

PF Reporter®

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the magazine of electronic servicing



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- Fusible Resistor Cross Reference
- Color Parts Guide
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**The NTSC (National Television Systems Committee) color signal is based on the fact that each transmitted color is produced by an NTSC-defined relationship between a 3.58 MC reference and a 3.58 MC chroma modulated subcarrier, with each color having a standard NTSC brightness component. This is the basis upon which all color-TV broadcasters must operate. There are no separate rules for color-TV reception, or color test sets.*

EICO EICO Electronic Instrument Co., Inc.
131-01 39th Ave., Flushing, N. Y. 11352

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This code of symbols is used to identify regular department locations in the subject page listings: CCM, Color Countermeasures; Sym, *Symfact*®; TE, Notes on Test Equipment; TS, The Troubleshooter; and VSS, Video Speed Servicing.

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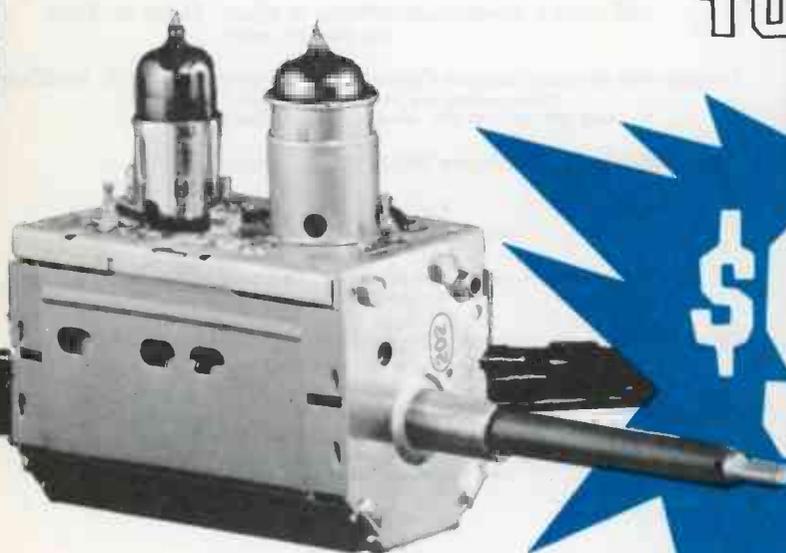
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About the Cover

A color receiver, flying spot scanner, and appropriate decorations help to convey to you our wishes for a very Merry Christmas and a most prosperous New Year. The preceding year has been, in most respects, generous to the electronics servicing industry.

It is our sincere hope that this publication has contributed to the professional prosperity of each reader and that we may continue to do so in the years to come.



WHY risk your reputation with "just-as-good" capacitors?

When you pay little or no attention to quality in tubular replacement capacitors, you leave yourself wide open for criticism of your work . . . you risk your reputation . . . you stand to lose customers. It just doesn't pay to take a chance on capacitors with unknown or debatable performance records when it's so easy to get guaranteed dependable tubulars from your Sprague distributor!

There's no "maybe" with these 2 great **SPRAGUE DIFILM[®] TUBULARS!**

The ultimate in tubular capacitor construction. Dual dielectric . . . polyester film and special capacitor tissue . . . combines the best features of both. Impregnated with H₂CX[®], an exclusive Sprague synthetic hydrocarbon material which fills every void in the paper, every pinhole in the plastic film *before it solidifies*, resulting in a rock-hard capacitor section . . . there's no oil to leak, no wax to drip. Designed for 105°C (220°F) operation without voltage derating.



DIFILM[®] BLACK BEAUTY[®]
Molded Tubular Capacitors

The world's most humidity-resistant molded capacitors. Tough, protective outer case of non-flammable molded phenolic . . . cannot be damaged in handling or installation. Black Beauty Capacitors will withstand the hottest temperatures to be found in any TV or radio set, even in the most humid climates.



DIFILM[®] ORANGE DROP[®]
Dipped Tubular Capacitors

A "must" for applications where only radial-lead capacitors will fit . . . the perfect replacement for dipped capacitors now used in many leading TV sets. Double-dipped in rugged epoxy resin for positive protection against extreme heat and humidity. No other dipped tubular capacitor can match Sprague Orange Drops!

For complete listings, get your copy of Catalog C-616 from your Sprague distributor, or write to Sprague Products Company, 105 Marshall Street, North Adams, Massachusetts 01247



WORLD'S LARGEST MANUFACTURER OF CAPACITORS

Circle 3 on literature card

Good medicine for tape recorder dealers and service centers!

Nortronics OPERATION HEAD/START

acts like a miracle drug to create a brand-new profit source

worn tape head replacements

Millions of tape recorders are victims of *deteriorated fidelity*, also called the mushy sound disease, often caused by a worn-out tape head. *You* can cure it by selling a Nortronics replacement.



Nortronics makes it easy, provides you a convenient, inexpensive package for handling over 750 different head replacements *on the spot*. Nortronics Head-Start Packages contain everything you need—your basic tape head inventory, all necessary hardware, complete easy instructions, point-of-purchase sales aids and promotional material.

Your investment? As low as \$35.37.
Your potential? Fantastic . . . and all found money!

Your Nortronics distributor? Send the coupon; we'll send his name by return mail. He has your Head-Start package in stock.

THE NORTRONICS COMPANY, INC.

8101 Tenth Avenue North .
Minneapolis, Minnesota 55427

Head-Start sounds like just what the doctor ordered! Who's my local distributor?

NAME _____

COMPANY _____

ADDRESS _____

CITY, STATE, ZIP _____

Letters to the Editor

Dear Editor:

I wish to thank you for the solutions to the problems in the December, 1965 column. In your comment you said, "They can be shown mathematically to be valid." To help you prove your point, I am sending you a set of trigonometry tables and some more information on the subject of parallel resistors and series capacitors.

Problems involving these components can be solved by the use of the tangents and cotangents from the tables in simple addition. Consider any two resistors, R1 and R2, to be connected in parallel. In the tangent column, find the value nearest to R1. Record the corresponding cotangent value. Find the tangent value nearest to R2. Add its cotangent value to that of R1. Find the cotangent value nearest to this sum and the parallel resistance value will be found in the tangent column. If we pick resistance values of 4 and 8 ohms:

Tan.	Cotan.
.39997	2.5002
.80020	1.2497
	3.7499, corresponding

to a TAN. of .26670, or a resistance of 2.667 ohms.

As proof:

$$\begin{aligned}
 RT &= \frac{R1 \times R2}{R1 + R2} \\
 &= \frac{4 \times 8}{4 + 8} \\
 &= \frac{32}{12} \\
 &= 2\frac{2}{3}.
 \end{aligned}$$

This method will work for any number of resistors in parallel or capacitors in series I call this method "tangent convergence"

MELVIN T. HYATT

Prairie Village, Kansas

We tried Mr. Hyatt's method on many different combinations and never failed to arrive at a very close answer. Possibly there are special conditions under which the method could fail, but we haven't found one.—Ed.

IF YOU PRIZE IT... KRYLON-IZE IT!



Goes on in seconds—
dries in minutes!
The spray that
pays off
in better, faster
electrical work!

Krylon...
America's No. 1 spray coatings





The Electronic Scanner

news of the servicing industry

Mergers & Expansions

International Rectifier announced plans for construction of a ¼-million dollar facility at Englewood, N. J., to serve as headquarters for foreign operations and a center for eastern distribution. The overseas headquarters will be moved from its present location at Fort Lee, N. J., and the eastern distribution center from the New Brunswick, N. J. plant of Xaloy, Incorporated, IR's metallurgical subsidiary. Xaloy needs the space for added production. The new Englewood building will be linked with the parent IR manufacturing complex in El Segundo, California through data processing equipment to facilitate movement of products and inventory.

Oak Manufacturing Co. has established a television tuner assembly facility in Kenosha, Wisconsin. The 12,000 square-foot plant will serve as a support operation for the company's principal U.S. tuner assembly facilities in Elkhorn, Wisconsin, and will initially employ approximately 200. In addition to the Kenosha and Elkhorn operations, Oak also has a 72,000-square-foot tuner assembly facility in Hong Kong, employing 1500 people.

The **Sprague Electric Company** announced plans for the construction of a major new manufacturing plant of 75,000 square feet in Wichita Falls, Texas. The plant, to be constructed on a 27-acre tract, will have an employment potential of 750 to 1000. The company has also taken an option on 30 additional acres to provide for future expansion. With the new plant in Wichita Falls, Sprague Electric will now have 25 manufacturing locations throughout the world.

Sylvania Electric Products Inc. announced plans to increase its 1967 production of integrated circuits to four times the present level by building a 30,000-square-foot assembly plant at Bangor, Maine, and expanding existing manufacturing at Woburn, Mass.

Construction of the Bangor integrated circuit plant will begin immediately. It is scheduled to be in full production by the second quarter of 1967 and will be devoted to the assembly and packaging of the circuits. The new facility will eventually employ between 1,000 and 1,300 people.

Sylvania also announced plans for a Central Advanced Applications Laboratory at Woburn with overall technical responsibility for the development and application of semiconductors, electronic tubes, and special products. The prime responsibility of the Laboratory will be to work with manufacturers of entertainment products in the development of solid-state devices, hybrid devices, and tubes.

Laboratory personnel will deal directly with designers, circuit engineers, and advanced applications groups throughout the industry to assure that components required to meet the changing design concepts in entertainment products are developed, tested, evaluated, and made available on schedule from Sylvania.

Experience for Sale.....45¢

Sure seems we started something!

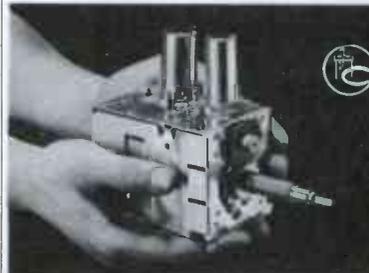
Yes; over ten years ago, when we started overhauling tuners (all makes and models), we set a price of \$9.95 for this service.

Apparently there are those who would like to imitate our achievement—and for 45¢ less.

Maybe the special skills, special equipment and downright old fashioned experience we built up during these past years are worth that little extra.—You be the judge.

Remember; 45¢ buys you more than a quarter of a million man/hours of experience, plus true devotion to our business . . . our only business . . . overhauling your television tuners the best way we know how. And in over ten years we sure know how!

Castle — The Pioneer of TV tuner overhauling
Not the cheapest — just the best.



For complete tuner overhaul we still charge only \$9.95. This includes all labor and parts; except tubes and transistors, which are charged extra at low net prices.

Simply send us the defective tuner complete; include tubes, shield cover and any damaged parts with model number and complaint. Your tuner will be expertly overhauled and returned promptly, performance restored, aligned to original standards and warranted for 90 days.

UV combination tuner must be single chassis type; dismantle tandem UHF and VHF tuners and send in the defective unit only.

Exact Replacements are available for tuners unfit for overhaul. As low as \$12.95 exchange. (Replacements are new or rebuilt.)

CASTLE

TV TUNER SERVICE, INC.

MAIN PLANT: 5701 N. Western Ave., Chicago 45, Illinois

EAST: 41-90 Vernon Blvd., Long Island City 1, N.Y.

CANADA: 136 Main Street, Toronto 13, Ontario

*Major Parts are additional in Canada

Circle 7 on literature card

Swingin'
Combo
for
Top
Performance!



NEW SENCORE SM112B SERVICE MASTER VTVM/VOM

Here it is — the third generation of Sencore's famous Service Master — the two-in-one professional instrument that saves your time, speeds your service work, puts extra profits in your pocket.

- Just one function switch, one range switch and one probe provide all functions of VTVM and VOM.
- Voltage, current and resistance in 33 ranges — for accurate measurements anywhere, anytime.
- VTVM operates from 115v AC for precise bench or lab work; battery powered VOM gives you a 5000 ohms per volt meter.
- Lighted arrows automatically indicate VTVM scales.
- Large, easy-to-read 6-inch two percent meter covers all measurements.
- Handsome new styling in tough, vinyl-clad steel case.
- Optional high voltage probe attaches for measuring up to 30,000 volts DC.

So why use two when one will do — the new Sencore SM112B. Truly professional quality, and still only **\$79.95**
High Voltage Probe HP118 **\$7.95**



SENCORE
NO. 1 MANUFACTURER OF ELECTRONIC MAINTENANCE EQUIPMENT
426 SOUTH WESTGATE DRIVE, ADDISON, ILLINOIS 60101

Circle 8 on literature card

In further activities, Sylvania dedicated a 221,000-square-foot entertainment products plant in Smithfield, N. C. The plant is designed for production of color and monochrome television, stereo phonographs and radios. Initial production of some components began Sept. 6, just five months after breaking ground for the project. The one-story steel and brick structure consists of 200,000-square feet of manufacturing area, and 17,000 square feet of office space.

In his address at the dedication ceremonies in Smithfield, president Gene K. Beare remarked: "The opening of new manufacturing plants, such as this one, and other facilities has become something of a hallmark for Sylvania. Sometimes it seems to me that at the end of the long list of electronic and lighting products turned out by Sylvania we should add the words 'large buildings'."

Money Matters

New highs in sales and earnings were reported by **Electro-Voice, Inc.** at the end of the first six months of their operating year through August 1966. In the current report to shareholders, sales are listed at \$8,603,351, an increase of 30.5% over the same period last year. President Albert Kahn, stated, "The real gains have been in the growth of commercial acoustical products. Manufacturing economies and improved techniques," he added, "have widened margins, offset somewhat by slightly increased operating costs."

The Board of Directors of **P. R. Mallory & Co., Inc.** declared a regular dividend at the rate of 40 cents per share on the common stock of the corporation, plus an extra year-end dividend of 10 cents per share on such common stock, payable December 5, to stockholders of record November 7, 1966. The quarterly dividend rate was increased from 35 cents to 40 cents per share at a meeting held last July. In October, Mallory reported record nine-month sales and earnings of \$99.4 million and \$6.3 million, respectively.

September sales of the Home Products Division, **Packard Bell Electronics Corp.**, were higher than for any other single month in the company's history. Kenneth R. Johnson, president of Packard Bell Sales, said that September sales were 14% greater than the previous record high established in March of this year. He added that the color TV boom was primarily responsible for the sales records, but that black-and-white TV and stereo also made major contributions. September sales to dealers of black-and-white television sets were up 123% over the same month last year.

Potpourri

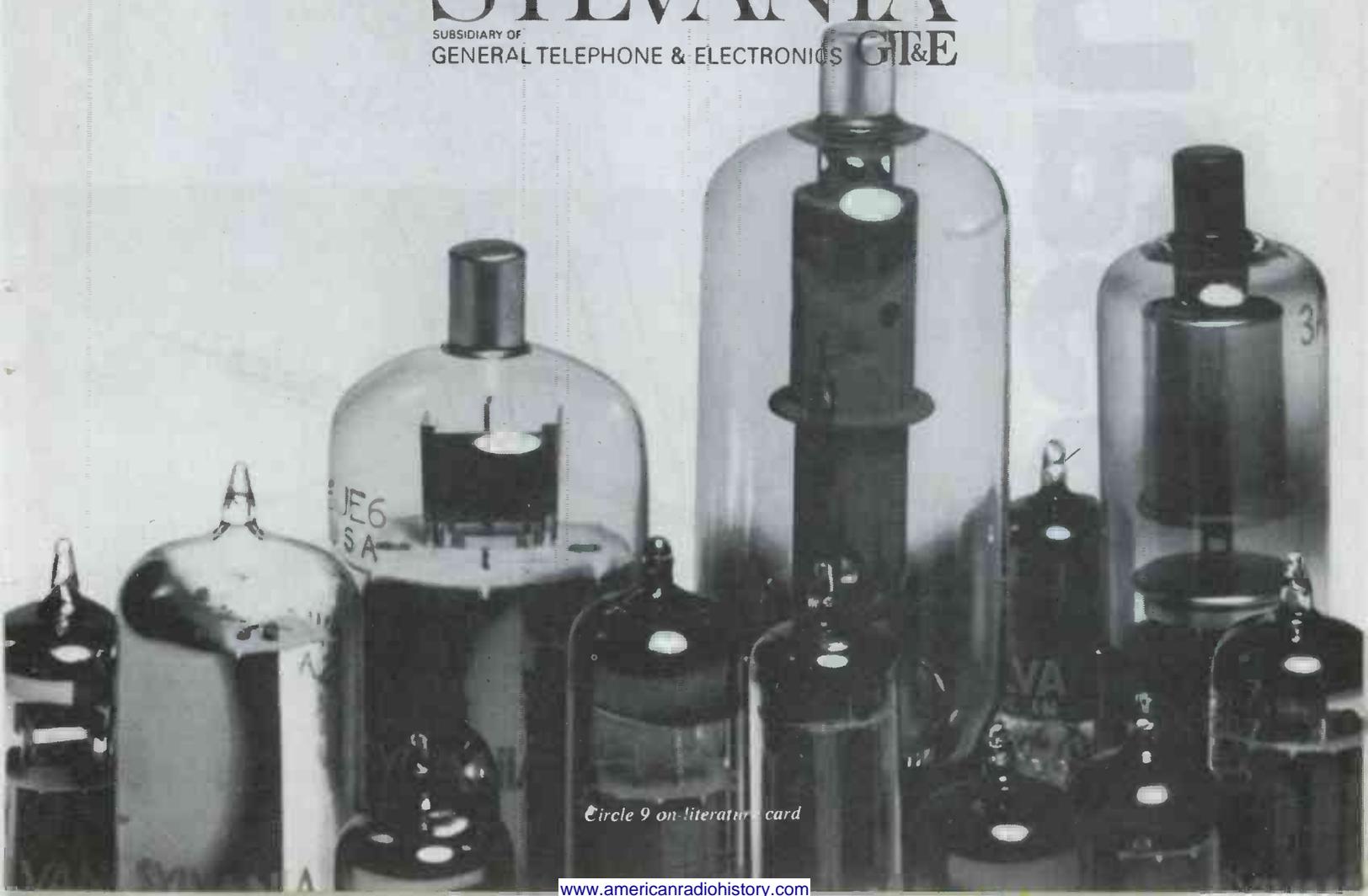
Sencore, manufacturer of test equipment, is including a half-hour film and an hour lecture on solid-state servicing of new TV receivers in 120 service clinics this fall from coast to coast. Bob Baum, Sencore Chief Engineer, explained that transistorized TV receivers, both black-and-white and color, were a real mystery to the technician who has not yet equipped himself to service these wired-in components efficiently. Sencore service clinics also feature a half-hour film on "scoping out the chroma circuits" of color TV receivers. Most clinic dates had been confirmed but that a few remained open. The Sencore sales representative should be contacted by distributors still desiring a technical clinic. ▲

A dozen ways to cut down on color call-backs.

In color TV set repair, these 12 Sylvania tubes do most of the work. They cut down on call-backs because their quality is assured by thorough testing before they leave our plant.

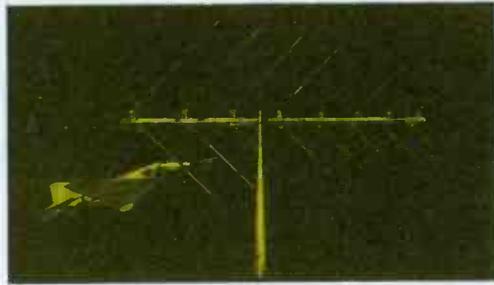
Sylvania makes color replacement receiving tubes for every major color TV set manufactured. Available quickly from your Independent Sylvania Distributor.

SYLVANIA
SUBSIDIARY OF
GENERAL TELEPHONE & ELECTRONICS **GTE**

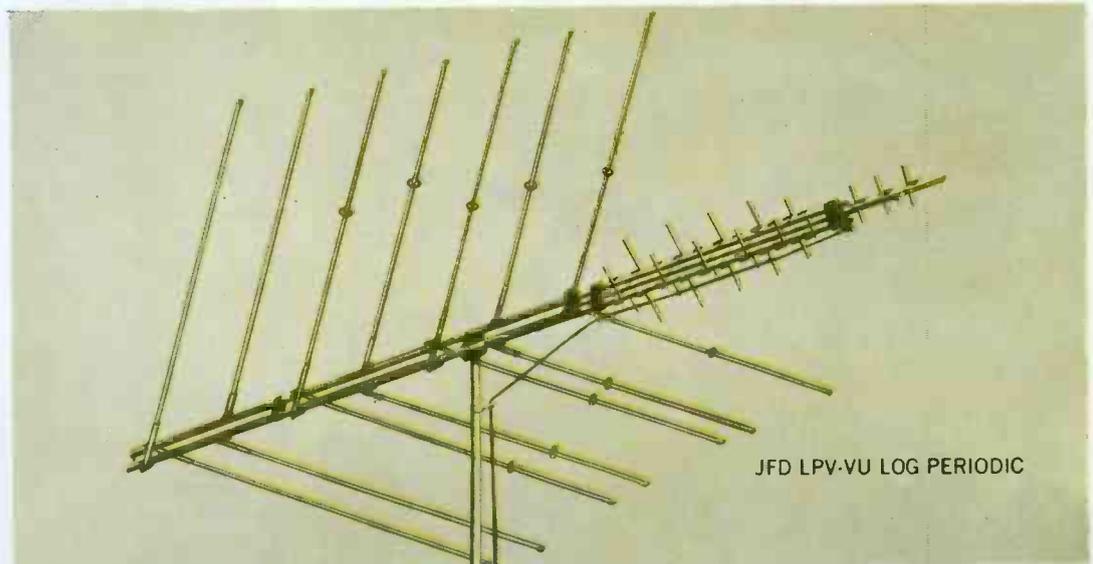


Circle 9 on literature card

assault on perfect



Back in 1962, we invented a new kind of TV antenna.



Licensed under one or more of U.S. patents 2,958,081; 2,985,879; 3,011,168; 3,108,280; 3,150,376; 3,210,767, RE. 25,740 and additional patents pending in U.S.A. and Canada. Produced by JFD Electronics Co. under exclusive license from the University of Illinois Foundation.

tion: PERFECTION CONQUERED

We did not improve on an old antenna. We started from scratch to design a new one. *Really new.*

It wasn't easy. And it wasn't cheap. But it worked like mad.

We called it the LPV Log Periodic. Its performance caught our competitors with their charts down. But it wasn't long before they came up with LPV copies in every way—except in performance.

Meanwhile back at the JFD labs in Champaign, Illinois, our scientists and engineers continued their "assault on perfection." In 1963, they again shattered antenna precedent by coming up with the *first* combination VHF/UHF/FM log periodic antenna, the LPV-VU. Instead of three different antennas, installers now needed only *one* LPV-VU and *one* downlead.

Our competitors scoffed at the idea. They said it couldn't be done. Until the "eyepopping" results started to roll in. Then there was a mad scramble for the LPV-VU bandwagon.

These "me-too" antennas looked like the LPV-VU Log Periodic. Sounded like it, too. But their charms were skin-deep.

Only the JFD LPV-VU delivered deluxe 82-channel log periodic performance. Because only the JFD LPV-VU followed the genuine patented log periodic concept of the University of Illinois Antenna Research Laboratories. Thanks to the protection of eleven different LPV-VU U.S. patents issued and pending—more than those of any other antenna.

You would think by now our Research and Development people in Champaign would leave well enough alone. But no. These "Young Turks" have gone and done it again. This time it's a new all-band log periodic design—the LPV-CL Color Laser. (Must be that "assault on perfection" bug they've still got up their polinear recorder.)

Why did we call it the Color Laser?

Well, engineers tell us that laser light beams with their tremendous bandwidth capacity are the communications carrier of the future. And we believe that our new VHF/UHF/FM Color Laser with its extreme bandwidth, among other unique characteristics, is the antenna of the future—only it's available to you *now*. How does the Color Laser deliver unsurpassed natural color, black and white across 82 channels, and FM, too?

Three reasons: (1) *Patented *VHF "cap-electronic" Log Periodic V Design*, (2) *a new*

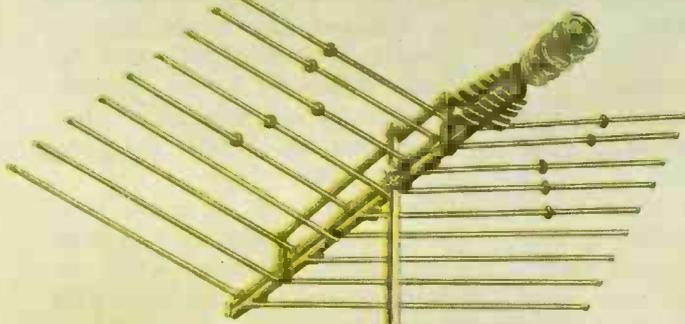
broad band UHF "zoned" trapezoid driver, (3) *a new disc-on-rod UHF director system*. And there are patents issued and pending on all three.

We've also spun off the LPV "cap-electronic" Log Periodic section of the Color Laser. It forms the heart of a great new VHF antenna series we've named the LPV-TV.

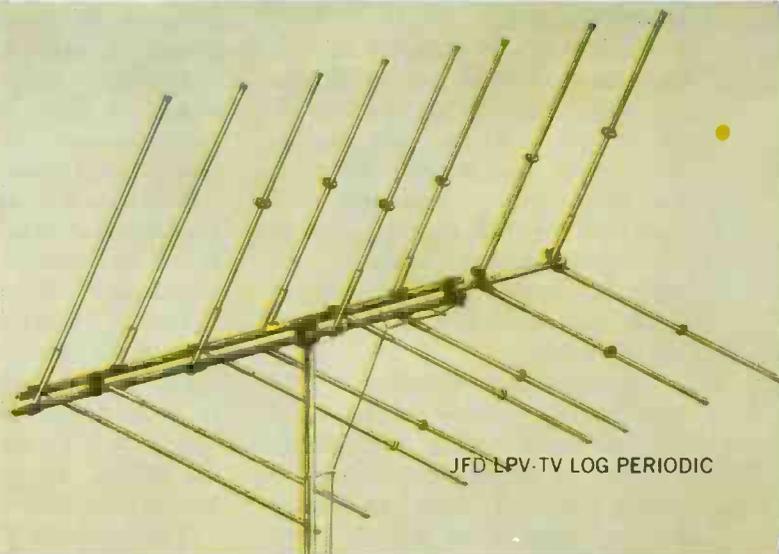
This "assault on perfection" of ours involved a complete new mechanical design, as well. Results: "fast-lok" element brackets, "hot" twin booms (no lossy harnesses or transformers), new super-strength double U-bolt profiles, high reliability cylindrical capacitors, plus our electrically conductive gold alodized aluminum.

If you're the breed of professional contract installer or self-servicing appliance dealer who *never* settles for less than the best, we have a suggestion. Use a JFD LPV-CL Color Laser or LPV-TV Color Log Periodic on your next installation. See what it feels like to install the *best* of all in performance and customer satisfaction.

You will also see why our research and development people have now changed their watchword from "assault on perfection" to "perfection conquered".



JFD LPV-CL COLOR LASER



JFD LPV-TV LOG PERIODIC

Licensed under one or more of U.S. Patents 2,955,287 and 3,015,821 and additional patents pending.

JFD®

JFD ELECTRONICS CO.

15th Avenue at 62nd Street, Brooklyn, N.Y. 11219

JFD International, 64-14 Woodside Ave., Woodside, N.Y. 11377

JFD de Venezuela, S.A., Avenida Los Haticos 125-97, Maracaibo, Venezuela

Circle 10 on literature card

December, 1966/PF REPORTER 17



Effective Communication



A MUST!

by Ralph M. Scott

What is communication? Very simply, it means the transmission of an idea from one person to another. Orally, or in writing, the only means whereby we communicate is by using words—put together in sentences, the units of logical thought.

Using words to transmit ideas is like driving down an unfamiliar highway, observing signs to follow the correct route to a destination. Too often the traveler becomes lost because the street and road signs are insufficiently clear — or missing altogether. Similarly, the reader or listener may become lost if the communicator lacks proper use of words.

Especially is it necessary to be exact in the writing of technical articles. Such writing is obviously intended to explain a process, describe a needed repair, or discuss the operation of an instrument or device. Frequently, the writer, abounding in technical knowledge, experience, and ability, lacks the communication skills to express himself accurately. The solution to this deficiency is to learn the

language, just as the individual learned his trade or profession.

Students in colleges, universities, and specialized vocational schools who seek degrees or other titles all too often ignore courses in composition, public speaking, and others designed to increase one's proficiency in oral and written communication. Such attitudes have about the same validity as saying that a person with 20-100 vision doesn't need glasses to read.

What good is an idea if no one else can understand it? What good is the utterance of truth if no one can accept it? How valid would Einstein's Theory of Relativity have been if no one could have understood his explanation? What good is an article submitted to a magazine if it is so poorly written that the editor, let alone the reader, cannot understand what is meant?

I suppose, in this day and age, it is acceptable in certain circles to declare, "I dig that cat. He's cool with that music to show me how to make bread to keep me in my pad."

Or, another may say, "The re-

condite, even abstruse, advice of that profound philanthropist enabled me to subsist in more than moderate circumstance."

In either event, the communicator is trying to say that someone advised him wisely in the making of money to live comfortably.

A wise professor at Columbia University once said, "It behooves the educated man to be able to converse at ease when with the erudite within the hallow, ivy-covered walls of universities—or when eating show with hoboos along the railroad tracks."

He spoke truth. It is the obligation of every thinking person to communicate clearly with all among whom he associates. This does not suggest either stilted, Victorian Age elegance, or the vulgarity of a cheap beer hall. What is inferred is the use of clear, understandable language.

Moreover, the personality, the character—and the ability—of a person is reflected by his communication, written or oral. Correctness, accuracy, and precision in speaking or writing indicate that the same

attributes are present in the individual's work and living habits. The service technician who can describe the troubles in a radio or television set accurately in layman's language establishes confidence in his customer. Regardless of his technical skill, the serviceman must be able to communicate well with every customer if he is to achieve the success he desires.

It doesn't require a college education to be proficient in communication. It does require the ability to read and understand good books, newspapers, and magazines—and the dictionary—plus a common-sense realization of the importance of our language, together with the determination to study it.

When any person writes an article for publication, he cannot accurately foretell who his readers will be. True, it is a long established rule that one does not "write down" to his readers—that is, insult their intelligence. It is equally true that he should not write over their heads. Neither is the writer to baffle, confuse, tire, or disgust his readers by strange terms, bad grammar, weird punctuation, out-worn phrases, or awkward grammatical structures.

No one, in reading a technical article, is irritated by simple, clear explanations. If the reader is already familiar with the subject under discussion, he may well appreciate a review or different approach couched in terms other than what he might use. If the reader is a novice, eagerly seeking knowledge, he cannot understand an explanation directed toward an experienced college professor.

Simplicity, clarity, and the use of concrete illustrations in presenting any idea are more than desirable—they are essential! Anything, to be acceptable, must have these qualities:

- (1) Simplicity—so every one can understand it;
- (2) Clarity—so every one can see it;
- (3) Honesty—so every one can accept it.

For example, consider this classic statement (used as an illustration in Howard W. Sams & Co. **Technical Writer's and Editor's Stylebook**, written by Rufus P. Turner): "When

exposed to air, iron has a propensity for entering into a chemical reaction with the oxygen of the air; a layer of iron oxide soon covers the surface." How much better it is to say, "Iron rusts easily."

What the communicator must persistently ask is, "What am I trying to say, exactly? Precisely, what is my point?" Then he must find words, build sentences, and construct paragraphs that say exactly what he wants to say. He must review his own work, revise, and edit. To compromise this truth is like saying, "The man went down the street." Actually, the man "walked," "ran," "stumbled," "staggered," "reeled," "wandered," "hobbled," "raced," "sped," or "ambled." But for accuracy, he did not just "go" down the street.

The American language is becoming recognized as the only one capable of expressing any idea—especially technological ideas. At last count, British English contained nearly 750,000 words. American English now has nearly 800,000 words and is still growing, largely as a result of the coining of new words in the electronics and other technological fields. "Television," "radar," "sonar," "transistor," "electromagnet," "radiometeorograph," and "astronaut," are but a few of the many words added to our vocabulary in recent years. Perhaps within a short time we will hear words like "moonscope," "space-gyrator," "universesometer," or "space-sconics."

Unquestionably, the language is difficult, because of its many grammatical rules and large vocabulary. Rules for its use have been largely derived from complex Greek and Latin grammar, and from the slow-developing Anglo-Saxon language. Moreover, American English contains words from every known language.

But these rules, complex as they superficially seem, provide the means to "say what you mean and mean what you say." Because American English is so large, one can say anything he desires, any way he wishes to say it. Not so for other tongues. In Japan, for example, one can walk into an automobile repair shop, not knowing a

word of Japanese, and say "carburetor," "transmission," "differential," (or "baseball"), and be understood. There was simply no way for Japanese to express these terms other than to borrow from English. The same is true with other languages. Consequently, American English is becoming the international means of communication in this technological, electronics age.

But words without rules of communication to govern their use are like wild mustangs without cowboys to break them to saddle or harness. They stampede into confusion.

Consider, for example, just one established rule. "Every pronoun must have a clearly defined antecedent." We have several kinds of pronouns—personal, relative, demonstrative, possessive, indefinite. But one that causes much difficulty among even experienced writers is the relative pronoun "which." By rule, it may stand for inanimate objects only. And it must, also by rule, have a definite antecedent, for the good reason that clear expression is necessary.

But what of this statement: "The man, who was a heavy drinker by habit, had an accident when he was sober, which is ridiculous." What's ridiculous?—The accident, that he was sober, or that he had an accident? For what specific noun (antecedent) does "which" stand? There is lack of clarity in the statement, hence it is poor communication. This is but one of thousands of graphic illustrations that could be given to demonstrate ignorance or neglect of the rules of the language. These violations garble the transmission of ideas.

In recent years, with our emphasis on speed, ease, and short-cutting in everything, abbreviations have become common in nearly all writing. From FDR to LBJ we have permeated our communication with initials and abbreviations. These, however time saving, can be most serious in sidetracking the reader. If a writer makes the following statement, what does he mean? "The AAA has been a valuable organization in our society." AAA

• Please turn to page 56

triggered S



Fig. 1. Trigger and magnifier controls on triggered sweep scope.



Fig. 2. Trigger control of CRT beam.

To get the most out of your triggered-sweep scope, you must know the functions of the various controls. These controls are provided to permit stable synchronization of all types of waveforms, and to permit the operator to select a desired point along the waveform for triggering the sweep. For example, suppose you wish to pick out the color burst in a complete color signal, and to expand the color burst by itself on the scope screen. Would you know how to adjust the time-base controls? It is the purpose of

this article to answer this and other questions that arise in practical service tests, in terms that are easily understood by the technician.

Simple Trigger-Sweep Action

Perhaps the simplest type of triggered-sweep controls are illustrated in Fig. 1. This particular scope has only a trigger sweep and a magnifier positioning control. Let us first investigate the function of the trigger sweep control. When the trigger sweep control in Fig. 1 is turned completely to the left (count-

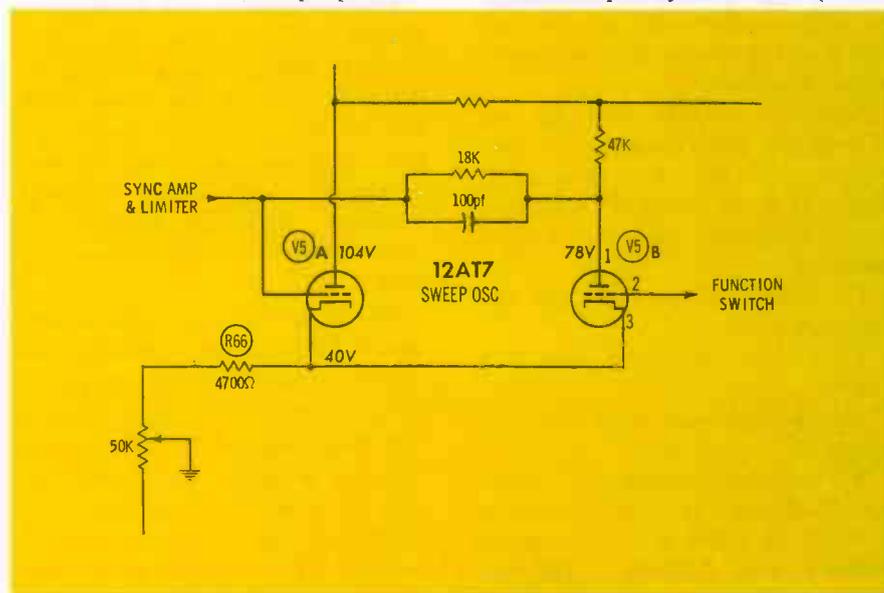


Fig. 3. Variable cathode bias added.

Weep Scope

by
Robert G. Middleton

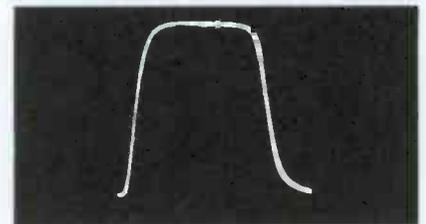
ter-clockwise), the sweep is free-running and we observe a horizontal trace on the screen as shown in Fig. 2B. On the other hand, when the trigger sweep control is advanced beyond a certain critical point, the sweep suddenly stops, and we see only a spot at the left-hand side of the screen, as illustrated in Fig. 2A.

What has happened is this: Fig. 3 shows how the cathode bias is increased to bias off the sweep oscillator. Sawtooth output ceases when the bias prevents free oscillation. However, if we apply an input sig-

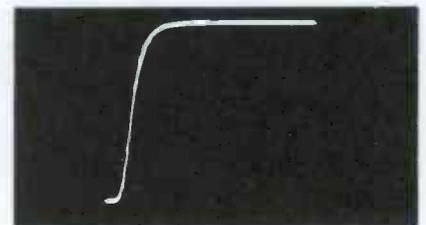
nal to the scope, the sync signal applied to the sweep oscillator will bring it out of cutoff when the level of the sync signal rises beyond the cutoff level and the sawtooth oscillator will go through one cycle of operation (generate one sweep excursion). Thereafter, the sweep oscillator remains cut off until another sync signal arrives. This is triggered-sweep action.

Trigger Control Operation

Let us consider trigger-sweep action step-by-step. A semi-square



(A) One-half cycle



(B) Higher sweep speed

Fig. 5. Triggered-sweep display of semi-square wave.

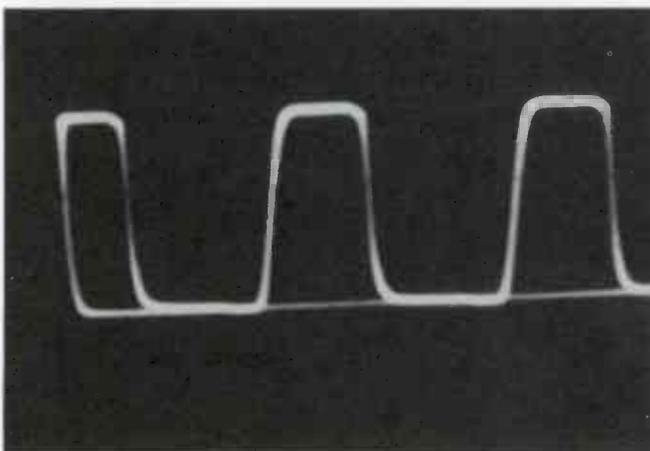


Fig. 4. Semi-square wave on free-running oscilloscope.

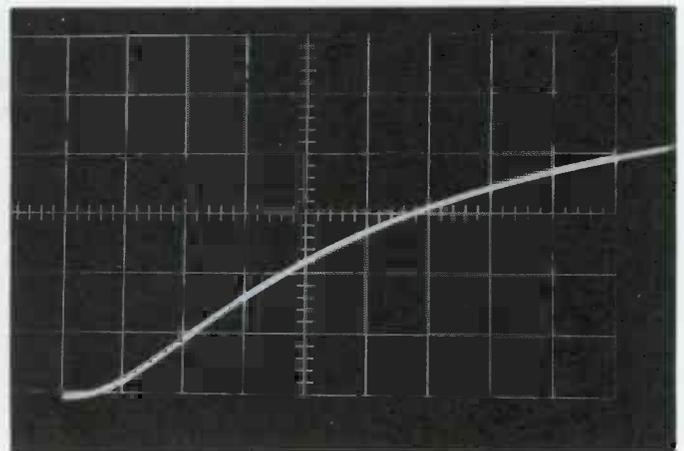


Fig. 6. Leading edge semi-square wave at high sweep speed.

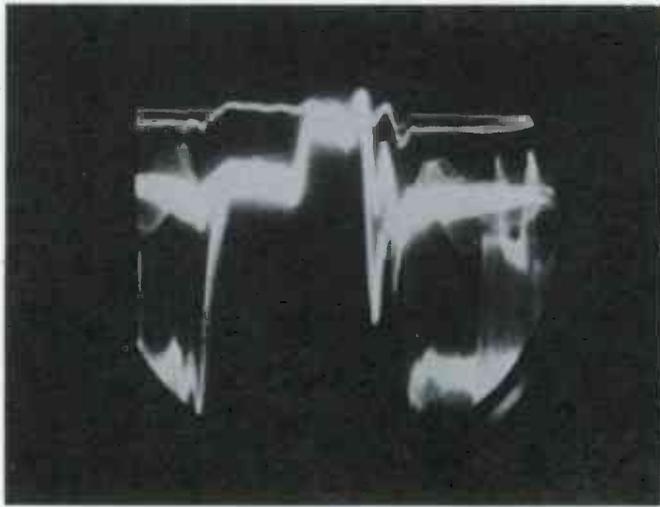


Fig. 7. Horizontal-sync pulse on free-running sweep.

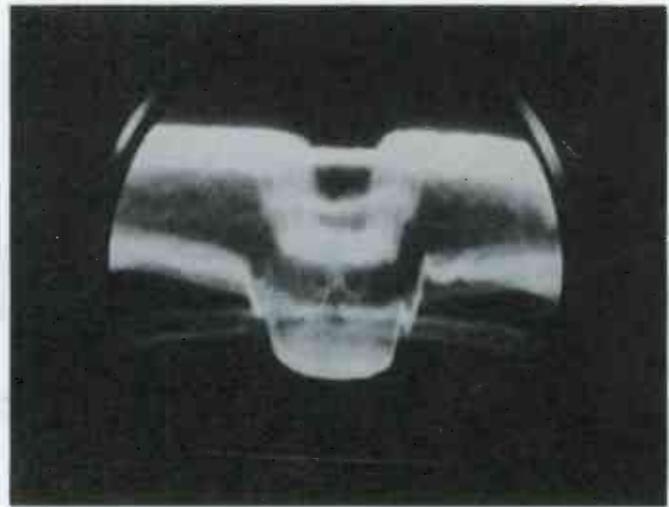


Fig. 8. Magnification of center portion of video signal.

wave, displayed on a free-running sweep, is illustrated in Fig. 4. If we operate the scope in its triggered-sweep function, we obtain the typical patterns shown in Fig. 5. We can speed up the sweep as much as we wish and the waveform remains triggered at the same starting point. The sole effect of speeding up the sweep is to expand the portion of the waveform following the trigger point, as shown in Fig. 5B. This fact is also evident in Fig. 6, which illustrates the leading edge of a semi-square wave displayed at a very high sweep speed. The illuminated graticule can be used with a calibrated time base to measure the elapsed time between any two points along the leading edge of the waveform. After this brief introduction to trigger control operation, we can now discuss the magnifier positioning control in Fig. 1.

Sweep Magnification

There are two types of sweep magnification provided by different scopes.

1. "Window" magnification dis-

plays a selected interval of the waveform; the desired interval is chosen by adjustment of the magnifier positioning control.

2. Total magnification greatly expands the entire waveform; the desired interval is chosen by adjustment of the horizontal position control.

Sweep magnification can be employed on either free-running or triggered sweep. If magnification and triggered-sweep functions are utilized simultaneously, the greatest possible expansion of a small interval in the waveform is realized. The magnification of a horizontal-sync pulse on a free-running sweep is illustrated in Fig. 7. To set up the display, the trigger-sweep and magnifier positioning controls are turned completely counterclockwise. The video waveform is then displayed in the conventional manner. Next, the magnifier positioning control is advanced clockwise, switching the magnifier circuit on and producing a greatly expanded waveform on the screen. Further adjustment of the magnifier posi-

tioning control brings the sync pulse into the "window."

The magnifier positioning control can also be adjusted to bring the center portion of the video waveform into the "window" as shown in Fig. 8. With this type of magnifier action, the pattern extends for only a short distance to the left or right off the screen; therefore, there is no possibility of observing any portion of the waveform beyond the "window" by adjustment of the horizontal position control.

However, let us suppose that we are using a triggered-sweep scope in which the entire waveform is expanded, and the "window" display is not present. In such a scope, the magnifier control is merely a switch, and the magnifier function is either on or off. When the magnifier is turned on, the waveform is greatly expanded (typically 5 times) and the desired portion of the magnified waveform is brought into view on the screen by adjustment of the horizontal position control. Although a different control is used to display the magnified portion of

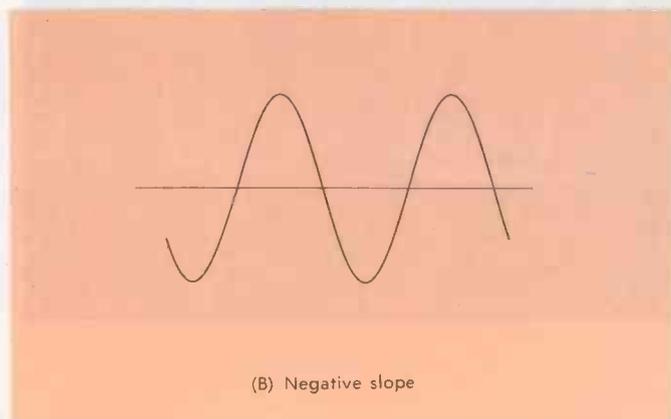
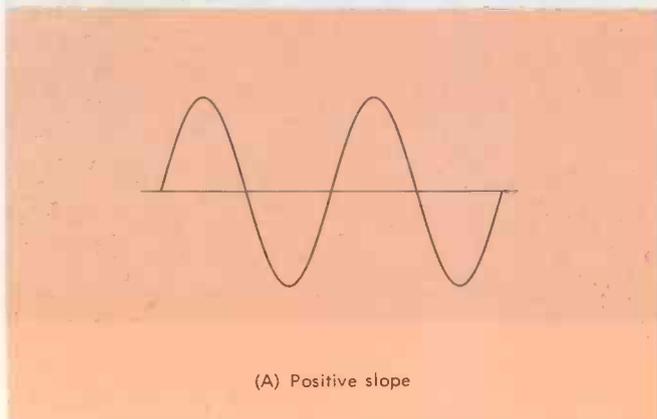


Fig. 9. Waveforms triggered on opposite slopes.



Fig. 10. Negative slope setting.

the waveform, the result is the same.

Positive and Negative Slope

Beginning technicians are often confused by the terms "positive slope" and "negative slope", used in triggered-sweep terminology. These are actually very simple terms, and their meaning is illustrated in Fig. 9. The rising portion of a waveform is said to have positive slope, and the falling portion of a waveform is said to have negative slope. We can synchronize, or trigger, on either slope. With reference to a scope with free-running sweep, the terms "+Sync" and

"-Sync" (Fig. 10) have the same significance as "positive slope" and "negative slope". The terms "+Sync" and "-Sync" are also used with reference to simple triggered-sweep scopes.

Consider the effect of varying the position of the trigger sweep control in Fig. 1, with the understanding that the control is being varied within the range of triggered-sweep operation. With the function switch set to "+Sync," the trigger-sweep control causes the waveform to trigger higher up on its leading edge, or positive slope, as shown in Fig. 11. With the func-

tion switch set to "-Sync," the trigger-sweep control causes the waveform to trigger lower down on its trailing edge, or negative slope (Fig. 12).

The trigger point can be placed anywhere on the positive or negative slope of a waveform by suitable adjustment of the sweep controls. This is a matter of very practical importance, because when we use triggered sweep, we will ordinarily be interested in observing a small interval in the waveform, which might be located anywhere along the waveform. The color burst in a complete color signal is a familiar example.

Display of the Color Burst

A complete color signal is illustrated in Fig. 13. When we "size up" this waveform, we observe that the color burst appears high up on the waveform, and that the positive peak of the waveform consists of the horizontal sync pulse. Thus, we are primarily concerned with the positive portion of the waveform. A good triggered-sweep scope is equipped with a trigger-level control that has a wide range. This control is set comparatively far up on its positive range—almost to the point where the screen goes blank. The sweep is then triggered

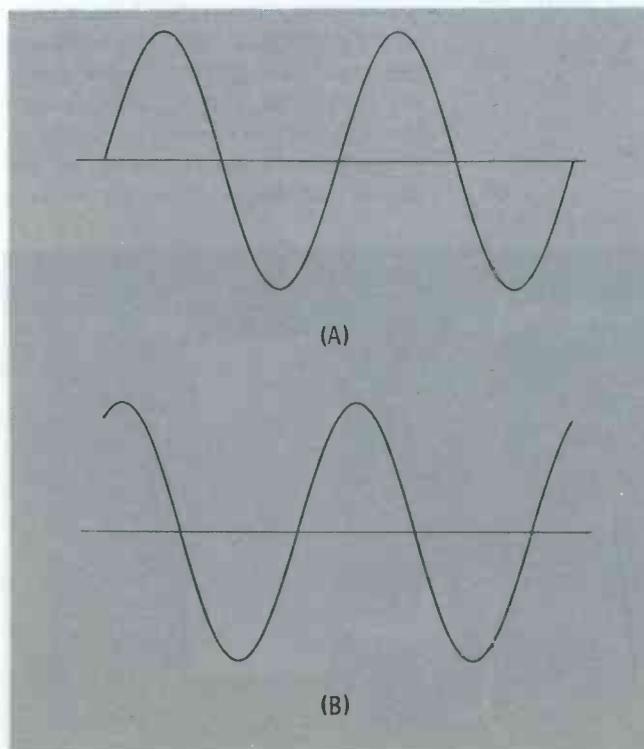


Fig. 11. Triggered higher on the leading edge with + sync.

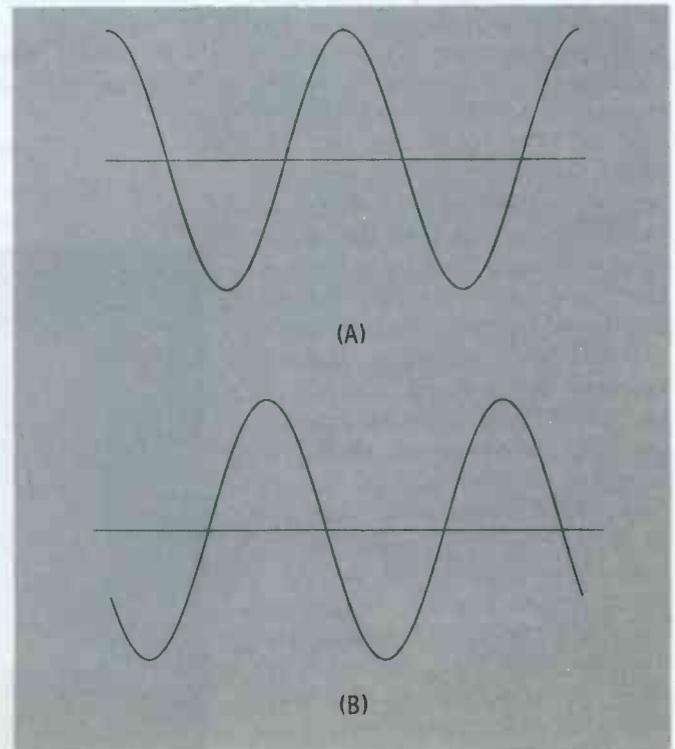


Fig. 12. Triggered lower on trailing edge with - sync.

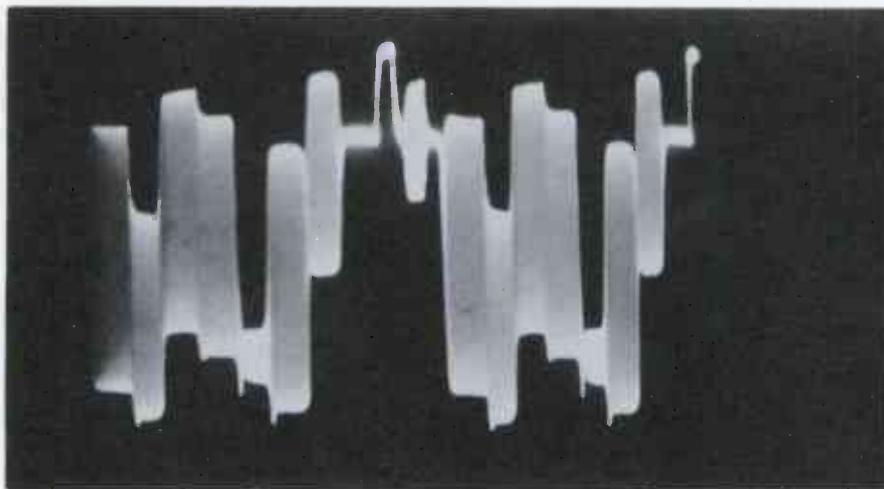


Fig. 13. Composite color waveform.

by the top of the sync pulse.

To eliminate practically all of the sync pulse from the display so that the color burst can be expanded to occupy the full screen, the controls are adjusted to trigger the sweep on the trailing edge of the sync pulse. This is accomplished by setting the trigger-selector control to “-Slope,” or “-Sync,” causing the sweep to trigger on the trailing edge of the sync pulse.

Good triggered-sweep scopes are also equipped with a stability control to eliminate any jitter or erratic triggering. However, it is possible that jitter or erratic triggering cannot be eliminated by adjustment of the stability control. In such instances, the trigger signal is processed to pass only the sync pulse and reject the high-frequency color signal. This is done by switching the scope to its “DC Trigger” position. This term can be confusing, because “DC” in this case means “low frequency.” What actually happens is that the trigger signal is passed through a low-pass filter or integrator that removes any high-frequency components.

With the preceding controls properly adjusted (in addition to the vertical gain and sweep speed), the color burst signal should be displayed as illustrated in Fig. 14. Thus, what might have appeared to be a difficult procedure is actually quite simple when we use a good triggered-sweep scope and know how to set the various controls. In every case, the waveform must be “sized up” to determine where the trigger point should occur. Then, we must relate this data to the scope controls and set them

accordingly. Let's consider another example in the same category.

Fig. 15 shows a complete color signal with the color burst located in the negative portion of the waveform. Therefore, to display the color burst, the control settings will be essentially opposite to those described previously. The trigger-level control must be set comparatively far down on its negative range—almost to the point where the screen goes blank. The trigger-selector control must be set to “+Slope,” or “+Sync,” because the sync pulse is rising along the desired trigger interval. Also, it will probably be necessary to switch to “DC Trigger” position to eliminate false triggering. Finally, adjustment of the stability control will permit display of the color burst, as illustrated in Fig. 14.

Conclusion

The controls of a triggered-sweep scope are less formidable



Fig. 14. Triggered-sweep scope display of color burst.

than they appear to the beginning technician. It is essential to clearly understand the function of each control, and to be able to relate these functions to waveform characteristics. In turn, the technician will be able to operate the controls systematically, because he knows the purpose and expected result of each adjustment. If the technician attempts to display the desired portion of a waveform by haphazard control adjustment, it is quite possible that he will give up before he obtains the desired pattern. Even if by sheer luck, the desired pattern might be obtained by trial and error, an enormous amount of time is almost certain to be wasted in the process.

The operations discussed in this article are very basic, and apply to almost any triggered-sweep scope that might be encountered. The beginning technician is advised to familiarize himself first with the use of comparatively simple triggered-sweep scopes that have a minimum number of controls. Although the capabilities of a simple scope are somewhat limited, the technician will progress more smoothly to a competent understanding of sophisticated triggered-sweep scopes. ▲

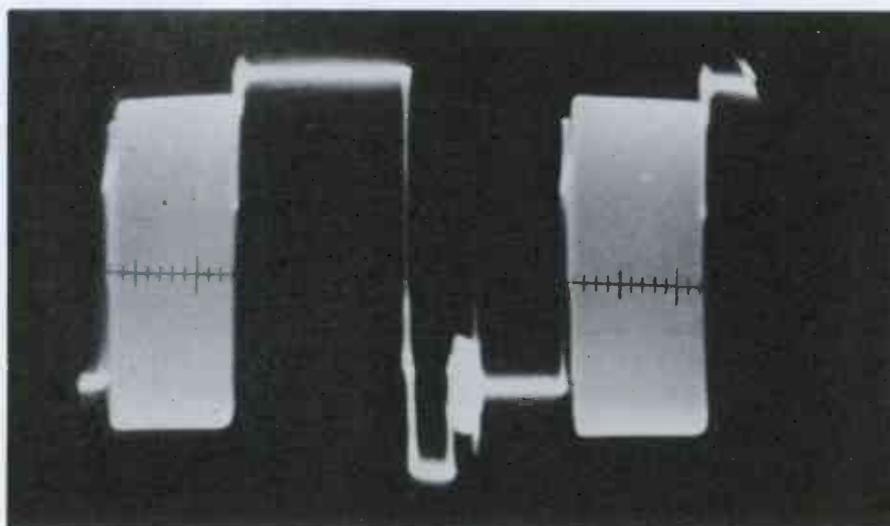


Fig. 15. Color burst located in negative portion of waveform.

FUSIBLE RESISTOR

CROSS REFERENCE GUIDE

Manufacturer	Part No.	Value Ohms Watts	Manufacturer	Part No.	Value Ohms Watts	Manufacturer	Part No.	Value Ohms Watts					
Admiral	61A19	7.5 5		47727-3	11 * TC (cold)		24B1116	4.7 5					
	61A19-2	7.5 5			22			43X0431-001	4.7 5				
	61A22	10 *			(hot)			46M-23018	9 5				
	61A28-3	5 5			47727-5		33 *	46M-25577	4.7 5				
	61B43-4	22 1			47727-6		16 *	816	22 5				
	61B43-10	100 4			47727-7		20 * TC (cold)	B154089-1-6	7.5 *				
	61B48-1	5.5 *					45	154087-1	7.5 5				
	61C20-24	5 10					(hot)	156540	7.5 *				
	61C43-5	47 1			47727-8		22 5	Curtis Mathes	FR-3	3 5			
	61C43-7	11 2			68504-130		4.7 10	Decca	RW10-1	22 3			
	61C43-8	1080 2			2000757-37		4.7 10	Delmonico	A04037-4K-3.9	3.9 *			
	Airline	B154089-1-6		7.5 5	Bracford Bendix		268021-1	5.6 5	Dumont	397148	22 5		
		E2311		22 5			V24002	4.7 *		0231001	7.5 5		
		F-15		5 5			43X0431-001	4.7 5		Emerson	394158	5 5	
		F-23		4.7 *			Buick	7276499			.33 *	394216	5 7
		R-1409		5.5 5				7281027			.51 *	397103	1 *
		V 24002		4.7 *				728-1890			.47 *	397118	6 *
20E1042		7.5 5		7286602		.68 *	397133	22 5					
34X380		7.5 5		CBS		31000472	7.5 6	397162			11 *		
43X394		4.7 *		Cadillac		7270608	.47 * TC	397180			62 *		
43X397		7.5 15				7281027	.51 *	397216			62 *		
43X398		4.7 *				7281890	.47 *	963378			220 *		
43X431		4.7 *				7286602	.68 *	Firestone			24B1116	4.7 5	
43X0431-001		4.7 *		Capahart		453924B-1	7.5 5				43X380	7.5 5	
46M2577		4.7 5		Catalina		V24002	4.7 *				46M-23018	9 5	
46M20681		5.6 5				43X086-001	22 *				ET14X182	5 5	
46M22301		9.1 5				43X396-001					ET14X183	3.6 7	
46M23018		9 5				43X0431-001	130 5				ET14X191	5 5	
259V002H01	7.5 *				4.7 5	RRW-048	4.6 *						
259V004M01	4.7 5			Chevrolet	7270608	.47 *	RRW-137		3 5				
259V007H02	7.5 *				7276499	.33 *	RRW-149		7.5 10				
053-458110	4.5 10				7281027	.51 *	Hallecrafters		024-201116	4.7 3			
099-001500	5 5				7281890	.47 *			24-1073	5 5			
Aiwa	V24002	4.7 *			7287480	.68 1			24-1116	4.7 5			
	V29001	4.7 *			TRP-28	4.7 5			24B1004	7.5 *			
Ambassador	672	130 4			V24002	4.7 *			24B1011	7.2 5			
	24-1073	5 5			024-2-1116	4.7 3			24B1116	4.7 5			
Artone	24B1116	4.7 5							25B1004	7.5 5			
	325-0134-13	47 5											
Arvin													

Manufacturer	Part No.	Value Ohms Watts	Manufacturer	Part No.	Value Ohms Watts	Manufacturer	Part No.	Value Ohms Watts	
Hoffman	25B1011	7.2 5	Packard-Bell	not avail.	7.5 5	Symphonic	A16120	47 2	
	224-20002	10 10		73500	5.6 *		A16121	22 3	
	4672	7.5 7.5		73720	7.5 *		not avail.	7.5 10	
	4762	5 *		73724	18 *		not avail.	4.7 *	
	J. C. Penney Magnavox	4798	7.5 *	Philco	33-1334-17	20 3	Travler	E47	47 *
		83001	7.5 *		33-1362-4	21 10		F6	5 *
		83002-1	7.5 *		33-1366	4.7 *		F6-1	5.6 5
		83003	4.7 *		33-1366-2	5.6 5		F8	7.5 5
		825023	7.5 10		33-1366-3	5.6 5		F-10	4.7 *
		43X431	4.7 *		33-1366-7	5.6 *		F15	5 5
24077-1		5 5	33-1366-9		5.6 *	F23		4.7 *	
240074-1		5 *	76-13605-2		1.45 *	TV-F-6		5 5	
240080-19		4.7 *	325-1441-16			Truetone		E27	27 *
240084-2		22 *			47 *	E47		47 *	
240084-3	22 *	Phonola	14135	47 *	F-15	5 5			
240601-1	7.5 5		Pontiac	7276499	.33 *	024-201116	4.7 3		
B-6,326-1	7.5 5		7281890	.47 *	24B1116	4.7 5			
Majestic	not avail.	47 *	7287480	.68 1	43X380	7.5 5			
Majorette	FRU-10P4B7	4.5 *	Raytheon	46M-20681	5.6 *	43X397	7.5 *		
Matsushita	FRU-2K	22 2		46M-22301	5.6 *	43X398	7.5 *		
	2000757-37	4.7 10		46M-23018	9 5	43X0398-001	4.5 *		
	PMA97478	7.5 5		46M-25577	4.7 5	46M-2557	4.7 5		
Meteor	7281890	.47 *	RCA	100117	5.6 5	46M-20681	5.6 5		
Mopar	7286602	.68 *		100117B	5 *	46M-23018	9 5		
Motorola	1K1027	7.5 5		103824	4.7 5	244-200002	10 10		
	1K711027	7.5 5		114481	3.5 *	816	22 5		
	1K711574	5 5	114966	5 10	240076-32	5 10			
	17A700149	5 5	115969	3.4 *	V.M.	12472	22 *		
	17A711027	7.5 5	942924-4	.35 *	17829	27 *			
	17A711500	7.5 5	Sentinel	B154089-1-6	7.5 5	Wells-Gardner	43X380	7.5 5	
	17A732655	7.5 *		20E1042	7.5 5	43X394	4.7 *		
	17A791166	7.5 5		240074-1	5 *	43X397	7.5 15		
	17A791696	5 5		240601-1	7.5 5	43X398	4.7 *		
	17B740668	3 *	Setchell - Carlson	FR-2	2 5	43X431	4.7 *		
17C67673A01	5 10	FR-3		3 5	Westinghouse	V-16023-1	7.5 5		
	17K711027	7.5 5	Silvertone	N41853	5 *	25V020873	100 3		
	17K738862	7.5 5	S43-1007	7.5 5	251V020H23	100 3			
	17K742136	5 5	T43-1007	7.5 5	251V020H66	5.6 8			
	17K744240	7.5 10	24-1073	5 5	251V020H73	100 3			
	17K748494	7.5 10	24-1116	4.7 5	251V035H02	33 *			
	65A61832A01	120 *	25B-1011	7.2 5	251VO36H01	5 7			
Muntz	RW-005-13	5 5	43-4-1	22 3.25	259V002H01	7.5 5			
	RW-022-15	22 5	43-1007	7.5 5	259V002M01	7.5 5			
	RW-055-13	5 *	43-1008	7.5 5	259V004M01	4.7 5			
	Not avail.	4.7 5	43-1009	5 5	259V007H01	7.5 *			
Nordmende	409.030	1.5K 5	43-1011	5 *	Zenith	WC14132	47 *		
	00038CTZ100	100 5	61-191-0	4.5 10	63-3269	7.5 5			
	00038CTZ1000	1K 5	61-193-0	14.5 5	63-3287	6 5			
	0038CZT	1.5K 5	14135	47 3	63-3644	6 5			
Oldsmobile	7276499	.33 *	16825	95 3	63-4450	6 10			
	728-027	.51 *	47727-3	11 *	63-5193	22 4			
	7281890	.47 *	(cold)		63-5306	33 *			
	7286602	.68 *	(hot)		63-6405	175 7			
Olympic	R-1409	5.5 5	Sonora	107474	3.1 *				
	RE3823	7.5 5	F-15	5 5					
	RE27113	10 *	R-1409	5.5 5					
	RE27133	3.5 *	Spartan	270074-1	5 5				
Opel	RE28476	5.5 7	Spartan	PA4227	7.5 5				
	RE32593	4.7 5	Studebaker	7276499	.33 *				
	RE32681	7.5 5	7281890	.47 *					
	7276499	.33 *	7287480	.68 1					
		Sylvania	187-0028	7.5 5					
			187-0053	4.7 5					
			189-0046	4.7 5					

* Wattage not given by mfr.
TC Temperature-Compensating

COLOR-PARTS



GUIDE

A guide to color parts was last published in the February '65 issue of PF REPORTER. Since then, there have been many changes in design and consequently many new chassis. The following parts guide lists the capacitors, resistors, sweep components, and other miscellaneous items needed to repair color TV receivers introduced since early 1965, including the recently-introduced chassis for 1967. As pointed out in the previous parts guide, the majority of these close-tolerance components are seldom used in black-and-white servicing;

therefore, it will probably be best if color and black-and-white inventories are separated. You can decide which items listed here are the most practical for you to keep.

The manufacturers part number is listed for all sweep-circuit and miscellaneous components. Exact replacements for most of these components are listed in the appropriate PHOTOFACT Folder and in your distributor's COUNTER-FACTS. "Th" appearing in front of the value of a resistor indicates the resistor is a thermistor.

	Fixed Capacitors			Electrolytics		Resistors			Miscellaneous
Admiral Chassis	2.2	pf	1KV	2	mfd 350 V	47	ohm	10W	Circuit Breaker
	47	pf N2200	2KV			270	ohm	5W	84D17-11
2G13,	68	pf	4KV			1	K	3W	84D17-9 (Ch. H12 & 1H12)
3G13,	100	pf	3KV 5%			1	K	20W	Convergence Rectifier
4G13,	100	pf N1500	6KV 10%			1.2	K	3W	93C1-21
5G13,	130	pf	3KV			1.4	K	3W	93C53-2 (Ch. H12 & 1H12)
6G13,	150	pf	1KV 10%			1.6	K	18W	Crystal 3.58 MHz
H12,	470	pf	1KV			2.7	K	5W	93B22-3
1H12	470	pf	2KV			4.7	K	4W	Delay Line
	470	pf	2.5KV			5.1	K	5W	72B217-3
	1000	pf	1KV			5.6	K	3W	
	1000	pf	1.4KV			8.2	K	3W	
	1500	pf	1KV			15	K	4W	
	1500	pf	2KV			17	K	7W	
	2200	pf	1KV			24	K	3W	
	2700	pf	1.6KV			27	K	3W	
	3300	pf	2KV			33	K	3W	
	4000	pf	3KV			500	K	3W	
	6800	pf	1.6KV			47	meg	6KV	
	.01	mfd	1KV						
	.01	mfd	1.4KV						
	.15	mfd	1KV						

	Fixed Capacitors			Electrolytics		Resistors			Miscellaneous
Dumont & Emerson Chassis	22	pf	1KV	10	mfd 10 V	1	K	5W	Boost Rectifier
	47	pf	2KV	160	mfd 150 V	1	K	10W	817124
120814A	68	pf	1KV			1.1	K	20W	Circuit Breaker
120822A	68	pf	4KV			4.3	K	5W	808022
120835A	130	pf	6KV			8.2	K	5W	Convergence Rectifier
	180	pf	1KV			10	K	10W	817149
	260	pf	2.5KV			13	K	7W	Crystal 3.58 MHz
	390	pf	1.5KV			66	meg	4W 6KV	817147
	470	pf	2.5KV						Delay Line
	1000	pf	2KV						709008
	3000	pf	1.6KV						Focus Rectifier
	3300	pf	1.6KV						817123
	8200	pf	1KV						
	.01	pf	1KV						

	Fixed Capacitors				Electrolytics		Resistors			Miscellaneous
General Electric Chassis HC & KC	22	pf	N750	1KV	1	mfd 25 V	.08	ohm	3W	Boost Rectifier ET57X31 (Ch. KC) Circuit Breaker ET10X50 (Ch. KC) Convergence Rectifier ET57X38 (Ch. KC) Crystal 3.58 MHz ET41X47 (Ch. HC) Delay Line ET36X809 (Ch. HC) ET36X556 (Ch. HC) Focus Rectifier ET57X32 (Ch. KC)
	24	pf	N750	4KV	1	mfd 450 V	1.75	ohm	5W	
	170	pf	N2200	4KV	200	mfd 15 V	3.6	ohm	7W	
	130	pf	N2200	6KV	220	mfd 200 V	(Th)3.8	ohm	Cold	
	160	pf	N1500	6KV			(Th)120	ohm	Cold	
	260	pf	N3300	2.5KV			250	ohm	10W	
	470	pf		1.4KV			300	ohm	3W	
	470	pf	N3300	2.5KV			680	ohm	5W	
	1000	pf		1.4KV			800	ohm	20W	
	1000	pf		2KV			1	K	3W	
	4700	pf		1KV			1.46	K	10W	
	5000	pf		1.4KV			3.6	K	3W	
	.0082	mfd		1.6KV			3.9	K	4W	
	.033	mfd		1KV			4.3	K	10W	
	.01	mfd		1.4KV			5.6	K	7W	
	.1	mfd		1KV			8.2	K	3W	
							10	K	10W	
						15	K	4W		
						15	K	10W		
						16	K	3W		
						22	K	4W		
						39	K	4W		
						(Th)1	.052 meg	Cold		
						66	meg	6KV		

	Fixed Capacitors				Electrolytics		Resistors			Miscellaneous
Hoffman Models 1P-5001, B W-5002, B SP-5003, B FP-5004, B W-5310 SP-5311 W-5320 MS-5322 W-5330 SP-5331 IP-7001 W-7002 SP-7003 MS-7005	22	pf	N750	1KV	10	mfd 10 V	(Th)1.25	ohm	Hot	Boost Rectifier 004-003100 Circuit Breaker 099-002500 Convergence Rectifier 004-003700 Crystal 3.58 MHz 136-000100 Delay Line 111-023800 Focus Rectifier 004-003200
	47	pf	N2200	1.4KV		N.P.	(Th)5	ohm	Cold	
	68	pf	N1500	4KV			270	ohm	3W	
	130	pf	N2200	6KV			680	ohm	4W	
	150	pf	NPO	6KV	5%		820	ohm	7W	
	180	pf		1KV			1	K	3W	
	200	pf		2.5KV			1.4	K	20W	
	390	pf	N1500	1.5KV	5%		2.7	K	3W	
	470	pf	N2200	2.5KV			3.3	K	3W	
	1000	pf		1KV			3.3	K	10W	
	.0033	mfd		2KV			5.6	K	4W	
	.0082	mfd		1KV			6.8	K	3W	
	.01	mfd		1.4KV			10	K	10W	
							11	K	7W	
							13	K	7W	
							66	meg	6KV	

	Fixed Capacitors				Electrolytics		Resistors			Miscellaneous
Magnavox Chassis T911 T918 T919 T920	22	pf	N750	1KV	160	mfd 250 V	270	ohm	3W	Boost Rectifier 530097-3 Convergence Rectifier (Dual) 430087-2 Convergence Rectifier (Single) 530098-1 Crystal 3.58 MHz 530089-2 Delay Line 360949-5
	47	pf		2KV			910	ohm	5W	
	68	pf	N1500	4KV			910	ohm	7W	
	130	pf	N2200	6KV			1	K	3W	
	180	pf		2KV			1.1	K	18W	
	390	pf	N1500	1.5KV			1.8	K	3W	
	1000	pf		1KV			2.2	K	3W	
	1000	pf		1.5KV			3.3	K	3W	
	1000	pf		2KV			4.3	K	5W	
	.002	mfd		1KV			5.6	K	3W	
	.0082	mfd		1KV			5.6	K	4W	
	.01	mfd		1.4KV			8.2	K	3W	
							15	K	7W	
							18	K	4W	
							66	meg	6KV	

	Fixed Capacitors				Electrolytics		Resistors			Miscellaneous
Motorola Chassis TS918 TS918A	2.2	pf	NPO	1KV	150	mfd 250 V	(Th)3.8	ohm	Cold	Boosted Boost Rectifier 48D67120A08 Circuit Breaker 80C66390A13
	33	pf	N150	2KV	160	mfd 250 V	820	ohm	3W	
	47	pf	N1500	6KV			820	ohm	7W	
	100	pf	N1500	3KV			1	K	20W	

	Fixed Capacitors			Electrolytics		Resistors			Miscellaneous
Motorola Chassis TS918 TS918A	120	pf	N750	1KV		1.5	K	3W	Convergence Rectifier 48S10062A01 Crystal 3.58 MHz 48C66865A03 Focus Rectifier 6D67800A03
	470	pf		1KV		2.2	K	5W	
	470	pf		2KV		2.2	K	10W	
	.001	mfd		2KV		2.7	K	7W	
	.0015	mfd		1.4KV		3.9	K	4W	
	.002	mfd		2KV		5.6	K	7W	
	.005	mfd		1KV		7.5	K	7W	
	.005	mfd		2KV		8.2	K	4W	
	.01	mfd		1KV		8.2	K	7W	
	.02	mfd		1KV		10	K	3W	
					10	K	5W		
					10	K	10W		
					15	K	4W		
					47	K	4W		

	Fixed Capacitors			Electrolytics		Resistors			Miscellaneous		
RCA Chassis CTC17 thru CTC25X	22	pf	N750	1KV	10	mfd	350V	(Th)1.25	ohm	Hot	Boosted Boost Rectifier 113391 Circuit Breaker 113950 Convergence Rectifier 114013 (Ch. CTC17 & CTC20) 118244 (Ch. CTC19, CTC21, CTC24, CTC25 & CTC25X) Crystal 3.58 MHz 105330 Delay Line 109837 (Ch. CTC17) 116505 (Ch. CTC19, CTC20 & CTC24) Pincushion Rectifier 113998 (Ch. CTC17) only 119593 (Ch. CTC21, CTC25 & CTC25X)
	47	pf	N1500	5KV	50	mfd	150V	(Th)5	ohm	Cold	
	68	pf	N1500	4KV				(Th)120	ohm	Cold	
	130	pf	N2200	6KV				270	ohm	3W	
	180	pf	N1500	1KV				560	ohm	7W	
	330	pf	N1500	2.5KV				600	ohm	18W	
	390	pf	N1500	1.5KV				680	ohm	3W	
	470	pf	N2200	2.5KV				680	ohm	10W	
	680	pf		1KV				680	ohm	15W	
	1000	pf		1KV				750	ohm	10W	
	1000	pf		2KV				820	ohm	3W	
	.001	mfd		2KV				820	ohm	7W	
	.0022	mfd		1KV				1	K	3W	
	.0022	mfd		2KV				1.2	K	4W	
	.0033	mfd		1.6KV				1.2	K	7W	
	.0047	mfd		1.6KV				1.8	K	3W	
	.0082	mfd		1KV				2.7	K	3W	
	.1	mfd		1KV				3.3	K	3W	
	.22	mfd		2KV				3.9	K	7W	
	3300	mfd		3KV				4.3	K	5W	
								4.7	K	3W	
								5.6	K	4W	
								6	K	15W	
								6.8	K	3W	
								6.8	K	4W	
								10	K	10W	
								13	K	7W	
								15	K	5W	
							16	K	3W		
							22	K	4W		
							39	K	3W		
							39	K	4W		
							66	meg	6KV		

	Fixed Capacitors			Electrolytics		Resistors			Miscellaneous		
Sylvania D01-1, -2, -8 D02-1 D02-7 thru 12 D03-2 D05-1, -2	22	pf		1KV	3	mfd	150 V	3.9	ohm	25W	Boosted Boost Rectifier 13-16105-3 Circuit Breaker 29-17690-1 (D01-1, -2, -8; D02-7 thru -12) 29-16012-4 (D02-1) 29-17312-1 (D03-2; D05-1, -2) Convergence Rectifier (Mult) 13-16247-3 (D01-1, -2, -8; D02-1, -7 thru -12) 13-17569-1 (D03-2; D05-1, -2) Convergence Rectifier (Single) 13-14627-1 (D02-7 thru -12) 13-10102-1 (D05-1, -2) Crystal 3.58 MHz 26-16162-1 Delay Line 32-16108-2 (D01-1, -2, -8; D02-1, -7 thru -12) 32-16108-3 (D03-2) 32-23216-1 (D05-1, -2) Focus Rectifier 13-16106-1
	47	pf		2KV	3	mfd	350 V	4.7	ohm	3W	
	68	pf		4KV	10	mfd	350 V	(Th)125	ohm	Cold	
	130	pf		6KV	160	mfd	250 V	270	ohm	3W	
	180	pf		1KV	200	mfd	25 V	900	ohm	30W	
	1000	pf		1KV	500	mfd	200 V	1	K	3W	
	1000	pf		2KV				1.2	K	4W	
	2200	pf		2KV				1.2	K	7W	
	3300	pf		1KV				1.2	K	20W	
	4700	pf		1KV				1.2	K	25W	
	5600	pf		1.6KV				2.2	K	3W	
	5600	pf		2KV				3.3	K	3W	
	.01	mfd		1.4KV				4.3	K	5W	
								4.7	K	3W	
								4.7	K	4W	
								5.6	K	3W	
								5.6	K	4W	
							5.6	K	5W		
							12	K	4W		
							13	K	7W		
							15	K	3W		
							33	K	5W		
							39	K	3W		
							39	K	4W		
							66	meg	6KV		

Fixed Capacitors			Electrolytics			Resistors			Miscellaneous	
Zenith	45	pf	5KV	4	mfd	475 V	300	ohm	10W	Circuit Breaker 85-763 Convergence Rectifier (Horiz.) 212-25 (Ch. 24NC31; 24MC32, 42) 212-63 (Ch. 25MC35, 36, 45, 46) Convergence Rectifier (Vert.) 212-50 Crystal 3.58 MHz 103-89 or 103-71 Delay Line S-65296 Focus Rectifier 212-48 (Ch. 25MC35, 36, 45, 46 only)
Chassis	75	pf	4KV	10	mfd	475 V	450	ohm	15W	
24NC31	90	pf	5KV	40	mfd	400 V	680	ohm	3W	
24MC32, 42	100	pf	4KV	160	mfd	250 V	3.3	K	4W	
25MC35, 36, 45, 46	150	pf	5KV				3.9	K	4W	
	150	pf	6KV				4.7	K	7W	
	470	pf	1KV				10	K	3W	
	.001	mfd	1KV				10	K	4W	
	.0015	mfd	1KV				10	K	5W	
	.0022	mfd	1KV				12	K	5W	
	.0068	mfd	1KV				18	K	3W	
	.01	mfd	1KV				22	K	3W	
	.015	mfd	1KV				39	K	3W	
	.033	mfd	1KV							
	.1	mfd	1KV							

Sweep Components

Admiral

Horiz Output Transformer	79D110-5 (Ch. 2G13, 4G13, 5G13) 79D110-6 (Ch. 3G13, 6G13) 79D126-1 (Ch. H12, 1H12)
Vertical Output Transformer	79D106-6
Yoke	94C304-2

Dumont & Emerson

Horiz Output Transformer	738213 (Ch. 120814A) 73814 (Ch. 120822 & 120835)
Vertical Output Transformer	738207
Yoke	708476 (Ch. 120814A) 708479 (Ch. 120822 & 120835)

General Electric

Focus Coil	ET36X710
Horiz Output Transformer	ET77X99 (Ch. HC Early Prod.) ET77X102 (Ch. HC Late Prod.) ET77X89 (Ch. KC)
Vertical Output Transformer	ET64X116 (Ch. HC) ET64X113 (Ch. KC)
Yoke	ET76X47 (Ch. HC) ET76X43 (Ch. KC)

Hoffman

Focus Coil	111-032200
Horiz Output Transformer	033-012700 (Models IP-7001, W-7002, SP-7003, MS-7005) 033-010200
Vertical Output Transformer	033-010300
Yoke	027-032000 (Models IP-5001, W-5002, SP-5003, FP-5004) 027-032800 (Models IP-7001, W-7002, SP-7003, MS-7005) 027-031400 (All others)

Magnavox

Focus Coil	361240-2 360957-5 (Ch. T918)
Horiz Output Transformer	361197-1 361241-1 (Ch. T918)
Vertical Output Transformer	320317-2 320111-6 (Ch. T918)
Yoke	361130-402 (Ch. T911) 360947-1 (Ch. T918) 361130-302 (Ch. T919) 361130-202 (Ch. T920)

Sweep Components

Motorola

Horiz Linearity Coil	24D65853A13
Horiz Output Transformer	24D67564B06
Vertical Output Transformer	25D66761A07
Yoke	24D67822A07

RCA

Focus Coil	113999
Horiz Output Transformer	115876 (Ch. CTC17 CTC21, CTC25X) 116554 (Ch. CTC19) 117426 (Ch. CTC20) 119834 (Ch. CTC24) 119876 (Ch. CTC25) 115835 (Ch. CTC17) 118980 (Ch. CTC19) 117428 (Ch. CTC20) 119828 (Ch. CTC24) 119615 (Ch. CTC21, CTC25 & CTC25X) 114741 (Ch. CTC17, CTC21, CTC24, CTC 25 & CTC25X)
Vertical Output Transformer	
Yoke	116324 (Ch. CTC19) 109457 (Ch. CTC20) 114741 (CTC21, 24, 25)

Sylvania

Focus Coil	50-16023-4 (Not in DC5-1, -2)
Horiz Output Transformer	56-16016-2 (D01-1, -2, -8) 50-17069-2 (D02) 50-17314-1 (D03-2) 50-17314-4 (D05-1, -2)
Vertical Output Transformer	56-16017-4 (D01-1, -2) 56-16017-6 (D01-8) 56-16017-5 (D02-1) 56-17559-1 (D02-7 thru 12) 56-17559-2 (D03-2; D05-1, -2)
Yoke	51-16083-1 (D01-1, -2, -8) 51-15949-1 (D02-1) 51-15949-2 (D02-7 thru 12) 51-17570-1 (D03-2) 51-17570-2 (D05-1, -2)

Zenith

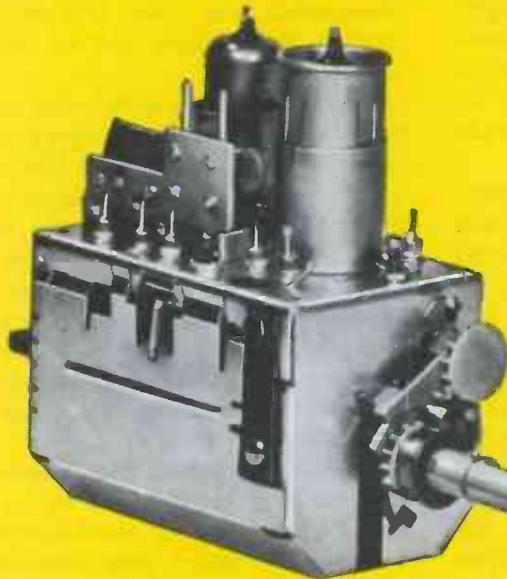
Horiz Output Transformer	S-71144 (Ch. 24NC31) S-67915 (Ch. 25MC35, 36, 45, 46) S-65465 (Ch. 24MC32, 42)
Vertical Output Transformer	95-2281 (Ch. 24NC31; 24MC32, 42)
Yoke	95-2222 (Ch. 25MC35, 36, 45, 46) 95-2280 (Ch. 24NC31; 24MC32, 42) 95-2286 (Ch. 25MC35, 36, 45, 46)



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Building Good Customer Relations



By Charles J. Collazzo†

Building good customer relations is a continuing task because it is made up of the many separate impressions which individuals form in their day-to-day contacts with owner-managers of small retail and service businesses. These impressions are gained not only in their business dealings but also in the community activities in which the owner-manager participates.

This *Aid* discusses both aspects of building good customer relations. In the store, itself, the task is one of setting policies and supervising activities which will appeal to customers. In community life, building good customer relations involves becoming a leader in activities which will promote civic progress.

What people in the town or city think can cause customers to visit or shun a store. The owner-manager can count on getting a fair share of the area's business when his store is considered as an asset to the community by its members. This is true even though some of them are noncustomers — people who don't need the products or services of the store. Often their recommendations result in sales.

Going Along With The Community

The owner-manager should be deeply concerned when even one person doesn't think highly of his store. For example, an ex-customer tells a neighbor who has just moved to town, "I don't trade there any more since he chased my son Billy out when he was distributing Boy

† This article was reproduced from *Small Marketers Aid No. 120, Small Business Administration, Washington, D. C. Copies of this Aid are available free from field offices and Washington headquarters of the Small Business Administration.*

Scout Week posters."

To the ex-customer, the retailer's rudeness to the Boy Scout meant a lack of interest in the community. To the retailer, it meant a loss of a customer and loss of a powerful selling tool—favorable word-of-mouth advertising.

An example of how interest in the community pays off is provided by the experience of a gasoline service station owner. He shows his concern by advising teenagers on the care of their cars, by lending them tools, and by providing a wholesome meeting place. As a result, many of their parents trade with him.

On the other hand, the experience of Tom Nevaton,* illustrates what can happen when an owner-manager disregards community interests. The Nevaton store was in a town where tradition dictated many community actions. Among them was a campaign for colonial motifs in all public and commercial buildings. At the urging of the historical society and the chamber of commerce, many of Mr. Nevaton's fellow merchants began to renovate their stores and remodel their store fronts.

Mr. Nevaton joined in. Besides installing a colonial store front, he enlarged and remodeled his store which was one block away from the most historical part of the town. However, as a finishing touch, he put up a new sign which became the talk of the town.

Not only was the sign out of keeping with the colonial motif, it was also ornate and brightly colored. It would have been considered garish by people of good taste in any town.

*All names are disguised in *Aids*.

Mr. Nevaton's disregard for the feelings of his fellow townsmen cost him their goodwill. The newspaper

criticized him, and many of his customers became ex-customers. His failure to go along with the community meant that the money he spent in renovating his store was lost as a result of the bad customer relations his sign had generated.

Support Local Improvement

Sometimes going along with the community means supporting local improvements even though they inconvenience your store. One small retailer, Bill Guston, learned this the hard way.

He opposed a street widening because it would require a complete alteration of his store front. Yet he had known for years that the street might be widened. Furthermore, he was to be repaid for the alterations.

As his neighbors saw it, many people would gain by the street widening and Mr. Guston had no problem. He was getting paid for losing the front of one of the ugliest buildings in town.

To his neighbors, Mr. Guston and his firm appeared to be opposed to progress for short-sighted reasons. He created poor relations with the community because he placed his own welfare before the community which he professed to serve.

Instead of fighting community pressures, the successful retailer tries to foresee how they might affect his business. He then tries to plan his actions so as to cope with them. Unless you are fighting for a worthwhile principle, it is usually better to cultivate goodwill by conforming to the consensus of the community.

Do More Than Is Expected

Customers, potential customers, and others expect small retailers and service operators to help in local charity drives, give window

space to educational and civic recreational activities, and support community building activities. They also expect merchants to respect the spirit as well as the letter of rulings of local regulating agencies.

If you want your store to be outstanding in its community, you have to go further than just meeting the standards expected by fellow townspeople. In effect, your store has to be a leader in community life. Such leadership can bring goodwill which advertising, low prices, high quality, and other merchandising tools cannot buy.

If a town, or city, is to progress, its business leaders must help solve the problems connected with zoning, urban redevelopment, parking street beautification, air pollution, and juvenile delinquency. Being a leader in such projects even when it is not your store's immediate concern puts you on record as being interested in the community. Moreover, when you are on the ground floor in community planning, you are in a better position to prepare for any proposed changes.

But suppose that, for sound reasons, you do not agree with the proposed solution to a community problem. What do you do? If some of your neighbors and competitors agree with you, then they can help tell your side of the story to the rest of the citizens and officials. If none agrees with you, you may want to reexamine your position before risking actions which could damage your customer relations.

You should keep in mind that it is always important to make your firm a part of the community. And when your position is different from the majority, you will have done a good job if your neighbor says, "He may not always agree with you, but you know his heart's in the right place."

Activities Within The Store

Community life is so complex that small retailers—even the ones who are civic leaders—sometimes have little control over the things which affect external customer relations. However, inside your store you *can* plan and control activities which make for good customer relations.

A question to consider is: Why do customers walk out without buy-

ing and often never return? When a sale is rung up on the cash register, the impression is that the customer is satisfied. Yet she may have come in as the lesser of several evils and is ready to move to the first competitor who satisfies more fully her needs.

The cash register does not tell what your customers and potential customers are like. Yet you have to know this if you are to plan the store's activities so they will build up good customer relations.

The activities suggested in this *Aid* are based on a recent survey of shopping behavior. An important trend is that consumer shopping behavior seems to be maturing. Tremendous numbers of people now have, for the first time, discretionary spending power and the knowledge they need for buying what they want. In effect, shoppers are maturing, and this maturity will increase as income, education, and occupational achievement increase.

This trend means that customers expect more from stores than formerly, and store activities which cause them disappointment or inconvenience make for bad customer relations.

Less Reliance on Advice

One of the things which irritates some customers is the amount and quality of the advice they encounter in stores. Mature customers want to make decisions as to whether they need a clerk's advice on the style, color, or material which is best suited for a particular purpose. They want to ask the clerks for advice and help rather than having it forced upon them.

In order to use advice and help as a goodwill builder, salespeople have to know their customers. They have to know when to hold back and when to step forward. Some people—those who lack buying experience or self-confidence—want clerical assistance.

It is a good idea to size up your trade. Do most of your customers and potential customers need and want help from a sales clerk? Or do most of them want to go it alone because they are mature shoppers?

Pleasant Surroundings

Pleasant surroundings are important to good customer relations be-

cause shopping competes with other activities in lives of mature shoppers. For certain of their purchases, they want to visit uncrowded, tastefully decorated stores that have comfortable temperatures. They have these conditions in their homes and are reluctant to shop in ugly and dingy stores.

Customers also want to shop in stores that are located near community functions such as medical, transportation, occupational, and entertainment centers. Thus, they can take care of several types of errands on a single trip.

Most lines of merchandise have their own natural neighbors, and a merchant eager to please will find a location near complementary shopping or service facilities. For example, a small hardware store owner will try to locate near a supermarket or other stores which householders visit each week rather than near an automobile repair shop which they visit infrequently.

Believable Advertising

Believable advertising is another activity which helps to make good customer relations. Such advertising stays away from promotions which offend customers. An unbelievable ad, for example, might proclaim an extraordinary bargain which even the most stupid customer recognizes as a "come on."

Blatant ads may destroy the customer's belief in the store's integrity—especially if he bought recently at full price the item which is now advertised at an extremely low one. Then, too, you should be alert for the nonbelievers — those who doubt most of what they read in an ad.

Some customers are skeptical about extreme advertising claims because they have been taken in before or know people who have been. This outlook also makes many consumers suspicious of promotional devices which some retailers use to attract and hold business. Promotional gimmicks should be handled with care lest they offend the very customers—the mature ones—which the store needs the most.

"Out-of-Stock" and Size

Some stores lose goodwill because of "out-of-stock" situations. Customers expect you to have their

sizes and the styles with which they are accustomed. They want them in season. Families want to make their buying decisions based on their budget needs rather than the merchandising expediencies of the merchant.

Stocking a complete range of sizes is an important consideration in good customer relations. Often size is more important to the customer than "price," "style," "color," "brand," or even "quality."

When size is out-of-stock, it creates inconvenience at best. If the owner-manager is lucky, the customer will make a second trip. But even then, her neighbors will hear about the inconvenience the store caused her.

Assortment

Carrying an assortment which customers want is another part of building good customer relations, but it is hard to do when the money you can invest in stock is limited. To obtain the right assortment requires that you study prospective customers and carry the merchandise that will appeal to the majority of them rather than trying to do the impossible job of being "all things to all people."

Another way to handle assortment is specialization—carry a narrow line but in great depth. For example, some retailers specialize in pillows rather than in dry goods. Others specialize in marble-top tables rather than in furniture or in high-fashion women's shoes rather than a complete line of women's shoes. Keep in mind, however, that successful speciality operation depends on store location. It requires a location near other speciality retailers who can share in providing one-stop shopping.

In using assortment to build good customer relations, the owner-manager should beware of inferior products. Being the exclusive dealer for inferior products can hurt a store's reputation.

Clerk Service

To the customer, the clerk is the store. When the clerk is rude, aggressive, lacking in product knowledge, slow, indifferent, or tricky, the store's reputation suffers. Most customers will not excuse rudeness, sloppy appearance, and so on. Therefore, salespeople should be

trained to foster good customer relationships.

Training should include how to handle returns and refunds—often the cause of conflict between clerk and customer. The possibility for arguments can be reduced by putting exchange and refund policies in writing so they are clear to the clerk and the customer. Except for clerical errors in billing, no other area is as likely to arouse intense emotions.

Self-service problems

In building good customer relations, self-service stores have particular problems. Customer relations are damaged by the lack of signs, inadequate price tags, carts which are hard to push, blocked aisles and shelves, poor layout, and crowded checkout stands.

Older people may be bothered more in inadequate self-service than others, but no one likes a crowded checkout counter. If customers are in a hurry, they resent being slowed down after they have raced through the store. Also customers who shop leisurely feel harassed in a crowded checkout. Many self-service stores need better control over checkout operations in order to give good service to customers.

Keeping In Touch

As the income and educational levels of customers increase, their shopping attitudes and patterns change. Such changes often mean that activities within the store must be adjusted in order to keep good customer relations from deteriorating.

Therefore, it is necessary to keep in touch with your customers. You should check periodically your ideas of what customers expect from your store. Jotting them down on a piece of paper can help your thinking and serve as a reference for your observation of how customers react when they are in the store.

You should keep an ear open for complaints. Handle them immediately to the customer's satisfaction. And ask some of your best customers—and some of the worst ones—for their opinions about your store and its merchandise.

The importance of such a check is shown by the experience of one

small retailer. A customer quit buying from the store when he was billed for a service call. He silently nursed and magnified what he felt was an unjust charge. "If he had told me," the retailer said, "I could have adjusted it."

Asking for customers' opinions at regular intervals should help you to obtain the information needed for keeping store activities in line with what customers expect. With it, you can plan and supervise activities to build good customer relations.

For Further Information

Readers interested in exploring the subject of building good customer relations may wish to consult the references indicated below. This list is necessarily brief and selective. However, no slight is intended toward authors whose works are not mentioned.

Shopping Behavior of Department Store Customer by Stuart U. Rich. 1963. \$5. Division of Research, Graduate School of Business, Harvard University, Soldiers Field, Boston, Mass. 02163.

The Social Context of Economic Behavior by W. T. Tucker. 1964. \$3.75. Holt, Rinehart, and Winston, 383 Madison Ave., New York, N.Y. 10017.

Motivation in Advertising by Pierre Martineau. 1957. \$6.50. McGraw-Hill Book Co., 330 W. 42nd St., New York, N.Y. 10036.

Marketing and the Behavioral Sciences by Perry Bliss. 1963. \$7.15. Allyn and Bacon, Rockleigh, N.J. 07647.

Profitable Community Relations for Small Business. Small Business Management Series No. 27. 1961. Small Business Administration. Available for 25 cents from the Superintendent of Documents, Washington, D.C. 20402.

"Pleasing Your Boss, the Customer." *Small Marketers Aids* No. 114. June 1965. Free. Small Business Administration, Washington, D.C. 20416. (or nearest SBA office).

"Quality and Taste as Sales Appeals." *Small Marketers Aids* No. 113. June 1965. Free. Small Business Administration, Washington, D.C. 20416 (or nearest SBA office). ▲

Winter Care for Marine Radiotelephones



by Larry Allen

Along, some of the northern waterways and lakes, it is not good practice to leave a boat exposed to ice, snow, and wind all winter. If your service shop is located in one of these areas, you may be asked to prepare a customer's marine radiotelephone for storage during the off-season for boaters. You can handle this without damage to the set, antenna, or power supply, provided you take a few precautions.

Before you disconnect any units of the system, it is wise to make sure the set operates properly. If any deficiencies are noted, they should be corrected before the set is taken off the vessel. This will prevent the owner having to wait for you to find time to fix the set in the spring when your workload is much heavier.

Testing Before Removal

First, check the power source

to be sure the set is supplied with proper voltages on both receive and transmit. The transmitter RF output can be checked with the antenna connected. If you prefer a dummy load, one can be made easily (see Figs. 1 and 2). Power output can be determined by the formula $P = I^2R$ (with R being the resistance of the dummy load and I being the reading on an RF ammeter in series with the dummy load.) You can also use the indirect method of power measurement: Measure plate voltage and current in the final stage, and use the same $P = I^2R$ formula to find the input power. RF power output should be about 50% of input power.

A frequency and modulation check can be made with a combination frequency meter. (When you shop for a marine-servicing frequency meter, be sure it covers

150-160 MHz as well as the HF bands; more and more VHF-FM sets are being introduced into marine use.) Frequency accuracy should be within $\pm 0.02\%$ of the designated channel frequency. Modulation should be between 75% and 100% on whatever modulation meter you use.

Winterizing

If possible, the set should be removed from the boat for storage. This may be impractical for some of the larger radiotelephones, but at least the antenna should be removed from its mount and stored out of the weather. Exposed portions of the antenna mount could be covered with waterproof tape, or with some waterproof coating such as grease or vaseline, to protect them from dirt and corrosion.

If the set is to stay on the boat, a 40-watt refrigerator bulb (West-

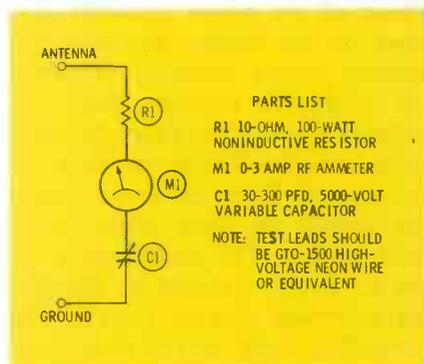


Fig. 1. Circuit diagram of dummy load.

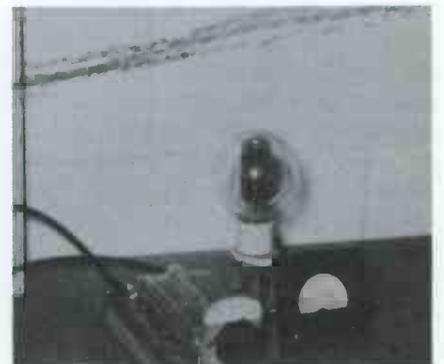


Fig. 2. Dummy load—finished product.

3-16-66 Remove from winter storage. Checkout in shop. Replace 6BH6 + three 807s. Adjust modulation limiting to eliminate overmodulation. Clean all relays. Adj. mixer + antenna trimmers—all channels. Replace noisy 6AQ5 in receiver.

3-21-66 Install on board. Resoldered braid joints from ground plate to engine. Adj. frequency all channels better than 91%. Modulation less than 90% limiting. Power input: 390 plate volts. 270ma plate current = 105 watts input. Calibur Model 99 Frog-Mech Meter serial # 9999.
John A. Hise P2-00-0000 Exp. 6-6-69

Fig. 3. Information recorded in log.



Fig. 4. Marine-radio servicing bench.

Check the frequency of the transmitter on every channel, using a frequency meter or a frequency counter. A tolerance of .02% is allowed in the HF marine band. If the frequency does not fall within this tolerance, the crystal will probably have to be replaced. Always use a crystal designed to be used in the particular set (there are many different oscillator circuits). Never load the final amplifier above levels recommended by the manufacturer.

Check the percentage of modulation with a modulation meter or your shop oscilloscope. If 75% to 100% modulation cannot be obtained, check the microphone. Waterlogged carbon microphones often cause this trouble; a new carbon element is the only sure cure. Check the speech amplifier and modulator tubes and replace weak or noisy ones. Transistor sets are usually trouble-free on this account. Modulation should never exceed 100%. When everything checks out satisfactorily, you are ready to reinstall the set on the boat.

Back Aboard

Check the mounts again for corrosion, and then remount the set. Clean off the power terminals and hook up the battery and fuse, observing proper polarity. Remove the protective covering from the antenna mount, and check for possible corrosion before hooking up the antenna. If you have used a coating instead of tape, clean it off with alcohol. The ground plate (if the set is AM) should be checked for corrosion and to be sure the grounding strap makes good connection. The plate may need cleaning, as it is one of the most

• Please turn to page 54

inghouse #4815 is typical) should be placed inside the set to combat condensation. All units of the system—lead-in, insulators, ground braids, mounts, etc.—should be given a thorough visual inspection for faults. All cables and connectors should be checked closely for shorts, cracks, and deterioration. Be especially watchful where cables pass through the bulkhead or deck and where they are exposed to water or the weather. All connectors should be checked for broken or bent pins.

If the set is to be removed from the boat, all connectors left aboard should be taped over with waterproof tape. The set should be removed from its mount, along with the power supply, any special batteries, and the dynamotor, if one is used. The units should be inspected thoroughly for any signs of damage or corrosion and placed in boxes, with wadded newspaper packing, for storage.

The boxes should be stored in a warm, dry place—at the owner's home or in your shop, if you have the space. One advantage of storage facilities at your shop is the availability of the set for repair at your convenience during the winter, if your preremoval tests revealed faults that need correcting.

Bringing It Out Again

Before the spring boating season, the set should be taken out of storage (or, if the owner is storing the set, brought to the shop) and oper-

ated for a week or so before it is to be reinstalled on the craft. It should again be checked visually for corrosion, loose wires, or damage that might have occurred during storage or that was overlooked in your prestorage checks.

Turn the set on and allow it to warm up, watching for smoke and sniffing for odors. Connect the shop antenna and tune in one of the marine channels to check reception. If it is early spring, you may be able to pick up signals only from commercial ships. Check the broadcast band, if the set has one. Use a signal generator to check sensitivity against the manufacturer's specifications. After being used all last season, most sets will need the antenna and mixer trimmers readjusted. In crystal-controlled receivers, the channel "noise" is useful for peaking these. (CAUTION: Be sure you don't transmit into the signal generator.) Check sensitivity on all channels. If all are weak, it may be necessary to tune the IF transformers or replace weak tubes. In transistor sets, lightning or static discharges sometimes damage the first transistor in the receiver, resulting in loss of sensitivity.

Use a dummy load as you check power output in the shop. If power is not up to snuff, check the tubes and the tuning. Be sure the input power doesn't exceed the rating for the set; if it does, transmitter tubes will be short-lived. Always be sure the PA final plate current is *dipped* before you measure input (or output) power.

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5

RCA Deluxe Transistorized Antenna Amplifiers

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4

RCA Deluxe Multi-Set Couplers

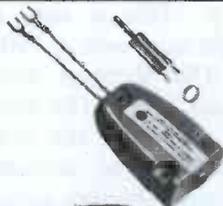
... UHF/VHF/FM 300 ohms, couple two or four sets to one antenna or amplifier. Channels 2 to 83, types 10P302 and 10P304. Also VHF/FM 75 ohm coaxial types 10P752 2-set coupler; 10P754 4-set coupler.



3

RCA Deluxe Band Splitters

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SQUARE WAVES to determine COIL Characteristics

by
Robert G. Middleton

Most technicians know that the AC resistance of a coil is much higher than its DC resistance, particularly at frequencies from 0.5 MHz to 4 MHz or higher. We can measure the DC resistance of a coil with an ohmmeter, but this tells us nothing about its AC resistance. Insofar as the performance of a coil in an RF circuit is concerned, only the AC resistance is of practical importance — we can forget about the DC resistance because it is negligible by comparison. AC resistance is

high because of skin effect, eddy currents, and dielectric losses. But how can we measure the AC resistance, or determine the inductance once the AC resistance is known? This is easy with a square-wave generator and scope.

Measuring AC Resistance

Connect the coil to the input terminals of a scope, and feed in a square-wave signal with a gimmick, as shown in Fig. 1. This is the same

test setup that is used to measure the Q of a coil. In this case, we will use it to measure the AC resistance of the coil. A waveform appears on the scope which is a damped sine wave, as depicted in Fig. 2. In this example, there are seven peaks, or cycles, from the 100% amplitude point to the 37% amplitude point. To measure the AC resistance of the coil, connect an arbitrary resistance in series with the coil, as shown in Fig. 3. (This is only a guess — we might start with a 150-ohm resistor). The damped sine wave now dies out faster. The correct value of R will cause the sine wave to decay to 37% in one-half the number of peaks (cycles), compared with the first test in Fig. 1. Or, to continue the example of the waveform in Fig. 2, R must have a value which makes the waveform decay to 37% in 3.5 cycles. In other words, the third cycle will have greater than 37% amplitude, but the fourth cycle will have less than 37% amplitude.

The value of R which makes the waveform decay twice as fast, equals the AC resistance of the coil. If you read the squares on the scope graticule as carefully as you would the scale on a meter, the method is surprisingly accurate. Use 1% re-

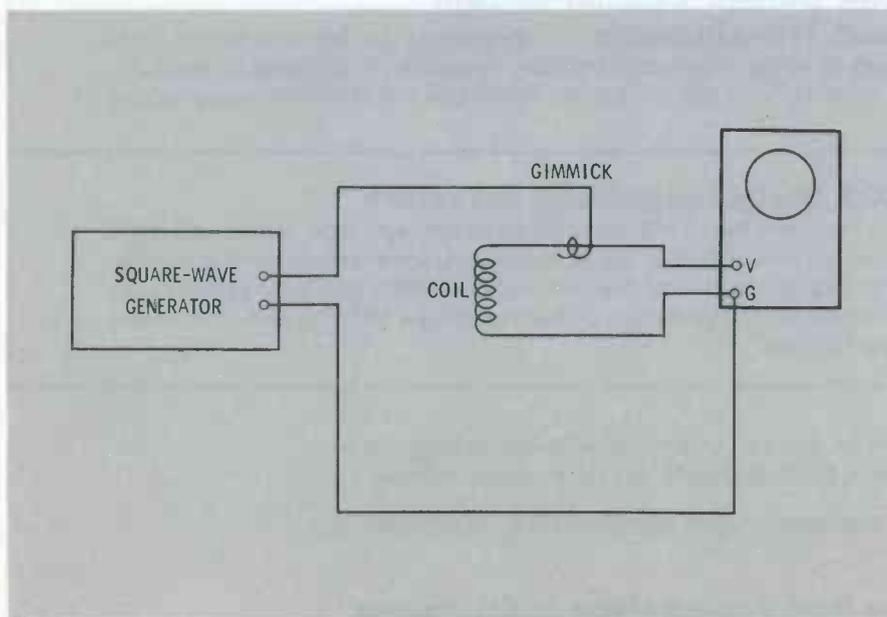


Fig. 1. Equipment setup to measure Q.

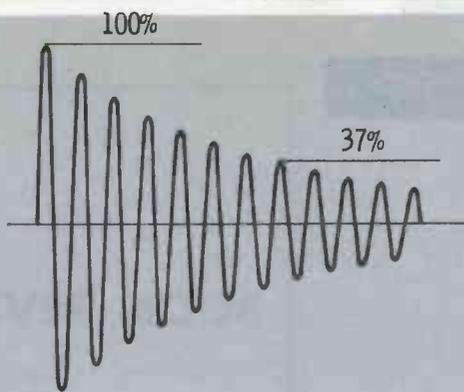


Fig. 2. Damped sine wave with 7 cycles between amplitude level of 100% and 37%.

sistors in the test, if you want to get really good accuracy. Square-wave tests of AC resistance provide measurements which compare favorably with those obtained on expensive laboratory equipment. Let us see how a square-wave test works on an RF coil from an ordinary broadcast radio receiver.

The resistance of the coil was first measured on an ohmmeter at 4 ohms; a Wheatstone bridge gave a reading of 4.1 ohms. This, of course, is the DC resistance of the coil. On a square-wave test, the waveform decayed to 37% in eight cycles. It required 180 ohms to make the waveform decay twice as fast. Accordingly, the square-wave test indicated an AC resistance of 180 ohms. Note that this is about 44 times greater than the DC resistance. Next, the AC resistance was measured on an expensive lab-type bridge, at the ringing frequency of 3.1 MHz. The bridge reading was 161 ohms, which is within acceptable experimental error.

We must recognize that although a coil has only one value of DC resistance, it has many values of AC resistance. The AC resistance depends upon frequency, in an unpredictable manner. Hence, AC resistance must always be measured at the frequency of interest in the application. For example, if you want to measure the AC resistance of the coil at a lower frequency, a variable capacitor must be connected across the scope terminals in Fig. 1. Tune the capacitor to get a 1-MHz ringing frequency. Then, insert resistance as in Fig. 3. to make the waveform decay twice as fast. The AC resistance at 1 MHz will be less than at 3.1 MHz, but we cannot say how much less until it

is measured.

Determining Q and Inductance

The ringing waveform in Fig. 2 gives the Q of the coil. In this case, the Q value indicated is approximately 22; $Q' = n\pi$, where n is the number of peaks from 100% to 37% amplitude. When we measure the Q and the AC resistance, we can easily calculate the inductance of the coil, because

$$Q = \frac{X_L}{R}$$

where X_L is the inductive reactance of the coil, and R is the AC resistance. X_L is equal to $2\pi fL$, where f is the ringing frequency.

Here is a practical example: The Q of a coil measured 20.4 in a square-wave test, and its AC resistance measured 175 ohms in the test setup of Fig. 3. The ringing frequency measured 3.1 MHz. It follows from the previous discussion that

$$L = \frac{nR}{2f}$$

Accordingly, the inductance of this coil was calculated to be 183 microhenrys—

$$\frac{6.5 \times 175}{2 \times 3.1 \times 10^6} = 183 \text{ microhenrys,}$$

approximately. To check the square-wave test, the coil was placed on a lab-type impedance bridge, which read 189 microhenrys. Accordingly, the accuracy of the square-wave test was better than 4%.

Special Considerations

Since the cost of lab-type impedance bridges is prohibitive for shop work, the good accuracy which can be obtained with square-wave tests

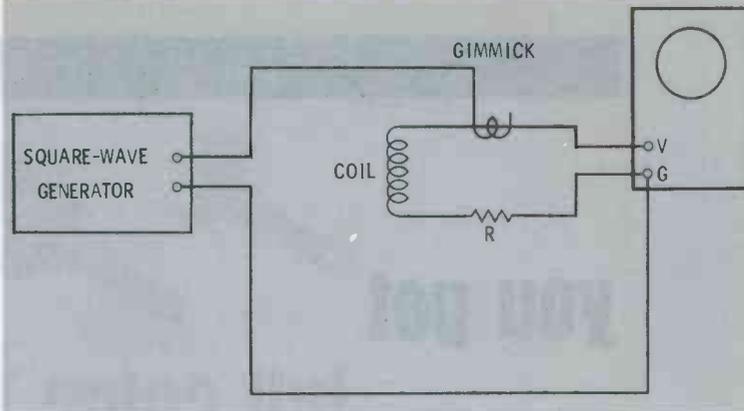


Fig. 3. Test setup with arbitrary resistance connected in series with coil.

makes the method very attractive. One precaution to observe when making square-wave measurements is to use a scope graticule which has closely-ruled divisions, so that waveform voltages can be read accurately. Keep your observation point the same when reading the 100% and 37% values, to avoid parallax error. (This is the same principle as using a meter with a mirrored scale to avoid parallax error). It is also important to rotate the scope graticule so that the horizontal center line runs exactly through the CRT trace when no signal is applied. Finally, be sure that the ringing pattern is exactly centered on the horizontal center line of the graticule. This will be the case if the CRT trace and the graticule center line coincide when the signal is removed. With a triggered-sweep scope, you can measure the ringing frequency directly, of course. Best accuracy is obtained by counting about ten centimeter squares on the graticule, and observing how many cycles occupy the ten intervals. If you try to measure just one cycle, there is likely to be an appreciable observational or experimental error.

Conclusion

Careful application of the foregoing techniques will enable the technician to determine the AC resistance, Q, and inductance of a coil without the added expense of a lab-type bridge. The results obtained with scope and square-wave generator may not be as accurate as those obtained with an expensive bridge; however, they are within the tolerance demanded by most shop measurements of reactive components. ▲

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BOOK REVIEW

Transistors: Principles and Applications: R. G. Hibbard; Hart Publishing Company, Inc., New York, 1965; 304 pages, 5½" × 8"; cloth, \$5.95, paperback, \$2.45.

This book outlines the history of semiconductor development, explains the fundamental principles of the operation, details the manufacturing process, and outlines the application of semiconductors in practical circuits, with emphasis on design considerations. Such semiconductor devices as germanium and silicon transistors, several types of diodes, and silicon controlled rectifiers are explained, and the words planar, zener, thyristor, and tunnel take on real meaning.

The limitations of each type of semiconductor with respect to frequency, temperature, current, and voltage are carefully delineated. Special consideration is given to these limitations in practical applications in oscillators, amplifiers, switches, and power supplies.

Concluding chapters discuss integrated circuits, solid-state components, and recent developments, including the semiconductor microphone and its unresolved problems.

A good working knowledge of vacuum-tube circuits is required for a full appreciation of this volume. The use of mathematics is limited to advanced algebra. In conjunction with manufacturer's semiconductor specifications, the book could be used as a design handbook. ▲

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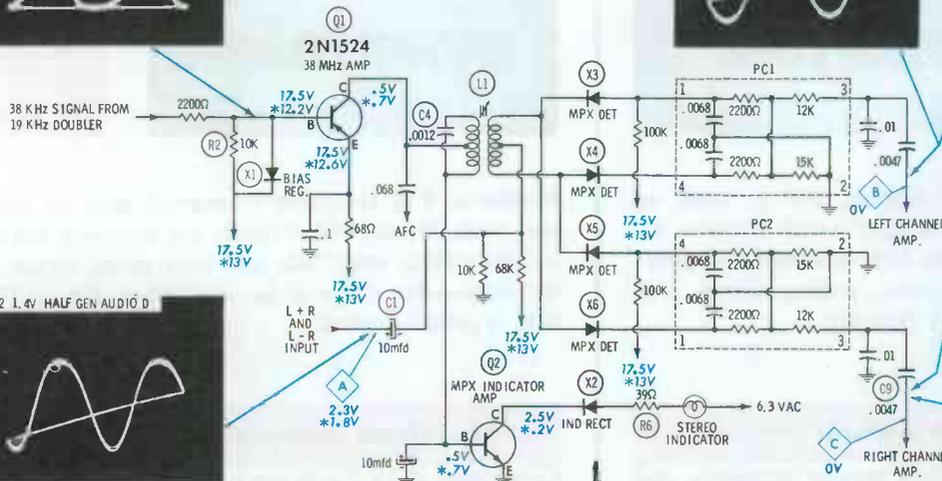
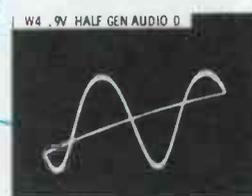
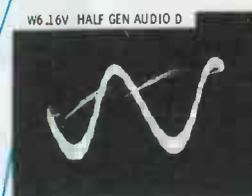
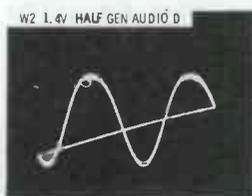
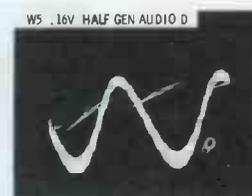
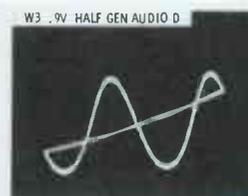
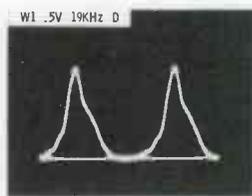
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Envelope Detection



DC VOLTAGES taken with VTVM; receiver off station. *Indicates voltage taken with signal from stereo generator present — see "Operating Variations."

WAVEFORMS taken with wideband scope, receiver controls set to produce normal stereo FM sound. D (direct) probe used for testing where indicated.

Normal Operation

Stereo FM audio is recovered by three basic methods —electronic switching, matrixing, and envelope. This circuit utilizes the envelope method. Stages ahead of detector circuit have divided opposite stereo FM signal into two portions; 19-kHz pilot signal (which is then doubled) and audio information (L + R and both sidebands of L - R). Doubler output consists of pulses at 38-kHz rate (W1). Q1 amplifies pulses, and since output of Q1 is tuned to 38kHz, waveform at collector of Q1 is 38-kHz sine wave. Conduction of Q1 changes bias of Q2, causing it to conduct, which in turn, causes stereo indicator to light. 38-kHz sine wave is induced into L1 secondary with 180° phase difference between ends of coil. Audio information is connected to center tap. Result is 38-kHz carrier signal plus L + R and both positive and negative going L - R signals at junction of X3 and X6. X3 is biased so that it conducts on positive going L - R signal (along with positive half cycle of carrier) and when combined with L + R signal, produces only "L" signal (L - R + L + R = 2L). X6 conducts only on negative going L - R and carrier signal; adding this to L + R results in -(L - R) + L + R = 2R. 38-kHz carrier is still present in output of X3 and X6 and, while not audible itself, may develop unwanted beat frequencies. X4 conducts directly opposite from X3—low-frequency audio signal is dropped across 2200-ohm and 15-K resistors, but higher 38-kHz signals are coupled through capacitors to X3 output and cancel each other. Action is similar in right channel.

Operating Variations

- Q1** Emitter, base, and collector all show expected change when W1 (from stereo generator or stereo FM station) is applied to base. Base goes from B+ potential to 12.2 volts, emitter from B+ to 12.6 volts, and collector from .5 to .7 volt.
- Q2** Q2 base is at same DC potential as Q1 collector and varies from .5 volt with no signal to .7 volt with signal. Collector of Q2 shows approximately 6.3 volts rectified AC (2.5 volts DC) under no signal conditions and .2 volt DC when transistor is conducting.
- A** Voltage variation of about .5 volt (2.3 volts with no signal, 1.8 volts with signal) is due to drop in B+ when transistors conduct.
- WAVEFORMS** Output voltages of diodes X3, X4, X5, and X6 vary with signal and with no signal according to polarity of diode. Example: X3 output is 2.4 volts DC with no signal applied and 1.2 volts DC with signal.
- DETECTORS** Waveform amplitude varies only with generator output or station strength. 38-kHz signal from local station (W1) is about same amplitude as generator signal. W3 and W4, with station signal, are approximately 75% of generator signal. Good separation is maintained on weak station when W1, W2, W3, and W4 are only about 50% of p-p voltages shown on schematic.

FM Weak

No Stereo Separation

Symptom 1

Both Stereo and Monaural
C1 Decreased In Value

(Coupling Capacitor—19mfd)

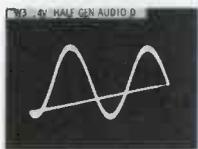
Symptom Analysis



AM and phono operation is normal. FM is weak on normally strong stations—normally weak stations almost lost. Stereo FM same as FM, separation is poor. Stereo indicator lights on stereo station signal. All symptoms point to stereo FM circuitry.

Waveform Analysis

W1 shows proper amplitude and content. Although not shown, normal waveform at Q1 collector (9 volts p-p sine wave) confirms part of detector circuitry is operating. Q1 conduction is necessary to light stereo indicator. W3 (shown) and W6 (not shown), with only left channel input, indicate low output and little separation. W2 low in amplitude (.5 volt) p-p normally 1.4 volts p-p) and 19-kHz signal dominates overall signal.



Voltage and Component Analysis

All voltages normal. Generator uses same audio frequency (180 degrees phase difference) to modulate both channels. W2 is sine wave at audio rate riding on 19-kHz carrier. (Some generators modulate each channel at different frequency, making waveform at point A more complex). Decrease in C1 to .1 mfd reduces audio information available to stereo FM detector. Monaural FM is also affected since FM audio signal is fed through stereo FM circuitry. Open C1 would cause complete loss of FM signal.

Best Bet: Scope solves problem.

Symptom 2

Mono FM Normal

C4 Decreased In Value

(Tuned Circuit Capacitor—.0012 mfd)

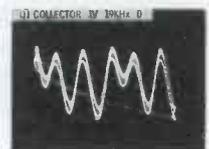
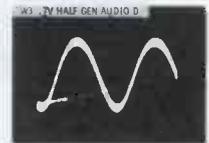
Symptom Analysis



Monaural FM reception is normal both in amplitude and tone. Stereo FM stations are received normally—no distortion, amplitude and tone good, stereo indicator lights—but there is no separation. Stereo FM section is prime suspect.

Waveform Analysis

Comparing W3 (.7 volt p-p) with W6 (.7 volt p-p), indicates there is no separation of channels since both outputs have the same amplitude with only left input signal applied. Although not shown, W4 and W5 also indicate same problem. W1 (not shown) is normal with 38-kHz pulses at an amplitude of .5 volts p-p. However, waveform at collector of Q1 is not true sine wave and amplitude is only about 1 volt p-p compared to normal 9 volts.



Voltage and Component Analysis

All Q1 element voltages measure near normal. With normal element voltages and signal voltage applied to collector of Q1, stereo indicator lights even though output at points B and C is not stereo. C4 and primary of L1 form tuned circuit that is resonant at 38 kHz. Normally amplified 38-kHz pulses from Q1 produce necessary high amplitude (compared to audio signal) sine wave that is induced into L1 secondary for proper demodulation. Decrease of C4 detunes circuit resulting in loss of 38-kHz sine wave and separation.

Best Bet: Careful scope work will locate.

Left channel weak

Symptom 3

Poor Separation

X3 Open

(MPX Detector Diode)

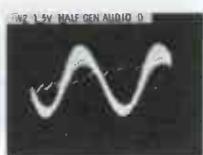
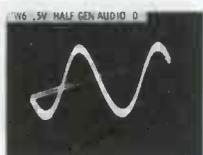
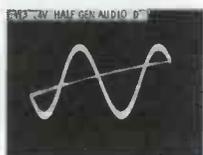
Symptom Analysis



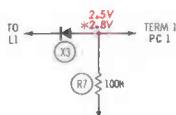
Left channel weak on stereo FM signal compared to right channel and has excessive noise (popping, cracking, etc.) and background "rush" noise. Separation poor. Monaural FM, AM, and stereo phono functions seem normal. Trouble suspected in stereo FM circuitry.

Waveform Analysis

Waveforms at points B and C indicate trouble is in MPX circuitry. With left signal only input, W3 is .4 volt p-p compared to normal .9 volt p-p. W6 measures .5 volt p-p (normally .16 volt p-p). Both waveforms indicate that excessive 38-kHz signal is reaching output points. W4 and W5 (not shown) are of near normal amplitude and content. Normal amplitude and content of W2 shows proper audio signal available to detector.



Voltage and Component Analysis



Best voltage clue is X3 output—2.5 volts without signal, 2.8 volts with signal. Polarity of diode dictates that negative voltage appear at output when signal is applied and, combined with positive bias voltage, should make reading less positive. However, with X3 open, positive going L-R is not recovered—only L+R signal is coupled through X4 to left output. 38-kHz signal is not filtered out, causing noise since cancelling action is lost with open diode. Open X6 would cause similar symptoms in right channel.

Best Bet: VTVM and careful circuit analysis.

No Stereo FM Separation

Stereo Indicator Does Not Light

X1 Shorted

(Bias Regulator Diode)

Symptom 4

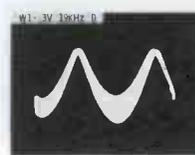
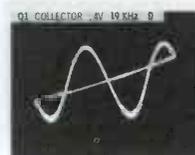
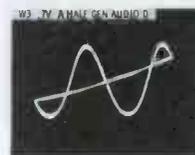
Symptom Analysis



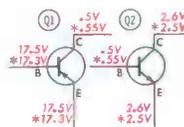
All functions of tuner/amplifier operate normally except stereo FM. There is little or no separation and indicator does not light on stereo FM station. Station trouble might be suspected, but MPX generator shows same problem. Stereo FM circuitry must be at fault.

Waveform Analysis

Comparing W3 and W6 (with left only input) confirms symptom analysis. W3 is near normal (.9 volt p-p) but W6 shows nearly same amplitude as W3 (not shown) instead of normal .16 volt p-p. Conclusion: no separation. Waveform at collector of Q1 shows reason—amplitude low (.4 volt p-p, normally 9 volts p-p). Waveform W1 slightly low in amplitude (.3 volt p-p, normally .5 volt p-p) and excessive audio in content.



Voltage and Component Analysis



Element voltages of both Q1 and Q2 show almost no change when signal is applied. Indicates Q1 is not conducting and confirms waveform analysis. X1, by being connected across R2, acts as a limiter to 38-kHz input pulses. X1 also filters out unwanted audio information of composite signal at this point. Shorted X1 maintains base at nearly same potential as emitter, nearly cutting off transistor. Since Q1 does not conduct, Q2 is also cutoff, and stereo indicator will not light when stereo FM station is being received.

Best Bet: Scope to isolate; VTVM to pinpoint.

Stereo Indicator Lights On All Functions

Symptom 5

Stereo Reception Normal

Q2 Shorted

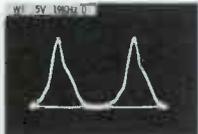
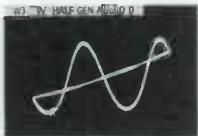
(MPX Indicator Amp)

Symptom Analysis



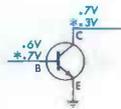
Stereo indicator remains lit with function selector in any position. All functions operate normally—stereo FM has good separation and normal amplitude and tone. Trouble is evidently in switching circuitry which turns indicator on and off with stereo signal.

Waveform Analysis



Left and right stereo FM outputs, W3 and W6, with left only signal input show normal amplitude. W4 and W5 show normal amplitude with right only input. This proves separation and other waveforms must be normal since 38-kHz pilot, $L + R$, and both sidebands of $L - R$ are necessary for proper separation. W1 shows normal amplitude and content. Only conclusion drawn is that stereo FM is operating properly.

Voltage and Component Analysis



Q2 collector voltage is clue—near normal with signal voltage (.3 volt, normally .2 volt), but without signal, voltage remains low (.7 volt, normally 2.5 volts). Normally, 38-kHz signal causes Q1 to conduct, increasing collector and base voltage of Q2. Q2 conducts from collector to emitter, effectively putting collector at ground potential. Since one end of indicator is connected to 6.3 volts AC and other end through R6 to Q2 collector, indicator lights. Leakage simulates Q2 conduction and light is on all the time.

Best Bet: VTVM will locate.

Right Channel Dead

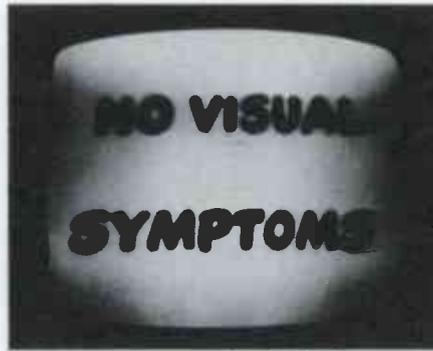
On FM Only

C9 Open

(Coupling Capacitor—.0047 mfd)

Symptom 6

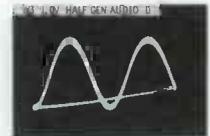
Symptom Analysis



Right audio channel is dead—no output whatsoever from speakers in either FM or FM stereo positions. Tuner/amplifier operates normally on AM broadcasts and phono-tape positions. Symptoms indicate trouble in stereo FM or switching circuitry.

Waveform Analysis

Waveforms at point B, are of proper amplitude and content—W3, with left only input reads 1.0 volt p-p and W5, with right only input, reads .2 volt p-p. Only waveform at point C (W4 or W6), right channel output, shows a small amount of radiated 38-kHz signal. Conclusion: Stereo FM detector is probably operating since both left and right information is present at point B; however, that signal is lost after detection.



Voltage and Component Analysis

All voltages are normal with and without signal, offering no clues. Note that careful symptom analysis has isolated trouble to multiplex or switch circuitry. Since monaural FM, as well as stereo FM is fed through multiplex circuitry in this unit, a completely open detector circuit not only stops one channel of stereo FM but also results in loss of monaural signal at input to AF amplifier. An open PC component or broken PC board could cause similar symptom. Circuit tracking with scope will locate problem.

Best Bet: Scope with careful symptom analysis.

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AMPHENOL

Circle 13 on literature card



Notes on Test Equipment

analysis of test instruments... operation... applications

by T. T. Jones

Portable VOM

Right on the heels of their fine model 1700 VTVM Mercury Electronics Corp. has released the Model 1800 VOM. This instrument follows their pattern; a lightweight, accurate, easy-to-use instrument at a low cost.

The lowest current range feeds directly to the movement, and the scale reads in 1 microamp increments on this range.

The DC voltage ranges start at a low 250 millivolts full scale. On this range the lowest increment is 5 millivolts. There is also a 1-volt DC range, and from then on the AC and DC ranges are identical

from 2.5 volts to 5KV full scale. Sensitivity is 20 K-ohms/volt on DC, and 5 K-ohms/volt on AC.

The ohms ranges are the usual $R \times 1$, $\times 100$, $\times 10K$, with 2K ohms full scale, giving a maximum reading of 20 megohms. Center scale is about 13.

There is a decibel scale thrown in for good measure, and it reads from -20 to $+50$ dBm.

As always, we measured the performance of the instrument against the published specifications, and the model 1800 did better than specs in all ranges. The AC performance was flat within $\pm 1/2$ dB from 10Hz to 110kHz, with reference of 2 volts at 500 Hz. The dB scales were used to correlate this.

The DC scales performed well within their claimed accuracy of

2%. We did not measure performance on the 5KV ranges, but the multiplier resistors on those ranges are 5% tolerance. All other resistors are 1%.

The instrument is housed in a grey high-impact plastic case with vinyl carrying strap, and weighs only 2 1/4 pounds. The meter is electrically damped when the function switch is in the off position. This adds up to a meter that should travel well in the truck, and perform well when it gets to the job.

For further information circle 45 on literature card

In-Circuit Transistor Tester

Fig. 2 is a somewhat deceiving picture of SENCORE's new TR139 transistor tester. When we ordered this unit we expected a meter about the usual VTVM size. We were somewhat surprised to unpack a unit half again as large as expected.

When we started to put the unit through its paces, we got some more surprises. This tester virtually ignores circuit loading of the transistor under test. Only with resistances under 50 ohms can we even detect a difference in beta readings, and the readings are still useful with loadings of 15 ohms.

The beta test circuit, shown in Fig. 3, is quite simple. The output voltage of T2 is controlled by the Beta CAL control. The zeners, CR1 & CR2, limit the input voltage to T2, to insure that the transistor under test will not have excessive voltage applied, regardless

Mercury Model 1800 VOM

Specifications

AC Volts:

0—2.5, 10, 50, 250, 1000, 5000
Volts RMS. 5000 ohms/volt, 10
Hz—100 kHz, 4% accuracy.

DC Volts:

0—.25, 1, 2.5, 10, 50, 250,
1000, 5000 volts. 20000 ohms/
volt, 2% accuracy.

DC Current:

0—50 μ a, 1, 10, 100, 500 ma,
10 amp. 2% accuracy.

Resistance:

4—2K, 200 K, 20 Meg ohms.

Decibels:

—20— +50 dBm.

Size (HWD):

7 1/2" x 6 1/2" x 4 1/4" overall.

Weight

2 1/4 pounds.

Price:

\$34.95.



Fig. 1. New VOM is a lightweight.

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MODEL #65-2 \$39⁹⁵ list

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- One 300 ohm input - 4 300 ohm outputs • Silicone diode rectifier for dependability • Flat response - $\pm 1/4$ db per 6 mc channel • Ventilated perforated steel cabinet $6\frac{1}{8} \times 3\frac{3}{8} \times 3\frac{3}{8}$ " • Metal enclosed to eliminate shock hazard - easy access for servicing
- Easy mounting and connecting • All fittings & brackets supplied • UL listed AC cord - 117 volts, 60 cycles • 100% test for all electrical characteristics

FINCO MODEL #65-2 \$39.95 list

Outstanding Features:

- 400,000 microvolts maximum input with +6dB to each output • 200,000 microvolt input - 1 volt output per band • Low noise 6HA5 premium tubes • One 75 ohm input - 4 75 ohm outputs • Most compatible "F" type input and output fixtures • Ultra-flat frequency response and complete RF isolation • Ventilated perforated steel cabinet $6\frac{1}{8} \times 3\frac{3}{8} \times 3\frac{3}{8}$ " • Metal enclosed to eliminate shock hazard - easy access for servicing • Easy mounting and connecting
- All fittings & brackets supplied • UL listed AC cord - 117 volts, 60 cycles • 100% test for all electrical characteristics



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Circle 14 on literature card

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Professional quality Xcelite nutdrivers have color coded, shockproof, breakproof, plastic (UL) handles; precision fit, case-hardened sockets.

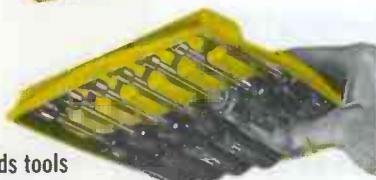
Hangs up



Stands up



Holds tools securely



No. 127TB "Tray Bien" set — 7 solid shaft nutdrivers (3/16" thru 3/8" hex openings)

No. 137TB "Tray Bien" set — 5 solid shaft nutdrivers (3/16" thru 3/8" hex openings) and 2 hollow shaft nutdrivers (1/2" and 9/16" hex openings)

No. 147TB "Tray Bien" set — 7 hollow shaft nutdrivers (1/4" thru 1/2" hex openings)

WRITE FOR BULLETIN N666



XCELITE, INC., 18 Bank St., Orchard Park, N. Y. 14127

Circle 15 on literature card

52 PF REPORTER/December, 1966



Fig. 2. Makes fast beta checks.

of line voltage. They also act as a line voltage regulator.

The output of T2 is adjustable to a maximum of about 1.25 VAC. This voltage is then applied to the transistor under test through R7 and R8. M1 reads the voltage across R8, in series with the collector. It is set to full scale by the Beta CAL control; this reading equals 2 ma collector current.

When the Beta TEST button is pushed, the meter is transferred to the base circuit, and base current is read. The meter is calibrated directly in beta. Since the test is for AC beta (h_{fe}) rather than DC beta (h_{FE}), the test is made under dynamic conditions more nearly simulating actual operating conditions of the transistor under test.

Not shown in Fig. 3 are the switching circuits for NPN-PNP,

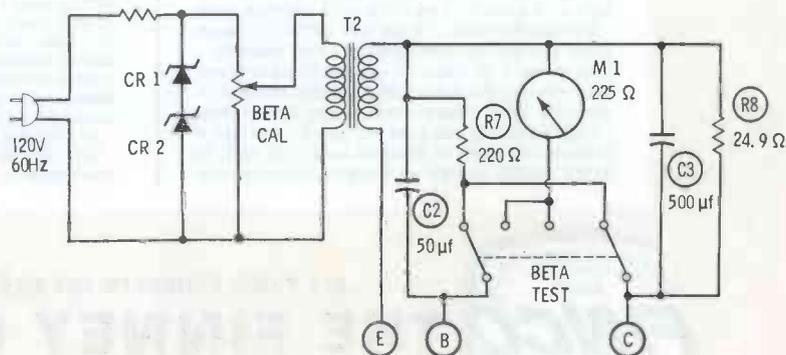


Fig. 3. Simplified schematic of the beta tester.

Sencore TR 139

Specifications

TRANSISTOR TESTS

Beta:

LO 2-100, H1 10-500. Accuracy: $\pm 5\%$ out of circuit, slightly less in-circuit.

Leakage:

I_{CBO} 0-5000 microamps.

DIODE TESTS

In-Circuit:

Shorts and opens tests, providing not less than 20 ohms parallel device under test.

Out-of-Circuit:

Forward current, reverse current.

Power Requirements:

117 VAC, 60 Hz, 2.5 watts.

Size (HWD):

9 1/2" x 7 1/2" x 6".

Weight:

7 pounds.

Price

\$89.50.

the beta range switch (2-100, 10-500), or the leakage tests. The leakage test uses a separate power supply which produces about 4 volts DC. With a diode and resistor compression network, the basic 200-ma meter is made to read 5 ma full scale, while retaining a 100- μ a center scale. The leakage tester can be used for testing solid-state diodes.

Included with the TR139 is a detailed operator's manual, with many application tips. Also included is a copy of the Howard W. Sams Transistor Specifications Manual HTA-1. ▲

For further information circle 46 on literature card

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(Continued from page 36)

commonly neglected parts of the system. Check all connectors for shorts, broken pins, and broken or deteriorated cables. Check the antenna- and plate-tuning clips on the tank coils for tightness. Check the power source for correct voltages *under load*.

Table 1. Steps For Tuning Final Stage

1. Tune all preceding stages for *maximum* drive to the power amplifier, indicated by maximum grid (or base) current.
2. Dip the plate (or collector) tank trimmer for *minimum* current in the cathode (or emitter) circuit, with antenna disconnected.
3. Connect antenna and check input power. If too high, reduce antenna loading (coupling). If too low, increase loading a *little at a time*, dipping plate tank each time loading is changed.

Connect an RF ammeter in series with the antenna to see if the antenna is loaded to the recommended value. It may be necessary to reset the loading clips. Use a milliammeter in the plate circuit to dip the plate current. The chart of Table 1 shows how.

Recheck the frequency and modulation on each channel. Make the appropriate entries in the station log (see Table 2 and Fig. 3). Make sure the ship license is current and is posted. If these steps are followed, the boat owner—now your regular customer—should have a summer of trouble-free and reliable communications. ▲

Table 2. Information To Be Entered in Log

1. Nature of repairs and adjustments made, in shop and on board.
2. Measured frequency of each channel.
3. Power input (in watts) on each channel.
4. Date of final check.
5. Type and serial numbers of measuring equipment used.
6. Technician's name.
7. Technician's license number and date of license expiration.

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Effective Communication

(Continued from page 19)

according to the dictionary, stands for Agricultural Adjustment Act and for American Automobile Association. As far as the reader may be concerned, it might stand for Advocates of the Abolition of Anonymity.

According to Webster's Dictionary, PA stands for "particular average," "passenger agent," "power amplifier," "power of attorney," "press agent," "private account," "prothonotary apostolic," "public address," and "purchasing agent."

The moral is clear. If the writer uses abbreviations, he must first identify them by using the full name, title, or term. The reader is not interested in guessing names. He reads for information. And the writer is not at liberty to coin unapproved abbreviations.

People these days do not like to read unnecessary words. Every one rushes—from eating instant breakfasts to reading condensed novels.

Therefore, the communicator must find concise, exact expression. Why say "according to the law," if "legally" will do? Why write or speak "each and every" when "each" or "every" suffices? Perhaps an individual might ease his conscience by saying "financially embarrassed," but he means "penniless"—or "broke." Many times, budding authors write "due to the fact that" when they mean "because."

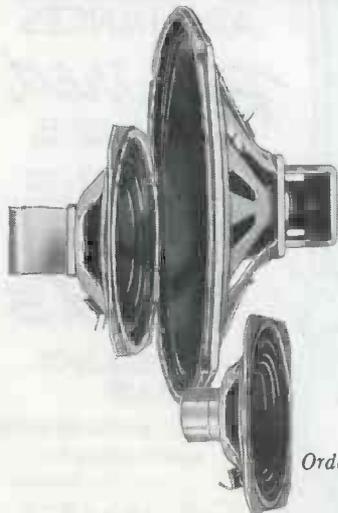
It is not an overnight job to build one's vocabulary and gain an adequate knowledge of the rules of grammar. But regardless of the difficulty involved in building vocabulary and learning rules in order to write and speak lucid, interesting, informative prose, the transmission of ideas is essential to our very way of life. In any field, vocation, or profession, without the continuous interchange of knowledge and experience there can be only stagnation and decay.

The task of learning to communicate well is far from impossible.

Any intelligent worker, technician, engineer, or other professional man can make his ideas profitable by arming himself with a good dictionary, Roget's **Thesaurus**, and a good style manual or stylebook. Words, definitions, rules of grammar, abbreviations, and a wealth of other information are available in a dictionary. A **Thesaurus** contains thousands of synonyms and antonyms to build vocabulary and sharpen expression. A good style manual (like **Writer's and Editor's Stylebook**) provides rules, examples of correct and incorrect usage, and much other information on correct style. The careful reading and study of good books and magazines offers vast opportunity to examine examples of effective communication.

Any normal human mind in any job or profession manufactures ideas. These ideas are valuable, necessary — and often financially profitable—only if they are simply, clearly, and honestly expressed for acceptance by other minds. ▲

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The Troubleshooter

answers your servicing problems

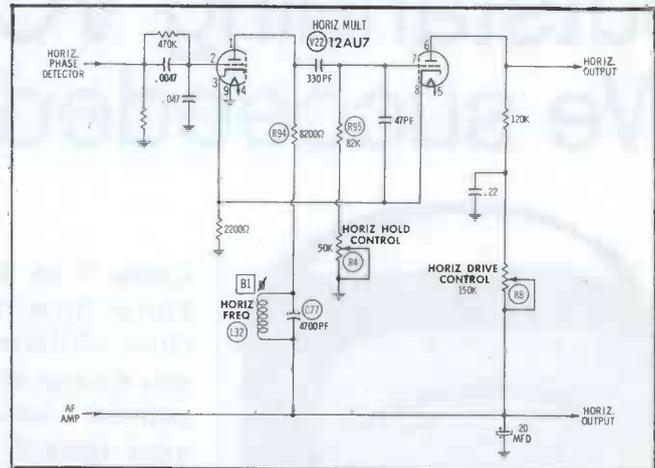
Intermittent Horizontal Sync

I am having horizontal sync trouble with a Radio Craftsman Model RC-101 (PHOTOFACT Folder 142-10). When the set is first turned on, the picture does not lock in horizontally. Adjusting the ringing coil clears up the trouble until the set has operated for about an hour. Then the picture falls out of sync again and the ringing coil must be adjusted once again. Thereafter, the ringing coil must be adjusted at varying intervals to maintain horizontal sync. The horizontal oscillator seems to be operating above and below the normal frequency of 15,750 hertz. What do you think is the cause of the trouble and what is the best troubleshooting procedure for uncovering it.

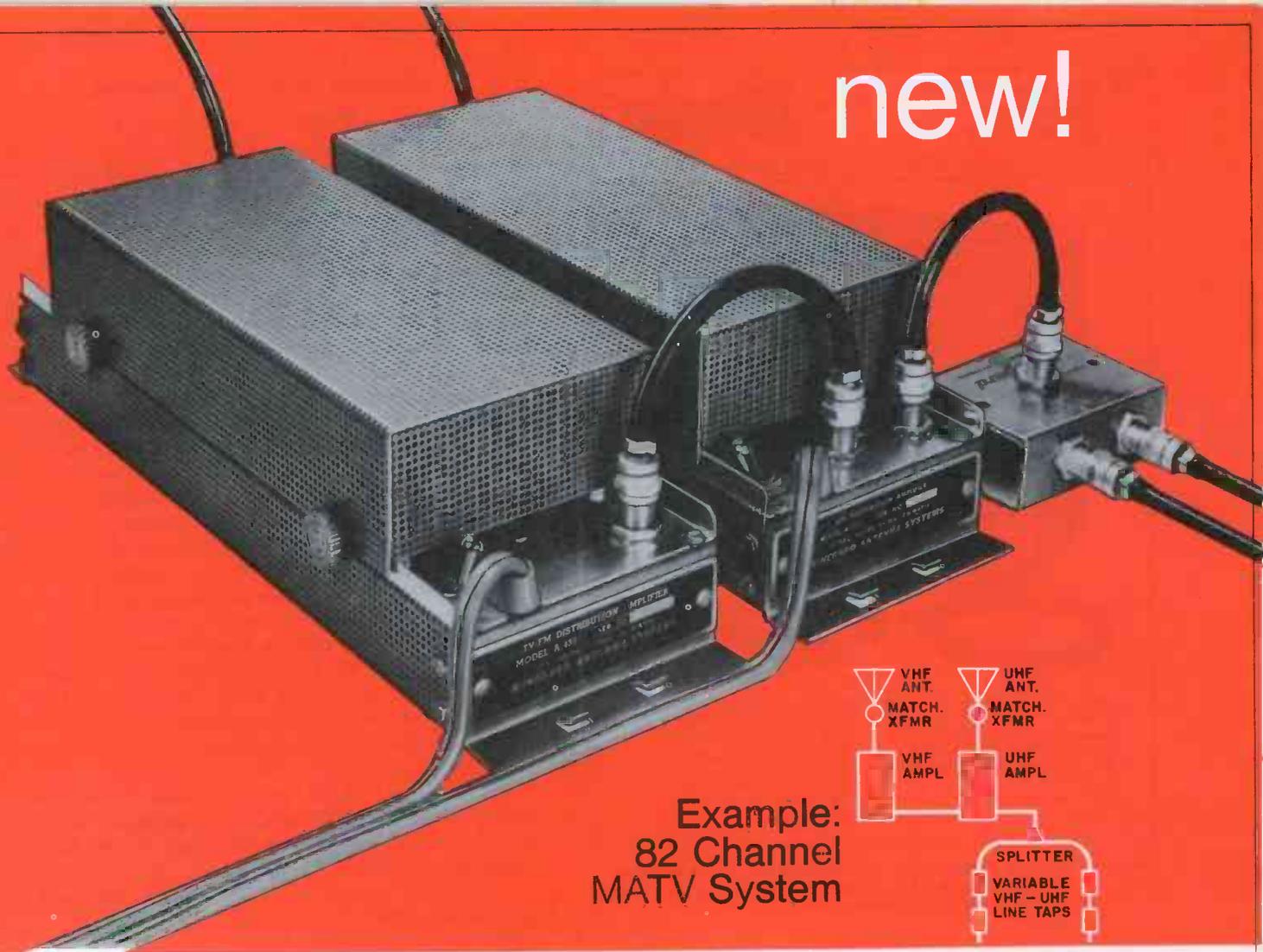
J. F. DALY

New York, N.Y.

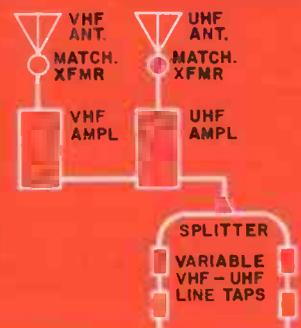
The trouble in this case is undoubtedly caused by thermal drift of one of the frequency determining components in the horizontal oscillator. R4, R95, C77, and R94 are likely candidates. Since there are so many other



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Circle 22 on literature card

Reduced Raster and Shading

The trouble symptoms in a Dumont Model RA-500 (PHOTOFACT SERVICER in PHOTOFACT Folder 514) have me puzzled. After the low- and high-voltage rectifiers and other weak tubes were replaced, the set operated perfectly for about four hours. Then, the vertical raster decreased at the bottom and retrace lines appeared. Also, the lower left corner of the raster darkened. The sound remained normal. Waveform checks reveal that the video and sync circuits are contaminated with horizontal spikes. As an example, the vertical-output waveform scoped at the bottom of the vertical-output transformer has "grass" at the horizontal frequency riding on top of the waveform. The horizontal oscillator and amplifier waveforms are normal, but reduced in amplitude by 30 to 40 percent. The horizontal-output grid voltage measures -30V, B+ measures 280 volts, and boost measures 450 volts.

Removing the horizontal phase detector, sync clipper, video amplifier, and vertical-output tubes does not affect the "grass" on the vertical-output waveform. However, when both vertical yoke leads are disconnected the "grass" disappears. I have replaced the yoke, vertical-output transformer and flyback, but the trouble persists. In addition I have substituted the horizontal-output, high-voltage, and damper tubes, as well as every capacitor and coil in the horizontal and vertical sweep sections, with the exception of the vertical integrator. I have also substituted the picture tube.

The dark area at the low left corner of the raster is getting larger. Do you have any suggestions that might shed some light on the possible cause of the symptoms I have described?

R. L. WOODHOUSE

Indianapolis, Ind.

Resorting to the scope was a wise move in this situation. Now that you have uncovered the probable cause of the trouble—contamination of the vertical sweep circuit by horizontal pulses—all that remains is to trace the interfering signal back to its source and point of entry into the vertical section. Check all the possible coupling points between the horizontal and vertical circuits, paying particular attention to decoupling capacitors. The purpose of a decoupling capacitor in any circuit common to both horizontal and vertical sweep is to shunt or bypass the horizontal pulses to ground, thereby keeping them out of the vertical circuit. One possible source of trouble is the boost line that supplies B+ boost to the vertical output tube. An open decoupling capacitor anywhere along this circuit could allow horizontal pulse contamination of the vertical circuit. Note that the horizontal size and brightness controls are in series and that the screen circuit of the horizontal output tube supplies B+ to the brightness control circuit. Also, note that a DC path exists between the screen of the horizontal-output tube, the brightness control circuit (cathode of CRT), and the cathode of the video amplifier. A defective decoupling capacitor in this circuit would allow horizontal pulse contamination of the video, CRT, and vertical sweep circuits, either directly or indirectly. Another possible source of trouble in a situation such as you describe is poor lead dress, particularly in the yoke circuit.

Width Reduced

The trouble symptom in a General Electric Model M940XMD (PHOTOFACT Folder 678-1) is reduced width

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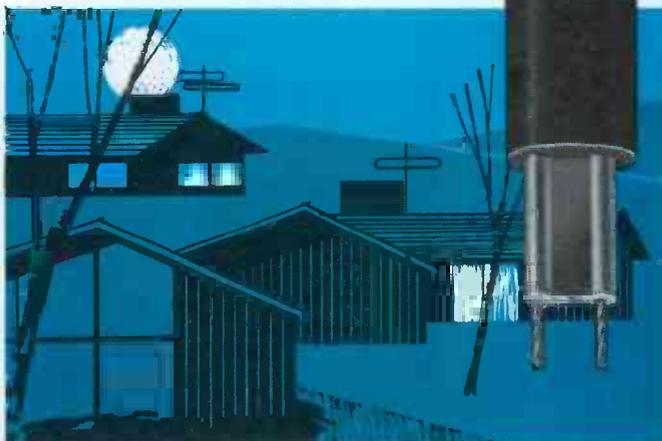
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†Patent No. 3,032,604

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Circle 24 on literature card

December, 1966/PF REPORTER 61

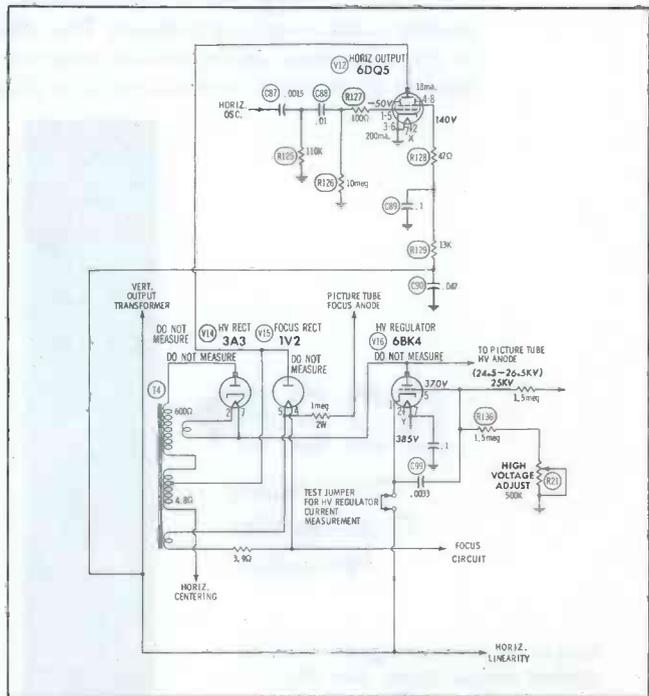
—right side drawn in about 1" and leftside about 1/4". The right side seems to breathe in and out. The horizontal-output tube screen voltage reads 100 volts (normally 140). I have replaced the high-voltage rectifier, horizontal oscillator, high-voltage regulator, and horizontal-output tubes. I have also replaced C89, C90, R129, and R128 without any noticeable effect on the narrowed raster. What could possibly be the trouble?

C. L. WILDE

Pinon, N. M.

Before attempting further component substitution, be sure the horizontal oscillator is providing sufficient drive to the horizontal-output tube and the high voltage is properly adjusted. Check the voltage and waveform at the grid of the horizontal-output tube. If the voltage or waveform is not close to that prescribed on the PHOTOFAC schematic, a check of the grid circuit is indicated—a leaky C87 or C88, or a change in value of R126 or R127 are possible defects. A quick check of the high-voltage adjustment can be made by connecting a 1.5 to 2 ma current meter in series with the high-voltage regulator cathode and monitoring the regulator current as the brightness control is varied. If the regulator current does not decrease as the brightness control is advanced, the high voltage is not adjusted properly or a defect exists within the regulator circuits. Perform a horizontal sweep circuit adjustment as outlined on page 7 of the PHOTOFAC folder. If the trouble symptoms persist or if the horizontal sweep circuits cannot be adjusted properly, check C99 for leakage or R136 for a change in value. Other components could be defective; however, these are the

most likely candidates. It should also be noted here that a circuit change has been issued for this model to correct a narrow width problem inherent in this particular chassis. This modification calls for the addition of a 33 pf (6000V) capacitor between pin 1 and pin 3 of the yoke socket.



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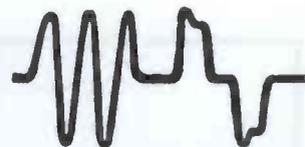


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Choosing electrolytic capacitors for color TV



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Color TV is tough on electrolytics. Ambient temperatures run hotter, because of the greater number of tubes and resistors inside crowded cabinets. Ripple currents are higher, so the capacitor has to do a better job of getting rid of internally generated heat. Voltage ratings are higher, too; most electrolytics in color TV are 400 volts or higher.

It's no surprise that leading color TV makers are pretty darn particular about the electrolytics that they use as original equipment. They demand a true high-voltage, high-temperature, high ripple capacitor... not one that's simply made to sell at bottom price. And meeting these demands is the way Mallory got to be the top supplier of electrolytics for color TV. We're the guys who pioneered the 85°C capacitor, who have consistently increased ripple current capacity, and who have the reputation of leadership in high voltage ratings.

Here's our tip of the month. To save yourself time, get a copy of our new cross reference, "Exact Replacement Metal Can Electrolytic Capacitors for Color TV". It lists the original part number and the catalog number of the corresponding Mallory replacement for 38 leading color TV manufacturers. To save yourself costly call backs, use only the best... and that's one of the Mallory FP-WP series, made to original equipment specs. To get everything you need for color TV service, see your Mallory distributor. He stocks Mallory power resistors, circuit breakers, carbon and wire-wound controls and Discap® ceramic capacitors.

For a copy of the Color TV cross reference, ask your Mallory Distributor, or write to Mallory Distributor Products Company, a division of P. R. Mallory & Co. Inc., Indianapolis, Indiana 46206.

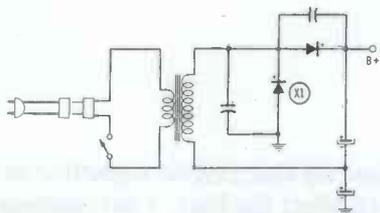
Color Countermeasures

Symptoms and Tips from Actual Shop Experience

Chassis: All Zenith chassis using silicon rectifiers.

Symptom: Low high voltage; no raster; sound normal.

Tip: Check for low B+. Check for open X1 silicon rectifier. If open, replace both rectifiers.



Chassis: All 25", 70° RCA color chassis.

Problem: Adapting 21", 70° color test jig for service of 25", 90° color chassis.

Tip: Present 21" test jigs can be converted to fire-up a 25" color chassis

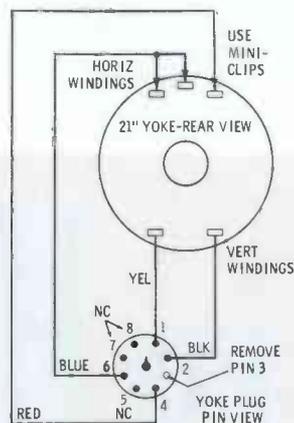
using the following procedures and adapter cables:

1. Construct a yoke extension/adapter cable as shown in Fig. 1. An old 8-pin yoke plug is suitable; be sure pin 3 is removed.
2. Use the regular 8-pin convergence extension cable (male to female) as used with the 21" jig.
3. Obtain a color kine socket adapter/extension from your local parts distributor (RCA Stock Number 13B111).

Vertical and horizontal yoke windings for the 21" and 25" picture tubes are different. For this reason, vertical linearity and size will be affected somewhat; some chassis may have slight vertical foldover at the top of the picture. Horizontal ringing will be exhibited at the left side and width may be reduced a small amount.

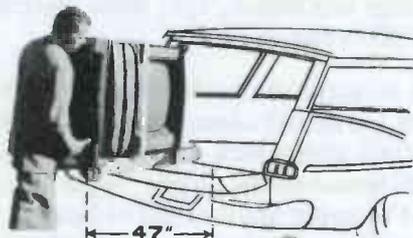
However, the distortion isn't large enough to disturb normal servicing procedures where the main concern is in the video, sound, or color cir-

cuitry. The majority of sweep circuitry problems can also be serviced once you learn what to expect on your particular jig. It's a good idea to fire-up a normally operating 25" color chassis and note how the raster is affected on the test jig. In this manner, you'll know what to expect in actual troubleshooting situations.



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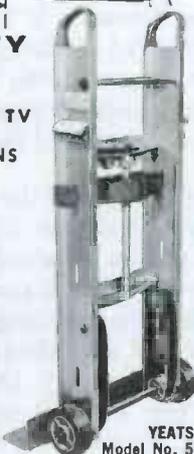
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Product Report

For further information on any of the following items, circle the associated number on the Catalog & Literature Card.



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(45)

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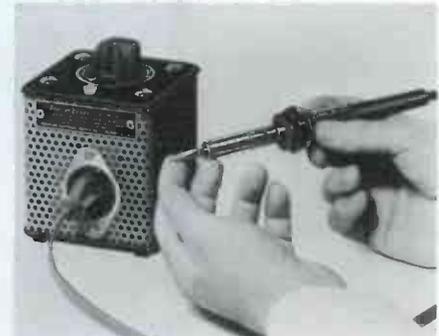
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(46)

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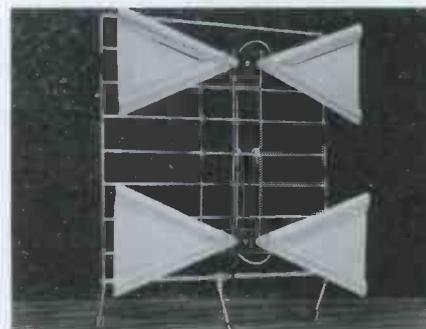


Transistor Tester
(48)

Servicing, quality control, and production line testing of complex solid-state equipment has been simplified with the announcement of a new in-circuit Transistor Tester by **Sencore**. Rather than pulling each transistor to test or substitute for it, the TR139 lets you check any transistor or diode without disconnecting a single lead.

The Sencore TR139 gives you two important readings; true AC beta, the gain factor of a transistor, and leakage current (Icbo) in microamps. In-circuit and out-of-circuit tests are identical.

A specially designed circuit protects the delicate low-current type transistor or diode from damage even if the leads are accidentally hooked up backwards. Parameters of unknown transistors are determined without a setup book or manual. Price of the tester is \$89.50.



UHF Antenna
(49)

A new UHF indoor TV antenna, de-

signed to match the "contemporary" furnishings of any living room, bedroom, family room, or den, is now being offered by Snyder Manufacturing Co.

Constructed to afford superior reception of all UHF channels, whether on color or black-and-white sets, this new antenna (Model UHF-1) may be attached to a receiver in seconds.

The space-saving slimline design of the UHF-1 measures 12½" x 15", and has a decor-matching gold tone finish. The three-legged base is equipped with protective, no-slide tips.

The Snyder UHF-1 indoor TV antenna is priced to retail for \$3.95.



Illuminated Switches
(50)

Two new illuminated long-frame switches—one a pushbutton type, the other a push-turn button type—and each designed with an extra-rugged "T-Beam" frame have been announced by Switchcraft, Inc. They are recommended for use in high quality communication equipment and telephone apparatus.

Both types are called "T-Lite" switches. The Series 3200 "T-Lite" is the momentary pushbutton type. The round, highly-visible pushbutton is ½" in diameter and frosted to diffuse the light evenly over its entire surface.

The Series 32000TL "T-Lite" has a paddle-shaped button. When simply pushed, action is momentary. When pushed and turned, locking results. The plastic button is also frosted and is designed with a black indicator line for quick indication of switch position.

The new switches feature leaf springs of special nickel silver and welded cross-bar palladium contacts rated at 3 amps. 300 watts. max., A.C., noninductive load. They may also be ordered with fine silver contacts to accommodate heavier current carrying circuits.

Models with standard contact assemblies range in price from \$6.00 to \$8.10 in small quantities.

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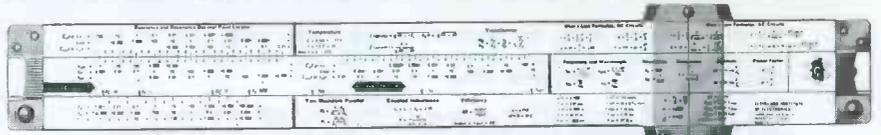
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"So easy to use! With my Sencore scope I can read high or low frequency signals without band switching. As easy to use as a voltmeter."—R. L., Portland, Ore.

"I've only had my PS127 a couple of months, but it's more than paid for itself already with the extra jobs I've been able to handle."—S. O., New Orleans, La.

"With the direct peak-to-peak readout I can compare voltage readings to those on the schematic without wasting valuable time setting up my scope with comparison voltages."—J. M. F., Plymouth, Michigan.

"Those Sencore exclusives really sold me, like the extra 500KC Horizontal Sweep range and the free high voltage probe."—D. N., Brooklyn, N.Y.

You'd expect a wide band scope of this quality to cost at least double."—W. L., Chicago, Ill.

"With the PS127, I find I can trouble-shoot those tough ones twice as fast as before—especially color TV."—F. C., Burlingame, Calif.

"Once I compared the specs, I knew Sencore had the best buy in scopes. We now have three PS127's in our shop."—J. S., Ft. Lauderdale, Fla.

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Vert. Freq. Resp. 10 CPS to 4.5 MC \pm 1 db, - 3 db @ 6.2 MC • Rise Time .055 Microseconds • Vert. Sens. .017 Volts RMS/inch • Horiz. Freq. Resp. 10 CPS to 650 KC • Horiz. Sens. .6 Volts RMS/inch • Horiz. Sweep Ranges (10% overlap) 5 to 50 CPS, 50 to 500 CPS, 500 CPS to 5 KC, 5 to 50 KC, 50 to 500 KC • Input Impedance 2.7 megohms shunted by 99 MMF, 27 megohms shunted by 9 MMF thru low-cap. jack • High Voltage Probe 5000 Volts Max. • Dimensions 12"x9"x15½", Wt. 25 lbs. • Price Complete \$199.50



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Circle 36 on literature card



Professional Pliers

(51)

A new line of precision-built professional pliers is now available from **Vaco Products Company**. The full line consists of 23 varieties that meet every trade and service need, and is available in four special assortments, each complete on a Vaco "custom plier" Vari-Board® display.

The pliers have color-coded, plastic-sleeve cushion grip handles for ease, comfort, grip control and eye appeal. Of hot drop forged alloy steel, hand finished, the pliers are individually tested, and their precision-ground jaws individually adjusted for accurate bite, strength and cutting efficiency. Like all Vaco products, the pliers are unconditionally guaranteed.



Electronic Library

(52)

IRC, Inc. has introduced a library of "How-To" electronic books. The first books in the library consist of 12 volumes for the hobbyist, experimenter, and do-it-yourselfer.

The original volumes being offered include titles such as "Diodes," "How To Read Circuit Diagrams," "Basic Electronics Math," "Learn Electronics In 5 Minutes, 37 Seconds," "The Oscilloscope," and "Practical Radio." Titled the "103 Series," the library will consist of 103 books when it is completed.

Each book lists for \$1.25.



Portable Base Station

(53)

This portable base station, designed for use with citizens band walkie-talkies, also features an AM radio. The New **General Electric** Model Y 7060 solid-state unit can receive all 23 of the citizens band channels that walkie-talkies use, and transmits voice or Morse code on Channel 14. Effective range is up to a mile, depending on conditions.

Uses of the unit include monitoring local CB activity, transmitting to other walkie-talkies either as a base station or as a walkie-talkie, serving as a wireless intercom, and as a portable or home AM radio. Features include a built-in telegraph key,

and a key jack for use with an auxiliary key. Signals are audible to the sender as well as receiver, which aids in practice. A microphone for transmitting voice and a headset for listening are also supplied with the unit. The 51" telescoping antenna used with the set provides CB performance as well as AM radio reception.

The unit operates on six "D"-size flashlight batteries and an optional a-c converter is available. Weight is five pounds and dimensions are 12.5" x 5.5" x 6". Price of the unit is \$34.95.



Rechargeable Portable Power Source

(54)

A new, portable, 12-volt recharge-

able power source, complete with built-in charger, has been introduced by **Centralab**. The CRL-1200 Power Pack is a portable source of regular, standby, or emergency electrical power. The versatile power pack covers a wide range of applications, transferring easily from one 12-volt appliance to another. Included among these are portable TVs, tape recorders, phonographs, camping lights, ski-trail lights, portable radios, electric shavers, public address systems, portable power tools, movie cameras, portable lamps, electric typewriters, and CB and FM radio communication units. Marine and aircraft uses include depth sounders, running lights, navigational aids, fog halers, and emergency radio needs.

The unit can operate continuously up to 40 hours or more, depending on the current or wattage requirement of the equipment it is powering. The average portable TV set will operate for 5 to 8 hours. Hundreds of holes can be drilled through a 2" board with a heavy duty, 1/4" power drill. A portable fluorescent camp light can be run for 13 to 15 hours, etc., or all of these can be

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combined, with appropriate reduction in operating time. Charging time is seven hours for 90% and 12 hours for a complete charge. Best operation is assured by charging before reuse.

The power pack operates efficiently from -30°F to $+122^{\circ}\text{F}$. It can't be damaged even if the temperature extremes drop to -60°F or rise to $+158^{\circ}\text{F}$. Charge loss during storage is only 3% per month. After 2½ years of shelf life, the unit can be recharged to its original full capacity.

Most 12-volt devices are already equipped with a "cigarette lighter" plug as standard equipment or as a readily available accessory to fit the socket of the power pack. On equipment with internal power supplies, it is only necessary to connect the power pack to the battery terminal points. The unit includes two type RP-680 6-volt, 8 ampere-hour, lead-silica-gel batteries and one CRL-1000 automatic charger. The charger is a solid-state electronic device with no moving parts which charges the batteries at 1.2-ampere rate. The complete unit is contained in a genuine black leather carrying case. The

power pack is 8.5" high, 2.25" wide and 9" long. It weighs 9½ lbs. Price is \$49.95.



Wide-Band Probe

(55)

A new scope probe, Type J6045, with DC to 230-MHz bandwidth, has been announced by Tektronix, Inc. It is designed for use with all Tektronix oscilloscopes, including various sampling instruments. The new unit introduces less circuit loading, and with 1× attenuation, permits displays of low-amplitude signals which might otherwise be unobtainable. A DC-offset control allows measurements of very small AC signals in the presence of DC potentials up to one volt. Risettime of the probe is approximately 1.5 nanoseconds, input resistance is 10 megohms, and input capacitance is less than 4 pf.

The probe consists of two major parts: a probe head connected by a cable to a compensating amplifier. A separate supply is provided to power the probe. Supplied with the attenuators and an AC coupling probe are plug on 10× and 100× capacitor. Output load impedance is 50 ohms. A switch on the compensating amplifier provides internal 50-ohm termination, or the probe can be terminated externally. The compensating amplifier is capable of driving lengths of terminated 50-ohm coaxial cable for uses such as coaxial switching in systems applications. It is also possible to extend the distance between the probe amplifier and the oscilloscope if desired. The small size and lightness of the probe makes it exceptionally easy to use in dense circuitry. Price of the unit with power supply is \$375.

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Marine TV Antenna

(56)

An antenna designed especially for all-channel TV reception on both cruising and anchored pleasure boats has been announced by **JFD Electronics Co.** The JFD Marine TV Antenna (Model MTV222) is supplied with a versatile marine mounting bracket which permits side or top mounting on any horizontal or vertical surface of the boat. Special features are built in to make it seaworthy.

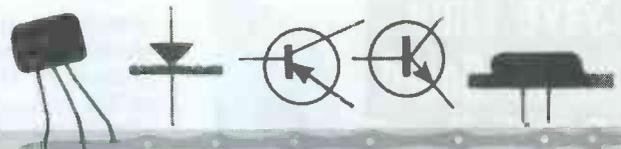
The antenna is an offset, omni-directional V-dipole unit that works with practically every portable TV set. It can be installed and detached in minutes and stowed away on any craft, large or small. Maximum signal aboard is produced through a six-position clarifier. Interference from ignition and motor is suppressed by a 25' shielded coaxial cable. Triple-chrome-plated brass construction eliminates corrosion and withstands severe weather conditions. The unit is priced at \$27.95, complete with non-ferrous mounting bracket.



Microphone

(57)

This new dynamic cardioid microphone features a dual



TEST TRANSISTORS IN SECONDS in circuit

TR139
89⁵⁰



Also check all transistors, diodes, and rectifiers out of circuit for true AC beta and Icbo leakage.

Your best answer for solid state servicing, production line testing, quality control and design.

Sencore has developed a new, dynamic in-circuit transistor tester that really works—the TR139—that lets you check any transistor or diode in-circuit without disconnecting a single lead. Nothing could be simpler, quicker or more accurate. Also checks all transistors, diodes and rectifiers out of circuit.

BETA MEASUREMENTS—Beta is the all-important gain factor of a transistor; compares to the gm of a tube. The Sencore TR139 actually measures the ratio of signal on the base to that on the collector. This ratio of signal in to signal out is true AC beta.

ICBO MEASUREMENTS—The TR139 also gives you the leakage current (Icbo) of any transistor in microamps directly on the meter.

DIODE TESTS—Checks both rectifiers and diodes either in or out of the circuit. Measures the actual front to back conduction in micro-amps.

COMPLETE PROTECTION—A special circuit protects even the most delicate transistors and diodes, even if the leads are accidentally hooked up to the wrong terminals.

NO SET-UP BOOK—Just hook up any unknown transistor to the TR139 and it will read true AC beta and Icbo leakage. Determines PNP or NPN types at the flick of a switch.

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impedance of 50,000 ohms or 200 ohms. The user can select either impedance by changing wires at the end of the microphone cable. Sensitivity with 50,000-ohm impedance is -83db at 1 kHz and -59 db at 1 kHz for 200-ohm impedance. Frequency range of the **Sonotone** Model CDM80 is 80 to 10,000 Hz with uniform rejection to reduce "squealing" in long-line applications. Front-to-back sound rejection is 16 to 20-db.

Other features include an on-off switch, dynamic diaphragm of polyester film, and rubber sleeve mounting of the complete cartridge motor to protect against sudden physical shock and noises produced from handling. The unit measures 5¼" high by 1¼" in diameter (at top). Made of die-cast metal and finished in brushed chrome, the microphone comes equipped with 15' of three-conductor cable, plus shield (no plug). Price of the single unit is \$43.50. The model is also available in matched pairs for stereo recording (Model CDMT80), priced at \$87.50, and a combination package of microphone and stand (Model CDMC80), priced at \$48.75.



Audio Circuit Slide Rule
(58)

A slide rule specially designed for those involved in the engineering of audio equipment has been announced by **Amperex Electronic Corporation**. The unit provides a dual function. First, it gives the circuit designer a quick means of determining the component values and transistor types required in a series of seven basic audio amplifier circuits ranging from a 1-watt amplifier to a 5-watt car radio. Merely by the movement of a hand, the engineer has a circuit layout from input through the speaker. The slide rule also serves as a handy audio calculator. Presuming either the known value of the output power or the load resistor, the user is able to calculate the related values required within a circuit of complementary symmetry, which enables the engineer to gain maximum effectiveness from the use of audio transistors. The unit which measures 4¼" x 8½", is priced at 50c.

Appliance Manual
(59)

A 32-page booklet on electrical appliance servicing has just been published by **Simpson Electric Co.** Titled "Simplified Electrical Appliance Servicing", the new booklet is a source of "how to do it" information on appliance troubleshooting with test instruments.

Subjects covered include measuring appliance current and temperature, testing split-phase motors, checking heating elements, and testing timers, thermostats, magnetic valves and other components. Photos of test situations and test circuit diagrams are included.

The new publication contains technical data that should prove helpful to appliance servicemen, schools, industrial maintenance men and do-it-yourselfers. It is available through electronic distributors or direct from Simpson by enclosing 50c to cover mailing and handling. ▲

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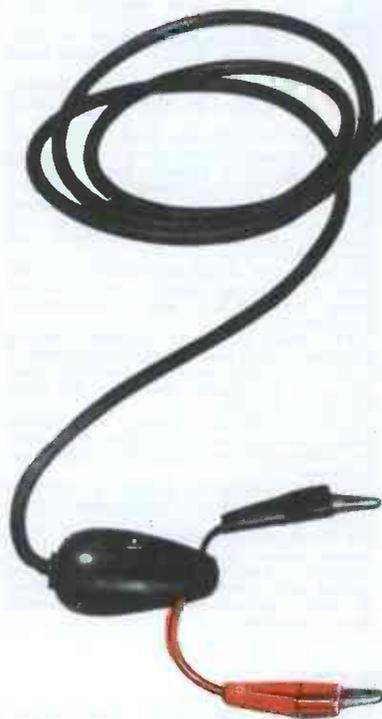
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- Individual inductance and capacitance adjustments for each range
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- Two-step RF attenuator switch plus a continuously-variable attenuator control
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*Check "Index to Advertisers" for further information from these companies.

ANTENNAS

70. **ALLIANCE**—Colorful 4 page brochure describing in detail all the features of Tenna-Rotors.
71. **ANTENNACRAFT** — Four-color catalog sheet about the new "Big-Shot-8" VHF-UHF-FM antenna designed for city and suburban use.
72. **BLONDER-TONGUE** — Compact brochure detailing a line of all-channel products, expressly designed to improve reception in the home and small MATV systems.
73. **CORNELL-DUBILIER** — New revised booklet shows how to use rotors to best advantage, depicts complete CDE rotor line.
74. **FINNEY**—Form 20-353 about the Finco-Axial 75-ohm antenna system for UHF-VHF and FM.*
75. **JERROLD**—New 4-page full-color catalog describes the new Paralog Plus antennas.*
76. **JFD**—Color Laser and LPV antenna brochures. New 1966 dealer catalog covering complete line of log-periodic outdoor antennas, indoor antennas, rotators, and accessories.*
77. **PAKKER** — Catalog sheets illustrating new UHF-VHF-FM color antennas.
78. **WINEGARD** — Literature on new 82-channel 2-set coupler; new 82-channel variable line tapoffs; new VHF-UHF matching transformers and color brochure on new sales aids.*

AUDIO

79. **ADMIRAL**—Folders describing line of equipment; includes black-and-white TV, color TV, radio, and stereo hi-fi.
80. **ATLAS SOUND** — Catalog 566-67 illustrates and describes many new models of public address loudspeakers, microphone stands, and accessories for commercial sound applications.
81. **JENSEN**—New brochure No. OJ featuring a full line of rear seat speakers.
82. **MARANTZ**—Flyer sheet on a new solid-state stereo amplifier featuring very low distortion.
83. **NUTONE**—16-page full-color booklet illustrating built-in stereo music, intercom, and radio systems.
84. **OKTRON** — "The Blueprint to Better Sound," an 8-page catalog of loudspeakers and baffles giving detailed specifications and list prices.
85. **OXFORD TRANSDUCER**—4-page catalog describing speakers, musical instrument & communication loud speakers.
86. **PERMA-POWER**—Catalog sheet about a new 25-watt solid-state megaphone.
87. **SONOTONE**—Set of 3 microphone frequency demonstration charts.

COMMUNICATIONS

88. **AMPHENOL** — 2-color spec-sheets on new Model 650 CB transceiver and Model C-75 hand-held transceiver.*
89. **FANON**—Descriptive brochure on 13 new transceivers including specifications. Includes new "Call-Tone Selector" which allows 5 CB's to selectively signal on each channel.
90. **INTERNATIONAL COMMUNICATION** —Comprehensive report on the market and applications for citizens band two-way radio equipment and accessories, and about the opportunities in marketing and servicing citizens band radio equipment.
91. **MOSLEY ELECTRONICS**—Folder about "Talk Power" and new stacked CB beams.
92. **MOTOROLA**—Brochure TIC 2042B describes high-power business-band base stations.
93. **POLYTRONICS**—New price sheets reflecting latest price reductions of Duo-

Com equipment. Flyer sheets on new 3-watt two-channel and 5-watt seven channel units.

94. **RAYTHEON**—Brochures about Webster mobile antennas and accessories for CB and Amateur bands. Also, Raytel TWR 8, 9, 11, & 11T CB transceivers.
95. **TURNER**—Booklet gives wiring instructions to hook up the +2 mike to all popular CB units.

COMPONENTS

96. **BUSSMANN**—Bulletin on BUSS Fustat Box Cover Units offers simple, low-cost way to protect work bench tools; soldering irons, drills and the like against damage and burnout. Units are easy to install—fit standard outlet or switch box, have fuseholder—plus a plug-in receptacle, pilot light, switch, etc. Ask for SBCU.*
97. **CENTRALAB**—Catalogs offered on electrolytic capacitors, PEC's and auto radio shafts and hushings.*
98. **GC ELECTRONICS** — FR-029E Electrocraft wall charts on plug-jacks, binding post etc.
99. **LITTLEFUSE**—Pocket-sized TV circuit breaker cross-reference gives the following information at a glance: Manufacturer's part number, corresponding Littlefuse part number, price, color or b/w designation. A second glance gives trip ratings and acquaints you with a line of caddies. Ask for CBCRP.*
100. **MERIT COIL & TRANSFORMER**—180-page complete-line catalog, stock control forms No. SR-216, and cross-reference pamphlet No. 716.
101. **OAK**—New eight-page two-color catalog describes a full line of rotary, pushbutton, lever and slide switches available from electronic distributors throughout the country. Form SP-228.
102. **QUAM-NICHOLS**—Catalog #66 listing public address, sound systems, high fidelity, automotive and radio-TV replacement speakers.
103. **SPRAGUE**—Catalog K-108 a complete electrolytic capacitor replacement cross-reference.
104. **SWITCHCRAFT**—Catalog A-401b illustrates audio mixers, speakers, controls, couplers, adapters, selector switches, molded cable assemblies and a wide variety of audio connectors. Detailed electrical data is provided.

SERVICE AIDS

105. **CASTLE** — How to get fast overhaul service on all makes and models of television tuners is described in leaflet. Shipping instructions, labels, and tags are also included.*
106. **CLEVELAND INSTITUTE OF ELECTRONICS** — New pocket-sized, plastic "Electronics Data Guide" of formulas and tables, including frequency and wavelength, dB formulas and table, antenna lengths, and color code.*
107. **ELECTRONIC CHEMICAL** — Brochure of aerosol chemicals for controls, tuners, and tape heads. Also brochure on Frigid-Air.
108. **LUXO**—Form 107 about counter-balanced and magnifying bench lamps.
109. **PRECISION TUNER**—Literature supplying information on complete low-cost repair and alignment service for any TV tuner.
110. **QUALITY TUNER SERVICE**—Introductory letter describing costs and service on all makes of TV tuners. Repair tags and shipping labels included.
111. **RAWN**—New catalog and instruction bulletins about knob and plastic repairs, and denture repairs.
112. **WILCO**—Catalog pages on an anti-static plastic cleaner and a scratch remover compound.

SPECIAL EQUIPMENT

113. **PERMA POWER** — New leaflet describes Perma-Power's new Electro-Lift Garage Opener.
114. **SOUND SENTINEL**—Brochure about a commercial-residential security alarm that uses paging and/or music speakers that are already installed as detectors.

TECHNICAL PUBLICATIONS

115. **HAYDEN**—Latest 64-page catalog listing books published by the Hayden Book Company, Inc. and John F. Rider Publisher, Inc. for the electronics service technician, student, and hobbyist.
116. **PHILCO**—Information about Tech Data & Business Management Service. Also, free parts catalog.*
117. **RCA INSTITUTES**—1967 career book describes programs and courses in television, telecommunications, automation and industrial electronics, drafting, and computer programming.*
118. **HOWARD W. SAMS**—Literature describing popular and informative publications on radio and TV servicing, communications, audio, hi-fi, and industrial electronics, including special new 1966 catalog of technical books on every phase of electronics.*

TEST EQUIPMENT

119. **B & K**—New 1966 catalog featuring test equipment for color TV, auto radio, and transistor radio servicing, including tube testers designed for testing latest receiving tube types.*
120. **EICO**—1966 short-form catalog is 48-pages long. Describes a complete line of test instruments, CB and ham equipment, hi-fi components, and miscellaneous electronic equipment.*
121. **HICKOK**—Specification sheets on Model GC 660 color generator and model 860 signal tracer.*
122. **JACKSON**—Catalog on "Service Engineered" test equipment featuring the new X-100 color generator.
123. **LECTROTECH**—Two-color catalog sheet on new model V6-B color bar generator, the latest improved model of the V6 color bar generator. Gives all specs and is fully illustrated.*
124. **MERCURY**—Complete catalog of new fall line of test equipment.
125. **PRECISION APPARATUS**—Illustrated catalog describing signal generators, oscilloscopes and meters.
126. **SECO**—New line folder describing fifteen items of test equipment.
127. **SEMITRONICS**—Brochure on the new model 1000 transistor tester.
128. **SENCORE**—Spec sheets on the TR-139 transistor tester, FS-14 field strength meter, the SM-112B VOM/VTVM, and the full line catalog.*
129. **SIMPSON**—Flyer giving specifications of Model 604 multicoorder for measuring and recording volts, amps, milliamps, and microamps.
130. **TRIPLETT**—Catalog D-66-I features the complete line of panel instruments.

TOOLS

131. **ARROW**—Literature describing 3 staple guns.
132. **ENTERPRISE DEVELOPMENT**—Time-saving techniques in brochure from Endeco demonstrate improved desoldering and resoldering methods for speeding and simplifying operations on PC boards.*
133. **VACO**—Catalog #SD-120 completely describes new Vaco screw launcher which holds, starts, and drives all straight slot screws.
134. **XCELITE**—Form S766 describing 2 new Series 99 "Plastic View" kits, each containing a plastic handle and a selection of interchangeable screwdriver blades.*

TUBES & TRANSISTORS

135. **IEC**—Literature on IEC service range receiving tubes.
136. **IR** — Transistor cross-reference guide JD61-C and semiconductor cross-reference guide JD198.
137. **RADIO CORP. OF AMERICA** — PIX 300, a 12-page product guide on RCA picture tubes covering both color and black-and-white. Includes characteristics chart, terminal diagrams, industry replacement, and interchangeability.*
138. **WORKMAN**—Transistor cross-reference for use with Miracle Five transistor line that replaces 2,977 entertainment-type transistors.

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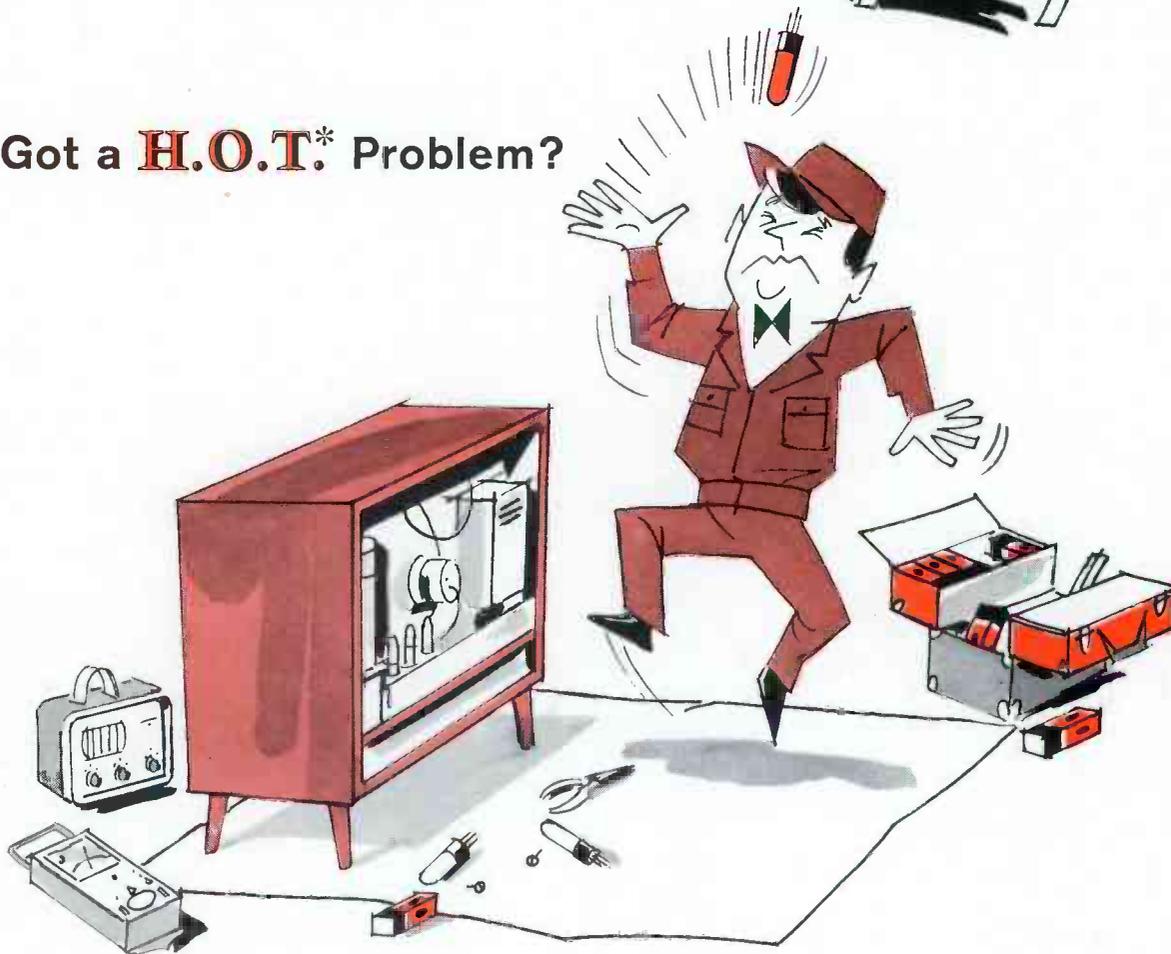
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Got a **H.O.T.*** Problem?



Keep it cool...and avoid burnout!

The *Horizontal Output Tube in a color set has to work hard . . . and efficiently. Abnormal circuit conditions can send its plate dissipation far beyond the allowable limit and permanently damage the tube.

The most likely source of damage is failure or removal of grid circuit drive for even 10 to 20 seconds. When servicing horizontal oscillator and deflection circuits, therefore, observe these "don'ts."

1. **Don't** pull the horizontal-oscillator tube with power applied to the set.
2. **Don't** apply power to a "warm" set if the oscillator tube is cold. Wait a few minutes, or heat the oscillator tube in a tube tester.
3. **Don't** risk H.O.T. damage by shorting out overload devices.
4. **Don't** disconnect the H.O.T. plate cap to kill high voltage. Use the method recommended by the set manufacturer.
5. **Don't** replace an H.O.T. without adjusting the horizontal-efficiency coil for correct cathode current.

Observing these precautions will help you to obtain maximum efficiency and longer life from the horizontal output tube. This is the latest in RCA's continuing series of color TV service hints. You will find your RCA tube distributor your best source for quality RCA receiving tubes for color TV, black and white TV, Radio and hi-fi. To help keep your customers happy, and avoid callbacks, always replace with RCA receiving tubes.

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