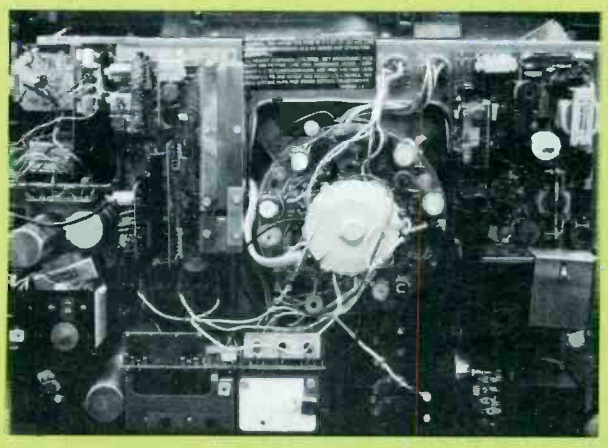
July, 1971 ☐ 75 cents

A HOWARD W. SAMS PUBLICATION

Electronic Servicing



Servicing RCA's Modular Color

Troubleshooting techniques and possible troubles, page 24

Minimum Scope Vertical Bandwidth Requirements

First of a series about servicing with a scope, page 16

The Income and Expense Summary:

Scorecard of your business, page 52

NEW!

Quarterly In ES . . .

PF Annual Index Supplement, page 61

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

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

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

That makes Sylvania tubes easier to sell.

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

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

Instead of just handing them a line.

GTE SYLVANIA

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

Circle 1 on literature card

Television Symptom Diagnosis

An Entry Into TV Servicing

This complete training program provides the necessary job-entry skills for students without previous knowledge of electronics circuitry. It teaches the two skills required for TV repair: how to diagnose the trouble, and how to locate the defect. Upon completion of the one-semester course, the student is qualified to efficiently repair an inoperative black-and-white or color-TV set.

Exclusive Single Concept Film Loop Series for Teaching Black-and-White and Color-TV Diagnosis and Repair

Prepared under the direction of Richard W. Tinnell of Oklahoma State University; reviewed and approved by the Service Committee of EIA (Electronic Industries Association).

This film-sound series is designed to help the student learn the effect and cause relationship of television troubles. Each film is short (2-5 minutes) and may be repeated over and over until the student has mastered the problem. In addition, most films have "stops" programmed after each trouble symptom is presented. The student, at that point, or at the end of the film completes a diagnosis and remedy sheet in the student-response manual, thus testing his comprehension of the text and film material. At the discretion of the instructor, another step allows the student to work with an actual black and white or color television receiver. The instructor can provide "bugged" receivers for the student to diagnose and sectionalize troubles.

These single concept film loops promote quicker understanding, longer retention, greater student interest and are particularly effective in developing diagnostic expertness which is the primary job skill required.

All films are contained in Technicolor continuous-loop cartridges for easy operation.
Order **20840.** 33-film cartridge set. **$1500**

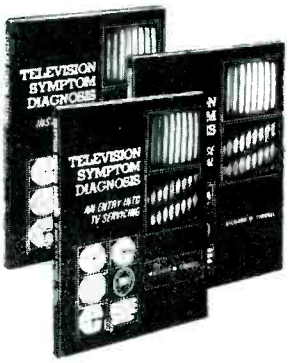
(Also available in 8-mm standard or super, and 16-mm consecutive subject reels at no additional cost. The series is also to be made available in cartridges for present A-V systems you are now using. Price and delivery quoted on request.)

Television Symptom Diagnosis—An Entry Into TV Servicing

by RICHARD W. TINNELL. *Oklahoma State University.* This profusely illustrated full-color text utilizes the cue-response concept of diagnosis. Used with the accompanying Student Response Manual and the Single-Concept Film Loop series, it comprises a complete one-semester TV trouble diagnosis course. Softbound.
Order **20810** (Tentative) **$6.95**

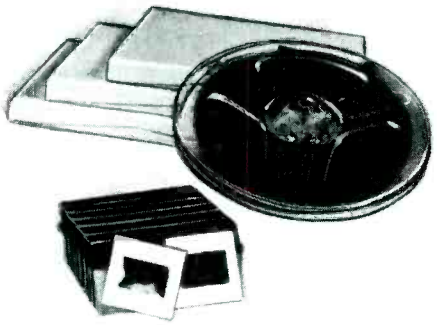
Student Response Manual. This is a vital key to the entire troubleshooting training program. Color photos and illustrated problems show hundreds of TV trouble symptoms. Softbound.
Order **20821** (Tentative) **$3.95**

Instructor's Guide. Contains all answers; provides detailed instructions for teaching the program. Softbound.
Order **20822** (Tentative) **$1.00**



Transistor Review Series

35-mm Slide and Tape Materials



These materials enable electronic technician trainees to gain a clear understanding of semiconductor theory and fundamentals, a grasp of transistor circuitry, and a knowledge of measurement techniques required for servicing solid-state equipment. The **Transistor Review Series** consists of three sets of 35-mm slides and accompanying sound tapes. Each series provides exceptional visual reinforcement for any electronics program offering transistor instruction, regardless of the text used.

SERIES NO. 1

Semiconductor Fundamentals

Deals with those basic concepts of semiconductor theory vital to the understanding of transistors and diodes. Defines the semiconductor and describes its characteristics. The series contains 29 slides and one reel of tape.
Order **20813** **$65.00**

SERIES NO. 2

Circuits and Associated Components

This series covers the use of semiconductors as circuit components, and explains typical radio circuit applications progressively by specific stages. Includes 30 slides and one reel of tape.
Order **20814** **$65.00**

SERIES NO. 3

Measurements and Circuit Analysis

This final presentation deals with the test instruments and measurements used in servicing semiconductor circuits, and discusses specific service problems and their diagnosis. Includes 30 slides and two reels of tape.
Order **20815** **$75.00**

Prices are list; school discount applies to books—examination copies on request

HOWARD W. SAMS & CO., INC.

Dept. AV-301, 4300 West 62nd Street, Indianapolis, Indiana 46268

Ask for 1971 Sams Educational Materials Catalog

July, 1971 • Volume 21, No. 7

Electronic Servicing

in this issue...

TEST EQUIPMENT

16 Minimum Scope Vertical Bandwidth Required—An analysis of the composition of the waveforms encountered in color TV servicing reveals the range of frequencies the vertical amplifier section of a scope must amplify equally to reproduce consumer electronic waveforms with acceptable accuracy. First of a series about scope applications. **(Servicing Consumer Electronics With A Scope/J. W. Phipps).**

COLOR TV

24 How to Service RCA's Modular Color Chassis—An analysis of what can and can not be serviced economically, plus a discussion of probable troubles and the best methods for troubleshooting and making adjustments. **(Bruce Anderson/ES Contributing Author).**

TV (GENERAL)

34 TV Ghosts—Causes and Cures—All about positive, negative, multiple probagation and leading "ghosts", plus a special discussion of the effects of ghosts on the screen of a color receiver and how to determine if what you see really are ghosts. **(Robert G. Middleton).**

61 Supplement to 1971 Sams PHOTOFACT Annual Index (January thru June)—A complete listing of new models of home entertainment electronic products covered in PHOTOFACT since December, 1970. Use this supplement with the PHOTOFACT 1971 Annual Index. Supplements will be published quarterly in ES.

AUTO ELECTRONICS

42 Stereo FM Radio Servicing—A General Review—How the circuitry of each chassis can be divided into sections according to function(s), and what troubleshooting techniques are most efficient for each section. **(Carr Electronics/Joseph J. Carr).**

SHOP MANAGEMENT

52 Income and Expense Summary: The Scorecard of Your Business—What it can and can not tell you about the health of your business. **(Better Management Guides/Robert G. Amick).**

DEPARTMENTS

Second class postage paid at Kansas City, Mo. and additional mailing offices. Published monthly by INTERTEC PUBLISHING CORP., 1014 Wyandotte St., Kansas City, Mo. 64105. Vol. 21, No. 7. Subscription rates $5 per year in U.S., its possessions and Canada; other countries $6 per year.

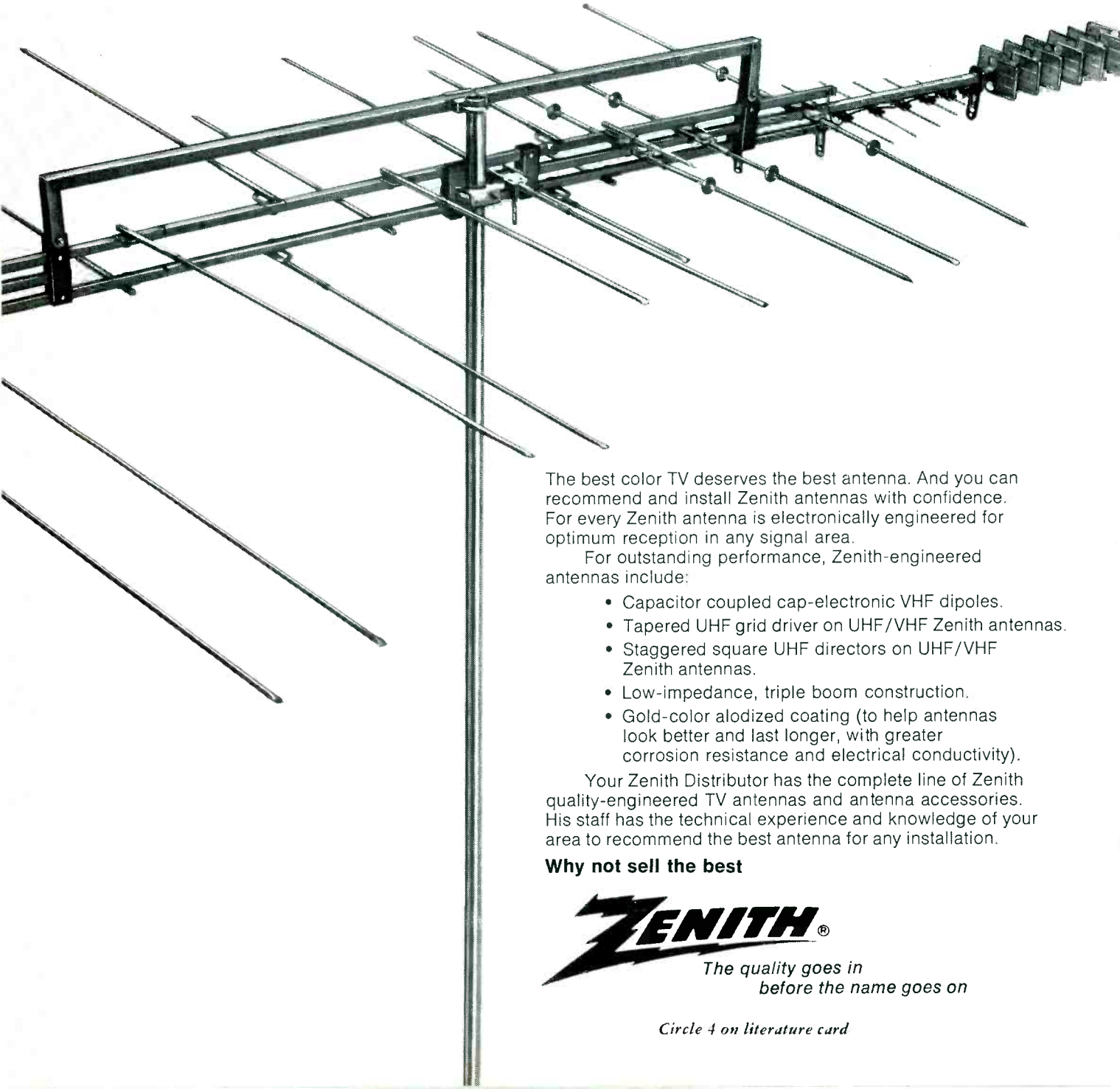
ELECTRONIC SERVICING (with which is combined PF Reporter) is published monthly by Intertec Publishing Corp., 1014 Wyandotte Street, Kansas City, Missouri 64105.

Subscription Prices: 1 year—$5.00, 2 years—$8.00, 3 years—$10.00, in the U. S. A., its possessions and Canada.

All other foreign countries: 1 year—$6.00, 2 years—$10.00, 3 years—$13.00. Single copy 75¢; back copies $1.
Adjustment necessitated by subscription termination at single copy rate.

Robert E. Hertel, Publisher
Intertec Publishing Corp.
Subsidiary of Howard W. Sams & Co., Inc.

Engineered for outstanding reception– Zenith outdoor antennas for Color TV!



The best color TV deserves the best antenna. And you can recommend and install Zenith antennas with confidence. For every Zenith antenna is electronically engineered for optimum reception in any signal area.

For outstanding performance, Zenith-engineered antennas include:

- Capacitor coupled cap-electronic VHF dipoles.
- Tapered UHF grid driver on UHF/VHF Zenith antennas.
- Staggered square UHF directors on UHF/VHF Zenith antennas.
- Low-impedance, triple boom construction.
- Gold-color alodized coating (to help antennas look better and last longer, with greater corrosion resistance and electrical conductivity).

Your Zenith Distributor has the complete line of Zenith quality-engineered TV antennas and antenna accessories. His staff has the technical experience and knowledge of your area to recommend the best antenna for any installation.

Why not sell the best

ZENITH®

The quality goes in before the name goes on

Circle 4 on literature card

electronic scanner

news of the industry

Virginia Studies Possible Need For Technicians Licensing

The Virginia Department of Consumer Affairs reportedly has recently held public hearings throughout the state to determine if there is a need for licensing of electronic technicians and technicians in other service fields.

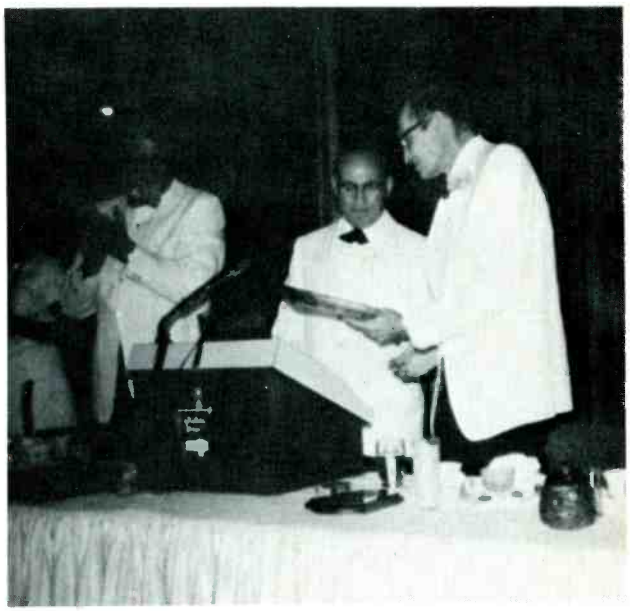
A committee of ten persons was set up by the director of consumer affairs, Roy L. Farmer, to help him conduct the study. Members of the committee were: Frank Blount, president, Virginia Electronics Association; Clifford Shaw, executive director, Virginia Electronics Association; Claude D. Fryman, General Electric Co.; F. T. Mathews, Sears, Roebuck & Co.; John Penn, Wards Co.; and Vernon E. LaPrade, Virginia Electronics Association.

TSA of Delaware Valley, Philadelphia, Gives "Service Award" To TV Station

The Television Service Association of Delaware Valley (TVSA), a group of independent television service technicians, has singled out WKBS TV, Philadelphia, for "their Promotional Programs offering better service to their viewers".

The "service award" from the TVSA was given to WKBS because of "the station's activity in an on-the-air campaign promoting correct antenna installations, proper UHF tuning, and reliance on qualified servicemen for repairs."

The plaque honoring the station was presented by TVSA President Harry Lublin to WKBS TV General Manager G. William Ryan at the group's annual banquet in Philadelphia.



Jack Betz, TSA Iowa, Elected to Electronics Hall of Fame

Jack Betz, long-time member and past president of the Television Service Association of Iowa, has become the third living member of the Electronics Hall of Fame.

The other living members are John P. Graham, TSA of Ohio, and Morris L. Finneburgh, Sr., Chairman of the board of The Finney Co., Ohio-based manufacturer of antenna system components.

Mr. Betz is shown here, on the right, receiving the official plaque of the Electronics Hall of Fame, Service Division, from Emmett Mefford, then president of the National Electronic Associations, which founded the Hall of Fame.

Three National Associations Form Committee To Discuss Service Industry Problems

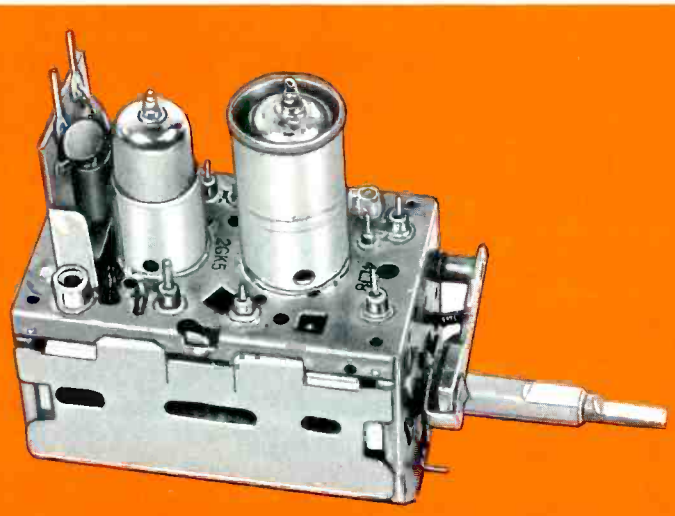
A "mutual cooperation" committee comprised of representatives of the National Appliance & Radio-TV Dealers Association (NARDA), the National Alliance of Television and Electronic Service Associations (NATESA) and the National Electronic Associations (NEA) was formed during NARDA's annual convention in Chicago in April, "to bring the full weight of the service industry to bear on the problems of the industry."

The committee also pledged mutual cooperation in such areas as management and service training, establishment and enforcement of codes of conduct of members, and upgrading of television reception.

The next meeting of the committee reportedly will be held August 26 in Hot Springs, Arkansas, during NATESA's annual convention.

Committee members are Jim Renier, NARDA vice president of service; Jules Steinberg, executive vice president, NARDA; Leroy Ragsdale, president NATESA; Frank Moch, executive vice president, NATESA; Sid Sabel, vice president, NEA; and Richard Glass, executive vice president, NEA.

(Continued on page 6)



$9.75

TUNER SERVICE CORPORATION

PROVIDES YOU WITH A COMPLETE SERVICE FOR ALL YOUR TELEVISION TUNER REQUIREMENTS AT ONE PRICE.

TUNER REPAIR

VHF Or UHF Any Type $9.75.
UHF/VHF Combo $15.00.

In this price all parts are included. Tubes, transistors, diodes, and nuvistors are charged at cost.

Fast efficient service at our 4 conveniently located service centers.

1 year guarantee backed up by the largest tuner manufacturer in the U.S.—SARKES TARZIAN INC.

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Replacement Tuner $9.75.

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

The price is the same for *every* type of universal replacement tuner.

Specify heater type

Parallel 6.3V
Series 450 mA
Series 600 mA

All shafts have the same length of 12".

Characteristics are:
Memory Fine Tuning
UHF Plug In
Universal Mounting
Hi-Gain Lo-Noise

If you prefer we'll customize this tuner for you. The price will be $18.25. Send in original tuner for comparison purposes to our office in INDIANAPOLIS, INDIANA.

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MIDWEST . . . . . 817 N. PENNSYLVANIA ST., Indianapolis, Indiana (Home Office) . . . . . TEL: 317-632-3493
EAST . . . . . 547-49 TONNELE AVE., Jersey City, New Jersey . . . . . TEL: 201-792-3730
SOUTH-EAST . . 938 GORDON ST., S. W., Atlanta, Georgia . . . . . TEL: 404-758-2232
WEST . . . . . SARKES TARZIAN, Inc. *TUNER SERVICE DIVISION*
10654 MAGNOLIA BLVD., North Hollywood, California . . . TEL: 213-769-2720

Circle 5 on literature card

(Continued from page 4)

Second-Year Warranty Offered On All RCA Colorama and HI-LITE Color TV Picture Tubes Sold For Replacement Use

An optional second-year warranty on all RCA Colorama and HI-LITE color television picture tubes sold for replacement use is now available from RCA Electronic Components.

Morris S. Lewis, Manager, Distributor Merchandising, RCA Receiving Tubes and Picture Tubes, said: "The optional RCA extended warranty enables RCA distributors to offer their customers a choice of the standard one-year warranty that applies to all RCA replacement picture tubes, or the new two-year warranty at modest additional cost."

To apply the second-year warranty on RCA color picture tubes, he explained, RCA supplies a new set of second-year warranty certificates to the distributor. One part of this certificate is to be physically applied to each part of the original warranty accompanying each tube, as well as to the funnel of the tube.

The registration postcard section of the warranty card must be properly filled out and returned to RCA within 10 days of tube installation. The warranty procedure reportedly is simple to handle—complete instructions are contained in the second-year warranty certificate.

EIA Petitions FCC For 80 New CB Channels In 220-MHz Band

The Citizens Radio Section of the Electronic Industries Association (EIA) recently petitioned the Federal Communications Commission (FCC) to establish a new "Class E Citizens Radio Service." The proposed Class E Service would have 80 channels with 25-KHz spacing from 220 to 222 MHz, and would utilize frequency modulation.

The petition states that the present Class D service has demonstrated "a strong and growing need for personal two-way radio communications for both safety and convenience of individual citizens in conducting their daily business and personal activities." Its goal is also to take what the industry has learned from the present service's alleged short-comings and apply the knowledge to the creation of the new and more effective Class E service. Absent from Class E would be skip interference, RF noise and over-crowding.

It is estimated by EIA that the proposed 80 new channels would be completely adequate for a minimum of 2,500,000 licensees. Power output to the antenna would be 25 watts.

Under the proposal, antenna height rules would also be changed. Antenna heights would be limited to 20 feet above the nearest man-made or natural object within 500 yards; or sixty feet above the existing ter-

rain (whichever is higher).

New and simplified licensing procedures are also recommended. A short-form license application, included with each set, would be used to self-assign call numbers based upon the individual's Social Security number.

The distinction among personal two-way radio communication, the Amateur Radio Service and the commercial portions of the land-mobile services (business/industrial) are:

- The Amateur Radio Service is international, and is domestically regulated. It is oriented primarily to long-distance two-way radio communication and experimentation of a hobby and public-service nature; and is intended to assist in the development of technical radio skills and experience of benefit to both government and society.
- The commercial segments of the Land-Mobile Radio Services are nationally regulated and are intended for necessary and specific business and industrial communications requirements over relatively short distances.
- The existing Class "D" Citizens Radio Service is intended to provide relatively unrestricted personal communication capability over short distances for personal convenience and safety. It has become the nation's largest radio service, with nearly 1,800,000 licenses issued—more than all the other radio services combined.

The proposed citizens radio service reportedly would provide the greatest possible system flexibility resulting in maximum licensed operators in a minimum spectrum segment. EIA citizens radio member manufacturers are confident that equipment costs at the outset would be completely acceptable to the user and would quickly be reduced, through volume, to cost comparable with Class D radios.

Crow Appointed Executive Director of ISCET

Ronald Crow, Ames, Iowa, has been appointed executive director of the International Society of Certified Electronics Technicians (ISCET).

Mr. Crow, chairman of ISCET until his recent appointment to the executive director position, will administer both ISCET and the Certified Electronic Technician (CET) programs. The CET program previously had been administered by the National Electronic Associations (NEA).

ISCET, a subsidiary organization of NEA, is comprised of technicians who have qualified as Certified Electronic Technicians and subsequently have elected to joint ISCET, which was formed a little over a year ago.

(Continued on page 8)

(Continued from page 7)

ISCET is an active participant in such electronics industry "co-operatives" as the Electronics Industry Council and the National Electronic Service Conferences.

Mr. Crow's office is located at 1306 Douglas, Ames, Iowa, 50010.

Succeeding Mr. Crow as chairman of ISCET is the past vice chairman, Darryl Widman, Santa Barbara, California, who also is an active member of the California State Electronics Association.

Sylvania Appoints Distributors

The following independent distributors have been appointed franchised distributors of Sylvania monochrome and color TV picture tubes, entertainment receiving tubes, replacement semiconductors, and special products:

Smith Electronics, Inc.
307 E. Magnolia St.
Knoxville, Tenn.

Hutch & Son, Inc.
1421 Triplett St.
Owensboro, Kentucky

C & R Electronics
500 Jefferson St.
Natchez, Miss.

SREPCO Electronics
2705 Fulton Dr., N.W.
Canton, Ohio

Service Parts & Supply Co.
535 S. Broad St.
Trenton, N.J.

VEA Convention In Historic Williamsburg

The seventh annual convention of the Virginia Electronic Association (VEA) will be held July 30 to August 1 at the Hilton Inn in Williamsburg, Virginia.

Unused Sub-Carriers of FM Radio Station Will Carry Slow-Scan Video In Michigan ETV Project

A pioneer educational program utilizing controlled, or slow-scan, television beamed on sub-carriers of an FM radio station reportedly will be launched next fall in Michigan by the Flint Public Schools.

The experimental project, first of its kind, will capitalize on the unused sub-carriers of Flint's educational FM station, WFBE, to transmit instructional television into four elementary schools.

Developed by specialists within the Michigan Department of Education in cooperation with the Flint schools, the project will test the feasibility and effectiveness of a new audio-visual instructional medium which reportedly promises tremendous savings over conventional ETV.

The method requires only a special transmitter to transfer the visual signal to the sub-carriers and special modulators to convert standard TV sets at the receiving end.

While the audio portion carries instantaneously, the controlled-scan picture takes approximately 10 seconds to build to full image, and can be sustained indefinitely.

In addition to extremely low transmitting costs, controlled-scan telecasting has the added advantage of storage and retrieval on standard quarter-inch audio recording tape for later replay. ▲

Now, your choice- 1 or 2 year warranty on all RCA color picture tubes

A big business builder for you with the industry's most complete line.

1. RCA offers an extended warranty, for a second year, on all Hi-Lite and Colorama color replacement tubes.

2. The second year is optional. You can still offer the customer RCA's one year warranty. Or for a modest extra charge there's a whole additional year of protection. It's your choice!

3. This extra protection will help you sell many customers on replacing the tube instead of the set.

4. It will keep them coming back to you for service on their TV sets and other equipment.

5. You can sell with extra confidence. There's added protection on the quality name picture tube line designed to enhance your professional reputation.

That's why the RCA extended warranty is your most powerful new sales tool for 1971! Get full details from your local RCA Distributor.

RCA | Electronic Components | Harrison, N.J. 07029

RCA

readers exchange

■ Electronic technicians and owners or managers of electronic service shops who need assistance obtaining a part, service literature or any other item related to the servicing of electronic equipment are invited to use this column to inform other readers of their need. Requests submitted for publication in this column should be sent to: Readers' Exchange, ELECTRONIC SERVICING, 1014 Wyandotte St., Kansas City, Mo. 64105. Include a brief but complete description of the item(s) you need, your complete mailing address, and how much you are willing to pay for the item(s). No item(s) can be offered for sale in this department. To sell items, please use the classified ad department, titled "The Marketplace." (For classified ad rates, see accompanying announcement on page 12.)

I would like to purchase a copy of Milton S. Kiver's "TV Analyzing Simplified", Vol. I and II; both are out of print. I would also like to purchase a wide-band oscilloscope and an Eico yoke and flyback tester in good condition.

Williams Radio & TV Service
106 S. Jefferson St.
Lewisburg, W. Va. 24901

I have a Philco, Model No. 7008 visual alignment generator for TV and FM. I have lost or misplaced the instruction and operational manual and would like to purchase replacements.

I have written the Philco distributor in this area and they have informed me that they do not have this particular manual.

I will appreciate any help offered.

Clarence L. Swanson
2126 12th St.
Moline, Ill. 61265

I would like to buy back issues of ELECTRONIC SERVICING and PF REPORTER, plus other servicing related literature. Please write giving issues or items available and prices.

John M. Jones
Rt. 2 Box 123
Norlina, N.C. 27563

I need the schematic diagram for an Arvin Model 49P69 portable solid-state combination radio/phonograph. Any help will be greatly appreciated.

Richard K. Smith
67799 Gleason Ave.
Richmond, Mich. 48062

I need the instruction manual and schematic for a Graymark 510, five-tube super AM radio kit. This kit is manufactured by Graymark Electronics, Los Angeles, Calif.

Willard E. Good
832 Bricker
Toledo, Ohio 43608

(Continued on page 12)

NEW... for ES readers only!

CLASSIFIED ADVERTISING
Beginning in the July issue of ES, a classified ad section, titled "The Marketplace", will be made available to electronic technicians and owners or managers of service shops who have for sale surplus supplies and equipment or who are seeking employment or recruiting employees.

Advertising rates
in the Classified Section are:
- 25 cents per word (minimum $3.00)
- "Blind" ads $2.00 additional
- All letters capitalized—35 cents per word

Each ad insertion must be accompanied by a check for the full cost of the ad.

Deadline for acceptance is 30 days prior to the date of the issue in which the ad is to be published. (Sept. inserts must be received by Aug. 1).

Send insertions with full payment to:

Electronic Servicing
Classified Advertising
1014 Wyandotte Street
Kansas City, Mo. 64105

(The Classified Section is not open to the regular paid product advertising of manufacturers. Classified advertising is intended as a service to technicians and shop owners or managers seeking employment or recruiting employees or who wish to dispose of surplus supplies and equipment.)

(Continued from page 10)

I need the schematic diagram for a Sound, Model 4000 and a Mostrite, Model 400. I also need a musical instrument amplifier for a Rithm Ace, type FR-1. Any help will be welcome.

Enrico Cardona Bonano
Apeninos 633
Puerto Nuevo
Puerto Rico 00920

I need a tube roll chart, for a Triplett tube tester, Model 4313-A.

I wrote to the Triplett Company, but this model tube tester has been discontinued for a long period of time. (This tube tester is 20 years old.)

I need a roll chart for the latest tubes, or any suggestions will be deeply appreciated.

Theofilo Maduro
De Veerstraat No. 2
San Nicolas, Aruba
Netherlands Antilles

We are trying to obtain a type 3A10 tube for a Ray-Counter or geiger counter, but have had difficulty because the company does not seem to be in existence. The unit is called a Ray Chronix Model A3 and was made by the Radioactive Products Corporation, 3201 East Woodbridge St., Detroit, Mich.

Would appreciate any information on this company.

Roy Stenfors
207 Stephenson Ave.
Iron Mountain, Mich. 49801

I have a RCA Senior Voltohmyst, WV-98C that I bought second hand. The meter movement does not work. I need the name and address of a meter repair company that could repair this meter movement.

Fred S. Yokum
504 Parkersburg Rd.
Savannah, Ga. 31406

I need a nuvistor tuner for an 11-year-old RCA TV. The distributor says that it is no longer available. The tuner is a KRK103C used in a 1960 model, chassis No. KCS-136A. Any help will be appreciated.

Landon's Electric Shop
Wayne, W. Va. 25570

I need a power transistor for a Precision ES-500 scope. I would appreciate any information available and will pay for same.

S. Stefanelli
21 Magnus Ave.
Somerville 43, Mass.

I need a set of Sams PHOTOFACTS, No.'s 752-1057, and would like to pay about $1.00 per issue. I'm also looking for a set of Sams AR series manuals.

David Smith
63 Stanford Rd. W.
Rochester, N.Y. 14620

I have a B & K Model 625 tube tester. I would like to purchase a Model C-40 adapter for this tester so I can test color picture tubes.

I am also interested in purchasing other types of used TV test equipment. Please send lists and prices.

Arnold A. Schaefer
603 Second Ave. S.E.
Watertown, S.D. 57201

(Continued on page 14)

Attention ES Readers:

Troubleshooting-by-Mail Program Changed

The staff of ELECTRONIC SERVICING regretfully announces that increased cost and an overwhelming volume of correspondence force us to discontinue the direct-mail troubleshooting assistance formerly provided ES readers.

Although we no longer are able to reply directly by mail to your request, we still intend to help you solve those "harder-than-usual" troubles with which all technicians occasionally are confronted. When you encounter a troubleshooting situation which has you baffled, please perform the following in the order presented:

- Check the ES Annual Subject-Reference index to determine if the situation was covered in a previous issue of ES. Chances are it has been. (A detailed subject-reference index of the content of the previous year's issues of ES is included in the January issue. If you have lost one or more of these "index" issues, copies can be obtained from the Circulation Department of ES for $1.00 per issue.
- If you are unable to find adequate information about your problem in a previous issue of ES, briefly describe on a postcard the general type of problem you have encountered, then mail the postcard to:

ELECTRONIC SERVICING, c/o Reader Preference
1014 Wyandotte, Kansas City, Mo. 64105

Although we will not be able to reply to you directly, we will cover the general category of your problem in ES as soon as possible.

ITS YOUR MAGAZINE—LET US KNOW WHICH SUBJECTS YOU WANT TO READ ABOUT AND WE'LL DO OUR BEST TO FULFILL YOUR REQUESTS . . . the editors.

Send a Complimentary Copy of **Electronic Servicing** to your Friends in the Business

Know some electronic technicians who might benefit by reading Electronic Servicing as you have?

Just fill in their names and addresses below—and your name and address—and tear out and mail to Electronic Servicing.

We'll send each one of them a copy of Electronic Servicing, with your compliments.

You'll do us and your friends a favor by helping spread the good word about the only magazine devoted exclusively to consumer electronic servicing.

Name .....
Address .....
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(Continued from page 12)

I need the schematic diagram for a Precise scope, Model 308C-K or W.

I called the Precise Development Corp. and was told the diagram was not available because they are no longer manufacturing test equipment.

Larry A. Muchka
770 Southern Parkway
Uniondale, N.Y. 11553

I need two (2) metal reels that fit over 3-inch plastic hubs.

Anthony Lonzo
P.O. Box 351
Pelliam, N.Y. 10803

I need a schematic and/or manual for a Heathkit FM Tuner, FM Model 2. Any information on this unit will be greatly appreciated.

Clayton J. Winkler
9201 16th Ave. South
Minneapolis, Minn. 55420

I have a Pan-Aire transistor radio, Model 613F, made in Hong Kong. It has an open primary winding in the power transformer. I need the schematic for this set and also information as to where I can obtain a transformer.

Any help on this will be appreciated.

Kyle Wilson
P.O. Box 105
Augusta, Wisc. 54722

I have a Golden Shield Model 4000 tape recorder which needs a new rubber belt. The cut length of the belt is 26-inches with a diameter of approximately 7/64 inches.

I have written the Golden Shield company and was informed they were out of business. Can someone help me find a belt this size?

Jim Talbot
201 South Eddy
Fort Scott, Kans. 66701

I would like to buy a used vectorscope/color generator comparable to the Heathkit IO-101. Either a kit or an assembled unit would be acceptable. I would need any manuals or leads included with the original kit. I would like to keep the cost under $100.00.

Edward Gebelein, Jr.
Electronic Equipment & Service Co.
Harwinton, Conn. 06790

I need the schematic for a Checkmate 25 12006 musical amplifier. This amplifier is made by Teisco Co., Ltd.

Any help will be appreciated.

Michael Meharra
2512 A St.
Liberty Boro
McKeesport, Pa. 15133

I need an IF replacement transformer for a Hallicrafter Model 409. I have written Hallicrafter but received no answer.

Arthur Krasenics
95 Henderson St.
Bristol, Conn. 06010

▲

letters to the editor

"There Still Seems to be Money in Servicing TV"

I am a retired electronic service technician. Recently, I called in another technician to service my TV. Listed below are the charges:

Service call	*$ 8.00*
Pickup and return	*5.00*
Bench work—per hour (regardless of time)	*15.00*
Replacement cost (Low-voltage condenser)	*7.00*
	$35.00

There still seems to be money in servicing TV. From now on, I'm fixing my own.

John L. Duffy
163 S. Worcester St.
Norton, Mass. 02766

Yes, Mr. Duffy, a competent electronic technician still can make a reasonable "living" servicing TV, provided he charges enough to offset his business costs and yet leave enough to provide that reasonable "living".

Recently, I had repaired three small holes about the size of a pin head in the fender of my auto. Following are the charges I paid for these repairs:

Labor	$27.00
Materials	3.00
Tax	.90
Total	$30.90

—Ed.

NATESA Attitude Toward Part-Time Technicians

In the April issue of ELECTRONIC SERVICING, Mr. Lou Rall of North Babylon, N.Y. asked for information concerning the position of the various national service associations with regard to part-time TV service technicians and dealers.

The reply which you offered was quite accurate and well stated. Professionalism and competency—not business size, volume or tenure—are the gauges used by the "voices of independent service" for measuring potential members.

The National Alliance of Television and Electronic Service Associations (NATESA) requires: (1) the availability of properly qualified technicians; (2) proper and adequate testing and servicing equipment; (3) accurate itemization of all bills presented to the customer; (4) proper identification to the public of the business location; (5) compliance with all local, state and federal laws dealing with home electronic servicing; (6) good personal and business character and (7) adherance to a sixteen-point code of business ethics.

Any independently operated home electronics servicing firm, full-time or part-time, which can meet the above requirements and live with the NATESA Code of Ethics is eligible—and welcome—for membership in their national, representative trade association. NATESA would be pleased to furnish copies of their professional code of ethics, membership application forms, or any other pertinent information to any interested person, upon request.

W. S. (Bob) Harrison
Secretary General
NATESA
5770 Chesapeake Blvd.
Norfolk, Va. 23513

Audio Amplifier Revisited

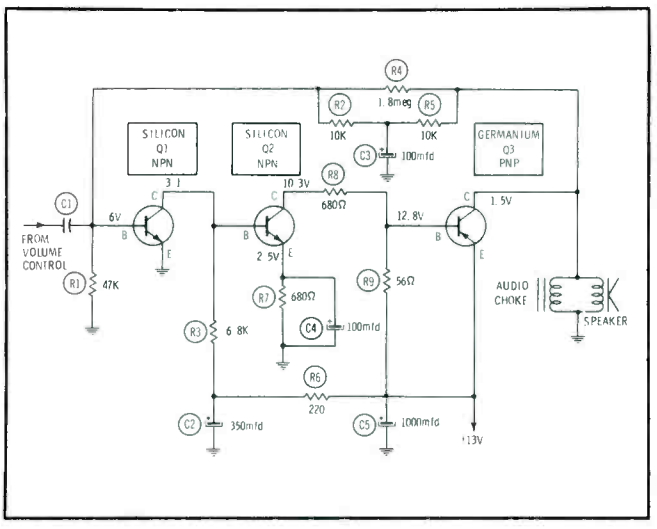
While looking through the November, 1969, issue of ELECTRONIC SERVICING, I stumbled across an article, titled "Troubleshooting Direct-Coupled Audio Circuits in Auto Radio". In this article, the author examines a DC-coupled circuit, shown in Fig. 1, page 27. He investigates this circuit by posing hypothetical problems that might occur. He asked a series of seven questions and at the end of the article he gives the correct answer.

My purpose in writing is to correct him on question 4. He claims that if R9 should open, the results are not very predictable. He also says that with R9 open, the bias to Q3 is removed and he goes on with some kind of an explanation about leakage currents, etc.

As I see it, if R9 opens, Q3 will just about saturate or at least conduct heavily. The base current to Q3 is supplied by the collector current from Q2. Under normal operation, both the base of Q3 and R9 show Q2 collector current. Q2 supplies a relatively constant current to R9 and the base of Q3. If R9 opens, the percentage of IC_2 that R9 shunts to +VEE under the normal operation will be coupled to the base of Q3. This will increase IB_3 and cause VCE_3 to increase. Admittedly, the feedback circuit (R2 and R5) will affect this condition. However, because an open R9 would cause about 50-percent change in IB_3, the degree of feedback is not enough to keep Q3 from conducting heavily. The feedback is only about 15 to 20 dB.

D. Sendowski
Hilsen Electronic Service
Burlington, N.C. 27215

Mr. Sendowski, you are absolutely correct; if R9 opens, the collector current of Q3 will increase, probably to saturation.—Ed. ▲



Servicing Consumer Electronics with a Scope

Minimum Scope Vertical Bandwidth Required

by J. W. Phipps

What Determines Which Type of Scope You Need

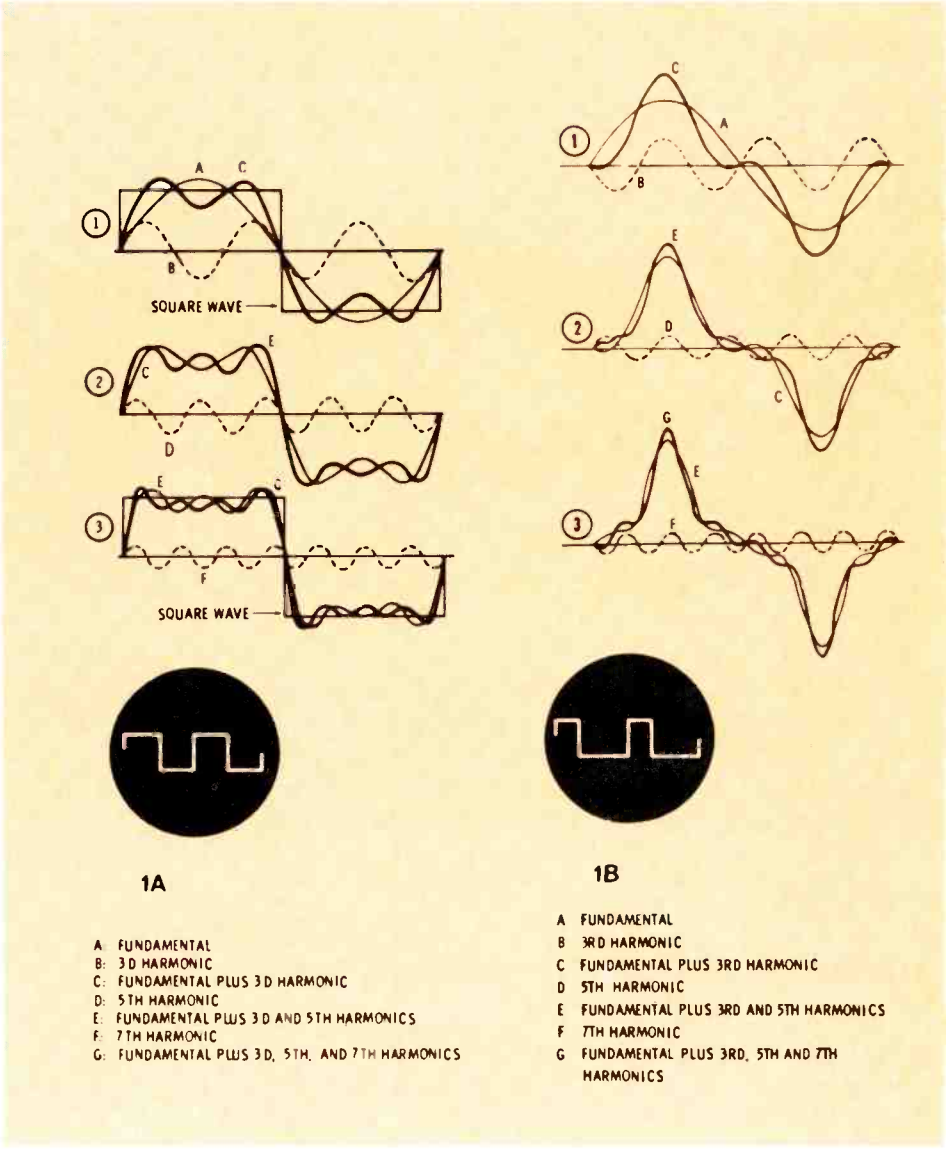
Fifteen years ago, nearly all new scopes priced within the range of consumer electronic service technicians were narrow- or medium-bandwidth, AC-coupled recurrent types with characteristics so similar that, for practical purposes, they were identical. The technician merely had to decide among **brands.**

Today, because more types of scopes with more features are priced within the range of most technicians, the choice is not so simple. Technicians now ask: "Which **type** of scope should I buy, conventional or triggered sweep? Should I buy a scope with an AC/DC-coupled vertical amplifier or one with both vertical and horizontal amplifiers capable of processing AC and DC? Or is an "AC-only" scope adequate? What bandwidth should the scope have? How sensitive should the vertical and horizontal amplifiers be?"

There is no single, universally applicable answer to any of these questions.

The characteristics of the waveforms to be observed and how accurately they must be measured to make valid judgements about circuit or component conditions determine the minimum requirements of the scope. The value of scope characteristics in excess of the minimums depends upon the skill of the technician in putting them to advantageous use, and how much he is willing to pay for any improved efficiency and/or convenience thus realized.

In the following series of articles about the characteristics, operation and application of scopes and the composition and interpretation of scope waveforms, we will attempt to provide all the information a technician needs to determine what type of scope he should buy and what characteristics and features it should have to meet his individual requirements, plus how to use it.



Scope Functions Required For Stable and Accurate Waveform Display

The primary function of any scope is to display on its screen, with sufficient detail, or clarity, an **accurate** and **stationary** reproduction of a waveform. To accomplish

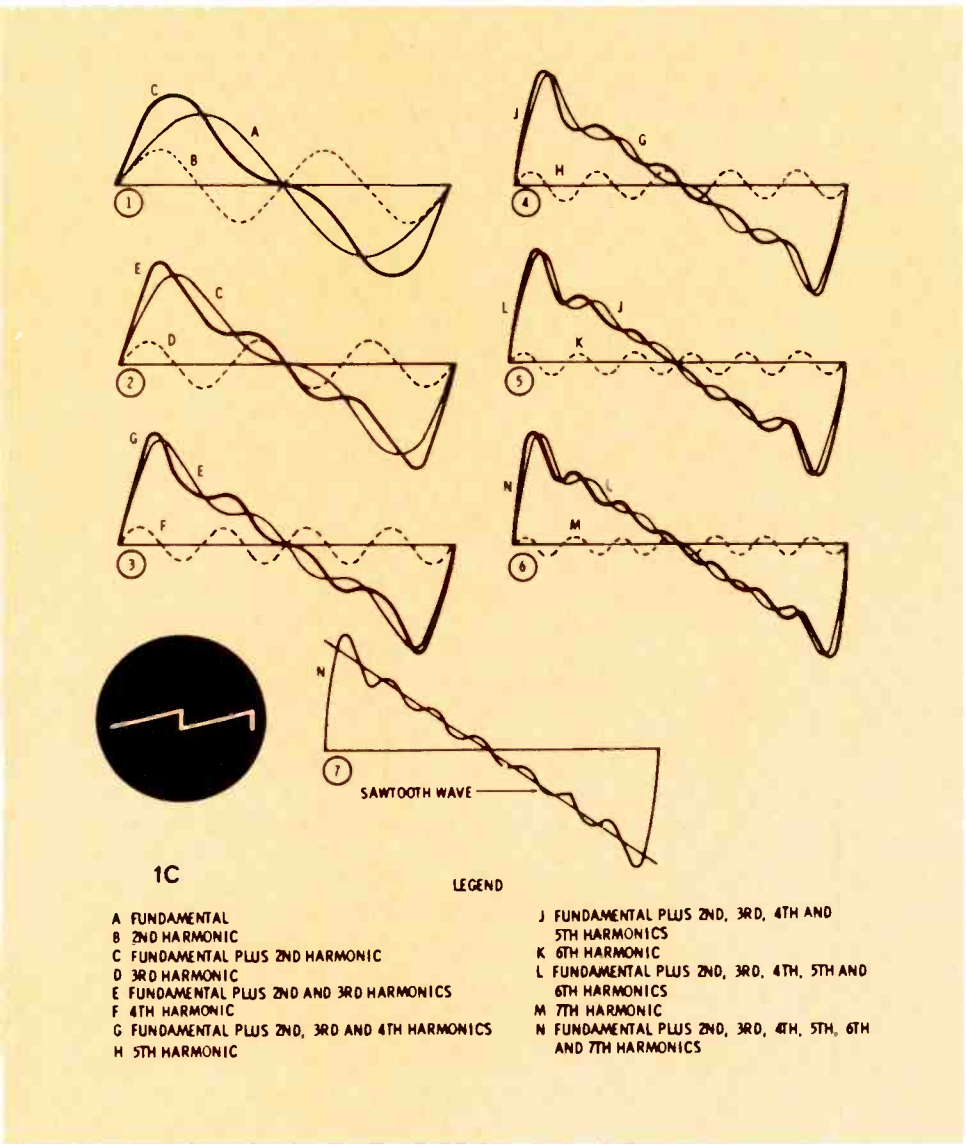


Fig. 1 All waveforms except sine waves are made up of the fundamental frequency plus various harmonics of it. (A) shows the composition of one type of complex waveform, a square wave, which contains the fundamental and related odd harmonics. (B) illustrates how one type of pulse is developed from the same frequency components which make up a square wave. Other types of pulses, such as the sawtooth shown in (C), are made up of the fundamental and both even and odd harmonics. To accurately reproduce a complex waveform, the vertical amplifier of a scope must amplify equally the fundamental and all significant harmonics of which it is composed. A more detailed analysis of the composition of waveforms will be presented in another installment of this series.

this, a scope must be capable of:

1) Accurately reproducing, for application to its vertical deflection plates, two waveforms of opposite polarity which have the same (or near-same) **shape, amplitude** and **duration** (frequency) as that of the waveform produced by the circuit whose condition is being analyzed;
2) Developing and amplifying, for application to its horizontal deflection plates, two sawtooth waveforms of opposite polarity whose **shape** and **duration** will cause the CRT beam to move horizontally and at a constant speed from left to right across the face of the CRT during the duration of the waveform(s) or portion of a waveform to be displayed, and return before the start of the next waveform.

Although **both** primary functions are essential to the accurate and stationary display of a waveform, and although there is some interdependency between the two, it usually is conceded that the accuracy with which a waveform is produced —including shape, amplitude and frequency—is affected most by the vertical amplifier section of the scope, and the stability of the display (absence of movement) is dependent most on the horizontal sweep and power supply sections.

Although there are other factors, such as horizontal sweep linearity, which affect the accuracy with which a scope reproduces a wave-

form for application to the vertical amplifiers, the most significant is the frequency response, or bandwidth, of the vertical amplifier section.

In this first installment of the series, the minimum vertical-amplifier frequency response, or bandwidth, required for servicing home entertainment electronic products will be analyzed. (Other important scope characteristics, or specifications, and features will be discussed in subsequent articles in this series.)

Waveform Composition

To understand how the frequency response of the vertical amplifier section of a scope affects the accuracy with which the shape and amplitude of a waveform are produced, you must first be familiar with the composition of the two basic types of waveforms, sine waves and complex waves, both of which are encountered in TV servicing.

Sine waves

A sine wave is the most basic of all waveforms. It contains only one frequency component—its fundamental frequency. Consequently, to accurately reproduce one cycle of a sine wave, such as the 3.58-MHz burst signal in a color TV receiver, the vertical section of a scope has to amplify only one frequency—in the case of the burst signal, 3.58 MHz.

Complex waveforms

Square and other rectangular waves (including pulses) and sawtooth waveforms, all of which also are encountered in TV servicing, are made up of a fundamental frequency and various harmonics of the fundamental, as illustrated in Fig. 1.

To reproduce with acceptable accuracy any of these waveforms, the vertical section of a scope must amplify equally, within 3 dB, the component frequencies at least up to the 15th harmonic, as illustrated for a square wave in Fig. 2, and preferably those up to or above the 20th.

For example, to reproduce with reasonable accuracy a 15-KHz rectangular waveform, or pulse, such as the horizontal sync pulse of a TV receiver, the vertical amplifier section of the scope must amplify to an equal level (within 3 dB) all frequencies from the fundamental up to about 225 KHz (15 X 15 KHz).

Fig. 3 provides further evidence of the degradation of a rectangular wave as a result of decreased amplification of the significant harmonics. (This series of photos was produced under controlled conditions in the ELECTRONIC SERVICING laboratory.) Shown in Fig. 3A is a normal rectangular waveform. Fig. 3B shows the waveform produced when the gain of the circuit was down –1 dB at the 20th harmonic of the fundamental frequency of the waveform. Note the slight rounding of the waveform edges. In the waveform in Fig. 2C, produced when the gain of the circuit was decreased to –6 dB at the 20th harmonic, rounding of the edges is very evident. Fig. 3D shows the waveform produced when the gain of the circuit was decreased to –11 dB at the 20th harmonic. Reduction of the gain 1 dB at the fundamental and 19 dB at the 20th harmonic produced the waveform in Fig. 3E.

From the preceding, it is evident that a scope equipped with a vertical amplifier section which will amplify to equal levels (within 3 dB) all frequencies from DC to 4 MHz will accurately reproduce one cycle

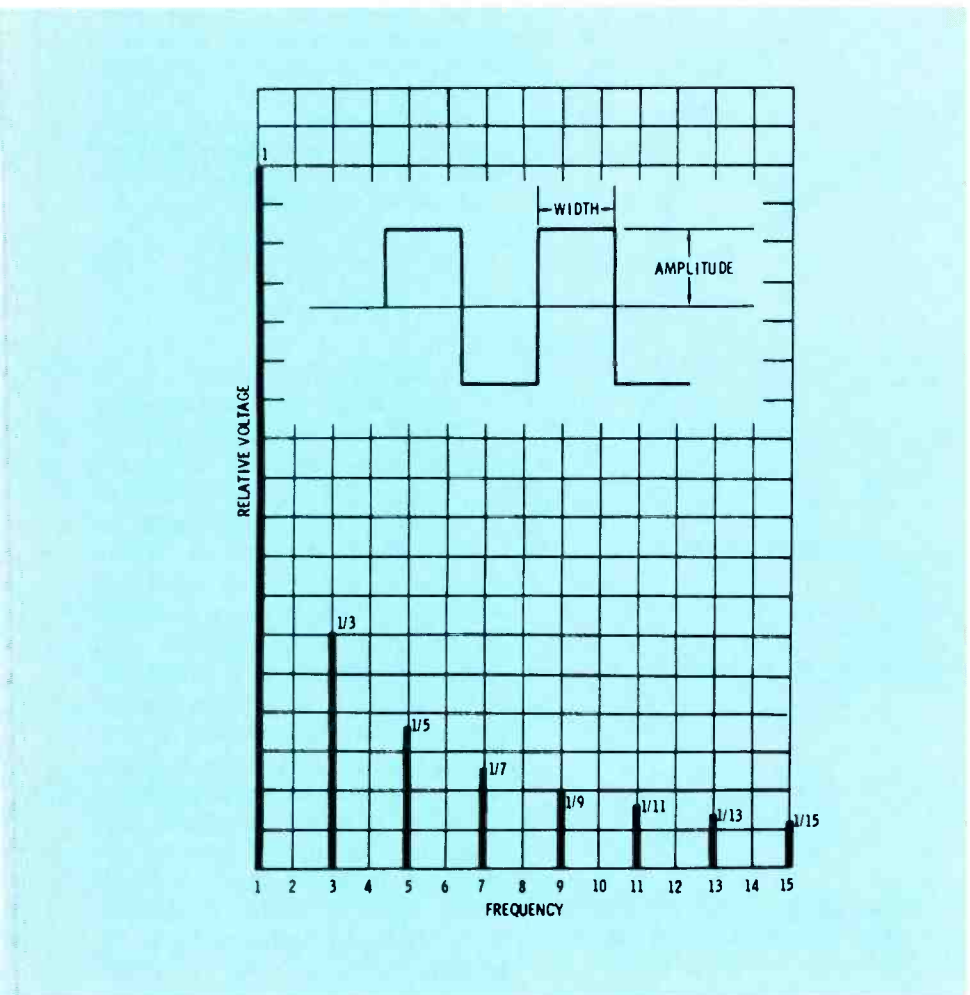


Fig. 2 The graph here illustrates the fundamental and harmonic components of a square wave which must be amplified equally to retain the shape and amplitude of the original waveform. Also shown are the relative amplitudes of the components of the square wave which must be retained.

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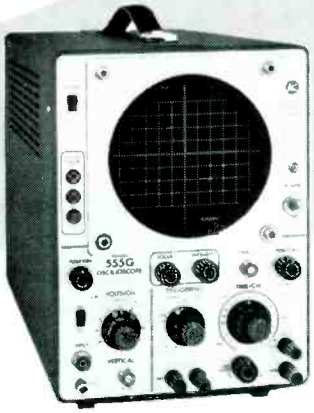

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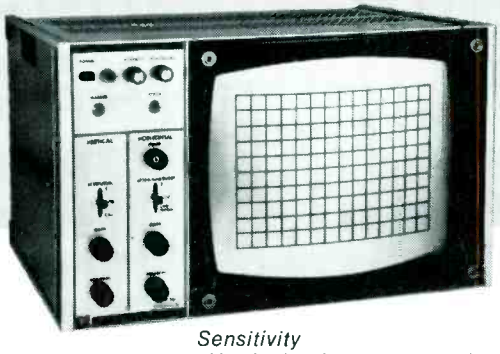

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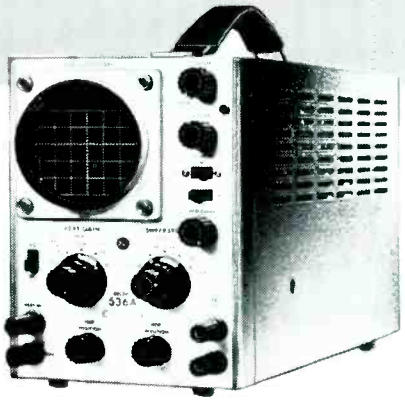

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Accuracy: ±5%
Expansion: 5x

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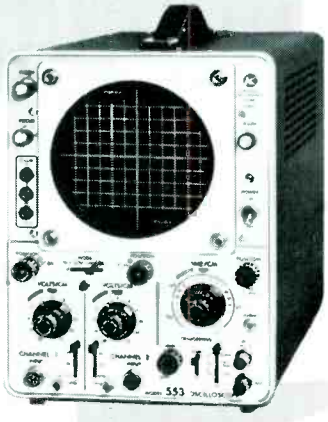

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of a 3.58-MHz TV color burst signal, because it is a sine wave and, consequently, is made up of only one frequency component, the fundamental, which, in this case, is within the bandwidth of the scope. However, the same scope will not reproduce with acceptable accuracy a 1-MHz square wave, because the square wave is made up of the fundamental frequency plus odd harmonics, of which those above the fifth are beyond the bandwidth of the scope. Consequently, the reproduced waveform would be distorted, as shown in the fourth photo of Fig. 4B.

The other waveform photos in Fig. 4 show the degree of accuracy with which scopes with bandwidths of 100 KHz, 4 MHz and 15 MHz reproduce square waves with fundamental frequencies of 60 Hz, 10 KHz, 100 KHz and 1 MHz.

The shape and amplitude of a complex waveform also is affected by how equally the **subharmonics** are amplified.

Tests conducted in the ELECTRONIC SERVICING laboratory reveal that, to avoid significant distortion of the shape of the waveform, equal amplification should occur down to 1/10th the fundamental frequency of the complex waveform. The waveform photos in Fig. 5 provide evidence of this fact. The rectangular waveform in Fig. 5A is normal. The photo in Fig. 5B reveals that some distortion is evident when the gain of the 10th subharmonic is decreased 1 dB.

Scope Vertical Amplifier Frequency Response (Bandwidth) Required for Servicing Home Entertainment Electronic Products

As implied previously, the wider the bandwidth of the vertical section of a scope, the more accurate and clearer, or more detailed, will be the waveform displayed on the screen. However, there is a limit beyond which increased upper bandwidth has no practical value for consumer electronic servicing.

Conventional troubleshooting procedures do **not** require direct visual examinations of the contents, shapes

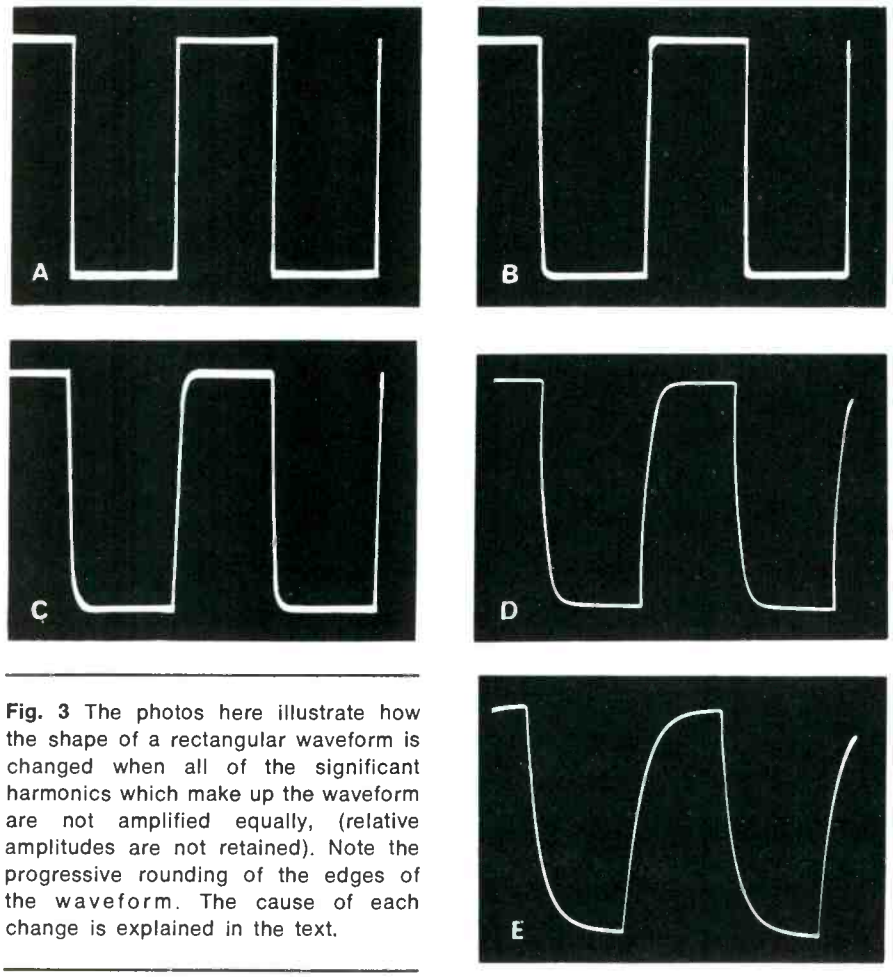
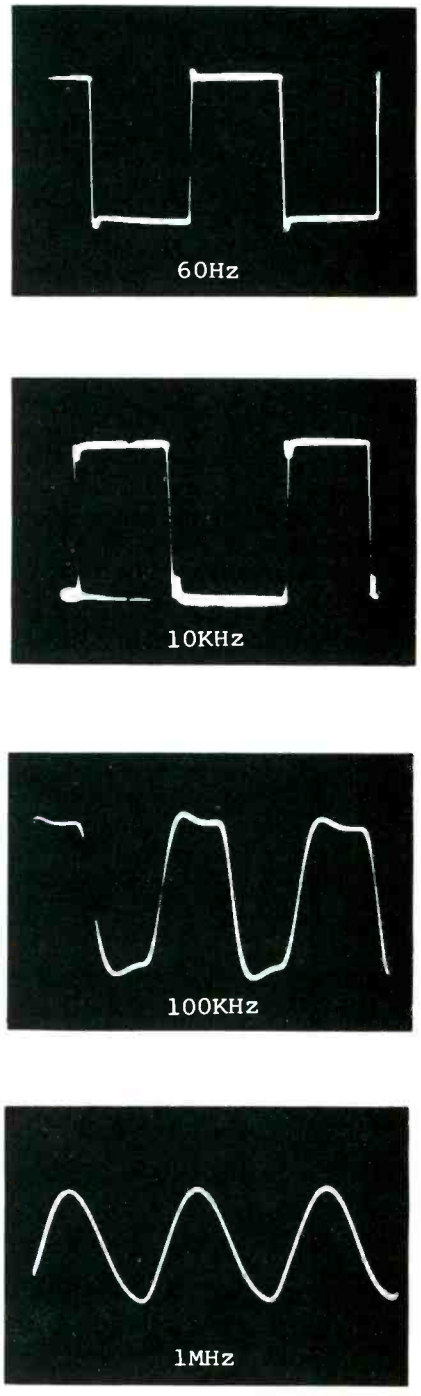


Fig. 3 The photos here illustrate how the shape of a rectangular waveform is changed when all of the significant harmonics which make up the waveform are not amplified equally, (relative amplitudes are not retained). Note the progressive rounding of the edges of the waveform. The cause of each change is explained in the text.



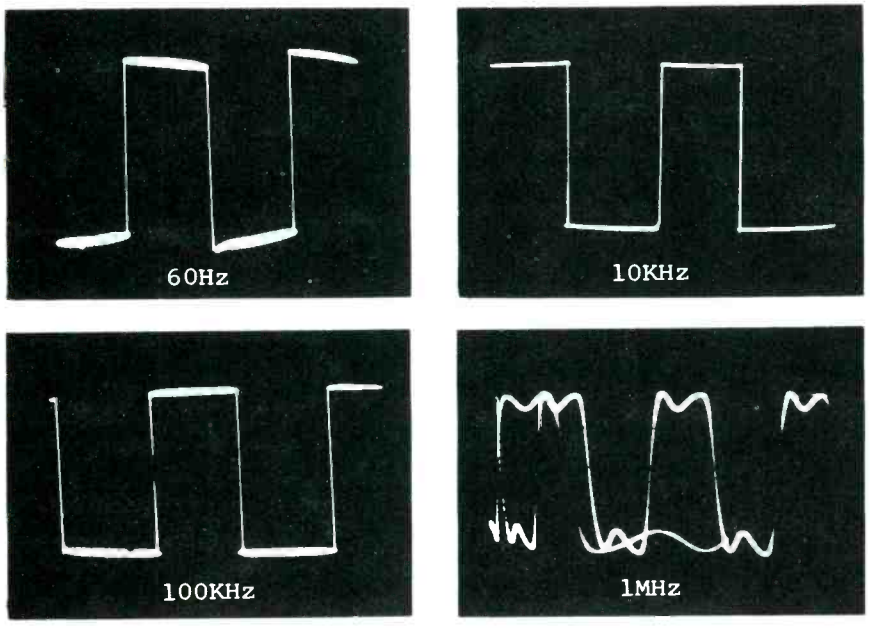
(A) Response of a recurrent 100-KHz.

and amplitudes of **all** the waveforms generated or processed by a color receiver.

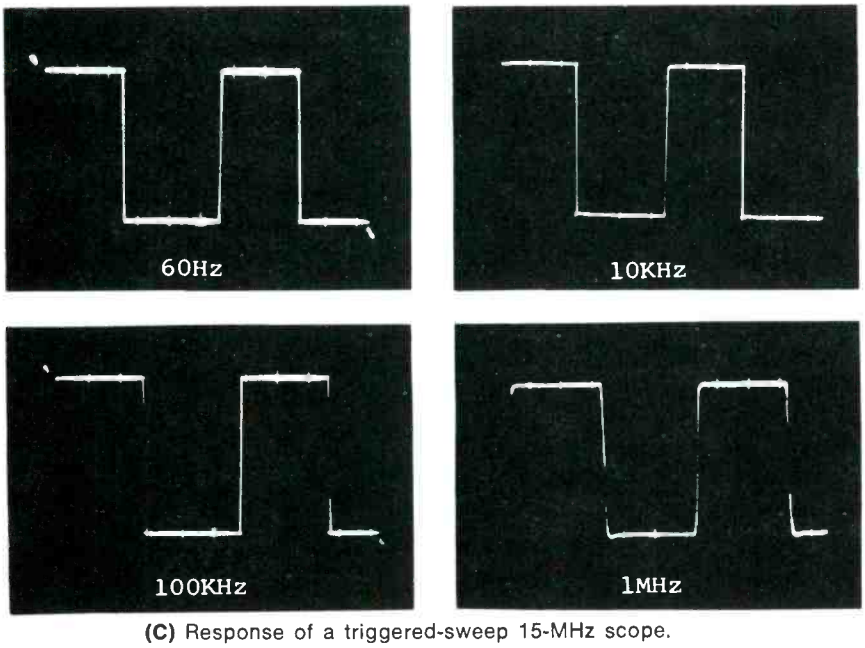
The waveforms normally **not** examined directly with a scope are the RF carrier portions of the modulated RF input and output of the RF amplifier in the tuner, the unmodulated RF output of the local oscillator in the tuner, and the RF carrier portion of the modulated RF signal processed by the video IF stages.

Representatives of the waveforms whose shapes, amplitudes and contents normally **are** examined directly on the screen of a scope are shown in Figs. 6 and 7.

The composite waveforms in Figs. 6A and 7A illustrate the waveform components and the related highest and lowest frequencies involved in the acceptable reproduction or processing of color TV waveforms by a scope. Both waveforms were obtained at the output of the TV video detector, which removes the composite video signal from the RF carrier, which is amplitude modulated. (The same composite waveforms, with different amplitudes and polarities, also can be obtained at the output of the mixer in the tuner or at the grids or plates of the video IF amplifiers, if a demodulator probe is used. The demodulator probe performs the same function as the video detector in the TV; however, because the loading effect of such probes upsets the characteristics of the circuit to which they are applied, and because the amplitudes of the signals in the stages prior to the video detector in the receiver are substantially less, the composite waveforms will be distorted and will lack detail. More detailed information about the functions, selection, applications and effects of probes will be presented later in this series.)



(B) Response of a recurrent 4-MHz scope.



(C) Response of a triggered-sweep 15-MHz scope.

Fig. 4 The photos of the waveforms here show how accurately scopes with various vertical amplifier bandwidths reproduce square waves with fundamental frequencies of 60Hz, 10KHz, 100KHz and 1MHz, respectively.

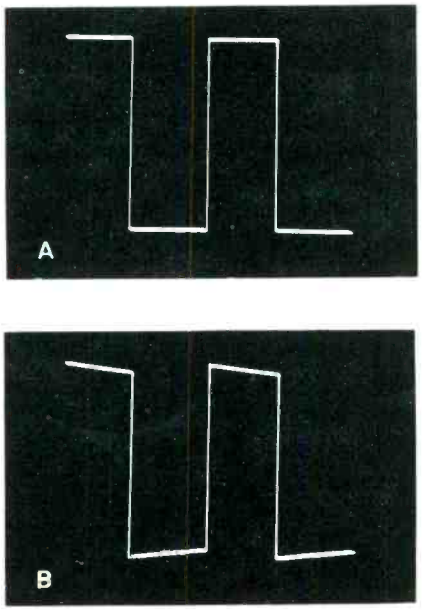


Fig. 5 Unequal amplification of subharmonics also changes the shape of a waveform, as illustrated by these two photos. **(A)** Normal rectangular waveform. **(B)** Distorted rectangular waveform produced when the gain of the 10th subharmonic was reduced 1 dB.

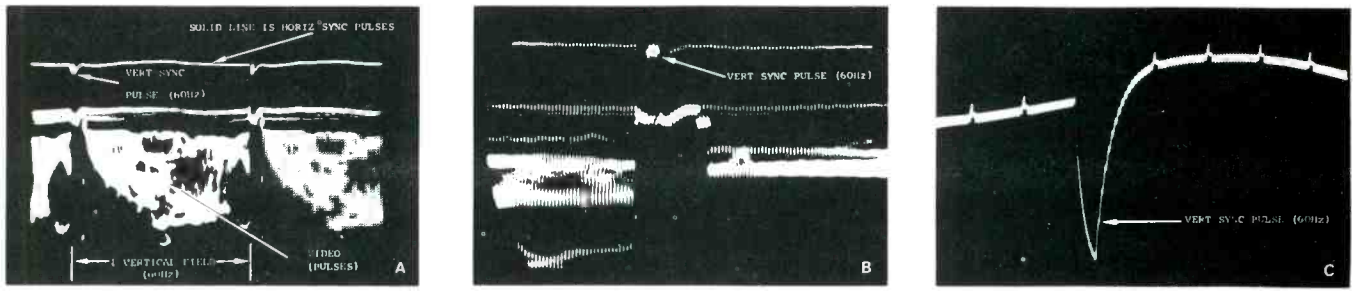


Fig. 6 Waveforms here display the TV vertical sync pulse, which has the **lowest** frequency (60Hz) of those normally displayed and analyzed in detail during conventional servicing of TV. **(A)** Composite waveform of TV vertical fields, obtained at output of TV video detector and reproduced with scope horizontal sweep rate set at 30Hz. **(B)** Expanded view of vertical sync pulse; serrations are horizontal sync pulses, which have a much higher frequency than vertical sync pulses. **(C)** Vertical sync pulse at output of vertical integrator (vertical sweep killed).

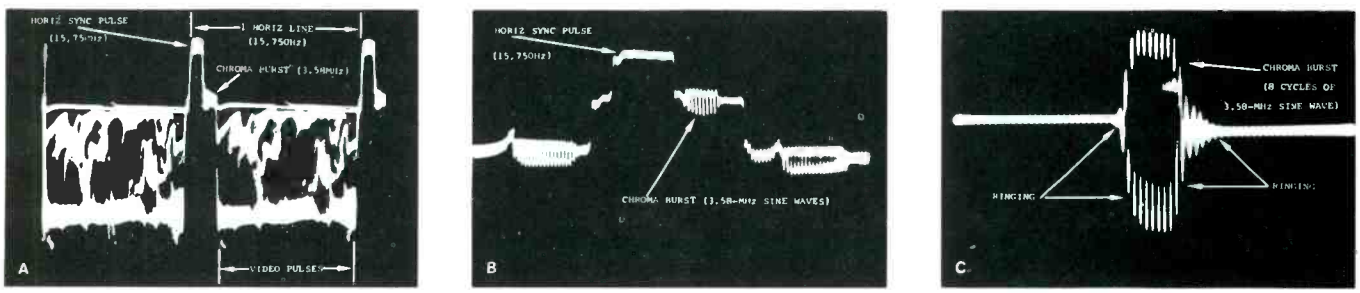


Fig. 7 Waveforms here display the chroma burst signal, which has the highest frequency (3.58 MHz) of those normally displayed and analyzed in detail during conventional servicing of color TV. **(A)** Composite waveforms of TV horizontal lines, obtained at output of TV video detector and reproduced with scope horizontal sweep rate set at 7,875 Hz (one-half TV horizontal frequency). Chroma burst signal is positioned on "back porch" of horizontal blanking pulse. **(B)** Expanded view of horizontal blanking and sync pulse and chroma burst, obtained at plate of 1st video amplifier. **(C)** Expanded view of chroma burst signal at secondary of burst transformer.

The components of the composite video waveforms in Figs. 6A and 7A which normally are examined in detail are the two sync signals—the vertical sync pulse in Fig. 6 and the horizontal sync pulse in Fig. 7—and the chroma burst signal, which is positioned on the "back porch" of the horizontal pulse, also shown in Fig. 7.

The actual video content of the composite waveforms in Fig. 6A and 7A normally is not examined in detail. The most detailed display necessary is that shown in Fig. 7A, which reveals the video content of one horizontal line. Larger or more detailed display of the actual video pulses is not necessary for conventional servicing of TV. The only characteristics of these pulses which are usually noted are their presence or absence and their overall amplitude relative to that of the sync pulses.

Lowest frequency

The vertical sync pulse has the lowest frequency (60 Hz) of any of the waveforms normally analyzed in detail during conventional troubleshooting of a color TV receiver. Its presence or absence in the received composite video waveform and its relative amplitude are normally determined by display of the composite waveform in Fig. 6A. How its shape is affected by the receiver circuits through which it is processed is revealed by waveforms like that in Fig. 6C, which was obtained at the output of the vertical integrator circuit.

Because the sync pulse is a rectangular waveform, it will be distorted significantly unless its harmonics, up to about the 20th and its subharmonics down to about the 10th are amplified equally, as pointed out previously in this article. Consequently, to display it without significant distortion, the vertical amplifier of a scope must have near-flat gain down to at least 6 Hz (60 divided by 10).

Highest frequency

The waveform which has the highest frequency of those normally analyzed in detail during conventional servicing of color TV is the chroma burst, which consists of from 8 to 10 cycles of a 3.58-MHz sine-wave signal. This signal is shown in the waveform photos in Fig. 7.

Although the upper frequency of the received chroma signal sidebands is higher (it is an amplitude- and phase-modulated 3.58 MHz signal whose upper sidebands extend up to about 4.1 MHz), the shape and amplitude of individual modulated or unmodulated cycles of it are not analyzed during conven-

tional troubleshooting. Instead, a keyed color-bar signal is used to indicate the condition of the chroma circuits. The demodulated keyed color-bar signals, obtained at the grids of the color CRT, and shown in Fig. 8, consist of ten 1,312-Hz pulses. Because the significant harmonics of these pulses are below the frequency of the color burst, any scope whose vertical amplifier frequency response will process the 3.58-MHz sine waves of the burst signal also will process, without significant distortion, the demodulated color-bar pulses.

Even though the chroma burst signal is not a complex wave and, consequently, does not require near-equal amplification of harmonics, it is still desirable for the scope vertical amplifier to have flat response out to and including 3.58 MHz.

This is because during troubleshooting the amplitude of the burst signal is used as an indication of the upper frequency response of the video IF amplifiers. If the gain of the vertical amplifier in the scope is not flat up to and including the burst frequency, the displayed waveform will not be an accurate representation of the true amplitude of the burst and, consequently, not an accurate indication of the upper frequency response of the video IF's. Such distortion is shown in Fig. 9.

Conclusion

The preceding analysis reveals that the frequencies of the sine waves and the fundamental and significant harmonics of the complex signals applied to the vertical amplifier section of a scope during conventional troubleshooting of a color TV fall within a range from 6 Hz to 3.58 MHz.

Consequently, it can be concluded that, for acceptable display of the waveforms normally analyzed to determine the condition of color TV circuitry, the gain of the vertical amplifier section of a scope must be flat within 3 dB from 6 Hz to about 3.58 MHz, although an absolutely flat response within 1 dB is preferable.

Because this range of frequencies —6 Hz to 3.58 MHz—also covers the frequencies of the signals normally analyzed during the troubleshooting of home radio and audio products and auto radio, it also can be concluded that a scope vertical amplifier section whose bandwidth meets the minimum requirements for conventional servicing of color TV also is adequate for servicing all home entertainment products. And, because the significant sine-wave RF signals of communications equipment have sufficient amplitude to permit direct application of them to the vertical deflection plates of a scope, the same scope probably also could be used for servicing most communications equipment.

Next

The minimum vertical deflection sensitivity and the minimum characteristics of the horizontal sweep system required for servicing home entertainment products will be analyzed next in this continuing series about servicing with a scope. ▲

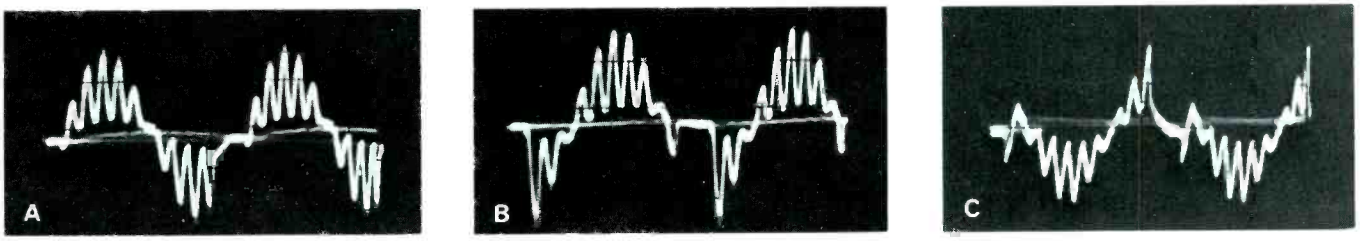


Fig. 8 Demodulated, keyed color-bar signals, obtained at grids of color CRT, consist of ten 1,312-Hz pulses. **(A)** R-Y signal at red grid. **(B)** B-Y signal at blue grid. **(C)** G-Y signal at green grid.

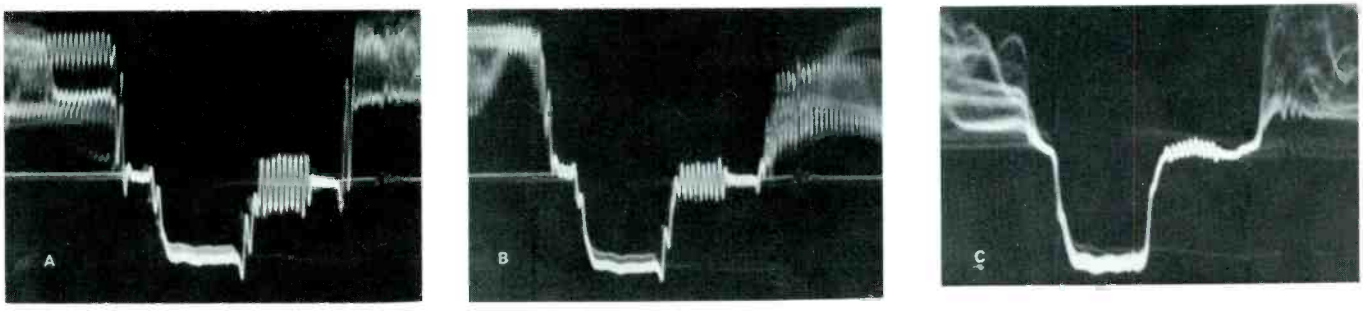


Fig. 9 If the gain of the scope vertical amplifier section is not flat up to and including the burst frequency (3.58 MHz), the amplitude of the displayed burst signal will not be an accurate indication of the upper frequency response of the TV video IF section. The photos here reveal how the amplitude of the burst is reduced by decreased circuit gain at and near the burst frequency. **(A)** Gain reduced 3.8 dB at 3.58 MHz. **(B)** Gain reduced 6 dB at 3.58 MHz. **(C)** Gain reduced 6 dB at 3 MHz.

How to Service RCA's Modular Color Chassis

by Bruce Anderson/ES Contributing Author

The concept of a modularized color TV receiver is not new. Motorola has been marketing their "Quasar" for more than three years, and Zenith has made a lot of progress in the same direction. Now, RCA has announced their two entries in the field: the CTC 49 portable chassis and the CTC 46 console version.

With three of the largest manufacturers committed to modular construction, it seems likely that more will follow.

RCA's Approach To Modularization

RCA decided to use modules in a portable before they tried it in a console, and so the 18-inch "Argosy" was introduced last September. In March of 1971, RCA took the wraps off its console version—the CTC 46.

In many respects, the two chassis are identical—same IF/AFT, sound demodulator, video amplifiers and drivers, chroma demodulator, and deflection oscillators. A total of nine modules are used to perform these functions. (There are three video drivers.)

One other module, the chroma bandpass amplifier and reference oscillator, is very similar in both chassis, but not interchangeable.

The power supply modules, which contain the rectifiers, but not the filters and transformers, are different; and the CTC 46 has one additional module for audio output.

The block diagram of the CTC 49 chassis in Fig. 1 shows the function of each of the modules.

Tuner and IF Amplifier

The tuner is a relatively standard four-tuned-circuit type, using a MOSFET RF amplifier and a cascode mixer. The principal difference between this tuner and the ones used by RCA in earlier solid-state receivers is the way the output is coupled to the IF amplifier. In the past, the output tuning of the mixer and the input tuning of the first IF amplifier were interdependent; replacing the tuner usually made it necessary to do some realigning.

As shown in Fig. 2, the tuner output in the CTC 49 is terminated in 50 ohms, and the IF input is terminated in a like impedance. This makes it possible to realign or replace either the tuner or the IF module without aligning the other.

Resistor R3 in the IF module (MAK 0001A) is partially shunted by a tuned circuit, making the impedance considerably less than 22 ohms. The tuned circuit parallel with R4 also reduces the impedance to ground to much less than 33 ohms. Thus, the total impedance from the input terminal of the module to ground is about 50 ohms. Looking backwards into the tuner, R1 appears in series with a series resonant circuit of very low impedance, making the output near 50 ohms. The length of the coaxial cable is not critical, because both ends are correctly terminated.

Fig. 3 is a simplified block diagram of the IF module (MAK 001A). It has two integrated circuits and two transistors. Whether or not this unit should be serviced depends on the individual technician, but it is doubtful if any repairs except obvious or minor ones should be attempted. If either transistor fails, or if there is a visable defect, an economical repair might be possible. On the other hand, if the trouble is not diagnosed within a few minutes, and is not a minor defect, it probably is better simply to replace the module.

If there is trouble in the "receiving" section of the set, the problem could be either in the tuner or the IF amplifier. A quick check is to substitute the module, which takes about thirty seconds, after the cabinet back is removed. If a spare is not at hand, try connecting a small capacitor between the input terminal (from the tuner) and the 4.5-MHz output terminal, preferably with the IF module removed from its socket. (If the input contact is the third from the top, the 4.5-MHz output contact is ninth from the bottom.) Normally, this will allow you to hear the sound portion of a telecast, because there is a lot of reserve gain in the tuner and the sound demodulator module. If no sound is produced, it is probable that the tuner, rather than the IF module, is defective.

Sound System

Two modules are used in the sound system of the CTC 46, one for demodulation and the other for audio output. In the CTC 49, the latter module is replaced by on-the-chassis transistors.

The sound demodulation module, PM 200, has been used previously in the "40" series of RCA portable chassis, and can be interchanged without readjustment.

If the sound is weak, distorted, or noisy, readjustment of the two tuned circuits of the demodulation module might be necessary. Simply tune the receiver to a weak station (remove the antenna lead-in, if necessary, to reduce the input) and adjust both cores for maximum output and minimum distortion.

An unusual feature of this module is the way in which volume is controlled. The volume control varies the bias of an amplifier within the integrated circuit, rather than "dividing" the audio signal. Because of this, no audio is present at the volume-control terminals; nor can a signal be injected from this point.

In the CTC 49, the output of the sound module is fed through a driver stage to a single-ended output transistor, which is coupled to the speaker through an output transformer.

In the CTC 46, the driver and output transistors are replaced by the MAN module, which has four transistors. Two of these are a PNP/NPN pair connected in a complementary symmetry configuration; they drive the speaker through a coupling capacitor.

Early production chassis of the CTC 46 design will use a MAN module with discrete components,

but it has been announced that later production units will use a throwaway ceramic module.

Chroma Circuits

The chroma circuitry is academically interesting, because integrated circuits (IC's) are used throughout (see Fig. 4).

One of the two modules does have a transistor, but it is used only as a voltage regulator. This transistor is mounted on the MAE module, but the zener regulator for its base is mounted on the MAC module. This introduces a tricky problem: If either module is removed, neither will have supply voltage.

The first of the chroma modules, called MAC, contains two stages of chroma-bandpass amplification, the burst amplifier and oscillator, plus the killer and ACC circuits—all inside one IC. Also in the chip, but with no connections to the other circuits, is a 12-volt zener diode, which provides the reference voltage for the voltage regulator mentioned previously.

This module comes in two slightly different versions: the MAC 001 is used in the CTC 49, and the MAC 002 fits the CTC 46. The only difference is in the gain control circuit, but they cannot be interchanged. The modules can be identified by the fact that the version used in the 49 has two small potentiometers on it, while the one used in the 46 has three.

Chroma adjustments

Most of the chroma setup adjustments are on the MAC module. The first is a 3.58-MHz oscillator frequency adjustment. To perform this adjustment, connect a color-bar generator to the receiver, and disable the burst amplifier and killer. (This can be done by shorting to ground test point 5 on the parent board and connecting test point 2 to +11 volts through a 50K-ohm resistor. Any resistance from 50K to 100K will do.) This will produce a barber-pole pattern which is "zero beated" (pattern upright by adjusting the trimmer capacitor physically adjacent to the 3.58-MHz crystal.

The second control is the bias adjustment for the first chroma amplifier, or ACC setup. To adjust it, leave the ground on TP 5, as described previously, and remove

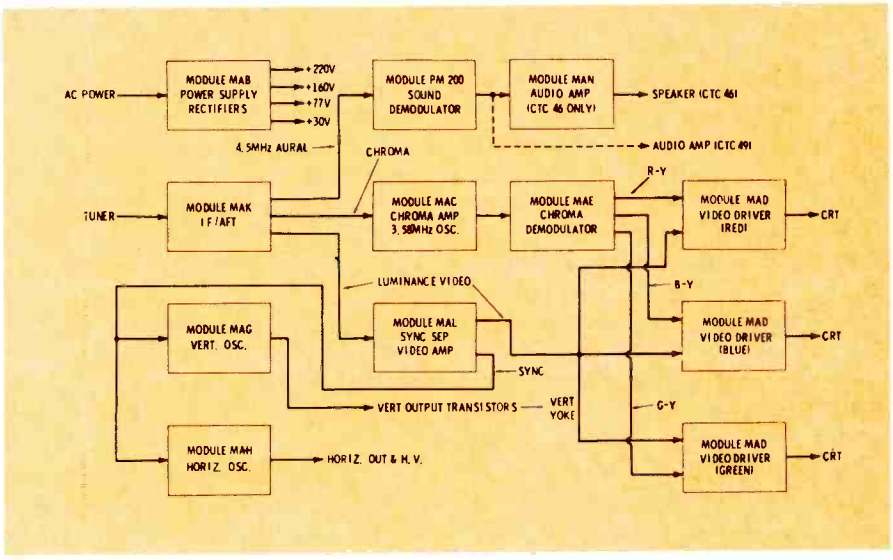


Fig. 1 Block diagram of RCA's modular chassis.

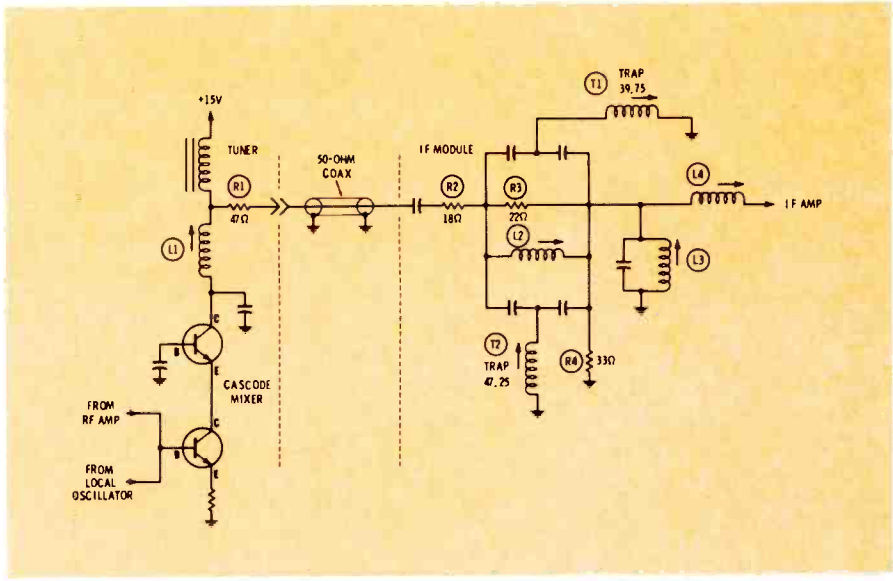


Fig. 2 Details of the 50-ohm tuner/IF link.

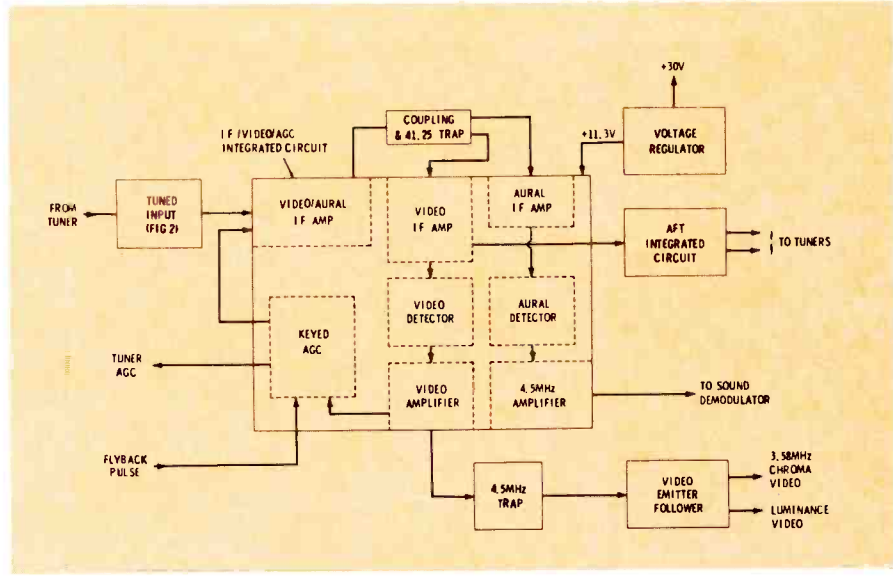


Fig. 3 Block diagram of module MAK, which contains the integrated-circuit IF amplifier, AGC and AFT circuits.

the voltage from test point 2. Then adjust the potentiometer at the rear edge of the module to produce .65 volt at test point 3 on the parent board. Remove the ground and set the killer by adjusting R7, the potentiometer just forward of the center of the module, so that color just disappears from the snow on a vacant channel. Make this adjustment slowly and carefully, because there is a lot of lag in the adjustment and it is easy to overcorrect the setting.

The –002 version of the MAC module has a third potentiometer located near the top edge. To set this one, turn the color control all the way counterclockwise and then adjust the potentiometer so that color just disappears from a normal color picture. This pot is essentially a ranging control for the color control on the front panel. This adjustment must be made with the "AccuMatic" switch turned off (AccuMatic will be discussed next).

The MAE module has only one adjustment, labelled L1. Preferably, this adjustment should be made while monitoring a rainbow color-bar pattern on the screen, but it can be done while watching a color-cast. Simply adjust L1 so that normal flesh colors are obtained at the center of the range of the tint control. Again, AccuMatic must be turned off while making the adjustment.

The AccuMatic Circuit

This year many TV manufacturers have decided to "put some frosting on the cake" insofar as the chroma controls are concerned. For a couple of years, several makers have equipped some of their sets with a demodulation-shifting circuit to produce better flesh colors. Now, they are providing a variety of systems which are designed to assure "proper" color with a minimum of effort on the part of the viewer.

In the RCA CTC 46 chassis, the ranges of the color and tint controls are restricted at the same time that the demodulation angles are shifted and the B-Y gain is decreased. All this will allow the customer to obtain reasonably good hues in the flesh-color region, regardless of how badly the controls are misadjusted. Fig. 5 shows the simplified circuits.

In the "on" position, the "A" section of the AccuMatic switch in Fig. 5 simply restricts the range of the color control by shunting a resistance across it and adding a small series resistance at one end. To adjust R4019, adjust the color control for best color with the AccuMatic switch in the "off" position; then place the AccuMatic control in the "on" position and turn R4019 until the same color level is obtained. The most difficult part of this adjustment is finding R4019. It is physically located on the front of tint control) and is accessible (hollow shaft surrounding solid shaft of tint control) and is accessible from the front panel after the tint control knob is removed.

The range of the tint control is restricted in about the same manner as the color control was, except section "B" of the AccuMatic switch is used and there is no auxiliary control to be set. If the hue is incorrect with AccuMatic turned on, readjust L1 of the MAE module.

The "C" and "D" sections of the AccuMatic switch change the axis of the B-Y demodulator and reduce the B-Y gain. There are no adjustments in either of these circuits. To check their operation, simply observe how they affect color reception.

The "E" section of the switch turns on an "AccuMatic on" indicator lamp.

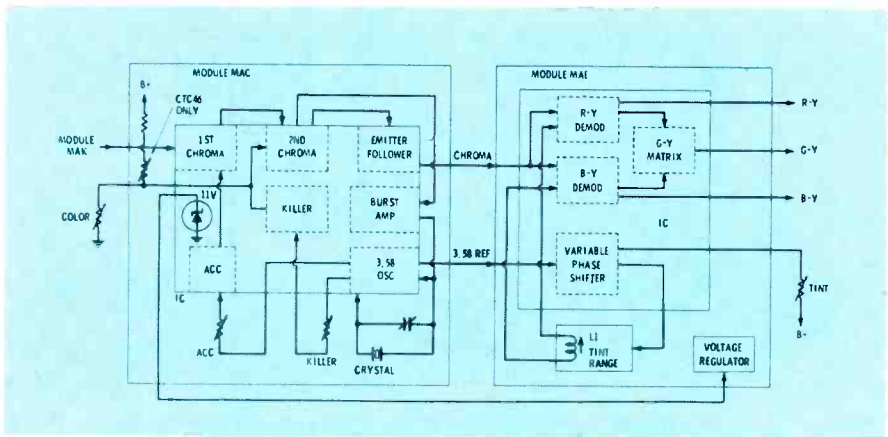


Fig. 4 Block diagram of the two chrominance modules, MAC and MAE.

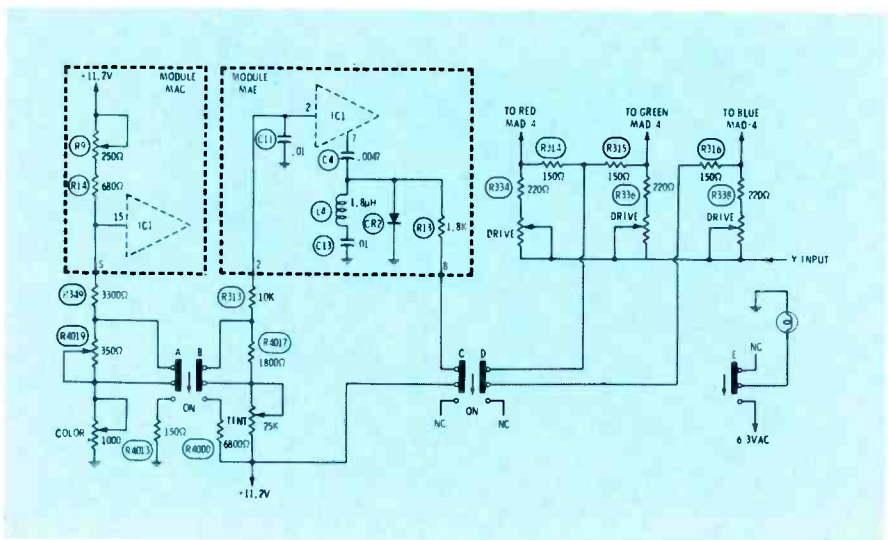


Fig. 5 Schematic diagram of the AccuMatic switching circuit used in the CTC 46 chassis.

Luminance Circuits

The luminance video signal from the IF/AGC module is fed to the video-amplifier (MAL) module. This module contains the sync separator, the delay line and two video stages, which actually are used more as processing circuits than amplifiers. Discrete components are used throughout the MAL module.

The amplitude of the video input

to the module is about 6 volts, but the amplitude of the output is only about 3 volts.

The video input signal drives both the sync separator and the delay line. The output of the sync separator is fed from this module to the vertical oscillator and horizontal oscillator, each of which is on its own module. The output of the delay line drives the sync separator.

The 1st video amplifier circuit is shown in Fig. 6. The contrast control, located in the emitter, controls the amount of degeneration.

An unusual feature, shown in the shaded areas of Fig. 6, is the use of a peaking circuit on each side of the contrast control, to maintain the same degree of peaking, regardless of the setting of the contrast control.

Horizontal and vertical retrace blanking pulses are injected into the collector circuit of the first video amplifier. Because both of these pulses are positive going, they drive the level of voltage on the collector to B+ during blanking time.

Because the output of the 1st video amplifier is capacitively coupled to the second amplifier, a fault in the first stage will not normally produce a radical change in brightness level.

The 2nd video amplifier, shown in Fig. 7, is an emitter follower which drives the CRT driver modules. Because direct coupling is used between the base of Q2 and the CRT, defects in the circuitry between these two points can cause a change in brightness.

The brightness control and brightness limiter establish the voltage level on the base of the 2nd video amplifier, Q4.

The DC return path for the high voltage normally holds the brightness limiter saturated, providing a ground for the brightness-control circuit. If the high voltage current increases enough to cut off the brightness limiter, the whole brightness control circuit swings positive; this drives the CRT cathodes more positive, limiting CRT beam current.

The brightness limiter transistor is socket-mounted on the board PW-300. If the collector of the transistor opens, the effect is constant limiting of brightness. If it shorts, there is no limiting, and the raster will bloom if the brightness control is advanced to about mid-range. Because the transistor plugs into a socket, it can be removed and checked quickly with an ohmmeter.

The output of the MAL module passes through the service switch to three identical CRT cathode driver modules, designated MAD.

It can be seen in Fig. 1 that one of the color-difference signals also is fed to each of these modules. Within the modules, the color difference signal is combined with the luminance video to produce color video, which drives the CRT cathodes.

The outputs of the CRT cathode driver (MAD) modules are clamped to 160 volts during retrace time. Because the MAD modules are encapsulated, they are unrepairable; consequently, the internal circuitry shouldn't be of much concern to service technicians.

If one color is missing from the CRT screen, a probable source of the trouble is the MAD module for the associated CRT gun. The quick-

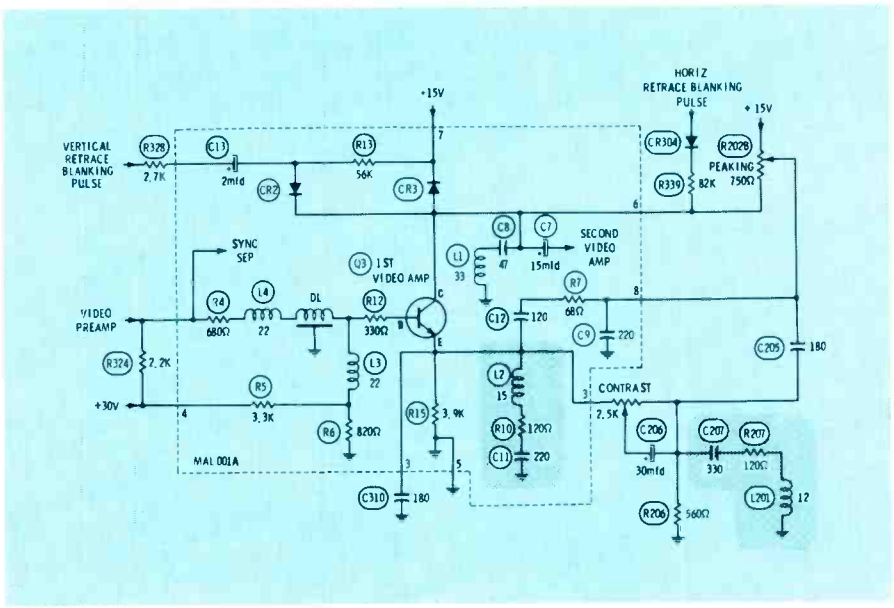


Fig. 6 First video amplifier circuit.

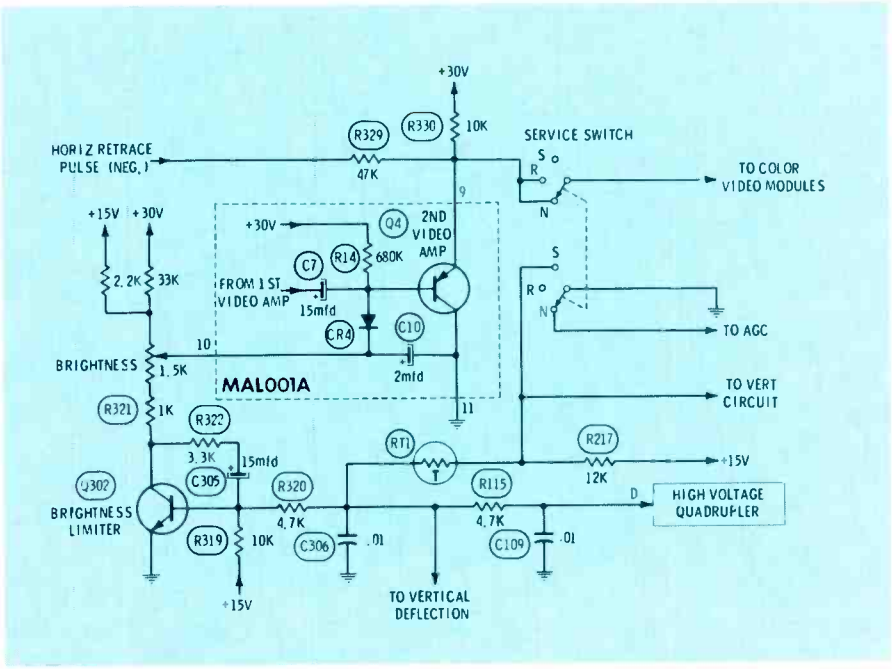
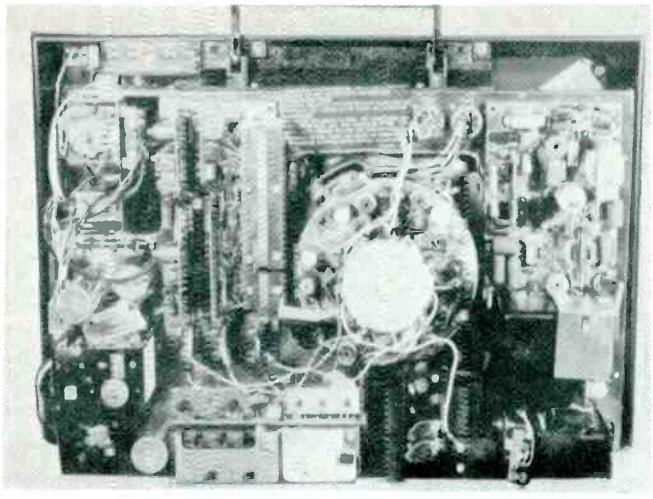
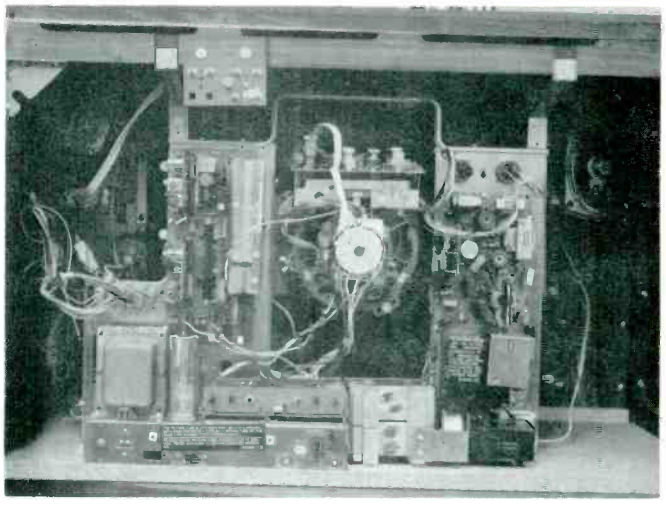


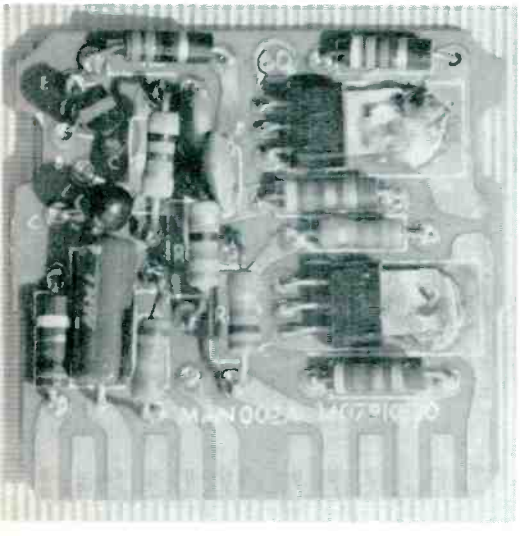
Fig. 7 Second video amplifier and brightness limiter circuits.



Rear view of the CTC 49 chassis, which is used in the EP 506 "Argosy" portable. The signal circuits are mounted on the parent board to the left of the CRT, and the deflection components are located to the right. The two vertical-output transistors and the two horizontal-deflection SCR's plug into the large heat sink. The audio output transistor is visible at the lower left.

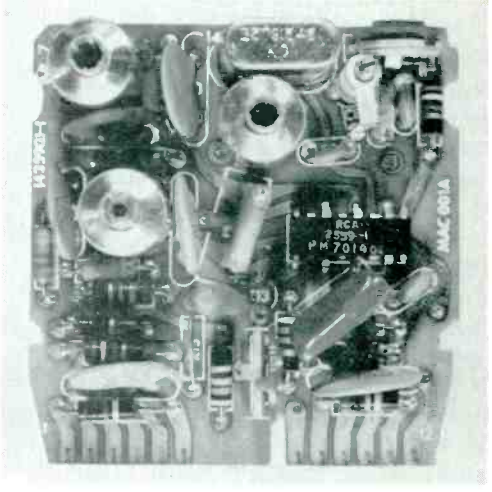


Rear view of the CTC 46 chassis. Layout of the two chassis is very similar, except that audio output is performed on a module, and the horizontal-output diodes are mounted on the parent board to the right.

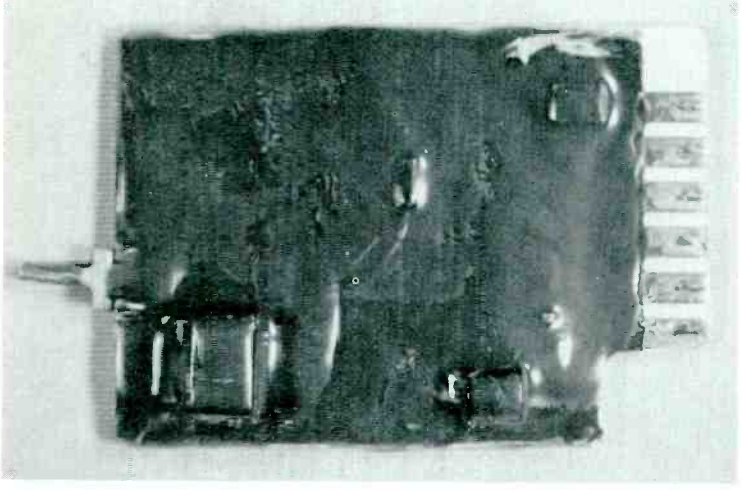


Module MAN 002A is used only in the CTC 46, replacing the chassis-mounted audio-output components of the CTC 49. RCA has announced that a ceramic substrate version will appear in later production chassis. It reportedly will be interchangeable with this one.

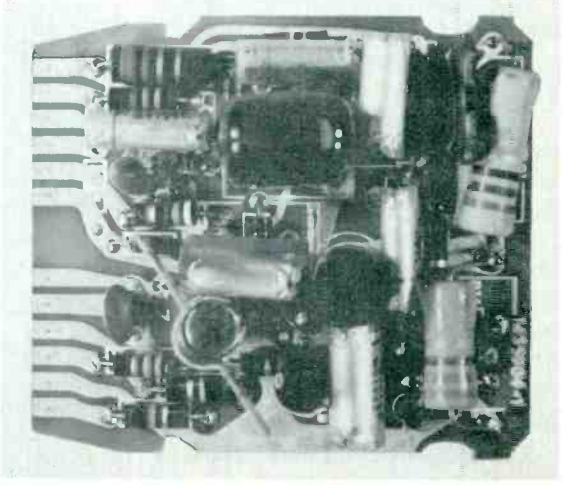
Modular Color Illustrated



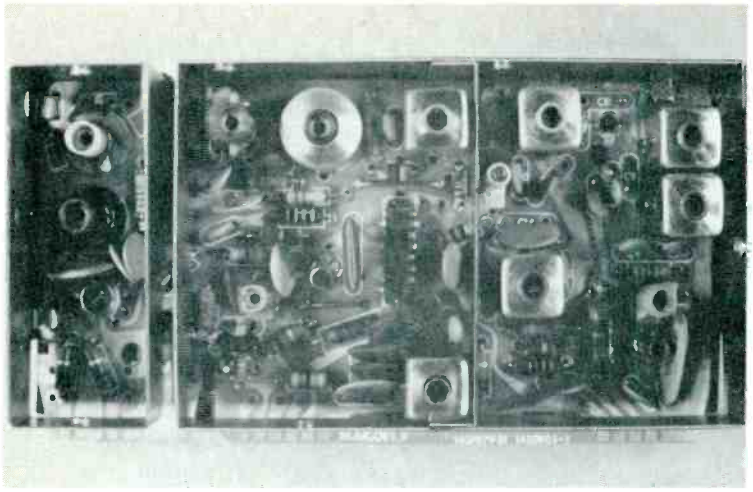
The chroma bandpass amplifiers, reference oscillator, burst amplifier, killer, and associated circuits are contained in a single IC which is part of the first chroma module. MAC 001A is used in the CTC 49 and is not interchangeable with MAC 002A used in the CTC 46.



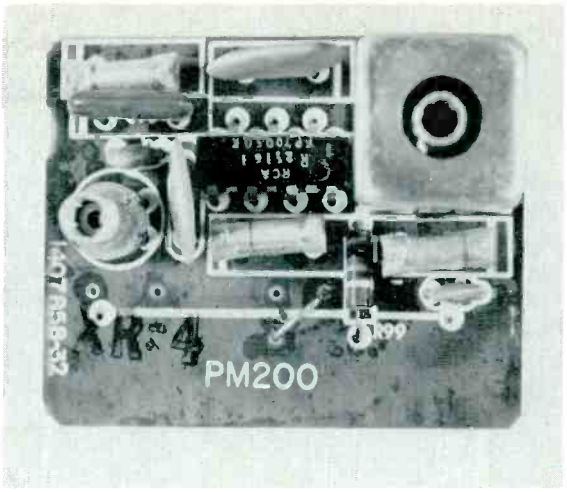
Three identical CRT cathode-driver modules (MAD 001A) are used in the 46 and the 49. Their function is to mix black-and-white video with the color-difference signals, and drive the picture tube. These ceramic-substrate modules cannot be serviced.



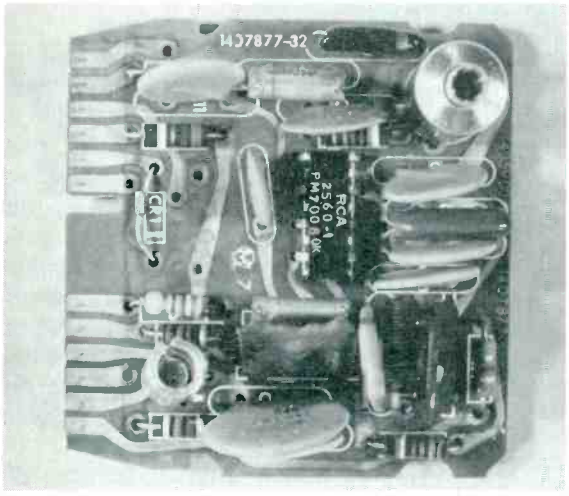
The vertical-deflection module, MAG 001A, is common to both chassis. It drives the complementary-symmetry vertical output stage, which is located on the chassis.



With the exception of the tuners, all of the "receiving" functions take place in the MAK 001A module. This includes IF amplification, video detection and amplification, AGC and AFT. The module contains two IC's and two transistors.

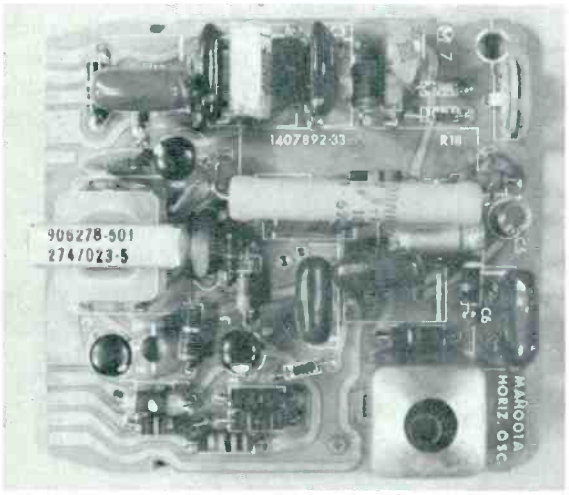


The PM 200 sound-demodulator module is used in both the CTC 46 and CTC 49, as well as in several other RCA color chassis.

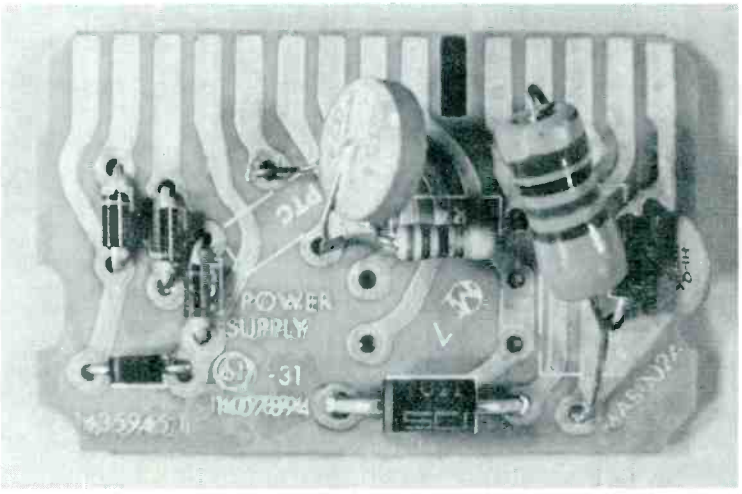


Module MAE 001A is the chroma-demodulator module for both receivers. The tint control range can be adjusted by slight adjustment of the only tuned inductor on the board.

Both chassis use the same module, MAL 001A, for video processing. This module also contains the sync separator.



Module MAH 001A is the horizontal-oscillator module for both the CTC 46 and CTC 49. The circuit is similar to the one used in RCA CTC 40 and CTC 44 chassis.



Power-supply module MAB 002A is used in the CTC 49, and module MAB 003A is used in the CTC 46. The main difference is that the -2 uses a half-wave rectifier for the 160-volt supply, while the -3 is equipped with a full-wave bridge for this function.

est way to check the modules is to interchange a pair of them.

A quick way to check the CRT guns is to swap the cathode leads; connect the red cathode to the green MAD module and the green cathode to the red MAD module, for example.

As was mentioned before, a black raster can be caused by several faults other than loss of high voltage. A quick check is to disconnect one of the CRT cathode leads from its MAD module (it is a slip-on connection) and touch it very briefly to the chassis. This will make the raster light if high voltage is present. If a cathode is to be grounded for more than a second or so, connect it to ground through a 1-megohm resistor. (Any value from about 500K to 5 megohms will do—the less resistance, the brighter the raster.)

Vertical Deflection

The vertical section uses one module, designated MAG, plus a pair of chassis-mounted output transistors. The system uses the "Miller feedback" circuit, which will be described in detail in a near-future issue of ELECTRONIC SERVICING.

The module has three transistors and four diodes; if trouble develops, it is likely that one of these will be the source of it. Also, because this is a direct-coupled circuit, including coupling from the module to the output transistors, failure of one transistor also can destroy a couple of others. Consequently, it always is good practice to check the output transistors before replacing the module. Also, check the transistors on the module before replacing the output transistors.

One of the unusual features of the CTC 46 and the CTC 49 is that they use capacitive coupling between the vertical-output transistors and the yoke, much the same as a transformerless audio-output stage. To make it a bit more confusing at first glance, the convergence circuits are in **series** with the yoke.

If you service the CTC 46 with a test jig, you can use the same one you use to test the RCA CTC 40, 44, and 47, but it is necessary to connect a jumper across the convergence-board jack of the 46 chassis, to complete the vertical yoke circuit. Also, an adapter is necessary to connect the octal yoke socket of the CTC 46 chassis to the rectangular plug of the CTC 40 yoke.

Horizontal Deflection

The module which contains the horizontal AFT and oscillator is the same for both the CTC 46 and the CTC 49. It is designated MAH 001 and plugs in near the lower right

corner of both chassis. A failure in this module probably will cause either a loss of deflection and high voltage, off-frequency horizontal sweep, or loss of horizontal sync. There are some possible failures in module MAH 001 which could cause the circuit breaker to trip, but this isn't very probable. To be sure, however, turn the instrument on with this module removed; if the circuit breaker continues to trip, the trouble is not in module MAH 001.

Turning the receiver on with module MAH out of its socket won't change anything, but it does remove the only bleeder for the 160-volt power supply. I suggest that you discharge this power supply before reinserting the module. To accomplish this, turn off the power, shunt the module socket B+ contact (top-most contact) to ground with about a 20K resistor. The resistor will prevent the arc normally produced by a short circuit. (Arcs can damage transistors, even with the instrument turned off. This is true of any solid-state equipment.)

If you have been servicing the other RCA solid-state color receivers, you won't find much that is different in the horizontal and high-voltage circuits of the CTC 46. The CTC 46 is equipped with the same circuit used in the earlier CTC 44, and most of the components are interchangeable.

The CTC 49 horizontal output system is slightly different than the CTC 44. For one thing, the 110-degree picture tube requires more deflection current, so there are some changes in component values. Also, there is a tuning adjustment for the flyback transformer, and a side-pincushion amplifier.

Tuning the flyback won't be necessary unless a component which could affect the flyback frequency is changed.

Adjusting the side pincushion is just a matter of turning the brightness up to normal viewing level and setting the side-pincushion control, located at the top edge of circuit board PW 400, for minimum bowing of vertical lines along the edges of the raster.

The side-pincushion circuit operates in conjunction with the high-voltage regulator, and a failure of the pincushion amplifier will normally affect high voltage. If the high voltage is excessive and uncontrollable, the cause is probably either a shorted pincushion transistor or an open regulator transistor. If the high voltage is low and uncontrollable, look for an open pincushion transistor or a shorted regulator transistor. Both transistors are located on PW 400, and are the only two transistors on this board.

Early CTC 49's had the high-voltage regulator transistor "heat sinked" to the flyback shield, but in later instruments the transistor is air cooled. I inquired about this and was told that replacement transistors do not require a heat sink.

Probably the most common cause of high-voltage failure will be a fault in one of the SCR's or deflection diodes. This seems to have been the case with the earlier receivers, and it doesn't appear that it would be different here. Fortunately, an ohmmeter check of these devices will normally reveal the bad one. In both the CTC 46 and the CTC 49, the SCR's are mounted on a heat sink at the rear of the chassis. In the CTC 49, the deflection diodes are stud-mounted to the chassis; in the 46, they are clip-mounted on circuit board PW-400.

In the first CTC 49's, the heat sink for the SCR's was anodized and there were no mica insulators between the heat sink and the SCR's. Apparently, this didn't work out so well, and later instruments have the mica insulators. Replacement SCR's should be installed using the mica insulators supplied with them. A good coating of heat-sink compound also should be used.

The Economics of Servicing Modules

In those modules which use integrated circuits—the IF/AGC module (MAK), chroma module (MAC and MAE), and the sound module (PM 200)—it seems a little optimistic to suppose that a module can be repaired more cheaply than it can be replaced. (Of course, because all the modules are in warranty for a year, the problem won't arise until this fall; but now is the time to be thinking about it.)

If one of these modules is defective, give it a quick inspection to detect a bad solder connection or an obvious damaged component. Also, there are two transistors in module MAK and one in module MAE which can be checked with an ohmmeter. Beyond this it is doubtful that locating a trouble in one of the modules and fixing it would be profitable.

The most costly module by far is the IF/AGC module, MAK. This one is designed to retail for about $30.00 (minus the usual dealer discount). It is probable that most failures, excluding the two transistors on the module, will involve defective IC's. To replace one of these is going to require almost an hour, at least, and then there will be the problem of realigning either the IF or the AFT, depending on which IC is replaced. This will take another half hour, at least.

With luck, repair of module MAK is going to take more than an hour, plus several dollars worth of parts. If things go wrong, the new IC could be damaged during replacement, or an off-tolerance component could damage it when the module is placed in service.

In short, with a little luck, you can expect to break even by choosing to repair an MAK module instead of replacing it.

The prospects are no brighter for profitably repairing the other modules which are equipped with IC's.

The time required to make the repairs probably will be less, but the cost of the module is about half as much to begin with. I know a lot of other service technicians who won't touch a $15.00 radio, and I tend to agree with them. The same reasons apply for not trying to repair a module of comparable price.

In the case of the modules which use discrete components, repairs might be feasible in many instances. After all, these modules are easy to work on, once they are unplugged. On the other hand, if you pull the chassis and take it to the shop, or just take the module to the shop, you are committed to a second trip, and this is bound to cost more than you can save by repairing the module instead of replacing it.

It appears that the best approach is to carry a set of replacement modules and change them in the home. I've added up the cost, and it comes to about a hundred dollars for a complete set for both chassis. (A complete set is available in a carrying case, so they aren't going to be rattling around in the truck and getting damaged.)

Conclusions

In spite of all the innovations, the RCA CTC 46 and CTC 49 are still, basically, just another couple of color TV chassis. The big differences to the service technician are that, instead of determining the general area of the trouble and then chasing down the specific component, he can simply replace the general area (the module). This means that he should be able to service several more receivers in a day's time, and hopefully, make a little more money.

To the owner of the receiver, the concept of modules means that he can expect to have his set repaired with a lot less delay—and often with less expense.

These two ideas appear to be contradictory, and in one sense they are. However, the **growing number** of color television receivers will undoubtedly continue to provide plenty of servicing for all the technicians who want to stay with it. ▲

TV Ghosts
Causes and Cures

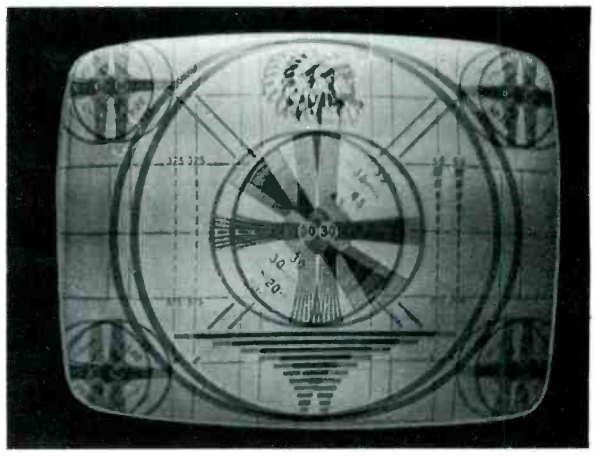


Fig. 1 A ghost caused by sync trouble.

How positive and negative, direct and indirect and single and multiple images are produced, and how they can be reduced or eliminated. **by Robert G. Middleton**

■ Many types of ghosts are encountered in practical service situations. Experienced technicians know that the cause of a ghost display might not be immediately apparent. For example, the double image illustrated in Fig. 1 could be caused by multipath reception, but actually was the result of instability and alternate locking in the horizontal-AFC/oscillator section. In this case, the possibility of multipath reception was quickly ruled out by switching the receiver to various active channels. Because the same trouble symptom appeared on each channel, it was concluded that the trouble could not have been caused by multipath reception.

Positive and Negative Ghosts

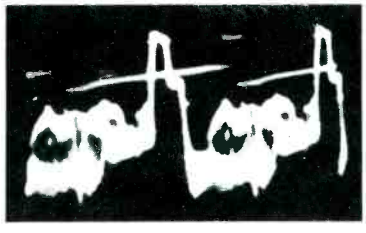
In "ghosty" reception areas, you will often observe negative ghosts. A negative ghost is the same as an ordinary (or positive) ghost, except that blacks appear as whites, and vice versa. In multipath reception, this condition results from interference that effectively reverses the polarity of the video signal, as shown in Fig. 2. However, it must not be supposed that inversion of video polarity is always caused by interference beats. For example, tuner-AFC trouble can cause vestigial-sideband distortion, resulting in trailing reversal, a close-in negative ghost, shown in Fig. 3.

When a defect is present in the tuner-AFC section, the picture carrier will not be correctly located on the video-IF response curve (Fig. 4). Instead, the picture carrier will be too high or too low on the curve. If it is much too low, most of the vestigial sidebands are removed, resulting in video-waveform distortion. This is a type of distortion that involves frequency-dependent phase shifts (envelope component time delays) which appear in the picture as a trailing reversal (technically described as a close-in, negative circuit-ghost).

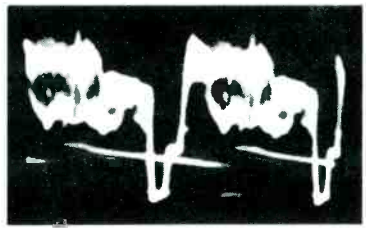
Multiple Ghosts

You also occasionally will encounter a multiplicity of ghosts (ringing), as illustrated in Fig. 5. Each successive ghost is **equally spaced** from the preceding ghost, and their **amplitudes decrease** progressively. This type of ghost display is usually caused by a sharply peaked response curve, such as shown in Fig. 6. The trouble can occur in the RF, IF, or video amplifier. In the example of Fig. 5, the symptom was caused by an undamped peaking coil in the video amplifier. An incorrect type of replacement peaking coil is the most usual source of such a defect—some peaking coils are wound on a core consisting of a damping resistor, while others are wound on a plastic core. If the latter is used to replace the former, ringing will result. Also inductance values are somewhat critical.

In the RF or IF sections, a sharply peaked response curve is usually caused by an open screen-



(A) Positive



(B) Negative

Fig. 2 Positive- and negative-going video signals.

Fig. 3 Symptom of tuner-AFC trouble.

bypass or decoupling capacitor, which permits the stage to become regenerative (oscillate). However, regeneration can also result from misalignment in the IF amplifier, when the grid circuit and plate circuit of the same tube are peaked to the same frequency (lack of stagger tuning). In solid-state receivers, an open neutralizing capacitor produces the same trouble symptom as an open screen-bypass capacitor in a tube-type receiver.

Multiple ghosts occasionally occur on very long lead-ins or coaxial cables in CATV systems. If both the input and output ends of the line are seriously mismatched, traveling waves corresponding to ghosts will be produced by successive reflections of voltage and current, as illustrated in Fig. 7. In this basic example, a battery is switched into a line which is short-circuited at one end and open-circuited at the other end. In the diagram, it is assumed that the line is lossless; however, in actual practice, successive reflections become progressively weaker. Attenuation is caused by line resistance, plus the amount of power consumed by the load. In a matched line, this attenuation is 100 percent.

Troubleshooting Propagation Ghosts

There are various ways of reducing or eliminating propagation ghosts which are caused by multipath reception. These methods are designed to improve acceptance of the direct wave, and enhance rejection of the time-delayed, reflected wave. It is interesting to note that sophisticated techniques are available to cancel a ghost signal at the receiver. However, cancellation methods are too costly for consumer use. Practical solutions are:

1) Relocation of the receiving antenna,
2) Increase of the antenna elevation,
3) Installation of a highly directional antenna,
4) Connection of receiver to a CATV system (if available).

Relocation of the antenna often is possible in rural areas, and will solve various ghost problems. For example, the antenna might be moved from the top of a house to a mast on the crest of a nearby hill. Such relocation is usually impossible in a congested urban area. However, a propagation ghost can sometimes be minimized or eliminated by a substantial increase in height of the antenna. When this approach is ineffective or impractical, a multielement Yagi antenna will often provide substantial improvement. A Yagi that is designed for single-channel reception has maximum front-to-back ratio and the narrowest forward lobe. If the existing field strength is ample, such a Yagi can be used for reception on other channels (usually it must be supplemented by a rotor).

In areas of unusually difficult reception, a CATV system might be available. This is a completely effective solution to the ghost problem; however, because of its continuing cost of operation, most customers prefer to explore the other possibilities first. "The cable" is often the only cure for UHF ghosts, which are much more difficult to eliminate than are VHF ghosts.

Ghosts in Color-TV Reception

A multipath-reception ghost of a black-and-white transmission appears the same whether it is displayed on a color picture tube or a black-and-white picture tube. On the other hand, when a multipath ghost is present on a color transmission, it often will appear similar to misconvergence on a color picture tube. This similarity is a result of the fact that delay interference causes a phase shift in the chroma signal; the phase shift, in turn, causes a change in hue.

The trailing ghost in Fig. 8 could be caused either by multipath reception or by misadjustment of the blue lateral corrector in a color receiver. Therefore, the first step is to check the reception on other active channels, or to feed the receiver with a color-bar generator.

When horizontal convergence of a Sony Trinitron color picture tube

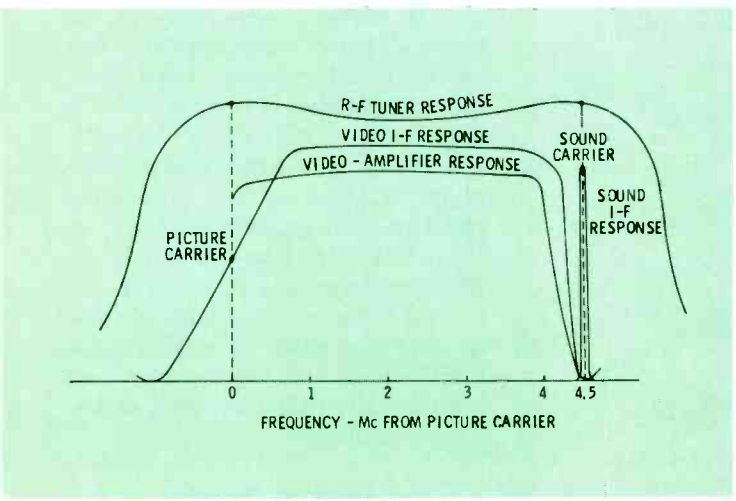


Fig. 4 Tuned-circuit responses in a television receiver.

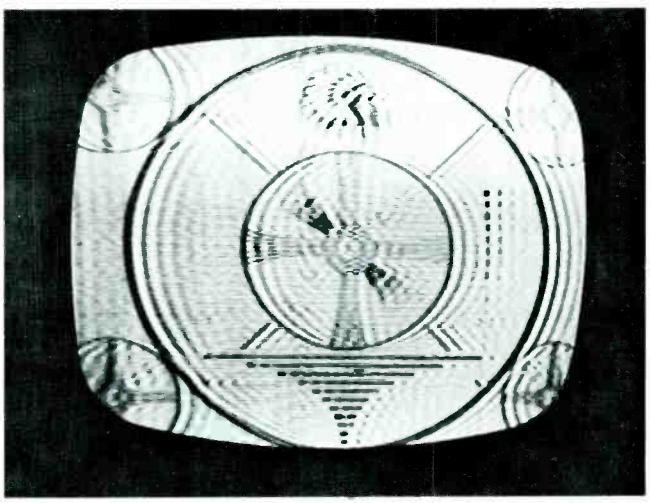


Fig. 5 A test pattern, showing the effect of transient oscillation.

is faulty, three images in red, green, and blue hues will be observed. Either one or three images must be displayed, because there is a single horizontal-convergence control. In a recent case involving a Trinitron, a triple-image display suddenly developed. It was determined that the symptom was not the result of multipath reception, because a color-bar generator display produced the same triple pattern. Nor could the misconvergence be corrected by adjustment of the horizontal convergence control. Visual inspection revealed that one terminal of a diode in the convergence section was loose, caused by a cold-soldered joint.

Next, we'll consider the characteristics of circuit ghosts occurring in the chroma section of a color receiver. One of the common trouble symptoms is poor color "fit", as depicted in Fig. 9. That is, the color image (–Y signal) is displaced with respect to the black-and-white (Y) signal. The –Y signal usually lags the Y signal (but can lead in some cases). For example, the lipstick on an actress face might appear displaced about ¼ inch to the right of the lip outlines, which appear in gray tones. This trouble can be caused by defects or misadjustments in either the black-and-white or the chroma section of the receiver. However, it is more likely to be caused by a defect in the black-and-white section.

Fig. 6 Sharply peaked video-amplifier response curve.

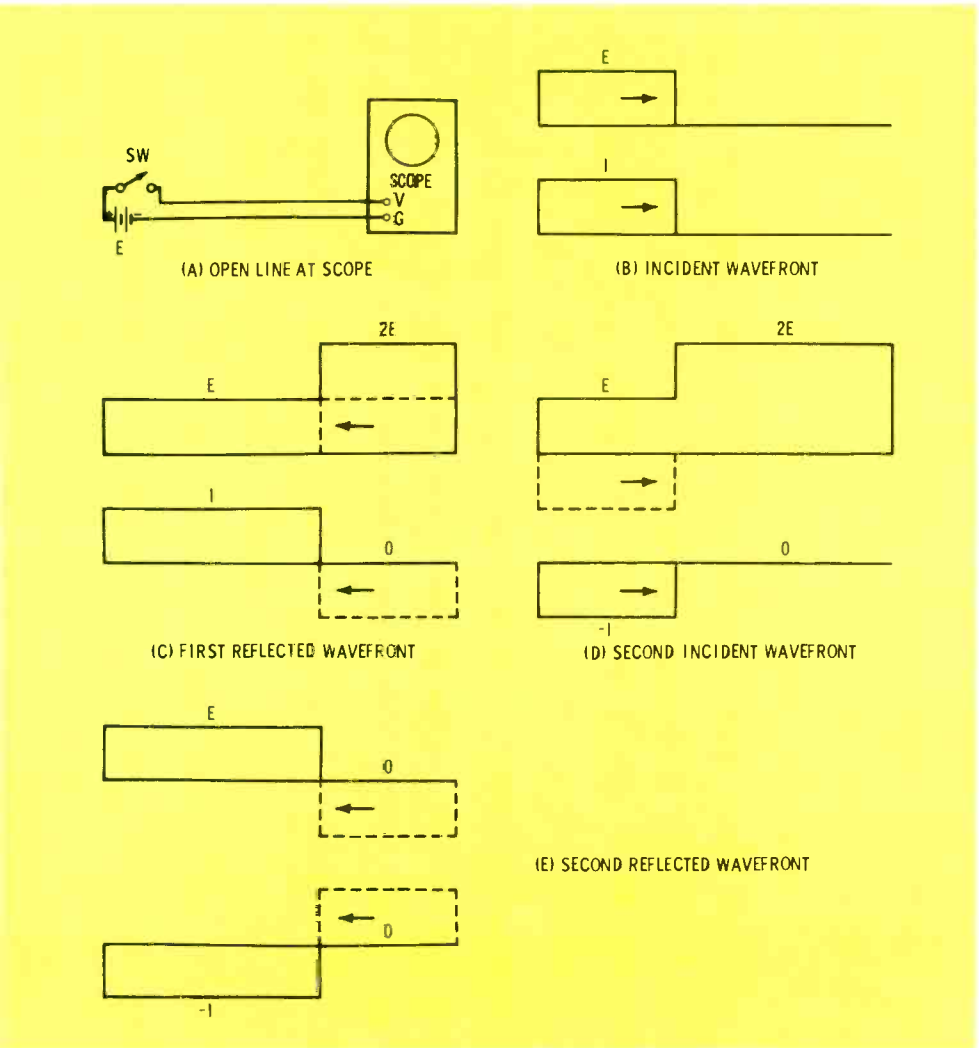


Fig. 7 Formation of ghosts on a long, improperly terminated line.

The most common causes of poor color "fit" are poor alignment of either the video IF or the chroma-bandpass sections. These tuned circuits have a certain phase characteristic, just as they have a particular frequency characteristic. Phase distortion caused by substantial misalignment corresponds to abnormal time delay, with the result that a chroma circuit ghost is displayed on the screen. Of course, misalignment can be caused by various component defects, such as open or leaky capacitors, incorrect replacement transistors, or open damping resistors. In such cases, the defective component must be replaced before the response curve specified in the receiver service data can be obtained.

Regeneration in any section of the signal channels can cause poor color "fit", because regeneration always causes distortion of the associated frequency-response curve. The usual general causes of regeneration noted previously for the RF and IF sections, also apply to the chroma section. Although delay-line trouble is not common, it can simulate regenerative symptoms when it does occur. For example, the delay line in Fig. 10 is terminated in 1803 ohms. If either of the terminating resistors substantially increases in value, the delay line will "ring" and produce circuit ghosts in the Y signal. All Y-signal delay lines produce a certain amount of ringing in a scope check, but the circuit ghosts are normally below the level of obvious visibility.

Leading Ghosts

Thus far, we have considered trailing ghosts only—that is, ghosts

that appear to the right of the direct image. However, you occasionally will encounter leading ghosts which appear to the left of the direct image. The usual cause is installation of a receiver in the vicinity of a TV transmitter. In case of a long run of line or cable, the chassis might pick up a leading signal which is displayed as a leading ghost. Multiple leading ghosts are often formed, and their intensity will change, as the technician walks about the receiver. The only cure is better shielding of the front end, and sometimes of the entire chassis.

In a recent case, I encountered a receiver which produced a leading ghost caused by pickup of radiation from a CATV cable system, while a weaker signal was intercepted directly by a pair of rabbit ears.

"Floating" ghosts occasionally are caused by radiation from the local oscillator in a nearby TV receiver. Such radiation usually produces a herringbone pattern, but sometimes develops a ghost image which floats around in the background of the picture displayed on another channel. To cure this trouble, the antennas and lead-ins should be separated sufficiently to bring the radiated signal below the threshold of visibility.

Conclusion

Experienced technicians know that multipath ghosts can be simulated by instability and alternate locking in the sync section. Negative ghosts can be caused either by interference beats or by vestigial-sideband distortion. Trailing ghosts appear to the right of the main image, while leading ghosts appear to the left of the main image. Multiple ghosts can be caused by multipath reception, by ringing in the signal channel, or by poorly installed and lengthy lead-in or cable runs. Chroma ghosts can be confused with misconvergence by less experienced technicians. Chroma ghosts can be caused by multipath reception, by misalignment, or by improper termination of the Y-delay line. "Floating" ghosts usually are caused by radiation from a nearby TV receiver. ▲

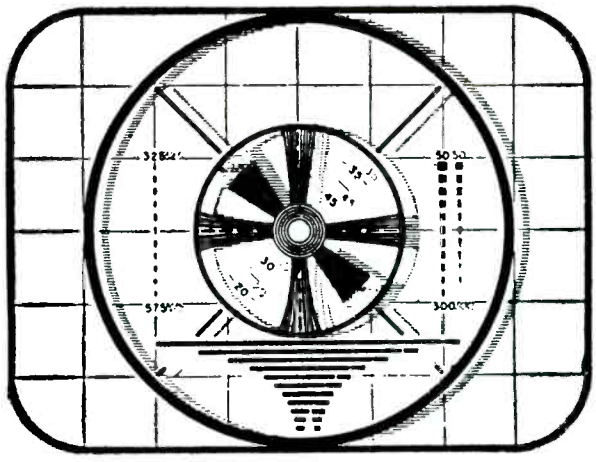


Fig. 8 A "ghost" might be simulated by misconvergence in a color picture tube.

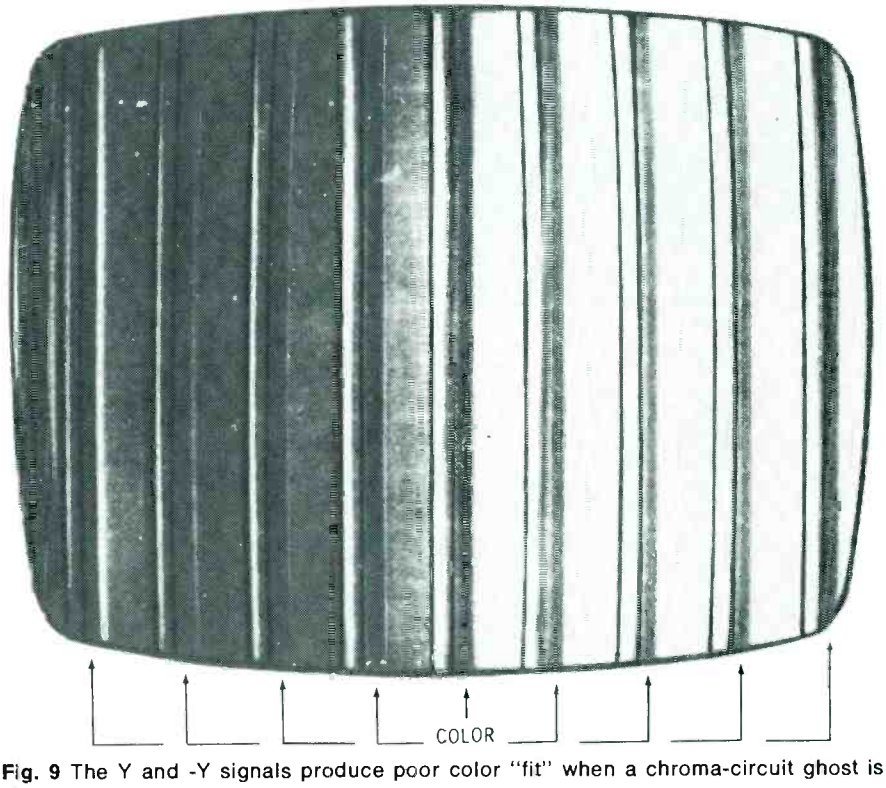


Fig. 9 The Y and -Y signals produce poor color "fit" when a chroma-circuit ghost is present.

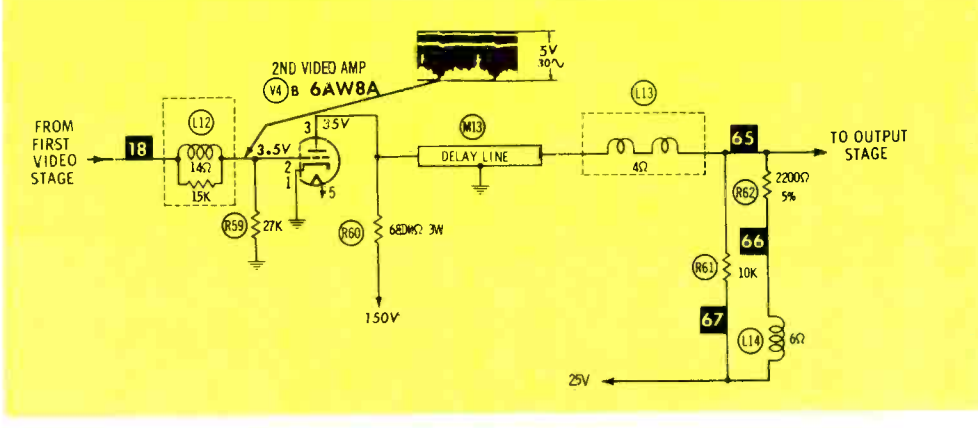


Fig. 10 The delay line shown here is terminated in 1803 ohms (R61 and R62).

test equipment report

Solid-State Triggered-Sweep Scope

A completely solid-state, wideband triggered-sweep scope has been introduced by B&K.

The new instrument, designated Precision Model 1460, is equipped with pre-set TV horizontal and TV vertical scope sweep frequencies, which are provided by a sync separator in the scope.

Other features and specifications of the instrument are:

Vertical Amplifier

Sensitivity—10 millivolts/cm to 20 volts/cm, ±5 percent, divided into 10 calibrated ranges, each with fine adjustment.

Frequency Response—DC: DC to to 10 MHz (–3 dB); AC: 2 Hz to 10 MHz (–3 dB)

Rise Time—35 ns

Overshoot—3 percent or less

Input Impedance—1 megohm, shunted by 35 pf (without probe) Maximum Input Voltage—600 volts P-P.

Sweep Circuit

Sweep System—Automatic and triggered sweep.

Sweep Time—0.5 microsec/cm to 0.5 sec/cm (±5 percent), divided into 19 calibrated ranges (1, 2, 5 steps), each with fine adjustment. Special TV-H position displays two horizontal lines and TV-V position displays two vertical fields

Magnification—5 times, at all speeds; increases maximum sweep to 0.1 microsec/cm.

Linearity—0.5 sec/cm to 2 microsec/cm ranges: 3 percent or less. 1.0 microsec/cm to 0.5 microsec/cm: 5 percent or less.

Triggering

Type—Internal, line and external.

Slope—Positive and negative.

Range—20 Hz to 10 MHz (minimum 1.0 cm deflection on CRT).

TV Sync—Sync separator circuit generates sweep synchronizing pulses corresponding to the vertical and horizontal sync pulses of complex TV waveforms.

Horizontal Amplifier

Sensitivity—300 millivolts/cm.

Response—DC to 800 KHz (–3 dB).

Input Impedance—100,000 ohms, shunted by 40 pf.

Calibration Voltage—1 KHz square wave, 5 volts P-P (±5 percent).

Intensity Modulation—30 volts P-P, minimum.

Dimension—9 inches x 10 inches x 17 inches.

Weight—27 lbs.

Power Requirements—105 to 125 VAC, 60 Hz.

Price of Model 1460 is $389.95, including a combination direct/low-capacitance probe, which in the low-capacitance position changes the input impedance to 10 megohms shunted by 18 pf of capacitance, and in the direct position changes the input impedance to 1 megohm shunted by 120 pf.

Circle 50 on literature card

Stereo Generator

The SMG-1 Stereo Generator, produced by The London Company, reportedly provides a complete source for high-quality stereo signals, with manual push-button control of the individual elements comprising the composite waveform, and offers a selection of low-distortion internal modulation frequencies, as well as external or stereo program sources.

The SMG-1 reportedly also features outputs for the pilot signal and RF, which can be attenuated from 100 mV to 10 μV.

Specifications reported by the manufacturer are:

L/R Separation—40 dB (typical KHz).

Composite Output—0 to 7 volts peak (switchable).

Pilot—19 KHz, ±2 Hz (switchable).

Meter—Pilot Level from 0 to 15 percent, 0 to 100 percent peak deviation.

Selectable Modulation Frequencies—50 Hz to 15 KHz (Standard units have 80 Hz, 1 KHz and 5 KHz to 10 KHz).

Nominal Output Impedance—75 or 50 ohms.

Price of Model SMG-1 is available on request.

Circle 51 on literature card

Triggered-Sweep Scope

Shown here is Kikusui's Model 555G wide-band, triggered-sweep scope.

Features of the instrument include a 5-inch screen, pre-set TV vertical and TV horizontal sweep frequencies, and a phase control, which is particularly useful during alignment applications.

Specifications of the scope reportedly are:

Vertical Axis

Sensitivity—0.02V/cm to 10V/cm, in 9 steps (1-2-5 sequence).
Calibration Accuracy—±3 percent (at correct line voltage).
Bandwidth—DC to 10 MHz
Rise Time—Approx. 50 ns
Input impedance—1 megohm 33 pf
Max. Input Voltage—600V P-P (DC + AC P-P).

Triggering

Synchronous System—Auto sweep and triggered sweep.
Triggering Signal—Internal, external, and line frequency.
Trigger Range—Internal 20 Hz to 10 MHz, External 20 Hz to 10 MHz.

Horizontal Axis

Sweep Range—1 μs/cm to 1 sec/cm (1-2-5 sequence) and TV H, TV V, in 21 steps.
Accuracy—±5 percent (at correct line voltage).
Line Sweep—Sine-wave sweep-Makes possible phase adjustment.
Magnifier—5 times, ±5 percent (at correct line voltage).
External Sweep Sensitivity—1V P-P/cm, 200 mV P-P/cm using 5 times magnifier. Bandwidth: (–3 dB), 2Hz to 200 KHz. Input Impedance: 1 megohm 40 pf.

Calibration

Output Waveform — Approx. 1KHz square wave.
Voltage—5/0.5/0.05V P-P.
Accuracy—±3 percent.

Power Requirement—100V, 50/60 Hz, Approx. 40 VA.

Dimensions (Max.)—8 1/12 inches. x 11⅝ inches x 17¾ inches.

Weight—24⅛ lbs.

CRT—5UP1F

Accelerating Voltage — Approx. 1.6 kV.
Z Axis Modulation—±10V P-P.
Effective Surface Viewing Area—3⅛ inches x 3 11/12 inches.

Accessories — Low-capacitance probe Type 951A, 1; Terminal Adaptor Type 941B, 1; Operation Manual, 1; Test Data, 1; Shorting Bar, 1.

Price of Model 555G is $346.00, not including low-capacitance probe type 951A, which is priced at $12.50.

Circle 52 on literature card

(Continued on page 40)

(Continued from page 39)

Solid-State VOM

A new solid-state, portable, battery-operated Volt-Ohm-Milliammeter, Model 801, has been introduced by Triplett.

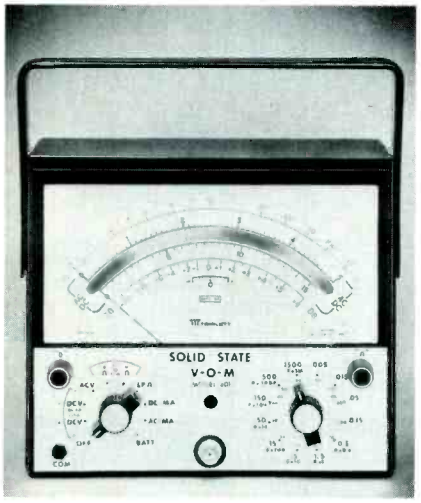
The unit measures DC voltages, resistances, AC-DC current and rms values of AC voltages. Features include: a "Low-Power Ohms" circuit for IC, transistor and other solid-state components measurements; a "Conventional Ohms" circuit with 1.5-volt battery power source useful for checking forward and reverse resistances of semi-conductors (plus offering polarity reversing function); a 1-ohm center scale; sensitivity starting at 5 mV AC, full scale; and a 10-megohm input resistance. All measurements are indicated on an 8-inch meter with a simplified scale having only 2 arcs for AC/DC volts. One small, compact test probe with built-in sliding switch is used for all DC, AC, current and ohms functions.

DC Voltmeter Ranges are: 0-.05, .5, 1.5, 5, 15, 50, 150, 500, 1500 Volts. **Accuracy** is: ±2% full scale on all ranges. Input resistance is 11 megohms on all ranges.

AC Voltmeter Ranges are 0-.005, .015, .05, .15, .5, 1.5, 5, 15, 50, 150, 500, 1500 Volts. Accuracy is ±3%. Input resistance is 10 megohms on all ranges. Frequency Range is 50 Hz to 50 KHz.

DB Measurement Range: –70 to +66 dB.

Current Measurements: 12 Ranges AC and DC. Full scale 5 μA, 15 μA, 50 μA, 150 μA, 500 μA. 1.5 mA, 15 mA, 50 mA, 150 mA, 500 mA, 1500 mA. **Accuracy:** ±3% and ±4%.



Resistance Measurements: Ranges, Conventional Ohms: X1, X10, X100, X1K, X10K, 100K, 1 Meg at 1.5 V Ranges, Low Power Ohms: X.1, X1, X10, X100, X1K, X10K, X100K, X1 Meg at 35 MV. Accuracy on all ranges is 3 degrees of DC arc.

The Triplett Model 801 reportedly utilizes a 25 μa suspension movement meter with approximately 7½ inches scale length. Power source for the portable Model 801 is three 4.5-volt Mercury or Alkaline batteries plus one 1.5-volt "D" type Carbon Zinc cell. Battery test can be made with the function selector switch.

The VOM case is constructed of black, molded phenolic. Dimensions of the new tester are 8 inches x 7 inches x 5 inches, not including the large plastic carrying handle.

Controls contained on the panel are: a 10-position function selector, 12-position range selector, 10-turn type zero adjusting potentiometer, ohms-adjust potentiometer, and a mechanical zero adjusting screw.

Price of the Triplet Model 801 VOM is $200, including shielded probe, with slide switch for AC/DC ohms functions, an input cable, a ground test lead, two alligator clips, 1.5-volt battery, instruction manual and warranty. A leather carrying case, part No. 10-2467, is available as an optional accessory for $37.10.

Circle 53 on literature card

Triggered-Sweep Scope

A wide-band, triggered-sweep scope, Model LBO-501, with the following reported specifications, is announced by Leader Instruments.

Vertical Amplifier

Deflection sensitivity—20 mV to 10 V/cm calibrated in 2-5-10 sequence in nine steps, accuracy within ±3 percent; uncalibrated continuous control between steps and up to 25 V/cm, approx.

Bandwidth—DC or 2 Hz to 10 MHz.

Rise Time—0.035 ns.

Input impedance—1 megohm/33 pf.

Max. input voltage—600 V (DC + AC P-P).

Time Base

Sweep Speeds—1 μs to 0.2s/cm, calibrated in 1-2-5 sequence, in

17 steps, accuracy within ±5 percent; uncalibrated continuous control between steps and up to 0.5s/cm, approx.

TV-Vertical: 33.3ms/10 cm. TV-Horizontal: 127 μs/10 cm.

Magnifier—X5 at any portion of displayed sweep (maximum speed, 0.2μs/cm).

Sweep modes—Triggered and automatic (recurring).

Trigger source—Internal and external, positive or negative.

Triggering level—Freq.: 50 Hz to 10 MHz; 20 Hz to 10 MHz INT: 10 mm display; 20 mm display. EXT: 1 V P-P input; 2 V P-P input.

Horizontal Amplifier

Deflection sensitivity (external input)—1 V P-P to 10 V P-P/cm, approx. with continuous control; 200mV P-P/cm with X5 magnifier.

Bandwidth (at –3 dB)—2 Hz to 200 KHz.

Calibration

Calibration voltages—0.05, 0.5 and 5 V P-P, within ±5 percent; square waveform at 1 KHz approx.

Cathode-ray tube—Type-130ARB1 (5-inch screen). Total accelerating potential: 1500 volts.

Power supply—115 V ±10 percent, 50/60 Hz; 50 VA approx. (Primary tapped for 100, 115, 200, 215 or 230 volt inputs.)

Size and weight (approx.)—10½ inches x 8 inches x 16½ inches; 21 lbs.

The price of Model LBO-501 is $339.50, including conventional and vector-pattern screen grids.

Circle 54 on literature card

Transceiver Tester

A new tester that reportedly can

check a CB transceiver's performance ten ways has been announced by the E. F. Johnson Co.

The unit is designed both for troubleshooting and for monitoring of on-the-air signals, reports the manufacturer. The tester reportedly reads true RF power output directly in watts, modulation directly in percentage, and standing-wave ratio (SWR). An audio jack allows headphone monitoring of the transmitted signal, and the tester reportedly can be installed to read received "S" units with transceivers that do not have S-meters.

Provisions for switching from the antenna to a built-in dummy load permit tests and adjustments off the air and then, without changing cables, switching to the antenna for transmitting. Built-in audio and RF generators, a crystal activity checker, and other functions make possible a variety of tests. Comparative field-strength readings of different antennas or transmitters also can be made using the built-in 42-inch telescoping whip antenna.

The tester—which is solid-state, battery operated and portable—sells for $49.95.

Circle 55 on literature card

Triggered-Sweep Scope

Lectrotech has recently introduced a wide-band, triggered-sweep 5-inch scope, Model TO-50.

Specifications reported by the manufacturer are:

Vertical Amplifier

Bandwidth—DC to 10 MHz (–3 dB).

Rise Time—35 ns

Sensitivity—0.02 volts/div. to 50 volts/div., in 2-5 sequence, with continuously variable gain control.

Input impedance—1 megohm in parallel with 30 pf.

Maximum input—600 volts (DC and AC P-P).

Horizontal Sweep Generator

Sweep Speeds—0.02 sec/div. to 1 μ sec/div. in 1-2 step sequence. Continuously variable control between ranges. With 5X magnifier sweep speed increases to 0.2 micro sec/div.

Magnifier—5X magnifier provides magnification at all sweep speeds.

Triggering

Sources—Internal, External and Power Line.

Type—Automatic or triggered, amplitude selection with Trigger Level control, with pre-set Stability.

Slope—(+) or (–), switch selected.

TV Sync—Vertical, Horizontal and Normal sweep positions.

Sync separation plus vertical integrator.

External Horizontal Amplifier

Bandwidth—DC to 0.5 MHz.

Sensitivity—0.5 volts/div.

Input impedance—100K ohms in parallel with 30 pf.

Internal Line Sweep—phase variable over 150 degrees.

Test Signals

Calibrate Gain—1-volt P-P 60-Hz square wave.

Probe Test—Fast-rise, 20-volt square wave at time base frequency, for probe adjustment.

Price of Model TO-50 is $339.50, including combination direct/low-capacitance probe. ▲

Circle 56 on literature card

carr electronics

by Joseph J. Carr/ES Auto Electronics Editor

Stereo FM Auto Radio Servicing:

A General Review

Major Systems in Stereo FM Radios

Because most stereo FM receivers are relatively complex pieces of equipment, it is best to divide them into their component systems before outlining related troubleshooting procedures. In this article, we will divide a typical system into the following categories: tuner (or front end), IF amplifier, detector, multiplex decoder and the stereo audio amplifiers.

Tuner

The tuner is the section which amplifies the various FM broadcast signals fed to it from the antenna, and then converts them to a lower, or intermittent frequency, (IF) usually 10.7 MHz in domestic FM sets. After conversion, the signal is then fed to the IF amplifier chain.

The so-called standard FM tuner consists of three transistors: an RF lator, as shown in Fig. 1. This parlator, as shown in Fig. 1. This particular tuner is used in the 1970 Ford Galaxy FM stereo car radio (Model OFBF), manufactured by Bendix.

The design of the RF amplifier in Fig. 1 follows the practice of using the common-base configuration for VHF amplifiers. Besides producing higher gain at these frequencies than some other configurations, it also requires little or no neutralization. If a common-emitter stage were used, neutralization would probably be necessary, to prevent the stage from oscillating.

The local oscillator circuit in Fig. 1 is a relatively standard circuit which uses a varactor for AFC correction.

The circuit in Fig. 2 is a newer version of the FM RF amplifier. This type of circuit, employed in both hi-fi FM tuners and at least one AM/FM car radio, uses an

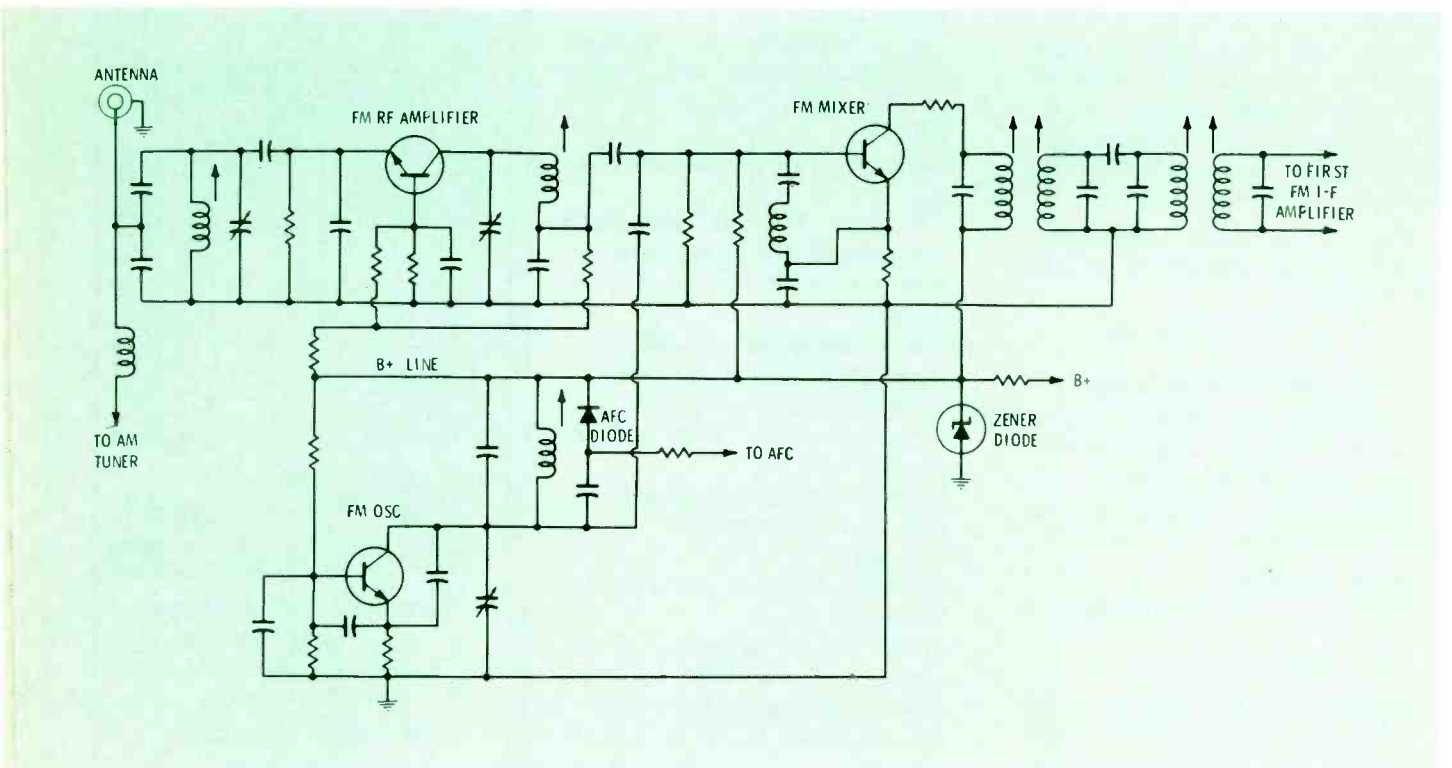


Fig. 1 FM tuner section used in Ford Model OFBF radio. Common-base configuration of FM RF amplifier stage requires little or no neutralization to prevent oscillation. Varacter provides AFC action.

IGFET (insulated-gate, field-effect transistor). The IGFET's extremely high input impedance and it's cross-modulation characteristics have made it attractive to FM-tuner designers during the past several years. Mass production and technological advances have lowered IGFET prices so that they can be used even in some relatively inexpensive FM sets.

The IGFET is extremely sensitive and must be handled properly to prevent tool and body static charges shorting out the gate insulation. Most replacement IGFET's come packaged with either a metal shorting ring binding the wire leads or a piece of lead foil sheathing them.

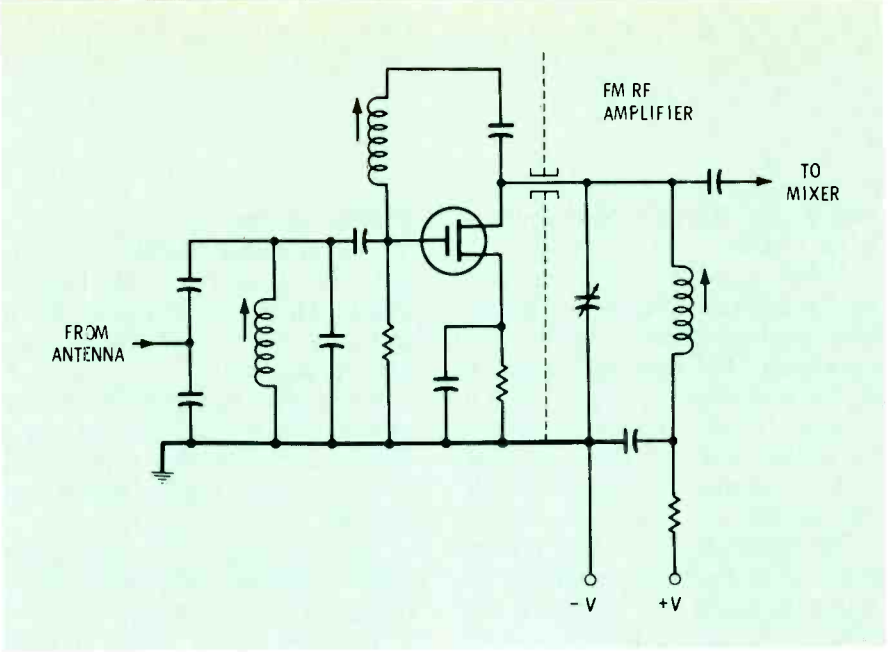


Fig. 2 Newer type of FM RF amplifier design uses insulated-gate, field-effect transistor (IGFET), which offers extremely high input impedance and is relatively immune to cross modulation. Because tool and body static can short out the gate insulation of IGFET's, most replacement units are packaged with leads shorted together.

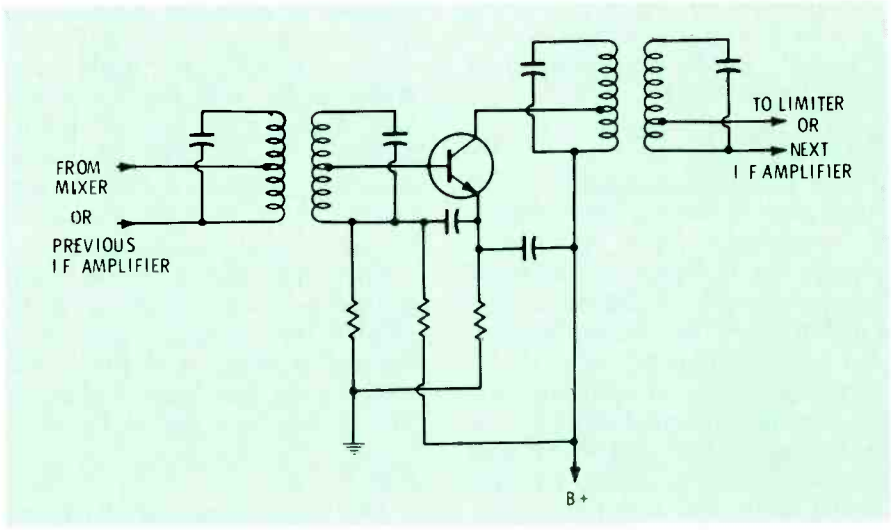


Fig. 3 Older design of FM IF amplifier, which uses conventional bipolar transistor. This basic design is still used in some stereo FM equipment. Three or four of stage shown here make up the IF amplifier section.

IF amplifier

The IF amplifier strip is a tuned-RF type of amplifier. It differs from the RF amplifier in the tuner in that it is tuned to only one frequency. Except in a few sets im-

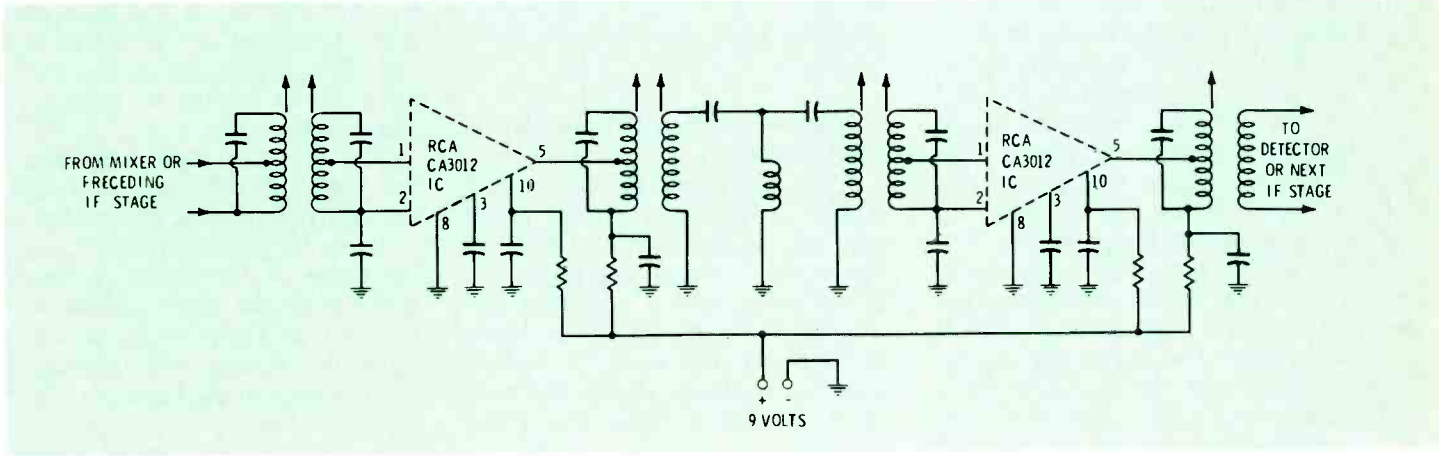


Fig. 4 Newer FM IF amplifier design uses integrated circuits (IC's).

ported from Europe, this frequency is 10.7 MHz.

There are, generally speaking, only two basic types of IF amplifiers used in modern Stereo FM equipment. The first, and older of the two, is shown in Fig. 3. It is a standard bipolar transistor circuit. In actual practice, three or four such stages make up the IF amplifier section.

The circuit in Fig. 4 is a version of the more modern type of FM IF amplifier, which uses integrated circuits (IC's). This particular circuit uses the RCA CA3012 IC. Several variations of this circuit have been used in a number of popular-brand FM stereo tuners and receivers (Further information about this and other types of IC circuits is available in a book titled "Linear Integrated Circuits", which is available from RCA distributors.)

The detector

The FM detector stage is one of those areas in which a good memory is a real asset. How many technicians can, for example, remember the fine points of difference that exist between the Ratio Detector and the Discriminator?

Another type of detector, the integrated-circuit quadrature type, is used now in hi-fi and in at least one brand of auto radio. TV men should be familiar with this system. Hi-fi and auto radio technicians, on the other hand, might have only recently encountered these circuit designs. Certain Delco stereo FM car radios have used this type of detector for the past three years.

The three basic types of detectors are shown in Figs. 5A, 5B and 5C. Several semiconductor manufacturers presently offer one or more IC's that include the limiter, two or more diodes for the detector, and, sometimes, even the last FM IF amplifier transistor. So don't assume that an IC in the last stage means that a quadrature detector is being used. The quadrature can be recognized by the presence of a phasing coil. Other types of IC FM detectors use a regular detector transformer or have no tuned circuit at all except in the input network.

Multiplex circuitry

The multiplex section processes the audio recovered by the FM detector (which contains both L+R and L–R signals), producing right and left separation.

Although a complete discussion of multiplex systems, processes, and circuits is beyond the scope of this article, I will briefly review the process.

The encoded L–R signal is a double-sideband, suppressed-carrier (DSB) form of modulation. (DSB is a variation of AM.) The frequency of the associated carrier (called a "sub-carrier", to distinguish it from the FM main carrier) is 38 KHz. Because this subcarrier is suppressed at the transmitting station, the receiver must generate and reinsert a subcarrier. Fortunately, there also is a 19-KHz pilot signal transmitted along with the L+R and L–R signals. By one of several methods, this 19-KHz pilot signal is used to generate a 38-KHz subcarrier which, in turn, is used to decode the two stereo channels.

The whole stereo process is explained in several ELECTRONIC SERVICING articles and in a Howard W. Sams book titled "FM Multiplexing For Stereo" (Catalog No. 20199), by Leonard Feldman.

Audio

The audio stages used in stereo FM receivers require little discussion because most are of common design. Consequently, the usual techniques used to isolate defects in conventional audio circuits also apply to those used in stereo FM receivers.

Troubleshooting Procedures

Tuner check-out

After connecting the power and speaker leads and any other leads required, adjust the controls to determine if proper operation can be achieved, and, if not, what the trouble symptoms are. Recognition of symptoms such as a high level of hiss, a blinking stereo-indicator lamp, or low volume with good sensitivity can help isolate the defective stage even before the set is warm.

Because of the more sensitive nature of VHF signals, the front end of an FM set is especially difficult to service. For example, test equipment probes often present considerable stray capacitance to the tuned circuits, which completely changes their response, or range of operation, particularly that of the FM local oscillator. Because of this, many otherwise routine tests are useless in this stage. Probably the most reliable method of determining whether the oscillator is operating is to check the bias on the oscillator transistor with a high-impedance DC voltmeter. Even though the frequency of the oscillator might have shifted or the function stopped completely, the bias probably will not be affected. This isn't always true, but is often enough to make it a useful indication.

An indirect check of the FM oscillator can be made by using a grid-dip meter for signal substitution, as shown in Fig. 6. I use a low-priced, kit-type meter. Although the output of the grid-dip meter is relatively unstable at VHF frequencies, it is sufficiently stable for this purpose. Tune the grid-dip meter to the approximate frequency of the FM oscillator (radio dial frequency plus 10.7 MHz). Then loosely couple the grid-dip meter coil to the FM mixer circuit. This usually requires placing the coil physically close to the FM mixer transistor. Sometimes, this method will work a foot or more from the set. Don't, however, depend on it. I did—only **once.** I assumed an oscillator was bad when, in fact, the grid-dip meter wasn't close enough to produce a recognizable effect.

If a defective local oscillator is the cause of abnormal operation, the receiver will pick up stations as you tune the grid-dip meter through the range of frequencies normally covered by the local oscillator of the receiver. The grid-dip meter will cause hetrodyning and quieting if another stage in the front end of the receiver is defective.

In areas where the local stations produce a high signal level, occassionally a receiver with poor sensi-

tivity will come to life when the shielding covers are removed. In areas of high signal levels, certain sensitivity problems can be "masked" unless the set is examined while tuned to a weaker station.

Loose mounting screws are common causes of poor sensitivity and other tuning problems. This is especially true in automotive equipment. Loose screws cause a wide and varying range of symptoms. Ground loops and open DC grounds seem to be the most common faults directly attributable to loose mounting screws. In some cases, the tuner will merely shift frequency, as if the AFC were at fault. In others, the loose mounting screws will cause a high level of static. In still others, there will be no FM reception. Although this problem does occur in some sealed tuner designs, it is more common in sets which use an open FM printed-circuit board that is bolted to the chassis.

The AFC circuit can usually be checked by tuning the receiver slightly off station with the AFC disabled. (Many sets provide a switch to disable the AFC). When the AFC is turned on again, the receiver should be automatically tuned to the exact center of the broadcast signal.

Listening to fringe-area or other very weak signals is one excellent way to evaluate the performance and condition of the FM tuner and IF strip. This type of test is even more meaningful if the technician is familiar with how such stations sound and act on a normally operating receiver of comparable design and quality. Note, for example, whether the stereo-indicator lamp lights and whether the signal is clear or fades or varies continuously. If the set uses an AC line cord or 300-ohm, twin-lead dipole as an antenna, make the preceding checks using that antenna. If the gain of the shop antenna is substantially higher than that of the receiver's antenna, it could mask a weak condition in the receiver.

The preceding tests are far too subjective to be considered absolute and infallible. They are useful, however, for making rapid judgements on which an estimate is to be based, or when trying to decide where to start searching for the defect.

Subjective determinations are also useful for checking out the IF amplifier chain. Suppose, for example, that a particular set has weak volume but can receive all local FM stations. If the set has a tuning meter across the FM detector, note whether it is registering a normal signal level. If it is, check the stereo indicator lamp. If it is illuminated, the defect probably is in either the composite signal path or in the audio amplifier chains. If the tuning meter indication is normal, yet the stereo lamp is not illuminated, check the coupling between the detector and the input of the multiplex section.

The tuning meter often is electrically located in some circuit other than the detector. In some modern hi-fi receivers it is placed electrically in one of the early IF stages. In such cases, it can help the technician determine which end of the

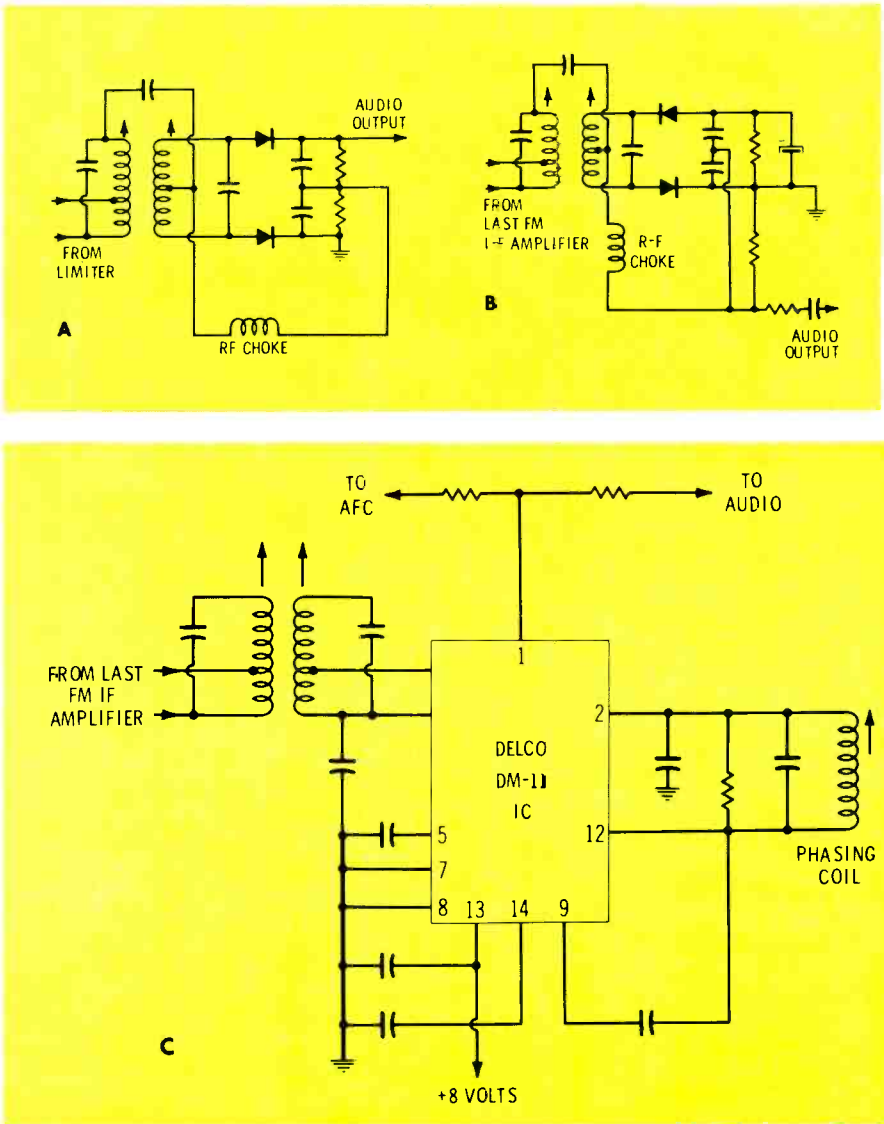


Fig. 5 Three basic types of FM detectors. A) Foster-Seeley design is usually preceded by a limiter because it is sensitive to any AM variations of FM signal. B) Ratio detector need not be preceded by a limiter stage because it has "built-in" AM suppression. C) Quadrature detector. The phasing coil, not use of IC, is best indication of quadrature design.

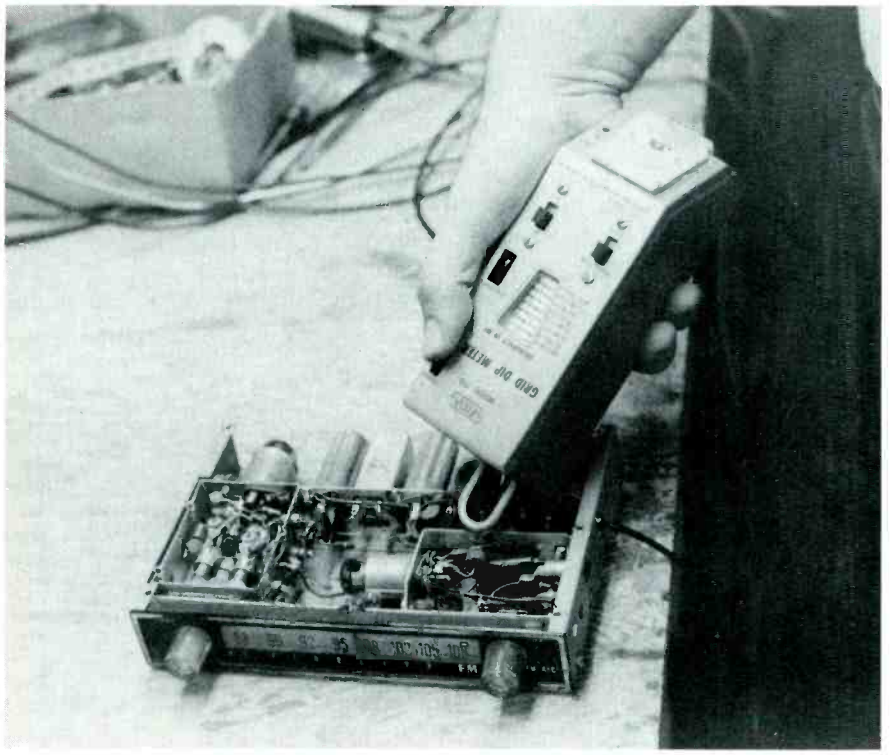


Fig. 6 Shown here is one method of determining whether or not a "dead" receiver is caused by an inoperative local oscillator. Grid-dip meter is tuned to frequency of signal normally produced by local oscillator and then is loosely coupled to FM mixer circuit. If broadcast station(s) is heard, FM oscillator is defective. If hetrodyning and quieting are produced, local oscillator is operating and defect is in other "front-end" stage. See text for more-detailed explanation of grid-dip meter method of testing.

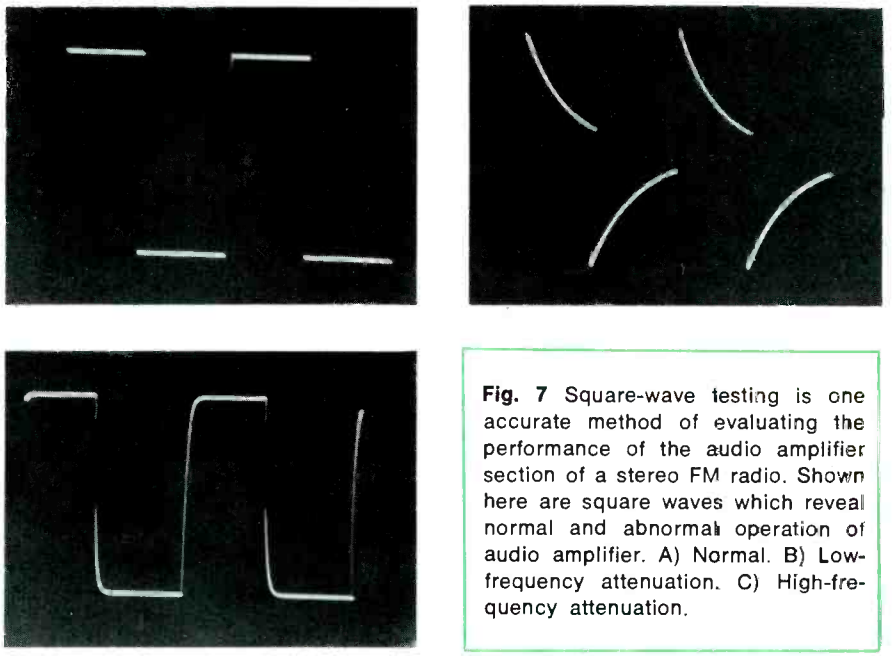


Fig. 7 Square-wave testing is one accurate method of evaluating the performance of the audio amplifier section of a stereo FM radio. Shown here are square waves which reveal normal and abnormal operation of audio amplifier. A) Normal. B) Low-frequency attenuation. C) High-frequency attenuation.

IF strip to check first. (However, if the meter itself is defective, the preceding test can be misleading.)

One effective method for locating a defective IF amplifier stage is to signal trace it with either a very sensitive oscilloscope or an aural signal tracer. However, when using such an instrument, be sure the demodulator probe is designed for the IF frequencies. Many probes that are suited only for AM servicing will seriously detune 10.7-MHz IF transformers.

If local off-the-air signals are too weak to permit effective signal tracing of the first two IF amplifiers (as is often the case if a low-sensitivity scope is used), try feeding the 10.7-MHz output of a sweep generator into each IF stage in succession while monitoring either the output of that particular stage or the output of the entire IF chain. Monitoring the entire chain offers the advantage of three extra stages of amplification. This added gain will be needed if "low-gain" test equipment is used.

The detector circuit in an FM set can be frustrating to troubleshoot. Certain designs will exhibit almost normal voltage and resistance readings, yet will fail to demodulate the FM signal. Analysis of detector waveforms can be useful in determining which detector component is defective.

The specific type of detector circuit being used can be another factor in troubleshooting. IC quadrature detectors, for example, are very sensitive to B+ line transients and momentary short circuits. The author recently heard an older technician complaining about this very problem. He remarked that in the older tube-type hi-fi's you could get away with being pretty sloppy with tools and what they touched. Then came transistor sets, in which sloppiness can cost a two-dollar bill. In integrated-circuit designs, such sloppiness can cost more than ten dol-

lars. To make matters even worse, IC lead wires are spaced extremely close.

The oscilloscope seems to be the best instrument for troubleshooting just about any type of FM detector circuit. The new 10-to-12-MHz triggered sweep scopes permit you to look at the FM IF signal before it is demodulated. When using a narrow-band scope, however, you must connect it to the detector through a demodulator probe at the detector input or a low-capacitance probe at the detector output. Either way, you will be looking at the audio component. The set probably will have to be tuned slightly off station before the audio can be extracted with a demodulator probe. This is because most probes are AM detector types, which use slope detection for FM.

The scope also is the most logical instrument to use for troubleshooting the multiplex section of the stereo FM receiver, because the majority of signals in this section are above the range of human hearing.

When confronted with a dead, or apparently dead, multiplex section, make a few preliminary observations before disassembling it. Note, for example, the amount of background hiss between stations, and whether the fringe stations usually heard are actually being received. This will indicate whether the sensitivity of the set is up to par. For example, a set with one defective IF amplifier can pass enough signal to drive the high-gain audio amplifiers, but not enough to overcome the multiplex threshold.

It is also wise to make a quickie separation check with an oscilloscope, to determine where the fault is located. This is accomplished by feeding the right channel into one input of the scope and the left channel into the other scope input. If the trace is a slanted, fuzzy line, either the set is tuned to a mono station or it is not separating the two stereo channels. A trace that resembles a nest of wiggly worms will be produced if good stereo separation is present. This information will tell you whether to start in the stereo-indicator lamp circuit or the multiplex section.

The audio chains used in FM stereo normally require only the standard troubleshooting procedures. Square-wave testing, for example, has been especially useful. Fig. 7 shows some of the ways that an audio amplifier can distort square waves.

A multiplex generator and a harmonic distortion analyzer are two other instruments that are very useful for stereo FM troubleshooting. Both of these instruments, when properly used, can save a lot of time.

The test setup shown in Fig. 8 is found on many hi-fi test benches. It makes possible separation checks of the entire system. Simply feed the signal to one of the stereo channels and calibrate the volume meter on that channel to 0 dB. The separation, in decibels, is read on the other meter. Although this setup doesn't take residual noise into account, it is practical for spotting serious separation problems. The Vu meters can be the "under-five-dollar" variety offered by many mailorder suppliers. ▲

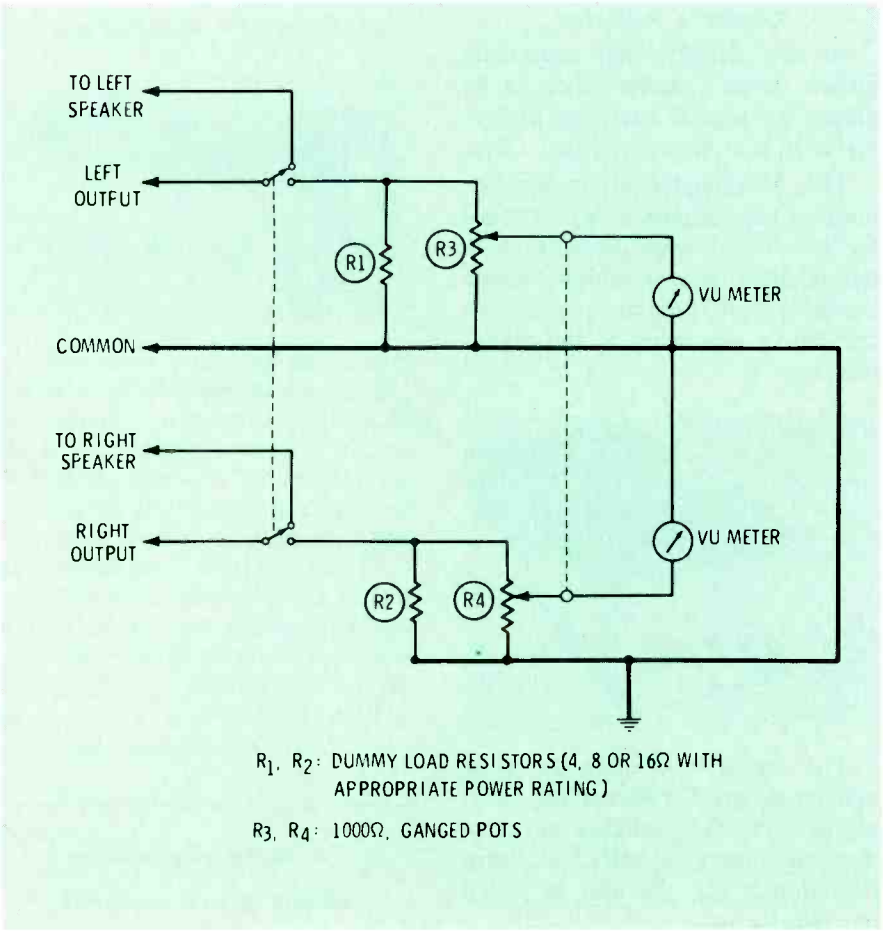


Fig. 8 Test setup for checking "serious" stereo separation problems. See text for details about use.

audio systems report

Audio and Adapter Cable Display

A display containing 17 different audio cables and 8 different audio adapters is offered by Workman Electronic Products, Inc.

Connectors for RCA plugs and jacks, some with alligator clips; 3.5-mm phone plugs adapters to match RCA jacks and plugs and regular phone plugs reportedly are included.

The dealer display board measures 24 inches x 32 inches and is made of pegboard. Price is provided on application.

Circle 57 on literature card

Sectoral Horn

A means of controlling the sound projection angle, while maintaining acceptable reproduction of the high and middle frequencies, reportedly is available with a sectoral horn, Model WCH-100, manufactured by Atlas Sound.

Model WCH-100 offers 120-degree horizontal and 50-degree vertical directivity with uniform frequency response above 250 Hz, according to the manufacturer.

The horn reportedly is designed for use in professional sound reinforcement installations and component two-way loudspeaker systems. It is recommended by the manufacturer for indoor or outdoor use in auditoriums, stadiums, transportation terminals and other locations where high-intensity audio and controlled directional projection are desired.

The sectoral horn measures 15 inches x 23 inches x 18 inches, and sells for $120.00.

Circle 58 on literature card

Cassette Adapter

A new adapter that reportedly allows stereo cassette tapes to be played on 8-track cartridge players has been introduced by Mura Corp.

The Muradapter eliminates the need to have separate sets of tapes for home and auto listening; with the adapter, any standard cassette can be played through any 8-track car stereo, according to the manufacturer.

The unit is inserted in the same manner as any 8-track cartridge and the pre-amplifier switches on automatically upon insertion. To turn the adapter off, the unit is pulled out two inches.

The Muradapter sells for $34.95.

Circle 59 on literature card

Headphone Extension Cable

A new stereo headphone extension cable has been introduced by Duotone Company, manufacturer of phonograph needles, tape and hi-fi accessories.

The SXC-15 extension cable is 15 ft. in length and is reportedly supplied with a 3-circuit plug and jack.

The price is $2.69.

Circle 60 on literature card

22-Watt PA Amplifier

Model AM-387, a new solid-state, 22-watt PA amplifier has been

introduced by Olson Electronics.

Features of the Model AM-387 include: microphone; phono and auxiliary inputs; outputs for 4, 8, and 16 ohms; hi- and low-impedance microphone inputs plus phono and tape deck or tuner inputs.

Model AM-387 measures 10 inches x 3¾ inches x 8 inches and has a mounting bracket for mobile use. Operation is from 117 volts AC or 12 volts DC.

Price is $59.88. ▲

Circle 61 on literature card

For more information about above products use reader service card

The MARKETPLACE

This classified section is available to electronic technicians and owners or managers of service shops who have for sale surplus supplies and equipment or who are seeking employment or recruiting employees.

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EQUIPMENT FOR SALE

FOR SALE—Lampkin 105B $150, 205A $150. PPM $75. Measurements 80 $250. Berkley 7160 Imc counter $150. Heathkit IM10 Transistor checker $25, IO-14 Scope $200. Jackson TVG2 Sweep. Jerrold Audiotrol $125.00. DB Electronics, Dennisville Road, Cape May Courthouse, N.J. 08210. 609-465-5005. 7-71-1t

Have on hand large stock Bendix, Motorola, Philips, Delco and Philco auto radio and auto tape player parts. Wholesale to everyone. Shipp Radio Service, P.O. Box 1345, Shreveport, La. 71102. 7-71-1t

I have 38 Sam's Photofact Folders running from No. 34 to 434 plus some miscellaneous schematics for sale. The lot for $35 F.O.B. George Epstein, 20027 46th Av., Flushing, N.Y. 11361. 7-71-1t

Surplus of test equipment for "The Marketplace" with all instruction manuals, and connected leads included. 1. RCA, signal generator, WR-50B, $25.00. 2. RCA, VOM, WV-38A, with H.V. probe, WG-297, $35.00. 3. RCA, T.V. bias supply W-G-307B, $10.00. 4. Eico, R-C-checker, 95B, $15.00. 5. Eico, audio-sine-square wave generator, 377, $30.00. 6. Cornell-Dubilier, R-C, checker, handi-chek, BF-90, $25.00. 7. Sencore, color-bar generator, CG-141-brand-new, $85.00. 8. Sencore, in circuit tr. tester, TR-139, $50.00. 9. Simpson, VTVM-311, with RF and H.V. probes, $60.00. 10. Conar, Instruments, color-bar generator, 681-new, $50.00. 11. Conar Instruments, transmitter-education with dummy antenna load, $25.00. William D. Shevtchuk, 1, Lois Avenue, Clifton, N.J. 07014. 7-71-1t

EQUIPMENT FOR SALE (Cont.)

CLOSING OUT: B & K 1076 Analyst, factory reconditioned, $125.00. Hickok CRO 5000 scope, factory calibrated, fully transistorized, DC-25 MHz, $450.00, new $650.00. Eico 369 Sweep Generator, $65.00. Heath IG-112 Stereo Generator, $55.00. Heath IG-72 Audio Generator, $35.00. DC Power Supply, 0-32 VDC, 20 A, Ripple 1%, $115.00. Eico 1140 Series-Parallel R-C Combination Box, $10.00. Eico 1171 Resistance Decade Box, $12.00. Heath AC VTVM IM-21, $20.00. Heath Transistor Tester IM-30, $40.00. All issue of ES, Dec. 1969 to date, $10.00. All guaranteed like new, with manuals. Value $882.00, take $750 for lot, FOB. W. R. Cleary, Space 187, 402-63rd St., San Diego, Ca. 92114. 7-71-1t

I have the following test equipment for sale: 1. Hickok Model 209A Volt-Ohm Milliammeter Probe 30 KV. 2. Hickok 590 Foster Transistor in or out circuit. 3. Hickok Mod. 675 A Scope, Wide Band 5" Band Color. 4. Eico Mod. 666 Tube Tester. 5. Eico Mod. 1060 Battery Eliminator Charge. 6. Eico Mod. 315 Signal Generator. 7. Eico Mod. 495 Voltage Calibrator. 8. Eico Eico Mod. 1140 Series Parallel Box R-C. Will sell all of above at very reasonable prices and if I can sell as a package deal will throw in some small pieces of equipment at no charge. Victor Garcia, 330 West 43rd St., New York 10036, N.Y. 7-71-1t

OBSOLETE TUBES—Brand New!! RCA, GE, Sylvania, etc. in stock. Vix Radio & TV Service, 301 W. 19th, Houston, Texas 77008. 7-71-1t

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Better Management Guides

Income and Expense Summary: the Scorecard of Your Business

by Robert G. Amick/ES Business Editor

This month, service shop owner Mike Farad learns how to interpret the Income and Expense Summary for his business and what it will and will not tell him.

Profit or loss? Increase or decrease?

Mike Farad slipped the sheet out of the envelope Jim Keeper handed him. It was headed **"Income and Expense Summary"** and looked like the summary in Fig. 1.

"This is what we keep track of sales and expenses for? This is the scorecard for last month, huh, Jim?"

"That's right, Mike. This is what it's all for—the care, the nitpicking, the exhaustive record-keeping. This is where you find out whether or not your business made a profit last month, and if so, how much," Jim agreed.

Mike, already studying the figures ranged in columns down the sheet, grunted and then exclaimed, "Looks like I lost last month."

He paused to figure, then looked up and said, "Net Income is down almost forty percent from the average for the last five months. How about that?"

The reason

Jim nodded. "Yes, I noticed that. It was off last month, a little. But, I think this is just a seasonal thing. You know what to expect better than I do—or should. But I suspect it's just the summer vacation lull.

"Do you think that's the explanation?"

Mike agreed it probably had a large bearing on what he saw in the Statement.

The two were sitting side by side on high stools at Mike's workbench, where Jim had found him when he dropped by with the August report. Mike asked if Jim had time to go into the Income and Expense Summary a bit more closely.

"I appreciate all the time you spend teaching me these things. I don't want to impose on you, but I'd like to learn as much as I can. Along with my reading."

Jim readily agreed to the plan.

"Looking further down the line in this Summary, Mike, we see that there weren't any unusual expenses last month. So, the drop in Net Income was caused by a drop in sales. It's up to you to find out why. I suspect it's seasonal, but you're the one to find out about that. Because you're still in your first year of operation, we just don't have anything else to go on.

Composition of the Summary

"But, getting on with the rest of the Statement, it's really a fairly simple matter. First we determine what your total sales were. That's a matter of totalling receipts, subtracting any refunds or allowances you may have had to make, to get Gross Sales.

"Then, we subtract the actual cost of what it took to complete those sales. The direct costs—parts, labor, shop supplies. That gives you **Gross Profit.**

"Finally, we subtract the costs of doing business which don't bear directly on producing income. Your overhead, administrative costs and miscellaneous expenses. That gives us **Net Profit.** So we have a kind of formula:

Gross Sales–Direct Costs=Gross Profit
Gross Profit–Indirect Costs=Net Profit

"I made up a little chart to explain this." Keeper handed him the chart shown in Fig. 2.

"I notice that you call this an Income and Expense Summary—isn't that the same as the **Profit and Loss Statement?"** Mike inquired.

"Yes. I use the terms interchangeably. When I was in school it was called the Profit and Loss Statement. Now, it's more popular to refer to it as the Income and Expense Summary.

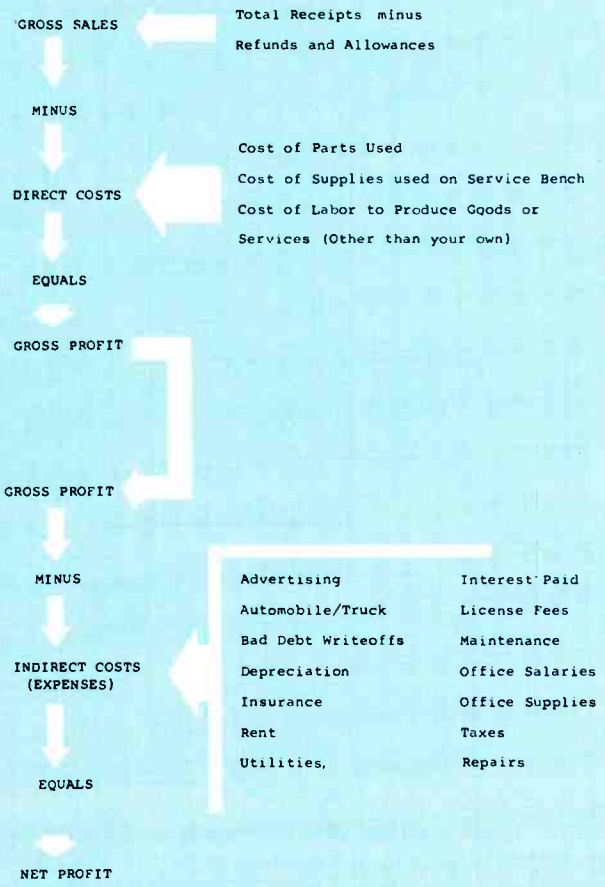
"Now, Mike, going down the list of the items in Fig. 1, we've got past the Gross Sales figure. As for the Cost of Goods Sold, it contains all those entries for a reason. You carry a stock of parts. In addition, you buy some almost every month. The total of that first-of-the-month inventory and what you buy gives you the total on hand to sell. That total to sell, less what's left at the end of the month, gives you the total of what's been sold.

"The Expense section is pretty much self-explanatory. Those are the expenses totalled from each Ex-

Fig. 1
Mike's TV-Electronics
Income and Expense Summary
For the Month Ending August 31, 19xx

		This Month	Year to Date
Receipts			
Labor Sales		$957.00	$6,078.00
Parts Sales		478.00	3,038.00
Total		$1,435.00	$9,116.00
Less Returns and Allowances			47.00
Gross Sales		$1,435.00	$9,069.00
Less Cost of Goods Sold			
Beginning Parts Inventory	$1,248.75		
Purchases	162.10		
Total To Sell	1,410.85		
Closing Inventory	1,268.85		
Cost of Parts Sold	142.00		
Cost of Labor (Inventory Control)			
Bench Supplies	71.50		
Total Cost of Goods Sold	213.50	213.50	1,189.10
Gross Profit		$1,221.50	$7,879.90
Less Expenses			
Auto/Truck Expense	101.45		451.31
Miscellaneous	59.20		536.80
Professional Fees	55.00		165.00
Rent and Utilities	96.00		493.23
Supplies (Office)	14.30		163.00
Total Expenses	$325.95	325.95	1,808.34
Net Profit		$895.45	$6,071.56

Fig. 2
How Net Profit Is Computed



pense Account ledger."

Jim handed him another sheet of paper, like that shown in Fig. 3.

"This is Schedule 'C' of the Federal Income Tax return. Would you care to compare this with the Income and Expense Summary?" he asked.

Mike studied it a moment, then laid his Income and Expense Summary alongside it on the bench. He looked from one to the other, then looked up:

"They're practically the same! All the same headings are here, except that some of them are in different order. But, this tax form follows your formula."

Jim nodded agreement and pointed out to Mike that tax reporting is simply the same thing as making up a business report from the books.

Mike laid the form aside and turned to Keeper.

What the Summary can tell you about your business

"Okay, Jim. This report tells me how I did last month, and for the year so far. Now, how about all that information I'm supposed to be able to derive from it?"

"You already have, Mike. You saw that your Net Income was off. You have eliminated the possibility that unusual expenses were responsible. You can establish the fact that it's because of a drop in Total Sales. You have a tentative explanation—probably the right one. But, you have to keep an eye on that situation for awhile to make sure it isn't because of something else. You could be up against more aggressive competition from someone, or a new shop may have opened in your market. You've found a question—now you have to find the answer. It could be in the Summary, although it isn't this time, or it could be elsewhere."

Mike asked if there were other "questions" being raised in the Summary for him to keep an eye on.

"Nothing serious, Mike. One thing puzzles me, though. Your inventory value has been rising slowly throughout the period since I began keeping your books. That might be an increase that's necessary to a growing business. Or, it might be a warning flag. I don't know your business well enough to say, yet.

"It could be you're adding too much to your inventory, or it could be you're carrying things you don't need as much as you expected to. As I said, it isn't serious. It might even be necessary and a good thing. But it is something to think about and to keep an eye on. You have a good bit of money tied up in your parts inventory. Good management practice demands that you see that every one of those dollars produces returns for you," Jim explained.

"I really want them to, Jim. You know, I got started with a small stock—too small. I pretty much aimed at adding to it as I got the business going. I'm still doing it. Do you think I ought to slow down?"

SCHEDULE C (Form 1040)
U.S. Treasury Department
Internal Revenue Service

Profit (or Loss) From Business or Profession

(Sole Proprietorship)

(Compute social security self-employment tax on Schedule C–3 (Form 1040))

19b

Attach this schedule to your income tax return, Form 1040 — Partnerships, joint ventures, etc., must file on Form 1065

Name as shown on page 1 of Form 1040 | Social security number

A Principal business activity (See separate instructions) ; product (For example: retail—hardware; wholesale—tobacco; services—legal; manufacturing—furniture; etc.)

B Business name C Employer Identification Number

D Business address (ZIP code)

E Indicate method of accounting: (1) ☐ cash; (2) ☐ accrual; (3) ☐ other.

F Was there any substantial change in the manner of determining quantities, costs, or valuations between the opening and closing inventories? ☐ YES ☐ NO. If "Yes," attach explanation.

G Were you required to file Forms 1096 and 1099 or 1087 for the calendar year 1968? (See "Item G" in separate instructions for Schedule C.) ☐ YES ☐ NO. If "Yes," where were they filed?

1	Gross receipts or gross sales $ ... Less: Returns and allowances $		$
2	Inventory at beginning of year (if different from last year's closing inventory attach explanation)		
3	Merchandise purchased $ ... less cost of any items withdrawn from business for personal use $		
4	Cost of labor (do not include salary paid to yourself)		
5	Material and supplies		
6	Other costs (explain in Schedule C–1)		
7	Total of lines 2 through 6		
8	Inventory at end of this year		
9	Cost of goods sold and/or operations (subtract line 8 from line 7)		
10	Gross profit (subtract line 9 from line 1)		
	OTHER BUSINESS DEDUCTIONS		
11	Depreciation (explain in Schedule C–2)		
12	Taxes on business and business property (explain in Schedule C–1)		
13	Rent on business property		
14	Repairs (explain in Schedule C–1)		
15	Salaries and wages not included on line 4 (exclude any paid to yourself)		
16	Insurance		
17	Legal and professional fees		
18	Commissions		
19	Amortization (attach statement)		
20	Retirement plans, etc. (other than your share—see separate instructions)		
21	Interest on business indebtedness		
22	Bad debts arising from sales or services		
23	Losses of business property (attach statement)		
24	Depletion		
25	Other business expenses (explain in Schedule C–1)		
26	Total of lines 11 through 25		
27	Net profit (or loss) (subtract line 26 from line 10). Enter here; in Schedule C–3, line 1; and on Form 1040, page 2, Part II, line 4. Figure your self-employment income and tax on Schedule C–3		

SCHEDULE C–1. EXPLANATION OF LINES 6, 12, 14, AND 25 C

Line No.	Explanation	Amount	Line No.	Explanation	Amount
		$			$

Fig. 3

The bookkeeper shook his head.

"I really don't know, yet, Mike. It's too early to tell. But the amount you have tied up in parts isn't big enough to be serious. First of all, we need to know more about a number of factors. Then, too, the increases haven't been big, or sudden.

"But, I will caution you that many small businessmen think the growth of inventory is part of the growth of their businesses. It can be—and it is, so long as that growth is **contributing** to the growth of the business. But just owning a big stock of parts isn't the objective —it's not what you're working for. You want enough

to avoid long delays while you order a part, and to save time by not having to go pick up a part every time you need it.

"But, one thing you don't want is a substantial investment in parts which may soon become obsolete, or are rarely needed.

"As to slowing down on inventory, I don't think it's time to consider that, yet. You've told me why it's been growing, and you're probably right in that decision. We'll know, in time.

Comparative information: the need for cumulative records

"And, that points up the limited value of short-term information. We can learn some things from your Summary each month, but we haven't much to **compare** them to, yet. If we had records for your business a year ago, we'd have an idea about whether your August receipts declined because of the season or for some other reason."

Mike took that up quickly.

"Wait a minute. If this Summary has limited value, when do I start getting my money's worth?"

Jim laughed. "It's worth what you're paying for it, Mike, believe me. You saw an indicator of something: The drop in Net Income. Your Summary told you that, and told you where the decline took place. I pointed out another indicator: The slowly-rising inventory. Neither one may be serious; neither may be a sign of trouble. But, each bears watching. And, as a good manager, you not only watch them, you look for explanations.

"Even if this report were only for the files now, it furnishes that valuable comparison this time next year. **Comparisons** are the key to the value of these records, Mike. As you accumulate information from year to year, the accumulated value of your records will be greater than ever. Then you'll see the trends of your own business—and be able to determine whether or not they're cyclical, or seasonal. You'll discover things about your own business you never even suspected. And, your decisions will be backed up by an accurate summary of your experience."

Mike held up his palms, as though to calm his bookkeeper.

"Take it easy, Jim. I'm not about to quit you. I just wanted to hear your explanation of that 'limited value of short-term information' business."

Jim tapped the Summary in Mike's hands with his finger.

What the Summary will not tell you

"Mike, this isn't the key to any absolute set of rules. Don't expect too much from it. It tells you how your business stands, how much business you're doing and how profitably. It doesn't tell you how much business you're missing. It can't tell you what's happening anywhere else, only what's going on right here in your business.

"When I mentioned comparisons, I was concerned with accumulated records of your business's performance. There are other comparisons we can make, at the right time. We'll get around to making comparisons with some of the industry averages compiled by trade associations, universities, the government and some of the business reporting firms. That'll furnish some information—even from these short-term reports and skimpy information," Jim said with a sly grin.

"The nearest thing to an absolute I can furnish you, Mike, is the figures themselves. If you've given me accurate information, and the books balance, then the records are absolutely correct. After that, however, we're back to imperfect judgments, opinions and decisions."

He looked at Mike intently for a moment, then said, "That sounds like I'm trying to unsell you on record-keeping, doesn't it?"

He went on to explain that the Income and Expense Summary is part of the total picture. That it can often raise questions for which it doesn't provide a complete answer.

"But you're ahead, Mike, just knowing there is a question for you to answer. The information that goes with your Summary is all around you. You have to dig it out, and you have to use it."

"You mine it and I smelt it," Mike laughed.

Competition, trends and industry conditions also must be weighed

"Yes. As far as your financial information is concerned. But, you mustn't lose touch with your business environment—general business conditions in the community, what your customers, your competitors, your suppliers and the manufacturers are doing. It all bears on what your Income and Expense Summary has to say. While you're paying strict attention to your own business, you also have to keep an eye on the other businesses, trends and conditions that affect your business."

Mike replied with the opinion that he expected that that meant he'd be reading more, and studying more, in his effort to become a better businessman.

"I guess I'm lucky I enjoy reading that material," he added.

Enjoy it or not, good management practices and information are necessary for business survival

Getting up to leave, Jim paused to say, "It's good you enjoy it, Mike. But enjoy it or not, it's as important as keeping up with technical developments in your field. Neither form of study is simply a question of pleasure. It's a question of survival." ▲

productreport

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

Tape-Head Aerosol Cleaner

An aerosol cleaner reportedly formulated for cassette, video, 8-track and reel-to-reel tape recorders has been introduced by Chemtronics, Inc.

This new aerosol reportedly will remove dirt, film and oxide build-up from heads, tape guides, capstan rollers and all other critical parts.

It cleans and dries without wiping, leaving no trace or residue, according to the manufacturer.

The cleaner is guaranteed, by the manufacturer, to be non-abrasive, safe for all plastics, non-flammable, non-toxic and non-conductive.

A six-inch spray extender is included with each 6-oz. spray can.

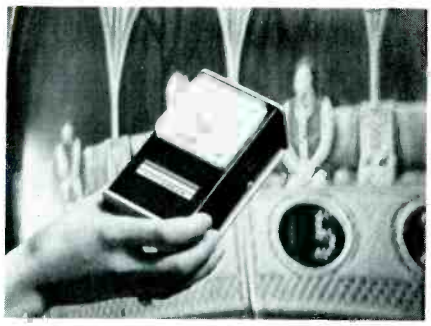
The tape-head aerosol cleaner sells for $1.95 per 6-oz. can.

Circle 70 on literature card

Radiation Detection Meter

The new 499 VIC-CHEK survey meter answers the need of TV service men to check radiation emitted from color TV sets, according to the manufacturer, Victoreen.

The VIC-CHEK detects both X-ray and gamma radiation, with a range from 0 to 1000 counts per minute and an accuracy of ±20% at full-scale reading. The detector, a Victoreen Geiger-Mueller counter



tube, is contained within the chassis. The meter circuits are all solid state, with a radiation window of aluminized mylar measuring 10 square centimeters.

A single pushbutton switch activates the circuitry to provide indications of relative radiation intensity. Power is supplied by one 9-volt transistor radio battery, and is applied only when the pushbutton is depressed.

Model 499 weighs 1 lb. and is priced at $79.50.

Circle 71 on literature card

Tool Kit

This seven-piece tool kit from GC Electronics consists of long-nose and diagonal-cutting pliers, screwdriver, soldering iron, soldering aid tool, heat sink tool and a coil of rosin-core solder.

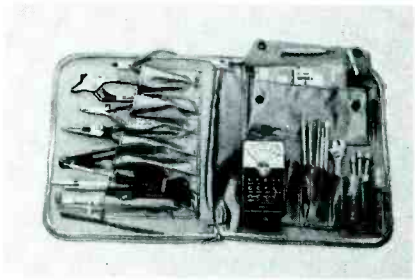
The kit is designated catalog number H3-378 and retails for $7.95.

Circle 72 on literature card

Tool Kit

A new tool kit, the JTK-16 "Detective" kit, with multi-purpose tools in a compact package, designed for field engineers and electronic technicians, has been introduced by Jensen Tools and Alloys.

Each kit reportedly contains: three regular screwdriver blades, three Phillips-type blades, a set of jeweler's screwdrivers, three nut-driver blades, an adjustable wrench, a 10-piece Allen-hex wrench set, a 10-piece Bristol-spline wrench set, utility-type pliers, long nose side-cutting pliers, miniature side-cutting pliers, chain nose pliers, a wire stripper, two multi-purpose handles,



a knife, saw blade, 6″ scale, miniature soldering iron, solder, solder aid, burnisher, alignment tool set, and a needle file. The tools are contained in a padded zipper case with pockets to hold each tool in place.

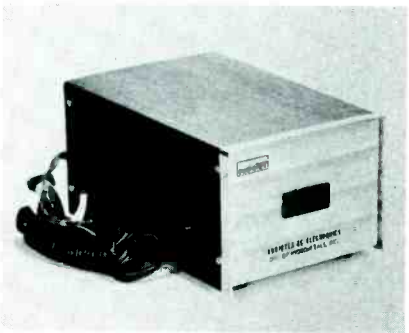
The JTK-16 tool kit, complete with a Simpson No. 355 VOM miniature tester, is priced at $104.50. The kit without the tester sells for $54.50.

Circle 73 on literature card

Power Converters For Home Use

A pair of power converters which make it possible to use automotive electronic equipment in the home have been introduced by GC Electronics. Both units reportedly convert 117 volts AC to 12 volts DC, but at different power demand levels.

The standard Model, No. 30-3090, provides 12 volts DC at 1.5



amperes continuous or 3 amperes peak. The Hi-Power Model, No. 30-3091, provides 4 amperes continuous or 8 amperes peak.

Both power supplies are fused

and are equipped with universal plugs that fit all standard stereo and other automotive electronic equipment, according to the manufacturer.

Both models are said to be completely solid state, have voltage-regulating circuitry and are hum-free.

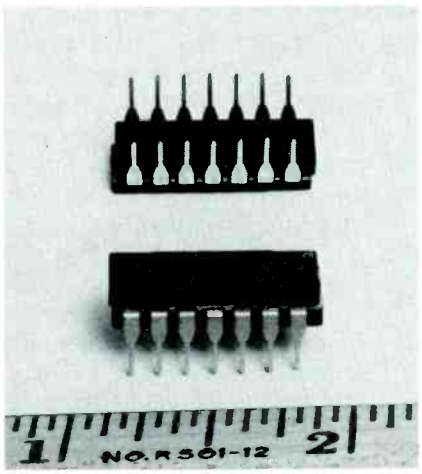
Model No. 30-3090 is priced at $26.95, and No. 30-3091 sells for $32.42.

Circle 74 on literature card

Linear Integrated Circuits

A group of linear integrated circuits suitable for use as replacement parts in home entertainment products is being offered by Sylvania Electric Products, Inc.

The linear integrated circuits reportedly complement transistors and other semiconductor devices included in the Sylvania ECG replacement line. Twelve linear types,



described as silicon monolithic integrated circuits, reportedly were selected by Sylvania to minimize inventories for service technicians while providing them with economical replacement parts for a wide variety of electronic entertainment equipment.

The units are available in a number of plastic and metal package configurations, including can-type and plug-in designs.

Prices start at $2.10. ▲

Circle 75 on literature card

For more information about above products use reader service card

advertisers' index

catalogs literature

ACCESSORY ITEMS

100. *Russell Industries*—announces their Catalog No. 72, which covers bumper feet and grommets. A new line of nylon "Caterpillar" grommets are included.

ANTENNAS

101. *Antenna Specialists*—has prepared a new complete line catalog describing its monitor products, covering 27 different antennas and accessories.
102. *Jerrold Electronics Corp.*—has released a 56-page full line general distributor catalog which includes a guide to MATV systems and nearly 300 Jerrold products. The catalog cost is $1.00.
103. *Jerrold Electronics Corp.*—Catalog S, titled "Systems and Products for TV Distribution," lists specifications of this manufacturer's complete line of antenna distribution products, including antennas and accessories, head-end equipment distribution equipment and components, and installation aids.
104. *Russell Industries*—announces the availability of a complete line of telescoping antenna rods with swivel bases and sliding adapters for rods to disappear. This line is ideal for walkie/talkie and all portable radio applications.
105. *Vikoa, Inc.*—is making available a 64-page, illustrated catalog covering their line of wire and cables and IDS/MATV equipment. Hardware, accessories, connectors, fittings and an index also are included.
106. *Winegard Antenna Systems*—has made available a 32-page catalog, designated No. 710, which gives specifications and descriptions on their line of outdoor and indoor TV and FM antennas, preamplifiers, wire, home TV systems equipment and commercial systems equipment. Winegard offers a complete selection of fine quality solid-state amplifiers, boosters and electronic devices for MATV systems.

AUDIO

107. *Altec Lansing*—introduces a 12-page brochure for information on sound systems in the sports and entertainment field, stadiums, automobile speedways, hotels, restaurants and other public entertainment facilities.
108. *American Geloso Electronics, Inc.*—has published an 8-page brochure on their line of mini-column sound systems and baffles and speakers. Specifications and installation instructions are included.
109. *Bell P/A Products Corp.*—new 6-page catalog gives detailed specifications and descriptions of the company's broad line of commercial sound components and special purpose sound system products.
110. *Darome, Inc.*—has released an 8-page brochure showing how a complete background music, local public address, and constant level paging system can be installed without using relays or complicated wiring.
111. *Duotone Company*—has made available a new color replacement needle wall reference chart. The chart covers almost all of the major manufacturers from American Microphone and Audax to Telefunken and Zenith. All catagories are grouped according to manufacturer enabling quick and precise answers.
112. *Jensen Manufacturing Div.*—has issued an 8-page catalog, No. 1090-E, which describes applications of 167 individual speaker models. Special automotive, communications, intercom and weathermaster speakers, plus a complete line of electronic musical instrument loudspeakers are featured.
113. *Nortronics Co., Inc.*—has released a new Tape Head Replacement Guide which contains tape head replacements for over 2,800 domestic and foreign recorder models, a cross-reference to both model and head part numbers for reel-to-reel and cartridge recorders.
114. *Shure Brothers, Inc.*—has published a 4-page brochure, "Professional Sound Systems in High Schools, Colleges, and Universities". No. AL 398, describes the company's Vocal Master Sound System and how it helps solve public-address problems.

AUTO ELECTRONICS

115. *GC Electronics*—has issued an 8-page, three-color brochure, FR-132, on their new line of car stereo and radio accessories. Included are cartridge radio tuners and burglar alarms.
116. *Littelfuse, Inc.*—has released a new 32-page, 1971 automotive replacement fuse guide for passenger autos, sports cars, trucks, and taxi cabs. Fuse descriptions and circuits they protect are included.

CABLE

117. *Belden Corporation*—announces a 60-page catalog, No. 871, featuring 134 new products for the instrumentation, communications and data processing fields. Line drawings show physical configurations of each cable type.

COMPONENTS

118. *Alco Electronic Products, Inc.*—introduces their line of Subminiature Incandescent Lamps as described in their new Alcolite Catalog, LA-711. Prices and complete specifications are given for Alco's lamps.

119. *Arco/LDP Div. of Loral Corp.*—has published a new cross-reference guide and price book for its miniature aluminum electrolytic capacitors. The four-page publication includes specifications for the Arco/LDP line of Miniature Arcolytics, cross-references them by part number with similar products of other capacitor manufacturers.
120. *Burstein Applebee*—announces a Guide to RCA Industrial Tube Products. The 31-page guide contains two major sections; Characteristics and Replacements.
121. *General Electric Tube Department* — has released a new 52-page Entertainment Semiconductor Almanac, No. ETRM-4311F. The almanac contains approximately 20,000 cross references from JEDEC, or OEM part numbers to GE parts numbers for universal replacement semiconductors, selenium rectifiers for color TV, dual diodes, and quartz crystals.
122. *General Electric* — a 12-page, 4-color, illustrated "Picture Tube Guidebook", Brochure No. ETRO-5372, provides a reference source for information about GE color picture tube replacements and tube interchangeability.*
123. *Loral Distributor Products* —has made available a 24-page electrolytic capacitor replacement guide. The catalog features replacement products by the original manufacturers part number.
124. *J. W. Miller Co.*—introduces a series of exact replacement coils for color TV and some black and white sets. Included in the series are convergence, stabilizer, chroma oscillator, balun coils and IF transformers.
125. *Motorola, Inc.* — has made available a HEP cross reference guide catalog No. HMA07 which lists replacements for over 27,000 different semi-conductor device type numbers available through authorized HEP suppliers.
126. *Precision Tuner Service*—announces a new tuner parts catalog. The catalog includes a cross reference list of antenna coils and shafts for all makes of tuners.
127. *RCA Distributor Products* —is offering an 8-page illustrated pamphlet entitled "When, Where and Why It Pays To Switch To RCA Alkaline Rechargeable Batteries," No. 1P1385.
128. *RCA/Solid State Division*—announces a revised edition of the Power Transistor Directory, which reflects new product programs, as well as new product data. All product matrices have been updated to include the latest commercial types as well as preliminary data on developmental types, including RCA power transistors, both silicon and germanium. The Index of Types has been expanded to include DT types as well as JEDEC (2N-Series) types and RCA 40-K series types. Copies are $ .40.
129. *Semitronics Corp.*—has a new, revised "Transistor Rectifier, and Diode Interchangibility Guide" containing a list of over 100 basic types of semiconductors that can be used as substitutes for over 12,000 types. Include 25 cents to cover handling and postage.
130. *Stancor Products*—pocket-size, 108-page "Stancor Color and Monochrome Television Parts Replacement Guide" provides the TV technician with transformer and deflection component part-to-part cross reference replacement data for over 14,000 original parts.
131. *Sylvania Electric Products, Inc.*—a 73-page guide which provides replacement considerations, specifications and drawings of Sylvania semiconductor devices plus a listing of over 35,000 JEDEC types and manufacturers' part numbers. Copies are $1.00.*
132. *Teledyne Semiconductor* — announces a new Dual Field Effect Transistor Selection Guide comparing the specifications of 78 different devices, including 10 monolithic FET's. Listed in the guide are several parameters and design considerations for each device, including matching characteristics, package types, breakdown and pinch-off voltages, and minimum/maximum leakage current values.
133. *Workman Electronic Products, Inc.*—has released a 32-page, pocket-size cross reference listing for color TV controls. 105 Workman part numbers are listed in numerical order with specifications and illustrations of the part.

GENERAL

134. *Allied Radio Shack* — announces a new 116-page Spring/Summer 1971 Electronic Parts, Accessories and Kits Catalog. No. 212, lists thousands of hard-to-find or specialized items, including tubes, transistors, cables, tools, connectors, wire, plugs, adapters, antennas and test equipment. It also includes Knight-Kits.

MISCELLANEOUS

135. *Electronic Industries Association* — announces the 1971 "Consumer Electronics Annual," describing developments in the consumer electronics industry over the past 51 years. Copies are $ .50 each.

PICTURE TUBES

136. *GTE Sylvania, Inc.* — has published an interchangeability guide listing 191 commonly used color TV picture tubes which can be replaced with 19 GTE Sylvania Color Bright 85® types.

SERVICE AIDS

137. *Chemtronics, Inc.* — has published a 6-page, 4-color, folder describing TUN-O-Brite chemical spray. Application uses are included.

SPECIAL EQUIPMENT

138. *Switchcraft, Inc.* — announces a new catalog which contains 25 new product listings and over 400 new individual items. All new listings are marked. The 36-page book covers such major Switchcraft product categories as jacks, plugs, switches, connectors, molded cable assemblies, and audio accessories.

TV ACCESSORIES

139. *Telematic*—introduces a 14-page catalog featuring CRT brighteners and reference charts, a complete line of test jig accessories and a cross reference of color set manufacturers to Telematic Adapters and convergence loads.

TECHNICAL PUBLICATIONS

140. *Associated Research, Inc.*—announces a 34-page operation and application handbook (Manual 17456) describing the MEG-CHEK, megohmmeter. Operating instructions, setups and procedures are included.
141. *Chemtronics, Inc.*—has published a pocket-sized booklet describing typical thermal intermittents and how Super Frost Aid aerosol coolant will locate them. A step-by-step service procedure is outlined.
142. *Howard W. Sams & Co., Inc.*—literature describes popular and informative publications on radio and television servicing, communications, audio, hi-fi and industrial electronics, including their 1971 catalog of technical books about every phase of electronics.
143. *RCA Commercial Engineering*—announces a two-page circular (MF901-C) describing a line of eleven comprehensive technical manuals covering solid-state and electron-tube devices and applications.
144. *Sencore, Inc.*—Speed Aligner Workshop Manual, Form No. 576P, provides 20 pages of detailed, step-by-step procedures for operation and application of Sencore Model SM158 Speed Aligner sweep/marker generator.
145. *Sylvania Electric Products, Inc., Sylvania Electronic Components Div.*—has published the 14th edition of their technical manual, which includes mechanical and electrical ratings for receiving tubes, television picture tubes and solid-state devices. Price of this manual is $1.90.*

TEST EQUIPMENT

146. *B & K Mfg. Div., Dynascan Corp.*—is making available an illustrated, 24-page 2-color Catalog BK-71, featuring B&K test equipment, with charts, patterns and full descriptive details and specifications included.*
147. *Eico*—has released a 32-page, 1971 catalog which features 12 new products in their test equipment line, plus a 7-page listing of authorized Eico dealers.*
148. *Leader Instruments Corp.*—presents a 20-page catalog detailing more than 50 test instruments and accessories for electronic equipment maintenance, repair and servicing.
149. *Leader Instruments Corp.*—announces the 1971 Catalog of Leader Test Equipment. Test equipment included is the LBO-301 portable triggered-sweep oscilloscope, LSW-330 new solid-state post injection sweep/marker generator, and the LCG-384 mini-portable, solid-state battery operated color-bar generator.
150. *Leasamatic*—has published a 16-page catalog of "Used Instruments for Sale". Instruments for sale include: Wave Analyzers, Counters, Digital Voltmeters, Impedance and Phase equipment, Oscilloscopes, Signal Sources, Temperature Chambers, Recorders, Voltmeters, Microwave Instruments, Amplifiers, Power Supplies and Microwave Components.
151. *Mercury Electronics Corp.*—14-page catalog provides technical specifications and prices of this manufacturers' line of Mercury and Jackson test equipment, self-service tube testers, testers, test equipment kits and indoor TV antennas.
152. *Pomona Electronics* — has published a 60-page, 1971 catalog of electronic test accessories which contains more than 450 individual products, including 47 new items.
153. *Sencore, Inc.*—Catalog No. 579P (1971) describes this company's complete line of test equipment. Sixteen pages of photographs, specifications, prices and other important data.
154. *Triplett Corp.* — Bulletin No. 51570, a 2-page technical bulletin which provides the specifications and price of Triplett's new Model 602VOM.

TOOLS

155. *Brookstone Co.*—introduces a new, expanded 32-page catalog offering hundreds of unusual and extremely useful hard-to-find tools. Among the new tools are: glass pliers, hand vises, glass drills, jewelers' screwdrivers, watchmakers' loupes and many other tolls and small power tools.
156. *Chapman Manufacturing Co.*—offers a pamphlet containing their line of tools and tool kits. Kit No. 6320, the Midget Ratchet is featured along with other available tool kits.
157. *General Electric* — has issued a 2-page brochure No. GEA-8927, describing the features of GE's new soldering iron.*

*Check "Index to Advertisers" for additional information. ▲

SAMS PHOTOFACT®

Supplement to 1971 ANNUAL INDEX

Covers PHOTOFACT Set Numbers 1146 thru 1181 and Specialized Volumes AR-87 thru AR-99, CB-31 thru CB-34, MHF-8 thru MHF-14, TR-72 thru TR-81, TSM-119 thru TSM-124 Released.

JANUARY thru JUNE 1971

This Supplement is your Index to new models covered by PHOTOFACT since December 1970. For model coverage prior to this date see the 1971 PHOTOFACT Annual Index. Use this Supplement with the Annual Index—together they are your complete Index to PHOTOFACT coverage of over 86,000 models.

NOTE: ● Denotes Television Receiver. ★ Denotes Color Television Receiver. **AOR** Denotes Available On Request. **AR** Denotes Auto Radio Series Volume. **CB** Denotes CB Radio Series Volume. **HTP** Denotes Home Tape Player Series Volume. **MHF** Denotes Modular Hi-Fi Series Volume. **PCB** Denotes Production Change Bulletin. **POM** Denotes Bonus Schematic in Photofact-of-the-Month Package—Unavailable After Month Of Issue. **SED** Denotes Special Equipment Data. **TR** Denotes Tape Recorder Series Volume. **TSM** Denotes Transistor Radio Series Volume.

Set No. Folder No.

ELGIN
Elgin National Industries, Inc.
50-35 56th Road
Maspeth, New York 11378

R-1150 (Similar to Page 31) ..... TSM—44
R-1650 ..... TSM—122
R-5100 ..... 1159—3

EMERSON
(Also See Changer Listing)
Emerson Television Sales Corp.
14th & Coles Streets
Jersey City, N.J. 07302

P1936/1937 (Ch. 120637/638) ..... 682—5,—6
●19FP01W (Ch. T2L2-1A) ..... 1140—POM
★12EP01W (Ch. T10K10-1D) ..... 1173—1
●13C46 (Ch. 120933A) (PCB 1175-3) 1048—1
●13C46 (Ch. 120933B) (Similar to Chassis) ..... 1048—1
●13C46 (Ch. 120933E) (PCB 1175-3) 1048—1
●13C51 (Ch. 120933A) (PCB 1175-3) 1048—1
●13C51 (Ch. 120933B) (Similar to Chassis) ..... 1048—1
●13C51 (Ch. 120933E) (PCB 1175-3) 1048—1
★16EP01W (Ch. T10K10-1C) ..... 1173—1
●16FP01/02W (Ch. T7K3-1A) ..... 1140—POM
★18EP01W (Ch. 920) ..... 1181—1
★18EP02W (Ch. 930) ..... 1181—1
●18EP03W (Ch. 4K16) ..... 1164—POM
●19FP00 (Ch. T25H4-1A) ..... 1140—POM
●19FP01 (Ch. T7K3-1A) ..... 1140—POM
●19FP02W (Ch. T7K3-1B) ..... 1140—POM
●19FP03W (Ch. T8K3-1B) ..... 1140—POM
●19FP04/05W (Ch. 11H5) ..... 1170—POM
●19P85W (Ch. 120969A) ..... 1112—2
●19P86 (Ch. 120948) (PCB 1175-3) 1048—1
★20C07W (Ch. 120919A) PCB 1165-4) 1063—1
★20EC01W (Ch. 4K16) 1164—POM
●22F101W/FC01W/FC02M, FC03S (Ch. 12H5) 1164—POM
★23EC02M, 23EC03S (Ch. 120980A or B) ..... 1141—1
★23EC04W/05M/06S (Ch. 5K16) ..... 1164—POM
★23ET01W (Ch. 5K16) 1164—POM
★25EC01W/02M/03S/04W/05S (Ch. 6K20) ..... 1170—POM
★26C52W/53M/54S (Ch. (120921A,B) (PCB 1165-4) 1063—1
★26C59W (Ch. 120974B) (Similar to Chassis) ..... 1104—2
★26K16W (Ch. 120923A,B,121007) For TV Chassis (PCB 1165-3) 1063—1
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★26K17S (Ch. 120923A,B,121003) For TV Chassis (PCB 1165-3) 1063—1
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★26T08W (Ch. 120921A) (PCB 1165-3) 1063—1
★26T10W (Ch. 120924A) Similar to Chassis) ..... 1104—2
★29P14W (Ch. 120916A,B) (PCB 1165-3) 1063—1
★29P15W (Ch. 120972A, 471965, 471918) For TV Chassis (PCB 1165-3) 1063—1
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33C46MH/47W/48S (Ch. 121007) ..... 1151—5
33C51W (Ch. 121007) ..... 1151—5
●Ch. T2L2-1A ..... 1140—POM
●Ch. T8K3-1B ..... 1140—POM
★Ch. T10K10-1C,-1D (Run 16) ..... 1173—1
●Ch. T25H4-1A ..... 1140—POM
★Ch. 4K16 ..... 1164—POM
★Ch. 5K16 ..... 1164—POM
★Ch. 6K20 ..... 1170—POM
●Ch. 11H5 ..... 1170—POM
●Ch. 12H5 ..... 1164—POM
★Ch. 920 ..... 1181—1
★Ch. 930 ..... 1181—1
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★Ch. 120916A,B (PCB 1165-3) 1063—1
★Ch. 120919A (PCB 1165-3) 1063—1
★Ch. 120921A,B (PCB 1165-3) 1063—1
★Ch. 120923A,B (PCB 1163-5) 1063—1
●Ch. 120933A,E (PCB 1175-3) 1048—1
●Ch. 120934A/935A,C (PCB 1152-4) 1057—1
●Ch. 120948 (PCB 1175-3) 1048—1
★Ch. 120972A (PCB 1165-3 1063—1
★Ch. 120974B (Similar to Chassis) ..... 1104—2
★Ch. 120980A,B ..... 1141—1
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F

FANON-MASCO
Fanon Electronic Industries
100 Hoffman Place
Hillside, New Jersey 07205

SFT-600 ..... CB—31
SFT-800A ..... CB—34

FISHER
Fisher Radio Corp.
11-40 45th Road
Long Island City, N.Y. 11101

R-200-B (Beginning with Serial #20001) ..... 1139—SED
440-T (Serial #20001 thru 29999) ..... 1094—SED

Set No. Folder No.

FORD
(See Auto Radio and Recorder Listings)

G

GENERAL ELECTRIC
For TV Models
General Electric Company
College Blvd.
Portsmouth, Virginia 23705
For Radio and Phonograph Models
General Electric Company
1101 Broad Street
Utica, New York 13501

A435g,h (Ch. TU240-13,T20G) (Similar to Chassis) ..... 1033—3
A501g,h (Ch. TU240-2,T20F) ..... 1033—3
A534g (Similar to Chassis) ..... 1072—5
A610A ..... 1168—SED
A772g (Similar to Chassis) ..... 1072—5
C251g,h/252g/253g (Ch. TU240-5,T20F) (Similar to Chassis) ..... 1033—3
C345g,h (Ch. TU240-13,T20G) (Similar to Chassis) ..... 1033—3
C374g (Ch. TU240-1,T7NK) For Radio Ch. ..... 1033—3
For Amp Ch. (Similar to) ..... 979—5
C378g (Ch. TU240-1, T20F) ..... 1033—3
C414g,h (Ch. TU240-13,T20G) (Similar to Chassis) ..... 1033—3
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C4510A,C4511A ..... 1149—3
C4515A ..... 1149—3
●CAM722BG-A1 (Ch. A1) (PCB 1154-4) 1015—1
★CAM909EWD (Ch. KE-II) 1177—2
★CBM250NWD-2 (Ch. N-2) ..... 1158—POM
★CBM261CWD-1 (Ch. C-1) (PCB 1175-3) 1100—2
★CBM264CWD-1 (Ch. C-1) (PCB 1175-3) 1100—2
★CBM271CWD-1 (Ch. C-1) (PCB 1175-3) 1100—2
★CBM610EWD (Ch. KE) (PCB 1144-3) 1028—1
★CBM906EWD (Ch. KE) (PCB 1144-3) 1028—1
★CBM909EWD (Ch. KE) (PCB 1144-3) 1028—1
★CCM610EWD (Ch. KE) (PCB 1144-3) 1028—1
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G478g (Ch. TU240-12, T20G) ..... 1033—3
G502g,h /503g (Ch. TU240-2,T20F) ..... 1033—3
G572g (Ch. TU240-1, T20F) ..... 1033—3
G778g (Ch. TU540-1, T30G) ..... 1078—4
●M151SBK-2/152SBN-2, SGL-2 (Ch. S-2) (PCB 1152-4) 965—1
●M157SBK-2/158SCG-2/159SBL-2,SBN-2 (Ch. S-2) (PCB 1152-4) 965—1
●M161SOL-2,SSG-2/162SWD-2 (Ch. S-2) (PCB 1152-4) 965—1
●M165SWD-2 (Ch. S-2) (PCB 1152-4) 965—1
●M168SWD-2 (Ch. S-2) (PCB 1152-4) 965—1
●M181SBN-2 (Ch. S-2) (PCB 1152-4) 965—1
●M1865CN-2 (Ch. S-2) (PCB 1152-4) 965—1
●M719WD-A2 (Ch. A2) 1158—POM
●M731WD-A2/733MP-A2 (Ch. A2) 1158—POM
●M761WD-A2 (Ch. A2) 1158—POM
●M806EWD,M807EWD (Ch. KE) (PCB 1144-3) 1028—1
★M816EWD (Ch. KE) (PCB 1144-3) 1028—1
★M881EWD/882EMP/883EPN (Ch. KE-II) 1177—2
★M885EWD /886EMP/887EPN (Ch. KE-II) 1177—2
★M903EWD (Ch. KE-II) 1177—2
★M908EWD,M909EWD (Ch. KE) (PCB 1144-3) 1028—1
★M910LWD-1/911LMP-1/913LPN-1 (Ch. C-1, L-1) (PCB 1175-3) 1100—2
★M914EWD/915EMP (Ch. KE-II) 1177—2
★M917EWD (Ch. KE) (PCB 1144-3) 1028—1
★M918EPN (Ch. KE-II) 1177—2
★M921EWD (Ch. KE) (PCB 1144-3) 1028—1
★M929EAP (Ch. KE) (PCB 1144-3) 1028—1
★M971EWD/972EMP/973EPN (Ch. KE-II) 1177—2
★M974EWD/975EMP/977EPN (Ch. KE-II) 1177—2
★M981EWD (Ch. KE-II) 1177—2
★M986EAP/987EPN/988EPN (Ch. KE-II) 1177—2
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P2760A,B ..... TSM—122
P2812A ..... TSM—121
P2820A ..... TSM—121
P2840B ..... TSM—124
P2860A ..... TSM—123
P2880A ..... TSM—124
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●SM150SSD-2,SVY-2/152SAV-2 (Ch. S-2) (PCB 1152-4) 965—1
T541h (Ch. T7N-J) ..... 979—5
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Set No. Folder No.

GENERAL ELECTRIC—Cont.

●TR120RVY (Ch. R-1) ..1158—POM
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V636J (Ch. T1N1) ..... 890—5
●WM020WEB-1 (Ch. W-1) ..... 1158—POM
●WM151SBK-2 (Ch. S-2, 1971 Prod.) ..... 1163—1
●WM152SAV-2,SGY-2/154SEB-2,155SEB-2/157SBK-2/158SCG-2 (Ch. S-2, 1971 Prod.) ..1163—1
●WM160SEB-2, SMD-2,SWD-2 (Ch. S-2, 1971 Prod.) ..1163—1
●WM163SWD-2/164SEB-2 (Ch. S-2, 1971 Prod.) ..1163—1
●WM169SWD-2 (Ch. S-2, 1971 Prod.) ..... 1163—1
●WM175SPN-2 (Ch. S-2, 1971 Prod.) ..... 1163—1
●WM193SAV-2,SFR-2,SGY-2/195SEB-2/197SWD-2 Ch. S-2, 1971 Prod.) ..1163—1
★WM212HAV-3 (Ch. H-3) ..1094—1
★WM217HAV-3,HHG-3, (Ch. H-3) ..... 1094—1
★WM217HWD-3 (Ch. H-3) 1094—1
★WM218HBW-3,HWD-3/219HWD-3 (Ch. H-3) (Similar to Chassis) ..... 1094—1
★WM238GWD-1 (Ch. G-1) (Similar to PCB 1057-3) 973—2
★WM257NWD-2 (Ch. N-2) ..... 1158—POM
★WM264CWD-1 (Ch. C-1) (PCB 1175-3) 1100—2
★WM274CWD-1 (Ch. C-1) (PCB 1175-3) 1100—2
★WM277CWD-1/278CCT-1 (Ch. C-1) (PCB 1175-3) 1100—2
★WM279CCT-1, CEA-1, CMD-1 (Ch. C-1) (PCB 1175-3) 1100—2
●WM410EB-D2 (Ch. D2) 1158—POM
●WM430HG-D2/431EB-D2 (Ch. D2) ..... 1158—POM
●WM436WD-D2/437WD-D2 (Ch. D2) ..... 1158—POM
●WM440WD-D2/441WD-D2 (Ch. D2) ..... 1158—POM
●WM505SGY-2/506SVY-2/507SEB-2 (Ch. S-2, 1971 Prod.) ..... 1163—1
●WM510SEB-2 (Ch. S-2, 1971 Prod.) ..... 1163—1
●WM521SEB-2/522SEB-2/524SWD-2 (Ch. S-2, 1971 Prod.) ..... 1163—1
●WM527SWD-2 (Ch. S-2, 1971 Prod.) ..... 1163—1
★WM818CWD-1 (Ch. C-1) (PCB 1175-3) 1100—2
●XCM719WD-A1 (Ch. A1) (PCB 1154-4) 1015—1
●XSM506SVY-2 (Ch. S-2) (PCB 1152-4) 965—1
●Ch. A-1 (PCB 1154-4) 1015—1
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★Ch. L-1 (PCB 1175-3) 1100—2
★Ch. N-2 ..... 1158—POM
Ch. PK3 ..... TSM—123
Ch. R-1 ..... 1158—POM
●Ch. S-2 (PCB 1152-4) 965—1
●Ch. S-2 (1971 Prod.) ..... 1163—1
●Ch. W-1 ..... 1158—POM

GENERAL MOTORS CORP. (GMC) (See Auto Radio and Recorder Listings)

GIBBS
(See Auto Radio and Recorder Listings)

GROMMES
Precision Electronics, Inc.
9101 King Street
Franklin Park, Ill. 60131

LJ8 ..... 1168—SED

H

HAMMOND
(See Auto Radio and Recorder Listings)

HARMON-KARDON
Harmon-Kardon Inc.
55 Ames Court
Plainview, L.I., N.Y. 11803

F-50X ..... 1153—SED

HITACHI
(Also See Recorder Listing)
Hitachi Sales Corporation of America
48-50 34th Street
Long Island City, N.Y. 11101

●IU-52/53 ..... 1158—POM
●IU-54 ..... 1152—POM
KS-1220H ..... 1147—3
KS-2400H ..... MHF—13
●SU-85 ..... 1158—POM
TPQ-201 ..... TSM—119
●TU-71 ..... 1166—2

I

IMPERIAL
(See Auto Radio Listing)

J

JEEP
(See Auto Radio Listing)

JOHNSON
E. F. Johnson Company
11-32nd Avenue S.W.
Waseca, Minnesota 56093

Messenger 102 ..... CB—32
242-102 ..... CB—32

Set No. Folder No.

JULIETTE
(Also See Recorder Listing)
Topp Electronics, Inc.
4201 N.W. 77th Ave.
Miami, Florida 33166

CTP-2010 ..... TSM—120
CTP-2076 ..... TSM—119
FCR-1235/1237 ..... 1158—5
FCR-1265 ..... 1150—6
FCR-1275 ..... 1160—5
FR-1245/1247 ..... 1158—5
R-2424X ..... MHF—14
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RPF-85 ..... 1162—4
RPF-955 ..... 1170—4

K

KLH
KLH Research & Develoment Corp.
30 Cross Street
Cambridge, Mass. 02139

Sixteen-F ..... 1169—SED

KNIGHT
Allied Radio Shack
2617 West Seventh Street
Fort Worth, Texas 76107

KN-150M (35DU819) 1169—SED
KN-3036 (35DU881) 1156—SED
35DU819 ..... 1169—SED
35DU881 ..... 1156—SED

L

LAFAYETTE
(Also See Auto Radio and Recorder Listings)
Lafayette Radio Electronics
111 Jericho Turnpike
Syosset, L.I., New York 11791

Comstat 258 (99-32146WX) CB—33
HB-525D (99-31759WX) CB—31
LR-20 (99-3549) ..... MHF—12
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Micro-12 ..... CB—34
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24-03236WX ..... MHF—9
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99-32146WX ..... CB—33
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LINCOLN
(See Auto Radio and Recorder Listings)

LLOYD'S
(Also See Recorder Listing)
Lloyd's Electronics of California, Inc.
6651 East 26th Street
City of Commerce, Calif. 90022

1J44G-37A ..... 1161—4
1V56W-34A ..... MHF—10
8R35-37A ..... 1176—SED
9F13-08 ..... MHF—13
9H32-16A ..... 1176—5
9J45G-37B ..... 1166—5
9M19 ..... MHF—12
9M39-94A ..... MHF—13
9M73 ..... MHF—12

M

MACY
Macy Dept. Stores
Herald Square
New York, N.Y.

5007 (Similar to Chassis) 1046—8

MAGNAVOX
(Also See Recorder Listing)
The Magnavox Company
Bueter Road
Fort Wayne, Indiana 46803

1R1205 ..... TSM—120
1R1226 ..... TSM—124
1R1708 ..... MHF—14
Chassis A507-01-AA, A507-01-BA ..... 1171—4
Chassis A509-01-AA, A509-02-AA ..... 1154—6
Chassis A576-03-BA 1144—1D
Chassis R228-01-BA 1144—1C
Chassis R230-01-AA, R230-03-AA ..... 1156—4
Chassis R230-71-AA, R230-73-AA ..... 1156—4
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Chassis R235-02-AA, AB (Similar to Page 81) MHF—13
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Chassis R271-71-AA, R271-72-AA ..... MHF—14
Chassis R273-01-AA, R273-02-AA ..... 1155—4
Chassis R273-71-AA, R273-72-AA ..... 1155—4
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★Chassis T904-04-HB,-IB (PCB 1158-4) 796—3
★Chassis T904-04-18 (PCB 1158-4) 796—3
★Chassis T904-04-31,-41,-51,-61 (PCB 1158-4) 796—3

Set No. Folder No.

MAGNAVOX—Cont.

★Chassis T904-07-HB,-IB (PCB 1158-4) 796—3
★Chassis T904-07-31,-41,-51,-61 (PCB 1158-4) 796—3
★Chassis T904-08-HB,-IB (PCB 1158-4) 796—3
★Chassis T904-08-31,-41,-51,-61 (PCB 1158-4) 796—3
★Chassis T904-09-HB,-IB (PCB 1158-4) 796—3
★Chassis T904-09-31,-41,-51,-61 (PCB 1158-4) 796—3
★Chassis T904-10-HB,-IB (PCB 1158-4) 796—3
★Chassis T904-10-31,-41,-51,-61 (PCB 1158-4) 796—3
★Chassis T904-12-HB,-IB (PCB 1158-4) 796—3
★Chassis T904-12-21,-41,-51,-61 (PCB 1158-4) 796—3
★Chassis T904-13-HB,-IB (PCB 1158-4) 796—3
★Chassis T904-13-41,-51,-61 (PCB 1158-4) 796—3
★Chassis T904-14-HB,-IB (PCB 1158-4) 796—3
★Chassis T904-14-41,-51,-61 (PCB 1158-4) 796—3
★Chassis T904-15-HB,-IB (PCB 1158-4) 796—3
★Chassis T904-15-,41,-51,-61 (PCB 1158-4) 796—3
★Chassis T904-16-HB (PCB 1158-4) 796—3
★Chassis T904-17-HB,-IB (PCB 1158-4) 796—3
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★Chassis T904-19-HB,-IB,-JC (PCB 1158-4) 796—3
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★Chassis T904-22-IB (PCB 1158-4) 796—3
★Chassis T904-23-IB (PCB 1158-4) 796—3
★Chassis T904-24-IB (PCB 1158-4) 796—3
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●Chassis T944-03-AB,-BB, T944-04-AB,-BB (Similar to Chassis) ..... 1085—1
●Chassis T944-05-AA,-AB,-BA,-BB, T944-06-AA,-AB,-BA,-BB (Similar to Chassis) ..... 1085—1
●Chassis T944-07-AA,-AB,-BA,-BB, T944-08-AA,-AB,-BA,-BB (Similar to Chassis) ..... 1085—1
●Chassis T945-01-AB,-BA,-BB (Similar to Chassis) ..... 1099—1
●Chassis T945-04-AA,-AB,-BA,-BB (Similar to Chassis) ..... 1099—1
★Chassis T947-01-AA ..... 1179—1
★Chassis T951-01-AA,-AB,-AX,-BA, BB,-BX,-CA,-CB,-CX, DA,-DB,-DX ..... 1180—1
★Chassis T951-02-AA,-AB, -AC,-AZ,-BA ..... 1180—1
★Chassis T951-03-AA,-AX, BA,-BB,-BX,-CA,-CX, DA,-DB ..... 1180—1
★Chassis T951-04-AA, -AB,-AC,-BA ..... 1180—1
★Chassis T951-05-AA, -AB,-AC,-BA ..... 1180—1
★Chassis T951-06-AA,-AC, BA,-CA,-DA,-DC ..... 1180—1
★Chassis T951-07-AA, BA,-BB,CA,DA ..... 1180—1
★Chassis T951-08-AA, AB,-AC,-BA ..... 1180—1
★Chassis T951-09-AA, -AB,-AC,-BA ..... 1180—1
★Chassis T951-10-AC, -CC,-DC ..... 1180—1
★Chassis T951-11-AC, -CC,-DC ..... 1180—1
★Chassis T951-19-AC ..... 1180—1
★Chassis T951-20-AA ..... 1180—1
★Chassis T951-70-AB,-AC ..... 1180—1
★Chassis T951-71-AB,-AC ..... 1180—1
★Chassis T951-72-AB,-DC ..... 1180—1
★Chassis T951-73-AB,-CB ..... 1180—1
★Chassis T951-74-AB,-AC ..... 1180—1
★Chassis T951-75-AB ..... 1180—1
★Chassis T951-76-AB ..... 1180—1
★Chassis T951-77-AB ..... 1180—1
★Chassis T951-78-AC ..... 1180—1
★Chassis T952-01-AA ..... 1164—POM
★Chassis T952-02-AA ..... 1164—POM
★Chassis 704041-1 (TV Remote Control Unit) ..... 1144—1B
★Chassis 704054-1 (TV Remote Control Unit) ..... 1144—1B
★Chassis 704058-1 thru 704058-12 (TV Remote Control Unit) ..... 1180—1A
★Chassis 704061-1 (TV Remote Control Unit) ..... 1180—1A

MALLORY
(See Recorder Listing)

MASTERWORK
(Also See Auto Radio and Recorder Listings)
Masterwork Audio Products
1080 Goffle Road
Hawthorne, New Jersey 07506

M300, M302 ..... 1177—4
M2404 ..... 1152—6
M2415 ..... MHF—10
M3224 ..... 1173—3
M3226 ..... TSM—119
M3306 ..... TSM—121
M3308 ..... TSM—121
M3316 ..... TSM—123
M4596 ..... 1160—SED
M4710 ..... MHF—10
M5134/35/36 ..... 1161—5

Set No. Folder No.

McMARTIN
McMartin Industries, Inc.
605 N. 13th Street
Omaha, Nebraska 68102

LX-40 ..... 1160—SED

MEDALLION
(See Changer Listing)

MERCURY
(See Auto Radio and Recorder Listings)

METEOR
Sears, Roebuck & Company
303 East Ohio Street
Chicago, Illinois 60611
Address Change

MGA
Mitsubishi International Corp.
7045 North Ridgeway Ave.
Lincolnwood, Illinois 60645

●BB-090 ..... 1146—POM
●BS-130 ..... 1146—POM
●BT-120 ..... 1146—POM
●BT-150 ..... 1146—POM
★CH-120 (Ch. 3D81) ..... 1176—3
★CH-140 (Ch. 3D81) ..... 1176—3
★CH-180,CH-1B) ..... 1146—POM
★CM-250A/251A/252A ..... 1171—1
Ch. T511, T512, T513, T514 ..... 1171—1
★Ch. 3D81 ..... 1176—3

MIDLAND
Midland International Corp.
P.O. Box 1903
Kansas City, Missouri 64141

3DX5451 ..... 1167—SED
11-335 ..... 1139—5
13-133E ..... CB—34
13-700 ..... CB—31
13-724 ..... CB—32
13-872 ..... CB—31
13-873 ..... CB—32
●15-114 ..... 1164—1
●15-119 ..... 1170—1
★15-215B ..... 1167—1
19-350 ..... 1167—SED
19-544 ..... MHF—9
19-545 ..... MHF—11
19-640 ..... MHF—9

MILLER (J. W.)
J. W. Miller Company
19070 Reyes Ave.
Compton, California 90221
(Address Change)

MILOVAC
Milovac International Co., Inc.
4215 West 45th Street
Chicago, Illinois 60632

●BW-75 ..... 1140—POM
★CT-180 ..... 1158—1
★CT-711 ..... 1159—1

MONTCLAIR
Oklahoma Tire & Supply
P.O. Box 885
2619 E. Admiral Place
Tulsa, Oklahoma

●C5340W (Similar to Chassis) ..... 858—1
●C5341W (Similar to Chassis) ..... 952—2
●C5345 (Similar to Chassis) 1048—1
●C5370MA (Similar to Chassis) ..... 858—1 or 952—2
●CC574W/575M (Similar to Chassis) ..... 1063—1
●P5010 (Similar to Chassis) 950—3
●P5020 (Similar to Chassis) 1056—2
●P5035 (Similar to Chassis) 838—2
●P5060 (Similar to Chassis) 1057—1
●P5075 (Similar to Chass s) (PCB 972-4) 838—2
●P5140 (Similar to Chassis) 1048—1
●P5180 (Similar to Chassis) (PCB 972-4) 838—2
●P5200 (Similar to Chassis) 1048—1
●T231M/232M (Similar to Chassis) ..... 658—1
●T233,M (Similar to Chassis) ..... 682—1 or 743—2
●T237,M/239M (Similar to Chassis) ..... 702—1
●T241,M/243,M/245,M/247 (Similar to Chassis) 702—1
●T251 (Similar to Chassis) ..743—2
●T5300W (Similar to Chassis) 952—2 or 1048—1
●T5325W (Similar to Chassis) 858—1
●U236/238 (Similar to Chassis) ..... 702—1
●U240/242/244/246/248 (Similar to Chassis) ..... 702—1
●19C-564 (Similar to Chassis) ..... 859—2
★23C-572W/573M,MA (Similar to Chassis) ..... 871—3
●85-503/504 (Similar to Chassis) ..... 838—2
●85-505 (Similar to Chassis) ..... 756—2
●85-508 (Similar to Chassis) ..... 801—1 or 838—2
●85-509 (Similar to Chassis) 801—1
●85-510/511 (Similar to Chassis) ..... 743—2
●85-512 (Similar to Chassis) ..... 776 or 801—1
●85-514 (Early Prod.) (Similar to Chassis) ..... 702—1
●85-514 (Late Prod.) (Similar to Chassis) ..... 801—1
●85-515/516 (Similar to Chassis) ..... 801—1
●85-524 (Similar to Chassis) 702—1
●85-532 (Similar to Chassis) 800—2
●85-533/535/536 (Similar to Chassis) ..... 858—1
●85-538 (Similar to Chassis) 800—2
●85-540 (Similar to Chassis) (PCB 953-3) 702—1
●85-545 (Similar to Chassis) 774—1
●85-550 (Similar to Chassis) 702—1
●85-560 (Similar to Chassis) 774—1
★85-580/581 (Similar to Chassis) ..(PCB 955—3) 871—3

MOPAR
(See Auto Radio Listing)

NOTE: ● Denotes Television Receiver. ★ Denotes Color Television Receiver. **AOR** Denotes Available On Request. **AR** Denotes Auto Radio Series Volume. **CB** Denotes **CB** Radio Series Volume. **HTP** Denotes Home Tape Player Series Volume. **MHF** Denotes Modular Hi-Fi Series Volume. **PCB** Denotes Production Change Bulletin. **POM** Denotes Bonus Schematic in Photofact-of-the-Month Package—Unavailable After Month Of Issue. **SED** Denotes Special Equipment Data. **TR** Denotes Tape Recorder Series Volume. **TSM** Denotes Transistor Radio Series Volume.

MORSE ELECTRO PRODUCTS
(Also See Recorder Listing)
Morse Electro Products Corp.
101-10 Foster Avenue
Brooklyn, New York 11236

Ch. 13 ... 1149–4
Ch. 13 ... 1157–4
Ch. 14 ... 1161–6
Ch. 16 ... 1164–5
Ch. 18 ... 1167–4
Ch. 21 ... 1156–5
Ch. 23 ... 1148–6
Ch. 24 ... 1163–5
Ch. 25 ... 1143–4
Ch. 27M ... 1173–4
Ch. 64 ... 1145–6
Ch. 71 ... 1141–5
Ch. 75 ... 1152–7
Ch. 81 ... 1149–4
Ch. 83C ... 1153–5
Ch. 91 ... 1156–5
Ch. 93M ... 1173–4

MOTOROLA
(Also See Auto Radio and Recorder Listings)
Motorola, Inc.
9401 West Grand Ave.
Franklin Park, Ill. 60131

● BL765FW/766FW (Ch. C22TS-611) ... (PCB 1161-3) 1004–2
● BP309GH-1 (Ch. C12TS-465) (Similar to Chassis) ... 1091–2
● BP317GU/318GW (Ch. C12TS-465) (Similar to Chassis) ... 1091–2
● BP402GU/403GW (Ch. C12TS-465) (Similar to Chassis) ... 1091–2
● BP523FN-1 (Ch. QJ19TS-597) ... 1087–2
● BT756FG (Ch. C22TS-611) ... (PCB 1161-3) 1004–2
● BU759FW (Ch. C22TS-611) ... (PCB 1161-3) 1004–2
★CL893DM (Ch. L23TS-921B,C) ... 1031–1
★HP558GW (Ch. D18TS-929A, B) ... 1175–1
★HT618CH,CN (Ch. E20TS-918, THS-67225) For TV Ch. (PCB 1031–3) 880—2 For Radio Ch. ... 960—1A
MP11FN ... 1158–6
NP12FG ... 1158–6
PP190FN,-1,-2,-1-2 (Ch. CHS-3292,-1) ... 1163–6
PP191FE,-1,-2,-1-2 (Ch. CHS-3292,-1) ... 1163–6
PP238GA (Ch. HS-63230) (Similar to Chassis) ... 911—5
SK5FW/6FP (Ch. CHC-62380) ... 1167–5
SK25FW (Ch. CHC-62376) ... 1167–5
TC2FH (Ch. FHT14) ... 1162–5
TP15GU ... TSM–123
TP20GN ... TSM–119
TT7FH (Ch. FHT13) ... 1162–5
★WL829GS (Ch. G23TS-915G) (Similar to Chassis) ... 1121–1
★WP457GN (Ch. 16TS-929) ... 1164–POM
★WP464GW (Ch. 16TS-929) ... 1164–POM
★WP467GWA (Ch. E16TS-929) ... 1164–POM
★WP553GN/554GW (Ch. 18TS-929) ... 1164–POM
★WP556GW (Ch. 18TS-929A, B) ... 1175–1
★WP557GW (Ch. C18TS-929A, B) ... 1175–1
★WP563GWA (Ch. F18TS-929) ... 1164–POM
★WT561FW (Ch. TS-934) ... 1159–2
★WT478FW (Ch. TS-934) ... 1159–2
★WT815GW/817GW (Ch. TS-934) ... 1159–2
★WU820FW/821FS/822FP (Ch. TS-934) ... 1159–2
★WU828GW (Ch. G23TS-915G) (Similar to Chassis) ... 1121–1
● XU770GS (Ch. 22TS-599B) (Similar to Chassis) ... 1134–1
● YBP317GU/318GW (Ch. YC12TS-465) (Similar to Chassis) ... 1091–2
● YBP402GU/403GW (Ch. YC12TS-465) (Similar to Chassis) ... 1091–2
● ZD402GU (Ch. ZDC12TS-465) (Similar to Chassis) ... 1091–2
● ZW402GU (Ch. ZWC12TS-465) (Similar to Chassis) ... 1091–2
★Ch. C18TS-929A-00 thru B-00 ... 1175–1
● Ch. C22TS-611 ... (PCB 1161-3) 1004–2
Ch. CHC-62376 ... 1167–5
Ch. CHC-62380 ... 1167–5
Ch. CHS-3292,-1 ... 1163–6
Ch. CHS-67295 ... 1173–5
★Ch. D18TS-929A-00 thru B-00 ... 1175–1
★Ch. E16TS-929 ... 1164–POM
★Ch. F18TS-929 ... 1164–POM
Ch. FHT13/14 ... 1162–5
● Ch. QJ19TS-597E-01 ... 1087–2
★Ch. TS-934 ... 1159–2
★Ch. 16TS-929 ... 1164–POM
★Ch. 18TS-929A-00 thru B-00 ... 1175–1
● Ch. 22TS-599B-00 (Similar to Chassis) ... 1134–1

N

NIVICO
(Also See Recorder Listing)
JVC America, Inc.
50-35 56th Road
Maspeth, N.Y. 11378

9810 ... MHF–9

O

OLDSMOBILE
(See Auto Radio and Recorder Listings)

OLYMPIC
Olympic Int'l. Ltd.
Service Dept.
89-89 Union Turnpike
Glendale, N.Y. 11227

F250AB ... 1173–SED
MA338 ... 1165–5
MA345 ... 1165–5
S100 ... 1158–7
SA790 ... 1147–4

OPEL
(See Auto Radio Listing)

P

PACE
Pace Communications Corp.
P.O. Box "P"
24049 South Frampton Ave.
Harbor City, Calif. 90710

TA2300/B ... CB–32
2376 ... CB–32

PACKARD BELL
(Also See Recorder Listing)
Teledyne Packard Bell Electronics
12333 West Olympic Blvd.
Los Angeles, Calif. 90064

★C9-6248CHT,C9-6249RSW ... 1164–2
★C9-6346WAL ... 1164–2
★CQ-964 (Similar to Chassis) ... 1023–1
● M9-1231BGE ... 1172–1
● M9-1234KQT/35GRN ... 1172–1
● M9-1252BLK ... 1172–1
● M9-3231BGE ... 1172–1
● M9-3254RED ... 1172–1
● M9-3257GLD ... 1172–1
● M9-3276WAL ... 1172–1
● M9-5231BGE ... 1174–1
● M9-5252BLK ... 1174–1
● M9-5254TAN ... 1174–1
● M9-5276WAL ... 1174–1
● M9-6231BGE ... 1175–2
● M9-6258CHT ... 1175–2
● M9-6276WAL ... 1175–2
RPC-270CL,ED,WL (Similar to Chassis) ... 1076–4
RPC-270R (Ch. 15TU5, DPA-150-4) For Radio, Amp Ch. ... 1076–4 For Tape Recorder (See Page 34) ... TR–73
RPC-370 (Ch. 15TU5, DPA-150-4) ... 1076–4
★2C934 (Similar to Chassis) ... 1124–2
★2C954 (Similar to Chassis) ... 1124–2
★3C958 (Similar to Chassis) ... 1124–2
★3C968 (Similar to Chassis) ... 1124–2

PANASONIC
(Also See Auto Radio, Changer and Recorder Listings)
Matsushita Elec. Corp. of America
Panasonic Service & Parts Div.
10-16 44th Drive
Long Island City, N.Y. 11101

● AN-76,C ... 1146–1
● AN-86D,DC ... 1146–1
● AN-132, C (Similar to Chassis) ... 1087–3
● AN-199E, EC ... 1180–2
● AN-219,C ... 1154–2
● AN-229,C ... 1154–2
● AN-239D,DC ... 1154–2
● CT-97P,PC ... 1153–2
● CT-98D, DC ... 1179–2
● CT-391E,EC ... 1151–1
★CT-991P (Early Prod.) ... 1169–1
RC-1280, C ... 1169–4
RC-7589 ... 1157–5
RE-7200 ... 1171–5
RE-7500 ... 1178–4
RE-7670, C ... MHF–12
SC-666 ... MHF–14
● TR-339RA ... 1168–2
● TR-339RN ... 1152–1
● TR-469B ... 1168–2
● TR-519,C ... 1146–POM

PEARCE-SIMPSON
Pearce-Simpson Inc.
4701 N.W. 77th Ave.
Miami, Florida 33152

Bearcat 23 ... CB–32
Bobcat 23 ... CB–33
Tiger 23 ... CB–32

PENNEYS-PENNCREST
(Also See Recorder Listing)
J. C. Penney Co., Inc.
1301 Avenue of the Americas
New York, N.Y. 10019

850-0142 ... TSM–122
1100 ... MHF–10
● 1321 ... 1152–POM
1944 ... TSM–122
1971 ... 1141–SED
1993 ... 1147–SED
2310-44 ... 1141–SED
2332/33 (Similar to Chassis) ... 1100–3
● 2338 ... 1162–1
● 2363B (Similar to Chassis) ... 1089–3
★2853 ... 1152–POM
★2871 ... 1140–POM
★2887 ... 1140–POM
★2890 ... 1172–2
3015 ... 1163–7
3545, A ... 1169–5
● 4351-48A ... (PCB 1157-3) 1006–3
● 4352-46A ... (PCB 1157-3) 1006–3
● 4391-48A ... (PCB 1157-3) 1006–3
4600A ... 1156–6
4708A ... 1164–6
4720 ... 1164–6
★4822B (Similar to Chassis) ... 1110–2
★4834A, 4835A (Similar to Chassis) ... 1165–1
★4848A ... 1165–1
★4854A, 4855A ... 1165–1
★4896A ... 4865–1
5110 ... 1059–4
5115 ... 1059–4
5157 ... 1059–4
6422,A ... MHF–9
6651 ... MHF–12
6815,A ... 1154–7
★6883B ... 1165–1

PENNEYS-PENNCREST—Cont.

★6891A ... 1165–1
8757,8758 ... 1154–7
★Ch. T511, T512, T513, T514 ... 1165–1
★Ch. T523, T524 ... 1165–1

PHILCO-FORD
(Also See Recorder Listing)
Philco-Ford Corporation
Tioga & "C" Streets
Philadelphia, Pa. 19134

A1010BL ... TSM–120
● B310UWH (Ch. 21HT15) ... 1164–3
● B321UAV (Ch. 21HT16) ... 1164–3
● B341UBK (Ch. 21HT16) ... 1164–3
● B412UBE,UBK (Ch. 21L23) ... 1162–2
● B422UAV,UHG (Ch. 21L23A) ... 1162–2
● B432UWA (Ch. 21L23A) ... 1162–2
● B521TBE,UAV (Ch. 20P24) ... 1148–1
● B531TWA (Ch. 20P24) ... 1148–1
● B660UBE (Ch. 20ST30A) ... 1172–3
● B660UBE-1 (Ch. 20ST30AV) ... 1172–3
● B711U8R (Ch. 20ST30) ... 1172–3
● B711UBR-1 (Ch. 20ST30V) ... 1172–3
● B716UWA-1 (Ch. 20ST30V) ... 1172–3
● B731UWA (Ch. 21ST31) ... 1172–3
● B731UWA-1 (Ch. 21ST31V) ... 1172–3
● B821UWA (Ch. 21ST31) ... 1172–3
● B821UWA-1 (Ch. 21ST31V) ... 1172–3
● B831UWA (Ch. 21ST31) ... 1172–3
● B831UWA-1 (Ch. 21ST31V) ... 1172–3
● B844UWA (Ch. 21ST31) ... 1172–3
● B844UWA-1 (Ch. 21ST31V) ... 1172–3
● B854UWA (Ch. 21ST31) ... 1172–3
● B854UWA-1 (Ch. 21ST31V) ... 1172–3
● B864UWA (Ch. 21ST31) ... 1172–3
● B864UWA-1 (Ch. 21ST31V) ... 1172–3
● B874UWA (Ch. 21ST31) ... 1172–3
● B874UWA-1 (Ch. 21ST31V) ... 1172–3
★C3750UBR (Ch. 20HT70) ... 1155–2
★C3760UWA (Ch. 20HT71) ... 1155–2
★C4540UBR (Ch. 20KT40B) ... (PCB 1174-4) 1122–2
★C4550UWA (Ch. 21KT41B) ... (PCB 1174-4) 1122–2
★C4551AWA (Ch. 21KT40) ... 1173–2
★C4560UWA (Ch. 21KT41B) ... (PCB 1174-4) 1122–2
★C4561AWA, AWAK (Ch. 21KT41, B) ... 1173–2
★C4561UWA (Ch. 21KT41, B) ... 1173–2
★C4565UWA (Ch. 20KT41BR) ... (PCB 1174-4) 1122–2
★C5550UWA (LP Ch. 20QT87, B - Run 8) (Similar to Chassis) ... 1126–2
★C7020UWA (Ch. 19QT85B) ... (PCB 1161-3) 1140–1
★C7030UWA (Ch. 20QT74) 1161–2
★C7030UWA-1 (Ch. 19QT85B) ... (PCB 1161-3) 1140–1
★C7040UWA (Ch. 20QT75) 1161–2
★C7040UWA-1 (LP Ch. 20QT87, B - Run 8) (Similar to Chassis) ... 1126–2
★C7050UWA (Ch. 20QT75) 1161–2
★C7050UWA-1 (LP Ch. 20QT87, B - Run 8) (Similar to Chassis) ... 1126–2
★C7220UWA (Ch. 19QT85B) ... (PCB 1161-3) 1140–1
★C7224UWA (Ch. 20QT74) 1161–2
★C7224UWA-1 (Ch. 19QT85B) ... (PCB 1161-3) 1140–1
★C7228UWA (Ch. 20QT75) 1161–2
★C7228UWA-1 (LP Ch. 20QT87, B - Run 8) (Similar to Chassis) ... 1126–2
★C7240UWA/41UMA/42UPC (Ch. 20QT76) ... 1161–2
★C7360UWA/7361UWA, 7362UPC (Ch. 21ST90T) ... 1174–2
★C7370UWA/7371UMA/, 7372UPC (Ch. 21ST90) ... 1174–2
★C7380UWA/7382UDK (Ch. 21ST90) ... 1174–2
★C8032USP (LP Ch. 20QT87, B - Run 8) (Similar to Chassis) ... 1126–2
★C8180UWA/8182UDK (TV Ch. Only—21ST90) ... 1174–2
★C9260UWA (Ch. 21KT41B) ... (PCB 1174-4) 1122–2
★C9261AWA, AWAK (Ch. 21KT41, B) ... 1173–2
★C9261UWA (Ch. 21KT41, B) ... 1173–2
★C9450UWA, 9452UDK (Ch. 21ST90T) ... 1174–2
H270TWA (Ch. T20STT) ... 1140–6
H281TMA (Ch. T20STT) ... 1140–6
H302TDK (Ch. T20STT) ... 1140–6
H322TMC (Ch. T20STTZ) ... 1140–6
H331TWA (Ch. T20STT) ... 1140–6
H341TWA (Ch. T20STY) ... 1140–6
H352TDK (Ch. T20STY) ... 1140–6
H360TWA-1 (Ch. T70STZ) ... 1142–6
H371TMA-1 (Ch. T70STZ) ... 1142–6
H410TWA (Ch. T70STX) ... 1142–6
H442TDK (Ch. T70STX) ... 1142–6
H461TMA (Ch. T70ST) ... 1142–6
H520TWA (Ch. T150ST) ... 1149–5
H547TMA (Ch. T150ST) ... 1149–5
H562TDK (Ch. T150ST) ... 1149–5
H662TDK (Ch. T300ST) ... 1146–5
H915TWA (Ch. T20STT) ... 1140–6
H920UEB,UWA,UWH (Ch. U70STDKX-T70STX) (Similar to Chassis) ... 1142–6
H940TDK (Ch. T70STX) ... 1142–6
H962UDK (Ch. T70STDK-T70STX) (Similar to Chassis) ... 1142–6
H965ALK (Ch. T70STX) (Similar to Chassis) ... 1142–6
M3700TWA (Ch. T20STX) ... 1140–6
M3850TWA (Ch. T150STA) ... 1149–5
P670BE ... 1101–6
P730BE/731BE (Ch. 9PS4) ... 1177–5
P740BE/741BK (Ch. 9PS4) ... 1177–5
P745WA (Ch. 9PS4) ... 1177–5
P771WA (Similar to Chassis) ... 1050–7

PHILCO-FORD—Cont.

● P2710BR/2712WH (Ch. 16H22) ... 1156–SED
● Q270BTN (Ch. 16H22) ... 1156–SED
R165BK ... TSM–124
R185BR, BR-1 (Ch. 9FS2F) ... TSM–123
R190BR (Ch. 9FS2F) ... TSM–123
R191BR (Ch. 9F2SH) ... TSM–123
R440WA (Similar to Chassis) ... 974—5
R445WA (Similar to Chassis) ... 974—5
R580WA (Similar to Chassis) ... 974—5
R969WH (Similar to Chassis) ... 976—7
● R1228PGY (Ch. 17C21) ... 897—1
● R1240TN,BR (Ch. 17C21V) ... 897—1
● R1242AV,BK,GY,SL,WH (Ch. 17C21AV) ... 897—1
● R1243WA (Ch. 17C21AV) ... 897—1
● R2608BE (Ch. 17H22) ... 895—3
● R2720BE,GY/2722WH (Ch. 17H22) ... 895—3
● R2724WA (Ch. 17H22) ... 895—3
● R3330WH/3331BE (Ch. 17J27) ... 861—1
● R3344GY/3346WA (Ch. 17J27A) ... 861—1
● R3396WA (Ch. 17J27) ... 861—1
● R3563TN (Ch. 17J25) ... 890—3
● R3566SD/3567WA/3569WA (Ch. 17J25) ... 890—3
● R3578WA (Ch. 17JT41) ... 888—3
● R3622EA (Ch. 17J25) ... 890—3
● R3626WA (Ch. 17JT41) ... 888—3
S746 (Similar to Chassis) ... 974—5
S976/978 (Similar to Chassis) ... 974—5
★S6604RWA/6606RMA (Ch. 19QT87R) (Similar to Chassis) ... 1026–3
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★SD6690WA/6691MA/6692WA (Ch. 19QT87) (Similar to Chassis) ... 1026–3
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PHILIPS
Philips Electronics Industries, Ltd.
156 Vanderhoff
Toronto 17, Ontario, Canada

AG9016/00 (Similar to Chassis) ... 599—9

PHONOLA
Telex-Waters Canley Co., Inc.
9600 Aldrich Avenue South
Minneapolis, Minn. 55420

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PILOT
Pilot Radio-Television Corp.
600 Monmouth Street
Jersey City, N.J. 07302

MC-30 (Ch. 123012) ... MHF–10
Ch. 123012 ... MHF–10

PLYMOUTH
(See Auto Radio and Recorder Listings)

PONTIAC
(See Auto Radio and Recorder Listings)

R

RCA
(Also See Changer Listing)
RCA Sales Corporation
600 North Sherman Drive
Indianapolis, Ind. 46201

● AM185W,WEN (Ch. RCS171F) ... (PCB 1151-3) 1061–1
● AM193YIP (Ch. RCS171E) ... (PCB 1151-3) 1061–1
● AM196WEN (Ch. RCS171E) ... (PCB 1151-3) 1061–1
● AM199WNS (Ch. RCS171H) ... (PCB 1151-3) 1061–1
● AM219WKEN (Ch. RCS171E) ... (PCB 1151-3) 1061–1
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● AP108Y (Ch. RCS176H, RC-3006) ... 1167–2
● AP122W (Ch. RCS169XA) 1140–2
● AP125WNS (Ch. RCS169XC) (Similar to Chassis) ... 1140–2
● AP133B,N,Y (Ch. KCS177C) ... 1149–2
● AP136Y (Ch. KCS177C) ... 1149–2
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RCA—Cont.

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● AP195WEN (Ch. KCS171E) 1061–1
● AP199WNS (Ch. KCS171H) ... (PCB 1151-3) 1061–1
● AP222WEN (Ch. KCS171K,KTJ) ... (PCB 1151-3) 1061–1
● AP229WKEN (Ch. KCS171L) ... (PCB 1151-3) 1061–1
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● AP262A (Ch. KCS179ZA) 1160–1
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● AQ191W/194W (Ch. KCS171E) (Similar to Chassis) ... 1061–1
● AQ201WEN (Ch. KCS174H) (Similar to PCB 1142-4) 1115–2
● AZ151W (Ch. KCS168XA) (Similar to Chassis) ... 1152–2
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● BQ121WEN (Ch. KCS179XA) ... 1160–1
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● EQ447W (Ch. CTC55XP) ... 1158–POM
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★FL619W (Ch. CTC38XP) ... (PCB 1146-4) 1000–3
★FM507W (Ch. CTC38XA) ... (PCB 1160-4) 1092–3
★FP 564W (Ch. CTC39XT) (Similar to Chassis) ... 1126–3
★FQ505W,WR (Ch. CTC46A,B) ... 1170–POM
★FS515W (Ch. CTC39XAP) (Similar to Chassis) ... 1126–3
★GJ725W (Ch. CTC31A) ... 928—3
★GL616W (Ch. CTC38XP) ... (PCB 1146-4) 1000–3
★GL621L (Ch. CTC38XP) ... (PCB 1146-4) 1000–3
★GL624W (Ch. CTC38XP) ... (PCB 1146-4) 1000–3
★GL636WX (Ch. CTC38XP) ... (PCB 1146-4) 1000–3
★GL650M (Ch. CTC38XP) ... (PCB 1146-4) 1000–3
★GL678S (Ch. CTC38XP) ... (PCB 1146-4) 1000–3
★GL684W (Ch. CTC38X) ... (PCB 1146-4) 1000–3
★GL684WR (Ch. CTC38XR) ... (PCB 1146-4) 1000–3
★GL690W (Ch. CTC38XP) ... (PCB 1146-4) 1000–3
★GL692D (Ch. CTC38X) ... (PCB 1146-4) 1000–3
★GL692DR (Ch. CTC38XR) ... (PCB 1146-4) 1000–3
★GL692S (Ch. CTC38X) ... (PCB 1146-4) 1000–3
★GL698L (Ch. CTC38XP) ... (PCB 1146-4) 1000–3
★GL759WK (Ch. CTC38XP) ... (PCB 1146-4) 1000–3
★GM521W (Ch. CTC38AB) ... (PCB 1160-4) 1092–3
★GM531W (Ch. CTC38XA) ... (PCB 1160-4) 1092–3
★GM553W (Ch. CTC38XA) ... (PCB 1160-4) 1092–3
★GM577W (Ch. CTC38XA) ... (PCB 1160-4) 1092–3
★GM607W (Ch. CTC38XJ) ... (PCB 1160-4) 1092–3
★GM609W (Ch. CTC38XF) ... (PCB 1160-4) 1092–3
★GM645W (Ch. CTC38XA) ... (PCB 1160-4) 1092–3
★GM743W (Ch. CTC38XJ) ... (PCB 1160-4) 1092–3
★GM765DK,SK (Ch. CTC38XA) ... (PCB 1160-4) 1092–3
★GP568W (Ch. CTC38P) ... (PCB 1160-4) 1092–3
★GP586W (Ch. CTC38XA) ... (PCB 1160-4) 1092–3
★GP596D,S (Ch. CTC39XA) (Similar to Chassis) ... 1126–3
★GP629W/631W (Ch. CTC39XAN) (Similar to Chassis) ... 1126–3
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★GP668W (Ch. CTC40P) ... (PCB 1174-4) 1111–3
★GP746W (Ch. CTC39XT) (Similar to Chassis) ... 1126–3
★GP750W (Ch. CTC39XT) ... (PCB 1169-3) 1126–3
★GP753L/754S (Ch. CTC39XT) ... (PCB 1169-3) 1126–3
★GQ575A,W (Ch. CTC46A) ... 1170–POM
★GQ579L (Ch. CTC46A) 1170–POM
★GQ583S (Ch. CTC46A) 1170–POM
★GQ725W (Ch. CTC46H) ... 1170–POM
★HL812M,W (Ch. CTC38K, RC-1227H) For TV Ch. ... (PCB 1146-4) 1000–3 For Radio Ch. ... 1001–3
★HL818W (Ch. CTC38K, RC-1227H) For TV Ch. ... (PCB 1146-4) 1000–3 For Radio Ch. ... 1001–3

RCA—Cont.

★HL818WR (Ch. CTC38XAE, RC-1227H) For TV Ch. (Similar to PCB 1146-4) 1000–3 For Radio Ch. ... 1000–3
★HL824L (Ch. CTC38XAD, RC-1227H) For TV Ch. ... (PCB 1146-4) 1000–3 For Radio Ch. ... 1001–3
★HL824LR (Ch. CTC38XAE, RC-1227H) For TV Ch. (Similar to PCB 1146-4) 1000–3 For Radio Ch. ... 1001–3
★HL830W (Ch. CTC38XAD, RC-1223D,RK-314H, RS-215M) For TV Ch. ... (PCB 1146-4) 1000–3 For Radio/Amp Ch. ... 1001–3
★HL884WK (Ch. CTC38XAD, RC-1227H) For TV Ch. ... (PCB 1146-4) 1000–3 For Radio Ch. ... 1001–3
★HL890LK (Ch. CTC38XAD, RC-1227H) For TV Ch. ... (PCB 1146-4) 1000–3 For Radio Ch. ... 1001–3
★HM801W (Ch. CTC38XC, RC-1239A,RS-252D) For TV Ch. ... 1092–3 For Radio/Amp Ch. ... 1087–5
★HM807W (Ch. CTC38XC, RC-1239A,RS-252D) For TV Ch. ... 1092–3 For Radio/Amp Ch. ... 1087–5
★HM813L (Ch. CTC38XC, RC-1239A,RS-252D) For TV Ch. ... 1092–3 For Radio/Amp Ch. ... 1087–5
★HM819W (Ch. CTC40AD, RC1238B,RS-253B) For TV Ch. ... 1111–3 For Similar Radio/Amp. Ch. ... 1123–4
★HM819WR (Ch. CTC40AE, RC-1238C,RS-253B) For TV Ch. ... 1111–3 For Similar Radio/Amp Ch. ... 1123–4
★HM831H,L (Ch. CTC40AD, RC-1238B,RS-253B) For TV Ch. ... 1111–3 For Similar Radio/Amp Ch. ... 1123–4
★HM831HR,LR (Ch. CTC40AE, RC-1238C,RS-253B) For TV Ch. ... 1111–3 For Similar Radio/Amp Ch. ... 1123–4
★HM837F (Ch. CTC40AD, RC-1238B,RS-253B) For TV Ch. ... 1111–3 For Similar Radio/Amp Ch. ... 1123–4
★HM843D,S (Ch. CTC40AD, RC-1238B,RS-253B) For TV Ch. ... 1111–3 For Similar Radio/Amp Ch. ... 1123–4
★HM843DR,SR (Ch. CTC40AE, RC-1238C,RS-253B) For TV Ch. ... 1111–3 For Similar Radio/Amp. Ch. ... 1123–4
★HM849W (Ch. CTC40AB, RC-1238B,RS-246B) For TV Ch. ... 1111–3 For Radio/Amp Ch. ... 1123–4
★HM849WR (Ch. CTC40AC, RC-1238C,RS-246B) For TV Ch. ... 1111–3 For Radio/Amp Ch. ... 1123–4
★HM855D,S (Ch. CTC40AB, RC-1238B,RS-246B) For TV Ch. ... 1111–3 For Radio/Amp Ch. ... 1123–4
★HM855SR (Ch. CTC40AC, RC-1238C,RS-246B) For TV Ch. ... 1111–3 For Radio/Amp Ch. ... 1123–4
★HM861WK (Ch. CTC40AF, RC-1239A,RS-253D) For TV Ch. ... 1111–3 For Radio/Amp Ch. ... 1087–5
★HM867LK (Ch. CTC40AF, RC-1239A,RS-253D) For TV Ch. ... 1111–3 For Radio/Amp Ch. ... 1087–5
★HM873SK (Ch. CTC40AF, RC-1239A,RS-253D) For TV Ch. ... 1111–3 For Radio/Amp Ch. ... 1087–5
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● JM195W (Ch. KCS 171D) ... (PCB 1151-3) 1061–1
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RZC240W ... 1159–4
RZG121T ... 1150–SED
RZG354E ... TSM–123
RZM146A,B ... TSM–120
RZM151E,T ... TSM–120
RZM175J ... TSM–122
RZM188B,E ... TSM–119
RZM193E ... TSM–122
RZM990EK ... TSM–122
RZM995EK ... TSM–119
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RZS472N,R,T ... 1159–4
RZS478W ... 1159–4
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VPP59W (Ch. RS-264A) ... 1177–6
VPP60B,W (Ch. RS-264A) ... 1177–6
VPP64W (Ch. RS-255B) ... MHF–8
VPT30W/31L 32S/33F (Ch. RC-1239D, RS-252E) ... 1169–6
VPT40W/41L/42D,S/43F (Ch. RC-1239E, RS-253E) ... 1169–6
VPT50W/51H/52S/54F (Ch. RC-1239E, RS-253E) ... 1169–6
VPT60W/61L/62S/63F (Ch. RC-1239E,J, RS-266A) ... 1169–6
VPT70E (Ch. RC-1239J, RS-266C, RK-331) ... 1169–6
VPT82S,VPT84F (Ch. RC-1233B,RS-238E, RS-247C) ... 1146–6
VQP55B (Ch. RS-248B) ... 1019–8

NOTE: ● Denotes Television Receiver. ★ Denotes Color Television Receiver. **AOR** Denotes **A**vailable **O**n **R**equest. **AR** Denotes **A**uto **R**adio Series Volume. **CB** Denotes **CB** Radio Series Volume. **HTP** Denotes **H**ome **T**ape Player Series Volume. **MHF** Denotes **M**odular **H**i-**F**i Series Volume. **PCB** Denotes **P**roduction **C**hange **B**ulletin. **POM** Denotes **P**hotofact-**o**f-the-**M**onth Package—Unavailable After Month Of Issue. **SED** Denotes **S**pecial **E**quipment **D**ata. **TR** Denotes **T**ape **R**ecorder Series Volume. **TSM** Denotes **T**ransistor **R**adio Series Volume.

Set No. | Folder No.

RCA—Cont.

★14H935MV,MU/936,MU (Ch. CTC15AC,AD, RC1121SC, RS-203B)
For Similar TV Ch. ... 673—2
For Radio/Amp Ch. 704—2C,-2E
★14H946MV,MU,RV (Ch. CTC15J,K,N, RC-1215C, RS-203B)
For Similar TV Ch. ... 673—2
For Radio/Amp Ch. 704—2C,-2E
★14H954MV,MU,RV (Ch. CTC15J,K,N, RC-1215C, RS-203B)
For Similar TV Ch. ... 673—2
For Radio/Amp Ch. 704—2C,-2E
★14H960MV,MU,RV (Ch. CTC15J,K,N, RS-1215C, RS-203B)
For Similar TV Ch. ... 673—2
For Radio/Amp Ch. 704—2C,-2E
★14H968MV,MU, RV/969MV, MU,RV (Ch. CTC15J,K,N, RC-1215C, RS-203B)
For Similar TV Ch. ... 673—2
For Radio/Amp Ch. 704—2C,-2E
★14H976MV,MU,RV (Ch. CTC15J,K,N, RC-1215C, RS-203B)
For Similar TV Ch. ... 673—2
For Radio/Amp Ch. 704—2C,-2E
★14H980MV,MU,RV (Ch. CTC15L,M,P, RC-1211B, RS-177J)
For Similar TV Ch. ... 673—2
For Radio/Amp Ch. ... 683—13
★14H986MV,MU,RV (Ch. CTC15L,M,P,RC-1211B, RS-177J)
For Similar TV Ch. ... 673—2
For Radio/Amp Ch. ... 683—13
★14H989MV,MU,RV (Ch. CTC15L,M,P, RC-1211B, RS-177J)
For Similar TV Ch. ... 673—2
For Radio/Amp Ch. ... 683—13
★14H995MV,MU,RV (Ch. CTC15L,M,P, RC-1211B, RS-204A)
For Similar TV Ch. ... 673—2
For Radio/Amp. Ch. ... 692—11
★Ch. CTC15AC,AD (Similar to Chassis) ... 673—2
★Ch. CTC15J,K,L,M,N,P (Similar to Chassis) ... 673—2
★Ch. CTC22AD (PCB 1152-4) 1107—1
★Ch. CTC38A (PCB 1146-4) 1000—3
★Ch. CTC38AB (PCB 1160-4) 1092—3
★Ch. CTC38K (PCB 1146-4) 1000—3
★Ch. CTC38P (PCB 1160-4) 1092—3
★Ch. CTC38X (PCB 1146-4) 1000—3
★Ch. CTC38XA (PCB 1160-4) 1092—3
★Ch. CTC38XAD (PCB 1146-4) 1000—3
★Ch. CTC38XF,XJ (PCB 1160-4) 1092—3
★Ch. CTC38XP,XR,XT (PCB 1146-4) 1000—3
★Ch. CTC39XT (PCB 1169-3) 1126—3
★Ch. CTC40P (1971 Prod.). (PCB 1174-4) 1111—3
★Ch. CTC41XP (PCB 1160-4) 1112—3
★Ch. CTC42A (PCB 1160-4) 1112—3
★Ch. CTC43XP (Similar to Chassis) ... 1137—1
★Ch. CTC46A,B,H ... 1170—POM
★Ch. CTC53A,A1,XP ... 1170—POM
★Ch. CTC55XP ... 1158—POM
●Ch. KCS168D (1971 Prod.) ... 1152—2
●Ch. KCS168XA (Similar to Chassis) ... 1152—2
●Ch. KCS169XC (Similar to Chassis) ... 1140—2
●Ch. KCS171D,E,F,H,J,K,L (PCB 1151-3) 1061—1
●Ch. KCS174H (PCB 1142-4) 1115—2
●Ch. KCS176H ... 1167—2
●Ch. KCS177C (PCB 1169-3) 1149—2
●Ch. KCS179XA,ZA ... 1160—1
●Ch. KCS183A ... 1151—2
●Ch. KCS-184A ... 1158—2
●Ch. KCS185B ... 1170—2
Ch. RC-1218D (Similar to Chassis) ... 786—10
Ch. RC-1218J,K ... 829—2B
Ch. RC-1233B ... 1146—6
Ch. RC-1239D,E,J ... 1169—6
Ch. RC-3006 ... 1167—2A
Ch. RK-331 ... 1169—6
Ch. RS-238E ... 1146—6
Ch. RS-247C ... 1146—6
Ch. RS-252E/253E ... 1169—6
Ch. RS-255B ... MHF—8
Ch. RS-264A ... 1177—6
Ch. RS-266A,C ... 1169—6

RANGER
(See Auto Radio and Recorder Listings)

REALISTIC
(Also See Auto Radio and Recorder Listings)
Radio Shack Corporation
2727 West 7th Street
Fort Worth, Texas 76107

SC-70 (13-1045) ... MHF—11
TRC-28 (21-116) ... CB—31
13-1045 ... MHF—11
13-1138 ... MHF—12
13-1174 ... 1175—5
13-1175 ... 1168—4
13-1179 ... 1177—7
21-116 ... CB—31
22W (13-1138) ... MHF—12

REALTONE
Realtone Electronics Corp.
34 Exchange Place
Jersey City, N.J. 07302

4332 ... 1141—6

Set No. | Folder No.

REGENCY
Regency Electronics, Inc.
7900 Pendleton Pike
Indianapolis, Indiana 46226

CB-254 ... CB—33
Imperial II (CB-254) ... CB—33

ROBERTS
(See Recorder Listing)

ROBYN
Robyn Company
P.O. Box 478
Rockford, Michigan 49341

J-123 ... CB—34

ROSS
(Also See Recorder Listing)
Ross Electronics Corporation
2834 South Lock Street
Chicago, Illinois 60608

RE-025 ... CB—31
RE-050 ... CB—31
RE-1080 ... 1160—6
RE-1085 ... 1172—4
RE-1096 ... 1162—6
RE-2095 ... TSM—119
RE-2260 ... 1178—6
RE-3800 ... TSM—120
RE-5100 ... 1167—6
RE-5200 ... 1170—5
RE-8801 ... TSM—121
RE-8994 ... TSM—122

S

SAAB
(See Auto Radio Listing)

SBE
Linear Systems Inc.
220 Airport Boulevard
Watsonville, California 95076

Cascade ... CB—31
SBE-3CB (Cascade) ... CB—31
SBE-6CB ... CB—33

SCOTT (H.H.)
H.H. Scott Inc.
111 Powder Mill Road
Maynard, Massachusetts 01754

344-B ... 1148—SED

SEARS-SILVERTONE
(Also See Auto Radio and Recorder Listings)
Sears Roebuck & Company
303 East Ohio Street
Chicago, Illinois 60611

132.20330000, .132.20330001 ... 1176—6
132.20340000, .132.20340001 ... 1176—6
132.20830000 ... 1176—6
132.22770000 ... TSM—122
132.96120000 ... 1151—SED
174.22960000 ... TSM—124
257.14312000 ... 1173—SED
528.31103000 ... 1172—5
528.31104000 ... 1172—5
528.31106000 ... 1172—5
528.31153000 ... 1172—5
528.31154000 ... 1172—5
528.31155000 ... 1172—5
528.31203000 thru .31203005 ... 1175—6
528.31204000 thru .31204005 ... 1175—6
528.31206000 thru .31206005 ... 1175—6
528.31253000 thru .31253005 ... 1175—6
528.31254000 thru .31254005 ... 1175—6
528.31256000 thru .31256005 ... 1175—6
528.31303000 thru .31303005 ... 1175—6
528.31304000 thru .31304005 ... 1175—6
528.31305000 thru .31305005 ... 1175—6
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528.31506000 thru .31506005 ... 1175—6
528.32522000 ... 1151—6
528.32622000/001/002 (Similar to Chassis) ... 1104—5
528.32662000/001/002/003 (Similar to Chassis) ... 1104—5
528.32711000/001 (Similar to Chassis) ... 1104—5
528.32712100 (Similar to Chassis) ... 1104—5
528.32722000/001 (Similar to Chassis) ... 1104—5
528.32820000/0001 (Similar to Chassis) ... 1104—5
528.32840000/0001 (Similar to Chassis) ... 1104—5
★528.40950000 ... 1146—POM
★528.41880000 ... 1152—POM
★528.42711000 ... 1152—POM
528.42790000 (Similar to PCB 1126-4) ... 965—2
★528.43050000 ... 1127—3
★528.43100000/110000/120000 ... 1152—POM
★528.43140000/150000/160000/170000 ... 1152—POM
●528.50380001 (Similar to Chassis) ... 1138—1
●528.50800001 (Similar to Chassis) ... 1138—1
●528.51030000 ... 1152—POM
●528.51140001 thru .51140005 (Similar to Chassis) ... 1134—3
●528.51150001 thru .51150005 (Similar to Chassis) ... 1134—3
●528.51200000/210000/220000 ... 1152—POM
●528.51260000 ... 1152—POM
●528.51710900/901/902 (Similar to Chassis) ... 1130—3
●528.71720900/901/902 (Similar to Chassis) ... 1130—3
★562.40280000 ... 1171—2
★562.40800000 ... 1154—3
★562.40900000 ... 1170—POM
★562.41550000 ... 1151—SED
●562.50260001 (Similar to Chassis) ... 1142—2
★564.41220000, 564.41220001 ... 1169—2

Set No. | Folder No.

SEARS-SILVERTONE—Cont.

●564.50080100 ... 1170—POM
833.63250 ... TSM—119
2056 (Ch. 132.51701) ... MHF—9
3017/18/19 (Ch. 528.64410/411) ... 1171—6
3035/36/37 (Ch. 528.64410/411) ... 1171—6
3045/46/47 (Ch. 528.64420) ... 1153—6
3050/51/52 (Ch. 528.64420) ... 1153—6
3060/61/62 (Ch. 528.64430) ... 1153—6
3075/76/77/78 (Ch. 528.64440/441/442 ... 1153—6
3080/81/82 (Ch. 528.64440/441/442,528.58341) For Radia Ch. ... 1153—6
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3083/84 (Ch. 528.64450/451,528.58341) For Radio Ch. ... 1153—6
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3295 (Ch. 528.64290) ... 1149—6
★3022 (Ch. 562.10501/502) (PCB 1142-4) 1108—2
★4159 (Ch. 564.80135/136/141) ... 1181—2
★4406 (Ch. 528/529.81360 thru 81365,528.64312) For TV Ch. ... 1127—3
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●5005 (Ch. 528.70581/582) (PCB 1163-3) 1064—3
●5022 (Ch. 564.80113) (Similar to Chassis) ... 1139—2
6458 (Ch. 787.10020) ... 1158—SED
7423 (Ch. 540.10070) ... MHF—11
7433 (Ch. 540.10090) ... MHF—14
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32922 (Ch. 528.64290) ... 1149—6
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★41101 (Ch. 564.80160) ... 1147—1
★41101 (Ch. 564.80161) (Similar to Chassis) ... 1147—1
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Ch. 528.64410/411 ... 1171—6
Ch. 528.64420 ... 1153—6
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★Ch. 528.72370 thru 72380 ... 965—2
★Ch. 528.72381/82/83/84/85 (Similar to Chassis) ... 965—2
★Ch. 528.72386 thru .72392 ... 965—2
★Ch. 528.81110 (Similar to Chassis) ... 1127—3
★Ch. 528.81116 (Similar to Chassis) ... 1127—3
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Ch. 540.10090 ... MHF—14
★Ch. 562.10501/502 (PCB 1142-4) 1108—2
★Ch. 562.10525 (PCB 1151-3) 1107—2
★Ch. 562.10531/532 (PCB 1143-3) 1120—2
● Ch. 562.10700/701/702/703 ... 1124—3
● Ch. 564.80051/52 (Similar to Chassis) ... 968—2
● Ch. 564.80113 (Similar to Chassis) ... 1139—2
★Ch. 564.80135/136 ... 1181—2
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★Ch. 564.80160 ... 1147—1
★Ch. 564.80161 (Similar to Chassis) ... 1147—1
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SHARP
(Also See Recorder Listing)
Sharp Electronics Corp.
10 Keystone Place
Paramus, N. J. 07652

★C-2010 ... 1158—POM
★C-2030 ... 1158—POM
★C-6010 ... 1158—POM
★C-8010 ... 1158—POM
●CN-62T,TA ... 1148—2
●CY-61PC ... 1163—2
FXC-39 ... 1170—6
RP-661A ... 1143—5
●SQ-65P ... 1164—POM
●TF-90P ... 1164—POM
●TM-68P ... 1158—POM
●TM-85P ... 1158—POM
●TN-39P ... 1154—SED
●TU-95P ... 1158—POM
●TU-96P (Similar to Chassis) 1136—2
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SIMCA
(See Auto Radio Listing)

SINGER
Singer Consumer Prod. Div.
30 Rockefeller Plaza
Room 6228
New York, New York

HE-3020 (Similar to Chassis) ... 1139—6

SONY
(Also See Recorder Listing)
Sony Corp. of America
47-47 Van Dam St.
Long Island City, N.Y. 11101

HP-480,A ... MHF—8
HP-580 ... MHF—11
●TV-130U ... 1140—POM
●TV-510U ... 1178—2
●TV-930U ... 1180—3
8F-51W ... 1011—5
8FS-50W ... MHF—13
8RC-62 ... 1168—5
8RC-74 ... 1166—6

SOUNDESIGN
Realtone Electronics Corp.
34 Exchange Place
Jersey City, N.J. 07302

4370 ... MHF—10
4488 ... MHF—9

SUNBEAM
(See Auto Radio Listing)

Set No. | Folder No.

SYLVANIA
(Also See Recorder Listing)
GTE Sylvania Inc.
700 Ellicott Street
Batavia, N.Y. 14021

★CD70 (Ch. D14-1) ... 1168—3
★CD71 (Ch. D14-2) ... 1168—3
★CD72/74 (Ch. D14-3) ... 1168—3
★CD82WR (Ch. D14-4) ... 1168—3
★CD82WR-1 (Ch. D14-5) ... 1168—3
★CF521W-1 (Ch. D12-15) ... 1143—1
★CF564A (TV Ch. Only D-12-9) ... 1143—1
★CF702/704/706 (Ch. D16-2) ... 1178—3
★CF711,-2/713,-2 (Ch. D16-2) ... 1178—3
★CF725DP-1,P-1 (Ch. D12-9) (Similar to Chassis) ... 1143—1
★CL810W-2/811W-1/813P-1 (Ch. D16-2) ... 1178—3
★CL818W-1,-2 (Ch. D16-2) Expanent 3/05W (PCB 1163-3) 1047—2
● MY80 (Ch. B10-4) (PCB 1163-3) 1047—2
● MY81/82 (Ch. B10-3) (PCB 1163-3) 1047—2
● MZ200 (Ch. B12-2) Code 01) (PCB 1144-3) 1094—2
SC33-1 (Ch. 800-2, 400-3,881-1) For Radio/Amp Ch. ... 645—13
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SC35-1,-2 (Ch. 800-2,-3, 400-5,881-1) For Radio/Amp Ch. ... 645—13
For MPX Ch. ... 770—11
SC36 (Ch. 800-2,400-5) ... 645—13
SC36-1,-2 (Ch. 800-2,-3, 400-5,881-1) For Radio/Amp Ch. ... 645—13
For MPX Ch. ... 770—11
SC37 (Ch. 800-2,401-1, 881-1) For Radio/Amp Ch. ... 645—13
For MPX Ch. ... 770—11
SC38 (Ch. 800-2,400-5) ... 645—13
SC38-1,-2 (Ch. 800-2,-3, 400-5,881-1) For Radio/Amp Ch. ... 645—13
For MPX Ch. ... 770—11
SC41-1 (Ch. 800-2,402-1, 881-1) For Radio/Amp Ch. ... 645—13
For MPX Ch. ... 770—11
SC388-1 (Ch. Q28-1, S32-6) ... 1114—1
TR1278K (Ch. 379-1) ... TSM—124
● Ch. A09-1 ... 1140—POM
● Ch. B10-1,-2,-3,-4 (Codes 01 thru 06) (PCB1163-3) 1047—2
● Ch. B12-1,-2 (Code 01) (PCB 1144-3) 1094—2
● Ch. B13-1 ... 1140—POM
★Ch. D05-14,-15 (Code C12) (PCB 1151-3) 1051—2
★Ch. D06-3,-4 (Code 09,10) (PCB 1143-3) 1072—2
● Ch. D11-1,-2 (Codes 02,03,04) (PCB 1057-3) 1011—2
● Ch. D11-1,-2,-3 (Codes 06,07) (PCB 1158-4,1057-3) 1011—2
● Ch. D11-3 (Codes 03,05) (PCB 1057-3) 1011—2
★Ch. D12-1 thru D12-8 (Codes 00 thru 05) ... 1045—2
★Ch. D12-1 thru D12-8 (Codes 00 thru 11) (PCB 1163-3) 1045—2
★Ch. D14-1,-2,-3,-4,-5 ... 1168—3
★Ch. D16-2 ... 1178—3
Ch. Q28-2 (Similar to Chassis) ... 1114—6
Ch. 379-1 ... TSM—124
Ch. 432-1 ... 1175—4
Ch. 881-1 ... 770—11

SYMPHONIC
Symphonic Radio & Elec. Corp.
Foot of John Street
Lowell, Massachusetts 01852

P1411/1413 (Ch. A-886) (Similar to Chassis) ... 1139—6
1013 (Ch. A-886) (Similar to Chassis) ... 1139—6
3204SA (Ch. A-885-3) ... 1139—6
3206BK (Ch. A-885-3) ... 1139—6
4200BK-SN (Ch. A-885-2) ... 1139—6
4201WA (Ch. A-885-1) ... 1139—6
4202TK (Ch. A-881-1) ... MHF—8
4301TK (Ch. R-821) ... 1147—6
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6201WA/02MA/03PC/04WA (Ch. R-821) ... 1147—6
6300WA (Ch. R-821) ... 1147—6
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Ch. R-824 ... 1172—6

T

TELEX-PHONOLA
(Also See Phonola and Recorder Listing)

TONECREST
Metro Wholesale Corporation
53 West 43rd Street
New York, New York 10036

T-7005 (Similar to Chassis) 1139—6

TOSHIBA
Toshiba America, Inc.
41-06 Delong Street
Flushing, N.Y. 11355

★C7A, C8A (Ch. TAC-3350/51) ... 1152—3
★C31B (Ch. TAC-4320/21) ... 1150—3
★C41A (Ch. TAC-4360) (PCB 1171-3) 1138—2
●V41 (Ch. TAM-3007) ... 1152—SED
★Ch. TAC-3350/51 ... 1152—3
★Ch. TAC-4320/21 ... 1150—3
★Ch. TAC-4360 (PCB 1171-3) 1138—2
● Ch. TAM-3007 ... 1152—SED

Set No. | Folder No.

TRAM
Tram Electronics, Inc.
P.O. Box 187, Lower Bay Rd.
Winnisquam, N.H. 03246

Titan III ... CB—34

TRUETONE
(Also See Auto Radio and Recorder Listings)
Western Auto Supply Co.
2107 Grand Avenue
Kansas City, Mo. 64108

DC4303 ... 1175—SED
DC4812B ... CB—34
MAE6105A-17 ... MHF—12
● MIC3912B-17 ... 1158—POM
● MIC3919B ... 1152—POM
★MIC4015A-17 ... 1158—POM
MIC4812B-17 ... CB—34
SYM6075B-07 ... 1148—7
SYR6070A-07 ... 1151—7
SYR6075A-07 ... 1148—7
SYR6095A-07 ... 1164—7
SYR609BA-07 ... 1164—7
★WEG2063B-17 (Smilar to Chassis) ... 1160—2
★WEG2887A-17 ... 1160—2
★WEG2889A-17 ... 1160—2
★2DC2063B (Similar to Chassis) ... 1160—2
★2DC2887/2889 ... 1160—2
● 2DC3912B ... 1158—POM
● 2DC3919B ... 1152—POM
★2DC4015 ... 1158—POM
4DC6070 ... 1151—7
4DC6075 ... 1148—7
4DC6095 ... 1164—7
4DC6098 ... 1164—7
4DC6105 ... MHF—12

U

ULTRATONE
Audio Industries Inc.
532 West 4th St.
Michigan City, Ind. 46360

401, 402, 403 ... 1151—8

V

V-M
(Also See Changer and Recorder Listings)
V-M Corporation
375 West Main Street
Benton Harbor, Mich. 49023

761-1 ... TSM—119

VISCOUNT
Webcor Electronics
50-50 Queens Midtown Expressway
Maspeth, New York 11378

VOLVO
(See Auto Radio Listing)

W

WARDS AIRLINE
(Also See Auto Radio and Recorder Listings)
Montgomery Ward & Co.
619 Chicago Avenue
Chicago, Illinois 60607

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GCI-2330A ... 1174—6
GCI-2340A ... 1174—6
GCI-2360A ... 1174—6
GCI-2421A ... 1163—8
GCI-2431A ... 1163—8
GCI-2451A ... 1163—8
GCI-2545A (Similar to Chassis) ... 1133—5
GCI-2630A ... 1155—6
GCI-2640A ... 1155—6
GCI-2650A ... 1155—6
★GCI-12420A,B,C,D ... 1147—2
★GCI-12460A, B ... 1170—3
● GCI-14829B (PCB 1171-3) 1040—3
● GCI-14849C (PCB 1171-3) 1040—3
● GCI-14859C (PCB 1171-3) 1040—3
★GCI-17241A,B ... 1170—3
GEN-930A ... 1161—7
GEN-1931A (Similar to Chassis) ... 1118—6
GEN-1941A,B,C (Similar to Chassis) ... 1118—6
GEN-2930A ... MHF—8
GEN-3970A ... TSM—120
GEN-3975A ... TSM—120
GEN-6121A (Similar to page 105) ... MHF—8
● GEN-11431A ... 1148—3
● GEN-11461A ... 1148—3
● GEN-11481A ... 1148—3
● GEN-11741A ... 1160—3
● GEN-11961A ... 1146—2
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★GEN-12440C ... 1162—3
★GEN-12441A,B ... 1162—3
● GEN-13460A (PCB 1152-4) 1025—2
● GEN-13461A ... 1158—3
GVC-9002A/9003A ... 1162—SED
GVC-9061A ... 1143—SED
GVC-9064A ... 1143—SED
JWR-2070B (Similar to Chassis) ... 1095—5
JWR-2812A,B ... MHF—10
63-13461 ... 1158—3

WARDS-RIVERSIDE
(See Auto Radio Listing)

WEBCOR ELECTRONICS
Webcor Electronics
59-50 Queens Midtown Expressway
Maspeth, New York 11378

●TV3012 ... 1174—3
★TV5018 ... 1146—3

Set No. | Folder No.

WESTINGHOUSE
(Also See Changer and Recorder Listings)
Westinghouse Electric Corp.
Consumer Electronics Div.
Route 27 Vineard Road
Edison, N.J. 08817

★H-C5220,U/5221,U/5223,U (Ch. V-2435-12/-13,V-2515-6) For TV Ch. ... 669—3
For Radio Ch. (PCB 665-4) 620—15
PAS7118A (Ch. V-4007C01) ... MHF—12
PMM7100A (Ch. V-4006C02) ... 1155—SED
PMM7110A (Ch. V-4006C01) ... TSM—124
RLA1010A/1011A (Ch. V-2576-1,-2) ... 1158—SED
RLA1010B/1011B (Ch. V-2576-3,-4) ... 1158—SED
RLA1020A/1021A (Ch. V-2576-1,-2) ... 1158—SED
RLA1020B/1021B (Ch. V-2576-3,-4) ... 1158—SED
RLA1070A (Ch. V-2599) ... 1174—7
RLA1100A (Ch. V-2576-1,-2) ... 1158—SED
RLA1100B (Ch. V-2576-3,-4) ... 1158—SED
RLA1110A/1111A (Ch. V-2576-1,-2) ... 1158—SED
RLA1110B (Ch. V-2576-3,-4) ... 1158—SED
RLA3190A (Ch. V-3016C01) ... 1174—7
RPF5060A (Ch. V-3018C01) ... TSM—124
RPF5080A (Ch. V-3015C01) ... TSM—121
RTA3010A (Ch. V-2576-1,-2) ... 1158—SED
RTA3010B (Ch. V-2576-3,-4) ... 1158—SED
RTA3110A/3111A (Ch. V-2576-1,-2) ... 1158—SED
Ch. V-2576-1,-2,-3,-4 ... 1158—SED
Ch. V-2599 ... 1174—7
Ch. V-3015C01 ... TSM—121
Ch. V-3016C01 ... 1174—7
Ch. V-3018C01 ... TSM—124
Ch. V-4006C01 ... TSM—124
Ch. V-4006C02 ... 1155—SED
Ch. V-4007C01 ... MHF—12

WIZARD
(See Auto Radio and Recorder Listings)

Y

YORK
York Radio Corp.
15 Empire Bldg.
So. Hackensack, N.J. 07606

DC-100 ... 1176—SED
TC-106 ... 1165—6

Z

ZENITH
(Also See Recorder Listing)
Zenith Sales Corporation
1900 N. Austin Ave.
Chicago, Illinois 60639

A602B,F ... TSM—120
★A4519P5,W5 (LP Ch. 12A13C52) ... 1157—2
★A4520M5 (LP Ch. 12A13C52) ... 1157—2
★A4524H5/25P5,W5/26H5/28DE5,P5 (LP Ch. 12A13C52) ... 1157—2
★A4530M5 (LP Ch. 12A13C52) ... 1157—2
★A4533W5 (LP Ch. 12A13C52) ... 1157—2
★A4538DE5,P5/39M5 (LP Ch. 12A13C52) ... 1157—2
★A4542P5 (LP Ch. 12A13C52) ... 1157—2
★A4619P5 (LP Ch. 12A13C52) ... 1157—2
★A4654P5/48DE5 (LP Ch. 12A13C52) ... 1157—2
B535J, Y (Ch. 8BT20) ... 1168—6
B595W (Ch. 10ZT30, 11ZT27) (See page 112) ... MHF—1
B960W (Ch. 6AT24, 29AT24) ... 1132—6
B966DE,P (Ch. 6AT24, 29AT24) ... 1132—6
●B2002J,J3 (Ch. 14B38Z) ... 1156—3
●B2005W2,W3 (Ch. 14B38Z) ... 1156—3
●B2009W3 (Ch. 14B38Z) ... 1156—3
●B2044W2 (Ch. 14B38) ... 1156—3
●B2044W3 (Ch. 14B38Z) ... 1156—3
★B2955W (Ch. 12B9C16) ... 1165—2
★B2995W1 (Ch. 14A9C50) (Similar to Chassis) ... 1097—3
●B2999W (Ch. 12B14C50) ... 1157—2
★B3510C,J2 (Ch. 12B8C15) 1165—2
★B3510C5 (Ch. 12B8C15) (Similar to Chassis) ... 1165—2
★B3520W, W2 (Ch. 12B8C15) ... 1165—2
★B3710J, J2 (Ch. 12B8C15) ... 1165—2
★B3710J5 (Ch. 12B8C15) (Similar to Chassis) ... 1165—2
★B3710L, L2 (Ch. 12B8C15) ... 1165—2
★B3710L5 (Ch. 12B8C15) (Similar to Chassis) ... 1165—2
★B3721DE, DE2, W, W2, W3 (Ch. 12B9C16) ... 1165—2
★B3910W,W2 (Ch. 14A9C29Z) (PCB 1177-3) 1116—3
★B3914W,W2 (Ch. 14A10C29Z) (PCB 1177-3) 1116—3
★B4025W,W2 (Ch. 4825C19) ... 1166—3
★B4030W,W2 (Ch. 4825C19) ... 1166—3
★B4509W3 (Ch. 14A9C50) (Similar to Chassis) ... 1097—3
★B4512W8,W9 (Ch. 14A9C50) (Similar to Chassis) ... 1097—3

NOTE: ● Denotes Television Receiver. ★ Denotes Color Television Receiver. **AOR** Denotes Available On Request. **AR** Denotes Auto Radio Series Volume. **CB** Denotes **CB** Radio Series Volume. **HTP** Denotes Home Tape Player Series Volume. **MHF** Denotes Modular Hi-Fi Series Volume. **PCB** Denotes Production Change Bulletin. **POM** Denotes Bonus Schematic in Photofact-of-the-Month Package—Unavailable After Month Of Issue. **SED** Denotes Special Equipment Data. **TR** Denotes Tape Recorder Series Volume. **TSM** Denotes Transistor Radio Series Volume.

ZENITH—Cont.

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★B4521M (Ch. 12B14C52)		1157-2
★B4521M1,P1 (Ch. 12B13C52)		1157-2
★B4522H,P/23DE,P (Ch. 12B14C52)		1157-2
★B4522H1,P1/23DE1,P1 (Ch. 12B13C52)		1157-2
★B4529W (Ch. 12B14C52)		1157-2
★B4529W1 (Ch. 12B13C52)		1157-2
★B4707W (Ch. 12B14C50)		1157-2
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★B4727M/4728DE,P (Ch. 12B14C50)		1157-2
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★B4736M/38DE,P (Ch. 12B14C50)		1157-2
★B4736M1 (Ch. 12B14C50)		1157-2
★B4744W (Ch. 12B14C50)		1157-2
★B4746DE (Ch. 12B14C50)		1157-2
★B4849P (Ch. 12B14C50)		1157-2
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★B6509W3 (Ch. 14A9C50, S-77536) (Similar to Chassis)		1097-3
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★B6523DE,P (Ch. 12B14C52)		1157-2
★B6523DE6, P6 (Ch. 12B14C52)		1157-2
★B6707W (Ch. 12B14C50)		1157-2
★B6707W6 (Ch. 12B14C50)		1157-2
★B6744W (Ch. 12B14C50)		1157-2
★B6744W6 (Ch. 12B14C50)		1157-2
★B8720W (TV Ch. Only 12B14C50)		1157-2
★B8732M/M1/34DE (TV Ch. Only 12B14C50)		1157-2
★B8770P (TV Ch. Only 12B14C50)		1157-2
★B8770P6 (TV Ch. Only 12B14C50)		1157-2
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R46C,J		TSM-122
Royal 16J, L, Y		1172-SED
Royal 32C, P		1172-SED
Royal 46C, J		TSM-122
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●S-85833 (TV Remote Control Unit)		1156-3A
★S-86335 (TV Remote Control Unit)		1166-3A
★S-86500 (TV Remote Control Unit)		1166-3A
★S-87286 (TV Remote Control Unit)		1157-2A
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●T2673W4 (Ch. 14B38)		1156-3
●T2673W5 (Ch. 14B38Z)		1156-3
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★T2932W5 (Ch. 14A10C29, Z) (PCB 1177-3)		1116-3
★T2932W56 (Ch. 14A10C29Z) (Similar to Chassis)		1116-3
★T2935W, W2 (Ch. 4B25C19)		1166-3
★T2977W (TV Ch. Only 12B14C52)		1157-2
★T2985M1 (Ch. 20Y1C50) (Similar to Chassis)		981—2
★T2986W (Ch. 12B14C52)		1157-2
★T2989M (Ch. 12B14C52)		1157-2
★T2990DE,P (Ch. 12B14C52)		1157-2
★T2994W5/95M5 (LP Ch. 12A13C52)		1157-2
★T2996W (Ch. 12B14C50)		1157-2
★T2997DE5,P5 (LP Ch. 12A13C52)		1157-2
★T2998DE,P (Ch. 12B14C50)		1157-2
★Z4532DE1,P1 (Ch. 20Y1C50) (Similar to Chassis)		981—2
★Z8530W1 (Ch. 20Y1C50, 20YT20) For Similar TV Ch.		981—2
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☆Ch. 12A13C52 (Late Prod.)		1157-2
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☆Ch. 12B9C16		1165-2
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☆Ch. 14A10C29,Z (PCB 1177-3)		1116-3
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AUTO RADIOS AND TAPE PLAYERS

A

AIWA
Milovac International Co., Inc.
4215 West 45th Street
Chicago, Illinois 60632

TP-1023		AR-91

AMERICAN MOTORS
American Motors Corp.
14250 Plymouth Road
Detroit, Michigan

IJA4009 (3601578)		AR-87
IRA5002 (3591052)		AR-87
3591052		AR-87
3601578		AR-87

ARVIN
Arvin Industries, Inc.
1531 Thirteenth St.
Columbus, Indiana 47201

50Y74-19 (Ch. 1.51001)		AR-92
Ch. 1.51001		AR-92

AUDIOVOX CORPORATION
Audiovox Corporation
300 Denton Avenue
New Hyde Park,
Long Island, N.Y. 11040

C-80		AR-90
C-410		AR-92
C-420		AR-93
C-440		AR-96
C-510		AR-92
C-520		AR-94
C-560		AR-94
C-565		AR-94
C575, C-576		AR-93
C-930		AR-91
C-935		AR-95
C-940		AR-99
C-950		AR-99

AUTOMATIC
Automatic Radio Mfg. Co., Inc.
2 Main Street
Melrose, Massachusetts 02176

CFE-8001		AR-91
EMX-6810		AR-89
ESS-8528		AR-95
SED-9060		AR-99
UAF-6270		AR-94
VP-6235		AR-89

AUTO-SONIC
Martel Electronic Sales, Inc.
2339 South Cotner St.
Los Angeles, Calif. 90064

Mark 88		AR-95
ST-48		AR-91
ST-88		AR-95
ST-120G (Late Prod.)		AR-99

B

BUICK
United Delco Distributors

04AFP2		AR-88
04APB1		AR-100
04EFM2		AR-88
04EFP2		AR-88
14AT411		AR-97
14BFM1		AR-98
14BFP1		AR-96
14BT411		AR-97
7307554		AR-97
7930144		AR-98
7930234		AR-96
7935347		AR-97

C

CADILLAC
United Delco Distributors

05CFPK2		AR-93
05CT412		AR-94
15CFMT1, 15CFMT2		AR-96
15CT411		AR-93
7930035		AR-96
7930495		AR-97

CHEVROLET
United Delco Distributors

01APB1,01APB2		AR-101
01BFP3		AR-92
01FFP1		AR-92
01FPB1		AR-101
01TFP3		AR-92
01TPB1,01TPB2		AR-101
01VFM3		AR-90
01VFP3		AR-92
11AFMT1 (See page 19)		AR-75
11APB1		AR-96
11APBT1 (See page 57)		AR-74
11BFP1 (7314221)		AR-93
11BFP2		AR-93
11BFPK1 (7933301)		AR-93
11BFPK2		AR-93
11BPB2, 11BPBK2		AR-97
11BT411		AR-97
11HFP2 (7936011)		AR-93
11HPB2		AR-97
11TPB1		AR-96
11TT411		AR-97
11VFM1 (See page 25)		AR-78
7305841		AR-96
7313971		AR-97
7314201		AR-97
7314221		AR-93
7933241		AR-96
7933291		AR-97
7933301		AR-93
7933641		AR-97
7936011		AR-93

CHRYSLER
Chrysler Corp.
P.O. Box 1118
Detroit, Michigan 48231

CF09503		AR-87
CF15703		AR-96
CF84403		AR-87
0BBCC		AR-94
0BDS		AR-92
0BVD		AR-94
1B8C		AR-89
1CH4007		AR-90
1BBFW1		AR-98
376 (7BC)		AR-42
2884095 (CF09503)		AR-87
2884633 (1CH4007)		AR-90
2884649 (0BDS)		AR-92
2884750 (0BVD)		AR-94
2884752 (0B8CC)		AR-94
2884844 (CF84403)		AR-87
3489157 (CF15703)		AR-96
3501013 (1B8C)		AR-89
3501164		AR-98

CRAIG
Craig Corp.
2302 East 15th Street
Los Angeles, California 90021

3108		AR-91
3116		AR-95
3117		AR-89
3119		AR-90
3123		AR-99

D

DODGE
(Also See Mopar)
Chrysler Corp.
P.O. Box 1118
Detroit, Mich. 48231

CF10503		AR-93
CF15703		AR-96
CF61003		AR-88
CF74903		AR-89
CF75203		AR-88
CF75603		AR-88
CF75703		AR-93
CG64803		AR-93
CG82704		AR-89
0B8CC		AR-94
0BBJ		AR-89
0BDS		AR-92
0BDT		AR-97
0BVD		AR-94
1B8C		AR-89
1BBJ		AR-89
1BVD (Similar to page 45)		AR-94
1CH4007		AR-90
1DT1919		AR-87
377 (7BBD)		AR-42
2824744 (0BDT)		AR-97
2824858/859 (0BDT)		AR-97
2824858/859/1160 (8BDT) (See page 79)		AR-60
2864513 (8BDA, 9BDA (See page 24)		AR-57
2884059 (8FBDA) (See page 41)		AR-58
2884063 (8FBCO) (See page 41)		AR-58
2884105 (CF15503)		AR-93
2884151 (8BDC) (See page 24)		AR-57
2884610 (CF61003)		AR-88
2884633 (1CH4007)		AR-90
2884649 (0BDS)		AR-92
2884749 (CF74903)		AR-89
2884750 (0BVD)		AR-94
2884752 (CF75203)		AR-88
2884752 (0B8CC)		AR-94
2884756 (CF75603)		AR-88
2884757 (CF75703)		AR-93
2884759 (0BBJ, 1BBJ)		AR-89
2884768 (8BCO, 9BBCC) (See page 24)		AR-57
2932706 (8FB0D) (See page 41)		AR-58
2958648 (CG64803)		AR-93
2958827 (CG82704)		AR-89
3420826 (1DT1919)		AR-87
3489157 (CF15703)		AR-96
3501013 (1B8C)		AR-89

DYNATRONICS
Inland Dynatronics, Inc.
111 Hackensack Ave.
Hackensack, N.J. 07601

S-401		AR-95
S-848		AR-91

F

FORD
Ford Motor Co.
Dearborn, Mich.

C8OA-19A049		AR-87
D0BA-10010 (See page 51)		AR-59
D0HA-18810 (See page 51)		AR-59
D0KA-18810 (See page 51)		AR-59
D0SA-19A242		AR-96
D1AA-19A241		AR-94
D1AA-18806		AR-94
D1DA-18806		AR-94
D1HA-18806		AR-94
D1OA-19A241		AR-94
D1OA-18806		AR-94
D1TA-19A241		AR-94
D1TA-18806		AR-94
D1TJ-18806AA		AR-97
D1UA-18806		AR-94
D1ZA-19A241		AR-94
D1ZA-18806		AR-94
D1ZA-18806		AR-94
ED-D1DA-19A241		AR-98
ED-D1TA-19A241		AR-98
ED-D1ZA-19A241		AR-98
ED1-D1OA-19A241		AR-98
ED1-D1TA-19A241		AR-98
ED1-D1ZA-19A241		AR-98
0FBSW		AR-96
1BTB/BTT/BTW (See page 51)		AR-59
1FBF		AR-94
1FBO		AR-94
1FBOO		AR-98
1FBOX		AR-98
1FBTP		AR-94
1FBTPP		AR-98
1FBTPX		AR-98
1FBZ		AR-94
1FBZX		AR-98
1FBZZ		AR-98
1FD5003 (C8OA-19A049)		AR-87
9TBTL/TBTLM/TBTU (See page 26)		AR-56

G

GENERAL MOTORS CORP. (GMC)
United Delco Distributors

01TPB1,01TPB2		AR-101
06TCFP2		AR-92
06TT412		AR-93
16TRMP1		AR-96
16TTCP1		AR-96
16TT411		AR-97
16UT411		AR-97
7305516		AR-96
7307456		AR-97
7308166		AR-97
7931766		AR-96

GIBBS
Gibbs Special Products Corp.
P.O. Box 471
Janesville, Wisc. 53546

805, 807		AR-87
950, 952		AR-87

GM & GMC
(See General Motors)

H

HAMMOND
(See Gibbs)

I

IMPERIAL
(See Chrysler)

J

JEEP
Kaiser-Jeep Corp.
200 Industrial Drive
Plymouth, Mich.

978322 (8BKJ) (See page 37)		AR-69
978339 (8BKJ) (See page 37)		AR-69

L

LAFAYETTE
Lafayette Radio Electronics Corp.
111 Jericho Turnpike
Syosset, L.I., New York 11791

Stereo 88 (99-15521W)		AR-91
99-15521W		AR-91

LINCOLN
Ford Motor Co.
Dearborn, Mich.

D0LA-19A241		AR-94
D0IA-19A242		AR-92
D1LA-18806		AR-98
D1VA-19A241		AR-97
D1VA-19A244 (See page 37)		AR-82
0FBX		AR-94
1B1SS (01VA-19A244) (See page 37)		AR-82
1FBL		AR-97
1MT4002 (D0LA-19A242)		AR-92

M

MEDALLION
Medallion Automotive Products Company
P.O. Box 1903
Kansas City, Missouri 64141

65-206		AR-98
65-212		AR-96

MERCURY
Ford Motor Co.
Dearborn, Michigan

C9MA-19A242C		AR-88
C8OA-19A049		AR-87
D1AA-18806		AR-94
D1DA-18806		AR-94
D1GA-19A241		AR-98
D1HA-18806		AR-94
D1MA-19A241		AR-98
D1OA-18806		AR-94
D1TA-18806		AR-94
D1UA-18806		AR-94
D1WA-19A241		AR-98
D1YA-19A241		AR-98
D1ZA-18806		AR-94
D1ZA-18806		AR-94
ED-D1GA-19A241		AR-97
ED-D1WA-19A241		AR-97
ED1-D1GA-19A241		AR-97
ED1-D1WA-19A241		AR-97
T9MM (C9MA-19A242C)		AR-88
1FBA		AR-98
1FBG		AR-98
1FBGG		AR-97
1FBGX		AR-97
1FBM		AR-98
1FBW		AR-98
1FBWW		AR-97
1FBWX		AR-97
1FD5003 (C8OA-19A049)		AR-87

MOPAR
Chrysler Corporation
P.O. Box 1118
Detroit, Mich. 48231

376 (2820635)		AR-51

MOTOROLA
Motorola, Inc.
9401 West Grand Ave.
Franklin Park, Ill. 60131

FM360A		AR-87
TF800S		AR-90
TM703S		AR-95

O

OLDSMOBILE
United Delco Distributors

03AFM2		AR-88
03APB1		AR-98
03BFM2		AR-88
03BT412		AR-87
03EFM2		AR-88
03ET412		AR-87
13AT411		AR-97
13BFM1, 13BFM2		AR-98
13BFMT1		AR-97
13BPBT1		AR-96
7930033		AR-98
7930053		AR-96
7930063		AR-97
7932763		AR-97

OPEL
United Delco Distributors

04LPB1		AR-100
04PPB1		AR-100
14BPB1		AR-97
14LPB2		AR-96
7312234		AR-97
7930254		AR-96

P

PANASONIC
Matsushita Elec. Corp. of America
Panasonic Service & Parts Div.
10-16 44th Drive
Long Island City, N.Y. 11101

CX-777SU		AR-99
CX-888SU		AR-95

PLYMOUTH
(Also See Mopar)
Chrysler Corp.
P.O. Box 1118
Detroit, Mich. 48231

CF10103		AR-88
CF61003		AR-88
CF74803		AR-90
CF75503		AR-87
CF79503		AR-92
0BBCC		AR-94
0BBJ		AR-89
0BDS		AR-92
0BVD		AR-94
1BBC		AR-89
1BBJ		AR-89
1BVD (Similar to page 45)		AR-94
1CH4007		AR-90
2864515 (8BBA, 9BBA) (See page 93)		AR-61
2864527 (8BVA, 9BVA) (See page 93)		AR-61
2864756 (8FBPD) (See page 41)		AR-58
2864767 (8BBE, 9BBCC) (See page 93)		AR-61
2884056/057 (8FBBA/BVA, 9FBVA) (See page 41)		AR-58
2884063 (8FBCO) (See page 41)		AR-58
2884101 (CF10103)		AR-88
2884610 (CF61003)		AR-88
2884633 (1CH4007)		AR-90
2884649 (0BDS)		AR-92
2884748 (CF74803)		AR-90
2884750 (0BVD)		AR-94
2884752 (0BBCC)		AR-94
2884755 (CF75503)		AR-87
2884759 (0BBJ, 1BBJ)		AR-89
2884795 (CF79503)		AR-92
3501013 (1BBC)		AR-89

PONTIAC
United Delco Distributors

02AFM2		AR-89
02AFP1/AFPK1		AR-94
02APB1/APBK1		AR-101
02BFM2		AR-89
02BFP1/BFPK1		AR-94
02BT412		AR-90
02FFP1/FFP2/FFPK2		AR-94
02FPB1/FPB2/FPBK2		AR-101
02FT412		AR-90
02GFP1/GFPK1		AR-94
12AFP1, 12AFPK1		AR-97
12APB1		AR-98
12APBK1		AR-98
12AT411, 12BT411		AR-97
12FFP1, 12FFPK1		AR-97
12FPB1		AR-98
12FPBK1		AR-98
12FT451		AR-97
12GFP1, 12GFPK1		AR-97
12GPB1		AR-98
12GPBK1		AR-98
92AFP6 (Similar to page 63)		AR-69
92APB6 (Similar to page 97)		AR-66
92BFP6 (Similar to page 105)		AR-73
92BPB6 (Similar to page 89)		AR-72
92GFP6 (Similar to page 63)		AR-69
92GPB6 (Similar to page 89)		AR-72
7307302		AR-98
7307332		AR-98
7307402		AR-97
7307432		AR-97
7307702		AR-97
7312892		AR-98
7312912		AR-98
7312922		AR-97
7312941		AR-97
7313522		AR-98
7313532		AR-97
7313552		AR-98
7313562		AR-97
7930492		AR-97
7934782		AR-97

R

RANGER
Ranger Auto Radio
19201 Cranwood Parkway
Cleveland, Ohio 44128

RR-MPX-1 (See page 95)		AR-63
RR-42-FT		AR-95
RR-46-FMTX For Radio Chassis (See page 83)		AR-62
For MPX Chassis (See page 95)		AR-63

REALISTIC
Radio Shack Corporation
2727 West 7th Street
Fort Worth, Texas 76107

12-1827		AR-95
12-1828		AR-99

S

SAAB
Saab, Inc.
100 Waterfront
New Haven, Conn.

500127 (8BSA) (See page 115)		AR-70

SEARS-SILVERTONE
Sears, Roebuck & Co.
925 South Homan Ave.
Chicago, Illinois 60607

564.5071		AR-99
564.50700/701		AR-99
564.626410		AR-88
564.626420		AR-93
564.626430		AR-92
833.R6286		AR-92
833.6236		1150-SED
833.50290		AR-89
833.62040		AR-91
833.62460		AR-92
833.62860		AR-92
833.62901		AR-92
833.63170		AR-99

SIMCA
Chrysler Corporation
P.O. Box 1118
Detroit, Michigan 48231

S-48136 (8BSI) (See page 115)		AR-66

SUNBEAM

R-80001 (8BSU) (See page 115)		AR-65

T

TRUETONE
Western Auto Supply Co.
2107 Grand Avenue
Kansas City, Missouri 64108

DC4060		AR-93
ID14DC7908A-86		AR-99
ID17908A-86		AR-99
ITC7006A		AR-91
ITC7010A-07		AR-99
ITC7908A-96		AR-99
ITC7910A-86		AR-95
MIC4060A-07		AR-93
4DC7006		AR-91
4DC7010		AR-99
4DC7908		AR-99
4DC7910		AR-95

V

VOLVO
Volvo Distributors, Inc.
Volvo Drive
Rockleigh, New Jersey

279956/958/959/961 (8BVO) (See page 109)		AR-67

W

WARDS-RIVERSIDE
Montgomery Ward & Co.
619 Chicago Avenue
Chicago, Illinois 60607

ZCX-16730A		AR-91
ZCX-16732A,B		AR-95
61-16730		AR-91

WIZARD
Western Auto Supply Co.
2107 Grand Avenue
Kansas City, Mo. 64108

ITC7910A-96		AR-95
4DC7910		AR-95

RECORD CHANGERS

A

ADMIRAL
Admiral Corporation
National Service Div.
P.O. Box 845
Bloomington, Ill. 61702

MC641		1141-3
750E1210-1		1141-3

E

EMERSON
Emerson Television Sales Corp.
14th & Coles Streets
Jersey City, N.J. 07302

ERC-10/-12 (Similar to Changer)		1135-3

P

PANASONIC
Matsushita Elec. Corp. of America
Panasonic Service & Parts Div.
10-16 44th Drive
Long Island City, N.Y. 11101

FA-707A, AD		1147-5
RD-7673 (Similar to Changer)		1135-3

R

RCA
RCA Sales Corp.
600 N. Sherman Drive
Indianapolis, Ind. 46201

RP-230-1,-2,-6,-8,-9		1155-5
RP-230-10,-11,-12,-14, -15,-16,-17,-18,-19		1155-5
RP-230-20,-21,-22		1155-5
RP-231-1,-3,-4,-5,-6,-7,-9		1155-5
RP-231-10,-11,-13		1155-5
RP-232-1,-2,-4,-5,-6,-7,-9		1155-5
RP-232-10,-11		1155-5
RP-233-1,-2,-3,-4,-5,-6,-7		1155-5
RP-234-1,-3,-5,-6		1173-6
RP-234-7 (Similar to Changer)		1173-6
RP-234-11,-12,-13		1173-6
RP-234-15,-16,17		1173-6
RP-234-19,-20		1173-6

V

V-M
V-M Corporation
375 West Main Street
Benton Harbor, Mich. 49023

A1286		1108-5
A1296		1108-5
1550-1		1108-5

NOTE: ● Denotes Television Receiver. ★ Denotes Color Television Receiver. **AOR** Denotes Available On Request. **AR** Denotes Auto Radio Series Volume. **CB** Denotes CB Radio Series Volume. **HTP** Denotes Home Tape Player Series Volume. **MHF** Denotes Modular Hi-Fi Series Volume. **PCB** Denotes Production Change Bulletin. **POM** Denotes Bonus Schematic in Photofact-of-the-Month Package—Unavailable After Month Of Issue. **SED** Denotes Special Equipment Data. **TR** Denotes Tape Recorder Series Volume. **TSM** Denotes Transistor Radio Series Volume.

W

WESTINGHOUSE
Westinghouse Electric Corp.
Consumer Electronics Div.
Route 27 Vineard Road
Edison, N.J. 08817

	Set No.	Folder No.
PCX9000A (Similar to Changer)		1127–5
670V056D01 (Similar to Changer)		1127–5

RECORDERS AND TAPE PLAYERS

A

ADMIRAL
Admiral Corp.
National Service Div.
P.O. Box 845
Bloomington, Illinois 61702

Chassis 5J4		TSM–122
TP360		TSM–122

AIRCASTLE
Spiegel, Inc.
1061 West 35th Street
Chicago, Illinois 60609

TCT-601C		TR–78
TR-1040		TR–76

AIWA
Milovac International Co., Inc.
4215 West 45th Street
Chicago, Illinois 60632

TP-1023		AR–91

AMC—AMCREST
Amcrest Corporation
1440 Broadway
New York, New York 10018

C-75		TR–79

AMERICAN MOTORS
American Motors Corp.
14250 Plymouth Road
Detroit, Michigan

1JA4009 (3601578)		AR–87
1RA5002 (3591052)		AR–87
3591052		AR–87
3601578		AR–87

AMPEX
Ampex Consumer Equipment Division
2201 Lunt Avenue
Elk Grove Village, Ill. 60007

Micro 9		TR–81
Micro 14		TR–79
Micro 95		TR–80
750		TR–73
755,A		TR–73
1450		TR–73
1455,A		TR–73

AUDIOVOX CORPORATION
Audiovox Corporation
300 Denton Ave.
New Hyde Park,
L.I., N.Y. 11040

C-930		AR–91
C-935		AR–95
C-940		AR–99
C-950		AR–99

AUTOMATIC
Automatic Radio Mfg. Co., Inc.
2 Main Street
Melrose, Mass. 02176

CFE-8001		AR–91
EMX-6810		AR–89
EPE-9821		TSM–121
ESS-8528		AR–95
SED-9060		AR–99
SEP-9800		TSM–119

AUTO-SONIC
Martel Electronics Sales Inc.
2339 S. Cotner Street
Los Angeles, California 90064

Mark 88		AR–95
ST-48		AR–91
ST-88		AR–95
ST-120G (Late Prod.)		AR–99

B

BELL & HOWELL
Bell & Howell General Service Dept.
7235 North Linder Avenue
Skokie, Illinois 60076

2423		TR–73
2433		TR–75

BUICK
United Delco Distributors

14AT411		AR–97
14BFM1		AR–98
14BT411		AR–97
7307554		AR–97
7930144		AR–98
7935347		AR–97

C

CADILLAC
United Delco Distributors

05CT412		AR–94
15CFMT1,15CFMT2		AR–96
15CT411		AR–97
7930035		AR–96
7930495		AR–97

CHANNEL MASTER
Channel Master Corp.
Ellenville, N.Y. 12428

6320		TR–76

CHEVROLET
United Delco Distributors

11BT411		AR–97
11TT411		AR–97
7313971		AR–97

CHRYSLER
Chrysler Corp.
P.O. Box 1118
Detroit, Mich. 48231

CF09503		AR–87
CF61003		AR–88
CF84403		AR–87
1CH4007		AR–90
2884095 (CF09503)		AR–87
2884610 (CF61003)		AR–88
2884633 (1CH4007)		AR–90
2884844 (CF84403)		AR–87

CONCERTONE
Concertone, Inc.
7035 Laurel Canyon Blvd.
North Hollywood, Calif. 91605

4001		TR–72

CONCORD
Concord Electronics Corp.
1935 Armacost Avenue
Los Angeles, California 90025

F-50		TR–74
F-95		TR–73
F-101		TR–72
MK-III		TR–79
509D		TR–80

CRAIG
Craig Corp.
2302 East 15th Street
Los Angeles, California 90021

2402		TR–75
2405		TR–75
2408		TR–76
2703		TR–77
2704		TR–80
3108		AR–91
3116		AR–95
3117		AR–89
3119		AR–90
3123		AR–99

D

DODGE
Chrysler Corp.
P.O. Box 1118
Detroit, Mich. 48231

CF10503		AR–93
CF61003		AR–88
1CH4007		AR–90
2884105 (CF10503)		AR–93
2884610 (CF61003)		AR–88
2884633 (1CH4007)		AR–90

DYNATRONICS
Inland Dynatronics, Inc.
111 Hackensack Ave.
Hackensack, N.J. 07601

S-401		AR–95
S-848		AR–91

E

ELECTROPHONIC
Electrophonic Corp. of America
9200 Atlantic Avenue
Ozone Park, N.Y. 11416

C5		TR–74
T-10		TSM–121
TR-20		TSM–123

F

FORD
Ford Motor Company
Dearborn, Mich.

C80A-19A049		AR–87
1FD5003 (C80A-19A049)		AR–87

G

GENERAL ELECTRIC
General Electric Company
1001 Broad Street
Utica, New York 13501

M8400C (Similar to page 53)		TR–53

GENERAL MOTORS CORP. (GMC)
United Delco Distributors

06TT412		AR–93
16TT411		AR–97
16UT411		AR–97
7307456		AR–97
7308166		AR–97

GIBBS
Gibbs Special Products Corp.
P.O. Box 471
Janesville, Wisc. 53546

805, 807		AR–87
950, 952		AR–87

H

HAMMOND
(See Gibbs)

HITACHI
Hitachi Sales Corporation of America
48-50 34th Street
Long Island City, N.Y. 11101

TPQ-201		TSM–119

J

JULIETTE
Topp Electronics, Inc.
4201 N.W. 77th Ave.
Miami, Florida 33166

CTP-2010		TSM–120
CTP-2076		TSM–119

L

LAFAYETTE
Lafayette Radio Electronics
111 Jericho Turnpike
Syosset, L.I., New York 11791

RK-90 (27-0110L)		TR–79
RK-100 (99-15679)		TR–75
RK-835 (99-1569WX)		TR–73
RK-870 (99-1566WX)		TR–74
RK-920 (99-15547WX)		TR–77
RK-960 (99-15489WX)		TR–77
Stereo 88 (99-15521W)		AR–91
27-0110L		TR–79
99-1566WX		TR–74
99-1569WX		TR–73
99-15489WX		TR–77
99-15521W		AR–91
99-15547WX		TR–77
99-15679		TR–75

LINCOLN
Ford Motor Co.
Dearborn, Mich.

DOLA-19A242		AR–92
1MT4002 (DOLA-19A242)		AR–92

LLOYD'S
Lloyd's Electronics of Calif., Inc.
6651 East 26th St.
City of Commerce, Cal. 90022

1V33B-07A		TR–80
9V89-92A		TR–74
9V91-114A		TR–77
9V95-114A		TR–78
9V95A-114		TR–78

M

MAGNAVOX
The Magnavox Company
Bueter Road
Fort Wayne, Indiana 46803

1K8868		TR–75
1K8879		TR–78
1V9024		TR–80
1V9030/31		TR–72
701317-1		TR–78

MALLORY
P. R. Mallory & Co., Inc.
3029 E. Washington St.
Indianapolis, Ind. 46206

MCR1204 (Similar to page 31)		TR–56
MCR1209 (Similar to page 45)		TR–56
MCR1232 (Similar to page 5)		TR–55

MASTERWORK
Masterwork Audio Products
1080 Goffle Road
Hawthorne, New Jersey

M404		TR–81
M656		TR–78

MERCURY
Ford Motor Company
Dearborn, Michigan

C9MA-19A242C		AR–88
C80A-19A049		AR–87
T9MM (C9MA-19A242C)		AR–88
1FD5003 (C80A-19A049)		AR–87

MORSE ELECTRO PRODUCTS
Morse Electro Products Corp.
9200 Atlantic Avenue
Ozone Park, N.Y. 11416

C1		TR–74

MOTOROLA
Motorola Inc.
9401 West Grand Ave.
Franklin Park, Ill. 60131

TF800S		AR–90
TM703S		AR–95

O

OLDSMOBILE
United Delco Distributors

03BT412		AR–87
03ET412		AR–87
13AT411		AR–97
13BFMT1		AR–97
13BP8T1		AR–96
7930053		AR–96
7930063		AR–97
7932763		AR–97

P

PACKARD BELL
Teledyne Packard Bell Electronics
12333 West Olympic Blvd.
Los Angeles, California 90064

TPA27 (See page 93)		HTP–6
TPAK25 (Similar to page 80)		HTP–1

PANASONIC
Matsushita Electric Corp of America
Panasonic Service & Parts Div.
10-16 44th Drive
Long Island City, N.Y. 11101

CX-777SU		AR–99
CX-888SU		AR–95
RS-254S		TR–78
RS-256US		TR–76

PENNEY'S-PENNCREST
J. C. Penney Co., Inc.
1301 Avenue of the Americas
New York, N.Y. 10019

6525		TR–79
6891 (Tape Deck Only)		TR–72

PHILCO-FORD
Philco-Ford Corporation
Tioga & "C" Streets
Philadelphia, Pa. 19134

A1010BL		TSM–120

PHONOLA-MAGNECORD
Telex-Waters Conley Co., Inc.
9600 Aldrich Avenue South
Minneapolis, Minn. 55420
Address Change

PLYMOUTH
Chrysler Corp.
P.O. Box 1118
Detroit, Michigan 48231

CF10103		AR–88
CF61003		AR–88

PLYMOUTH—Cont.

1CH4007		AR–90
2884101 (CF10103)		AR–88
2884610 (CF61003)		AR–88
2884633 (1CH4007)		AR–90

PONTIAC
United Delco Distributors

02BT412		AR–90
02FT412		AR–90
12AT411		AR–97
12BT411		AR–97
12FT451		AR–97
7307702		AR–97
7930492		AR–97
7934782		AR–97

R

RCA
RCA Sales Corporation
600 North Sherman Drive
Indianapolis, Indiana 46201

YZB387T		TR–81

RANGER
Ranger Radio
19201 Cranwood Parkway
Cleveland, Ohio 44128

RR-42-FT		AR–95

REALISTIC
Radio Shack Corporation
2727 West 7th Street
Fort Worth, Texas 76107

12-1827		AR–95
12-1828		AR–99

ROBERTS
Rheem Manufacturing Co.
Califone-Roberts Div.
6050 West Jefferson Blvd.
Los Angeles, California 90016

95		TR–75
100		TR–76

ROSS
Ross Electronics Corporation
2834 South Lock Street
Chicago, Illinois 60608

Mark 2150		TR–72
Mark 8200		TR–75
Mark 8500		TR–77
Mark 8600		TR–78
RE-2095		TSM–119
RE-3800		TSM–120
RE-8801		TSM–121
RE-8994		TSM–122
2200		TR–74
8300		TR–76

S

SEARS-SILVERTONE
Sears Roebuck & Company
303 East Ohio Street
Chicago, Illinois 60611

564.5071		AR–99
564.50700/701		AR–99
833.6236		1150–SED
833.62040		AR–91
833.63170		AR–99
833.63250		TSM–119
2044 (Ch. 564.40070/71)		TR–72
Ch. 528.58341 (See page 77)		TR–49
Rh. 564.40070/71		TR–72

SHARP
Sharp Electronics Corp.
10 Keystone Place
Paramus, N.J. 07652

RD-403		TR–73
RD-404		TR–81
RD-407		TR–76
RD-408		TR–79
RD-708		TR–72
RD-709		TR–77
RD-711		TR–72

SONY
Superscope, Inc.
8150 Vineland Ave.
Sun Valley, Calif. 91353

TC-18		TR–77
TC-100F (See page 86)		TR–71
TC-106 (Similar to page 81)		TR–47
TC-230,W		TR–80
TC-252		TR–78
TC-357-A (Similar to page 97)		TR–46
TC-365 (Similar to page 97)		TR–46
TC-560		TR–81

SONY—Cont.

TC-1160 ("PEN") (See page 87)		TR–60
TC-1165 ("L") (Similar to page 87)		TR–60
TC-1170 ("MATE") (See page 110)		TR–70
TC-1177 ("GO") (Similar to page 110)		TR–70
TC-1300 (See page 103)		TR–34
TC-3125 ("STEREO E") (See page 97)		TR–51
TC-5100 ("G-1") (Similar to page 81)		TR–47
TC-6250 (See page 95)		TR–56
TC-6251 (Similar to page 65)		TR–56

SYLVANIA
GTE Sylvania Inc.
700 Ellicott Street
Batavia, New York 14021

CT100 (Ch. TC3)		TR–79
Ch. TC3		TR–79

T

TELEX-PHONOLA
Waters Conley Company
501 N.W. First Avenue
Rochester, Minnesota 55901

B9122		TR–73

TRUETONE
Western Auto Supply Co.
2107 Grand Avenue
Kansas City, Missouri 64108

1D14DC7908A-86		AR–99
1D17908A-86		AR–99
ITC7006A-07		AR–91
ITC7010A-07		AR–99
ITC7908A-96		AR–99
ITC7910A-86		AR–95
4DC7006		AR–91
4DC7010		AR–99
4DC7908		AR–99
4DC7910		AR–95

V

V-M
V-M Corporation
375 West Main Street
Benton Harbor, Mich. 49023

746-1		TR–74
761-1		TSM–119

W

WARDS (AIRLINE-RIVERSIDE)
Montgomery Ward & Co.
619 Chicago Avenue
Chicago, Illinois 60607

GEN-3620A		1147–SED
GEN-3940A		TR–79
GEN-3970A		TSM–120
GEN-3975A		TSM–120
ZCX-16730A		AR–91
ZCX-16732A,B		AR–95
61-16730		AR–91

WESTINGHOUSE
Westinghouse Electric Corp.
Consumer Electronics Div.
Route 27 Vineard Road
Edison, N.J. 08817

TMC2030B (Ch. V-5007C01)		TR–81
TMC8030A (Ch. V-5007C01)		TR–81
Ch. V-5007C01		TR–81

WIZARD
Western Auto Supply Co.
2107 Grand Avenue
Kansas City, Mo. 64108

ITC7910A-96		AR–95
4DC7910		AR–95

Z

ZENITH
Zenith Sales Corp.
1900 North Austin Ave.
Chicago, Illinois 60639

A602B, F		TSM–120

NOTE: ● Denotes Television Receiver. ★ Denotes Color Television Receiver. **AOR** Denotes Available On Request. **AR** Denotes Auto Radio Series Volume. **CB** Denotes CB Radio Series Volume. **HTP** Denotes Home Tape Player Series Volume. **MHF** Denotes Modular Hi-Fi Series Volume. **PCB** Denotes Production Change Bulletin. **POM** Denotes Bonus Schematic in Photofact-of-the-Month Package—Unavailable After Month Of Issue. **SED** Denotes Special Equipment Data. **TR** Denotes Tape Recorder Series Volume. **TSM** Denotes Transistor Radio Series Volume.

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