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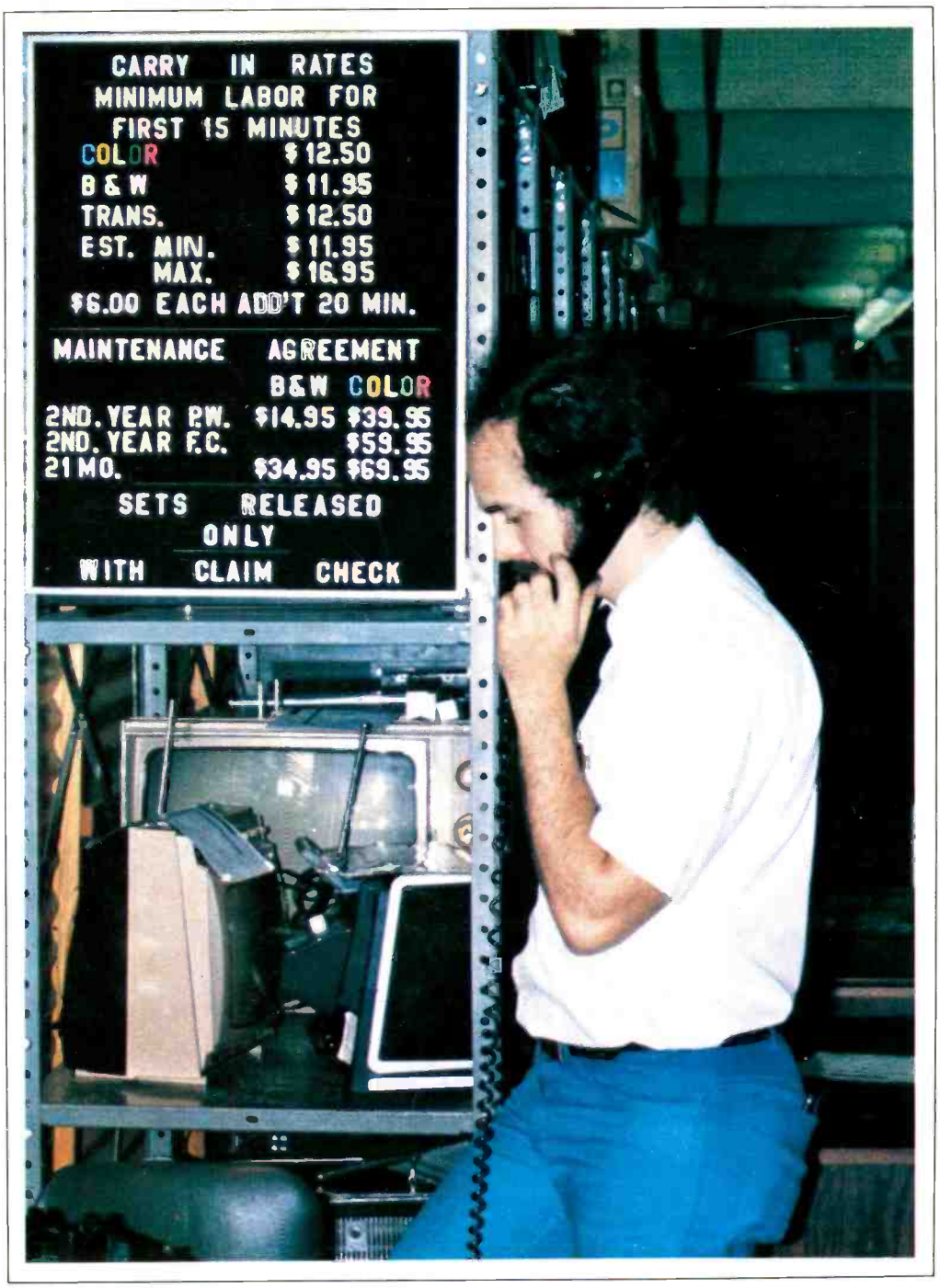
ELECTRONIC TECHNICIAN/DEALER

WORLD'S LARGEST TV-RADIO SERVICE & SALES CIRCULATION



Annual Subject Reference Index

Carry-In TV Servicing—
Passing Fad Or Established Trend?

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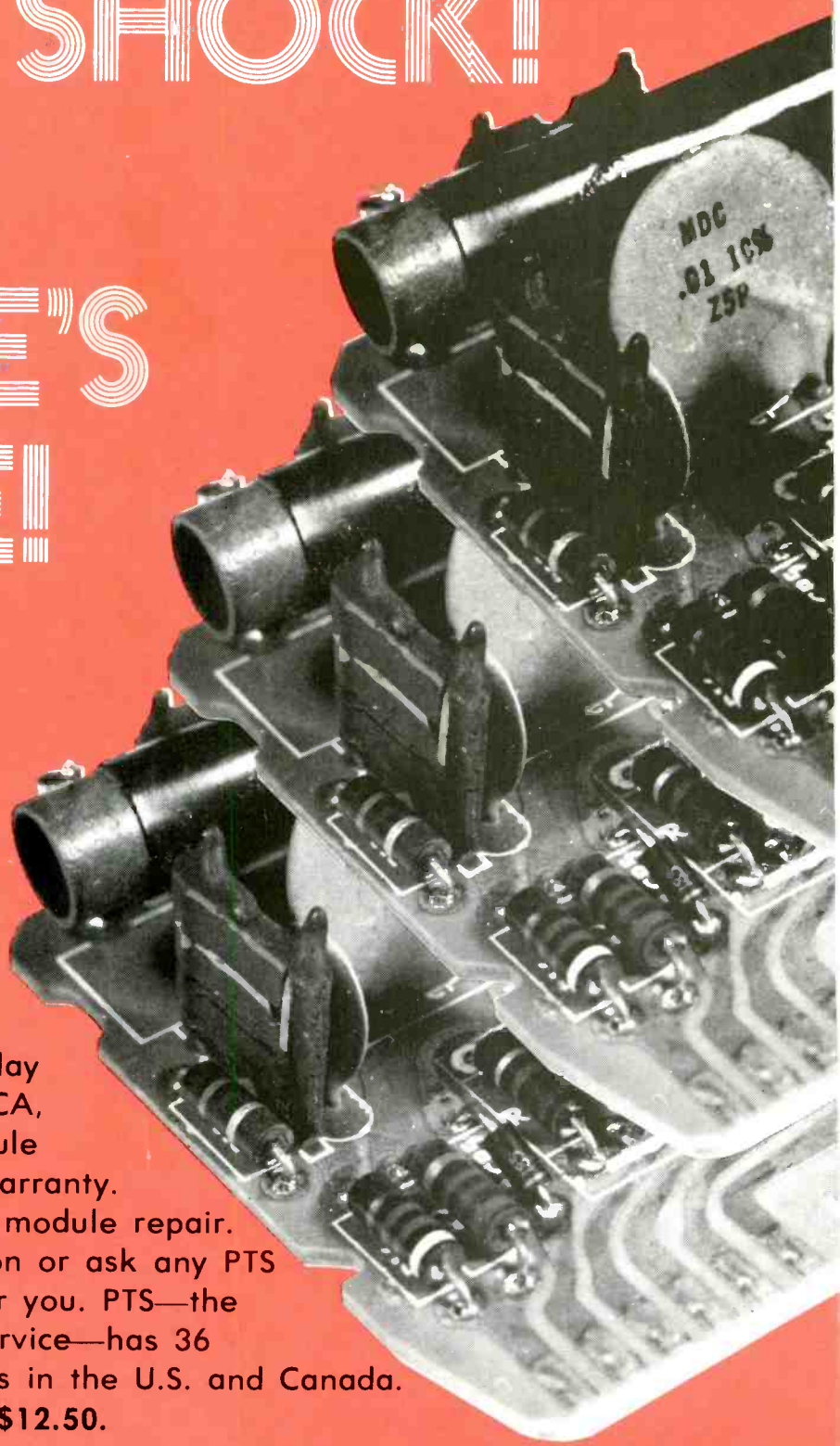

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THE COVER: Taken in the carry-in area of a large electronic service company in Chicago, the cover photo this month symbolizes the increase in carry-in TV servicing which is the subject of the Profitably Speaking article in this issue.

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NEWS OF THE INDUSTRY

Factory Installed Car CB Not Yet A Reality, But On Horizon

Although no U.S. auto maker is yet offering CB radio on an original equipment basis, a recent report in *Television Digest* implies that factory installed units are not far down the road.

Says the report: "Ford and other auto firms are known to be discussing the feasibility of offering CB as original equipment with several CB makers, including E.F. Johnson and Motorola."

Ford is the only one of the four major auto makers who presently does not offer CB as a dealer-installed option.

General Motors, says the report, has the broadest CB program and offers both Pearce-Simpson and E.F. Johnson units to GM dealers through the GM Parts Division. GM's Delco Division, as yet, is not in the CB business, but, according to the report, a Delco spokesman acknowledged that Delco is "looking at designs to decide whether or not it is desirable." The Delco spokesman, says the report, would not comment on reports that Delco is developing its own in-dash CB/tape player combination unit.

Chrysler, at the time the *Television Digest* report was written, was in the process of choosing one of three CB bands—E.F. Johnson, Cobra or Kraco—which it will offer its dealers through its Mopar service and replacements parts division.

American Motors, according to the report, presently offers its dealers a range of E.F. Johnson CB units.

E.F. Johnson, says the report, is also a big suppleir of CB parts to the truck industry, including Peterbuilt, Kenworth, Mack, White, International, GMC and Ford.

The *Television Digest* report also stated that, although Motorola is not yet committed to the CB market, Motorola President William Weis recently told security analysts in Chicago that Motorola probably will enter the field.

RCA Now Remanufacturing Defective Color TV Modules

The RCA Distributor and Special Products Division in November announced that it had begun factory repair of certain RCA color TV modules.

Under the new program, TV dealers and technicians can return certain out-or-warranty defective RCA color TV modules to "appointed RCA replacement parts distributors" and receive from 50 cents to $2.00 credit for each module, depending on the type and resale value of the module. The distributor, in turn, sends the defective module to RCA for remanufacture.

The remanufactured RCA color TV modules are returned to RCA replacement parts distributors, for resale to dealers and technicians at the same prices as new units. Remanufactured modules are indentified as such by a label affixed to each unit and by an imprinted notice on each carton.

According to RCA, the module remanufacturing program, which involves about 20 types of modules employed in various RCA color TV chassis (excluding those in RCA's new ColorTrak series), was inaugurated "to insure that reliable replacement modules will be available for continued servicing of RCA television receivers" and "is especially important with respect to older chassis designs in which some modules are currently being phased out of production."

Describing the module remanufacturing process, an RCA spokesman said: "All modules are screened by RCA before being remanufactured. Those which pass examination are sent to the RCA factory in which they were originally manufactured. There they undergo diagnosis and repair, including alignment of tuned circuits and temperature cycling. If circuit improvements have taken place since original production, the required modifications will be made during remanufacturing, to take advantage of technological advances."

Other color TV manufacturers who have instituted module remanufacturing programs include Sylvania, who remanufactures Philco modules, and Quasar, who remanufactures both Motorola and Quasar modules.

Philco Finance Sold By Ford Motor Credit To ITT Financial

ITT Consumer Services Corporation and Ford Motor Credit Company have announced the completion of the sale of the wholesale finance receivables and certain other assets of Philco Finance Corporation to ITT Financial Corporation.

The assets acquired from Philco Finance will be employed by ITT Diversified Credit Corp., a wholly-owned subsidiary of ITT Financial Corporation, in the financing of 3,500 dealers through 18 branches across the U.S.

Philco Finance, previously a wholly-owned subsidiary of Ford Motor Credit Company, had provided financing on home appliance inventories for the 3,500 dealers. Because Aeronutronic Ford Corporation (formerly Philco-Ford Corporation) is no longer involved

in the consumer products business, except for refrigerator and freezer sales, there is no longer a need for Philco Finance, which substantially ceases operation with the completion of the sale.

Sarnoff Resigns From RCA Corporation

Robert W. Sarnoff, who for ten years served as president and then as chairman of the RCA Corporation, on December 31 resigned as chairman and a member of the board of directors of that company.

Anthony L. Conrad, who became president of RCA on August 1, 1971, has been designated both president and chief executive officer of RCA Corporation by the RCA board of directors. Conrad, whose career with RCA spans a quarter of a century, was president of the RCA Service Company for eight years prior to his appointment to the RCA corporate staff in August, 1968. Conrad joined the RCA Service Company in 1946 following his discharge from the U.S. Army Signal Corps.

Slumping TV Sales and Continued Japanese Competition Might Force Sears-Supplier Warwick Out of TV Business

The chairman of the Whirlpool Corporation, John Platts, in an interview published recently in the *Wall Street Journal,* stated that the combination of continued declines in color TV sales and increased pricing competition from Japanese TV manufacturers could eventually force Warwick Electronics Corporation out of the TV manufacturing business.

Warwick, of which 57 percent is owned by Whirlpool and 25 percent by Sears, Roebuck and Co., is a major supplier of TV to Sears.

Platt, who is also chairman of Warwick, said that, although Warwick would not abandon the TV business in the near future, if the current combination of slumping TV sales and increased foreign pricing competition continue "we will have to reassess our position."

Warwick early last year stopped manufacturing 17- and 15-inch color TV for Sears because, as Platts stated, "we were not competitive with the Japanese."

To recover costs and make a reasonable profit, said Platts, 19-inch color TV receivers should be retailed for about $499. However, foreign competition has forced down the retail price of such sets to the $369-to$399 range, and lower. (A recent *Television Digest* report stated that in early November Sears was advertising a Japanese-made color TV set in the New York area for $269.)

Western Appliance Electronic Dealer Show Scheduled For July 11-13 In Los Angeles

PREVIEW/77, which is billed as the first large-scale, West Coast dealer trade show for appliance, TV, audio and personal communications products, is scheduled for July 11-13 at the Hyatt International Hotel, Los Angeles Airport.

CATV Now Serving 15.3% Of U.S. TV Homes

Community antenna television (CATV) systems were serving 15.3 percent of the nation's 70.5 million TV homes at the end of last year, according to estimates by *Television Digest.*

At year's end, says *Television Digest,* there were about 3,450 CATV systems operating in the U.S., compared to 3,366 at the end of 1974.

RCA Abandons Magnetic Tape Home Video Tape Player/Recorder

RCA has discontinued further development of its Mag Tape Selectra Vision home video tape player/recorder and will channel its technical and financial resources into the development and marketing of its Selectra Vision disc-type home video player, according to a report by *Television Digest.*

The reason given by RCA for dropping its Mag Tape system is that the "retail price would have exceeded the range necessary to make it a viable consumer product."

Proposed Aerosol Ban Based On "Unproved Theory" Says Electronics Aerosol Producer

"The claim that aerosols pollute the atmosphere is an unproved theory with no evidence to back it up."

This is the opening statement in a "position paper" recently released by Al Friedman,

president of Chemtronics Inc., a major producer of aerosols for the electronics industry.

The aerosol controversy was started by Drs. Rowland and Molina, two University of California scientists. Their theory is that fluorocarbons used as aerosol propellants get into the earth's stratosphere (about 25 miles above the surface) where they destroy ozone. Because the ozone layer protects us from ultra-violet rays, a substantial decrease in the amount of ozone in the stratosphere would lead to an increase in the incidence of skin cancer.

Friedman contends that there is "absolutely no reason for aerosol products to be banned at this time."

Reaction by other scientists to the Rowland/Moline theory that fluorocarbons deplete the ozone layer, says Friedman, range from complete agreement, to characterizations of the hypothesis as "utter nonsense."

For example, says Friedman, leading British meteoroligist Dr. Richard S. Scorer has stated: "The whole issue has been blown up out of all proportion, and the subsequent outcry is an overreaction to a scientifically questionable theory."

On the other hand, points out Friedman, Dr. Michael McElroy of Howard has taken the position that "the burden of proof is on those who challenge the theories. We don't have to prove it is right. Somebody has to prove it is wrong."

This same attitude, says Friedman, was adopted by the states of New York and Oregon, who have passed legislation that will ban aerosol fluorocarbons in the future unless it is proven that they do not destroy the ozone layer.

According to Friedman, such proof is virtually impossible. "You cannot disprove a negative," he said. "The less evidence there is to indict fluorcarbons, the harder it is to prove they are innocent."

The only hard evidence pertinent to the controversy, says Friedman, has come from Drs. London and Kelley of the University of Colorado. "Careful measurements made by these scientists indicate that from 1957 through 1970, the ozone layer over the Northern Hemisphere has actually *increased by 7 percent.*"

"Other scientists have shown that nitric acid, not chlorine, is the dominant factor governing ozone layers," contends Friedman, "And 50 to 70 per cent of ozone destruction is caused by combination with nitric oxide, according to Dr. Harold Johnson of the University of California at Berkley."

According to Friedman, alternative propellants are presently available for most, but not all, electronic chemicals.

Dynascan To Insure And Prepay All Cobra CB Radio Shipments

Dynascan Corporation, manufacturer and marketer of Cobra CB radios, has announced that it is now providing full insurance protection for all of its Cobra shipments and, in addition, is prepaying all freight charges so that distributors and dealers will be able to receive Cobra products "with a minimum of paper-work and a maximum of safety."

The reasons behind this new policy, according to Carl Korn, president of Dynascan, "stem from the limited liability assumed under the regulations of the Motor Freight Carriers Association, and the fact that CB equipment has become a favorite target for theft."

"Standard liability for freight carriers is based on weight," says Korn, "with $5.00 per pound as the maximum claim. However, for expensive, light-weight products, such as CB radios, this limit falls far short of actual value."

PTS Opens New TV Tuner Service Center In Los Angeles

PTS Electronics, Inc., an Indiana-based TV tuner service company, has opened a new repair facility at 4184 Pacific Way, Los Angeles, California 90023.

Magnavox Producing CB For E.F. Johnson

Magnavox reportedly has contracted to manufacture 100,000 mobile CB radios for E.F. Johnson,a Minnesota-based producer and marketer of communications equipment.

The Magnavox-produced CB units will be marketed by E.F. Johnson under its *Messenger* brand name. The first 8,000 units reportedly will be delivered to E.F. Johnson by year's end.

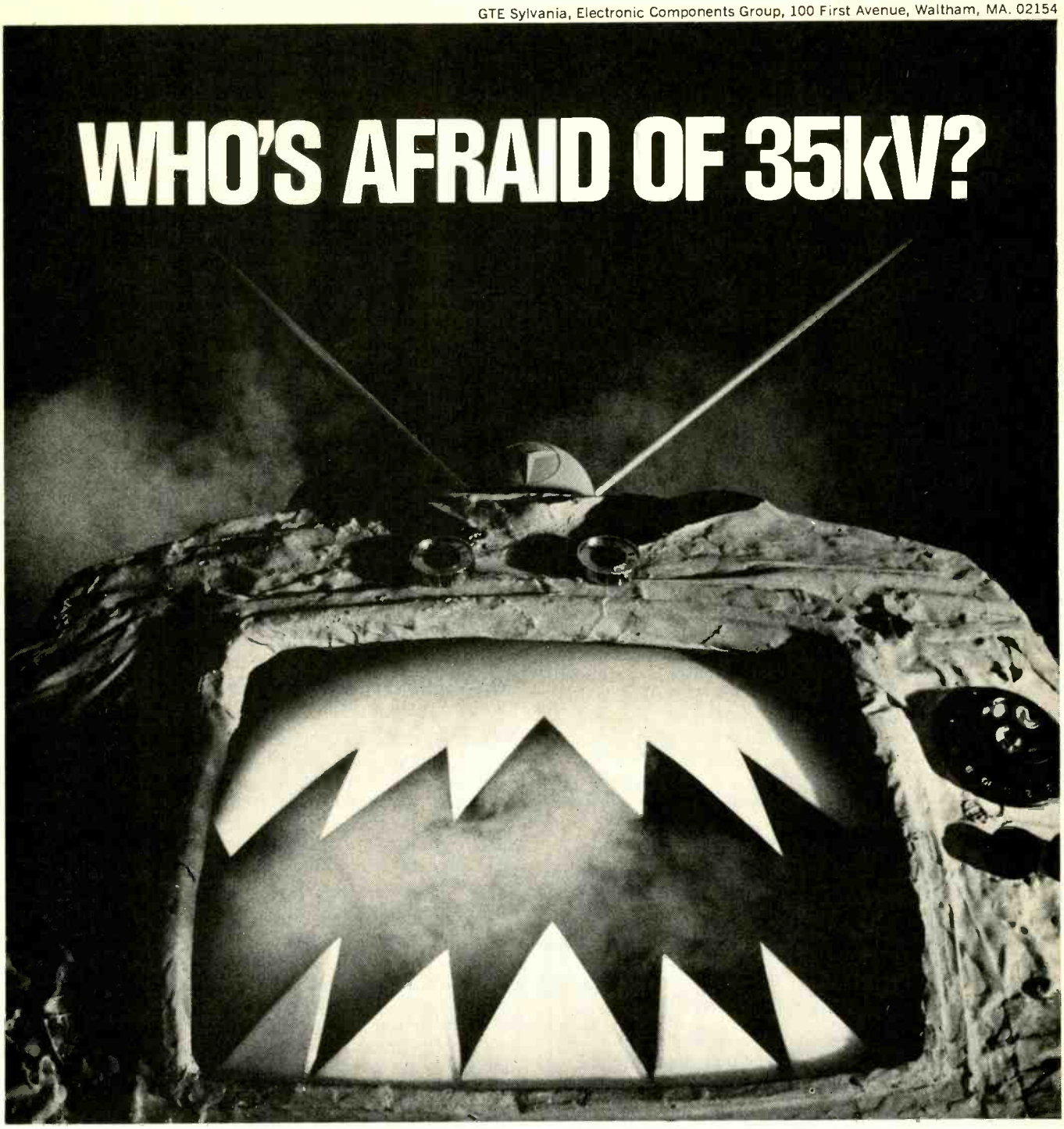
The terms of the Magnavox/E.F. Johnson private label contract reportedly precludes the possibility of Magnavox moving into the CB market with its own product or brand.

RCA Executive Says 45% Of Color TV Sales Are Replacements

Jack K. Santer, Division Vice President, Marketing, RCA Consumer Electronics, in a speech to TV servicers in Indianapolis on Oct. 21, said that 45 percent of color TV receivers sold now are replacements for old color receivers; 30 percent are purchased by first-time color TV buyers; 20 percent are purchased for use as second or third sets; and 5 percent are purchased for institutional use (hotels, motels, etc.). ■

GTE Sylvania, Electronic Components Group, 100 First Avenue, Waltham, MA. 02154

WHO'S AFRAID OF 35kV?



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GTE SYLVANIA

ELECTRONIC ASSOCIATION DIGEST

NESDA 1976 Annual Convention

The National Electronics Service Dealers Association (NESDA) has announced that its 1976 annual convention will be held in the San Antonio Convention Center, San Antonio, Texas, August 13-17.

Hosting this year's NESDA annual convention is the Texas Electronics Association (TEA), which is expected to hold its annual state convention in conjunction with the NESDA convention.

Included among the many events already scheduled for the convention is the NESDA Open Annual Golf Tourney, which this year will be sponsored by *Electronic Technician/Dealer* magazine.

For more information about the 1976 NESDA annual convention contact Dick Glass, CET, NESDA Executive Vice President, 1715 Expo Lane, Indianapolis, IN 46224 (phone 317-241-8160).

EIA Consumer Electronics Instructors Workshop Feb. 9-11

The Service Committee of the Electronic Industries Association's Consumer Electronics Group (EIA/CEG) will conduct an instructor workshop February 9-11 at Appalachian State University, Boone, North Carolina.

The purpose of the 30-hour-long instructor workshop is to update college and university vocational instructors on the latest electronic technical developments and "hands-on" teaching techniques of the industry.

The workshop will be divided into three sessions: audio, television, and methods. Each session will be taught by qualified industry representatives who are familiar with the industry's latest technical developments in his field.

The college and university instructors who complete the workshop will then teach at CEG's 1976 summer seminars, which are attended by high school vocational instructors from across the country.

Approximately 20,000 high school students are enrolled annually in vocational programs which will eventually lead to a career in consumer electronics servicing.

The EIA's Consumer Electronics Group also has prepared for teachers of electronics courses a new handbook which lists electronic training aids.

The 225-page *Electronics Multimedia Handbook* was produced under the Association's Service Technician Development Program.

Listed in the handbook are the prices of the training materials and the location from where they may be purchased. Some of the items which are in the comprehensive listing include: Super 8MM and 16MM films, film loops, video tapes, filmstrips, cassette tapes, transparencies and charts.

On an introductory basis, the book is still being made available free-of-charge to vocational instructors by writing to:

EIA/Consumer Electronics Group
2001 Eye Street, N.W.
Washington, D.C. 20006

The EIA *Electronics Multimedia Handbook* was edited by Dr. Irving W. Larson and will be updated periodically as part of the CEG Service Technician Development Program.

IESA Member Appointed To Indiana Service Examiners Board

Frank J. Teskey, CET, owner/operator of Teskey's TV Center, Indianapolis, Indiana, and a member of the Indiana Electronic Service Association, recently was appointed by Indiana Governor Otis Bowen to that state's Board of Television and Radio Service Examiners, a five-member panel which supervises the regulation of home entertainment electronic technicians and electronic service businesses in that state.

NATESA Secretary General Dies

Leo P. Shumavon, Secretary General of the National Alliance of Television & Electronic Service Associations and two-time president of that association, died in St. Petersburg, Florida, on November 18.

Mr. Shumavon, who for many years had owned and operated an electronic service business in Dorchester, Massachusetts, retired and moved to St. Petersburg seven years ago. In addition to performing in many positions and functions in NATESA, Mr. Shumavon also had been a leader in the Florida Electronics Service Association since moving to that state and has been honored many times for his work in local, state, regional and national electronic service association.

Colorado Elects New Officers

The Colorado Professional Electronics Association recently elected the following new officers: Robert Kavan, Denver, president; Leo Hofelich, Colorado Springs, vice president; Tom Thomas, Pueblo, secretary; and Harold Hollis, Denver, treasurer. ■

ORIGINAL SONY TV ANTENNA AND KNOB KITS

KIT #1	KIT #2
Consists of 4 color and B&W antenna used in most Sony TV sets.	Consists of 14 color and B&W VHF channel selector knobs used in most Sony TV sets.
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PROFITABLY SPEAKING

With J.W. Phipps

Carry-In Servicing—Passing Fad Or Established Trend

■ The majority of home entertainment electronic servicers to whom I've talked in the past year say that carry-in TV servicing is on the increase and the demand for in-home servicing is slowly declining.

Whether or not this is a permanent, nationwide trend, and whether or not it is causing, or will cause, a net loss or net gain in TV service profits, is still hard to say.

Some servicers who are experiencing increased carry-in business attribute it solely to "consumer concern about present and future economic conditions" and believe that as soon as the economy shows a steady improvement consumers will regain their confidence and once again will be more interested in the convenience of in-home servicing than in any savings they might realize from carry-in servicing.

Other TV servicers, particularly those who also sell TV receivers, view the increase in carry-in volume as a *permanent* trend resulting from three principal factors: 1) Increasingly larger percentages of the sets sold in recent years have been table and portable models which, because of size and weight reductions, are becoming increasingly easier for consumers to lift and transport; 2) consumer psychological conditioning to carry-in service as a result of manufacturers' carry-in warranty policies on portable and table models; and 3) consumer psychological conditioning to carry-in service as a result of the do-it-yourself trend, which in the past two years or so has been reinforced by consumers' need for budget tightening—a condition that most consumers are experiencing as a result of the combined effects of inflation and recession.

Statistics on TV sales to dealers during the ten-year period 1965-1974, compiled and published by the Marketing Services Department of the Electronic Industries Association (EIA), not only substantiate the contention that total sales of table and portable models in the past ten years have exceeded those of console and combo units, but also show that table and portable models have predominated by a factor of almost three to one. As revealed by Table 1, of the total of 121,976,000 TV receivers sold to dealers during this period, a whopping 70.5 percent were table or portable models.

As shown by Table 2, which is a more detailed breakout of the ratio of table and portable to console and combo models in monochrome and color TV sales during the ten-year period 1965-1974, the 60,498,000 color TV sets sold during this period were almost evenly split between the two general categories of model types, with 49.9 percent being table or portable models and 50.1 percent being console or combo models. Of the 61,748,000 monochrome TV receivers sold during this period, over 90 percent were table or portable models.

Table 3, which is a yearly breakout of the types of monochrome and color TV receivers sold to dealers during the five-year period from 1970 to 1974, clearly reveals that the predominance of table and portable models in TV sales is a well established trend and that, although Table 2 shows that *total* color TV sales during the period 1965-1974 were almost evenly split between the table/portable and console/combo categories, table and portable models actually began to dominate color TV sales in 1971, and by the end of 1974 were accounting for 67.7 percent of total annual color TV sales to dealers. (Although not directly revealed in Table 3, by 1974 annual sales of color TV were exceeding those of monochrome, and accounted for 56.9 percent of the total TV sales that year.)

Despite the fact that a statistical breakout of TV sales during 1975 was not yet available at press time, TV industry sources whom I have questioned say that the general trends revealed in Table 3 undoubtedly continued in 1975.

To relate the preceding statistics to the present TV set population, I have attempted to determine what percentage of the present TV set population was produced during the period 1965-1974 (to which the preceding sales-to-dealers statistics apply). According to data published by EIA's Marketing Services Dept., there were an estimated 70.6 million TV receivers in use as of 1965. Adding to this figure the 122 million sets sold to dealers during the period 1965-1974, produces a total of 192.6 million TV receivers, from which must be subtracted the total number of TV receivers estimated to have been scrapped during the period. (According to GTE Sylvania's Marketing Research Dept., an estimated average of 7.4 million TV receivers were scrapped each year during the period 1965-1973. Based on this scrappage estimate, approximately 74 million TV receivers were scrapped between 1965 and 1974.) Subtracting the 74 million scrapped receivers from the previously computed figure of 192.6 million, leaves 118.6 million receivers in use as of the end of 1974—slightly less than the total 122 million TV receivers sold to dealers during the ten-year period ending in 1974. This indicates

TABLE 1

Total TV Sales to Dealers 1965-1974 (Monochrome & color combined)

TYPE	UNITS	% OF TOTAL
Table/Portable	86,008,000	70.5%
Console/Combo	35,968,000	29.5%
Total	121,976,000	

Source: EIA Marketing Services Dept.

TABLE 2
Total TV Sales To Dealers 1965-1974
(By Type)

TYPE	UNITS	% OF TYPE		% TOTAL mono/color
MONOCHROME				
Table/Portable	55,805,000	90.8%		
Console/Combo	5,673,000	9.2%		
Total Monochrome			61,478,000	(50.4%)
COLOR				
Table/Portable	30,203,000	49.9%		
Console/Combo	30,295,000	50.1%		
Total Color			60,498,000	(49.6%)
Total Monochrome & Color TV Sales			121,976,000	

Source: EIA Marketing Services Dept.

TABLE 3
TV Sales To Dealers 1970-1974
(By Year & Type)

MONOCHROME (add 000)

	TABLE/PORTABLE		CONSOLE/COMBOS	
YEAR	UNITS	%	UNITS	%
1970	4,172	91.8	374	8.2
1971	4,530	92.4	344	7.1
1972	7,851	96.4	294	3.6
1973	6,787	96.5	246	3.5
1974	5,791	97.5	150	2.5

COLOR (add 000)

	TABLE/PORTABLE		CONSOLE/COMBOS	
YEAR	UNITS	%	UNITS	%
1970	2,419	50.2	2,403	49.8
1971	3,461	56.0	2,720	44.0
1972	5,340	63.7	3,038	36.3
1973	6,081	65.6	3,182	34.4
1974	5,304	67.7	2,526	32.3

Source: EIA Marketing Services Dept.

that, for all practical purposes, all of the TV receivers in use as of the end of 1974 were produced during the preceding ten-year period (1965-1974) and, consequently, as revealed by the EIA sales-to-dealers statistics in Tables 1, 2, and 3, are predominately table and portable models.

I have not been able to uncover any data which positively proves that a significant percentage of the receivers which EIA classifies as "table" models are sufficiently small and light enough to be easily lifted and transported by most consumers. However, according to the EIA, the majority of color TV receivers sold in 1974 were in the below-21-inch category, with 19-inch receivers the best selling size. And, says EIA, the 12-inch size accounted for almost 50 percent of monochrome TV sales in 1974.

Complementing these indications of the increasing popularity of smaller screen sizes is what the EIA calls a "continuing transition to all-solid-state designs," most of which are significantly lighter than comparable tube and hybrid designs. According to the EIA, "72.6 percent of color and 39.1 percent of monochrome receivers manufactured or imported in 1974 were fully solid-state."

The preceding data does not by itself conclusively prove that a shift from in-home to carry-in TV servicing is occurring. However, in my opinion, it does indicate that there is a sufficient percentage of table and portable models in the present TV set population to make such a shift highly probable, and if it is not yet occurring, it probably will in the near future.

How and to what degree the profitability of TV servicing will be affected by the seemingly inevitable shift of an increasingly larger percentage of total volume to carry-in business is difficult to predict. However, there undoubt-

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edly will be an impact, and the sooner that servicers recognize the trend and react to it, the greater will be their chances of overcoming any negative aspects and, conversely, of taking advantage of any positive aspects.

On the one hand, more carry-in business and less in-home servicing seemingly should improve the overall productivity of service businesses, making them more profitable. Direct improvements in technician productivity should result from having all or most technicians working in the shop, where tighter supervision and more efficient workload control are possible, along with easier access to a larger, more complete parts inventory, a broader range of test equipment and a more comprehensive service library.

In addition, with more business from carry-in trade and less from in-home servicing, service businesses should be able to significantly reduce the redundant inventories of equipment and parts required to stock service vehicles. These savings, plus those realized from reductions in overhead expenditures for vehicle operation, maintenance, insurance and licenses, if used in total or in part for more efficient shop facilities and equipment, could further improve the productivity and profitability of most service businesses.

On the other hand, a shift to carry-in service might require that the shop be relocated to an area more conveniently accessible to customers, with a larger parking space and carry-in area. It also might require a larger space for TV storage.

Of the many possible changes that could result from what appears to be a gradual but inevitable trend toward carry-in business as the predominate source of TV servicing income, perhaps the most significant possibility is the re-emergence of the "TV sales and service dealer" as the prime merchandiser of consumer entertainment and communications electronic products.

High customer traffic, lower prices and higher volume are three interdependent factors which have permitted mass merchandisers to siphon a significant volume of business away from TV sales and service dealers. Carry-in TV servicing, which literally should bring back to the doors of TV sales and service dealers increasing numbers of consumers, just might bring back sufficient traffic and therefore sufficient sales volume to permit sales and service dealers to reduce or eliminate the one advantage that mass merchandisers have enjoyed—lower prices.

Once the pricing edge of mass merchandisers is reduced or eliminated, the advantages that sales and service dealers have always been able to offer consumers—the convenience and confidence of being able to obtain product, installation and service from a single source which by nature is significantly more knowledgeable and therefore more helpful than any other source of consumer electronic products—should tip the scales in favor of the sales and service dealer.■

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GTE Sylvania & Philco Color TV 1976

By Joseph Zauhar

All-solid-state chassis, with emphasis on automatic tuning, highlight GTE Sylvania's and Philco's color TV lines

■ GTE Sylvania introduced an all-solid-state line consisting of 49 color TV sets, and five home entertainment centers which are TV/stereo combinations. Forty-four of the receivers now feature GT-Matic self-adjusting tuning, 37 have the GT-Matic II feature.

The line includes 13-, 17-, 19-, 21- and 25-inch (diagonal) screen sizes. The 15-inch screen size has been discontinued in the new line.

Included in most of the TV sets is a negative guard band black matrix color picture tube, featuring a dark faceplate which absorbs room light and provides higher contrast and a sharper picture. The Dark-Lite 50 picture tube is employed in 26 of the 25-inch (diagonal) color TV sets and in all home entertainment centers. This picture tube is employed in a 21-inch model, and in two 19-inch portable TV sets. In three 19-inch (diagonal) and four 17-inch sets the picture tube is designated Dark-Lite. Five 13-inch sets; four 17-inch units and three 19-inch models will employ the Chroma-Line, in-line picture tube.

Six chassis will be employed in the new color TV line.

The E11 and E12 color TV chassis will be used in the 19-, and 25-inch (diagonal) screen size sets, featuring GT-Matic II self-adjusting tuning. The E20 chassis will be used in 13-inch (diagonal) table TV sets without the GT-Matic feature or with GT-Matic I. The E21 chassis will be employed in 17- and 19-inch (diagonal) size table model TV sets with or without the GT-Matic I tuning. The E40 chassis will be employed in 25-inch (diagonal) consoles and 21-inch table models with the GT-Matic II tuning feature. The E10 chassis is carried over from last year and will be employed in 25-inch (diagonal) screen size TV.

Photos and illustrations supplied through the courtesy of GTE Sylvania.

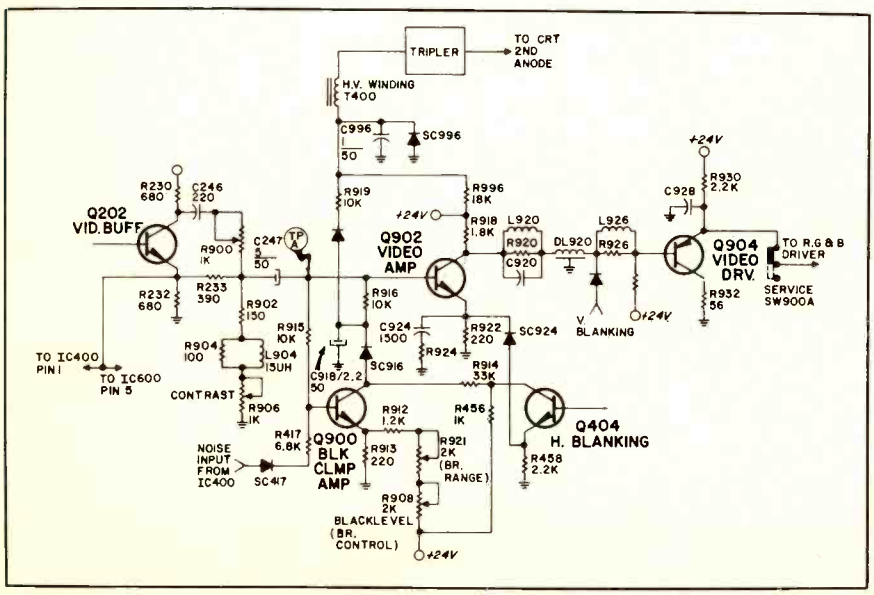

Fig. 1—Automatic Black Level circuit employed in GTE Sylvania's E20/21 color TV chassis.

Color TV Chassis E11/E12

The E11 and E12 are the highest performance color TV chassis and are employed in 25-inch (diagonal) color TV receivers. The chassis provides 30 kv of high voltage, and has the GT-Matic features.

A Ferro-Resonant Self-Regulating power transformer is used which provides a number of advantages.

The power supply regulator circuit automatically compensates for variations in power line voltages, maintaining constant chassis voltages. The transformer acts as a surge protector absorbing line voltage surges and transients, preventing damage to critical components employed in the chassis. Lower power consumption, reduces chassis heat. The Ferro-Resonant transformer draws only as much power as is actually needed, electronic regulators draw a higher level of power and convert the excess energy into heat.

Seven plug-in IC's (eight in Varactor-Tuner models), approximately 36 plug-in transistors, (68 in Varactor-Tuner models), four transistors in Varactor tuners and three transistors in the turret tuners are employed.

IC's are employed in the Auto Color/Auto Tint, Auto Black/White, Chroma Amp/Subcarrier Regenerator, Chroma Demodulator/Drive, Vertical Countdown, Horiz/Sync, Sound Demodulator, and the Voltage Regulator circuit (Varactor Models).

Plug-In Circuit Modules

Four modules perform the circuit functions and they are sensibly and functionally grouped to simplify troubleshooting of the chassis if required.

IF/Sound Module—The module is new and is not interchangeable with other existing chassis or panels. The module contains improved AFC and AGC circuits.

Video/Chroma Module—The GT-Matic circuitry included on this module is identical to and interchangeable with the E09, E10, and E40 chassis *Video/Chroma* panel. It is not interchangeable with older models or panels.

Deflection panel—this panel is

designed to drive the 30 kv deflection system and it is interchangeable with other existing panels used in previous E11 chassis.

Bandswitch Panel—The panel is only used with the varactor tuner models. The E11 chassis panel is interchangeable with previous E11 chassis modules. The E12 chassis panel is new and not interchangeable.

UHF Control Module—This module is employed on the 21 Detent tuner. It supplies the tuning voltage for the Varactor UHF tuner and AGC voltage to both tuners.

Color TV Chassis E20/21

The E20 and 21 color TV chassis are the second generation family of 100 percent solid-state chassis which are designed for use in 13- through 19-inch (measured diagonally) screen size color TV receivers where size, weight and carry-in service policy are of major consideration. They replace, and are mechanically very similar to the E06/E08 chassis with modifications made in the configuration of the chassis to be used with the new 17-inch and 19-inch TV receiver cabinets.

Chassis Features

The following chassis features have been carried over into the E20 and E21 from last year's E06 and E08 all solid state chassis.

Eight plug-in integrated circuits (seven on models without the GT-Matic feature) and 27 plug-in transistors (26 on TV models without the GT-Matic feature).

The number of IC's employed remains the same as in the E06/E08 chassis. The functions of the two IC's employed in the IF amplifier are as follows:

Integrated Circuit IF Amplifier—Two IC's replace the three or four discrete transistors normally used in the IF amplifier. One IC is used as a low level synchronous video detector. Because of its better detection linearity the synchronous detector reduces unwanted frequency by-products of the detection process to a level well below that of a standard diode detector.

GT-Matic Features

The GT-Matic features found on the step-up models include: Vertical Countdown IC (eliminates the *vertical hold* control). Horizontal-Sync IC (eliminating the *horizontal hold* control). Two-part color level circuit. Perma-Tint flesh-tone correction circuit. Black Level Clamp circuit. Automatic frequency control (AGC). Automatic voltage regulation. The non-GT-Matic TV models include many of the GT-Matic features. All include the Black Level Clamp circuit, horizontal/sync IC, Perma-Tint flesh tone correction circuit, amplified AGC and automatic voltage regulations.

Most of the new circuit employed in the E20/E21 chassis is possibly the most critical parameter in producing a good color picture with proper color intensity.

We often find that if the blacks are too light, the picture will look washed out and if the blacks are too dark, the important low brightness portions of the picture will be lost and the picture will appear to have too much color.

A relatively simple Black Level Clamp circuit (Fig. 1) has been added to the chassis. This circuit recognizes the blackest information in the scene and maintains it at some predetermined level which has been preset by the viewer with the *brightness* control.

Clamping the black video level is an effective method of retaining the black level in the video channel. This circuit function prevents the black level from becoming too dark or becoming too grey or washed out. This situation occurs under certain conditions of varying transmitted signal, received and detected video signal.

The video signal is AC coupled through capacitor C247, from the buffer stage, where the contrast level is adjusted to the viewers preference, to transistor Q902 the video amplifier and Q900, the black clamp amplifier. Noise cancellation also occurs in the base circuit of Q900 by coupling positive noise pulses through diode SC419. This circuit action prevents the black amplifier from detecting noise and setting up a black level voltage related to it.

Horizontal pulse cancellation is also required and accomplished by tying the collectors of Q900 and Q404 together with resistor R914. Tying of the collectors causes Q900 to be disabled during horizontal blanking. The horizontal blanking pulse which in turn lowers its collector voltage to four or five volts and removes all B+ voltage on the collector of Q900.

The black level is set by adjusting the *brightness* control, which in turn, controls the conduction level in Q900. The black clamp amplifier base voltage is developed through the resistor diode consisting of R456, R914, SC 916, C918, R916, R915, and its emitter voltage is developed through R908, R921, R912, and R913.

The adjustment of the *brightness* control, R908, varies the DC voltage obtained at test point TPA. By lowering or raising the black clamp amplifier emitter voltage it will in turn lower or raise the DC level at test point TPA. By the same circuit action developed in the black clamp amplifier, the black level is preserved. When the black video signal tries to drive the DC level at test point TPA, lower than the preference level, Q900 reduces

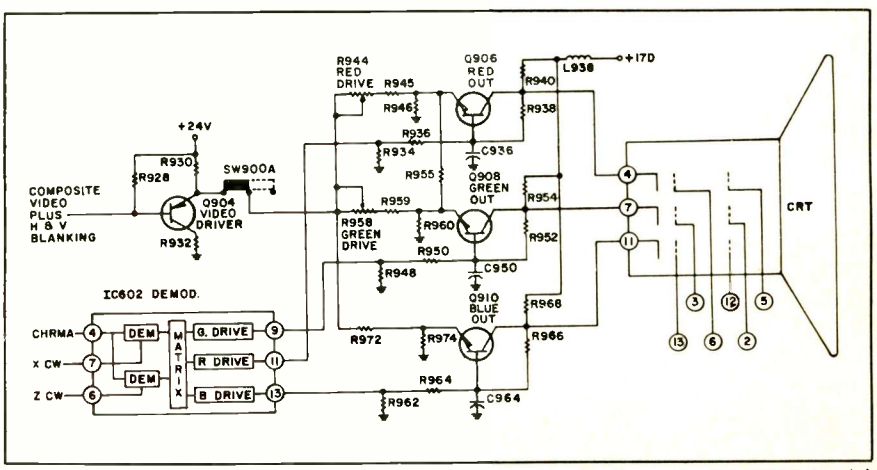

Fig. 2—The R, G and B amplifier, demodulator and video output circuits employed in GTE Sylvania's color TV chassis E20/21.

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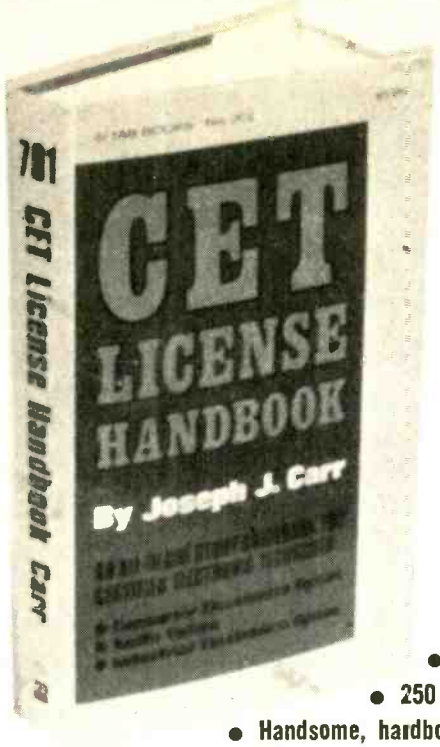

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This brand-new volume is intended as a review for anyone preparing for a CET (Certified Electronic Technician) exam (television, audio, or industrial), a state or local license exam, or a job-entry exam. The material is arranged logically for minimum study time and maximum retention, and each Chapter contains questions (with answers) at the end typical of those appearing in the real exams. In all, there are 538 questions and answers in this unique new volume.

The first few Chapters explain the administration and scope of the CET exams, which are given by the National Electronics Association (NEA). They offer a review of simple AC and DC circuits, and include a painless "minicourse" in simple circuit math—no difficult math is required.

To prepare you for specific test questions, various common circuits are clearly explained: filters, resonant circuits, differentiators, etc. One Chapter is devoted to universal circuits using tubes and transistors. Then, anticipating the CET exam's RF questions, a meaty Chapter tells how AM, FM, and TV signals are shaped up and shipped out by modulators and transmitters. This makes the book extremely practical as a reference volume as well as a study guide.

Systematically, the text takes the reader through antennas and transmission lines, electronic servicing equipment, the use and application of common circuit components, basic TV theory, and troubleshooting. Then there is a complete guide to waveform analysis and its use in TV troubleshooting. You'll find this information priceless for day-to-day servicing—you'll refer to it again and again.

In brief, here is all the dope you need to pass the two brand-new CET exams and qualify as an industrial and audio electronics expert—THIS IS THE FIRST CET GUIDE WITH SUCH COVERAGE! A replica test, which will serve as a dry run for the CET exam, is included to help you know you're ready for the real thing! 276 pages, 289 illustrations. Hardbound. Publisher's List Price $8.95.

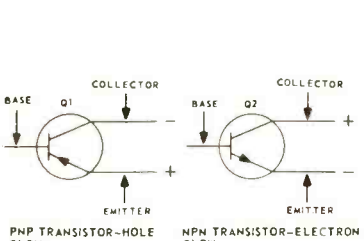

Fig. 9-7. Symbols for bipolar transistors.

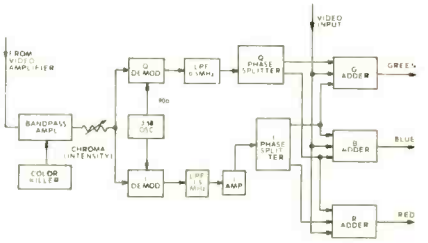

Fig. 12-7. An example of IQ demodulation.

Over 250 clearly drawn illustrations and schematics—plus easy-to-understand text—cover scores of topics like test equipment, color TV, solid-state devices, etc.

AN EXTRAORDINARY OFFER...

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conduction, and its collector voltage rises, charging capacitor C918 through SC916 to a higher DC level. This voltage is connected to test point TPA through R916 and prevents the DC level change related to the black video level increase.

Improved Color Fidelity

FCC regulations state that, for the color TV system approved for broadcasting in the U.S., the R, G, B, voltages used to form the composite color signal are to be suitable for a color picture tube having primary colors with NTSC chromaticity coordinates. Some picture tubes may have phosphors whose chromaticity differ substantially from these primaries. If the signals applied to these tubes are formed by color decoding which is the inverse of the NTSC encoding, color errors will result.

In the E20 and E21 chassis the color decoding has been modified to minimize these errors. As a result better greens and reds should be obtained with some improvements also noticeable in the flesh tone and magenta colors.

The circuit supplying the correction signal to the chromaticity is found in the R and G amplifier, (Fig. 2) and it functions by increasing the emitter voltage of the amplifier not being driven through R985 a 1.8 K resistor, which is connected to the emitters of Q906 and Q908. This circuit functions to turn down the color driver, reducing the beam current for that color.

Color TV Chassis E40

The E40 color TV Chassis which is employed in both the 21- and 25-inch (measured diagonally) color TV receivers is an all solid-state modular chassis.

If the chassis is used in either screen size TV receivers they will be electrically identical and use the same set of circuit modules and deliver 26.5 kv of picture tube second anode voltage.

The full power transformer chassis has clean, uncluttered, layout design which permits free access from both sides of the chassis and the circuit panels are roadmapped from the top and bottom sides. The major components and sub-assemblies plug into the main frame of the chassis. All seven IC's and approximately 36 transistors plug-in to make servicing of the chassis easier.

In the E40 color TV chassis the Deflection and Video/Chroma panels are identical to and interchangeable with those employed on the E09 and E10 chassis. The new IF/Sound panel is not interchangeable with the previous models.

The automatic control system used in the E40 chassis consists of the following ten elements:

Sample and Hold Automatic Color Level Circuit. Automatic Black-Level Circuit. Automatic White Level/Contrast Circuit. Selective Automatic Tint Circuit. Vertical Countdown IC. Horizontal/Sync IC. Automatic Fine Tuning (AFC). Keyed Automatic Gain Control. Automatic (Color) Phase Control and Automatic Voltage Regulator.

Some of the customer controls have been eliminated and the remaining controls employ integrated circuits which act to maintain their picture settings even with some wide variations of station transmissions or adverse reception conditions for better picture performance.

The Sylvania developed IC with sync separation, automatic noise gate and double balanced horizontal frequency control, plus the Vertical Countdown IC provide good picture stability in the presence of electrical noise and other types of interference.

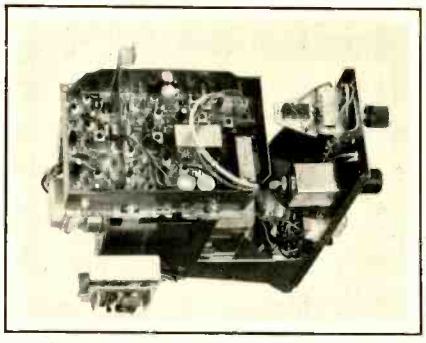


Fig. 3—The Remote Control Cluster has the remote receiver chassis mounted above the 21-position UHF/VHF strip tuner.

Fig. 4—Remote Control, Five-Button, Transmitter Model 17 replaces the older bulky case and rocker arms.

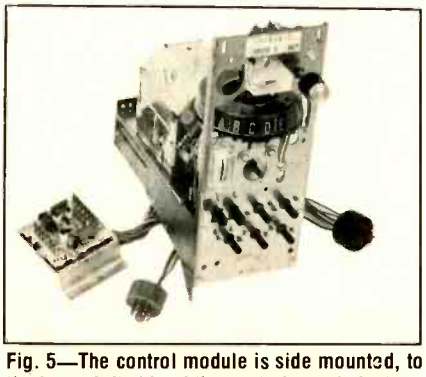


Fig. 5—The control module is side mounted, to the lower left side of the control panel cluster.

Five Function Remote Control System

Color TV receivers with the One-Knob Rotary Tuning System are now available with a new five-function remote control system.

The new remote control system employs the following features:

- Two-Way Channel Selection—enables tuning to a higher or lower channel with equal ease.
- Two-Way Preset Volume—Separate volume up and volume down functions. The volume control employs an electronic memory.
- On/Off—Depressing a button will turn the TV receiver on and off alternately without changing the volume or channel selections.
- Full manual control of all functions on the color TV receiver.
- The low three-watt standby power can be switched off for energy conservation or vacations.
- The new transmitter is designed for better reliability, greater ease of alignment and is powered by a nine-volt battery.

Remote Control Tuner Cluster

The tuning cluster assembly (Fig. 3) has the remote receiver chassis mounted above the 21-position UHF/VHF strip tuner.

Removing the receiver from the tuner cluster is simplified, and requires loosening of three screws and sliding the remote chassis

from the slots in the side brackets.

Remote Control Transmitter

The remote control transmitter Model R17, Fig. 4, has a new appearance, with a new thin case and square buttons.

The transmitter's circuitry employs two transistors which are powered by a 9-volt battery.

Control Panel

The control panel (Fig. 5) on the front of the TV set features the channel window with insertable UHF channel numbers.

All picture controls are front mounted in addition to the UHF meter, AFC and Perma Tint switches.

The control module providing AGC, AFC and tuning voltages to the tuners, is side mounted to the lower left of the cluster and is anchored by one screw.

Philco Color TV 1976

The Philco Consumer Electronic Division of GTE Sylvania Incroporated introduced its line of 1976 color TV.

The Philco color TV line features four color portables, one 19-inch, two 17-inch and one 15-inch set.

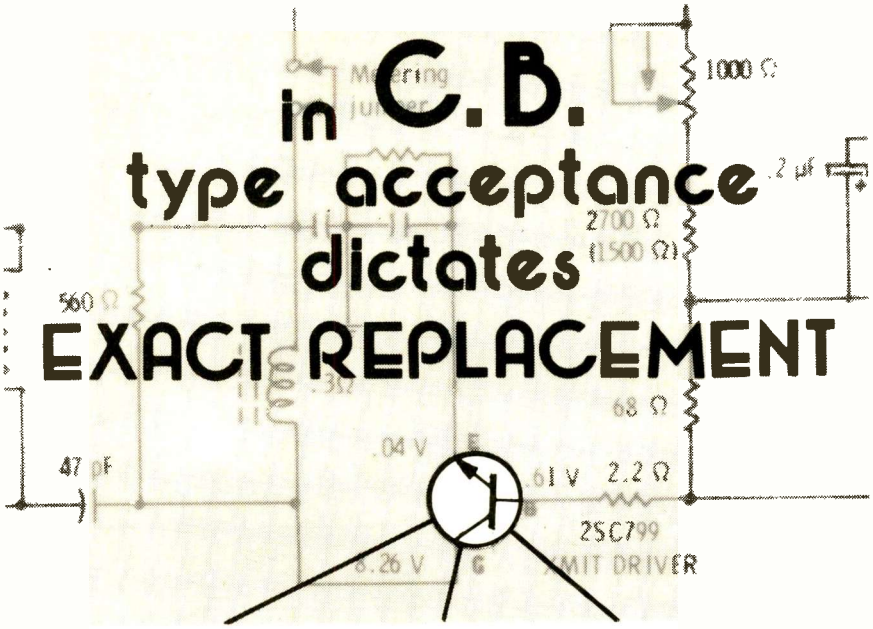
The 19-inch (diagonal) Model C2095GWA features a BOSS 200 chassis (equivalent to GTE Sylvania E21 chassis); Philcomatic automatic tuning; black matrix picture tube; lighted channel indicators, and a 5-inch oval speaker.

The 17-inch (diagonal) Model C2705GWA includes the same features as the C2905GWA, but employs the BOSS 101 chassis (equivalent to GTE Sylvania E20 chassis).

A 15-inch (diagonal) model has the BOSS 100 chassis (equivalent to GTE Sylvania E20).

Two other 19-inch portables in the 1976 line were introduced earlier.

Ten 25-inch (diagonal) color receivers are included in the 1976 Philco line. Seven are consoles, one is a table model, and two are home entertainment centers—color TV and stereo combinations. Each features the BOSS solid-state modular chassis; Philco ATC; black matrix picture tube; 70-position click-stop UHF tuning; lighted channel indicator and the Philco-Guard System.■



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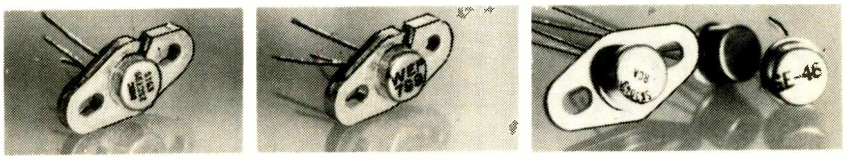
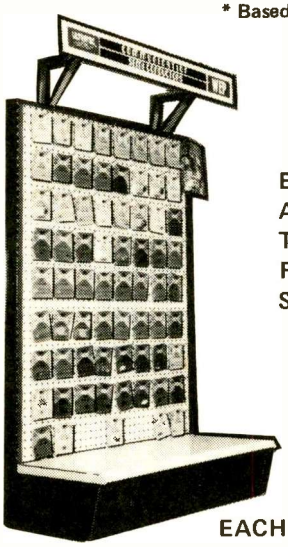


* Based on latest available published cross reference data.



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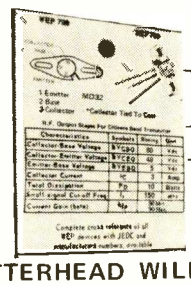

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COLOR TV MODULE GUIDE

General Electric Color TV Modules

Ten modules are available for General Electric's present modular 25-inch console TV receivers. These same modules can be used to repair all of the earlier modular 25-inch receivers, the earliest of which began production in 1972. The chassis covered by these modules are the MA, MB, MB-75, MB-2, MC, MC-2, and MH chassis. Seven modules are available for all of General Electric's modular portable receivers. This includes the 13-inch, 17-inch, and 19-inch YA and 19-inch YC chassis.

MODULE DESCRIPTION CATALOG NUMBER	CHASSIS NUMBER										
	MA	MB	MB-75	MB-2	MC	MC-2	MH	13YA	17YA	19YA	19YC
IF EP93X37	X	X	X	X	X	X	X				
AUDIO EP93X40	X	X	X	X	X	X	X				
SIGNAL CONDITIONER EP93X44	X	X	X	X	X	X	X				
HORIZONTAL BUFFER EP93X45	X	X	X	X	X	X	X				
HV REGULATOR EP93X46	X	X	X	X	X	X	X				
LOW LEVEL VIDEO EP93X74	X	X	X	X	X	X	X				
RGB EP93X79	X	X	X	X	X	X	X				
POWER SUPPLY EP93X80	X	X	X	X	X	X	X				
VERTICAL EP93X88	X	X	X	X	X	X	X				
CHROMA EP93X89	X	X	X	X	X	X	X				
CONVERGENCE EP93X64								X	X	X	X
CRT SOCKET EP93X66								X	X	X	X
VERTICAL EP93X67								X	X	X	X
POWER SUPPLY HORIZ BUFFER EP93X68								X	X	X	X
HORIZ OSCILLATOR EP93X69								X	X	X	X
CHROMA/VIDEO EP93X70								X	X	X	X
IF/AUDIO EP93X72								X	X	X	X

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8. **RANGES**
   - DC and AC volts, 0-1, 10, 100, 1000V;
   - DC and AC current, 0-1, 10, 100, 1000mA;
   - Ohms, 0-100, 1K, 10K, 1 meg, 10 megs.
   - 10 meg industry standard input impedance
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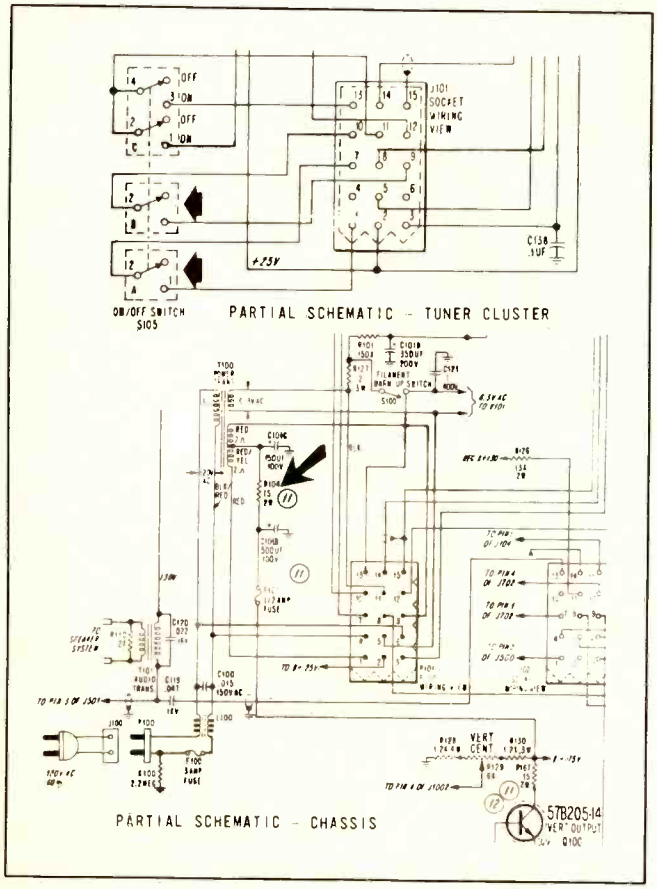
Color TV Chassis M25-Service Hint

A problem causing R104 (15 ohm, 2 watt) resistor to overheat, and found in the 75 volt power supply can be caused by an open contact in the on/off switch, S105. With the Instant Play feature found in the M25 chassis, the B+ circuit is opened when the on/off switch is in the off position. Both the start and finish of the secondary winding of T100



are opened by sections A and B of S105. With one switch section open, the AC circuit is incomplete, resulting in excessive current in R104.

Connect a jumper across the S105 A contacts, then across the B contacts, to determine which section is open.

Color TV Chassis M10—Service Hint

Loss of color sync, snowy picture, hum in sound and dark band across the picture, can be caused by a defect on the M1000 Pincushion module.

The defective component would be associated with the 24 volt scan-derived B plus supply. The symptoms may be intermittent and/or appear only after the set warms up.

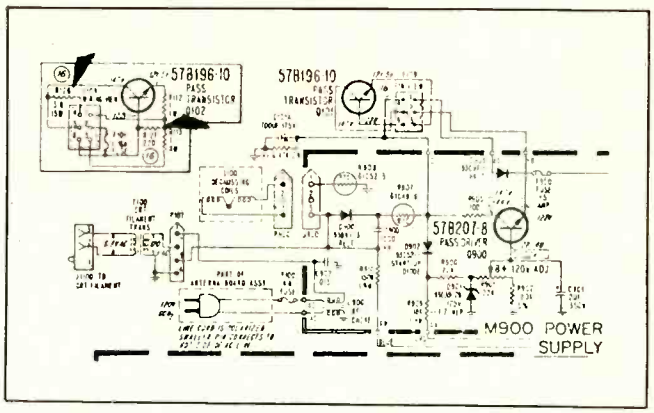
Color TV Chassis M10—Service Hint

A symptom of high voltage shutdown circuit triggering, which causes pulsating audio and flashing (on-off) of the raster at a once per second rate, can possibly be caused by increased 120 volt B+ line voltage. The increase can be possibly caused by a defective pass transistor Q101 and/or Q102. The above problem can be comfirmed by measuring the regulated 120 volt B+ supply line at fuse F900. This voltage is adjustable by the B+ 120 volt *Adjust* control, R901, on the power supply board. You should be able to vary it slightly above and below 120 volts. Leaky or shorted pass transistors can cause this voltage to increase to 140 or 150 volts. If you have too much voltage on the 120 volt line, the problem is in the power supply. Increased B+ will result in the horizontal system trying to produce excessive high voltage and the high voltage shutdown circuit will activate.

If the set continues to operate with high B+ voltage, F900 (120 volt B+ fuse) and F101 (1/16 amp fuse) in the pass transistor circuit may open. This may be the result of the horizontal output transistor Q103 failing. If transistor Q103 shorts, it will cause F900 to open immediately when the TV set turned on. This transistor can be temporarily removed if suspected of being defective.

The 120 volt B+ supply can be operated with F900 removed for checking or repairing that supply (with no load, the voltage will increase by 2 to 3 volts.)

Be sure to discharge the power supply through a resistor to ground before installing the fuse (use a 10 K, 1 watt



resistor). Grounding direct to the chassis will blow the 1/16 amp fuse, F101. Discharge both sides of the fuse holder because the capacitors in circuits beyond the fuse may be charged.

Be sure to adjust the B+ 120 volt supply adjustment to exactly 120 volts when the repairs have been completed.

Note: Resistors R126 (5.6 ohm, 15 watt) and R127 (220 ohm, ½ watt) added in RUN 16.

GENERAL ELECTRIC

Color TV "M" Series Chassis—Power Supply Transformers

Power supply transformers are now in stock for all "M" series chassis (MA, MB, MC, MB-75, MC-2, MB-2, MH). Complete power supply assemblies are not available for any of these chassis.

To determine which transformer to use for a specific chassis, consult the matrix shown:

Replacement transformers have crimped-on terminals

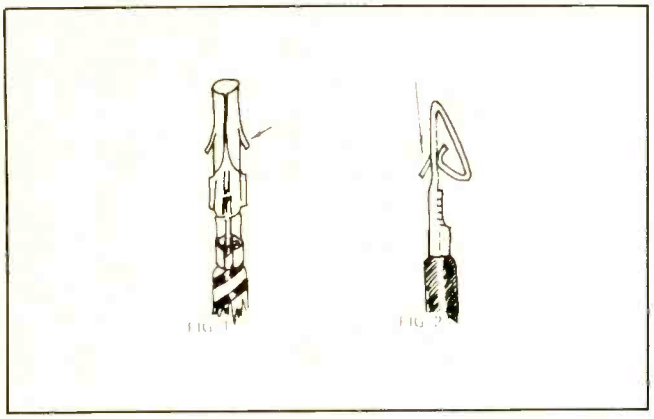
Chassis	Power Transformer	Notes
MA	EP88X6	
MB (early)	EP88X6	Original Transformer stamped EP62X34 or EP62X43
MB (late)	EP88X4	Original Transformer stamped EP62X45
MB-75, MH, MB9200	EP88X4	
MB-2	EP88X4	Use with sets having separate filament transformer
MB-2	EP88X6	Use with sets having no filament transformer
MC	EP62X54	Use with sets having a separate filament transformer
MC	EP88X7	Use with sets having no filament transformer
MC-2	EP88X7	

on all leads which go to sockets or connectors. There are two types of terminals: round and flat. They are shown in Figures 1 and 2. With the illustrations, are instructions for removing and installing the terminals.

The other leads must be cut to proper length and soldered directly to their terminals. Do not splice any leads.

Removal And Installation

1) Cut the wire from the old transformer as close to terminal as possible. 2) With a small screwdriver, push the terminal (from the wire side) out of the front of the receptacle. 3) Push the new terminal in from the wire side until it snaps into place. Shown in Fig. 1 is the round type terminal.



Removal And Installation

1) With a pair of pliers, grasp the wire from the old transformer close to the terminal and pull it out of the receptacle. 2) Push the new terminal into the receptacle until it snaps into place. Shown in Fig. 2 is the flat type terminal.

MAGNAVOX

Eight-Track Tape Player MODEL VE16—Mechanical Noise And/Or Slow Speed

The 171396-1 kit for minimizing symptoms of mechanical vibration was announced in the May, 1975 Service Tips. The plastic thrust cap which is held against the motor pulley is available under Part No. 143745-1, if the one supplied in the kit should ever require replacement. Mechanical noise or slow speed symptoms may result if the thrust cap wears out.

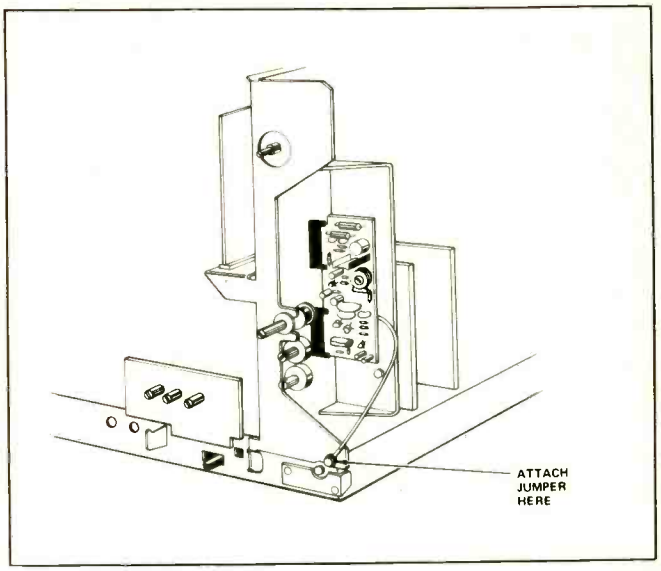
Star Remote Control—Use One Chip Sound Module Only

The STAR remote control system varies the volume level by applying a DC voltage to the 703639 Sound Module in the T995 color TV chassis. This Sound Module is the one which uses only one integrated circuit (one chip). Sound Module Part No. 703727-1, used in other T995 models, has two integrated circuits (two chip). The two chip and one chip Sound Modules are interchangeable in the T995 chassis, *except with STAR models*. STAR models must use the one chip Sound Module, Part No. 703639-1. When a two chip Sound Module is placed in a STAR set, the result is "no sound".

The Magnavox Parts Division stocks the 703639-1 as a universal replacement Sound Module for all T995 chassis.

Color TV Chassis T989—Black Shadow On Screen

A black shadow on the CRT, usually appearing in the upper right portion of the screen, can be eliminated with the addition of a jumper wire to the chassis from the Vertical Oscillator/Driver module on the "D" panel. The jumper is soldered to the ground land at the junction of R3 and C2 on the module. The other end of the jumper is attached to the chassis frame as shown in the illustration. The jumper plus instructions will accompany all replacement "D" panels and Vertical Oscillator/Driver modules.



Color TV Chassis T985/986—Poor Reception On Low VHF Channels With Built-In Antenna

This symtom may be due to the built-in rabbit ear antenna. The solution is to replace the antenna with a Part No. 701315-19. The two elements of the replacement antenna each have eight sections and extend to 48 inches. In addition, the two elements can be separated 180 degrees apart. The full 180 degrees separation is desired for best reception on low VHF channels.

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By David Norman, ET/D Communications Editor

COMMUNICATIONS ELECTRONICS

■ This is the first of a series aimed at helping technicians understand typical circuits used in modern CB transceivers and thus enable him to quickly locate and repair problems in less time than it has been taking.

It is our premise that most circuit problems are basically simple to solve if you know how the circuit works. Actual theory is not nearly as important to the "working" technician as is his ability to keep all repairs "on the clock." Of course, it would be all but impossible to make a living in two-way communications if you knew *no* theory, but we feel that one of the best ways to learn is to *do*.

The circuits used in this series are not intended to represent actual circuits used in any unit currently being manufactured. In fact, many of them would not even work as depicted. In some cases, they are made more complicated than necessary in order to relate as much information as possible in the available space. In other cases, the circuits have been greatly simplified to teach as much as possible with the least amount of verbage. Hopefully, the conflict between actual and illustrated circuits will neither confuse you nor elicit too many letters explaining why a circuit can't possibly work.

DC-INPUT SUPPLIES

By far the best seller nationwide, the 12 VDC mobile unit, is also the one that you will see most often on the bench. Besides the obvious fact that there are more of them than anything else, mobile units are subjected to more abuse than would be a base station in the same system.

Probably the most common CB complaint is "the unit blows fuses." An analysis of the circuit in Fig. 1 will reveal several reasons why.

When switch SW1 is closed, the battery voltage instantly appears across protection diode D1. If the polarity of the power leads is correct, all is well. However, all too often, someone has goofed (hopefully not the technician) and reversed the polarity. In this case, diode D1 performs its design function and presents a short circuit to fuse F1. The idea, of course, is for fuse F1 to blow before anything is damaged. Usually it works.

The problem is that people who are prone to reverse power leads are also prone to over-fuse or even "straight wire" a unit. In either case, diode D1 is usually damaged (normally shorted) and must be replaced if protection is to be restored. In extreme cases, diode D1 will burn and open. When that happens, repair bills go up.

Choke L1 and bypass capacitor C1 form a low-pass filter; their valves are selected so that they keep RF noise out of the B+ bus.

Choke L2 and electrolytic capacitor C2 are designed to remove audio frequency "hum" or alternator "whine" from the B+ line.

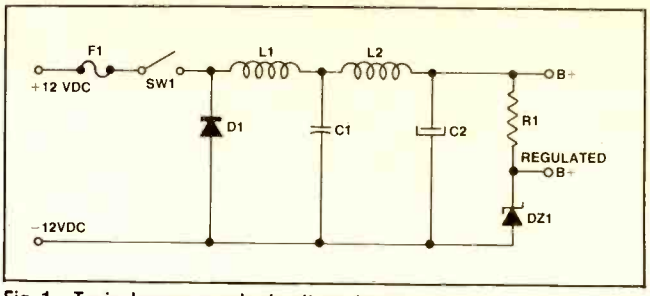

Fig. 1—Typical power supply circuit employed in CB units powered directly from storage batteries or other DC source.

Resistor R1 drops the voltage appearing across Zener DZ1 by acting as a voltage divider with the circuitry on the regulated B+ line.

If polarity protection diode D1 is burned open, immediate failure of choke L1, electrolytic C2, resistor R1, and Zener DZ1 is possible and even likely. Choke L2 is usually pretty heavy and C2 is usually rated at a high voltage.

After cleaning up the mess in the power supply section, you may still have considerable damage in the rest of the unit. Fortunately, diode D1 does its job unless the fuse is super high in rating or non-existant. Electrolytics can blow (literally) if subjected to reverse or overvoltage, and such damage is usually quite obvious.

Lightning can destroy Zener DZ1, even if there was not a direct hit.

As a general rule, failure of DZ1 doesn't do any other damage. Such failure might cause IF instability or oscillation or improper squelch operation. Of course, if the Zener shorts out, the overall gain of the receiver might be significantly reduced.

A power supply similar to Fig. 1 is usually easy to troubleshoot. Continuity checks with a VOM are about all that is required. Because failure in this type of circuit is almost always caused by abuse or carelessness, diplomatic instructions to the customer might prevent a recurrence.

DC/AC-INPUT SUPPLIES

Fig. 2 is an example of a "budget" AC-to-DC power supply. A CB unit designed for operation from either a 117 VAC or 12 VDC might contain a combination of Figs. 1 and 2, or something similar. In an actual CB set, more than one transistor would probably be used in the regulator circuit.

You will note that Fig. 2 shows the fuse in the primary circuit of the transformer. This is a typical practice. A dead short in the secondary circuit will blow a properly rated fuse, but sometimes the delay is too long. Without data to the contrary, it is reasonable to assume that the "hot" primary design affords some spike protection to the filter circuit.

In the example in Fig. 2, a diode bridge is used. A center-tapped transformer using two diode in full-wave configuration is also quite common.

Capacitor C1 is an electrolytic, as are capacitors C2 and C3. Resistor R1 limits current through Zener DZ1, which provides a more or less constant reference for transistor Q1. Resistor R2 is merely a load for Q1, and in many cases will not even be in the circuit.

The circuit in Fig. 2 provides good regulation

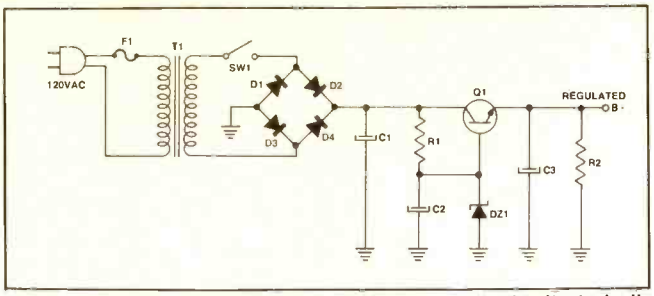

Fig. 2—Simplified version of the regulated power supply circuitry typically employed in CB units designed for operation with either AC or DC input.

of the output voltage, assuming that the change which requires regulation originate in the load. This supply regulator will not compensate for excessive swing of the primary voltage.

This example shows an NPN as Q1; you are just as likely to find a PNP being used in the negative side of the B+ supply.

Most failures in this type of circuit are caused by a short or "near short" across R2 (output), or by failure of one or more diodes in the bridge, which, in turn, is usually caused by one of the filter caps becoming "leaky."

If lightning or any other type of power surge in the primary causes DZ1 to open up, failure of Q1 is apt to follow. If no data is available regarding the exact value of DZ1, replace it with a 1-watt or higher unit with the same breakover voltage as the nominal output of the supply (probably 12 to 14 VDC). The regulator transistor is usually mounted on an insulated heatsink and care should be taken to see that any replacement is carefully mounted.

If DZ1 should be found defective, check R1 to be certain that it is still in the ballpark—probably 500 to 1000 ohms.

When several transistors are used in a regulating circuit and one is bad, check all of them before restoring power.

If the unit contains an adjustment for setting the output voltage, don't succumb to the temptation to crank up the RF output by increasing the output voltage of the power supply. You might get your customer a citation and you very likely will have to go back and repair the unit, perhaps at your own expense. Many of the CB SSB base stations are capable of withstanding the higher voltage stresses caused by such adjustment—but only for a while.

Anytime that you require a replacement for a filter capacitor, be certain that the *actual* voltage present in the supply does not exceed the working volt (WVDC) rating of the replacement. You can get by with selecting higher WVDC, but never select a lower one.

When failure of a power supply component leads you to believe that excessive current is being drawn by the unit, look closely at the audio output/modulator section. Most audio output components are constructed with heavy leads and can carry the excessive current caused by a short for several seconds or longer without visible damage. Wax under the audio output transformer is one of the telltale signs of excessive current for which you should look.

Next month: CB audio circuits. ■

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COMM CHAT

With David Norman, ET/D Communications Editor

■ Those of us involved with two-way communications equipment often forget that only a relatively small part of the radio spectrum is used for such purposes. Sometimes, we even consider our particular "turf" or specialty the only one that counts and the other uses merely infringement. Well, there's a whole 'nother world out there.

Analysis of the entire spectrum (known spectrum, that is) would (and has been known to) fill several volumes. About the best that we can do here is to briefly review in a broad, general manner some of the characteristics and uses of the most common segments of the spectrum.

The various parts of the radio spectrum are designated broadly by frequency range (Fig. 1). Remembering that not all frequencies in any given category (band) have exactly the same propagation characteristic, (for example, 30 MHz is quite different from 300 MHz), let's take a look at each of these bands from the standpoint of propagation expectations.

The *LF* band (30 KHz to 300 KHz) is useful for extremely reliable communications over great distances. The only real limitation on range in this band is available transmitter power; to achieve long range communication in the *LF* band requires lots of power. Many of these transmitters are in the Megawatt class. The other prerequisite is a monstrous antenna system, mostly buried underground.

As we move up in frequency to the *MF band*, (300 KHz to 3000 KHz) communications over hundreds and even thousands of miles are possible with moderate power. (AM broadcast stations are in this band.) Direct groundwave coverage is relatively short on a continuous basis and is subject to atmospheric electrical interference. At night, skywave coverage doubles or quadruples range, requiring either "clear channel" regulation or power reduction (or both).

Most long-range (over 100 miles) and some local two-way communications take place in the *HF band* (3 MHz to 30 MHz). As frequency is increased in this band, range for a given radiated power increases, up to 25 MHz or therabouts, but the usable time of each day for long-range communications decreases. As frequency increases, predictability of propagation also becomes less reliable.

The HF band is used heavily by international broadcasters, amateurs, military groups (foreign and domestic), private industry, and vessels of all types. Within the HF band is contained a large part of the world's most exciting communications, including the Class D portion of the Citizens Radio Service. In an effort to relieve overcrowding in this band, the trend internationally has been toward SSB, RTTY, and other modes which reduce the required bandwidth and allow more channels in a given portion of the spectrum.

Everyone wants a piece of the HF band because of its unique quality—the ability to transmit information over thousands of miles with low-power stations (many under 1 kW) utilizing relatively unsophisticated equipment, yet with a good degree of reliability. None of the other "bands" can even come close.

Another band being used heavily, particularly in the U.S., is the *VHF band* (30 MHz to 300 MHz). The bottom part (30 to 50 MHz) exhibits some of the characteristics of the HF band (skywave propagation) in a somewhat unpredictable manner, but overall the VHF really "shines" in its ability to provide very reliable short-range communications with modest power requirements. Superefficient antennas require little space in the VHF band, particularly in the upper portions. With the advent of transistors capable of handling a hundred watts or so of RF power, small, highly efficient transceivers began finding their way into hundreds of different applications. This compactness is ideally suited for mobile-to-mobile and base-to-mobile two-way communications.

The VHF band is almost completely immune to atmospheric disturbance, and when FM is used as the transmission mode, it is almost completely immune to man-made electrical noise. Ranges of more than 100 miles are easily obtainable, depending more on antenna height, terrain, and antenna gain than actual transmitter power. The VHF band contains most of the Public Service channels, the VHF TV channels, FM broadcast, the Marine VHF band, Aviation Com-Nav channels, three amateur bands, and a host of other private and public applications. Even with a band that is 270 MHz wide, crowding is beginning to be a problem, mostly around the large metropolitan areas. Answers to this crowding are being provided by new technology in the form of high-speed bursts of information, which take up less time on a given channel for a given amount of data, and narrow-band modes of transmission, which permit more channels in a given portion of the spectrum. It is not unreasonable to assume that at some future date a 20-KHz portion of the band will carry a dozen voice channels rather than only one. Perhaps it won't sound as good as it does now, but it will still do the job.

The *UHF band* (300 MHz to 3000 MHz) is the highest and the last band we will examine. The lower portion of the UHF band is very similar both in propagation and uses to the upper portion of the VHF band. However, above about 500 MHz or so, things start getting exotic. A capacitor may be more of an inductor than anything else, and most tuned circuits are carefully machined boxes. Klystrons and magnetrons and

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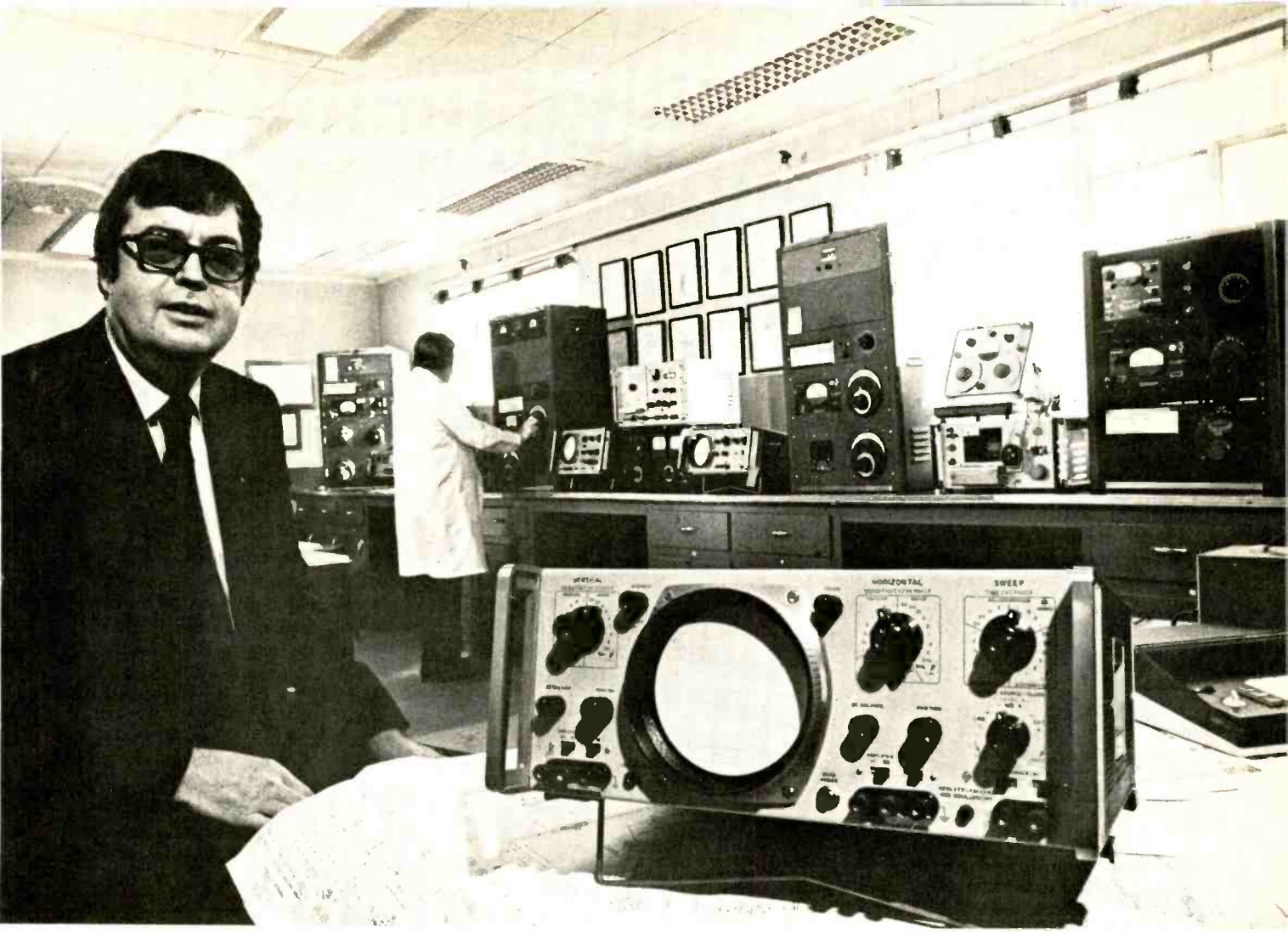

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TECHNICAL LITERATURE

POWER RECTIFIERS

A 4-page brochure explaining an innovative approach which permits industrial companies and distributors to eliminate power rectifier replacement delays and how to reduce inventory stock is now offered. Listed are 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 requirements. *International Rectifier*, 233 Kansas St., El Segundo, CA. 90245.

SPEAKER/MICROPHONE STAND

An 8-page loudspeaker catalog, Form 7602, provides complete specification data plus application recommendations for a product-line including the AP-series omni-purpose speakers, indoor/outdoor music units, decor speakers, professional sound system components, Columnair sound columns, heavy duty industrial speakers, life-safety system and mobile communications speakers. Detailed in a 4-page, Form 7601, microphone stand catalog, are a full range of stage, studio and general purpose stands, boom stands, loudspeaker and desk stands, plus the largest assortment of microphone stand accessories and adapters. *Atlas Sound*, Division of American Trading and Production Corp., 10 Pomeroy Road, Parsippany, NJ. 07054.

ULTRASONIC CLEANING

A 20-page booklet provides practical "how-to" information on the use of bench-top ultrasonic cleaning units in repair shops, laboratories and manufacturing plants. It tells how and why ultrasonic cleaning works and illustrates two basic cleaning methods and discusses selection of cleaning agents and use of accessories. Service Department, *American Electrical Heater Co.*, 6110 Cass Ave., Detroit, MI. 48202.

CLOSED-CIRCUIT VIDEO EQUIPMENT

A 8-page product guide covering a line of general purpose, high performance cameras and video products is now available. The general purpose, low cost cameras include the TC1000 family used widely for surveillance systems. The high performance cameras cover the TC1005 family for CCTV, CATV, MATV, braodcast and demanding industrial use. In addition, the booklet lists VTR cameras and CCD cameras. Other video products include monitors, accessories, a sequential switcher, a date and time generator, and VidAlert motion detectors. The publication "General Purpose, High Performance Cameras and Video Products", CCV-118, provides a quick overview of your CCTV system product needs. *RCA Closed Circuit Video Equipment*, Lancaster, PA. 17604.

RECEIVING TUBE MANUAL

A new 754-page RCA Receiving Tube Manual No. RC-30 is now available. Like its predecessors, it has been written for engineers, service technicians, educators, experimenters, and others interested in electron tubes and their applications. It includes chapters on the basic principles of operations of electron tubes as well as their significant electrical characteristics and circuit applications. Technical data are included on active as well as discontinued tube types. Among the many other valuable features of the book are tube terminal diagrams, a picture tube characteristics chart and an expanded updated replacement guide for entertainment and industrial receiving tubes. The manual has a suggested list price of $2.95, plus 50¢ postage and handling charge. *RCA Distributor and Special Products Division*, P.O. Box 85, Runnemede, NJ. 08078.

THYRISTORS AND RECTIFIERS

A 376-page technical manual that describes basic theory, performance capabilities, and circuit applications of thyristors and silicon rectifiers is now available. The RCA Thyristor and Rectifier Manual, TRM-445, is intended as a guide to the selection and use of silicon rectifiers and thyristors (silicon controlled rectifiers and triacs) for a variety of power control and switching functions. The manual covers general physical theory, thermal considerations, packages, handling and mounting, maximum ratings, electrical characteristics, and circuit applications of thyristors and rectifiers. It also provides an up-to-date listing, together with brief descriptive data, of thyristors and rectifiers currently available from RCA. Device selection criteria are explained, design examples are shown and described, and performance data are given for a broad range of circuits, including DC power supplies, voltage regulators, converters and inverters, AC power controls, TV horizontal deflection circuits, and electronic ignition systems. Copies of the manual are available at $5.00 each (optional distributor price). *RCA Solid State Division*, Box 3200, Somerville, NJ. 08876.

MEASURING PARAMETERS OF AUDIO PRODUCTS

A 16-page brochure discusses the various types of distortion that occur in audio amplifiers, tape recorders, equalizers and loudspeakers. Methods of measurement are shown. Frequency response measurements of these products are explained in detail. How to use low-frequency wave and spectrum analyzers to measure distortion, frequency response, wow and flutter, signal-to-noise ratio and cross talk of high-quality products is detailed in a new application note. An analyist of harmonics in musical instruments illustrates the use of the spectrum analyzer in synthesizing voices of various instruments. Sections are devoted to acoustic response of rooms, signal-to-noise ration and cross talk. Application Note 192, Using a Narrow Band Analyzer for Characterizing Audio Products' is available free of charge. *Hewlett-Packard Co.*, 1501 Page Mill Road, Palo Alto, CA. 94304.

SPEAKERS

A 12-page catalog listing 127 different speakers is published. The catalog, "Quam76, The Sounds of America," lists general purpose, automotive, high fidelity, music instrument, and sound system speakers, as well as matching transformers. All the speakers listed in the catalog are stocked by Quam's distributor network. In addition to the standard units listed, the catalog describes special modification services available. Complete price and ordering information is included in a simple, easy-to-read format. *Quam-Nichols Co.*, 234 East Marquette Road, Chicago, IL. 60637.

POWER TRANSISTORS

An updated and expanded 44-page edition of the RCA Power Transistor Directory, PTD-187E, is now available. The catalog lists the power transistors and power hybrid circuits currently available, and provides selection charts and significant data on the devices. Applications information, a list of transistors which may be used as complementary pairs, and charts showing high-reliability and military-specification types of power transistors are also listed. *RCA Solid State Division*, Box 3200, Somerville, NJ. 08876■

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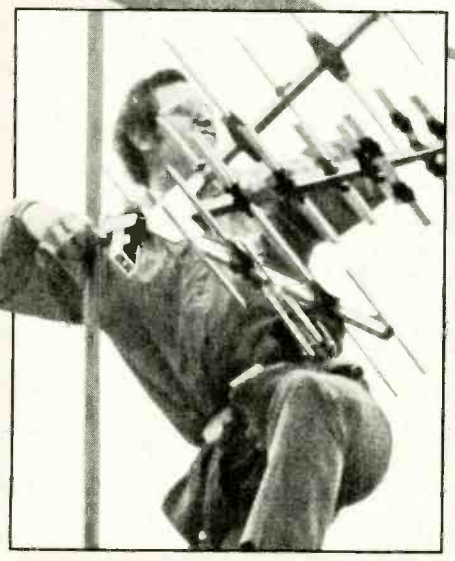

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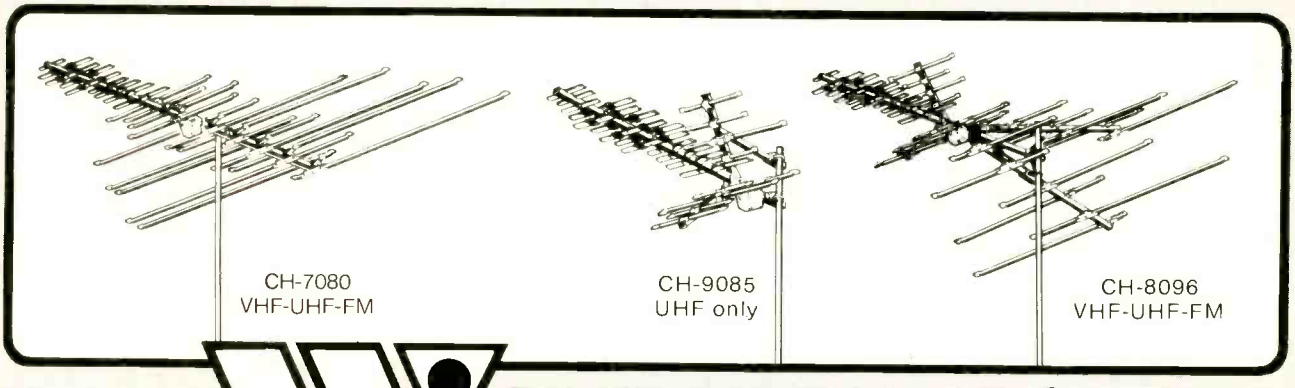

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TEST INSTRUMENT REPORT

B & K Transistor Tester Model 520. For more information about this instrument circle 105 on the Reader Service Card.

B & K TRANSISTOR TESTER MODEL 520

■ Practically all electronic products now employ complex solid state circuitry. Many of us are not experts in transistor theory, transistor basing or understand some of the circuit in which the transistor is used.

If you now employ the old method of removing the solid state device for testing, you are not only spending valuable servicing time, but are taking the risk of damaging the component or circuit board itself.

The B & K Transistor Tester Model 520 is designed for in-circuit transistor testing, with special features for making additional tests for devices out-of-circuit.

This instrument employs the manufacturer's Dynapeak system which allows accurate testing of transistors in low impedance circuits. Reliable testing of a transistor in-circuit depends upon application of a base test signal at a level of least equal to the threshold of forward conductance of the device, or the transistor must be turned on. This voltage is approximately 300 millivolts for Germanium and 700 millivolts for Silicon devices. To develop this much voltage across the device while it is shunted by low resistance or high capacitance, the generator must have several volts output and its internal series impedance must not be too large. It must be able to supply high current for a short period of time.

The testing system applies enough peak test voltage in the common low resistance shunt circuit to "turn-on" a silicon device with ample margin, while the voltage available from the base to emitter from a continuous square wave type transistor tester is less than one-tenth that required.

The system applies power with only a five percent duty cycle, the maximum energy applied to a junction is less than one-tenth of the maximum safe level.

A short test pulse is applied only ten times per second and the detector in the tester processes the digital information and converts it to the continuous tone and LED display. You can perform a series of tests almost as fast as you can attach the leads.

Other Tests Performed

1) Determines good or bad diodes in or out of circuit. 2) Base, collector and emitter identification. The base (or gate) lead is automatically identified by the color in the window on the instrument's front panel. Collector and emitter (source and drain) leads are also color identifiable. 3) Indicates the polarity of good devices (NPN or PNP). If a good device is PNP, the PNP LED on the front panel of the instrument will illuminate; if NPN, the NPN LED will illuminate. 4) Automatic Silicon/Germanium identification. It is automatically displayed when you turn the identity switch and the proper Silicon or Germanium light on the front panel will illuminate. 5) Measure ICES or IBES of transistors. 6) Measures IDSS of FET's. 7) Measures gate leakage of FET's. 8) Measures reverse leakage current of diodes. 9) Determines whether the device is bipolar, FET, or SCR.

Testing Transistors/FET's (In-circuit)

The three locking, color coded test leads can be connected in any manner to the three leads of the device you wish to test. Also, the device can be plugged into the convenient test socket on the front panel of the instrument in any manner for out-of-circuit testing.

Then the *test* switch on the front panel is moved through its six positions until the tone is heard. With most transistors and FET's, the tone will be heard in two positions. Transistors have some gain when the collector and emitter are interchanged and most FET's are symmetrical. If the tone is heard, one of the two red indicators will light up indicating whether the device is NPN or PNP. If no tone is heard in any of the six switch positions, the device is probably defective.

If the device tests bad in-circuit, the test can be verified by removing the device from the circuit and tested out-of-circuit.

Testing Bipolar Transistors (Out-of-circuit)

To test Bipolar transistors, the instrument is set up in a similar manner as testing transistors/FET's in-circuit. Now leakage tests can be made without referring to charts. Turn the *function* switch to *leakage* position and note the meter indication. Hold the *function* switch in the *leakage* position and move the *test* switch to the other position (the position at which a tone was heard), which displays the same color in the *base* window. The leakage should be about equal in both *test* positions, and within the limits shown on the meter scale. In one of the positions, the meter indicates ICES, in the other IEBS. To determine which measurement is being made, the collector and emitter of the transistor must be identified.

The leakage indicated can be then compared on the logarithmic meter scale which reads in microamps and milliamps. Leakage limits are shown directly on the scale for each type of device; Germanium or Silicon and power or signal.

Specifications

Applied Test Currents: *Collector Current:* 250 ma at 5 percent duty cycle. *Base Current:* 125 ma at 5 percent duty cycle. *Test Repetition Rate:* 10 per second. *Reverse Voltage For Leakage Test:* 3.5 volts.

Limiting In-Circuit Shunt

Values For Good/Bad Test: Resistance: Greater than 10 ohms. Capacitance: Up to 5 mfd with low beta devices, up to 15 mfd with higher betas.

The instrument measures 8

inches by 7 inches by 3½ inches and weighs 5 lbs. Price is $150.

RCA DUAL-TRACER MODEL 541A

Many of us may own a good triggered or recurrent-sweep oscilloscope, but would like to adapt the instrument for dual-trace waveform observation at a minimal cost.

The new RCA Dual-Tracer Adapter can be quickly attached to any triggered or recurrent-sweep oscilloscope for dual-trace operation. If the unit is used with a dual-trace oscilloscope, you will be able to view three traces.

With the dual-trace capability provided by the instrument, you can now use your single trace oscilloscope for applications such as making comparison tests of gain, frequency response, distortion, phase shift, and time delay.

The wide frequency response of the instrument permits displays of high frequency patterns such as TV video waveforms. A frequency compensated six-step attenuator (1, 2, 5 ratio) is provided for each channel, along with the selection of AC or DC coupling. *Vertical position* controls for each channel are included on the front panel of the instrument.

Display modes of the instrument are Channel A only, Channel B only, or both A and B channels simultaneously ("chopped" or "alternate"). The alternate mode is used for most applications, with the chop mode used to display only low frequency waveforms. An important feature is the instrument's continuously variable switching frequency range to reduce flickering and beat interference. Another equally important feature is the Channel A sync output with variable level and choice of sync polarity.

The Dual-Tracer operates on a principle similar to that used in "built-in" dual-trace oscilloscopes.

RCA Dual-Tracer Model 541A. For more information about this instrument circle 106 on the Reader Service Card.

A square-wave switching signal is generated by the instrument. In the chopped mode, the signal is chopped into small segments, displaying every other segment for each channel. This circuit operation provides displays with signal frequencies that can be viewed with the scope sweep set to the lower frequencies below approximately 200 Hz. As the sweep speed becomes higher, the waveform will break into the chopped segments, making this mode unusable.

In the alternate mode, the pattern is alternately switched from one display to another after each entire sweep cycle. The alternate mode provides patterns when the oscilloscope sweep is set to display waveforms above approximately 200 Hz. The alternate mode is usually the most useful function because it can be used with all but very low signal frequencies. When swept at low frequencies in the alternate mode, the display will break up displaying the Dual-Tracer square wave switching signal.

There is sufficient range of frequency adjustment in both modes so that intermediate signals in the 100 to 300 Hz range can be viewed.

Set-Up

The unit only requires two connections to the oscilloscope, Fig. 1. The output cable from the back of the Dual-Tracer is terminated with a BNC connector and is connected to the *vertical input* of the oscilloscope. Its *sync output* jack on the front panel is connected to the *external sync* connector of the oscilloscope.

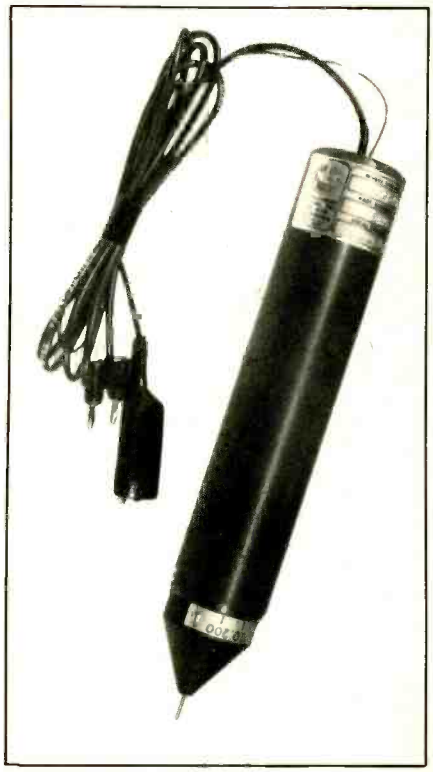
Calibration and Voltage Measurement

Peak-to-peak voltage measurements can be made by calibrating the Dual-Tracer and oscilloscope combination. This procedure involves applying a calibrating signal through one channel of the Dual-Tracer, then adjusting the Dual-Tracer attenuator and oscilloscope *vertical gain* controls to establish a given peak-to-peak voltage for each reference division (centimeter, inch, full-scale, etc.)

Electrical Specifications

Frequency Response: Usable DC to 10 MHz *Input Impedance:* 1 Megohm shunted by 55 pf *Maximum AC Signal Input:* 50 volts peak-to-peak (500 volt peak-to-peak with 10 X probe) *Maximum Signal Output:* 1 volt peak-to-peak *Noise Level:* Less than 10 millivolts.

The Dual-Tracer employs the latest COS/MOS integrated circuitry and zener-regulated power supply with LED power-on indicator. The price is $108.



NLS RMS Measurement Probe Model RMS-10. For more information about this instrument circle 108 on the Reader Service Card.

NLS RMS MEASUREMENT PROBE MODEL RMS-10

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Recurring Failures In Car Radios

Symptoms and causes of some of the most common defects By Joseph J. Carr, ET/D Vehicular Electronics Editor

■ As in most other types of electronic products, certain components and devices in car radios seem to fail more frequently than do others. Also, certain basic circuit designs, some of which are used in a number of different brands and/or models of car radios, seem more prone to certain types of failures than do others. In this and subsequent "reports" about recurring failures, I will inform you not only of the specific symptom(s) and cause(s), but also the basic circuit designs in which they seem to occur most often.

BENDIX AUDIO POWER AMP

The circuit in Fig. 1 is an audio power amplifier used in Bendix-designed Ford AM/FM Stereo receivers of the 1969-70 era. Similar circuitry is also used in Bendix radios of other years and in radios produced by other manufacturers. Actually, this circuit design can be traced back to the 1967 Volkswagen AM receivers, which were the first 12-VDC VW radios. The "common feature" in this series of radios is Q3, the NPN audio power transistor.

Audio Power Transistor

Transistor Q3 is usually a tab-mounted, plastic, P-66 type. In 1969-70, Ford Galaxy and LTD radios, this transistor is mounted to a ⅛ inch-aluminum plate which serves both as the heat sink for Q3 and as the rear cover for the radio. Although this same mounting arrangement for Q3 is used in many other models, in a few models, Q3 is mounted on the heavy cast-metal front escutcheon above the volume control.

The first indication of a defective power transistor comes when you first turn on the receiver. Normally, there should be a sharp "click" or "thump" and the receiver should begin to draw slightly more than 1 ampere of "A-line" current. However, if Q3 is defective, neither will occur and the audio, if present at all, will be weak and distorted.

In audio power amplifiers equipped with a PNP Germanium power transistor, collector-emitter leakage is the usual failure mode. However, with the P-66 class of NPN Silicon transistor, an open base-emitter junction is the most common cause of failure. Normally, the base-ground voltage of Q3 is between 2.5 and 3 volts. When the base-emitter junction opens, it causes the base voltage to increase to a level closer to that of the collector.

Transistor Q3 in Fig. 1 can be replaced with an OEM P-66 type from Bendix or, if necessary, you can replace it with a substitute plastic-case type from Motorola (HEP), General Electric (GE), Sylvania (EGG), RCA (SK), International Rectifier (IR) or any of the semiconductor replacement lines. When selecting a substitute, pay particular attention to the physical design; because some plastic-case substitute types have different mounting dimensions than the OEM version, they might not fit as conveniently as you desire.

Another alternative type which I have used in many instances in place of the P-66, is either a TO-3 or TO-66. The mounting plate of most radios which are factory equipped with the P-66, are already drilled to accept either the TO-3 or TO-66 types. (In most, the screw which holds the tab of the P-66 type uses one of the holes drilled for the TO-3 or TO-66.)

Another recurrent (although rarer) defect related to Q3 in Fig. 1 is a fault in the insulator which is supposed to prevent the collector tab from coming in contact with ground. The fault in the insulator grounds the +14-VDC source, thereby destroying the audio output transformer.

Audio Bypass Capacitor

When you encounter a Bendix radio with weak audio, normal

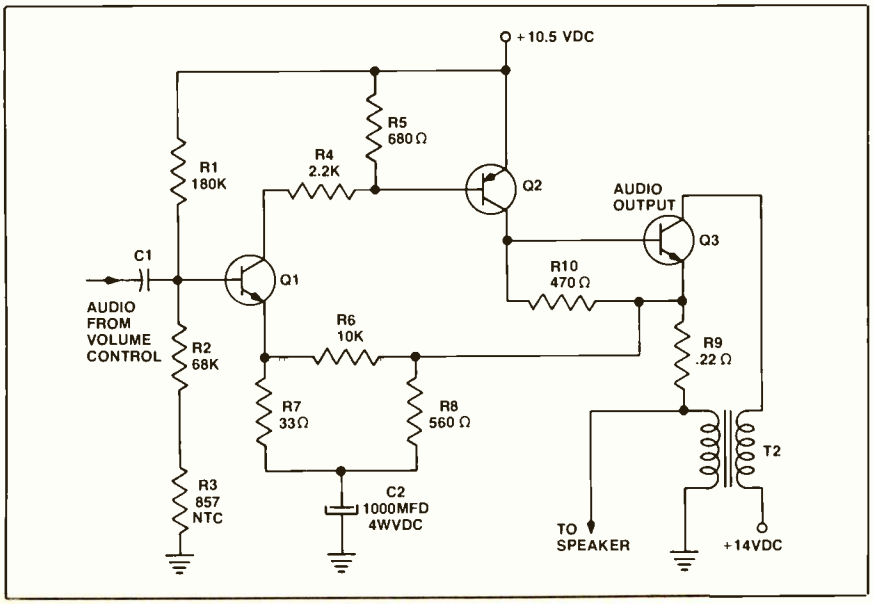

Fig. 1—Audio power amplifier circuit used in some Bendix-produced AM/FM stereo car radios of 1969-70 vintage.

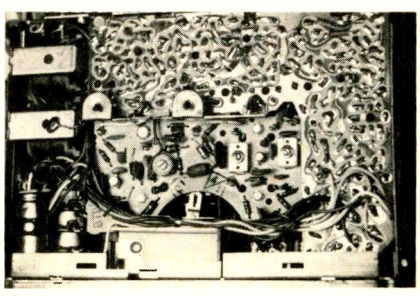

Fig. 2—Top view of the circuit board of Bendix-made Ford AM/FM stereo radio of late '60s/early '70s vintage.

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- External fuse replacement
- All controls flush with edge of case
- Single range switch
- Self-storing handle
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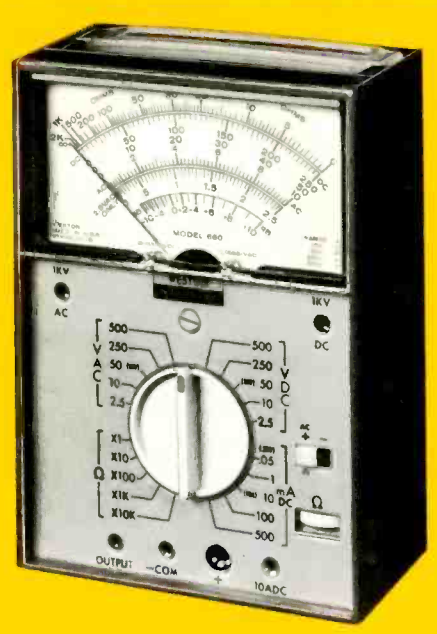

Specifications

	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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current drain and less distortion than is usually produced by a defective audio output transistor, check for an open audio bypass capacitor in the output stage (C2 in Fig. 1).

Bridge a known-good capacitor of identical or similar value across C2; if the audio level then returns to normal, C2 is open.

In most Bendix radios, C2 (or its equivalent) is a small, black plastic capacitor mounted on the printed-circuit board. In a few Bendix designs, the equivalent of C2 is one section of a two-section electrolytic. (The other section functions as the AGC bypass capacitor.)

FORD AM/FM RADIOS

Fig. 2 is a top view of the circuit board of a popular Bendix-made Ford AM/FM stereo car radio. This series of radios has been used by Ford for several years under a number of different model designations.

FM Local Oscillator

One frequently encountered trouble symptom in this series of Ford radios is intermittent FM reception. In a large percentage of such cases, the cause is a defect in the FM local oscillator, the circuit of which is shown in Fig. 3.

Substitution the FM local oscillator with a grid-dip oscillator is one quick method of verifying that the receiver's local oscillator is inoperative. Tune the radio to a section of the FM band in which there are two or more active stations, then loosely couple the external coil of the grid-dip oscillator to the FM RF amplifier input from the local oscillator. If the receiver's local oscillator is operating, you will hear the "beat squeals" produced by hetrodyning as you tune the grid-dip oscillator across the frequency spectrum of the receiver's local oscillator. If the receiver's local oscillator is inoperative, the output of the grid-dip oscillator will function as the local oscillator and FM reception will be heard as you effectively tune across the band with the tuning knob of the grid-dip oscillator.

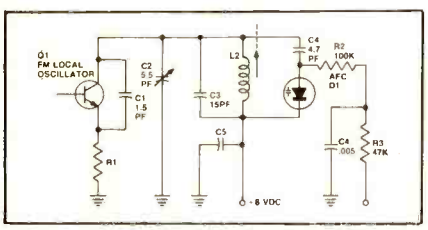

Fig. 3—FM local oscillator circuit employed in several Bendix-produced AM/FM stereo radio models.

If the FM local oscillator is completely inoperative or is so far off frequency that no output is produced, suspect the AFC diode, D1, in Fig. 3. Replace D1 with either an OEM version or, if the OEM type is not locally available, replace it with a Delco type DS-55. (Although some semiconductor cross-reference guides list 1N34, 1N60, etc., types as replacements for D1, I have tried several without success.)

C2, the ceramic trimmer capacitor in Fig. 3, is another frequent cause of missing or intermittent FM reception. To determine if it is the cause, gently touch it with an insulated, non-metallic tuning tool; if C2 is the cause, FM reception probably will cut in and out or return completely when it is gently probed.

Improperly soldered connections on the FM RF printed circuit board also is a frequent cause of intermittent FM reception or noise in this series of Ford AM/FM stereo radios. The improper solder connection(s) often can be isolated by gently tapping various components and areas of the board, although in some cases it seems that every area of the board is the cause. Because removal and reinstallation of the FM RF board is a time consuming procedure, before you begin it you should verify that the customer is willing to pay for the "extra" time, particularly if the radio is five or more years old.

The coils on the FM RF board are printed foil which come up through holes in the board. Before attempting to remove the board, it is necessary to first unsolder the coil ends. Once you have the board free, you can remove it and scrape off the varnish with a razor blade or sharp knife, and then retin all conductors on it. Reinstallation of the board requires a high degree of manual dexterity because you must carefully thread the coil ends back through the holes in the board and then lower the board back down into its mount. Be sure the mounting screws are snug because, if loose, they also can cause intermittent FM reception.

Limiter Section

The circuitry shown in Fig. 4 is another source of recurrent trouble in this series of Ford AM/FM stereo car radios.

Transistor Q3 is a trigger stage which turns off the stereo decoder when the received signal is too weak to produce acceptable stereo. If defective, this transistor eliminates stereo even when the received signal is strong.

Another common cause of "no stereo" is an open in the secondary winding of transformer T1 in Fig. 4. This defect does not eliminate all FM reception, but it does reduce the received signal so that no

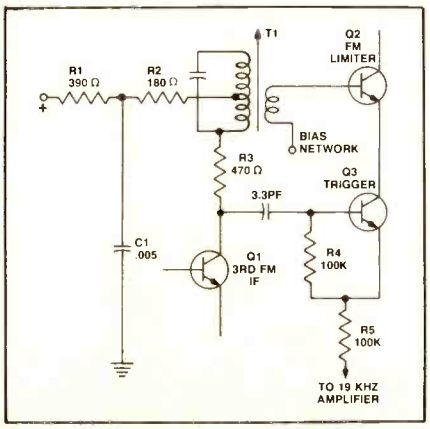

Fig. 4—Limiter section employed in Bendix-produced Ford FM receivers.

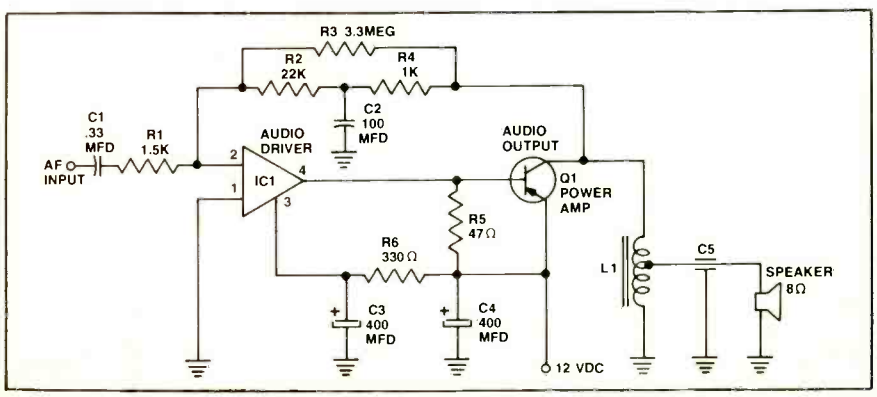

Fig.5—IC-equipped audio circuit used in FM receivers produced by Motorola for imported cars.

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Fig. 6—Typical version of under-dash stereo FM car radios produced for several years by Motorola.

stereo is produced, and it also might aggravate fading and other FM reception problems.

Because T1 is a special type of transformer, it must be replaced with an OEM version. If the OEM version is not available locally, you might try repairing the defective transformer. The most usual problem is lack of solder on the five wires of the secondary output pins. The best procedure is to remove the metal shield of T1 and resolder *all* associated leads.

MOTOROLA INTEGRATED CIRCUITS

Audio IC

The audio circuit in Fig. 5 is found in a number of Motorola car radios produced for "factory installation" in many makes and models of imported cars, particularly Volkswagen.

The audio driver IC (usually a Motorola MFC4050) in these radios can cause all of the trouble symptoms traditionally associated with a shorted audio output transistor. Consequently, before replacing output transistor Q1 (a PNP Germanium, usually a 2N176), first short together the base and emitter terminals of Q1 while monitoring the A-line current. If the current drops to near zero, driver IC1 probably is defective.

After replacing IC1, measure the collector voltage of Q1 and compare it with the value specified in the Motorola or Sam's AR service manual. If the measured voltage is excessive, Q1 probably is leaky and should be replaced. Also check L1 for signs of overheating. (Do not mistake the wax and varnish on L1 for burn marks; the color is similar.)

FM IF ICs

Motorola has produced a number of stereo FM car radio models in both "factory installed" and "add-on" versions (including the under-dash design in Fig. 6).

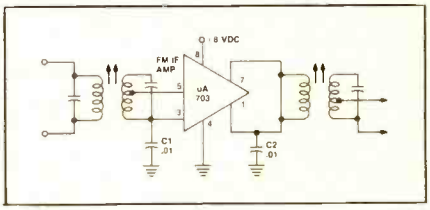

Fig. 7—IC-equipped FM IF amplifier stage employed in many Motorola car radios. (In most designs, four of these stages are connected in cascade.)

In these radios, weak or no FM can be caused by a defective tuner module; however, a more frequent cause of either of these trouble symptoms is a defective IC in the FM IF amplifier section (Fig. 7). First, measure the voltage on the IC input terminals (3 and 5) and the output terminals (1 and 7). The voltage on terminals 3 and 5 should be slightly less than 2 VDC, and that on terminals 1 and 7 should be close to 8 VDC. If the voltage on any of these terminals is significantly different than that specified or is zero, replace the IC.

If the voltages on the IC terminals are normal or near normal, tune the radio to a relatively weak FM station and, while audibly monitoring the audio output, bridge a .01-mfd capacitor across IC terminals 5 and 7. If the output level increases, the driver IC probably is defective.

The μA703 audio driver IC used in many of these radios is available from most electronic parts houses. I prefer the metal case 703 over the plastic case type because it seems to be more reliable and costs only a little more.

Be extremely careful when troubleshooting these ICs. One slip of a probe and you have a defective IC for sure. ■

CARR TALK

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

■ There are well over a hundred different brands of car tape players on the market. Some of these are produced by a relatively small number of "major" manufacturers who market them under their own brand name or sell them to large, private-label marketers. Direct replacement parts usually are available from these "major" manufacturers and/or marketers, although in some cases you have to "order and wait."

However, there is a significant percentage of car tape player brands for which direct replacement parts are not available under any conditions—regardless of how long you and the customer are willing to wait. (It seems that the post office boxes of some of these "off brand" car tape player marketers are canceled even before the last of their units are in the hands of the "bargain-oriented" consumers who buy them.)

The manner in which you handle these "off brand" can have a significant impact on the profitability of your vehicular electronics servicing business. In my opinion, there are only three realistic approaches you can use:
1) you can courteously explain to the customer that, because replacement parts are not available, the unit is economically unrepairable and therefore, in the interest of the customer's pocketbook, you must decline to attempt repairs.
2) You can courteously explain to the customer that, because direct replacement parts are not available for the unit, the "bargain aspect" of his or her "bargain" tape player automatically terminated when the player ceased to operate properly and that you will accept the unit for repair only if the customer is willing to pay the "extra" labor charges that will be incurred if you have to spend additional time repairing or fabricating a replacement for a nonstandard part.
3) You can courteously explain to the customer that, because direct replacement parts are not available for the unit, you will accept it only for *attempted* repair and then only under the condition that the customer must pay for the *diagnosis* even if it reveals that the unit is unrepairable because a "nonavailable" part is defective.

Regardless of which of the preceding approaches or combination of approaches you use, to avoid "customer relations" problems later, it is wise to have available, for the customer's signature, a "standard" form which clearly and precisely spells out the conditions under which you are accepting the unit for repair or attempted repair. The form also should probably spell out the applicable provisions of the mechanics lien law in your city or state, if there is one. (Most lien laws specify the conditions under which unreclaimed equipment becomes the property of the servicing agency.)

Before you decide to take on or continue the repair of those brands of car tape players for which direct replacement parts are not available, you first should consider the following factors:
1) If you presently have a sufficient volume of "major brands" servicing to fill in all of your shop time, there really is no "percentage" in tackling "off brand" servicing except in the inevitable, but hopefully rare, case in which you need to do so to keep a "good" customer happy.
2) If you presently have some shop "open" time and *definitely* know that you cannot fill it in by actively soliciting more "major" brand servicing, you probably will be financially better off if you take up the slack by first accepting some brands for which the availability of parts is *questionable* and then, if necessary, by accepting those brands for which you know that direct replacement parts are not available.

Accumulation of an assortment of "nonrepairable" car tape players from which you can cannibalize any needed parts that are not available from conventional sources will increase your chances of realizing a realistic level of profit from "off brand" servicing. Because of the duplications and similarities inherent in the electrical and mechanical designs of most brands of car tape players, the use of cannibalization as an alternative source of parts is probably more successful for car tape players than with any other type of consumer entertainment product—but only if you have a sufficient variety of brands from which to cannibalize, and then only if you have the time and are inovative and skilled enough to perform the bending; filing and other types of fabricating that often are required.

Playback heads and drive motors are two examples of the many car tape player parts which are relatively easy to replace either by cannibalization or by the use of "universal" replacement.

Fortunately, because there are relatively few really different designs of playback heads used in 8-track and cassette car tape units, a large percentage of playback heads can be replaced with the universal types available from most electronic parts distribution. In those few situations in which a universal type will not fit, you often can use a smaller head by placing brass or copper shim stock in the extra space between the head and the head carriage assembly.

Despite the fact that there seemingly is a wide variety of tape player motors, a high percentage of these also can be replaced with either universal types or by cannibalization and minor fabrication. The first characteristic to consider is whether the original motor rotates clockwise or counterclockwise (motor mounted "pulley up" or "pulley down"). The second consideration is whether the original has three or four wires. (If you are familiar with winding and centrifugal switch connections of player motors, you might be able to convert a four-wire motor to three-wire opera-

continued on page 49

ET/D 1975 SUBJECT REFERENCE INDEX

The first numerical group following each listing indicates the month of the issue in which it appeared, and the second numerical group indicates the page on which coverage of the topic appears or begins. The two-letter alphabetical code in parenthesis immediately following some listings indicates coverage in one of the following ET/D regular departments: Dealer Showcase (DS), New Products (NP), Technical Digest (TD), Test Instrument Report (TR).

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SHOP EQUIPMENT

TELEVISION (General)

TEST INSTRUMENTS

ARTICLE INDEX

continued on page 49

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.

EIGHT-TRACK DECK TESTER 134

Aspen Ltd., introduced a new Deck Tester, a simplified approach for evaluating all 8-track cartridge players. The Deck Tester No. 12A is encased in an 8-track cartridge with which anyone can check to determine that his 8-track deck is operating properly or if it is in need of repair. No meters or other electronic equipment are needed to test home and auto players. An instruction booklet is included with the two-color package. A tape speed test can be timed over a six minute period or the correct speed can be ascertained immediately by comparing Middle A on a musical instrument with the test tone. Also included is a tonal right and left speaker test and a tonal speaker rattle test. The speakers are electrically thrown in and out of phase so the individual can easily hear the difference. The tests indicate whether the speakers are operating properly and are placed properly. Wow and flutter, head alignment, worn head and cross talk problems can be readily determined. An automatic channel switching test assures the listener that the deck is changing to the correct tracks. Price is $6.98.

ELECTRICAL TOOL 135

Hunter Tools announces a multipurpose, five-in-one Model 55A Electrical Tool. This tool features serrated plier jaws for gripping, pulling, or bending. Its stripper capabilities will handle gauges 10 through 22 AWG solid wires, and 12 through 24 stranded wires. As a steel sharpened wire cutter, it becomes a screw cutter for six of the most common screw sizes, 4-40, 5-40, 6-32, 8-32, 10-24. The tool will crimp insulated terminals, insulated terminals 12-10, insulated terminals 22-14, 7mm auto, and RG59 coax. A new and uniquely designed stop prevents the wire stripping holes from closing beyond the wire diameter and cutting the wires. The handle is rolled and dipped to provide a comfortable, ¼ inch cushioned vinyl grip.

DIGITAL MULTIMETER 136

A new 4½ digit, five-function digital multimeter from *Hewlett-Packard* combines low cost with accuracy for both bench and field use. Called the Model 3465A, the multimeter covers a DC measurement range from 1μv to 1 kv with a mid-range accuracy of ± (0.02 percent of rdg. + 0.01 percent of rge.). AC measurement range is 10 μv to 500 volts with a mid-range accuracy of ± (0.15 percent of rdg. +0.05 percent of rge) over a 40 Hz to 20 KHz bandwidth. AC and DC current measurement range is from 10 nanoamps to two amps. DC current accuracy for the 10 mA range is ± (0.1 percent of rdg. + 0.01 percent of rge.) AC current measurements are made over a frequency band of 40 Hz to 20 KHz with a mid-band accuracy of ± (0.25 percent of rdg. + 0.25 percent rge.). Resistance range is 10 milliohms to 20 Megohms with a mid-range accuracy of ± (0.02 percent of rdg + 0.01 percent of rge). Open circuit voltage on the ohms terminal when set to its lowest range does not exceed 5 volts, preventing damage to most solid-state devices. Input protection is provided to 1 kv on and DC range, 500 Vrms on any AC range, and 350 V peak on any resistance range. A front panel fuse protects the instrument from overload when measuring current. Input terminals are recessed to meet safety requirements. The input terminal for current also contains the fuse and is easily extracted from the front panel. International symbols as well as voltage limitations are shown on the front panel. The price of the Model 3465A, Option 002, D-cell batteries, is $425, Option 001, AC only is $480, and with rechargeable nickel-cadmium batteries is $500.

MOBILE CB NOISE FILTER 137

Cornell Dubilier has developed a 60 amp and 100 amp Alternator/Generator Noise (electromagnetic) Filter. These units, designed for easy installation, block out unwanted

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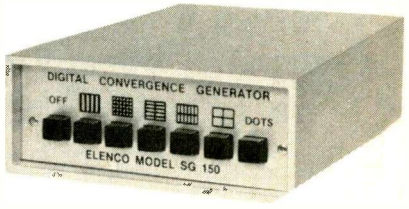

MODEL SG-150 $75.95

MODEL SG-100

ONLY $59.95

2 Patterns: 20 x 16 Crosshatch, 320 Dots, weight only 17 oz.

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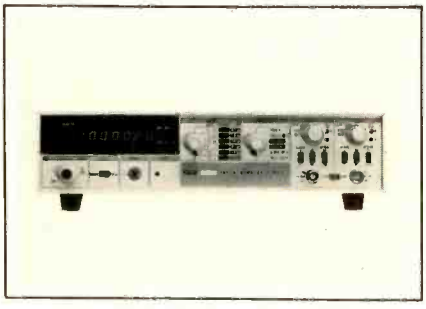
"conducted" noise created by alternator/generator systems in automobiles, trucks, tractors, and marine vehicles. The filters are designed with capacitive and inductive elements, providing a broad range of noise suppression produced at different speeds. They do not require tuning, further simplifying their use and applications. The CB60 and CB100 are designed for long trouble-free service and can withstand shock, vibration, corrosion and extreme temperatures. They are installed by simply removing one bolt from the alternator/generator and installing the filter's termination. Flexible cabling allows easy application in variety of vehicle configurations.

UNIVERSAL COUNTER/TIMER 138

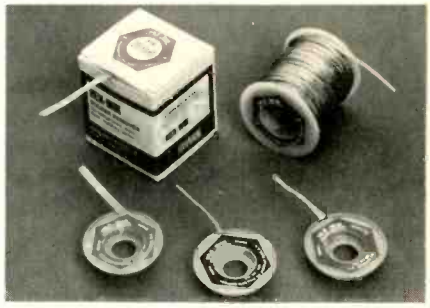
A high-performance 80 MHz universal counter/timer is introduced by *John Fluke Mfg. Co., Ltd.* The Model 1952B, is a 7-digit, 6-function counter/timer featuring direct coupled inputs, dual trigger status indicators, variable trigger level controls, and an oscilloscope marker output. Counting from DC to 80 MHz, the instrument measures frequency, frequency ratio, single period, multiple period averages, time interval, totalize and gateable totals. The LED display incorporates automatic units annunciation, overflow indication, and leading zero suppression. The two input channels are direct coupled, eliminating any possibility of waveform distortion, while the use of dual trigger status



indicators simplifies triggering level adjustment. Control of coupling, slope and trigger level is provided including both pre-set and variable trigger level controls that let you start and stop your triggering points anywhere on the waveform. In addition, a 5-volt marker output signal, when connected to an oscilloscope Z axis, intensity modulates the portion of the waveform displayed during the time interval being measured. Price is $750.

SOLDER REMOVER BRAID 139

Hexacon Electric Co., announces a new size and packaging for Hex-Wik, its solder remover braid. It is now available in a 5/32 inch width as well as in 1/16 inch and 1/8 inch wide sizes. The specially tinned wire promotes



solderability and wicking action and extends shelf life. The fine, 40 AWG wire (only .0031 inch diameter) provides more surface area, almost 18 square inches per foot of braid, and consequently greater capillary action and capacity to absorb solder. The sol-

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The brochure is free, but, if you'd like still more information on the operation of the ATC-10, you can obtain a copy of the 2 volume (home-shop) owner's manual. Just include $1.00 for postage and handling. Act now and evaluate for yourself the many ways the ATC-10 can be a real MONEY GENERATOR for you.

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3AF4					12SQ7
3AU6					13FD7
3BU8					14J7
3BZ6					15KY8
3CB6					16AQ3
3DG4					17AY3
3DT6					17BF11
3GK5					17DQ6
3S4	6AU4	6CM7	6GU7	6SQ7	17JN6
3V4	6AV5	6CY5	6H6	6T8	18GB5
4CB6	6AV6	6DE4	6HA5	6X4	19Q9
4EJ7	6AW8	6DE6	6HB7	6X5	21LU8
5BQ7	6AX4	6DG6	6J5	6X8	22JU6
5CL8	6AY3	6DQ5	6J6	7A4	23Z9
5J6	6BA6	6DQ6	6JC5	7AU7	24A
5T8	6BC5	6DW4	6JH6	7H7	25BQ6
5U4	6BF6	6EB8	6JS6	8B10	25CD6
5U8	6BG6	6EJ7	6JT8	8FQ7	25L6
5V4	6BH6	6EM7	6K6	8LT8	25W4
5V6	6BK4	6ES5	6K11	9A8	25Z6
5X8	6BL7	6EW6	6KY8	10DE7	27
6AF4	6BL8	6EZ5	6KZ8	10GK6	31LZ6
6AF11	6BN6	6F5	6LB6	10GN8	33GY7
6AG5	6BZ6	6FH5	6LU8	12AE10	34CE3
6AG7	6BZ7	6FQ7	6MD8	12AT7	35LR6
6AH4	6CB6	6FS5	6MN8	12AU7	39/44
6AK5	6CE3	6GC5	6Q11	12AV5	42EC4
6AL5	6CD6	6GE5	6S4	12AV6	50C5
6AM8	6CG8	6GF7	6S8	12AX4	50L6
6AR11	6CJ3	6GJ7	6SA7	12AX7	77
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der remover braid is available in standard lengths of 6, 10, 25, 50 and 100 feet. Lengths of 25 feet and longer are packaged in the new Dispenser Pak which provides added protection and permits easy withdrawal of the braid under production conditions.

AUDIO ACCESSORY PRODUCTS 140

A new profitable line of audio accessory products are introduced by *Tech Spray, Inc.* The product line is marketed under the name of Kleer Tone. The product line consists of 13 products, formulated to maintain audio

equipment and help improve audio fidelity. Introduced are three new products for the audio market. The first is Speaker Cone Renew (Stock No. 2213) designed to rejuvenate stiff, dry speaker cones, second, a Wood Oil Treatment (Stock No. 2206) formulated to prevent oiled wood cabinets from splitting and cracking and third, a Record Shampoo (Stock No. 2207) made to be mixed with water to remove dirt, dust and oily fingerprints. The balance of the line is comprised of Tape Head Cleaner, packaged in both aerosol and bottle, Tape Head Lube, Cleaning Sticks and Cloths, Record Cleaner, Speaker Cement and Contact Aerosol Spray Cleaner.

TV ANTENNA TOWER 141

Western Communications Service is building and assembling a 400-foot tower for use in television antenna systems. Assembled in 21-foot sections, the tower is manufactured from cylindrical high grade steel, and braced with one-inch nominal diameter steel pipe. The guyed tower utilizes ⅜-inch, seven-strand galvanized steel wire. Each section, containing bands of international orange and white, is hot-dipped zinc galvanized and contains a coat of rust inhibiting red

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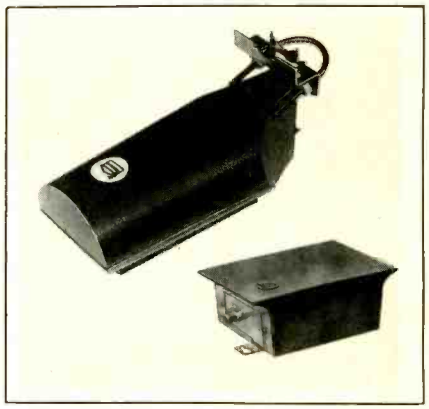
primer paint. All towers are designed for 125-mile winds with no ice, and 95-mile winds with ½-inch radial ice load. The towers are open face and of triangular configuration. Each of the 21-foot sections weighs approximately 500 pounds. The towers are plumbed within 1-inch plus or minus of plumb per 100 feet in height, and a ladder for climbing is provided on one face of the tower.

SWEEP/MARKER GENERATOR 142

The Model LSW-333, an all-channel sweep/marker generator for checking and aligning all tuned circuits in TV/VHF/UHF and FM receivers is introduced by *Leader Instruments Corp.* The circuitry of the generator allows it, in combination with an oscilloscope, to align tuners, video sound, IF amplifiers and traps in less time one normally would take. The sweep section covers TV channels 2 to 13 and 14 to 83 while video sweep modulation is available for VIF and chroma circuit checking. FM and IF sweeps are also included. The marker section of the generator is also said to feature an high level of accuracy through the use of crystal controlled signals and permits the use of 100 KHz and 1 KHz side markers on all signals. Trap adjustments and IF alignments are simplified because of the use of ten VIF markers with horizontal and vertical tilt. There is also a 1 KHz AM modulation signal. Polarity reversal switches for inverting both the vertical and horizontal traces, as well as three bias supplies are also present. Other features include: a vertical gain with X 5 magnification to compensate for scope sensitivity; an output meter with calibrated attenuator and 15.75 MHz filter to suppress TV horizontal receiver sweep; sweep output voltage of over 100mV/rms into 75 ohms. Price is $649.95.

ANTENNA PREAMP/AMPLIFIER 143

A new combination UHF/VHF/FM preamplifier is announced by *Jerrold Electronics*. Called the Powercaster Model 4287-PC, the unit combines a Jerrold mast mounted Powermate type preamplifier with a Jerrold Colorcaster type indoor amplifier. The result is high gain and high output capability. The unit is expected to be especially popular in fringe areas, for use with multiple set installations in homes, apartment houses, hotels and motels. VHF gain is 30 dB, UHF gain is 25 dB and the FM gain is 18 dB. Output capability is + 40 dBmV for each of four VHF channels and 37.5 dBmV for each of the three UHF channels. Input of the mast or boom mounted preamp is matched to 300 ohm antennas. Downlead and output impedance are 75 ohms. A built-in 12 dB FM tunable trap can be used to eliminate interference from a local FM station. For reception in deep fringe areas, noise figure of the unit is very low, 6 dB at VHF and 8 dB at UHF. Price is $97.50.



APPLIANCE NOISE FILTER 144

Cornell-Dubilier announced a new and efficient filter for interference produced by hot combs, blenders, electric shavers, etc. Simply plug the Model CBBS-1 Noise Filter into the wall socket and then plug the "noisy" appliance into the unit. Most annoying noise which hampers radios and TV's are removed. The unit is lightweight, reliable and is built to resist the effects of heavy usage.

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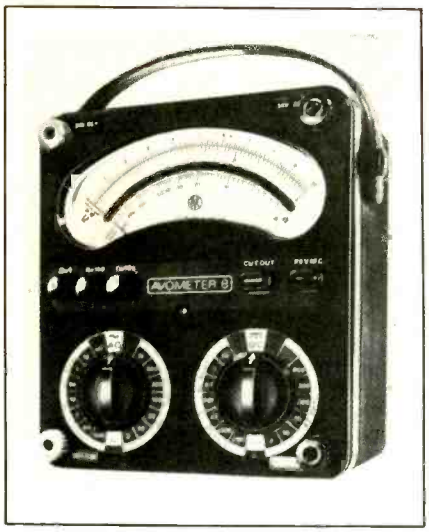
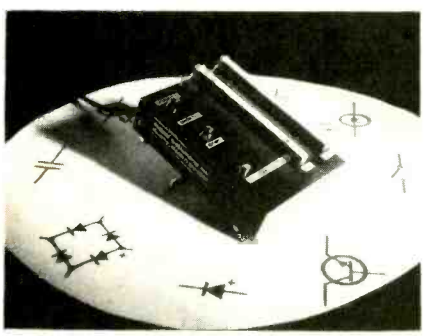
MULTIMETER 145

A new multimeter is introduced by *James G. Biddle Co.* The Model AVO 8/Mark 5 Multimeter allows you to read AC or DC current to 10 amperes, and AC or DC voltages up to 3000 volts. You can also measure resistances to 20 megohms (200 megohms with



external power supply), plus make decibel readings on the AC volt scale. Easy-to-read, clear, linear scales with anti-parallex mirrors, plus unique overload protection are employed in all AVO 8 instruments. All of the instruments receive a 7 kv flash test before they leave the factory. Price is $215.



COMPONENT TESTER 146

The new Component Tester Model CT-10 introduced by *Instant Instruments Inc.*, verifies any type diode rectifier, silicon, germanium or selenium as well as most solid state junction electronic devices in use today. Devices such as PNP and NPN transistor junctions, FET's LED's rectifier assemblies and most other PN junction semiconductors, are affectively verified. The tester determines 1) Junction shorted 2) Junction open 3) Junction conducting 4) Direction of current flow (polarity). An additional test function allows polarized and nonpolarized capacitor verification for polarity, leakage, open and short circuit. Test leads are also provided, when the tester is used for in-circuit trouble shooting, or as a continuity checker. Price is $19.

SIDEBAND CB RADIO 147

The *E.F. Johnson Co.*, introduced a new SSB/AM mobile radio, the "Viking 352". Featured on the radio are easy to use individual controls for all functions, eliminating tandem-type dual function controls. Also featured is a mode selector employing color keyed amber, red, and blue lights to give indication of AM, USB, and LSB

modes at a glance. For protection from interference, the receiver utilizes a crystal lattice filter to achieve selectivity of -60 dB at ± 15 KHz. Both a full time automatic noise limiter circuit and a separate RF-type noise blanker are provided. The transmitter is rated at the maximum legal power on both AM and sideband and features automatic speech compression for consistent, high level modulation. The radio also features a built-in PA function, illuminated metering, and dual polarity operation from positive or negative ground 12 volt DC.

COMMUNICATIONS OSCILLOSCOPE 148

IF circuit wave form observations along with SSB and AM transmitter signal monitoring has been made possible by *Leader Instruments Corp.* through the introduction of its new LBO-310 Ham Oscilloscope. The new 3-inch scope, which has a vertical sensitivity of 20 mVp-p/div and a vertical bandwidth of DC to 4 MHz will also

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indicate the tuned condition for RTTY operation as well as facilitate SSB signal observation through the use of an internal, two-tone generator. The oscilloscope in combination with the LA-31 adapter will also provide continuous monitoring of RF output to 500 W. Maximum input to the vertical amplifier is 600 v, DC + AC peak-to-peak at a 1M impedance. Transmitter monitoring is possible from 1.8 to 54 MHz at power levels from 2 to 500 W with a deflection sensitivity of 1 W per division into 50 ohm or 75 ohm impedances. The oscilloscope is priced at $269.95. The LA-31 Adapter is $22.95.

DIGITAL MULTIMETER 149

The Siliconix DVM Chip Set is combined with a 3½-digit LED display to provide simplified construction in this new multimeter announced by *Alpha Centauri Electronics*, Inc. Basic DC accuracy is .05 percent of reading ± digit with a full scale range of 1999. In

addition to DC voltage ranges from 200 mv to 2000 volts the meter has ACV, DC ma, K Ohms and a separate Megohm range that goes to 2000 Megohms full scale. The multimeter is available with either the Litronix ½-inch LED's as Model 75A priced at $159.59 or with .3-inch LED's as Model 75B for $149.95. ■

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CARR TALK

continued from page 39

tion.) Compare the color coding of the wires of the original and the prospective replacement, if they are the same, your chances are improved. Also compare the DC resistances of the two motors; if they are within ± 25 percent, the chances of a compatable replacement are further improved. Finally, connect up the replacement and see if it works.

If the speed of the replacement motor is too fast or too slow, replace the original flywheel with one that has a larger or smaller diameter. (A stock of used and universal flywheels is essential.)

An alternative cannibalization procedure is to measure the diameter of the original flywheel and then find a "nonrepairable" tape player with the same size of flywheel and a known-good motor and regulator circuit. Remove all three from the nonrepairable unit and "fit" them into the unit you are attempting to repair.■

COMM CHAT

continued from page 28

waveguides take the place of transistors, power amplifier tubes, and coaxial cables.

The upper portion of the UHF band is used for long-range radar, as well as for much of the point-to-point repeater communications used by civilian and military groups. Microwave signals can be directed in a very tight beam by antennas which, although physically small, may be hundreds of electrical wavelengths across. A very weak signal can be transmitted either to or from a satelite. Much of the data transmitted in the UHF band is pulse rather than voice and is therefore highly immune to interference, both natural and man made.

We have only scratched the surface of the total RF spectrum and have not even mentioned the frequencies below 300 KHz or above 3000 MHz. Relatively few technicians are concerned with operations on these frequencies, and frankly I don't know a thing about them myself. However, if enough of you are interested, either myself or a specialist in low- or high-frequency radio will put together an introductory piece. (By the way, that's all you have to do to find out about almost any subject within the scope of this magazine—tell us what you want.)■

1975 SUBJECT REFERENCE INDEX

continued from page 42

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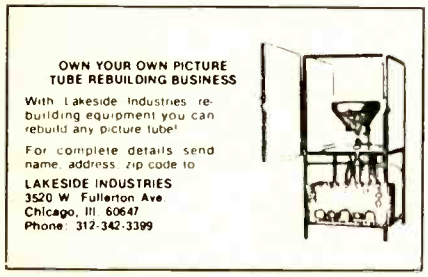

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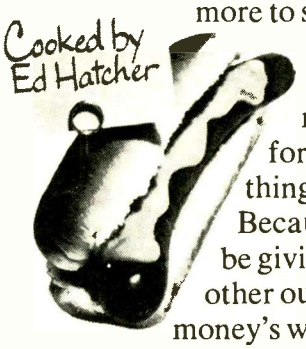

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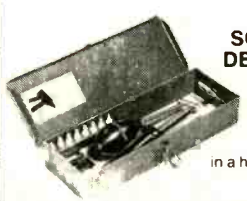

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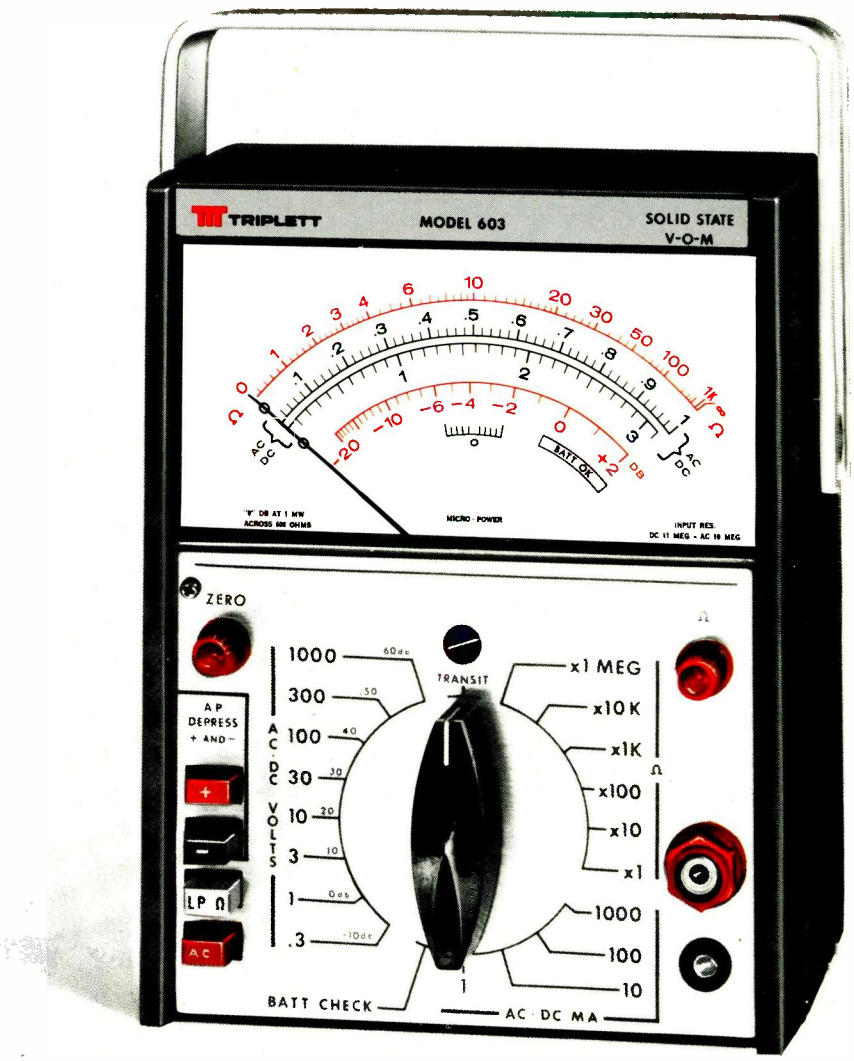

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