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# ELECTRONIC TECHNICIAN/DEALER

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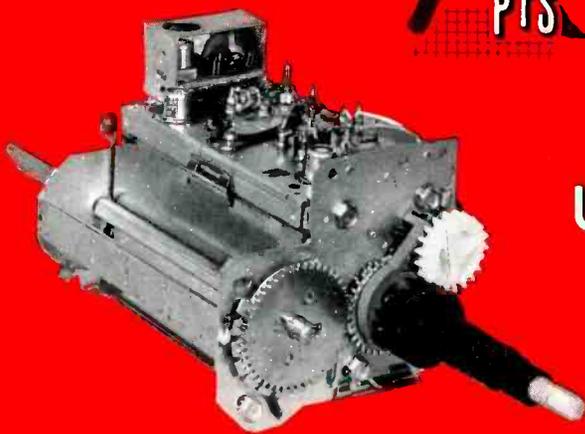
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Model 11-101**

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**Trunk Mount Antenna Model 10-230**

Sturdy, durable, no-hole required in trunk of vehicle. Super 44" stainless steel whip, base loaded low-profile antenna with stainless shock absorbing spring, chrome plated brass bell housing, 18-foot shielded coaxial cable and solderless connections.

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# ELECTRONIC TECHNICIAN/DEALER

November 1975 • VOLUME 97 NUMBER 11

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**THE COVER:** Mel's TV-Audio, Duluth, Minnesota, is a \$1,300,000-a-year electronic sales and service business whose owner/operator, Mel Cohen, believes in diversification. Cohen, who has been in business 29 years, sells and services a broad range of consumer and commercial electronics, including home entertainment products, antenna systems, commercial audio, CCTV and VTR's. Last year, his six electronic technicians produced gross service revenue totaling \$200,000 and his sales operation grossed \$1,100,00—all from a market area of about 150,000 people.

## BUSINESS MANAGEMENT/SHOP OPERATIONS

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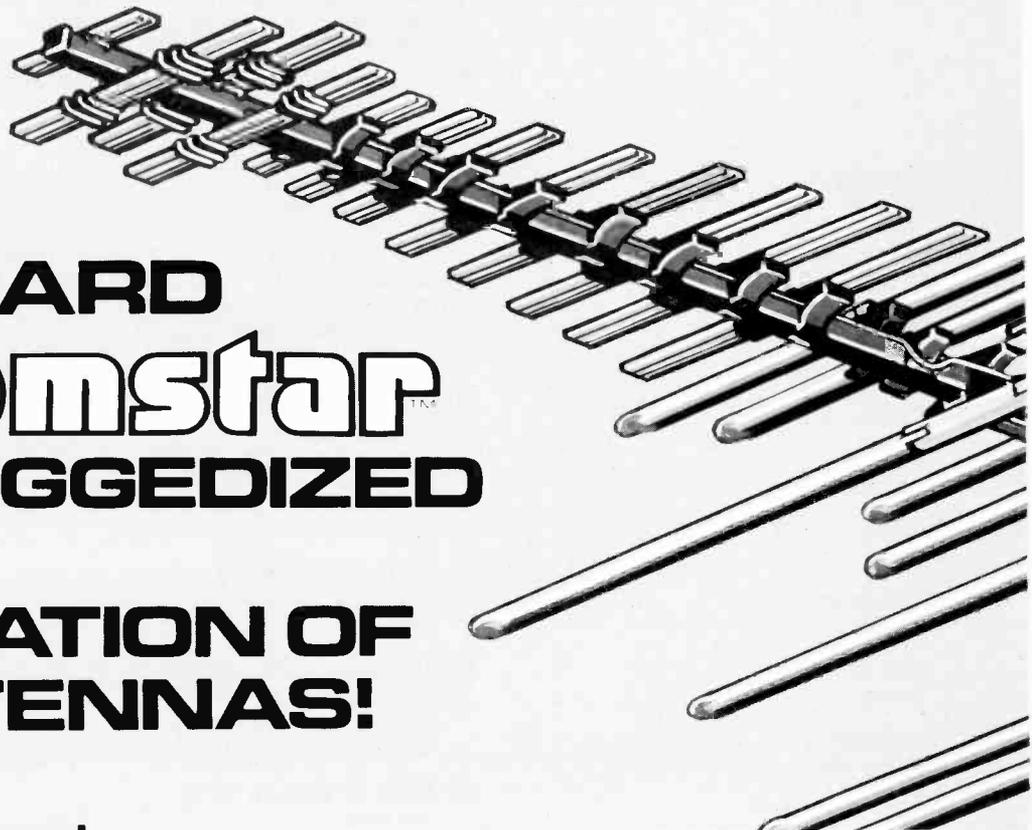
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ELECTRONIC TECHNICIAN/DEALER is published monthly by Harcourt Brace Jovanovich Publications. Corporate offices: 757 Third Avenue, New York, New York 10017. Advertising offices: 43 East Ohio Street, Chicago, Illinois 60611 and 757 Third Avenue, New York, New York 10017. Editorial, Accounting, Advertising Production and Circulation offices: 1 East First Street, Duluth, Minnesota 55802. Subscription rate: one year, \$7; two years, \$12; three years, \$16 in the United States and Canada. Other countries: one year, \$15; two years, \$24; three years, \$30. Single copies: 75¢ in the U.S. and Canada; all other countries: \$2. Second Class postage paid at Duluth, Minnesota 55806 and at additional mailing offices. Copyright © 1975 by Harcourt Brace Jovanovich, Inc. All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopy, recording, or any information storage and retrieval system, without permission in writing from the publisher.

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**PLUS...** New Generation FM Antennas.  
High Performance Ruggedized Yagis.  
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**WINEGARD**  
TELEVISION SYSTEMS

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## NEW TRI-LINEAR UHF DIRECTOR SYSTEM\*

Increases Gain up to 30%!

Provides broader signal capture area in a more compact configuration.

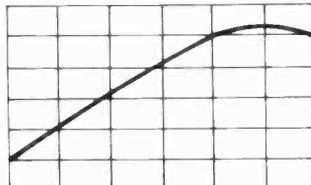
### ORDINARY UHF Director System.



Uses half-wave directors approximately 5 1/2" long which respond primarily to the high end of the band, with very little gain on the low end.



Boom length required for 12 directors

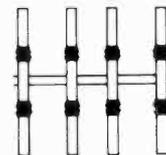


Typical gain curve with ordinary UHF directors  
Note low response on low end of band.

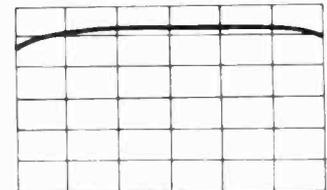
### WINEGARD High Gain Tri-Linear® Directors



Act as 3 half-wave directors on the high end of the band, and re-resonate as a loaded half-wave director on the low end of the band. This results in high linear gain on all UHF channels, giving the antenna sharper directivity and up to 30% more gain over other high gain UHF antennas.



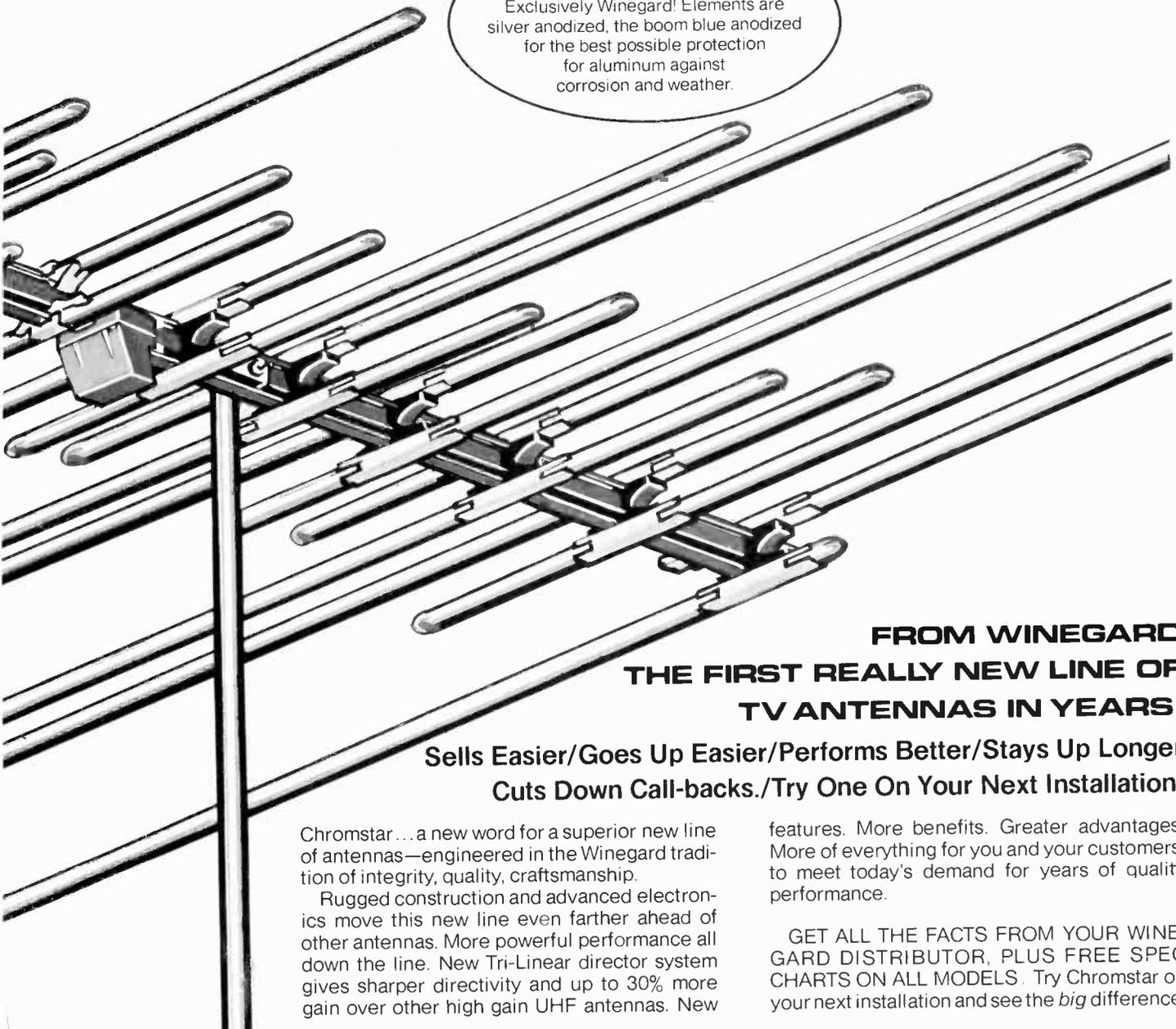
Boom length required for 12 directors



Typical gain curve with Winegard Tri-Linear directors  
Note high uniform gain across entire band

## ANODIZED!

Exclusively Winegard! Elements are silver anodized, the boom blue anodized for the best possible protection for aluminum against corrosion and weather.



## FROM WINEGARD THE FIRST REALLY NEW LINE OF TV ANTENNAS IN YEARS!

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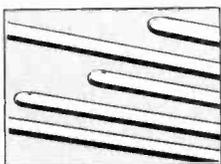
Chromstar... a new word for a superior new line of antennas—engineered in the Winegard tradition of integrity, quality, craftsmanship.

Rugged construction and advanced electronics move this new line even farther ahead of other antennas. More powerful performance all down the line. New Tri-Linear director system gives sharper directivity and up to 30% more gain over other high gain UHF antennas. New

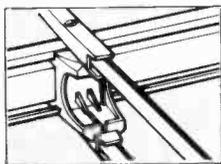
features. More benefits. Greater advantages. More of everything for you and your customers, to meet today's demand for years of quality performance.

GET ALL THE FACTS FROM YOUR WINEGARD DISTRIBUTOR, PLUS FREE SPEC CHARTS ON ALL MODELS. Try Chromstar on your next installation and see the *big* difference.

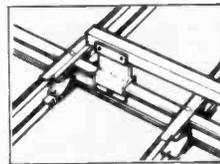
**RUGGEDIZED!** Chromstar antennas are designed to defy weather and wear—are engineered for extra strength at all points of stress. You can actually see the difference in the rugged construction.



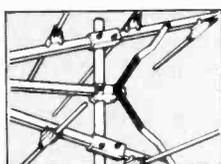
Exclusive 7/8" diameter aluminum tubing for 30% greater strength, better performance, longer life. Winegard is the first and only manufacturer to use this larger diameter.



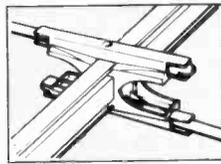
New truss-type phasing bars, top and bottom, with more conductive surface, give maximum transfer of signal. Truss-type "bridge" construction more than doubles boom strength.



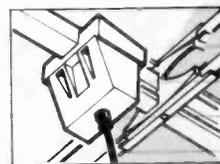
Double boom on longer flat line models for extra strength & rigidity.



New scissors-type struts between upper and lower booms and center boom on wedge models, for extra support, easier installation.



High-impact girder design support insulators are moulded of super-tough Noryl G-E plastic. Four positive locks give maximum support and permanent alignment.



Critical-point weather protection! \*New compact weatherproof cartridge housing for downlead, preamplifiers and filter modules. New... printed circuit downlead module with both twin lead and 75 ohm coax connections. No separate matching transformer required.

## TV ANTENNAS MORE PEOPLE LOOK UP TO

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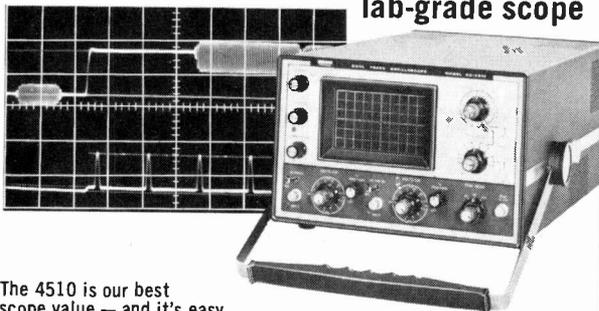
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## The single trace 4530...a professional service scope



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## ELECTRONIC ASSOCIATION DIGEST

Information about the activities of national, state and local associations of electronic servicers, dealers and manufacturers. Material for publication in this department should be addressed to: Service Association Digest, ET/D, 1 East First St., Duluth, Minn. 55802.

### NARDA Member Experiments With \$25 One-Year, Labor-Only Service Contract For Three TV Sets

Dewey Reinhard, an electronics servicer from Colorado Springs, Colorado, and a member of the Board of Directors of NARDA, Inc., is currently "experimenting" with a \$25 one-year, labor-only service contract which covers any three TV receivers or appliances in a home, according to a report in *NARDA News*, the official publication of the Chicago-based association.

Describing his "experiment" to the other 290 retailers and servicers attending NARDA's 1975 Institute of Management at the University of Notre Dame in South Bend, Indiana, in August of this year, Reinhard stated that "it is too soon to say how this will work out," but he did reveal that, by paying careful attention to overhead and by eliminating unprofitable in-warranty work, in fiscal 1975, he netted 13 percent on sales of \$101,000 from 2,300 calls compared to 9 percent on sales of \$158,000 from 6,051 calls in 1973.

### NESDA Membership At 2,105 As Of July 1975

Membership in the National Electronic Service Dealers Association (NESDA) was 2,105 as of July 1975, down 13.6 percent from the 2,434 members reported in July 1974.

According to the state membership figures listed in NESDA's annual report for the year ending June 30, 1975, about 47 percent of NESDA's total membership is concentrated in three states: California (621 members), Texas (221 members) and Wisconsin (141 members).

The NESDA year-end report also reveals that the following 27 states have only 25 or less NESDA members: Alabama (1), Alaska (1), Arizona (25), Colorado (25), Delaware (2), Idaho (9), Kentucky (13), Louisiana (14), Maine (6), Maryland (25), Massachusetts (0), Minnesota (6), Mississippi (5), Montana (5), Nevada (8), New Hampshire (4), New Jersey (18), New Mexico (1), North Carolina (24), Oklahoma (4), Pennsylvania (14), Rhode Island (2), South Carolina (3), Tennessee (9), Utah (24), West Virginia (2), and Wyoming (1).

### NARDA 1976 Annual Convention To Be In Las Vegas

NARDA's 1976 annual convention will be held March 29-April 1, 1976, at Caesar's Palace in Las Vegas.

The registration fee for NARDA members is \$115 (\$75 extra for spouses), and includes admission to all sessions, four luncheons and the closing-day banquet. Nonmember registration is \$145 (\$220 per couple). Special "early bird" fees for members who register before December 31, 1975, are \$100 per member or \$175 for member and spouse, and for nonmembers they are \$130 per individual or \$205 for nonmember and spouse.

Special NARDA convention room rates at Caesar's Palace are \$32 for a single room and \$36 for a double room.

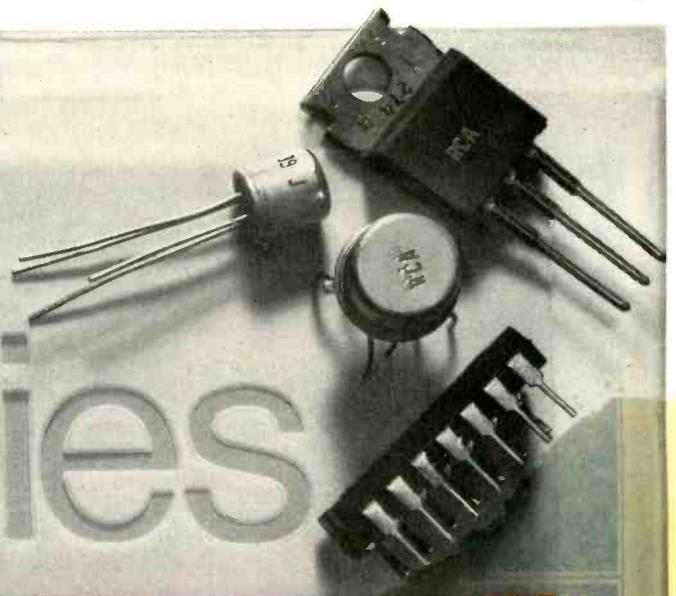
For further information about the NARDA convention or to register, contact Jules Steinberg, Executive Vice President, NARDA, 318 W. Randolph St., Chicago, Ill. 60606. (If registering, send check for full amount.) ■

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 you need  
 here.

Over 103,200 devices can be replaced by 250 RCA SK Series types. That's 410 to 1! Best ratio in the industry. Which means the odds are, SK is your best, fastest way to get what you need. With minimum inventory. And RCA provides the top quality you'd expect from a top manufacturer of OEM devices. Same strict AQL standards, same strict Director of Quality Assurance. Get SK devices and your free 1975 SK Series Replacement Guide from your local RCA distributor.



**RCA** SK Series



It's OK if it's **sk**

...for more details circle 127 on Reader Service Card

# TUNER SERVICE CORPORATION

**SUBSTITUNER**



JUST  
**\$44.95**  
U.S.A. ONLY  
WITH CABLES

ONE YEAR  
GUARANTEE

STILL ONLY



**\$9.95**  
U.S.A. ONLY  
MAJOR PARTS  
AND SHIPPING  
CHARGED  
AT COST

## FEATURES

- A UHF Tuner with 70 channels which are detented and indicated just like VHF channels.
- A VHF Hi Gain Solid-State Tuner
- AC Powered
- 90-Day Warranty

Demonstrate the **SUBSTITUNER** to your customers and show improved reception with their TV sets.

You may place your order through any of the Centers listed below.

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

## REPAIR

VHF OR UHF ANY TYPE ..... (U.S.A. ONLY) \$ 9.95  
UHF/VHF COMBINATION ..... (U.S.A. ONLY) \$15.00

Major Parts and Shipping Charged at Cost.

- Fast, efficient service at our conveniently located Service Centers.
- All tuners are ultrasonically cleaned, repaired, realigned, and air tested.

## REPLACE

UNIVERSAL REPLACEMENT TUNER \$12.95 (U.S.A. only)

- This price buys you a complete new tuner built specifically by Sarkes Tarzian Inc. for this purpose.
- All shafts have a maximum length of 10½" which can be cut to 1½".
- Specify heater type parallel and series 450 mA or 600 mA.

## CUSTOMIZE

- Customized tuners are available at a cost of only \$15.95. With trade-in \$13.95. (U.S.A. only)
- Send in your original tuner for comparison purposes to any of the centers listed below.



HEADQUARTERS	BLOOMINGTON, INDIANA 47401	537 South Walnut Street	Tel. 812-334-0411
ARIZONA	TUCSON, ARIZONA 85713	1528 S. 6th Avenue	Tel. 602-791-9243
CALIFORNIA	NORTH HOLLYWOOD, CALIF. 91401	10654 Magnolia Boulevard	Tel. 213-769-2720
	BURLINGAME, CALIF. 94010	1324 Marsten Road	Tel. 415-347-5728
	MODESTO, CALIF. 95351	123 Phoenix Avenue	Tel. 209-521-8051
FLORIDA	TAMPA, FLORIDA 33606	1505 Cypress Street	Tel. 813-253-0324
	FT. LAUDERDALE, FLORIDA 33315	104 S.W. 23rd St. Box 18	Tel. 305-524-0914
GEORGIA	ATLANTA, GEORGIA 30310	646 Evans Street S.W.	Tel. 404-758-2232
ILLINOIS	CHAMPAIGN, ILLINOIS 61820	405 East University Street	Tel. 217-356-6400
	SKOKIE, ILLINOIS 60076	5110 West Brown Street	Tel. 312-675-0230
INDIANA	INDIANAPOLIS, INDIANA 46204	112 West St. Clair Street	Tel. 317-632-3493
IOWA	DES MOINES, IOWA 50310	505 Douglas St. No. 50	Tel. 515-278-4217
KENTUCKY	LOUISVILLE, KENTUCKY 40205	2244 Taylorsville Rd.	Tel. 502-452-1191
LOUISIANA	SHREVEPORT, LOUISIANA 71104	3025 Highland Avenue	Tel. 504-821-3027
MARYLAND	BALTIMORE, MARYLAND 21215	5505 Reisterstown Rd. Box 2524	Tel. 301-358-1186
MASSACHUSETTS	SPRINGFIELD, MASSACHUSETTS 01108	409 Dickinson Street	Tel. 413-788-8206
MISSOURI	ST. LOUIS, MISSOURI 63132	10530 Page Avenue	Tel. 314-429-0633
NEVADA	LAS VEGAS, NEVADA 89102	1412 Western Avenue No.	Tel. 702-384-4235
NEW JERSEY	TRENTON, NEW JERSEY 08638	901 North Olden Avenue	Tel. 609-393-0999
	JERSEY CITY, NEW JERSEY 07307	547-49 Tonnetta Ave. Hwy. 1 & 9	Tel. 201-792-3730
NO. CAROLINA	GREENSBORO, NO. CAROLINA 27405	2914 E. Market St.	Tel. 919-273-6276
OHIO	CINCINNATI, OHIO 45216	7450 Vine Street	Tel. 513-821-5080
	CLEVELAND, OHIO 44109	4525 Pearl Road	Tel. 216-741-2314
OREGON	PORTLAND, OREGON 97210	1732 N.W. 25th Avenue	Tel. 503-222-9059
PENNSYLVANIA	PITTSBURGH, PA. 15209	503½ Grant Avenue	Tel. 412-821-4004
TENNESSEE	MEMPHIS, TENNESSEE 38111	3158 Barron Avenue	Tel. 901-458-2355
TEXAS	DALLAS, TEXAS 75218	11540 Garland Road	Tel. 214-327-8413
VIRGINIA	NORFOLK, VIRGINIA 23513	3295 Santos Street	Tel. 804-855-2518
CANADA	ST. LAURENT, QUEBEC H4N-2L7	305 Decarie Boulevard	Tel. 514-748-8803
	CALGARY, ALBERTA T2H-0L1	448 42nd Avenue S.E.	Tel. 403-243-0971
		P.O. Box 5823, Strn. "A"	

IF YOU WANT TO BRANCH OUT INTO THE TV TUNER REPAIR BUSINESS, WRITE TO THE BLOOMINGTON HEADQUARTERS ABOUT A FRANCHISE.

...for more details circle 135 on Reader Service Card

# NEWS OF THE INDUSTRY

## **Installation And Reliable Service Essential To Successful CB Marketing Say Manufacturers**

Executives of three national manufacturers of CB equipment, speaking to more than 700 electronic retailers at a CB Symposium in Houston, Texas, on September 13 and 14, urged retailers to be prepared to provide installation and servicing.

Kirby West, CB Products Sales Manager, Regency Electronics, Inc., pointed up the need for what he calls "total service" and added that "if you can't install CB equipment, at least recommend an installation source."

"Know the equipment and always have someone on the premises who is well acquainted with the equipment, its capabilities and limitations," advised Ed Walsh, National Director, Communications Div., Craig Corp.

Commenting on the essentials for successful retailing of CB, Roy Myers, Sales Manager, Consumer Products, E.F. Johnson Company, said that retailers must "have reliable service available" and "have a CB department with someone running it who knows the equipment."

## **BRH Eyes Distributors And Retailers In Panasonic Color TV Excessive X-radiation Problem**

The Bureau of Radiological Health (BRH), according to *Television Digest*, believes that distributor's and dealer's failure to record and furnish purchasers' names is part of the reason that about 10,000 affected color TV owners have not yet been notified of an offer whereby Panasonic will at no charge, modify their sets to eliminate the possibility of the emission of excessive X-radiation.

Despite this alleged obstacle, during the past nine months Panasonic has been able to locate and notify about 278,000 of the 288,000 owners of Panasonic color TV sets involved in the recall program ordered last year by BRH to eliminate the possibility of excessive X-radiation in these sets.

According to the *Television Digest* report, BRH Assistant Director Arthur Lazell "hasn't ruled out possible legal action against some large offending dealers or distributors, to set an example." Commenting about dealer's and distributors' customer record-keeping obligations, which are required by the Radiation Control Act, Lazell stated, "We're taking a good hard look at this problem, and what should be done."

## **Ban On "Hobby Use" Of CB Seemingly Dropped By FCC**

The Federal Communications Commission (FCC) recently amended its rules which govern how Citizens Band (CB) radio can be used. Some of the amendments seemingly legalize practices which previously were banned to prevent the use of CB as a "hobby."

One amendment eliminates the restriction on inter-station contacts and establishes Channel 11 nationwide as a "calling channel" which can be used only for initial contact and to arrange follow-up contact on another channel. Although Channel 11's use is restricted to that of a "calling channel," other channels may be used for the same purpose.

Two other amendments, one of which limits conversations to five minutes, with one minute of silence between successive conversations, and another which extends to receiving antennas the height restrictions which already apply to transmitting antennas, should help ease the present congestion on some Citizens Band channels.

Station identification procedures also have been modified so that call letters are required only at the beginning and end of conversations, and nicknames may be used as supplementary identification.

## **Throwing Away Repairable Modules A Waste Of Vital Energy Says GTE Sylvania Product Manager**

The accelerating need for increased conservation of energy could make the concept of throw-away TV modules unrealistic, according to Gerald L. Quint, Product Marketing Manager, ECG Semiconductor Line, GTE Sylvania.

In a speech on August 15 to members of the National Electronic Service Dealers Association (NESDA) attending that Association's annual convention in Winston-Salem, N.C., Quint stated that he believes the energy crunch and the resultant on-going need for increased conservation of energy "will probably exert more influence over the future of our industry than any other single circumstance."

After reviewing how the need for energy conservation has contributed to the elimination of the instant-on feature in new TV receivers, Quint asked NESDA members to consider how much energy is expended in the manufacture and assembly of every component part of a TV receiver. Using semiconductors as one example, Quint said, "...it

has been suggested that one kilowatt hour of electricity will produce about three dollars worth of semiconductors. On this basis, it is estimated that, in 1974, the U.S. semiconductor industry consumed 800 million kilowatt hours of electrical energy...this is roughly the equivalent of one million barrels of oil, enough to run the whole country for one hour...imagine the energy that is thrown away any time an entire TV receiver or any product is scrapped."

Relating the concepts of energy conservation and energy recycling to TV modules, Quint said, "With the rapid trend toward modularization of all consumer products, we could be well on our way to, or lured into, a throw-away module concept. But aren't we really throwing away energy? Suppose a module were inoperable due to a single component failure. Aren't we throwing away all the energy that was consumed to produce that module, while the expenditure of a minute amount of energy for the replacement part could salvage this energy? Perhaps I'm really reaching a little, but the day could come when literally millions of modules could be scrapped, with a resultant waste of energy."

Suggested Quint, "Perhaps we should encourage the consumer to repair his entertainment products not just to save the replacement cost but to conserve energy. I believe that it is becoming a fact of life that we cannot tolerate a throw-away life style forever."

### **Admiral Warns of Possibility Of Defective Line Cords On Some Of Its Color TV Receivers**

The Admiral Group of Rockwell International Corporation has informed the Consumer Product Safety commission and Admiral authorized service centers that the line cord on about 500 of its color TV receivers distributed since October 1973 might be defective.

Some of the models involved were marketed through Montgomery Ward and K-Mart, who, along with Admiral, reportedly already have sent letters to an estimated 45,000 customers as part of a program to locate and have repairs made on what Admiral says is "a small percentage of color TV sets that are in the hands of consumers, dealers and distributors."

The possible defect, which Admiral says might have occurred during manufacturing, is a break, crack or cut in the insulation which can expose the conductor of the line cord at any point between the plug and the cabinet.

The Admiral color TV models in which this defect might exist are:

5L5921	19C657	25L41	SK25L161	25C631
5L5925	19C658C	25L53	SK25L165	25C633
5L5928	SK19C677	25L55	SK25L168	25C635
5L5941	SK19C678	25L71	SK25L177	25C636
13C628	25L11M	25L77	25C611	25C643
SK13C668	25L25	25L91	25C615	25C657
17C638	25L28	25L98	25C618	SK25C671
19C638C	S25L38	25L101	25C628	SK25C673
				SK25C676

The allowance which Admiral is paying its Mastercare Maintenance Service Centers for replacing the defective cord on customer-owned units is \$15 for carry-in portables and \$20 (plus approved mileage, where applicable) for console units.

### **PTS Opens New Tuner Repair Centers In Tampa And Indianapolis**

PTS Electronics, Inc., an Indiana-based TV tuner repair company, recently announced the opening of two new repair centers, one in Tampa, Florida (2703 S. Macdill, P.O. Box 14301, 33690) and one in Indianapolis, Indiana (28 E. 14th St., 47401).

### **GTE Sylvania To Buy Motorola's Hotel/Motel TV Business**

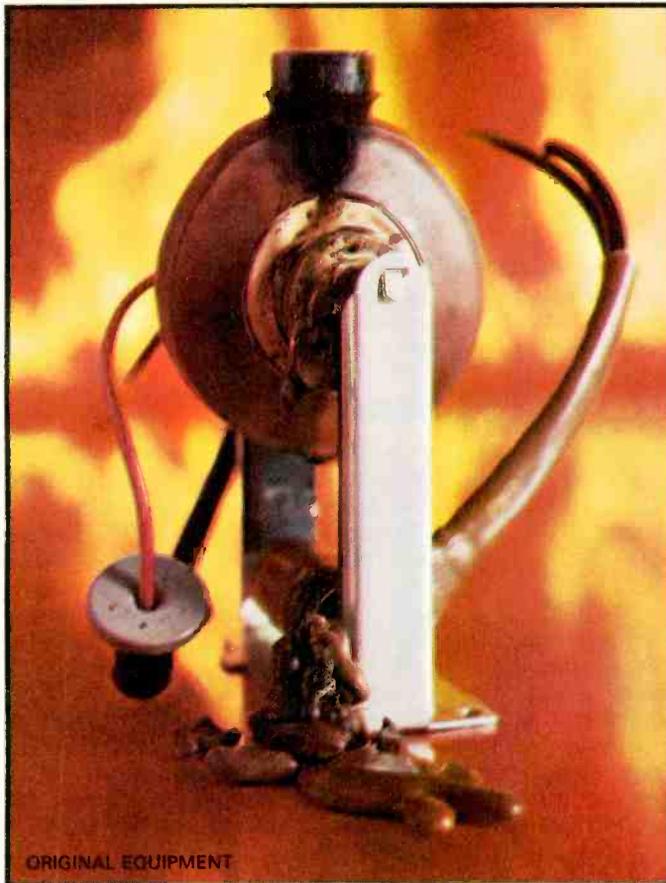
GTE Sylvania Inc. and Motorola Inc. have announced an agreement in principle whereby GTE Sylvania will purchase certain assets of Motorola's Institutional Electronics Unit which leases and sells television receivers and associated equipment to hotels and motels.

George Konkol, GTE Sylvania Senior Vice President, said GTE Sylvania plans to form its own hotel/motel TV business as part of its Entertainment Products Group, which is headquartered in Batavia, N.Y.

GTE Sylvania will make service available to Motorola hotel/motel customers, and will assume Motorola's obligation for current maintenance contracts.

The probable reasons for the sale, according to a recent report in *Television Digest*, are: 1) Since the sale of its TV set operation to Quasar, Motorola has had no in-house supply of TV receivers, and 2) unlike Sylvania, neither Motorola nor Quasar has a company-owned national TV servicing organization.

According to *Television Digest*, RCA Service Company is number one in the hotel/motel TV business and, prior to the Motorola-Sylvania sale, Motorola was ranked number two but its share was significantly reduced when Holiday Inns Products recently switched to Zenith as its exclusive supplier of about 20,000 receivers annually. ■



ORIGINAL EQUIPMENT



THORDARSON

## The difference in flybacks is a hot subject

After numerous lawsuits and liability claims against electronics service dealers, government regulations now require flame retardant flybacks in all new TVs. But most OEM replacement flybacks for pre-regulation sets do not meet those standards. Does it make sense to install a part that would be illegal in a new set today?

That's a risk THORDARSON believes you shouldn't have to take. So every color replacement flyback we make meets today's fire retardance standards.

99% of THORDARSON replacements sold are exact replacements, right down to the mounting holes and wiring color code.

And THORDARSON knows you can't afford long waits for replacements... so your TM distributor stocks in depth. And he can use our unique Rush Order system for factory shipment of hard-to-get parts directly to you!

It almost always costs less to specify THORDARSON quality... and it could keep you out of some very hot water.

Ask your independent distributor for your free THORDARSON Pocket Replacement Guide or write to...

**THORDARSON**  
Established 1895

THORDARSON MEISSNER INC.  
A subsidiary of Components Corp. of America  
Electronic Center Mount Carmel, IL 62863

Support your independent parts distributor... we do! NEDA



Associate Member

...for more details circle 133 on Reader Service Card

# ARROW AUTOMATIC STAPLE GUNS

## CUT WIRE & CABLE INSTALLATION COSTS

... without cutting into insulation!

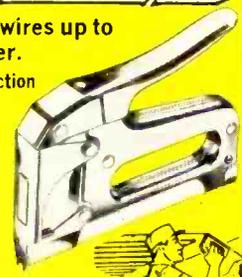
**SAFE!** Grooved Guide positions wire for proper staple envelopment! Grooved Driving Blade stops staple at right depth of penetration to prevent cutting into wire or cable insulation!



**No. T-18—Fits wires up to 3/16" in diameter.**

**BELL, TELEPHONE, THERMOSTAT, INTERCOM, BURGLAR ALARM and other low voltage wiring.**

Uses T-18 staples with 3/16" round crown in 3/8" and 7/16" leg lengths.



**No. T-25—Fits wires up to 1/4" in diameter.**

Same basic construction and fastens same wires as No. T-18.

Also used for **RADIANT HEAT WIRE**

Uses T-25 staples with 1/4" round crown in 9/32", 3/8", 7/16" and 9/16" leg lengths.



**NEW! Intermediate No. T-37—Fits wires and cables up to 5/16" in diameter.**

Same basic construction as Nos. T-18 & T-25.

Also used for **CATV and DRIVE RINGS** in stringing wires.

Uses T-37 staples with 5/16" round crown in 3/8", 1/2" and 9/16" leg lengths.



**No. T-75—Fits wires and cables up to 1/2" in diameter.**

**RADIANT HEAT CABLE, UF CABLE, WIRE CONDUIT COPPER TUBING** or any non-metallic sheathed cable.

Also used as **DRIVE RINGS** in stringing wires.

Uses T-75 staples with 1/2" flat crown in 9/16", 5/8" and 7/8" leg lengths.

**ARROW FASTENER COMPANY, INC.**  
271 Mayhill Street, Saddle Brook, N. J. 07663  
...for more details circle 108 on Reader Service Card

## TECHNICAL LITERATURE

### PICTURE TUBE BRIGHTNER GUIDE

A new Perma Power Color-Britener Selector Guide is now available. It contains a complete listing of all color picture tube numbers, color-coded to simplify proper britener selection. The guide also calls attention to a number of unusual picture tube styles with special sockets, which cannot be brightened with a plug-in britener, but can be brightened with a wired-in Perma Power Tech-Brite. *Chamberlain Manufacturing Corp., Perma Power Division, 5740 North Tripp Avenue, Chicago, Il. 60646.*

### TEST EQUIPMENT

A new 24-page, 1975-76, up-dated catalog on RCA's broad line of electronic instruments for use in electronic servicing, industrial maintenance, schools and safety tests is now available. The catalog provides highlights on the features of 58 instruments, detailed specifications, photos and applications information for each. In addition, an array of 89 accessory items (probes, cables, etc.) that can be used with these RCA instruments, or with similar instruments manufactured by other companies, is also provided. *RCA Distributor and Special Products Division, Cherry Hill Office, Camden, NJ. 08101.*

### TV SYSTEMS EQUIPMENT

A 40-page, Television System Equipment catalog, No. 110 is now available. The products listed include; amplifiers, antenna couplers, attenuators, band separators, cable, closed circuit equipment, enclosures, converters, line drop taps, line splitters, matching transformers, outlets, power supplies, rack mounts, tap-offs, tools, traps, filters, and miscellaneous items. Four pages are devoted to sample antenna systems layouts. Also listed is a page of television frequency allocations. *Winegard Television Systems, Winegard Co., Burlington, IA. 52601.*

### OSCILLOSCOPES

A new 12-page catalog describing the new T900 Series of oscilloscopes, which includes five new instruments is now available. The oscilloscopes all feature a large, bright 8 x 10 cm CRT, beam finder, single knob trigger control, delay line, to enable viewing of the waveforms leading edge, and automatic selection of TV line or frame

display. *Tektronix, Inc., P.O. Box 500, Beaverton, OR. 97077.*

### BROADBAND ANTENNAS

An 8-page catalog describing broadband antennas and systems is published. Spiral, horn, biconical, Lindenblad, log periodic, and rotating direction finding antennas are covered along with a description of GTE Sylvania's antenna systems capabilities. *GTE Sylvania, Antenna Department, Box 188, Mountain View, CA. 94042.*

### SEMICONDUCTORS

A new 116-page semiconductor replacement guide and catalog, is now available. It provides interchangeability data for more than 22,000 types of transistors, rectifiers, zeners, SCR's, triacs, and IC's. The guide cross-references universal replacements, registered types, and domestic and foreign set manufacturers' part numbers to the new Raytheon "RE" line of replacement semiconductors. It also contains complete specifications and outline drawings for all "RE" types. *Raytheon Co., Distributor Operation, Fourth Avenue, Burlington, MA. 01803.*

### AUDIO CABLES

Seven molded cables ranging in length from 20 to 50 feet for use in long audio cable runs, such as stereo and quad speaker wiring, are described in a new product bulletin. A clear plastic sheath provides low cable visibility and options of molded phono plug terminations, stripped and tinned leads, and spade lugs are available. Complete information on the seven cable series, which offer a variety of lengths and the advantages of low visibility in home or apartment use, are presented in the New Products Bulletin No. 290. *Switchcraft, Inc., 555 No. Elston Ave., Chicago, IL. 60630.*

### FM SIGNAL GENERATOR

Descriptive literature about the Model 800A Measurements FM Signal Generator is offered. This fully solid state unit is designed to meet precision and reliability requirements for mobile communications, laboratories, and on-line quality control. *McGraw-Edison Co., Edison Electronics Div., Grenier Field Municipal Airport, Manchester, NH. 03103.*

### SECURITY EQUIPMENT

A new 96-page alarm and security equipment catalog, A-76, is offered which features an informative guide  
*continued on page 14*

# TV service technicians name Zenith for the two things you want most in color TV.



## I. Best Picture.

In a recent nationwide survey of independent TV service technicians, Zenith was named, more than any other brand, as the color TV with the best picture.

**Question:** In general, of the color TV brands you are familiar with, which one would you say has the best overall picture?

**Answers:**

Zenith	36%
Brand A	20%
Brand B	10%
Brand C	7%
Brand D	6%
Brand E	3%
Brand F	2%
Brand G	2%
Brand H	2%
Brand I	1%
Other Brands	3%
About Equal	11%
Don't Know	4%

Note: Answers total over 100% due to multiple responses.

## II. Fewest Repairs

In the same survey, the service technicians named Zenith as the color TV needing the fewest repairs. By more than 2-to-1 over the next brand.

**Question:** In general, of the color TV brands you are familiar with, which one would you say requires the fewest repairs?

**Answers:**

Zenith	38%
Brand A	15%
Brand C	8%
Brand D	4%
Brand B	3%
Brand I	2%
Brand F	2%
Brand E	2%
Brand G	1%
Brand H	1%
Other Brands	4%
About Equal	14%
Don't Know	9%

We're proud of our record of building dependable, quality products. But if it should ever happen that a Zenith product doesn't live up to your expectations—or if you want details of the service technicians' survey—write to the Vice President, Consumer Affairs, Zenith Radio Corporation, 1900 N. Austin Avenue, Chicago, IL 60639.

The Bordeaux, Country French style, with beautiful simulated wood finish and genuine wood veneer top. Model SG2569P. Simulated TV picture.

**ZENITH** 100% SOLID-STATE  
**CHROMACOLOR II**

The quality goes in before the name goes on.

continued from page 12

to alarm equipment applications. The guide includes general alarm system discussion, basic installation procedures, and detailed connection diagrams. It describes and offers over 500 intrusion and fire alarm products, many UL listed. Broad product lines provide a one-stop source of supplies for alarm installers, dealers, business and industrial security departments, and skilled electronic and electrical technicians who require alarm systems, parts and accessories. Products are described in detail regarding application, principle of operation and specifications, with many connection diagrams included to allow skilled technicians to make the right choices. *Mountain West Alarm Supply Co.*, 4215 North 16th Street, Phoenix, AZ. 85016.

### SEMICONDUCTORS

A new 60-page catalog which provides complete electrical and mechanical characteristics on more than 10,000 power semiconductors including high-speed switching transistors, Zener diodes and TransZorb transient voltage suppressors is now available. *General Semiconductor*, 2001 W. 10th Place, P.O. Box 3078, Tempe AZ. 85281.

### SOUND REINFORCEMENT PRODUCTS

Offered is an easy-to-use guide showing which products from its SR Line of professional audio equipment are needed to provide a complete, but not excessive, sound system for installations of virtually any size. Called Sound Ideas, the guide lists the SR components needed for both portable and permanent sound reinforcement systems for clubs, churches, etc. The systems described in the guide range from a small stage monitor to a high-powered, wide-range, 1,000-watt system. Also included is a block diagram of each system, showing the interconnections of the individual components together with technical data such as the resultant frequency response of each system, the continuous RMS wattage output, and the number of available microphone inputs. *Shure Brothers Inc.*, 222 Hartrey Avenue, Evanston, IL. 60204.

### HIGH FIDELITY PRODUCTS

A 16-page High Fidelity Products catalog, No. AL210-P is now offered. It lists high fidelity phono cartridges, replacement styli, tone arms, preamplifiers, headphone amplifiers and stylus force gauges. Also, a comprehensive guide for selecting the cor-

rect replacement styli is contained in the catalog. *Shure Brothers Inc.*, 222 Hartrey Avenue, Evanston IL. 60204.

### BUSINESS FORMS

An all new, full-color catalog featuring over 200 standard and personalized time-saving business forms, designed with both traditional and striking graphics is now available. It includes a new, complete selection of office paper, labels, and filing accessories, and an assortment of employment applications, newly revised in accordance with federal and state requirements. *Mattick Business Forms*, 333 W. Hintz Rd., Wheeling, IL. 60090.

### CB ANTENNAS

The latest antenna information is fully illustrated in the new Hustler CB catalog including the "Power Packer", advanced design "Hi-Q" Twin Huskies and the customized "Super Hustler". Antenna mounts, cables with noise immunity, accessories and monitor antenna systems are just a few of the items described. *New-Tronics Corp.*, 15800 Commerce Park Drive, Brookpark, OH. 44142.

### TEST EQUIPMENT

A 64-page catalog No. 39, lists performance verified test equipment specials at beat inflation prices. Also listed are wave guide components, coaxial components precision meters, recorders, environmental equipment, line regulators, frequency changers, 400 cycle supplies, variable auto transformers, constant voltage transformers, power supplies, Simpson meters and many more. *Baynton Electronics Corp.*, 2709 North Broad Street, Philadelphia, PA. 19132.

### CLOSED-CIRCUIT VIDEO EQUIPMENT

A new 8-page product guide covering RCA's line of general purpose, high performance cameras and video products is now available. The general purpose, low cost cameras include the TC1000 family used widely for surveillance systems. The high performance cameras cover the TC1005 family for CCTV, CATV, MATV, broadcast and demanding industrial use. In addition, the booklet lists VTR cameras and CCD cameras. Other video products include monitors, accessories, a sequential switcher, a date and time generator, and VidAlert motion detectors. The publication "General Purpose, High Performance Cameras and Video Products", CCV-118, provides a quick overview of your CCTV system product needs. *RCA Solid State Division*, Route 202, Somerville, NJ. 08876. ■

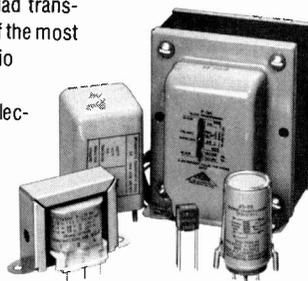
# Triad. Everything from A-1X to YT-116-2.

Whatever your transformer requirements, there's a Triad transformer to satisfy them exactly. Triad manufactures one of the most complete lines in the industry — including power, audio and filament transformers, filter chokes, width and linearity coils, vertical outputs, blocking oscillators, deflection yokes, flybacks and more. And they're all available worldwide. Write Triad today for your free catalog.



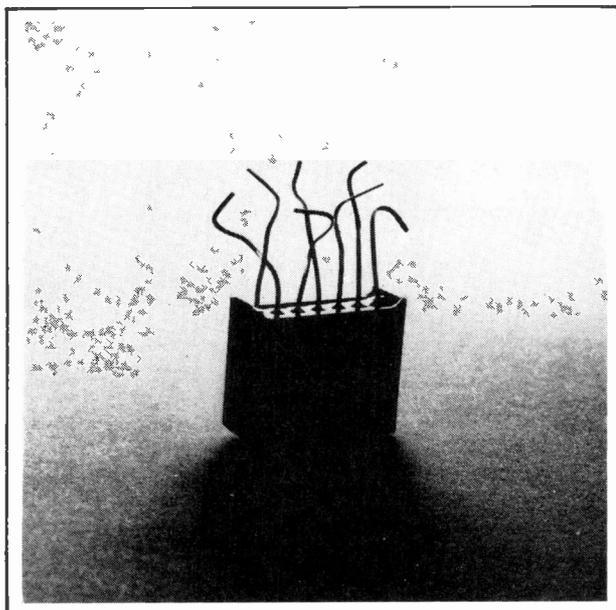
**TRIAD-UTRAD**

Litton Distributor Services  
305 N. Briant St., Huntington, Indiana 46750



...for more details circle 134 on Reader Service Card

# The death of a solid-state device needn't complicate your life.



Repair over 126 domestic and imported brands with Sylvania modules and IC's.

You take a look at the job and the brand name's Bigston or Kobekiito or Teaberry or Pace.

No problem!

Sylvania replacement modules and IC's fit these brands like a glove. They also fit over 122 other brands, including RCA, Panasonic, Sony—and, of course, Sylvania.

For the vast majority of domestic and imported electronic equipment, all you need is a basic stock of Sylvania ECG™ Semiconductors. And our new Replacement Guide to show you which ones go where.

For a copy, see your Sylvania distributor.

We're helping you make it.

**GTE SYLVANIA**

also can lend stability  
not only offers tax adv  
tern, or annuity, i  
system in effect bet  
receives from full  
system, the m  
initial capi  
Once it  
Background info  
photos for this article wa  
by John F. Gallo &  
Manager, Delta Berco C

# MATV Leasing

By J.W. Phipps

An alternative, long-term source of income for electronic servicers

■ Mike Gast is presently installing a master antenna television (MATV) system in a large mobile home park. When it is completed, Gast will *not* present the owner of the mobile home park a bill for the equipment and installation, nor will the park owner ever have to pay Gast for maintenance or servicing of the system.

No, Mike Gast is not an egocentric millionaire whose guilt about making so much money has driven him to installing, maintaining and servicing MATV systems free for disadvantaged owners of mobile home parks. Not by a long shot!

Instead, Gast, who is the owner/operator of Mike's Antenna Service, Buffalo, New York, is one of a small but growing number of antenna installers and electronic servicers who recognize the financial viability of "leasing" MATV systems to the owners of large apartment, townhouse and mobile home complexes.

These "leased" MATV systems are operated much like community antenna television (CATV) systems. The tenants of the multi-dwelling complexes in which the MATV systems are installed pay a monthly fee for use of the system. The complete system remains the property of the installer, who also is responsible for all maintenance and servicing.

Once the installer recovers his initial capital investment in the system, the monthly revenue he receives from subscribers to the system in effect becomes a long-term, or annuity, income, which not only offers tax advantages but also can lend stability to the sea-

*(Background information and photos for this article were supplied by John F. Galko, MATV Sales Manager, Delta Benco Cascade, Inc.)*

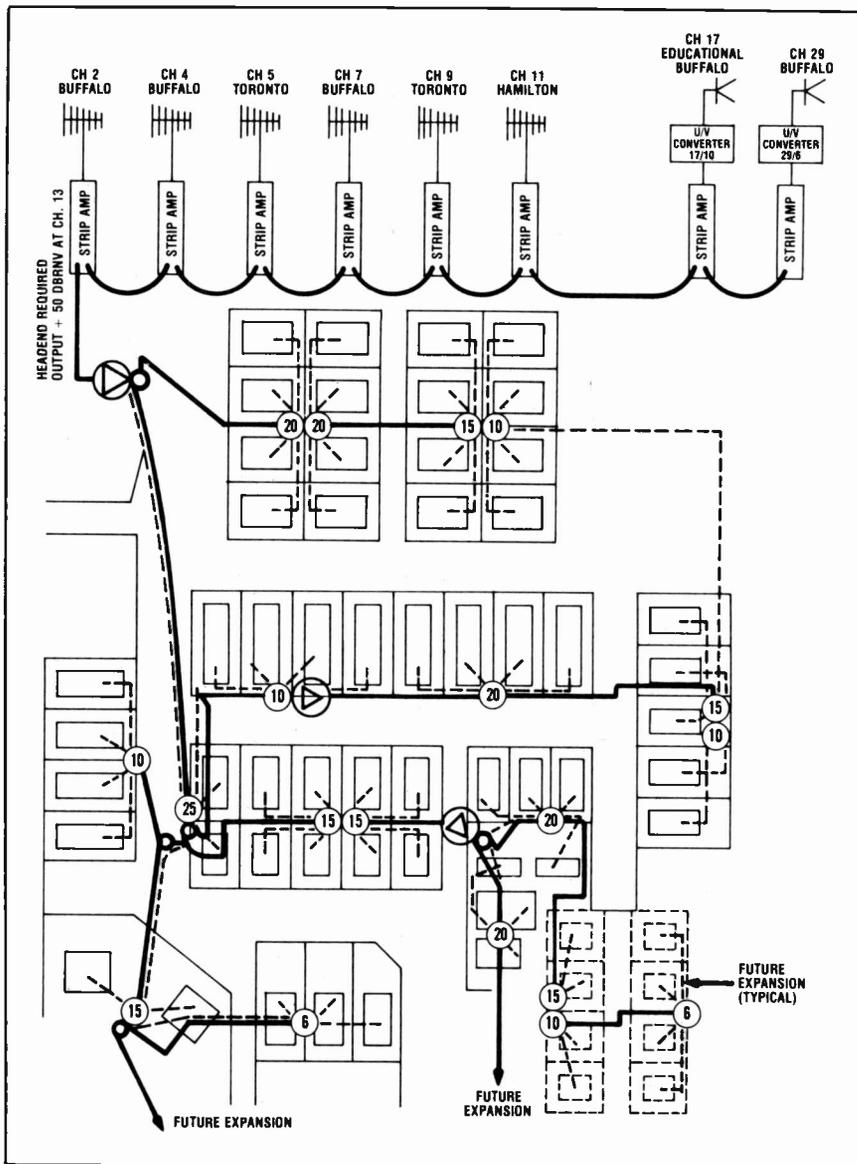


Fig. 1—Functional diagram of the multi-channel MATV system which Mike Gast, Buffalo, New York, is leasing to the owner of a mobile home park.

sonal income and profit structures inherent in most antenna installation and electronic servicing businesses.

A functional diagram of the multi-channel MATV system Gast is installing in the mobile home park is shown in Fig. 1, and a financial projection of it is presented in Table 1.

Gast has estimated that his initial capital investment, including equipment and installation costs, will be \$15,000, a portion of which he has financed with a bank loan secured by the lease contract. If his projections in Table 1 prove to be reasonably accurate, Gast should be able to recover his initial capital investment within at least two years.

Of the projected 300 mobile homes which will occupy the park when it is completed, Gast esti-

mates that an average of 60 percent, or 180 tenants, will subscribe to his MATV system at an initial monthly fee of \$4.00, which is significantly less than the average \$6.50 monthly fee charged by CATV operators. Gast's estimate of the average number of subscribers might seem conservative considering the fact that the owner of the mobile home park, to maintain the park-like environment of his complex, activity discourages the use of single-residence TV antennas by the tenants, plus the fact that for a relatively modest fee Gast's system will provide subscribers with at least eight TV channels whose amplified signals will produce significantly better pictures than those presently being received by conventional, single-residence antennas in the area. However, in

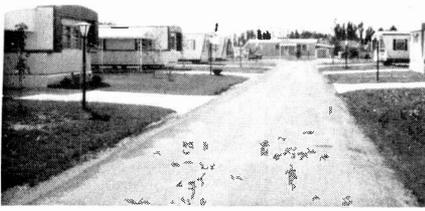


Fig. 2—A partial view of one of the streets of the mobile home complex in which Gast is installing and leasing an MATV system. By eliminating the need for individual outside TV antennas, Gast's MATV system will help the owner maintain the uncluttered, park-like appearance of the complex and yet provide tenants with high-quality multi-channel TV and FM reception.



Fig. 3—Gast, owner/operator of Mike's Antenna Service, is shown here connecting a multi-tap to one of the .412 underground trunk cables he is installing in the mobile home park. All cable in the park is run underground.



Fig. 4—Pedestal type enclosure which houses one of the multi-taps Gast is using to split and tap off the signals from the underground trunk cable.

arriving at his projection of the average number of subscribers, Gast has wisely taken into account the fact that every space in the park will not always be occupied, plus the fact that, regardless of the modest cost and the quality and variety of signals, a small percentage of tenants will not subscribe either because they feel they cannot afford it or because they feel that they do not watch TV enough to justify subscribing to the system.

Excluding the cost of operating, maintaining and servicing the system, if his projections are correct Gast will realize over the 15-

year term of the lease contract a gross return of over 800 percent on his original \$15,000 capital investment—and even more if he minimizes his financing costs by paying off the financed portion of his capital investment as quickly as possible. And, unlike the relatively large tax rate he would have had to pay on the lump-sum profit from an installation/sales contract, the annuity-like net income he will receive from "leasing" the system provides a definite tax advantage because it is averaged out over a 15-year period.

### SELLING THE LEASE CONCEPT

As is true in promoting and selling any viable product or service, selling the concept of a "leased" MATV System to owners of multi-dwelling complexes is principally a matter of pointing out the financial advantages it offers.

In addition to the obvious indirect financial benefit of being able to guarantee his tenants consistently good multi-channel TV and FM reception at a relatively modest monthly fee, a "leased" MATV system offers the owner of an apartment, townhouse or mobile home complex the following direct financial benefits not inherent in a purchased system:

- *No capital investment*—Because the cost of purchasing and installing the MATV system is borne by the installer, there is no capital investment required of the complex owner, who, in many cases, already has a heavily financed capital investment in the complex itself.
- *No maintenance and servicing costs*—Because the system installer is responsible for all maintenance and servicing, the complex owner is freed of all maintenance and servicing costs.
- *Guaranteed optimum system performance*—Because the installers income from the System is directly dependent on the performance of the system, the complex owner (and his tenants) have a greater assurance of consistently good system performance and, when needed, rapid servicing.

If the system installer wishes to, or believes there is a need to, he can "sweeten the deal" for the complex owner by 1) paying for the power consumed by the system, 2) paying a nominal rental

fee for the space occupied by the system's equipment, and/or 3) by giving the complex owner a mutually satisfactory commission in exchange for promoting the system to new tenants and for collecting the monthly subscriber's fees (which the complex owner can collect along with his monthly rentals at no additional administrative cost).

### CONTRACT PROVISIONS

Although the specific terms of the formal lease contract between the MATV equipment installer (leser) and the complex owner (leasee) depend on the specific arrangements negotiated and agreed on by the two principals, the equipment leaser generally should be certain that the contract:

- Covers a long term (ten to twenty years), with a renewal provision
- Stipulates that *all* equipment purchased and installed by the leaser remains the leaser's sole property during and after the contract period, even if the complex is sold
- Guarantees the leaser continued use of an unrestricted accessibility to the space(s) in which the system equipment is installed
- Stipulates that the monthly subscription fee will be established and changed only by the leaser
- Stipulates that, within the limitations of local, state and federal laws, no competing TV and FM signal distribution system will be permitted to serve the complex during the term of the contract.

The formal contract should be prepared or, at least, reviewed by the leaser's attorney prior to signing. In addition, the leaser should obtain liability insurance which covers the installation, operation and storage of the MATV equipment.

### CATV: COMPETITOR OR POTENTIAL CUSTOMER?

Regardless of whether or not a CATV system is presently operating in or is being planned for the MATV leaser's area of operation, the present and/or future effect of CATV on his operation must be considered at the outset by the MATV leaser.

CATV can be either a direct

competitor to or a potential customer of an MATV system leaser and consequently should be considered from both viewpoints.

One of the principal reasons that MATV leasers can compete with CATV is that MATV is not subject to the various municipal and federal regulations which require CATV operators to build into their systems various capabilities and specifications which are not essential for conventional, high-quality reception and distribution of TV and FM signals. These nonessential requirements increase the cost of CATV systems. Consequently, MATV leasers, who have more flexibility in the planning of their systems and in the selection of their equipment than do CATV operators, can purchase, install and operate a signal distribution system within a cost-profit structure which makes it possible for them to offer comparable (or even better) local, medium-distance, and network TV reception at a substantially lower cost to subscribers than can most CATV operators. In addition, an MATV leaser, if necessary, can put the complex owner in his corner by giving him a percentage of the subscription fee in exchange for collecting it.

Despite the advantages of lower systems costs and resultant lower subscription fees, to successfully compete with CATV, MATV leasers must provide the best possible picture quality and most, if not all, of the regular over-the-air channels which CATV provides (or will provide when it is introduced into the area).

On the other hand, as implied previously, CATV could end up purchasing an existing MATV system at a price which provides the MATV leaser with a generous return on his investment. If the equipment and operating characteristics of the existing MATV system are compatible with the requirements of the CATV system, the CATV operator might find it more economical to purchase and use the existing MATV distribution system than to install a new one.

John Galko, MATV Sales Manager, Delta Benco Cascade Inc., who has an intimate knowledge of MATV leasing, recently told me



Fig. 5—Pete Wunsch, an employee of Mike's Antenna Service, is shown cutting a trench for the underground cable. Note multi-tap pedestal behind Wunsch.

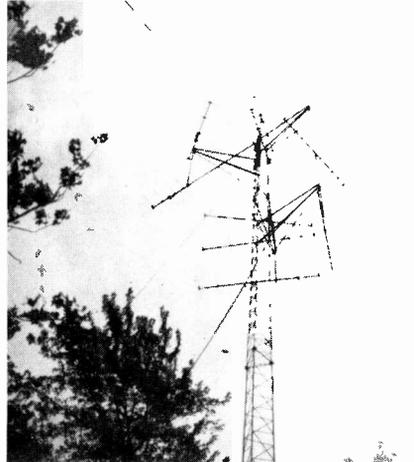


Fig. 6—To get the antennas above the surrounding trees and terrain, Gast had to install them on the relative high tower shown here. Each antenna feeds a single-channel amplifier. The antenna site is in a remote, out-of-the-way location near the back of the mobile home park.

about one MATV leaser whose principal goal is to build up what the leaser calls an "MATV land bank." According to Galko, this leaser presently has about 1400 MATV subscribers within a few franchised CATV operating areas. He was able to attract this relatively large number of subscribers by charging only \$2.00 per month. When the CATV operators in his area are ready and offer the right price, he will sell them his MATV distribution systems, the amplifiers and passive network of which he purposely designed to be compatible with CATV. It is on these sales of his systems to CATV operators, and not the lease income, that he intends to make his investment pay off.

### CONCLUSION

MATV leasing can be profitable 1) if you have or can get the finances needed to start and sustain the operation throughout the critical two-to-three-year start-up phase, during which most subscriber income should be used to pay off your initial capital investment; 2) if you design and install a system whose initial and long-term costs make it possible to recover your investment and realize a reasonable investment return from a subscriber fee which is competitive with that charged by CATV, and, yet, is a system which provides the consistently high-quality, multi-channel, trouble-free reception required to attract and retain a high average number of subscribers; and 3) if you choose a multi-dwelling complex with a size and location and with a management whose attitude and policies help assure the number of subscribers needed to make the operation profitable.

Although the preceding number of "ifs" might seem formidable, they merely represent the type and amount of consideration and planning which should be undertaken in any new business venture.

If you are interested in a supplemental, long-term source of income that can help stabilize the seasonal nature of your present electronic servicing business, choose and evaluate the potential of one or two new or existing complexes in your area, then present

*continued on page 55*

### TABLE 1 FINANCIAL PROJECTIONS

#### Mobile Home Park Leased MATV System Installed & Operated By Mike's Antenna Service

Mobile homes (projected)	300
Average hook-up percentage	× 60%
Average number of customers	180
Monthly fee	× \$4.00
Average monthly gross income	\$720
	× 12 months
Average annual gross income	\$8,640
Term of contract	× 15 years
Total gross income over contract term	\$129,600
Initial system cost (install & equip.)	÷ \$15,000
Gross return on original capital investment	864%



# General Electric TV 1976

By Joseph Zauhar

Two general production changes have been made in GE's new color TV line. The Insta-View and Insta-Color circuitry have been eliminated for energy conservation and the B+ boost potential has been removed from all printed circuit boards of all chassis

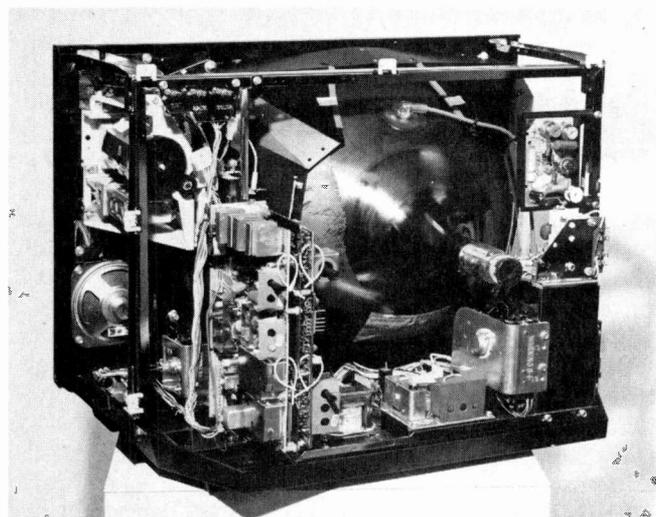


Fig. 1—Rear view of General Electric's 10-inch (diagonal) YC modular color TV chassis.

■ General Electric's 1976 Color TV line consists of three basic chassis types. The MB-2 and MC-2 chassis are employed in the large screen 25-inch (measured diagonally) color TV consoles. The YA and YC chassis shown in Fig. 1, are used in the 13-, 17-, and 19-inch (measured diagonally) color TV receivers. The 10HE chassis is retained in the new line and is used with small screen color TV portables.

## YA COLOR TV CHASSIS

The General Electric YA chassis is a carry-over from last year's color TV line. The modular chassis is 100 percent solid state (excluding the picture tube) and is built around a swing-away chassis concept, which allows access to all of the modular sub-assemblies.

There are seven modules employed in the YA chassis receivers, and contain most of the electrical components in the receiver.

Four of the modules are mounted on a hinged module pack which can be swung out to permit troubleshooting of the modules with the power applied to the chassis. The modules can be removed separately with the aid of plastic pull-tabs, as shown in Fig. 2. The

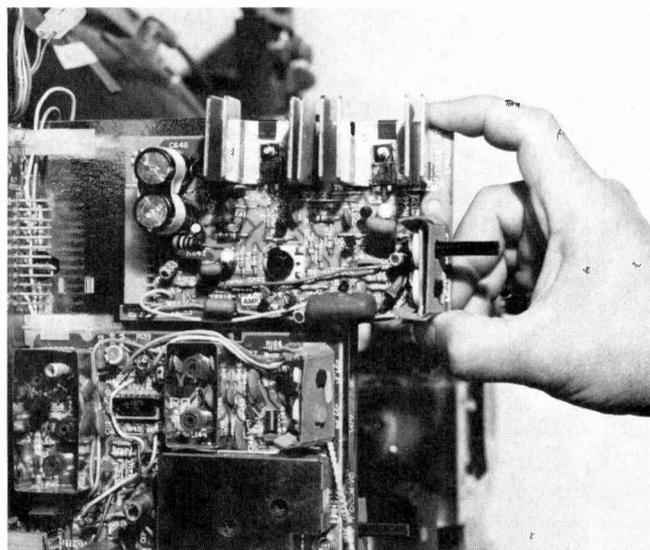


Fig. 2—A plastic pull-tab aids the removal of the modules from the module pack.

complete module pack is removable from its hinge to permit access to other areas of the chassis. Each of the modules on the module pack feature a plastic pull for easier removal of the module from the pack.

All five of the integrated circuits used in this chassis plug into sockets for easy troubleshooting.

The Quadline picture tubes used with this chassis have slotted shadow masks and striped phosphor faceplates. Some models also feature a composite black matrix faceplate which combines the advantages of both positive and negative guard band matrix systems. This matrix system is designated MX-2.

The Quadripole Spectra-Line convergence system used in conjunction with the Quadline picture tubes, has only eight adjustments; four static and four dynamic. The static adjustments are on an assembly which also contains the purity magnet, and the dynamic adjustments are located on the convergence module.

## Custom Picture Control

The *Custom Picture* control permits balanced adjustment of picture contrast, brightness, and color. Once the controls have been adjusted for the desired ratio of contrast, brightness, and color, the ratio will remain the same with subsequent adjustments of the control. This feature is made possible because the control is coupled into the contrast, brightness, and color circuits.

## One Touch Color System

The improved *One Touch Color System* incorporates *Tint Lock*, *AFC*, and "AUTO" *Present* controls. The *Tint Lock* circuit has the effect of widening the color demodulation angle by cross-coupling the B-Y and G-Y signals at the output of the chroma demodulator IC. The *brightness*, and *tint* controls which are less accessible to the user than the manual *color*, *brightness*, and *tint* controls. The advantage of these preset controls is that an experienced user can adjust them for the best compromise of color reception for all the stations in an area.

## 19YC COLOR TV CHASSIS

General Electric's 19YC chassis is a continuation

Illustrations and photos supplied through the courtesy of General Electric.

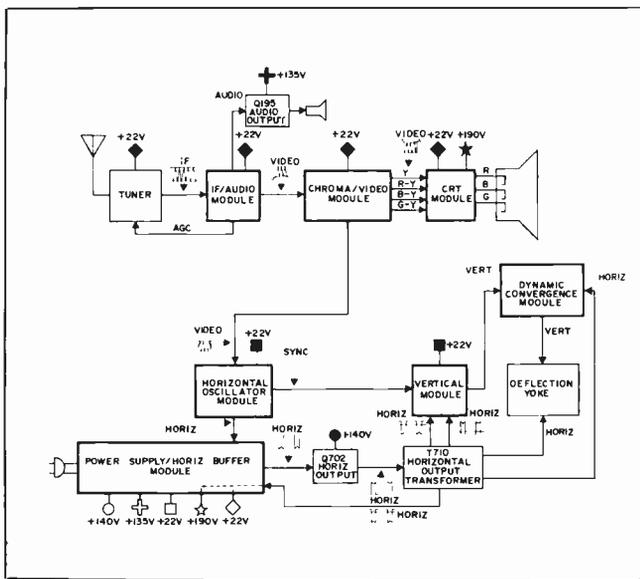


Fig. 3—Block diagram of General Electric's YC color TV chassis.

of the modular, solid-state YA line of color TV receivers introduced in 1974. Only minor circuit modifications have been incorporated in the YC chassis to accommodate the larger screen size. The modules employed in the Y-Series chassis are interchangeable and the adjustment procedures remain essentially the same.

Special features such as Quadline picture tubes, Custom Picture Control Improved One Touch Color system, Automatic Frequency Control (AFC), Automatic Color Control (ACC), DC restoration, and a Sharpness Control are standard features for the 13-, 17-, and 19-inch (measured diagonally) color TV sets.

The YC chassis layout Fig. 2 is very similar to the YA chassis. Seven modules (shown in block diagram Fig. 3) contain the bulk of the receivers circuitry.

The Vertical, Horizontal Oscillator, IF/Audio, and Chroma/Video modules plug into a hinged, moveable interconnect board. The module pack (four modules and interconnect board) can be swung out or completely removed to provide access both to the modules and to the interior of the receiver. The receiver remains operable with the assembly swung out or even dismantled from the chassis.

Other components not located on the modules are very accessible. The speaker, customer controls, tuner assembly, auto pre-set controls, high voltage rectifier, and pincushion transformers are found in convenient accessible areas of the main chassis.

The 4-ampere AC line fuse and the 1½ ampere B+ fuse plug into clips which are a part of the AC interlock bracket. The complete assembly may be dismantled by removing two screws.

Plugs and connectors are used extensively throughout the 19YC chassis. All modules are provided with disconnect devices. The high voltage rectifier, audio output transistor, horizontal output transistor, integrated circuits and fuses are mounted on plug-in sockets.

### Horizontal Output Circuit

There are only minor differences between the horizontal output circuitry of the 19YC chassis as shown in Fig. 4, and the 13- and 17-inch YA chassis. The 19YC chassis employs a different deflection yoke and

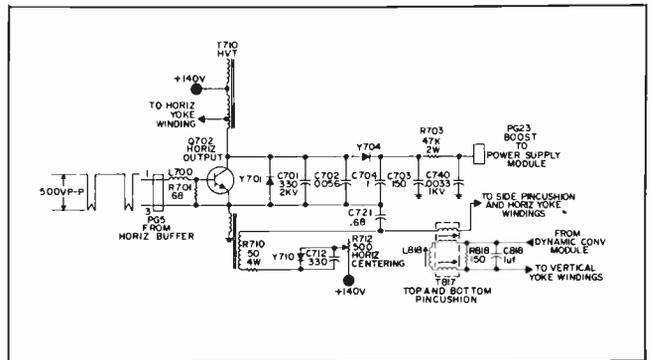


Fig. 4—Schematic of the horizontal output circuit employed in the 19YC color TV chassis.

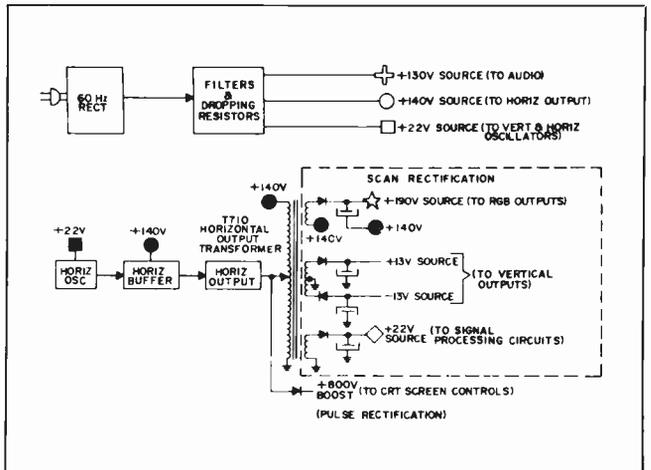


Fig. 5—Diagram of the B+ distribution system employed in the YC chassis which provides voltages for the audio output, horizontal output and sweep oscillator circuits. The remaining B+ voltages, except the boost voltage is supplied by scan rectification.

horizontal output transformer to produce adequate sweep and high voltage for its 19-inch picture tube. The high voltage potential of this chassis is 29.5 kv.

More pincushion correction circuitry has been added to the 19YC chassis. A pincushion transformer T817, has been placed in series with the vertical deflection coils to correct the horizontal bending that might be present at the top and the bottom of the raster. The top and bottom pincushion correction adjustment are the same as the MA/MB/MC chassis.

### Low Voltage Distribution System

The block diagram of the B+ distribution system employed in the YC chassis is shown in Fig. 5. A conventional 60 Hz power supply provides the B+ voltage for the audio output, horizontal output and sweep oscillator, the remaining B+ supplies, with the exception of boost voltage, are supplied by scan rectification.

The scan rectification is dependent on the horizontal sweep for its operation. The 60 Hz low-voltage power supply, horizontal oscillator, buffer, and horizontal output stages must operate properly before any output voltages can be obtained from the scan rectified sources. There are two 22-volt sources: One is derived directly from the 60 Hz rectifiers and the other from a scan rectified source.

### M-SERIES CHASSIS

The M-Series modular, solid-state chassis have one major design change. The high-voltage transformer

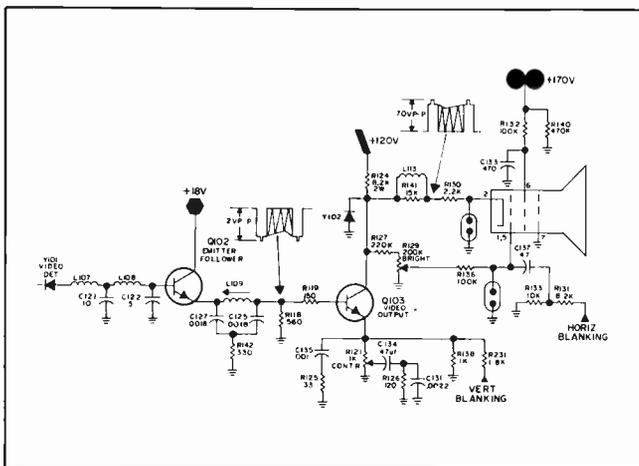


Fig. 6—DC coupling is used from the video detector to the cathode of the picture tube in General Electric's XB chassis.

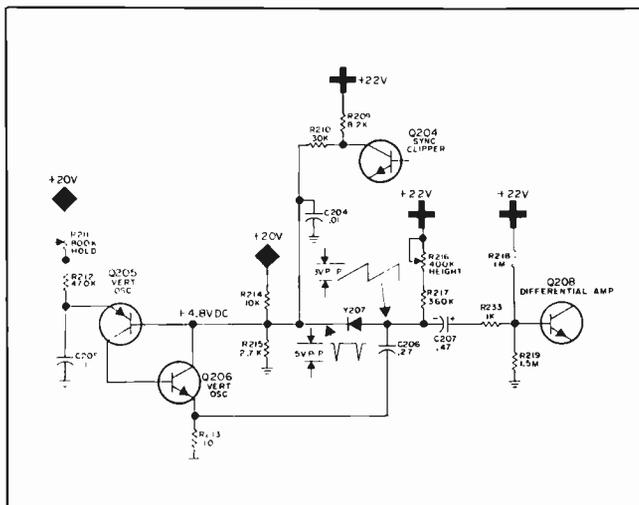


Fig. 7—Schematic of the vertical sawtooth generator circuit employed in the XB chassis.

and high voltage multiplier used in the MC-2 chassis is now a voltage tripler arrangement instead of the quadrupler which was employed in last year's MC chassis. This new high voltage transformer employed in the MC-2 chassis develops 10 kv which is tripled to produce 30 kv of picture tube second anode voltage. The MC chassis high voltage transformer developed 7.5 kv which was quadrupled to 30 kv. The transformer cannot be interchanged between the chassis.

You may already be familiar with the serviceability features found in the "M" series chassis:

- Individual plug-in modules.
- Sectionalized main chassis construction allowing the functional assemblies to be removed and serviced.
- Quick-disconnect plug-in interconnecting harness wiring.
- All test points, main chassis components and adjustment controls are readily accessible.

Simplified construction to allow for relatively easy disassembly and reassembly in the field when replacing controls, sweep transformers, high voltage rectifiers and other components mounted on the subassemblies.

**B-W XB TV CHASSIS**

General Electric's b-w line of TV receivers will

employ one basic chassis type. The 19-inch (measured diagonally) TV receivers will employ the familiar XA chassis introduced last year. The 12- and 15-inch receivers will use the XB chassis, which is a modified version of the XA chassis.

The basic layout of the XA and XB chassis are very similar. Their printed circuit board layouts are practically identical. The solid state devices and approximately 90 percent of all components are identical.

Several areas of the circuitry differ in the XB chassis from the XA chassis.

The picture tube filament voltage is now tapped from a winding on the horizontal output transformer, eliminating the need for a step-down filament transformer in the low-voltage power supply.

The noise canceler stage transistors Q161 and Q162, has been removed from the XB chassis. The sync clipper stage in both the XA and XB chassis is relatively immune to noise conditions by virtue of its dual time constant input circuit, making active noise cancellation an unnecessary feature for small screen B-W receivers.

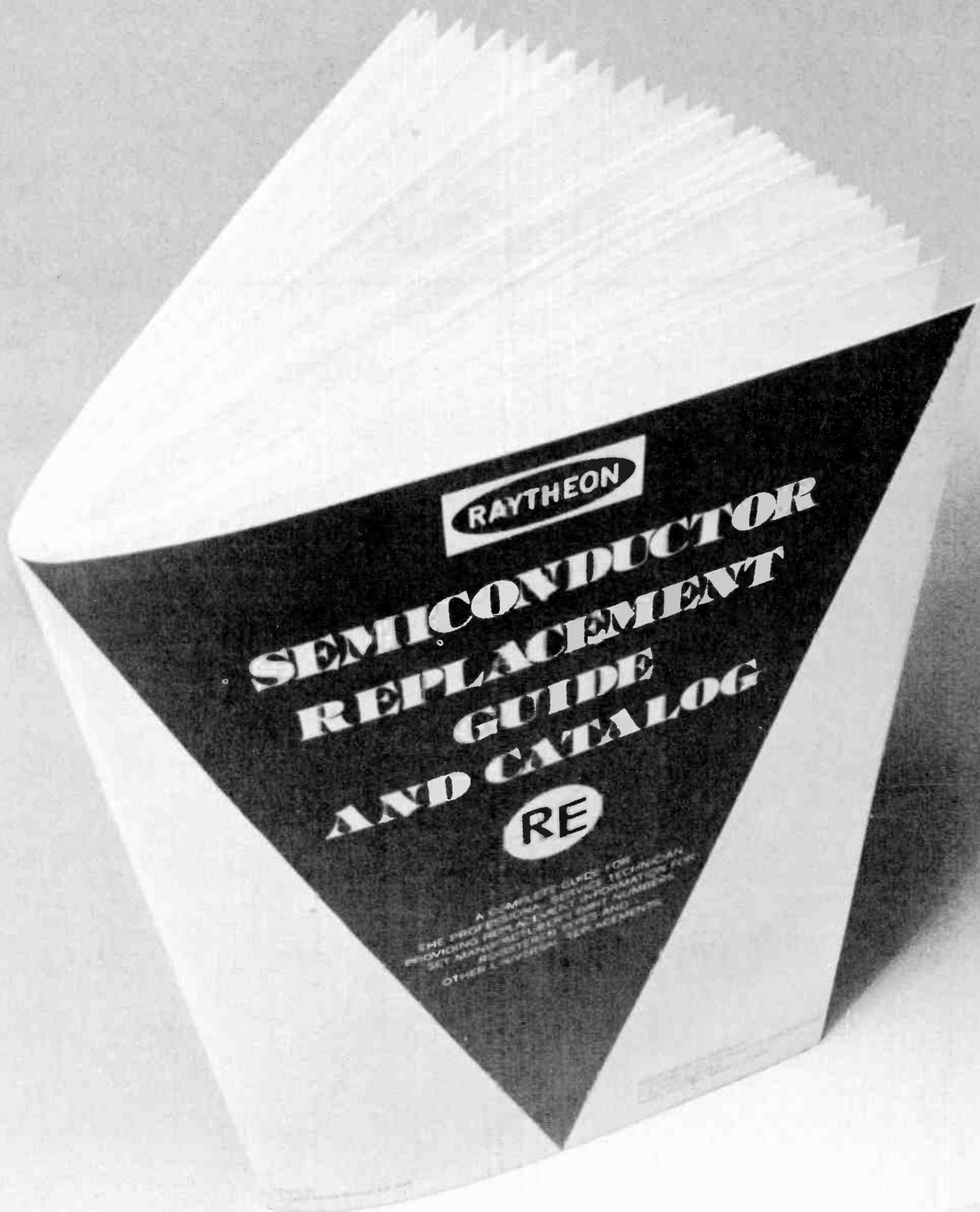
In the XB chassis, the DC controlling voltage for the IF AGC stages are not adjustable. An optimum fixed-voltage is supplied by the voltage-dividing resistors rather than a potentiometer.

Possibly, the most major change which took place in the XB chassis is the introduction of directly coupled video amplification, Fig. 6. DC coupling is used from the video detector to the cathode of the picture tube. This feature provides a brighter, sharper picture containing the video DC level. The brightness control, R129, now varies the bias of the picture tube grid, rather than the cathode and has a potential of +20 to +30 volts DC. Horizontal blanking is introduced into the control grid through coupling capacitor C137.

If a problem would occur in the video amplifier, detector or IF stages of the SB chassis, the video output transistor, Q103, may cease to conduct. Under this condition, no voltage will be dropped across its collector load resistor, R124, and the DC voltage on the picture tube cathode will rise to approximately 120 volts DC, biasing the tube out of connection. Any failures in the DC coupled video stages can cause a *no raster* symptom. This differs from the AC coupled circuitry employed in the XA chassis where any failure in the circuitry would result in a *no video* symptom.

A diode is employed as the vertical sawtooth generator in the XB chassis, Fig. 7. Operation of the circuit remains practically the same as the XA chassis, which uses a transistor in this stage. Capacitor C206 charges from the 22 volts DC source. A negative triggering pulse from the vertical oscillator biases Y207 into conduction at the proper time allowing capacitor C206 to discharge and produce the 3 volt p-p vertical sawtooth. This circuit change also is scheduled to be incorporated into the XA chassis.

The high voltage rectifier in the XB chassis is encapsulated with the horizontal output transformer, except in a few early production receivers. This single, sealed-unit design will eliminate any problems of arcing rectifiers or becoming loose in its socket because of rough handling. ■



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**RAYTHEON**

# COLOR TV MODULE GUIDE

## RCA Color TV Modules

Module Designation	Function	Stock Number	RCA Color TV Chassis																			
			CTC-46A, H, P	CTC-46B	CTC-48A, H, P, R, T, U	CTC-48B, J	CTC-49XA	CTC-51A, B, E, K	CTC-51AE, AF, XM, XN, XT	CTC-51XP, XU, XM, XAA, XAB, XAC, XAD, XAL	CTC-52A, B, C, D, E, F, AD, XP, XR	CTC-52XK, XAC	CTC-52XN	CTC-52XAB, XAE, XAF, XAH, XAL, XAK, XAM	CTC-53A, B, C, D, E, F	CTC-53H, K, XAA, XAB, XAC, XAD, XAE, XAF, XAH	CTC-53XM, XP, XR, XU	CTC-54A, P	CTC-54B	CTC-54H	CTC-55A, B	
CRM001A	Memory	131789		•	•																	
CRM002A	Memory	135081																				
MAA001A	Sound	130753	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
MAB002A	Power Supply	132581																				
MAB003A(1)	Power Supply	133563	•	•	•	•	•															
MAB003B	Power Supply	133563	•	•	•	•	•											•	•	•		
MAC001A	Chroma I	139546						•														
MAC002A(2)	Chroma I	134007	•	•	•	•	•															
MAC002B	Chroma I	138697	•	•	•	•	•															
MAD001A(3)	Kine Drive(3)	132579	•	•	•	•	•															
MAD001H	Kine Drive(3)	139685	•	•	•	•	•															
MAD001J	Kine Drive(3)	139685	•	•	•	•	•															
MAE001A(4)	Chroma II	132580	•	•	•	•	•															
MAE001B	Chroma II	136691	•	•	•	•	•															
MAG001A(5)	Vertical Osc.	132585	•	•	•	•	•															
MAG001B	Vertical Osc.	135871	•	•	•	•	•															
MAG004A	Vertical Osc.	139340																				
MAH001A	Horizontal Osc.	132582	•	•	•	•	•															
MAH004A(6)	Horizontal Osc.	137604																				
MAH004B	Horizontal Osc.	139042																				
MAH007A	Horizontal Osc.	140068																				
MAH008A	Horizontal Osc.	139657																				
MAH009A	Horizontal Osc.	140502																				
MAJ002A	Voltage Control	134400																				
MAJ003A	Voltage Control	137062																				
MAK001A(7)	Pix IF/AFT	132586	•	•	•	•	•															
MAK001B	Pix IF/AFT	137186	•	•	•	•	•															
MAK002A	Pix IF/AFT	140069																				
MAL001A(8)	Video Sync.	132584	•	•	•	•	•															
MAL001B	Video Sync.	137187	•	•	•	•	•															
MAN002A	Audio Output	133455	•	•	•	•																
MAN003A	Adaptor	135054																				
MAN004A	Audio Output	140066																				
MAP001A	Motor Control	134397																				
MAS001A(9)	Demod. Non-Accutint	133620						•														
MAS002A(10)	Demod. Accutint	133144																				
MAS003A	Demodulator	135332						•	•													
MAS004A	Demodulator	136590																				
MAY001A	Preamplifier	137356																				
MAY002A(11)	Preamplifier	137357																				
MAY003A	Preamplifier	137358					•															
MAY004A	Preamplifier	137417																				
MAY005A	Preamplifier	137358																				
MAY006A(12)	Preamplifier	139152																				
MAY007A	Preamplifier	139153																				
MAY008A	Preamplifier	139031																				
MAZ001B	Memory	137366				•																
MM200A	Sound	140067																				

(1) MAB003A use MAB003B Stk. No. 133563  
 (2) MAC002A use MAC002B Stk. No. 138697  
 (3) MAD001A use MAD001H Stk. No. 139685

(4) MAE001A use MAE001B Stk. No. 136691  
 (5) MAG001A use MAG001B Stk. No. 135871  
 (6) MAH004A use MAH004B Stk. No. 139042

(7) MAK001A use MAK001B Stk. No. 137186  
 (8) MAL001A use MAL001B Stk. No. 137187  
 (9) MAS001A use MAS003A Stk. No. 135332

(10) MAS002A use MAS004A Stk. No. 136590  
 (11) MAY002A use MAY004A Stk. No. 137417  
 (12) MAY006A use MAY007A Stk. No. 139153

# RCA Color TV Modules

Module Designation	Function	Stock Number	RCA Color TV Chassis																			
			CTC-55XP, XR, XT	CTC-55XN, XAB, XAD, XAE, XAF, XAH	CTC-58A, C, E, H, K, L, N	CTC-59XA, XD, XF	CTC-59XB, XE	CTC-60A, B	CTC-60F, EX	CTC-62A, B, N, P, R	CTC-63XA, XC, XF, XH, XJ, XK, XL, XM, XP	CTC-64A	CTC-66XA	CTC-68A, P, H, AD, AE, AF, AJ, AK, AL, AM, AN, AT	CTC-68AR	CTC-70H, K, M	CTC-70P	CTC-71A, B, C, E, H, J, L	CTC-72A, B, N, P, R	CTC-72AB	CTC-72AC	CTC-76A, C, E
CRM001A	Memory	131789	•				•															
CRM002A	Memory	135081																				
MAA001A	Sound	130753	•	•																		
MAB002A	Power Supply	132581																				
MAB003A(1)	Power Supply	133563																				
MAB003B	Power Supply	133563																				
MAC001A	Chroma I	139546																				
MAC002A(2)	Chroma I	134007																				
MAC002B	Chroma I	138697																				
MAD001A(3)	Kine Drive(3)	132579																				
MAD001H	Kine Drive(3)	139685																				
MAD001J	Kine Drive(3)	139685																				
MAE001A(4)	Chroma II	132580																				
MAE001B	Chroma II	136691																				
MAG001A(5)	Vertical Osc.	132585																				
MAG001B	Vertical Osc.	135871																				
MAG004A	Vertical Osc.	139340																				
MAH001A	Horizontal Osc.	132582																				
MAH004A(6)	Horizontal Osc.	137604																				
MAH004B	Horizontal Osc.	139042																				
MAH007A	Horizontal Osc.	140068																				
MAH008A	Horizontal Osc.	139657																				
MAH009A	Horizontal Osc.	140502																				
MAJ002A	Voltage Control	134400																				
MAJ003A	Voltage Control	137062																				
MAK001A(7)	Pix IF/AFT	132586																				
MAK001B	Pix IF/AFT	137186																				
MAK002A	Pix IF/AFT	140069																				
MAL001A(8)	Video Sync.	132584																				
MAL001B	Video Sync.	137187																				
MAN002A	Audio Output	133455																				
MAN003A	Adaptor	135054																				
MAN004A	Audio Output	140066																				
MAP001A	Motor Control	134397																				
MAS001A(9)	Demod. Non-Accutint	133620																				
MAS002A(10)	Demod. Accutint	133144	•																			
MAS003A	Demodulator	135332																				
MAS004A	Demodulator	136590	•	•																		
MAY001A	Preamplifier	137356																				
MAY002A(11)	Preamplifier	137357																				
MAY003A	Preamplifier	137358																				
MAY004A	Preamplifier	137417																				
MAY005A	Preamplifier	137358																				
MAY006A(12)	Preamplifier	139152																				
MAY007A	Preamplifier	139153																				
MAY008A	Preamplifier	139031																				
MAZ001B	Memory	137366																				
PM200A	Sound	140067																				

(1) MAB003A use MAB003B Stk No. 133563  
 (2) MAC002A use MAC002B Stk No. 138697  
 (3) MAD001A use MAD001H/J Stk No. 139685

(4) MAE001A use MAE001B Stk No. 136691  
 (5) MAG001A use MAG001B Stk No. 135871  
 (6) MAH004A use MAH004B Stk No. 139042

(7) MAK001A use MAK001B Stk No. 137186  
 (8) MAL001A use MAL001B Stk No. 137187  
 (9) MAS001A use MAS003A Stk No. 135332

(10) MAS002A use MAS004A Stk No. 136590  
 (11) MAY002A use MAY004A Stk No. 137417  
 (12) MAY006A use MAY007A Stk No. 139153

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

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# TECHNICAL DIGEST

## MAGNAVOX

### Star Remote Control—Tuner Subber Aids Troubleshooting

When troubleshooting a STAR equipped T995 chassis, the trouble must first be isolated to a chassis problem or a STAR problem. A tuner subber can easily determine where the fault lies. A tuner subber is a commercially available self contained tuner which can be used to substitute the original tuner. The tuner subber connects to the IF input of the TV chassis. If the television produces a good picture with the tuner subber, the fault must be with the STAR. If not, the fault lies in the TV chassis and the STAR system need not be replaced unnecessarily.

To use a tuner subber, unplug the TV IF cable from the STAR Tuning Assembly and plug the cable into the IF receptacle provided in the tuner subber. Also, connect the antenna to the tuner subber. When connected in this manner, the STAR system should operate normally except for channel selection. The tuner subber is also helpful when performing the T995 Chroma Oscillator adjustment, which requires detuning of a station.

### Star TV Remote Control—Random Shut Off

If a STAR equipped instrument randomly turns itself off, the cause could be a momentary interruption of AC power to the STAR Tuning Assembly. The AC line cord, circuit breaker, and AC wiring to the STAR Tuning Assembly are likely items to check for intermittent power interruption. Whenever the AC power is interrupted, the STAR DC power supply drops, turning the set off.

Switching the Remote switch off, can help isolate the source of the random shut off problem. If the set no longer turns itself off, the problem is likely in the STAR Remote Receiver. If the set continues to randomly turn off, the problem is likely with the STAR Tuning Assembly or intermittent AC power interruption.

## ZENITH

Color TV Chassis 17EC35, 17EC45, 19EC45 (Run No. 401 and higher only) 17FC35, 17FC45, 19FC45, 19FC45Z, 19FC46, 23FC45, 25FC45 (all). Color TV Models E, F, S, and T.

Field experience has disclosed a reliability problem with the 22-7233 capacitor that was not discovered in laboratory or quality controls tests.

Typically, the failure occurs after many months of operation. The capacitor fails suddenly, causing a secondary failure of one or more other components and immediately disabling the receiver. Horizontal output transistor, tripler, vertical module, picture tube (neck crack), or other parts may be affected.

An intensive engineering investigation of this problem has been carried out both in the laboratory and in field service and has established that there is no safety problem involved. However, the failure repair costs may be higher than the customer should be expected to pay.

Failures, occurring *within warranty* are, of course, covered by the warranty. Failures occurring due to this problem *after warranty* will be covered by the Zenith Policy Adjustment Program until further notice. Policy Adjustment claims for this problem only are to be made on Warranty Claim Form number 3744C.

To minimize continuing failures of this part and the attendant consumer dissatisfaction, the following procedure is to be instituted by distributor-approved Zenith Service Centers. This applies to any of the above chassis when serviced for any reason, in-home or in-shop, and also to any stock merchandise still in distributor or dealer inventory.



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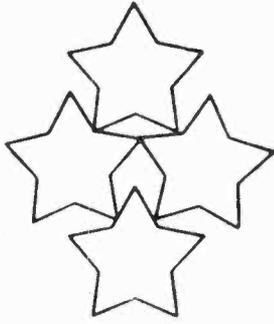
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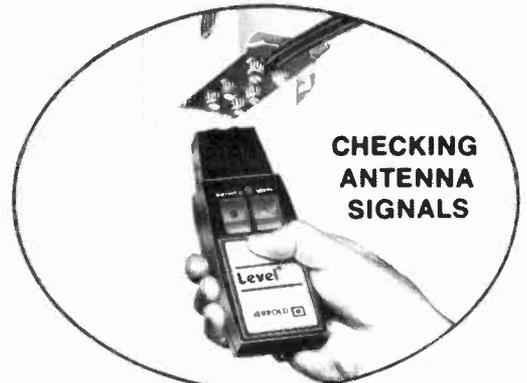
Levelite is not just a new product, it's a completely new type of test instrument . . . so different it has been granted a U.S. patent. About the size of a pocket calculator, it makes instant go, no-go tests for TV signals at antennas, preamplifiers, downlead, splitters and MATV outlets.

Just plug Levelite into an outlet, press the button and watch the green light. If the green light glows, you have TV signals. If not, there is insufficient signal.

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SIGNALS**



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a GENERAL INSTRUMENT company

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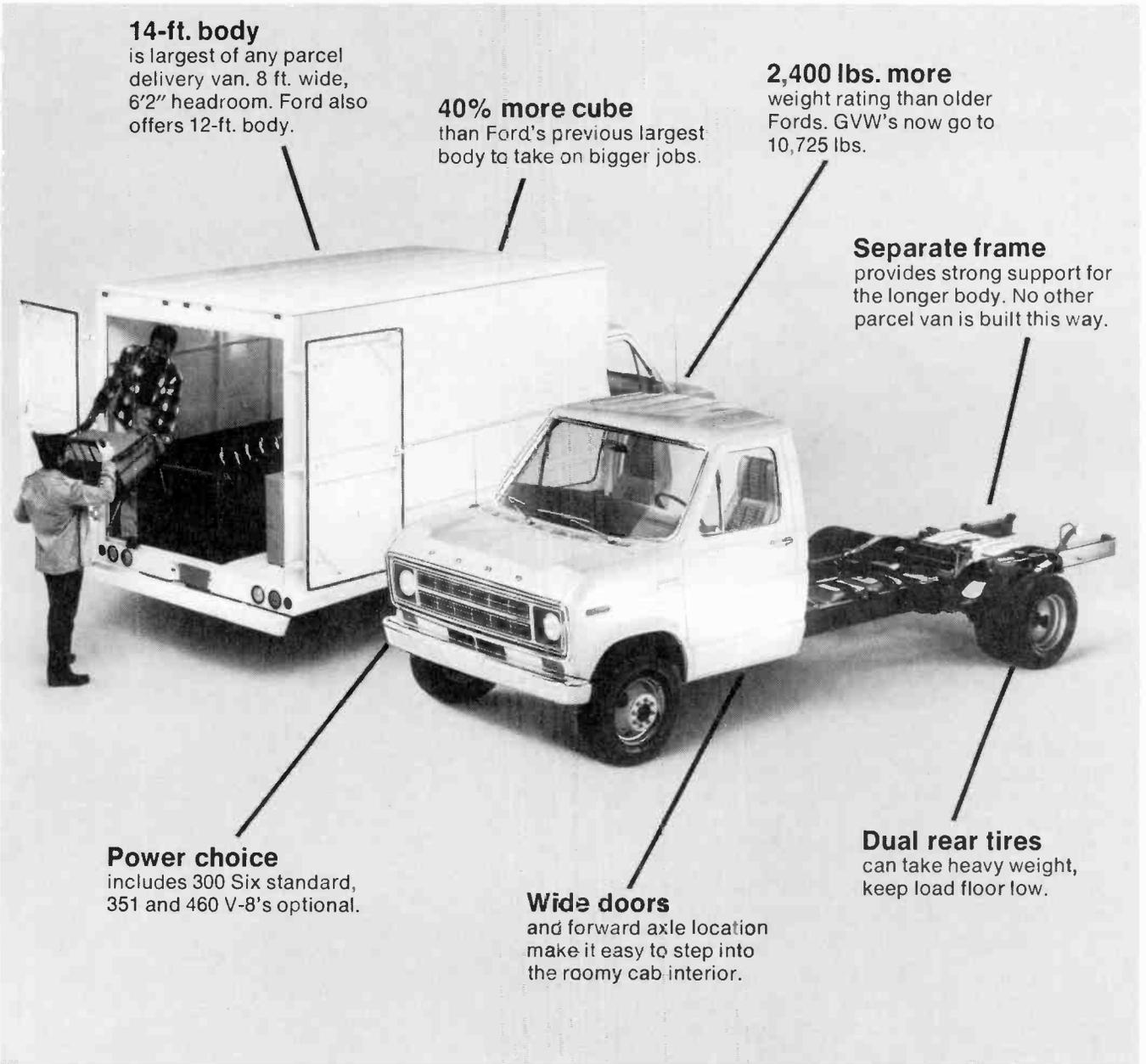
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can take heavy weight, keep load floor low.

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

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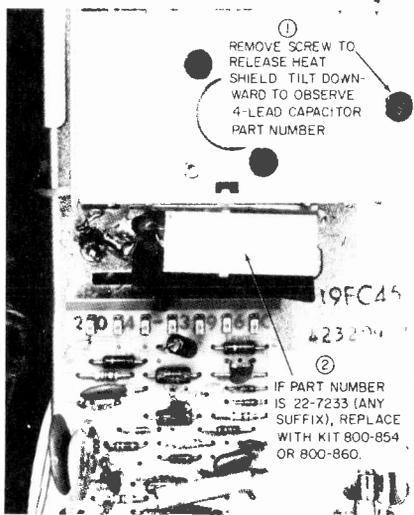
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## FORD ECONOLINE VANS

FORD DIVISION 

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Inspect the four-lead capacitor below the heat shield and replace it if it is part number 22-7233 of any suffix version. (See Photograph). Use only kit 800-854 (with new capacitor 22-7465) for replacement or alternate kit 800-860 with capacitor 22-7504, which will also be supplied later this year. Always follow servicing guidelines and safety checks given in service manuals.



The replacement capacitor will be supplied through Zenith distributors. A labor claim of \$4.50 for preventive maintenance will be paid through the Zenith distributor on Warranty Claim Form Number 3744C.

All labor claims associated with this capacitor problem are to be made on Warranty Claim Form Number 3744C and submitted to the Zenith distributor.

A special code number must be written in the box labelled, "On Special Distributor Instructions" as follows:

Situation:	Code Number
<i>Routine in-warranty service:</i>	18
Also replace 22-7233 as Preventive	

Maintenance and add \$4.50 to profile rate

*In warranty*  
Capacitor Failure 19  
Repair labor at profile rate

*Out of Warranty*  
Preventive Maintenance 20  
Special labor charge of \$4.50

*Out of Warranty*  
Capacitor failure, Policy Adjustment 21  
Repair labor at profile rate

Credit will be given for all parts replaced under this program. Parts are to be returned to the Zenith distributor accompany labor claims and with a Defective Warranty Parts Tag attached (old form 901-82 or new form 3618). Parts Tag must show:

- Warranty Claim number
- Date failed or replaced
- TV model and serial numbers
- TV date code

The letters " PM " written in the upper left corner for 22-7233 capacitor replaced for preventive maintenance only (not failure).

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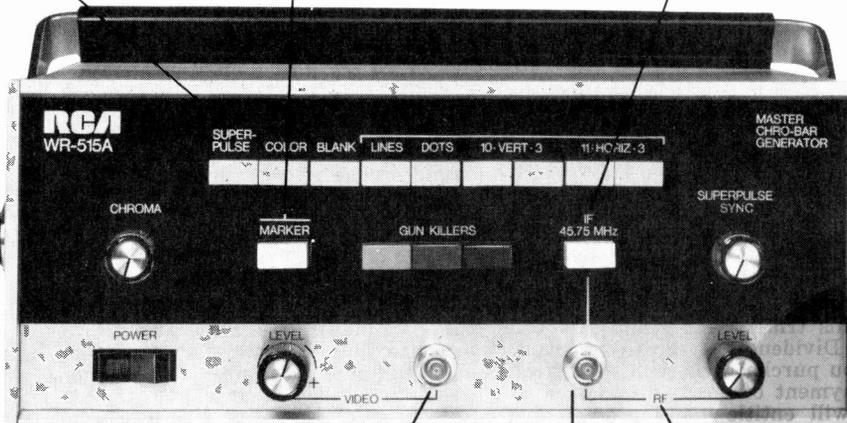
**Superpulse** — Provides a big, fat square pulse for easy CRO tracing in the set, and a white window pattern for quick checks of gray-scale tracking, smearing, and ringing right on the TV screen.

**Bar Marker** — Identifies color bars, 3, 6, 9 — a "must" on overscanned sets.

**IF Output** — at 45.75 MHz for troubleshooting in mixer and IF stages. Excellent for servicing "modular" solid-state sets.

The RCA WR-515A offers time and money-saving returns in fast diagnosis and adjustment in both home TV or commercial/industrial broadcast installations, including VTR's and video monitors. More details at any of the more than 1,000 RCA Distributors worldwide. Or contact: RCA Distributor and Special Products Division, Bldg. 206-2, Cherry Hill Offices, Camden, N.J. 08101 (Phone 609 779-5715).

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\*Suggested Price

**Video Output** — 2 volts, max. "+" and "-" at 75 ohms for commercial/industrial closed-circuit TV.

**75- and 300-Ohms Output** at both RF and IF. Snap-on BNC heads for fast impedance changes. RF works into MATV, CATV systems.

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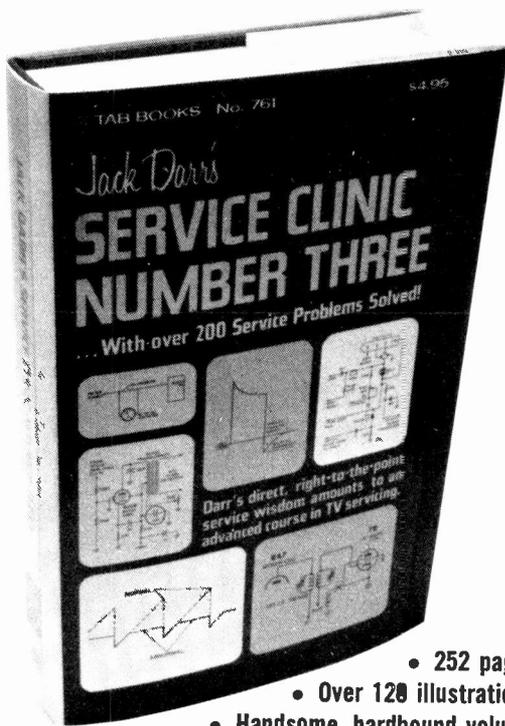
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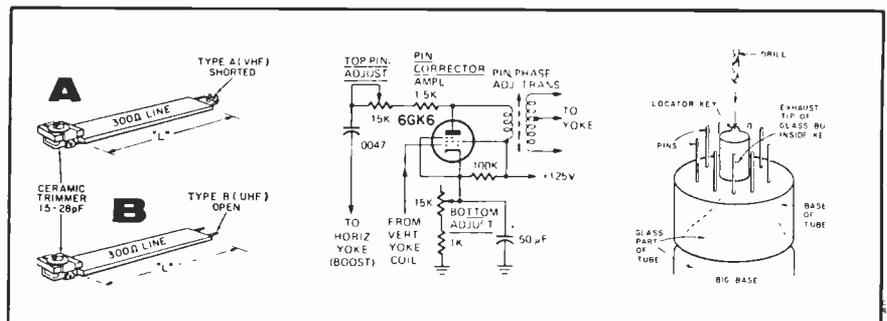
Here are straightforward solutions to over 200 individual servicing problems from the wizard of electronics repair, Jack Darr, who has become something of a "landmark" in servicing: a repairman's repairman. Jack has been turning tough dogs into pussycats for as long as TV sets have been acting up. Now,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

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

It's not all TV, either. A Chapter on test equipment contains a variety of extremely practical advice on how to get more from your equipment than the manufacturer intended, tells how to make a simple wattmeter using your VOM, plus a number of special tricks the author has picked up during his many years as an experienced

troubleshooter. This Chapter winds up with an open forum of questions from servicemen who can't psyche out certain troubles they're having with their test equipment—the VOM, electronic voltmeter, and the scope, to name but a few. Darr answers them all, incorporating detailed schematics where necessary to stress a point or to show key trouble areas in a specific piece of gear.

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



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

# AN EXTRAORDINARY OFFER...

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# FM Receiver Alignment

A review of traditional and not-so-traditional techniques

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

■ There are at least four different methods commonly used for alignment of an FM receiver (five if you consider "by ear" a valid method). Each is described in the following paragraphs.

## INPUT SIGNAL CONNECTIONS

If your signal generator is equipped with a suitable RF output (88-108MHz), you can connect the generator output to the antenna input terminals of the receiver through a suitable pad or dummy antenna, as specified by the manufacturer.

If your generator has only a 10.7-MHz IF output, you can use any of at least three different points for injection of the test signal: the base of the mixer transistor, the RF-IF connection link (usually a piece of coaxial cable), or through a "gimmick" placed inside the first IF transformer. For the first two types of connections, connect the generator output to the appropriate injection point through a small-value capacitor or any RC-networks which the receiver manufacturer specifies. For the "gimmick" types of connection, connect the signal generator "hot" wire to a one inch (or less) piece of *insulated* wire and drop this inside the first IF transformer primary slug. (Use of the "gimmick" technique is limited to those receivers which use "hex tool" adjustment slugs. Those which use "slot" type slugs are more difficult to couple into.)

## OUTPUT INDICATOR CONNECTIONS

As stated previously, there are four basic methods of alignment, and some of them require their own special hook-up techniques. In general, though, several pieces of advice can be offered which are reasonably universal.

In most cases, you need to know when two things occur: 1) *correct*

*adjustment of the RF/IF tank circuits, and 2) correct adjustment of the demodulator transformer secondary tank circuit.*

If nonswept alignment techniques are used, the first of these can be determined by connecting a DC voltmeter to some point which has a DC level proportional to the signal strength. In limiter-equipped sets, this would be the limiter emitter resistor or, alternatively, the emitter-base voltage drop. In receivers which use ratio detector circuits, a good point is the minus (-) side of the AM suppression/diode-bias electrolytic capacitor in the detector circuit. In other cases, it is possible to monitor the signal voltage at either the input to the limiter or the detector by use of a DC VTVM equipped with an RF demodulator probe.

If a sweep generator or a true FM generator is used for alignment, the RF/IF adjustments can be monitored on an oscilloscope. The receiver's audio output is applied to the input of the vertical channel of the scope, and the horizontal channel is synchronized to the sweep rate of the generator.

Regardless of which alignment technique is used, adjustment of the secondary winding of the demodulator transformer is best monitored at the AFC error signal line. The voltage on this line will be zero when the transformer secondary is correctly turned and will deflect either positive or negative if the transformer is mistuned. Either an oscilloscope or a zero-center voltmeter can be used as the output indicator at this point.

Many late-model receivers have output jacks which allow you to check alignment without removing the cover of the receiver. The "recorder" or "rec" outputs are two such jacks. This is especially easy if the generator has a VHF RF

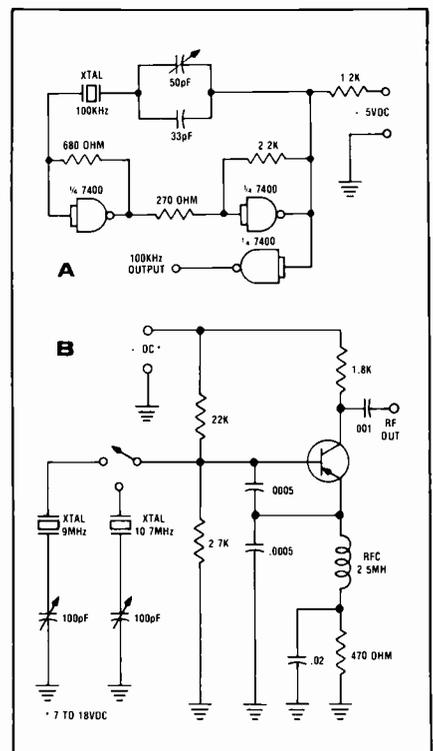


Fig. 1—Two types of generator calibration oscillators: A) A 100-KHz crystal-controlled marker oscillator in which the active component is a type SN7400 TTL digital IC, also known as a "quad two-input NAND gate." B) A two-frequency, crystal-controlled oscillator. The crystal frequencies are 9 and 10.7-MHz, and the transistor can be any medium-gain, germanium RF oscillator type usable at FM IF and RF frequencies. A similar silicone transistor also can be used, but might require design adjustment of the bias network.

output, which can be fed directly to the antenna inputs.

## NONSWEEP TECHNIQUES

Virtually any signal generator which produces the correct output frequency can be used for nonswept FM alignment if the short-term frequency stability is good enough to allow you to get through the job without the frequency changing too much. Even generator dial accuracy is not a factor if some form of market generator or other frequency calibrator is available to tune the generator to the correct frequency. These can be either 10.7-MHz or 100-KHz crystal-controlled oscillators or some similar crystal-controlled signal source. Examples of simple frequency calibrators are shown in Fig.'s 1A and 1B. In the circuit of Fig. 1B, an extra crystal at 9.0-MHz is provided, in addition to the 10.7-MHz output needed for calibrating the generator to the IF signal. The 9-MHz crystal output can be used to calibrate or check the receiver

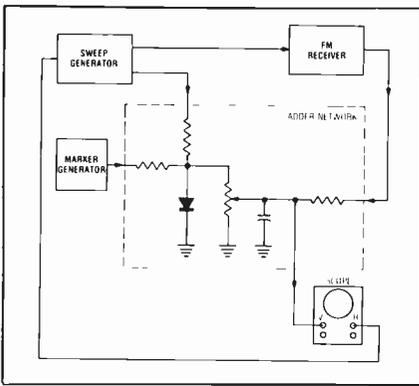


Fig. 2—Equipment setup for standard sweep alignment of an FM receiver.

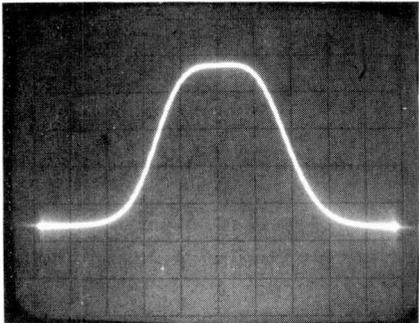


Fig. 3—Standard-sweep response curve of the RF/IF passband of a typical FM receiver. (Courtesy of Sound Technology, Inc.)

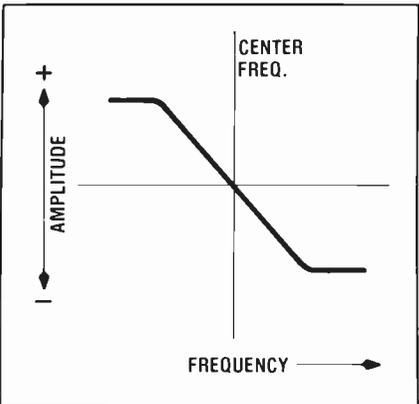


Fig. 4—The standard-sweep discriminator "S" curve, shown here, reveals the frequency response characteristic of an FM detector.

dial because it produces usable harmonics at 90-MHz, 99-MHz, and 108-MHz, which are reasonably decent "cal" points for the 88-108-MHz FM broadcast band.

Connect a high-impedance, DC zero-center voltmeter to the AFC line and turn on the 10.7-MHz crystal output. Connect the coaxial cable from the signal source to one of the IF signal inputs points discussed earlier. Turn up the signal amplitude, if possible, until the receiver "quiets". Adjust the slug which tunes the detector transformer secondary until zero voltage is indicated across the AFC line.

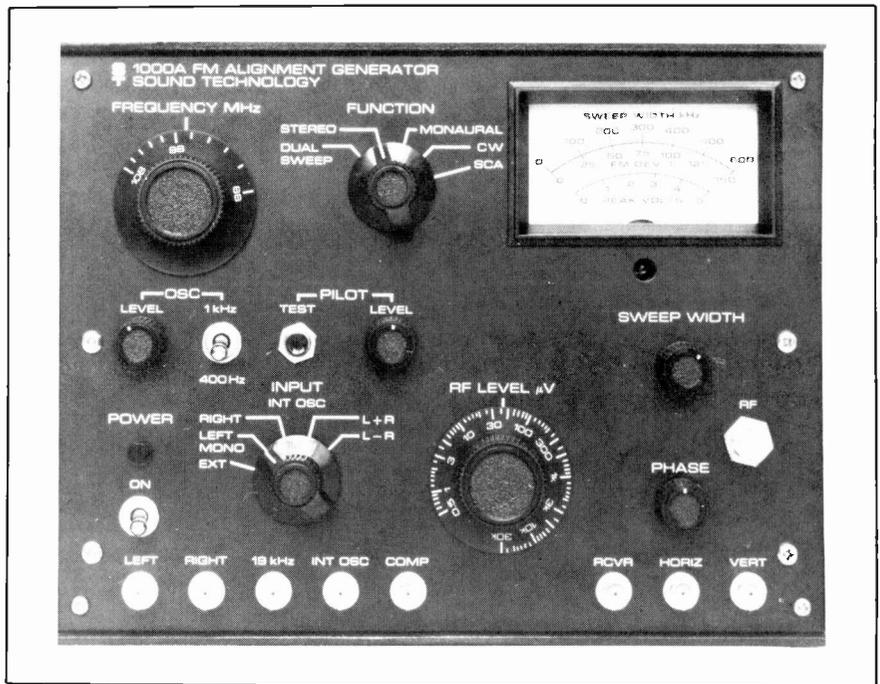


Fig. 5—Sound Technology Model FM1000A dual-sweep signal generator.

The IF and RF tank circuits can be adjusted by using the 9.0-MHz crystal, as can the local oscillator trimmer. During adjustment of the RF and IF tanks, the signal should be reduced below "quieting" so that the output indicator reading is a true indication of the changes which occur as the tanks are aligned. If this condition is not established, the receiver might "saturate."

Adjust the various RF and IF tank slugs until no further increase in signal amplitude is achieved. This might require that each adjustment be made several times because they often are slightly interactive.

For local oscillator adjustment, a zero-center voltmeter connected to the AFC line is used as the indicator, and the 9.0-MHz crystal is used as the signal source. Set the receiver dial to *exactly* 108- or 99-MHz. At the beginning, the voltmeter probably will indicate either a positive or negative voltage. Adjust the local oscillator trimmer until the voltmeter indicates zero. Check all three calibration points—90, 99, and 108-MHz—for proper tracking. If tracking is off, it will be necessary to "track" the local oscillator alignment by adjusting the coil slug at the low end of the band and the trimmer capacitor at the high end. Do not, however, expect perfect tracking all of the time; knowing when to quit is important to

profitable servicing.

### STANDARD SWEEP TECHNIQUES

Fig. 2 shows the equipment setup required to perform a traditional swept alignment on an FM receiver. Although two separate signal generators are shown in Fig. 2, most generator manufacturers incorporate both signal sources into a single instrument. One signal source is the sweep generator and the other is a crystal-controlled marker which is used to identify specific frequency points on the response-curve waveform.

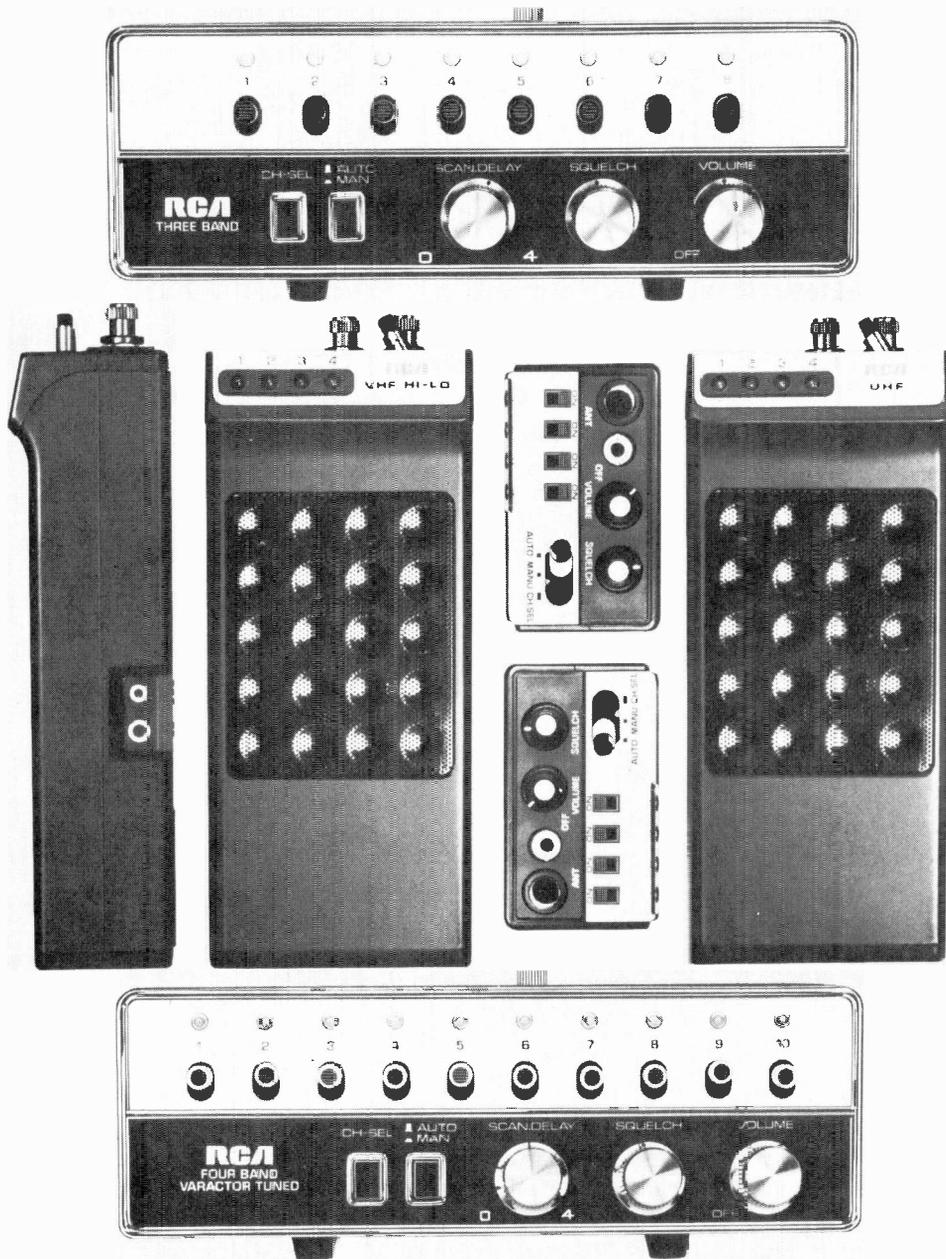
Most sweep generators either sweep the carrier back and forth across the RF/IF passband of the receiver at a 30-60 Hertz rate and have an adjustable sweep width, or else they frequency modulate the carrier at 400 or 1000 Hertz and have adjustable FM deviation.

The marker "pips" will show up on the oscilloscope trace so that you are able to see the relationship of the swept passband and key frequencies.

The adder is merely a resistive mixer much like those used in audio work, but with a nonlinear element (a diode) added to cause heterodyning instead of simple linear co-mingling of the signals.

Fig. 3 shows the IF/RF response curve obtained during sweep alignment. Ideally, optimum bandwidth, correct shape, and





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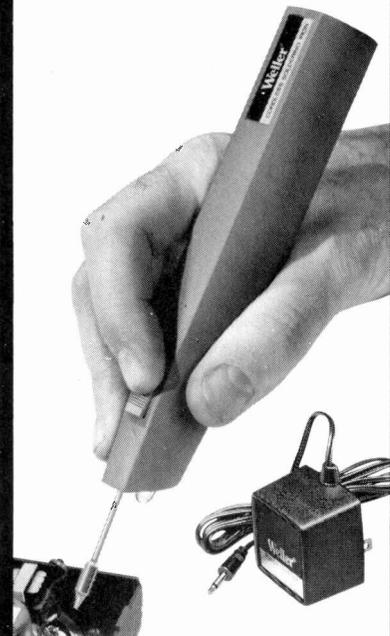
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shows how a misaligned discriminator affects the 10-KHz waveform displayed on the oscilloscope. (This technique is the equivalent of applying a modulated 10-KHz signal and plotting the response of the detector on a point-for-point basis.)

Fig. 7 shows the curve generated by the dual-sweep method when the detector transformer is correctly aligned.

Fig. 8 shows the three basic response curves and their relationship—dual sweep, FM/IF response and discriminator "S".

I had the use of an FM-1000A for about eight weeks a few years ago and found it to be a sensitive method for aligning both FM home receivers and FM car radios. To align a receiver detector with the FM-1000A, you connect the generator and scope shown in Fig. 9A and adjust the secondary of the detector transformer to produce optimum flatness of the top of the unique dual-sweep display on the scope screen.

### QUAD DETECTOR ALIGNMENT WITH THD

Most IC quadrature detectors require special techniques for alignment of the associated phase coil. For most of these, you connect an AC VTVM across the audio output (or to the "rec" jack, if available) and apply a 10.7-MHz signal to the IF. As the phase coil is adjusted through its range, two "noise" peaks should be produced. The correct setting is the "quiet" point, or null, which should be midway between the noise peaks.

Unfortunately, there often are some difficulties involved in this type of alignment. One is the fact that the electrical relationship between the noise peaks and the bottom of the null might not be symmetrical and, therefore, the null will be closer to one peak than the other. Another possible problem is the existence of multiple noise peaks.

Both of these difficulties can be eliminated by using a *total harmonic distortion (THD) analyzer* to determine which setting of the phase coil gives the least THD. The phase coil setting which produces the least THD is the correct setting.

The dual-sweep alignment method, described previously, also

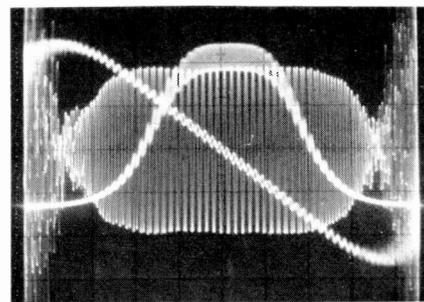


Fig. 8—Triple-exposure photo which shows the relationships of the dual-sweep, standard-sweep RF/IF passband response curve and standard-sweep discriminator "S" curve produced by a correctly aligned FM receiver.

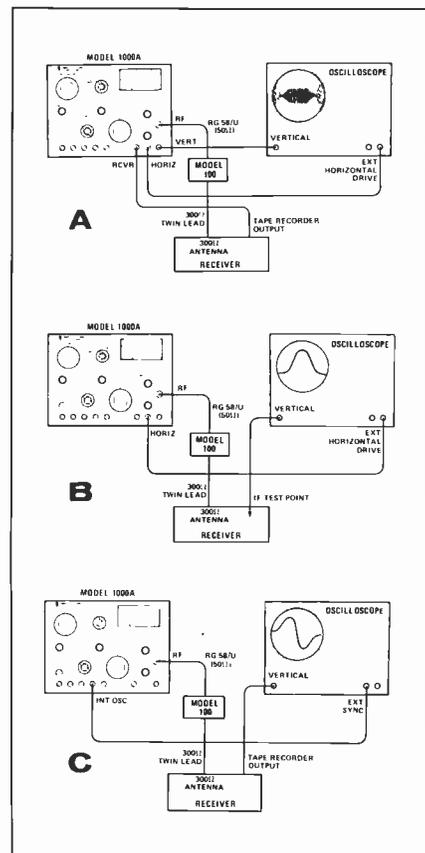


Fig. 9—Equipment setups for use of the Model FM 1000A for A) dual-sweep discriminator alignment, B) RF/IF sweep alignment, and C) alternate RF/IF/detector and stereo decoder alignment.

avoids the problems of nonsymmetrical noise peak-null relationships and multiple noise peaks.

### MAKING THE CHOICE

There are many different designs of FM receivers. Some of them require special alignment techniques, while others require none at all! Always consult the manufacturer's service literature for specific details and for the location of alignment points. Then use whichever of the preceding four basic methods you deem is most appropriate. ■

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has separate U/V inputs and a coax output. Finally, it's specially designed for lightning prone areas.

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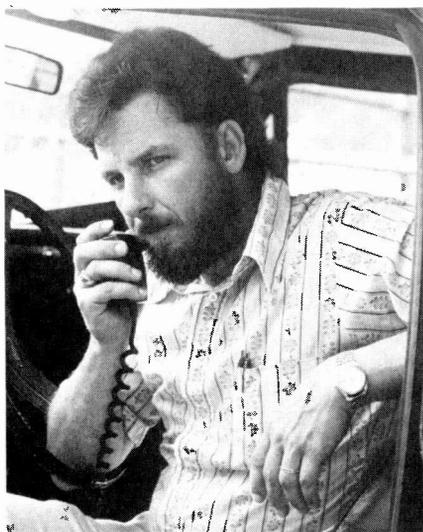


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AS \ ELECTRONIC TECHNICAL



With David Norman,  
ET/D Communications Editor

■ Almost every electronics magazine contains ads which state that jobs are available for graduates of whichever school is paying the freight for the ad. In the same issue, you often find either articles or reader letters stating that there are not enough jobs or pay to go around. Based on my own observations, neither statement is completely true *nor* completely false.

Not every graduate of every school (even my alma mater, the school of hard knocks) is going to have a successful career in electronics. Some simply don't have the aptitude or attitude to hack it when the going gets tough. Not that they are stupid—its just a case of "different strokes for different folks."

At the same time, in some areas of electronics and some locations, servicing is simply not being done because no one knows how to do it *profitably*.

Assuming that a technician is competent and willing to change specialties and place of domicile, I see little evidence that he will walk the street, at least for very long. On the other hand, a technician who is locked in to a particular field or location might find himself at the bottom of the competition pile. But then he has fallen to the technicians anathema—being unable to change with the times and trends. What do you

think would have happened had the Wrights not been able to adjust to the interest in aviation?

Okay, maybe the analogy is stretching it a bit, but my point is that technicians wanting to work, can work. The main requirement is *flexibility*.

Let's assume that a technician wants to switch to a new segment of the industry. He needs to teach himself, by whatever means are at his disposal, all that he (or she) can about this new area. After a working knowledge is acquired, experience is necessary if the new skill is to be developed into a lucrative profession. If this sounds too simple—it is.

To start with, no employer is going to hire a new man at a new job for anything like top pay. Would you? However, many shop operators are interested in expanding the horizontal scope of their operations—both sales and service. They are even more interested if they can try this expansion at little risk or expense.

Your best approach is one of frankness and lots of enthusiasm. For example, suppose you decide that you would like to repair CB radios and have acquired the necessary license and as much knowledge as you can. If the person you approach is already into sales of CB but has no satisfactory service arrangement, he may be a real pushover for the right approach. Instead of asking him for a job *per se*, what if you offered to take care of his installations and checkouts on a contract basis? You will have to check on this, but even in the states that do not recognize contract labor, you usually can do this legally by getting your own business license.

A contract labor arrangement is usually attractive to the small shop because it means that technically you are self-employed. The amount that you discount your labor or shop time to the shop or business owner is subject to negotiations. I would try for a 75-25 split, with you taking the large part. But until you are in a bargaining position, take what you can get. As a rule, this type of arrangement won't *net* you a lot of profit until after you have purchased all of the equipment needed for service and have estab-

lished enough of a reputation to attract business from other shops.

This arrangement also has a few other risks and drawbacks in it for the technician. One is that you usually must provide your own tools and handle your own callbacks. (If that scares you, forget it—you'll never make it.)

The last drawback to the initial stages of skilled labor contracting is that you or your wife probably will have to provide the bulk of the income from another job. But take heart, as your expertise and reputation grow, so does the income.

While I personally can not qualify as a beginner because I've had too many hours on the bench on my own payroll (which in the beginning often amounted to almost nothing), I recently moved to a new area (the Gulf Coast) and the second day here I found a contract labor arrangement for between \$150 and \$250 per week. (The wide variation is because the amount of work varies from week to week.) I am not bragging, and I am certainly not complaining; just telling you what *I* know *can* be done.

With my present arrangement, I can find time for writing, fishing and other things that make living more than just a drag to be endured.

If you are a real beginner, it might be best to start on a part-time basis with an established shop. You can learn a lot in 3 or 4 hours a week. At the same time, you can work full-time at another trade. Believe me, it's a lot easier to work an *additional* 4 hours in a job with promise and where everything is new and interesting that it is to work 8 or 12 hours straight at a job which offers no promise or challenge.

Perhaps the main beauty of labor contracting, such as I have described, is that each person doing so is being paid only for what they do. And, besides the personal satisfaction, the economy doesn't have to absorb wages paid for work not done. I kinda like that idea. (If everyone was paid in this manner, incentive would be the norm rather than the exception.)

The labor contracting approach can be used by retiring military techs, students, or nearly anyone wanting to expand their skills and

income. And, further, during the "learning phase" you don't have to compete with highly skilled techs. Just look for a need that isn't being properly filled and jump out there.

CB is only one of many potential fields for labor contracting. Other fields such as pocket calculators, marine electronics, electric music instruments, small appliances, or just about anything that turns you on, are potential gold mines—in personal satisfaction, if not in immediate "big money." Use your imagination and you might surprise yourself by coming up with a service (and a job) where none existed before.

Anybody want a prediction? Well, here it is anyway. Within a few months, many new communications transceivers, transmitters, and receivers will be introduced with digital techniques which make it possible to obtain many "channels", or frequencies, from a single oscillator. Of course, there's nothing new about this idea; it is being used now in very expensive communication equip-

ment. But, the price of this technology seems to be coming down to the level that makes it possible to use it in less expensive equipment. Now might be a good time to brush up on, or else acquire skills in digital logic. I am currently in the process of doing the latter. I kept ignoring it and hoping it would go away (I was the same way about transistors), but it is catching up with me.

An easy way of making up coax connectors when you are using the UG-175 adapters with small (RG-58) coax, is to solder the shield of the coax to the adapter *before* assembling the connector (PL-259).

Strip the RG-58's outer jacket back about 1½ inches, taking care not to damage the outer braid. Trim off all but ¼ inch of the braid and center insulator, this time being careful not to damage the center conductor(s). Slip the UG-175 adapter over the end and stop it flush with the shoulder left when the outer jacket was removed. Fold the braid back over the adapter and solder at several

points on the forward edge of the adapter. Use a fast-heating iron or gun so that the coax doesn't become overheated. (Solder should be used sparingly or else the adapter will not fit into the PL-259.)

Now, all that remains is to assemble the connector/adapter as you normally would—except that you will need two pair of pliers. If the solder lump is too big to permit assembly, trim it down with a file, knife, or try crimping it with pliers. When the adapter "shoulders-up", solder the center conductor to the pin and you will have the strongest connection you ever made.

This procedure is almost essential for proper assembly with foam coax because of the lower melting point of the foam insulation. Soldering the connector and adapter together through the holes will accomplish little more than heat the coax—and it might ruin the whole thing. In addition, pulling and twisting on the coax is apt to break the coax as quickly as pulling it out of the connector. ■

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NOVEMBER 1975, ELECTRONIC TECHNICIAN/DEALER / 43

# Equipment For SSB Servicing

What you need and don't need

By David F. Norman, ET/D Communications Editor

■ As single sideband (SSB) expands out of the military and amateur domains into more diverse services such as long-range marine, business, and CB communications, we, as technicians, must either prepare to service it or be left out of the gravy.

Except for the transitory affliction known as Amplitude Modulation Equivalent (AME), which has caused problems for every technician who has encountered it, servicing SSB equipment is not any more difficult than servicing other types of communications gear. The major difference is that a multi-channel SSB transceiver has more circuitry than most other types of equipment and, in most services, the operating tolerances are much tighter.

For example, the frequency tolerance of a transmitter operating as a Marine Coastal Station is  $\pm 20$  Hz. Above 20 MHz, this amounts to less than one-part-per million and means that, for "safe" measurement, you must use an instrument accurate to *at least* 0.5 ppm, and that starts to separate the inexpensive instruments from the multi-kilo-buck jobs. A dodge that has been used and probably will be used again is to make final adjustments "on-the-air" against a station thought to be dead on frequency. While it works, such a practice is illegal. (You have to lie about what you used as a standard, and how do you know the other guy didn't do the same thing?) Don't take needless chances with that FCC license; it's too hard to get.

When you consider a frequency meter or counter, check the specs carefully. Remember that an FCC monitoring station thousands of miles away can check your handiwork without even making a local check. When you decide to take on SSB service (with the possible

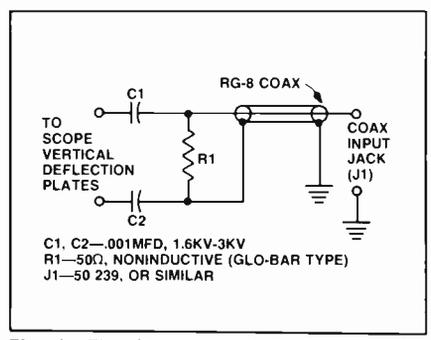


Fig. 1—The direct-to-vertical plates adapter shown here makes it possible to display high-frequency transmitter outputs on a scope whose vertical amplifier frequency response does not extend up to such frequency ranges. The values of C1 and C2 can be changed to minimize SWR at J1. (SWR should be checked only between J1 and the antenna terminals of the SSB transceiver.) If desired, you can attempt to tune out all reactance by placing tunable capacitors in series with the coax center conductor or across R1.

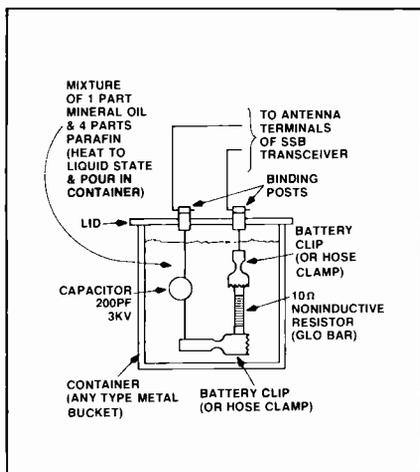
exception of presently type-accepted Class D CB equipment, and even the  $\pm 50$  ppm presently allowed for this equipment will almost surely be tightened in the near future), make up your mind to spend some money or, at least, to commit yourself to a lease. Singer, Cushman, Lampkin, Motorola, and several other manufacturers make test equipment which is satisfactory for SSB service, and most work hand-in-hand with one or more leasing companies.

You must also have an instrument capable of measuring Peak-Envelope Power (PEP). Standard wattmeters won't fill the bill unless you are willing to risk the transmitter's final by sustained single-tone testing (which gives you a fairly accurate indication of PEP output power, but does so by operating the finals at several hundred percent overload).

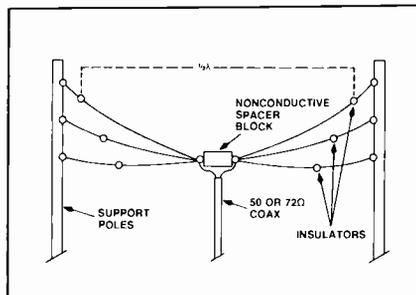
The Bird 4311 or equivalent is a meter which will read either average power or, at the flip of a switch, PEP. This means that you can use a two-tone generator and thus simulate voice modulation *under controlled conditions*.

A two-tone audio generator may be purchased either assembled, built from a kit or from scratch, or jury-rigged by using two single-tone sources. The latter solution is satisfactory only if you don't mind the hassle of balancing the outputs each time you wish to check a unit.

A scope which will handle the high-frequency output is essential if you are to check for distortion



**Fig. 2—Side view of a dummy load which you can build for testing transmitters under simulated single-wire feed conditions (as would be the case if the transmitter were loaded into a long-wire antenna).**



**Fig. 3—A Multi-band HF doublet antenna. Each antenna is  $\frac{1}{2}$  wavelength at its resonant frequency. Although there is some interaction between wires, for all practical purposes it can be disregarded.**

and linearity. This is one area where you can save money by tapping directly into the vertical deflection plates of an inexpensive scope (Fig. 1). Be certain that the blocking/coupling capacitors (C1 and C2) are hefty enough to carry the power and voltage safely. (Your safety is at stake as well as that of the unit being tested.)

Your present signal generator might fill the bill if it is reasonably stable after warm-up and if the attenuator is reasonably accurate. A much better choice might be a generator combined with a frequency measuring unit. Some manufacturers already offer this combination, and others offer it as an option. My personal preference is an instrument such as the Lampkin 107C, which is highly accurate (0.5 ppm guaranteed) and combines frequency measuring and generating with AM or FM modulation as required and, in addition, contains an FM deviation function. With coverage from 10 KHz to over 1 GHz and a cost of about \$3000, this instrument is well suited for the shop which services a variety of different types of communications equipment. There are many other choices available; the Lampkin 107C is just one of them.

Most of the other items needed for complete SSB servicing are the same as those you are now using to service less exotic gear. Your VTVM should have a good RF probe. (I like the Hewlett-Packard 410B.) Some late-model VTVM's behave strangely in the presence of strong RF fields, especially at

low frequencies (2 to 4 MHz). Most FET voltmeters cannot be used around RF.

You also will need a couple of dummy loads. One should be 50 ohms at 150 watts or more. The other can be made by connecting a non-inductive 10-ohm resistor in series with a 200-pf capacitor (Fig. 2). This latter dummy load is for testing under simulated single-wire feed conditions, as would be the case if the unit is loaded into a long-wire antenna.

Power supplies for SSB service must be well regulated. A unit which draws only 2 or 3 amps (or less) in the receive mode might draw ten times as much when modulated heavily. Unless you have one of the old heavy-duty surplus power supplies, your best bet is a 4- to 10-amp charger "floated" across a large automotive or marine battery. I like to use two 60 amp/hr batteries in parallel. By changing a couple of jumpers (which should be No. 10 AWG, or larger), I can obtain either 24 or 36VDC. Remember that a series arrangement will have regulation only as good as that of the charger. Don't worry about 36 volts being too high for 32-volt equipment; most all such equipment is rated to operate between about 30 and 37 volts.

Another handy item is a spare final amplifier tube(s) for the unit being adjusted or repaired. Despite manufacturers claims to the contrary, the initial transmitter tuneup might subject the final amplifier tube(s) to relatively long periods of "key-down" operation with the carrier inserted. The same is true when turning a new antenna system. The spare tube can bear the brunt of the abuse imposed on the finals during tuneup, and final "tweaking" then

can be done with a new tube. Final measurements should be accomplished with the new tube in place because the "spare" tube might develop 15 to 50 percent less output. Because SSB finals are linear amplifiers, the tube must be in peak condition for best performance.

To my knowledge, there is no way that you can legally test a Marine or Business SSB transmitter over the air from your shop. This does not mean that you don't need a good antenna for each frequency band that you service equipment for. Your shop CB antenna also can be used for CB SSB, and if you already service 2-MHz marine equipment, the whip or longwire you are currently using is okay for SSB versions of this equipment because most 2MHz SSB is still operated into nominal 10-ohm whips. The rub comes with the HF frequencies those above 2 megs, i.e., 4.1, 4.4, 6, 8, 12, 16, 22 MHz, etc.

You have several choices of HF antennas. One of the easiest is to purchase an antenna/coupler (tuner) combo and ask the factory to pretune it for the frequencies desired. Another solution is to purchase a multi-band doublet. Still another alternative is a multi-wire doublet, which is really several dipoles with a common feedpoint (Fig. 3). These multi-wire doublets may be purchased more-or-less assembled or you can "roll your own." Any comprehensive amateur radio handbook or antenna construction manual contains the information for computing wire lengths.

Because the primary (and only legitimate) use for the HF antenna is for checking receiver operation under actual receiving conditions, exact matching is not required. However, you will find that receiver sensitivity is severely reduced by a high VSWR.

As you begin servicing different types of equipment, you will develop preferences for this or that service aid or gadget. Fine, just let your common sense and pocketbook be the controlling factors. However, remember that you seldom save money by buying cheap tools or test equipment. **NEXT MONTH: Troubleshooting SSB Equipment.**

## CARR TALK

By Joseph J. Carr, CET

■ Although the subjects discussed in this column are supposed to be related directly to vehicular or outdoor electronics, the many reader inquiries I have received about my two medical electronics articles in recent issues of ET/D make it impossible for me to answer each individually. Consequently, just this once, I am going to deviate from vehicular and outdoor electronics and attempt to answer the one question asked by almost everyone who wrote me about medical electronics servicing: "How do I get started in it?"

As with any type of electronic servicing, you first should gain a working knowledge of the functions of the equipment, how it performs them, and how it is operated. This knowledge can be gained from both magazines and books about the subject. One magazine which I have found to be most helpful is *Medical Electronics & Data* (2994 W. Liberty Ave., Pittsburgh, Pa. 15216; \$10/year).

Two books which I have read and which I recommend are:

- *Handbook of Biomedical Instrumentation & Measurement*, by Harry E. Thomas, Reston Publishing Co., Reston, Va. 22090, \$24.50. (Address your request to Mr. Weldon Reckley.)

- *Biomedical Instrumentation and Measurement*, by Leslie Cromwell, et al, Prentice-Hall, Englewood Cliffs, N.J., about \$18. The first of these two books is especially suited to servicers because it contains complete schematics for several typical instruments actually used in hospitals. Also, examine the TAB and Sams book catalogs; they also have a few listings pertaining to medical electronics.

When you first enter the medical electronics servicing field (or any other new field), it might be wise to specialize in a certain class of instruments or those of a certain manufacturer. Electrosurgery instruments are a good starting point. (These devices use spark gap, vacuum tube or solid-state oscillators to generate a powerful RF signal for cutting tissue and cauterizing blood vessels during

surgery.) Electrosurgical machines tend to have simple, easy-to-repair defects, which can help make that all-important reputation. After establishing a name in the locale for servicing these devices in your area, you can go on to patient-monitoring equipment, defibrillators, etc.

Your first contact with local hospitals should be the administrator, head of purchasing or director of nursing. These people might not actually make service purchases themselves, but they should know who does. Purchasing policies and staff responsibilities vary among hospitals. You might hit pay dirt by contacting the previously mentioned individuals, or you might be required to "sell" the head nurse or doctor responsible for each department in which you want to do business. In other cases, a "unit manager" (or whatever title) may be responsible for service and repairs to equipment.

Another source of business might be the medical supply companies in your area. They sell equipment as well as bandages and bedpans. In some cases, their service is handled by outside contractors. In others, their service department may be your only competitor, so they may not be too sympathetic! To most, though, service is an onerous step-child imposed on them by the manufacturer, and they might be very receptive to the idea of turning it over to a competent local servicer.

There are a few other points which you should consider before attempting to break into medical electronics service. One is the *personal appearance* of your service technicians. Although the TV customer or industrial user of your service might overlook the "blue jeans technician," it may be that hospital people will look on them as "non-professional." Uniforms are also a negative thing. Although clean sports shirt and work pants are usually acceptable, you will find that slacks and white shirt (with tie) elicit the best response. This might seem silly, but it is a fact of life that, to many

people, you are upgraded from the status of "repairman" or "maintenance man" to "field engineer" by merely changing your clothes.

Another point for you to ponder is the *level of service which you plan to render*. Many items in the hospital can be serviced on a "business hours" basis. But if you plan to service life-saving (or support) and patient monitoring equipment, plan to offer full time, instant-response service. This means 24 hours a day, 365 days a year. You need not be open those hours, but someone in your organization will have to carry a "beeper" (paging receiver) so that your answering service can locate a technician. This type of duty is usually assigned on a rotating basis so that one man isn't "stuck" all the time. Local radio communications firms and the phone company rent and sell beepers. The Bell System brand name for them is *Bellboy*.

Although it should not be necessary to say, I feel it imperative to remind the reader that although workmanship is extremely important in any service endeavor, in medical electronics it is *critical*. I recall a case in which a defibrillator misfired during a nurse's daily inspection. It was sent to the repair shop and the defect traced to a shorted section in a multi-section electrolytic filter capacitor. It seems that some technician in the past had found a section of the electrolytic open and had bridged a tubular filter capacitor across it to avoid changing the whole can. Eventually, the open section shorted to the case and rendered the defibrillator useless. Fortunately, the defect was uncovered during a routine inspection, before the machine was needed for a life-saving resuscitation. If you are the kind of technician who would leave that capacitor in there, stay out of medical electronics, or you will eventually kill someone.

You probably already own most of the instruments needed to begin medical service. Electrosurgical instruments can usually be serviced using a VOM, an RF ammeter (0-2 amps) and an inexpensive,

*continued on page 55*

# TAB ALL-IN-ONE SCHEMATIC/SERVING MANUALS FOR COLOR and B & W TV, RADIOS and HI-FI



Here is complete service data, including full-size schematic diagrams, waveforms, setup and alignment instructions, field modification changes, trouble case histories, etc., for the most popular name-brand TV receivers. Each manual contains everything needed to service all models of the brands covered, including full-size schematic diagrams for every model year. In addition, each manual has something special to offer in the way of unique or improved trouble-finding techniques or in other informative material related to TV servicing in general. Most manuals have parts lists included. All are 3 1/2" x 11", 196 or more pages, including schematic diagram foldout. EACH MANUAL PRICED AT \$7.95 IN LONG-LIFE LEATHERETTE, \$4.95 IN PAPERBACK, UNLESS OTHERWISE NOTED.

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# TEST INSTRUMENT REPORT



REM Cathode Recovery Unit and CRT Checker Model CRU-1B. For more information about this instrument circle 105 on the Reader Service Card.

## REM MODEL CRU-1B CATHODE RECOVERY UNIT/CRT TESTER

■ A completely new principle of cathode repair, which practically eliminates the danger of damage to the cathode material, is used in REM's Model CRU-1B Cathode Recovery Unit and CRT Tester.

In the past, you may have had bad experiences when you tried to rejuvenate picture tubes, because some of the various rejuvenator systems depended on the breaking away of essential cathode coatings during the cleaning process.

The REM recovery system carefully avoids the removal of the cathode material and allows it to be used as a standard service procedure.

With good results when attempting picture tube repairs, it is now profitable to complete many repairs rather than lose the job to new set sales. In many cases the customer cannot afford a new picture tube and the TV set would otherwise be scrapped.

When a picture tube loses brightness after a period of time, in most cases the barium oxide on the cathode of the picture tube becomes coated with impurities. The only portion of the barium coating that is important to the picture quality is its surface and if it be-

comes contaminated, its emission will be reduced, causing a loss of brightness. It is difficult to remove this surface contamination without completely removing the oxide coating and exposing the tungsten base.

The REM Cathode Recovery System, according to the manufacturer, employs an entirely different process to remove the impurities. Instead of chipping away at the essential barium oxide surface, the objective of this system is to prevent the removal of the barium. It gradually raises the current level through the picture tube to a point so that the recovery process can take effect. The final current level is sufficient enough to cause the barium coating to become soft and plastic like. In this condition, the clean material is brought to the surface of the coating.

Since the mass of the contaminant is minute, usually less than 1/100 of 1 percent of the mass of the barium, it is not necessary to become destructive in attempting to remove it. The entire surface of the cathode is treated equally without having risked stripping the surface. The final current is safely controlled from the instrument. With fixed current levels maintained and accurately timed by the instrument, precise applications of power are assured without damaging the cathode of the tube.

When testing a picture tube, the objective is to determine whether or not the electron gun is capable of producing an electron beam strong enough to provide a full range of brightness on the face of the picture tube.

The REM unit checks the electron beam itself, after it has passed through the control grid and at a level more than sufficient to provide a high brightness picture. Many testing devices in use today check emission at the control grid and at a comparatively low current level. Consequently, because a tube may operate reasonably well at low brightness levels, and yet fail at normal or high brightness, testing a picture tube at low current levels most frequently fails to disclose emission problems.

The Cathode Recovery Unit and CRT checker is furnished with

three adapters, one being a three-in-one. The adapters will accommodate the 20 mm B/W tubes commonly found in General Electric and Japanese sets, RCA inline, Sony Trinitron and General Electric 11SP22 picture tubes. The unit will check all picture tubes available and if the need for additional adapters arise, they will be readily available to the owners of the unit.

When the picture tube is treated with the REM Cathode Recovery Unit, the customer receives a one-year warranty on the picture tube. If the picture tube does not emit a picture of satisfactory quality, the full amount paid for its recovery treatment will be credited toward the purchase of a replacement tube.

The unit performs three major functions: First, it will check the picture tube quality; second, it restores the emission of the tube, if necessary; and third, is to check its estimated life expectancy.

## Operation

The manufacturer felt that the unit is so simple to operate that they did not supply a complete operation manual which would cover each step in detail. The simplified operating instructions are found on the inside of the cover where they will always be with the unit when needed, in an easy-to-read position with large print.

Provided with the unit is a list of CRT types and recommended REM sockets and filament voltages taken from standard industry sources.

## Quality Checks

When making the quality check, the *function* switch is turned to position 2 which will check the picture under normal operating conditions. Next, by pressing the *supercharge* button, the quality readings will be provided simultaneously on three separate quality meters for the red, green, or blue/b-w picture tube guns. The meters are separated into three color regions and numbered from one to ten. If the meter pointer falls in the red area of the meters, the picture quality of the TV set will be poor. If it falls in the green shaded area, the picture will have marginal brightness and contrast. If the pointer

indication reads in the green area or above five, the picture tube compares to a new one.

In position 1 of the *function* switch, the picture tube is checked with a 10 percent reduction in heater voltage to detect guns abnormally sensitive to temperature change. In this condition the tube will have a short life expectancy. If the changes are less than 1½ units on the quality meter, the picture tube is normal.

For proper tracking, all meters should move up scale. If one or more of the meters does not move up scale when the *Supercharge* button is pressed, the picture tube will have poor color tracking.

### Short Check

If one of the guns have a heater-to-cathode short, there will be no change in the meter reading when the *Supercharge* button is pressed. If an inter-element short is encountered, it will cause the meter to "peg" during the quality check.

To clear a shorted picture tube, the *function* switch is turned to position 4 and the timer is set to 10 seconds. Then set the *Gun Selector* switch to the *all* position, start the timer and allow it to complete the cycle.

### Cathode Recovery

Set the *Function* switch to position 5, which is the cathode recovery setting. Set the timer to 25 seconds. Set the *gun selector* to *red*. Start timer and wait 5 seconds. Press and hold the *Supercharge* button for 15 seconds. If the *current* meter does not rise, it will not recover. Allow timer to complete the cycle. Then repeat this procedure for each gun.

### Life Test

Allow the picture tube to warm-up to the normal operating temperature. Set the timer to "O" on the outer scale. Simultaneously, turn the *Function* switch to position 3 and start the timer. Press the *Supercharge* button and note the time on the outerscale, at which the first gun drops into the red area of the quality meter. If the first gun drops in the red area in seconds or more, it has approximately the life of a new tube. If it takes 5 to 9 seconds, one year or more; 3 to 5 seconds, six to twelve months; and under 3 seconds, the

picture tube has a life expectancy of probably less than 6 months.

We tried the unit and was quite pleased with the results. The picture tube which we restored was previously blasted with another rejuvenator a number of times and then a brightener was installed. The green gun of the tube hardly registered on the meter and after a couple of tries it was restored to a useable condition. This amazed us, because a tube in this condition can seldom be restored after the cathode may have been damaged.

The instrument is enclosed in a durable solid-wood case with vinyl covering and steel corner protectors. The price of the Model CRU-1B is \$262.45.

### SANWA MODEL EM-800 ELECTROTESTER

The Sanwa Model EM-800 Electrotester is a new-mode measuring instrument with ultrahigh sensitivity and employs junction-type FET transistors which enables the instrument to have extremely high input impedance.

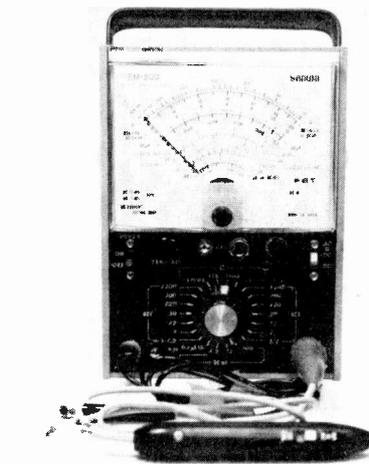
Its compact size, high impact plastic case, and self-contained battery power supply makes it an ideal instrument for field or bench service applications.

To meet the electronic service demands of today, the performance of the multitester has been enlarged with emphasis on its circuit design in two areas which distinguishes it from other conventional multitesters.

The input impedance of the voltmeter is maintained at a uniform high level for all measurement ranges. Its input impedance is maintained at 12 M for every DC volt range keeping the measurement loss very low, especially for the lower ranges.

When employed to make DC volt measurements, 3 megohms of the probe are placed in series with the input circuit cutting off  $C_{in}$  (parallel capacity loss across the input terminals) in consequence, not disturbing the condition of the circuit being checked. The input impedance on some conventional testers becomes less as the range is lowered. The frequency coverage of the instrument is extended up to the MHz level.

The COM negative jack is insulated from the case so that intermediary voltage of a divided cir-



Sanwa Model EM-800 FET VTVM. For more information about this instrument circle 106 on the Reader Service Card.

cuit can be correctly measured. When the ground of the equipment being measured is required to be connected to the instrument, a separate ground terminal is provided next to the COM jack.

We noted a number of other important features that distinguish the Electrotester from many other conventional multitesters:

**Instant Operation**—Solid-state circuitry eliminates the troublesome zero adjustment, allowing the instrument to function as soon as the switch is turned on.

**Single Control**—The *function* switch is eliminated and the various measurements are controlled by a single range switch operated like a conventional tester.

**Concentrated Input**—The one probe, which is connected to the input positive terminal, makes all measurements, then displays the measured values on the meter in a plain easy to read form.

**DCV Measurement**—A flip of the *polarity* switch on the front panel of the instrument readily allows measurement of positive or negative DC voltage. It is an essential step to diagnose the performances of various circuits:  $\mu$

**Self-Calibrated Pointer**—After the first initial calibration of the pointer, it is then stabilized by the FET transistors and no further calibration is necessary, and the instrument is ready for use.

**Zero-Center Reading**—By adjusting the meter pointer to the O-center of the scale, the instrument serves as a galvanometer for

*continued on page 54*

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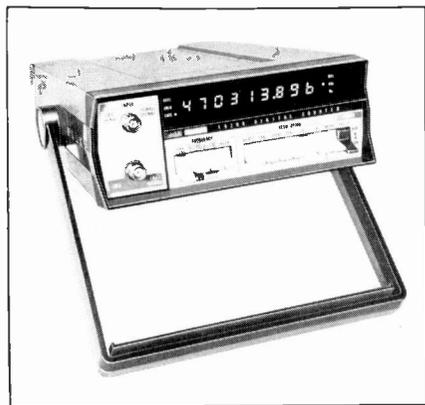
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# NEW PRODUCTS

## FREQUENCY COUNTER 138

A portable high-sensitivity frequency counter designed specifically for telecommunications applications is introduced by *John Fluke Mfg. Co.* This all-new frequency counter, Model 1920A, incorporates many new and innovative features including advanced LSI/MOS circuitry. It features a 9-digit LED display, sensitivity to 15 mV, AGC standard, and a frequency range of 5 Hz to 520 MHz. Optional internal prescalers to 1000 MHz and 1250 MHz cover the UHF television, 900 MHz telecommunications, and TACAN/DME bands. Direct and pre-scaled inputs are color-coded to match their corresponding function switches to facilitate operation, while the large, 7-segment, 9-digit LED display incorporates full leading zero suppression, automatic annunciation, overflow, and a self-check mode which lights all digit segments. In addition

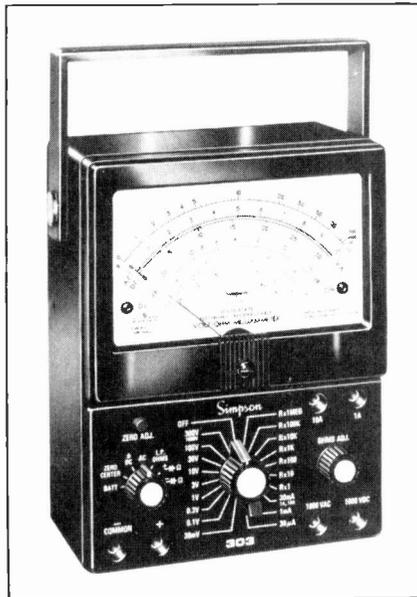


to normal frequency measurements, a burst function switch is provided, permitting the measurement of RF bursts having 2 ms or greater duration. To avoid erroneous reading, the display is automatically reset to zero if the burst width is less than the gate time selected. Price is \$859.

## VOM 139

A new solid-state, portable electronic VOM designed and engineered primarily for servicing the needs of the communications industry is introduced by *Simpson Electric Co.* The Model 303-3XL VOM features automatic LED indication of "polarity" and "power on", switch-selectable zero center scale for nulling, conventional and low-power ohms and and frequency response to 100,000 Hz. The instrument can be operated by both AC power line with battery in place and by charged battery alone. A single rechargeable nickel-cadmium "D" cell for 20-hour operation is supplied. A

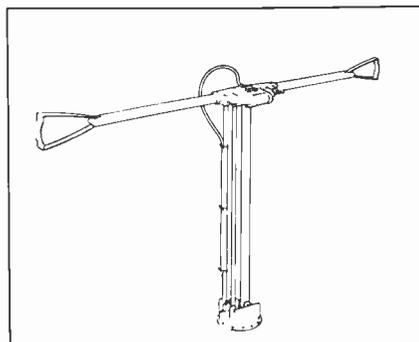
battery charger adapter is also provided. Packaged in a high-impact, shock-resistant case, the unit FET, IC and LED components in an all-solid-



state circuitry to achieve 10 M input impedance on both AC and DC, high sensitivity and drift-free performance. There are 10 AC and DC voltage ranges from .03 volt to 1000 volt, seven standard and low power ohms ranges, and five AC and DC current ranges from 30  $\mu$ A to 10 A. This versatile new unit is accurate to  $\pm 2$  percent full scale in all DC ranges. Compact size is 5.5 x 7.2 x 3.3 inches (140 x 183 x 84 mm) and weighs only 2.5 lbs. Price is \$165.

## TV ANTENNA 140

The Target 360 TV antenna introduced by *S & A Electronics* mounts on any recreational vehicle and receives signal within a range of 50 miles. Its solid state modular construction re-

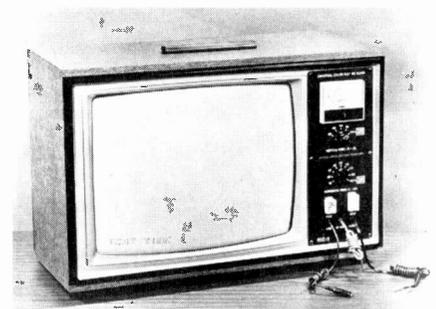


ceives UHF/VHF TV channels 2 through 83 in color and b-w, as well as AM/FM radio. Through dual controls, the antenna can be raised, lowered or rotated from inside of the vehicle. It can be raised 35 inches from the roof and rotated a full 360 degrees. The antenna folds down securely in a specially designed nesting system for

travel. The enclosed weather-resistant design has corrosion-resistant anodized aluminum, stainless steel and high stress plastic components. Easily installed, the antenna requires only  $\frac{3}{8}$ -inch holes.

## COLOR TV TEST JIG 141

A new test instrument which facilitates the servicing of over 8600 different color TV receivers is announced by the *RCA Distributor and Special Products Div.* The unit enables service technicians to remove the chassis section of a faulty TV receiver for diagnosis and repair without the need for transporting the entire set to the service shop. The Universal Color TV Test Jig 10J106 has its own picture tube, adjustable deflection components and speaker which connect to the chassis of the receiver being repaired in place of its own. When it is adjusted to match the electrical characteristics specified for the chassis under test, the resulting picture is identical to the one which would be obtained in the home while the TV receiver was intact. Specially designed built-in transformers with a switching system to permit the testing



of almost all television receivers. Yoke impedances for virtually every TV set are matched by simply turning two switches. They select the vertical yoke resistance and horizontal inductance values to match the chassis under test. Simple pin-to-pin adapters are available to match the different connectors used by various manufacturers. The jig has a built-in high voltage meter calibrated up to 35 kv, with an accuracy of  $\pm 2$  percent. Also there is a built-in high voltage lead, a ground lead, an audio cable and a 16-ohm monitor speaker. It comes complete with extension cables and adapters needed for almost all RCA Color chassis manufactured within the past ten years. A complete cross-reference handbook which explains the use of the jig with almost all TV receivers is included. Price is \$339.95.

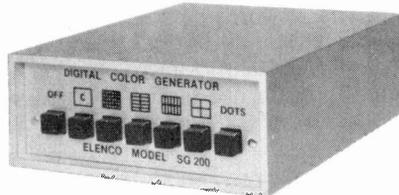
## TWO-WAY FM BUSINESS RADIO - 142

*Pace Two-Way Radio Products*, introduced an all new, economical two-

## DELUXE DIGITAL COLOR CONVERGENCE GENERATOR

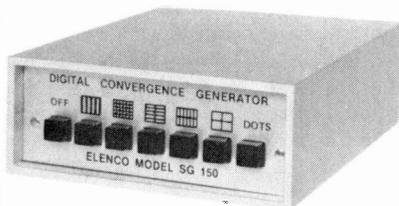
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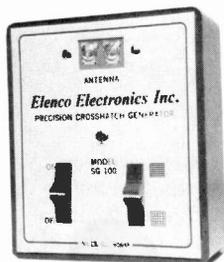
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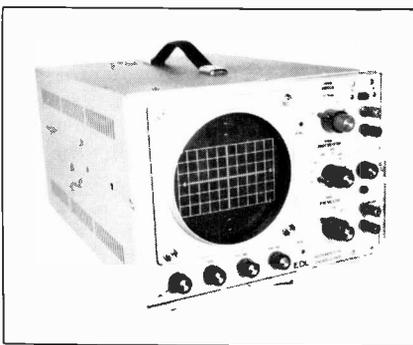
way lead mobile FM transceiver. The Model BI3100 radio provides office-to-job or mobile-to-mobile communications. This six-channel unit offers maximum power of 12 watts in the frequency range of 148-174 MHz. Other features include: monolithic crystal filter to minimize receiver dis-



tortion, optional sub-audible tone squelch, transmit mode indicator light, "busy" lamp for alerting in use of selected channel, audio switch for optional telephone handset, built-in speaker and plug-in microphone.

### OSCILLOSCOPE 143

EDL Instruments, Inc. announces the introduction of four new general purpose all solid state oscilloscopes. The Model 170 (shown in photo) is a DC to 1.5 MHz scope having a 5-inch flat faced CRT. Vertical sensitivity is 20 mv/cm. Input impedance is 1 megohm shunted by 30 pf. Sweep frequency is 10 Hz to 100 KHz. This basic scope is also available as the Model 170T, differing only in that triggered sweep has been added, and having sweep speeds to 10 micro seconds/cm. The new Model 230 scope has a band width of DC to 5 MHz, sweep fre-

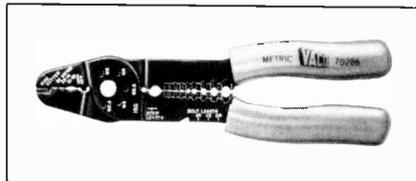


quency of 10 Hz to 500 KHz. This scope is also available with triggered sweep as the Model 230T and having sweep speeds to 1 micro second/cm.

### WIRING/CRIMPING TOOL 144

The Metric "WirePlier" No. 70285, combination wiring and crimping tool is introduced by Vaco Products Co. This new metric version of the popular tool offers several features and advantages not found in other similar tools. Crimping dies for 1.25, 2.0 and 5.5 mm size terminals and 7 and 8 mm ignition terminals are included, along

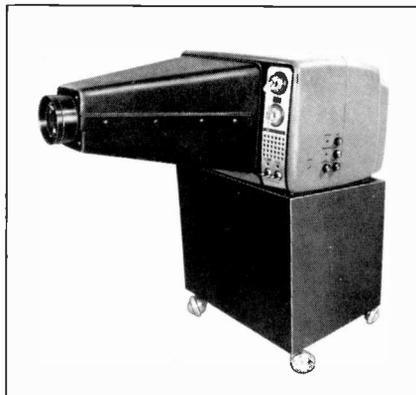
with standard 22-8AWG crimping dies. Stripping dies for 0.75 to 14 mm and 22 to 6AWG wire sizers are built-



in. The bolt cutter will accept M2.6, M3, M3.5, M4, and M5 metric bolts. Standard features incorporated into the tool include a wire cutter, strip-length and bolt length guides. The tool measure 22.25 mm (8 3/4 inches) long, and has black oxide finish with white lettering. It has over-size red cushion grip handles for more comfortable crimping.

### PROJECTION TV KIT 145

Miami Projection TV introduced a new Projection Television Kit that easily converts any color or black and

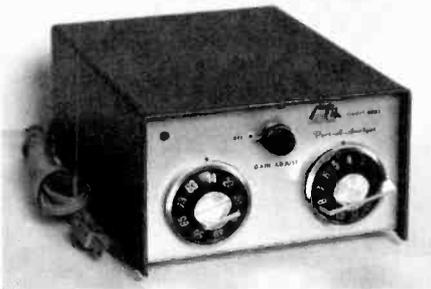


white set to wall size projection with a 50-inch picture. The kit consists of a specially designed TV projection lens and a high efficiency screen. An high-voltage intensifier for brighter pictures is also available. Complete instructions for converting the TV set and installing the necessary components are furnished. A completely assembled projection TV set with a 13-inch color tube and an attractive stand is also available.

### TUNER SUBSTITUTION UNIT 146

PTS Electronics, Inc., has introduced a new dual-purpose tuner substitution unit named "Port-A-Analyst", Model 4001. It can be used to substitute the regular tuner for checking both the VHF and UHF tuners. In addition, the tuner can be plugged into the IF input connector of the TV set and left in the home until the tuner is repaired, allowing continuous operation of the TV set. The unit has an input impedance of 300-ohm balanced VHF or UHF, and is electrically iso-

lated. The sensitivity of the unit is 30  $\mu$ v, with a 41 MHz output. It can be



powered by AC or a self-contained battery and is housed in a sturdy vinyl-clad aluminum cabinet. The price is \$59.95.

### CORDLESS SOLDERING IRON 147

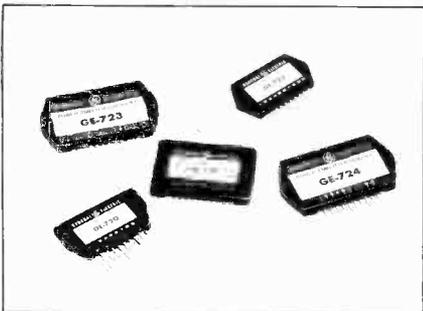
The features of total portability, instant heat and minimum weight have been combined to make the *Weller* cordless soldering iron an essential bench and service kit tool. The fully self-contained Model WC100 iron, with long-life, rechargeable nickel cadmium batteries and complete with overnight power charger, provides instant heat to 700-degrees F. for about 15 minutes of intricate to heavy duty



soldering with three available interchangeable tips. The soldering iron, weighing only 5 3/4 oz, is contoured and balanced for maximum hand comfort, and features both built-in work light and safety-lock switch.

### POWER AMPLIFIER MODULES 148

*General Electric's* Tube Products Dept. has introduced five solid-state power



amplifier modules primarily for replacement use in domestic and imported stereo components. The five devices cover a range of power outputs

from 8- to 25-watts. They are included in GE's 1975 Replacement Semiconductor Guide, with cross references to RCA, Sylvania and original equipment part numbers. This offering of solid-state devices is to be expanded in the near future to make it easier for electronic technicians to service audio equipment.

### ANTENNA COUPLER 149

Cleaner signal reception and better transmission at maximum power output result from the use of the new LAC-895 Antenna Coupler, from *Leader Instruments Corp.* The instrument is said to provide proper antenna matching, virtually removing all T.V.I. problems. Frequency range is 3.5, 7, 14, 21, 28 MHz, amateur



band. Input impedance is 50 ohms while load impedance is 50 ohms or 75 ohms coaxial cable. Power consumption is 200 W while the insertion loss is 0.5 dB or less. The unit may be left in circuit to facilitate optimum operating capability. Price is \$159.95.

### CB ANTENNA 150

*Russell Industries, Inc.* introduced a replacement antenna for CB (27 MHz). Labeled Duck-CB, the part is



said to be the first unbreakable CB antenna. The "Rubber Duckie" continuously loaded 12-inch antenna is designed for portable transmitters and receivers. Insulated with vinyl coating, the antenna clamps onto existing antenna with one set screw. Individually packaged in color-coded sleeves, the durable antenna can be bent at all angles without breaking.

### UHF TRANSCEIVER 151

*Regency Electronics, Inc.* has announced the introduction of their first UHF-band business transceiver. Operating on the 450-470 MHz range, the new unit offers 70 dB intermodulation rejection and 75 dB adjacent

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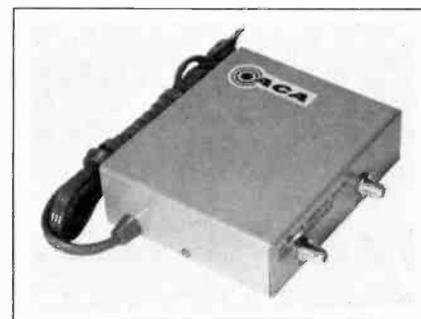


channel selectivity. The new unit, designated Micro-Com U-11, can be ordered with the Action-Call plug-in tone coded squelch option. The price is \$495.

**DISTRIBUTION AMPLIFIER 152**

ACA has added a very high input and exceptionally high output distribution amplifier to its MATV line. The model MSV 70 has a 3.0 volt output with an input capability of 126,000 microvolts. The bandwidth

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**TEST INSTRUMENT REPORT**

*continued from page 49*

adjusting transistor and FM discriminating circuits, etc.

*Joint Use Of Probes*—An optional RF probe, as well as a 30 kv high voltage probe, are available as optional accessories and can be jointly connected to the instrument.

When the range switch is placed in the "G" position, the instrument functions as an amperemeter reading 0.1  $\mu$ a full scale, and as a voltmeter reading 0.3 volt full scale. Although the "G" range uses the instrument as a 0.3 voltmeter, the probe switch is placed to the opposite side. On the DC position, the instrument functions as a voltmeter to read 0.6 volt full scale.

**Specifications**

DC Volt Ranges: ( $\pm$ ) 0.3, 1.2, 3, 12, 30, 120, 300, 1200. Input Impedance: 12 Megohms (3M for 0.3 volts). DCA: ( $\pm$ ) 0.1  $\mu$ a (G-Range), 1.2 ma, 12 ma, 300 ma. Voltage Drop Between Terminals: 300 mv. AC Volt Ranges: 1.2, 3, 12, 30, 300, 1200. Input Impedance: 1 M. Frequency Coverage: 30 Hz to 5 MHz ( $\pm$ 3 dB). Ohm Scale: X1, X100, X1K, X100K. DB: -20 to +3 dB, -10 to +10 dB, 0 to +23 dB, +40 to +63 dB. The price is \$165.95. ■

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## CARR TALK

continued from page 46

service-type oscilloscope. A 250-ohm, 500-watt non-inductive dummy load will absorb the power generated. Some of the items you should have are:

*Normal Electronics Instruments:*

- 1) VTVM
- 2) VOM (avoid FET types)
- 3) Triggered-sweep portable oscilloscope (500 KHz or better)
- 4) Collection of regulated bench power supplies

*Special" Instruments (Manufacturers of these advertise in Medical Electronics & Data magazine):*

- 1) ECG waveform simulator (a kind of signal generator, Parke-Davis 3150 or equivalent, slang term "chicken heart").
- 3) AC leakage tester for microampere level currents (Instrutek or bio-design)
- 4) Stylus pressure gauge
- 5) 0-2 amp RF ammeter and 250-ohm/500-watt dummy load  
*"Nice to Have If you can afford them" Instruments*
- 1) Briefcase tool kit (w/tools)
- 2) Portable DMM (Fluke 8000 or equivalent)
- 3) Polaroid CR-9 hand-held scope camera for analyzing certain defibrillator defects
- 4) Frequency counter ("high resolution" type preferred)
- 5) Tektronix 211-series or equivalent battery-powered miniscope
- 6) Tektronix TM-500 series instruments on their "medical service" cart (nice, but costly).■

Next month, we'll get back to vehicular & outdoor electronics topics.

## PROFITABLY SPEAKING

continued from page 21

RCA 34-module inventory in one of your service vehicles and out of it your home-call technician sold an average of only 1 module per day during his 5-day workweek. At an average gross profit of \$7.00 per module, from the color TV module sales of this one technician you would realized \$140 gross profit per month from your \$372.70 investment, or an annual gross return of 450 percent on your investment.

Although handling, storage and

other inevitable inventorying costs will cause the net profit and net return in the preceding example to be slightly less than the gross figures, in my opinion it clearly shows that brand-selective inventorying of color TV modules can be both profitable and a sound investment even at a relatively conservative volume projection of one per day. What do you think?■

## MATV LEASING

continued from page 18

the layout situation to one of the many MATV system manufacturers who are willing to provide free assistance with system design and cost estimating. Once you have a system design and an accurate estimate of its cost (including installation), weigh the cost against the subscriber potential of the complex and prepare a financial projection. If it looks promising, make a pitch to the complex owner. If you can reach a mutually beneficial arrangement with the owner and need partial financing, present the scheme to your local banker. Once you have the assurance of any needed financing, have your attorney draw up a comprehensive lease contract.■

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1. The names and addresses of the publisher, editor and managing editor are: Publisher, Alfred A. Mengus, 757 Third Avenue, New York, New York 10017; Editor, J. W. Phipps, 1 East First Street, Duluth, Minnesota 55802; Managing Editor, Joseph Zauhar, 1 East First Street, Duluth, Minnesota 55802.

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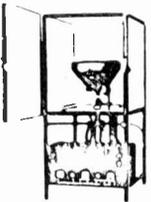
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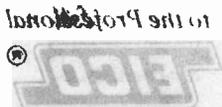
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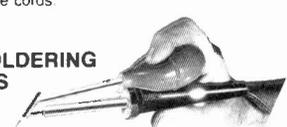
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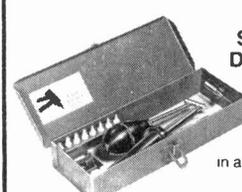


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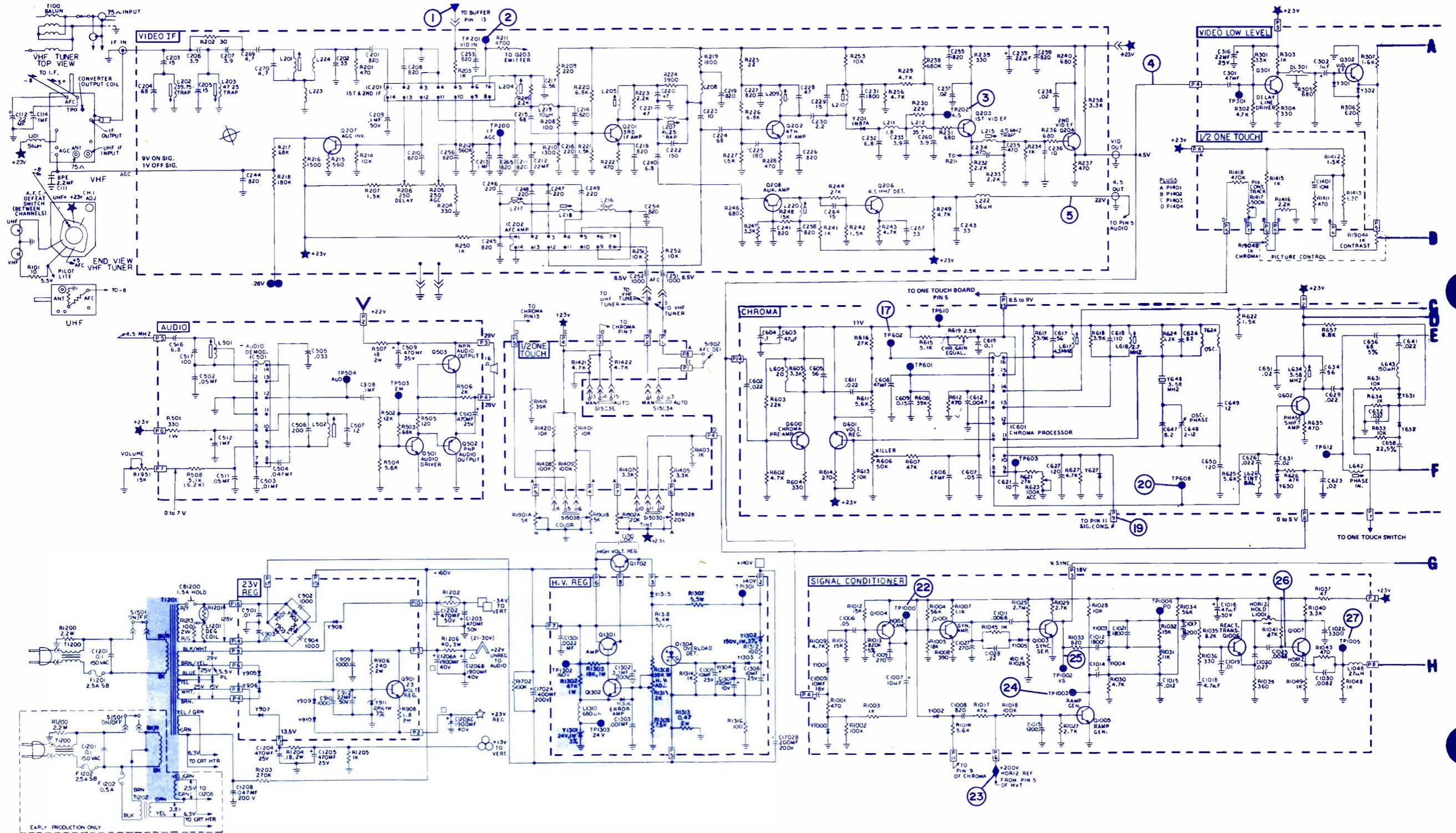
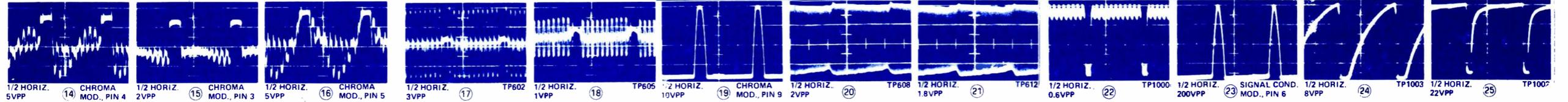
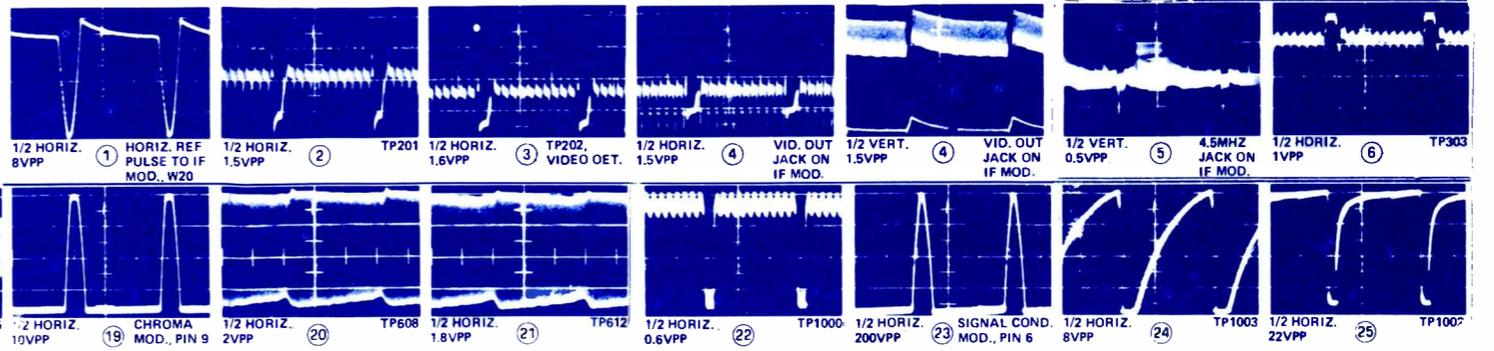
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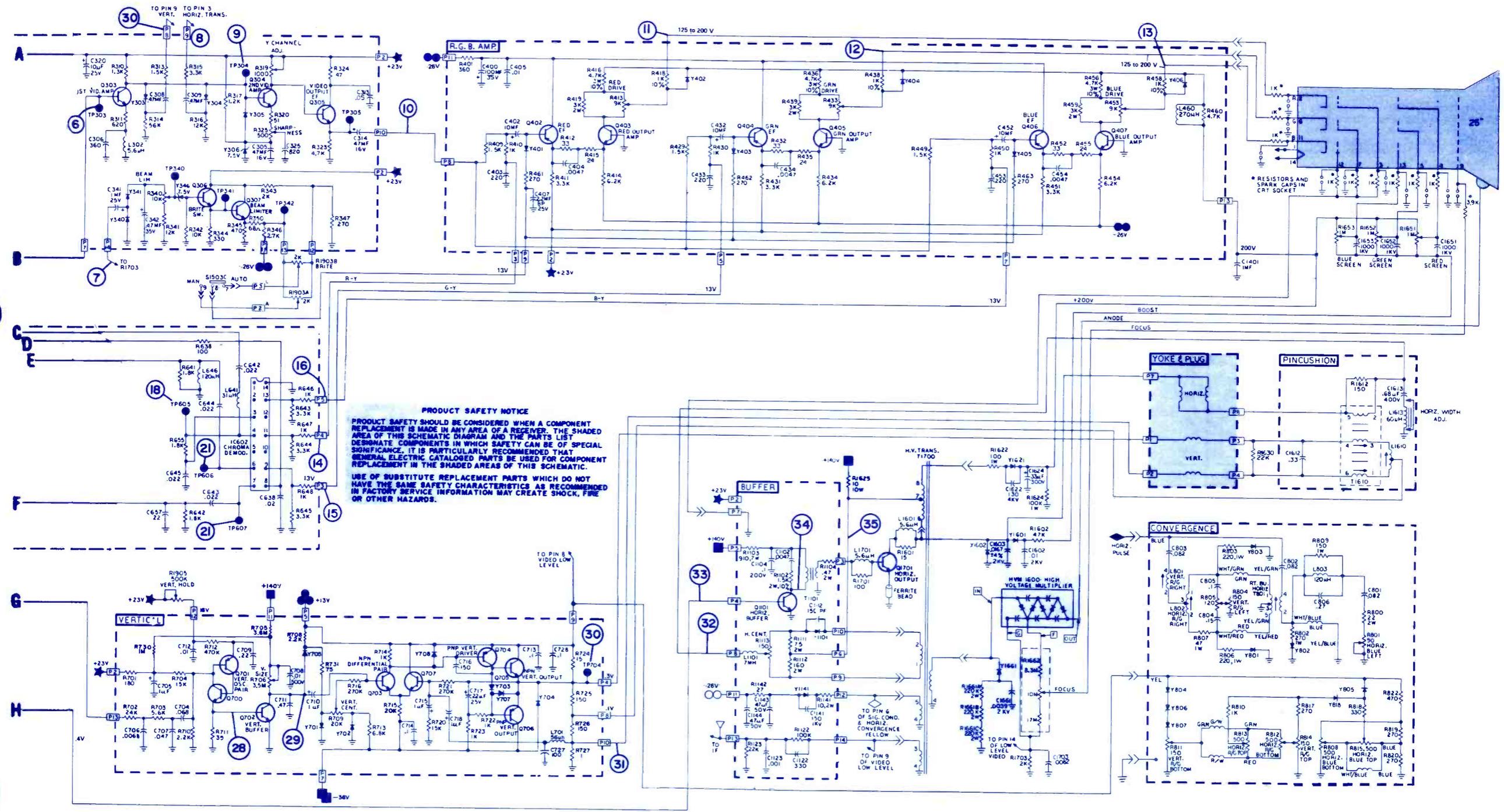
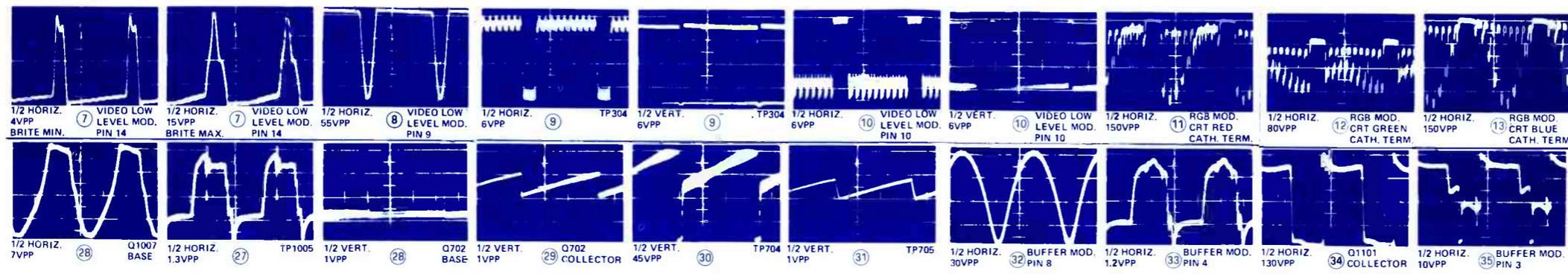
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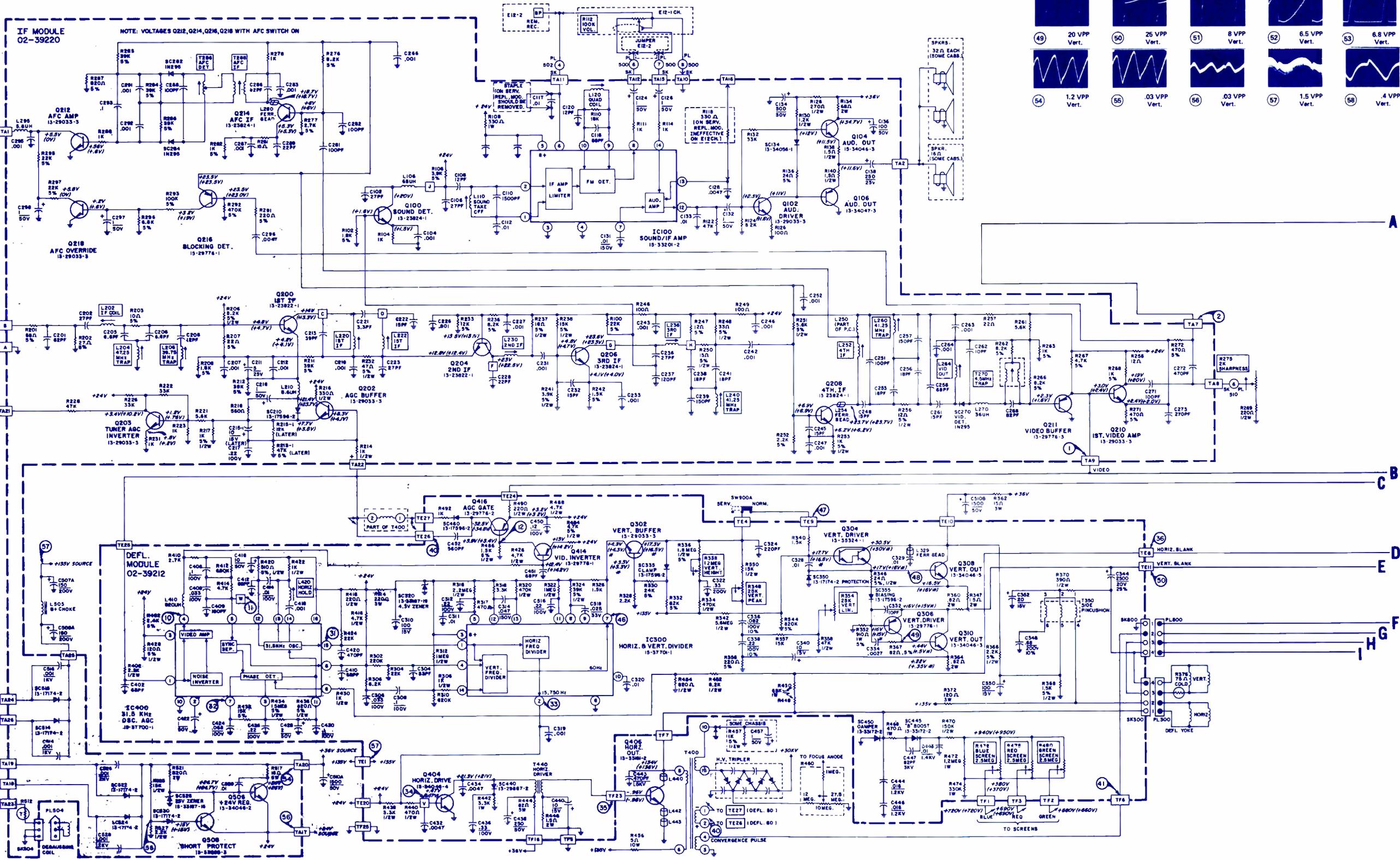
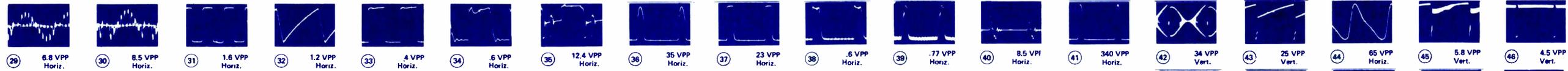




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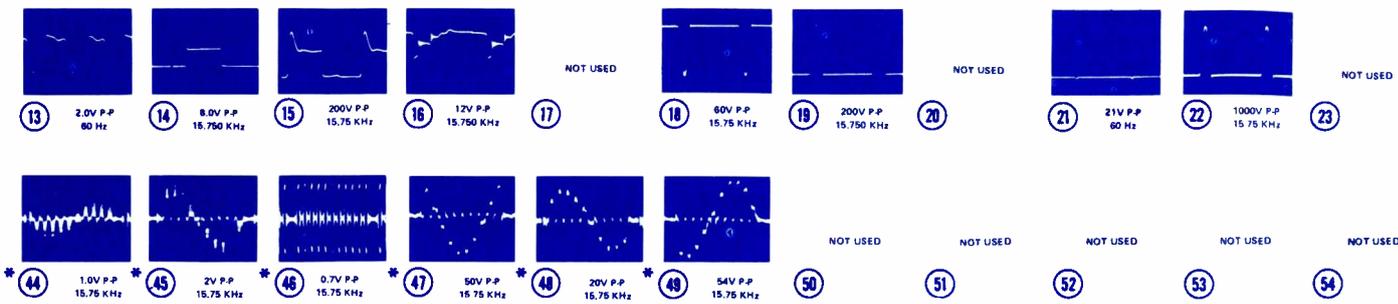




IMPORTANT SAFETY NOTICE

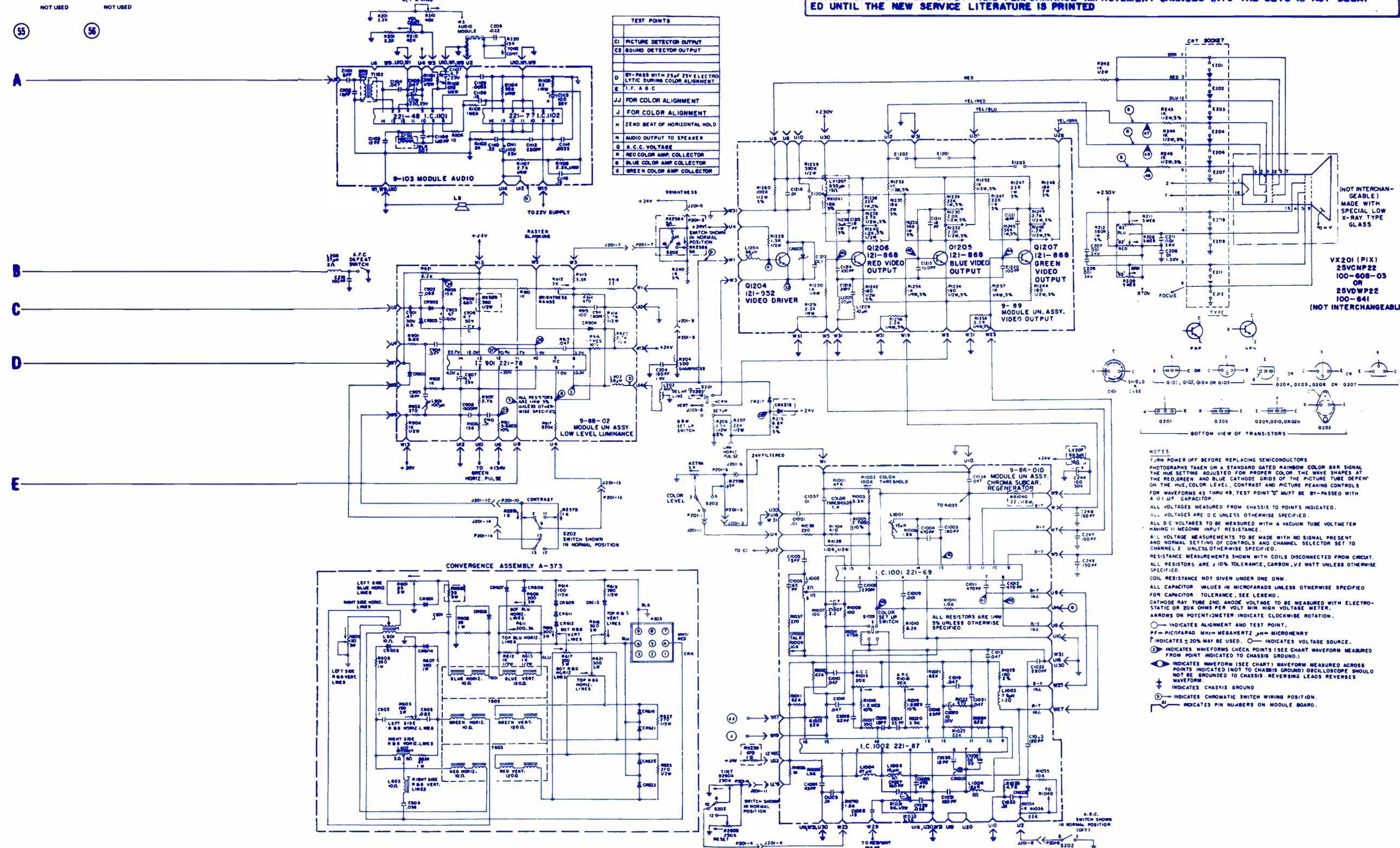
WHEN SERVICING THIS CHASSIS UNDER NO CIRCUMSTANCES SHOULD THE ORIGINAL DESIGN BE MODIFIED OR ALTERED WITHOUT PERMISSION FROM THE ZENITH RADIO CORPORATION. ALL COMPONENTS SHOULD BE REPLACED ONLY WITH TYPES IDENTICAL TO THOSE IN THE ORIGINAL CIRCUIT, AND THEIR PHYSICAL LOCATION, WIRING AND LEAD DRESS MUST CONFORM TO ORIGINAL LAYOUT UPON COMPLETION OF REPAIRS. IN SOME INSTANCES REDUNDANT CIRCUITRY IS INCORPORATED FOR ADDITIONAL CIRCUIT PROTECTION AND X RADIATION SAFETY SPECIAL CIRCUITS ARE ALSO USED TO PREVENT SHOCK AND FIRE HAZARD. THESE CRITICAL AREAS ARE SHADED ON THE SCHEMATIC FOR EASY IDENTIFICATION. THE LETTER "X" INCLUDED IN THE ITEM NUMBER DESIGNATES SPECIAL FAIL SAFE COMPONENTS IN THESE AREAS (SEE PERTINENT NOTE) WHICH ARE REQUIRED TO MAINTAIN SAFE PERFORMANCE, NO DEVIATIONS ARE ALLOWED WITHOUT PRIOR APPROVAL BY THE PRODUCT SAFETY ENGINEERING DEPARTMENT.

**CAUTION:**  
THIS CIRCUIT DIAGRAM MAY OCCASIONALLY DIFFER FROM THE ACTUAL CIRCUIT USED. THIS WAY IMPLEMENTATION OF THE LATEST SAFETY AND PERFORMANCE IMPROVEMENT CHANGES INTO THE SETS IS NOT DELAYED UNTIL THE NEW SERVICE LITERATURE IS PRINTED

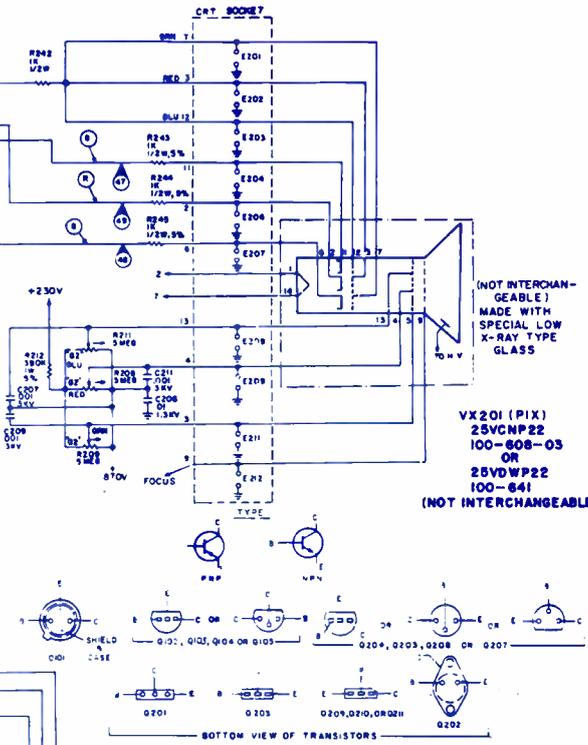


\* FOR WAVEFORMS 43 THROUGH 49, BYPASS TEST POINT "D" WITH 1.0 MF CAPACITOR.

55 NOT USED  
56 NOT USED



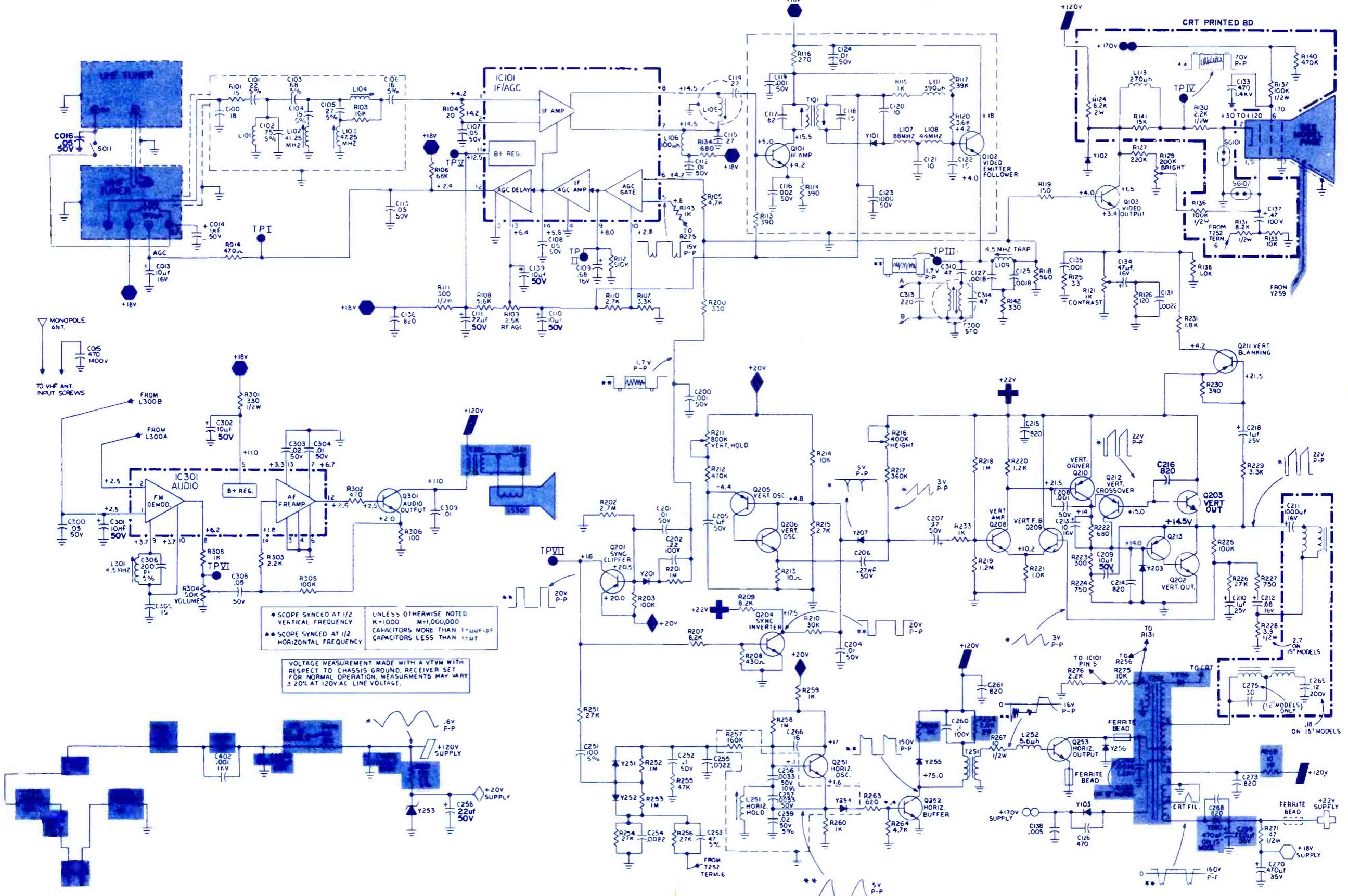
TEST POINTS	
C1	PICTURE DETECTOR OUTPUT
C2	SOUND DETECTOR OUTPUT
D	BY-PASS WITH 25µF 25V ELECTROLYTIC DURING COLOR ALIGNMENT
E	I. F. A. G. C.
J1	FOR COLOR ALIGNMENT
J	FOR COLOR ALIGNMENT
H	ZERO BEAT OF HORIZONTAL HOLD
N	AUDIO OUTPUT TO SPEAKER
A	A.C. VOLTAGE
B	RED COLOR AMP. COLLECTOR
C	BLUE COLOR AMP. COLLECTOR
D	GREEN COLOR AMP. COLLECTOR



- NOTES
- TURN POWER OFF BEFORE REPLACING SEMICONDUCTORS
  - PHOTOGRAPHS TAKEN ON A STANDARD GATED RAINBOW COLOR BAR SIGNAL THE HUE SETTING ADJUSTED FOR PROPER COLOR. THE WAVE SHAPES AT THE RED, GREEN AND BLUE CATHODE GRIDS OF THE PICTURE TUBE DEPEND ON THE HUE, COLOR LEVEL, CONTRAST AND PICTURE PEAKING CONTROLS. FOR WAVEFORMS 43 THRU 49, TEST POINT "D" MUST BE BY-PASSED WITH A 0.1µF CAPACITOR.
  - ALL VOLTAGES MEASURED FROM CHASSIS TO POINTS INDICATED.
  - ALL VOLTAGES ARE D.C. UNLESS OTHERWISE SPECIFIED.
  - ALL D.C. VOLTAGES TO BE MEASURED WITH A VACUUM TUBE VOLTMETER HAVING 11 MEGOHM INPUT RESISTANCE.
  - ALL VOLTAGE MEASUREMENTS TO BE MADE WITH NO SIGNAL PRESENT AND NORMAL SETTING OF CONTROLS AND CHANNEL SELECTOR SET TO CHANNEL 2 UNLESS OTHERWISE SPECIFIED.
  - RESISTANCE MEASUREMENTS SHOWN WITH COILS DISCONNECTED FROM CIRCUIT.
  - ALL RESISTORS ARE ±10% TOLERANCE, CARBON, 1/2 WATT UNLESS OTHERWISE SPECIFIED.
  - COIL RESISTANCE NOT GIVEN UNDER ONE OHM.
  - ALL CAPACITOR VALUES IN MICROFARADS UNLESS OTHERWISE SPECIFIED FOR CAPACITOR TOLERANCE. SEE LEGEND.
  - CATHODE RAY TUBE 2ND ANODE VOLTAGE TO BE MEASURED WITH ELECTROSTATIC OR 20K OHMS PER VOLT MIN. HIGH VOLTAGE METER.
  - ARROWS ON POTENTIOMETER INDICATE CLOCKWISE ROTATION.
  - ⊙ INDICATES ALIGNMENT AND TEST POINT.
  - PF = PICOFARAD MHZ = MEGAHERTZ µH = MICROHENRY
  - INDICATES ±20% MAY BE USED. ○ INDICATES VOLTAGE SOURCE.
  - ⊙ INDICATES WAVEFORMS CHECK POINTS (SEE CHART WAVEFORM MEASURED FROM POINT INDICATED TO CHASSIS GROUND.)
  - ⊙ INDICATES WAVEFORM (SEE CHART) WAVEFORM MEASURED ACROSS POINTS INDICATED (NOT TO CHASSIS GROUND) OSCILLOSCOPE SHOULD NOT BE GROUND TO CHASSIS. REVERSING LEADS REVERSES WAVEFORM.
  - ⊙ INDICATES CHASSIS GROUND.
  - ⊙ INDICATES CHROMATIC SWITCH WIRING POSITION.
  - ⊙ INDICATES PIN NUMBERS ON MODULE BOARD.

SYMBOL	DESCRIPTION	GENERAL ELECTRIC PART NO.
R109	— 2.5K, 20%, RF AGC	EP49X191
	— potentiometer, dual	ES49X106
R211	— 800K, vert hold	
R216	— 400K, vert height	
C403A	— 300mfd, 175v	ES31X50
C403B	— 300mfd, 150v	
	— yoke asm 12 in.	ES76X16
	— yoke asm 15 in.	ES76X17
L102	— coil 4.25	ES36X83
L105	— coil	ES36X124
L106	— coil	
L109	— coil 4.5MHz	
L251	— coil horiz osc	
T252	— xformer HV	
T300	— coil sound take off	
T301	— audio output	
L402	— choke 800µh	
L403	— choke 800µh	
IC101	— IF/AGC	
IC301	— audio	
	— fuse 2a, 250v fast blo pigtail	

ES36X127
ES36X123
ES36X88
ES77X22
ES36X129
ES64X13
ES36X132
ES36X132
EP84X10
EP84X2
ES10X46



• SCOPE SYNCED AT 1/2 VERTICAL FREQUENCY  
 • SCOPE SYNCED AT 1/2 HORIZONTAL FREQUENCY

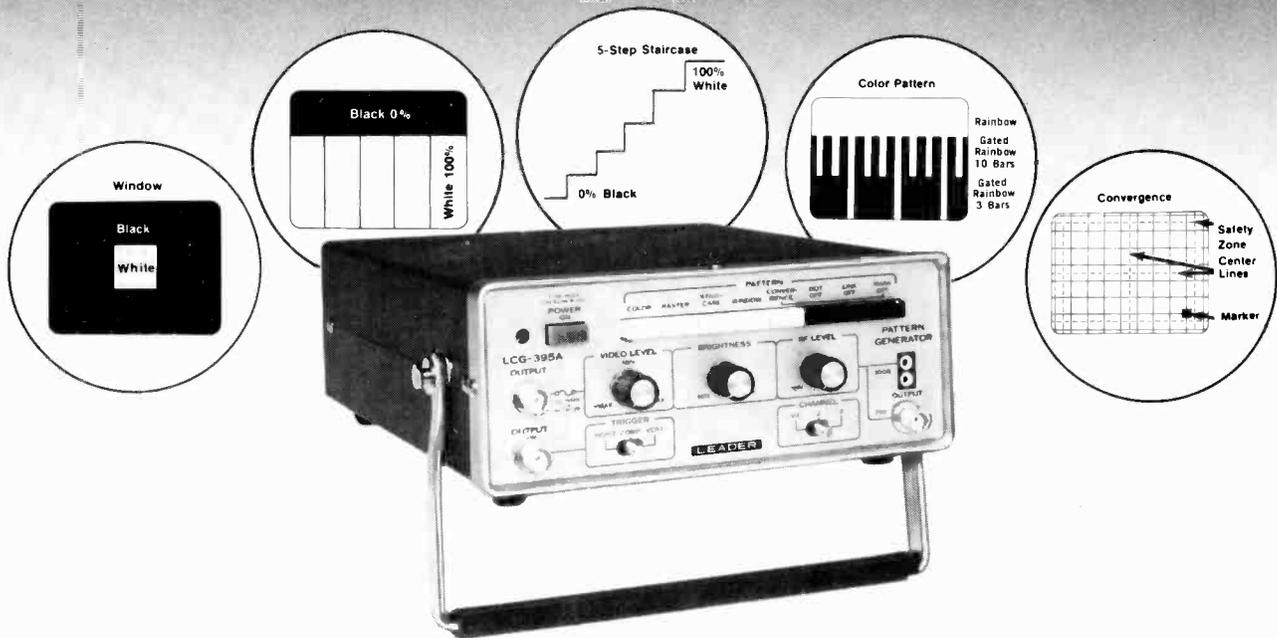
UNLESS OTHERWISE NOTED  
 K=1,000 M=1,000,000  
 CAPACITORS MORE THAN 1µF=µF  
 CAPACITORS LESS THAN 1µF

VOLTAGE MEASUREMENT MADE WITH A VTVM WITH RESPECT TO CHASSIS GROUND. RECEIVER SET FOR NORMAL OPERATION. MEASUREMENTS MAY VARY ± 20% AT 120V AC LINE VOLTAGE.

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for periodic meter reassurance checks after overload/drops.

**BURNOUT-PROOF**  
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(Especially designed recessed safety connectors and heavily insulated alligator clips)

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**DETTENTED HANDLE POSITION.**



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