DECEMBER 1975 • 75 CENTS
A HARCOURT BRACE JOVANOVICH PUBLICATION

ELECTRONIC TECHNICIAN/DEALER

WORLD'S LARGEST TV-RADIO SERVICE & SALES CIRCULATION

Legal Structures For Businesses

RCA's New ColorTrak TV

Using A Field-Strength Meter

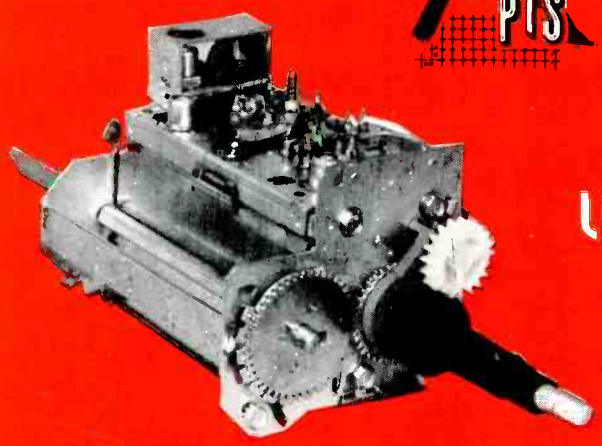
Adjusting SSB Transceivers

Equipment For Your Auto Bench

TEKFAX Annual 10-year Index

PTS ELECTRONICS

Precision Tuner Service



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PTS No 1

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A wide selection of "revolutionary" new CB High Efficiency communications antennas of superior strength, electronically and physically, for all the talk power your CB rig will deliver —coming and going in the 27 Megahertz frequency band.

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Gutter Mount Antenna
Model 10-245

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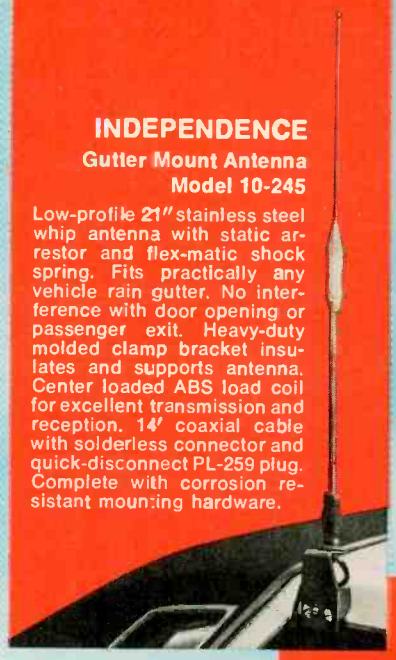

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Special "power-plus" 42″ base-loaded roof mount with long-life stainless steel whip, rugged stainless steel shock spring and high-quality 16-ft. shielded coax cable and solderless connections for fast "on-the-air" installation. Named after the famed communicator and hero of revolutionary era.

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Omni-directional
¼-Wave Base Antenna
Model 11-101

High in quality, performance and efficiency, low in cost. Has three 108″ quarter wave tubular aluminum radials plus a quarter-wave radiator (vertical element). Heavy-duty U-clamp fits mast up to 1⅝″ diameter. Built-in lightning protector. SO-239 style connector mount. Mates with PL-259 plug. Shunt loaded coil. Heavy duty insulated molded clamp bracket. Easy to assemble and dis-assemble. Fixed construction.

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West Coast Mirror Mount
Dual Truck, RV Antennas
Model 10-200

Weather resistant dual 57″ stainless steel whip antennas with static arrestor tips. Secure horizontal or vertical mounting to West Coast side view truck type mirrors. Twin antennas co-phased for more directional power and easily adjustable for fine tuning. Hermetically sealed, white oversized ABS center load. Dual 18′ low-loss coaxial phasing harnesses with solderless connectors and quick disconnect PL-259 plugs. Complete with corrosion resistant mounting hardware.

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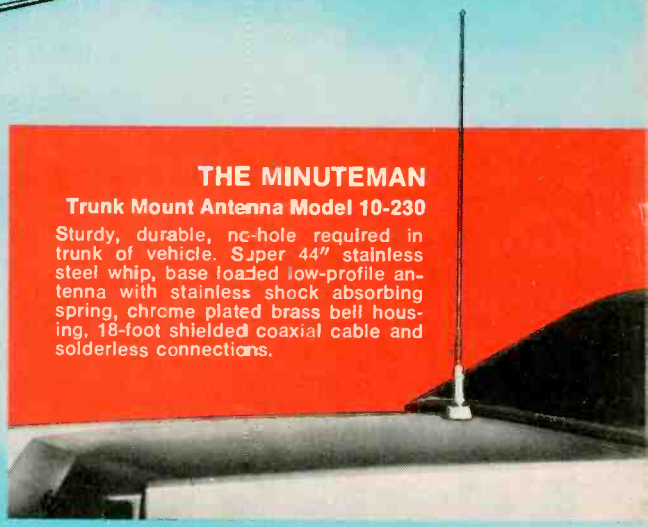

"Just say it with Breaker!"
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BREAKER CORPORATION

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Arlington, Texas 76011

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THE COVER: The graphic designer of ET/D, John Paszak, recently was asked to produce for our media folder a cover photo symbolic of the products sold and used by independent electronic servicers and servicing dealers. Paszak's photo received such widespread acclaim that we decided to share it with you.

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Its amplifier puts out 12 watts of power per channel (min. RMS) into 8 ohms, yet total harmonic distortion is held to a low 0.5% or less (Power bandwidth: 40 to 15,000 Hz).

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And they do it so efficiently that other systems with comparable size air-suspension speakers need amplifiers with twice the power to match Allegro's overall sound performance.

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Choose from a whole line of Zenith Allegro stereo and 4-channel sound systems, with performance and features tailored to suit your ears.

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Model GR596W. Simulated wood with richly-grained walnut finish.

Zenith introduces The Wedge.

NEWS OF THE INDUSTRY

Zenith And BRH Disagree About Effect Of Hold-Down Capacitor Failure In Zenith Color TV

The length of time that about 1.4 million Zenith solid-state color TV receivers continue to operate after failure of a four-lead, high-voltage hold-down capacitor is the basis of a conflict presently boiling between Zenith and the Bureau of Radiological Health (BRH).

If the BRH wins the argument and decides that corrective modification is required on all Zenith receivers equipped with the special hold-down capacitor, it will be the biggest recall ever of a major consumer electronic product. (Reportedly, almost all of Zenith's solid-state color TV receivers produced between January of 1974 and the Spring of 1975 are involved.)

Failure of the special hold-down capacitor which replaced several separate capacitors used in previous designs of Zenith color TV chassis, and which ironically is intended as a radiation-prevention device, reportedly allows the high voltage to increase to a level which causes X-radiation in excess of the legal limit of 0.5 millihoentgens per hour (mR/h).

Early in August, prior to the BRH's involvement, Zenith recognized the "quality problem" with the hold-down capacitor and authorized its 1500 service centers to make no-charge repairs of any defects resulting from the capacitor failure or replace the capacitor on a no-charge basis when any of the affected chassis are being serviced for any other reason.

Late in August, the BRH reportedly learned from an independent electronic technician that after failure of the hold-down capacitor the chassis continued to produce high voltage, and at an excessive level. The BRH then conducted its own tests and reportedly found that during a "normal failure" the chassis produced slightly excessive X-radiation for a "short time," but "under lab conditions" it can be made to operate and produce "slightly excessive" X-radiation for up to 24 hours.

Zenith disagrees with the BRH's test results and says that its own tests reveal that failure of the hold-down capacitor disables the receiver after a "very brief period" so that no picture is produced.

Zenith estimates that only about 2.5 percent (or about 40,000) of the involved chassis will ever experience hold-down capacitor failure and that to date less than 1 percent have experienced such failure.

CB Boom Causes Increase In TV and Audio Interference

The Federal Communications Commission (FCC) reports that the number of complaints about interference with TV and audio reception in the year ended in June increased 6,600 over the level of the previous year and that a higher percentage of the complaints were traced to CB.

Of the 45,000 TV/audio interference complaints received by the FCC in the current year, 69 percent were caused by CB, compared to only 46 percent of the 38,400 complaints received during the previous year.

TV/Appliance Dealers Realized 2.2% Profit Margin In 1974 Says NARDA

A cost-of-doing business survey conducted on an annual basis by the National Appliance & Radio-Electronic Dealers Association, a division of NARDA Inc., reveals that the average profit margin of television/appliance dealers in 1974 was 2.2 percent of sales, a decline of .5 percent from the 2.7 percent they realized in 1973.

The survey also reveals that during the same period television/appliance dealers' operating expenses increased from 25.7 percent of sales in 1973 to 26 percent in 1974, while gross margins for both years remained at 28 percent.

Magnavox Quits Home Security/Fire Alarm Business

The Magnavox Company has announced that it is getting out of the home security and fire alarm business.

Magnavox's entire inventory of home security alarm systems and smoke detection products have been sold to GBC Closed Circuit TV Corporation, New York.

The inventory, with a reported retail value of $1.25 million, is being sold by GBC at prices 70 percent below Magnavox's original suggested list prices.

Admiral To Return To 90-Day Color TV Labor Warranty Next Year

Admiral, one of the few major color TV manufacturers to stay with a one-year color TV labor warranty this year, will switch back to a 90-day labor policy next year.

According to a recent report in *Television Digest,* Admiral will stay with the one-year

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color TV labor warranty until the end of this year and then sometime in the new year will switch back to a 90-day labor policy which will be supplemented with an optional 9-month warranty labor extension retailing for about $40.

The *Television Digest* report also contained statements by the president of Admiral, Charles J. Urban, who alluded to "dramatic developments in the wings" at Admiral—developments which will be introduced by Admiral in the coming year. One of these, which Urban describes as "a patentable feature developed in Anaheim (Calif.) and England," will be introduced next May along with four new Admiral color TV chassis.

New York CATV Operator Offers Subscribers TV Service Contract

Cablevision, a CATV operation which serves the New York communities of Babylon, Hempstead, North Hempstead and Oyster Bay, is presently offering its subscribers a TV service contract for a monthly fee of $6.00 for the first set and $4.00 for additional sets.

The Cablevision TV service contract covers all parts and labor on any TV receiver less than seven years old, including repair or replacement of the picture tube, plus the loan of a 17-inch color TV.

Repairs under the Cablevision service contract will be performed by Broadway Maintenance Corporation, which, according to a Cablevision letter to subscribers, performs servicing on the cablevision CATV system itself and is "the world's largest electronics maintenance firm."

EIA-Sponsored Winter Consumer Electronics Show In Chicago January 7-9; Summer CES June 13 In Chicago

The Fourth Annual Winter Consumer Electronics Show (WCES) will be held January 7-9 at the Conrad Hilton Hotel in Chicago.

The three-day WCES, sponsored and produced by the Consumer Electronics Group of the Electronic Industries Association (EIA), is open to all consumer electronic retailers and will feature displays and programs for merchandising of the industry's 1976 television, radio, phone, audio compact and component systems, video systems, tape, CB and allied product lines.

The dates for the WCES bridge the dates on which the International Home Furnishings Market (IHFM) and the National Housewares Exposition (NHE) shows will be held in Chicago.■

TECHNICAL LITERATURE

TV RECEPTION PRODUCTS

A 30-page catalog No. CP-2, Winegard Television Reception Products, is now available. Products listed include antennas, amplifiers, antenna preamplifiers, band separators, booster couplers, cablemate, connectors, couplers, interference rejection filters, matching transformers, outlets, line splitters, traps, tools and wire. Price $.50. *Winegard Television Systems, Winegard Co.,* Burlington, IA. 52601.

RECTIFIERS

A 4-page brochure which explains how to eliminate power rectifier replacement delays and reduce inventory stock is now available. The brochure lists the 16 basic rectifiers with general specifications and provides an extensive alpha-numeric cross reference chart correlating the International Rectifier basic part numbers with JEDEC and other manufacturer numbers. The cross reference chart permits a rectifier user to assess quickly the suitability and potential value of the "Basic 16" program to his requirement. Sales Dept., *International Rectifier,* 233 Kansas St., El Segundo, CA. 90245.

POWER TRANSISTOR MANUAL

A 112-page manual on the design and application of power transistors is now available. RCA Power Transistors for Amplification, Switching, and Control (Technical Series PM-82) is intended to provide a basic understanding of the design and application of high-speed, high-voltage, and high-current power transistors. It covers the design and fabrication, safe-operating area, thermal fatigue, and operation and requirements of such transistors in typical circuits that illustrate amplification, switching and control applications. Selection charts are included to facilitate choice of the optimum type of power transistor for a variety of military, industrial, or commercial applications. Copies of this manual are available at $2.00 each. *RCA Solid State Division,* Box 3200, Somerville, NJ. 08876.

DIPLEXER FAMILIARIZATION BOOKLET

A 20-page booklet, the newest in its series entitled "About Combiners" is now available. Various types of combiners—both transmitter and receiver—are described in detail. The text also includes different methods of combining a number of duplex or repeater and/or simplex systems on the same antenna. This booklet can be most helpful to those with limited application experience—to select the proper combiner for this specific requirement. *Decibel Products, Inc.* P.O. Box 47128 Dallas, TX. 75247.

ADHESIVES

A new full color folder No. 775, describing the expanded line of Instant-Weld Adhesive formulas is published. The literature describes five different types of the Alpha Cyanoacrylate Adhesives giving full details on uses, setting time, viscosity, etc. It also contains a Formula Selector Guide graphically illustrating the recommended types for a great variety of both similar and dissimilar materials. *Oneida Electronic Mfg., Inc.* P.O. Box 678, Meadville PA. 16335.

TEST EQUIPMENT

A new 16-page catalog No. 61-T, describing test equipment is now available. Listed are General Multi-Purpose VOMs, Special Feature VOMs, FET VOMs, Laboratory Accuracy VOMs, Sound Level Instruments, G/P Portables, Temperature Tester, Accessories, Sales & Service Reps, and a VOM Selection Chart. *Triplett Corp.,* Bluffton, OH. 45817.

GENERAL ELECTRONICS CATALOG

A 48-page general electronics catalog is now available. Listed are tools, audio accessories, tubes, transistors, test equipment, service chemicals, books, soldering supplies, B/W and color TV picture tubes and many more. *Cornell Electronics Co.,* 4217 University Ave. San Diego, CA. 92105.

TOOL CATALOG

A 112-page catalog describing over 2,500 individual items is offered. "Tools for Electronic Assembly and Precision Mechanics" is of particular interest to electronic technicians, engineers and scientists. Section headings include Screwdrivers, Wrenches, Pliers, Tweezers, Files, Scissors, Knives, Microtools, Relay Tools, Power Tools, Metalworking Tools, Wire Strippers, Wire Wrappers, Soldering Equipment, Books, Lighting and Optical Equipment, Work Holders, Test Equipment, Engineering and Drafting Supplies, Metric Tools and Electronic Chemicals. In addition,

continued on page 29

Reappraising The Legal Structure Of Your Business

By Edward L. Anthony & A. Barr Comstock*

Single proprietorship, general partnership, limited partnership or corporation?

■ A growing number of owners of electronic service and electronic retail businesses are taking a new look at the legal structure of their firms. Many individual proprietors are wondering if they would be better off with a different set up. They aren't sure. They'd like more information, but haven't time to do research. And before consulting a lawyer on the matter they want some background knowledge as a basis for discussion. One man put it this way: "Without boning up on partnerships and corporations, I wouldn't even know what questions to ask."

The purpose of this article is to meet the need for a brief, general picture of what the different legal structures involve.

THREE MAIN CHOICES

Broadly speaking, there are three principal kinds of businesses:

• *Proprietorship,* which is the easiest to begin and end (sometimes prematurely), can have the most flexible purpose for its operations, needs no government approval, has business profits taxed as personal income, and makes the owner personally liable for debts and taxes.

• *Partnership,* which is the simplest for two or more people to start and terminate, has the same flexibility of objective, has partners taxed separately, and makes all except limited partners personally liable for debts and taxes.

• *Corporation,* which is the most formal of structures, operates under State laws, has continuous and separate legal life, has its scope of activity and name restricted by a charter, has the business' profits taxed separately from earnings of executives and owners, and makes only the company (not the owners nor managers) liable for its debts and taxes.

(There are other types of legal structures such as syndicates, joint stock companies, Massachusetts trusts, and pools. However, these are specialized and rare. For that reason they are eliminated from this discussion.)

SIX POINTS TO CHECK

In analyzing your own situation, it pays to go to the expense of getting advice and guidance from competent legal counsel. Great care should be taken to make the right decision the first time. Among other things, it is worthwhile for the "top executive" to be familiar with the highlights of six main points on legal structure in addition to tax considerations: 1) Costs and procedures in starting; 2) size of risk—that is, amount of investors' liability for debts and taxes; 3) continuity of the business; 4) adaptability of administration; 5) influences of applicable laws; and 6) attraction of additional capital.

Costs and Procedures in Starting

Single proprietorships are the easiest to get started. The costs of formation are low. Basically all you have to do is find out whether you need a license to carry on your particular business, and whether you have to pay a State tax or license fee.

General partnerships are also started quite simply. You can set one up by having the principals in the business sign what is called a partnership agreement. A written document, however, is not necessarily a prerequisite, since an oral agreement can be equally effective. Moreover, a partnership may even be implied by actions which the managers of an unincorporated business have taken—even though no agreement of any kind, oral or written, exists.

Limited partnerships are somewhat more difficult to set up. To form one, you file, with the proper State official, a written contract drawn according to certain legal requirements. This contract permits you to limit the liability of one or more of the partners to just the amount which they invested. But you must designate at least one general partner in addition to the limited partners. And all limited partners must have actually invested in the partnership. According to the Uniform Limited Partnership Act, those investments may be either cash or tangible property, but not services. Lastly, you must conform strictly to the laws of the particular State in which you organize; otherwise your business will be considered as a general partnership.

Corporations are more complicated to form than any of the other types of organization. You can create one only by following strictly the legal procedures of the particular State in which the corporation is being set up. First, certain responsible people are needed to organize and become officials in the new corporation. Next they must file with the designated State official a special document called the "articles of incorporation." They must pay an initial tax and certain filing fees. And finally, in order to do the business for which the corporation was formed, various official meetings must be conducted to deal with specified details of organization and operation.

The Size of the Risk

The degree to which investors in your enterprise risk legal liability for the debts of the business is a cardinal consideration. Regardless of legal structure, creditors are always entitled to be paid out of business assets before any equity

*Mr. Anthony is a former chief of the Publications Division of the Small Business Administration, and Mr. Comstock formerly was Special Assistant to the Attorney General of the United States.

capital may be withdrawn. In cases where those assets are insufficient, the extent to which owners can be compelled to meet creditors' claims out of their own pockets varies with the type of organization.

A *single proprietor* is *personally* liable for all debts of his business—to the extent of *his entire* property. He cannot restrict his liability in any way.

Likewise, each member of a *general partnership* is, himself, fully responsible for all debts owed by his partnership—irrespective of the amount of his own investment in the business. In a *limited partnership,* however, the limited partners are protected; they risk only the loss of the capital they have invested. But the general partners in a limited partnership are liable jointly and severally for all debts, just like any other general partner. And remember, there must be at least one general partner in any limited partnership.

Corporations have a real advantage, as far as risk goes, over other legal structures. Creditors can force payment on their claims only to the limit of the *company's* assets. Thus, while a shareholder may lose the money he put into the company, he cannot be forced to contribute additional funds out of his own pocket to meet business debts. This is true even though the corporate assets may be insufficient to meet creditors' claims.

Continuity of the Concern

In choosing the legal structure for your business, you should also understand clearly how it influences the continuity of the business. Although *single proprietorships* have no time limit on them by law, they are not fundamentally perpetual. Illness of the owner may derange the business, and his death ends it. *Partnerships* are perishable in the same general sense—since they are terminated by the death or withdrawal of any one of the partners.

Corporations have the most permanent legal structure of all. They have a separate continuous life of their own. The withdrawal, insolvency, injury, illness, or death of a person officially concerned in a corporation does not mean its finish. Moreover, the certificates of stock, which represent investments and ownership in the business, may be transferred from one person to another without hampering the concern's operations.

Adaptability of Administration

In the *single proprietorship,* policy and operations rest, of course, in one individual. This situation can be both good and bad. On the one hand, concentration of management in one individual avoids the problems of opposing factions and divided responsibilities. The fact that the "chief executive" is in full charge, and is in complete control of profits, can be an incentive to careful management. On the other hand, many a man is not competent to handle all management jobs himself. To be sure, an owner can, and often does, employ assistants to whom he assigns various details. But he still reaps the rewards or the penalties of what they do. (It is also worth noting that after incorporating, the owner of a small business does not necessarily lose control of the enterprise. In many small, closely held corporations, the former sole owner can and often does retain control by the ownership of a majority of the stock in the newly formed corporation.)

In *general partnerships,* each partner typically has an equal role in administration, with the various operating functions divided among them. The combined abilities and knowledge of several "executives" gives the partnership an advantage over the single proprietorship. But the division of functional responsibility among the several partners may lead to fundamental policy disagreements. When you compare them with corporations, partnerships have the following administrative features: Decisions may be taken and changes adopted simply by oral agreement among the partners. In limited partnerships, the limited partners may not engage in management functions; if they do, they may be held fully liable as general partners. They are, however, entitled to inspect the books and obtain full and complete information regarding the business.

In *corporations,* the stockholders do not necessarily participate either in operations or in policy formulation, but they may. Often, however, those functions are centralized in a relatively small group of "executives" who own only a small percentage of the shares. Although corporations can get away from the shortcomings of the limited ability or knowledge of one person, they do run some risk of inefficient management where those in control have little or no direct financial interest. Corporations have an advantage over partnerships in this way: In partnerships each partner can act as general agent for the business; but in corporations, the stockholders cannot bind the firm by their acts just because they have invested capital in it.

Influences of Applicable Laws

Single proprietorship is the oldest and most widespread legal structure of business. As a result, little doubt remains as to the influences of laws regulating its legal rights and obligations. Likewise the relationships are clear between a sole owner, his agents, his creditors, and others with whom he deals in business. For example, a private citizen working in Iowa can carry on business in Kansas without paying any greater taxes or incurring any more obligations in Kansas than local Kansas businessmen have.

Broadly speaking, this same situation is also true for a *partnership.* Of course, a State may require the purchase of a license to carry on a particular kind of business. But the license will be equally available to businessmen of any State so long as they conform to prescribed uniform standards. (This equality of opportunity derives from the United States Constitution, which guarantees to citizens of each State "all privileges and immunities" provided to citizens of the other States.) Thus, the legal structures which do not involve any artificial entity (as a corporation does) provide in all States a freedom of action which corporations

cannot match.

Corporations owe their legal life solely to the States in which they are organized. No other State is required to recognize them. To be sure, all States do permit out-of-State corporations to function inside their boundaries. Nevertheless, out-of-State corporations must always comply with special in-State obligations such as 1) filing certain legal papers with the proper State officials; 2) appointment of a representative in the State to act as agent in serving process on the "foreign" corporation; and 3) payment of specified fees and taxes.

Also, corporations are regulated by numerous State laws which vary considerably. Even when the language is similar, these laws can be, and have been, interpreted differently in different places. Therefore, in running a corporation effectively, competent legal counsel is virtually indispensable. The normal course of business, for example, can easily involve statutes and court decisions of a State other than the one where the corporation was founded. Nevertheless, the essential feature of limited liability of stockholders is preserved in every State.

Attraction of Additional Capital

Every business might require additional funds from time to time to carry on operations. And if it can't obtain adequate capital, it might well be headed for failure. It is important, therefore, in deciding upon the legal structure of your business to take into account the means for attracting new money for the business.

In *single proprietorships,* the owner may raise additional money by borrowing, by purchasing on credit, and by investing additional amounts himself. Since he is personally liable for all the debts of his business, banks and suppliers will look carefully at his *personal* wealth. Consequently, the funds he can get will always be limited by his own financial circumstances. For this reason alone, a business requiring large amounts of capital for successful operation probably should not be organized as a single proprietorship.

Partnerships can often raise funds with greater ease, since the resources of *all* partners are combined in a single undertaking. Like single proprietors, partners must accept full *personal* liability for business debts; for this reason, a partnership may be able to borrow on better terms than some corporations. In addition, outsiders may be willing to extend credit because of the security deriving from the individual partners' full liability.

Corporations are usually in the best position of all to attract capital. They may, for example, acquire additional funds by borrowing money by pledging corporate assets. Also, they may sell securities to the public and attract a wide range of investors. A shareholder's investment in a corporation will not subject him to any financial risk beyond the amount of his holdings. In addition, as a part owner, he has the prospect of sharing directly, through dividends and rising value of securities, in any profits the business makes.■

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PROFITABLY SPEAKING

■ Justified or not, seven top executives and department managers of the Consumer Electronics division of RCA recently took a lot of heat from independent electronic servicers as a result of the policies and practices of the RCA Service Company—a separate, autonomous division of RCA over which the RCA Consumer Electronics division ostensibly has no direct control.

The date of the RCA Consumer Electronics "roasting" was October 21; the site was the spacious auditorium of RCA Consumer Electronics headquarters in Indianapolis; and the occasion was an open panel discussion among the seven RCA Consumer Electronics executives and managers and some fifty independent servicers from around the country who, along with electronic association representatives and members of the trade press, had been invited by RCA Consumer Electronics to a three-day product-familiarization/dialogue/plant - tour session.

The cause of the "roasting" was the $19.95 nine-month color TV labor warranty extension which RCA Service Company is presently offering to retailers who agree to offer the warranty labor extension on all RCA color TV receivers they sell. The retailers, in turn, either can include their cost of the nine-month warranty labor extension in the retail price of the sets they sell or they can sell it separately at a suggested retail price of $39.95.

Those retailers who choose not to commit themselves to a blanket inclusion of the warranty labor extension on all RCA sets they sell can purchase the extension on a "single-unit" basis for $24.95.

Included in the price of the warranty labor extension is one free "set-up/customer education" service call.

At the outset of the meeting, some of the attending servicers contended that they "know it costs the RCA Service Company more than $19.95 to make a single service" and therefore the Service Company's nine-month warranty labor extension "has to be a loss-leader to build sales." They also

With J.W. Phipps, Editor, ETD

contended that the Service Company's warranty labor extension is illegal because it is being sold "at a loss to stifle competition." Other servicers contended that the RCA Consumer Electronics division is supplying the RCA Service Company with the names and addresses of purchasers of new RCA color TV receivers.

After listening attentatively to the servicers' opening barrage, head "roastees" Jack K. Sauter, Vice President, Marketing, RCA Consumer Electronics, and Arnold T. Valencia, Director, Marketing Programs, RCA Consumer Electronics, patiently explained that, because the Service Company and the Consumer Electronics divisions are operated autonomously, neither division has any direct control over the other's operating policies and practices. Both also emphatically denied that the Consumer Electronics division is supplying the Service Company with names and addresses of new-set purchasers.

The servicers responded by pointing out that the practices and pricing policies of the RCA Service Company were nevertheless "inhibiting" RCA Consumer Electronics' sales because such practices and policies "have caused a deep well of resentment" among servicers and, as a result, servicers "won't promote RCA sets." Said one servicer, "The difference betwen your present market position and what you'd like to have can be attributed to the RCA Service Company." Said another servicer, "Captive service put Westinghouse out of the TV business."

In response to servicers' questions about RCA Consumer Electronics' warranty costs, Valencia stated that the color TV failure rate during the one-year labor warranty program averaged out to about .5 service call per set for the 12-month warranty period, producing an average warranty cost of between $12 and $15 per set. He also pointed out that about 50 percent of the set failures during the one-year warranty period occurred within the first three months after purchase and, consequently, if you apply this cost/failure experience to the new 90-day labor warranty period, you come up with a nine-month warranty labor extension cost of between about $6 and $8, plus the cost of set-up/customer education call.

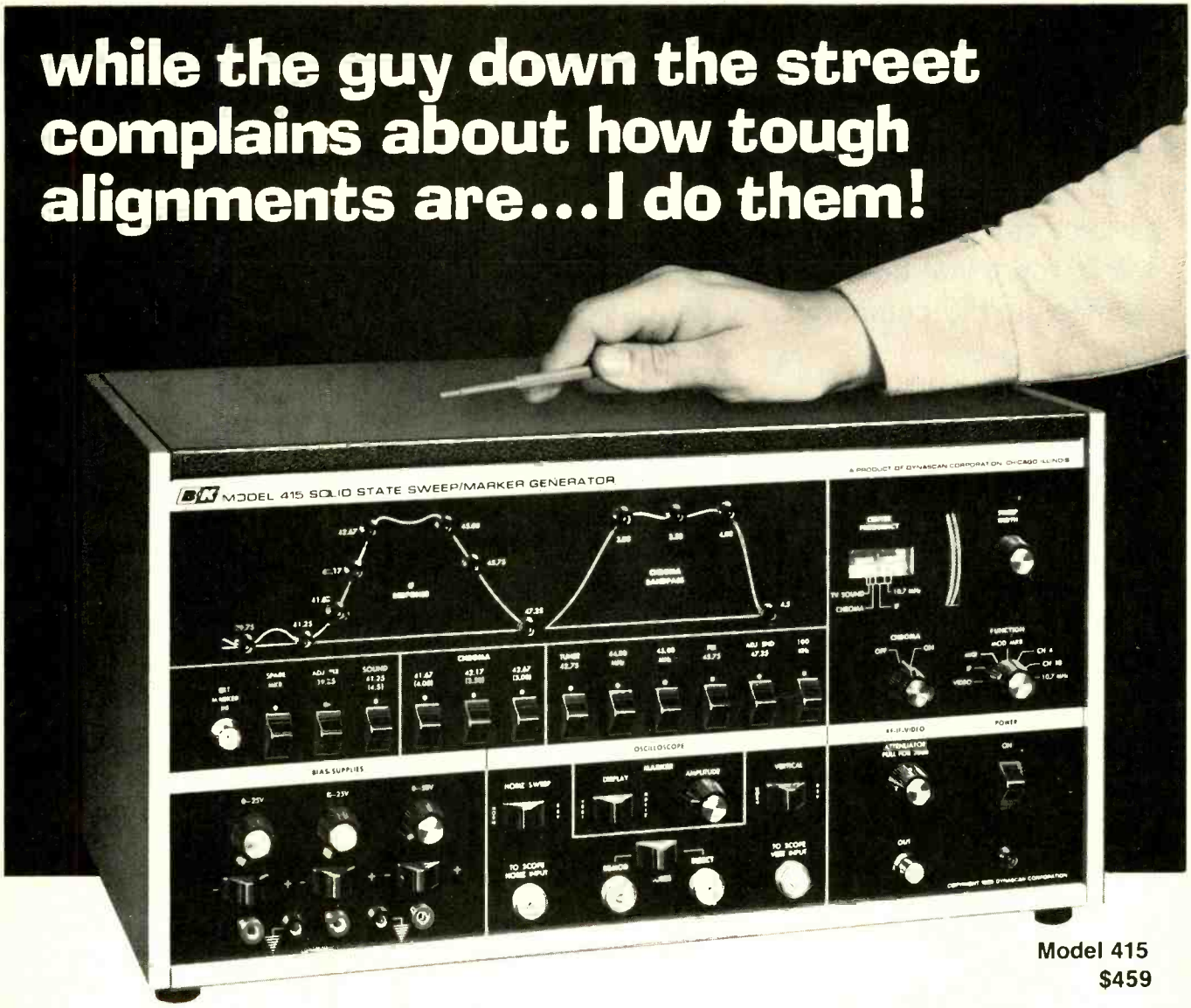
After sitting silently through much of the blast directed at the Consumer Electronics division by the fired-up servicers, RCA Service Company vice president Martin Barnabik, who also was an invited guest, decided that it was time to don his asbestos suit and take some of the heat that rightfully belonged to his division, if it belonged to anyone.

Barnabik told the servicers that they were "suffering under a lot of misconceptions" and that his division does have to show a profit. He explained that the $19.95 nine-month warranty labor extension was developed not as a loss-leader but, instead, to meet the request of RCA retailers who felt they needed a full one-year labor warranty. Asserted Barnabik, "We're not promoting it or advertising it. We don't want it and we don't have many dealers on it. We've had few takers."

(Lending creditability to Barnabik's assertion that the RCA Service Company can make a profit from its $19.95 color TV labor warranty extension is a report in the October 27 issue of *Television Digest* which states that the executive vice president of NARDA, Jules Steinberg, who also attended the RCA affair, told *Television Digest* representatives at the meeting that "his computer surveys showed that independent service dealers could profitably sell the warranty extender at $20, including the counseling call."

continued on page 49

while the guy down the street complains about how tough alignments are...I do them!



Model 415
$459

I used to hook up a separate sweep generator, marker generator, marker adder and bias supply, hope that everything was properly calibrated and adjusted, and pray that the alignment would hold after I disconnected the cables draped all over the bench.

I didn't do it very often.

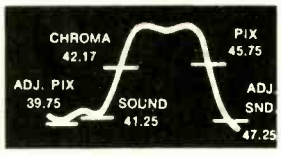
Now, in the time it used to take me just to set up, I can almost complete an alignment. And I'm confident the set will perform as well as it possibly can. My customers notice, too. That's the difference B&K's 415 Solid-State Sweep/Marker Generator made.

Setup is no problem. After I connect the 415's outputs to my scope (there's even low-frequency compensation to eliminate pattern errors), I connect its RF outputs (channel 4 or 10) to the antenna terminals or mixer test point, the direct probe to the video detector test point (or anywhere else after the video detector diode) and the demodulator probe to the bandpass amplifier output.

They're all clip-on connections, and the 415 comes with all the accessories I need. Once I've made the initial signal and bias hookups, there's nothing else to connect or reconnect. All intercabling changes and generator functions are controlled from the front panel. There's even a 15,750Hz filter to eliminate disabling the set's horizontal output section.

Shaping the waveform is easy, because the 415 has 10 crystal-controlled IF markers, each of which lights up on the front-panel waveform diagram as it is used. Markers can be shown either vertically or horizontally on the scope trace. There's a 100kHz modulated marker that makes nulling the traps so easy it's almost automatic. And three low-impedance, reversible-polarity bias supplies—two, 0-25VDC; one, 0-50VDC.

Vertical Markers



Markers Tilted Horizontally

Every step is easy to understand, too, thanks to the comprehensive manual.

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RCA's New ColorTrak TV

A completely new chassis, filtered phosphor picture tube, automatic contrast/color circuit, room light picture control, and new remote control system represent the most significant advances in the company's TV set design.

By Joseph Zauhar

■ Introduced are two new RCA ColorTrak chassis which have not only changed physical appearance but employ a new family of modules.

The physical design permits maximum accessibility to all modules and discrete chassis components. With fewer modules employed, isolating the problem to a specific module is much easier than in previous chassis and reduces the number carried for in-home servicing.

Performance and the features of the new sets should please the electronic technician, consumer and the dealer, as well. Now an automatic room-light compensation circuit is added to the list of previous circuits to provide better viewing conditions under all variations in room lighting.

A new unique remote control system (Direct Address) features on-screen display of the selected channel numbers and the time-of-the-day. The customer selects channels by addressing the system with the channel number desired. Therefore, eliminating the necessity of the customer having to sequence through a series of undesired channels, as is the case with most channel selection systems.

A new black matrix color picture tube employing filtered phosphor reduces the reflections from ambient light, producing pictures with more contrast and brighter colors.

The new RCA CTC74 and CTC81 feature only six circuit modules performing the same basic functions as the ten modules in the CTC68 chassis. Several different versions of the two chassis permit a wide choice in RCA's 1976 "U"-Line models.

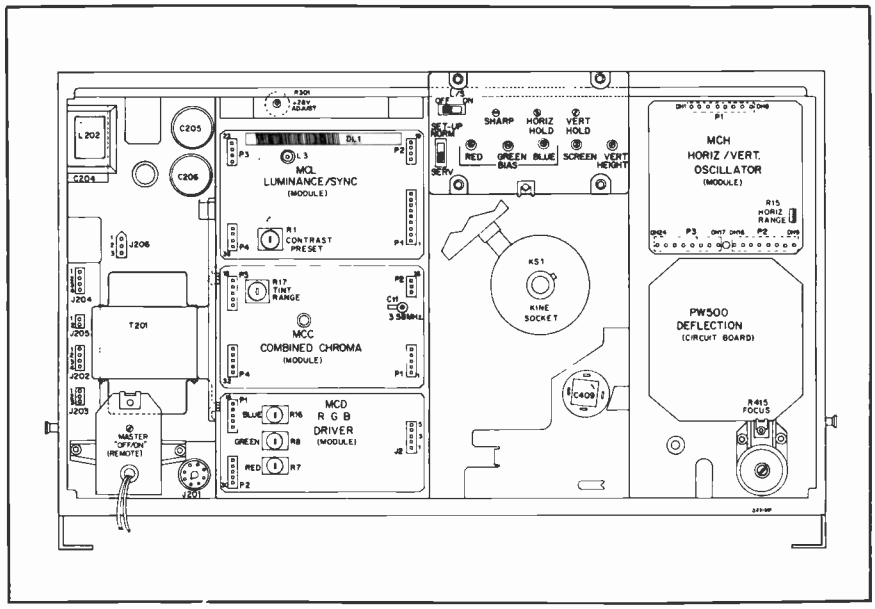

Fig. 1—Rear view of RCA's CTC74 Color TV Chassis showing the location of the modules.

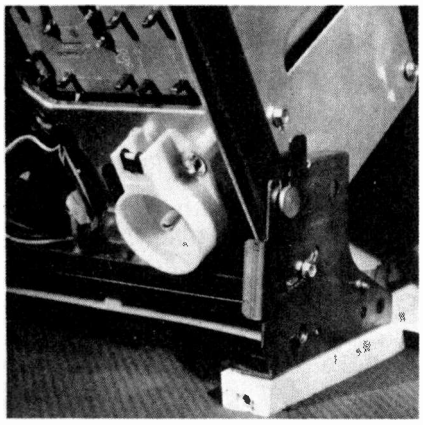

Fig. 2—The TV chassis can be placed and locked in several positions by a "slotted pivot" groove located at the bottom of the chassis.

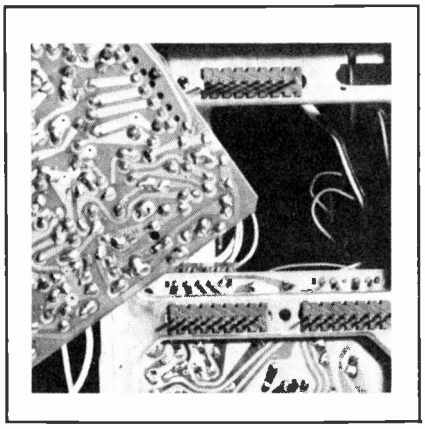

Fig. 3—Module connections are made through a pin and socket arrangement and the master board is eliminated.

Color TV Chassis CTC74

All U-Line color TV models employing the CTC74 chassis, Fig. 1, will feature modular construction, 30 kv anode voltage, AccuFilter PIL picture tube, automatic fine tuning, a constant voltage power transformer, automatic color control and automatic room-light compensation circuitry.

The CTC74 color chassis is used in manual and remote table TV models, equipped with a 19-inch (diagonal) Precision-in-line AccuFilter picture tube. Remote control TV sets employing this chassis are equipped with three additional modules: remote power and control, digital memory, and the remote preamp which is considered as a plug-in module.

All remote control and some of the manual TV sets employing the CTC74 chassis feature a 20-position VHF/UHF varactor tuning system. All 12 VHF channels and up to 8 UHF channels can be preset. Mechanically switchable tuners are also used which include the KRK 229 VHF and KRK 231 UHF tuners. While the KRK 231 UHF tuner has been employed in

prior chassis, the KRK 229 is a new VHF tuner. It is electrically very similar to the KRK 205 VHF tuner used in later Model CTC68 chassis.

Color TV Chassis CTC81

The U-Line models employing the CTC81 color TV chassis, feature second anode voltage of 31 kv, AFT, constant voltage transformer, automatic color control, automatic room-light compensation, varactor tuners and a 25-inch (diagonal) AccuFilter picture tube.

In addition to the mentioned features, the top-of-the-line TV sets employing the CTC74 and CTC81 chassis are equipped with direct address system, instant electronic tuning, with channel numbers and time displayed on the screen of the picture tube.

Serviceability Features

The chassis layout of the CTC74 and CTC81 permits maximum accessibility to all modules and discrete chassis components. The chassis tilts out of the cabinet and can be placed and locked in several positions by virtue of a "slotted pivot" groove, Fig. 2, located at the bottom mounting of the chassis. In the full-down position, most of the components mounted in other locations within the cabinet are very accessible.

Complete removal of the chassis from the cabinet is simplified by the mounting design. In its "up" position, the chassis is secured to the top support bracket by two ¼-inch metal screws.

Plug-in socket arrangements are employed for all subassemblies working in conjunction with the chassis. These include the tuner mounting assembly (TMA), varactor tuner control assembly, and the auxiliary control panels. In TV sets equipped with auxiliary functions, such as remote controls, the same rule applies—these assemblies are easily disconnected from the main chassis through the use of plugs and sockets.

To remove the chassis from the cabinet, remove the two bottom pivot screws, then pivot the chassis to the 45-degree position, and remove the chassis from the cabinet mounting slots by lifting up and then out after all other plugs are disconnected.

The ouput devices for vertical deflection, and the horizontal ITR's (SCR and diode in the same package) are plug-in devices located on their respective heat sinks. Four of the five protective devices (fuses) used in the chassis are plug-in type mounted in fuse clips. The fifth fuse is a fusible resistor which is soldered in and protects the picture tube screen circuit.

Circuit Modules

Five of the six modules as used in the basic CTC74 and CTC81 color TV chassis are identical, except for the module which contains the vertical and horizontal oscillator stages. The MCH 001 Vertical/Horizontal Oscillator module in the CTC74 chassis is not interchangeable with the MCH 002 Vertical/Horizontal Oscillator module employed in the CTC81 chassis.

Identification of the modules is similar to that used in the first family of XL-100 modules. The new series of modules all have the first letter "M" designating it as a module; the second letter is also common to all the modules in this new family. The letter "C", for

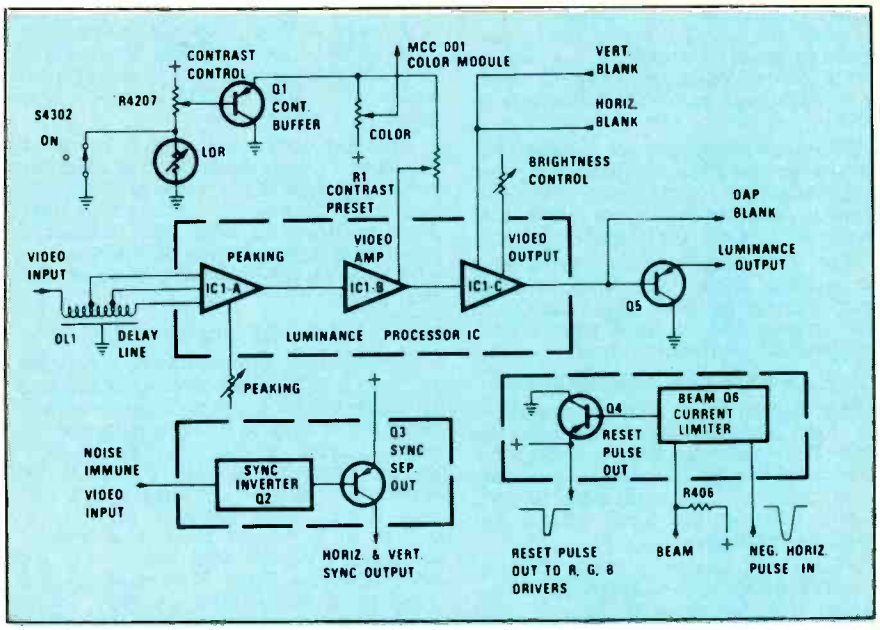

Fig. 4—Block Diagram of the Luminance Module MCL001 and associated circuitry.

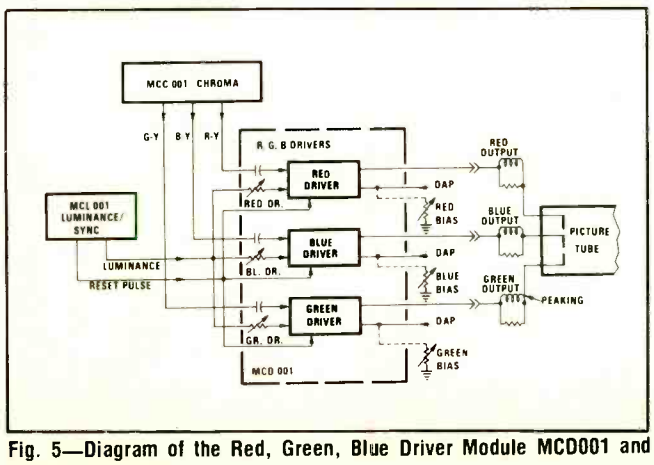

Fig. 5—Diagram of the Red, Green, Blue Driver Module MCD001 and associated systems.

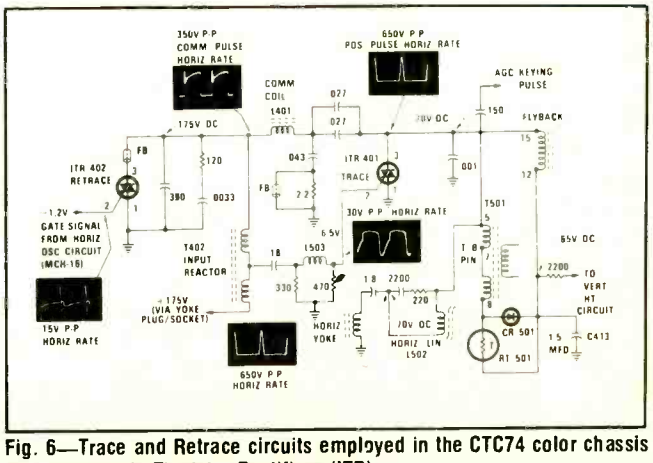

Fig. 6—Trace and Retrace circuits employed in the CTC74 color chassis feature Intrinsic Thyristor Rectifiers (ITR).

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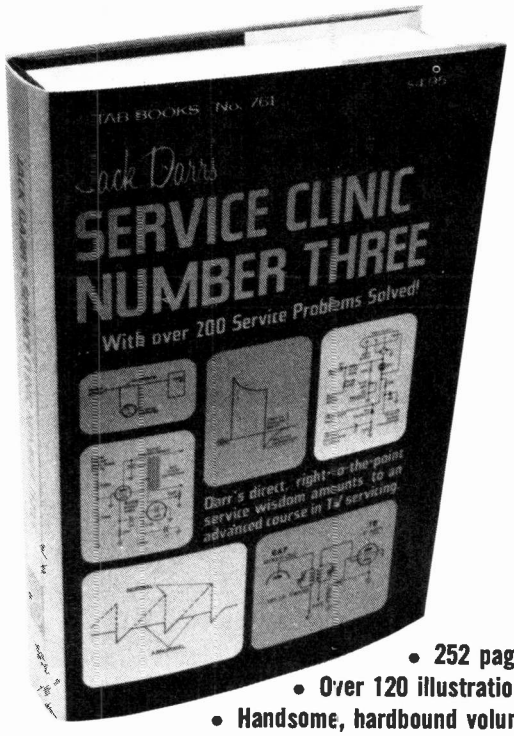


Jack Darr's Service Clinic No. 3

By Jack Darr

Jack Darr's direct, right-to-the-point service wisdom amounts to an advanced course in electronics servicing!

- **252 pages**
- **Over 120 illustrations**
- **Handsome, hardbound volume**

Partial List of Contents

Color Problems
Color Oscillator: It's Easy to Know—Categorizing the Trouble—Diode Grid Leakage—Smeary Color—Convergence Controls—Comb Color Troubles Out of Your Hair!—AFPC Troubles—Reader Questions.

Sweep & Deflection Problems
Heeding the Clues—Same Trouble, Different Causes!—Vertical Output Circuits—Vertical Output Transformer—Yoke—White Vertical Line—Vertical Controls — Complementary Vertical Sweep Circuits—Reader Questions.

Component Peculiarities
Checking the Chip—A Dropping Diode—What Is It?—ICs. TV and You—Replacement Parts—Solid State "Tubes"—Getting to Know Varactor Diodes—Replacing Hard-to-Find Transistors—Reader Questions.

CRT Troubles: Flyback, Focus, Voltages, Etc.
Heater-to-Cathode Shorts—Focusing—Flyback Transformers—Reader Questions.

Tuners, Noise, and AGC Problems
Mixer Noise—TV Boosters—Interference—Reader Questions.

Diagnosing Trouble & Shaking Down Intermittents
Asking the Right Questions—The Trouble Tree—Case History—Recognizing Intermittents—Reader Questions.

TV Sets and CATV
Cable Systems—The Videotape Machine—Reader Questions.

Test Equipment
Capacitances — Cable Reaks — Homebrew AC Ammeter Wattmeter—Homebrew Scope "Prescaler"—The VOM Around the Car—Reader Questions.

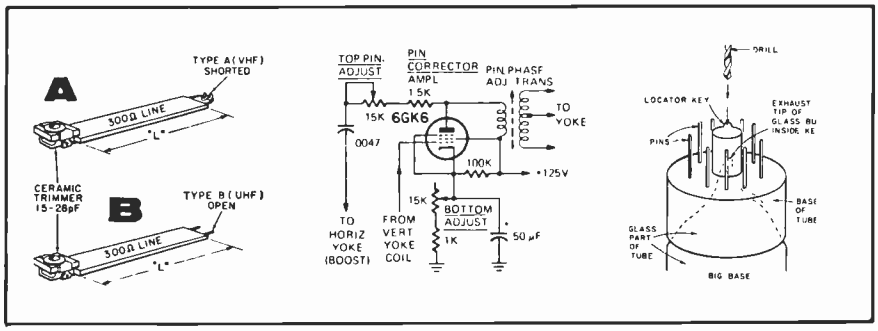
The Open Forum
Voltage Problems—Horizontal and Vertical Problems—AFC Problems—Sync Problems—Non-TV Equipment.

Here are straightforward solutions to over 200 individual servicing problems from the wizard of electronics repair, Jack Darr, who has become something of a "landmark" in servicing: a repairman's repairman. Jack has been turning tough dogs into pussycats for as long as TV sets have been acting up. Now, this single, practical volume presents the very best of Darr: his penetrating way of seeing the source of the trouble while most of us are wondering over the symptoms, his plain-talk wisdom and down-to-earth humor, and his timeless but simple philosophy (think, think, think!).

The best of Darr's two series, *The Service Clinic* and *In the Shop*, have been combined with service questions asked by practicing repairmen, and arranged into a logical sequence according to symptom category, which should make finding a solution to a dead-end problem no more difficult than looking up a word in the dictionary.

It's not all TV, either. A Chapter on test equipment contains a variety of extremely practical advice on how to get more from your equipment than the manufacturer intended, tells how to make a simple wattmeter using your VOM, plus a number of special tricks the author has picked up during his many years as an experienced troubleshooter. This Chapter winds up with an open forum of questions from servicemen who can't psyche out certain troubles they're having with their test equipment—the VOM, electronic voltmeter, and the scope, to name but a few. Darr answers them all, incorporating detailed schematics where necessary to stress a point or to show key trouble areas in a specific piece of gear.

While the thrust of the book is color TV and the perplexing problems associated with servicing the more popular brands, nothing in the home-entertainment field is overlooked. The final Chapter covers tape players, stereo systems, intercoms, car radios, and a host of other items that go on the blink from time to time. Each of the book's nine Chapters winds up with a question-and-answer session relating to material presented within that Chapter. The questions are letters from servicemen who got stumped at some point during their trouble analysis. The answers to these questions serve a twofold purpose: They comprise a valuable, well organized file of true case histories that are bound to prove extremely helpful to any practicing repairman or technician who runs into a blind alley on a repair job; and they point the way to success in solving unusual problems that recur in specific color TV models.



Over 120 schematics and complete illustrations make each of the hundreds of entries in "Jack Darr's Service Clinic No. 3" of practical, immediate benefit.

AN EXTRAORDINARY OFFER...

Fig. 7—The new Direct Address System control center is operated through a push-button array resembling that of a push-button pocket calculator keyboard.

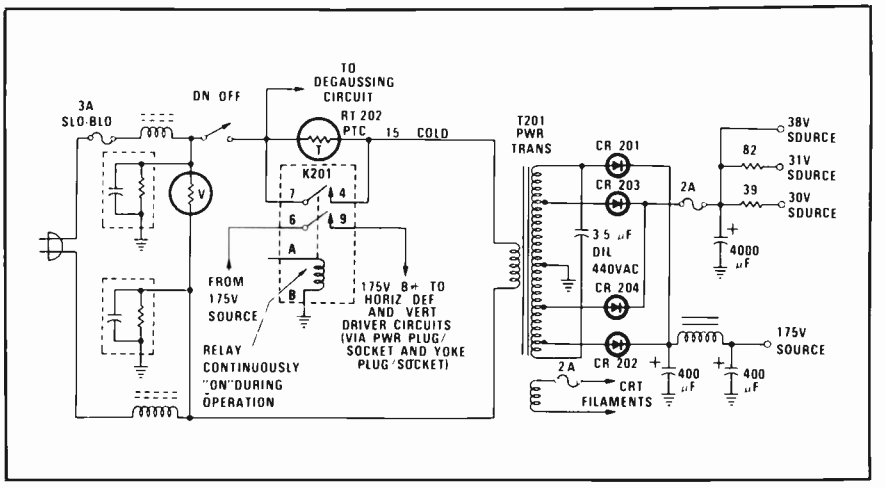


Fig. 8—Basic CTC74 and CTC81 color chassis power supply circuit employing a constant voltage transformer. *Photos and illustrations supplied through the courtesy of RCA.*

example, displaces the middle letter "A", as used in previous modules. The last letter of the six basic modules in the CTC74/81, is somewhat indicative of the previous series, and in all instances its counterpart can be recognized.

Previously the circuit modules used in XL-100 TV chassis were of the edge-connector type and the connection of the module was usually made through sockets mounted on the master circuit board. In the CTC74/81 series chassis, the module connection is made through a pin and socket arrangement, Fig. 3, and the master board is eliminated. The chassis comes equipped with a special plastic module removal tool located on the power supply unit.

IF/AFT Module MCK001A

The video IF system, including AGC, video detection, noise cancellation, AFT and sound detection circuitry is found on the MCK001 module.

This module employs three picture IF amplifier stages, using discrete MOSFET devices, and a video buffer stage using a bipolar transistor.

Transistors are also used in circuits for the AGC keyer, RF AGC amplifier, and the noise inverter for the sync stage. The AFT, sound detection, and sound IF amplification signal processing is performed in one integrated circuit.

Sound Module MCS001A

All of the functions for sound demodulation, audio preamplification, and approximately 1.75 watts of audio output, are performed by one integrated circuit on this module. Control circuits include those used for volume and tone if employed.

Luminance/Sync Module MCL001A

The integrated circuit employed on this module amplifies the luminance video information. A total of six discrete transistors are used to perform the video buffer, video amplifier, brightness limiter, blanking, sync inverter, and sync separator functions.

Circuitry found on this module provides customer control of video response (peaking), contrast and brightness, as well as automatically adjusting contrast in response to ambient light. This new ColorTrak feature is accomplished by employing a light dependent resistor (LDR) and it can be disabled by the customer at his option.

The *color* control is coupled to the contrast control circuit allowing the picture color content to vary in direct proportion to the contrast setting. This new ColorTrak circuit provides a constant luminance to color gain ratio and the customer need not readjust the color level when the contrast level is changed.

The video output stage (IC 1-C), Fig. 4, contains a "black level" clamping circuit which clamps the video signal blanking (or black) level to a reference voltage determined by the *brightness* control.

Chroma Module MCC001A

Two integrated circuits are employed on this module to perform the functions of color bandpass, AFPC, ACC, reference oscillator, and demodulation. Control circuits operating in conjunction with this module include the *color* and *tint* controls, and the automatic tint correction defeat switch.

The circuitry found in the MCC001 Chroma Module is capable of minimizing tint errors in the flesh-tone region without much effect on non-fleshtone colors, such as the blues and greens. If non-tint error exists, the customer can defeat the automatic tint correction feature.

This chroma module amplifies and demodulates the chroma sidebands, providing color difference signals to the driver module MCD001.

R/G/B Driver Module MCD001A

Six transistors are employed in the R/G/B driver module, Fig. 5, which consists of three bias-reset stages, and three color driver stages.

The red, green, and blue video output signals obtained from this module are coupled to the respective cathodes of the color picture tube.

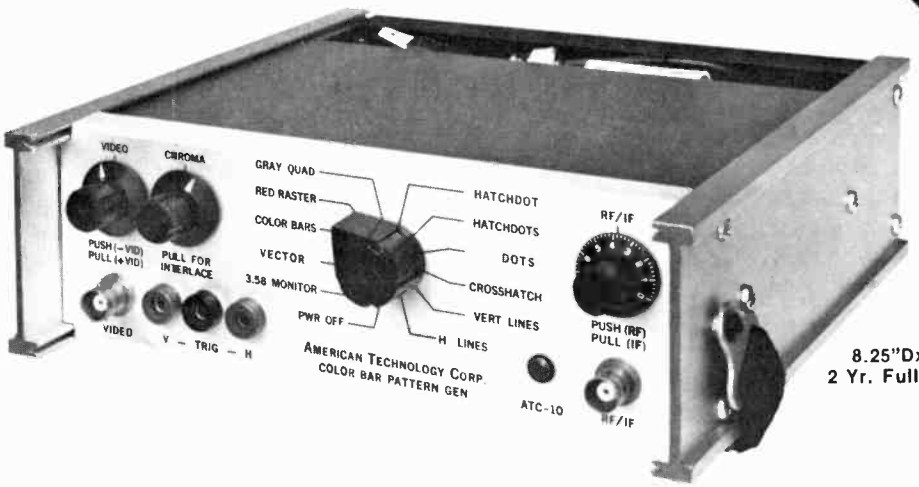
Vertical/Horizontal Oscillator Module MCH001A/MCH002A

The MCH001A module (CTC74) and the MCH002A module (CTC81) contain the complete circuits to produce the vertical and horizontal sweep signals. The vertical stages found on the module

the Money Generator

NEW

MODEL ATC-10
Patent Pend.



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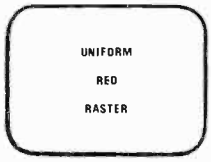
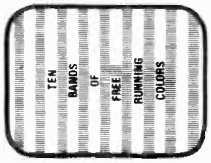
ATC-10's Unique Patterns



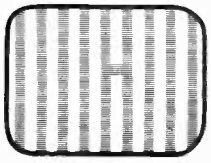
RED RASTER

Check and adjust purity at the flip of a switch without disabling blue and green electron guns.



3.58 MONITOR

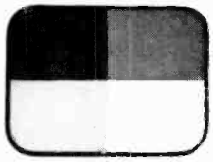
Check and adjust color Sync. OSC. Freq. at the flip of a switch (No need to ground AFPC Test Point.)



COLOR BARS

Sixth bar marked for identification.

Luminance pedestal shows color fit.

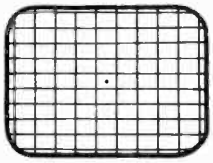


GRAY QUAD

Gray scale tracking checks/adjustments.

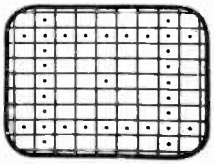
Yoke orientation.

L.F. video response.



HATCHDOT

Composite convergence patterns enable you to complete an entire convergence series with no need to alternately select separate patterns for DC and dynamic convergence.



HATCHDOTS

The hatchdots pattern with its frame-of-dots is also great for size, linearity, centering, and pincushion checks and/or adjustments.

A Great Profit Generator for You

If you are the kind of service technician who realizes that efficient use of time is the key to greater profits, the new Model ATC-10 is for you. This is the kind of TV servicing instrument you have been waiting for. We've nicknamed it the MONEY GENERATOR. It is efficiency oriented for the busy technician who often finds his days too short, or becomes frustrated when a difficult problem takes longer to locate than a "happy customer will be willing to pay for." The ATC-10 not only has features which speed up home service calls, but it's also ideal for analyzing those tough dogs in the shop. When the set goes back to the customer, it's with greater confidence that the job has been done right.

Incorporated into a single instrument are the features of other color bar pattern generators plus many new timesaving patterns and added features such as a wide range, calibrated, RF/IF output control for receiver sensitivity and dynamic range tests. It's a maxi pattern generator with the value-packed versatility of performing the most commonly used functions of an analyst and a tuner subber. The ATC-10 is a highly portable instrument and sells direct-to-you for only $299.95.

The best way to see for yourself the profit generating capability of the ATC-10 is to put one to work in your own shop. We've made that easy for you with our 30 day money back guarantee. Put it to the test for 30 days. Then, if you feel that it's not a real money generator/profit maker for you, return it to us for a full refund.

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  ☐ Chan. 3 (Optional) crystal installed (Chan. 2 transmitter in our area.)

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include the switch, two predrivers, and two driver stages. A sync blanker signal is employed in the integrating network associated with incoming sync to the vertical switch circuit. The horizontal stages include a phase splitter and two AFC diodes which operate in conjunction with a sample feedback pulse and sawtooth stage. A blocking oscillator provides a gating pulse for the retrace ITR.

Vertical and Horizontal Deflection Circuits

The vertical and horizontal deflection circuits employed in the CTC74 and CTC81 color TV chassis, Fig. 6, are quite similar to those employed in previous XL-100 chassis. The deflection circuitry used in the CTC74 chassis has the same basic circuit configuration as the CTC72 color chassis, but the physical configuration is quite different between the two chassis series and the previous XL-100 chassis.

In the CTC74/81 chassis, the circuit functions for the vertical and horizontal oscillators are located on a single module board, in previous XL-100 chassis they were located on two separate modules.

The two vertical output transistors are not an integral part of the module as in the CTC72 chassis. The vertical transistors are now mounted on a heat sink and are of the plug-in type.

The trace and retrace functions in the CTC74 and CTC81 employ intrinsic rectifiers (diode and SCR in a common case.) The basic deflection design remains similar to that used in the CTC72 chassis.

Previously in the CTC62/72 chassis the majority of operating B+ voltage for the chassis was developed from the retrace circuit. The low voltage sources, including three DC supplies and the picture tube filament AC supply, were provided by the secondary windings on the input reactor. In the CTC74 color chassis, they are developed directly from the power transformer circuit.

There is no need for a high voltage regulating circuit in the CTC74 or CTC81 chassis because a self-regulating power input transformer is employed.

A horizontal protective circuit operates in conjunction with the horizontal hold circuit. If an "open" develops in the trace circuit or component, the protective circuit functions to disable the oscillator circuit producing a loss of horizontal sync.

Remote Control (Direct Address System)

Selected models of the CTC81 and CTC74 chassis feature a unique remote control system which provides on-screen display of the selected channel number and the time-of-day. The channels are selected by addressing the system with the channel number desired, eliminating the necessity of having to sequence through the undesired channels, as with most channel selection systems.

This new system also includes remote control of volume, color, tint, and chassis power. The TV set is automatically turned *on* when a channel is selected, and then turned *off* from the remote transmitter.

The ultrasonic transmitter called an "XL-100 control center", is the only means of TV set control available to the user. There are no manual operated controls on the TV set which duplicate the functions of the control center.

This control center, Fig. 7, is operated through a push-button array resembling that of a push-button telephone or pocket calculator keyboard.

Ultrasonic signals from the control center are received and amplified by the MCY001 ultrasonic preamplifier. Then the energy from this unit is coupled to the post amplifier MCZ001, which amplifies and amplitude limits the incoming ultrasonic energy before application to the command module.

The MCT001A command module converts the 14 possible ultrasonic frequencies into digital codes which control the functions desired. These digital codes are applied to the display module, MCA001, which converts the channel number codes into video information that is displayed as channel numbers on the TV screen. The display module also contains an electronic clock which provides the time-of-day information to the display circuitry for display on the TV screen.

Channel selection digital codes from the MCT001A command module are applied to the MCV001A VHF tuning and MCV001A UHF tuning modules. These modules select the appropriate analog voltage for the varactor tuner operation. The tuning modules also provide the appropriate power and bandswitching for their respective tuners. The tuners are physically mounted to their respective tuning modules.

The various DC voltages required to operate the direct address system are supplied by a separate power supply module, MCP001A. Standby voltages, as well as some operational voltages, are obtained from the AC line input through a module-mounted transformer and rectifier circuit. The other required voltages are provided by the chassis 175-volt DC and 38-volt DC supplies.

Low Voltage Power Supply

The CTC74 and CTC81 are the first chassis from RCA in which a constant voltage transformer (Fig. 8) is employed. The transformer is a self-regulating, power limiting device, having a saturable secondary, shunted by a 3.5 mfd, oil-filled capacitor. The output voltage is held fairly constant, with line voltage changes in the 105 volts to 135 volts AC range.

All of the power supply circuitry is protected by a 3-amp, slow-blow fuse in the primary circuit. The degaussing circuits are basically the same as employed in previous RCA color TV sets.

Protection for the B+ circuits is provided by an input thermistor, operating in conjunction with a power switching relay. This arrangement replaces the manual reset-circuit breaker used in previous XL-100 color TV chassis.

To ensure the 175 volt source is available before the deflection circuits are permitted to operate, the sweep oscillators receive operating power through another path. They will then be operating "on frequency" before power is available to the deflection circuits.

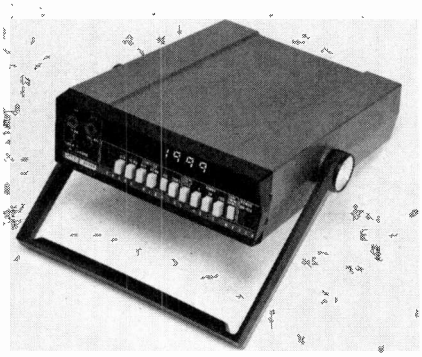
The switching relay and thermistor found in the primary of the transformer provide protection of B+, and delay of B+ to the deflection stages.■

Your VTVM is obsolete!

This may sound like a harsh claim, but it's true. Thousands of TV technicians are using instruments designed in the 1950's to trouble-shoot circuits designed in the 1970's.

And now, most color TV's have solid state circuits. So use of out-of-date test equipment just compounds the problem.

The generation gap has grown too big.



The Fluke 8000A 3½ digit multimeter

Solid state calls for new performance standards.

Your "old fashioned" test equipment simply doesn't measure up to today's requirements. For example, the typical VTVM gives you 5% accuracy and 2% resolution. In the old days, that was good enough. Not so today.

Now you need an instrument to look at the voltages at each pin of an IC with sufficient accuracy and resolution to determine proper IC operation.

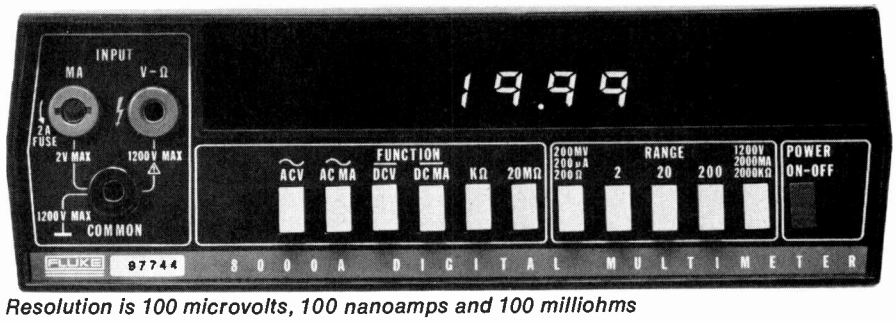
For example, a reading of "around 2.8 volts" is no longer sufficient. You must be able to distinguish between 2.80 and 2.82 volts.

You need a test instrument that gives you 0.1 ohm resolution so you can reliably measure resistance of switch contacts, circuit breakers, and low value resistors.

To do all this and more, you need the superior capabilities of the Fluke 8000A 3½ digit multimeter.

An instrument designed specifically for testing solid state equipment.

The 8000A gives you up to 50 times the accuracy and 20 times the resolution of a VTVM, so you can measure the various voltage levels in a solid state chassis with absolute confidence.



Resolution is 100 microvolts, 100 nanoamps and 100 milliohms

You get the sensitivity you need for low level dc measurements. The 200 millivolt range with 100 microvolt resolution tells you *exactly* what your values are.

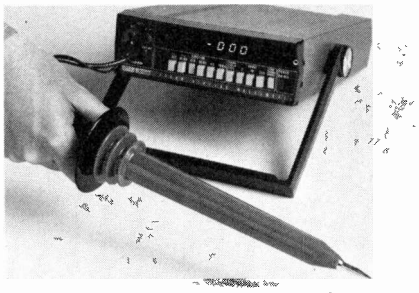
The 8000A has an AC frequency response from 45 Hz to 20 KHz and, with accessory probes, to 500 megahertz. Resistance measuring capability ranges from 100 milliohms to 20 megohms. It offers a 15°C to 35°C accuracy temperature span. And a 1-year accuracy time span, meaning it seldom needs calibration.

Unlike other DMM's the 8000A has fast response time—3 readings a second. And the bright, digital readout means that no interpolation is necessary.

The 8000A measures high voltages, too.

Our 8000A is designed to answer *all* the needs of an electronic service technician.

One very important (and talked about!) safety requirement is that the picture tube anode voltage must not exceed the maximum specified by the manufacturer. Our 8000A has an optional high voltage probe that gives you guaranteed accuracy of 1% at 25,000 volts. The probe also extends the capability of the 8000A to 40,000 volts to measure the high voltage in the new 32,000 volt chassis.



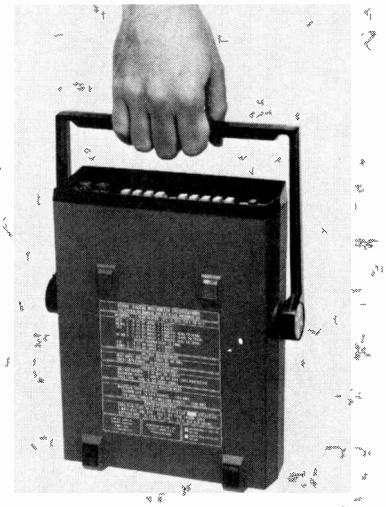
High voltage probe accessory gives you 1% accuracy at 25,000 volts

There's new high voltage protection on all ac/dc voltage ranges. The instrument will take transients up to 6 KV, 10 μseconds wide over a duty cycle of 60 per second.

Get the most up-to-date instrument available.

Don't be caught in the typical trap. Many electronic service shops don't really update their equipment when they decide to update. Switching to a TVM or a FET voltmeter doesn't really give you the accuracy and resolution you need today, or for that matter, tomorrow.

But with the 8000A on hand, you know you have a *true* solid state testing device.



Carry it anywhere. Use it on line or with optional rechargeable battery power ($50 extra). Note the conveniently mounted specs on the bottom decal.

It costs just $299 ($40 more with HV probe).* And it is far and away the largest selling, most rugged and reliable 3½ digit multimeter in the world.

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Circuit Modules (Continued)

Recommended Replacement Part Number	Replaces Part Number	Function	Chassis Applications													
			T936	T952	T956	T957	T971	T974	T979	T981	T982	T985	T986	T987	T989	T991	T995
703661-1	703661-1	24/250 Volt Supply										X	X				
703662-1	703662-1	Video Delay										X	X				
703662-2	703662-2	Video Delay														X	
703663-2	703663-1 & 2	Chroma Demodulator										X	X				
703664-1	703664-1	Chroma Processor										X	X				
703665-2	703665-1 & 2	RGB Output										X	X			X	
703667-2	703667-1 & 2	V. Osc./Driver										X	X			X	
703668-1	703668-1	H. Osc./Driver										X	X				
703669-1	703669-1	Videomatic										X	X				
703728-1	703728-1	H. Osc./Driver								(12)	(12)			(12)			
703743-1	703743-1	Chroma														X	
703744-1	703744-1	Regulator														X	
703745-1	703745-1	Horiz. Oscillator														X	

Circuit Panels

This list provides a cross-reference of plug-in circuit panels for those Magnavox Color TV Chassis models incorporating such panels. Those circuit panels in your stock bearing numbers different than those in Column 1 may not be used and should be returned to Magnavox for exchange with the recommended types. If a number such as (15) rather than (X) appears in the Chassis Applications column, consult the explanatory notes printed at the end of this listing.

Recommended Replacement Part Number	Replaces Part Number	Panel Identification	Chassis Applications	
			T979	T989
703502-22	703502-1,2,3,4,20,22 & 201	"A" Panel	X	
703502-66	703502-5,6,7,66 & 601	"A" Panel		X
703503-11	703503-1,2,3,10,11 & 101	"B" Panel	X	
703504-11	703504-1,2,11 & 101	"C" Panel	X	
703505-11	703505-1,11 & 101	"D" Panel	(13)	
703505-22	703505-2, 22 & 201	"D" Panel	(14)	
703506-11	703506-1, 11 & 101	"E" Panel	X	
703574-11	703574-1,2,3,11 & 101	"B" Panel		X
703575-11	703575-1, 11 & 101	"C" Panel		X
703576-11	703576-1, 11 & 101	"D" Panel		(15)
703576-22	703576-2, 22 & 201	"D" Panel		(16)

NOTES:

1. Used in chassis with F-Pin Module connector only.
2. Replace with 703503-11 "B" Panel including soldered-in Audio Output Module.
3. Used in chassis with Edge-Board Module connector only.
4. Replace with 703502-22 "A" Panel including soldered-in Sound Detector Module.
5. Use in T981-01 thru 07, 10, 12; T982-01 thru 08; T987-01,03,04,06,08,09,10 only.
6. Use in Chassis with Plug-in Module T981-02, T982-02, T987-01 only.
7. Use in T989-01,03,04,05,08,10,15,16 only.
8. Use in T989-11, 12, 18 only.
9. Use in T989-02 only.
10. Use in T989-14 only.
11. Use in Non-Videomatic Chassis T995-03 only.
12. Use in T981-08, 09, 11; T982-12 thru 17; T987-05, 11, 12 only.
13. Use in Remote/Search Models T979-02, 03, 04, 05 only.
14. Use in Non-Remote/Non-Search Models T979-01, 06, 50, 52 only.
15. Use in T989-03,04,05,15,16 only.
16. Use in T989-01,02,09,10,11,12,14,18 only.

MAGNAVOX COLOR TELEVISION CIRCUIT MODULE & PANEL CROSS-REFERENCE LIST

Circuit Modules

This list provides a cross-reference of all recommended replacement plug-in circuit modules identifying their application for the corresponding Magnavox Color TV Chassis models. The recommended replacements represent the minimum investment for the servicer to achieve the maximum circuit module benefits. Any modules in your stock bearing numbers shown in Column 2 may be used successfully in any application where that specific module was used as original equipment. If a number such as (1) rather than (X) appears in the Chassis Applications column consult the explanatory notes printed at the end of this listing.

Recommended Replacement Part Number	Replaces Part Number	Function	Chassis Applications														
			T936	T952	T956	T957	T971	T974	T979	T981	T982	T985	T986	T987	T989	T991	T995
612003-101	612003-1 & 101, 703327-1	Audio Output	X	X	X	X	X										
612003-102	612003-2 & 102	Audio Output						X									
612004-101	612004-1 & 101	Sound Detector	X	X	X	X	X	(1)									
612034-101	612034-1 & 101	Chroma Demodulator								X	X			X	X		
612036-101	612036-101	Signal Processor								X	X			X			
612041-101	612041-1 & 101	Chroma Processor								X	X			X			
612046-202	612046-2, 102 & 202	Audio Output							(2)								
612047-202	612047-1, 101 & 202	Sound Detector						(3)	(4)	X	X			X	X		
612062-202	612062-101, 102, 201 & 202	Audio Output								X	X			X	X		
703507-1	703507-1	HV Regulator							X								
703508-1	703508-1	Videomatic							X								
703508-2	703508-2	Videomatic													X		
703549-2	703549-1,2	Video IF								X	X			X			
703550-1	703550-1	AFT								X	X			X			
703551-3	703551-1, 2, 3	Video Delay								X	X			X			
703552-4	612032-1,101;703552-1,2,3,4	Video Output								X	X			X	X		
703553-1	703553-1	V. Osc./Driver								X	X			X			
703554-1	703554-1	H. Osc./Driver								(5)	(5)			(5)			
703556-4	703556-1, 2, 3, 4	H.V. Regulator								X	X			X			
703573-1	703573-1	Videomatic								(6)	(6)			(6)			
703577-2	703577-2	H.V. Regulator													X		
703579-1	703579-1	Videomatic Switch													(7)		
703579-2	703579-2	Videomatic Switch													(8)		
703606-1	703606-1	Videomatic Switch													(9)		
703606-2	703606-2	Videomatic Switch													(10)		
703607-1	703607-1	AGC Interface													X		
703616-1	703616-1	V. Osc./Driver													X		
703617-2	703617-2	Digital Lamps													X		
703636-1	703636-1, 2, 3	IF										X	X			X	X
703637-1	703637-1	AFT										X	X			X	X
703638-1	703638-1 & 2	AGC/Sync										X	X			X	X
703639-1	703639-1 & 2; 703727-1,2,4,5	Audio Output										X	X			X	X
703640-3	703640-1 & 3	Low Level Video															X
703642-1	703642-1	Chroma Processor															X
703643-1	703643-1	Chroma Oscillator															X
703644-2	703644-1 & 2	RGB/CRT															X
703645-1	703645-1	Horizontal															X
703646-1	703646-1	Vertical															X
703647-1	703647-1	Retrace/Screen															X
703648-1	703648-1	Power Supply															X
703653-1	703653-1	Horiz. Scan/H.V.															X
703654-2	703654-1 & 2	Videomatic Switch															X
703656-2	703656-2	Videomatic															(11)
703656-3	703641-1, 703656-1 & 3	Videomatic															X
703660-1	703660-1	120 Volt Regulator										X	X				

How To Use A Field-Strength Meter

By Bert Wolf*

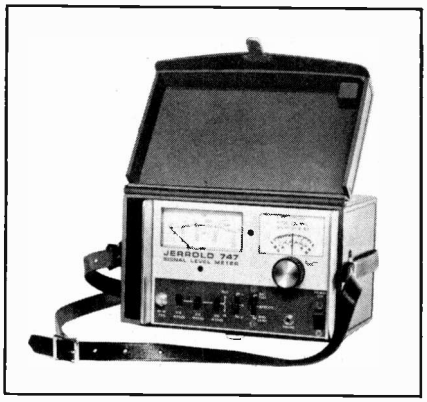

Fig. 1—A typical field-strength meter.

■ Anyone who does antenna or MATV work should have a good portable, battery-operated, field-strength meter. (The meter face of a typical field-strength meter is shown in Fig. 1.) A field-strength meter can tell you precisely what strength of signals you are working with at all times. Without a field-strength meter, you are only guessing.

A field-strength meter (or FSM) is, basically, a tuneable voltmeter. However, it is different from ordinary voltmeters in two very important ways:

1) The FSM measures voltages at specific FM frequencies in the UHF, VHF and FM ranges.

2) The FSM can accurately measure RF voltages; voltages as low as 50 microvolts (.00005 volts).

The FSM is an ideal tool for selling and installing antennas. Suppose, for example, that you make a service call where the complaint is snowy pictures. The trouble could be in the TV set, or it could be in the antenna system. Many technicians go to the trouble of hooking up a second TV to the same antenna, to determine where the problem lies. However, this is often a nuisance and it's always a relatively time-consuming procedure.

Your best bet is simply to measure the signal level by connecting the antenna lead-in wire or cable to the FSM and take a reading. If the signal level is low, the problem is definitely the antenna system. If the signal level is adequate, the problem is definitely in the set.

JOB SITE _____
Street Address City State

OWNER _____
Name Address

TYPE OF BUILDING _____
(hospital, school, hotel, motel, etc.)

NUMBER OF FLOORS _____ NUMBER OF ROOMS _____

CHANNELS TO BE RECEIVED

CHANNEL NUMBER	LOCATION (City)	PICTURE CARRIER SIGNAL (In microvolts)	SOUND CARRIER SIGNAL (In microvolts)

SURVEY PREPARED BY

_____
Signature

Fig. 2—A typical MATV signal survey form.

HOW MUCH SIGNAL IS ENOUGH?

At this point, we come to the question of: How much signal is enough to produce a snow-free picture? Although picture quality is dependent on a number of factors, including how good the tuner of the set is and even the line voltage, the most significant factor is the amount of noise mixed in with the signal. Snow, after all, is nothing more than visible noise. Remove the antenna from a TV set and you will probably see a lot of snow on the screen. In the absence of strong antenna signals, AGC voltage is minimal, which means that the tuner and IF stages of the receiver are cranked up to full gain. Noise voltage is relatively low, but when it is amplified many times, it becomes clearly visible on the TV screen.

In other words, picture quality is determined not just by how much signal we have, but how much signal we have compared to the noise present. This concept is usually expressed in terms of signal-to-noise (S/D) ratio. For example, if the signal level is 100 microvolts, and the noise level is 10 microvolts, the signal-to-noise ratio is 10 to 1, or 20 dB.

Bell Laboratories say you need a signal-to-noise ratio of 50 dB for an absolutely snow-free picture. However, Bell is traditionally conservative. Years ago, the Television Allocation Study Organiza-

*The author is the vice president and general manager of the DSD Division of Jerrold Electronics.

tion (TASO) made a study of the subjective reactions of viewers of black-and-white pictures. Their ratings are as follows:

44 dB S/D Ratio—Excellent Picture

34 dB S/D Ratio—Fine Picture

27 dB S/D Ratio—Passable Picture

17 dB S/D Ratio—Inferior Picture

You should aim for at least a 44 dB signal-to-noise ratio, except in the deepest fringe areas, where customers might be satisfied with 34 dB.

The amount of noise at the input of a TV receiver depends on many factors, but in an unamplified system, you won't be too far off if you estimate TV input at 8 microvolts across 300 ohms. 44 dB is equal to a multiplication factor of 160. Therefore, to get a 44 dB signal-to-noise ratio, you will need 1280 microvolts of signal (1280 to 8 = 160:1). To simplify matters and to compensate for "sky" noises, we generally round off 1280 to 2000 microvolts. We then arbitrarily say that a signal level of 2000 microvolts across 300 ohms is equal to 0 dBmV.

In other words, when you take your FSM readings across 300 ohms you should get about 2000 microvolts on each picture carrier. However, if you get as little as 1000 microvolts, the receiver should still produce an acceptable picture if it has a good tuner.

So far, we have specified FSM signal-level readings across 300 ohms. However, FSM readings are usually taken across 75 ohms in MATV systems and in home installations using coaxial cable downleads. Most FSM's you will encounter are calibrated to be read *directly* for 300-ohm input. With a 75-ohm input, meter sensitivity is approximately doubled because of the step-up ratio of the matching transformer. Therefore, you have to divide the FSM microvolt reading by 2. For example, a reading of 2000 microvolts across 300 ohms is equal to a reading of 1000 microvolts across 75 ohms. And therefore 1000 microvolts across 75 ohms is equal to 0 dBmV, just as is 2000 microvolts across 300 ohms.

If you are working with "75-ohm" signal readings, an FSM reading of 1000 microvolts should be enough to produce an excellent picture on most sets. In MATV work we always design for at least 1000 microvolts across 75 ohms (0 dBmV). In fact, in strong signal areas, we usually design for up to 6 dBmV, or 2000 microvolts across 75 ohms.

USING THE FSM TO TROUBLESHOOT & SELL ANTENNAS

Let's get back to our hypothetical house call. The picture is snowy and your FSM reading is in the neighborhood of 300 microvolts across 300 ohms. It is obvious that the problem is either in the antenna or the lead-in wire.

Show your customer the low reading and explain what the reading should be. Then, go outside and look at the antenna from the ground. If the antenna has broken or has bent elements, point this out to the customer. The appearance of the antenna plus the meter reading should clinch the sale of a new antenna.

If the physical condition of the antenna appears to be good, the source of the problem is probably the lead-in wire. You can easily confirm this by climbing to the roof and taking an FSM reading directly from the antenna output. This is not difficult, because today's FSMs are light and battery powered.

ANTENNA INSTALLATION APPLICATIONS

An FSM is also very useful when installing a new antenna. If necessary, first use a compass to point the antenna in approximately the right direction. Then, use your FSM to "fine tune" the antenna orientation. When you

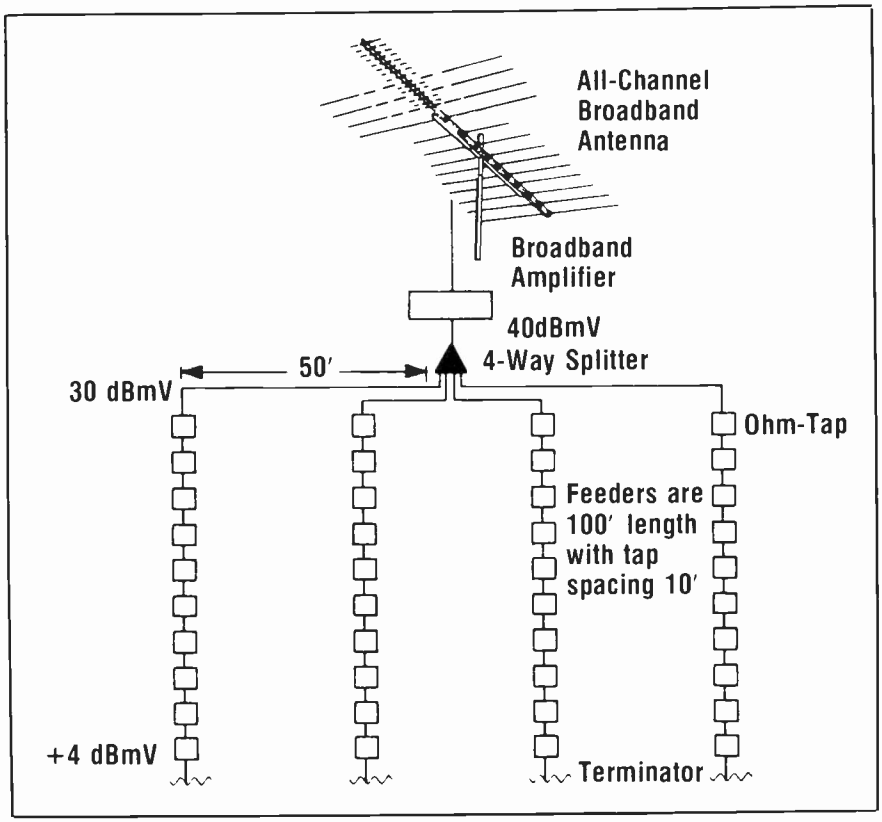

Fig. 3—Functional diagram, or layout, of a typical "all-channel" MATV system.

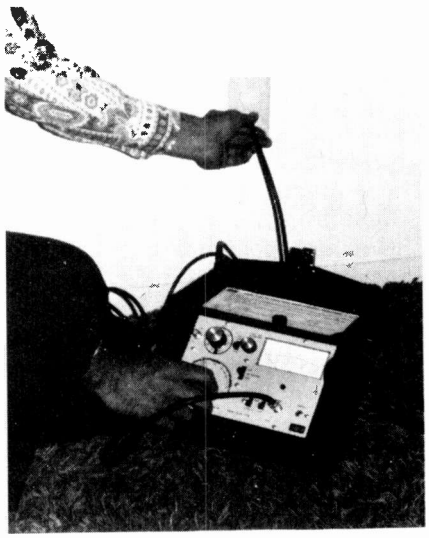

Fig. 4—Troubleshooting antenna systems with an FSM, as shown here, eliminates the need for removal of all plates and the disconnection of input and output cables of tapoffs.

aim the antenna for the highest possible reading on an FSM, you know that the antenna orientation is perfect.

Even if it's a rotor installation, the FSM is still useful. First, use a compass to orient the antenna toward North and set up the rotor control so that it also indicates North. Then, with the FSM meter connected to the antenna cable or lead-in, use the rotor control to position the antenna for the highest signal level on each channel. This will enable you to preset pushbuttons or mark the corresponding positions on the rotor control so that your customer will know the precise rotor control positions which produce the best possible pictures. Aiming the antenna accurately not only provides maximum signal, it also minimizes ghosts and color smears.

In some areas, the strength of the signal from the antenna will not be sufficient to produce acceptable pictures. For these areas, preamplifiers are required. If you are familiar with reception in the area, you probably know from experience whether or not a preamp is necessary. If not, you can find out easily enough with a test antenna and an FSM. A foldable type antenna such as the Jerrold Traveltenna is best for this purpose, because it is easiest to handle. Mount the antenna on a 10-foot mast and connect it with coax to your FSM. (Coax is preferred because it won't be affected by proximity to your body or to the mast.)

Climb upon the roof and aim the antenna in the direction of the TV transmitter. Then, carefully walk around the roof, looking for the best signals. Move the antenna up and down, because height sometimes makes a big difference.

You might not always choose the exact spot that provides the highest signal strength, because that's not always the most convenient spot to mount an antenna. The spot you choose will probably be a compromise between maximum signal and ease of installation. But at least you will have all of the facts to choose intelligently.

When you've chosen the spot to mount your antenna, take final FSM readings on the weakest channels and record them. Now that you know the levels of the signals you'll have to work with at the antenna, you can make some calculations to determine what you actually will have at the TV input.

First, you will have to adjust for antenna gain. Suppose, for example, that your weakest channel is 13 and your test antenna provides about 2 dB gain at that frequency. In a weak-signal area you will obviously use a higher gain antenna for the actual installation. The Jerrold VU-935S, for example, provides about 13 dB gain at Channel 13. The difference is 11 dB, which means that you can expect to pick up about 3½ times as much signal with the VU-935S than you did with your test antenna.

Next consider the downlead. One hundred feet of coaxial cable causes about 4 dB loss at the frequency of Channel 13. In other words, only about 60-percent of the signal picked up by the antenna actually reaches the TV set through 100 feet of cable. (Twinlead losses are theoretically lower, but when you add in the "bumps" caused by standoffs and staples, plus the effect of moisture, 100 feet of twinlead can easily cause 10 dB or more of actual loss.)

Deduct the downlead loss from the antenna gain and this will tell you how much signal you have to work with. Calculations are easy if you translate everything into dBmV. Suppose, for example, that you picked up 200 microvolts across 75 ohms with your test antenna. 200 microvolts is equal to −14 dBmV.

You'll gain 11 dB using the VU-935S and lose 4 dB in cable attenuation. The net gain is +7 dB.

When you add −14 dBmV signal to +7 dB gain, you get a signal of −7 dBmV at the TV set.

Preamplifiers do not improve the signal-to-noise ratio at the antenna, since they amplify noise along with signal. However, preamps make the signal so strong that the effect of downlead noise is negligible. What's more, good solid-state preamps often have lower noise figures than most TV tuners, which means an additional overall signal-to-noise improvement.

Let's suppose we start with the same 200 microvolt test antenna signal, and use a VU-935S and a mast-mounted preamplifier with a 20-dB gain. Since the gain of the VU-935S is 11 dB higher than that of the test antenna, you will pick up −3 DBmV of signal at the antenna. If we add this to the -20 dB gain of amplifier, and the 4 dB loss of the downlead, we find that we have +13 dBmV signal at the TV set. Assuming that we started with a noise level of about −55 dBmV and the noise was amplified 20 dB, we would have −25 dBmV at the TV set. This is a 38 dB/+13 DBmV − (−25 dBmV) signal-to-noise ratio, which results in a picture that falls somewhere between "Fine" and "Excellent" on the TASO scale. Thus, the preamp has made a significant improvement in picture quality.

MATV DESIGN & SERVICING

Field-strength meters are especially useful for designing, installing and servicing MATV systems. Your first step in planning any MATV system should be to make a signal survey, using a form such as that shown in Fig. 2. Record the picture carrier levels of every TV channel. Plan to use a preamp for every channel where the reading is below −6 dBmV (500 microvolts across 75 ohms).

Next, layout the system. A typical layout is shown in Fig. 3. Calculate the losses from the head end to the last tap on the longest line, to be sure you get at least 0 dBmV signal to each set in the system.

Once the system is installed, use your FSM to record signal levels on your "as built" diagram.

Record each actual picture and sound level from each antenna, at the output of each preamp, at the input and output of each amplifier, at the input and outputs of each head-end splitter, and at the end of each trunkline. These readings will be invaluable when the time comes for system servicing.

If you have "as built" diagrams, with all signal levels recorded, troubleshooting is a snap. All you have to do is take a new series of readings in suspected parts of the system and compare them with the "as built" readings. Any major discrepincy pinpoints a trouble. (But don't be surprised if signal levels fluctuate a little, due to sys-

continued on page 49

continued from page 7
other sections include Tool Kits and Tool Cases, Solder, and technical data on tool selection. *Jensen Tools and Alloys*, 4117 N. 44th Street, Phoenix, AZ. 85018.

UHF ANTENNAS

Nine UHF antenna types designed for color TV are described and illustrated in a new, condensed catalog which is now available. Sixteen models in all are shown, including Parabolics, Yagis, Bandsaws, Corner Reflectors, and various special designs and combinations. The brochure covers antennas for every type of reception area, in all price ranges, and includes performance data. Sales Dept., *Channel Master Div. of Avnet, Inc.*, Ellenville, NY. 12428.

SYMPTOM REPAIR MANUAL

A 70-page Symptom Repair Manual lists a variety of symptoms for individual General Electric TV chassis and tells you what to check and in what order. These symptoms and repairs were developed from thousands of service technician invoices and represent the combined experience of hundreds of technicians. Free to subscribers of GE Technical Data, the manual is offered to every nonsubscriber technician for $1.00 handling charge. "Dutch" Meyer, *General Electric Company*, College Boulevard, Portsmouth, VA. 23705.

TEST INSTRUMENTS

A 60-page catalog No. 4400, listing panel meters, chart recorders, meter relays, controllers, and a wide variety of test equipment is now offered. A selection of over 2,000 stock ranges, sizes and types of analog digital and AnaLed panel meters are available. *Simpson Electric Co.*, 853 Dundee Avenue, Elgin, IL. 60120.

REPLACEMENT TV TUNERS

A 2-page catalog lists replacement TV tuners available for most TV sets. They are listed by the original tuner part numbers. *Tuner Service Corp.*, 537 South Walnut St., Bloomington, IN. 47401.

TECHNICAL BOOKS

A 96-page catalog describes over 1,000 current books from 16 major publishers. Descriptions are conveniently grouped into 43 areas of technical interest, including all fields of electronics, computer technology, programming, control systems, and mathematics. Over 400 of these books are discount priced. In addition, free research and price quotation is offered on any book not listed. *TechniBooks*, Dept. N., P.O. Box 11665, Santa Ana, CA. 92711.

INSTRUCTIONAL VIDEO TAPES

A 24-page 1975 catalog of video tapes covering technical electronics subjects is now offered. More than 200 titles are listed; there is a tutorial series on transistor theory, tapes on troubleshooting solid-state circuits, a tutorial series on digital electronics, many tapes on general measurement techniques, and medical electronics, and a series on using and servicing specific instruments. Many are available in languages other than English, and in color. Standard formats are ½-inch EIAJ-1 and ¾-inch "U-Matic" video cassette; other tapes can be ordered. *Hewlett-Packard Company*, 1501 Page Mill Road, Palo Alto, CA. 94304.

ELECTRONIC COMPONENTS/TOOLS

A 12-page catalog lists low cost electronic components, tools and supplies. Each catalog is supplied with an order form and complete ordering information. *Woas Electronics*, P.O. Box 2637, El Cajon, CA. 92021.■

Tips For Easier Adjustment of SSB Transceivers

By David Norman, ET/D Communications Editor

An overview of general procedures

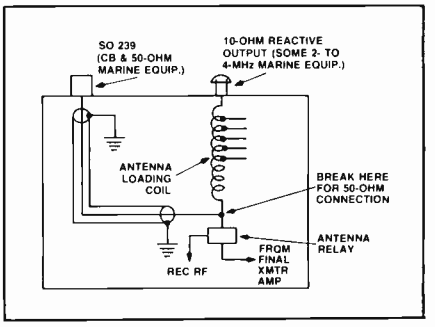

Fig. 1—Composite illustration which shows the locations of the 50-ohm output test points in typical types of SSB equipment.

■ Most SSB units can be accurately classified as "transceivers" because they use much of the same circuitry for both the receive and transmit modes. Because of this "dual" use of some circuits, the order of tuning is sometimes very critical, especially frequency adjustment of oscillators. If the oscillators are the last or nearly last items to be adjusted, IF and BFO (or equivalent) adjustments often will not be compatible and the whole setup procedure might have to be repeated several times. Thus, you should always adjust the oscillator frequency first.

One nice thing about SSB is that most oscillators are very stable (although drift of more than 200 Hz can cause signals to be completely unreadable) and adjustments usually cover a more than adequate range. The proper test point is indicated on practically all schematics and/or service manuals. (Right here is as good a place as any to note that if you have a unit for which no service data is available, you have two choices—either tell the customer, "Thanks, but no thanks," or be prepared to spend a *lot* of time on the job.)

Adjust the trimmers to the *exact* prescribed frequency, taking care to avoid loading the oscillator. After completing the oscillator frequency adjustment, recheck it. (Did you ever watch a frequency counter and "diddle" the wrong adjustment?) For most oscillator adjustments, the "clarifier," or fine tuning, adjustment must be set to midrange.

When oscillator frequency adjustment is completed to your satisfaction, proceed to transmitter alignment and carrier balance. (Note: Some manufacturers specify IF alignment as the next step. In such cases, use your own judgment to determine whether or not to deviate from the manufacturer's recommended procedure.) If the oscillator cannot be adjusted to your satisfaction, replacement of the oscillator crystal might be necessary.

If you did not connect a 50-ohm dummy load to the transmitter prior to making the oscillator frequency adjustment (frequency often can be adjusted with the transceiver in the receive mode, which does not require a dummy load), now connect the "input" side of a wattmeter (Bird Model 43 or equivalent) to the 50-ohm output of the transceiver and then connect a 50-ohm dummy load to the "output" side of the wattmeter. If the unit has an SO-239 or similar coaxial output, use that point. If the unit is designed for single-wire feed, as are many older marine units, you might have to look around a bit for the proper point—it is usually on the arm of the antenna relay or at the "inboard" side of the antenna loading coil (see Fig. 1).

Connect a scope or sensitive RF TVM (see the SSB article in the November 1975 issue of ET/D) across the 50-ohm point and key the transmitter on a channel programmed for A3J (carrier 40 dB down from full PEP output), or SSB Suppressed Carrier. If *any* modulation is noted, disconnect or short the mike output to eliminate any chance of confusion. (Carrier balance can still be achieved even with some modulation, but it is a lot easier with all audio removed.) Adjust the carrier balance control(s) for *minimum* carrier out. Use the formula P (power) = E^2 (RF rms voltage squared) divided by R (resistance of the dummy load) to determine that the suppressed carrier is at least 40 dB down. Table 1 gives approximate RF voltage readings for various modes and power levels.

If the carrier won't balance, check the diodes in the balanced

TABLE 1
RF RMS Voltages Vs PEP Power Across 50-Ohm Load ($P=E^2/R$)

	RATED PEP OUTPUT			
OPERATIONAL MODE *	15W (CB)	50W	100W	150W
SSB Full Modulation (Single Tone)	27.5V	50.0V	70.7V	86.5V
SSB Reduced Carrier (16 dB down, no modulation)	NA	7.9V (1.25W)	11.2V (2.5W)	13.7V (3.75W)
SSB Suppressed Carrier ** (40 dB down, no modulation)	.275V	–5V	– 7V	.86V
AME (carrier 6 dB down, no modulation)	NA	7.9V (1.25W)	11.2V (2.5W)	13.7V (3.75W)

* See text regarding power supply limiting
** Depending on unit, these readings might be zero

modulator or its equivalent or check the possibility that power supply hum is causing unwanted modulation. If the equipment is required to operate in transmit modes A3H or A3A (see Table 2 for an explanation of operating modes), set up or program the transceiver for the required carrier insertion. Because there are so many different methods of achieving carrier insertion, you usually should follow the procedure outlined in the manufacturer's data.

Once proper carrier insertion is achieved, proceed to the ALC (automatic limiter control) adjustment. Apply single-tone modulation for this adjustment.

The ALC limits the output to a preset level regardless of how much excess modulation (mike audio) is applied. If the output exceeds or is less than the manufacturer's specs dictate, it might be necessary to check the regulated voltage which controls the ALC circuitry. At this point you might need to "tweak" the output circuitry if it has been misadjusted.

The next step is to adjust the channel levels for approximately equal output readings. Despite manufacturers' claims, exact equalization might not be possible because of inherent nonlinear gain of the amplifiers across the frequency spectrum. Just do the best that you can. If the output levels on all channels are about the same except for one or two—and you can bet that these will be *low*, not high—with the drive adjustments reduce the output level of the "high-gain" channels down to the lower level. You might then be able to increase the gain of all channels with the ALC or final bias adjustment.

Don't let the final bias vary much from the recommended setting. If excessive final current is drawn, the final won't stay until the water gets hot. Some newer units are purposely equipped with weak, or "soft", power supplies to protect the final circuitry. In other words, they will only deliver a limited current at the rated voltage. Always operate the unit at power levels below the point where this "poor boy" limiting occurs. If the unit is properly adjusted and the finals have not been damaged in the process, the output on all channels will usually be within 10 percent. Most SSB units have enough reserve drive to permit "evening out" of the output on all channels.

All adjustments mentioned so far have used either carrier alone or single-tone modulation. Because of power supply limiting action and the design of the final amplifier, some units will not produce full PEP with single-tone modulation. If you suspect that SSB Suppressed Carrier operation is less than it should be, apply two-tone modulation and compute PEP from a scope or a peak-reading wattmeter. Just remember that, because two-tone modulation provides a much lighter duty cycle than does single-tone modulation, two-tone modulation readings on a standard wattmeter must be multiplied by 2.5 to obtain PEP readings.

After you have the transceiver operating normally into a 50-ohm load, you are ready to perform antenna adjustments. These are made by tuning the antenna, antenna coupler, or antenna loading coils and capacitors for minimum SWR or reflected power. During this procedure, leave one side of the wattmeter connected to the 50-ohm output of the transceiver and the other side connected to where the 50-ohm output would be connected during normal operation. If the meter is a type which has low insertion loss, removal after tuning will have negligible effect on performance.

Before you have to tune a unit with a customer looking over your shoulder, practice a few times in seclusion. The experience and confidence gained will be well worth the time invested.

As far as I am concerned, the most difficult and critical part of SSB servicing is AME (amplitude modulation equivalent) adjustment. (If it makes you feel any better, I have never personally spoken with anyone who was satisfied with AME, or A3H, performance. About the only thing for which it is really useful is tuning and loading.)

Loading is extremely critical on AME channels and might even require modification of output circuitry to achieve reasonable performance. If you get into trouble here, contact the factory; one of their technicians might be able to suggest a few things you can try.

Just don't lose your cool; any reasonable expense can and should be charged to the customer. If this is your first SSB installation, don't give away all your profit; leave some slack for callbacks. You will probably need it.

When ordering a "first" unit, call the factory or their representative and tell them as much as you can about the particular installation you have in mind. After you are satisfied that the person to whom you are talking knows his stuff, ask him to recommend at least one antenna that he *knows*

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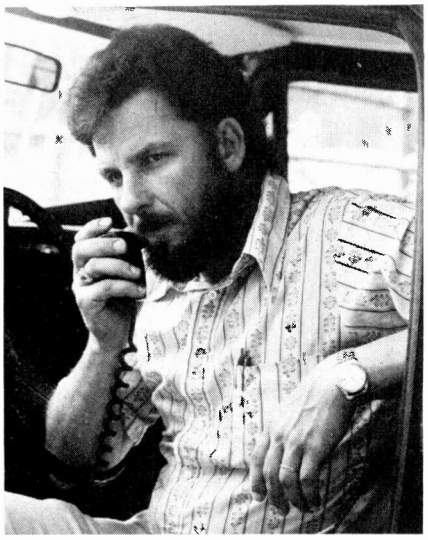
TABLE 2
Modes of SSB Operation

MODE	TERMINOLOGY	CARRIER LEVEL
A3J	SSB Suppressed Carrier	Carrier at least 40 dB down from full PEP output
A3A	SSB Reduced Carrier (Also called "Pilot Carrier")	Carrier 16 dB down from full PEP output
A3H	SSB Amplitude Modulation Equivalent CAME—often mistakenly called "SSB full carrier"	Carrier 3 to 6 dB down from full PEP output

Note: A3J has lightest duty cycle and produces maximum range for comparable power consumption—A3A is next and A3H is last. As a rule, all three modes are full PEP rated when fully modulated; the difference is the amount of carrier present. (Even conventional AM transmission can be PEP rated.)

COMM CHAT



With David Norman, ET/D Communications Editor

■ "Haste makes waste."

The truth of this trite old saying is being poven today by some of the manufacturers of CB units. In their rush to meet the demands and reap the profits of a booming CB market, some manufacturers seem to have thrown quality control and final inspection "out the window." (And, based on the increasing number of dead-on-arrivals, it seems to me they must also be literally throwing some of their products out the factory windows too.)

Because of this lack of reasonable attention to quality control and final inspection by some CB manufacturers (not all are guilty), I and many of the other CB dealer/servicers whom I know have been forced to adopt the costly policy of opening up certain brands of new CB units and giving them a complete check out before delivering them to the customer. I don't care if final inspection stickers and quality control labels are stuck over every square inch of the boxes these units are shipped in, experience has proven to me that I shouldn't believe them.

As proof of this problem, following is a list of a few of the "hot from the factory" defects I and other CB dealer/servicers have recently encountered on a recurring basis in the "average-priced" units of some nationally-known brands of foreign- and domestically-produced CB units:

1) Wide variations in output power, even among units in the same shipment. Such variations range from a high of nearly 6 watts to a low of below 2.5 watts.

2) Crystal problems of diverse types. Most common are dead or "low-activity" crystals, but in some cases the right crystals were soldered in the wrong places. While frequency is *usually* well within permitted tolerance, variations of more than plus or minus 1 KHz have been encountered.

3) Excessive mike gain, sometimes so bad that background noise in a moving automobile or office prevents intelligible conversation.

4) Improperly tuned transmitters. This problem is usually related to problem No. 1 and is easily corrected—if the slugs don't break while you are attempting adjustment.

5) Improperly aligned receivers. Sensitivity isn't as big a problem here as is distortion.

6) Cold solder joints, and even intermittent shorts between component leads. These often show up after a few days or hours of normal operation.

7) Defective microphone elements and other faulty or poorly built components.

The preceding list is only a partial one. I am sure that many of you could add to it.

Although defects 2, 6 and 7 in the preceding list can be caused by shipping damage, the lack of visible damage to shipping containers leads me to conclude that even these defects are usually "factory originated," probably as a result of the manufacturer's acceptance and use of poor-quality components from vendors, and, in some cases, even poor design.

If only a small percentage of microphone elements failed after a month or so of operation, I would be willing to attribute the probable cause to user abuse; however, a failure rate of 50 percent, which I personally have experienced with some brands, implies that the cause of the eventual failure existed *before* the customer purchased the unit.

Another example of "factory originated" defects is the number of receiver RF amplifiers which I have to replace in one brand and model of CB unit after every electrical storm. This indicates to me that this manufacturer has not designed his CB units to withstand even a small amount of static buildup.

I recently purchased for my own use a $170, American-made CB unit. After receiving several poor-signal reports, I benched the unit and discovered that several channels were out of tolerance to a degree that made the unit *illegal*. The unit had been in operation only three months.

I replaced it with another American-made unit from another manufacturer and found the replacement so plagued with alternator whine that I had to install an audio choke in the power supply to correct the situation. Had this occured only on my vehicle (a 1974 Ford pickup), I would have suspected impending alternator failure and would not have blamed the CB unit. However, this is not the case. On the contrary, several owners are experiencing similar problems. (Former models of this brand included a line choke, but it was left out of the "redesigned" unit.)

My principal reason for discussing in this column the problem of "factory-originated" defects is to make newcomers to CB retailing and servicing aware of the fact that, before they commit themselves to the sale and warranty servicing of a particular brand, if possible they first should check with other communications dealer/servicers in their area to determine whether or not the brand is one of those plagued by the "built-in" troubles I've described.

It is not only aggravating but also time-consuming and costly to have to open up every unit of a particular brand and perform adjustments, alignment and final inspection procedures which should have been accomplished before the unit was put in the box at the factory. So before you commit yourself, do some checking, and then be selective.

Hopefully, the problem of "factory-originated" defects will eventually be eliminated as more CB manufacturers begin to realize that the costs of in-warranty re-

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Sylvania Chek-A-Color Model CK3000 Color TV Test Jig

■ The color TV test jig, when used properly, can be the most valuable piece of test equipment for shop or field applications. Not only does it make shop service work physically lighter, but saves a substantial amount of time and effort when troubleshooting color TV sets.

Many of the difficult to locate problems in color TV sets can be caused by a defect in the picture tube itself, and unfortunately, some of these defects cannot be detected by the better color picture tube tester.

To replace a color picture tube for test purposes can be a time consuming practice and one mistake can practically equal the cost of a test jig.

When troubleshooting with the test jig, we know that the picture tube and other jig components are good, and suspected components in the defective TV set can be quickly checked by the substitution method.

A shorted deflection yoke winding or defective dampening components, which cause the loss of high voltage or insufficient vertical and horizontal sweep, are other problems which can be quickly checked. Convergence board and picture tube neck components are also among the many troubles that can be diagnosed with the color TV test jig.

Employing the test jig as a monitor to locate problems in the chassis, enables the chassis to be worked on with physical freedom without disturbing the alignment of the receiver's picture tube.

When applied on service calls, the test jig will often enable accurate determination of how much of the receiver will have to be removed for shop service. With heavy console models, this is a very important factor. Pulling and transporting only the chassis, in comparison to the complete receiver, can eliminate an extra man's time and heavy lifting.

You may now be using a test jig, but it may have become obsolete since the introduction of hybrid, all solid state, new high-anode voltage and in-line picture tube chassis, and you would like to purchase a new test jig to service all chassis types with a minimum number of accessories.

Recently we had the opportunity to review Sylvania's new Chek-A-Color, Model CK 3000 Solid-State/Hybrid/Tube Color receiver test jig, shown in Fig. 1.

Test Jig Components

The principle components employed in the Chek-A-Color test jig, Fig. 2, include a 90-degree

Fig. 1—Sylvania Chek-A-Color Model CK 3000 Solid-State/Hybrid/Tube Color Receiver Test Jig. For more information about this instrument, circle 105 on the READER SERVICE CARD.

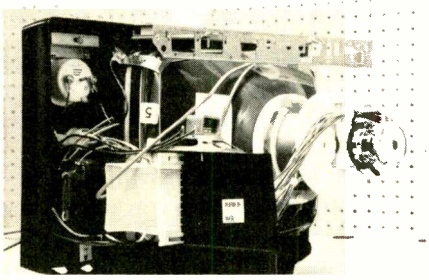


Fig. 2—Side view showing the principal components employed in Sylvania's Chek-A-Color test jig.

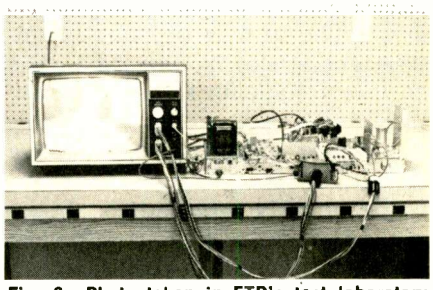


Fig. 3—Photo taken in ETD's test laboratory showing the test jig in operation, producing a well proportioned TV picture.

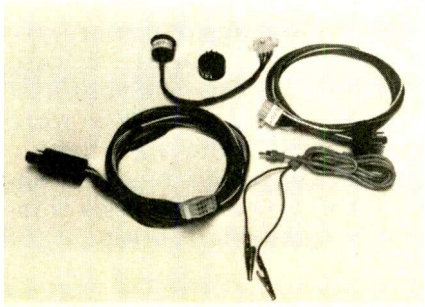
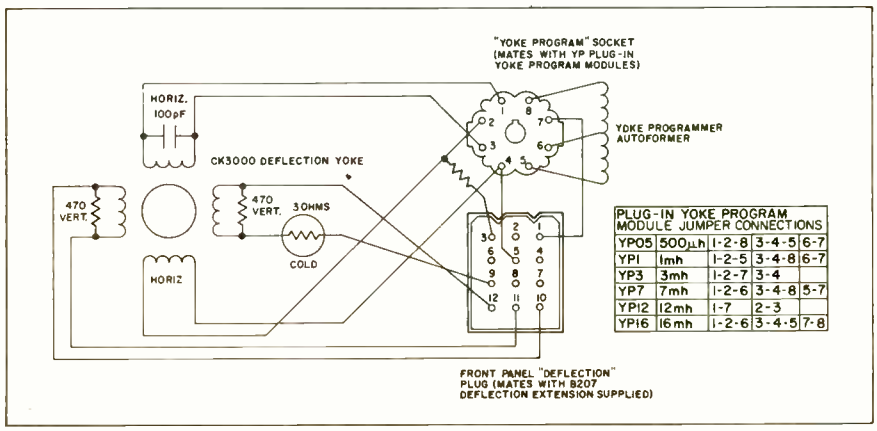


Fig. 4—Adapters and extensions used to connect the test jig to a Sylvania E10-2 color TV chassis.



PLUG-IN YOKE PROGRAM MODULE JUMPER CONNECTIONS				
YP05	500μh	1-2-8	3-4-5	6-7
YP1	1mh	1-2-5	3-4-8	6-7
YP3	3mh	1-2-7	3-4	
YP7	7mh	1-2-6	3-4-8	5-7
YP12	12mh	1-7	2-3	
YP16	16mh	1-2-6	3-4-5	7-8

Schematic diagram of deflection circuit employing a Yoke Programmer Autoformer. *Courtesy Of Sylvania.*

strontium-leaded, 13V, vertical-line phosphor screen, in-line color picture tube, a 90-degree deflection yoke, an in-line static convergence and purity magnet assembly, an exclusive Sylvania-patented, impedance-matching (Yoke Programmer) deflection circuit, and an adjustable focus voltage supply featuring a thick film, voltage-divider circuit for chassis with other than a 4.5 kv supply. The high voltage meter has a 50 μa movement with a multiplier for measuring receiver anode voltage from 0-35 kv. A speaker is also standard equipment on the unit.

General Features

The first important feature which caught our eye was its compact size, and the ability to be used with SCR, transistor, tube, and hybrid sweep TV sets; the newer high-anode 30 kv voltage chassis 70-and 90-degree delta deflection systems; and high and low focus-voltage chassis of almost all makes and models of TV sets, excluding receivers employing a toroidal deflection yoke.

All input connections to the test jig are located on the front panel and are of the plug-in type, allowing it to be used on the bench or it can be built into the wall, if desired. The unit is light and compact enough to be carried in the service vehicle for in-home servicing.

Another important feature we liked about the test jig is its ability to be quickly adapted to almost any solid state, SCR, hybrid, as well as tube deflection receiver, with the yoke program modules supplied with the jig. This adaptability feature is achieved by Sylvania's new patented Yoke Programmer circuit. The Yoke Programmer modules are simply plugged into the Yoke Program socket located on the front panel of the instrument. The modules series, parallel and/or transform the test jig yoke coupling to reflect a variety of impedances to the sweep circuits of the TV receiver.

If the TV receiver under test provides a standard focus voltage of about 4.5 kv, it is coupled to the jig through the B230 CRT Extension which is supplied, then the focus is adjustable at the TV receiver.

Fig. 5—All input connections to the test jig are located on the front panel and are of the plug-in type.

If the TV receiver under test is not equipped with a standard focus supply, the focus lead of the B230 Extension is interrupted at a pin and jack connector. Then simply connect the pin plug to the *focus* jack on the front panel of the jig, and focus the picture with the *focus adjust* control mounted below the meter on the front panel of the color TV test jig.

Setup and Operation

The Chek-A-Color test jig was connected to a new Sylvania solid-state E10-2 color TV chassis, as shown in Fig. 3.

All accessories numbers required for the set-up were found in the Check-A-Color Setup manual supplied with the jig. The model and chassis numbers of most TV sets are listed, and then you are referred to a set-up number which lists the accessories to use for the connections between the jig and the TV chassis. The set-up number for this particular chassis is 67A, that requires a number YP1 Yoke Programmer, D407/B207 Deflection Yoke Adapter/Extension and a B230 Picture Tube Adapter/Extension, Fig. 4, which is common to most 90-degree deflection TV chassis. A Convergence Ballast was not required, instead we grounded pin 3 of the convergence socket. The covergence circuit is not generally so critical and in some sets can be left open if a suitable adapter is not available. The deflection yoke must always be properly connected before turning on the power to the receiver. The chassis under test may be damaged if the deflection circuit is not properly terminated.

The specified YP1 Yoke Programmer Module was inserted into the Yoke Programmer socket on the front panel, Fig. 5, of the jig. For this 90-degree receiver deflection chassis, CRT Extension B230 (supplied) was used to connect the receiver CRT socket to the jig front panel "CRT" plug. When adapting to a receiver, such as this one, the pin and jack are left connected so that the receiver supplies focus voltage directly to the test jig CRT, and the focus was adjusted at the receiver. If the receiver has other than standard focus voltage, break this connection and plug the pin into the "Focus" voltage jack on the front panel of the test jig. In this case, the jig CRT focus voltage is obtained from the receiver anode voltage through the voltage divider network contained in the test jig. The focus is now adjusted by the *focus* control on the front panel in this case.

The chassis ground lead terminated in an alligator clip, emerging from the front panel of the jig, was connected to the color TV receiver chassis. It is important that this connection is securely made before applying power to the chassis to prevent a shock hazard and potential damage to receiver chassis components, as well as to provide accurate front panel anode voltage metering.

The speaker wires of the TV chassis were connected to a phono jack on the front panel of the jig with a two-wire lead terminated on one end with phono plug and the other end with alligator clips.

The test jig was received completely assembled, pre-converged, and ready for use.

We were quite pleased with the well proportioned picture received, as shown in Fig. 3, with very little indication of yoke mismatch. No adjustments were necessary on the TV chassis, eliminating many repeated adjustments when the chassis is replaced in the color TV set.

Accessories

Provided with each Chek-A-

continued on page 47

Now buy the WESTON "Drop-Proofed" champ on your credit card*

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For the first time, an opportunity to get the Weston "Drop-Proofed" VOM on your credit card . . . and have the meter of your choice drop-shipped directly to you. Save time and energy.

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Please send me the WESTON 660 VOM "Drop-Proofed" Champ

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City _____ State _____ Zip Code _____

Model	660	661	662	663	666
Price	$79.00	$91.00	$122.50	$135.00	$164.00
Quantity	( )	( )	( )	( )	( )

Add $2.00 for handling charge. (New Jersey residents add 5% sales tax to cost of unit.)

Total amount of purchase $_____

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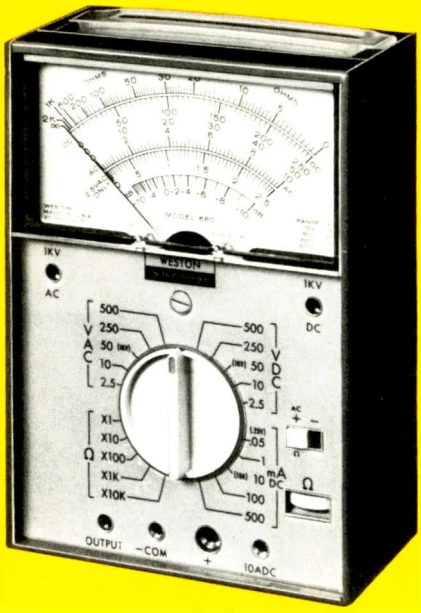
Offer effective through Mar., 1976.

General Features

- Completely drop-proofed
- Custom ruggedized self-shielded taut-band mechanism
- Diode-protected meter movement
- Temperature compensated
- Unique pluggable circuit board assemblies
- Special calibrated scales for dB measurement
- Circuit recalibration without case disassembly
- Quality components used throughout
- External fuse replacement
- All controls flush with edge of case
- Single range switch
- Self-storing handle
- Input terminals spaced for use with double banana jacks



Specifications

	MODEL 660	MODEL 661	MODEL 662	MODEL 663	MODEL 666
Accuracy	2% DC (1.5% on 50 ua range) 3% AC	1% DC 2% AC	2% DC (1.5% on 50 ua range) 3% AC With Overload Relay	1% DC 2% AC With Overload Relay	2% DC volts, 3% AC volts 3% DC current, 4% AC current
Sensitivity	20,000 ohms/volt DC 5,000 ohms/volt AC	20,000 ohms/volt DC 5,000 ohms/volt AC	20,000 ohms/volt DC 5,000 ohms/volt AC	20,000 ohms/volt DC 5,000 ohms/volt AC	10 megohm DC, 10 megohm (100 pfd) AC, current circuit 100 millivolt drop
Dimensions	7"H X 5"W X 2¼"D	7"H X 5"W X 2¼"D	7"H X 5"W x 2¼"D	7"H X 5"W X 2¼"D	7"H X 5"W X 2¼"D
Weight	Less than 2 lbs. (Batteries included)	Less than 2 lbs. (Batteries included)	Less than 2 lbs. (Batteries included)	Less than 2 lbs. (Batteries included)	Less than 2 lbs. (Batteries included)
Ranges	DC Millivolts 0-250 DC Volts 0-2.5/0-10/0-50/0-250/0-500/0-1000/ AC Volts 0-2.5/0-10/0-50/0-250/0-500/0-1000/ VAC Output 0-2.5/0-10/0-50/0-250 DC Microamps 0-50 DC Milliamps 0-1/0-10/0-100/0-500 DC Amps 0-10 Ohms RX1(0-2K)20Ωcenter/RX10(0-20K)200Ωcenter/RX100(0-200K)2000Ωcenter/RX1000(0-2Meg)20KΩcenter/RX10K(0-20Meg) 200KΩcenter dB Scales (1 mw on 600 ohm line) −10 to +10/+2 to +22/+16 to +36/+30 to +50/+36 to +56	DC Millivolts 0-250 DC Volts 0-2.5/0-10/0-50/0-250/0-500/0-1000/ AC Volts 0-2.5/0-10/0-50/0-250/0-500/0-1000/ VAC Output 0-2.5/0-10/0-50/0-250 DC Microamps 0-50 DC Milliamps 0-1/-10/0-100/0-500 DC Amps 0-10 Ohms RX1(0-2K)20Ωcenter/RX10(0-20K)200Ωcenter/RX100(0-200K)2000Ωcenter/RX1000(0-2Meg)20KΩcenter/RX10K(0-20Meg) 200KΩcenter dB Scales (1 mw on 600 ohm line) −10 to +10/ +2 to +22/ +16 to +36/ +30 to +50/ +36 to +56	DC Millivolts 0-250 DC Volts 0-2.5/0-10/0-50/0-250/0-500/0-1000/ AC Volts 0-2.5/0-10/0-50/0-250/0-500/0-1000/ VAC Output 0-2.5/0-10/0-50/0-250 DC Microamps 0-50 DC Milliamps 0-1/0-10/0-100/0-500 DC Amps 0-10 Ohms RX1(0-2K)20Ωcenter/RX10(0-20K)200Ωcenter/RX100(0-200K)2000Ωcenter/RX1000(0-2Meg)20KΩcenter/RX10K(0-20Meg) 200KΩcenter dB Scales (1 mw on 600 ohm line) −10 to +10/ +2 to +22/ +16 to +36/ +30 to +50/ +36 to +56	DC Millivolts 0-250 DC Volts 0-2.5/0-10/0-50/0-250/0-500/0-1000/ AC Volts 0-2.5/0-10/0-50/0-250/0-500/0-1000/ VAC Output 0-2.5/0-10/0-50/0-250 DC Microamps 0-50 DC Milliamps 0-1/0-10/0-100/0-500 DC Amps 0-10 Ohms RX1(0-2K)20Ωcenter/RX10(0-20K)200Ωcenter/RX100(0-200K)2000Ωcenter/RX1000(0-2Meg)20KΩcenter/RX10K(0-20Meg) 200KΩcenter dB Scales (1 mw on 600 ohm line) −10 to +10/ +2 to +22/ +16 to +36/ +30 to +50/ +36 to +56	DC Millivolts 0-100/0-300 DC Volts 0-1/0-3/0-10/0-30/0-100/0-300/0-1000 AC Millivolts 0-100/0-300 AC Volts 0-1/0-3/0-10/0-30/0-100/0-300/0-1000 DC Microamps 0-1/0-10/0-100 DC Milliamps 0-1/0-10/0-30 AC Microamps 0-1/0-10/0-100 AC Milliamps 0-1/0-10/0-30 Ohms (7 normal and 7 low power ranges) RX1/RX10/RX100/RX1K/ RX10K/RX100K/RX1Meg dB Scales −40 to −18/ −30 to −8/ −20 to +2/ −10 to +12/ 0 to +22/ +10 to +32/ +20 to +42/ +30 to +52/ +40 to +62

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Selecting Equipment For Your Auto Electronics Bench

By Joseph J. Carr, ET/D Vehicular Electronics Editor

What you need and do not need

■ The inventory of equipment which *you* should have for accurate and efficient bench servicing of auto electronics products depends on what *types* of products you service, how *much* of each type you service, and your *approach* to servicing each.

Because of these variables, it is unrealistic to attempt to come up with an "all-inclusive" list of equipment brands and specs. However, there are some "common denominators' which generally apply to all situations, and it is on these *general* requirements that this article focuses.

THE POWER SUPPLY

The one instrument common to all auto electronics service operations is a DC power supply. There are several alternatives available and at least one should be suited to your needs.

In my book titled *Automobile Electronics Servicing Guide* (Sams 20927) I describe several power supply systems which use auto storage batteries and various charging schemes. The one advantage of such systems is that an extremely large amount of current is available at relatively low cost.

You cannot, however, make decisions based on a single advantage, and the disadvantages to such systems are powerful. One is the need for weekly service of the battery. (In my "apprentice" days I must have checked and filled batteries with distilled water a thousand times.) Another disadvantage is the *danger* inherent in batteries. Besides acid spills, there is also the possibility of explosion if the vent holes get clogged or if someone causes a spark around the battery. (I saw one man take a facefull of sulphuric acid because he did not turn a charger off before disconnecting it from the battery.)

If you want to avoid these problems, you can just as easily use a medium-or heavy-duty *battery eliminator* such as those shown in Figs 2A and 2B. Several manufacturers offer ready-built and/or kit power supplies which are capable of handling all or at least part of the supply chores on an auto electronics bench.

If you have a good source of surplus electronics, you might want to build your own supply into the bench. A circuit such as that in Fig. 1 has been used successfully in the past. The transformer is a military surplus type which offers a secondary voltage of 12-30 volts (rms) and a current of 10-30 amperes. Don't ask for type numbers, because such transformers are available only on a catch-as-catch-can basis. Try shopping where ham radio operators do or attend their "hamfests." Such transformers often turn up at those places. (I once found one in a city dump.)

The diodes used to rectify the AC in Fig. 1 are stud mounted on heat sinks. They should have current ratings of not less than 25 amperes (50 or 100 ampere types are preferred). The peak inverse voltage (PIV) rating of any power supply diode used with a capacitive input filter system must not be less than 2.82 (3, if a safety factor is desired) times the rms voltage applies. If your transformer offers up to 30 volts (rms), the smallest standard PIV rating will be greater than the required rating ($3 \times 30 = 90$ volts), so buy a diode with a 100-volt PIV rating (or greater). A Variac transformer is used in the primary of the circuit in Fig. 1 to control output voltage. Try to avoid SCR "lamp dimmer" types of controls because they create "hash" interference in the AM band.

There are several good reasons why you should have a heavy-duty supply for auto electronics servicing. One, of course, is that some auto electronics equipment draw a lot of current. (Signal seeker radios and many tape players use solenoids which can draw a relatively large amount of current when energized.) Another reason for a heavy-duty supply is to allow you to "cook test" several sets at a time without tying up your workbench. Weak supplies, even if they can "hack it" for single ratio operation, tend to give up the ghost (often before they are fully paid for) because of the inevitable shorted power leads that seem to plague auto electronics benches.

Delco has offered some attractive power supplies which are custom designed for servicing their heavy-drain, signal-seeker re-

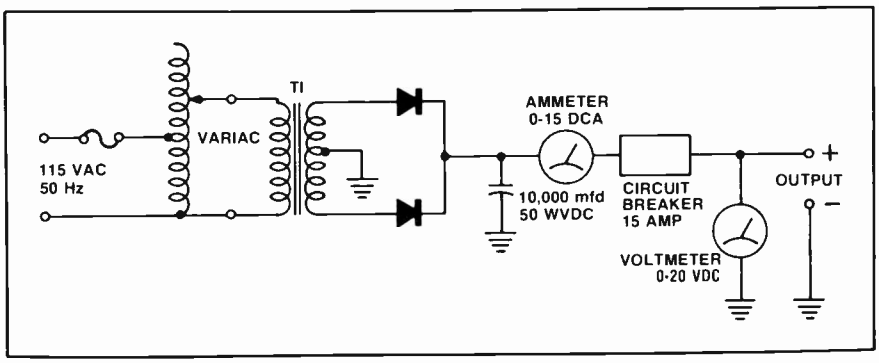


Fig. 1—Power supply for car radio/tape player servicing.

Fig. 2—Examples of typical heavy- and medium-duty bench power supplies. A) Medium duty. B) Heavy duty.

ceivers. The Model P1200 and P612 Delco supplies were once something of a standard. If you can obtain one of these at a reasonable price, do so (at last word they were no longer being made). Heath, Eico, RCA, B & K and certainly others also make power supplies suitable for auto electronics servicing. Look for a variable voltage over a range of 0 - 20 or 0 - 30 volts and a current capability of not less than 6 amperes continuous and 15 amperes intermittent. (The rule of thumb regarding current capability is "the more the supply will hack, the better." Buy as tough of a supply as you can afford.)

SIGNAL GENERATORS

The "good old days" in auto electronics were simpler than today. All we really "needed" for a signal generator was a Don Bosco Mosquito and a wet thumb. (Some repairs can be accomplished even today with such simple and inexpensive equipment, but not many.)

For servicing in the AM band, you can use just about any of the

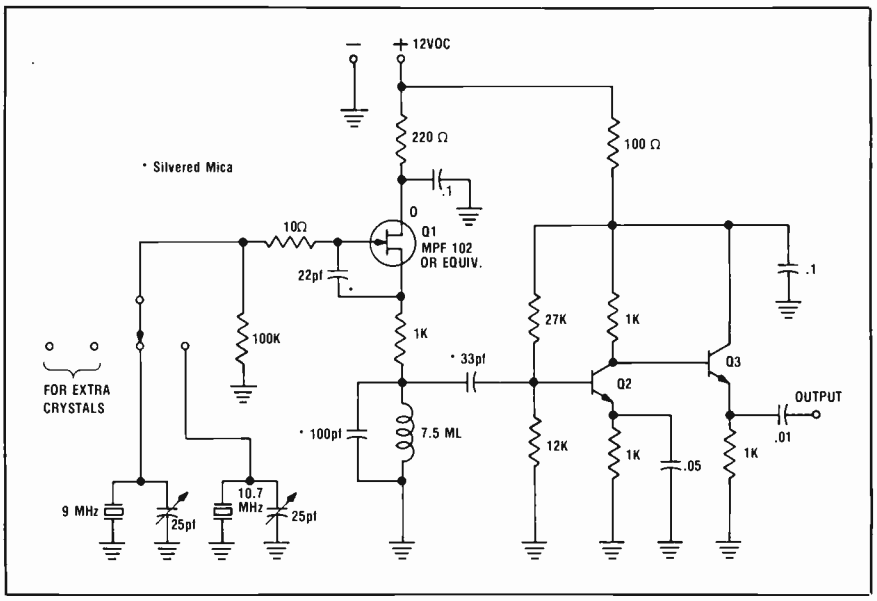


Fig. 3—Crystal-controlled, 1-to-20MHz oscillator.

"service-grade" types of RF signal generators. Of course, if you have a lab-grade, multi-kilobuck generator, don't retire it; it'll do just as fine. It isn't, however, an essential item.

Alternatively, if you have more time than service volume, you can make up a crystal-controlled, battery-powered, RF marker generator such as those in Figs. 3 and 4. By choosing a 9-MHz type as one of the crystals, you can obtain three very convenient calibration points at both of the ends and the middle of the FM broadcast band. (Harmonics of 9 MHz include 90, 99, and 108 MHz.)

When stereo car radios were first introduced we could get by with the slight misalignment of the decoder section which resulted from our use of "off-the-air" signals during alignment. Today, many car stereo radios are as good as most home stereo component receivers and better than many. With 2- and 4-channel stereo so widespread and with more customers who "know how it should sound," today you must have a decent stereo generator. Seat-of-the-britches alignment is no longer acceptable.

TRACERS, METERS & SCOPES

The test equipment requirements of auto electronics servicing are generally simpler than those of TV or other types of servicings. To be sure, the stereo generator is needed, but in many other classes of instrument relatively common types will suffice. You occasionally need a signal tracer. You also need an oscilloscope. If forced to make a choice, I prefer a scope in lieu of the tracer.

A wide-band scope is not *essential* for auto electronics servicing, but because the difference in price between some service-grade, wide-band and narrow-band types is relatively small, the extra utility of a wide-band type might be worth the price difference to some auto electronics *specialists*. Those of you "nonspecialists" who also service TV have no choice—you need a wide-band (at least up to 5-MHz) scope.

Your *bench* VTVM should have 0.5-, 1.5- and 15-volt DC scales. These seem to be the best ranges for typical auto-radio voltage levels. If you prefer a VOM, try getting one with 100,000 ohms/volt, for use in solid-state circuits.

For *in-the-car* use, opt for an inexpensive, small VOM. Another reason for using a cheap VOM for in-car servicing is that, for some reason, expensive VOMs tend to "leave with the customer" more often than the $10 imported type. Also, all you need a VOM for in most in-car situations is to measure continuity (not how many ohms) and to find out whether or not 12 volts is on an "A" lead.

If you have an old, cheap audio scope, it might be wise to permanently connect its vertical input across one speaker of a stereo system and its horizontal input across the other. The predictable difference between mono and stereo patterns displayed by such

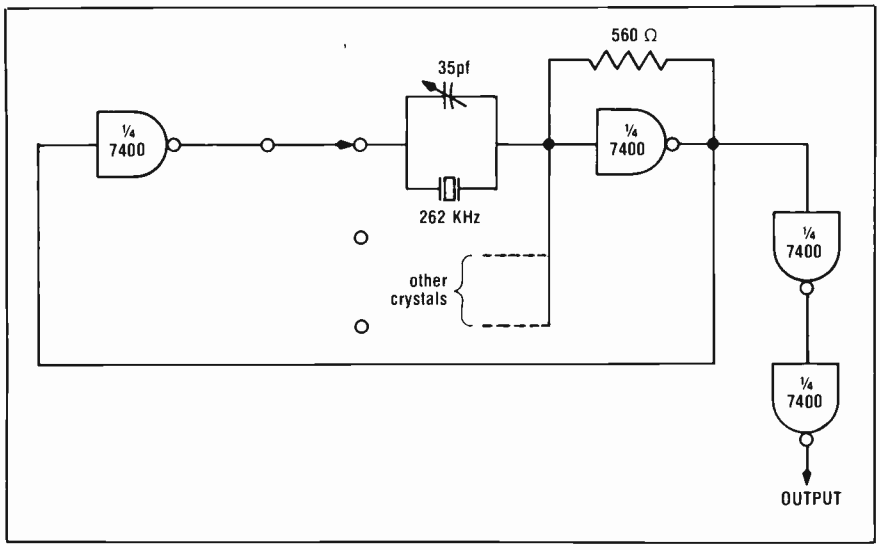


Fig. 4—Crystal-controlled, 100-KHz to 2000-KHz oscillator, most of the circuitry of which is contained in a single type SN7400 TTL integrated circuit. (Crystals for this oscillator circuit and that in Fig. 3 are available from a number of sources, including JAN Crystals, 2400 Crystal Dr., Fort Meyers, Florida 33901. Specify for a 32-pf load and whatever type of holder you want—type HC6/V or HC25 are recommended.)

a set up provide a quick go/no-go test of decoder action in "stereo-lamp-not-lit" cases.

THE BENCH ITSELF

As with text equipment requirements, there is no one bench configuration that can be called "ideal" for all auto electronics servicers.

One "popular" bench configuration is illustrated in Fig. 5. The "shelf" is used for test equipment and power supplies. The "panel" between the bench and the shelf is used for speakers and connections.

Whatever the configuration, the bench should be wide enough to permit the technician to simultaneously service two or more pieces of equipment. (Unless you are luckier than most of us auto electronics techs, you'll probably need "extra" bench space for setting up and monitoring at least one intermittent-plagued radio.)

Some shop owners place behind the technician a low shelf on which are stored the radios "up next" for service. Some shops also place at one end of the bench a shelf for "just serviced" equipment, which later is picked up by the boss or a "helper" who prices the job and, if necessary, places the equipment in a more permanent storage area. These two bench features help improve technicians productivity.

Another feature which also saves the bench technician both time and effort, and therefore also helps improve his productivity, is adequate bench space and/or bench drawers for the most frequently used parts, components, and service aids.

Loudspeakers should be built into the bench, and don't be sparse. At least four speakers are needed for quad and it is often useful to have a couple of extras. Consequently, shoot for at least six loudspeakers.

There are two schools of thought about which speakers should be used. Almost everybody uses the standard 6 × 9 car radio speaker mounted behind a gray RSS grill. The controversy is whether you are better off with "cheapies" and constant replacement, or heavy-duty types which require less replacement but higher initial cost. My preference is the most expensive, heavy-duty speaker and an in-line fuse, to protect it against excessive current. (It's absolutely amazing how often power leads fall across the speaker leads. This is an application of "Murphy's Law of Selective Gravitation": Anything dropped will fall where it does the most damage in the shortest period of time.)

Speaker leads can be brought out to phone jacks on the bench "panel." Two should be brought out to a single stereo phone jack, so that you can make up special speaker cables which permit quick speaker connection to standard Ford, Delco, Crysler and AMC radios. Also make several alligator-clip adapters for speaker connection to "non standard" radios.

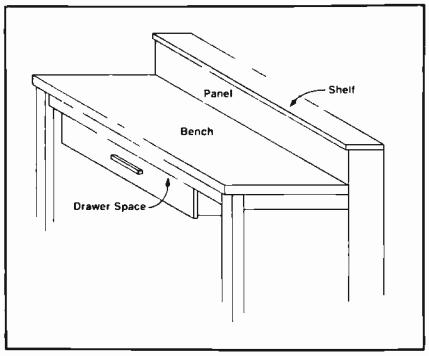


Fig. 5—One "popular" auto electronics bench configuration.

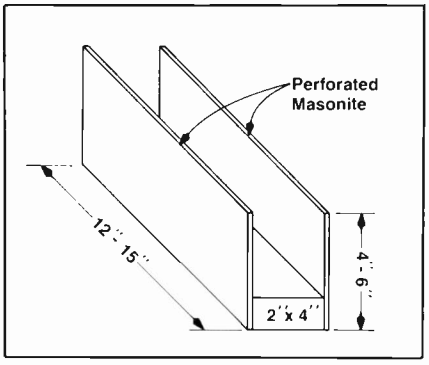


Fig. 6—Auto radio holder devised by Frank Weisel, Norfolk, Virginia.

Fig. 6 shows a build-it-yourself radio holder which will prove useful on any car radio/tape bench. Devised by Frank Weisel of the *Auto Radio Center* of Norfolk/Virginia Beach, Virginia, this "holding" device can be made removable, for even greater bench utility. Radios and tape players are placed on top of the jig while being serviced. This allows access to both halves of the set without disturbing those connections which are always threatening to disconnect. Additionally, if you use perforated masonite for the sides, you will find that the holes are just the right size to hold the standard ⅛-inch volume control shaft used in OEM US car radios. This feature is a real blessing when you are changing a multi-gang pot to which are clinging an assortment of capacitors and resistors.

SHARE YOUR IDEAS

If you have any advice, ideas and/or comments which you believe will be helpful to other auto electonics servicers (or even a few you aren't sure about), send them to me, Joe Carr, ET/D, 1 E. First St., Duluth, Minn. 55802. I'll include them in CARR TALK, with, of course, credit to you.■

CARR TALK

With Joseph J. Carr, ET/D Vehicular and Outdoor Electronics Editor

■ Whether you are a "young" electronic technician with theory still fresh in your memory or an "older" technician with many years separating you from the laws and formulas of "textbook" electronics, there probably will come a time in the near future when you'll be confronted with the need to take a vocational test—either an FCC, state licensing, pre-employment, or Certified Electronic Technician (CET) test—or maybe all four types.

The "opportunity" for vocational test taking by electronic technicians is on the rise. Increased consumer and business use of FCC-controlled products such as CB and other types of two-way communications equipment, and the probability that more states will require licensing of electronic technicians, plus the fact that the increased complexity of electronic technology and design probably will invite more stringent testing of electronic technicians by prospective employers, increase your chance of having to take a vocational test.

And because most electronics vocational tests, particularly CET, pre-employment and state licensing tests, cover both theory *and* practical knowledge, neither the "theory-wise" younger technician nor the "practical-wise" older technician has any particular advantage. Both categories of technicians have inherent "knowledge gaps" which they must recognize and "fill" before sitting down to take a vocational test.

The first step in preparing for a vocational test is to take an *honest* inventory of what you know and don't know. Pinpointing the knowledge areas in which you are weak is probably the most difficult and the most important aspect of test preparation.

One method which I have found to be effective is the "study guide" type of book, which includes questions (and, in some cases, answers) after each segment of material. Not only does this type of book help you evaluate your understanding of the various knowledge areas covered by a particular test and thereby help you pinpoint your weaknesses, but it also provides an effective method of review. This method is even more effective if you can entice some other knowledgeable technician(s) to "expand on" the questions in the book by asking you other probing questions about any points of which you are unsure.

Another important aspect of preparing for a vocational test is to begin far enough in advance of the test date so that you have adequate time to pinpoint and fill in your knowledge gaps without having to resort to last minute "cramming." If you begin early enough, you'll not only have a better chance of obtaining a working knowledge of all areas covered by the exam, you'll also be in a more relaxed state of mind when test day comes. Any educator or test administrator will tell you that pre-test anxiety flunks about as many test takers as lack of knowledge.

Strategy is an important aspect of taking tests. Try to avoid taking tests when you are tired or irritable. Try to be at the examination place a bit early to fill out the paperwork yet still have time for relaxation. If possible, schedule the exam at the time of day when you are at your peak. My best time is early morning and that's when I like to take tests. Appear for your exam early, rested, really relaxed, and with an empty bladder.

If the exam requires you to work problems, learn to use either a slide rule or a scientific calculator. The "slip-stick" is adequate and costs under $10. Good scientific calculators which can probably do more math than you need cost less than $100.

When you start the test, do not work problems or answer questions in sequence. Make several passes through the exam. On the first pass, answer those questions you know "cold turkey." On the second pass, answer those questions which require a moment of thought and those which require a few quick, simple calculations. After you have done this, if time permits, go back and try to answer the "dogs." If the exam is of the usual multiple-choice type, you lose just as much for no answer as for a wrong answer. Consequently, if you are totally blind on any one questions, an "eeny, meeny, miny, mo..." answer is better than none at all. Even through arbitrary selection of an answer you have a one-in-four chance of "lucking out." Also, if a couple of answers are totally impossible, you can raise the odds in your favor by eliminating them at the outset. For example: "An Inductor _____"

A) Is the guy who leads the orchestra
B) Causes E to lead I in AC circuits
C) Causes I to lead E in AC circuits
D) Is an animal of the reptile family much like a long, slimey, green thing.

Obviously, only B and C are possible answers. Your chances are now two to one rather than four to one.

If you begin early and make a reasonable and honest effort to determine in which of the possible areas of the test you are the most weak and then concentrate on filling in these gaps along with a general review of all knowledge areas covered by the tests, when test day comes you'll be both sufficiently knowledgeable and emotionally geared to take the test. And if you supplement your knowledge and confidence with the test-taking tips I've listed, there is no way any test can whip you. ■

TECHNICAL DIGEST

The material used in this section is selected from information supplied through the cooperation of the respective manufacturers or their agencies.

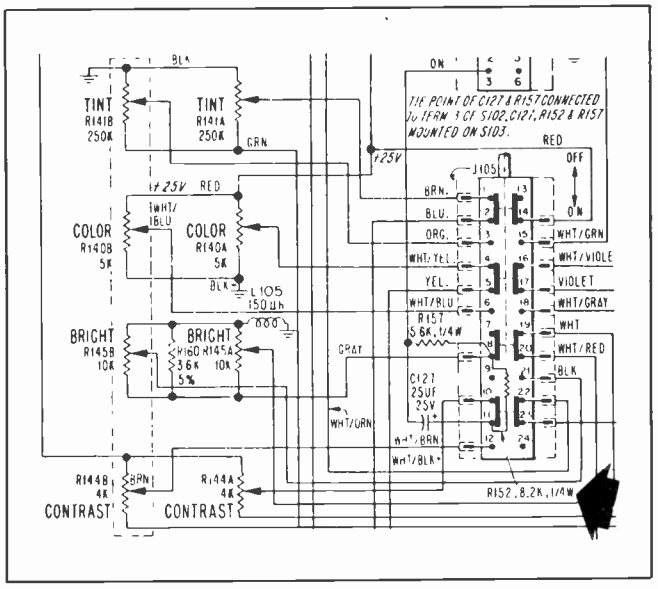
ADMIRAL

Color TV Chassis M24, M25, M30—Service Hint

A symptom of insufficient brightness and the *brightness limiter* control has very little effect, can be caused by resistor R152 (8.2 K ¼ w) having increased in value.

This resistor is located on the *Color Master* switch.

Since there are many other things that can cause brightness problems, a few preliminary checks should be made



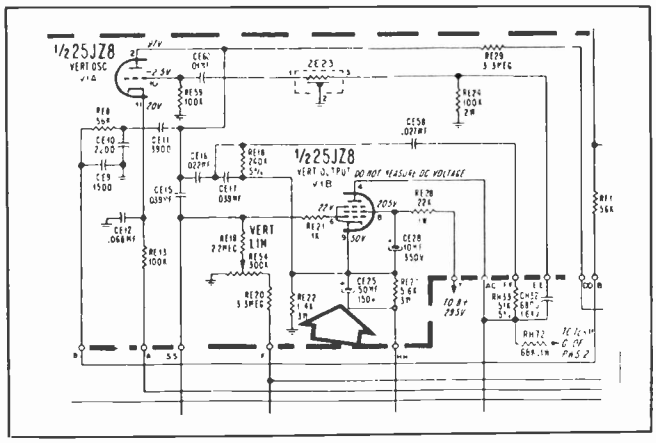
before pulling the control cluster to measure resistor R152.

For example, substitute the RGB/Chroma module; also, check the 800 volt B+ supply for the CRT screen elements.

An 8.2 K, ½ watt resistor for the replacement of R152 is available under Admiral Part No. 60A102-822.

Color TV Chassis K10—Insufficient Vertical Sweep

A symptom of insufficient vertical sweep in the K10 color chassis can possibly be caused by an open CE25 capacitor



(50 mfd, 150 volts). This capacitor is in the cathode circuit of the vertical output tube. Replace it with Part No. 67A27-8.

Some K10 chassis use the 25LU8 tube instead of the 25JZ8 as shown in the schematic diagram, however, the CE25 capacitor is used in the circuit regardless of the type of tube used.

GENERAL ELECTRIC

Color TV Chassis MB-75—Power Supply Transformers and Assemblies

Power Supply Transformers for the MB-75 chassis are now stocked separately. Previously they were stocked as part of the Power Supply Assembly. If a transformer fails, repair costs will be much less if you replace only the transformer instead of the complete assembly. The transformer catalog number is EP88X4.

Since most of the transformer leads have crimped-on terminals for sockets and connectors, you will have to cut these leads and splice them. Be sure to cut them at a point that will allow a safe splice. Each splice must be twisted, soldered, and covered with heat shrinkable tubing. The tubing is packed with the transformer.

This information applies to MA, MB, and MB-75 chassis only. MC chassis use an entirely different transformer.

MAGNAVOX

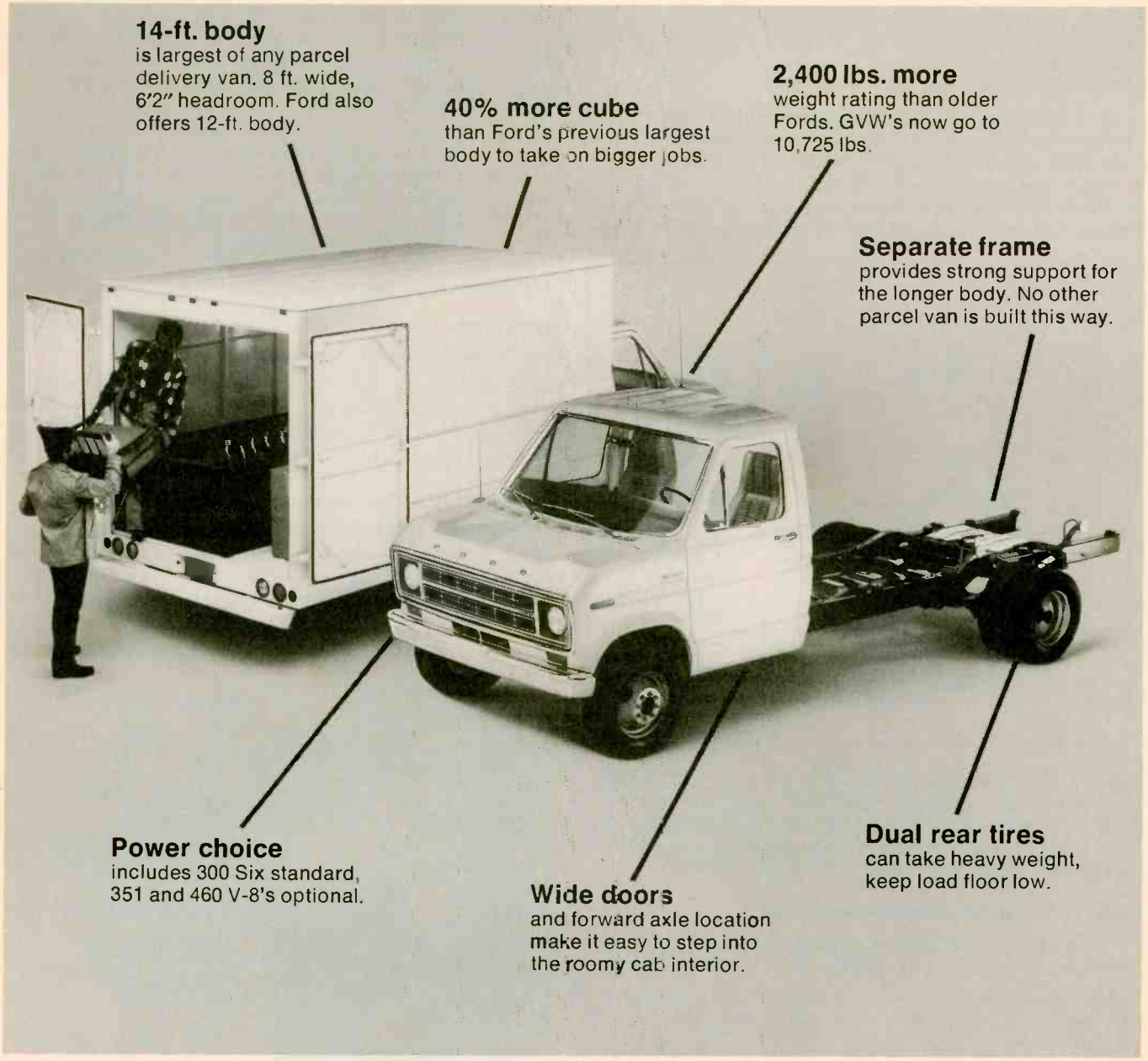
Color TV Chassis T985/986—Inoperative Set

The 120 volt Regulator module (Part No. 703660-1) could develop an open connection at pin 11 and cause this symptom. The problem can be corrected by resoldering *all* connector pins on this module.

Radio Chassis R331/2/3/4—High Volume Whistle

Some R331, R332, R333 or R334 radios may whistle at half to full volume due to the dress of the wire between points W127 and W128. This wire is located on the component side of the main P.C. board and must be routed in the

FROM FORD: THE BIGGEST PARCEL VAN EVER BUILT



Ford Parcel Delivery Vans not only take on big jobs, they make the driver's job easy.

The engine's forward out of the way. There's more room to get in, more room to drive in. You can step right across the cab or into the load area. Cruise-O-Matic and power front discs are standard. See what's new in vans; see your local Ford Dealer.

...for more details circle 11[illegible] on Reader Service Card

FORD MEANS DURABILITY
93 out of 100 of all Ford trucks built in the last 12 years are still on the job (R.L. Polk & Co. figures).

FORD ECONOLINE VANS

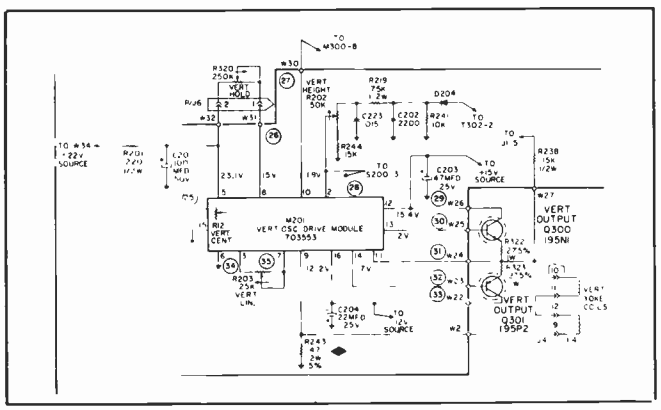
FORD DIVISION Ford

cable channel underneath the input shielded cable adjacent to transformers T202 and T203. For minimum pickup the lead should lie close to the chassis pan. If the lead must be redressed, remove all the wires from the cable run, lay the lead from W127 to W128 next to the P.C. board and replace all cables back in the run.

This condition could also be caused by a defective coil L402. In the event redressing the wire does not correct the problem, replace L402.

Color TV Chassis T981/2/7—Keystoned Or Slanted Raster

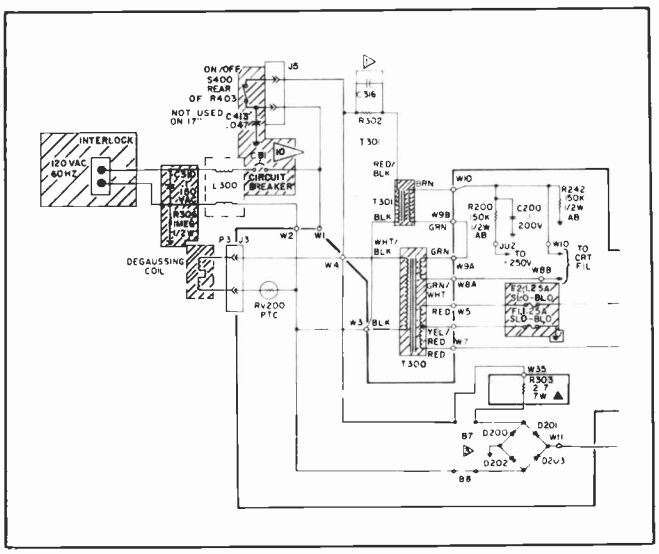
Capacitors C203 and C204 are the plus and minus 12-volt filter capacitors used in these chassis. When the capacitor fails, it usually causes a small slanted raster with



a keystone effect similar to a shorted yoke. These parts should be replaced with 100 mfd. capacitors @ 25 VDC, Part No. 270109-1225, to prevent the problem from re-occurring.

Color TV Chassis T981/2/7—Overheating Filament Transformers

Early versions of these chassis use a constant voltage filament transformer that requires a series capacitor for



proper operation. The capacitor is designated C316 and the schematic has a footnote indicating which capacitor is required. If a wrong value capacitor is used, the transformer will overheat.

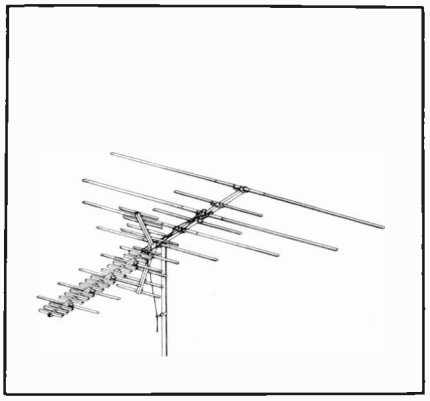
Later version chassis do not use the constant voltage filament transformer and, therefore, the capacitor is not required. Some early version chassis were field modified to eliminate buzzing transformers and the capacitor was shorted out when the constant voltage type was replaced with a non-constant voltage type.■

NEW PRODUCTS

Descriptions and specifications of the products included in this department are provided by the manufacturers. For additional information, circle the corresponding numbers on the Reader Service Card in this issue.

VHF/UHF/FM ANTENNA 137

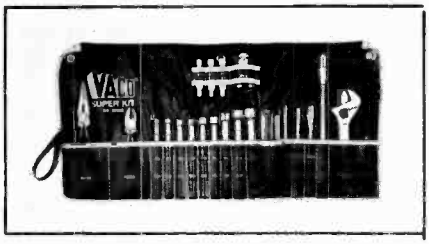
The Finney Co. announces a new antenna, Model 1776. It is a 37 element VHF-UHF-FM antenna featuring a 1-inch square boom and measuring 111⅛ inches long. The multiple drive VHF section with reflector elements for both low-band and hi-band assures high gain and good front-to-back ratio on the VHF response. The UHF section of the antenna incorporates the features of a broadband yagi type



array and a corner reflector type array for flat response and high gain across the entire range of UHF channels. A behind-the-set signal splitter is included in each carton. The antenna is packaged in a colorful red, white and blue carton.

TOOL KIT 138

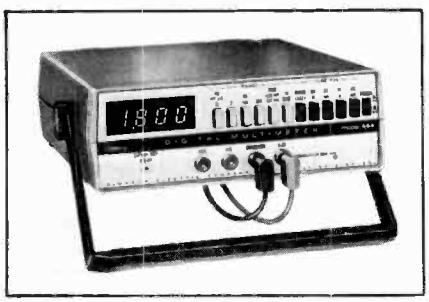
Super Kit, No. 99500, a complete tool kit in a pouch, has been introduced by *Vaco Products Co.* This addition to the Vacombo Kit program offers the convenience of 20 of the most often used tools in a versatile roll up pouch. The Super Kit contains a standard and a stubby type heavy duty handle with snap-in interchangeable screw and nut drive blades, reamer and extension, plus two pliers and an adjustable wrench. The screw driver blades are 3/16 in. and ¼ in. slotted and No. 1 Phillips types. The 12 nut driver blades range in size from 3/16 to ½ in. including three stubby models. The reamer has a 5 in. body tapered from ½ in. in diameter to a point. The extension blade adds an additional 7 in. of working length to all of the nut driver and screw driver components. All of the blades will fit into either the standard or the stubby handles. The kit also contains a 6 in.



long needle nose plier with the wire cutter, a 5 in. diagonal wire cutter and a 6¼-in. adjustable wrench. The kit measures 19⅝ in. wide and 19⅛ in. high. The blue pouch with yellow trim is made from top grade, durable vinyl. Pockets and dividers are double stitched. A matching blue dust cover keeps all components clean.

DIGITAL MULTIMETER 139

Simpson Electric Co. announces the introduction of its all-new, low-profile 3½-digit, Model 464 Digital Multimeter with extra-large 0.43-inch LED readout. Housed in an attractive, high-impact, shock-resistant molded case, the instrument features: full push-button operation—ranges and functions; low-profile, modern case design; tilt-and-view, adjustable handle; 0.2 percent VDC reading accuracy; bi-polar operation and automatic zero; and built-in rechargeable battery circuit in one version. It measures all popular electrical parameters in 28

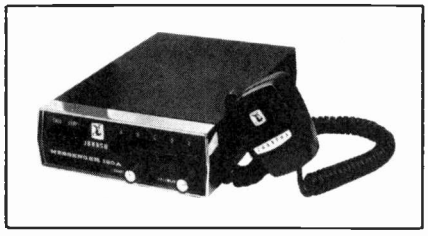


ranges; six DC and AC current ranges to 10 amperes, six resistance ranges to 20 Megohms and five AC and DC voltage ranges to 1000 volts. The multimeter is offered in two models, 464A and 464D. The A version, priced at $210, operates at line voltages of 120/240 VAC, 50-400 Hz. The 464D, (complete with internal battery-charging circuit), priced at $235., permits line-free battery operation in the field for up to eight hours in addition to full AC line operation without batteries.

CB TWO-WAY RADIO 140

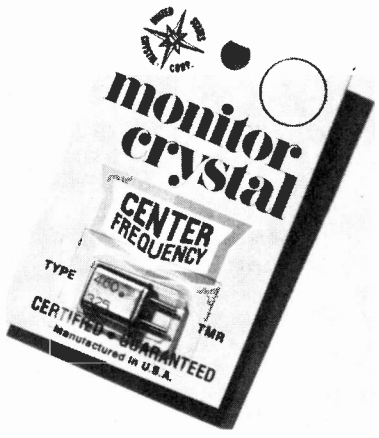
The *E.F. Johnson Co.* introduced a new CB two-way radio, the Messenger 120A, with a selective calling feature that keeps it completely silent until called by another radio equipped with the correct code tone. The selective calling system, trademarked "Tone

Alert", is built-in the radio as a standard feature. The system also helps prevent missed calls since the operator does not have to listen to all calls on the channel. When a call is made from another radio in the system, a tone sounds and a red "call" light illuminates to alert him to the call. Even if the driver has temporarily left his vehicle, he will be alerted when he returns because the "call" light stays illuminated. There are 10 code tones available in the system, resulting in 220 available separate systems in any local area by utilizing the 22 CB channels available for everyday, non-emergency communications. Other features include easy push-button selection of up to five channels, high torque rotary controls for volume and squelch, and built-in speech compression on transmit for longer range. The price is $149.95.



MONITOR CRYSTALS 141

A precision "Center-Frequency" Monitor Crystal is introduced by *United States Crystal Corp.* The new quartz crystals are designed for improved reception plus greater stability and improved adjacent channel rejection. A new blister-pack package is used to identify the new crystal and to provide protection in shipping and handling. Advanced technology allows precision grinding of the quartz element.



ALARM INSTALLER'S TOOL KITS 142

Two professional alarm installer's tool kits are introduced by *Mountain West Alarm Supply Co.* The MW-751 Economy Kit is for alarm installers who already own their basic hand tools and provides a low-cost set of alarm tools and testers. The MW-711 Professional Kit contains tools selected for the installation and repair of burglar and fire alarms including basic tools needed. Both kits come in

attache cases that have a solid wood frame, mahogany panelling, aluminum partitions, and two removable pallets to hold more than 60 tools. The MW-751 Economy Kit contains 15 different hard-to-find alarm specialty tools such as circuit tester, window foil brushes and splicing tools, long 18-inch drills, 30,000 Ohms/Volt Multimeter, etc. The MW-711 Professional Kit contains 41 different tools

made by leading manufacturers. There are tools for hardwire systems as well as items needed for the adjustment and servicing of ultrasonic, radar, infrared, CCTV, and other advanced detectors. Most of the tools are mounted on two removable pallets. The pallets in turn are mounted in a deluxe attache case.■

Please do not send money for items for which there is a fee. The Reader Service Card indicates your interest in an item. The company or organization will bill you directly.

TEST INSTRUMENT REPORT

continued from page 34

Color unit are set-up and instruction manuals, two 70-degree adapters, two 90-degree extensions, one audio extension, six yoke programmer plugs and four convergence ballast plugs. Available as optional accessories, are adapter kits for the eight most popular set brands and discrete adapter for 42 more.

The Model CK 3000 Chek-A-Color portable color TV test jig weighs less than 25 lbs. Price is $297.00. ■

COMM CHAT

continued from page 32

pair of such defects (and the resultant loss of reputation and sales) far outweigh any "savings" they hope to realize by cutting corners in design, quality control and final

inspection. In the meantime, servicing dealers can help both themselves and the CB manufacturers by directly reporting chronic cases of "factory-originated" defects to the *upper* management echelons of the companys in whose products such defects occur. Often, the magnitude and urgency of a problem are "watered down" in an organization simply because of the "distance" between the people at the operating level and the decision makers and problem solvers at or near the top of the organization.

As I stated before, not all CB manufacturers are guilty of the "boom market-corner cutting" syndrome I've described. Fortunately for everyone concerned, most of the "good guys" have been in the market place too long to make such mistakes—at least not to a *chronic* degree. And equally pleasing, most of the "good guys" recognize the advantages that marketing through a *servicing* dealer can offer them, on both a short- and a long-term basis, compared to the mass merchandiser. They realize that we servicing dealers are not only knowledgeable enough about the product to sell it better than a sales clerk but we are also able and willing to provide installation, servicing and the other after-the-sale support that is essential to establishing and maintaining a products reputation.■

SERVICING OF SSB

continued from page 31

will be suitable for your planned installation. Of course, for SSB CB, any standard CB antenna is fine. If the unit is to be operated only on SSB Suppressed Carrier, your problems are usually much simpler. If the unit is to be operated only in one band (2, 4, 6, 8, etc.) in pure SSB, you've got it made. But watch that AME.

Standard receiver RF and IF alignment procedures are fine for SSB, with one exception: Since the same IF's and filter circuitry are usually used for both receive and transmit, some compromise tuning might be necessary to achieve optimum performance in both modes. Follow the manufacturer's data, at least until you develop a better procedure. ■

FIELD STRENGTH

continued from page 28

tem aging and changes in signal propogation.)

Even if you don't have "as built" drawings, the FSM is still a tremendous MATV troubleshooting tool. First, check inputs and outputs of all head-end equipment. If an amplifier that is supposed to provide 40 dB gain actually has +2 dB going in and only +12 dB coming out, it is obviously not operating correctly.

To check a distribution system trunkline, start in the middle of the line and check signal output levels at each tapoff. Levels will decrease rapidly as you get nearer to the tap-off that causes the problem. You can, of course, check out tapoffs with an ohmmeter, but this process involves removing wall plates and disconnecting all of the input and output cables. Troubleshooting with an FSM is much faster because you simply plug the meter into the tap-off output, as shown in Fig. 4.

If you do antenna or MATV work, a good FSM will pay for itself many times over.■

PROFITABLY SPEAKING

continued from page 12

I came away from the meeting with mixed feelings. On the one hand, I feel that RCA Consumer Electronics' announced reason for holding the panel discussion—to provide an open forum for mutually beneficial dialogue between it and independent servicers—was motivated by a genuine desire to work with independent servicers. During the course of the meeting, various Consumer Electronics executives and department managers stated that they recognize the influence which independent servicers have on the home entertainment electronics market and the value of having the independent electronic servicers as their "partners" in the marketing and after-sale support of their products.

Within this context, I came away hoping that the blast leveled against RCA Consumer Electronics by servicers as a result of the RCA Service Company's policies and practices would not leave the executives and managers of RCA Consumer Electronics with the impression that their sincere efforts to work with independent servicers have been nullified by the servicers' obvious, and I believe justified, irritation at the RCA Service Company.

Frankly, I am impressed by the cooperative attitude and seemingly sincere willingness to "do right by servicers" that the relatively new group of RCA Consumer Electronics executives and managers is projecting.

On the other hand, I hope that, as a result of the October 21 meeting, the management of RCA Consumer Electronics has a better measure of the level of irritation and frustration which some of the policies and practices of the RCA Service Company (and all other manufacturer-owned service companies) have caused among independent servicers, regardless of whether or not all of it is justified. Hopefully, RCA Consumer Electronics will use its intracorporate influence to eliminate or at least temporize some of the more irritating practices of its corporate brother.■

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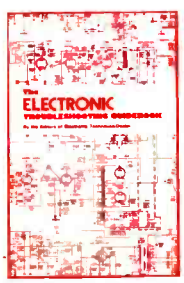

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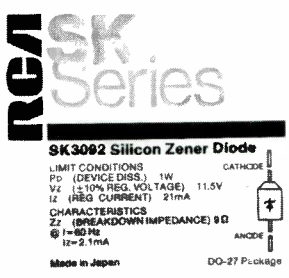

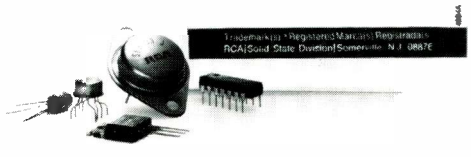

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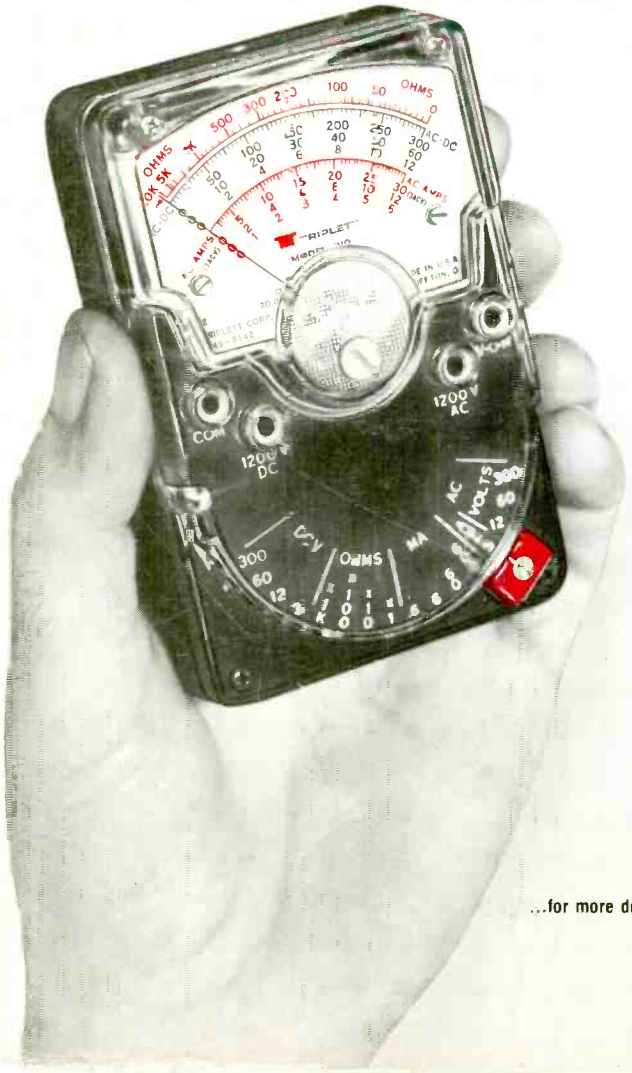

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