal to that provided for VHF, we are rectifying the omission.

Basic UHF Tuning Systems

Tuning the UHF channels has always been a problem. The old "two-speed" tuning knob was the first attempt at moving rapidly between two widely-separated stations with provision for vernier tuning once the channel had been reached. Many users failed to get the "hang" of it, and remote control was impossible.

To my knowledge, no UHF tuner

has ever had detented stops for all 70 UHF channels. Such a system boggles the mind. Some receivers have opted for a compromise with 6 to 20 preset channels available. Electronic tuning by preset voltages applied to varicap diodes is becoming popular, but the drawback is inaccurate channel indication.

Signal-Seeking UHF Tuning

Many of the objections to other UHF tuning systems have been minimized or eliminated (at the expense of increased electronic complexity) by the signal-seeking system used in the RCA CTC47. All signal-seeking systems continuously scan the band, stopping only at signals which have the required characteristics of signal strength and modulation. So it is with this system.

Tuner and Drive Motor

The UHF tuner basically is no different than most other continuously-variable UHF tuners, consisting of a preselector, local oscillator, and mixer. Three segmented variable capacitors are mounted on a common shaft to allow tuning. The shaft is driven by a small reversible motor, which also turns a channel-indicator drum. A set of reversing switches which cause the motor to reverse at the limits of tuner shaft rotation are mounted in the gear

train.

The drive train has no detents. This allows the system to operate quietly. In fact, it cannot be heard even a foot or so from the cabinet. Also, elimination of the detenting mechanism reduces the torque load on the motor, allowing it to tune across the UHF band in a few seconds.

Power for the UHF local oscillator and for the channel-indicator drum lamp is derived from the VHF tuner control system and is supplied only when that system has been set to the UHF "position."

Motor Control System

The basic control system is illustrated in the block diagram of Figure 1. One end of each motor winding is connected to the motor supply, a 28-volt transformer winding. The two motor-control circuits are essentially switches, and depending upon which one is "closed," the motor will run upwards or downwards through the channels. The remainder of the circuitry controls which of the motor-control circuits will be turned on.

There are three means available for starting the UHF signal-seeking sequence. These are:

- by depressing either the local or remote "up" switch (the local switch directly connects to the control input and applies a ground, while the remote

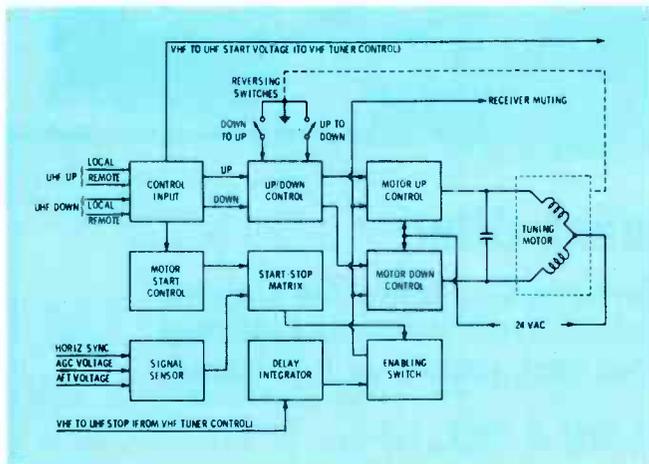


Fig. 1 Block diagram of the UHF signal-seeking control system used in the RCA CTC47.

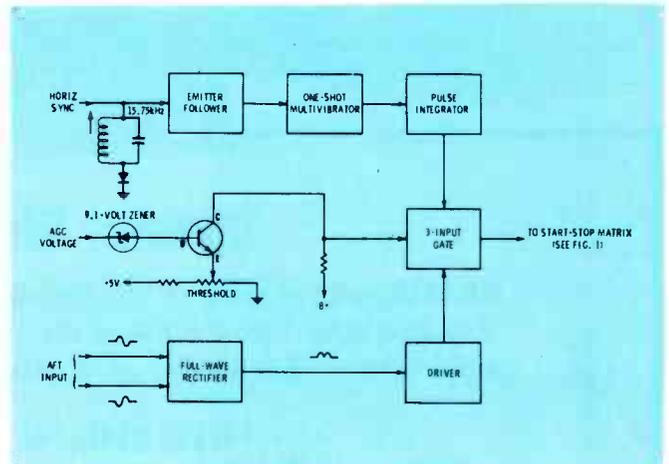


Fig. 2 Three signals are necessary to stop the seeking: AGC voltage above a certain level, horizontal sync pulses, and AFT voltage.

switch saturates a transistor by action of the remote receiver);

- by depressing either the local or remote "down" switch; or
- by sequencing the VHF tuner to the UHF position.

The exact sequence of operation will be modified by previous settings of the VHF and UHF tuners. If the VHF tuner already is set to UHF, depressing any UHF up or down switch will cause the motor to begin turning in the desired direction. However, if one of these switches is depressed when the VHF tuner is set to a VHF channel, the VHF tuner will switch to UHF reception but the UHF motor will not begin turning if the UHF tuner is already tuned to a station. Also, if the sequence is initiated by channelling the VHF tuner to the UHF position, the UHF tuning motor will not begin to rotate if the tuner already is tuned to a UHF station.

Assume the operator is viewing a VHF channel and decides to select a UHF channel. Depressing a UHF switch (either local or remote) for at least 100 milliseconds actuates the control-input circuit, and this starts three sequences. A command is routed to the VHF tuner-control system to switch the VHF tuner to UHF. A voltage is supplied to the up/down control, (a flip-flop multivibrator) which disables the up motor control. A one-shot (monostable) multivibrator in the motor-start control block is triggered on and produces a start pulse lasting for about 130 milliseconds. If a UHF-up switch had been depressed instead of a down switch, the sequences would have been the same except that the down motor control would have been disabled.

If, at some earlier time, the UHF tuner had been stopped on a channel (the usual case), this would be detected by the signal sensor as soon as the VHF tuner reached the UHF "position." The UHF starting sequence already described would override the signal sensor for the duration of the start pulse (130 milliseconds) but then the signal sensor would once more take control of the motor.

When the system is switched from

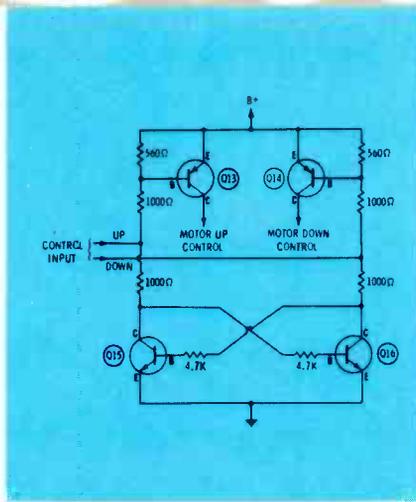


Fig. 3 Schematic of a typical bistable multivibrator with emitter-follower output amplifiers.

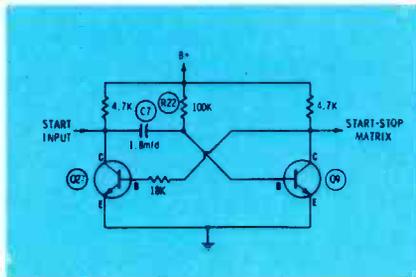
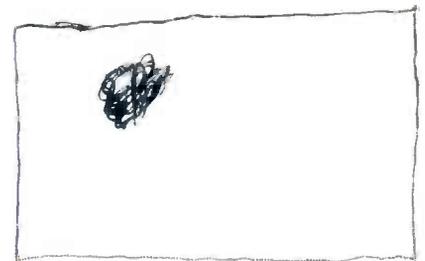


Fig. 4 Schematic of a typical monostable (one-shot) multivibrator.

VHF to UHF, a 200-millisecond delay is introduced into the motor-control loop by the delay integrator, so that a 130-millisecond start pulse, standing alone, will not start the motor. Then, if the signal sensor determines at the end of 130 milliseconds that the UHF tuner is receiving a station, it regenerates a stop command before the delay time expires. Conversely, if the UHF tuner is positioned to a vacant channel, there will be no stop command at the end of 200 milliseconds and the tuning motor will commence turning.

A second method of changing from VHF to UHF can be used by the operator; he might simply operate the VHF selector button enough times to advance the VHF tuner to the UHF "position". In this mode of operation, the UHF motor-control system will be delayed for 200 milliseconds by the delay integrator, after which it will begin searching for a channel if none is being received, or remain on the active channel to which it is tuned, as the case may be.

The third mode of operation takes place if the receiver already is tuned to a UHF channel and the operator depresses a UHF up or down button. The three sequences initiated by the control input are: (1) a command to the



VHF tuner to tune to UHF, which does nothing since the VHF tuner is already in the UHF "position," (2) the up/down control disables the appropriate motor-control circuit, and (3) the 130-millisecond start pulse is generated by the motor-start control circuit.

The start pulse overrides the signal sensor, and since the delay integrator timed out when the VHF tuner first was set to UHF, the tuning motor will rotate. After 130 milliseconds, the start pulse ends, but by that time, the motor has driven the UHF tuner off of the channel to which it was previously tuned, and the signal sensor allows the motor to continue running until another UHF channel is received.

If there is no other UHF station on the air, the motor will tune to the end of the band, reverse, and return to the original channel.

The same control voltage which turns on the motor-control circuit also provides a muting signal to the video and audio outputs of the receiver. Thus, whenever the UHF motor is turning, the raster is dark and there is no sound output. To avoid any possibility the operator might suspect a malfunction of the receiver, when in fact it is only searching for a channel, the muting voltage also turns on a small indicator lamp, dubbed the "search-light."

Signal Sensor

Since there are possibilities of a number of spurious signals being present in the UHF band which might cause the receiver to generate AGC voltage, a signal sensor actuated solely by AGC (as in radios) would be inadequate. Further, a TV signal might cause somewhat more AGC to be developed when the receiver is detuned towards the video carrier, and the result would be inaccurate tuning, perhaps beyond the range of a simple AFT (automatic fine tuning) system.

By incorporating a circuit in the signal sensor which can detect horizontal sync pulses, the possibilities of "locking up" on a spurious signal are significantly reduced; but as with AGC voltage, maximum sync-pulse amplitude

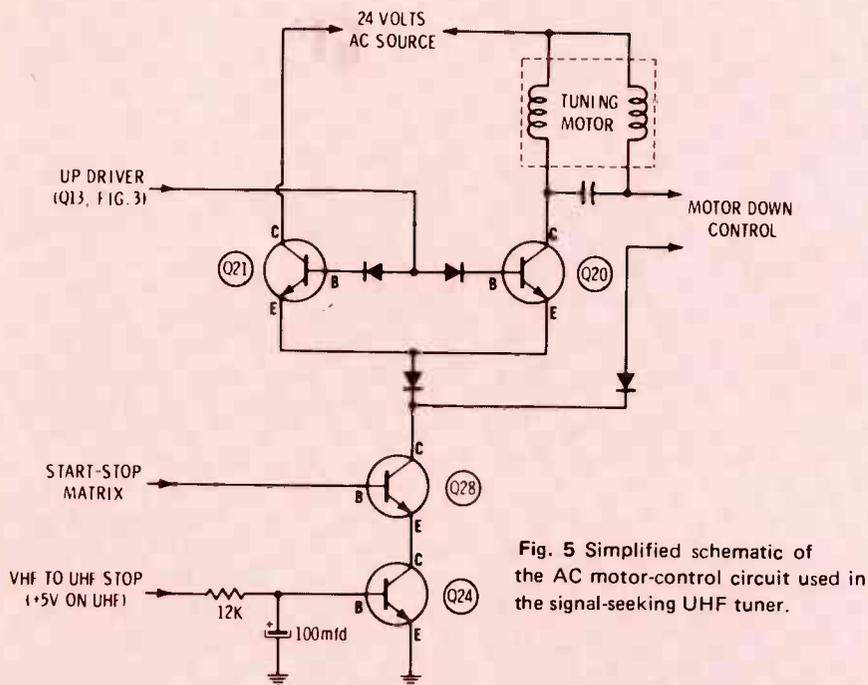


Fig. 5 Simplified schematic of the AC motor-control circuit used in the signal-seeking UHF tuner.

is not necessarily coincident with optimum timing. For this reason, the control voltage from the AFT system also is used as an input to the signal sensor, and all three inputs, sync pulses, AGC voltage, and AFT voltage, must be present before the signal sensor will decide that a legitimate signal is being received.

As a means of allowing the user to reject weak stations, a sensitivity control is provided which allows him to set the level of AGC voltage below which the signal sensor will not operate.

The signal sensing circuits are shown in the functional diagram of Figure 2. The horizontal sync pulses enter an emitter follower by way of a tuned circuit which shunts noise, equalizing pulses, vertical-sync pulses, vertical-sync pulses, etc. to ground. The diode between the tuned circuit and ground clips the sine waves coming from the tuned circuit, so the signal at the base of the emitter follower is a series of pulses. These pulses trigger a monostable (one-shot) multivibrator which produces one output pulse of constant amplitude and duration for each input sync pulse. These are integrated (to prevent a single noise pulse from appearing as a sync pulse). The integrator is constructed so that when sync is present the output falls to approximately zero volts.

The normal AGC voltage of the receiver ranges between about +10 and +20 volts, increasing with signal strength. A 9.1-volt zener reduces the AGC voltage to a range from about zero to 10.9 volts, depending on signal level. When this voltage exceeds the emitter voltage of the transistor, as determined by the operator control, the transistor saturates and the output goes approximately to zero.

The AFT input voltage is a differential voltage. That is, the two conductors have equal voltages of opposite polarity. If these voltages were observed while the tuner was scanned across a channel, they would appear as shown. Notice that both inputs fall to zero when the tuner is far off-channel and also when it is tuned exactly on-channel. The full-wave rectifier converts all input voltages to positive polarity, so that a positive voltage will be presented to the driver whenever a station is approached. When a station signal is approached, output of the driver goes nearly to zero, and this constitutes the third input to the gate circuit.

Notice that the AFT-stop signal is generated only when the tuner is near a station signal, but not when it is precisely tuned to the station carrier. This is not detrimental to the operation of the system for three reasons. First, the start-stop matrix (see Figure 1) is

bistable so that once a stop command is generated, the motor cannot restart unless ordered to do so by the operator. (This also prevents the tuner from reverting to a continuous-search mode when the last station goes off the air.) Second, it is not necessary that the tuner mechanically be tuned exactly to the channel, since the AFT circuit will hold it on the channel. Third, because of the inertia of the motor, it coasts towards the exact point of tuning after it is de-energized.

Circuit Details

To analyze all circuits of the control system would require much more space than is available here. Nor is it necessary to do so, since most of the individual circuits are straightforward and operate either at saturation or cut-off. In the paragraphs which follow, bistable and one-shot multivibrators will be described in some detail, as will be the motor-control circuit, which also is of interest.

Bistable Multivibrator

Figure 3 shows the up/down control, which consists of a bistable multivibrator and a pair of output drivers. At turn-on, it is a matter of chance which transistor, Q15 or Q16, first will go to saturation. The important point is that whichever condition occurs it will continue until an input command reverses it. Assume that Q15 saturates. The collector voltage will drop nearly to zero, holding the base of Q16 below conduction. The collector voltage of Q16 approaches supply voltage, holding the base of Q15 in saturation. If, by chance the Q16 had saturated at turn-on time, the reverse conditions would have prevailed; in either case the circuit will remain stable.

Again assuming that Q15 saturated, the practical means of cutting it off is to momentarily ground the "down" input. This removes the positive voltage from the base of Q15, causing it to cut off, allowing its collector to rise to the supply voltage, and causing the base of Q16 to be saturation biased. When the ground is removed from the "down" input, the collector of Q16 saturates, holding Q15 in cutoff. This new condition continues until the "up" input is grounded, when the original conditions are restored.

The output drivers simply repeat the condition of the multivibrator transistors to which they are connected. When Q15 is saturated, so is Q13, etc.

In the up/down circuit, the inputs come from the control inputs and from the reversing switches attached to the tuner gear train (Figure 1). The start-stop matrix uses a similar multivibrator, except that its inputs come from the start multivibrator and the signal sensor as shown in Figure 4.

Motor Switches

Figure 5 shows one of the motor-control circuits. The one chosen drives the motor in the direction which tunes upwards across the UHF band; the other control tunes downwards. Besides AC power, three inputs are necessary. The up driver of the up/down circuit must provide positive bias to the bases of Q20 and Q21. The VHF tuner must have been in the UHF "position" for at least 200 milliseconds to allow Q24 to go into saturation, and a positive output from the start-stop matrix must saturate Q28.

When all of these requirements have been fulfilled, the emitters of Q20 and Q21 are effectively grounded and the emitter-base junctions are forward biased. Assume that the instantaneous motor voltage is positive at the collector of Q21. This transistor is forward biased, and normal current can flow. However, the current in Q20 requires an explanation, since electron current at this instant must be from collector to emitter, unusual for an NPN transistor.

A simplified (perhaps oversimplified) explanation is this: It can be demonstrated in low-frequency circuits that many transistors will work about as well even if the emitter and collector leads are interchanged. Thus, we can assume that for the moment this is the case with Q20, and that electrons can flow from the "emitter" to the "collector". When the instantaneous voltage of the motor supply reverses, Q21 will conduct in the normal direction, and the emitter and collector of Q20 will be effectively reversed. Because of this seldom-appreciated characteristic of a transistor, it is possible to use a pair of them to control a moderately-powered AC motor.

Summary

In this article a number of types of circuitry new to television have been introduced. Unlike circuits in the receiver proper, these circuits operate either at saturation or cutoff. Linearity, distortion, gain in the usual sense, noise, etc. are not nearly so critical. It follows that servicing is simplified, since any specific circuit either does or does not work. There is little chance for marginal operation.

While the individual circuits of these control systems are relatively simple, the concepts involved in the complete systems are not. Because of this, we in the servicing industry might have to rearrange our techniques. It is likely that we will spend less time worrying with individual components and much more in learning what each multivibrator, gate circuit, etc. does, and what the symptoms will be if it fails. For example, there are 31 transistors, 34 diodes, and 4 integrated circuits in the VHF tuner-control system. Unless you have a fair knowledge of the block diagram of the system, you can spend hours just getting to the general area of the failure. Fortunately, once the general area is determined, final isolation is fairly simple because of the "go/no-go" characteristics of the circuits.

Another interesting feature of these circuits is that a scope is not a particularly useful troubleshooting tool. For the most part, we are interested in DC levels and pulses which occur only once, rather than AC signals or rapidly recurring pulses. There are some exceptions, of course, and in those instances where a scope is needed it must be a good one; certainly with DC input, and preferably with triggered sweep.

We realize that few service technicians will be faced with the job of repairing the CTC47 chassis. Reportedly, only about 2000 of them were produced. On the other hand, we feel certain that an increasing amount of sophisticated circuitry will be used each year, some of it similar to that which we have discussed. Also, the use of integrated circuits and modular construction are going to make the "block-diagram approach" more and more useful as time goes by. □

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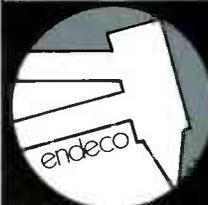
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A first look at the DELCO RADIO-TAPE COMBO



By Joseph J. Carr

Many of the first Delco radio/8-track combinations now are out of warranty and will be showing up for service at independent shops. Become familiar with these models before you're called on to service them.

Two problems have plagued the use of "bolt-on" 8-track stereo-tape players. One is the ease with which the players could be removed and stolen. The other is the space problem in adding another unit under the instrument panel.

Both problems were solved when the Delco Electronics Division of General Motors brought out radio/tape combinations which mount in the dash. AM-only and AM-FM-Stereo radios use the same 8-track tape-player mechanism (see Figure 1).

Mechanics Of The Tape Player

The motor/flywheel drive system is standard for 8-track players, although Delco uses two small square belts instead of one larger flat belt, as is the case with other brands.

The circuit board containing the IC tape-head preamplifiers is located on one side of the motor, along the back panel of the player chassis. On the other side of the motor, is located the motor-speed-regulator circuit board. The double-ended dial lamp is located just in front of the flywheel.

Customers owning these models will be happy to know that the dial lamp can be changed without removing the radio from the dash. The bulb is accessible (to technicians having finger dexterity) by opening the tape trap door.

An interior view of the Delco tape player after the tape-deck chassis has been removed is shown in Figure 2. Visible is the top plate of the tuner assembly and the component side of the radio and audio amplifier circuit board. Manual tuning is accomplished by the flexible shaft on the right side of the unit.

The tape deck connects to the radio board by a Molex connector mounted to the back of the radio-tape change-over switch, which is located on the motor-speed-regulator board.

When service is required to the underside of the board, it's quite inconvenient to keep the tape deck hanging by its wires. Eliminate this nuisance by buying a spare radio-tape changeover switch (part number 7931634) from your local Delco car-radio parts department. Remove the tape-deck chassis, and plug the spare switch into the Molex connector.

How can the tape-deck chassis be removed?

The first time a technician attempts to remove the tape-deck chassis, he should have no difficulty finding the two screws holding the rear apron of the chassis. But he might wonder where that third screw is located. To find it, he should open the tape-cartridge trap door (see Figure 3) and look to the left for a ¼-inch hex-head screw. After removing this screw, he should find the tape-deck chassis easy to remove from the mainframe.

When the time comes to re-install the tape-deck chassis, it is wise to use a gripping nutdriver to replace this third screw. If you should drop it into the machine, it might damage the ten-slide pushbutton tuner or cause a short circuit. Remove the black-plastic front escutcheon, if it is necessary to retrieve the screw.

Details Of The Pointer And Pilot Lamp

In the event you wonder what happens to the radio-dial pointer when the tape-cartridge door is opened, the answer is that it's done with mirrors. The pointer is attached flat to the top of the tuner frame, and a mirror image is seen in the dial window which is in the center of the trap door. This causes some parallax problems when you align the local oscillator. Be sure to look at the pointer straight on.

When the tape cartridge is inserted it moves a switch (Figure 4) which turns off the pilot lamp. Suspect the switch of sticking in the on position, if the complaint is melted areas on the plastic tape cartridges.

Intermittent Static

The tape-preamplifier board (shown removed in Figure 4) normally is mounted parallel to the solenoid-cam housing. Intermittent static, sounding like voltage-regulator hash, has been caused in many cases by the connector of the preamp board. Installing a new connector might help, but Delco solved the problem in late-production models by eliminating the connector. If you find a symptom of this type of noise, cut off the connector and solder the wires directly to the board.

Locations of the solenoid-cam and head-height assemblies are shown in Figure 4, along with the dial lamp and lamp switch.

Components On The Underside

The large "Y" shaped object on the underside of the tape-deck chassis (see Figure 5) is the head-height tension spring. At one side is the solenoid which ejects the tape cartridge when any of the station-selector pushbuttons are depressed. Opposite the solenoid is the circuit board containing the motor-speed regulator components

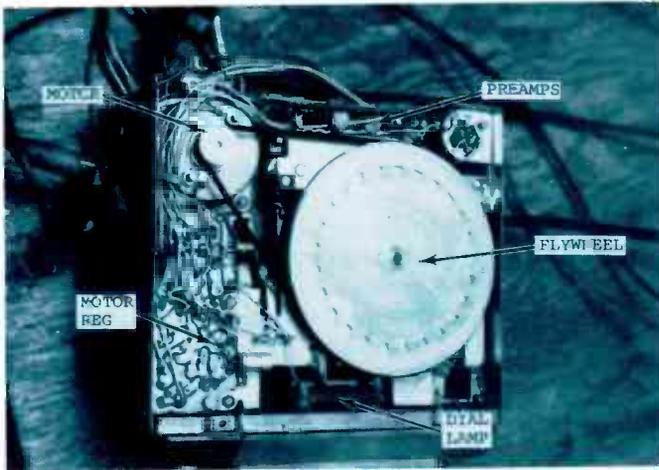


Fig. 1 Top view of the Delco combination radio/8-track tape machine.

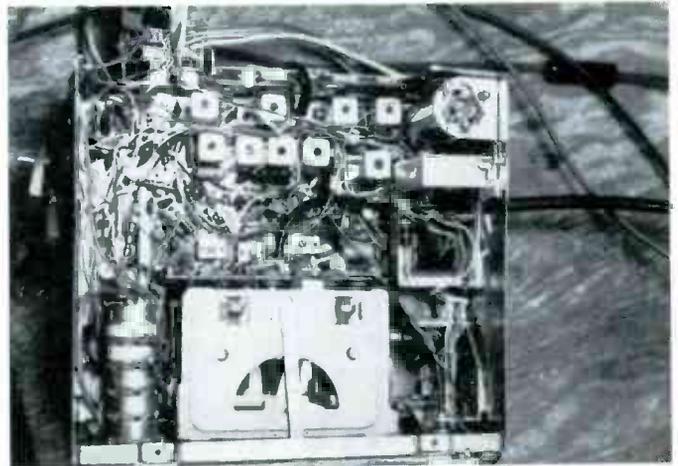


Fig. 2 Component-side view of the Delco combo.

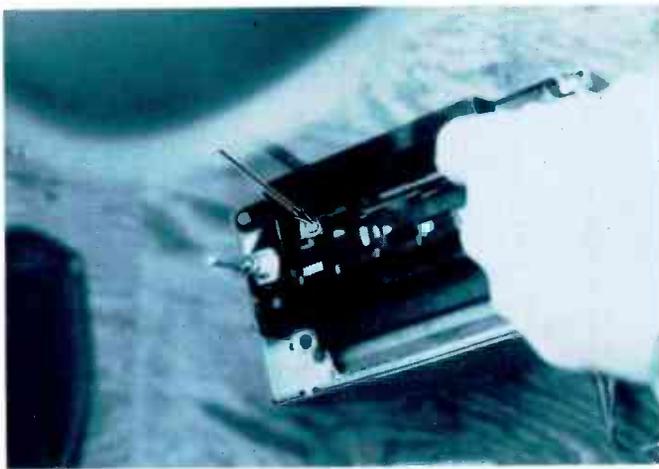


Fig. 3 Arrow points to the last screw holding the tape deck to the mainframe. Be careful not to drop the screw into the radio.

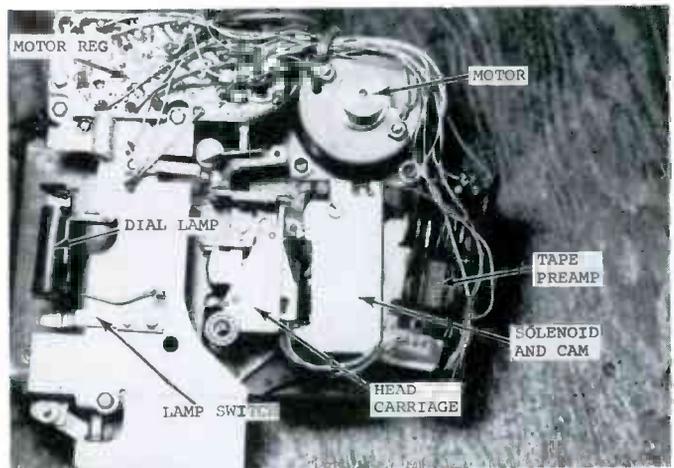


Fig. 4 Top view of the tape-deck mechanism after it has been removed from the mainframe.

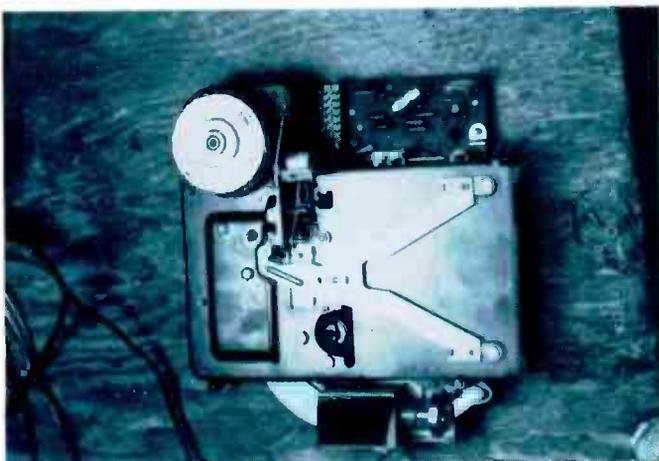


Fig. 5 Bottom view of the tape deck shows the "Y" spring which provides lifting pressure for the head mechanism.

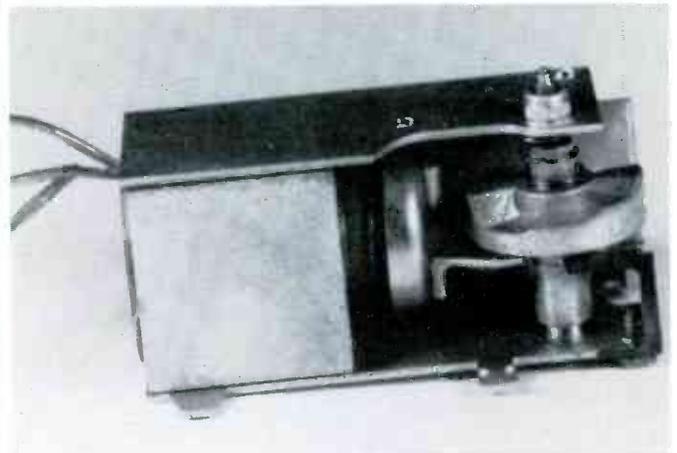


Fig. 6 Closeup of the solenoid and track-change cam assembly.

and the radio/tape changeover switch. Through a hole in the chassis can be seen the motor-speed switching transistor which controls the current through the windings of the drive motor.

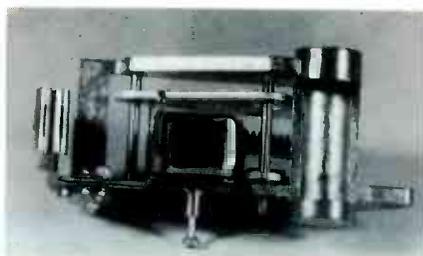


Fig. 7 Closeup of the head-carriage and sleeve-bearing assembly.

is recommended strongly that you clean and lubricate the tape-deck mechanism. This sharply reduces the possibility of call-backs.

Remove the deck from the main-frame, and set aside the radio portion for the present. Remove the belts and store them in a safe place. Remove the flywheel by disengaging the small "E" clip at the bottom. Caution: be careful not to lose either the clip or the washer. These parts are worth peanuts when you have them, and appear to be valued at a fortune if they become missing.

Clean the capstan bearing housing and the playback head with a good solvent. Some technicians find it easier to remove the sub-assembly for this step.

Track Change And Head Height

About the same type of track-change and head-height mechanisms are used in all 8-track machines. The Delco cam and solenoid (Figure 6) are mounted in a removable sub-assembly which is bolted to the chassis of the tape deck.

The playback head, as shown in Figure 7, is mounted on a moving carriage within a framework that also includes the main capstan sleeve bearing. The "Y" spring supplies a small

amount of lifting force to the head assembly.

Adjustment of the head height (which minimizes crosstalk between tracks) is accomplished by turning a slotted screw located at the top of the cam housing. It is not necessary to remove the deck from the mainframe to make this adjustment.

Lubrication

Regardless of any other repairs or adjustments that might be necessary, it

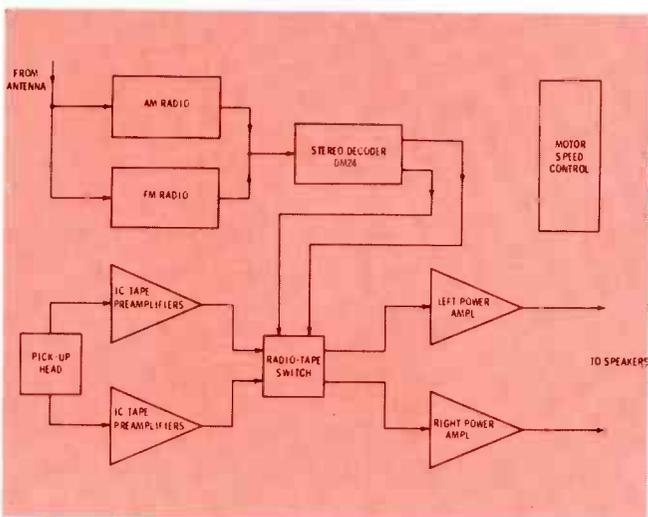


Fig. 8 A block diagram showing the signal flow through the Delco combo machine.

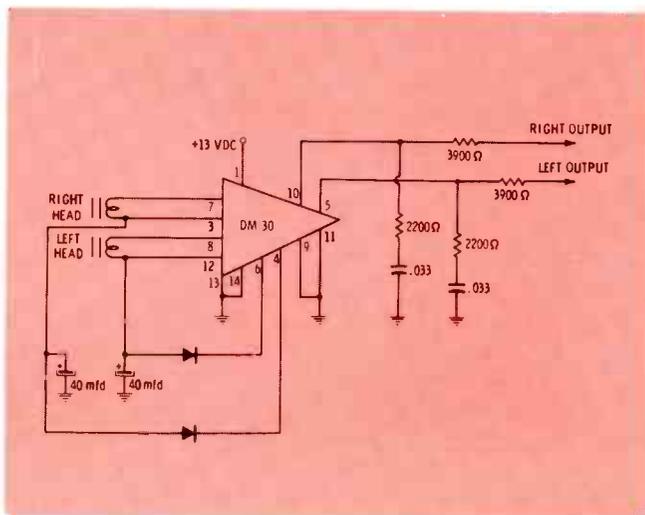


Fig. 9 Schematic of the stereo tape preamplifier using a DM-30 IC.

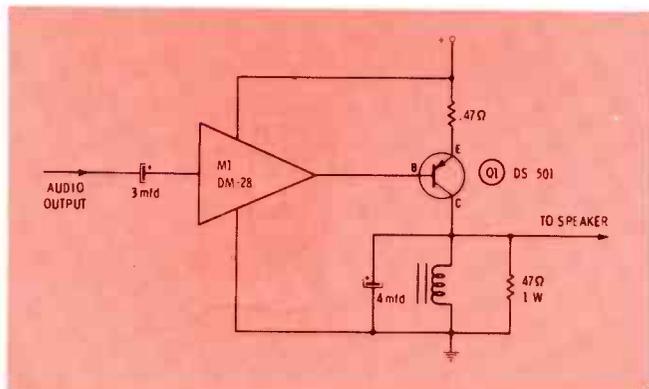


Fig. 10 Schematic of the DM-28 driver and DS-501 power amplifier circuits. Two are used for stereo.

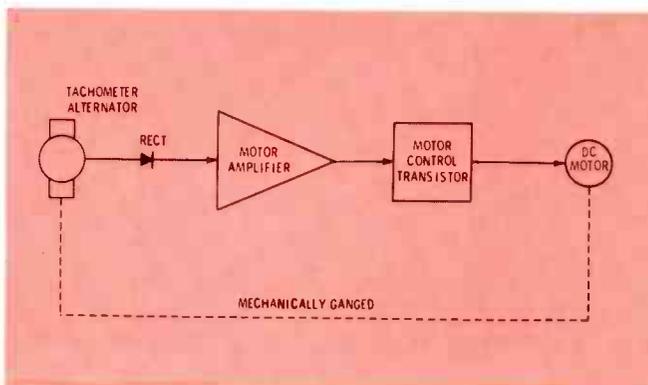


Fig. 11 A block diagram of the motor-speed control system using DC negative feedback.

To remove it, take out the three screws and the two power springs (one conventional and one "Y"). You also can remove the solenoid-cam housing for cleaning.

Inspect the cam for grooves or other signs of excessive wear. Replace the cam with a new one, if it shows any evidence of wear. Doing it now can prevent some of the weird track-change problems that worn cams cause (repaired for free on a callback, of course).

Use paper towels, cotton swabs and a good solvent, such as isopropyl alcohol (rubbing alcohol) or Ampex head cleaner. The latter is superior in degreasing, but it can damage plastic parts, so use caution.

Another precaution is the correct replacement of the small plastic "stripper" located behind the capstan shaft between the shaft and the rear wall of the bearing housing. Before removing the flywheel, memorize how this stripper is installed (tab to the right), because a reversed position can cause breakage of tapes. When the complaint is tape breakage, I usually replace the stripper on general principles.

Electronic Circuitry

The signal-path of the Delco tape/radio combination is shown in Figure 8. Without a cartridge, the radio/tape changeover switch connects radio audio from the stereo decoder to the right and left power amplifiers and speakers.

When a cartridge is inserted through the trap door, it trips the changeover switch, applying power to the tape-deck circuits and switching the output of the pre-amplifiers to the power amplifiers.

The tape preamplifier (Figure 9) consists mainly of the familiar Delco DM-30 integrated circuit. RC filters at the outputs of the IC produce the rising bass response necessary with tape. Because the outputs of the IC are not supplied by separate positive and negative supplies, it seems a good guess that the DM-30 is a modified operational-amplifier (Op-Amp).

Also, the audio amplifier section uses the standard Delco DM-28, which has been used in other Delco radios for

several years. Perhaps you remember that the DM-28 isn't an integrated circuit, but is a subassembly packaged with more conventional components. Actually, it is related to the old couplers, used many years ago, and is potted in a compound (epoxy?) that prevents contamination (and repairs).

Output of each DM-28 drives a DS-501 germanium power transistor, as shown in Figure 10.

Both the AM and FM-stereo radio sections closely follow the circuitry and layout used in previous Delco radios. For example, the FM detector is a quadrature type using the well-known DM-11 integrated circuit. Then the outputs of both radios are fed through the DM-24 stereo decoder. Use of the DM-24 for AM is permissible because the IC gives only a slight amount of gain without decoding when the 19-KHz pilot carrier is absent. Decoding into right and left channels occurs only when the pilot carrier is present in the signal.

Motor-Speed Regulator

Motor-speed regulators in Delco tape players usually are more elaborate than those used in other brands. Some technicians believe this system gives less "wow" and "flutter" than that obtained from others.

All regulator systems operate by an alternate slowing down and speeding up of the motor shaft. The conditions are chosen so that the motor speed unregulated would be too fast. At a certain high-speed threshold the voltage to the motor is reduced and the motor slows down until it reaches the low-speed threshold where the voltage is restored or increased, etc. The two thresholds are called "system hysteresis", and the closer they are together, the better the speed control.

In the Delco regulator (Figure 11), the speed-control action is a type of negative feedback. The motor and alternator (tachometer) are on the same shaft, so the changing motor speed produces a changing AC voltage from the alternator. This AC voltage is processed into a DC control voltage which is amplified by a power transistor and is used to vary the voltage applied to the motor. □

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“The close-up's are sharp, but the backgrounds are *blurred*”

By Carl Babcoke

How often we have heard TV customers make a similar remark when describing the symptoms of their set. This is one of the times a knowledge of camera lenses can be helpful to a TV technician.

Every scene of a TV program started with an optical lens. So, the characteristics of lenses determine the “look” of all TV pictures. TV technicians who know the peculiarities of lenses can explain to their customers that certain symptoms don't indicate defects in the receiver.

The basic characteristics of optical lenses are the same regardless of the system in which they are used. So, an explanation of the actions in still-camera lenses will apply also to movie or TV-video camera lenses.

Exposure Equals Light Plus Time

Each type of film requires a certain exposure; and exposure is the result of the amount of light versus the length of time the light reaches the film. All films are rated for sensitivity to light, or “speed”. Some require much more light than others for the same exposure. From that statement, a person might be led to believe that a sensitive film requiring very little light for a normal exposure might be desirable. This is not necessarily true; it depends on the usage. Generally speaking, the “faster” the film the less sharpness and the more graininess is obtained. The opposite is true of “slow” films.

Shutter Speeds And F-Stops

Adjustable cameras, as shown in Figure 1, have two separate adjustments for determining the amount of exposure of the film to light.

The markings from 1 to 500 are shutter speeds from 1 second to 1/500th second; the larger the number the shorter the amount of time the shutter is open permitting light to en-

ter. In the TV system, the video cameras don't have shutters, but scanning gives the equivalent of 1/30th second.

“F-stops” are indicated by the numbers from 2 to 22. F2 is obtained when rotation of the ring opens the lens diaphragm to the widest point allowing the maximum amount of light to enter. As the ring is rotated to decrease the size of the opening in the lens, the F-stop numbers get larger (F2.8, F4, F5.6, etc) up to F22 which is the smallest diaphragm opening in this particular camera.

Many Combinations Produce Correct Exposure

Each “stop” of either shutter speeds or diaphragm opening changes the exposure by double or half. In other words, changing from 1/60th to 1/125th of a second produces one stop less exposure, while going from F11 to F8 gives one stop more exposure.

Therefore, for each amount of light on a scene, there are many different combinations of F-stops and shutter speeds which will provide the same correct exposure. For example, 1/8th second at F22 gives the same exposure as 1/125th second at F5.6.

You might wonder why so many ways are provided to do the same thing. And, if all pictures were taken of flat, motionless objects, there would be no need to make variable both shutter speeds and exposure stops. But in real life, subjects move and objects in the picture vary in distance from the camera. In addition, these extra stops give the expert photographer ways to be artistic in selecting the conditions to give the effects he wants.

Shutter Speeds

Slow shutter speeds allow light to enter for a longer amount of time, but there is a possibility the picture will be blurred by any motion occurring during the time of exposure. On the other

hand, a high shutter speed might not allow enough light for correct exposure to enter according to the available light and the maximum diaphragm opening.

Another consideration is camera shake during exposure. Some of the larger photo labs report that the main cause of unclear pictures is camera movement. A good rule-of-thumb with normal lenses is to use 1/125th of a second (or faster) for hand-held camera shots. If the lens is a wide-angle type, 1/60th of a second can give the same immunity from camera-shake. On the other hand, the use of a telephoto lens dictates the selection of faster shutter speeds. For shutter speeds of 1/30th (or slower) with a normal lens, a tripod to steady the camera is recommended.

Depth Of Focus

Perhaps the most frequent customer complaint about TV pictures is, “The close-ups are sharp, but the backgrounds are blurred.” This is not a defect at all, but the normal operation of a lens characteristic called “depth of field” or “depth of focus”.

To be perfectly accurate, any lens can be focused for the sharpest operation **only at one** distance at a time. No lens has ever been equally sharp at all distances with only one adjustment.

Although we have seen pictures in which all areas **appeared** to be in sharp focus, in others a nearby object was clear, but the background was blurred. These are two extreme examples of the depth of focus at work.

The extent of the zone of acceptable focus is affected by three general conditions. They are:

- whether the lens is focused on a nearby object, or on a far one;
- how much the lens is “stopped” down by decreasing the size of the hole in the diaphragm; and
- the focal length (normal, wide-angle, telephoto, etc) of the lens.

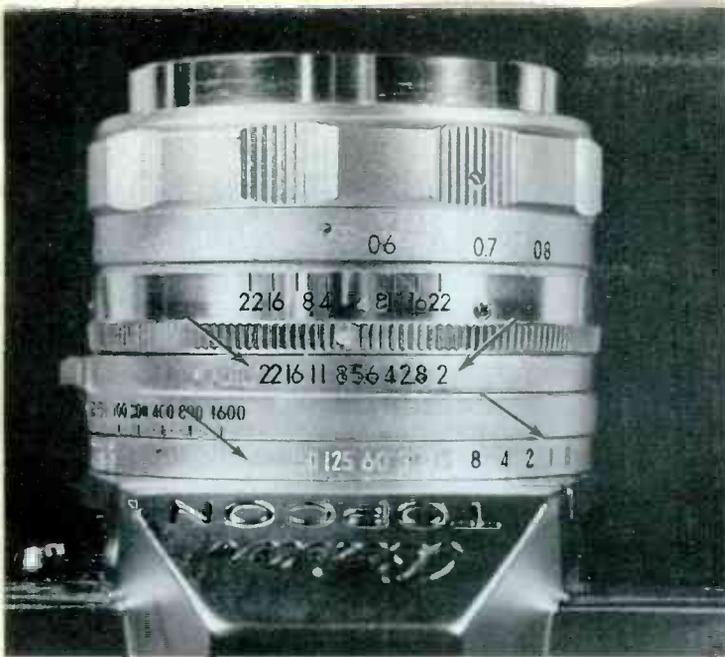


Fig. 1 In addition to the focusing ring, an adjustable camera will have F-stops (F2, F2.8, etc. up to F22) and shutter speeds (1 second up to 1/500th second). Both shutter speeds and F-stops contribute to the total exposure of the film. Shutter speeds determine the effects of movement, and F-stops set the depth of focus.

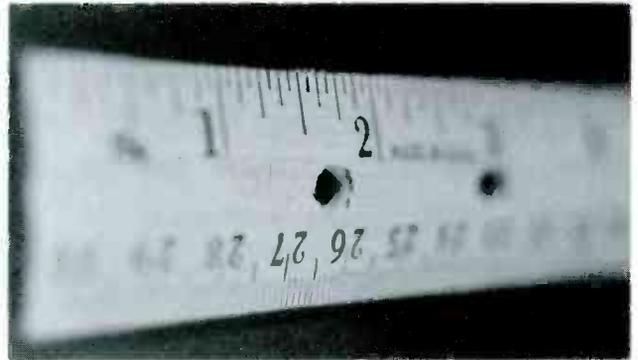


Fig. 2 When any camera is focused on an object very near the lens, the depth of field apparently becomes very shallow. Notice that only the markings on the ruler around 1 1/2 inches are in focus, although the diaphragm was set for F4.



Fig. 3 The picture at the left shows the shallow depth of focus produced by a setting of F2. Only the second magazine is in good focus. While the picture at the right, taken at F16, shows good focus of all four magazines.



Fig. 4 A comparison of the visual differences between pictures taken with telephoto or wide-angle lenses. The telephoto lens, left picture, gives a very shallow depth of focus, in addition to compressing the front-to-back distances. The right picture, taken with a wide-angle lens, has a much wider depth of focus, as well as an expansion of the apparent distance between the subjects.

Close Focusing

Focusing on an object near the camera appears to produce a very shallow depth of focus. The photographic experts tell us the depth of focus remains at a fixed percentage; however the eye sees it as a narrower depth of focus. One example is the picture of an ordinary wooden ruler shown in Figure 2. A macro-type of closeup lens was used at F4, and the depth of focus was only about 1/4 inch. The same lens at the same F-stop would show fairly good depth of focus if focused on a building 30 feet away.

Small diaphragm openings widen the depth of focus

In Figure 3 are examples of the depth of focus obtained at F2 (lens diaphragm wide open) and F16 (diaphragm nearly closed).

Longer focal lengths produce shallower depth of focus

"Selective focus" is the technical term for the shallow depth of focus shown by the top picture in Figure 4. The image of the young lady in the foreground is fairly sharp, but it is almost impossible to recognize the two ladies standing in the background because their images are so blurred. A normal lens for the camera is 50 mm, while this picture was taken with a 105-mm telephoto lens.

When a 24-mm wide-angle lens was

substituted for the 105-mm telephoto, the picture (bottom one in Figure 4) included 4 times the area of the auditorium and widened the depth of focus about 4 times. F2.8 was used in both cases, and the positions of camera and subjects remained the same for both pictures.

How Non-Adjustable Cameras Operate

Because of the difficulties in obtaining good focus over wide areas, and the huge choice of b-w, color-slide, or color-print film, a beginner at photography well might wonder how a non-adjustable camera could ever produce a satisfactory picture. Yet the thousands of pictures taken every day by use on the instant-loading types (descendants of the old box "Brownies") of camera prove it possible.

Several factors contribute to this success. First, the speed of film to fit cameras of the non-adjustable type is usually restricted to the range between ASA64 and ASA100. Most pictures coming from such cameras are prints made from negatives, and there is a large built-in latitude against exposure errors in a negative system. However, color slides made outdoors on a rainy day are almost certain to be underexposed, and slides of a white house in brilliant sunshine likely will be badly overexposed. There are limits to a simple system.

Next, moderately-wide-angle lenses

are used to provide the wider depth of focus previously mentioned. Such lenses are factory focused to about 20 feet.

Finally, the lenses have fixed diaphragm stops of about F11, and this further extends the depth of focus. Therefore, the wide-angle lenses stopped away down provide a reasonably good focus from about 10 feet to infinity.

To complete the non-adjustable camera, it's likely the shutter speed is selected to give normal exposure in daylight with the F-stop of the lens that was previously chosen to provide good depth of field.

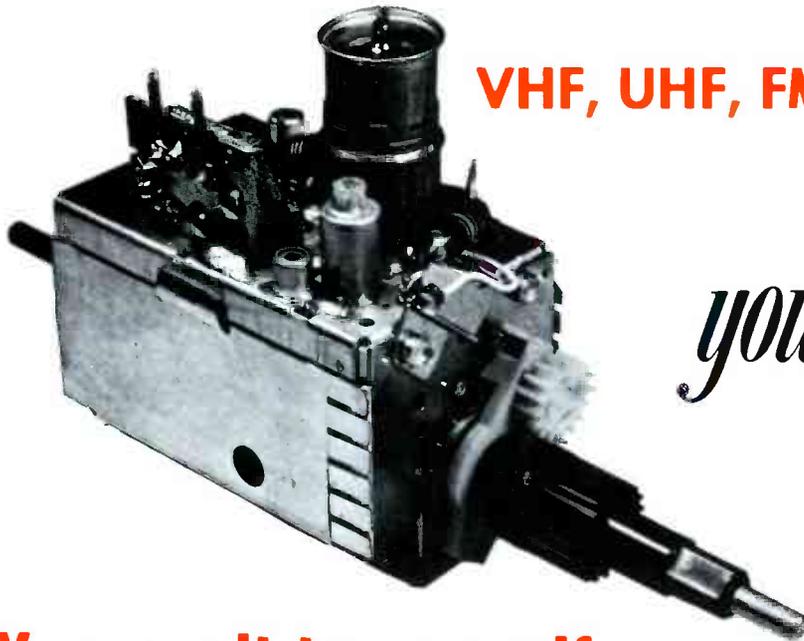
The TV Picture With Selective Focus

The reasons why a closeup showing an actor's head filling most of the TV screen should have a blurred, out-of-focus background become clear when the facts about lenses are applied to this particular case.

All three reasons for having a shallow depth of field are present here. The lens is focused near the minimum permitted by the design, the amount of light on a TV stage is not sufficient to stop the lens down very far, and most such closeups are made with the lens zoomed in to about a 5X or 8X telephoto.

There can't be any doubt why "The closeups are sharp, but the backgrounds are blurred"!
□

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For More Details Circle (11) on Reply Card

January, 1973/ELECTRONIC SERVICING 39



Drew W. Koontz of The Finney Company answered questions at the IESA convention about the planning of MATV systems.

News from the

SERVICE ASSOCIATIONS

Indiana Electronic Service Association Convention

The annual fall convention of the Indiana Electronic Service Association (IESA) was held in Fort Wayne, Indiana November 3, 4 and 5. Traditionally, the fall convention is reserved for technical seminars and organizational business. Business-management sessions are held during the spring convention.

Some highlights of the convention included:

- a seminar about designing and installing MATV systems by Drew Koontz from the Finney Company;
- technical tips about troubleshooting RCA modular color receivers by Carl Moeller, Administrator of Field Technical Services, RCA Sales Corporation;
- a slide presentation of little-known facts about vertical and horizontal deflection plus color trouble symptoms from the screen of the CRT's by Carl Babcoke, Managing Editor of ELECTRONIC SERVICING;

- Dean Moch, Chairman of the Indiana Board of Television and Radio Service Examiners, spoke about administration of the state law and how it has benefited both servicers and their customers;
- a technical seminar by Chet Dun of the Magnavox Service Training staff about the theory and servicing of the new Magnavox solid-state color TV.

Arrangements for the convention were made by J. W. Phipps, Executive Director, and Ron Wentworth.

NEA and NATESA are in an all-out drive for new members. This drive started in November and continues until March 31, 1973. One of the extra inducements is the furnishing of gifts amounting to over \$40 in retail price by the sponsoring manufacturers to each new member. At this writing, the sponsors are: Amperex Electronic Corp., Tech Spray, Finney Company, Electronic Devices, Inc., and International Rectifier. Theme of the campaign is: "Support Your Supporters". More information can be obtained from NEA, 1309 West Market Street, Indianapolis, Indiana 46222 or NATESA, 5908 South Troy Street, Chicago, Illinois 60629.

(Continued on p. 44)

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January, 1973/ELECTRONIC SERVICING 43



Dean Moch (standing), Chairman of the Indiana Board of Television and Radio Service Examiners, explained at the IESA convention the administration and beneficial results of the state law. Field Investigators **Jim Baker** (center) and **Charlie Conwell** (right) also attended.

(Continued from p. 40)



Carl Moeller, Administrator of Field Technical Services for the RCA Sales Corporation, at the IESA convention presented technical tips for servicing RCA modular color receivers, and explained the operation of the transistorized horizontal-sweep circuit of the CTC60 chassis.

CET tests will be given again on March 15. If you don't know the test location nearest you, write to the Managing Editor, **ELECTRONIC SERVICING** and we will supply that information.

Frank Moch has written an open letter to **Bess Myerson** of the Department of Consumer Affairs protesting the distortion by some government officials of her public statements. Mr. Moch pointed out that persons without knowledge of a business which services a complex product do a disservice to the public in trying to arbitrarily determine prices and practices. The technology of solid-state color receivers is so complex that trained technicians must "run just to stand still"; therefore, laymen cannot be expected to understand the implications. Although TV receivers can be mass produced by low-paid foreign workers, the job of making repairs is always a custom operation requiring knowledge, training and good judgement in a technician who is paid the American scale of wages. In addition, the bugging of receivers as a test of a technician's honesty often is done incorrectly. For example, a blown fuse to a layman is a simple defect which should be found and corrected at low cost. But a good technician would not stop there. What caused the fuse (a protective device) to blow? Another point often overlooked is the degree of restoration. By the time a receiver is several years old it often has borderline defects, in addition to the main complaint, which require repairs if the machine is to be placed in like-new condition. Most servicers recognize the right of set owners to decide how far restoration should be carried, and if the owner says, "Just make it work", the cost is far less than a full restoration. Any such restrictions should be understood clearly and marked on the claim check along with the minimum fee (if any) for estimates. Customers who patronize shops offering gifts, free calls, gimmicks, or impossible bargains are encouraging the possibility of shady tactics. **NATESA** has worked for ethical practices for a quarter of a century and believes the problem operators can and should be identified without maligning the vast numbers of honest servicers. □



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AD143	179	OP 6	179
AD143B	179	OP 7	179
AD148	131	OP 8	130
AD149	104	OP 8-T	130
AD149-01	121	OP 8-P	130
AD149-02	121	OP-10	179
AD149B	121	OP-11	130
AD150	121	OP-12	130
AD152	131	OP-13	185
AD155	131	OP-14	184
AD156	131	QP8-6623N	105
AD157	131	QP-13	153
AD159	121	QP-14	152
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bookreview

How To Solve Solid-State Circuit Troubles

Author: Wayne Lemons

Publisher: TAB Books, Blue Ridge Summit, Pennsylvania

Size: 5 1/2 x 8 1/2 inches, 304 pages

Price: Softcover \$5.95; hardcover \$8.95.

This reference handbook contains 161 circuit descriptions and many step-by-step troubleshooting procedures. For each circuit the author includes a schematic diagram, a full description of circuit operation, and a logical procedure for tracking down trouble and pinpointing the defective component. The book is organized into sections covering specific circuit types which represent more than 90% of those in common use.

CONTENTS: General Servicing Procedures—Radio Frequency Amplifiers—Oscillators—Converters—Mixers—Automatic Fine Tuning—IF Amplifiers—AM Detectors & AGC—FM Detectors—Stereo Multiplex—Video Amplifiers—Sync Separators—Noise Inverters, Clippers, Gates, and AGC—Vertical Deflection—Horizontal Oscillators, Drivers, and Output Stages—Special Color TV Circuits—Audio Amplifiers—Power Supplies—Tape Recorder Oscillators—Index.

Security Electronics

Author: John E. Cunningham

Publisher: Howard W. Sams & Co., Inc., Indianapolis, Ind.

Size: 5 3/8 x 8 1/2 inches, 159 pages

Price: Softcover \$4.50.

Basic operating principles of various electronic devices and systems used in providing security against theft and sabotage are discussed in depth. The coverage opens with a general description of electronic intrusion alarms. Succeeding chapters detail the principles and circuitry of different types of intrusion-detection devices. Also included are other topics such as bugging, de-bugging, speech-scrambling systems, examples of practical installations, and a look into the future of security electronics.

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Photofact Bulletin lists new Photofact coverage issued during the last month for new TV chassis.

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TV22-1631A, TV22-6407A 1280-1

CURTIS MATHES

Chassis C40 CMC40 1283-1

JC PENNEY

2320 1285-1

MGA

CH-121, CH-141 1281-2
CS-165 1282-1
CH-160, CH-190, CH-191 1283-2

PANASONIC

TR-465R 1284-1

RCA

Chassis KCS171AE/AF/XC 1280-2
Chassis KCS179XM 1282-2
Chassis KCS176H/XH, RC-3006 1283-3
Chassis CTC39XAJ/XBE/XBJ 1284-2
Chassis KCS183F 1286-1

SANYO

91C16 1279-2
51C11 1282-3

SEARS

Chassis 564.80153, 564.80154 1279-3

SHARP

C-9311 1284-3
IT-10U 1285-2
C-9310 1286-2

SINGER

HE-8060 1280-3
HE-8020 1286-3

SYLVANIA

Chassis EO1-9, EO1-10, EO1-19, EO1-20 1285-3

ZAYRE

ZM187S, ZM288S 1281-3

PRODUCTION CHANGE BULLETIN

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Chassis 1K2084-2, 2K2085-5 1283-4

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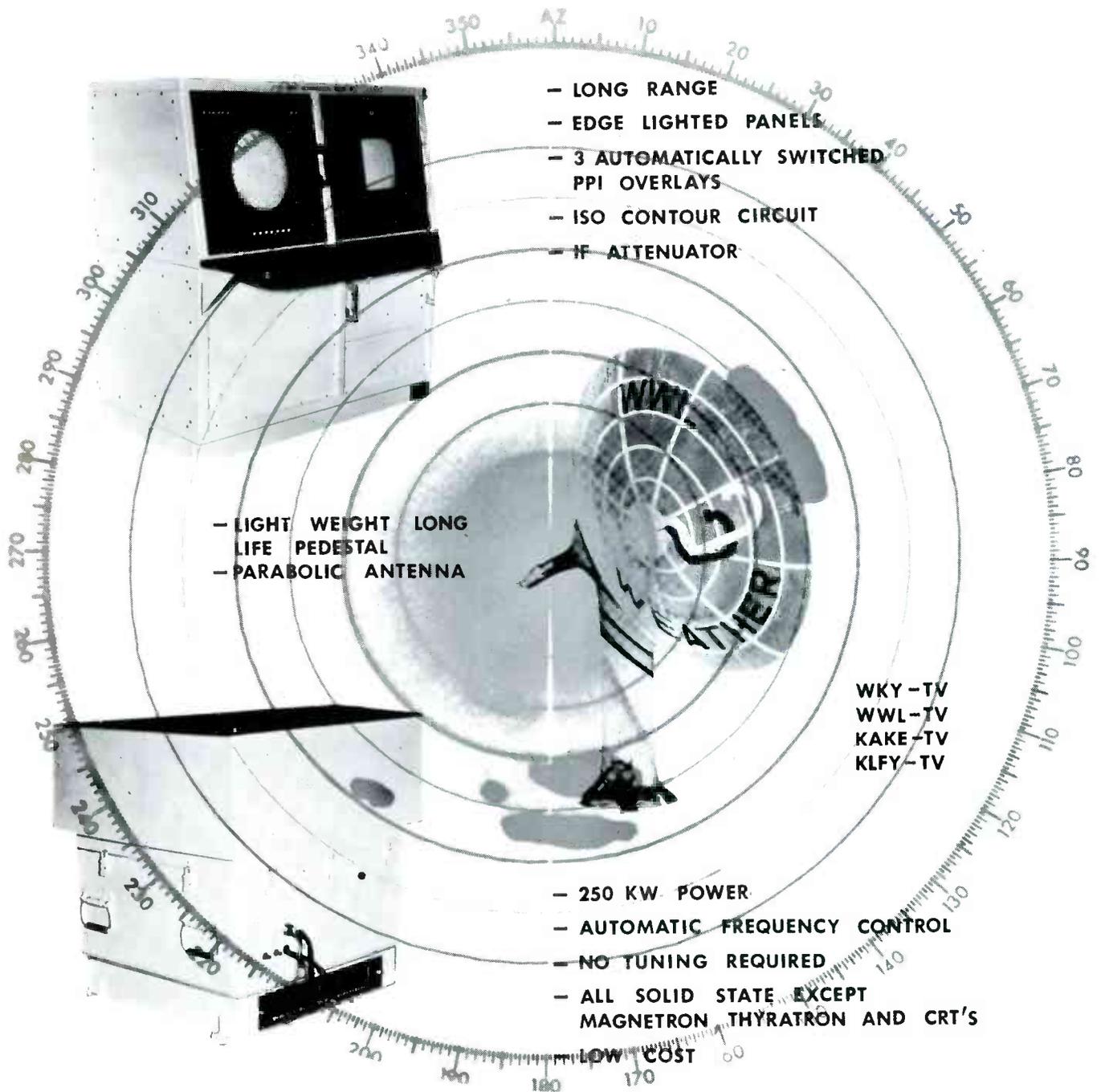
Chassis 22QT79, 22QT80 1283-4
Chassis 20QT74, 20QT75, 20QT76 1285-4

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(Continued on p. 50)

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(Continued from p. 48)

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Chassis T952-06-AD/-AE/-AF/-ED/-EF,
T952-08-AD/-AF, T952-10-AD/-AF/-EF,
T952-11-AF/-ED/-EF, T952-12-AD/-AF,
T952-14-AF/-EF, T952-15-AF/-EF,
T952-75-AF/-EF, T952-76-AD/-EC/-ED 1293-1
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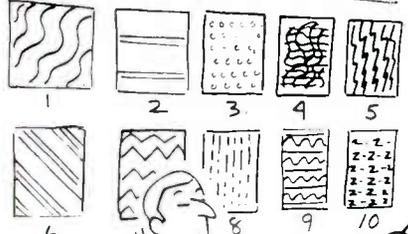


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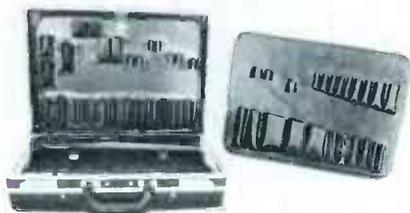
"I just moved into town from Texas. Could you test my picture tube?"

productreport

for further information on any of the following items, circle the associated number on the reader service card.

Tool Case

Product: Model 54C745 case for electronic tools by Jensen Tools and Alloys.



Features: Model 54C745 features two removable tool pallets which hold about 60 tools. There is room in the case for larger tools, part boxes or test

instruments. Also, a document pocket is provided in the lid for manuals and schematics. The heavy-duty construction attache-style case is useful for traveling field engineers and technicians. It is made of ABS thermoplastic "Royalite" with fiberglass reinforced corners.

Size: Inside dimensions are 17 3/4 x 12 1/2 x 4 3/4 inches.

Price: \$49.50, including shipping.

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Burglar-Fire Protection

Product: Electro-Sentry Burglar Alarm by GC Electronics.

Features: The Electro-Sentry self-contained battery-operated alarm installs with wires to protect any door or window from intrusion. A second burglar alarm is the UltraSonic Sentry which detects movement within 25 feet by means of ultrasonic waves. The Magna-Sentry is a battery-operated unit with a built-in fire alarm that sounds any time the temperature reaches 135 degrees F. These three types of alarms are part of the Security Systems



49-1430 which also offers a complete selection of related accessories that allow for expanded protection. The entire line of "do-it-yourself" security products are available on a self-service display merchandiser.

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Adhesive Selector

Product: Instant-Weld Evaluation Kit by Oneida Electronics Mfg., Inc.

Features: The kit contains a new 5-pack selection of permanent-bond instant-weld alpha-cyanoacrylate adhesive. The powerful, single-component adhesive is said to have a tensile strength up to 5,000 pounds-per-square inch. The 5-pack evaluation kit contains all of the four different formulas packed in 2-gram tubes. Red Label - 101, for use when bonding any combination of plastic, rubber, ceramic or glass. Sets in 10-20 seconds. Blue Label - 102, for use when bonding any combination of plastic, rubber, ceramic or glass. Sets in 45-60 seconds. Yellow Label - 747, for use when metal is one or both of the bonded components, such as metal to plastic or metal to rubber, glass, etc. Sets in 30-45 seconds. Green Label - 240, holds porous and non-porous materials. It holds all previously-mentioned materials plus leather, paper, soft woods, many fibrous substances, etc. Sets in 60-120 seconds. The Kit has been made up to help users find the most effective type for their specific bonding application.

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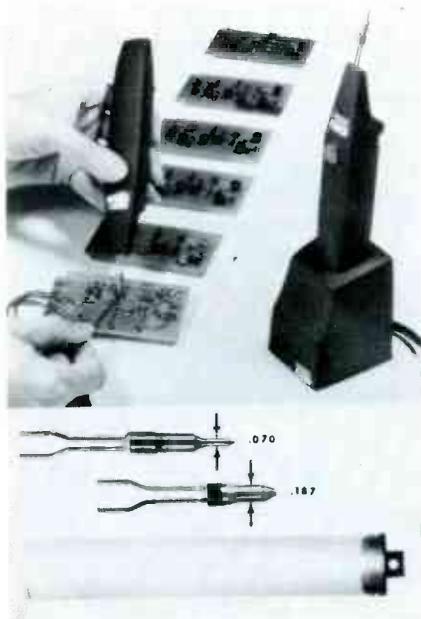
STATE _____ ZIP _____

Prices and specifications subject to change without notice

For More Details Circle (21) on Reply Card

Soldering Iron Kit

Product: Catalog No. 7500 Kit consists of the cordless soldering iron, separate recharging stand, one No. 7545 fine tip and an instruction booklet by Wahl Clipper Corporation.



Features: The cordless iron solders up to 150 joints or more per charge. When used for soldering, the iron has no AC leakage or induced current to damage delicate electronic components. Two irons can insure maximum production with one iron charging while the other is in use. When the button is pressed, the tip heats to over 700 degrees F in about 5 seconds. Also available is the plastic Protective Carrier/Storage Tube, No. 7595, which facilitates safe handling.

Size and Weight: It is 8 inches in length, and weighs 6 ounces.

Price: \$19.95 for the No. 7500 Kit.

For More Details Circle (33) on Reply Card

Appliance Dolly

Product: Tele-Caster TV Dolly, Model TC-1 by The Finney Co.

Features: An automotive type lifting jack makes it possible for one man to move heavy TV sets, appliances, desks and files. The operator places the jack plate under one end of the object, raises it with the jack until it clears the floor, secures it with the nylon strap, and wheels the object like a wheel barrow, or dolly. The TC-1 can also "walk"

up and down stairs, can be used to tip a TV set or appliance upside down in order to work on the bottom, and can remain attached to the TV set or other object while in the service vehicle. The square tubular frame is padded with 3/8 inch thick foam tape on contact areas, and has large 8-inch steel wheels with rubber tires and ball bearings. The unit is shipped assembled except for the wheels.

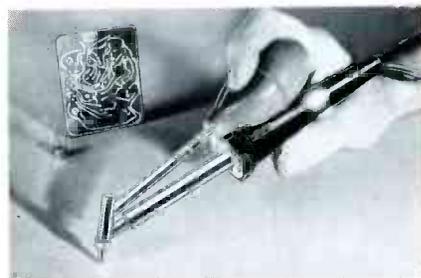
Price: The TC-1 sells for \$89.50.

For More Details Circle (34) on Reply Card

Desoldering Iron

Product: Endeco Model 510 desoldering iron by Enterprise Development Corporation.

Features: This pencil-type desoldering iron has safety power-indicating light, 3-way on-idle-off switch, and a suction bulb placed for one-hand operation. Normal operation is at 40 watts, or it idles at 20 watts for longer tip life. Located inside the handle, the light in-



dicates operation at both heats, with a different intensity for each. The iron also has six tip sizes, a cool, unbreakable polycarbonate handle, and a flexible, burn-resistant neoprene cord.

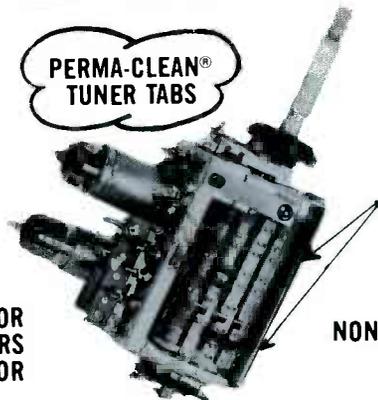
Size and Weight: The length is 8½ inches, and the weight is 3½ ounces.

Price: Endeco Model 510 desoldering iron sells net for \$16.00. □

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Hopkins, Minnesota 55343

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January, 1973/ELECTRONIC SERVICING 53

test equipment report

Features and/or specifications listed are obtained from manufacturers' reports. For more information about any product listed, circle the associated number on the reader service card in this issue.

Dual-Mode Oscilloscope

Product: "Triggered or Recurrent Sweep" Oscilloscope, WO-535A, by RCA.

Features: With the dual-mode operation the RCA instrument has a usable bandwidth of DC to 10 MHz and comes complete with probes. The solid-state WO-535A has exceptionally high gain. In the Recurrent Sweep Mode, the WO-535A is a continuous-sweep type oscilloscope with time-base references and pre-set V and H sweep positions. A separate phase control varies the phase of the sweep voltage when the "LINE" position of the sync

or H amplifier switch is used. The triggered sweep system is different using continuous adjustment of hori-



zontal gain and a high degree of expansion. Simplified calibration is convenient in reading the voltage and allows for the collapsing of the pattern to a single vertical line. The power supply is regulated. Other features include a flat-face cathode-ray tube, return-trace blanking, illuminated graph screen and camera mounting studs. The RCA WO-535A Oscilloscope comes complete with one

WG-400A Direct/Low Capacitance Probe and cable ground lead, plus a slip-on alligator clip with insulator.

Price: The WO-535A sells for \$329.

For More Details Circle (36) on Reply Card

AM-FM Stereo Analyzer

Product: Model SG165 Stereo Analyzer by Sencore, Inc.



Features: The SG165 is a complete generator covering the IF and RF bands for both AM and FM. As an IF signal generator, it provides every IF frequency and form of modulation. To check for alignment and bandwidth in stereo receivers, a 10.7-MHz crystal oscillator is provided, plus sweep and markers to add post-injection 100-KHz markers on the scope screen. It is also a complete audio generator with straight MPX signals, 400-Hz sine waves and 400-Hz square waves.

For More Details Circle (37) on Reply Card

Field Strength Meter

Product: VHF/FM/UHF Field Strength Meter Model FSM-2 by Blonder-Tongue Laboratories.

Specifications: Model FSM-2 has an accuracy of ± 1.5 dB over its entire frequency range from 54 to 216 MHz and from 470 to 890 MHz. Because of the maximum-sensitivity scale of 100 microvolts, readings of as little as 10 microvolts, or as high as 3 volts, can be taken. Front panel switches select average or peak readings, UHF or VHF scales, and 120-volt AC or battery operation. The all-transistor superheterodyne circuitry gives up to 50%



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54 ELECTRONIC SERVICING/January, 1973

For
Better
Results
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Card
on
Page
41

longer battery life, and a regulated power supply eliminates adjustments as batteries age. The meter movement is a taut-band wide-scale 1-milliamper unit. Completely shielded for operation in strong magnetic fields, the new model comes equipped with a removable dust-proof cover with safety lock which, when closed, automatically turns off the unit. Also, a DC output connection permits making field-strength surveys using a graphic recorder. Input connection at 75 ohms is made through a type F connector located on the front panel.

Size and Weight: The new FSM-2 measures 12-5/8" x 7" x 7-3/4" and weighs 13 pounds, including batteries. **Price:** \$815.10.

For More Details Circle (38) on Reply Card

Frequency/Multiplier Counter

Product: Model 6220 2-MHz Frequency/Multiplier Counter by Systron-Donner Corporation.



Features: The Model 6220 features a unique phase lock/multiplier technique which makes possible high-resolution measurements without an increase in measuring time. It can resolve 0.001 Hz in 1 second. The phase lock/multiplier technique also offers high rejection of random electrical noise. Other features include AGC (automatic gain control) which sets all input adjustments automatically for total hands-off operation, zero suppression to blank out all leading zeros for easier reading of measurements and a parallax-free digital readout with an autoranging decimal point and units annunciator. The 2-MHz frequency measuring range of the 6220 is covered by four manually-selectable frequency multiplier ranges. In the Auto-ranging mode the counter will automatically select the appropriate resolution to fill the display register, or give a maximum resolution reading in 1 second.

Price: Model 6220 costs \$350.00.

For More Details Circle (39) on Reply Card

Miniature Resistance Calculator

Product: Model R-1 by Lee Electronic Labs, Inc.

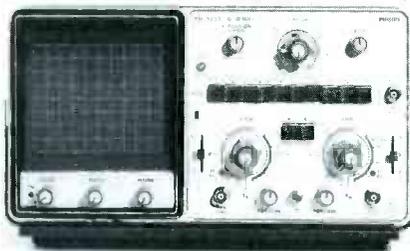
Features: When used as a substitution box, over 825 different values are covered. As a 10 percent step decade, ranges are from 100 ohms to 11 megohms. The R-1 is also used as an automatic voltage divider with up to 25 different deviations from one source. The R-1 comes complete with three leads.

Price: The R-1 sells for \$17.45.

For More Details Circle (40) on Reply Card

Dual-Beam Oscilloscope

Product: PM3232, a general-purpose oscilloscope, by Test & Measuring Instruments, Inc., a subsidiary of the North American Philips Corp.

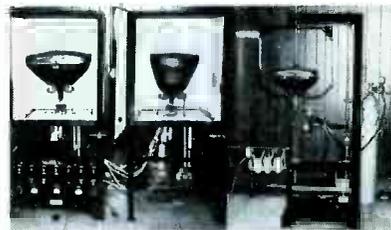


Features: The PM3232 has a sensitivity of 2mV/cm, 10-MHz bandwidth and dual-beam operation. The PM3232 combines a number of features that can often eliminate the need for a more expensive, wider-bandwidth instrument when only one or two individual features, such as 2-mV sensitivity across a wide band or DC triggering, are required for a particular application. In addition to being a true dual-beam instrument having no possibility of phase displacement between the two traces, the PM3232 also offers universal triggering facilities including automatic level, DC coupling, and automatic TV line/frame selection. The 8- by 10-cm screen and excellent light output is derived from the post-deflection acceleration system so that even low duty-cycle, fast-sweep signals are displayed clearly. Dual-beam operation is preferred over dual-trace because the waveforms are not chopped or switched; they are brighter, and without discontinuities.

Price: \$900.00. □

For More Details Circle (41) on Reply Card

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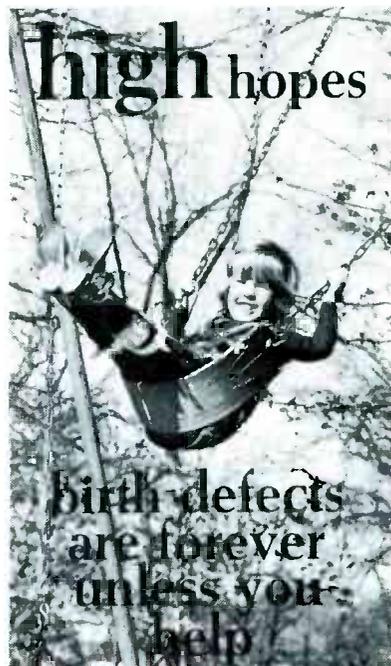
With the Lakeside Industries precision picture tube rebuilding unit, you can rebuild any picture tube, be it black and white or color or 20mm or etc. We offer you the most revolutionized precision equipment of our modern times. This unit is easy to operate and requires only 4 x 8 ft. of space. You can rebuild the finest tube available. The picture will be clear and sharp. Your cost to rebuild a color tube is \$6.60. Your cost to rebuild a black and white tube is \$1.85.

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For further information, please send your name and address to Lakeside Industries, 3520 W. Fullerton Ave., Chicago, Illinois 60647. Phone: (312) 342-3399.

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Council for Financial Aid to Education, Inc.

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audio systems report

Cassette Tape

Product: Series 261 cassette tapes by Irish Magnetic Tape.

Features: The lifetime-guaranteed cassette series uses wide-range full-fidelity ferro-sheened tape, and minimizes head clog and wear. Torque-control liners are made of graphite-coated polyester and the case is high-impact plastic with sealed windows. The tape-guide system has lubricated stainless steel pins with rotating guide rollers.

Price: \$1.80, \$1.85, \$2.90 and \$3.45 for 40, 60, 90 and 120 minute tape cassettes.



For More Details Circle (42) on Reply Card

Stereo Home Converters

Product: Models 12R900 and 12R1000 stereo home converters by RCA.

Features: Two new RCA home converters allow stereo buffs to take the players from their cars right into their living rooms and slide them into RCA home converters. Model 12R900 is designed specifically for use with RCA's Q-8 4-channel player (the 12R800)

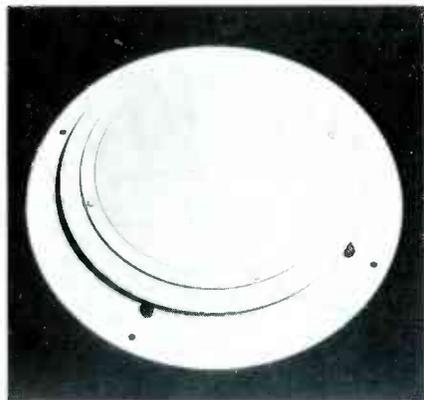
which features a "Quick Release" mounting bracket as standard equipment. RCA's 12R1000 home converter can accommodate all other RCA car stereo players when they're equipped with the optional "Quick Release" mounting bracket. Optional matching speaker sets, 12R410, feature a distributed-port reflex design and are internally damped. Two speaker sets are required for use with the Q-8 12R800.



For More Details Circle (43) on Reply Card

catalogs literature

Product: Model WS-114 ceiling speaker by the Weltron Company.
Features: The WS-114 was designed



for low-to-medium power background and paging systems. The 3-watt 8-ohm speaker has a thin profile which makes it ideal for mounting on the surface of ceilings and walls in offices, restaurants and recreation rooms. It can be used with acoustical drop-in ceilings at less cost than recess models. A screw-driver is all that is needed for complete installation.

Size and Weight: 1 3/4" deep x 6 1/2" round contained in a 9 3/8" white baffle. 1 1/4 lbs.

Price: \$13.40.

For More Details Circle (44) on Reply Card

P.A. Speaker

Product: HFS high-fidelity coaxial projector by the Bogen Division of Lear Siegler, Inc.

Features: The HFS is an all-weather high-fidelity coaxial speaker for either indoor or outdoor sound applications. This projector is useful for systems requiring wide-range reproduction and 120-degree high-efficiency sound projection. Separate horn-loaded cone-type driver units are featured for minimizing acoustic phase distortion and inter-modulation effects. A 1-KHz crossover is built-in. Maximum-power rating is 15 watts rms. □

For More Details Circle (45) on Reply Card

Got A Troubleshooting Tip?

If you've recently run across an unusual trouble symptom, send a thorough description of it and the solution to:

Troubleshooting Tip,
Electronic Servicing
1014 Wyandotte St.
Kansas City, Mo. 64105

100. **Jensen Tools and Alloys** — announces its new Catalog 572, "Tools for Electronic Assembly and Precision Mechanics." The 96-page handbook lists and describes over 1900 individual tools, kits, and solders. There are four pages of technical data on tool selection.

For More Details Circle (46) on Reply Card

101. **Mountain West Alarm** — introduces a new alarm equipment catalog, the M-73. Over 400 intrusion and fire alarm products are described in some detail regarding application, principle of operation, and specifications. Also featured are eight pages of "Application Notes" for alarm equipment.

For More Details Circle (47) on Reply Card

102. **B&K** — Catalog No. BK-73 lists test instruments, including a variety of oscilloscopes, tube testers, generators, CRT tester-rejuvenators, a VTVM, an electronic multimeter, capacitor and transistor analyzers, and the popular 1077B Television Analyst. It also devotes two pages to probes and other accessories. There are eight new items in the catalog.

For More Details Circle (48) on Reply Card

103. **B&K** — A 28-page "mini-catalog" of the full B&K test equipment line is now available. The BK-1 contains basic specifications, features, and illustrations on 26 B&K models.

For More Details Circle (49) on Reply Card

104. **TAB Books** — has made available the 1972-1973 Catalog of Technical Books, which names over 235 current and forthcoming books, plus 10 Electronic Book/Kits. The 28-page catalog includes a full description and list of contents for each book, and a picture of each book's cover.

For More Details Circle (50) on Reply Card

105. **EICO Electronic Instrument Co., Inc.** — has just published a 12-page short-form catalog-and-mailer which describes the vital features of 5 EICO "Fail-Safe" do-it-yourself security systems and 37 accessories.

For More Details Circle (51) on Reply Card

106. **Howard W. Sams & Co., Inc.** — has released the 1973 Technical and Scientific Book Catalog which describes over 400 popular hardbound and paperback books. Electronics, electricity, amateur radio, audio & hi-fi, mathematics, plus Audel do-it-yourself books on appliances, mechanical power, and sheet metal are among the many topics covered. The authors who are experts and professionals write in easy-to-understand language and use understandable show-how photographs and drawings.

For More Details Circle (52) on Reply Card

107. **California Instruments Co.** — offers a brochure on the operation, features and specifications of the Model 8310 automatic digital multimeter. Content of the brochure also includes a block diagram explaining circuit design. □

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Deadline for acceptance is 30 days prior to the date of the issue in which the ad is to be published.

This classified section is not open to the regular paid product advertising of manufacturers.

FOR SALE

SELL: TV Shop near Disney World. On busy highway. 28x36 Building + 4-room house. Land for expansion, in growing area. \$49,500.00. Terms. Owner retiring. Adams TV, Highway 17-92, Davenport, Florida 33839. 1-73-1t

RIDERS RADIO DATA. Volumes 6 to 14 inclusive. 1935 to 1942. Each volume practically complete. Make offer. James O. Woodward, 1615 D Ave., New Castle, In. 47362. 1-73-1t

FOR SALE (Cont.)

TV & RADIO TUBES 36c EA.!! Free color catalog. Cornell, 4221 University, San Diego, California 92105 9-72-6t

RIDER'S TROUBLE SHOOTERS MANUALS: Masters and volumes 3-21 except volume 9. Best offer. Rich Guglielmi, 2810 McKoon, Niagara Falls, New York 14305. 1-73-1t

FOR SALE: Wow-Flutter Meter by Amplifier Corp.—491-B—Paid \$500.00—First \$125.00 gets it. Henry Friedman, 172-24 Jamaica Ave., Jamaica, N.Y. 11432. 1-73-1t

EDUCATION INSTRUCTION

REPAIR TV TUNERS—High Earnings, Complete Course Details, 12 Repair Tricks, Many Plans, Two Lessons, all for \$1. Refundable. Frank Bocek, Box 3235 Enterprise, Redding, Calif. 96001. 1-73-4t

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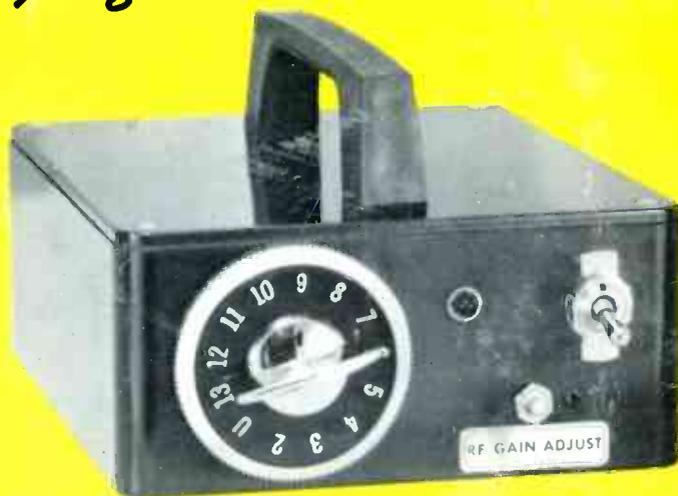
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