

ELECTRONIC TECHNICIAN / DEALER

WORLD'S LARGEST TV-RADIO SERVICE & SALES CIRCULATION

JANUARY 1970  A HARCOURT BRACE & WORLD PUBLICATION



TEKLAB REPORT ON ZENITH
ROTATOR MAINTENANCE
TWO WAY RADIO ON THE GO

FRISEW33474652M8728J3A1 8698

WILLIAM W FRISE
7176 GALE RD
ATLAS MI

XX

48411

The absolute end of an old fear.

The new B&K Sweep/Marker Generator does for TV sets what no other instrument or instruments can do. It makes alignment of color, as well as black & white TV, simpler and easier than ever.

Remember all your old fears about TV alignment (especially color)? Well, now you can forget them!

In the past, a marker generator and a separate sweep generator were used with a marker adder and a bias supply. All four of these now are combined in one easy-to-use instrument.

(We've made benchwork so much simpler by doing away with the need for hooking together a lot of cables and costly instruments.)

The Sweep/Marker Generator is both an instrument and a guide. As a guide, the bandpass

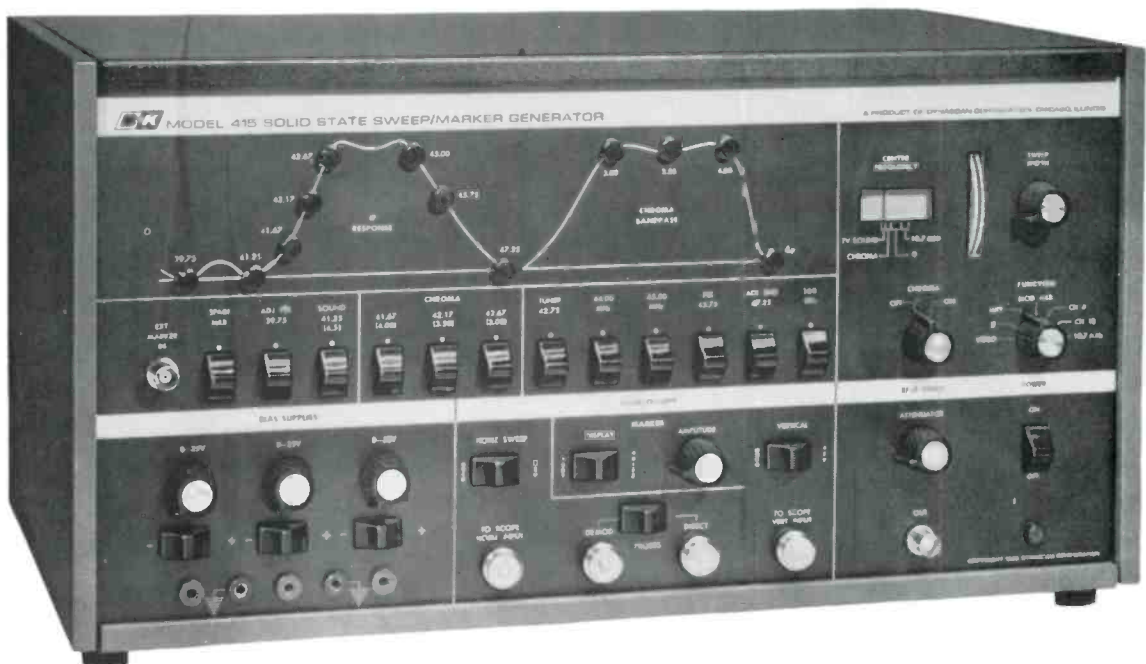
and chroma bandpass curves are visually reproduced and the individual markers are clearly indicated by lights—right on the front panel—for quick, easy reference.

As an instrument, the Sweep/Marker Generator not only generates the marker frequencies (all crystal controlled), but also sweeps the chroma bandpass, TV-IF, and FM-IF frequencies.

See it soon at your B&K distributor or write us for advance information on the product that makes TV alignment procedures of old a fearless operation: simple, fast, accurate. The new Sweep/Marker Generator, Model 415. Net: \$399.95



PRODUCT of DYNASCAN CORPORATION
1801 W. Belle Plaine - Chicago, Illinois 60613
Where electronic innovation is a way of life.



New B&K Sweep/Marker Generator.

... for more details circle 102 on Reader Service Card

TEK FAX

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR 6 NEW SETS

**RCA VICTOR
TV Chassis
KCS178 Series**

JANUARY • 1970

GROUP
209

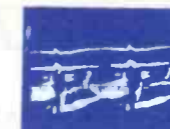
SCHEMATIC NO. SCHEMATIC NO.

ADMIRAL TV Chassis NA1-1A	1273	OLYMPIC TV Models 9P44/9P45/ 9P46/9P54	1275
AIRLINE TV Model GEN-111 60A	1274	RCA VICTOR TV Chassis KCS178 Series	1270
MAGNAVOX Color TV Chassis T939	1271	ZENITH Color TV Chassis 12A10C15	1272

SYMBOL	DESCRIPTION	RCA VICTOR PART NO.
C101A	4 section elect 250µf, 200v	129099
C101B	650µf, 175v	129099
C101C	50µf, 175v	129099
C101D	10µf, 150v	129099
C226	6pf ±0.5pf 500v, NPO cer	121225
C261	68pf 20% 500v NPO cer	109232
L102	6.2µh	107286
L202	AGC	114315
L203	470µh	124271
L205	2.7µh	107463
L207	stabilizer	114486
L210	RF	114314
R112	39Ω 5%, 10w WW	124272
R226	control, contrast, vert/ horiz hold	121222
R257	control, vert size	121223
R260	control, vert lin	121944
R275	62K 5% 1/2w film	233094
RF101	therm fuse, 0.35Ω 1.1a	124263
T102	horiz output	124462
T103	vert output	127812
T104	audio output	124276
T201	4.5MHz	114489
T202	sound, IF	118411
T203	quad	118410
T204	47.25MHz trap	113097
T205	video IF grid	113097
	thermistor - temp. comp	118375
	yoke - deflection	124256
	VHF tuner, KRK 148A	
	UHF tuner, KRK 152A	



1 PW200-TP3
PICTURE 2ND DETECTOR
3V. P-P VERT. RATE



2 V205-9
VIDEO OUTPUT PLATE
80V. P-P VERT. RATE



3 PW200-Z
AGC KEYING PULSE
450V. P-P HORIZ. RATE



4 V205-2
AGC GRID
40V. P-P HORIZ. RATE



5 V201-1
HORIZ. SYNC PULSE
50V. P-P HORIZ. RATE



6 R249-R246 JUNCTION
VERT. SYNC PULSE
22V. P-P VERT. RATE



7 V206-9
VERT. OSC. GRID
145V. P-P VERT. RATE



8 V206-2
VERT. OUTPUT GRID
26V. P-P VERT. RATE



9 SR201
CATHODE JUNCTION
13V. P-P HORIZ. RATE



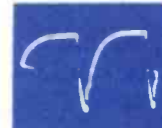
10 SR201
ANODE JUNCTION
16V. P-P HORIZ. RATE



11 PW200-TP4
HORIZ. CONTROL PLATE
20V. P-P HORIZ. RATE



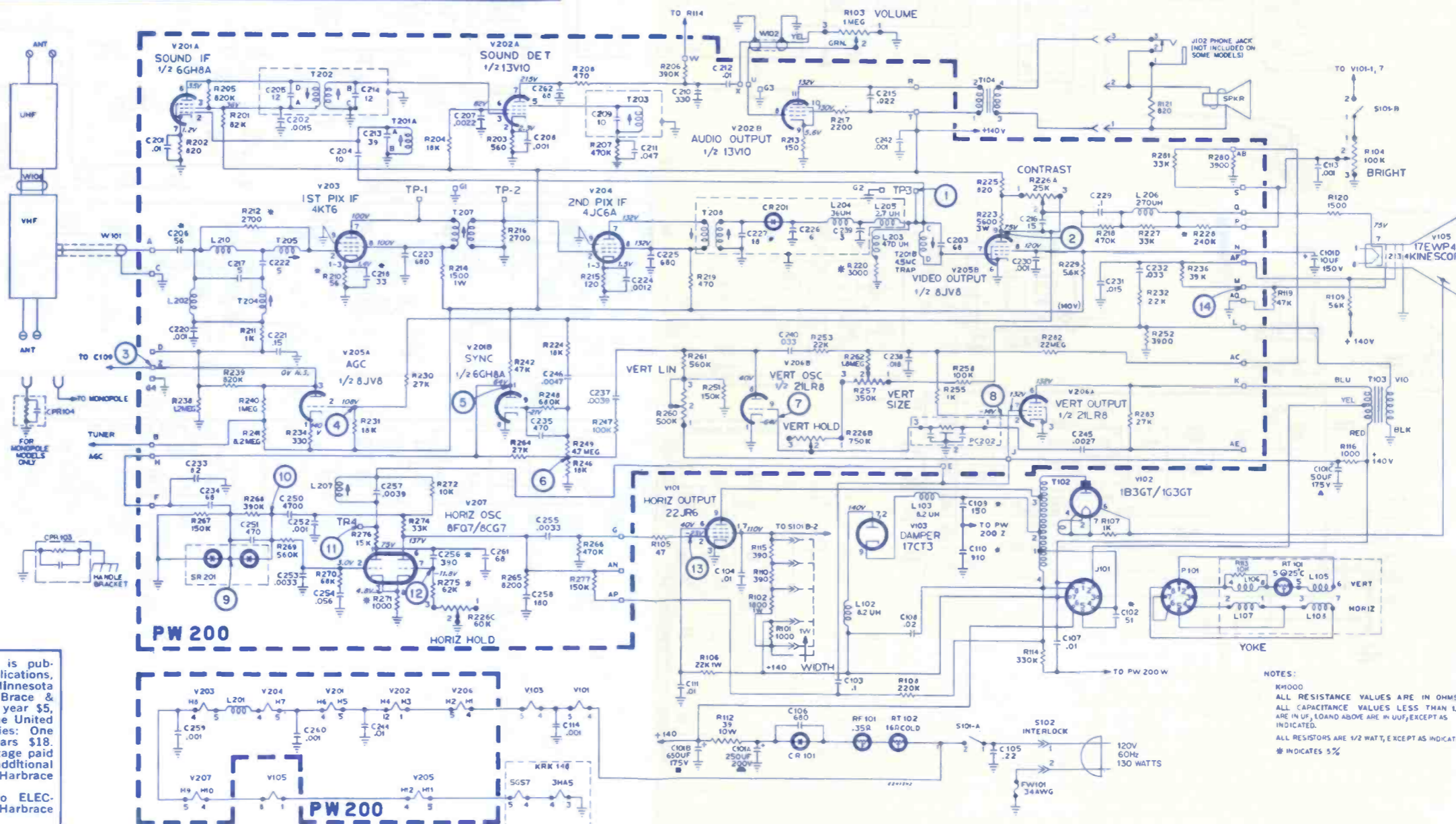
12 V207-7
HORIZ. OSC. GRID
34V. P-P HORIZ. RATE



13 PW200-G
HORIZ. OUTPUT GRID
120V. P-P HORIZ. RATE



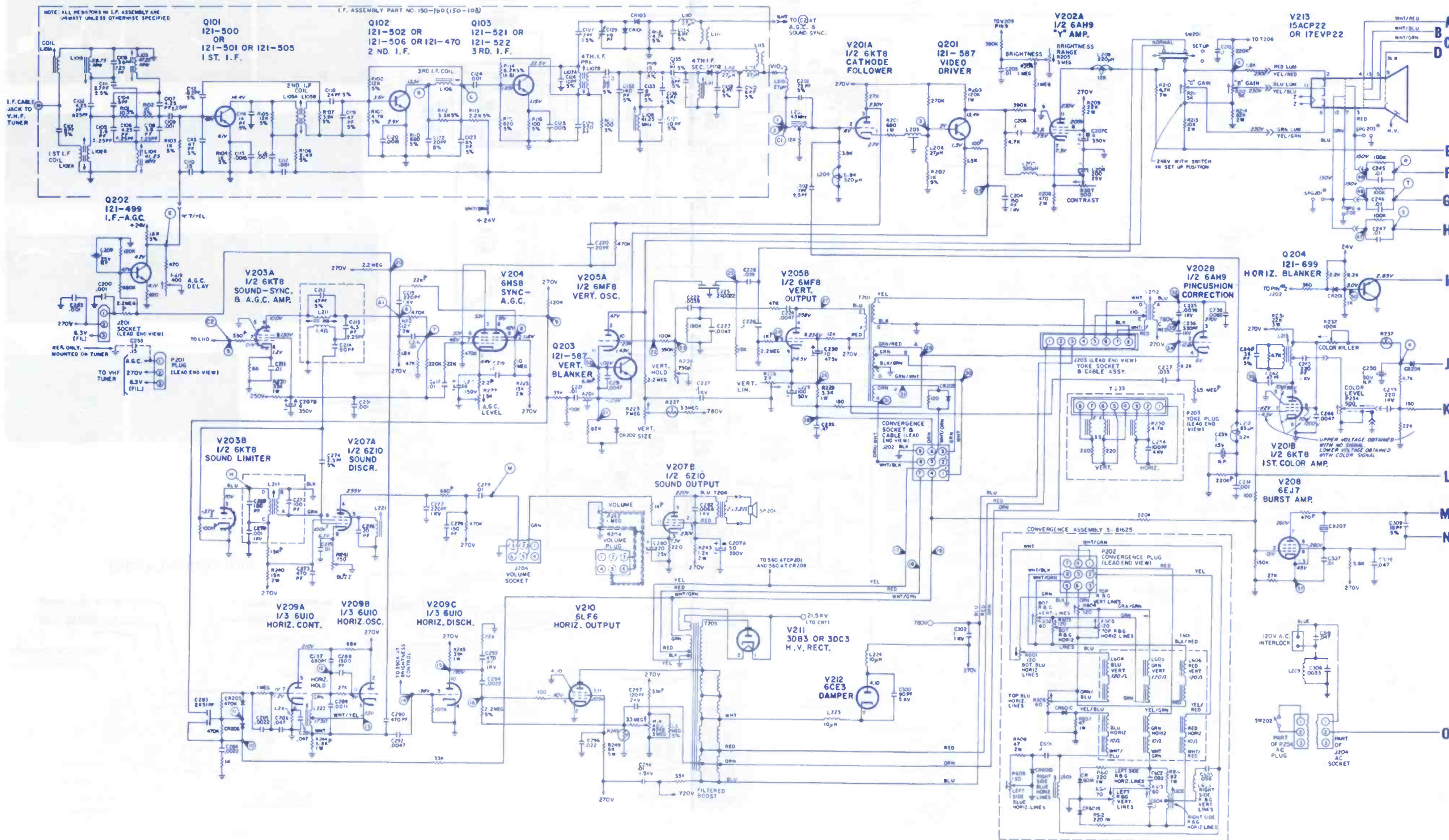
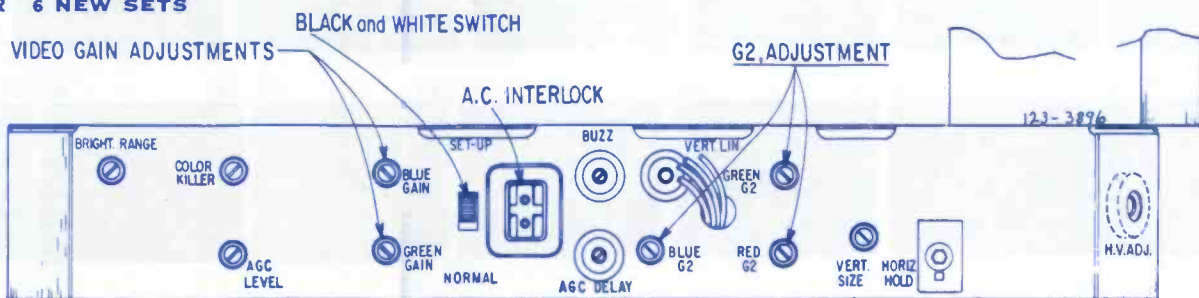
14 PW200-M
VERT. BLANKING PULSE
60V. P-P VERT. RATE



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NOTES:
RHOOD
ALL RESISTANCE VALUES ARE IN OHMS.
ALL CAPACITANCE VALUES LESS THAN 10 ARE IN UF, LOADS ABOVE ARE IN UUF, EXCEPT AS INDICATED.
ALL RESISTORS ARE 1/2 WATT, EXCEPT AS INDICATED.
* INDICATES 5%

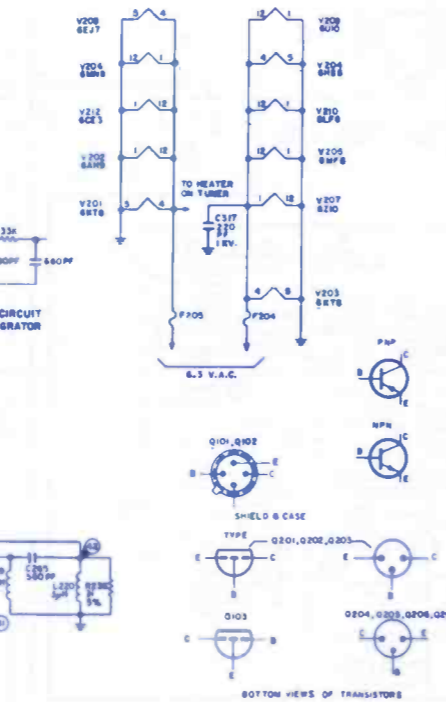
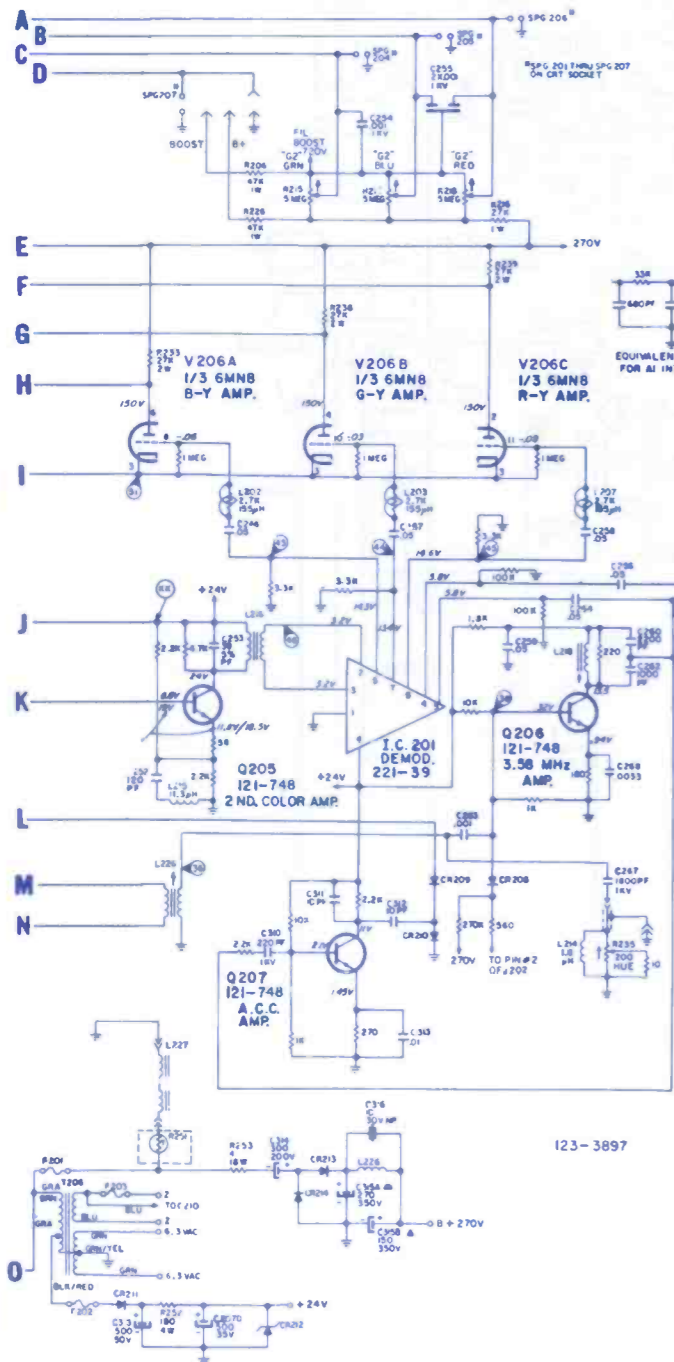
SYMBOL	DESCRIPTION	ZENITH PART NO.
C129	1-9 PF trimmer cap 500v	22-5478
C207A	50µf elect cap 350v	22-5714
C207B	4µf elect cap 350v	22-5714
C207C	4µf elect cap 350v	22-5714
C207D	500µf elect cap 35v	22-5714
C209	1µf elect cap NP 20% 25v	22-4909
C239	2µf elect cap NP 20% 15v	22-4902
C250	1µf elect cap NP 50v	22-3818
C297	12-pf disc cap 10% 2kv	22-5710
C315A	270µf elect cap 350v	11-5748
C315B	150µf elect cap 350v	22-5748
R204	1M bright control	63-7974
R205	3M bright range control	63-7977
R207	500Ω contrast control	63-7975
R211	5K gm gain control	63-6334
R215	5M G2 gm control	63-6976
R217	5M G2 blu control	63-6977
R219	400Ω AGC delay control	63-7982



ZENITH
Color TV Chassis 12A10C15

R222 - 5K AGC level control	83-7976
R224 - 750Ω vert hold control	83-7973
R225 - 7M vert size control	83-8433
R227 - thermistor	83-8824
R228 - 2K vert lin control	83-7983
R232 - 100K color killer control	83-7978
R234 - 500Ω color level control	83-7981
R235 - 200Ω hue control	83-7980
R237 - voltage dependent resistor	83-7143
R241 - 750Ω buzz control	83-8487
R242 - 1M volume control & ac switch	83-7979
R247 - voltage dependent resistor	83-7858
R248 - 3M high voltage control	83-7828
R249 - 6K resistor 10% 5w	83-5011
R251 - thermistor degausser	83-7156
L101A,B - 39.75MHz trap & link coil ass'y	20-1858
L104 - 41.25MHz input trap coil ass'y	20-1859
L108 - 41.25MHz trap coil ass'y	20-1857
L201 - 4.5MHz trap coil winding ass'y	S-77869

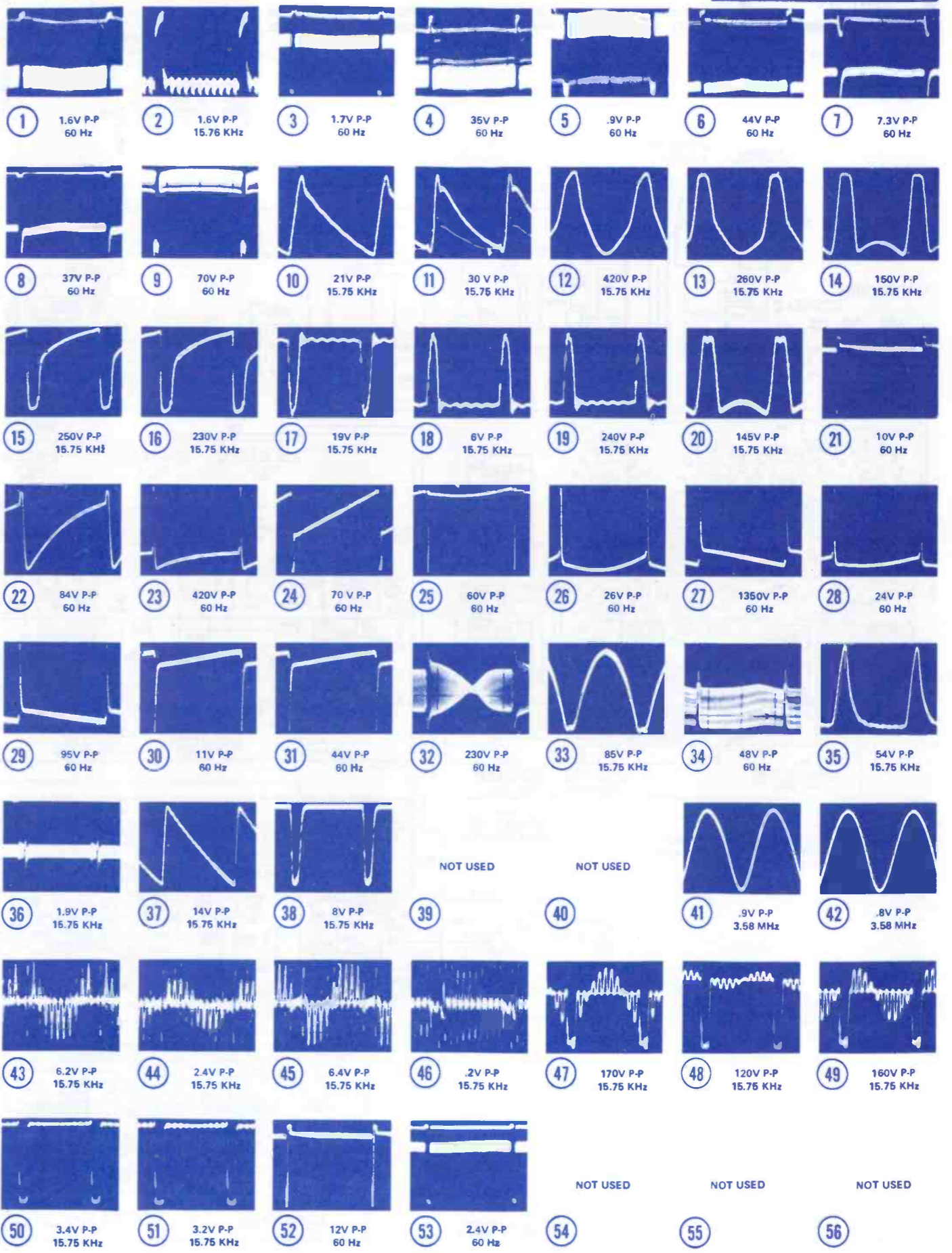
L205 - delay line winding ass'y	S-80475
L211 - sound take-off coil ass'y	S-77414
L216 - 2nd color amp plate coil	S-83210
L218 - collector coil ass'y	S-81327
L221 - quad coil ass'y	S-80411
L222 - horiz osc coil ass'y	S-77584
L223 - spook choke coil	20-2006
L228 - 3.58MHz burst amp plate coil winding ass'y	S-80791
L228 - filter choke	95-2890
T201 - vert opt xformer	95-2887
T202 - pincushion coil winding ass'y	S-77784
T203 - def yoke	95-2896
T204 - sound opt xformer	95-2888
T205 - horiz sweep xformer	S-81812
T206 - filament xformer	95-2691
A201 - integrator	87-7
F201 - 2a bel-fuse	136-86
F202 - .35a bel-fuse	136-76



NOTES:
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 GUNDS OF THE PICTURE TUBE DEPEND UPON THE HUE SETTING.
ACCURACY OF FINE TUNING IS IMPORTANT WHEN VIEWING WAVEFORMS. 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 MIN. PER VOLT HIGH VOLTAGE METER.
ARROWS ON POTENTIOMETERS INDICATE CLOCKWISE ROTATION.
⊕ INDICATES ALIGNMENT & TEST POINT.
PPF = PICOFARAD MHz = MEGAHERTZ = MEGACYCLE PER SECOND.
⊖ INDICATES ±20% MAY BE USED. ⊕ INDICATES VOLTAGE SOURCE
⊥ INDICATES CHASSIS GROUND. ⊕ INDICATES CONNECTORS

⊕ INDICATES WAVEFORM CHECK POINTS. (SEE WAVEFORM CHART)

TEST POINTS:
A1 SOUND - SYNC - A.G.C. AMP OUTPUT M SOUND OUTPUT
B SECOND I.R. COLLECTOR Q A.C.C. VOLTAGE
C1 PICTURE DETECTOR OUTPUT R R-Y GRID OF CRT
C2 SYNC SOUND DETECTOR OUTPUT S B-Y GRID OF CRT
E LF - A.G.C. T G-Y GRID OF CRT
G 3RD I.F. ALIGNMENT POINT
H SOUND LIMITER PLATE
K SHORT TEST POINTS
K1/K2 TO OPEN COLOR CHANNEL

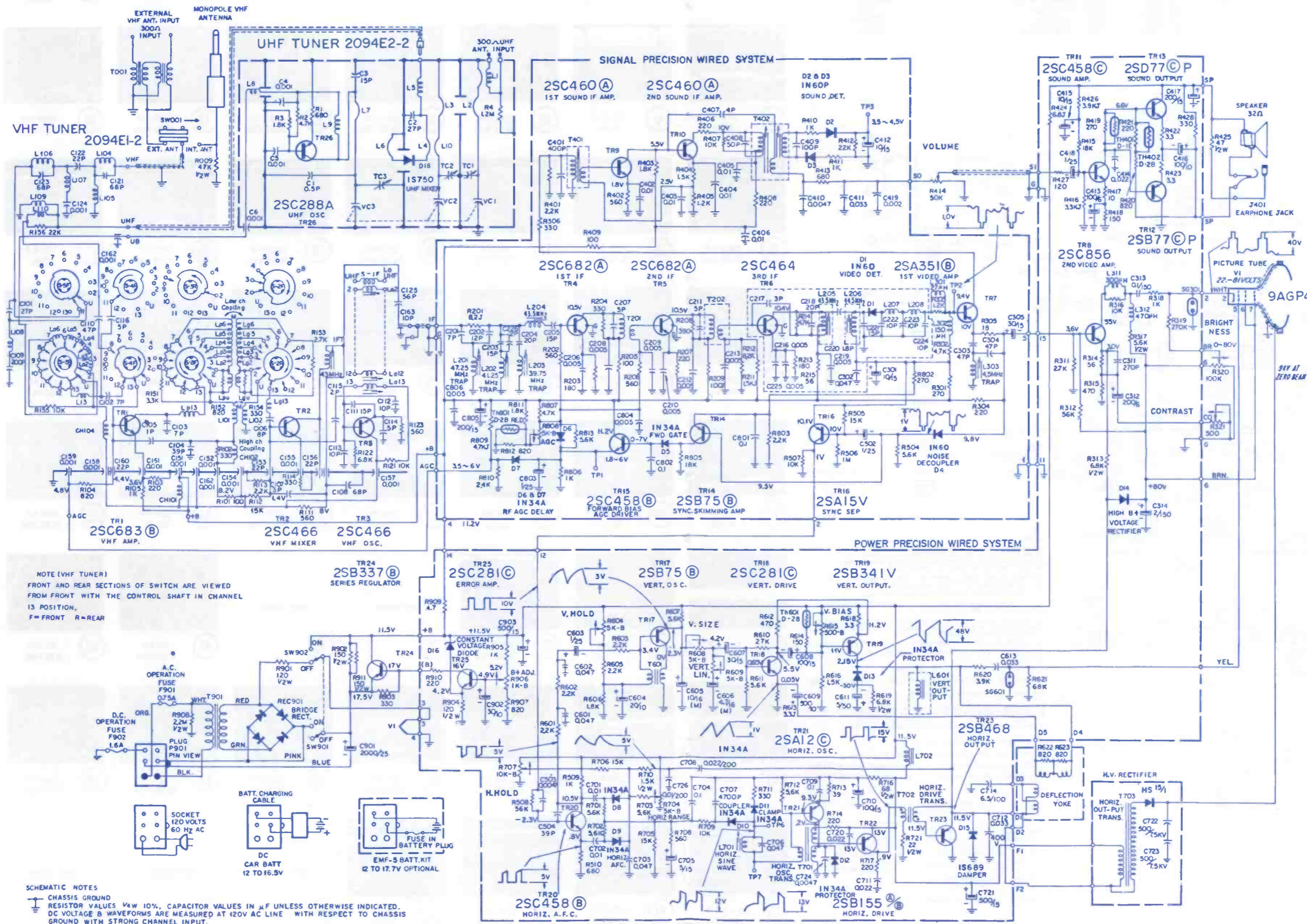


COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 6 NEW SETS

SYMBOL	DESCRIPTION	ADMIRAL PART NO.
R320	— 100K bright control	2075889-76
R321	— 500Ω contrast control	2075889-77
R414	— 50K volume control W/SW901,902	2075889-78
R422,R423	— 3.3Ω, 5%, 1/4w	2060857-11
R424	— 8.8Ω, 5%, 1/4w	60828-89
R604	— 5K vert hold control	2075889-74
R808	— 5K vert size control	2075889-75
R609	— 5K vert lin control	2075889-75
R615	— 500Ω vert bias control	2075889-73
R704	— 5K horiz	2075889-71
R707	— 10K horiz hold control	2075889-72
R808	— 5K AGC control	2075889-75
R806	— 1000Ω B plus control	2075889-70
R809	— 4.7Ω, 10%, 1/4w	60828-11

TH401	— thermistor	2061845-39
TH402	— thermistor	2061845-10
C416	— 100μf, 10v, elect	2067864-69
C809	— 500μf, 10v elect	2067864-80
C721	— 500μf, 15v elect	2067864-93
C722,C723	— 500pf, 7.5kv	20668112-154
L201	— 47.25MHz trap coil	2073872-69
L203	— 39.75MHz trap coil	2073872-67
L208	— filter coil	2073872-75
L303	— 4.5MHz trap coil	2073872-68
L311	— 300μh peak coil	2073872-72
L312	— 470μh peak coil	2073872-73
L601	— choke	2073872-77
L701	— horiz stability coil	2073872-76
T601	— vert osc xformer	2079A2-3

T701	— horiz osc xformer	2094A3-2
T702	— horiz drive xformer	2079A2-2
T703	— horiz output xformer	2079A2-4
T801	— power xformer	2080C1-9
	deflection yoke	2073A3-1
D1	— video det diode	93841-2
D4	— noise gate diode	93841-2
D5	— AGC coupling diode	93838-1
D12	— osc protector	93838-1
D13	— vert damper	93838-1
D14	— boost rectifier	2093841-32
F801	— .75a fuse	2084A1-2
F902	— 1.6a fuse	2084A1-1
	UHF tuner	2094E2-2
	VHF tuner	1094E1-2



NOTE (VHF TUNER)
FRONT AND REAR SECTIONS OF SWITCH ARE VIEWED FROM FRONT WITH THE CONTROL SHAFT IN CHANNEL IS POSITION.
F=FRONT R=REAR

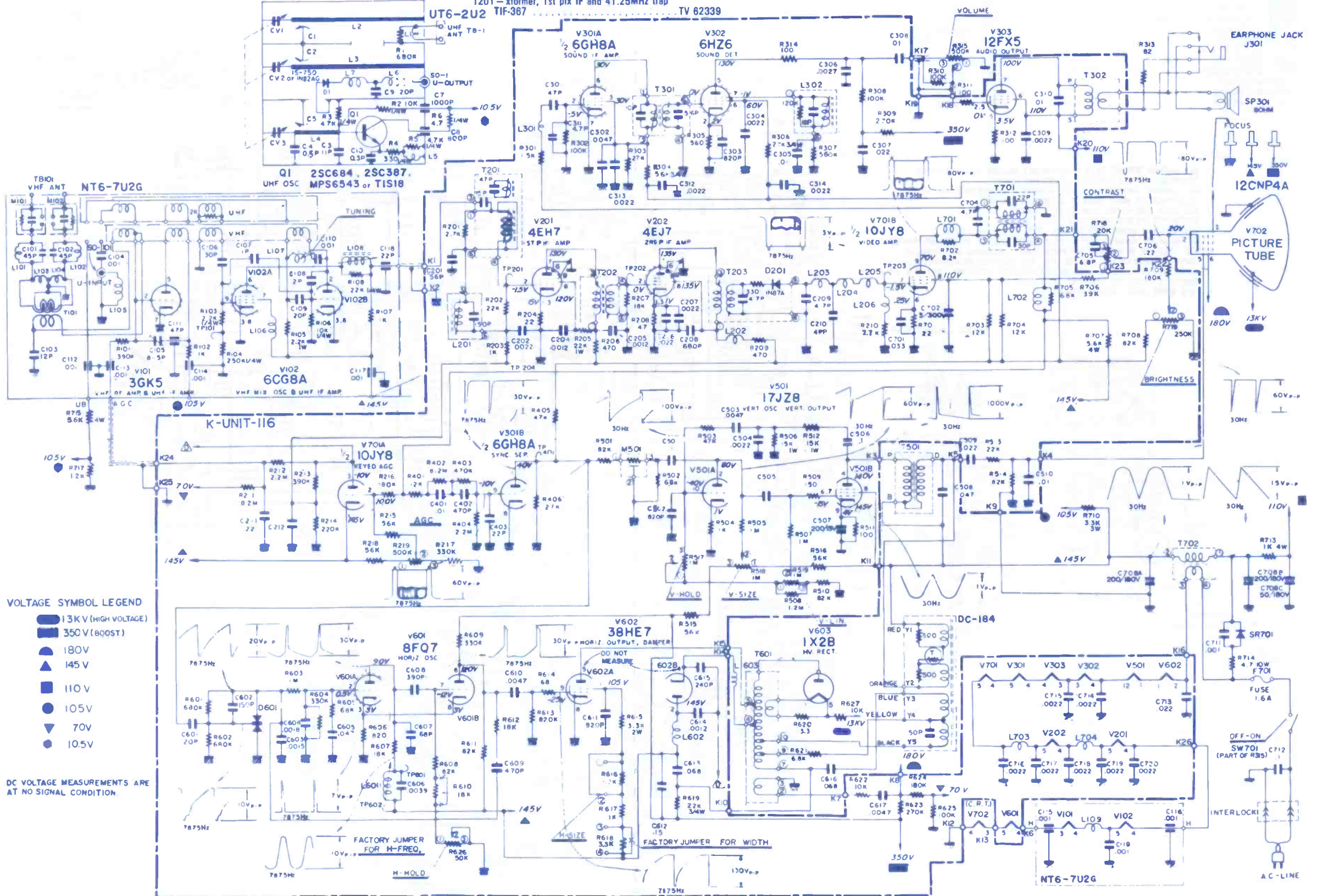
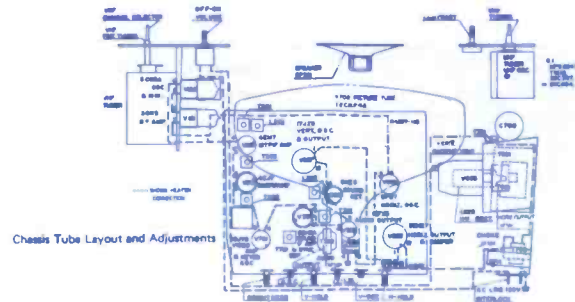
SCHEMATIC NOTES
CHASSIS GROUND
RESISTOR VALUES 1/4w 10%, CAPACITOR VALUES IN μF UNLESS OTHERWISE INDICATED.
DC VOLTAGE & WAVEFORMS ARE MEASURED AT 120V AC LINE WITH RESPECT TO CHASSIS GROUND WITH STRONG CHANNEL INPUT.

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 6 NEW SETS

SYMBOL DESCRIPTION AIRLINE PART NO.

R714 - 4.7Ω, 10w, 10%, resin	TV 2386
R715 - 5.8Ω, 4w, 10%, oxide film	TV 23272
R219 - 500K, pot., AGC (9V-120)	TV 25234
R315, SW701 - 500K, pot., on-off, volume w/switch (8V-020UL)	TV 25274
R517 - 1M, pot., vert hold (9V-117)	TV 25237
R518 - 1M, pot., vert size (9V-119)	TV 25238
R519 - 1M, pot., vert lin (9V-119)	TV 25238
R626 - 50K, pot., horiz hold (9V-182)	TV 25314
R718 - 20K, pot., contrast (8V-007)	TV 2572
R719 - 250K, pot., bright (9V-118)	TV 25239
L302 - coil, sound det (TIF-544)	TV 82254
L801 - coil, horiz hold (TL-23)	TV 61174
L703-L704 - coil, RF choke TL-803	TV 6191
T201 - xformer, 1st pix IF and 41.25MHz trap	TV 62339
T202 - xformer, 2nd pix IF TIF-379	TV 82340
T203 - xformer, pix det TL-99	TV 82290
T301 - xformer, sound IF TIF-378	TV 82341
T302 - xformer, audio output 7T-194	TV 11255
T501 - xformer, vert opt 8T-192	TV 11218
T601 - xformer, horiz opt 8T-668	TV 11256
T701 - xformer, sound IF & 4.5MHz trap	TV 82252
T2IF-491	TV 82252

T702 - xformer, power choke 9T-204	TV 11218
M501 - capacitor PRC-302	TV 3455
F701 - fuse, 1.6a	31501.8
printed circuit board, K-UNIT-116 complete assy	TV 98418
tuner, VHF NT6-7U2G	TV 35182
tuner, UHF UT6-2U2	TV 35148
yoke, deflection ass'y	TV 61477



VOLTAGE SYMBOL LEGEND

- 13KV (HIGH VOLTAGE)
- 350V (BOOST)
- 180V
- 145V
- 110V
- 105V
- 70V
- 10.5V

DC VOLTAGE MEASUREMENTS ARE AT NO SIGNAL CONDITION.

SYMBOL	DESCRIPTION	OLYMPIC PART NO.
VR101	500Ω variable, picture power	PTJ33383
VR102	500K variable, volume sw, power on-off	PTJ33382
VR103	1M variable, vert hold	PTJ33383
VR108	100K variable, bright	PTJ60110
VR104	1M, 500K & 500K variable	PTJ60111
VR105	vert height, vert lin	PTJ60111
VR107	horiz hold	PTJ60111
R101	5Ω, 10%, 10W	REJ33209
C103	250μf + 200μf + 50μf 200V	COJ33413
T101	speaker output	TRJ33387
T102	vert output	TRJ60103
T103	high voltage xformer	TRJ60106
T201	IF xformer A	CLJ33418

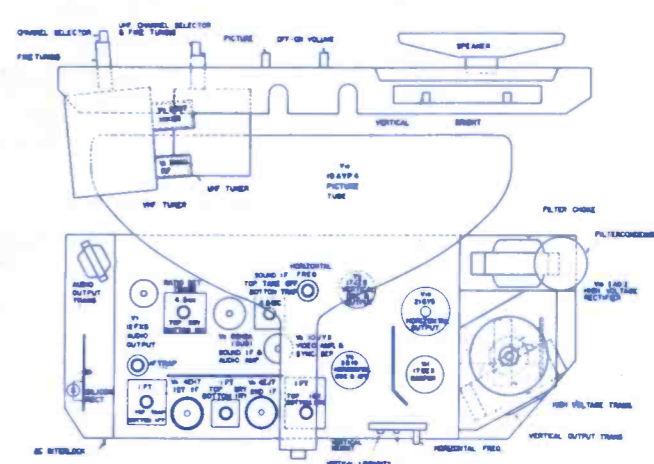
T202	IF xformer B	CLJ33418
T263	IF xformer C	CLJ33417
T204	sound IF xformer	TRJ33022
T205	ratio det	TRJ33241
L102	choke coil assy	CKJ33385
L201	choke coil	CKJ61291
L202	choke coil	CKJ61291
L203	inductor 47Ω	
L204	inductor 180Ω	
L205	inductor 330Ω	
L208	inductor 390Ω	
L207	choke coil	CKJ61290
L209	trap coil	CLJ61289
L210	inductor 5.6μh	
L301	AFC coil	CLJ33390

RESISTANCE MEASUREMENTS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9	Pin 10	Pin 11	Pin 12
V 1	3HA5	440KΩ	0Ω	0Ω	—	75KΩ	0Ω	0Ω	—	—	—	—	—
V 2	5GS7	11KΩ	75KΩ	0Ω	—	75KΩ	90KΩ	0Ω	200KΩ	—	—	—	—
V 3	4EH7	33Ω	150KΩ	33Ω	—	—	—	—	75KΩ	0Ω	—	—	—
V 4	4EJ7	68Ω	0Ω	68Ω	—	—	—	—	75KΩ	83KΩ	0Ω	—	—
V 5	10JY8	0Ω	1.8MΩ	130KΩ	—	—	—	—	840KΩ	75KΩ	78KΩ	—	—
V 6	6GH8A	150KΩ	2.5Ω	83KΩ	—	—	—	—	83KΩ	150Ω	2.2MΩ	—	—
V 7	12FX5	150Ω	500KΩ	—	—	400KΩ	75KΩ	75KΩ	—	—	—	—	—
V 8	8B10	—	1.2KΩ	900KΩ	83KΩ	180KΩ	150KΩ	1.2KΩ	700KΩ	300KΩ	40KΩ	0Ω	—
V 9	17JZ8	—	1.3KΩ	NC	75KΩ	NC	1.8MΩ	1.6MΩ	75KΩ	0Ω	1.3MΩ	—	—
V10	21GY5	—	NC	75KΩ	0Ω	950KΩ	NC	75KΩ	NC	950KΩ	0Ω	75KΩ	—
V11	17BE3	—	NC	NC	75KΩ	NC	NC	950KΩ	NC	NC	75KΩ	NC	—
V12	19AYP4	—	85KΩ	950KΩ	1MΩ	NC	85KΩ	—	—	—	—	—	—
V13	1AD2	—	—	—	—	—	—	—	—	—	—	—	—

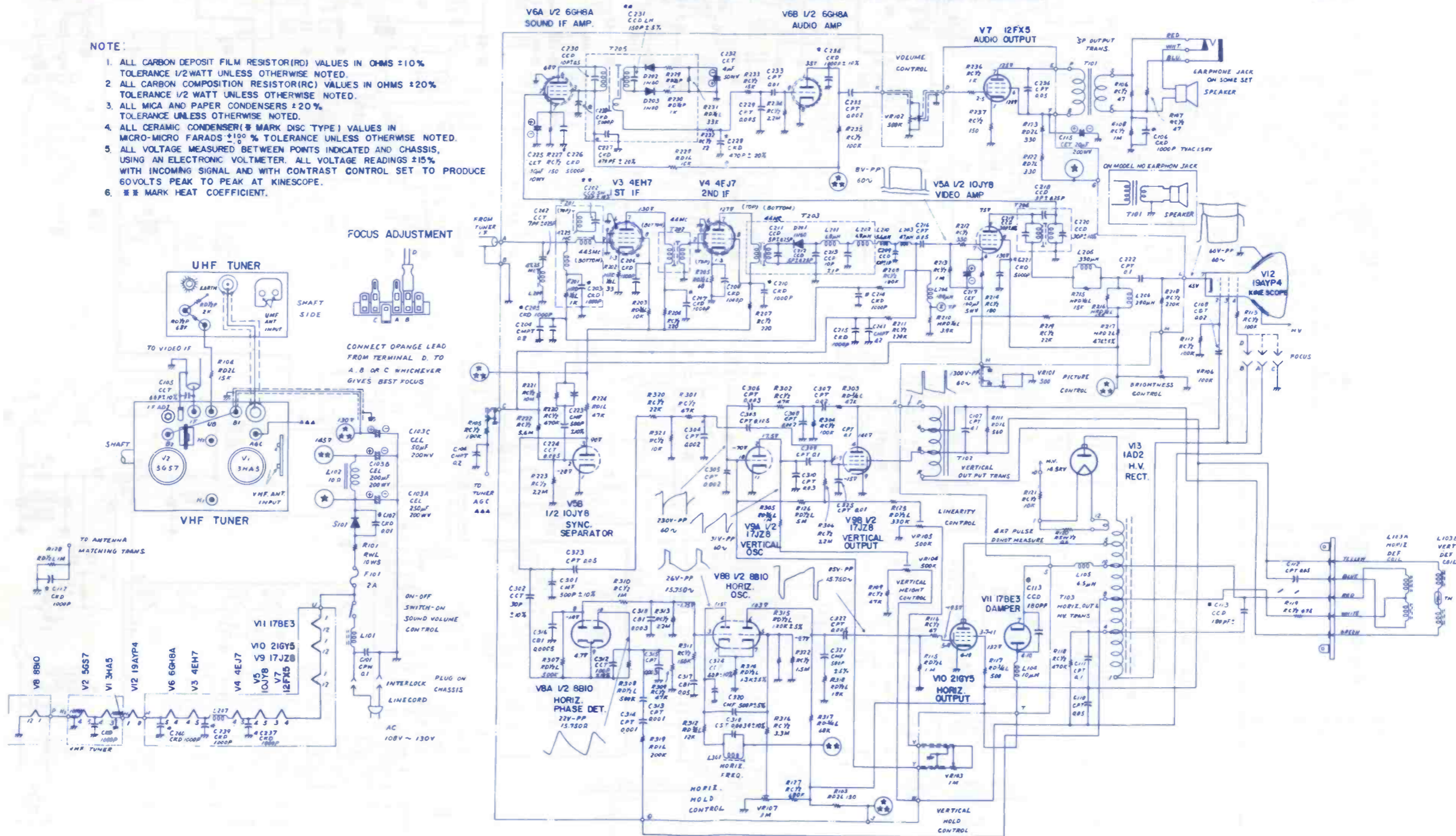
NC NO CONNECTION
 * 1 THIS READING WILL VARY DEPENDING UPON THE CONDITION OF PICTURE.
 * 2 THIS READING WILL VARY DEPENDING UPON THE CONDITION OF VOLUME.
 * 3 THIS READING WILL VARY DEPENDING UPON THE CONDITION OF VERTICAL HEIGHT.
 * 4 THIS READING WILL VARY DEPENDING UPON THE CONDITION OF VERTICAL LINEA.
 * 5 THIS READING WILL VARY DEPENDING UPON THE CONDITION OF VERTICAL HOLD.
 * 6 THIS READING WILL VARY DEPENDING UPON THE CONDITION OF BRIGHTNESS.

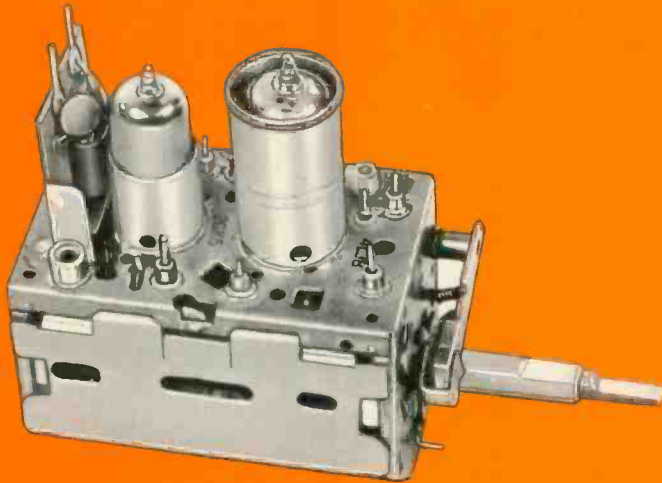
TUBE LAYOUT



NOTE:

- ALL CARBON DEPOSIT FILM RESISTOR(RD) VALUES IN OHMS ±10% TOLERANCE 1/2 WATT UNLESS OTHERWISE NOTED.
- ALL CARBON COMPOSITION RESISTOR(RC) VALUES IN OHMS ±20% TOLERANCE 1/2 WATT UNLESS OTHERWISE NOTED.
- ALL MICA AND PAPER CONDENSERS ±20% TOLERANCE UNLESS OTHERWISE NOTED.
- ALL CERAMIC CONDENSER (MARK DISC TYPE) VALUES IN MICRO-MICRO FARADS ±10% TOLERANCE UNLESS OTHERWISE NOTED.
- ALL VOLTAGE MEASURED BETWEEN POINTS INDICATED AND CHASSIS, USING AN ELECTRONIC VOLTMETER. ALL VOLTAGE READINGS ±15% WITH INCOMING SIGNAL AND WITH CONTRAST CONTROL SET TO PRODUCE 60VOLTS PEAK TO PEAK AT KINESCOPE.
- MARK HEAT COEFFICIENT.





\$975

TUNER SERVICE CORPORATION

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

TUNER REPAIR

VHF Or UHF Any Type \$9.75.

In this price all parts are included. Tubes are charged at cost.

24 hour service at our conveniently located service centers.

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

All tuners are cleaned inside and out, repaired, realigned and air tested.

TUNER REPLACEMENT

Replacement Tuner \$9.75.

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

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

Specify heater type

Parallel 6.3V
Series 450 mA
Series 600 mA

All shafts have the same length of 12".

Characteristics are:

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

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



TUNER SERVICE CORPORATION

FACTORY-SUPERVISED TUNER SERVICE

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Mallobin[®]. The smartest way to buy components . . . in this sturdy, stackable plastic case with partitioned drawers that keep parts where they belong. Indexed for instant access. Instant inventory.

The Mallobin you see here contains a popular assortment of our quality MTA capacitors. But that's just the beginning. We have others. There's one containing an assortment of 2-watt MOL resistors with ranges from 33 ohms to 56K ohms. Another contains MTV molded aluminum electrolytic capacitors with values from 750 mfd at 6

WVDC to 100 mfd at 50 WVDC. And there are many other cases which contain either GP, PVC, TT or TC capacitors. There are Mallobins for carbon and wirewound controls, too. Each with a wide range of popular values. The choice is yours.

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HUGH "SCOTTY" WALLACE

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ELECTRONIC TECHNICIAN / DEALER

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JANUARY 1970 • VOL. 91 NO. 1

49 TEKLAB REPORT

This month's study will cover the new Zenith color TV chassis 12A12C52, complete with circuit description and diagrams.

54 ROTATOR MAINTENANCE

Part two concludes this informative series with a practical breakdown of individual rotator systems and procedures for field adjustments.

63 TEST INSTRUMENT REVIEW

Part three and the conclusion of this timely, informative feature starts with FET testers and ends with a complete listing of test instrument manufacturers.

71 TWO-WAY RADIO ON THE GO

By Leo Sands. Part three of this series describes up-to-date servicing techniques for the modular and IC type circuits. Most of the information is devoted to practical testing and troubleshooting of special importance to communication technicians.

73 TESTLAB REPORT ON LECTROTECH'S MODEL TO-50

Our lab technicians evaluate Lectrotech's Model TO-50 solid state Oscilloscope/Vectorscope and the Weston Model 166 Instrument Calibrator.

22 EDITOR'S MEMO

26 NEW PRODUCTS

30 LETTERS TO THE EDITOR

40 TECHNICAL DIGEST

44 COLORFAX

83 DEALER SHOWCASE

85 CATALOGS AND BULLETINS

88 AD INDEX

COVER

This month's exciting cover shows a silicon ingot which is sliced to microscopic proportions and processed to form integrated (IC) circuits. The photo was furnished by Ed Rittershaus and Bill Preiss of Motorola, Semiconductor Products Division.

TEKFAX • 16 PAGES OF THE LATEST SCHEMATICS • Group 209

ADMIRAL: TV Chassis NA1-1A

AIRLINE: TV Model GEN-11160A

MAGNAVOX: Color TV Chassis T939

OLYMPIC: TV Models 9P44/9P45/9P46/9P54

RCA VICTOR: TV Chassis KCS178 Series

ZENITH: Color TV Chassis 12A10C15



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Rising Wages

As one well known comedian puts it, "And away we go!" Off on another year of things that will be generally rising—skirts, maybe, taxes probably and wages certainly—along with the cost of just plain "being."

A recent press release from the U.S. Department of Labor indicates that hour wage scales in the union building trades averaged \$5.67 on the first of October 1969. The Bureau of Labor Statistics survey of seven major building trades in 100 cities across the country also showed upward scale adjustments in one-fifth of the 700 bargaining units which were studied in the third quarter of 1969. These revisions, from negotiations or earlier agreements, averaged 35 cents an hour and ranged from less than 10 cents to more than \$1 an hour. Plumbers had the highest hourly scale at \$6.38 an hour. Other journeyman trades averaged from \$5.51 per hour for painters to \$6.26 per hour for electricians. The rest of the average rate levels as of October 1, 1969 look like this: Bricklayers, \$6.17. Carpenters, \$5.92. Plasterers, \$5.85. I guess we could all generally agree that these averages do not exactly reflect what a radio-TV service technician earns in a typical shop. In a comparison chart I received from a reader, shop-owner and member of a trade association, the average pay scales for technicians went like this: Black and white, and color technicians earned an average of \$4.50 in the field and \$5 for bench work in 1968. We haven't any available figures on the current averages, but from what we've been able to find out in talking to various service dealers, the average hasn't gone up much, if any. If anyone has any later figures or statistics, I'm sure our readers would be happy to hear of them. One thing is for sure—we can't all be plumbers.



Paul Kowalski

ELECTRONIC TECHNICIAN/DEALER

**Experience:
the invisible
ingredient.**



With all the fancy names and gimmick claims, it's tough to weed through brand after brand of aerosol products today and really know which one is best.

One very important guideline is experience.

GC has been supplying chemical products for about forty years — aerosols, tubes, bottles, drums — a size and formula for every need.

And we are manufacturers and fillers — not just selling agencies.

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**GC CHEMICALS
THE ONLY AEROSOL CHEMICAL LINE
THAT GIVES YOU EVERYTHING**



Look for our new **Extra Dry Super Freeze Mist**. Cools circuits three times faster than standard coolers... leaves no liquid residue... absolutely non-toxic and odor free... specifically designed to locate problem capacitors, transistors and oxidized joints by instantly cooling components. Cat. No. 10-702... 15-oz. Aerosol Can

NUVI-TRAN TUNER CLEANER
For Critical Nuvistor and Transistor Circuitry. The non-toxic, non-drift, non-conductive cleaner, specifically formulated for sensitive nuvistors and transistor tuners. Cat. No. 5555... 8-oz. Aerosol Can

ACTION
The Silicone-Based Tuner Cleaner at a new low price. Fast-acting cleaner, completely safe for plastics; silicone base provides long-lasting protection against dirt and corrosion. Cat. No. 99-06... 6-oz. Aerosol Can

SPRA-LUBE
Cleaner-Lubricant for Color TV Tuners. The non-drift cleaner and lubricant, for color TV tuners. Safely cleans away dirt, dust and oxidation. Uses NASA approved solvents. Cat. No. 8888... 8-oz. Aerosol Can.

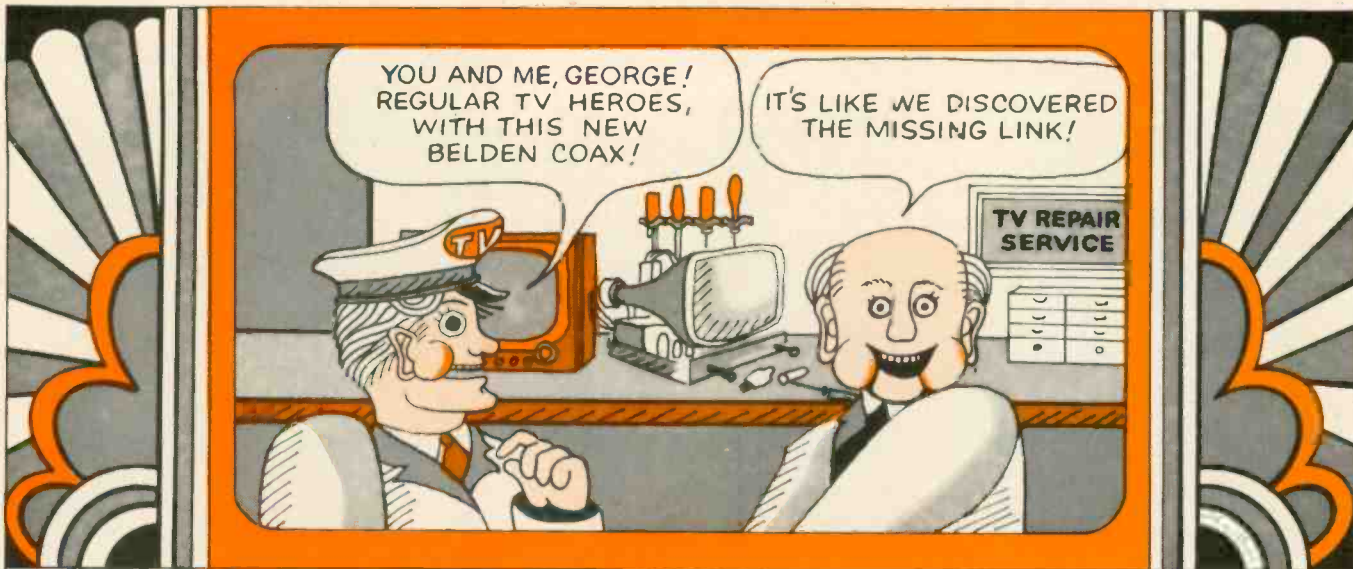
Send for your free catalog. Write to . . .



GC ELECTRONICS
400 SO. WYMAN ST., ROCKFORD, ILL. 61101
A DIVISION OF HYDROMETALS, INC



... for more details circle 117 on Reader Service Card



Jacket

Black all-weather PVC .030 nominal wall with a .242" nominal O.D.

Dielectric

Low loss cellular polyethylene, .180" nominal O.D.

Conductor

18 AWG solid, annealed, bare copper.

8228 BELDEN DUOFOIL

Drain Wires

4-28 AWG solid tinned copperweld conductors applied spirally and positioned uniformly around the circumference of the shield.

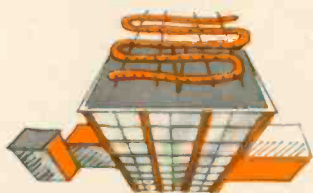
Shield

Belden DUOFOIL 100% shield is a polyester film with aluminum lamination on both outside surfaces.

THE MISSING LINK TO PERFECT VHF AND UHF COLOR AND B/W RECEPTION

BELDEN 8228 DUOFOIL®

75 OHM COAXIAL CABLE • 100% SHIELDED • 100% SWEEP TESTED



For MATV distribution systems, DUOFOIL is the finest coax yet. Its low loss, 100% shielding keeps B/W and color VHF and UHF signals pure. Apartment dwellers, hotel and motel tenants, etc.—even in congested areas—get sharp, clear reception. Its small diameter provides extra space savings in conduit installations.



Is CATV coming into your area? DUOFOIL is the perfect underground drop cable. Its exceptional flexibility and moisture resistance assures extra-long service life, and preserves the impedance values of the cable design.

LOW, LOW ATTENUATION

Nom. Attenuation per 100'	
mc	db
50	1.5
100	2.1
200	3.1
300	3.8
400	4.5
500	5.0
600	5.5
700	6.0
800	6.5
900	6.9

Available in 100, 500 and 1000 ft. spools. See your local Belden Distributor for full details or to order. For a copy of the reprint article, "Electronic Cable," write: Belden Corporation, P.O. Box 5070-A, Chicago, Illinois 60680.

Don't forget to ask them what else needs fixing?



8-5-8



Perfect fit: Econoline Van custom-designed to your job.

CUSTOM-DESIGN YOUR VAN

Your job may call for a one-of-its-kind van. You can get it in an Econoline, and all from one place—from your Ford Dealer.

Sound impossible? Not for the man with better ideas. Your Ford Dealer can custom-design the Econoline's interior into *your* kind of efficient working space, and it comes to you *ready for work*.

WIDE CHOICE OF MODULAR UNITS

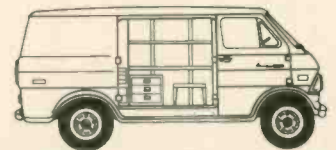
Econoline modular units (like those shown above) are the answer. Components include: racks, adjustable shelf units, drawer units, cabinets, bins (both padded and plain), padded trays, tote trays, hanging baskets, book compartments, storage boxes, partitions, padded siderails, padded floor, equipment holders, ladder racks, and many more.

These are not just parts and pieces, but a system of Econoline-engineered units designed to fit and work together. Constructed of heavy gauge steel with gray enamel finish, they bolt to floor and/or body pillars to become permanent yet movable parts of the van. Traveling showcase or workshop—you name it and it's yours with the Ford Econoline.

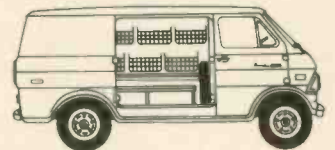
BETTER IDEAS EASE YOUR WORK

However you design your van, you have all of Econoline's basic better ideas going for you. Convenient outside front service center for quick-checking engine and related parts. Driver "walk-through" for easy access to the load compartment. More clear floorspace by 23% than any other van. Wide 5½-ft. stance for stability, yet a sharp 40-ft. turning diameter for maneuverability. And, of course, exclusive Twin-I-Beam independent front suspension for great durability, easy handling, low maintenance, long tire life.

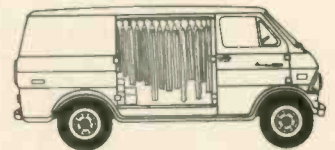
Because it is the one-of-its-kind van, you see more and more Econolines on all kinds of jobs. See how much more an Econoline Van can do for you—see your Ford Dealer.



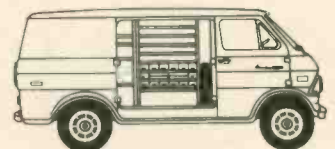
Radio, TV, Appliance Repair



General Utility



Laundry and Dry Cleaning



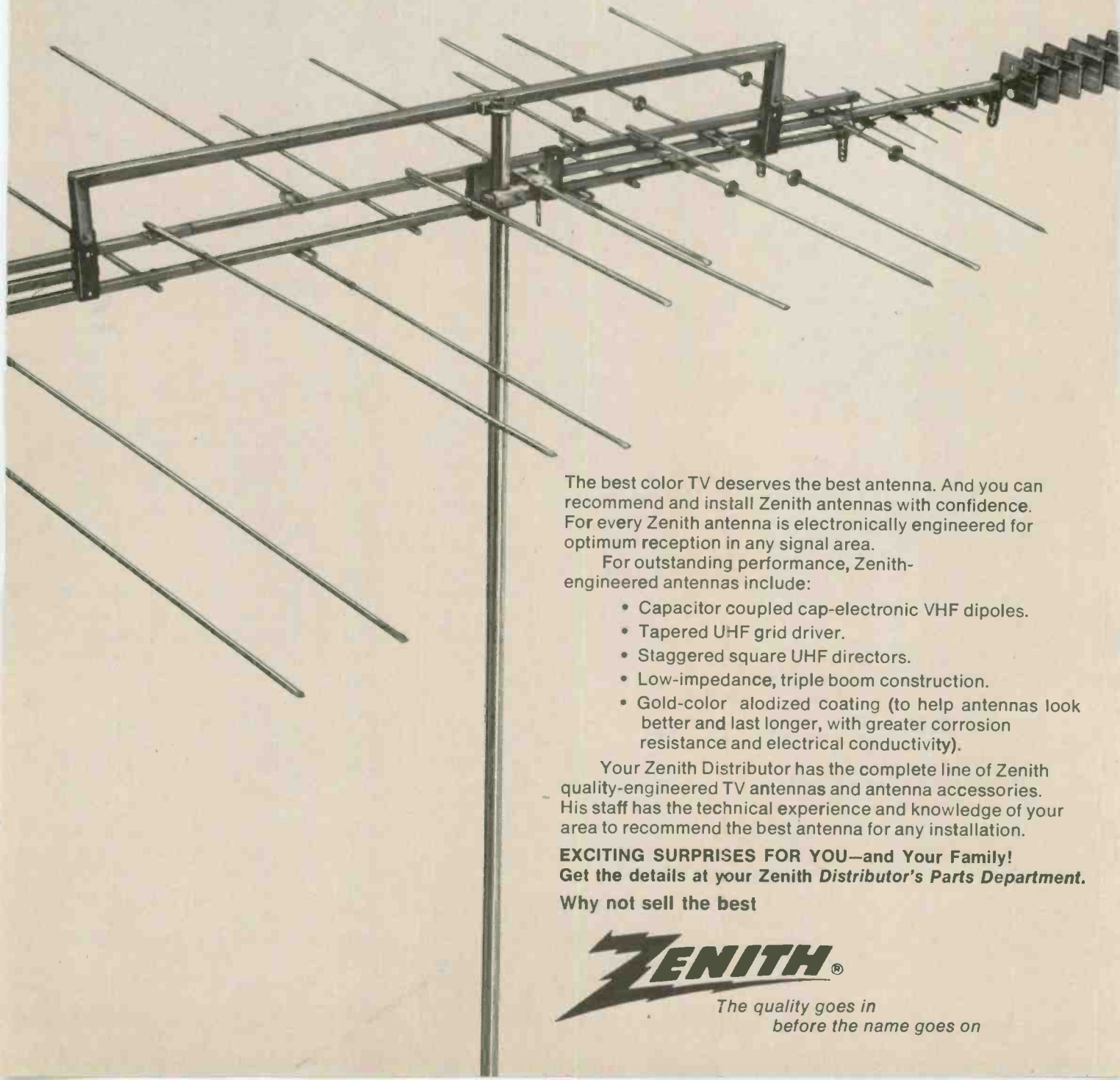
Vending Repair

FORD ECONOLINE VANS



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



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

For outstanding performance, Zenith-engineered antennas include:

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

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

EXCITING SURPRISES FOR YOU—and Your Family!
Get the details at your Zenith *Distributor's Parts Department.*

Why not sell the best

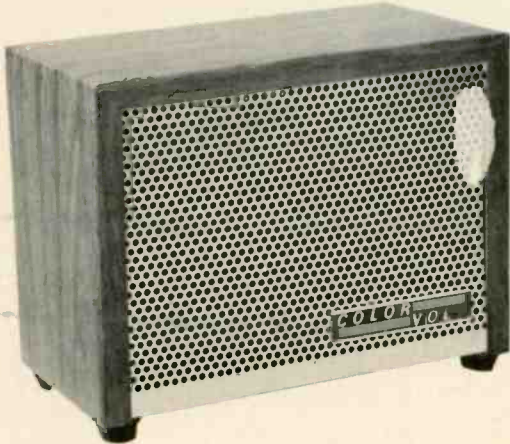
ZENITH[®]

*The quality goes in
before the name goes on*

VOLTAGE REGULATOR 700

Provides steady voltage despite momentary line voltage variations

A television voltage regulator designed to eliminate variations in color TV picture quality is introduced. Called the Colorvolt, the device will reportedly provide steady voltage to the TV set despite momentary voltage fluctuations. In addition, the unit will add life to the television set, because it will prevent damage to components caused by such fluctuations. The user merely plugs the unit into an electrical outlet, then plugs the television power cord into the Colorvolt. Voltage control is automatic and constant; picture values are not distorted; voltage is controlled before it reaches the set's circuitry. Suggested retail price is about \$60. Sola.



**FOR MORE
NEW PRODUCTS SEE
PAGES 83 & 84**

**VHF RADIO 701**

Automatically scans eight VHF channels

Automatic monitoring on any combination of eight VHF channels is the feature of the newly introduced Monitoradio/Scanner. Push-button program control enables the operator to monitor his choice of crystal-controlled channels in the 148-174MHz band. Readout lights for each frequency show the process of the receiver's search for a transmitted signal. Upon finding an active signal, the radio locks on and receives the message. At end of transmission, the search for a return, or other signal, resumes immediately and automatically. Programming is accomplished by activating push buttons for any combination of the eight channels. This feature enables an operator to hear both sides of duplex or simulcast base/mobile networks. It also enables insertion of the 162.55MHz continuous carrier weather frequency crystal in the spectrum. The scanning device allows the monitor to hear a multitude of police, fire, civil defense, radio telephone and marine signals that would normally be missed on manually operated, crystal-controlled or tunable receivers. Plug-in crystals for any frequency within the band are readily available and easily installed. The radio is designed for $1/2\mu\text{v}$ sensitivity; 50dB at 15kHz selectivity and produces 5w of audio output at 1kHz. Rate of scan is measured at .05sec per channel. Designated Model TMR 8, the transistor receiver is delivered complete with built-in speaker and universal power supply cords for both 12vdc and 117vac operation. A removable telescope antenna and mobile mounting bracket are standard equipment. Standard auto antenna jack and external speaker terminals are located on the rear panel and the front panel contains a push button for automatic or manual operation as well as a push button for each of the eight channels. The entire package measures $2\frac{1}{4} \times 5\frac{1}{2} \times 7\frac{1}{2}$ in. List price is \$139. Regency.

More than 5 million two-way transmitters have skyrocketed the demand for service men and field, system, and R & D engineers. Topnotch licensed experts can earn \$12,000 a year or more. You can be your own boss, build your own company. And you don't need a college education to break in.

HOW WOULD YOU LIKE to earn \$5 to \$7 an hour... \$200 to \$300 a week... \$10,000 to \$15,000 a year? One of your best chances today, especially if you don't have a college education, is in the field of two-way radio.

Two-way radio is booming. Today there are more than five million two-way transmitters for police cars, fire trucks, taxis, planes, etc. and Citizen's Band uses—and the number is growing at the rate of 80,000 per month.

This wildfire boom presents a solid gold opportunity for trained two-way radio service experts. Most of them are earning between \$5,000 and \$10,000 a year more than the average radio-TV repair man.

Why You'll Earn Top Pay

The reason is that the U.S. doesn't permit anyone to service two-way radio systems unless he is licensed by the FCC (Federal Communications Commission). And there aren't enough licensed experts to go around.

This means that the available licensed expert can "write his own ticket" when it comes to earnings. Some work by the hour and usually charge at least \$5.00 per hour, \$7.50 on evenings and Sundays, plus travel expenses. Others charge each customer a monthly retainer fee, such as \$20 a month for a base station and \$7.50 for each mobile station. A survey showed that one man can easily

maintain at least 15 base stations and 85 mobiles. This would add up to at least \$12,000 a year.

How to Get Started

How do you break into the ranks of the big-money earners in two-way radio? This is probably the best way:

1. Without quitting your present job, learn enough about electronics fundamentals to pass the Government FCC License. Then get a job in a two-way radio service shop and "learn the ropes" of the business.

2. As soon as you've earned a reputation as an expert, there are several ways you can go. You can move out, and start signing up your own customers. You might become a franchised service representative of a big manufacturer and then start getting into two-way radio sales, where one sales contract might net you \$5,000. Or you may be invited to move up into a high-prestige salaried job with one of the same manufacturers.

The first step—mastering the fundamentals of Electronics in your spare time and getting your FCC License—can be easier than you think.

Cleveland Institute of Electronics has been successfully teaching Electronics by mail for over thirty years. Right at home, in your spare time, you learn Electronics step by step. Our AUTO-PROGRAMMED® lessons and coaching by expert instructors make everything clear and easy, even for men who thought they were "poor learners."

Your FCC License... or Your Money Back!

By the time you've finished your CIE course, you'll be able to pass the FCC License Exam with ease. Better than nine out of ten CIE graduates are able to pass the FCC Exam, even though two out of three non-CIE men fail. This startling record of achievement makes possible our famous FCC License Warranty: you'll pass the FCC Exam upon completion of your course or your tuition will be refunded in full.

Find out more. Mail the bound-in post-paid card for two FREE books, "How To Succeed In Electronics" and "How To Get A Commercial FCC License." If card has been detached, use coupon below.

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CIE Cleveland Institute of Electronics

1776 East 17th Street, Cleveland, Ohio 44114

Please send me without cost or obligation:

1. Your 44-page book "How To Succeed In Electronics" describing the job opportunities in Electronics today, and how your courses can prepare me for them.
2. Your book on "How To Get A Commercial FCC License."

Name _____ Age _____

(PLEASE PRINT)

Address _____

City _____ State _____ Zip _____

Accredited Member National Home Study Council ET-55

How to get into one of today's hottest money-making fields—servicing 2-way radios!



He's flying high. Before he got his CIE training and FCC License, Ed Dulaney's only professional skill was as a commercial pilot engaged in crop dusting. Today he has his own two-way radio company, with seven full-time employees. "I am much better off financially, and really enjoy my work," he says. "I found my electronics lessons thorough and easy to understand. The CIE course was the best investment I ever made."



Business is booming. August Gibbemeyer was in radio-TV repair work before studying with CIE. Now, he says, "we are in the marine and two-way radio business. Our trade has grown by leaps and bounds."

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FAST

COMPLETE SERVICE ON ALL MAKES OF TV TUNERS

Maximum Time In Shop 24 Hrs.

(90 Day Warranty)

(WE SHIP C.O.D.)
YOU PAY SHIPPING
\$9.95



Black &
White
or Color

VHF or
UHF

UV Combo's \$16.50

Price includes all labor and parts except Tubes, Diodes & Transistors. If combo tuner needs only one unit repaired, disassemble and ship only defective unit. Otherwise there will be a charge for a combo tuner. When sending tuners for repair, remove mounting brackets, knobs, indicator dials, remote fine tuning arrangements and remote control drive units.

All tuners must have remote control units and/or mounting brackets removed before tuner can be cleaned and repaired. Please remove these accessories before shipping, as we will not be responsible for loss or damage.



All tuners are serviced by **FACTORY TRAINED TECHNICIANS** with years of experience in this specialized field. All tuners are **ALIGNED TO MANUFACTURER'S SPECIFICATION** on crystal controlled equipment and air checked on monitor before shipping to assure that tuner is operating properly.

GEM CITY TUNER REPAIR SERVICE

Box 6D Dabel Station
2631 Mardon Drive
Dayton, Ohio 45420

ET/D

LETTERS TO THE EDITOR

A Friend in Need

I'd like to thank Standard TV Company of St. Louis and Mr. W. E. Holtkamp, Sr., of Beaumont, Texas for information on the Candle TV Model MT-510.

A friend of mine needs information on a Philco Electronic Circuit Master VTVM Model 7001.

I'm passing on to him a subscription blank from **ELECTRONIC TECHNICIAN/DEALER**, also. His address is: Frank E. Comstock, 4922 Crawford St., Oxon Hill, Md. 20021.

Thanks again for all your help and all the fine people who take the time and trouble to pass along information.

E.J. CORS

170 Hylton Ave.
Woodbridge, Va. 22191

Readers' Aid

I have picked up a Meissmen Analyst and I would like to know if one of your readers has a monaural and operating instructions for it. I would be glad to pay a reasonable price for them.

C.T. LANG

826 Hillcrest Ave.
Council Bluffs, Iowa 51501

I have recently subscribed to your magazine and find it to be quite rewarding.

Having exhausted all other sources of information without any luck, I thought that one of your readers could help me with my problem. I need a schematic for a Paco-Push-Pull Oscilloscope, Model S-50. I've been told that the company has been out of business for quite a while and no local suppliers carry their schematics. Any assistance with this will be greatly appreciated. I will be glad to defray the cost of any reader who can loan or sell me the schematic.

DENNIS CHOLEZ

965-A San Pedro Avenue
Morgan Hill, Calif. 95037

I need operational instructions and schematics for the following Superior Instruments Company test equip-

ment: A multi-meter (volt-ohm-amp-capacitor), Model 670-A and a CRT tube tester, Model TV40. I will gladly defray the associated cost if one of your readers can supply me with the above information.

DORSEY D. CROSS

Route 3, Box 114D
Denison, Texas 75020

Could an **ELECTRONIC TECHNICIAN/DEALER** reader help me on the following unit? I have a portable tape recorder made in Japan and sold by Martel here in L.A. I wrote the company for a schematic but, no luck. The serial number has been wiped off. The chassis number is E-610.

DOYLE JONES

20105 Runnymede
Canoga Park, Calif. 91306

I would appreciate it if one of your readers could supply me the schematics for the Supro Thunderbird bass guitar amplifier, Model No. S-6420, or the address of the manufacturer. I have the name Valco Guitars, Inc.,

It costs only



New Easy Dispenser Pak 60/40 18 S.W.G.*

1/100 of 1¢ more



Latest PC (Printed Circuit) Pak
60/40 Extra Thin 22 S.W.G.—.028"*

per solder joint to know you are using the world's finest cored solder

* Each only 59¢ per package at your dealer.

ERSIN



FIVE-CORE
SOLDER

MULTICORE SALES CORP., WESTBURY, N.Y. 11590

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Do you choose capacitors
the same way
Fran French and Lew Russell do?

Then you're sure to pick
Sprague Twist-Lok[®] Capacitors when
you need twist-prong electrolytics.

Fran French and Lew Russell keep everything humming smoothly at Delaware Valley TV Service, Philadelphia, Pa. Fran, as Gen. Mgr., and Lew, as Shop Mgr., have had a lot to do with building this 13-man organization's reputation as specialists in color TV. With 20 years' TV servicing experience apiece, Fran and Lew agree about many things. One is twist-prong electrolytics. Both prefer Sprague Twist-Lok Capacitors for reliability and availability.



Ask your Sprague distributor for a copy of Sprague's
Electrolytic Capacitor Replacement Manual K-109 or write to:
Sprague Products Company, 65 Marshall St., North Adams, Mass. 01247.

**P.S. You can increase your business 7½% by participating
in EIA's "What else needs fixing?" program. Ask your
distributor or write to us for details.**

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



TECH

SPRAY THE CHEMISTS THAT BROUGHT YOU

**BLUE STUFF
FOR TUNERS**

&

BLUE SHOWER

NOW BRING
YOU . . .

BLUE FROST
INSTANT WINTER IN A CAN

A TOTALLY NEW CONCEPT
IN CHILLING SPRAYS

Not just an intermittent locator, BLUE FROST has all kinds of new uses as well . . . Need to see if a unit will perform in cold weather? Put the unit into a box and flood the box with BLUE FROST using the special large nozzle and extension . . . Need to fit two snug fitting metal parts together? Shrink the one that goes on the inside by chilling it with BLUE FROST using the exclusive large head and extension . . .



This "Two-gun Troubleshooter" comes with two "guns" . . . two sprayhead and extension combinations . . . one, regular size for ordinary intermittent locating and the one extra large oversize head and nozzle for flooding chassis to re-create wintertime conditions.

Packed in two sizes—20 ounces for the bench (4 ounces more than ordinary large size chilling sprays) and a handy 8 ounce can for your caddy. 20 ounce can No. 1660-20S just \$3.24 8 ounce can No. 1660-8S just \$1.99

Special introductory offer . . . Purchase the large 20 ounce can and get an 8 ounce can FREE. Use the 8 ounce can and if not delighted return the unused 20 ounce can for a full refund.

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ET/D

LETTERS
TO THE EDITOR

but need the rest of the address. Any help will be appreciated.

EARLE ARNOLD

16 Narragansett Ave.
Jamestown, R.I. 02835

We have a citizen band transceiver manufactured by Alltone. It's a model SS-1 Space Spanner. We cannot locate the manufacturer or distributor to obtain a schematic. We would appreciate it if you could put this in your Letters to the Editor column. If there is any cost involved we would gladly defray it. Your fine magazine is a great help to us and we look forward to it every month.

R. FETZER

22 Monaco Ave.
Elmont, L.I., N.Y. 11003

About six months ago I bought a Simpson tube tester, Model 555 and wrote to Simpson for a new roll chart assembly and new chart. I received a reply that Simpson no longer stocks parts for this tester. Perhaps one of your readers would know where I can get one. Your magazine is one of the best electronics publications for the technician.

BRUCE RITTENHOUSE

5469 Casper
Detroit, Mich. 48210

I would like to buy a schematic and Instruction Manual for an electronic voltmeter-ohmmeter made by Electronic Designs, Model 100.

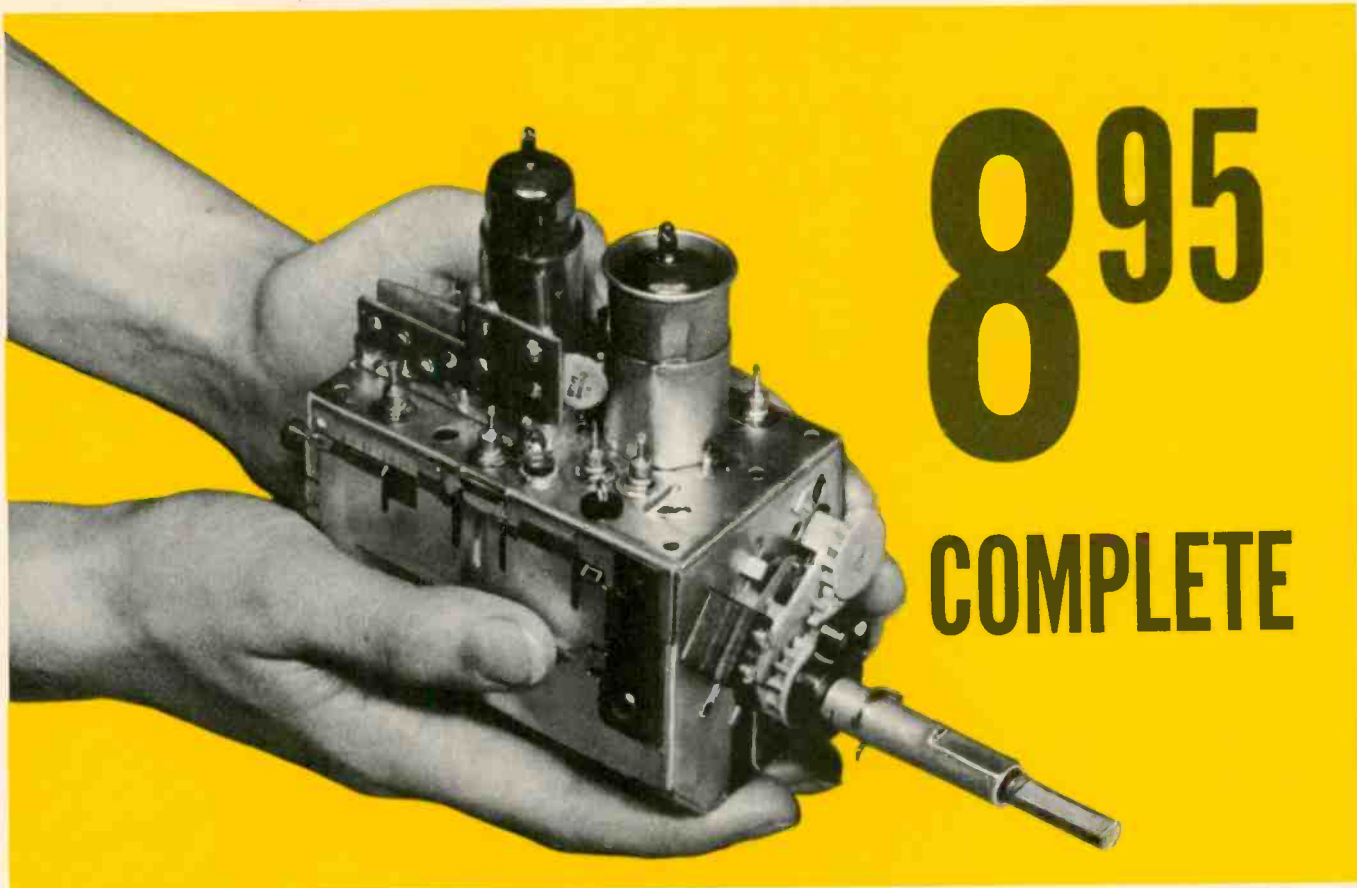
OLAN R. FELIPE

2008 N. Humboldt
Chicago, Ill. 60647

Finney Promotes Better Service Techs

Your excellent editorial in reference to the extreme importance of increasing active membership in NATESA and NEA has been brought to my attention. May I congratulate you on the excellent material that you presented. And I am sure that your effort will be of material assistance

ELECTRONIC TECHNICIAN/DEALER



895 COMPLETE

Castle, the pioneer of television tuner overhauling, offers the following services to solve ALL your television tuner problems.

● **OVERHAUL SERVICE** — All makes and models.
(1960, or later)

- VHF or UHF tuner \$9.95
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- TRANSISTOR tuner \$9.95
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(Guaranteed color alignment . . . no additional charge)

Overhaul includes parts, except tubes and transistors.

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

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

And remember—for over a decade Castle has been the leader in this specialized field . . . your assurance of the best in TV tuner overhauling.

Remove ALL accessories, or dismantling charge will apply.

● **CUSTOM REPLACEMENTS**

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

● **UNIVERSAL REPLACEMENTS**

Prefer to do it yourself?

Castle universal replacement tuners are available with the following specifications.

STOCK No.	HEATERS	SHAFT		I.F. OUTPUT		PRICE
		Min.*	Max.*	Snd.	Pic.	
CR6P	Parallel 6.3v	1¾"	3"	41.25	45.75	8.95
CR7S	Series 600mA	1¾"	3"	41.25	45.75	9.50
CR9S	Series 450mA	1¾"	3"	41.25	45.75	9.50
CR6XL	Parallel 6.3v	2½"	12"	41.25	45.75	10.45
CR7XL	Series 600mA	2½"	12"	41.25	45.75	11.00
CR9XL	Series 450mA	2½"	12"	41.25	45.75	11.00

*Selector shaft length measured from tuner front apron to extreme tip of shaft.

These Castle replacement tuners are all equipped with memory fine tuning, UHF position with plug input for UHF tuner, rear shaft extension and switch for remote control motor drive . . . they come complete with hardware and component kit to adapt for use in thousands of popular TV receivers.

Order universal replacements out of Main Plant (Chicago) only.



CASTLE TV TUNER SERVICE, INC.

MAIN PLANT: 5713 N. Western Ave., Chicago, Illinois 60645

EAST: 41-92 Vernon Blvd., Long Island City, N.Y. 11101

. . . for more details circle 107 on Reader Service Card

in this important project.

Possibly you do or do not know that our company (FINCO Antennas) has given both NATESA and NEA a strong, friendly challenge and objective this year.

We have offered beautiful award-winning plaques for the most successful district, local chapter and individual in each of these outstanding or-

ganizations for the most successful accomplishment in obtaining new membership. We have supported this "plaque award" with an offer to each organization of a check for one thousand dollars (\$1000) to be contributed to their treasury, if they obtain during this current year ending with their National Convention next year...one thousand (1000) new members. The offer, of course, is completely individual and by that we mean the offer of the plaques plus the \$1000 award applies to either or both applies to either or both associations. It is our sincere hope that both NATESA and NEA will qualify for their award.

We are hopeful that other liberal and interested national manufacturers will join us in this project by possibly adding funds to the "Accomplishment Award." In any event, The Finney Company is dedicated to the success, welfare and security of both NATESA and NEA (individually and collectively). We feel that the service industry is of vital importance to the manufacturers in the electronics industry and to the wholesale distributors in the electronics industry. We feel that it is through the efficient-aggressive execution of technical service in the field, that electronic products and their producers can be assured of product service and product reputation in the hands of the ultimate user.

Thus, I extend to you the hand of friendship and congratulations on helping the service technician.

MORRIS L. FINNEBURGH, E.H.F.
Chairman of the Board

The Finney Company
Bedford, Ohio

Likes CAT Game

I want to comment on the CAT game which appeared in the October 1969 issue of ELECTRONIC TECHNICIAN/DEALER. This was really a good quiz. I was pleased with the article and certainly wish you would prepare more like it in the near future.

BRIENO LAROCHE

ET/D BOOK REVIEWS

CB RADIO OPERATOR'S GUIDE
by Bob Brown & Paul Lawrence, published by TAB Books, Inc., 224 pages. Hardbound, \$6.95; softbound, \$3.95.

This book does a very acceptable job of letting the CB radio user in on the facts of citizens band two-way communications. It gives everything the reader wants to know and should know to get and keep his license. It also provides advice on what equipment to purchase and how to get the best out of it along with some pointers on antenna systems. There are 10 chapters in the book covering such subjects as installation, optimizing your station, troubleshooting, CB and public service and providing emergency assistance. The appendix includes the FCC rules, Canadian rules, a listing of the Class D channels and frequencies as well as those available for Part 15 walkie talkie operation.



Beauty Is MORE Than Skin Deep Here

So beautifully finished they could occupy a position of pride in a jeweler's window. But, for all their eye appeal, these Channellock Little Champ pliers aren't decorator pieces. They're down-to-earth worksavers on hundreds of delicate jobs that need firm treatment. . . . in short, the finest precision pliers you can buy.

We don't ask that you take our word for it. We merely suggest you tell your dealer you want to see and try Channellock Little Champ pliers. We'll wager it will be a case of love at first sight. You can get the whole pedigree on Little Champs—and their equally fine big cousins—in our catalog. Let us send you a copy, no charge.

TOOLS BY
CHAN NEL LOCK
MEADVILLE, PA.

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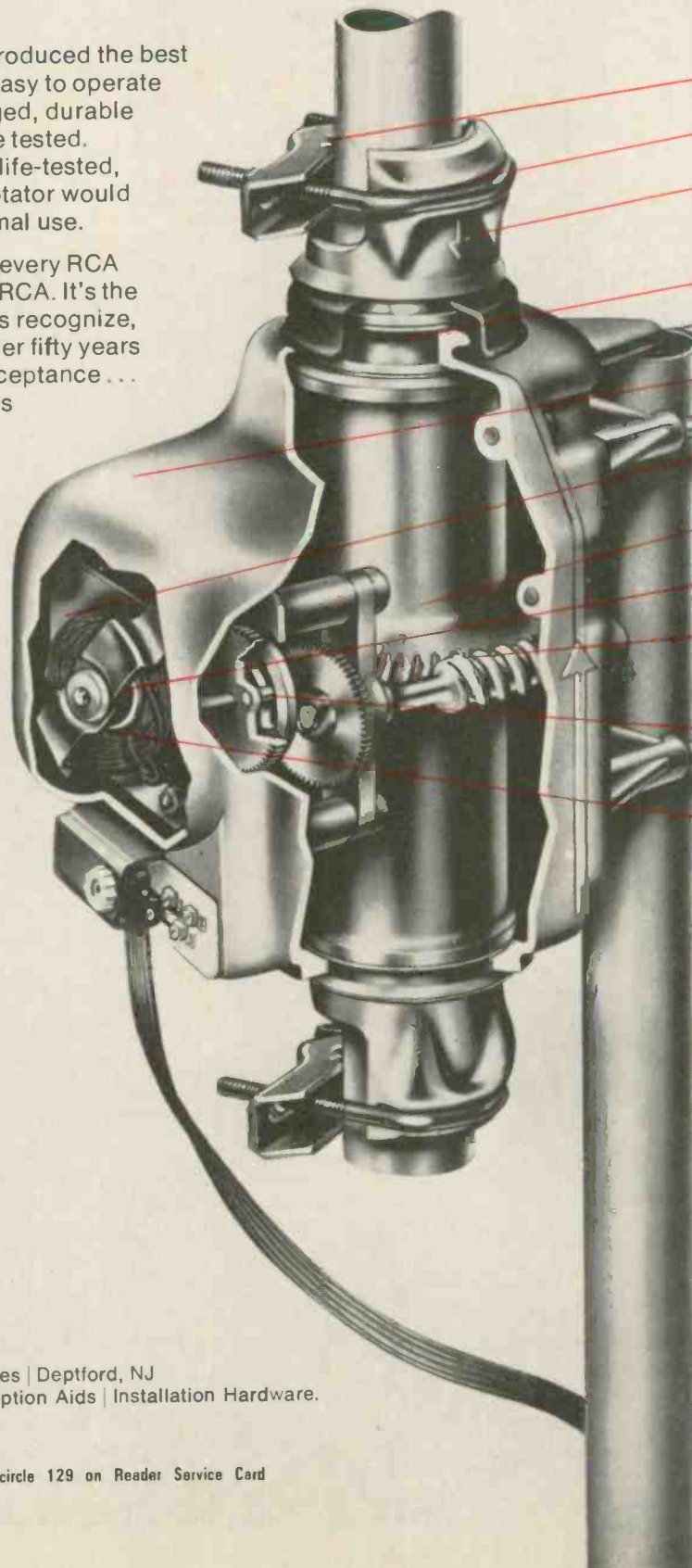
The RCA rotator has many features your customers won't understand. It has one that everyone recognizes: the name, RCA.

RCA engineers have produced the best in rotators. Beautiful, easy to operate control cabinets. Rugged, durable drive units. And they're tested. Continuous operation life-tested, under conditions no rotator would ever encounter in normal use.

The "extra feature" in every RCA rotator is the name . . . RCA. It's the feature your customers recognize, rely upon. It's taken over fifty years to build this kind of acceptance . . . acceptance that means more sales for you.

RCA

Rotators



V-block serrated clamping system locks mast securely.

Reinforced shaft has nested "U" bolt.

Center-position alignment markers speed installation.

Stainless steel bearings are permanently lubricated. No external thrust bearings required.

High-tensile aluminum housing is rugged, lightweight for less inertial loading on mast.

High-temperature insulation on motor allows continuous operation.

Main drive gear is cast integral to main shaft; can't loosen.

Positive disc brake on motor prevents "overshoot."

Positive worm drive prevents windmilling.

Overtravel clutch permits motor to run before load is engaged—for pre-turning momentum.

High-efficiency motor consumes less power; less voltage drop over long cable runs.



Model 10W707

The RCA fully automatic Rotator has solid state circuitry for positive synchronization. Positive directional indicator lights. Silent operation.



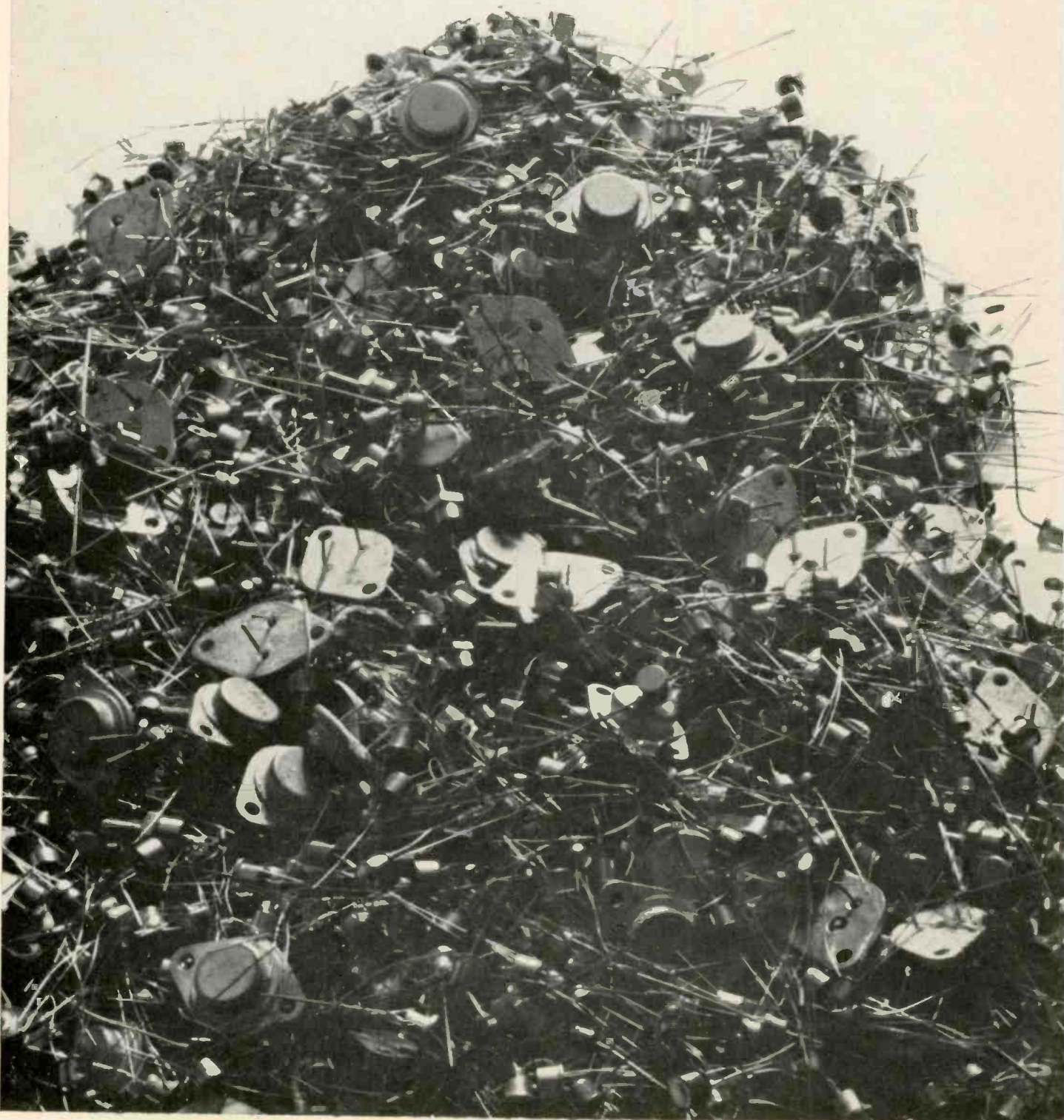
Model 10W505

The RCA positive push-button fingertip control Rotator with 360° indicator dial. Unique design assures precise control with few moving parts. RCA performance and quality at a modest price!

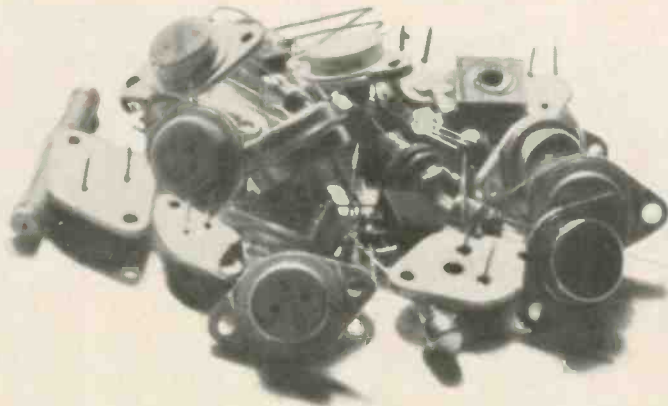
RCA | Parts and Accessories | Deptford, NJ
Rotators | Antennas | Reception Aids | Installation Hardware.

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**This is 30,000
solid state replacement parts.**



So is this.



It used to be if you wanted to satisfy everyone, you had to stock over 30,000 different solid state replacement parts.

Well, everyone realized that was ridiculous. So some enterprising people came up with a bunch of universal replacements.

Then you only had to stock about eleven or twelve hundred.

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So two years ago (when we went into this business), we figured out how to replace all 30,000 with only 60.

Now all you have to do is stock 60 of our diodes, transistors, integrated circuits, etc., and you can replace any of the 30,000 parts now in use. Including

all JEDEC types, manufacturers' part numbers, and foreign designs.

That means you invest less money.

You don't tie up valuable space.

You do away with complicated inventory control.

And you operate more efficiently.

To make life even easier, we've got a new book that gives you all the cross references you need to figure out which part replaces which.

It's available from your Sylvania distributor.

If the whole thing sounds rather incredible, you're right. But why not give your distributor a call and let him narrow the incredibility gap.

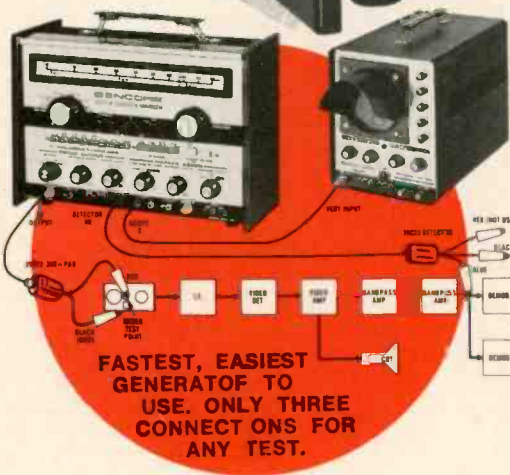
SYLVANIA
GENERAL TELEPHONE & ELECTRONICS

The only complete SWEEP & MARKER GENERATOR

\$395.00 (Lowest price going on a complete crystal controlled generator and marker combination)

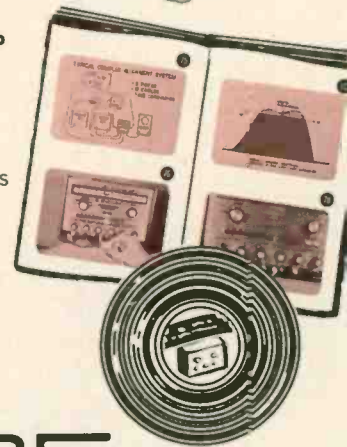


ALL SOLID STATE-INSTANT ON



FREE WITH YOUR SWEEP AND MARKER:

80 full color reproductions direct from Sencore technical training film clearly depicts alignment from beginning to end using SM152. Pictures are numbered so you can review a section at a time if you are in trouble. 35 minute LP record direct from film clearly leads you all the way. Also packed with each SM152. Numbers are announced for each picture so you can review a section when necessary.



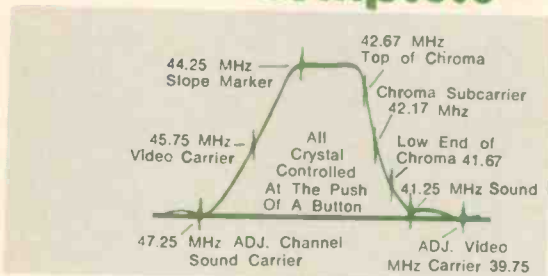
SENCORE

NO. 1 MANUFACTURER OF ELECTRONIC MAINTENANCE EQUIPMENT

426 SOUTH WESTGATE DRIVE, ADDISON, ILLINOIS 60101

ONLY GENERATOR THAT GIVES YOU A COMPLETE IF, CHROMA, ALL CHANNEL VHF, UHF AND FM ALIGNMENT SIGNALS IN ONE UNIT

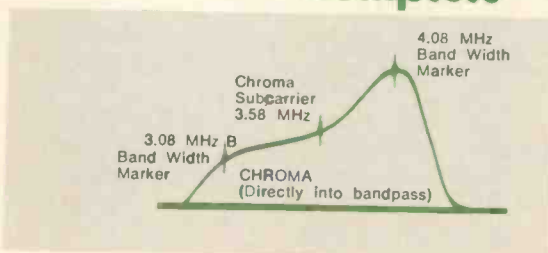
complete IF SWEEP AND CRYSTAL CONTROLLED MARKERS



View the complete IF response curve with full 15 MHz sweep width (competition has only 12 MHz, restricting view on RF and some solid state receivers that have extra traps). Press one or all of the crystal controlled marker push buttons without upsetting response curve. Post injection is used all the way to prevent overloading the TV receiver. Crystal markers are provided for all critical check points as shown on the response curve. Also sweeps 20 MHz IFs as found on older sets and new import color sets. Major competition does not cover these frequencies. Special spot align position converts the sweep generator to a regular signal generator for spot alignment or dipping odd traps. Only Sencore goes all the way.

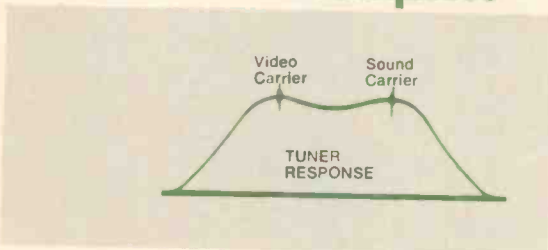
Note that Sencore has a base line giving you a reference to zero. Competitive models do not.

complete CHROMA SWEEP AND CRYSTAL CONTROLLED CHROMA MARKERS



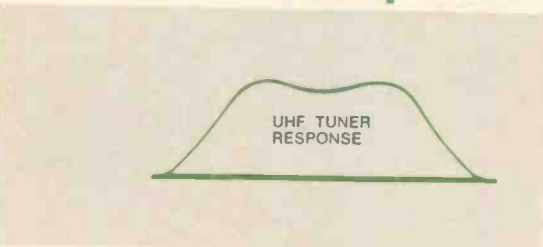
You can inject the chroma signal directly into the chroma amplifiers as shown here or through the IF amplifiers for a flat response. You are equipped to follow manufacturer's recommendation either way. Injection directly into the chroma amplifiers is a must for fast trouble shooting of color circuits.

complete ALIGNMENT SIGNALS FOR VHF TUNER OR OVERALL ALIGNMENT



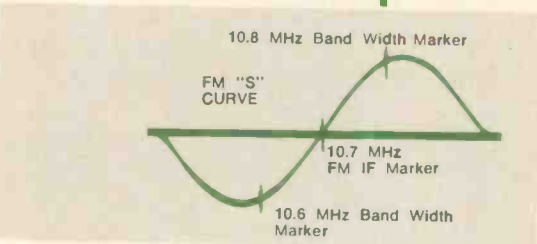
The SM152 sweeps all of the VHF channels for complete tuner check from channel 2 through 13. Competitive models sweep only two VHF channels. Push button markers are provided for channels 4, 5, 10 and 13 for both the video carrier and the sound carrier. The second low and high channels are available in case you have a station operating on the same channel . . . which will cause the patterns to be upset. You want to align on an unused channel and check it on the channel in operation for best results. Only Sencore goes all the way.

complete UHF SWEEP FROM CHANNEL 14 THROUGH 82



After completely aligning a TV set, you'll want a complete check on the UHF tuner to be sure that it is operating on all channels. Markers aren't necessary as you just view the RF or over-all curve to see that the curve looks the same as the VHF and output remains reasonably constant. Only Sencore has UHF output; all new tuners are required to cover all UHF channels and you will come up short if you own any other alignment generator than the SM152. A UHF sweep generally costs hundreds of dollars more.

complete FM SWEEP AND CRYSTAL CONTROLLED MARKERS



You won't be stopped with just TV alignment. You can align the IF amplifiers of the FM receivers with the 10.7 MHz crystal for maximum as indicated in service manuals. Then, throw on the scope and sweep the amplifiers and view the "S" curve if you have stereo. Two markers, 100 KHz above and below the 10.7 MHz mark the limits of the curve for good stereo. You can align the front end of the receiver too. Competitive units cover only the IFs and you find the job only half done.

There are other features too numerous to mention that makes the Sencore SM152 the most complete sweep and marker generator on the market. Ultra linear sweep from 10 MHz to 920 MHz, exclusive calibrated sweep width that is constant on all channels

and RF calibrated output for circuit trouble shooting are only a few of the things that places the SM152 in a class by itself. Dare compare and you'll see your distributor today for a good look at the SM152.

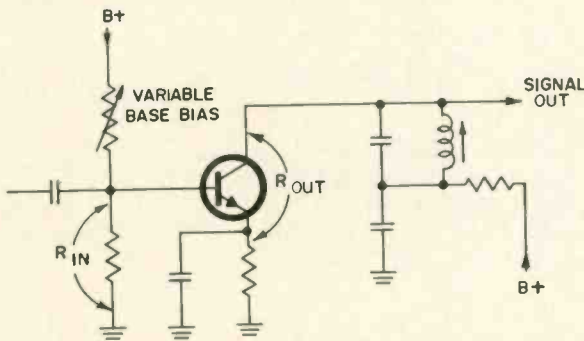
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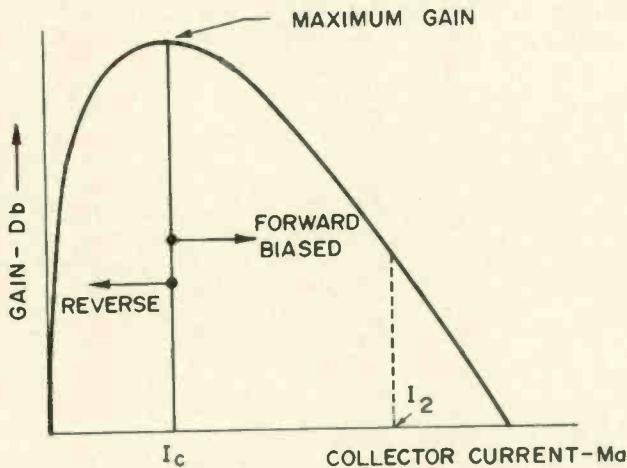
RCA VICTOR

Color TV Chassis CTC38/CTC40—Gain Control of Transistor Stages

RCA solid-state television chassis employ variable gain stages to regulate the amplitude of particular signals in the automatic chroma control circuit and the 1st and 2nd IF stages.



A gain change is effected by varying the operating point (bias) of the transistor to be controlled. The transistors used in variable gain stages are especially chosen for a characteristic whereby the gain is a function of the collector-emitter current. The transistor characteristic curve shown illustrates that a stage using this type transistor will exhibit maximum gain at one particular value of collector current (I_c). On both sides of this maximum point, the gain



diminishes, resulting in two modes of gain control—forward bias and reverse bias. Both of these systems of gain control are commonly used; the final choice is dependent upon other design considerations.

The basic difference between a forward bias and a reverse bias gain control system is that the collector current of the amplifier stage in the forward bias mode is made to increase for a reduction of gain, and collector current is made to decrease in a reverse bias system.

To understand the forward bias system it is first necessary to examine the transistor amplifier stage when it is at maximum gain. Under these conditions, the stage is designed to furnish a good impedance match to the transistor at its input and output terminals (R_{in} and R_{out}), and

the operating current (I_c) is chosen to yield the highest gain. If the base bias of the transistor is increased, the collector current will increase, to a new level I_2 . The dotted line represents the new value of collector current (I_2), and is accompanied by a substantial gain reduction.

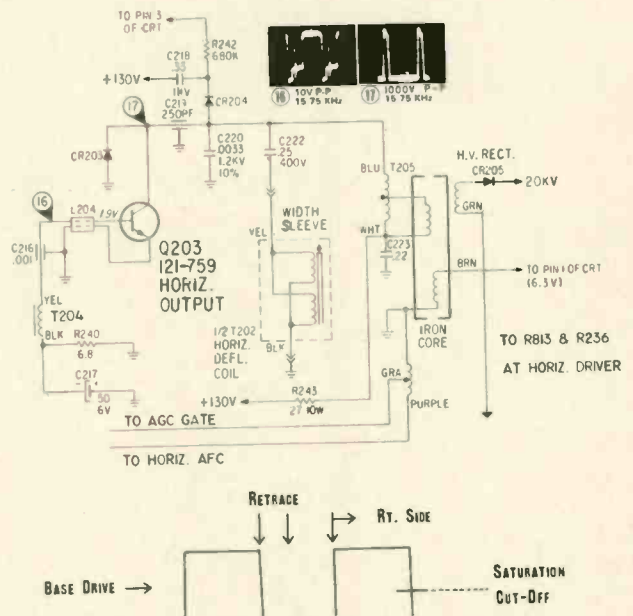
The cause of gain reduction is twofold: First, the internal gain of the transistor is lowered, and secondly, the input and output impedances (R_{in} and R_{out}) have been reduced thereby introducing mismatch of insertion loss.

The forward bias control system is often used because the forward bias gain characteristic is more linear than the reverse current section of the curve. This does not mean however, that the reverse characteristics are undesirable. In fact many times it is advantageous to use the reverse bias system. When the nonlinearity of gain vs collector current is overcome by proper design, an advantage can be realized, in that gain reduction may be accomplished with a substantially smaller collector current change. This often results in simpler circuitry.

ZENITH

TV Chassis 22AB55—Horizontal Output Circuit Description

The base of the horizontal output transistor is connected to the top of the secondary winding of the horizontal



driver transformer. The bottom of the winding is returned to ground through resistor R240. Bypassing is provided by capacitor C217. The emitter of Q203 is returned directly to ground. The ferrite bead (L204) over the base and emitter leads, suppresses "spooks" generated by the rapid switching of the base-emitter junction. The collector is connected to the primary of the sweep transformer T205, the deflection yoke and the damper diode CR203. The lower winding (primary) of T205 is returned to 130v through R243. The primary winding of T205 and the deflection yoke are

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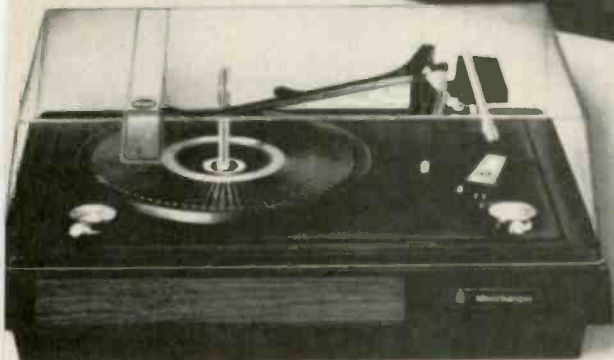
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BSR Minichanger

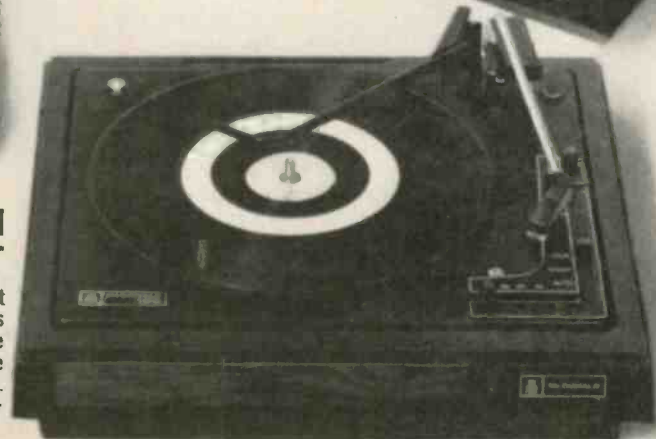
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magnetic cartridge
and base.

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*Suggested retail prices.

Only Admiral gives you the color picture tube with built-in customer satisfaction.



The exclusive Admiral 3-year warranty.

Now Admiral offers all new Super-Brite color picture tubes with the exclusive Admiral 3-year warranty. This industry exclusive provides your customers with maximum satisfaction.

Every Admiral Super-Brite color picture tube has Admiral-engineered thermal compensation for unexcelled color purity and the newest phosphors that give your customers clear, bright, sharp color pictures.

Here's another Admiral exclusive: In model 25SP22 (25AP22), our engineers have developed a vacuum deposited thin-metallic film on the inside of the envelope to assure trouble-free operation and longer life.

Admiral Super-Brite service color picture tubes aren't rebuilt. They're 100% brand new. From Admiral, producers of more rectangular color picture tube sizes than anybody in the world—the only one with the 3-year protection you asked for.

Admiral

Mark of Quality

Admiral Corporation warrants this picture tube to be free from defects in material or workmanship for 3 years after date of sale to the consumer.

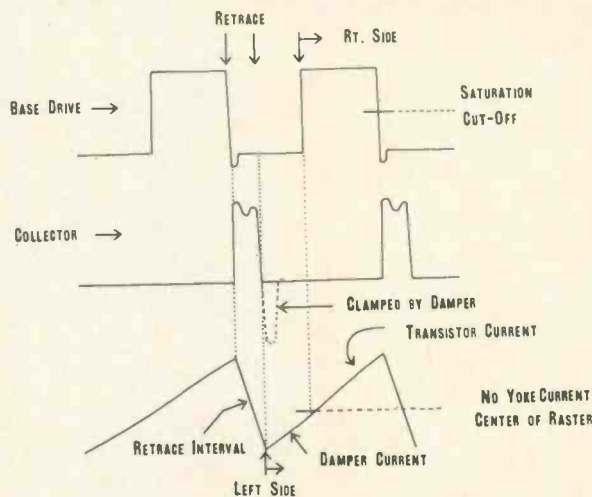
Admiral's obligation is limited to supplying a suitable replacement picture tube. This warranty is effective if the picture tube is registered with Admiral within 10 days after date of sale to the consumer.

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ET/D

TECHNICAL DIGEST

in parallel from a current waveform standpoint. Referring to the illustrations, when the base drive wave-



form swings positive (center of raster) the output transistor is driven to complete saturation. This causes a voltage collapse through the primary of T205, with a resulting current increase through both the output transformer and yoke. This increase in current deflects the beam from the center of the screen to the right edge. At the end of the scan (beginning of retrace interval) the base drive swings sharp-

Attracts bugs!



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ELECTRONIC TECHNICIAN/DEALER

ly negative. The undershoot appearing at the beginning of the negative portion of the square wave insures complete cut-off of the output transistor. As the transistor cuts off, the current previously developed collapses completely, resulting in a high collector voltage increase (1000v P-P). This high increase in voltage decays rapidly (end of retrace interval) and would tend to swing negative. However, at the beginning of the negative swing, the damper diode conducts, discharging the previously developed positive voltage appearing across the yoke and capacitor C220. The rapid voltage discharge results in a high increase of "negative" current through the yoke (beginning of scan at left edge). As the current decays back to zero, the beam is deflected to the center of the raster, where the output transistor takes over again, completing the cycle. Capacitor C222, in series with the yoke, maintains horizontal linearity.

The positive pulses developed at the output transistor are stepped up by the tertiary winding of T205. The pulses are rectified by diode CR205 to provide the required 20kv second anode voltage for the picture tube. The bottom of the tertiary winding is returned to the junction of resistors R813 and R236 in the horizontal driver base circuit. In the event of picture tube arc-over, a negative pulse would appear at the base of the driver, cutting it and the output transistor off during the time duration of the arc. This circuit protects the output transistor from transient pulses coupled through the sweep transformer during the arc.

The horizontal output transformer also contains windings to deliver negative going pulses to the AGC and horizontal AFC circuits. The winding terminating at the brown wire delivers 6.3v to the picture tube filament.

Horizontal retrace blanking for the picture tube is achieved by coupling a negative going sweep pulse (the same one used by the AFC circuit) through R233 and a neon bulb (PL201) to the grid of the CRT.

Diode CR204 (at the collector of Q203) rectifies the horizontal output collector pulses to provide the required dc voltages for the screen and focus elements of the picture tube. Filtering, after rectification, is provided by capacitor C218.

Comments from our readers are always welcome.

Address your letter to:
The Editors
Electronic Technician
Harbrace Building
Duluth, Minn. 55802



When you charge your customer \$137.00* for a replacement color picture tube, you'll want to be certain it was his tube that was defective... not your tester!

You can be sure, if you use RCA's really reliable, all solid-state WT-509A to test for emission quality, interelectrode leakage, shorted elements... (WT-509A even includes an "activate" function to boost the performance of some low-emission tubes.)

Along with the WT-509A, you get five test sockets, one of them a "universal" test adaptor — unique from RCA — that can be used with any type of tube or socket arrangement.

Useful extra's: big, readable meter and a sturdy luggage-type carrying case with a handy storage compartment.

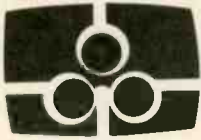
Add this fact: the suggested retail price is only \$118.00**

See WT-509A at your Authorized RCA Test Equipment Distributor, or write RCA Commercial Engineering, Department 25X/A-205, 415 South Fifth Street, Harrison, New Jersey 07029.

RCA

*Optional List Price for RCA H-25XP22
**Optional Distributor Resale Price

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COLORFAX

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

GENERAL ELECTRIC

Color TV Chassis H-1—Intermittent Hum Bar

An intermittent hum bar in the 10 in. H-1 Color chassis receivers may be caused by a poor connection at the black ground lead from the vertical output transformer.

On some sets, this lead is grounded at the same terminal board as the AC line choke. Poor contact with chassis ground because of a loose or stripped screw can cause AC to modulate the vertical sweep, producing intermittent hum in the picture.

Move and solder this black ground lead to the lance located on the top right side of the high voltage transformer cage. The black lead from the convergence assembly is also connected to this point. Check the terminal board screw for tightness. If stripped, replace with a larger diameter screw or solder the lug and screw to the high voltage cage. Be careful not to change the lead dress or damage any wire insulation in this area while soldering.

Etched Surface On Picture Tube Face-Plates

Some television picture tubes, both color and monochrome, have etched face-plates to minimize glare and reflections. The etching process produces random microscopic depres-

sions in the face-plate surface. If any foreign adhesive material becomes embedded in the depressions of the etched surface, it is virtually impossible to remove. This will cause light refractions which will be noticed principally on color programs. It is very important, therefore, that the following cautions be observed.

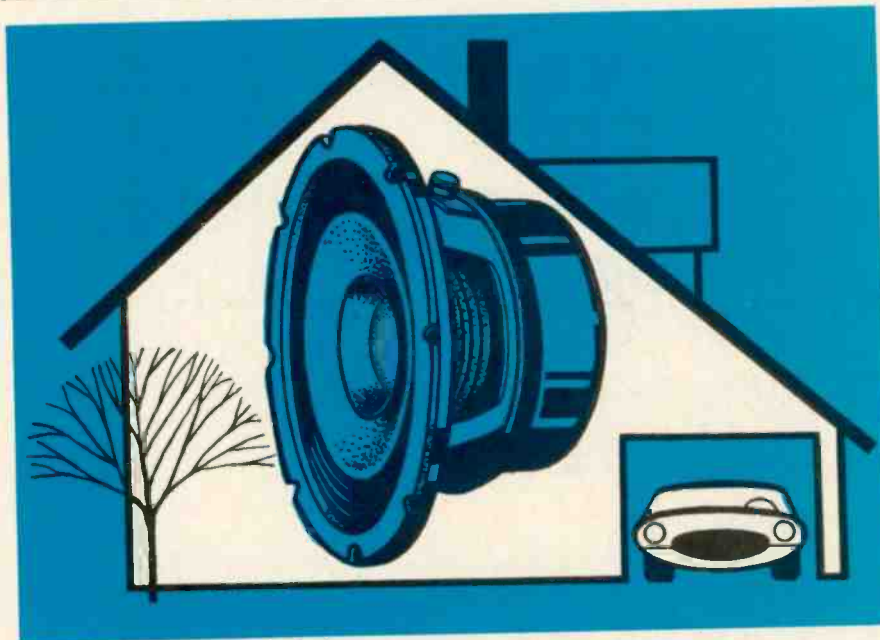
Caution: Never stick tags, banners or labels to an etched face-plate with tape, glue or other means. In addition, never write or mark on the etched surface with any writing devices. These include wax crayons, felt-tipped marking pens and the common graphite pencils.

Returning Tuners for Repairs

We wish to stress the importance of proper handling of VHF tuners (and UHF Tuners) which you return for repairs. Improper or careless handling and packing of tuners means additional work for the repair service plus the possible introduction of extra defects, including intermittents. Therefore, in the interest of improving the quality and prompt return of tuners from the repair service, the following points should always be observed: (1) Clip all wires at feed-through capacitors. (Unsoldering frequently damages the feed-through capacitor.) (2) Do not clip IF line cables. Unsolder carefully to preserve the cable length and prevent damage to tuner feed-through. (Unsolder at tuner end.)

Color TV Chassis KE—Obscure Problems

Problem: 1. Grayish hum bar floating vertically at low brightness. Cure: Replace C201 and/or C202 (either may be open). 2. No video, vertical retrace lines, no audio (short surge of normal audio immediately after set is turned off). Cure: Replace C202 (shorted) 3. Horizontal bending or pulling, black floating hum bar. Cure: Replace C152 ("B" section open).
continued on page 77



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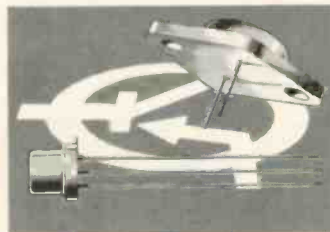
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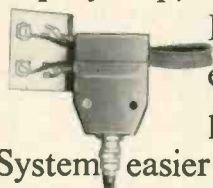
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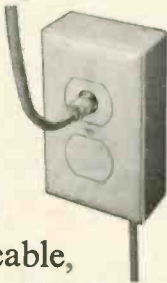
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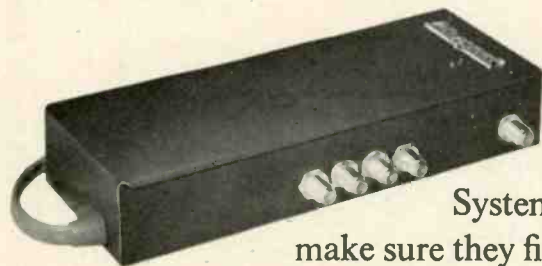
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ET/D

TEKLAB REPORT

Zenith's 12A12C52 Color TV Chassis

Although the IC color demodulator module is new, the interconnection system and legend simplify the servicing of the most critical circuit in the color set

■ Each year as the new television sets appear, they reveal a number of solid-state circuit advancements. Many are going from the hybrid toward all solid-state chassis with additional transistors and integrated circuits. Integrated circuits are creating a color picture and perform the most critical and complex job in the entire set. We also find tuning of the set simplified, the picture tube hav-

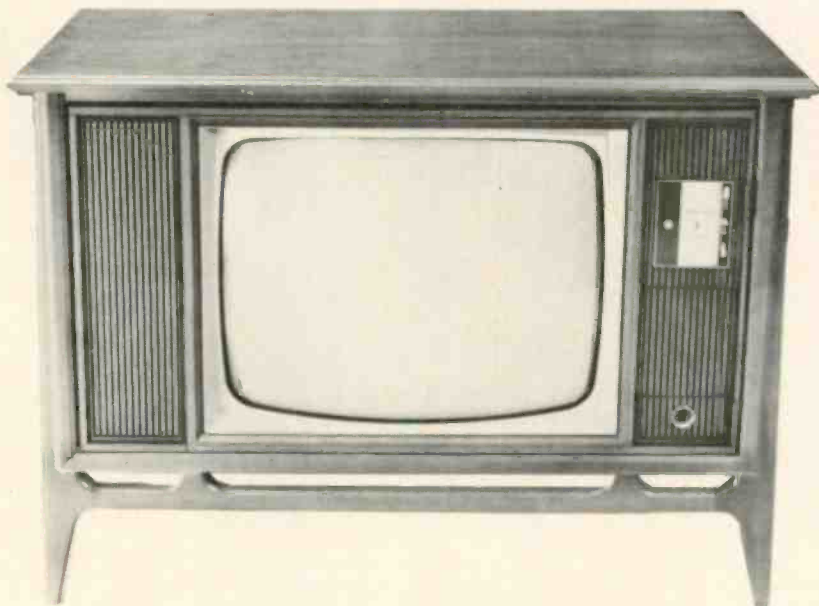
ing more brightness and contrast than previous tubes.

Recently we received the Zenith Model A6533-2 employing the 12A12C52 chassis, which in many respects, is similar to the previous year, with a number of improved circuits which we will review.

Starting at the front control panel, the Ultramatic tuning system lets the viewers automatically select as many as 18 pretuned (12 VHF and six UHF) channels with just the touch of a finger at the set or on a remote hand control.

You may ask why the two color controls—the color commander and chroma level—without a contrast control. The color commander control permits color level tracking with contrast in a single control simplifying adjustment. Normally, if it is desired to lower the contrast for a particular program transmission, the color level must also be lowered for proper "tracking" between the B/W and color information. The "color commander" is essentially a contrast control and is ganged with a color level control on this chassis. Both contrast and color level are adjusted simultaneously. On monochrome transmissions the control is used for

Zenith's Model A6533-2 color television set employing the 12A12C52 chassis.



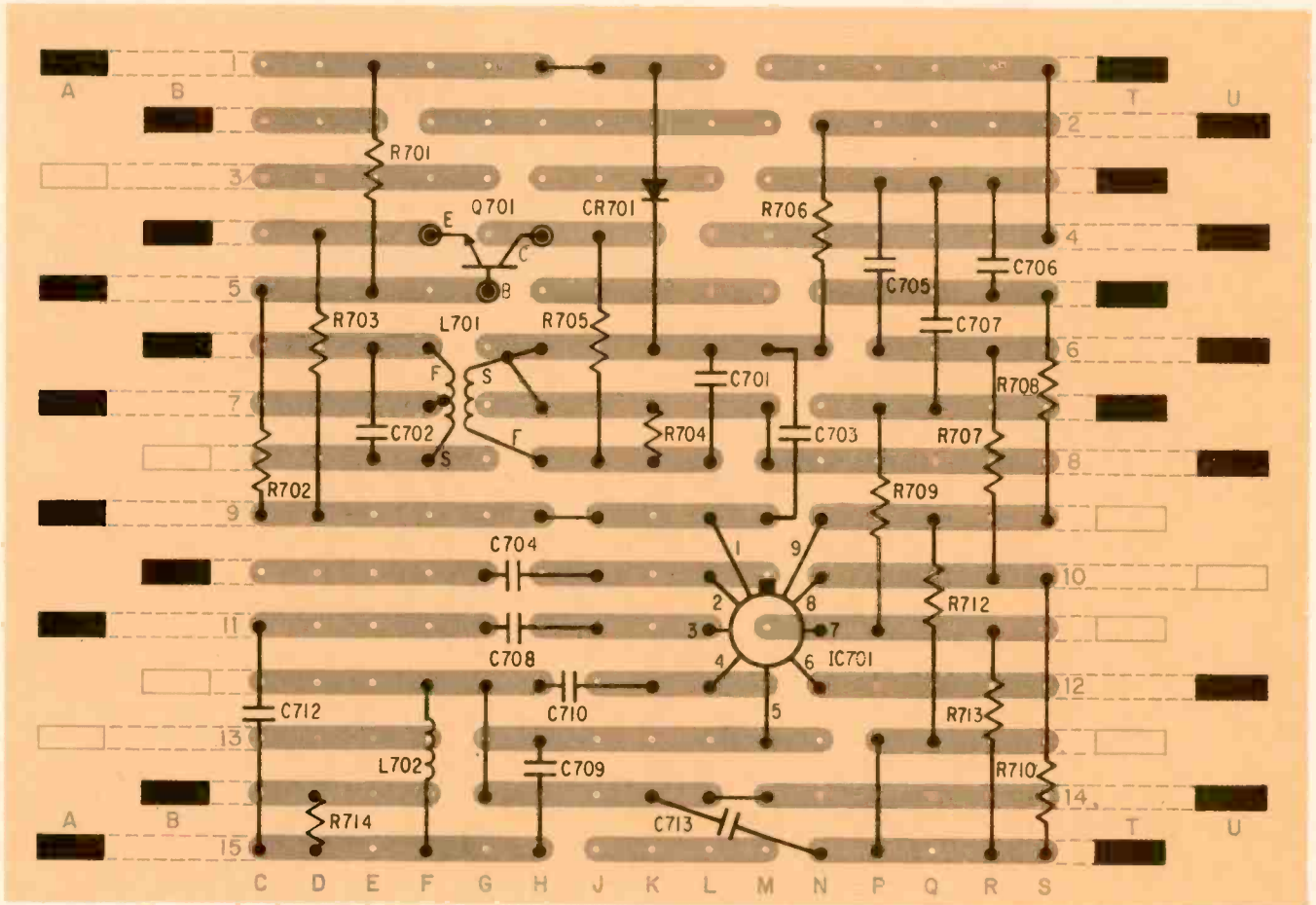
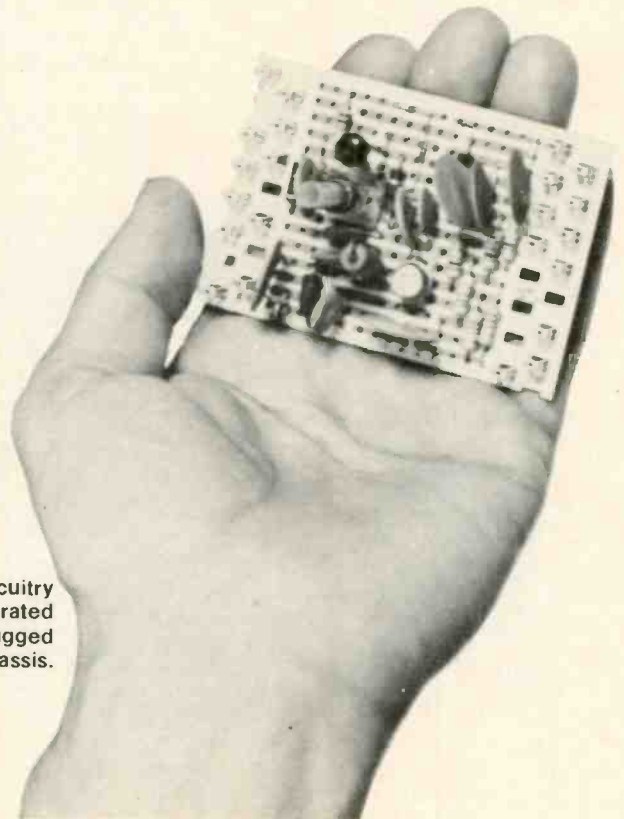


Fig. 1—Wiring diagram of the 2nd color amplifier and demodulator module assembly.



The small Dura-Module contains the circuitry of the 2nd color amplifier and integrated circuit demodulator. The module is plugged into the circuitry of the chassis.

contrast settings. A separate color level control is in series with the color commander control and permits adjustment for optimum tracking between contrast and color level when using the color commander control.

Another feature found on the front of the set is the location of the convergence panel. The speaker is pulled forward by removing two screws, exposing the convergence panel which can be adjusted from the front of the set.

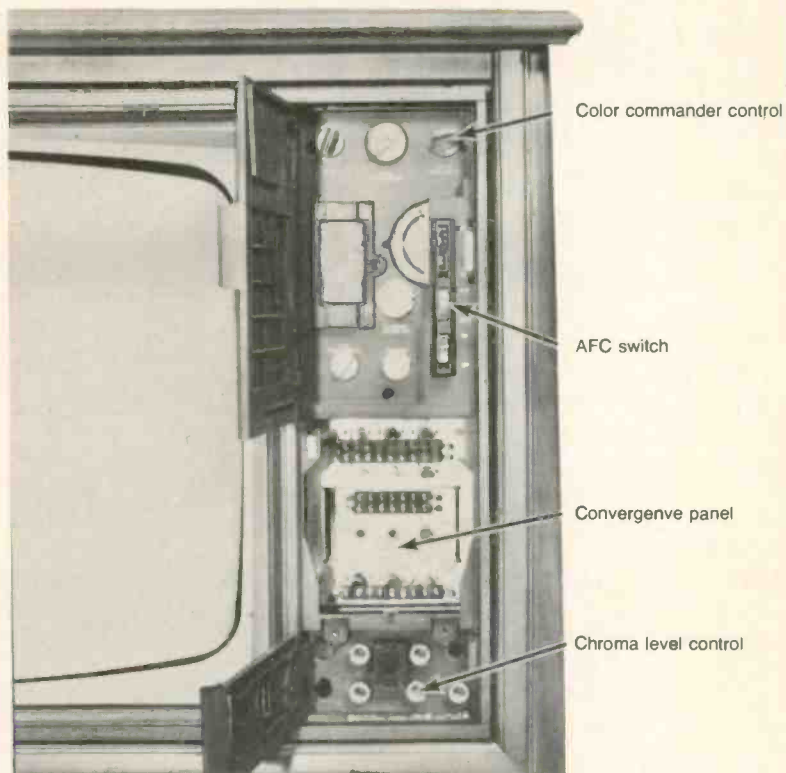
The basic physical chassis arrangement is similar to the previous chassis with the exception of an integral brace through the center of the chassis increasing its ability to withstand rough handling. Another addition is a positive temperature coefficient thermistor employed in the automatic degaussing circuit.

DURA-MODULE

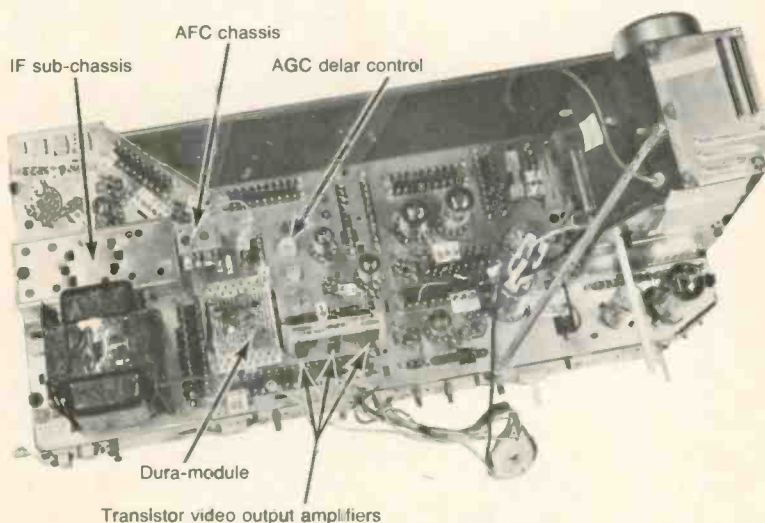
An interesting new plug-in module was noted on the top of the chassis. The module measures 2.4 x 3.5in. with parallel rows of conductive segments and spaced holes extending through these segments. The module circuitry is shown within the heavy dark lines in Fig. 1. Points of connection to the module such as U6, T5, A5 correspond to the letters and numbers used in the schematic of the chassis. This identification process enables quick locations from the schematic to the physical contact point on the module.

If it is desired to locate terminal point A5 for a measurement of the color signal at the base of Q701. Viewing Fig. 1, it will be noted that this point is at the intersection of the vertical row "A" and horizontal row number "5" (5th horizontal row across). This identification process enables quick locations from the schematic to the physical contact point on the module and vice versa.

The conductor pattern legend is a bright contrasting col-



Front control panel with speaker removed exposing convergence panel making adjustments easy from the front of the set.



Top view showing chassis layout, Dura-Module, Solid-State IF sub-chassis, AFC chassis and other important components.

or on the top or component side of the module.

Plug-in hardware was specifically designed to connect the module into the circuitry of the TV chassis, and the staggered contact positions on the module prevent it from being plugged in backward. This module contains the circuitry of the 2nd color amplifier and Integrated Circuit (IC) Demodulator.

RGB SYSTEM

An interesting feature of this chassis is contained in the circuitry involving color and Y signal matrixing. The monochrome video (Y) signal is matrixed with the (R-Y), (G-Y) and (B-Y) color difference signals prior to coupling to the CRT. The signal voltage coupled to the picture tube, which presents R, G and B color, eliminates matrixing in the picture tube. This circuit design is called the RGB system.

In the RGB system, the R, G and B signal voltages are coupled to the R, G and B cathodes of the picture tube respectively. The control grids of the picture tube are at fixed dc potentials.

The (Y) signal is matrixed with the color difference signals of (R-Y), (G-Y) in the color amplifier stages.

In the color difference system the Y signal voltage is coupled to the three cathodes of the picture tube and (R-Y), (G-Y) and (B-Y) signal voltages are coupled to the Red, Green and Blue control grids respectively.

The (Y) signal is matrixed with the color difference signals of (R-Y), (G-Y) and (B-Y) in the picture tube. The matrixing principle of both systems is shown in Fig. 2.

A notably sharper color picture with better color fidelity than in the previous chassis was produced, employing the RGB color signal circuitry.

From the service standpoint, lower color drive to the CRT, fewer components and the use of transistors should make the

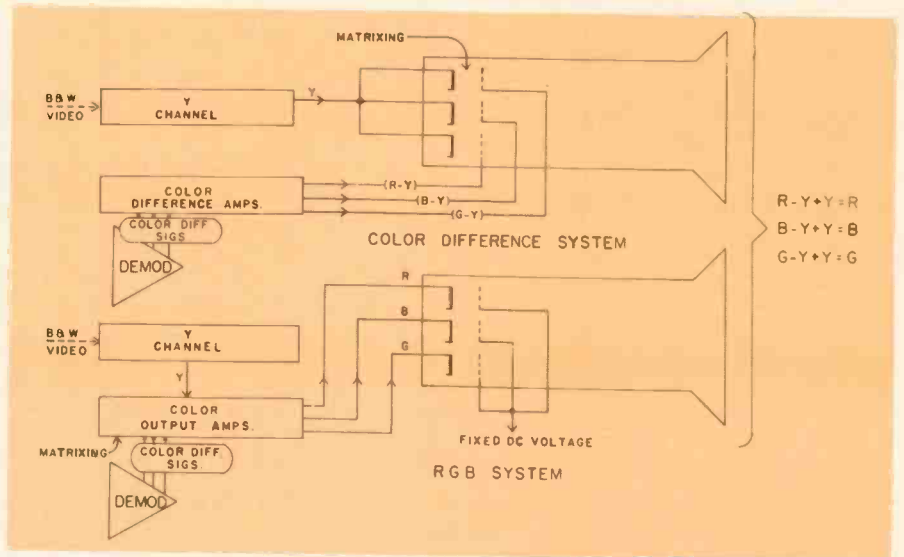


Fig. 2—Diagram showing the matrixing principle of the color difference system and the RGB system.

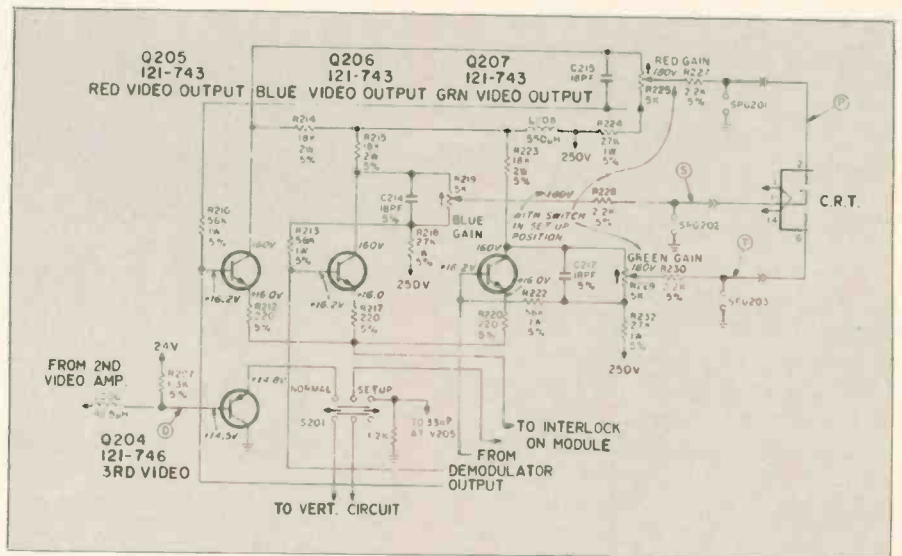


Fig. 3—Diagram of the video output amplifiers consisting of three transistors which perform the function of amplifying both monochrome video (Y) signal and color signals as well as matrixing.

chassis more dependable and simplify servicing.

VIDEO OUTPUT AMPLIFIERS

The video output amplifiers employed in this chassis consist of three transistors, Q205, Q206 and Q207 which perform the function of amplifying both the monochrome video (Y) signal and color signals, as well as matrixing as shown in the diagram Fig. 3.

Three demodulator output signals consisting of $-(R-Y)$, $-(B-Y)$ and $-(G-Y)$ are coupled respectively to the base of Q205, Q206 and Q207. Since the mono-

chrome signal is also coupled to all three amplifiers, matrixing is accomplished in these stages producing R (red), G (green) and B (blue) signal voltages in the amplifiers outputs.

The design and function of all three amplifiers are identical.

NOISE GATING-SYNC

The circuitry for noise gating and sync separation has been slightly modified. The relative efficiency of the noise gating circuitry is somewhat dependent upon the amplitude of the noise pulses on video and tolerances in the circuit employed.

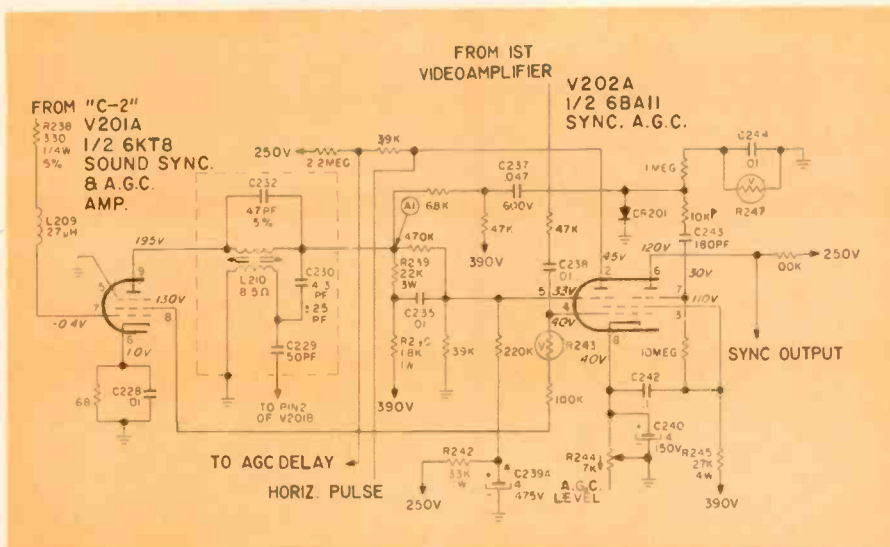


Fig. 4—Schematic of the sync, sound and AGC amplifier circuits.

In previous chassis, sufficient amplitude for effective noise gating was accomplished by employing the cathode follower stage in the video (Y) amplifier system as an amplifier. A slight amplification of the video signal (and any associated noise pulses) could be obtained at the plate of the cathode follower and was therefore utilized for this purpose.

In this chassis, the 1st video stage is transistorized (emitter follower) performing a function comparable to the previously used cathode follower and its "amplification" is insufficient to be employed in a similar manner. Thus, the circuitry in the sync coupling networks has been modified as shown in Fig. 4.

A low amplitude negative-going composite signal is coupled from the base input of the 1st video stage to the control grid of the sync-AGC tube. Any noise pulses associated with this signal will be sufficient for adequate noise gating affecting AGC action, but will be insufficient for noise gating of the sync separator. Therefore, the composite signal used for sync separation must be free from noise pulses prior to coupling to the grid (pin 7) of the sync separator. This is accomplished in the following manner.

As shown in Fig. 4, the positive-going, composite signal appearing at test point A1 is coupled through a 6.8K resistor to capacitor C237. The capacitor charges to the most positive portion of the signal (sync tips) through diode CR201. The result is a "clamped" signal with sync tips clamped at zero potential. A "load" is presented to the capacitor by the 1M resistor, and R247 (VDR) bypassed by capacitor C244. A "load" is necessary to prevent C237 from charging to the tips of noise pulses which are higher in amplitude than the sync tips. Noise pulses, of course, will occur at random and may be present during the sync or video interval. Should C237 be charged to the tips of noise pulses, this "excess" charge will quickly dissipate through the load and the desired clamping level will be maintained.

The VDR presents a variable load for the circuit. Should noise pulse amplitude increase causing a larger charge on C237, the VDR resistance will decrease (larger load) presenting a shorter time constant for the discharge of C237.

The composite signal, essentially free from noise pulses in excess of sync tip level, is then coupled through an 180pf capacitor to the grid (pin 7) of the sync separator tube. It should

be stated that a dc coupled oscilloscope would be advantageous in servicing this circuit.

Proper circuit action could be checked by observing the waveform at the high side of CR201 (junction of 1M and 10K resistors) and noting if sync tips are at or very near the baseline (zero potential) on the oscilloscope. If not, the diode may be open. If syncs are badly crushed or if video is not present, the diode may be shorted or the .01μf capacitor may be shorted. An open .01μf capacitor (C244) may cause sync jitter under noisy signal conditions.

CHROMACOLOR PICTURE TUBE

A new patented color television picture tube is featured in 33 different cabinet models in the company's 1970 line of 46 basic color models.

According to the manufacturer, the picture tube has a new patented "Iris" aperture mask, a light-absorbing black framing 1,350,000 picture producing phosphor dots, a brighter rare-earth red phosphor and high transmission glass.

The 450,000 small holes in the mask are engineered to be smaller during screen processing and larger in the completed tube.

The smaller openings in the mask are used to put both a contrast area for the jet-black, light-absorbing material and the phosphor dots on the screen. For color TV operation, the apertures are opened to allow electron beams larger than the phosphor dots to totally excite all of the screen's phosphors.

The area between the smaller, screened phosphor dots of the new tube is filled with black-surroundings which absorb room light to improve picture contrast and permit use of a higher transmission glass in the CRT face.

The picture viewed on the set for this report has improved brightness and shows a very considerable amount of increase in contrast and sharper detail. ■

Rotator Maintenance

Part Two

Part one of this series (ETD-November 1969) introduced rotator systems, installation and operation. This article concludes the series and describes individual circuits with practical troubleshooting and field maintenance procedures

ALLIANCE MODEL C-225

■ The Alliance service manual indicates two procedures which should be followed before a system is installed. These are the power-off and power-on checks.

The power-off checks are as follows:

1. Be sure the five conductor cable is connected to the proper terminals. Refer to the schematic diagram, Fig. 1.

2. The hollow shaft assembly must have "play." Refer to item 27, Fig. 2.

3. As viewed from the rear, switch contacts S1-1 and S1-4 of the switch assembly should be closed. Refer to item 116 in Fig. 3. Primary input contacts S1-2 and S1-3 of the switch assembly should be open and have approximately 1/16in. clearance.

The power-on checks are as follows:

1. Check for proper line voltage (approximately 117vac).

2. Turn the knob (item 137 in Fig. 3) to the extreme clockwise stop. The rotator must turn to

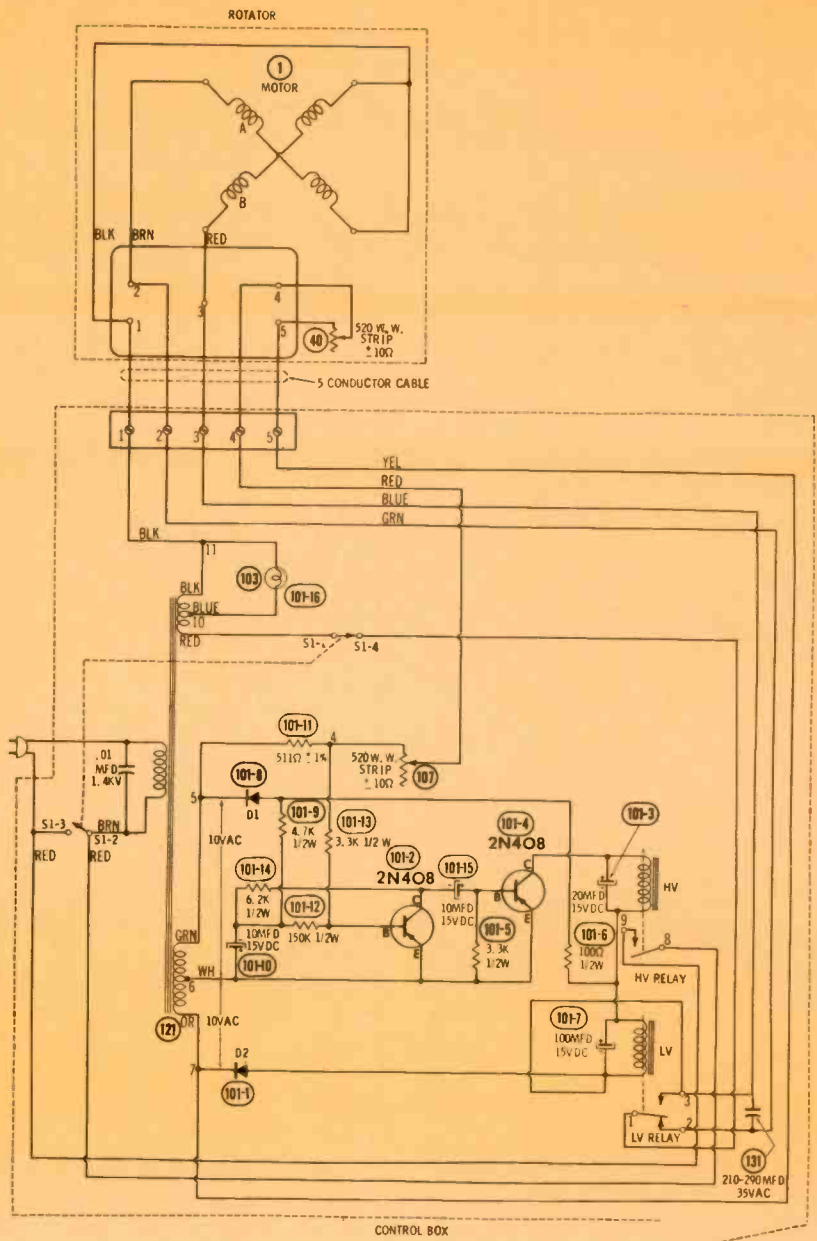
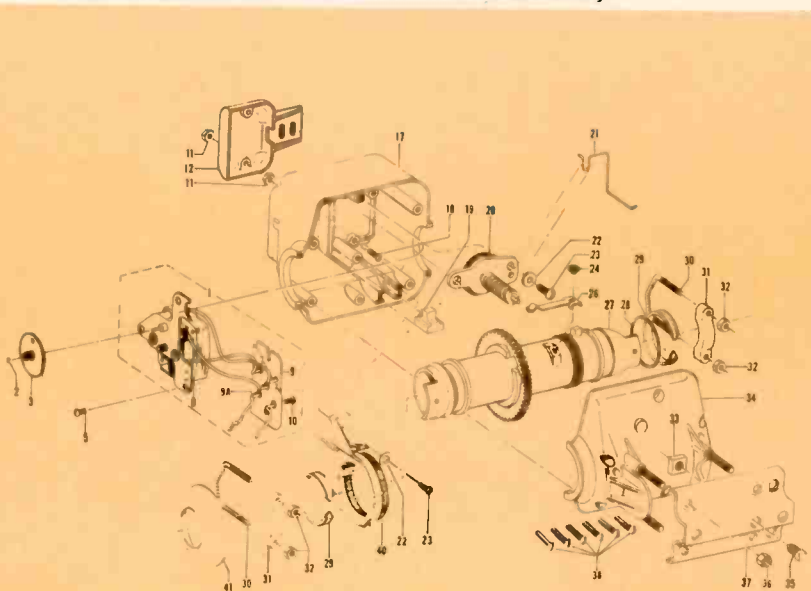


Fig. 1—Schematic diagram of the Alliance C-225 rotator system.

Fig. 2—An exploded view of the C-225 rotator drive assembly.



the extreme CW stop and the indicator light must go out when the rotator reaches the stop.

3. Turn the knob to the extreme counter-clockwise stop. The rotator must turn to the extreme CCW stop and the indicator light must go out when the rotator reaches the stop.

4. Switch assembly contacts S1-2 and S1-3 should make contact. S1-1 and S1-4 should be open while the knob is being turned. Note: If the light comes on bright but the rotator does not turn when the knob is released or if the unit is intermittent, check the friction spring. See Fig. 4. Tighten one notch at a time. Early models had one spring while later models have two. Check these springs in case of difficulty.

One way to check a defective rotator system from the ground is by taking appropriate resistance measurements. The following measurements on the C-225 should be obtained using a VTVM. Readings will vary depending on the control cable lead length and accuracy of the meter. However, the readings should indicate if the problem is in the rotor or cable even though they are not 100 percent accurate. The readings are taken with the control cable disconnected.

Lead #1 to lead #2— 2.5Ω plus lead resistance

Lead #1 to lead #3— 2.5Ω plus lead resistance

Lead #1 to lead #4—infinity

Lead #1 to lead #5—infinity

Lead #2 to lead #3— 5Ω plus lead resistance

Lead #2 to lead #4—infinity

Lead #2 to lead #5—infinity

Lead #3 to lead #4—infinity

Lead #3 to lead #5—infinity

Lead #4 to lead #5— 2 to 511Ω plus lead resistance depending on the position of the contact on the potentiometer, meter accuracy and lead length. Note: The resistance of each lead of a #20 five conductor cable is approximately 1Ω per 100ft.

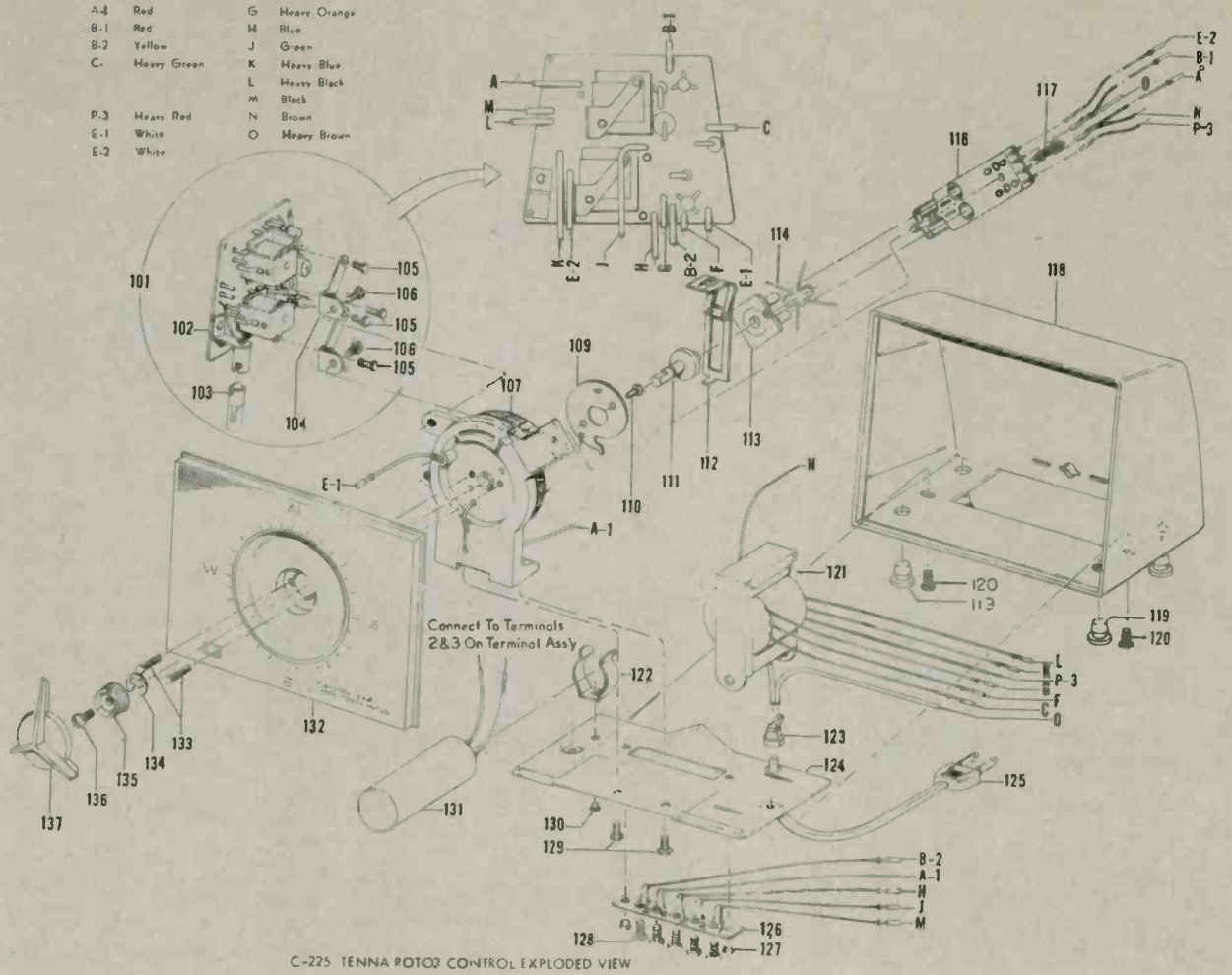
Example: When checking a rotor installed with 75ft. of #20 wire, you should obtain the following readings:

Lead #1 to Lead #2—Ap-

Symptom	Cause
Rotator fails to operate when knob is turned to desired direction	<p>If indicator bulb does not light: Check 117v source. Tighten friction spring. (See note under "Power-on Checks") Unit may be overheated causing the thermostat to open. Wait 10 to 15 minutes for unit to cool and the thermostat to close. if indicator light is dim: Check gear train for improper meshing or slippage. Replace motor capacitor (Item No. 131) Check hookup of five conductor cable. Check five conductor cable with an ohmmeter for shorted or open leads.</p> <p>If indicator light is bright: Check low voltage contacts. (Adjust and tighten friction spring. Fig. 4) Check for open white or red lead to switch assembly. Check five conductor lead and hookup. Replace circuit board.</p> <p>If indicator light is very bright or burns out: Check black lead to board. Check 24v winding of transformer (Item No. 121). Replace if defective.</p>
Rotator turns before control knob is released.	<p>Check switch. Tighten friction spring (See Fig. 4).</p>
Rotator turns but indicator light does not come "on."	<p>Check bulb. Replace with #47 if defective. Check for open blue lead from transformer.</p>
Rotator turns to one position and stays there	<p>Check hookup of five conductor cable. Check for shorted or "open" #4 and #5 lead in five conductor cable. Check for open or dirty potentiometer (Item No. 40) in rotator. Check for open or dirty potentiometer (Item No. 107) in rotator. Replace circuit board.</p>
Rotator operates slowly or sluggishly	<p>Check size and length of five conductor cable. (See Fig. 5) Change capacitor (Item No. 131). Clean potentiometer. Replace if necessary.</p>
Rotator oscillates back and forth. Light blinks	<p>Check for shorted contacts on switch assembly (Item No. 116). Replace circuit board.</p>

COLOR CODING - LEADS

- A Red
- A-1 Red
- B-1 Red
- B-2 Yellow
- C Heavy Green
- P-3 Heavy Red
- E-1 White
- E-2 White
- F Heavy White
- G Heavy Orange
- H Blue
- J Green
- K Heavy Blue
- L Heavy Black
- M Black
- N Brown
- O Heavy Brown



C-225 TENNA ROTATOR CONTROL EXPLODED VIEW

Fig. 3—An exploded view of the C-225 control console.

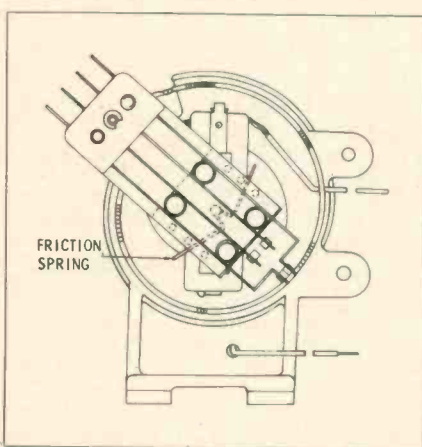


Fig. 4—Friction spring adjustment on Alliance Model C-225.

AWG	STRANDING	50ft.	100ft.	150ft.	200ft.	250ft.	300ft.	350ft.	400ft.
22	7 x 30	█							
20	7 x 28	█	█						
20	DOUBLED 7 x 28	█	█	█					
20	10 x 30	█	█	█	█				
20	DOUBLED 10 x 30	█	█	█	█	█			
18	16 x 30	█	█	█	█	█	█		
18	DOUBLED 16 x 30	█	█	█	█	█	█	█	█

Fig. 5—Wire chart for various cable runs.

proximately 2.5Ω plus 1.5Ω (2 leads @ .75Ω each) 4Ω

Lead #1 to Lead #3—Approximately 2.5Ω plus 1.5Ω (2 leads @ .75Ω each) 4Ω

Lead #2 to Lead #3—Approximately 5Ω plus 1.5Ω (2 leads @ .75Ω each) 6.5Ω.

Note: Alliance recommends that circuit board assembly ser-

vice should not be attempted. Defective boards should be disconnected at pin connectors and replaced as assemblies.

CHANNEL MASTER ROTATORS

The schematic diagram of Fig. 6 shows the circuit for the Channel Master automatic units. These

systems are normally synchronized when shipped. However, if field synchronization is necessary, it can be accomplished as follows: On the Model 9502, 9512 and 9516A, rotate the knob on the control console clockwise to "N." When the disc stops, rotate the knob counter-clockwise to "N." When the disc stops, the

VOLTAGES SHOWN UNDER LOAD

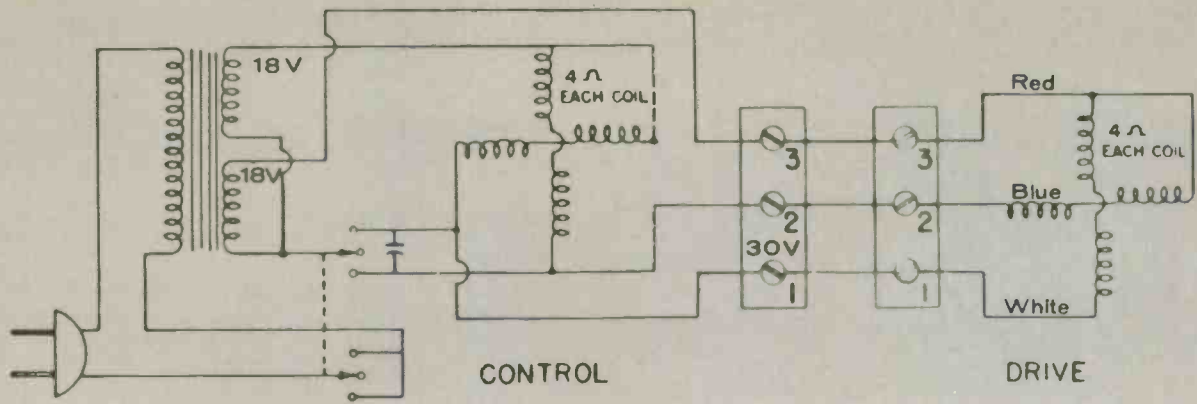


Fig. 6—Schematic diagram of Channel Master automatic units.

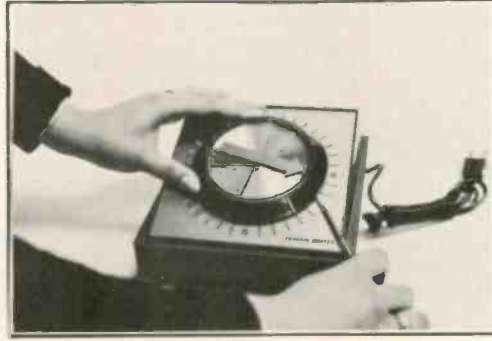


Fig. 7—Place control on non-slip surface. Turn knob until any snap leg is in position shown. Leg of snap shows as a dark, clear spot in the brown part of upper knob. There are 3 legs. Arrow points to one. Push hard against side of knob toward arrow, place flat screwdriver under edge close to leg and lift up about 1/2 in. Release hand pressure, move hand around, placing thumb under knob to hold knob up, remove screwdriver.

Fig. 8—With thumb, push knob toward another snap leg, slip screwdriver under knob close to leg and pry up lightly. With two snap legs loose, knob will easily come off.

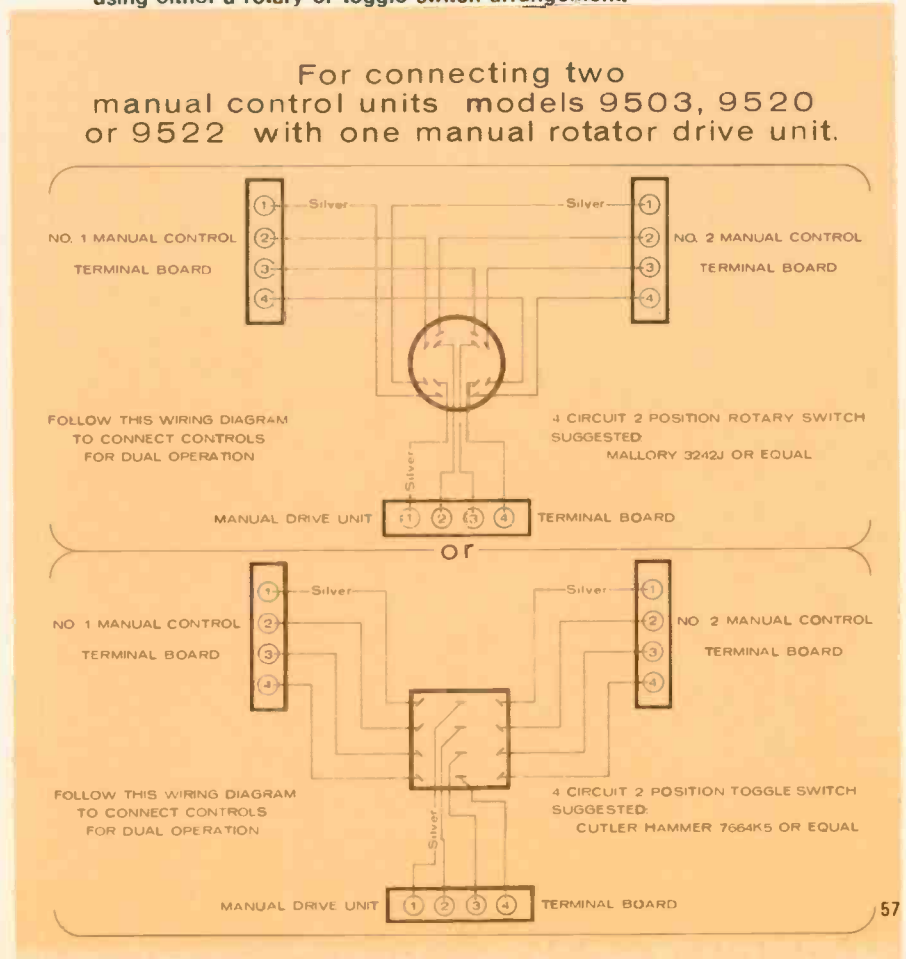
units are synchronized. The procedure for synchronizing Model 9505 and 9513 is the same except that the control button must be depressed and held until the disc stops rotating.

If you have to service the Channel Master Model 9512 control unit, the control knob must be removed to gain access to components. The diagrams in Fig. 7 and 8 show the proper procedure for removing this knob.

There are times when a customer might want to combine two manual control units with one manual control drive system. The diagrams in Fig. 9 show the wiring for such a system. Any combination of the Channel Master Models 9503, 9520 and 9522 will work as a pair if connected as shown. The same diagrams will work for the 220vac units, but a 220vac system cannot be paired with a 117vac system.

If the service technician finds himself with a customer who wants

Fig. 9—Wiring diagram for connecting two CM units to one manual drive system using either a rotary or toggle switch arrangement.



to convert an existing manual rotator system to automatic, the diagram in Fig. 10 shows how, using the CM9526. The procedure first requires identification of the existing system. Then locate the #1 terminal on the existing control unit and trace it to the proper terminal on the CM9526. Disconnect the wire from the #1 terminal and reconnect it to the proper terminal on the CM9526. Follow the same procedure for the rest of the leads. As you can see, the numbers will not always correspond between units. Also, the automatic control only uses three leads so you may have unused wires. Any unused wires should be cut off and taped. Once all the connections are made, the control unit can be plugged into 117vac—not before! To synchronize the system, rotate the knob with the red pointer clockwise. When the followup pointer stops, rotate the knob counter-clockwise. When the followup pointer stops, the drive is synchronized.

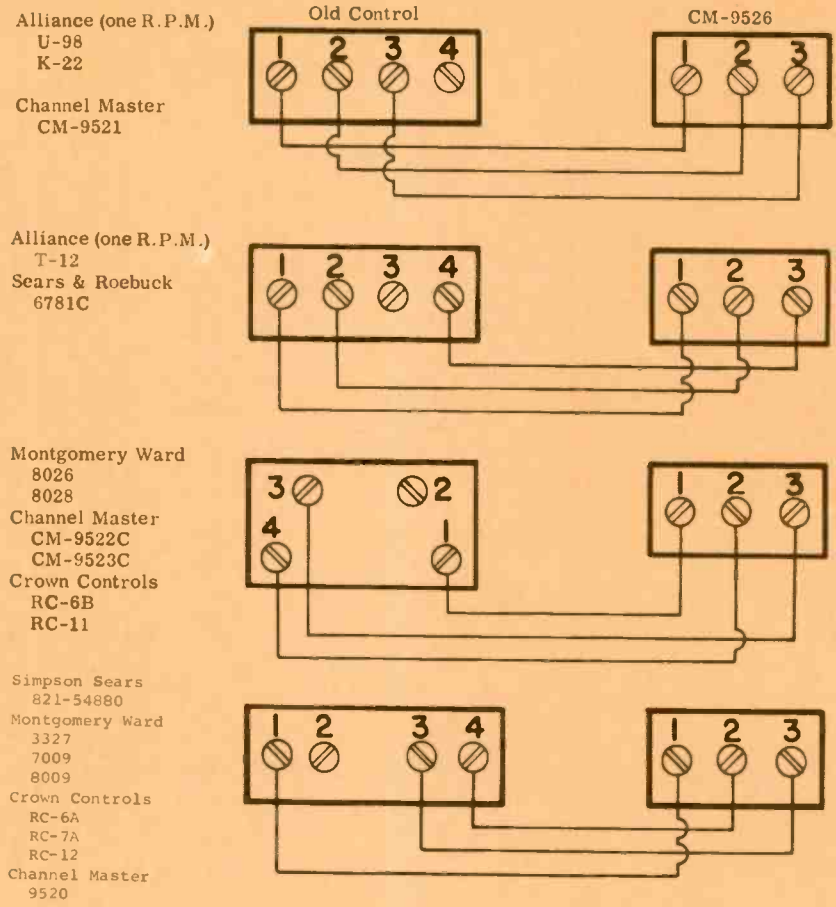
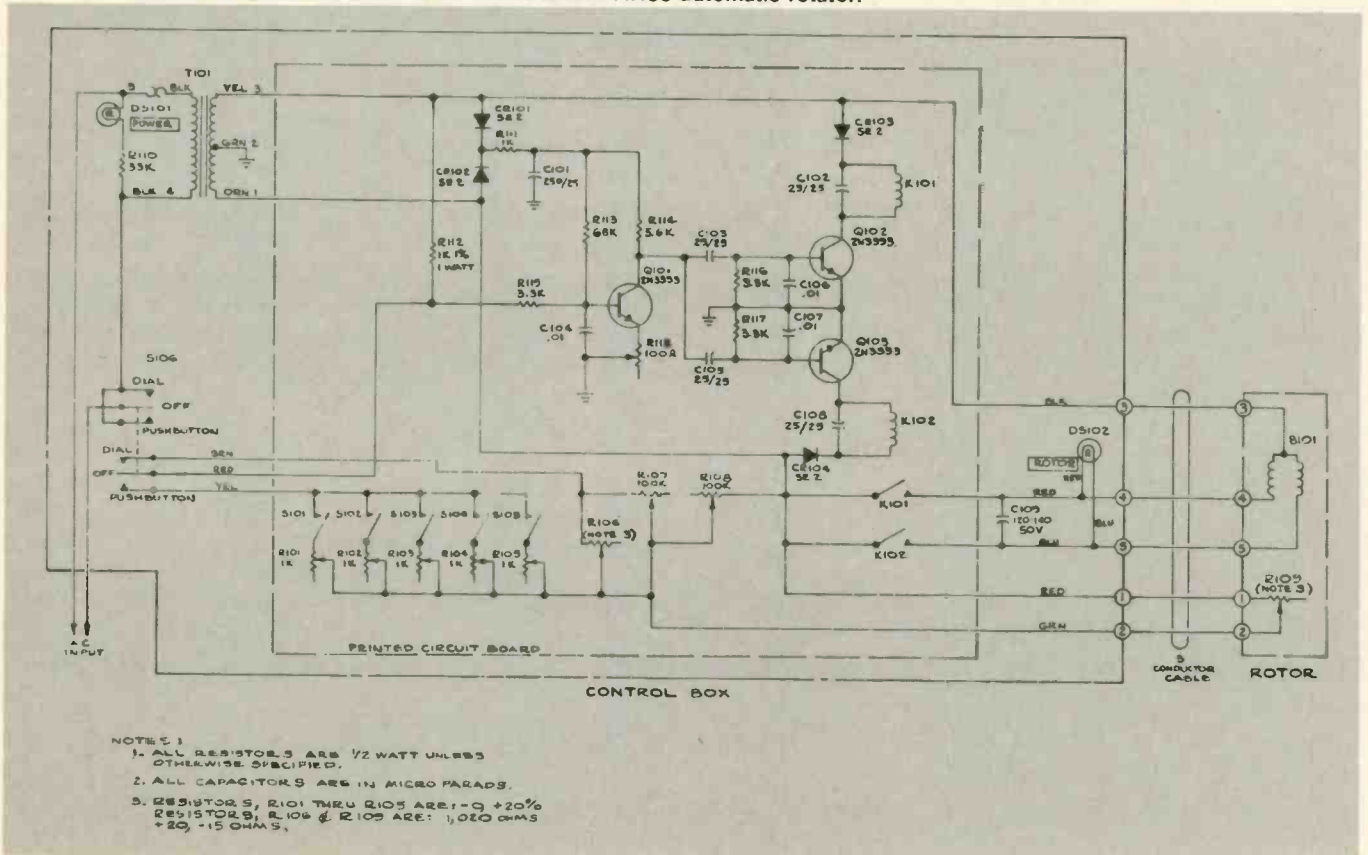


Fig. 10—Conversion of one rpm manual systems to automatic systems using the CM 9526 control unit.

Fig. 11—Schematic diagram of the Cornell-Dubilier Model AR33 automatic rotator.



TROUBLESHOOTING

A. General:

1. Check for loose, shorted or broken wires.
2. Check for proper cable connection sequence.

B. Inoperative Drive—Operative Control:

1. Open secondary winding in transformer.
2. Defective cable.
3. Jammed or broken gear train in drive.
4. Defective motor in drive.

C. Inoperative Control—Operative Drive:

1. Open secondary winding in transformer.
2. Jammed or broken gear train in control.
3. Defective motor in control.

D. Inoperative Control—Inoperative Drive:

1. Open or shorted wire in line cord.
2. Check switch for broken clips or blades and for misalignment.
3. Defective capacitor.
4. Open primary or both secondary windings in transformer.

E. Control and Drive Run in One Direction Only:

1. Check switch for broken clips or blades and for misalignment.

F. Drive and Control Motors Do Not Stop at Same Time:

1. Dirt or oil on surfaces of brake washer in motor.
2. Motor shaft in either motor is not free to raise and lower properly. Shaft should move at least 1/16in. when moved by hand.

CDR ROTATORS

The CDR AR33 rotator shown in the schematic diagram of Fig. 11 provides an end of rotation adjustment plus a sensitivity and adjustment. In this unit, when the compass dial is set to the end of rotation in a clockwise direction, the "rotor" light should go out. If not, slowly rotate the end of rotation control until the light does go out. Refer to Fig. 12. The sensitivity adjustment should be re-set if the antenna

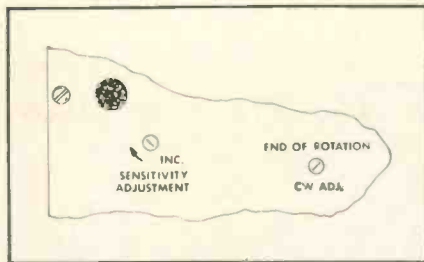


Fig. 12—End of rotation and sensitivity adjustments are located on the bottom of chassis.

oscillates. To do this, slowly turn the sensitivity pot clockwise until the "rotor" light stops blinking.

The AR33 control console also has five push buttons which can be preset for reception on selected channels. The push buttons are adjusted by first removing the escutcheon plate above the switch button. Press one end of the escutcheon plate toward the cen-



Fig. 13—Front panel view shows removal of the escutcheon plate on the AR33 and location of adjustment pot directly above each selector switch.

ter and lift it out. See Fig. 13. An adjustment pot is located behind each switch as shown. Depress the first button and turn the TV set to receive the desired channel. Then slowly rotate the potentiometer until a peak picture is obtained. Turning the pot clockwise moves the rotator clockwise. Repeat the procedure for the other four buttons. The escutcheon plate should be marked to indicate the channel for each button. Replace the escutcheon plate.

The CDR AR22 requires synchronization if the indicator lights stay on after pulsing has stopped. To synchronize this unit, turn the knob on the control unit to

the extreme counter-clockwise position. If the lights stay on after pulsing has stopped, trip the synchronization lever on the bottom of the chassis until they go

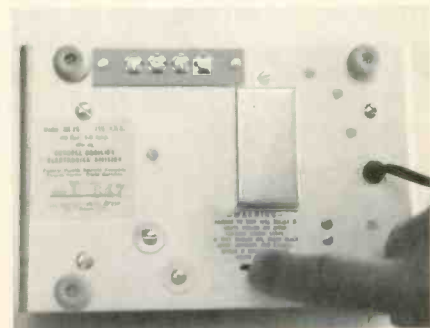


Fig. 14—Control unit "trip" lever for synchronization on Model AR1, AR22, AR22R and AR10 rotator systems.

out. See Fig. 14. Now turn the knob to the extreme clockwise position. Again, if the lights stay on, trip the synchronization lever until they go out.

Service problems in the AR33 will usually fall into two types: rotation in one direction only (either CW or CCW), and no rotation with or without the indicator light.

The probable causes for clockwise rotation only are: (1) frayed, (shorting) leads between terminals one and two on the control console and (2) defective relay K-102 (Fig. 11).

Counter-clockwise rotation only can be caused by (1) frayed (shorting) leads between terminals two and three, (2) open potentiometer R109 (see Fig. 11) in rotator or open R106 in control unit, (3) broken lead on terminal one or two, and (4) defective relay, K-101.

No rotation and no indicator light can be caused by a defective transformer, T-101. Note: T-101 has a thermo switch. Allow 10 minutes for the unit to cool off and then re-check it. No rotation and a normal rotator light may be traced to (1) defective capacitor C-109, (2) broken leads on terminals 3, 4 or 5, (3) defective motor or gears in rotator. The AR33 rotor can also be checked from the ground by taking resistance readings. Be sure the control cable is first dis-

connected from the control box. The following readings should be obtained:

Terminal #1 to #2 — 0 to 1000Ω (depending on rotator position)

Terminal #3 to #4 — 2.5Ω plus cable resistance

Terminal #3 to #5 — 2.5Ω plus cable resistance

Terminal #4 to #5 — 5.0Ω plus cable resistance.

RCA ROTATORS

The antenna drive unit and the control console are set by the manufacturer to be in sync when the system is shipped. Synchronization means that the rotator indicator or lights coincide with the antenna direction. In other words, if the rotator is fully CCW, the light or pointer should show this position and any position between the end stops. In the case of the RCA Model 10W707 shown schematically in Fig. 15, synchronization is a matter of first turning the control knob to North and checking to see that the drive shaft on the drive unit is aligned with the "North" arrow on the drive unit housing. Once this mechanical alignment is made, the control unit can be checked. Turn the control knob

Control Unit	Symbol	Stock No.	Description
	CR2		Not Used
	K1	245364	Relay — Power Hold. Coil resistance changed from 530 ohms to 325 ohms.
	R6		Not Used
	R9		Not Used
	R10		Not Used
	R11		Not Used
	R12	502156	Resistor, 560 ohms, ±10%, ½ w.
	R13	502112	Resistor, 120 ohms, ±10%, ½ w.
	T1	245368	Transformer — Power. Center tap added to transformer secondary winding (holding relay circuit).

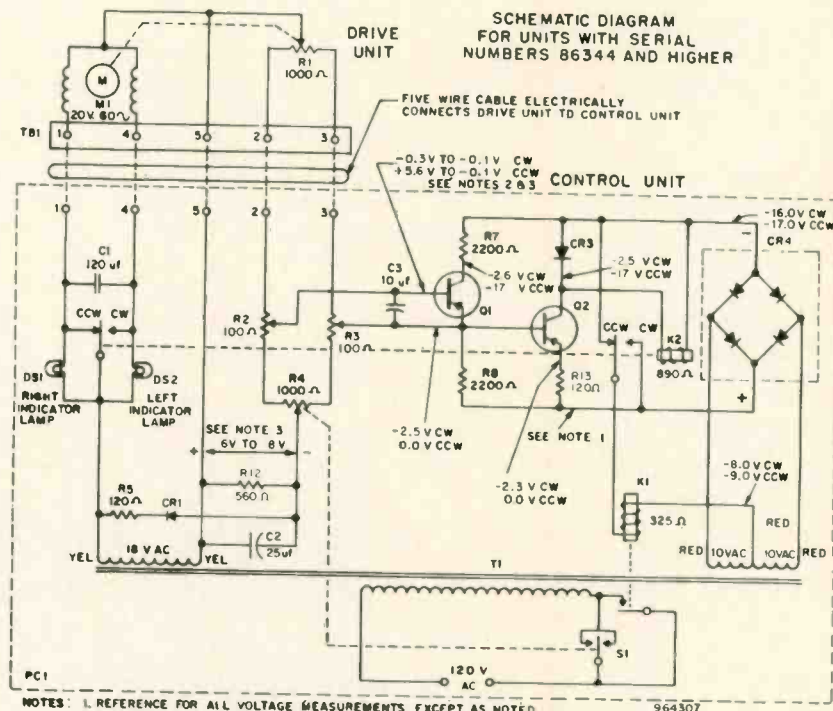


Fig. 15—Schematic diagram of the RCA Model 10W707 rotator system.

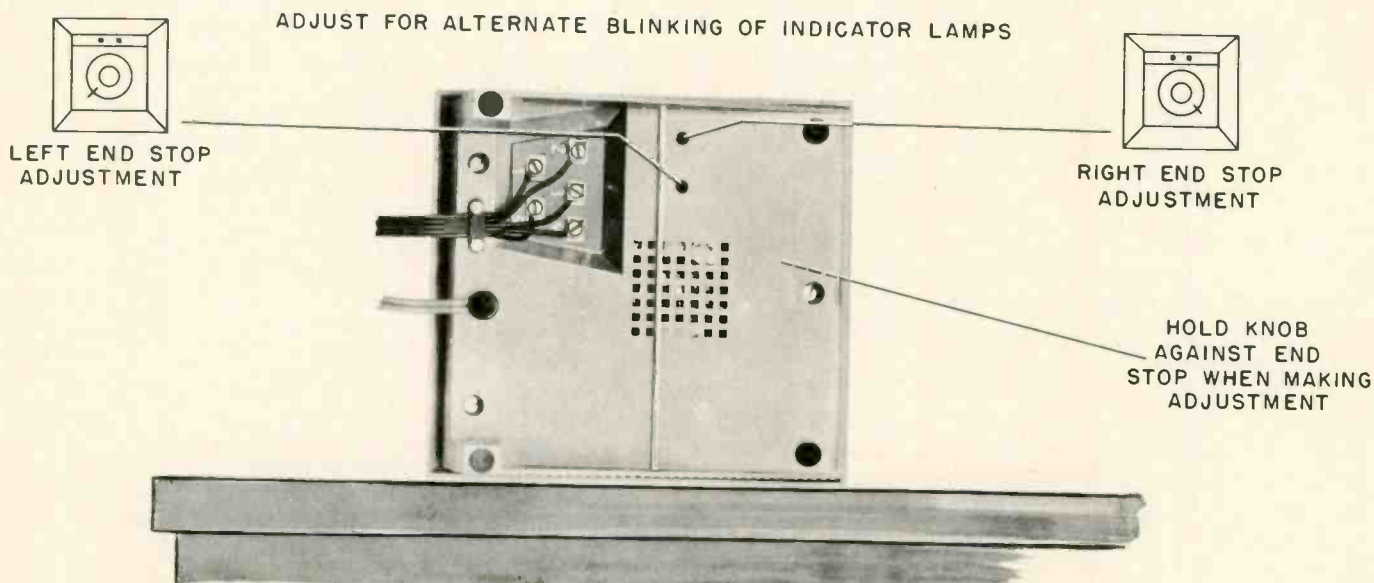
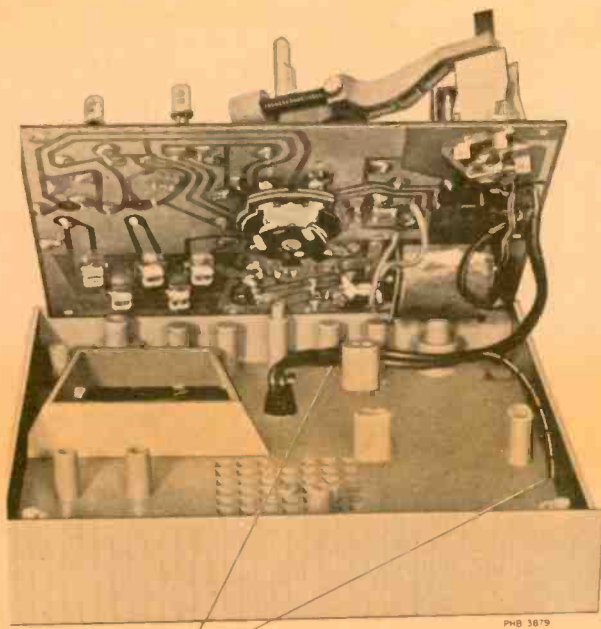


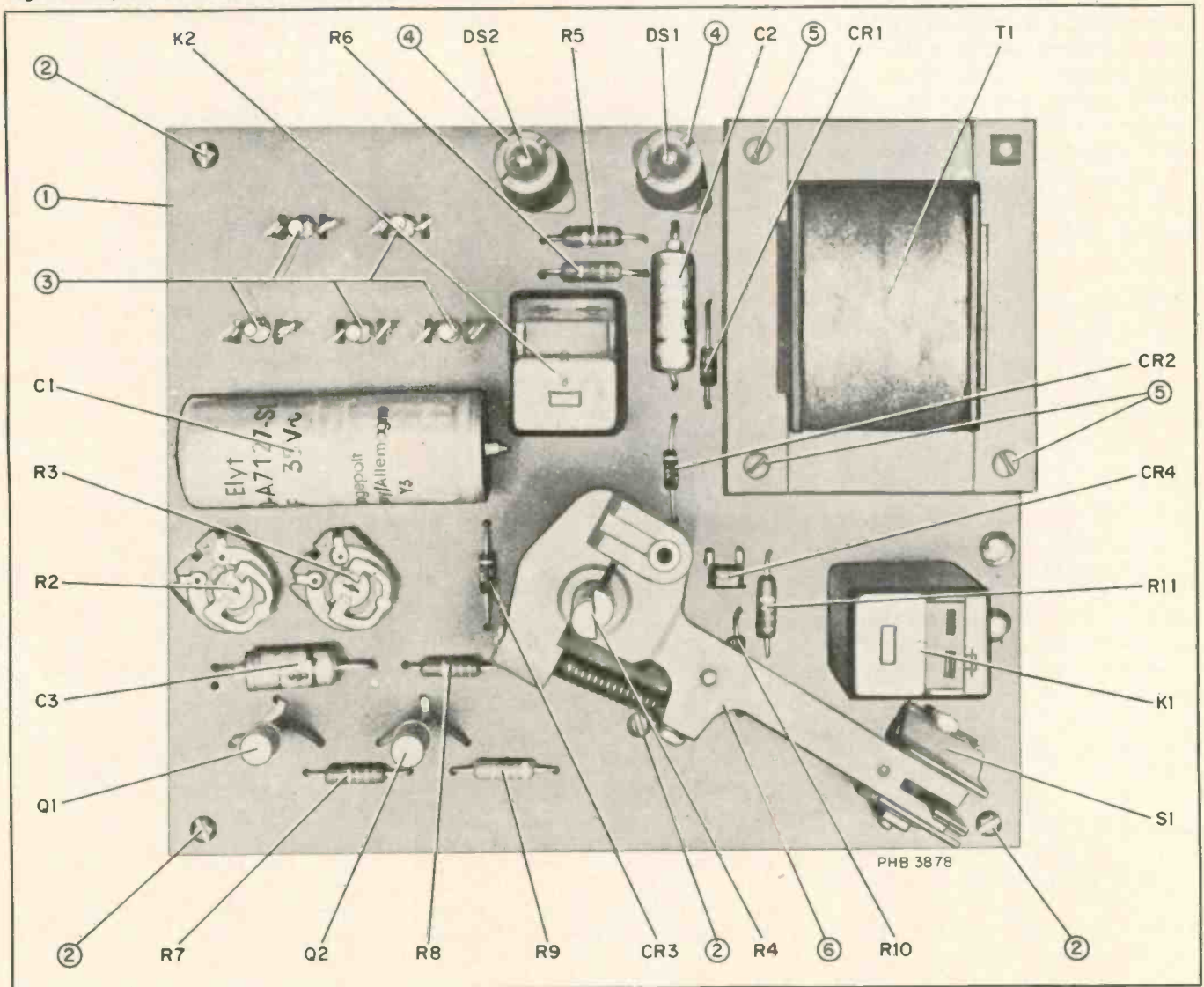
Fig. 16—Location of the end stop adjustments.



DRESS AC CORD AROUND MOUNTING SCREW BLOCKS

Fig. 17—Internal view of 10W707 shows circuit board and ac power cord lead dress.
 Fig. 18—Top view of circuit board showing components.

fully CW. The right-hand lamp should go out when the drive shaft reaches the end of its clockwise travel. The same holds true for the left-hand light when the rotator drive shaft reaches the full CCW position. If either light does not go completely out, the end stop control potentiometers can be adjusted. This is done by holding the spring-loaded control knob against the stop end and slowly turning the appropriate potentiometer until the two (left and right) lights blink alternately. See Fig. 16. Releasing the control knob should cause the light to go out. Rotate the control knob to the opposite stop end and check to see if that light goes out as required. If not, hold the control knob against the stop end and



adjust this potentiometer as before. Now rotate the control knob back to the "North" position. The rotator drive shaft should stop within 20 degrees of "North." If it doesn't, readjust the two end stop potentiometers. If the end stop controls do not provide satisfactory operation, it may be necessary to replace the potentiometer in the drive unit.

If it is necessary to service the RCA 10W707 control unit, the cover can be removed by pulling the control knob off the shaft and removing the three screws in the bottom of the unit. The printed circuit board can then be removed by taking out the seven mounting screws. There is one screw in each corner and a fourth just below the control knob shaft. The other three screws are located at the three inside corners of the transformer. These screws also hold the transformer. It is not necessary to remove the fourth transformer screw on the outside corner. When replacing the circuit board, be sure to dress the power cord between the circuit board and the base as shown in Fig. 17.

CONTROL KNOB TORQUE ADJUSTMENT

The control knob will not operate correctly unless the proper amount of friction is maintained between the control knob shaft and the switch (S1) arm. This friction is controlled by the tension of the switch arm spring. Proper adjustment should allow the control knob to continue turning with moderately applied torque after firm switch contact has been made. See Fig. 18.

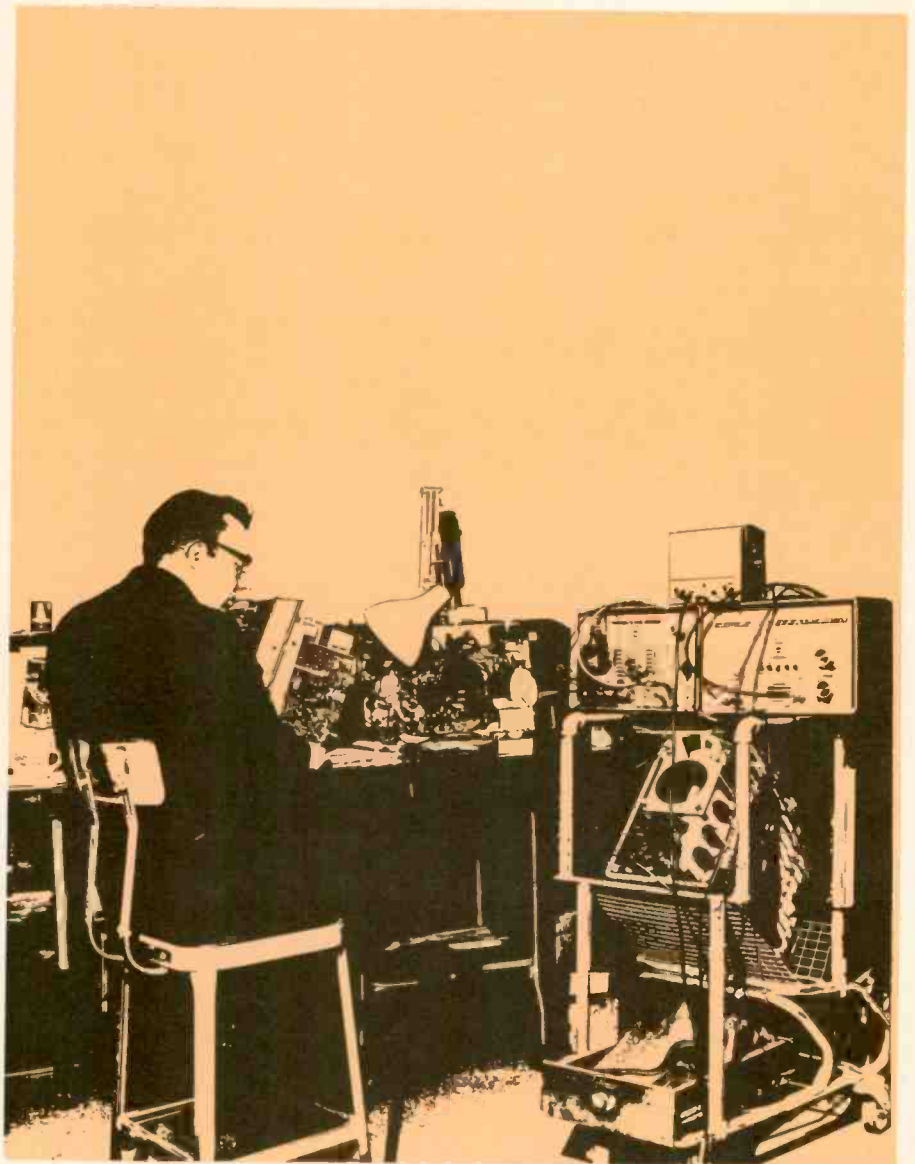
Proper operation of the control switch, S1, requires a clearance between adjacent contacts of between .030 and .035in. This spacing is adjusted by carefully bending the contact brackets with a pair of long-nose pliers. Be sure to disconnect ac power before making this adjustment.

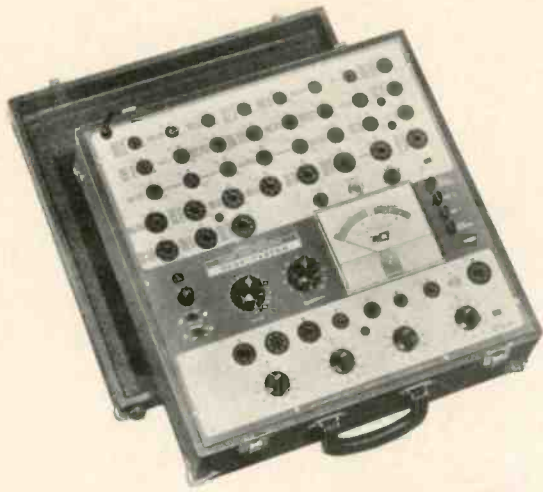
Troubleshooting the 10W707 can be accomplished by referring to the schematic diagram and the following chart. ■

Symptom	Cause
Drive unit will not rotate	<ol style="list-style-type: none"> 1. Power cord disconnected 2. Rotator cable connected incorrectly 3. Line 1,4 or 5 of cable open 4. Motor capacitor C1 open or shorted 5. Relay contacts on K2 (motor circuit contacts) open 6. Transformer T1 secondary (in motor circuit) open or shorted 7. Motor winding open or shorted 8. Contacts of control switch S1 do not close properly 9. Control knob friction insufficient to activate S1
Drive unit will not rotate clockwise	<ol style="list-style-type: none"> 1. Line #3 of rotor cable open 2. Diode CR1 or CR2 open 3. Capacitor C2 or C3 shorted 4. Resistor R5, R7 or R9 open 5. Bridge potentiometer R1,R2, R3 or R4 variable tap open 6. Bridge circuit between variable taps of R1 and R3 or between R2 and R4 open 7. Transistor Q1 or Q2 open 8. Diode CR3 shorted 9. Relay coil K2 open 10. Leads of right indicator lamp DS1 shorted
Drive unit will not rotate counter-clockwise	<ol style="list-style-type: none"> 1. Line #2 of rotator cable open 2. Bridge circuit between variable taps of R3 and R4 or between R1 and R2 open 3. Transistor Q1 or Q2 shorted 4. Leads of left indicator lamp DS2 shorted
Drive unit stops rotating when control knob is released (CW or CCW)	<ol style="list-style-type: none"> 1. Relay coil K1 open 2. Relay contacts (K2 bridge rectifier circuit) defective 3. Defective contacts on K1 4. Resistors R10 and R11 open
Excessive relay chatter	<ol style="list-style-type: none"> 1. Capacitor C2 or C3 open
No clockwise rotation	<ol style="list-style-type: none"> 1. Bridge rectifier CR4 open or shorted
Rotates counter-clockwise only if control knob is held CCW	<ol style="list-style-type: none"> 1. Bridge rectifier CR4 open or shorted 2. Transformer T1 secondary winding (bridge circuit) open or shorted
Right indicator lamp remains lit when drive unit is rotated fully CW against stop	<ol style="list-style-type: none"> 1. End stop trimmer pot R2 requires adjustment (Accessible through hole number two in bottom of control unit)
Left indicator remains lit as above	<ol style="list-style-type: none"> 1. End stop trimmer pot R3 requires adjustment (Accessible through hole number one)
Indicator lamps blink alternately when control knob is released	<ol style="list-style-type: none"> 1. Control switch S1 or holding relay contacts (relay K1) shorted

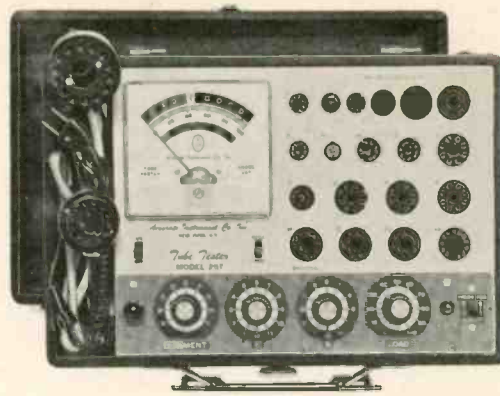
TEST INSTRUMENT REVIEW PART III

We wrap up part three and the conclusion of this series with a handy reference listing of test instrument manufacturers





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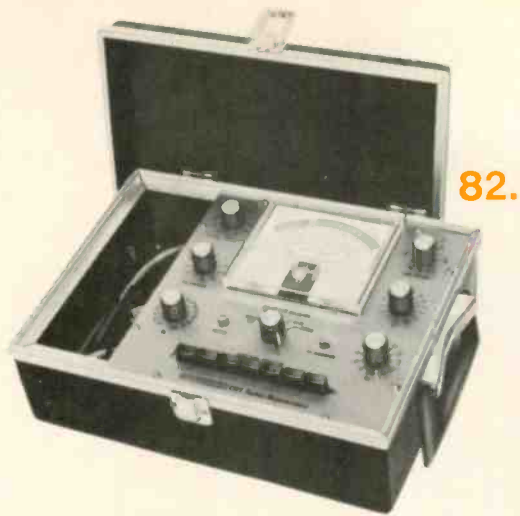
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77.

TUBE TESTERS

Mfg.	Model	Type	Test Functions	Available Sockets
Accurate 76.	257	Tube & CRT Emission	Shorts, leakage, cathode emission	Novars, nuvistors, 10pins, magnovals, compactrons, decals
Allied 77.	KG- 600C	Tube & CRT Emission	Shorts, opens, emission and gas	2,4,5,6 & 7 pin tubes; octals; loctals; 7,9 & 10 pin miniatures; 9 pin magnovals; 9 pin ncvlar; 10 pin decals; compactron and pilot lamps
B&K 78.	707	Dynamic Mutal Conductance	Shorts, leakage, Gm measurements, gas, grid emission	All standard types plus 10 pin; compactrons and nuvistors tubes
B&K 79.	465	CRT Tester	Shorts, leakage, cathode emission opens. Rejuvenation function.	Television picture tube test cables
Conar 80.	223UK	Tube emission	Open element, filament continuity, special tubes, leakage, shorts, emission	Standard base types plus octal, loctal, nuvistors, novars, compactrons
EICO 81.	635	Tube emission	Shorts, grid leakage, gas and cathode emission	Standard base types plus novars, compactrons, nuvistors, battery types, auto radio hybrids, decals and magnovals
EICO 82.	633	CRT Tester	Tests and rejuvenates most picture tubes including color	Television picture tube test cables
Heath 83.	TT-1A	Mutual Conductance	Indicates Gm to 24,000 μ mhos, grid current, leakage, life	All standard base types plus octal, novar, loctal, 9 pin, 10 pin miniatures, nuvistors, compactrons



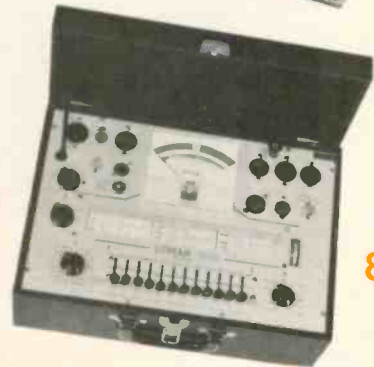
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80.

Type of Chart	Additional Features	Price
-----	Will test black and white picture tubes as well as color tubes for emission, leakage and shorts using special cable included with unit.	\$47.50
Illuminated built-in roll chart, with thumb wheel drive.	Has filament voltage settings from 0.63 to 117v. Also line, load voltage adjustments and individual tube settings.	\$44.95 (Kit)
Separate tube chart	Will test over 2200 tube types including regulators, hybrids, thyatrons and European types. Also features "Jet-Check" section for rapid tests and provision for new socket if necessary for newer tube types.	\$199.95
Separate setup chart	Will test and rejuvenate old and new tubes including the "Low G2" tubes requiring 50v or less of GZ potential and tubes operating at low emission currents.	\$99.95
Built-in roll chart	Has transformer isolated test currents for safety, 12-lever element selector-distributing system and independent filament terminal selection to prevent obsolescence due to tube changes.	\$49.95 (Kit)
Separate tube chart	Has burn-out protected meter circuit and comes in scuff-proof luggage type case.	\$44.95 (Kit)
Separate tube chart	Employs high dc voltage for rejuvenation welding and short-clearing process. Variable filament over 12 ranges from 1 to 12v.	\$69.95 (Kit)
Illuminated built-in roll chart	Features constant current heater supplies plus a special discount switch to remove all voltage from selector switches as protection against damage during setup.	\$160 (kit)

continued



TUBE TESTERS *continued*

Mfg.	Model	Type	Test Functions	Available Sockets
Lectro-tech 84.	CRT-100	CRT Analyzer	Grid-cathode leakage, heater-cathode leakage, emission of B/W and color, shorts, life test and rejuvenation	Cables for B/W and color picture tubes
Mercury 85.	2000	Mutual Conductance	Dynamic mutual conductance (Gm), gas, grid emission, shorts and leakage	All standard tube types plus new decals, novars, compactrons, magnovals, also color and B/W with optional cables
Mercury 86.	880	CRT Analyzer	Beam current, tracking, shorts and leakage of B/W and color picture tubes plus rejuvenation	B/W and color picture tube test cables
RCA 87.	WT-509A	CRT Tester	Tests color and B/W for emission, leakage and shorts	B/W and color CRT test cables
SECO 88.	HC-8	Horiz. Output Tester	Checks cathode current of horiz. output tubes using adapter cables	Adapter cables for most horiz. tube types
SECO 89.	88A	Emission Tube & CRT	Makes up to 11 simultaneous tests for leakage, shorts, grid emission, tube merit and filament continuity	All standard base types plus novars, compactrons, decals and magnovals
Sencore 90.	MU150	Dynamic Mutual Conductance	Gm tester using 5000Hz square wave, grid leakage, intermittents, cathode emission	Tests over 3000 domestic and foreign types
Sencore 91.	CR143	CRT Tester	Checks color tracking, plus standard shorts test, emission and life. Also provides rejuvenation	B/W and color CRT test cables



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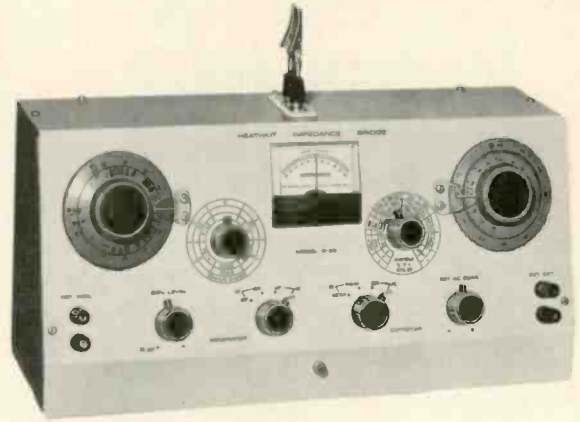
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Type of Chart	Additional Features	Price
-----	Features high energy rejuvenation circuit which applies momentary high energy between grid and cathode. Removes shorts by high potential burning of particles.	\$89.50
Separate chart	Features 13-section, 3-position master lever distribution system to prevent obsolescence from new base pin arrangements.	\$129.95
Separate chart	Features adjustable G1 bias and G2 dc voltages plus direct reading filament voltage. Tests each gun of color CRT.	\$79.95
Enclosed in case cover	Tests over 1000 tubes and includes five plug-in test sockets. Also has input jack for high voltage measurements to 50,000v.	\$118
Built-in labels	Features in-circuit testing of horizontal tube current which is monitored on large meter for accurate adjustment. Especially useful during color TV setup.	\$34.50
Built-in flip chart	Features low test voltages to reduce shock hazard and five setup controls for speed. New setup information free periodically to equipment owners.	\$74.50
Built-in flip chart	Flip chart in cover is plastic coated for durability. Controls are designed for speed of operation.	\$229.50
Built-in flip chart	Has rejuvenation circuit and provides automatic comparison of CRT color guns.	\$119.50

continued



93.



94.

92.

MISCELLANEOUS INSTRUMENTS

Mfg.	Model	Function	Specifications	Price
Conar 92.	311	Tests: resistors, capacitors; including mica, cer, paper, oil-filled & electrolytic	Resistance Ranges: 500Ω, 100-50K, 10K-5M, 1.8-150M. Capacity Ranges: 0.1-50mfd, .001-.5mfd, .0001-.005mfd, 18-150mfd. Has "floating" chassis and provides actual rated dc working voltages to capacitors. Operates from 110-120vac, 60Hz. Optional test leads.	\$29.95 (Kit)
EICO 93.	HVP-5	High Voltage Test Probe	Gain: approximately 3000 at 1kHz; usable bandwidth: 50Hz to 200kHz (extended to 200MHz with demodulator tip supplied); Input impedance: 3500Ω using probe only, 35000Ω using 20dB attenuator probe tip, 350,000Ω using 40dB attenuator tip. Output is 0.3v P-P. Power supply is one "AA" battery. 0-30 dc kilovolt meter built-in.	\$19.95 (Kit)
Heath 94.	IB-28	Impedance Bridge	Four separate bridge circuits measure resistance, capacitance, low and high Q inductance. Meter reads 100-0-100μa. DC measurements: built-in power supply. AC measurements: built-in 1000Hz generator with terminals on front panel for external generator at other frequencies. Reads capacitance from 100pf to 100μfd; inductance from 0.1mH to 100H. Operates on 105-120vac or 210-250vac, 50/60Hz.	\$89
Heath 95.	IM-58	Distortion Meter	Frequency: 20 to 20,000Hz in three ranges; reads distortion: 1,3,10,30 at 100% full scale; voltmeter: 1,3,10,30v full scale. Input resistance: 300K. Minimum input voltage for distortion measurements: 0.3v. Operates on 105-125vac or 210-250vac 50/60Hz	\$65
Leader 96.	LPC-924B	TV Field Level Meter	Frequency range: VHF 12 channels and UHF. Input signal level in VHF: 20 to 120dB. Input signal level UHF: 30 to 100dB. Input impedance is 75Ω VHF and 300Ω UHF. Attenuation: 80dB total (2) 10dB and (3) 20dB steps. Operates from eight 1.5v batteries. Comes with earphone, 300 to 75Ω matching pad and carrying case.	\$219.50
Sencore 97.	FS134	Field Strength Meter	Tuning range: TV channels 2 to 13, UHF channels 14 to 83 plus FM band 53 to 109MHz. Sensitivity: ±3dB from 53 to 109MHz and 173 to 218MHz; ±6dB from 465 to 895MHz. Input impedance 75 and 300Ω. Attenuators: 0dB, 20dB and 40dB. Eight "C" are required for the 12v supply and one "C" cell for bias. Optional accessory is a rechargeable battery supply.	\$229.95
Weston 98.	166	Instrument Calibrator	Calibrates VOMs, portable instruments and panel meters for all meter parameters including ac and dc current and resistance. Output levels: voltages - 1mV to 1111.110v, 1uV to 1111.110mV; Currents - 1μa to 11.111110a; resistance 1Ω to 11.111110M. Output frequencies: 50,60,400 and 1000Hz ±1% plus any external frequency between 50 and 1000Hz. Unit performs fully within all rated specifications from +5C to +35C. Input power: 115 or 230vac, 50/60Hz, 350w.	\$41.95

98.



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95.

96.



TEST EQUIPMENT ROUNDUP ADDRESSES

Accurate Instr.
2435 White Plains Rd.
Bronx, N.Y. 10467

Allied Radio Corp.
100 N. Western Ave.
Chicago, Ill. 60680

B & K DIV
Dynascan Corp.
1801 W. Belle Plaine
Chicago, Ill.

Blonder-Tongue Laboratories, Inc.
9 Alling St.
Newark, N.J. 07102

Commander Corp.
133 N. Jefferson
Chicago, Ill. 60606

Components Spec., Inc.
101 Buffalo Ave.
Freeport, N.Y. 11520

Conar Div. of
Nat'l Radio Institute
3939 Wisconsin Ave.
Washington, D. C. 20016

Cornell-Dubilier Electronics
50 Paris St.
Newark, N.J.

Dynasciences Corp.
9601 Canoga Blvd.
Chatsworth, Calif. 91311

EICO
283 Malta St
Brooklyn, N.Y. 11207

Electronic Measurements
625 Broadway
New York, N.Y. 10012

General Instruments
65 Gouverneur St.
Newark, N.J. 07104

Gerber Scientific Instr. Co.
PO Box 305
Hartford, Conn. 06101

Heath Co
Benton Harbor, Mich. 49022

Hickok Electrical Inst.
10514 Dupont Ave.
Cleveland, Ohio 44108

Ideal Precision Meter Co.
214 Franklin St.
Brooklyn, N.Y.

Instruments Div.
Solitron Devices, Inc.
256 Oaktree Rd.
Tappan, N.Y. 10983

J-B-T Instruments, Inc.
424 Chapel St.
PO Box 1818
New Haven, Conn. 06508

Jerrold Electronics Corp.
401 Walnut St.
Philadelphia, Pa. 19105

Karg Laboratories, Inc.
162 Ely Ave.
South Norwalk, Conn. 06854

Lampkin Laboratories, Inc.
Bradenton, Fla. 33505

Leader Instr. Corp.
24-20 Jackson Ave.
Long Island City, N.Y. 11101

Lectrotech, Inc.
1221 W. Devon Ave.
Chicago, Ill. 60626

Mercury Electronics
3155 Roslyn Rd.
Mineola, N.Y. 11501

Phillips Elec. Instr.
750 S. Fulton Ave.
Mount Vernon, N.Y. 10550

Precise Electronics & Development
76 E. 2nd St.
Mineola, N.Y.

RCA/Electronic Components
Harrison, N.J. 07029

Sanwa Corp. of America
2500 Woodbridge Ave.
Edison, N.J. 08817

Sencore, Inc.
426 So. Westgate Dr.
Addison, Ill. 60101

Simpson Electric Co.
5200 W. Kinzie St.
Chicago, Ill. 60644

Sprague Products Co.
North Adams, Mass. 01247

Sylvania
Batavia, N.Y.

Systemation, Inc.
140 Erie Blvd.
Schenectady, N.Y. 12305

Tektronic, Inc.
PO Box 500
Beaverton, Ore. 97005

Triplett
Bluffington, Ohio 45817

Video Instr. Corp.
116 Toledo St.
Bloomington, N.Y. 11735

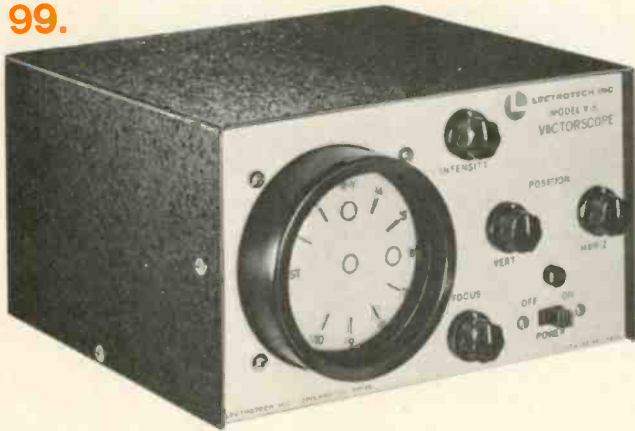
Waterman Instrument Corp.
400 S. Warminster Rd.
Hatboro, Pa. 19040

Western Instr. Div. of
Western Instr., Inc.
17 Hartwell Ave.
Lexington, Mass. 02173

Weston Electrical Instr. Co.
614 Frelinghuysen Ave.
Newark, N.J.

Workman Electronic Products, Inc.
Box 3828
Sarasota, Fla. 33578

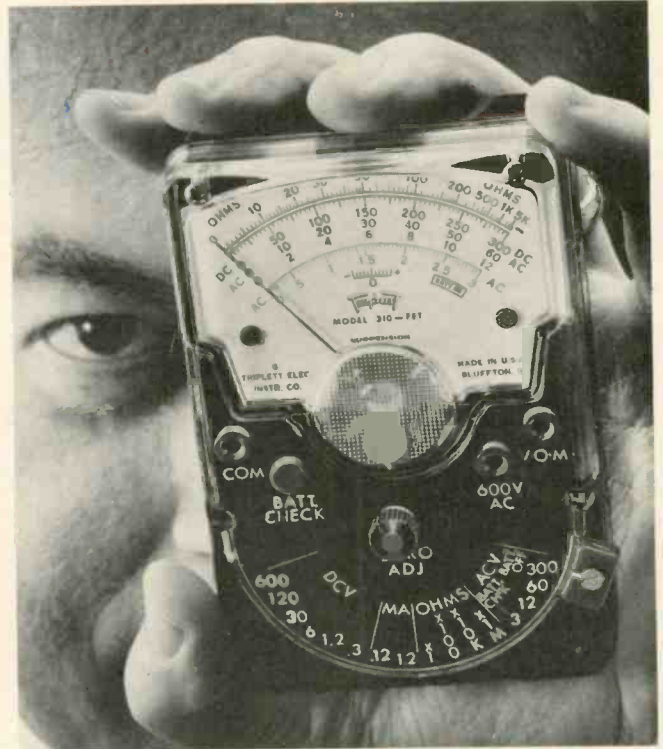
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101.



ADDITIONAL TEST INSTRUMENTS

99. Lectrotech Model V5 Vectorscope indicator is designed to operate with any standard color bar generator for troubleshooting and alignment of color receivers. It provides an accurate measurement of color demodulation for checking R-Y, B-Y and color bars for color phase angles and amplitude. The instrument can also be used for color amplifier gain tests, to adjust color sync and for proper hue control centering. The unit weighs 5 lb and comes complete with all leads and servicing guide. \$79.50.

100. The Lectrotech Model V6-B is an all solid state, ac operated generator. It provides a crystal-controlled keyed rainbow color display, crosshatch, dots, vertical lines only, horizontal lines only, gun killers, an adjustable horizontal line width voltage regulated timing circuits and rapid calibration. The unit also features an adjustable dot size, RF output of more than 10,000mV, operation on channels 3,4 or 5, and color level control for color sync servicing. All cables are permanently attached and housed in the test lead compartment of this caddy size unit. Price \$99.50.

101. The Triplet Model 310 FET Volt-Ohm-Milliammeter features single selector switch operation, 20,000Ω per volt dc sensitivity, shirt pocket size, provision for ac clamp-on ammeter, shielding for operation in magnetic fields and unbreakable meter window. Specifications: dc and ac volts at 0 to 3, 12, 60, 300 and 1200 (20,000 ohms per volt on dc and 5000 ohms per volt on ac). Ohms ranges: 0-20K, 200K, 2M and 20M. Current ranges: dc; 0 to 600μA at 250mV, 0 to 6, 60, 600mA at 250mV. The unit comes complete with leads, battery and manual. \$37.50.

Two-Way Radio on the Go

Don't be reluctant to service transistorized two-way equipment. Part three of this series provides some practical hints to make the transition easier

■ The two-way radio service technician will not become obsolete just because of the trend toward modular construction of equipment. It will still be necessary to know which module to replace, whether it is a plug-in type or soldered into the assembly. And someone will have to know how to repair the modules even if they can be sent back to the factory for replacement or repair because of the time factor.

Some technicians, however, have become obsolete because of their lack of knowledge of transistor circuitry. Most have mastered tube circuits but some are reluctant to tackle solid-state equipment, at least with confidence.

TRANSISTOR TESTING

Actually, transistor circuits are no more complex than tube circuits. Often they are simpler. And, there are no high voltage problems.

Since most transistors are soldered in place, they cannot be readily removed like tubes for testing. Therefore, they usually have to be checked without removal from the equipment. And that's not too difficult as you will see.

Perhaps the easiest way is to use an in-circuit transistor tester with the equipment turned off. Simply connect the tester's leads to the transistor leads and adjust the tester.

But, there's another way. Almost every transistor has a resistor connected in series with its emitter. When emitter-collector current flows through the transistor there is a voltage drop across the resistor. Simply turn the equipment on and measure the voltage with

a VOM, preferably one with a high input impedance. Then use a clip lead to short the transistor base to its collector and watch the meter. If the transistor is operating normally, the meter reading should "drop" since forward bias has been reduced to zero. (See Fig. 1.)

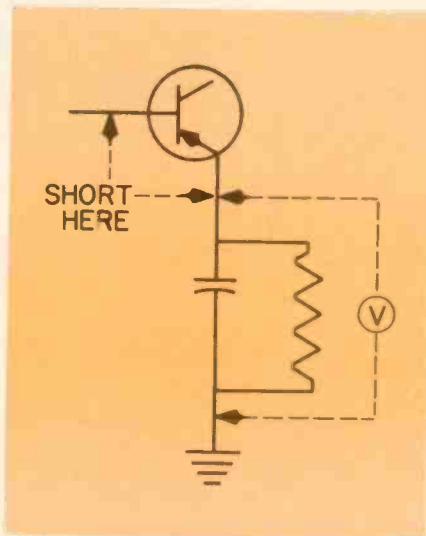


Fig. 1--Connect a high impedance VOM across emitter resistor and short base to collector. Meter reading will decrease on normal transistor.

If there is no emitter resistor, connect the VOM across the collector and emitter of the transistor. Voltage will be indicated unless the transistor is shorted or forward-biased to saturation. If voltage is present, short the base to the emitter with a clip lead. The meter reading should "rise" since the forward bias is reduced to zero and the collector-emitter path is almost an open circuit. (See Fig. 2.)

It doesn't matter whether it's an RF, IF, AF, mixer, oscillator or squelch stage, nor does it matter if the load is a resistor or an inductance.

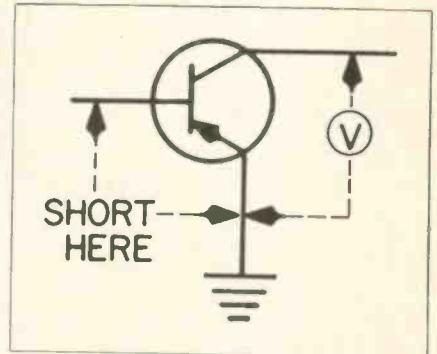


Fig. 2--Connect VOM between emitter and collector if circuit has no emitter resistor. Meter will indicate voltage unless transistor is shorted or biased to saturation.

TUBE TESTING

You can do the same thing with tubes. Measure the voltage drop across the cathode resistor (if there is one) and short the control grid to the cathode momentarily with a test lead. The meter should "rise" since cathode current is higher because the reverse bias has been removed. (Fig. 3.)

Or, measure the dc voltage

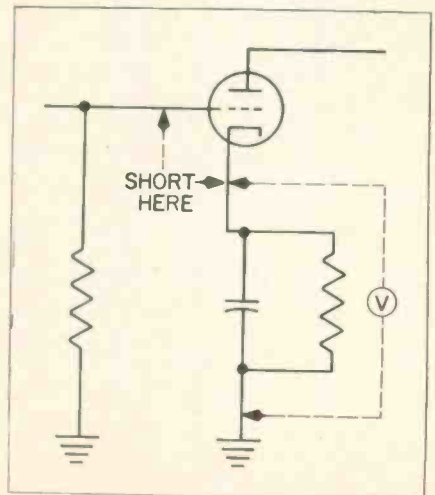


Fig. 3--An in-circuit test of tube operation is made similar to transistor test by measuring across cathode resistor and momentarily shorting grid to cathode.

between plate and cathode and again short the control grid to the cathode momentarily. The voltage should "drop" since plate current should have increased. (Fig. 4.)

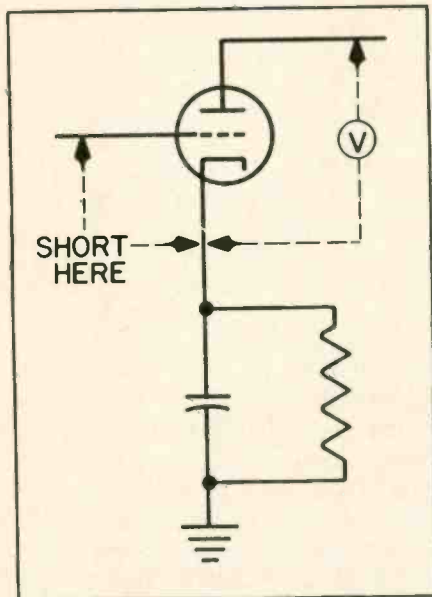


Fig. 4--An optional test of tube performance is made by measuring the voltage drop between cathode and plate while momentarily shorting grid to cathode.

Of course, it is easier to test or substitute the tube. But, the above test is also a check of the circuit.

While we're talking about tubes, here's another tip. Don't fully rely on your tube tester, even if it is of the transconductance type, and much less if it is of the emission type. Even the best of tube testers will often fail to reveal an ailment known as "grid emission." Some general purpose tube testers check for this malady. Otherwise, you should use a special grid circuit tester.

A tube can check normal but can cause subtle, hard-to-detect troubles. If its control grid is contaminated, it may act like a cathode after it gets hot because of its proximity to the cathode. Then, if its grid circuit resistance is high, grid current will flow because the grid emits electrons. This can affect voltages in other stages as well as its own. So back to our old stand-by, if you're not sure, substitute.

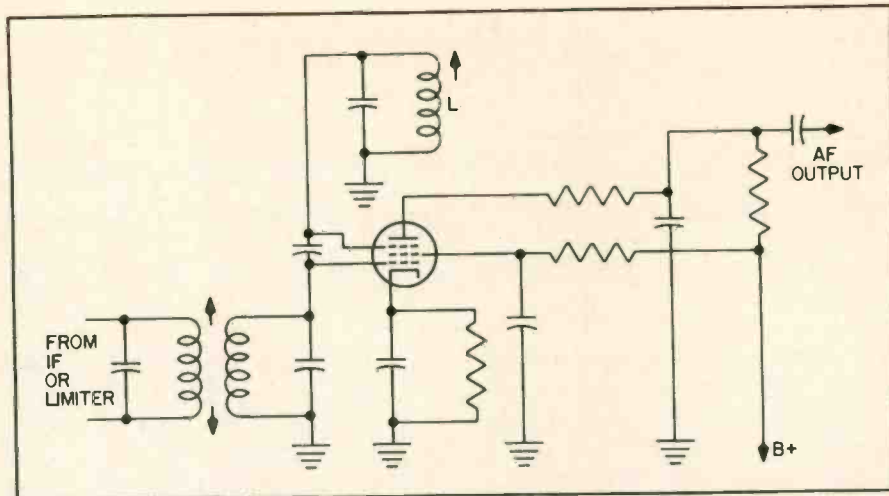


Fig. 5--Gated beam FM discriminator/limiter is adjusted by tuning coil (L) for maximum audio while receiving a signal.

DISCRIMINATORS AND ALIGNMENT

Essentially all early FM mobile receivers employed the familiar Foster-Seeley discriminator which every technician should know how to adjust. Then came the Bradley detector which worked well, but to adjust it an FM signal generator and scope were required. Much later, the gated beam detector (6BN6, etc.) was introduced and many technicians condemned it not knowing that it is easy to adjust and probably one of the best FM detectors (Fig. 5). No instruments are required. Just tune the quadrature coil (L) for maximum audio recovery when receiving a signal.

Another tip on tube circuits--don't replace a tube unless it is necessary. If a receiver still has $1\mu\text{v}$ or better sensitivity, don't replace used tubes with unknown new tubes. Chances are that the used tubes will last longer than an unaged new one. It has been reported that new tube failures occur during the first 200 hours of operation. If they last 200 hours, they are apt to last much longer.

Surprisingly, many technicians, particularly those new to the game, think an expensive VHF/FM signal generator is required for aligning FM receivers. It's not necessarily so. A low cost AM signal generator can be used even if it doesn't tune into the

VHF band. It does put out harmonics which you can use.

To align the front end, you don't even have to connect the signal generator output to the receiver input. Plug a dummy load into the antenna connector (a #47 pilot lamp soldered to a PL-259 plug will do). Then bring the signal generator output cable near the dummy load. With the squelch open so you can hear background noise, and with the signal generator modulation turned off, slowly tune the signal generator until a harmonic quiets receiver noise.

Now, set the receiver test meter to indicate limiter voltage or connect a DC VTVM to the limiter test point. Retune the signal generator for maximum limiter voltage. Then reduce the coupling to the signal generator or turn down its output level, or both, until you still get a useful meter reading and hear some background noise. Now, align the front end for maximum limiter voltage.

If you have any doubt about the harmonic being at the channel frequency, compare it with a signal from a transmitter operating on the same channel.

You can also use an AM signal generator for second mixer and IF alignment. Still monitoring the limiter voltage, align the IF stages by loosely coupling the signal generator output

continued on page 86

Lectrotech Model TO-50 Triggered Sweep Oscilloscope

Many color circuit problems can be quickly diagnosed with one easily read waveform using the vectorscope technique

... for more details circle 900 on Reader Service Card

■ The oscilloscope/vectorscope combination has become a popular instrument in color TV service shops and with the bandwidth offered in this instrument it can be used in various applications in industrial electronics.

The vectorscope technique is not new. An article by Robert Middleton describing its use appeared in *ELECTRONIC TECHNICIAN* in August 1957. The article explained how the oscilloscope can be set up to produce vectorscope patterns.

A tremendous amount of color circuit information can be obtained in a vectorscope waveform for professional repair of color TV sets.

Most of the controls and input connectors on the front panel of the oscilloscope are similar to those found on other triggered sweep scopes to simplify setup operations.

Input jacks and switches for vectorscope operation and the vertical and horizontal vectorscope display positioning controls are placed on the back panel. The red jack is marked R-Y and is connected to the red grid of the color CRT. The blue jack marked B-Y is connected to the blue grid of the CRT and a third jack connects the TV receiver chassis to ground.

A book by Wayne Lemons is supplied with the instrument explaining applications, methods of use and detailed alignment instructions.

The oscilloscope chassis employs three circuit boards, the vertical amplifier, horizontal amplifier and the high voltage stages.

The vertical amplifier system is all solid-state in design with the exception of the input stage, which is a vacuum tube (12AT7). A tube is used to provide protection against damage to the oscilloscope when subjected to large overvoltage.

Input signals to the vertical amplifier may be either ac or dc coupled, depending upon the setting of the AC-DC-GND switch. In the ground position the input to the vertical amplifier is disconnected from the input con-

Lectrotech's Model TO-50 triggered sweep oscilloscope/vectorscope.



ductor and connected to chassis ground.

The vertical amplifier has a basic sensitivity of .02v per division. To display longer input signals, they must be attenuated to provide a display within the limits of the calibrated graticule and this is the function of the input attenuator.

The Schmitt trigger circuit provides a constant amplitude output square wave which is used to drive the following stage. This output signal is always a square wave and of constant amplitude regardless of the amplitude or shape of the input signal. This enables the trigger circuit to work with a uniform signal regardless of the nature of the triggering signal fed to the input of the triggering circuits.

One of the most useful features of this scope is the automatic sync function. To place the instrument into the AUTO SYNC mode pull the TRIGGER LEVEL knob out from the panel. This mode permits triggering automatically at the average of the input signal. In the automatic mode the TRIGGER LEVEL control is inoperative.

When the oscilloscope is placed the auto mode of sync, the time base circuit is triggered at a 45Hz note. Since the sweep circuits are operating under this condition, a trace will appear and override the dc unblanking. This is convenient when positioning of the trace is desirable to estab-

lish a dc reference level. The automatic mode will provide a horizontal sweep for this purpose.

The most difficult signal for an oscilloscope to trigger on is a composite video signal consisting of vertical and horizontal sync pulses plus video information. To provide positive triggering on this type of signal, an additional switch is employed in the triggered circuits of this scope. This is the TV sync switch which has three positions. In the normal position, this switch and its associated circuitry is inactive and the trigger circuits work in their normal manner. When the switch is in the H or horizontal position, the signal is sharply differentiated and the trigger amplifier acts as a sync separator. Under these conditions positive synchronizing is achieved for viewing of signals at the TV horizontal scanning rate.

When the switch is in the V or vertical position, the sync signal is integrated and again the trigger amplifier acts as a sync separator. Under these conditions positive triggering is achieved for viewing signals at a vertical sync rate.

As a convenience in using this

oscilloscope for television waveforms, three points on the TIME/DIV. switch are not only marked in time, but are also identified as to the switch position which would be used to view signals at the vertical rate, the horizontal rate and the color rate.

Vertical information would normally be viewed at the 2ms position. Next to this marking you will find a red V meaning vertical.

At the $10\mu\text{s}$ position where horizontal information would be viewed is a red H for horizontal TV rate. Color information would be viewed in the last TIME/DIV. switch position, $1\mu\text{s}/\text{DIV}$. This has a red C for color.

External horizontal amplifier operation is also offered on this scope. This function is used when it is desirable to plot one function against another as in an X-Y display. It is also used in sweep generator alignment setups where an external sweep must be applied to the horizontal deflection plates of the CRT. The external horizontal amplifier comes into operation when the TIME/DIV. switch is rotated fully clockwise to the EXT position.

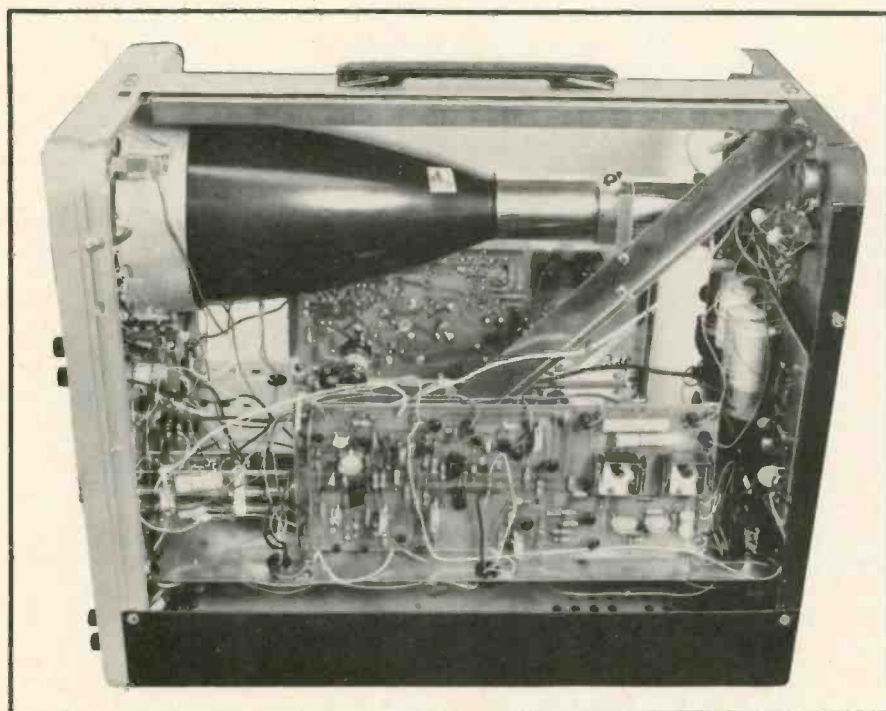
The increased use of transis-

tors will make it mandatory that the technician be able to use the oscilloscope. The oscilloscope allows the technician to view the electronic circuits at work.

Guesswork and the swapping of parts can prove to be rather unsuccessful and slow, so get in the habit of using an oscilloscope and other service aids to make servicing more profitable. ■

SPECIFICATIONS:

- Vertical Amplifier.** (a) 3db bandwidth, dc to 10MHz. (b) Risettime: 35ns. (c) Sensitivity: 0.02v/div to 50v/div in 2-5 sequence with continuously variable gain control. (d) Input impedance: 1M, in parallel with 30pf. (e) Maximum input: 600v, dc and P-P.
- Horizontal Sweep Generator.** (a) Type: Miller integrator. (b) Sweep Speeds: 0.02 sec/div to $1\mu\text{s}/\text{div}$ in 1-2 steps sequence. Continuously variable control between ranges. With 5X magnifier sweep speed increases to $0.2\mu\text{s}/\text{div}$.
- Triggering.** (a) Source: Internal, External and Power Line. (b) Type: Automatic or amplitude selection (with Trigger Level control) with preset Stability. (c) Slope ..+ or -, switch selected. (d) TV Sync Vertical, Horizontal and Normal positions. Sync separation plus vertical integrator provide positive sync of composite video signals.
- External Horizontal Amplifier.** (a) Bandwidth: dc to 0.5MHz. (b) Sensitivity: 0.5v/div. (c) Input impedance: 100K in parallel with 30pf. (d) Internal Line Sweep: variable in phase over 150deg. Compatible with all sweep generators.
- Test Signals.** (a) Calibrate Gain: 1v P-P square wave at line frequency. (b) Probe Test: Fast rise 20v square wave at time base frequency for probe adjustment.
- Cathode Ray Tube:** (a) Display Area: 8 x 10cm. (b) Blanking: dc unblanking. (c) Tube Size: 5in. round.
- Power Requirements:** (a) Voltage: 105-125v. (b) Frequency: 50-60Hz. (c) Power: 65w.
- Mechanical:** (a) Size: 14 1/8 x 10 1/4 x 16 1/2in. (b) Weight: 23 lb. (c) Cooling: Convection, no fan required.



Interior view showing the vertical amplifier, horizontal amplifier and the high voltage boards.

Weston Model 166 Instrument Calibrator

Not every shop can justify the cost of a test instrument's test instrument. But in case you are 'just looking,' here's a unit that will calibrate a wide range of moving-coil and electronic instruments

... for more details circle 901 on Reader Service Card

■ The Weston Model 166 Instrument Calibrator provides current and voltage functions for both ac and dc. It also has calibrated resistance decade facilities for calibrating ohmmeters and multimeters.

However, before we get into explaining the whys and wherefores of this instrument, you might be interested in knowing that this particular model sells for \$4195. Obviously, not every shop can justify the cost of such an instrument. But we feel our Testlab readers should know about these test instruments since units of this type are needed and used by many technicians in our industry.

Actually, test instruments are becoming more complex because their functions demand it. And in many cases calibration and maintenance are also more critical. So more shops are providing instrument calibrating services. There are also many shops involved in two-way radio service which are required to have periodic calibration checks made on their test instruments. Whatever your service business, you do use and need calibrated test instruments.

Multimeters such as VOM's are gaining in popularity. They are used in production, engineering and by service technicians with all degrees of skill. Multimeters are also exposed to a wide

and uncontrolled range of current, voltage, shock and vibration such as it would get in the back of the technician's service truck. The result is that because a VOM is more exposed to abuse, it requires more frequent calibration checks.

A typical VOM has approximately 6ac and 8dc voltage ranges, 5dc current ranges and at least 5 resistance ranges for a total of 24 ranges. The recommended VOM calibration procedure calls for checking at least two of the ac scales at least five points on each to be certain that rectifier aging has not damaged the ac accuracy. Actually, the total number of tests for a single VOM is about 40. Going through a large number of accurate tests on a VOM can be time consuming and expensive, thus the reason for units like the Weston Model 166. Here's what the 166 will do.

It has several features designed to reduce the number of steps required for calibration, reduce operator calculation, reduce danger from high voltage and to reduce operator error. The 166 features that make this possible are as follows:

1. It provides a complete range of voltage, current and resistance parameters. This includes voltages up to 1100v and currents to 11a. DC can be either (+) or (-) ground. AC frequencies of 50, 60, 400 and 1000Hz and resis-



Weston Model 166 Instrument Calibrator.

tance values up to 11M are also available.

2. All outputs of the 166 used for multimeter calibration are brought out to a single set of binding posts. Thus, connecting changes are not necessary during calibration.

3. Operation is provided by one switch for selecting volts, milliamperes, etc., and a second switch to select ac, + dc or - dc.

4. Seven decade dials allow the operator to simply set up the value to correspond with the field scale value of the meter being tested. Fixed decimal points are located between the 4th and 5th dials. One of the advantages of this digital scheme is that full accuracy is obtained in any decade setting. Earlier calibrators used precision meters as standards and the highest accuracy could only be obtained when the full-scale value of the calibrating instrument was the same as the meter being tested. An-

continued on page 86



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LETTER FROM THE PUBLISHER

The staff of ELECTRONIC TECHNICIAN/DEALER wishes to thank its readers and manufacturers for their excellent support during 1969. It was an exciting year for all of us in electronics, a year marked with many new features and theories, and we are happy to have been of service by bringing the reports of these happenings to you.

To the many manufacturers, who for years have backed our efforts by their continued vote of confidence and advertising programs, our sincere thanks. Their efforts have helped us achieve our goal of being the number one publication in the servicing market. Without their support and assistance, our task would have been difficult.

To our thousands of readers throughout the U.S., Canada and overseas, we express our deep appreciation for your continued support. And to make 1970 an even better year, we pledge our unending efforts to provide up-to-date, timely servicing information to help you become the most efficient and well-advised readers in the industry. Along with our continuous coverage of radio, TV and audio equipments, we will expand our exposure in areas of CCTV, two-way radio, antennas and test instruments. To meet the needs of our readers and fulfill the additional requirements we have set for ourselves, we continue to add knowledgeable and capable personnel to our staff.

As a publication dedicated to providing a service, the editorial staff and marketing managers welcome the opportunity to be of assistance. If there is anything we can do to help you or if you have any suggestions which may help us to do a better job, please let us know.



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Scotty Wallace

HUGH "SCOTTY" WALLACE

continued from page 44

MAGNAVOX

Color TV Chassis T924/T939—No HV In Chassis Used With 22in. or Larger CRT

A "No High Voltage Condition," in a chassis using a pin-cushion correction circuit, could possibly be caused by a faulty pincushion transformer, T106. To check this, unplug the deflection yoke and check for partial restoration of high voltage, approximately 12kv. If high voltage is partially restored with the yoke unplugged, transformer T106 is one possible cause of the problem.

Color TV Chassis T936—3rd IF Transformer L8

Reports from the field indicate some confusion regarding proper adjustment of the 3rd IF transformer L8. L8 differs from past IF transformer design to the extent that provision is made for adjusting both the inductance of the coils and the coupling between the coils. The inductance is adjusted in the conventional manner by positioning slugs within the coil form. The top of the L8 coil form consists of a plastic cap with a hex adjustment opening in the center. The plastic cap can be rotated to vary the coupling between the primary and secondary windings by physically varying the distance between them. Varying the coupling between the primary and secondary windings varies the bandwidth of the circuit. Adjustment instructions for this transformer are given in the Service Manual 7314.

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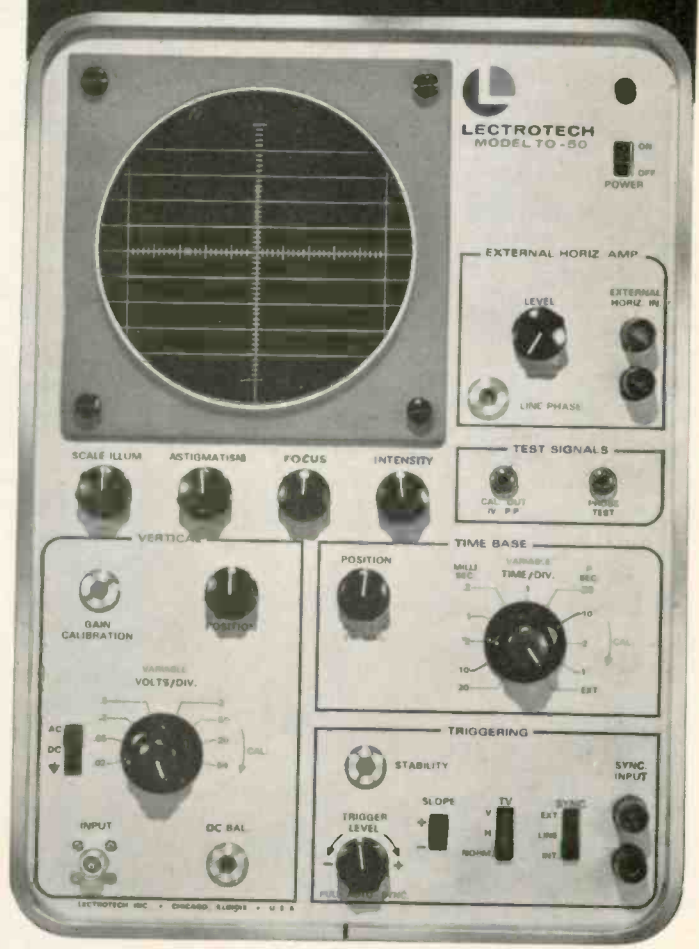
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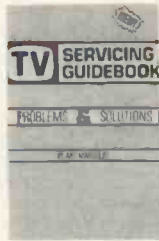
RCA Color TV Service Manual



A brand-new full size manual, covering 23 RCA Color chassis. Includes complete schematic diagrams for 12 chassis, from the CTC-12 to the CTC40 all-transistor model. Here in one compact, handy manual is everything you need to quickly and competently repair any RCA color set—from the CTC12 to the 1969 all-transistor CTC40.

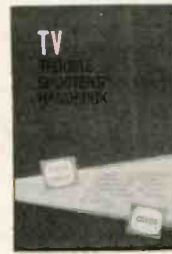
Encompasses both general and specific troubleshooting data applicable to all RCA chassis. The text delves into each section (Video, chroma, vertical, horizontal, etc.), and points out specific problems as well as general servicing procedures. Troubleshooting tips on each chassis, including circuit changes and factory modifications, are covered. While this material is related directly to RCA sets, much of it is applicable to other sets patterned after RCA designs. 176 pps., 8½ x 11, plus 36-page schematic foldout section. Over 175 illus.
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TV Troubleshooter's Handbook—New 2nd Edition



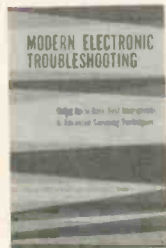
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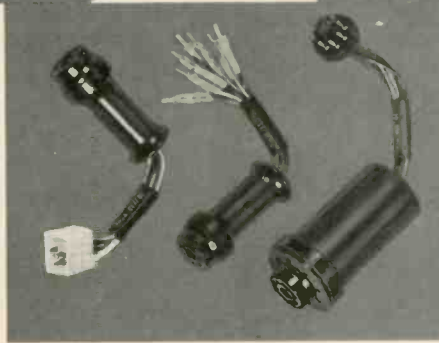
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*Industry Compatible Test Jig

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ICTJ lets you pull a chassis with the complete assurance that the picture in your shop will be the same as the customer sees in his home.

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Deptford, New Jersey

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ET/D DEALER SHOWCASE

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BATTERY DISPLAY 702

Product visible from all directions

A general purpose counter merchandiser containing a product assortment of batteries for radio, photo, and lighting is introduced. Designed



to meet the needs of mass merchandising at counter level, the display is an impulse purchase stimulator that provides a full view of the product assortment from all directions. Pilfer-proof, it is bright red with a Plexiglass front and 3/4 sides. Dimensions: 19in. wide, 14 1/4in. deep, 26 3/4in. high, wt. 25 lb. Mallory.

TAPE DECK 703

Winding speed of 110sec for a 1100ft tape

Introduced is the Model T-600 solid-state tape deck. The tape deck records and plays back four-track two-channel stereo or four-track one-channel mono in either direction, automatically or by touchbutton control. A center capstan is used for automatic reverse or automatic repetition playbacks in conjunction with a sensing tape. Any tape can be played repeatedly between any two positions by attaching a sensing tape. The unit has two 4-track 2-channel heads for recording and playback and two 4-track 2-channel heads for erasing. It is equipped with a built-in, solid-state pre-amp employing 18 transistors and 8 diodes with a reported fre-



quency response of 30-13,000Hz at 3 3/4ips or 30-20,000Hz at 7 1/2ips and a signal-to-noise ratio of 50db. Wow and flutter are reportedly less than 0.12 percent at 7 1/2ips and less than 0.20 percent at 3 3/4ips. There are two easy-to-read volume-unit operating indicators (VU meters) which operate in both record and playback modes. Other features include mike and line inputs for recording purposes and two outputs for playback; one has a fixed level while the other is variable to make it compatible with any other system for recording purposes. It also has a headphone jack with adjustable output level. Price \$299.95. Pioneer.

Introducing the world's only \$339 triggered scope.

Before you say you don't need a triggered scope, look what's happening to TV servicing: tubes are out, transistors and IC's are in.

With tubes you could play hit-or-miss, knowing the tube would take the overload. Try the same thing now, and good-bye transistors.

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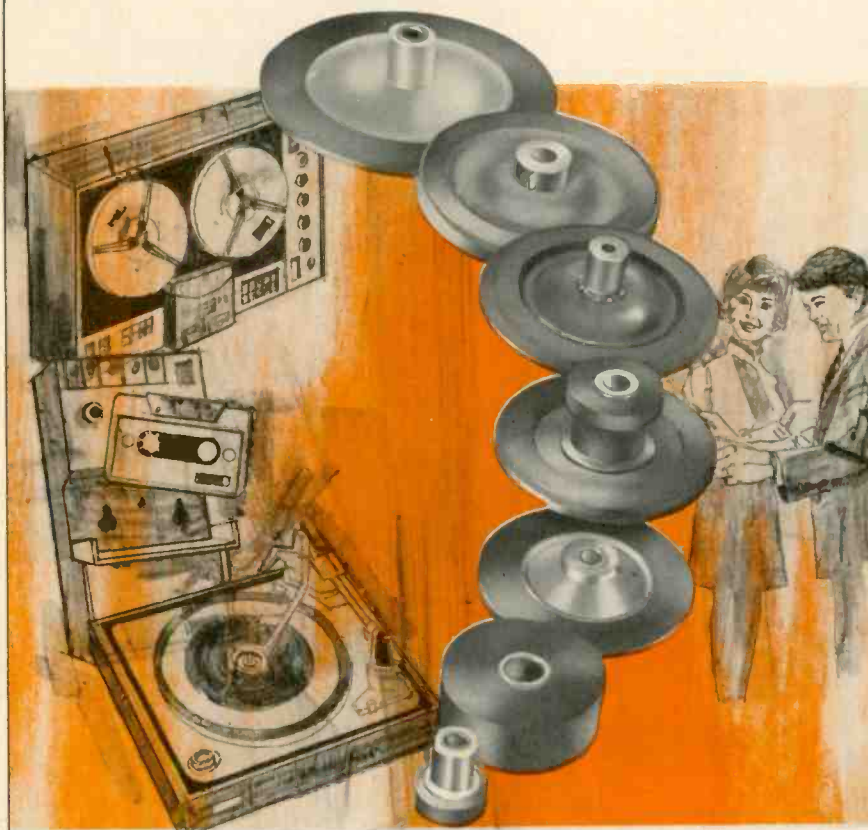
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ET/D NEW PRODUCTS

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Color Generator 704 Fits into a tube caddy

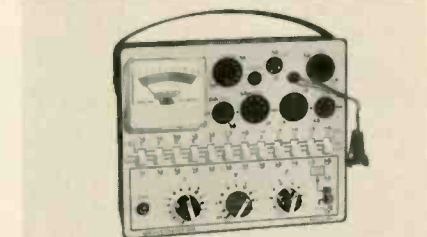
Announced is a miniature color generator small enough to fit into a tube caddy. The model CG19 generator,



appropriately named the Caddy Bar, is smaller than a box of panatella cigars and weighs two pounds. Standard RCA licensed color bars, crosshatch, white dots, vertical lines and horizontal lines are generated. The circuitry is designed for low current drain, allowing full voltage regulation on all circuits rather than just the timer circuits. Timer range on the generator has been doubled over the company's earlier models and the timer controls have been made into screw-driver adjustments rather than operator controls as were present on earlier models. The generator sells for \$84.50. Sencore.

Tube Tester Kit 705 Fits tube caddy and weighs 4 1/2 lb

A miniature-sized Tube Tester Kit is announced which provides a full cathode conductance test on all tubes

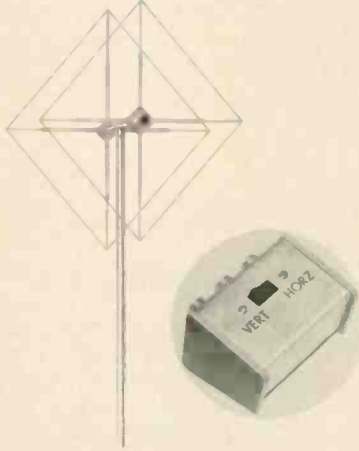


and comes complete complement of latest sockets. An open-circuit meter switch selector makes this unit obsolescence-proof. Tube set-up data is abreast of latest tube releases and is permanently kept up-to-date. The unit is compact enough to fit into a tube caddy. It is American made, comes with a full one year warranty and is packaged in a high impact molded instrument case. The unit measures 6 1/2 x 3 1/2 in. and weighs 4 1/2 lb. Wiring instructions are in-

cluded and the meter can be assembled in a matter of hours. The tester is sold factory wired for \$34.95, and in kit form for \$21.95. Mercury.

CB Antenna 706
Switches from vertical to horizontal polarity

Introduced is the Model PDL-27A with signal directivity combined with the ability to transmit or receive on either horizontal or vertical polarity. Mobile contacts can be made on the vertical mode or switched instantly to horizontal polarity for commu-



nications with other bases. The unit has a reported power gain of 11db. A stacking kit is also available for coupling two units together for approximately 150w of "talk power." The patent provides that the antenna operates as a five element beam with the increased aperture of the quad type design and the stacked antennas operate as stacked five element beams. Avanti.

TOOL SET 707
Miniature tools for subassembly work

For the hobbyist, sportsman, and do-it-yourself radio, TV, or Hi Fi enthusiast, the new Master Kit is offered.



The kit (MMK-6) features six precision tool sets—screw driverawl set, tap set, tap drill set, phillips driver and allen type wrench set, non-magnetic pocket wrench set, offset open end wrench set. Each set contains five interchangeable precision tools housed in a domed dust-free package, and comes in a leatherette carrying case, measuring 8 1/8 x 3 1/2 x 1 1/2in. Moody.

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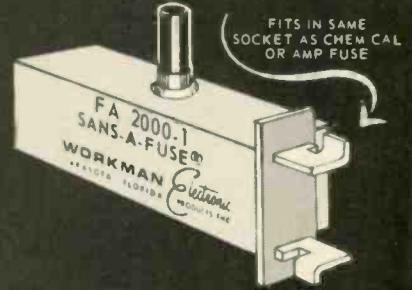
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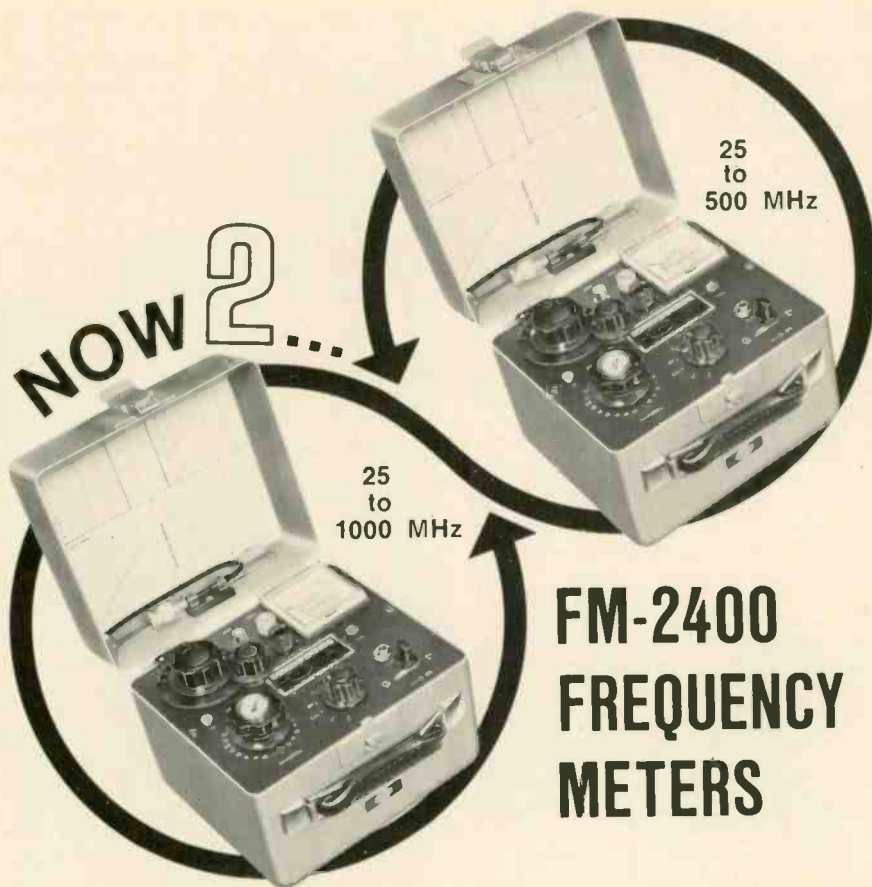
ET/D CATALOGS & BULLETINS

Antennas 400

A 20-page CB catalog is available. Printed in three colors, it includes more than 80 models with details for complete coverage of every antenna requirement ranging from 25in. center loaded short antennas to power gain base station arrays, monitor antennas, and accessories. New-Tronics.

Data Set 401

A brochure describing the "100 Series Data Set" is available. Data sets with either of two methods of receiver coupling, magnetic (for 500 type telephone sets), and acoustic (for AE type 80 telephone sets), are available. Each type is available configured for originate only, and originate or answer. Electronic Voice.



FM-2400CH (New)

- Tests Predetermined Frequencies 25 to 1000 MHz
- New Extended Range Covers 950 MHz Band
- Pin Diode Attenuator

FM-2400C

- Tests Predetermined Frequencies 25 to 500 MHz

The new FM-2400CH and the FM-2400C provide an accurate frequency standard for testing and adjustment of mobile transmitters and receivers at predetermined frequencies. The FM-2400CH with its extended range covers 25 to 1000 MHz. The Model FM-2400C covers 25 to 500 MHz. The frequencies can be those of the radio frequency channels of operation and/or of the intermediate frequencies of the receiver between 5 MHz and 40 MHz.

Frequency Stability: $\pm .0005\%$ from $+50^\circ$ to $+104^\circ\text{F}$

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 RF crystals (less temperature correction)..... 18.00 ea.
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Two-Way Radio . . .

continued from page 72

lead to the second mixer. Tune the signal generator to the intermediate frequency (IF) and adjust all IF stages for maximum limiter voltage. Always work with the weakest possible input signal.

If in doubt about the frequency accuracy of the signal generator, connect an antenna to the receiver and adjust the signal generator for zero beat when receiving an on-channel signal.

An FM signal generator is an absolute necessity when making "proof-of-performance" tests which will be discussed in a later feature of this series. ■

Model 166 . . .

continued from page 75

other obvious advantage of decade dial presentation is the speed at which it can accurately be read.

The 166 has two modes of operation: manual and automatic. The manual mode makes it possible to measure the percent error of the instrument being calibrated. Automatic operation provides exact outputs eliminating tedious nulling operations for "go-no-go" meter tests. The 166 also provides for any of three calibration methods. Method #1 consists of determining the percent of error of the meter under test at one or more points. This method is used when an actual reading is required as opposed to simply determining if a meter is within tolerance. Method #2 involves determining if a meter is within tolerance without recording the readings. This is a "go-no-go" test which is faster than Method #1. In Method #3, a calibration table is made for the instrument under test by applying nominal values and taking readings or by determining the actual value required to produce a nominal indication on the test meter.

We tried out the 166 on a Triplet Model 671 multimeter using Method #1—the percent of error method. We wanted to check the dc voltage scales and set the

meter to the 12vdc scale first. Then we connected the test leads to the high-row sense output terminals on the calibrator. Of course, we had previously turned the 166 on to warmup and set the course voltage output control to zero as indicated in the instructions.

According to the instructions, we then set the ERROR METER SENSITIVITY switch to the 5% position (recommended setting for multimeters). Then we set the decade dials to read 0012.00

vdc the full value of the meter scale we were testing. We set the OUTPUT SELECTOR switch to the FULL DECADE SETTING, and the MODE switches to +dc and "V." We turned the course voltage output control clockwise to give us a full scale reading on the 641. We set the meter for exactly full scale using the FINE output adjustment. Now we simply read the percent of error from the panel meter. In our case it read +.75% error. This means that the 641 reads .9vdc high on the 12vdc scale.

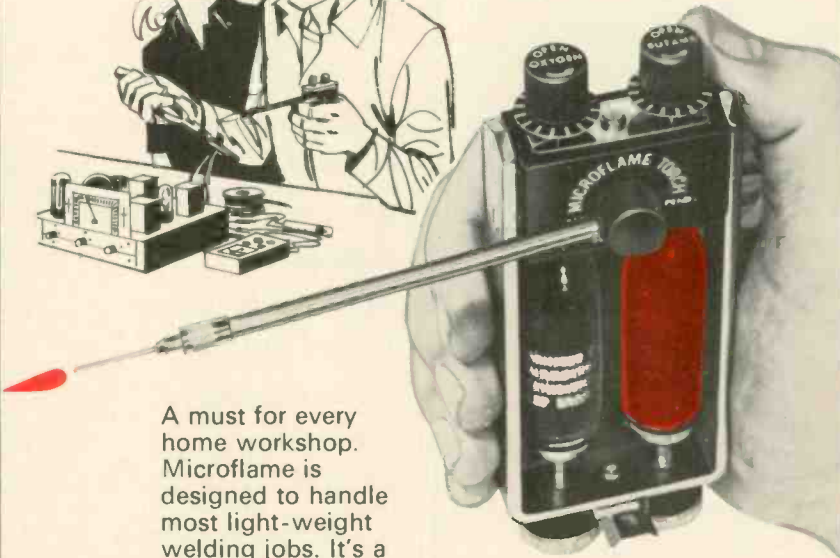
We also checked the unit on the 60vdc scale and it read +1.5% high or 9v high. We wanted to check individual points on the scales as recommended, so we moved the OUTPUT SELECTOR to the FRACTION OF DECADE SETTING position. Leave the decade dials in the same position as they were; in this case 60vdc. The first position on the fractional decade switch is .9 (full CW) and at this position the percent of error meter reading went up to 2.46 percent. The multimeter reading dropped to 54.8v. Using the COARSE and FINE output voltage adjustments we set the multimeter reading to exactly 54vdc (.9 of 60vdc). Now the percent of error has dropped to 1.25%. We continued checking the multimeter at the various points. At .5 or half of full scale the error had dropped to .6%.

The procedure for checking the ohmmeter portion of the multimeter varies slightly. In this case, the MODE switch is moved to K-ohms and all decade dials are set to zero. The COARSE control is also set to zero. ■

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CHEMTRONICS, INC.



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ET/D AD INDEX

Admiral Corporation	42
B & K Division of Dynascan Corporation	2nd Cover
BSR (USA) Ltd.	41
Belden Corporation	23
Book Club—Tab Books	78-81
C.R.T. Equipment Co.	77
Castle TV Tuner Service	33
Channelock, Inc.	34
Chemtronics, Inc.	83, 85, 87, 88
Cleveland Institute of Electronics	27-29
Cornell-Dubilier	3rd Cover
Enterprise Development	44
Ford Motor Company, Econoline Van Div.	24
GC Electronics	22, 84
Gem City Tuner Service	30
International Crystal Mfg. Co.	86
Leader Instruments Corporation	83
Lectrotech, Inc.	77
Mallory Distributor Products Co.	20
Microflame	87
Mueller Electric Company	42
Multicore Sales Corp.	30
Oaktron Industries, Inc.	44
RCA Institutes Inc.	45-47
RCA Parts & Accessories	35, 82
RCA Electronic Components Picture Tube Distributor	4th Cover
RCA Electronic Components Test Equipment	43
RMS Electronics, Inc.	85
Sencore, Inc.	38-39
Sprague Products Company	31
Sylvania Electric Products	36-37
Tech Spray	32
Tuner Service Corporation	19
Winegard Company	48
Workman Electronic Products, Inc.	85
Zenith Radio Corporation	25

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110 111 112 113 114 115 116 117 118
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137 138 139 140 141 142 143 144 145
146 147 148 149 150 151 152 153 154

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Why do you protect your service reputation each time you install an RCA color picture tube?



Whether it's in the customer's living room, or at the bench in the shop, it helps to be able to replace a color picture tube with confidence.

If it's an RCA tube that's being installed, the tube itself can contribute to that confidence.

Here is a product made with know-how...from the most experienced manufacturer in the business. A tube unstintingly manufactured to the highest quality standards... RCA standards. A color picture tube whose built-in technology helps protect your time and talent.

Why not specify RCA picture tubes for your requirements? They'll help protect your service reputation. Just as they're designed to protect the biggest reputation in the COLOR TV industry.

RCA Electronic Components, Harrison, N.J.

RCA