ELECTRONIC TECHNICIAN / DEALER

WORLD'S LARGEST TV-RADIO SERVICE & SALES CIRCULATION

JUNE 1969 A HARBRACE PUBLICATION

SOLID STATE DEFLECTION SYSTEMS

MODERN MARKER SWEEP ALIGNMENT

TUNER SERVICING

ELECTRONIC TECHNICIAN / DEALER

TEKFAX

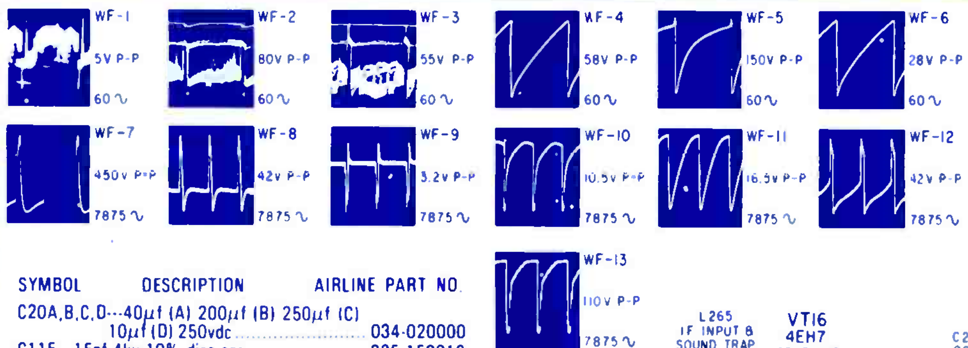
COMPLETE MANUFACTURER S' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 6 NEW SETS

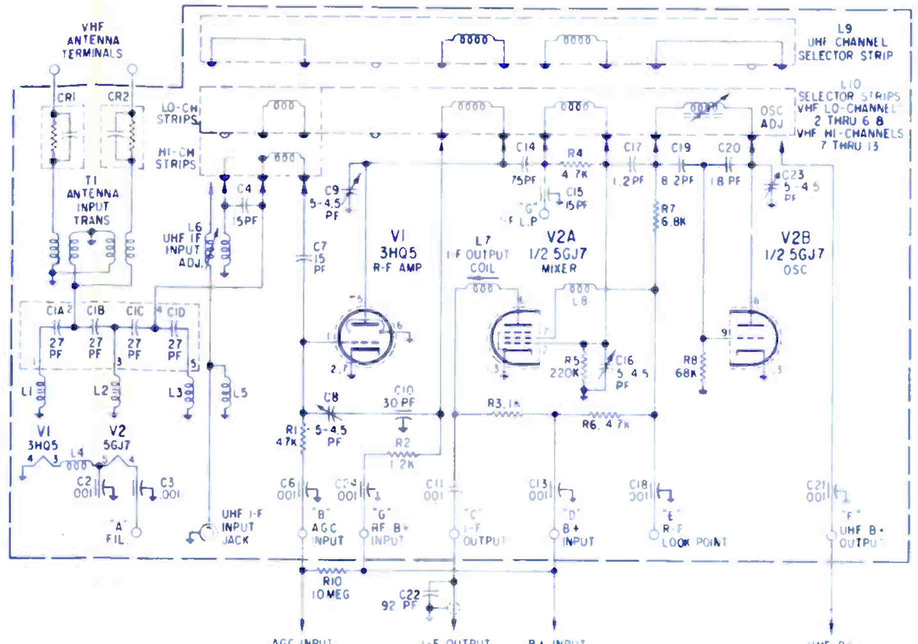
GROUP 202

1229

AIRLINE TV Models GHJ-14829A, GHJ-14849B,59B

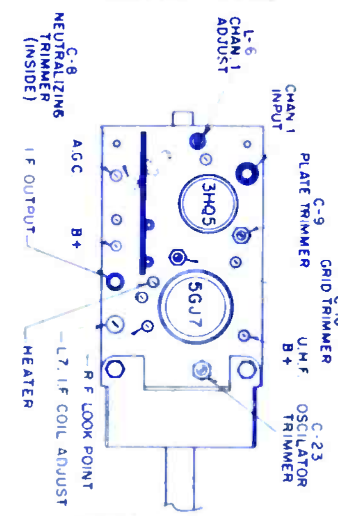
JUNE • 1969



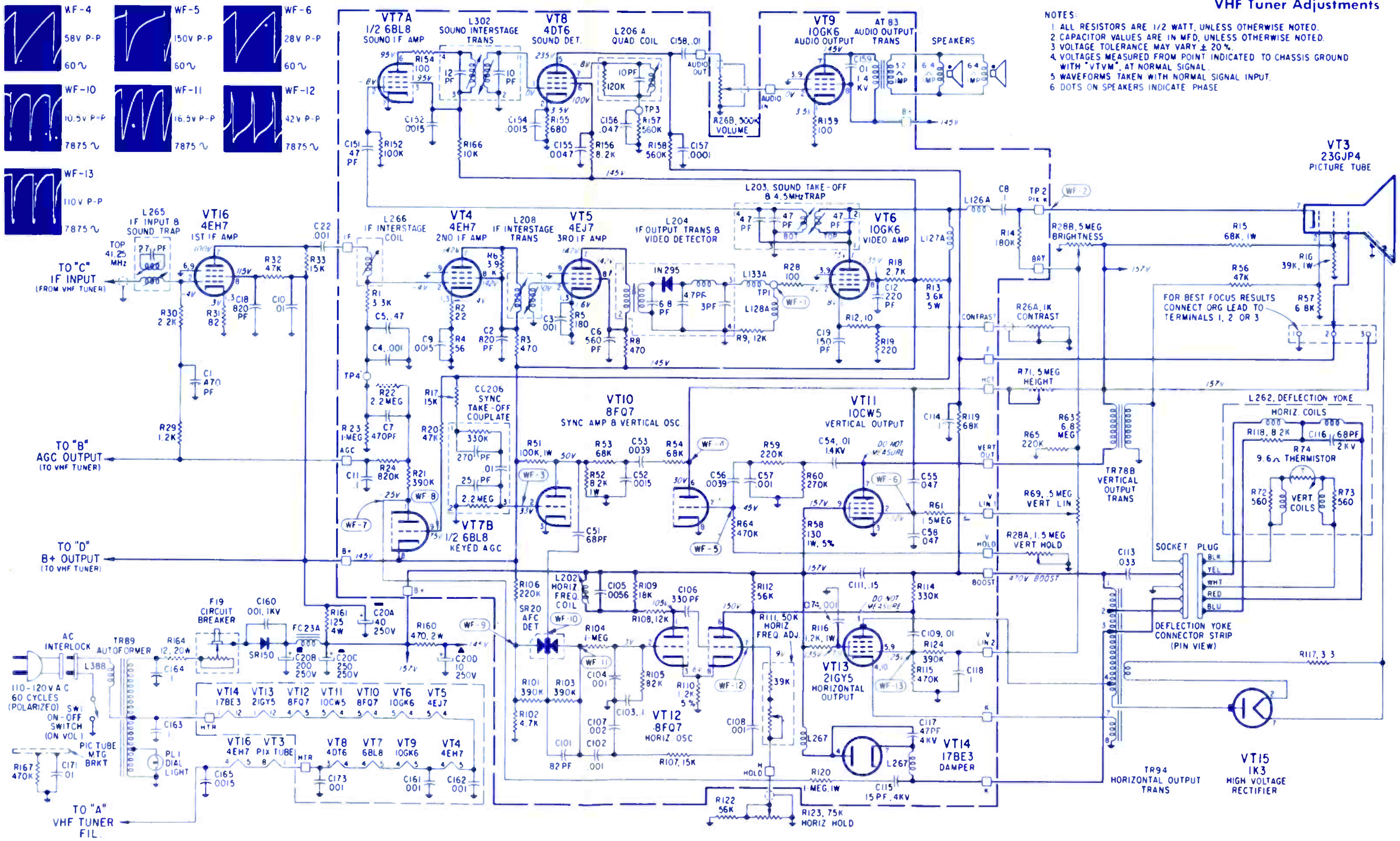


NOTES
1. ALL RESISTORS ARE 1/2 WATT, UNLESS OTHERWISE NOTED
2. CAPACITOR VALUES ARE IN MFD, UNLESS OTHERWISE NOTED
3. TUNER IS SHOWN IN VHF CHANNEL POSITION

VHF Tuner Schematic Diagram



VHF Tuner Adjustments



NOTES:
1. ALL RESISTORS ARE 1/2 WATT, UNLESS OTHERWISE NOTED.
2. CAPACITOR VALUES ARE IN MFD, UNLESS OTHERWISE NOTED.
3. VOLTAGE TOLERANCE MAY VARY ± 20%.
4. VOLTAGES MEASURED FROM POINT INDICATED TO CHASSIS GROUND WITH "VTVM", AT NORMAL SIGNAL.
5. WAVEFORMS TAKEN WITH NORMAL SIGNAL INPUT.
6. DOTS ON SPEAKERS INDICATE PHASE.

SYMBOL	DESCRIPTION	AIRLINE PART NO.
C20A,B,C,D	40µf (A) 200µf (B) 250µf (C) 10µf (D) 250vdc	034-020000
C115	15pf 4kv 10% disc cer	825-150016
R13	3.6K 5w 10%	063-362610
R74	9.6 Ω thermistor	057-056500
R164	12 Ω 20w 10%	053-120310
R26A,B	contr vol w/switch SW1	055-067000
R28A,B	vert hld bright	055-067100
R69	vert lin .5M	055-035000
R71	height 5M	055-035100
R111	horiz freq adj 50K	055-041700
R123	horiz hold 75K	055-032000
SR20	diode sel horiz AFC	003-002000
SR150	rec sil 1.0a 900 PIV	004-003500
AT-83	xformer audio output	031-008301
FC-23A	filter choke	032-002301
L128A	coil peak	111-012800
L202	coil horiz freq	110-020200
L203	xformer sound take-off 4.5MHz trap	109-020300
L204	xformer IF output video det	109-020400
L206A	coil sound quad	109-020601
L262	def yoke	027-026200
L265	coil IF input sound trap	109-026500
L266	coil IF interstage	109-026600
L267	coil choke 2 used	111-026700
L302	xformer sound interstage	109-030200
L388	coil line filter	111-038800
TR78B	xformer vert output	033-007802
TR89	autoformer	033-008900
TR94	xformer horiz output	033-009400
	printed circuit board	073-041200
F19	circuit brkr	099-001900
CC206	couplate, sync take-off	134-020600

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DUMONT
Color TV Chassis
120926, 28

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ELECTRONIC TECHNICIAN / DEALER TEKFAX

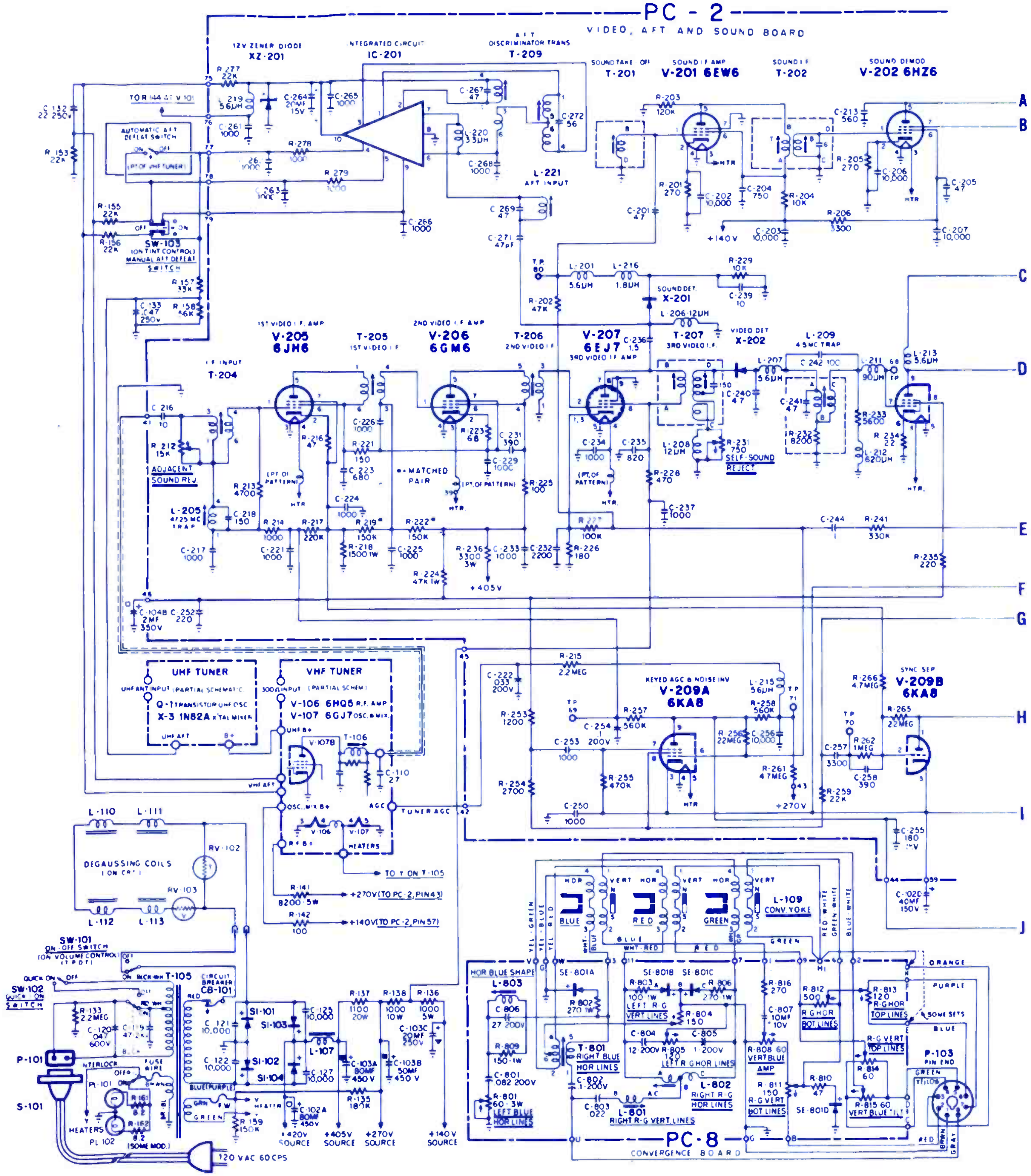
COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 6 NEW SETS

VOLTAGE MEASUREMENTS
T. V. CHASSIS 120926, 120928

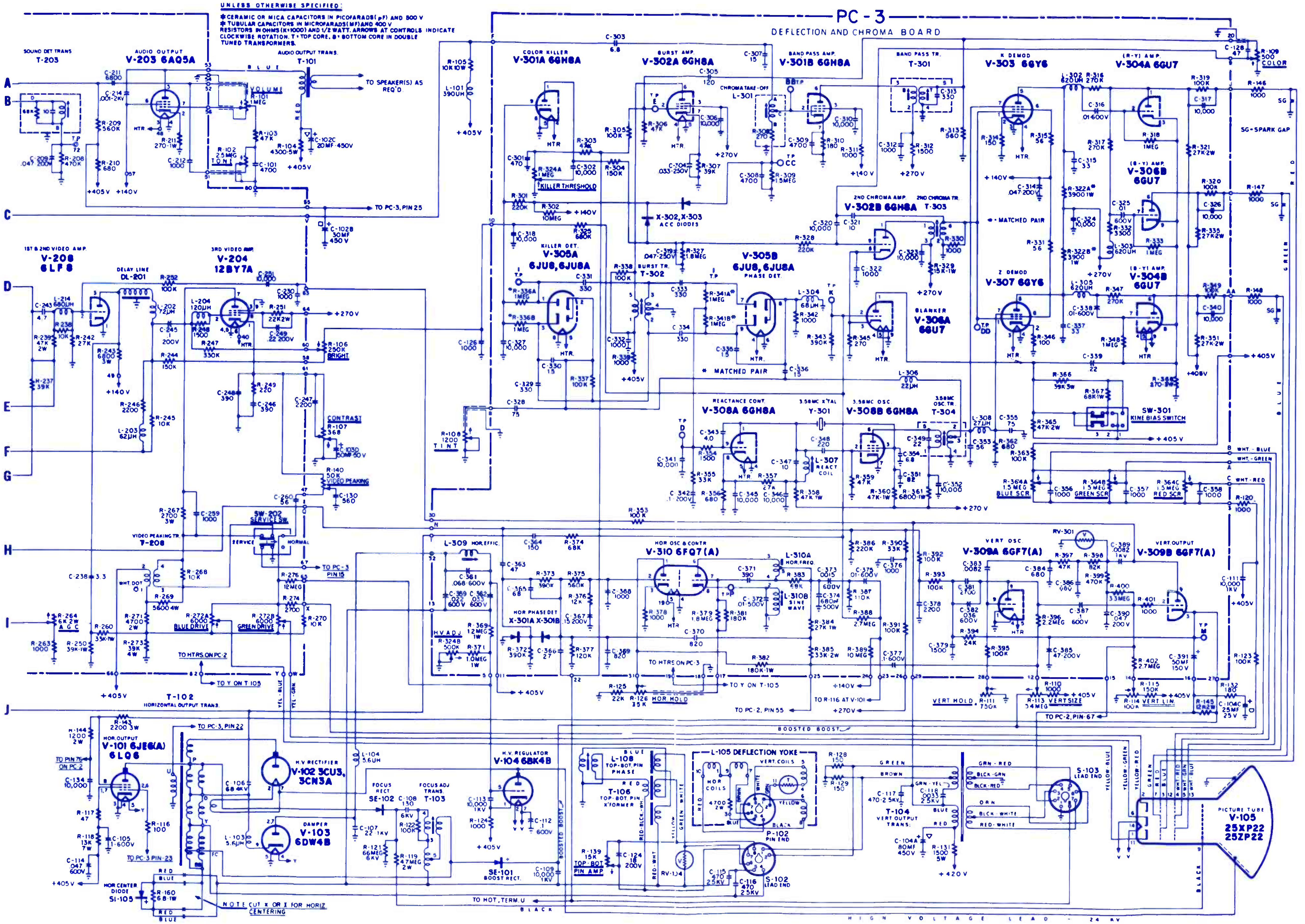
SYMBOL	TUBE TYPE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
V-201	6EW6	0	1V	Fil	Fil	80V	80V	0		
V-202	6HZ6	0	2V	Fil	Fil	155V	100V	0		
V-203	6AQ5A		5.5V	Fil	Fil	300V	130V	0		
V-204	12BY7A	8V	6V	0	Fil	Fil	Fil	210V	145V	0
V-205	6JH6	*-3.5V	7V	Fil	Fil	190V	190V	7V		
V-206	6GM6	190V	193V	Fil	Fil	360V	370V	193V		
V-207	6EJ7	2V	0	2V	Fil	Fil	0	165V	180V	0
V-208	6LF8	0	3.5V	25V	Fil	Fil	0	-2.5V	160V	185V
V-209	6KA8	125V	-10V	15V	Fil	Fil	2V	13V	160V	-30V
V-301	6GH8A	-1V	0.1V	135V	Fil	Fil	265V	1.8V	0	-2V
V-302	6GH8A	200V	0	270V	Fil	Fil	425V	42V	3.5V	-1V
V-303	6GY6	0	1V	Fil	Fil	250V	125V	0		
V-304	6GU7	170V	-1.5V	7V	Fil	Fil	170V	-1V	7V	Fil
V-305	6JU8(A)	-50V	0	35V	Fil	Fil	Fil	-35V	0	35V
V-306	6GU7	110V	-100V	3V	Fil	Fil	170V	-1V	7	Fil
V-307	6GY6	0	1V	Fil	Fil	250V	125V	0		
V-308	6GH8A	90V	-4V	110V	Fil	Fil	200V	0	2.5V	0
V-309	6GF7A	0	40V	90V	Fil	Fil	350V		140V	-20V
V-310	6FO7A	25V	-0.5V	0.6V	Fil	Fil	265V	-95V	0.5V	Fil
V-101	6JE6	150V	-50V	Fil	Fil	Fil	-50V	150V	30V	
V-102	3CU3	Adjusted for 25kv Normal Picture								
V-103	6DW4		400V		Fil	Fil		400V		H.V.Pb. 900V
V-104	6BK4B	370V	Fil			340V		Fil		
V-106	CRT	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
		Fil	270V	160V	820V	820V	270V	150V		5kv
		PIN 11	PIN 12	PIN 13	PIN 14					
		270V	150V	820V	Fil					

* Reading varies with T.V. signal strength.

SYMBOL	DESCRIPTION	PART NO.
C102	80/30/20µf	925686
C103	80/50/20/50µf	925586
C104	80/2/25µf	925650
C106	68µf 4K	929096
CB101	cir brkr	808252
DL201	delay lin	709011
IC201	integrated cir AFT	815215
L105	def yoke	708516
L107	filter choke	737057
L209	4.5MHz trap	708432
L221	AFT take-off coil	720576
L301	chroma take-off coil	708438
L305	reactance coil	708439
L307	horiz osc coils	708434
L309	horiz eff coil	708462
R101	vol cont 1M on-off switch (chassis 120926)	391035
R101	vol cont 1M on-off switch (chassis120928)	391036
R102	tone/bright cont 2.5m/250K	390970
R105	10K 10w 10%	394260
R106	tone/bright cont 2.5m/250K	390970
R107	video peak/contr cont 50K/368	390963
R108	tint cont 1.2K	390965
R109	color cont 500 Ω	390966
R111	vert/horiz hold cont 750K/35K	390962
R113	vert size cont 3.4M	390908
R114	vert lin cont 100K	390785
R118	13K 7w 10%	394255
R121	66M 4w 6KV	397176A
R126	vert horiz hold cont 750K/35K	390962
R140	video peaking/contr cont 50K/368	390963
RV102	thermistor	397187
RV103	voltage dep resistor	397186
RV104	voltage dep resistor	397191
R212	adj sound cont 10K	390954
R231	sound rej cont 750 Ω	390883
R264	AGC cont 6K	390882
RV301	varistor	397171
R804	left rd/grn vert lin cont 150 Ω	390795
R813	rd/grn horiz top lin cont 120 Ω	390792
R815	vert blu tilt cont 60 Ω	390793
SE102	sel rect (focus)	817123
SW103	AFT switch	510256
T101	audio output trans	734223
T103	focus adj trans	708461
T104	vert output trans	738207
T105	power trans	730157
T201	sound take-off trans	720558
T202	sound IF trans	720471
T203	sound quad trans	720472
T206	2nd video IF trans	720476
T208	video peak trans	708474
T301	bandpass trans	720515
T302	burst trans	720516
T303	2nd chroma trans	720575
T304	3.58MHz osc trans	720579
X301	horiz phase det	817126
Y301	3.58MHz crystal	817155



DUMONT
Color TV Chassis 120926, 28



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OLYMPIC
Color TV Chassis
CTC31

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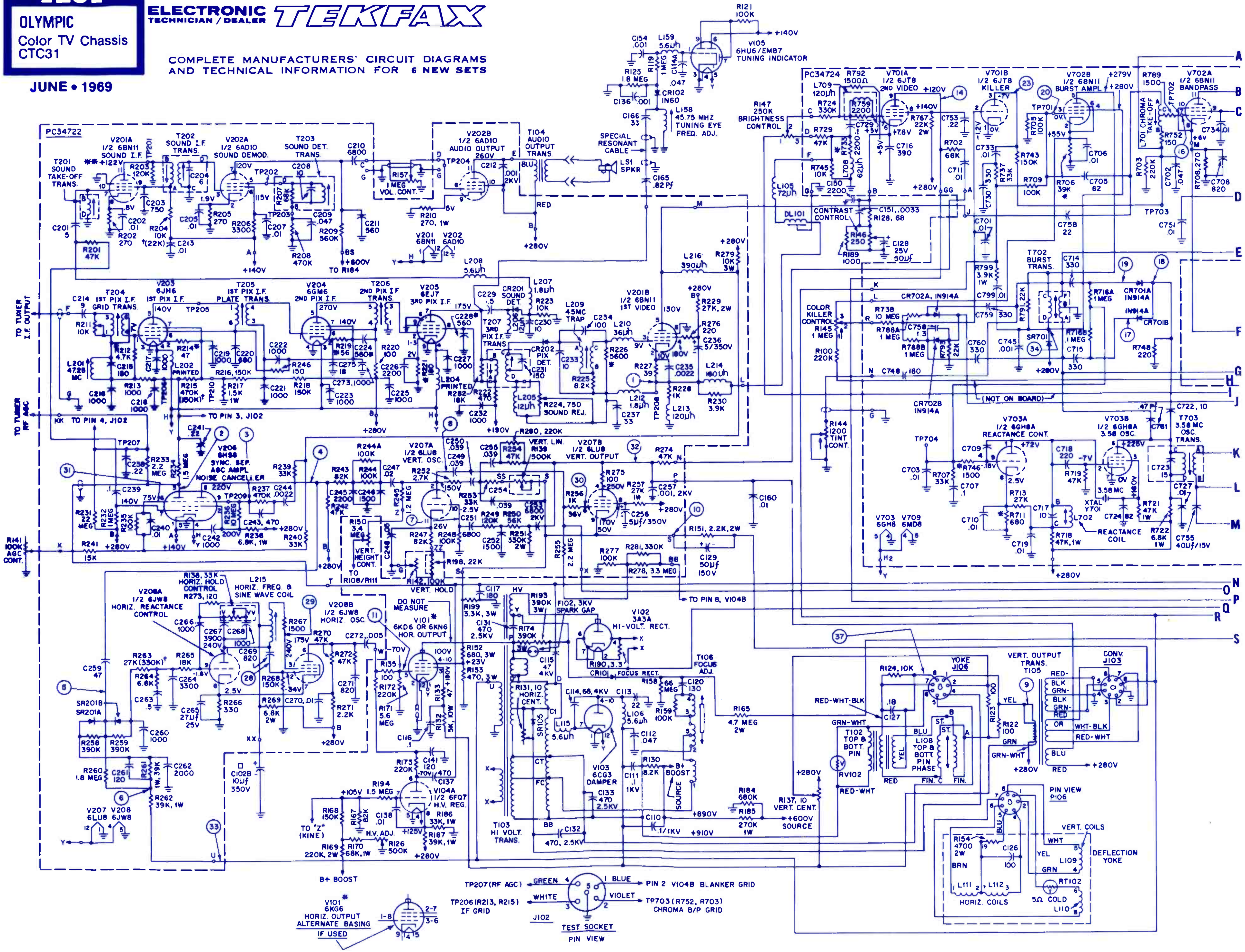
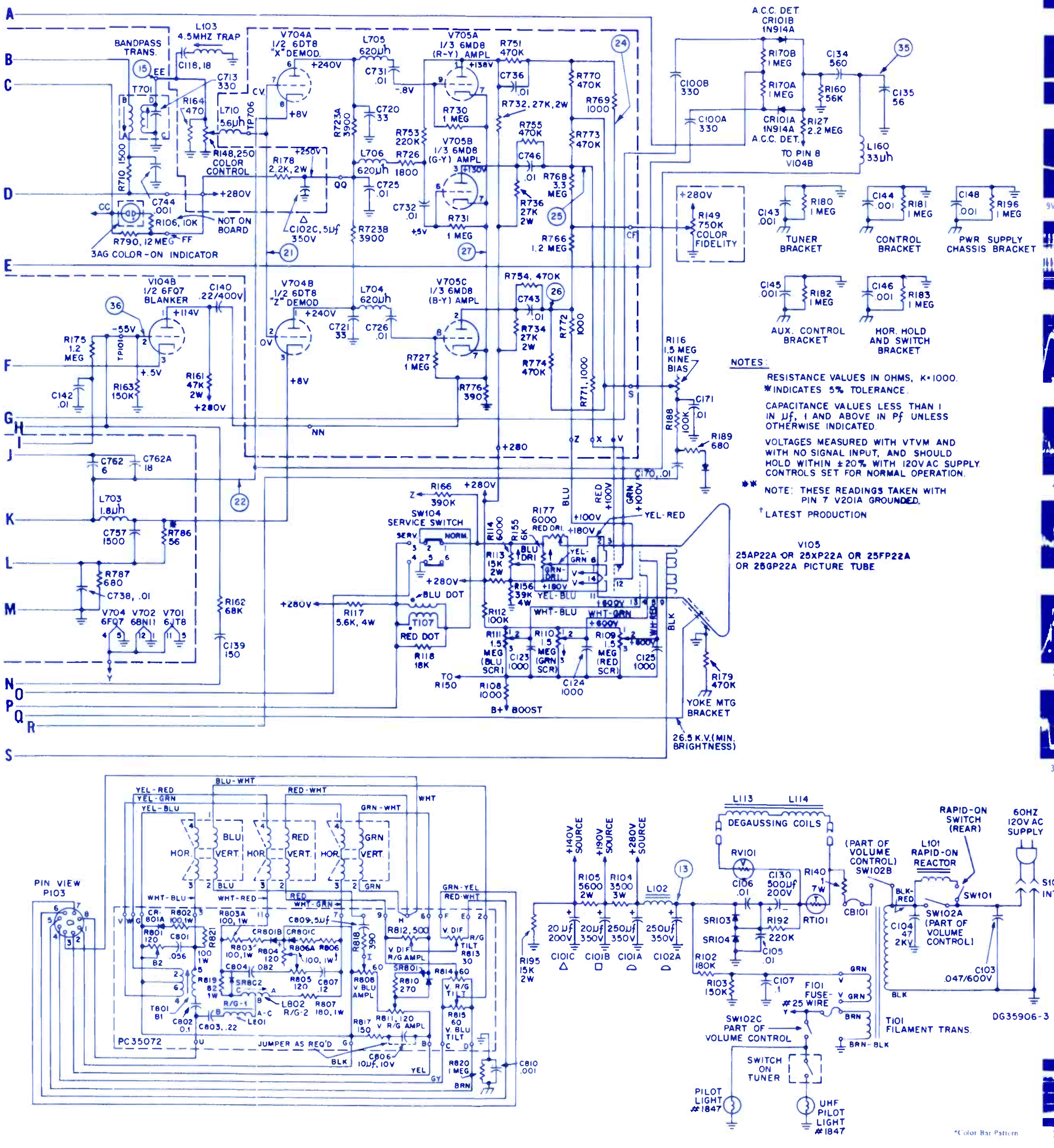
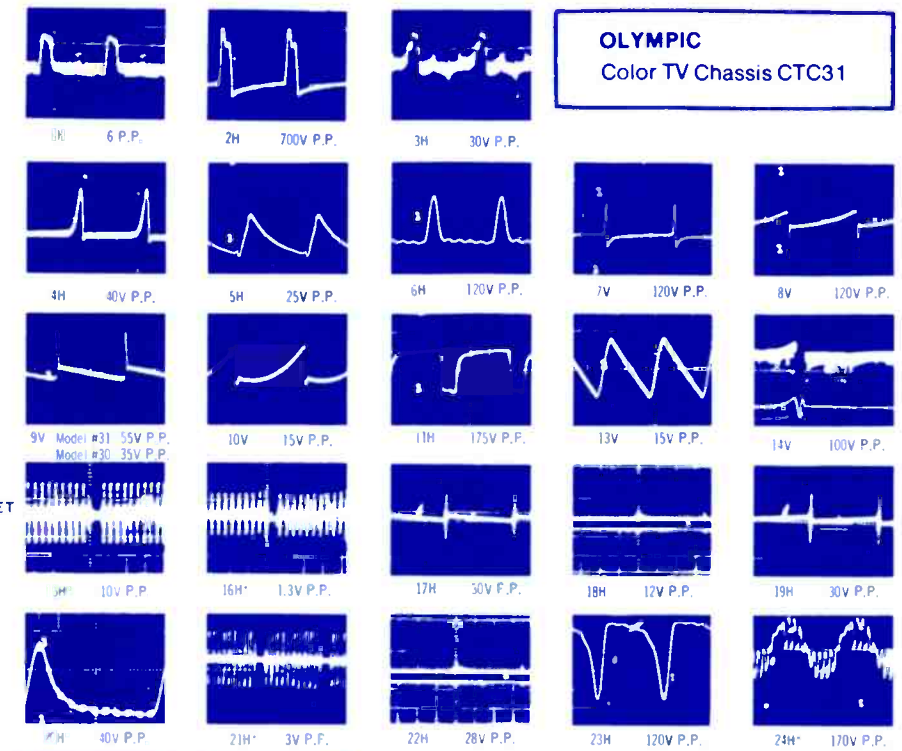
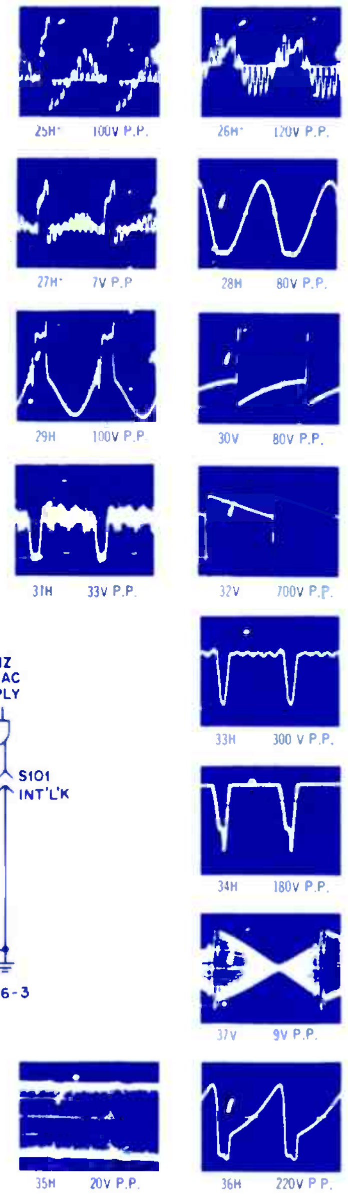


OLYMPIC
Color TV Chassis CTC31







SYMBOL	DESCRIPTION	OLYMPIC PART NO.
	tuner, UHF	CL34315
	tuner, VHF	CL34835
C101-A, B, C	25C+20/350v 20/200v elec	C034860
C102-A, B, C	250μf 10μf 350v elec	C034861
C114	68μf ±10% 4KV	C032092-42
CB101	brkr, cir	RL34856-1
CR101	rec (focus)	RF32103-1
DL101	delay line	DE32105-3
F102	470pf ±20% 2KV spark gap	C034853-1
L102	choke filter	CK34653
L108	coil pin cushion top and bottom	CL34090-2
R114	6K ±20% 1/2w var blu dr	PT32067-17
R126	500K ±30% 1/4w var high v adj	PT32067-4
R137	10Ω WW var vert cen	PT32066-17
R138	33K ±20% var horiz hold	PT34849
R139	500K var vert lin	PT32067-27
R140	1Ω 7w WW	RE35417
R141	100K ±30% 1/4w var AGC	PT32067-25
R142	100K ±20% 1/2w var vert hold	PT32065-28
R145	1M ±30% 1/4w var color killer	PR32067-2
R146	250Ω ±20% 1/4w var contrast	PT32065-33
R147	250K ±20% 1/4w var bright	PT32065-30
R148	500Ω ±20% 1/2w var color	PT32065-29
R150	3.4M 30% 1/4w var v.height	PT32067-24
R157	1M with slide sw volume	PT34747
RT101	thermistor	RE33795
RV101	varistor	RE33794
RV102	var ±15% @ 1MA 175v	RE34098
T101	xformer filament	TR34648
T102	xformer pin cushion	TR34093-1
T103	xformer horiz output	TR34650-1
T104	xformer audio output	TR33549-1
T105	xformer vert output	TR34652
T106	coil focus	CL32071-5
L201	xformer 47.25MHz	TR32444-6
L206	coil 12μh	CK32098-251
L209	trap 4.5MHz	CL32422-4
L215	coil horiz freq lin wave osc	CL34719
T201	xformer sound take-off	TR32413-3
T202	xformer sound IF w/C204/6μf	RE32423-4
T203	xformer sound det w/68K/R207 & 10μf/C208	TR32413-2
T204	xformer 1st pic IF grid	TR32444-3
T205	xformer 1st pix IF plate	TR3244-8
T206	xformer 2nd pix IF	TR32444-7
T207	xformer 3rd pix IF w/150μf/C231	TR32421-2
CR702A	crystal diode	RF34661
L701	coil chroma take-off	CL32420-3
L702	coil reactance	CL32418-2
L705	coil peaking 620μh	CL32442-14
L706	coil 62μh	CL32442-2
T701	xformer band pass w/C713/33μf	TR32424-2
T702	xformer burst phase	TR32419-2
T703	xformer 3.58EOC w/C723/15μf	TR32411-3
T801	coil horiz	CL34517
	yoke converg	SA34504
	def yoke assy	SA34503

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MOTOROLA

TV Chassis TS-613 Series

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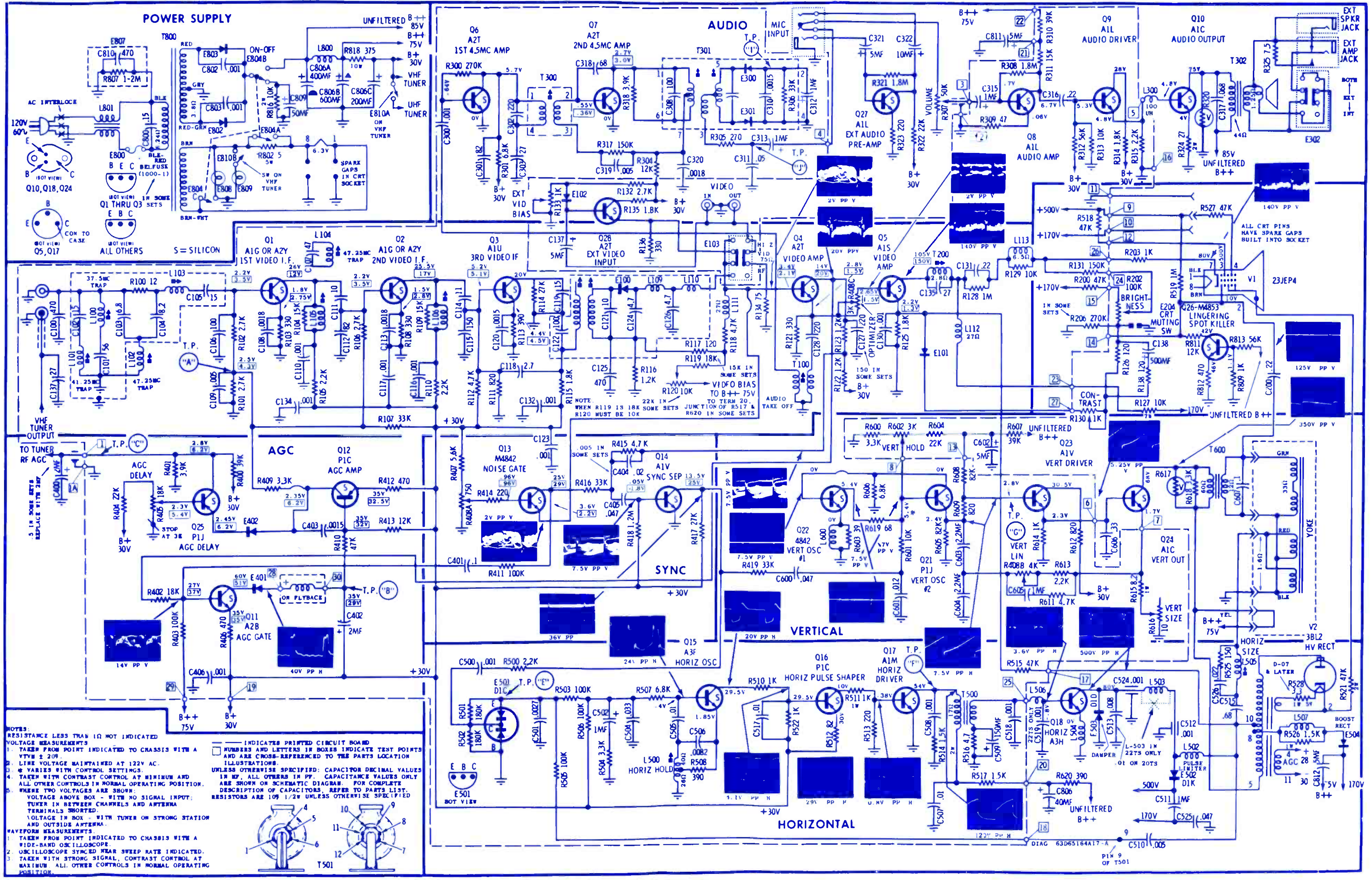
SYMBOL	DESCRIPTION	MOTOROLA PART NO.
C-806	400µf/125v 40µf/100v 600µf/100v 200µf/50v elec	23C65807A33
E-102	diode, crystal video det	48C65837A02
E-401	diode crystal AGC gate	48C67120A02
E-402	diode crystal AGC amp	48C65837A02
E-502	diode silicon D1K pulse limiter	48S134978
E-503	diode silicon D1D damper	48S134921
E-800	fuse	65C67985A03
E-804	switch on-off incls mtg brkt	1V68608A03
L-101	41.25MHz trap incls core	24D67754A23
L-104	1st IF & 47.25MHz trap incls C107 & core	24V68607A31
L-500	horiz osc incls core	24D68130A03
L-502	choke horiz suppressor	24D65947A86
L-505	horiz size	24D69163A01
L-506	horiz choke	24D69044A03
L-700	yoke, def 114deg	24D68523A03
L-800	choke filter	25D67554A12
Q-1	1st IF amp A2Y - use 48S134904	48S134981
Q-2	2nd IF amp A2Y - use 48S134904	48S134981
Q-3	3rd IF amp A1u	48S134932
Q-4	1st video amp A1T	48S134970
Q-5	video output A1A - use 48S137002	48S134927
Q-6	1st 4.5MHz amp A2T	48S134970
Q-7	2nd 4.5MHz amp A2T	48S134970
Q-8	audio amp A1L	48S134918
Q-9	audio driver A1L	48S134918
Q-10	audio output A1C	48S134900
Q-11	AGC gate A2B	48S134942
Q-12	AGC amp P1C	48S134910
Q-13	noise gate M4842 - use 48S134992	48S134842
Q-14	sync separator A1V	48S134933
Q-15	horiz osc A3F	48S134992
Q-16	horiz pulse shaper P1C	48S134910
Q-17	horiz driver A1M	48S134919
Q-18	horiz output A3H	48S134995
Q-21	vert discharge P1J	48S134843
Q-22	vert pulse inv M4842-use 48S134992	48S134842
Q-23	vert driver A1V	48S134933
Q-24	vert output A1C	48S134900
Q-25	AGC delay P1J	48S134943
Q-26	spot killer M4853	48S134853
Q-27	microphone input A1L	48S134918
Q-28	video tape input A2T	48S134970
T-100	4.5MHz trap & ATO: incls core	24D68822A02
T-301	ratio det	24V66550A80
T-302	audio output	25D67552A18
T-500	horiz driver	25D67440A03
	horiz output xformer	24D68804A07
	primary/sec winding only	24D67601A23
T-600	vert output	25D65840B23
T-800	power	25D68164A08
R-120	video bias 22K	18D66401A35
R-130	contrast: 1K	18D67637A70
R-133	external video bias: 1K	18D64401A21
R-202	bright: 100K	18D67637A69
R-307	volume: 50K	18D67562A10
R-405	RF AGC delay: 18K	18D66401A20
R-408	vert line: 4K noise gate 750Ω opt 3K	18D67678A05
R-602	vert hold: 3K	18D67637A68
R-616	vert size: 10 Ω	18D68447A02
R-320	varistor audio output	6C66263A16
R-617	varistor vert	6C66263A16
	VHF tuner - DOPTT-411	



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

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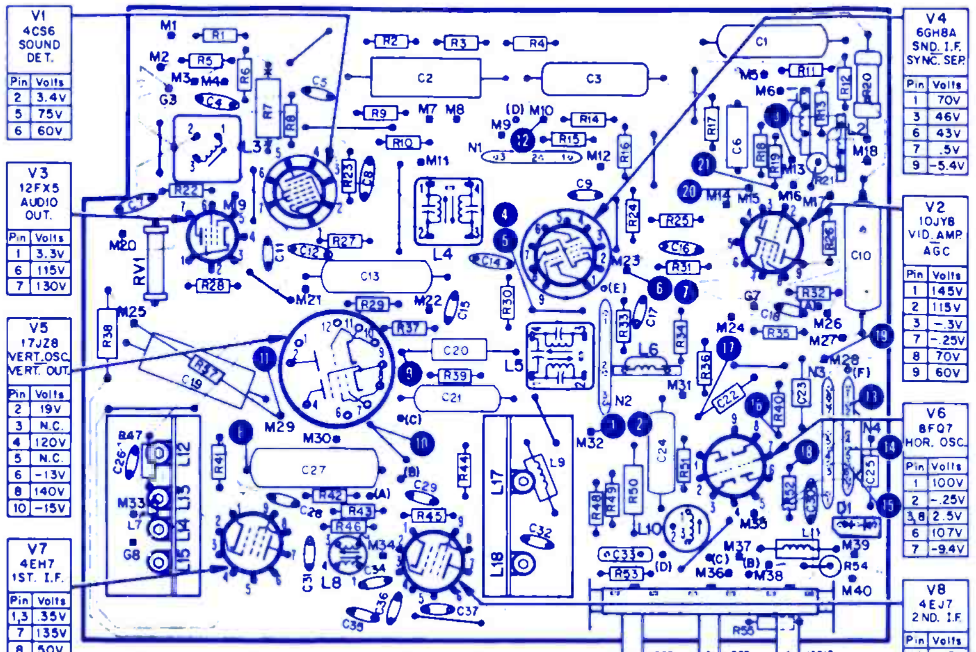
PHILCO-FORD TV Chassis 19L21

SYMBOL	DESCRIPTION	PHILCO-FORD PART NO.
C41	240µf 240µf/200v B+160µf 5µf filter	30-2801-33
D1	dual phase comp	34-8037-1
D2	1N60C 2nd det	34-8022-6
L3	quad snd det	32-4876-1
L4	sound IF	32-4745-12
L5	4.5MHz & STO	32-4888-14
L7	tuner cplg	32-4852-101
L10	horiz stab	32-4754-3
L12	47.25MHz trap	32-4652-78
L13	41.25MHz trap	32-4852-80
L17	video det coil	32-4852-79
L19	60MHz damp cath	32-4112-63
N1	retrace suppression	30-8024-9
N2	vert integrator	30-8030-12
N3	horiz osc	30-8057-1
N4	phase comp	30-8035-2
RV1	varistor 560v @10ma vert out	33-1373-6
F1	5.6 Ω fusistor	33-1386-22
AOT	audio output	32-10013-5
FC	filter choke .6hy	32-10075-1
HOT	horiz out	32-10008-8
VOT	vert out	32-10012-9
VR1	500K size 2M lin 80K horiz hold	33-5595-18
VR2	500K vol & on-off sw	33-5819-22
VR3	250K bright	33-5819-21
VR4	15K contrast	33-5819-20
VR5	135K vert hold	33-5819-23
	yoke & cable assy	78-12942-9
	tuner-UHF TT-152B	78-13827-2
	tuner-VHF TT-164CS	78-13579-10



Top View–Perma Circuit Panel Components

RESISTANCE CHART

SYMBOL	TUBE	FUNCTION	1	2	3	4	5	6	7	8	9	10	11	12
V1	4CS6	Sound Detector	5.5Ω	560Ω	FIL.	FIL	200K	12K	2.5Ω					
V2	10JY8	Video Amp. & Gated AGC	4.5K	25K	1.8M	FIL	FIL	0Ω	3.3K*	14K	10K			
V3	12FX5	Audio Output	82Ω	0Ω	FIL	FIL	0Ω	16K	14K					
V4	6GH8A	Snd. IF & Sync. Sep.	15K	3Ω	13K	FIL	FIL	13K	150Ω	0Ω	1.9M			
V5	17JZ8	Vert. Osc.	FIL	3.5M	INF.	14K	INF.	1.3M	1.3M	14K	0Ω	150K	0Ω	FIL
V6	8FQ7	Horiz. Osc.	23K	2.1M	820Ω	FIL	FIL	40K	120K	820Ω	0Ω			
V7	4EH7	1st Video IF	20Ω	600K	20Ω	FIL	FIL	0Ω	14K	26K	0			
V8	4EJ7	2nd Video IF	100Ω	0Ω	100	FIL	FIL	0Ω	14K	14K	0Ω			
V9	38EH7	Horiz. Out & Damper	FIL	13K	NC	8M	8M	NC	NC	0Ω	330K	NC	18K	FIL

*Depends on meter polarity

OSCILLOSCOPE WAVEFORMS

These waveforms were taken with the receiver adjusted for an approximate output of 2.5V p/p at the video detector. Voltage readings taken with raster just filling screen and all controls set for normal picture viewing except for photos 1, 2 and 3 where contrast was at maximum. The voltages given are approximate peak-to-peak values. The frequencies shown are those of the waveforms...not the sweep rate of the oscilloscope. All readings taken with Model 1450 B&K Oscilloscope.

1 4 Volts p/p. 15,750 Hz (max contrast)

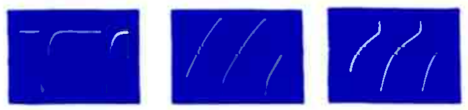
2 4 Volts p/p. 60 Hz (max contrast)

3 90 Volts p/p. 15,750 Hz (max contrast)

4 80 Volts p/p. 15,750 Hz

5 80 Volts p/p. 60 Hz

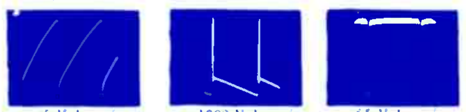
6 50 Volts p/p. 60 Hz



7 50 Volts p/p. 15,750 Hz

8 48 Volts p/p. 60 Hz

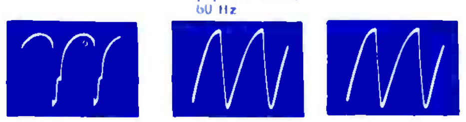
9 60 Volts p/p. 60 Hz



10 45 Volts p/p. 60 Hz

11 1000 Volts p/p total, 180 Volts p/p. sawtooth, 60 Hz

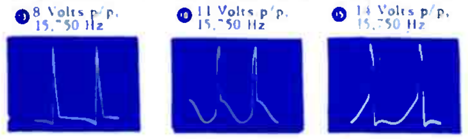
12 55 Volts p/p. 60 Hz



13 8 Volts p/p. 15,750 Hz

14 11 Volts p/p. 15,750 Hz

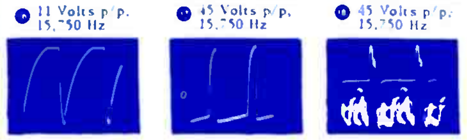
15 14 Volts p/p. 15,750 Hz



16 11 Volts p/p. 15,750 Hz

17 45 Volts p/p. 15,750 Hz

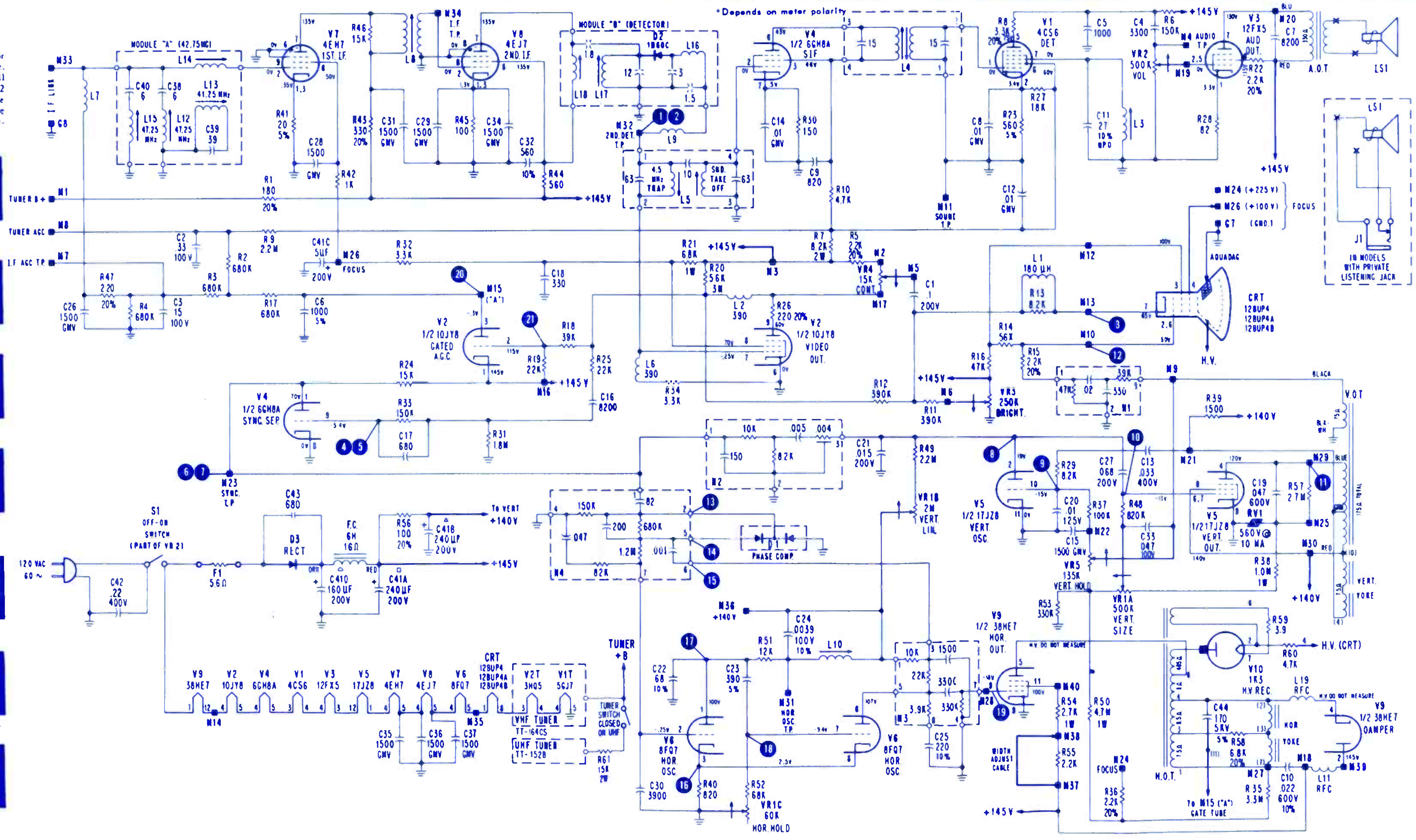
18 45 Volts p/p. 15,750 Hz



19 86 Volts p/p. 15,750 Hz

20 400 Volts p/p. 15,750 Hz

21 50 Volts p/p. 15,750 Hz



1234

SYLVANIA

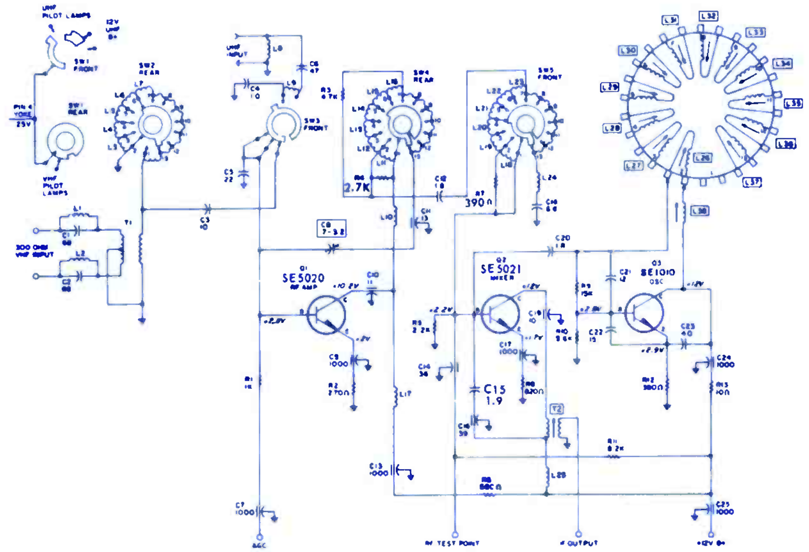
TV Chassis A04-3

JUNE • 1969

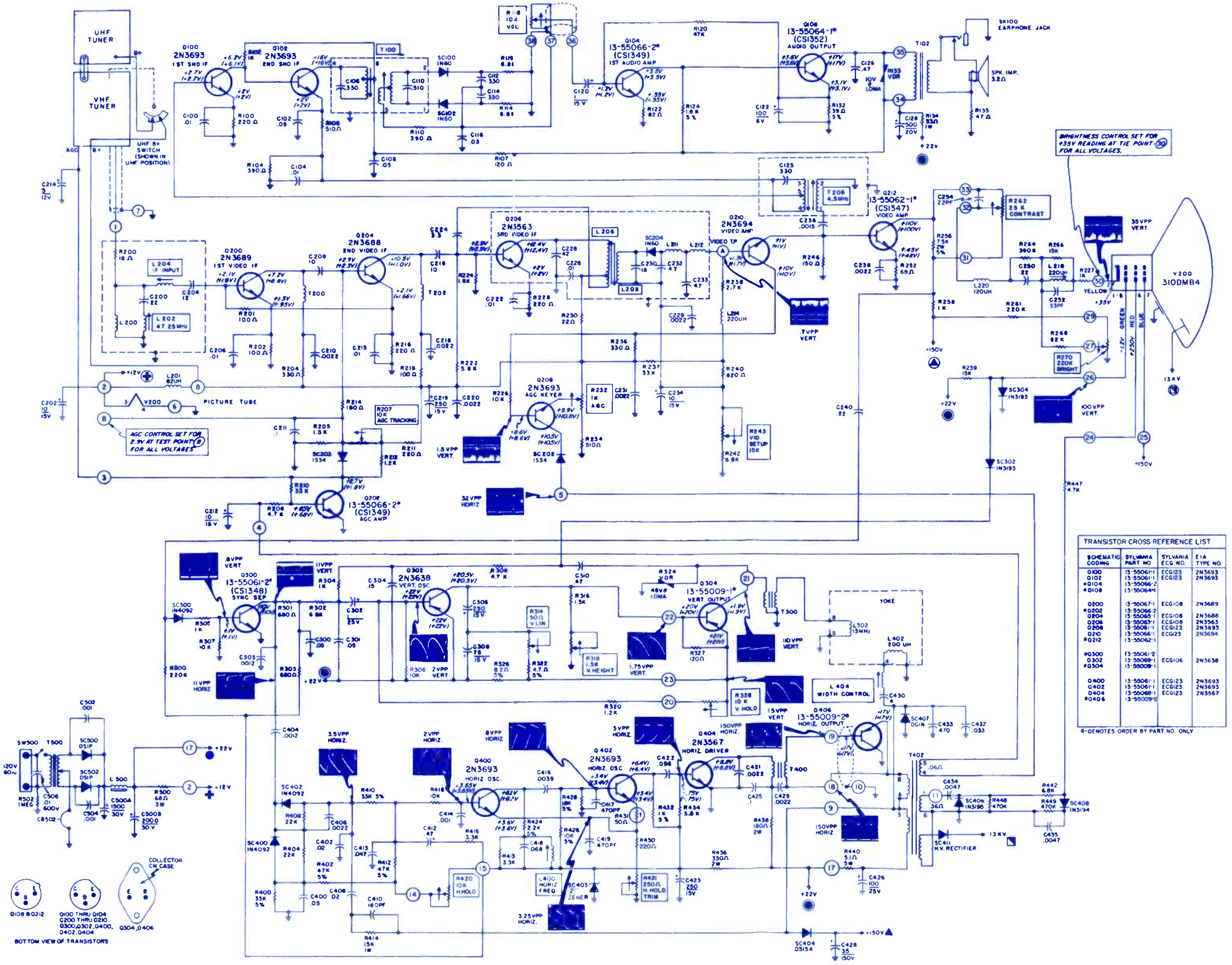
ELECTRONIC TECHNICIAN / DEALER TEKFAX

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

SYMBOL — DESCRIPTION	SYLVANIA PART NO.
C500---2 sec elect.	41-55012-1
C500A---1500/30V	41-55012-1
C500B---2000/30v	41-55012-1
R133---VDR	38-55105-2
R256---7.5K -2w 5%	
R324---VDR	38-55105-1
R400---33K 5%	
R402---47K 5%	
R414---15K 1w	
R431---50 thermistor	38-55106-1
L202---47.25MHz trap	57-55044-1
L204---IF input	57-55045-1
L211---filter	50-55040-1
L214---220µh peak	50-15318-12
L302---vert def.	part of yoke
L400---horiz freq	50-55058-1
L402---horiz def.	part of yoke
L404---width	50-55039-1
T100---ratio det.	57-55057-1
T102---audio output	56-55035-1
T200---1st video IF	50-55043-1
T202---2nd video IF	50-55043-1
T208---sound take off	57-55058-1
T300---vert output	56-55037-1
T400---buffer	56-55038-1
T402---high volt	50-55033-1
T500---power	55-55034-1
R118---10K vol/on/off	37-55050-1
R207---10K AGC track	37-55051-2
R232---1K AGC	37-11632-12
R243---15K video set-up	37-55051-3
R282---25K contr.	37-55053-3
R270---220K bright	37-55053-2
R314---50 vert lin	part of R232
R318---1.5K vert height	part of R232
R328---10K vert hold	37-55053-1
R420---10K horiz hold	37-55007-1
R421---250 horiz hold trimmer	37-55051-1
CB502---cir brkr	29-17620-1
SC302---diode vert blanking	13-55031-1
yoke def.	51-55055-2
tuner VHF	54-17907-3

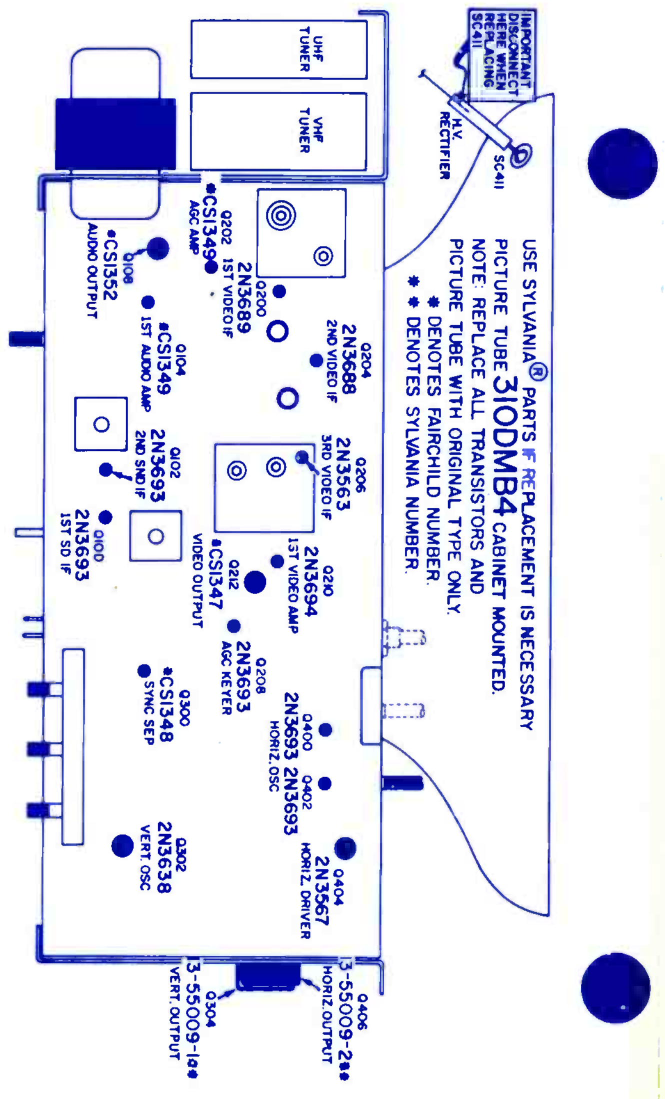


SCHEMATIC DIAGRAM VHF TUNER



TRANSISTOR CROSS REFERENCE LIST			
SCHEMATIC CODING	SYLVANIA PART NO.	SYLVANIA ECG NO.	EIA TYPE NO.
0100	13-55061-1	ECG123	2N3693
0102	13-55061-1	ECG123	2N3693
*0104	13-55066-2		
*0108	13-55064-1		
0200	13-55067-1	ECG108	2N3689
*0202	13-55066-2		
0204	13-55065-1	ECG108	2N3688
0206	13-55063-1	ECG108	2N3563
0208	13-55061-1	ECG123	2N3693
0210	13-55066-1	ECG123	2N3694
*0212	13-55062-1		
*0300	13-55061-2		
0302	13-55069-1	ECG106	2N3638
*0304	13-55009-1		
0400	13-55061-1	ECG123	2N3693
0402	13-55061-1	ECG123	2N3693
0404	13-55068-1	ECG123	2N3567
*0406	13-55009-2		

*-DENOTES ORDER BY PART NO. ONLY



TRANSISTOR LAYOUT DIAGRAM

OVERHAUL

$9.75

GUARANTEED for 1 Year

OVERHAUL $9.75 • REPLACEMENT TUNERS...$10.45

Nine-seventy-five buys you a complete tuner overhaul—including parts (except tubes or transistors)—and *absolutely no hidden charges*. All makes, color or black and white. UV combos only $15.

Guaranteed means a full *12-month* warranty against defective workmanship and parts failure due to normal usage. That's 9 months to a year better than others. And it's backed up by the only tuner repair service authorized and supervised by the world's largest tuner manufacturer—Sarkes Tarzian, Inc.

Four conveniently located service centers assure speedy in-and-out service. All tuners thoroughly cleaned, inside and out . . . needed repairs made . . . all channels aligned to factory specs, then rushed back to you. They look—and perform—like new.

Prefer a universal replacement? Sarkes Tarzian will give you a universal replacement for only $10.45. This price is the same for all models. The tuner is a new tuner designed and built specifically by Sarkes Tarzian for this purpose. It has memory fine tuning—UHF plug-in for 82 channel sets—universal mounting—hi-gain—lo-noise.

ORDER TUNERS BY PART NUMBER, AS FOLLOWS:

Part #	Intermediate Frequency	AF Amp Tube	Osc. Mixer Tube	Heater
MFT-1	41.25 mc Sound 45.75 mc Video	6GK5	6LJ8	Parallel 6.3V
MFT-2	41.25 mc Sound 45.75 mc Video	3GK5	5LJ8	Series 450 MA
MFT-3	41.25 mc Sound 45.75 mc Video	2GK5	5CG8	Series 600 MA

Prefer a customized replacement tuner? The price will be $18.25. Send us the original tuner for comparison purposes, also TV make, chassis and model numbers.

SEND ORDERS FOR UNIVERSAL AND CUSTOMIZED REPLACEMENT TUNERS TO OUR OFFICE IN INDIANAPOLIS.

TSC

TUNER SERVICE CORPORATION *FACTORY-SUPERVISED TUNER SERVICE*

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

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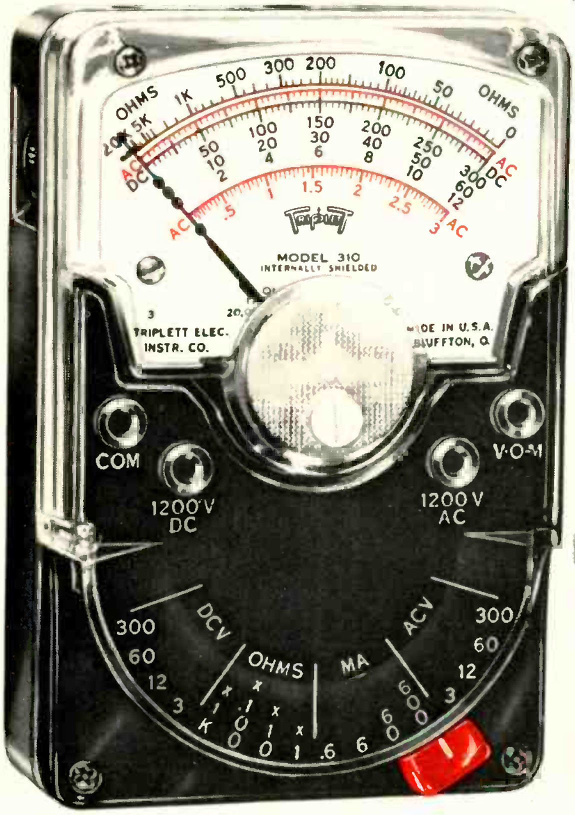

MODEL 310
World's Largest Selling
Volt-Ohm-Milliammeter
(SHOWN ACTUAL SIZE)

1. HAND SIZE V-O-M WITH PROVISION FOR ATTACHING AC CLAMP-ON AMMETER.
2. 20,000 OHMS PER VOLT DC SENSITIVITY; 5,000 AC.
3. ONE SELECTOR SWITCH MINIMIZES CHANCE OF INCORRECT SETTINGS AND BURNOUTS.

MODEL 310-C
Volt-Ohm-Milliammeter

310-C PLUS FEATURES

1. Hand size V-O-M with provision for attaching AC Clamp-on Ammeter.
2. 15,000 OHMS per volt AC sensitivity; (20,000 DC same as 310).
3. Single fully enclosed Lever Range Switch, plus DC Polarity Reversing.

MODELS 100 AND 100-C

Comprehensive test sets. Model 100 includes: Model 310 V-O-M, Model 10 Clamp-on Ammeter Adapter; Model 101 Line Separator; Model 379 Leather Case; Model 311 leads. ($83.20 Value Separate Unit Purchase Price.)

MODEL 100 — U.S.A. User Net $78.00

MODEL 100-C — Same as above, but with Model 310-C, Net $88.00

SELF-SHIELDED Bar-Ring instrument; permits checking in strong magnetic fields. FITTING INTERCHANGEABLE test prod tip into top of tester makes it the common probe, thereby freeing one hand. UNBREAKABLE plastic meter window. BANANA-TYPE JACKS—positive connection and long life.

Model 310—$44.00 Model 310-C—$56.00 Model 369 Leather Case—$4.20

All Prices are Suggested U.S.A. User Net, Subject to Change

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JUNE 1969 • VOL. 89 NO. 6

COVER
The lovely Miss Arlington Texas promotes goodwill for her home town and reflects the goodwill of the local service-dealers such as West Part TV who show that no matter where the service call, they are ready.

TEKFAX • 16 PAGES OF THE LATEST SCHEMATICS • **GROUP 202**
AIRLINE: TV Models GHJ-14829A, GHJ-14829B, GHJ-14859B
DUMONT: Color TV Chassis 120926, 28
MOTOROLA: TV Chassis TS613 Series
OLYMPIC: Color TV Chassis CTC31
PHILCO-FORD: TV Chassis 19L21
SYLVANIA: TV Chassis A04-3

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ET/D EDITOR'S MEMO

The Night People

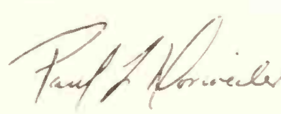
The seemingly unanswered cries of shop owners for more technicians, and the technician's laments about money, are not exactly parallel problems. In fact, being "underpaid" doesn't appear to bother some technicians.

The procedure often referred to as "moonlighting" has a new twist. A service shop sends a technician on a house call. It turns out to be an expensive TV repair problem. The set owner, feeling a twinge in the pocketbook, wishes out loud that there was a less expensive way to enjoy his favorite color program.

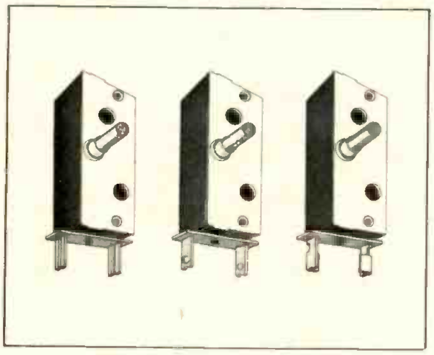
The technician mentions that he sometimes repairs sets at home in his spare time. Since his overhead is low, the repair cost will be greatly reduced. To many a man with a sick color set, a family intent on watching TV and a moth-filled pocketbook, it's a deal. After all, the technician must be reliable; he works for a reputable service shop. If it means a smaller repair cost and (often) a faster job, why not?

The customer informs the shop owner that the repair is too costly and he will wait awhile. The shop owner may realize what's happening, but what can he do about it? Technicians claim that they need night work to subsidize their low salary, and shop owners take a soft attitude. They can't afford to lose the technician—some even feel lucky if the technician uses his own rather than the shop facilities. The situation is, of course, a product of increased service work and fewer men to do the job. The money is merely the clincher.

In today's TV business, a service technician might earn as much as \$100 a week in home repairs—most of it picked up through shop contacts. As one technician bluntly put it, "If I get fired, I'll stay home and earn as much as I do at the shop."



ET/D NEW AND NOTEWORTHY



NEW PRODUCTS

Circuit Breaker/Fuse 700

Adaptable to chemical or amp fuse socket

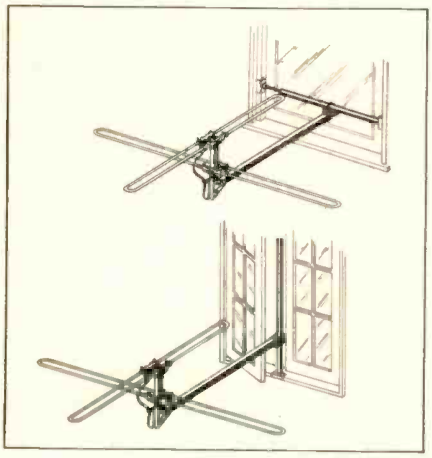
Introduced are circuit breakers with amp fuse pins. In TV repair involving a blown chemical or amp fuse, several fuses can be blown before the trouble is found. This can be expensive and if a jumper is used, it can cause extensive damage. The FA fuse, which fits in the same socket as the chemical or amp fuse, can eliminate this problem because it can be reset as often as needed, or until the cause of breakdown is found. The FA fuse can be left in the set after the repair is made. Model numbers FA350-1, FA1000-1 and FA2000-1 have the same carry and break currents as the chemical fuses with the same model number. Workman.

DEALER SHOWCASE

Indoor Clock-Sign 701

Internal illumination and built-in clock give additional life and utility

An animated indoor clock-sign is introduced to help dealers identify their home products. Dealer identification is given added impact by a "moving" home products logo and a stylized home and antenna. Bands of red, blue, green and white (suggesting color TV reception) flow from the antenna into the home. Internal fluorescent illumination and a built-in electric clock give the sign additional "life" and utility. Dealers add their individual messages to the signs using acetate letter sets inserted in a track on the panel. The sign, 15 x 37 in. in size, can be set up, suspended or wall-mounted. Jerrold.



NEW PRODUCTS

FM Window Antenna 702

Solves reception problems where a rooftop antenna is prohibited

Announced is a window-mounted FM turnstile antenna, a solution to reception problems in apartment buildings and other locations where a rooftop antenna cannot be installed. The all-direction antenna is designed for reception over the full FM band from 88 to 108 MHz without necessity for rotation. The two folded dipoles are matched with a quarter wave phasing stub for optimum gain and an approximately circular pick-up pattern. The all-aluminum antenna has a gold corrosion-proof finish and carries a list price of $16.95. The antenna can be mounted either horizontally or vertically to fit any type of window with a span up to 42in. For wider or higher windows, two extension mount bars are available: the Model FCW-18, which extends the mounting an additional 18in. and carries a list price of $2.97, and the Model FCW-30 which extends the mounting an additional 30in. and has a list price of $3.25. Finney.

FOR MORE DEALER SHOWCASE SEE PAGE 58

FOR MORE NEW PRODUCTS SEE PAGE 68

DEALER SHOWCASE

Component Merchandiser 703

Self-selling display holds 53 items

A new point-of-purchase display merchandiser offers a complete line of blister-packaged connector components. The new display contains 53 different items—from microphone connectors to lightning arrestors—attracting the customer's attention as well as telling the complete product story. Colorful, informative and to the point, it provides maximum component visibility and clean over-all package appearance. Amphenol.

ET/D LETTERS TO THE EDITOR

Thanks

I am writing in regard to a letter from Arthur Clendenon of Tennessee which appeared in the October 1968 issue of ELECTRONIC TECHNICIAN/DEALER. His letter said he would give back copies of ELECTRONIC TECHNICIAN/DEALER to anyone who needed them. I went to Mr. Clendenon to get the magazines and told him I would write and let you know so you could thank the many readers who wrote him. I read and enjoy every issue.

WILLIAM R. ROSE
Kingsport, Tenn.

Multiple Ghosts

I am having a problem in my area with multiple ghosts. I am located in the flat lands of Louisiana right in the middle of two grain elevators. These buildings are approximately 300 ft. high and .4 mile apart. I have tried ghost killers, high and low gain antennas of every shape and form to no avail. I would appreciate any help from your readers or antenna manufacturers. I have approximately 150 customers with the same situation and if I could solve the problem, I could sell 150 antennas. I have been a faithful reader of ELECTRONIC TECHNICIAN/DEALER for years and enjoy it very much. Keep up the good work.

SALVADOR A. PORTERA, JR.
Jr.'s Sales & Service
102 Lorraine Ave.
Destrehan, La. 70047

Hot Chassis

Without going into the details of my near tragedy, I found out that a piece of equipment with a transformer power supply had a "hot" chassis. I was working on one of the better, higher-priced CB transceivers, but it could have been any brand. The unit was blowing fuses and yet B+, filaments and the 110vac circuits tested normal. The chassis was hot through the transformer laminations which provided a contact between the primary and secondary. The oxide and shellac on the laminations isolated the core from the chassis and caused the unit to act like an autotransformer. When I attempted to attach the antenna coaxial connector, I got the full jolt—certainly more than 110vac!

M. J. CAPRIOLI
Phoenix, Ariz.

ET/D LETTERS TO THE EDITOR

Wants Back Issues

I am interested in obtaining back issues of ELECTRONIC TECHNICIAN/DEALER starting from the first issue up to February 1963. No doubt one of your subscribers has these copies. If so, I would appreciate hearing from any reader who is willing to part with his back copies if he would write and advise me of the cost.

ANTONIO HERNANDEZ L
c/o La Villa de Paris
Nogales, Ariz. 85621

Readers' Aid

I need a schematic and instruction book for a Triplett Model 3434 TV-FM marker signal generator. I have written the manufacturer and was told the information is not available. I will gladly defray the cost if any ELECTRONIC TECHNICIAN/DEALER reader can supply me with the original or copies.

AVON BAUMAN
Bauman & Sons TV Service
3255 Mangum Lane S.W.
Atlanta, Ga. 30311

Schematics Not Available

Thank you for your help, but the reply from Candle American, Inc., was negative. I would appreciate help from your readers. My problem is poor sync causing pulling and rolling. I would like to know if any modifications were made. The set is a Candle Model MT-510.

SSGT EDWARD J. CORS
AF17360777
Box 575
57F15
FPO 09571, N.Y.

Editor's Note

Candle America, Inc., indicated in its reply to SSGT Cors that schematics are no longer available for Models MT-510 and MT-510A Candle and Valiant brands of micro TV. The supply was exhausted a year ago and since the firm discontinued TV manufacturing over five years ago, it will not have diagrams reprinted. However, Candle indicates that if the TV set has not been tampered with, one of the company's service technicians will repair it. Further information on this can be obtained by writing T. Kikuchi, Candle Corp. of America, 1457 Venice Blvd., Los Angeles, Calif. 90006 . . . Ed.

The prize you get depends on how many tubes you buy.

Every time you buy 20 Sylvania receiving tubes from your distributor, he gives you a certificate called a "Bright Buck," which works like a trading stamp. When you've collected enough Bright Bucks, you turn them in for prizes.

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It's not exactly getting something for nothing. But it's close.

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ET/D BOOK REVIEWS

TRANSISTOR-TV SERVICING GUIDE *by Robert G. Middleton. Published by Howard W. Evans & Co., Inc., 128 pages, 8½x11 in. softbound. $3.95.*

This book is a revised edition of the first printing. It has eleven chapters which cover circuit troubles in every stage of a TV set including the tuner, AGC, picture tube and low voltage power supply. The first chapter gives a few pointers on general troubleshooting and information on typical transistorized circuits. This information will be especially useful to technicians who are not well acquainted with servicing transistor circuits. The book is profusely illustrated with supporting diagrams, waveforms, test instrument connections and video patterns. In most of the chapters, a general circuit discussion leads into a numbered outline of symptoms followed by an explanation of probable causes and cures. The book is a practical reference source for any technician involved in transistorized TV servicing.

RCA POWER CIRCUITS MANUAL, SP-51. *Published by RCA Electronic Components, Harrison, N.J., 8¼ x 5¼, 448 pages, $2.00.*

This manual provides a valuable source of information on characteristics and applications of some of the latest devices with a brief theory of operation.

The manual is divided into ten main chapters explaining semiconductor materials, theory of silicon rectifier and thyristors (including SCK's, triacs, diacs), silicon power transistors, rectifier circuits, power conversion, regulation, thyristor ac controls and power amplifiers.

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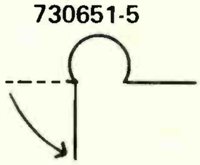
ET/D TECHNICAL DIGEST

MAGNAVOX

Radio Model R10/C10—Installing Heat Sinks on Output Transistors

The output transistor in the R10 and C10 radios may fail because of excessive heat. It is recommended that a heat sink, part No. 730651-5, be installed on all 2SB178 and 2BS324 output transistors in these units. The heat sink must be reformed, as indicated in the illustration, by bending one of the flanges 90deg so that it will not interfere with the cabinet or output transformer.

730651-5



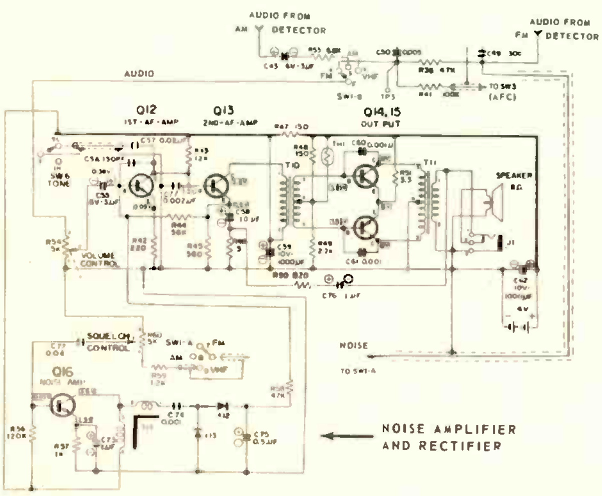
Bend one Flange 90 degrees

Remember to apply silicone grease between transistors and heat sinks.

WESTINGHOUSE

Radio Model 23S18B—'Squelch Circuit' Description

On this three-band radio, squelch is used for VHF only. The squelch control at the back of the radio is used to eliminate noise and to allow reception when a station transmits. Many times only one half of a conversation can be



heard because of the location and the power of the stations which are communicating with each other. The squelch circuit silences the radio when a large amount of noise is being received. The desired signal must be moderately strong, stronger than the noise. Example: if a police broadcast is being heard and the SQUELCH control is set to the point where disturbing background noises just disappear, the police broadcast will still be heard. When the station stops transmitting (standby) no noise or weak stations will be heard. This is possible because the SQUELCH control can be set so that when the station stops transmitting, the receiver "noise" increases and this "noise" is used to control the cutoff point of the audio amplifier.

The squelch control circuit can be used, only when the BAND SELECTOR is in the VHF position. When switch SW1-A is in the AM or FM position, "noise" cannot reach the noise amplifier to "cut off" the audio amplifier. When only noise is present on the station, it will be amplified and fed to a rectifier circuit to provide bias voltages for the audio amplifiers. When an RF signal stronger than the noise is received, the noise will be blocked out. When noise is removed from the noise amplifier, the first audio stage current is reduced and the second audio stage is allowed to conduct normally.

The amount of noise received and the setting of the SQUELCH control determine the effectiveness of "squelch" action. The amount of noise amplified determines the rectified bias voltage to the first audio amplifier transistor. The bias voltage of course controls the amount of current through the collector to emitter circuit. Since the collector of the first audio amplifier and the base of the second audio amplifier are common, an increase in the first audio collector current will result in a voltage decrease at the base of the second audio amplifier. When the voltage at the base of the second audio amplifier is low enough, it causes "cutoff." There is no output and noise is "squelched" until a signal from a transmitting station is received.

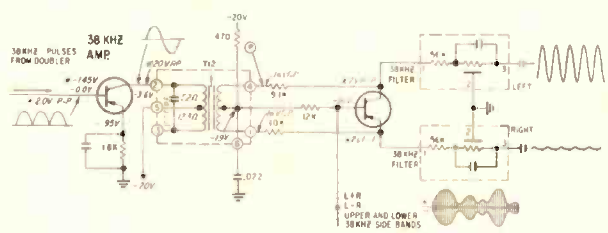
ZENITH

FM Multiplex Receiver Chassis 25ZT120—Biplex Detector Circuit Description

The 121-347 PNP transistor used in the Biplex detector circuit, although not a bilateral transistor, exhibits bilateral characteristics. As a result, its function can be best explained by the operation of a normal bilateral transistor.

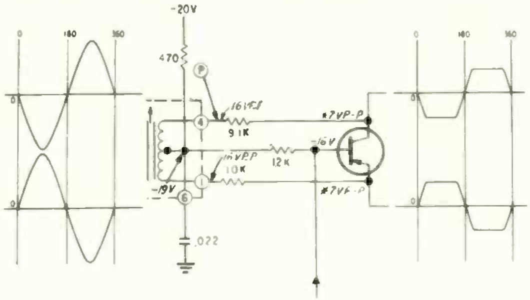
A bilateral transistor is a special type in which the collector will serve as the emitter and the emitter will serve as the collector under certain conditions. When switched by a properly applied ac voltage, in push-pull, sufficient in value to overcome the cutoff bias normally applied, the bilateral transistor will pass current in both directions in accordance with the alternations of the switching voltage. The switching voltage in this case is the regenerated 38kHz subcarrier signal.

The transistor is not biased in the conventional manner. For the following refer to the illustration. The base is biased at −16v while the collector and emitter are both



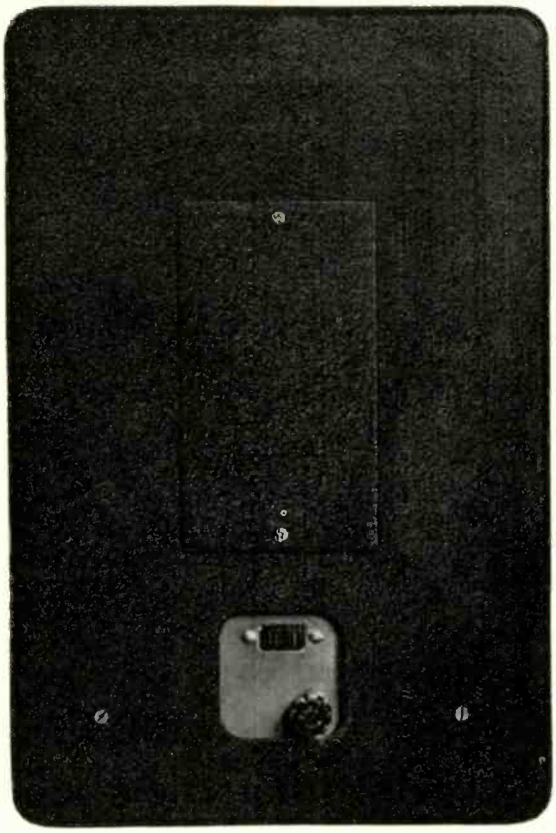
biased at −19v (as shown at the center-tap, terminal No. 6 of transformer T12). The −19 and −16 are obtained from the voltage divider consisting of the 1.2K and 470Ω resistors and TR12. Note that the collector and emitter are connected to the opposite ends of the 38kHz output transformer secondary winding (part of T12). Under no-switching voltage conditions, the transistor is biased to cut off due to the 3v difference between the 16v at the base and the 19v at the emitter. To forward bias the transistor and cause current flow, the voltage at the emitter must be positive or less negative than the voltage at the base. The required forward bias is supplied by regenerated 38kHz subcarrier (a CW signal) when the value of the 38kHz voltage exceeds the reverse bias between base and emitter.

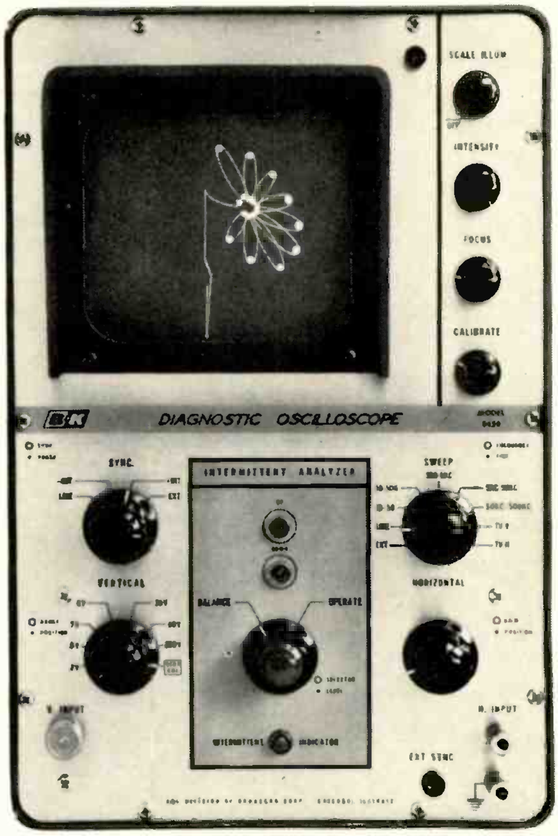
Referring to the illustration showing the input and output waveforms of the 38kHz switching signal only, note that



the upper 38kHz input wave supplies the positive bias from the emitter to the base on the first half-cycle. At the same time, the lower wave supplies the negative bias from the collector to the base. During the second half-cycle the reverse is true, but the action of the transistor is the same due to the bilateral effect.

The back. The front.





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ET/D TEKLAB REPORT

Setchell Carlson's Model 2900 Portable Color TV

Circuit study and plug-in construction can shorten troubleshooting time, making servicing more profitable

■ Every day we see more solid-state or hybrid circuitry on the market employing etched circuit boards. This particular receiver represents a balance between solid-state and vacuum tube technology.

Setchell Carlson is continuing its unitized concept and now employs an aluminum base chassis construction with ten etched "plug-in" circuit board units.

This type of construction provides the separation of circuit functions and aids in more economical servicing. The circuit board substitution method allows faster isolation of the trouble and most repairs can be accomplished in the home.

When we unpacked the Setchell Carlson Model 2900 for this Teklab report, the first thing we noticed was the walnut cabinet. Another feature is the console-size 6 in. speaker, rare in portable models.

The front panel controls include: CHANNEL SELECTOR, UHF TUNING, FINE-TUNING, VOLUME, TINT, COLOR BRIGHTNESS and TV OFF/ON switch.

The controls on the back of the chassis which we feel should be more conveniently placed for ease of adjustment are: CONTRAST, VERTICAL HOLD and HORIZONTAL HOLD.

Antenna terminals are provided at the rear of the receiver to permit attachment of outdoor antennas. A slide switch on the antenna terminal board connects the receiver to the built-in VHF antenna or to an external VHF antenna which

Setchell Carlson's Model 2900 portable color television in a walnut cabinet.

Unitized circuit boards are changed without tools. Positive electrical connection is assured by nylon catches which hold the board firmly in place and allow quick removal.

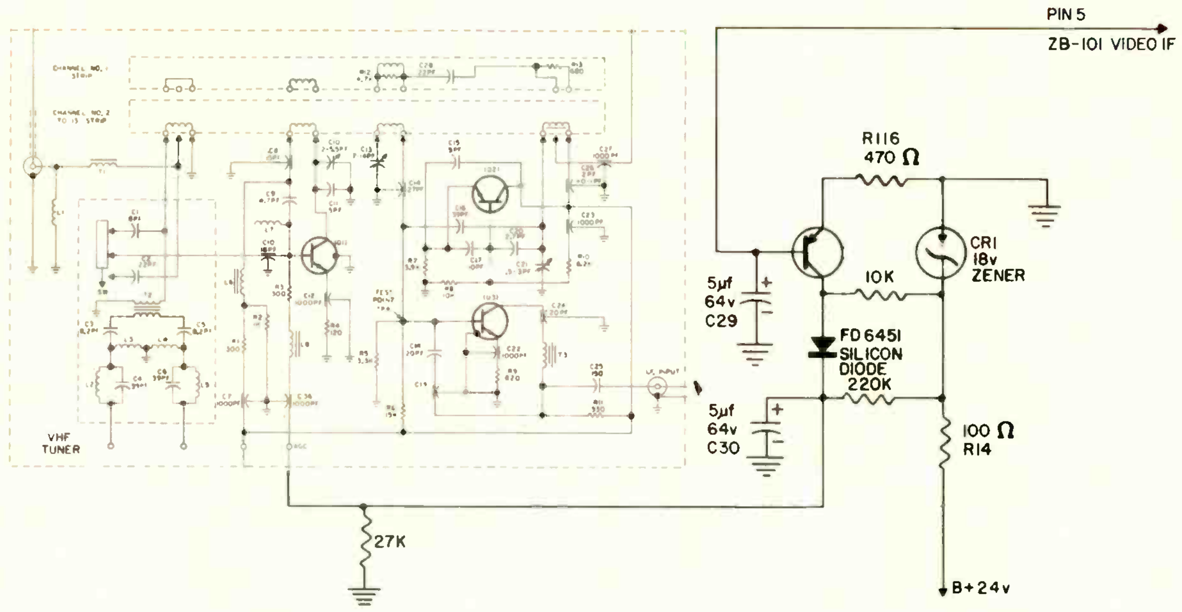


Fig. 1--Schematic showing the modification made to the tuner AGC circuitry.

attaches to terminals directly below the slide switch.

When an external UHF antenna is used, the internal UHF antenna must be removed.

When the set was first turned on, we were not overly impressed with the picture quality. It happened to be an early model lacking the AGC modifications to the tuner and other minor changes to several of the plug-in circuits. Once these modifications and the plug-in circuits from the manufacturer were installed, the set produced a good picture.

The modification made on the tuner AGC circuitry is provided here for comparison purposes and also as a point of interest to those with earlier production units. The tuner AGC circuitry shown in Fig. 1 is used on all Model 2900s and 2800s other than early production models. Optimum performance will be obtained from the new ZB-101 units with present tuner AGC circuitry. The tuner AGC circuitry can be checked without removing the chassis by observing the tuner through the slots in the bottom of the cabinet. The tuner incorporates the latest AGC circuitry if the 27K resistor is present on the tuner. If not, it can be modified in the following manner: Check C29 and C30 for connection as shown in the schematic. Add the 220K resistor and silicon diode if required.

The chassis employed on this portable is divided into ten plug-in units and a common chassis into which they connect. Actually there are nine plug-in circuits, the tenth being the circular convergence adjustments and related solid-state circuitry in one complete package with electrical connections made through a plug and socket.

TUNER

The tuner shown in Fig. 1 is a conventional turret-type consisting of the RF amplifier (Q1), mixer (Q3) and the oscillator (Q2). With the VHF channel-selector in the "UHF" position, the UHF tuner is supplied with collector voltage through a segment of the channel strip. Transistor Q31 is then activated as a UHF oscillator.

VIDEO IF AND AGC ZB-101

Because of gain/bandwidth requirements in many special applications for which this receiver is often used, four video IF amplifier stages are used instead of the usual two or three. The video IF and AGC schematic is shown in Fig. 2. Rather than the conventional keyed AGC, an amplified sync system was developed to permit employment in certain video tape applications. Transistors Q101, 102, 103 and 104 are video IF amplifiers. Signal for the 4.5MHz sound detector, D102, is taken from the collector circuit of transistor Q104. The secondary of the output IF transformer, T102, includes a 41.25MHz trap which removes practically all of the sound signal from the video detector, D101. The video detector signal passes to transistor Q106, an emitter follower which matches the impedance of the detector to the low impedance of the contrast control and following stages.

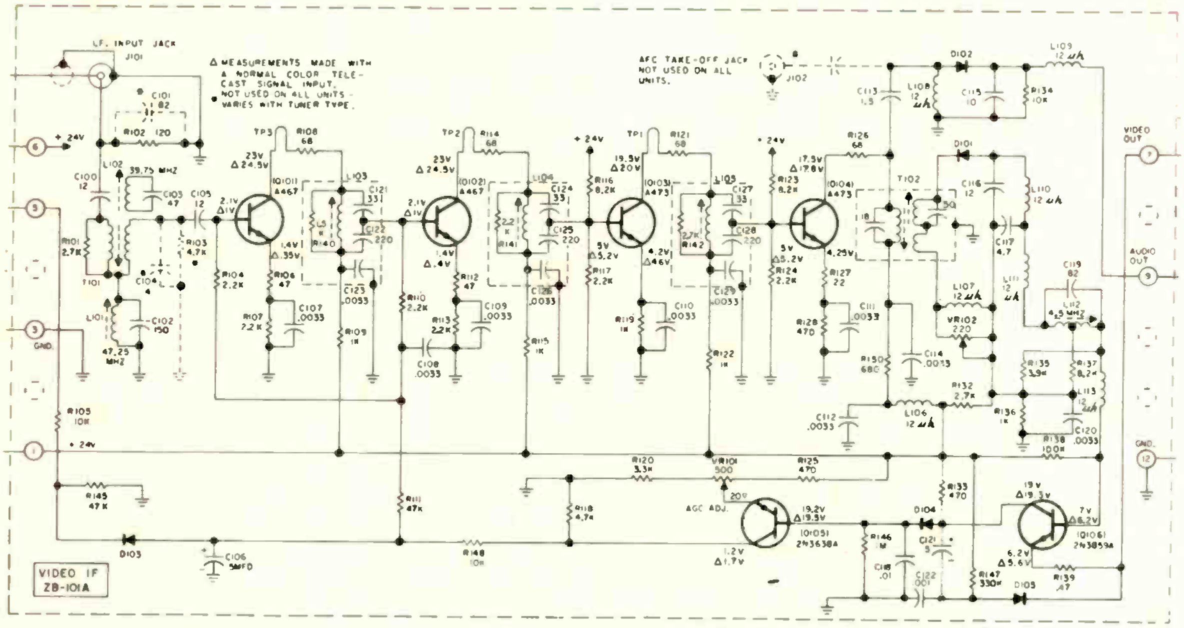
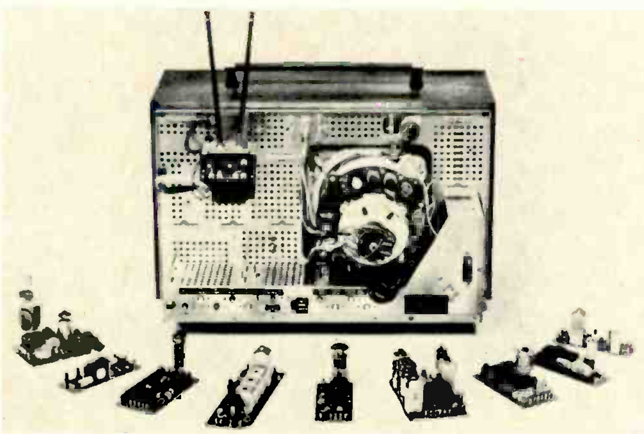


Fig. 2--Four stages of video IF are employed instead of the usual two or three. A special sync system permits certain video tape application.

Capacitor C121 and diode D105 comprise a very effective noise gate. All of the noise pulses in higher amplitude than the average determined by the sync pulse level will be shorted between collector and emitter of Q106 and thus prevent signal or AGC output. Positive-going sync signals are formed in the collector circuit of Q106, clipped by diode D104, amplified and inverted by transistor Q105 and applied as reverse AGC to the first two stages of the video IF amplifier. This signal is delayed by D103, amplified and inverted by Q4, further delayed by D1 and applied to the tuner RF stage as forward AGC. Forward AGC is used on the tuner for best cross-modulation characteristics, while reverse AGC is applied to the video IF stages to minimize impedance shift with varying signal levels. The AGC is adjusted to determine the detector output level on strong signals.



Over 90 percent of all circuit components are mounted on 10 plug-in units. Nine units plug into the chassis while the tenth mounts on the picture tube.

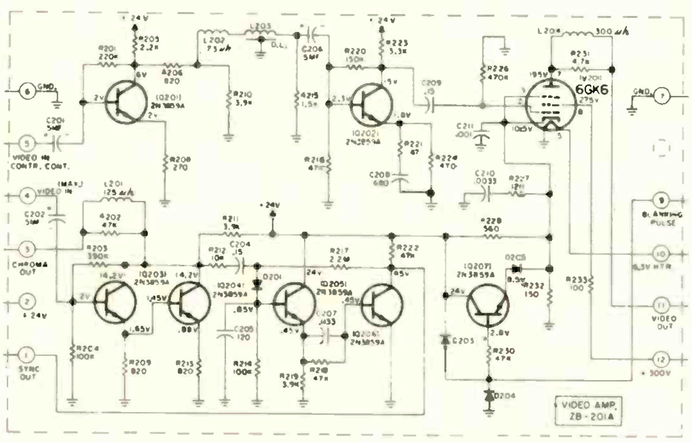


Fig. 3--Transistors Q203 and Q204 are connected as a Darlington pair and comprise the first chroma and sync amplifiers.

VIDEO SYNC UNIT ZB-201

The signal from the contrast

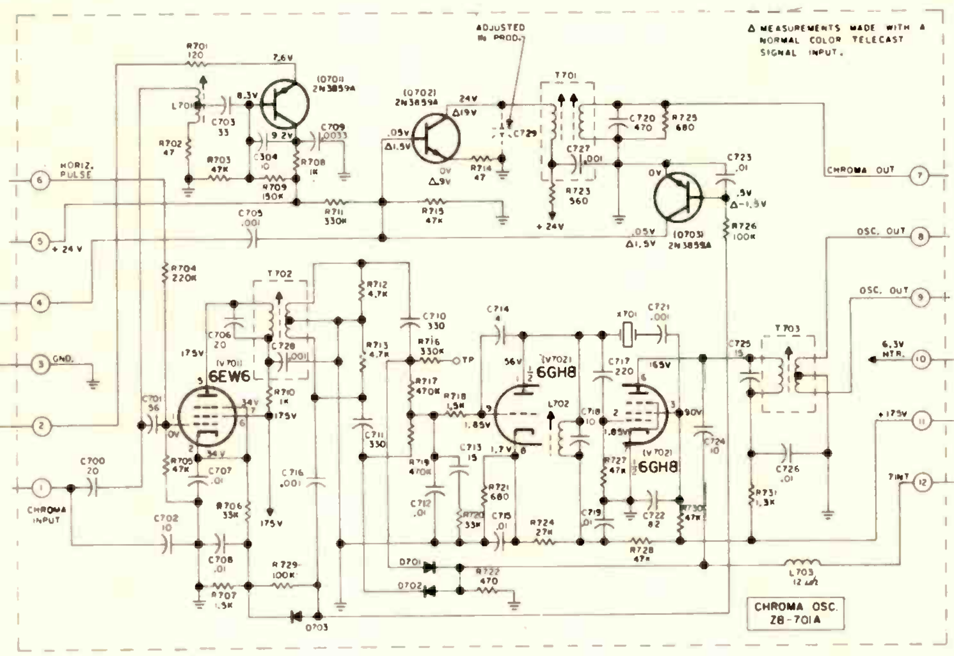


Fig. 4--Schematic showing the chroma processing unit.

control is amplified by the first video amplifier, Q201, passed through the delay line to bring it into phase with the chroma signal and further amplified in Q202 and V201. (See Fig. 3.) The luminance signal is fed to the cathode of the picture tube. If it is necessary to adjust the luminance drive to compensate for differences in picture tube gun characteristics, a resistor network (R51 and R52) is provided on the cathode drive socket. The plug-in cathode connections may be adjusted as required but are normally used in the maximum drive position.

Transistors Q203 and Q204 are connected as a Darlington pair and comprise the first chroma and sync amplifiers. Diode D201 and transistor Q205 act as sync levelers before feeding the sync signal to the sync separator, transistor Q206. Transistor Q207 is a blanking amplifier which, together with diodes D203, D204 and D205, shapes the horizontal and vertical blanking pulses from the deflection circuits and applies them to the cathode of the video output tube.

CHROMA OSC ZB-701

Chroma signal is received from the video-sync unit, (Fig. 4) which is tuned by coil L701 and matched to the low impedance of the color control by the emitter follower transistor Q701. It is further amplified by transistor Q702 and fed through the bandpass transformer (T701) to the chroma demodulators on the chroma output unit. V701, the burst amplifier, is keyed on during burst time by a pulse from the horizontal output transformer. The amplifier burst is applied through T702 to diodes D701 and D702 which act as automatic phase detectors. Their output signal controls the phase of the chroma oscillator tube, V702, to keep it locked in sync with the burst signal. When the burst signal is present, diode D703 develops a negative voltage which biases off the color killer transistor Q703. If no color signal is being received, Q703 conducts and cuts off Q702.

CHROMA OUTPUT ZB-751

The chroma and chroma oscillator signals from ZB-701 are applied to the balanced demodulators, diodes D751, 752, 753 and 754. (See Fig. 5.) The B-Y and R-Y signals are derived directly from the demodulators and amplified by transistors Q751, Q752 and the red and blue amplifier sections of tube V751. Green is derived by matrixing the red and blue signals. It is then amplified by its section of V751, after which the chroma is applied to the CRT.

4.5MHz SOUND IF AMPLIFIER UNIT ZB-301

The sound detector on ZB-101 feeds its signal through a 4.5MHz amplifier transistor (Q301), a limiter-amplifier transistor (Q302), and then to the ratio-detector diodes D301 and D302. Their output is passed through the volume control to audio amplifier ZB-401.

AUDIO AMPLIFIER ZB-401

The audio amplifier is conventional and consists of amplifier transistors (Q401 and Q402) in a Darlington pair driving a class "B" output stage (Q403 and Q404). Their output feeds a 16Ω speaker.

VERTICAL DEFLECTION UNIT ZB-601

The vertical deflection unit consists of V601, the multivibrator-amplifier tube and related components. Its function is conventional except for diode D601, which permits the vertical sync signal to be fed to the multivibrator cathode but prevents the vertical retrace pulse from feeding back into and upsetting the horizontal sync.

HORIZONTAL DEFLECTION UNIT ZB-501

Horizontal sync is fed to a conventional phase detector (dual diode DD501) and used to control the frequency of the horizontal multivibrator tube V501. (See Fig. 6.) The horizontal output tube V502 connects to the output transformer. The high voltage is regulated by taking a reference voltage from Boost B+and using it to control the regulator transistor Q501. Together with diodes D501 and D502, transistor Q501 regulates the high voltage by shaping V502's grid drive waveforms thus controlling the rate of change of the output plate current.

HORIZONTAL EFFICIENCY UNIT ZB-551

This unit (shown in Fig. 7) contains the damper diode D551 and the efficiency control components. The horizontal efficiency coil L551 is adjusted for minimum 6JE6 cathode current.

POWER SUPPLY

The power supply components are located on the main chassis. Two separate full-wave supplies are included. The 300v supply feeds only the deflection circuits while the video output circuits are powered from the 24v supply. (See Fig. 8.) ■

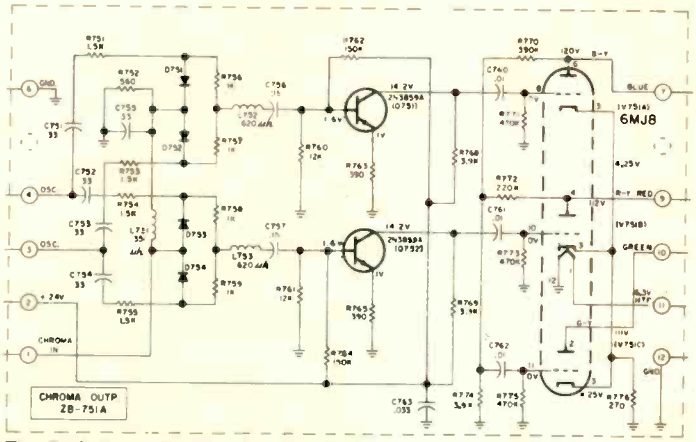


Fig. 5--Schematic showing the chroma output circuitry.

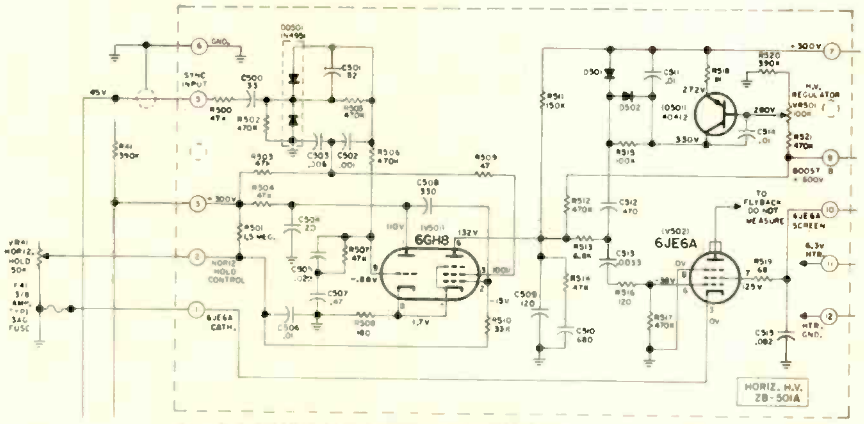


Fig. 6--The horizontal sync signal is fed to a conventional phase detector and is used to control the frequency of the horizontal multivibrator tube.

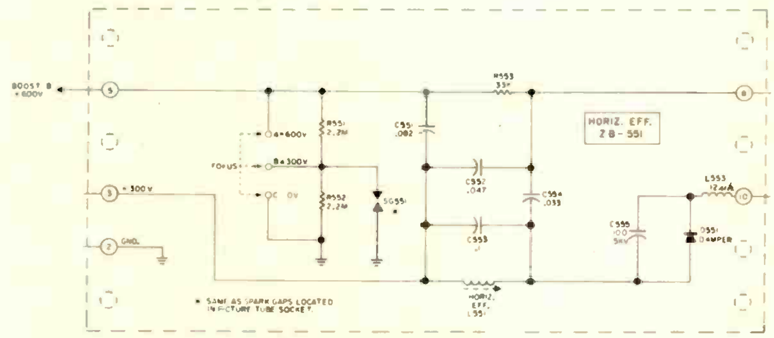


Fig. 7--Horizontal output tube cathode current can be measured across the fuse terminals on the main chassis.

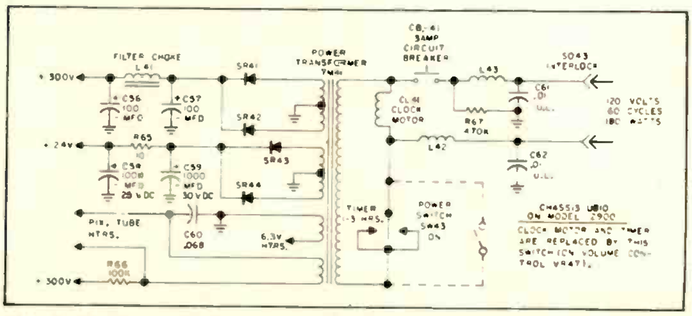


Fig. 8--As shown in the schematic, the 300v supply feeds only the deflection circuits. Video output circuits are powered from the 24v supply.

TV Tuner Servicing

There are times when it is profitable to repair a TV tuner, and times when it is more profitable to send it to a specialist--knowing the difference can save you a lot of headaches

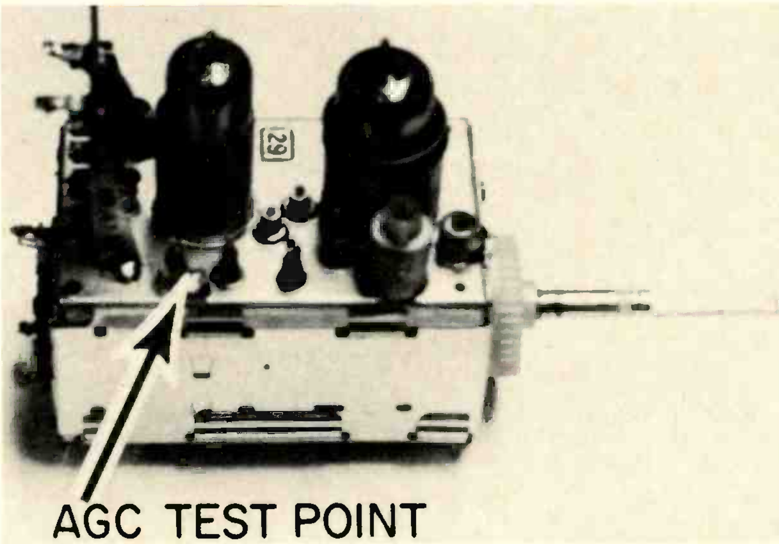


Fig. 1--The first step in isolating the trouble to a tuner is to check the AGC action by shorting the AGC test point to ground.

■The tuner takes more of a beating than any other section in a TV set. With the average family watching TV 46 1/2 hours per week, it has been estimated that channels are changed 3000 to 4000 times per year! This puts quite a strain on the tuner and therefore they account for a fair percentage of TV troubles. The following symptoms are typical of problems often caused by a defective tuner:

(1) "snowy" picture
(2) raster, but no sound or picture
(3) loss of UHF channels
(4) loss of high or low VHF band channels
(5) streaking or flashing in the picture
(6) separation of sound and picture
(7) picture pulling
(8) picture distortion
(9) partial blanking of the raster

FIX IT FAST OR FORGET IT

In addition to being one of the most common sources of trouble, the tuner is undoubtedly the most difficult to repair. For one thing, mechanical problems which don't apply to any other part of the TV set may be difficult or impossible for the average technician to correct, even if he knows precisely what is wrong. For another, few shops have the equipment to sweep and align a TV tuner properly. Finally, at the frequencies involved, strange things can happen. Just moving a critical part physically can make the tuner inoperative.

It is because of the difficulty of repairing tuners in the field that repair and rebuilding specialists have sprung up all over the country. (See list of specialists at end of this article.) For an average of $10, these businesses will restore any tuner to top working order.

This brings us to the prime rule of tuner repair: If you can't fix it fast, forget it! Don't waste a lot of time trying to do something you're not equipped to do. Remember, you are in business to make money and time is your most precious asset. It may give you satisfaction to lick a tough tuner after a couple of hours of struggling, but it also costs you money.

The professional way to handle tuner troubles is: (1) make sure it's the tuner that is causing the trouble, (2) clean the tuner thoroughly, (3) check the tuner quickly for obvious troubles, (4) if the trouble is easy to find and easy to fix, go ahead, (5) if you think the trouble may take more than an hour to find and repair, send it to a tuner specialist.

MAKE SURE IT'S THE TUNER

Before you start to troubleshoot a TV tuner, make sure it is really the tuner that's at fault. IF and AGC troubles often cause symptoms that appear to be tuner problems.

If the picture is snowy, for example, too much AGC voltage may be the problem. This is easy enough to check out. Simply short the AGC test point (see Fig. 1) to the tuner ground. This reduces the AGC voltage to zero, enabling the RF amplifier to operate at maximum gain.

If shorting out the AGC improves the picture significantly, the trouble is in the AGC. If not, it is probably in the tuner. AGC voltages normally measure about -1.5v. If the voltage goes below -3v, it often causes snow.

However, it is also possible for snow to be caused by the IF stages. This is rare, but you'd feel foolish sending a tuner in for repair only to find out it was really an IF trouble. Therefore, it pays to check this out.

If you have a good IF sweep generator and a scope, this is an ideal way to check the IF stages for proper gain.

If not, you can accomplish approximately the same effect with a little improvising. Start with a known good TV receiver connected to an antenna and displaying a normal picture. Then, connect the IF cable from the tuner of the normal receiver to the IF input of the receiver you are repairing. Be sure that you connect the shield of the IF cable to ground and that the center conductor is isolated from the defective receiver by a coupling capacitor. Don't use an ac/dc or line connected TV set as your good receiver because there may be a difference in potential between grounds on the two chassis.

If substituting a good tuner via this method brings in a normal picture, you know your problem is in the tuner. If not, it's undoubtedly a chassis problem.

Substitution of a known good tuner, (preferably a similar tuner) as described above is, of course, an excellent method of isolating any tuner trouble, making sure the tuner is at fault.

START WITH A CLEAN TUNER

Technicians often forget that dirty tuners just don't work very well. Tuner specialists report that many of the units they receive for repair need nothing more than a thorough cleaning. Intermittent troubles, snowy pictures, streaking or flashing pictures, and poor color response are all troubles commonly caused by corrosion or dirt on contacts.

In fact, many troubles can be caused by dirty contacts. If a tube socket is dirty, for example, the tube pin fails to make contact and the circuit doesn't operate properly.

The best way to clean a tuner thoroughly is with a high pressure washing or degreasing spray as shown in Fig. 2. Don't use a spray that includes a lubricant. These sprays are fine for tuners that are working, but a pure cleaner is normally more effective than a combination cleaner/lubricant.

Of course, you have undoubtedly tried new tubes in the tuner before starting your servicing procedure, but don't leave them in their sockets. Remove the tubes from the tuner and spray it thoroughly, including the tube sockets.

HINT: Never spray the neutralizing capacitor in a Nuvistor tuner. Even the best tuner spray can cause permanent detuning if used on this capacitor.

TUNER CHECKUP

Once the tuner is clean, give it a fast but thorough checkup. Remove the cover and start with a visual inspection. But be careful not to poke around inside the tuner or disturb the placement of components. Once a wire or coil is moved, it's almost impossible to get it back into the proper operating position without alignment equipment.

If your preliminary inspection reveals a shorted or gassy tube, chances are that excessive current has burned up or changed the value of a resistor. Burned resistors, of course, are easy to spot visually.

If your visual inspection reveals no problems, make voltage checks at the test points provided. B+ test points are most likely to reveal trouble (some tuners have two or three B+test points). Check the schematic for proper voltages. Your readings should be accurate within ±20%.

Then make voltage-resistance checks at the tube sockets. Since tuners are so compact, the easiest way to do this is with a test socket.

You can't expect the tuner to operate properly with test sockets in the circuit, but the voltage and resistance readings should be fairly accurate.

If you read a low plate or screen voltage it generally indicates that a series resistor has chang-

Tuner Servicing . . .


Fig. 2-- Before troubleshooting the set, clean the tuner thoroughly.

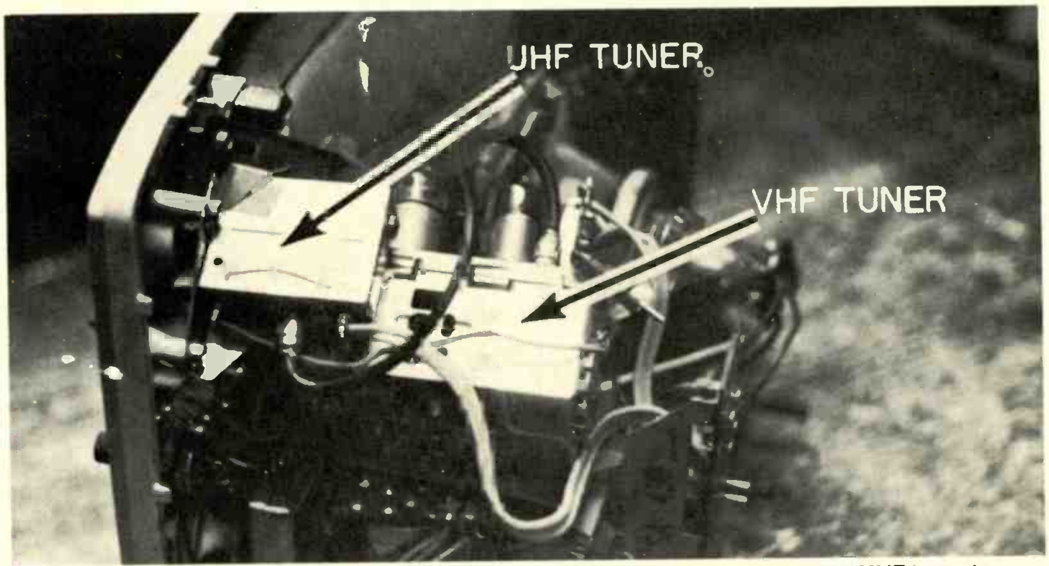
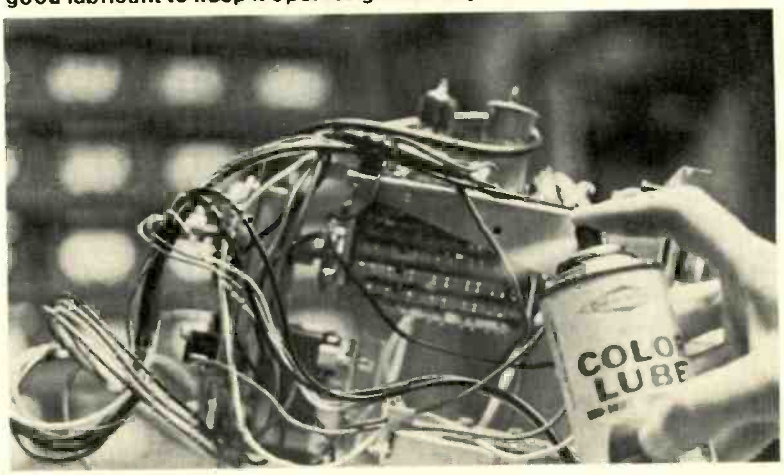


Fig. 3--In some sets, it may be necessary to remove the UHF tuner to get at the VHF.

Fig. 4--Once the tuner has been repaired, it should be sprayed with a good lubricant to keep it operating smoothly.



ed value or a capacitor going to ground is leaky or shorted. If the voltage change is intermittent, you can usually isolate the defective part by spraying components with freezing solution.

A dead oscillator is most often caused by a defective plate load resistor. You can tell whether the oscillator is working or not simply by checking the oscillator injector voltage at the mixer grid test point. In a tubed tuner, this voltage should be about -1.5 to -3.5v.

In a solid-state tuner, you can tell whether or not the oscillator is working by checking at the base of the oscillator. You should read about -1 or -2v. However, in many solid-state tuners it's difficult to take this reading and you may be better off sending the tuner to a specialist for repair.

In making resistance checks, don't overlook the balun coils. Defective baluns can often cause snow or loss of high and low VHF bands. Careful resistance tests will usually turn up balun problems quickly. Since there are such a wide variety of balun configurations, however, it is imperative that you check the schematic before jumping to any conclusions.

Internal tuner voltages and resistances can be very difficult to check. In many modern TV sets, for example, you have to take out the UHF tuner in order to get at the VHF tuner. (See Fig. 3). Some tuners, especially foreign made and solid-state tuners, are simply too compact to get at. In this case, you're usually better off sending the tuner out for repair.

REPLACING DEFECTIVE PARTS

Once you locate a defective component in a tuner, your problem is to reach it without disturbing a lot of wires. Tuner specialists use tiny soldering irons and slim tools.

Be sure you obtain an exact replacement for the defective part if possible. Otherwise the tuner may work, but not properly.

Many of the problems you spot will not be easy to correct, especially mechanical problems.

If the defective part can be replaced with an exact replacement, be very careful. Cut lead lengths to the exact length of the original and substitute the new part for the old one without disturbing lead dress or coils. Lead dress is especially critical in UHF tuners.

HOW TO SEND A TUNER

Let's suppose that you've isolated the trouble to the tuner, given it a thorough cleaning, replaced the tubes, tested it and decided to send it out for repair. There is a right way.

You'll save yourself a lot of headaches if you follow this procedure:

(1) Disconnect the wires going to the tuner, but don't unsolder them. Clip them with a pair of diagonal cutters, leaving a little of each colored wire on the terminals. This will make it easy for you to reconnect the tuner to the chassis once you get it back, without relying on your memory or taking the time to make a drawing.

(2) Remove the mounting brackets from the tuner and fasten them to the chassis. This way they won't be lost. Lost brackets can take weeks or months to replace and impossible to explain to an irate customer.

(3) Do not remove the tubes. Leave them snugly in their sockets. Tuners should always be aligned with the tubes the customer is going to use, so tubes must be included. Make sure the tubes are in the center of the package and surround the entire tuner with at least 2 in. of other packing material.

You can make money with tuner repairs if you use a common sense, professional approach. ■

Tuners Inc.
6302 5th Ave.
Brooklyn, N. Y.

Castle TV Tuner Service, Inc.
5713 N. Western Ave.
Chicago, Ill. 60645

Castle TV Tuner Service (East)
41-92 Vernon Blvd.
Long Island City, N. Y. 11101

Tuner Service Corp.
817 N. Pennsylvania St.
Indianapolis, Ind.

Tuner Service Corp.
547-49 Tonnele Ave.
Jersey City, N. J.

Tuner Service Corp.
938 Gordon St.
S. W. Atlanta, Ga.

Tuner Service Corp.
10654 Magnolia Blvd.
North Hollywood, Calif.

Mid-State Tuner Service
1504 So. College
Box 1141
Bloomington, Ind. 47401

Gem City Tuner Repair
Box 6, Dable Station
2631 Mardon Drive
Dayton, Ohio 45420

TV Tuner Service
118 Third St. W
P. O. Box 793
Twin Falls, Idaho 83301

Precision Tuner Service
P. O. Box 272
Bloomington, Ind. 47401

Superior Tuner
1377 N. Curry Pike
P. O. Box 368
Bloomington Ind. 47401

J. W. Electronics
1538 W. Jarvis
Chicago, Ill. 60626

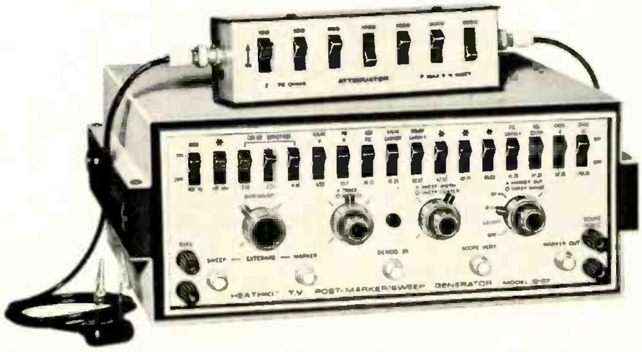
POST MARKER COLOR TV SWEEP ALIGNMENT

Boost your efficiency in sweep alignment by reviewing some practical procedures using a post marker generator

B&K Model 415 solid-state sweep/marker generator.

Sencore Model SM152 sweep and marker generator.

Heath Model IG-57 TV post-marker/sweep generator.



■ A tuned amplifier, such as the IF amplifier in a television receiver, is designed to pass a band of frequencies and reject frequencies outside of this band. For example, a color television IF amplifier is designed to pass frequencies between 41.67 and 46.75MHz and reject frequencies below 41.25 and above 47.25MHz. This wide passband is obtained by having several IF stages each tuned to a different part of the band -- stagger tuned.

Alignment of this amplifier using a standard signal generator is difficult because each stage has to be aligned individually and the over-all response checked laboriously recording the output as the input frequency is changed in small steps across the band. Plotting the output against frequency on a graph provides a response pattern.

If you were able to tune the frequency of the signal generator at a constant rate back and forth across the frequency band of interest, you could observe the output (after detection) on an oscilloscope and actually see the response of the amplifier. This is what a sweep generator does. The output signal from the generator is a constantly changing frequency over a selected range as determined by the tuning and sweep width settings of the generator. The rate at which the output is swept is low. For convenience it is normally set at the frequency of the ac line.

Markers are added to the response curve to show the frequency accurately at different parts of the curve. They are generated by amplifying the low frequencies on each side of the zero beat that develops when the frequency of the sweep signal passes through the marker oscillator frequency. Generating markers external to the amplifier under test and adding them to the response curve is called post injection. It is superior to a pre-injection system in which the marker signal is fed to the amplifier along with the sweep signal, because pre-injection markers can distort the response curve or become lost in traps making sweep alignment more difficult.

THE COLOR TV IF RESPONSE CURVE

The ideal color TV IF response curve is shown in Fig. 1. You should become totally familiar with this curve because it can be an excellent troubleshooting aid. Note that the top of the curve shown is flat. However, some sets will have a dip in the top; others (the newer color sets) may have a rounded or "hay stack" top.

The shape of the response curve skirts is also very important. The picture carrier (45.75MHz) and the color sub carrier (42.17MHz) are approximately at the 50 percent points on the skirts. Color signal information 0.5MHz away (41.67MHz) must still pass through the amplifier, but the sound carrier (41.25MHz) must be trapped out so this skirt has a fairly steep slope. The opposite slope is not quite as steep, but should rise linearly for best recovery of low frequency video information. The upper adjacent channel picture carrier (39.75MHz) and the lower adjacent channel sound carrier (47.25MHz) must be trapped out to prevent interference. The amplifier has minimum or zero gain at these frequencies.

There are a number of things that will affect the response curve. For example, if a trap is misadjusted it will be impossible to get the correct curve and a lot of time can be wasted if this is not recognized. One or more weak stages will also give a poor curve, so the tubes should always be checked or substituted before alignment is attempted. The design of an amplifier takes into account the internal tube capacity. When tubes are replaced in an amplifier, a different internal capacity could upset the alignment.

TV RECEIVER ALIGNMENT HINTS AND PRECAUTIONS

Disable the HV applied to the CRT. This can be done by removing the plate cap from the horizontal output tube. Then connect the load specified by the manufacturer from B+ to ground to apply the proper load to the low voltage power supply.

Another method of removing hash and interference on the response curve, sometimes called "grass" (Fig. 2), is caused by the horizontal output tube. One of the easiest ways to eliminate the radiation is to remove the tube from its socket. In series wired receivers a dummy tube may be used or a resistor placed across the filament pins on the socket. If a compactron tube is used, the filament pins are 1 and 12. The novar filament pins are 4 and 5. Connect a voltmeter across the resistor to be sure the voltage drop is equal to the filament voltage of the tube.

Interference from the vertical circuits is generally a spike that will drift through the response curve and cause distortion as it passes through. This type of interference is caused by the vertical frequency difference between the TV set and the sweep generator. Many sets have a "setup" switch that can be used to disable the vertical deflection system and eliminate the vertical interference.

Use care when adjusting a transformer or coil that has two slugs as each slug may have two positions that appear to tune to the correct frequency. The position farthest out from the center of the coil form is correct; the position near the center of the coil form is incorrect because of coupling from one coil to the other.

Use only the proper cables that are supplied with the generator. Be sure the RF cable is terminated with its proper impedance. Keep the leads from the terminated cable as short as possible at the point of connection to the receiver under test.

Check that there are no ground loops between the pieces of equipment. This is done by observing the trace on the oscilloscope while touching each piece of equipment. If the trace moves or changes shape, check all ground connections. It may become necessary to ground all the cables at one common point.

Do not dress the sweep generator output leads or demodulation input cable leads over the IF board, IF coils or tubes as it may result in detuning or oscillation in the section under test.

Use bias voltages as specified by the set manufacturer of the receiver under test.

More accurate trap adjustments can be obtained by reducing the bias on the IF. Prevent overload of the IF circuits by reducing RF signal from the generator.

Set the oscilloscope vertical gain control near its most sensitive position and keep the sweep generator output as low as possible. This will prevent overloading the IF amplifiers with a sweep signal which may produce an improper curve.

POST MARKER GENERATOR FEATURES

The post marker generator produces accurate markers at the IF and RF frequencies specified by most manufacturers.

The generator mixes the marker signal with the demodulated signal from the circuit being tested or aligned. Markers are normally well defined and should not alter or distort the response curve of the circuits involved. Therefore, the oscilloscope will show the actual waveshape of the TV receiver being checked or aligned.

As many as eight markers may be made to appear simultaneously on an IF alignment scope trace. This enables you to adjust the IF circuits for proper waveshape and bandwidth in less time than would be possible if you were to use the old variable marker system which must be reset and calibrated for each marker frequency.

Additional post markers are provided for color bandpass alignment, picture and sound carrier frequencies, FM tun-

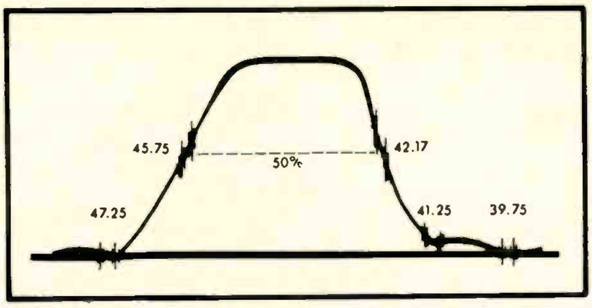


Fig. 1--The ideal response curve of a color TV receiver.

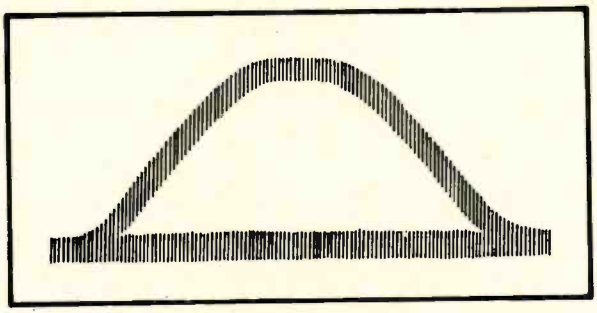


Fig. 2--Horizontal interference in the response curve caused by output tube radiation.

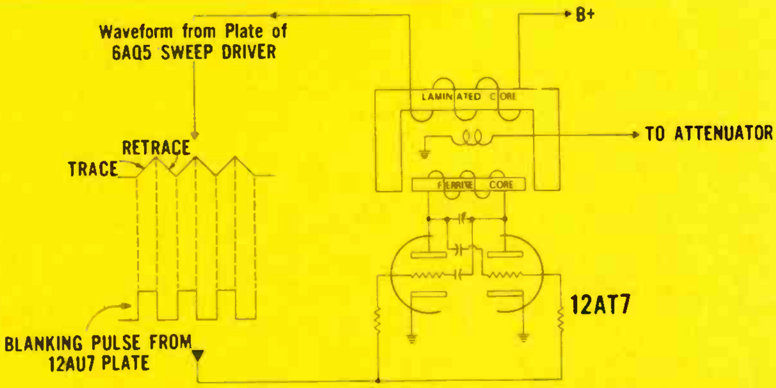


Fig. 3--Schematic of the sweep oscillator employed in the Zenith.

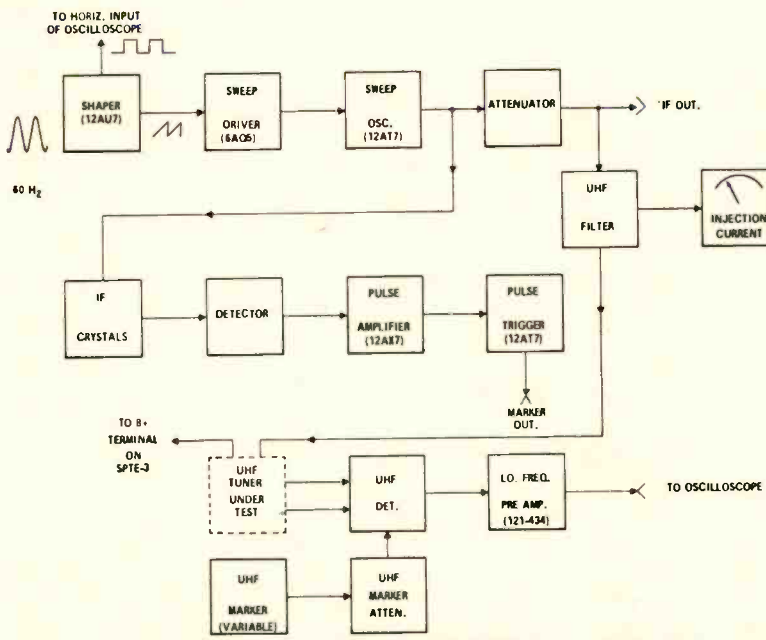


Fig. 4--Block diagram of Zenith's Model SPTE-3 speed aligner.

er, FM IF, discriminator alignment, and TV sound IF adjustments. Modulation is provided for trap adjustment as well as for checking and adjusting FM tuners.

ZENITH SPEED ALIGNER GENERATOR OPERATION

The heart of this typical generator is the sweep oscillator. A dual triode, operated in parallel to provide adequate power output, is connected in a modified colpitts arrangement with its tank circuit-center tuned to 43.5MHz. The tank includes a variable inductance shown in Fig. 3 whose reactance depends on the amplitude of current flowing through it. By providing a current of the proper phase, shape and amplitude, the inductance of the oscillator changes at a given rate, thus producing a frequency deviation which is used to provide the required sweep frequency output. This method is superior to sweep techniques using a synchronous motor and to a speaker system with a specially designed spider driving a sweep capacitor.

Markers are produced by first supplying a sample of the swept oscillator voltage to a set of crystals. The sample voltage is of sufficient amplitude to allow the crystal to "ring," or oscillate at its natural frequency. The resultant oscillator voltage is then detected, amplified and shaped to provide the proper output marker "pip" display on the scope. A block diagram of this generator is shown in Fig. 4.

The 40MHz sweep oscillator is also used to provide the necessary signal for UHF tuner alignment. The principle of operation is similar to that encountered in a normal superheterodyne receiver: an oscillator frequency mixes with an RF signal to provide an IF output. The IF signal is then mixed with an oscillator frequency and the resultant RF frequency can be used as the signal source for the alignment of the UHF preselector circuits. The resultant output from the UHF tuner antenna terminals is detected and then amplified for proper oscilloscope display. A UHF marker at the channel sound carrier frequency is injected at the detector to provide a means of tracking the oscillator rotor to a given calibration standard. A 50-0-50 microammeter is provided to show injection voltage at all times when a UHF tuner is being swept or adjusted.

DETERMINING THE ACCURACY OF THE SCOPE FOR SWEEP ALIGNMENT

The oscilloscope is an important tool in sweep alignment. If it has poor low frequency response, a phase shift in the vertical amplifier or a phase shift between the horizontal and vertical amplifier, the response curve on the scope screen can be misleading as to the actual condition of the television receiver. Any of the above conditions can distort the response curve enough to give inaccurate results when the TV set is aligned. The Sencore SM152 provides an ultra linear sweep and a flat, automatically controlled output which allows a test of the scope before alignment is started. Once the scope is tested, the results can be taken into consideration during alignment to provide greater accuracy.

The following procedure illustrates the use of the SM152 to test an oscilloscope response:

1. Set the sweep marker generator to the 10-55MHz range and the tuning dial to about 43MHz. Set the sweep width to 15MHz.

2. Connect the RF cable using the 300Ω matching pad to the detector probe (blue lead) input and the scope vertical input to the SCOPE V jack on the generator.

3. Adjust the scope vertical gain until a usable pattern is achieved. If the scope has no phase shift and normal low frequency response, the pattern should appear as shown in Fig. 5.

If it has a poor low frequency response, the pattern will appear as shown in Fig. 6. The more the pattern bows or tilts, the more undesirable the low frequency response. Some bowing or tilting of the pattern is acceptable, but it should be taken into consideration when adjusting the television receiver. Other scope deficiencies are shown in Fig. 7 and 8. If any of these problems appear to excess, they will affect the response curve of the TV set.

The signal at the SCOPE H jack is about 60v P-P. This voltage is high enough to provide adequate horizontal drive for most scopes, but may overload some. This may be avoided by shunting the horizontal input terminals with a suitable resistor. Turn the horizontal gain control down about 1/3 from maximum gain and try a few values of shunt resistor until finding one which gives about full screen deflection. For the Sencore PS148, a suitable value would be about 330K. After the resistor is connected, the HORIZONTAL PHASE adjustment on the rear of the SM152 must be reset in accordance with the manufacturers instructions. This adjustment will be set once for the scope used.

The next article will cover actual applications of sweep marker generators in the alignment of the TV receiver tuner, IF, chroma bandpass and the RF and IF amplifiers in FM receivers. ■

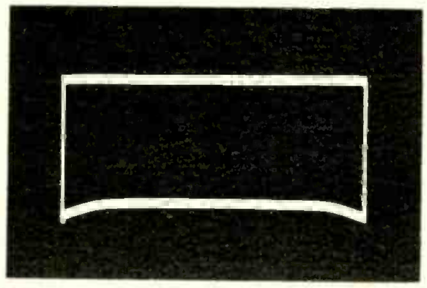


Fig. 5--A normal scope pattern with no phase shift and sufficient low frequency response.

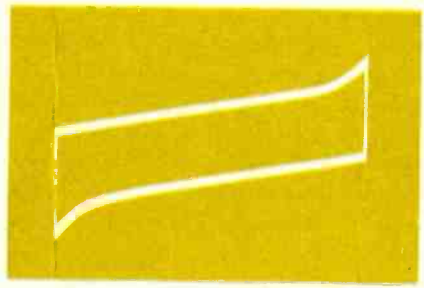


Fig. 6--The tilted or bowed pattern shows poor vertical low frequency response.

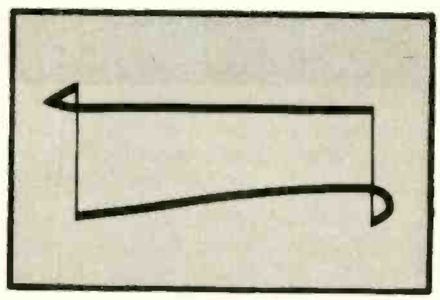


Fig. 7--Pattern showing phase shift in the horizontal amplifier.

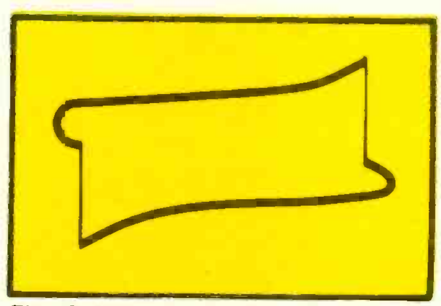


Fig. 8--Pattern showing phase shift and poor low frequency response.

Solid-State Horizontal Deflection Systems

■ The horizontal-deflection system employed in the RCA CTC40 chassis is believed to be unique in television designs currently on the market. The switching action required to generate scan and retrace yoke current, as well as high voltage pulses, is accomplished by two bipolar switches, each consisting of an SCR and a fast-recovery diode. The essential components of the system, including the high-voltage regulator, are shown in Fig. 1.

By using resonant LC circuits in the design of the systems, switching transients, which might damage the solid-state devices, are avoided. Also, the total voltage across the combination of the yoke and C1 is very low (approaching zero) during trace, and rises to only about 400v during retrace.

The circuits will be thoroughly explained later but for the moment assume that the trace switch is closed during scan time and the retrace switch is closed during retrace time. Therefore, during scan time, the yoke and C1 are connected together in a resonant circuit whose period is roughly twice one horizontal-retrace interval. During retrace, the retrace switch is closed and the trace switch is opened. In this configuration, the yoke and C1 become part of a resonant circuit whose period is about twice the horizontal-retrace interval.

RETRACE INTERVAL

At a point about 3μ s before the end of a horizontal scan, near the right edge of the raster, SCR2 starts to conduct by a positive trigger from the horizontal blocking oscillator. The conditions which exist in the circuit just after SCR2 is triggered into conduction are shown in Fig. 2. The charge on C2, 270 to 300v, causes electron flow through the yoke an C1 to ground and then through SCR2 and L1 to C2. Current also begins to flow from C3 to ground, up through SCR2, L1 and back to the opposite side of C3. Since each of these circuits is resonant, current rises sinusoidally rather than instantaneously. At the time SCR2 is driven into conduction, a current of about 4a already is flowing in the yoke, C1 and SCR1. As the current from C2 increases toward 4a, the current through SCR1 decreases toward zero. When the current from C2 exceeds the yoke current, the additional current from C2 passes through CR1, SCR2, L1 and back to C2. This conduction through CR1 removes forward bias from the anode of SCR1, causing cutoff.

The conditions at the start of retrace are shown in Fig. 3A. Current through the yoke has reached maximum at the moment retrace begins and therefore the field around it is maximum. Then the field begins to collapse,

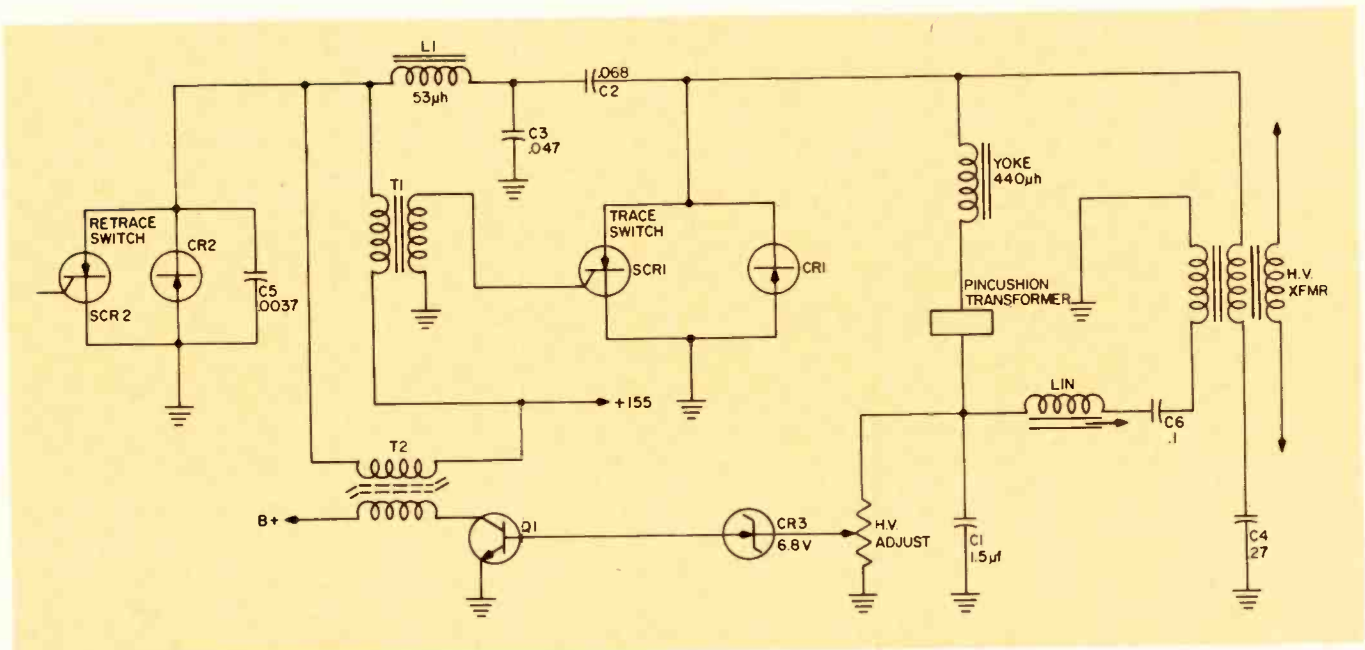


Fig. 1--Simplified schematic of the horizontal deflection system employed in RCA Victor'sCTC40 chassis.

With this troubleshooting method, you should have no difficulty servicing SCR sweep systems

causing the yoke to be the energy source for retrace deflection. Since electron flow is from positive to negative within a source (as in a battery, for instance), the top of the yoke (junction of the yoke and C2) swings positive. This cuts off CR1, and SCR1 cannot conduct because no trigger pulse is present at its gate. The trace switch is open during retrace. The yoke current decreases from its maximum value at the beginning of retrace to zero about 5.5μs later, because of circuit resonance.

Once the yoke current has dropped to zero, it increases sinusoidally in the opposite direction and rises to a maximum value of about 4a. This completes the retrace deflection of the CRT. The resonant circuit of which the yoke is a part during retrace consists of the yoke itself, capacitators C1, C2 and C3. The resonant frequency of this circuit is about 45.5kHz, so the time required for one cycle is about 22μs. ($F = \frac{1}{2\pi\sqrt{LC}}$). During retrace, current in the yoke changed from maximum in one direction to maximum in the opposite direction--only one-half of a cycle $\frac{1}{M}$ requiring about 11μs retrace time.

During retrace time, a second resonant circuit Fig 3B also is of interest. This circuit consists of L1 and C3, resonant at about 100kHz. Since capacitor C3 is common to both resonant circuits, there is a continuing interchange of energy between the two during retrace.

The high-voltage transformer and capacitor C4 are not shown in Fig. 2 because the impedance of this branch is so high that it does not present a significant load on the deflection circuit during trace time. During retrace time, the transformer becomes a fairly well-matched load for the yoke and it extracts power from the deflection circuit. This power, of course, is ultimately used in high-voltage circuit.

At the end of retrace, shown in Fig. 4, the yoke current is at maximum and begins to decrease. The field around the yoke begins to collapse, and thus the yoke itself is the energy source. The yoke end connected to C2 and CR1 becomes negative, and electrons flow in the resonant circuit consisting of the yoke, CR1 and C1 resulting in current decay which is sinusoidal.

The current in the resonant circuit consisting of L1, C3 and CR2 reverses, cutting off CR2. SCR2 has no trigger pulse applied to its gate, so it remains cut off; therefore the retrace switch is opened by L1 and C3.

When the retrace switch was closed, C5 was effectively shorted but with the switch open it is in a resonant circuit with L1 and C3. This allows current to flow back into C2 and a positive pulse of voltage appears at the junction of C5 and L1. Again the current reverses, and CR2 conducts a second time. Because of resistance in series with C5, as well as the action of T1 and T2 (to be discussed), circulating current in L1, C3 and C5 drops to insignificance after the time shown in Fig. 4B. Therefore, the retrace circuit is inactive during the remainder of the trace interval.

TRACE INTERVAL

The circuit action during the scanning (or trace) interval is shown in Fig. 5. During the first half of this interval, yoke current decreases sinusoidally from about 4a to zero. During the second half of this interval, the current reverses and increases sinusoidally toward 4a. This half-sine-wave of current causes the beam to be deflected from left to right across the screen like reading a typed page.

In order to have current flow through SCR1 during the second half of the trace interval, this device must be gated on. A positime gate voltage is derived from the secondary of T1 during most of the trace interval. Thus when the anode of SCR1 becomes positive at mid-trace, the device can conduct. The positive gate is removed when retrace is initiated, and the positive anode voltage is removed shortly after.

LINEARITY CIRCUITS

The yoke current just described cannot produce a linear sweep, since it is essentially sinusoidal. Two circuits are used to provide linearity. One is not shown in this article. It consists of a 4.7Ω resistor shunted across one turn of the high-voltage transformer. This combination is connected between SCR1 and CR1 so that the instantaneous voltages on these devices are slightly different.

The second linearity circuit is shown in Fig. 1. The coil and capacitor connected between a winding of the high-voltage transformer and the junction of the yoke and C1 are tuned to approximately the second harmonic of the scan frequency. The circuit is shock excited during retrace time, and during scan time it adds a second-harmonic current to the yoke to make the total current nearly a sawtooth.

POWER INPUT CIRCUIT

To understand how energy from the power supply is supplied to the deflection system, it is necessary to consider the function of T1 and T2. During

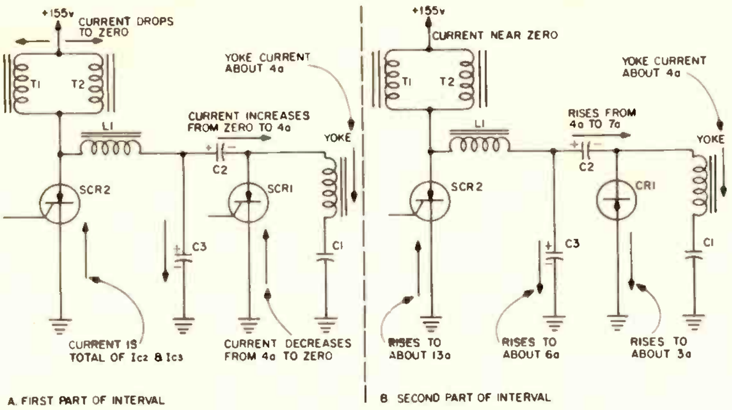


Fig. 2--Circuit action during the 3μs interval before retrace.

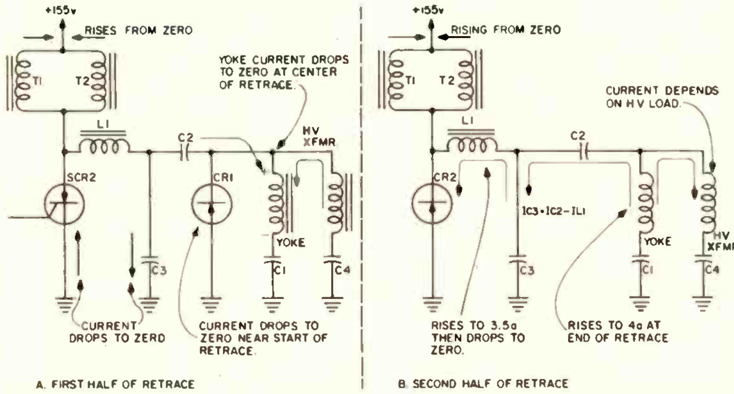


Fig. 3--Circuit action during retrace. First half of retrace is shown in Fig. 3A.

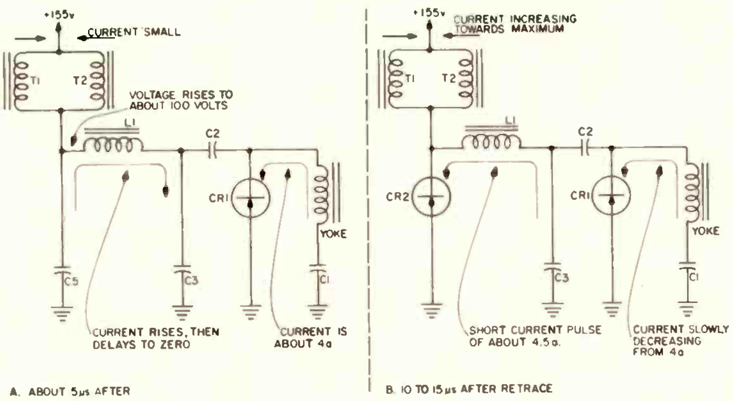


Fig. 4--Circuit action at start of trace interval.

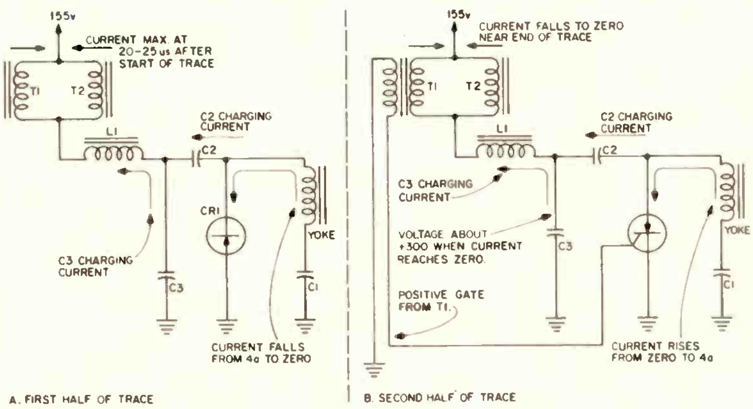


Fig. 5--Circuit action during trace interval.

retrace (Fig. 3) these transformers are connected between B+ and ground. This interval is so short that the current rises only to a small value. During scan time, the right end of C2 is connected to ground by the trace switch. A series resonant circuit exists between ground and B+. Starting from ground, the components are C2 and C3 in parallel, L1, and the parallel combination of T1 and T2. This circuit is resonant at about 5100Hz if no current flows in the control winding of T2, which is a saturable reactor.

At the start of trace, the voltage across C2 and C3 begins to rise, reaching a maximum in one-fourth of a cycle, or 49μs. Since the scan interval is about 52μs and SRC2 begins conduction about 3μs before the end of the scan interval, the voltage across C2 and C3 is maximum at the moment when the retrace switch is closed. This voltage is slightly less than twice the supply voltage, or about 300v, and it is the energy which is supplied to the yoke and high-voltage circuits during retrace.

HIGH VOLTAGE REGULATION

If high voltage suddenly begins to increase, the voltage across C1 (Fig. 1) increases. This causes the regulator transistor, Q1, to conduct more, allowing a greater current to flow in the control winding of T2. This tends to saturate the core of T2, lowering the primary inductance. But T2 is part of the resonant circuit through which C2 and C3 receive energy from the power supply. Reducing the inductance of T2 raises the resonant frequency of the charging circuit so that the voltage on C2 and C3 passes through at maximum and begins to decrease before retrace is initiated. This, of course, reduces the amount of energy available to the yoke during retrace, and stabilizes the HV.

SERVICING

From the servicing point of view, the design of the deflection system offers several distinct advantages. Possibly the most welcome of these is that the loss of drive (horizontal-oscillator failure) is not destructive as it is in vacuum--tube circuitry. No more incinerated 6JE6s and sockets are caused by oscillator failure. Also, since the yoke and the high-voltage transformer are effectively parallel loads on the deflection system, it is possible to isolate the high-voltage transformer without disabling the deflection system. This, of course, makes it a simple task to determine whether the fault is in the yoke or the transformer.

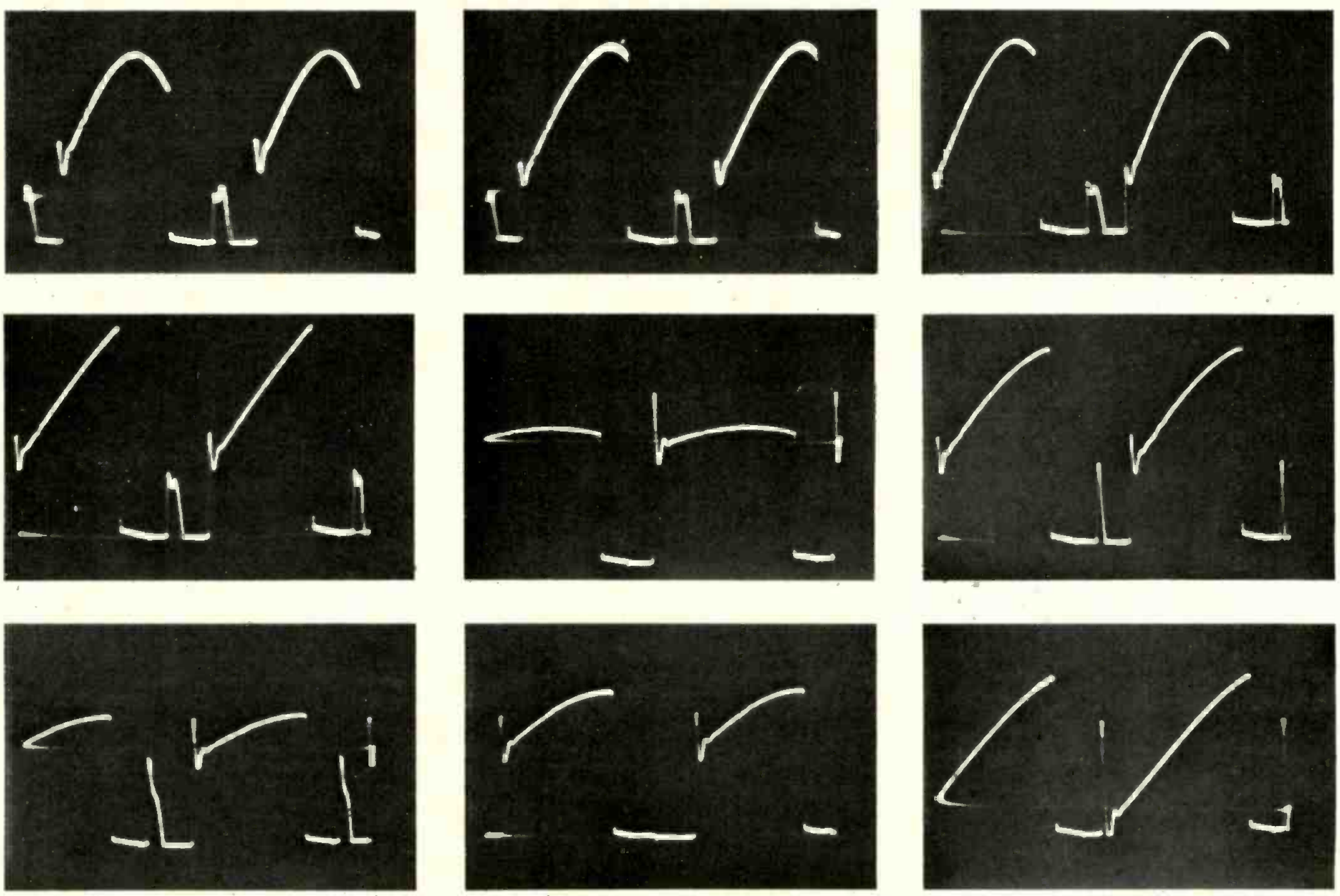
While space does not permit a description of the symptoms attending the failure of each component, it is possible to isolate faults into three general areas of the circuit quickly and accurately. Referring to Fig. 1, notice C2 isolates the trace circuit from B+. Therefore, only shorted components in the retrace circuit can overload the power supply if trigger is removed. By removing the lead to the gate SCR2 and observing whether or not the circuit breaker trips at switch-on, shorts may be isolated to the retrace circuit.

The second step in isolating faults is to short directly across the trace switch (SCR1 to ground). When the set is switched on with SCR1 shorted, the power supply will not be overloaded unless trouble is present in the retrace circuit, or the trigger pulse to SCR2 is at fault.

The next step in isolating trouble is to disconnect the high voltage transformer at its junction with C4. Before turning the instrument on with the transformer disconnected, reduce the line voltage to less than 100v to prevent exceeding the PIV or CR1, then turn the instrument on. If the power supply overloads under these conditions, the fault is in the trace circuitry; if it does not overload, the problem is the high-voltage system. Observation of the waveform at the anode of SCR2 also is helpful in isolating faults. The appearance of the waveform under various circuit conditions is shown in Fig. 6.

This system simplifies rather than complicates servicing of the horizontal system. Because of the relatively low operating potentials and the absence of switching transients, it appears that this circuit or variations of it will become common in the not-too-distant future. With a minimum of effort in learning how the circuit works and a logical troubleshooting procedure, as outlined, the average technician should have no difficulty servicing SCR sweep systems. ■

Fig. 6--Waveform at anode of SCR2. (A) Normal operations, brightness minimum. (B) Normal operation, brightness maximum. (C) Q1 shorted, any brightness setting. (D) T2 primary open, any brightness setting. (E) SCR1 shorted. (F) Capacitor C3 reduced to .0022 μf. (G) HV transformer disconnected, no circuit faults. (H) HV transformer disconnected, capacitor C3, reduced to .022 μf. (I) HV transformer disconnected, C1 leaky (10Ω).



Service-Dealers Promote Technician

Active recruiters engineered their own technician training program

■ If you lack good service men in your city, don't waste your time complaining--do something about it. Get together with other dealers who have the same problem and then interest a college in your area in establishing a training course.

"That's just what we did in Dallas," reports Tilman Babb, president of the Wilshire Television Sales and Service. Babb's partner, Gilbert Smith, is one of the five Dallas dealers serving on the Advisory Committee to the Television and Radio Repair Course at the El Centro College.

The course began in September and El Centro College's assistant dean, Dean Van Trease, says that the "response was amazing." There are now 26 men enrolled, ranging in age from 18 to 45 and the college has invested $105,000 to provide the students with the latest and most modern electronic equipment.

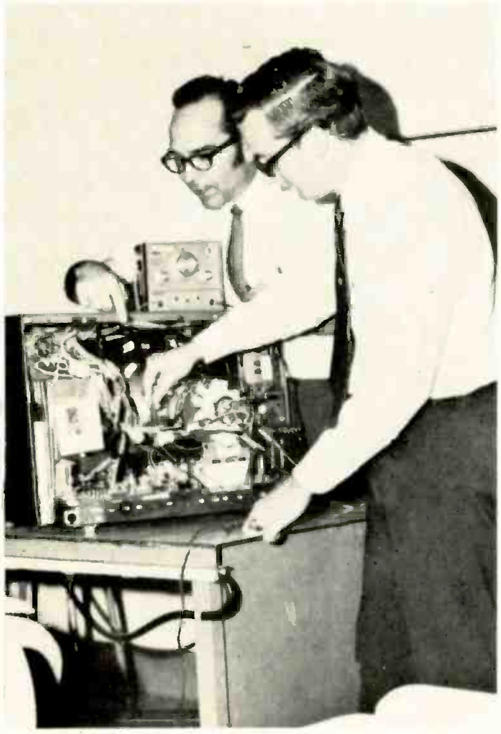
"The interest in this class has been so great that we are planning to offer it in our night school this coming fall," Van Trease indicates. He believes this course to be the only one of its kind in Texas, and one of very few in the country.

In addition to Smith, the Advisory Committee includes: "Dawes Skeen, Ace Television Sales and Service; Dee Sponsel, Sponsel Radio and TV Service; Doc Childers, Childers Radio and TV Service; and Richard Kozelski, Kozelski Electronics -- all dealers in Dallas. The purpose of this committee is to help establish curriculum and evaluate the program.

The course has already been

The Advisory Committee meets (left to right) with Dean Van Trease, assistant dean of El Centro College (standing) seated is Richard Kozelski, Kozelski Electronics with Dawes Skeen of Ace Television and Gilbert Smith of Wilshire Televison at extreme right.

Training



pledged the support of the Texas Electronic Assn. and will soon be brought to the attention of high school students and their parents in the Dallas County area by the Second Annual Technarama which will be held in El Centro College.

However, before offering a pattern - that - your - community - can-follow, Van Trease offers this advice: "First, make sure that there is a need for such a class in your community. Secondly, make sure that you get a good advisory committee of dealers who have been successful because of their good service. There is no doubt that in most communities there is a strong need for such a course. And it will take educators a long time to saturate the present needs."

The El Centro College educator reveals that in addition to the night school class already being considered for the fall curriculum, serious thought is being given to an advanced course in electronics to be given to men already in the television and radio business.

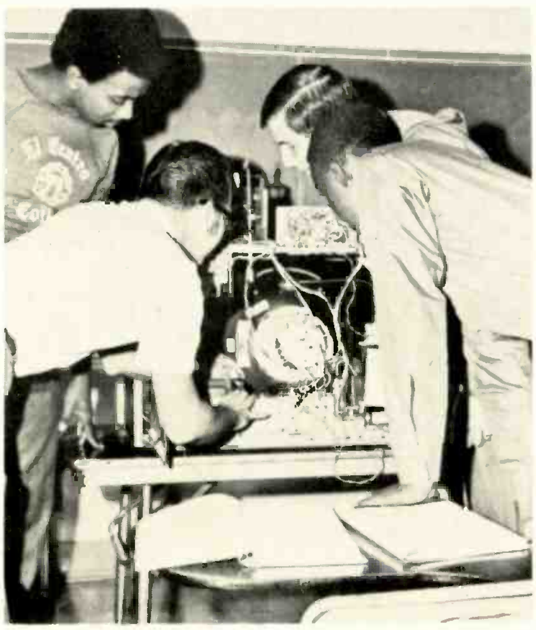
Babb urges dealers in other communities to follow the Dallas example. "These courses will make more qualified technical people available and you owe it to your community. The electronic industry is changing so fast, that unless you have access to men with training on the latest and most modern of equipment, you as a dealer just cannot keep up with it."

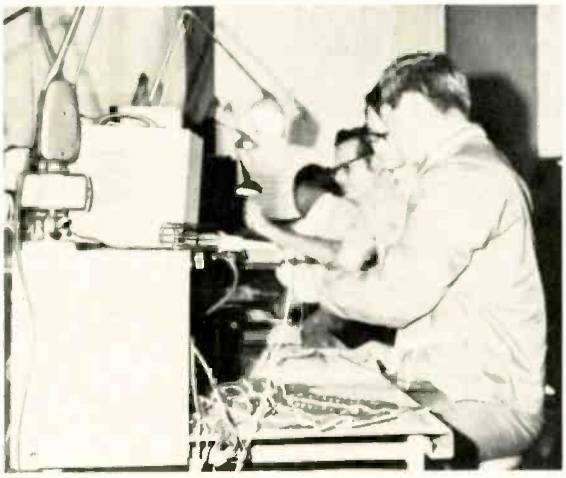
Babb outlines a few points he feels necessary to a profitable and successful service business:

1. Have properly trained personnel.
2. Maintain excellent customer relations.
3. Make adequate charges for the work performed.
4. Maintain a proper volume.
5. Consider the possibility of selling service contracts.
6. Use the service department as an aid to sales.

The technicians at Wilshire Television receive constant training at monthly store meetings and by attending courses given by NARDA and by the Texas Electronics Assn. Babb indicates that technicians should be encouraged to take courses like the one Dale Carnegie offers so that they can meet the public well. "The sales ability they can gain from such courses will not only enable them to sell the service that the customer's set needs, but also to sell the customers on the limitations of the product," Babb stresses.

"This may sound negative, but many customers purchase a radio, TV or stereo and expect too much in the way of performance. This is not always their fault. Many times, from what the salesman or the advertisements have said, they expect a perfect picture at all times. And when the picture isn't perfect, they blame the technician. For this reason, the technician should be able to express





The class receives up-to-the-minute training with more than $105,000 in modern electronic equipment at their disposal.

Students interested in television and radio service classes range in age from 18 to 45 years.

himself well so he can provide a proper explanation to the customer and maintain goodwill."

Keeping service records with 8000 customer cards in the files has also helped tremendously in achieving a periodic maintenance schedule on customer sets. As Babb points out, "These case histories enable us to give the customer a quick and accurate report on his set. If we didn't know the last time we serviced the product, what we did and what we charged for, we could lose both time and a customer. It takes work, but it is worth it.

"We do not attempt to do major repairs in the home. An auto mechanic will certainly not come to your home to overhaul the transmission of your car. The technician making home calls must be able to determine if a change of tubes will repair the set, and if not, be able to give the customer a reliable estimate of the work that has to be done in the shop."

Important, too, in a thriving service business is a good employee - employer relationship, Babb admitted. "We pay our men a salary and a small commission. We have found this to be best. We also have a profit-sharing plan for our employees. I don't know for sure if a profit-sharing plan works, but I am inclined to think so. We have men who have been with us for 6 to 14 years and we believe that long tenure breeds loyalty and loyalty pays off where the customer is concerned." Wilshire television also furnishes uniforms, white dress shirts, ties, wool trousers and even coveralls for the antenna men when they go under the house or on the roof. "Expensive yes, but we think it is worth it," Babb reports. "We also provide a hospitalization plan which gives an employee medical care in a hospital up to 70 days and an $11,000 life insurance policy. Both insurance plans are unusual because we bear the entire cost, while many such plans expect the employee to pay part of it," he says.

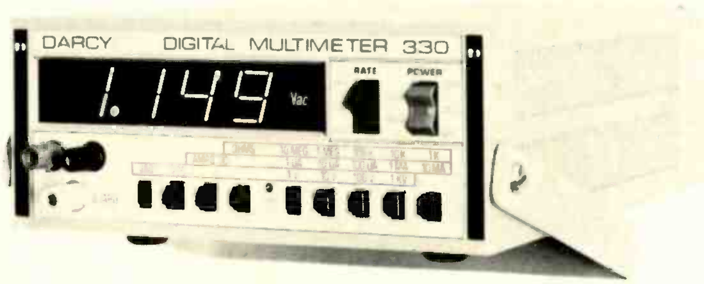
The technician training program, in which it is actively involved, and maintenance of its own highly trained staff has paid dividends for Wilshire Television. It sells its customers through better service and as Babb indicates, "Many of our new customers come to us as referrals. If you do a good job, you'll get additional business and a reputation that can't be beat."■

Tilman Babb checks the repair records with one of his servicemen. The files contain 8000 cards.

ET/D TEST LAB REPORT

Darcy DM330 Digital Multimeter

A low-cost digital multimeter combines the functions of a milliammeter, an ac-dc voltmeter and an ohmmeter to increase your service efficiency in today's space-age circuitry



Darcy Model DM330 digital multimeter.

for more details circle 900 on postcard

■ We ordered the Darcy DM330 digital voltmeter to evaluate it in test lab because more and more shops are purchasing units of this type for their versatility, speed and accuracy--especially for transistorized service. The unit came packed in a heavy box filled with cut cardboard which literally suspended it.

The first thing we noticed about the DM330 was its ease of operation and the sharp readout display. Packed with the unit is a service/operating manual which explains all of the operating ranges and contains complete maintenance procedures and replacement parts list.

The DM 330 is a transistorized digital multimeter for measuring dc volts, dc current, ac volts and ohms. It operates on either 117 or 220vac. The operating voltage must be specified when the unit is ordered, but it can be easily changed later by referring to the manual.

The instrument provides five resistance ranges from 1K to 10meg, ac and dc volts from 1v to 1kv and dc current from 1μa to 10ma. All operating controls are push-button operated and the readout display automatically indicates the type of measurement (vac, vdc, KΩ, ma, μa) and the polarity. Decimal point positioning is also automatic.

The display provides a full three-digit readout with a 50 percent overrange on all ranges. This means if you measure a voltage on the 0-100vdc range, it is possible to actually read up to 150vdc. If the measured voltage goes over 150vdc, an overrange indicator will come on which tells you to go to the next higher range--in this case, 1000vdc.

Digital test instruments, of course, have several important features such as speed, accuracy and high input impedance. We first tested the DM330 on a transistor TV set to note the circuit loading effects.

The DM330 has three input terminals on the front panel which are designed to accept standard voltmeter leads. Besides the normal black and red terminals found on most meters, the unit has a third "GUARD" terminal which is used when measuring with shielded test leads. The GUARD terminal is normally connected to the black ground terminal unless shielded leads are used.

The manual says to start with the unit on the highest range if the measured voltage is unknown, just as with a conventional meter. Since we already knew that the transistor circuit would read less than 20vdc, we started out on the closest range, 100vdc. The circuit voltages were less than 10vdc in this case and the manual says to reduce the range until the overrange indicator lights and then go back to the next higher range. We were reading voltages between 2.5 and 8vdc and the overrange indicator came on when we reached the 1vdc range, so we went

Continued on page 69

ET/D TEST LAB REPORT

B&K Model 1077 television analyst, showing test pattern produced.

B&K Model 1077 Television Analyst

Reduce service time by employing signal injection to isolate circuit defects

for more details circle 901 on postcard

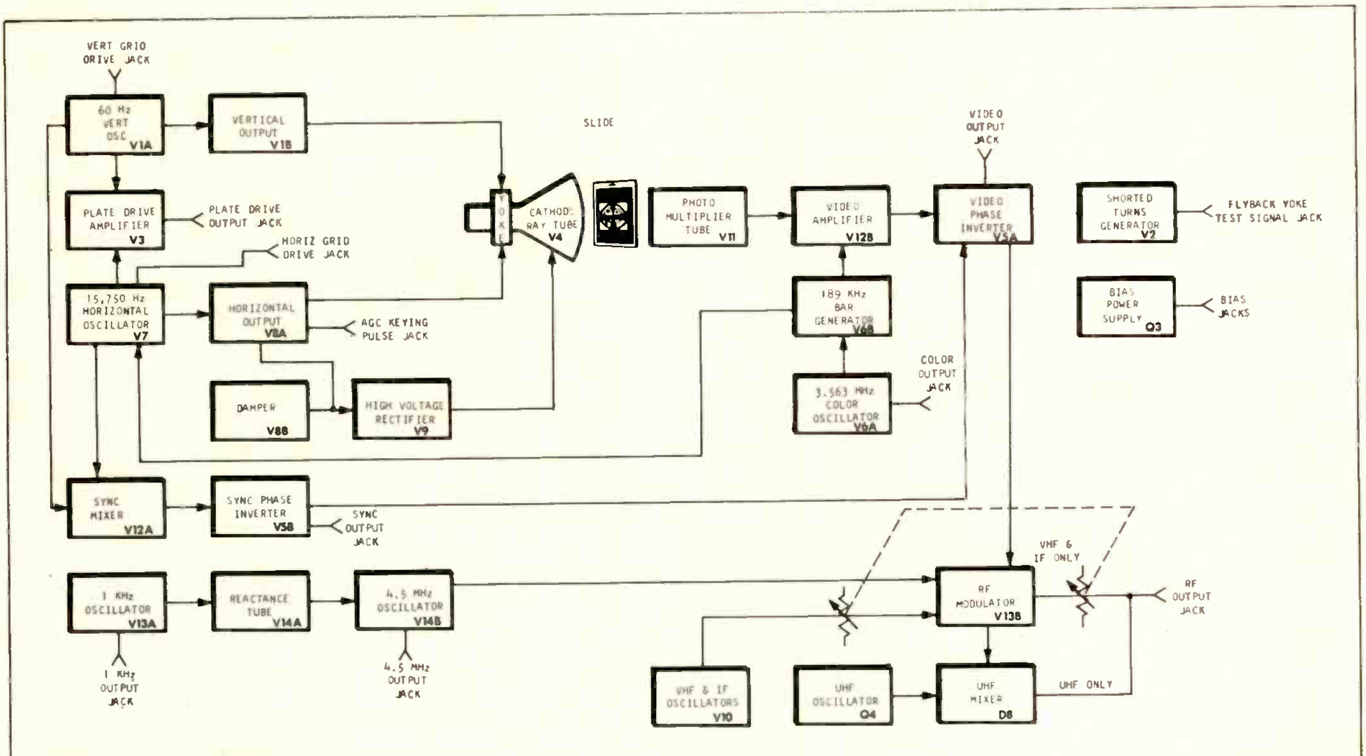
■ With more transistorized television receivers to service, we must change our service techniques. We believe that one of the fastest methods is the use of signal injection to isolate a defective stage. The finger on the volume control method to check the output stage of a radio is a simple form of signal injection. Unfortunately it is only useful in limited applications.

Actually, having a television analyst is like having a TV station of your own. You can inject your own TV signal at any time or point to isolate intermittent or general TV trouble while viewing the test pattern on the screen.

As we unpacked the analyst for this report, we compared it with the Model 1076 which has been a part of our test lab equipment for some time. There is some resemblance in size, but the 1077 has a more modern panel.

One of the panel features first noticed was the addition of a UHF output. And many of the earlier 1076 circuits were revised for testing transistorized TV sets with complete safety by providing the proper impedance match for transistorized circuitry.

For those who are unfamiliar with the television analyst, here are a few of the signals the unit will generate. (1) All signals normally transmitted by a TV station and those produced within a TV receiver for point-by-point signal substitution. (2) UHF signals on channels 14 through 83, VHF channels 2, 3, 4, 6, 7, 8, 12 and 14 for testing tuners. (3) IF signals of 20 to 48MHz for testing IF amplifier stages. (4) A positive or negative composite video signal for injection into video stages. (5) A keyed color bar pattern which modulates the RF output for troubleshooting and adjusting color circuits. (6) A color rainbow signal for injection into color amplifiers and demodulators. (7) 4.5MHz sound channel test signal that is frequency modulated by 1kHz audio tone and a 1kHz tone for audio circuit testing. (8) Composite sync pulse signal of positive or negative polarity, adjustable in amplitude with var-



Block diagram of the television analyst.

iable impedance for troubleshooting sync circuits, picture tubes, blanking circuits and transistorized keyed AGC circuits. (9) Vertical and horizontal grid drive signal for troubleshooting sweep circuits. (10) Vertical plate drive signal for checking vertical output transformers. (11) Vertical yoke test signal to determine if vertical yoke windings are defective. (12) Horizontal plate drive signal for checking horizontal output transformers. (13) A high level keying pulse for testing keyed circuits, AGC, burst amplifiers and blanking.

There are a number of other uses for the analyst such as: generating a test pattern for color convergence adjustments; checking bandwidth resolution, shading and contrast capabilities of the TV receiver; displaying pictures on the TV screen for advertising and as a transmitter for video paging at conventions, hospitals and other gatherings.

One particular feature we would like to see added is a horizontal and vertical grid drive signal to drive transistorized sweep circuits. We feel this would be of great value in servicing the smaller transistorized sets.

The scanning section is the heart of the analyst. It consists primarily of the CRT and the photo-multiplier tube. Basically, the scanning circuit provides the following functions: A dot of light scans the CRT. A slide masks the light which reaches the photomultiplier tube and the photomultiplier tube converts the light into a video signal that is equivalent to the image on the slide.

An electron beam scans the face of the CRT just as in a TV receiver. As the electron beam scans, it produces a flying dot of light. The light is directed toward a photomultiplier tube which produces an output signal proportional to the amount of light which strikes it. A positive transparency slide is inserted between the cathode ray tube and the photomultiplier tube. As the small spot of light sweeps across the slide from left to right, light passes through the transparent portions of the slide and an output voltage is produced by the photomultiplier tube. When the spot passes behind the black parts of the slide, no light reaches the photomultiplier tube and no output voltage is produced.

Shades of gray in the transparency will produce some output voltage, but less than the fully transparent areas. Thus, as the entire slide is scanned, the photomultiplier tube will produce video signal voltages equivalent to the side image.

After the repair is complete, the analyst can be used to test the over-all performance of the TV receiver. The receiver can be checked for RF sensitivity, AGC action, centering, size and linearity, shading, resolution, bandwidth and frequency response.

The manual supplied with the instrument is almost a complete television repair course in itself. It takes you step-by-step through the various stages of operation and covers procedures, symptom analyses and troubleshooting techniques. The troubleshooting procedure section with its condensed charts provides a quick reference to symptoms, causes and cures. Net price is $379.95. ■

DEALER SHOWCASE

For additional information on products described in this section, circle the numbers on Reader Service Card. Requests will be handled promptly.

FM/AM Stereo Receiver 704

Deluxe receiver at a moderate price

The KR-100 stereo receiver features a silicon power transistor amplifier section with 140w of music power

(IHF) at 4Ω, 110w at 8Ω. It reportedly has distortion rated less than .5 percent and a frequency response of 13 to 70,000Hz. The inputs accommodate the most complex stereo system requirements including provision for two turntables. There is a separate preamp output as well as two pairs of stereo speaker outputs plus center channel. It also features a 1.8 μv RF section. Four integrated circuits and two field-effect transistors (FET) permit excellent FM selectivity and reception, and the low IM distortion delivers clear low-to-high-level listening. Additional features include: front panel jacks for dubbing/tape record and headphone; push-button controls to regulate inter-station MUTING, LOUDNESS control, tape monitor and low and high filters. Price is $299.95. Kenwood.

Speaker 705

Designed for solid-state components

Announced is the S20 controlled impedance speaker system designed for solid-state components. The systems' Mediterranean styling features an antiqued pecan finish with ornate scrollwork grills. A flamenco red grill cloth is supplied with the speakers, al-

though other colors may be substituted. Inside, the system includes a 10in. woofer and a 5in. dual-cone midrange/tweeter in a 22¾in. x 11¾ in. x 11in. enclosure. S20 price is $129.95. Scott.

Portable Phonograph 706

Portable stereo phonograph with built-in eight-track tape player

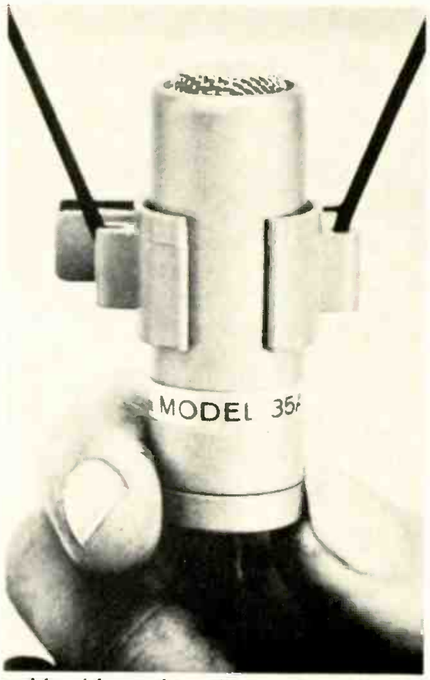
A portable stereo phonograph with a built-in eight track stereo tape cartridge player is introduced. The model CP500E features an eight-track stereo tape deck with automatic program ad-

vance and manual program selector. The record changer, with diamond stylus, plays standard record sizes and speeds. Also included is a 45 rpm spindle. The solid-state amplifying system produces 8w peak or 4w EIA music power output. Two 6½in. detachable speakers, separate volume, balance and tone controls are among the features. The phonograph has a high impact polystyrene brown cabinet with walnut grained vinyl inlay. List price is $159.95. Motorola.

Microphones 707

60db output and 50-12,000 Hz frequency range

"Mini-mike," a dynamic, omnidirectional microphone with a tailored frequency response over the entire speech range is announced. The microphone is designed for broadcast, recording and public address applications. The Model 35 is ¾in. in diameter, 3in. in length with a high-low impedance combination and a weight (less cable) of 41g. The model 35A is 2¼in. in length, ¾in. in diameter with a 150Ω impedance and a weight of 29g. Both models reportedly feature a 60db output level and a 50-12,000Hz frequency range. They are finished in desert



gold with a chromium grill. A 25ft. shielded cable, lavalier cord and clothing clip are included with each microphone. The Model 35 has a list price of $65; Model 35A, a list of $75. Conrac.

Speaker 708

Wide range provides response from 40 to 15,000 Hz

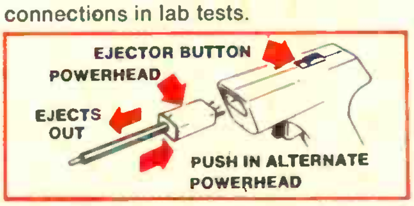
Announced is a portable, weather-resistant, Hi Fi speaker system. Designated the 829A patio speaker, the system features the Model 755E 8in., wide-range speaker claimed to provide response from 40 to 15,000Hz. The

Now one tool combines all the advantages of a lightweight pencil type iron, a fast heating soldering gun, and tip temperature control.

Features Weller's exclusive new POWERHEAD

The heart of this new tool is its long-life, high efficiency POWERHEAD . . . another great innovation from Weller. The POWERHEAD contains Weller's temperature control system (which has been so successful in Weller temperature controlled soldering irons). The result is maximum protection of components even in the most delicate work situations.

The integral points of the POWERHEAD have made over 30,000 solder connections in lab tests.



The points have a special premium plating which vastly extends life. And the POWERHEAD completely eliminates filing and frequent tip changes as encountered with conventional non-temperature controlled tools.

Two POWERHEADS are available: A 700°F. 3/16" chisel point POWERHEAD or a 600°F. 1/8" conical point POWERHEAD. A convenient ejector button makes switching POWERHEADS easy.

The entire tool weighs only 7 ounces. Its trigger turns heat on and off. And the stainless steel barrel has long reach.

Ideal for service, repairs, PC boards, models and hobbies. Order these new Weller TEMPMATIC models now.

Weller®

WELLER ELECTRIC CORP., Easton, Pa. World leader in soldering tools

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ET/D DEALER SHOWCASE

cocoa brown cabinet is molded of high-impact-resistant Kydex. A chrome-plated stand is coupled to the cabinet using pivot bolts with knurled knobs to permit angular adjustment of the cabinet for standing on the ground or for wall mounting. Net price is $71.50. Altec.

Tape Player 709

Adaptable to auto or home

A line of "Cartable" eight-track tape players is introduced. Six portable models designed for easy transfer

between auto, boat and home cover each price bracket. The top-of-the-line is the "Cartable 2800," a solid-state, woodgrain, eight-track stereo system adaptable to auto or home. The unit features four 5¼ in. speakers plus optional matching woodgrain speakers for indoor installation. Belle Wood.

Phone Stylus Cleaner 710

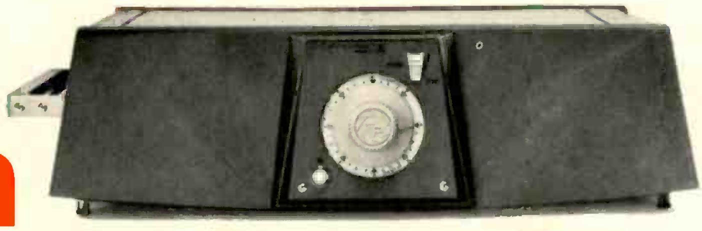
Consists of lint-free, treated pad

Introduced is a cleaner for the phonograph stylus. It features a lint-free, treated pad, and reportedly provides

easy mounting without causing damage to the stylus. Instructions indicate that it can be used either on radial or elliptical styli. The cleaner comes in a case to keep it free of dust and dirt. Elpa.

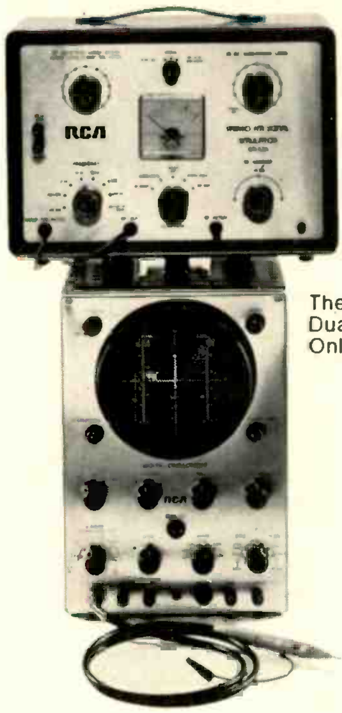
For more information on DEALER SHOWCASE See page 83 READERS SERVICE

There's a reward



on their heads.

FREE:
The Copymate Dry Copier, with 20 sheets of copymate paper, with your purchase of the RCA WR-52A Stereo FM Signal Simulator or WO-91C oscilloscope!



The WR-52A Stereo FM Signal Simulator only $248.00*

The WO-91C 5-Inch Dual Band Oscilloscope Only $269.00*

Now you can own one of the fastest, most accurate trouble-shooters in the East (West, North and South), and receive, absolutely free, the new all-electric Copymate!

Copymate is the portable dry copier that copies anything—...checks, invoices, schematics, photos, your children's drawings and school work—without liquids, chemicals or sprays!

The Copymate, with paper, has a retail value of $31.94, but you can get it free... Here's how.

Buy the WR-52A or WO-91C between April 15 and July 15. Mail us your warranty card and the blue label on the outside of the carton no later than July 31st and we'll ship the Copymate to you at once, freight prepaid!

Good deal? You know it is.

Mail your card and label to: RCA Electronic Components, Test Equipment Headquarters, Bldg. 17-2, Harrison, N.J. 07029.

*Optional distributor resale price.

RCA

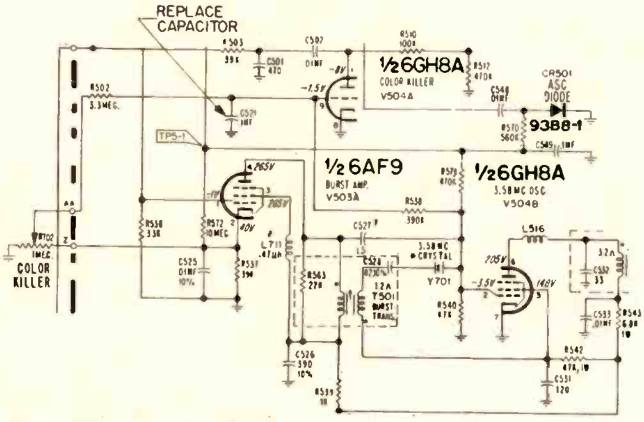
. . . for more details circle 129 on postcard

COLORFAX

ADMIRAL

Color TV Chassis G11/G13/H10/H12/K15 Series—Weak or No Color

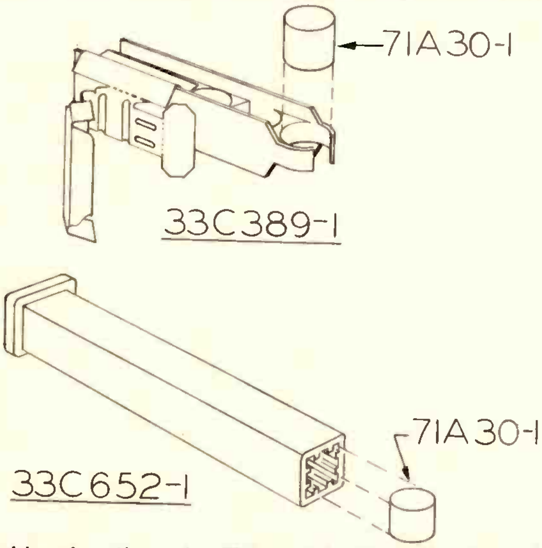
This problem can be caused by failure of disc capacitor C521 (.1µf, 50v). Failure of this capacitor permits a negative voltage to be produced at the plate (pin 9) of the color killer which will bias off the 2nd bandpass amplifier. Sub-



stitute this capacitor to determine if it has failed. Measuring it with an ohmmeter may not reveal a defective capacitor. Replace with a .1µf of higher working voltage such as 64C53-98 (.1µf, 200v) which is now used in production.

Color Convergence Magnets

The replacement parts pictured are available to replace the nylon slider (magnet holder) used on the convergence



assembly of earlier color TV models. Order the type shown in the drawing. The magnet (71A30-1) is not included with either type. The mounting clip shown with 33C389-1 is included.

Color TV Chassis G11/G13/H10/H12—Wrong Colors

If you encounter a complaint of chartreuse (yellow green) flesh colors which turn blue when the tint control is rotated, check the ECO transformer. Using the incorrect transformer will cause the 3.58MHz to be applied to the color demodulators 180deg out of phase. A keyed rainbow from a color bar generator will show the blue and red bars reversed. They will also roll toward or away from each other when the tint control is rotated, instead of shifting to one side together.

The correct ECO transformer for the G11, G13 and H12 series chassis is 72B285-1. The correct transformer for the H10 series chassis is 72B285-2. Be sure you use the correct replacement—they look alike!

Color TV—Service Hint
Sound But No Picture, Except Briefly When Set Is Turned Off

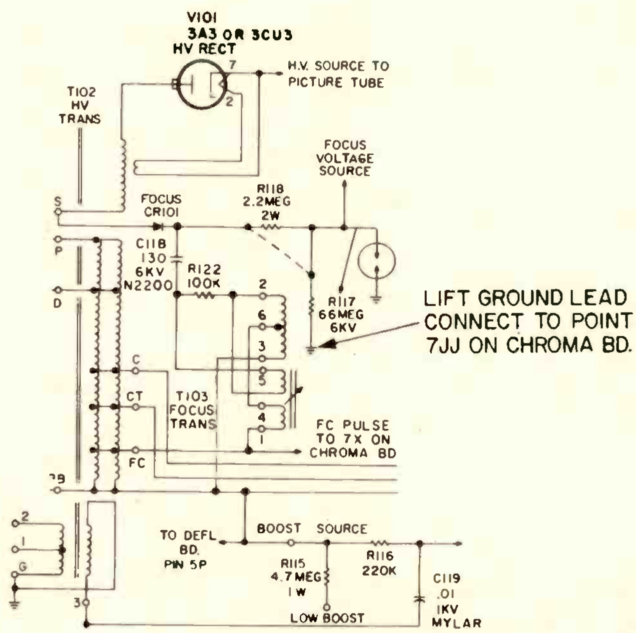
We have had several reports of this unusual condition which is not actually a fault but it can generate a service call. If the brightness control is accidently used to try to turn the set off, the next time the customer turns it on with the regular on-off switch, he will get sound but no picture. If he then turns the set off, the picture will come on briefly and fade out. This causes him to think something is wrong when all he needs to do is turn the brightness up!

This condition occurs in models with the spot eliminator circuit. These models have an extra switch on the ON-OFF switch which causes the picture tube to conduct at full brightness as the set is turned off. This drains off the high voltage rapidly and prevents a lingering spot on the face of the picture tube.

MAGNAVOX

Color TV Chassis T924—Elimination of Afterglow on CRT Face

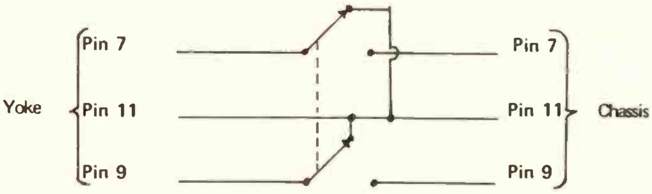
Afterglow on the face of a CRT used with a T924 chassis can be eliminated by lifting the ground end of resistor R117, the 66M 6kv focus resistor and soldering it to point



7JJ on the chroma board. This can be most readily accomplished by lifting the ground lead of R117 from its ground connection and moving the lead to one of the blank holes on the terminal board. Run the lead through the hole and bend it around the edge of the terminal board to minimize its movement. Solder a length of hookup wire to the resistor lead and route the wire to point 7JJ on the chroma board by the most convenient route. Solder it to this point.

Color TV Chassis T924—Modification of Color Test Fixture

Refer to Service Manual 7297, Sections 4.1 and 2. The test fixture yoke is wired as shown on the schematic for the T924-03, 07 and 09 versions. These chassis are directly

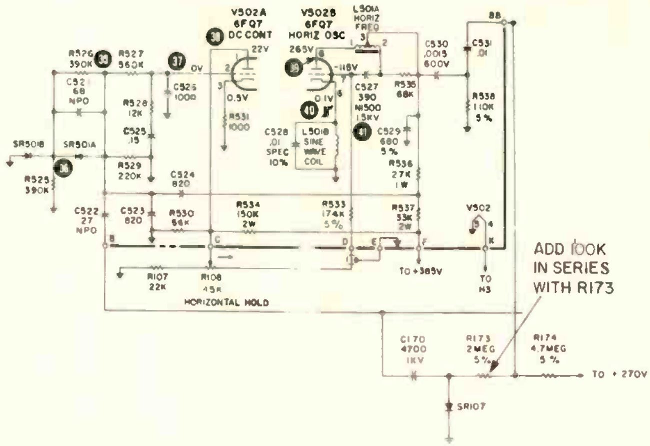


DPDT

adaptable to the test fixture. However, the vertical yoke windings are connected internally in the T924-01, 02, 05, 06, 08 and 10 versions. These versions will have no vertical sweep when used with the fixture. A DPDT switch, such as part No. 160370-5, can be inserted in the yoke extension cable as shown to enable the fixture to be used with all T924 versions.

Color TV Chassis T933—Service Hints Horizontal Jitter, Low 6BK4 Current, Raster Size Change as Brightness Control Setting Is Changed

Resistor R173 (2M, ½w, 5%) in the grid circuit of the 6JE6 horizontal output tube can cause horizontal jitter, low 6BK4 current and changing raster size as the brightness



control setting is changed, and when its value drops below 1.9M. If the value is indicated as being near the low tolerance limit and the ohmmeter is not known to be accurate, add a 100K resistor in series with R173. Recheck the circuit for elimination of the symptoms.

Minimum 6BK4 Current

With CRT BIAS and BRIGHTNESS controls set for a dark screen (no CRT current) the 6BK4 current must be minimum of 1ma. This current can be checked by measuring

Continued on page 67

Continued from page 64

the voltage across R121, the 1K cathode resistor of the 6BK4. This voltage must be a minimum of 1v (I=E/R).

Channel Eight Tweet Reduction

The following circuit modification is recommended for the reduction of channel eight tweet.

(1) Install a 15K, 2w resistor between the junction of R909 and R903 on the AFC board, and point VA(+270v) on the chroma board. This can be accomplished from the underneath side of the boards and will require an extension wire. (2) Remove and discard L905 and its extension lead. L905 is connected on the underneath side of AFC board between the junction of R909 and C913 on the AFC board and point YC(+140) on the chroma board. (3) Also remove and discard R909 on the AFC board.

Once this circuit modification has been completed the plate/screen supply for V901 will be the 270v source.

WESTINGHOUSE

Color TV Chassis V8001—Demodulator Circuit

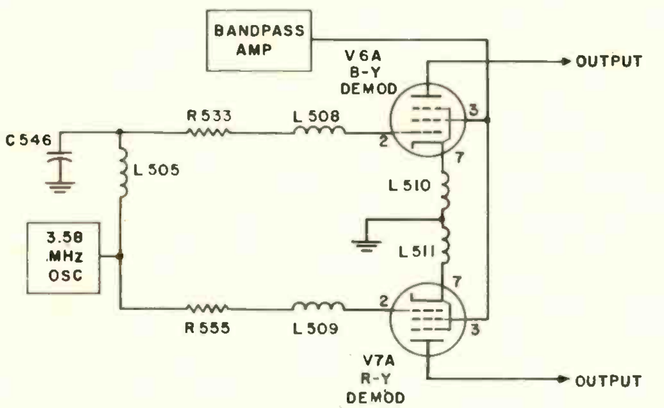
The demodulator system is a two stage circuit that consists of V7A called the R-Y demodulator and V6A called the B-Y demodulator, and their associated components. Both demodulators use 5GH8A tubes. Each demodulator requires two input signals. The two input signals are:

1. The output signal of V12A, the bandpass amplifier.
2. A 3.58MHz CW signal from V8A, the local oscillator.

The output of the bandpass amplifier is passed to the screen grids (G2) of the two demodulators.

Two signals from the 3.58MHz local oscillator, differing only in phase, are fed into G1, the control grids.

The purpose of the demodulator is to convert the phase



and amplitude differences of the two input signals into information that the color difference amplifier circuit can enlarge to magnitudes necessary for driving the CRT grids.

At the transmitter during a color telecast only the intelligence contained in the red information signal and the blue information signal has to be transmitted for color reproduction. Combining the R-Y and B-Y signals algebraically and electronically in the receiver will result in the reproduction of the green color. The R-Y and B-Y signals at the transmitter are fed into separate modulators and maintain a 90 degree phase relationship by the introduction of a signal from an oscillator at the transmitter into the two modulators that are 90 degrees apart in phase. In circuitry of receivers in the past the same relationship of 90 degrees was maintained by introducing the 3.58 MHz signal of the receiver's local oscillator into the R-Y and B-Y demodulators 90 degrees apart in phase.

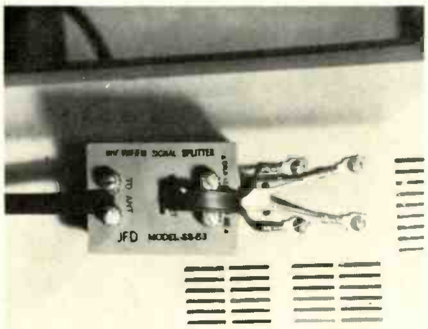
ET/D NEW PRODUCTS

For additional information on products described in this section, circle the numbers on Reader Service Card. Requests will be handled promptly.

3-Way Signal Splitter 711

Provides three twinlead outputs from single input

A 3-way signal splitter capable of meeting the requirements of an 82 channel TV antenna installation is introduced. The Model SS83 signal

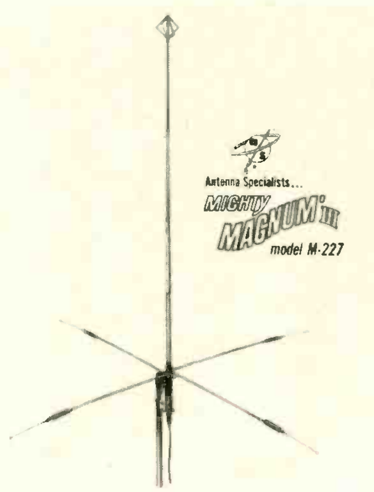


splitter provides separate twinlead outputs for UHF, VHF and FM from a single 82 channel twinlead input. Virtually all TV sets require separate inputs to their UHF and VHF antenna terminals. The splitter not only provides two separate inputs from a single all-channel antenna downlead, it also provides an extra input to an FM or stereo FM receiver and makes it possible for a single antenna to provide signal voltage to an all-channel TV set as well, without the need for a separate coupler. Splitting loss on the unit is negligible, reportedly less than 1db. Isolation between outputs is 18db and response is flat over the entire TV-FM spectrum ±0.5db. It is equipped with no-strip terminals for the input and FM output. Twinlead is simply inserted under these terminals and the screws are tightened down for positive mechanical and electrical connection. Appropriate lengths of twinlead with spade lugs are factory attached to the UHF and VHF TV output. The splitter can easily be attached to the back of any TV set by means of an adhesive. List price is $4.95. JFD.

CB Base Antenna 712

Shorter radials with 4db omnidirectional gain

A half-wave, 4db gain, omnidirectional base station antenna is announced. The model M-227 is the third generation of the company's Magnum series introduced in 1961. Over-all configuration of the antenna is similar to previous versions but with modifications in the loading static arrester assembly at the top of the five-section aluminum dipole and the radials. The static arrester is a diamond-shaped double loop designed to improve static drain-off, reduce noise and lower the radiation angle. The radials are shorter than on previous models to make them more rugged. This is accomplished by four small



loading coils which electrically lengthen the radials to a full 1/4 wavelength thus producing a low radiation angle and a claimed 4db of omnidirectional gain. Other construction features include a waterproof coax connector jacket, chemically welded dual phasing coil jacket, and double-interlock dipole joints. The VSWR is rated at 1.05 to 1 at centerband and 1.4 to 1 at the band edges. List price is $36.95. Antenna Specialists.

Solid-State VOM 713

Battery-operated VOM features field-effect-transistorized circuitry

Introduced is a battery-operated volt-ohm-milliammeter featuring a field-effect circuit with a 10M constant input resistance on all dc voltage ranges and sensitivity approximately ten times greater than the conventional bench-type VTVM. The unit, which slips easily into a shirt pocket, is 2¾ x 4¼ x 1⅛ in. and weighs 14oz. It has a thumb switch on the side for reversing polarity, a single test/range selector switch on the front panel and provision for attaching an ac clamp-on ammeter adapter. Adding to its ease-of-use in the field, the VOM has a battery-test provision as one of the selector-switch positions. The VOM reportedly performs with an accuracy of 3

percent on all dc ranges, 4 percent on all ac ranges and 3 percent on ohms. Available ranges in dc volts are: .3, 1.2, 6, 30, 120 and 600v with an input resistance of 10M constant on all ranges. In the ac position, the unit covers 3, 12, 60, 300 and 600v (for greater accuracy, a separate scale is provided for 0-3v), with input resistance of 5000Ω per volt. DB measurements are .1 to 600v and dc current measurements in two ranges, 0-120 μa, and 0-½ μa at 300mv. Four resistance measurement ranges are available (all read on the 50Ω center scale): X1, X100, X10K, and times 1M so that resistances from 1Ω to 5000M can be conveniently measured. The VOM utilizes two batteries, a 7v type NEDA 1501 to power the FET bridge circuit, and a 1½ v ASA type N for the ohms circuit. Net price complete with probes and insulated leads is $70. Triplett.

For more information on these NEW PRODUCTS See page 83 READERS SERVICE

DARCY . . .

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back to the 10vdc range. The unit was used to measure critical circuits such as the sync and oscillator sections which continued to operate normally proving the absence of circuit loading.

Measurements on the other ranges for ac, ohms and amps also proved to be fast and accurate.

Since digital test instruments are just now really getting into the pricing category of the small shop, we were concerned with the warranty and repair situation. The manual that came with the DM330 we received was not up to date, according to the people representing Darcy, when we contacted them about it. They indicated that a new warranty was being printed which better explains their program. In essence it says that Darcy provides regional repair centers. The DM330 is warranted for one year and can be sent to the closest repair center. However, the manual is purposely complete enough to allow the technician to repair the DM330 in his own shop if he wishes. But like a fine watch, once the owner opens the unit for repair, the warranty is voided. If the technician wants to repair it, he can order parts from the factory but again, the parts will not be covered under warranty unless the unit is repaired by an authorized repair center. Darcy has repair centers in the East and Midwest regions. The factory handles the Western region.

As we mentioned earlier, digital test instruments are getting closer to the price a technician and service shop can afford. The service business today is more demanding and time is more valuable so test instruments become a most important asset. Because of this, we will continue in future Testlab reports to bring you the latest designs in test instruments.

Next month's Testlab will review the Seco 88A tube tester, Sencore Model SM152 sweep and marker generator. ■

ET/D NEWS OF THE INDUSTRY

Sylvania Plans Introduction of Three Color CRTs in 1970

The Electronic Tube Div. of Sylvania Electric Products, Inc. has revealed plans for the introduction of three new color television tube types in 1970, including the industry's largest tube and the first 110deg. color tube. Sylvania is a subsidiary of General Telephone & Electronics Corp.

George Konkol, vice president-operations, said the new tubes will consist of a new large screen, 25in. viewable 90deg. square corner; a 21in. viewable 90deg. square corner tube, and an 18in. viewable 110deg. tube.

Preliminary drawings for these tubes will be distributed to manufacturers of color television sets this month. Production schedules for the new tubes are predicated entirely on the availability of the new glass sizes and shapes required, Konkol said. However, plans call for the 25 and 21in. tubes to be sampled in January 1970.

Konkol said the square corner feature of the 25 and 21 in. tubes will provide a flatter and more pleasing appearance than current tubes.

Admiral Reports Profit in 1968

Admiral Corp. reported 1968 earnings after taxes of $494,430 or 10 cents a share, compared with a loss of $3,770,061 or 74 cents per share in 1967. Profits before taxes were $894,430 in 1968, while in the preceding year there was a loss of $7,707,061. The electronics-appliance manufacturer said consolidated sales were $377,013,813 in 1968, which compares with $380,941,526 in 1967.

Fourth quarter sales were $96,071,068, contrasted with $108,230,891 in 1967. The drop in volume was attributed to a later-than-usual introduction of appliances—December against August—which prevented sizable shipments in the fourth quarter, lower sales by the government electronics division, and changeover to the new 4-4-5 weeks per quarter accounting periods ending on the Sunday nearest Dec. 31.

Profits before taxes in the quarter were $1,891,707 against a profit of $1,505,315 in 1967. Net profits were $781,306 or 16 cents per share, compared with $622,266 or 12 cents per share.

EIA Reports FM Radio Growth Up Constituting 37.1 Percent of Radios

The FM share of the radio market continued to grow in 1968, registering increases and new highs in all categories, according to the Electronic Industries Assn. Consumer Products Div. and based on EIA Marketing Services Dept. statistics.

FM radios constituted 37.1 percent of domestic-label radios (table, clock, portable) in 1968, compared to 33.5 percent in 1967. In numbers, FM radios grew from 4.21 million table, clock and portable units in 1967 to 4,322,000 units in a total domestic-label radio market that decreased from 12,6 million units in the previous year to 11.7 million in 1968. These statistics are increased to 47 percent and 42.3 percent, respectively, for 1968 compared to 1967 when TV and phonograph combinations are included.

Measured in dollars, however, FM accounted for 56.4

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percent of the factory value of all domestic-label table, clock and portable radios in 1968 compared to 55 percent in 1967. Table, clock and portable units all registered increased percentages in FM saturation, while portables showed a decrease in dollar sales. The average value of an FM home radio decreased from $26.55 in 1967 to $24.92 in 1968.

NEA'S Certified Electronic Technician Program Now International

In March and April of this year NEA's certification committee issued certificates to electronic technicians in several countries outside the United States, including Guam, Canada, South Vietnam, Argentina and Germany. Other technicians are attempting to qualify in Brazil, Spain, Puerto Rico and Mexico.

To become registered by NEA as a CET, a technician must successfully complete a 126-question technical test offered by NEA's CET committee. He must have completed four years of schooling and experience in consumer electronics service. Successful passage of the test entitles him to a framed wall certificate, a wallet identification card and the use of CET following his name.

Presently, the Raytheon Co. Tube Div. is presenting CETs with lapel pins. Also, in the coming months the CET committee is offering CET patches for use on blazers which many of the professional technicians now wear.

Dick Glass, CET, president of NEA, stated that "The CET Program has reached the point where it is now recognized by the entire industry. It has registered close to 800 CETs."

Technicians may take the CET test in various locations. In California, New York and Pennsylvania the majority of tests are given in two-hour sessions at association meetings. Military service personnel have their tests monitored by base education officers. Several vocational schools and some radio stations have been used as test monitors. In Nebraska, five area vocational colleges hold test sessions regularly each month in various places in the state.

International Correspondence Schools, Scranton, Pa., has been grading the CET test papers. Due to increased volume, however, the CET Committee has designed new tests for computer grading to speed up the program.

Sony Produces Braille Manuals For Tape Recorders

Superscope Inc., exclusive U.S. distributor of Sony tape recorders and related equipment, has started producing braille instruction manuals for three tape recorders. The manuals will be available free upon request.

"With the increasing use of tape recorders by the blind as one of their primary sources of education, entertainment and relaxation, we believe that these people should have the dignity of self-sufficiency in being able to operate and care for their recorders without help," the firm said.

The 10- by 12in. instruction manuals will be for the Sony models 100, 104 and 105 tape recorders that are most frequently used by the blind because of their simplicity of operation. They will be produced by Boston-based National Braille Press, Inc.

The entire braille alphabet can be printed from a combination of six dots. A special stereotype machine punches the dots onto a thin 9- by 28in. zinc printing plate. After the plates are proofed (by a blind person), they are run on an inkless cylinder press which prints four pages to a sheet at the rate of 3000 copies an hour.

"To the best of our knowledge, no other tape recorder company provides this service," the company noted.

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1969 DIRECTORY

ELECTRONIC
TECHNICIAN / DEALER

A

AC Electronics Div. GMC, 1925 E. Kenilworth, Milwaukee, Wis. 53202
ATR Electronics, 300 E. 4th St., St. Paul, Minn. 55101
Acme Electric Corp., 31 Water St., Cuba, N.Y. 14727
Acme Lite Products Co., Congers, N.Y. 10920
Acoustic Research, 24 Thorndike St., Cambridge, Mass. 02138
Acro Products, 369 Shurs Lane, Philadelphia, Pa. 19127
ADC, Inc., 2833 13th Ave. S., Minneapolis, Minn. 55407
Adler TV Specialties, PO Box 2005, Atlantic City, N.J. 08406
Admiral Corp., 903 Morrissey Drive, Box 845, Bloomington, Ill. 61701
Advance Relay, 2435 N. Naomi St., Burbank, Calif. 91504
Aerovox Corp., 740 Belleville Ave., New Bedford, Mass. 02745
Akro-Mills, 820 Market St., Akron, Ohio
Alco Electronic Products, Inc., PO Box 1346, Lawrence, Mass. 01843
Allen-Bradley, 136 W. Greenfield Ave., Milwaukee, Wis. 53204
Alliance Mfg. Co., Alliance, Ohio 44601
Allied Radio, 100 N. Western Ave., Chicago, Illinois 60680
Almo Industrial Electronics, Inc., 412 N. 6th St., Philadelphia, Pa. 19123
Alpha Wire Corp., 180 Varick St., New York, N.Y. 10013
Altec-Lansing, 1515 S. Manchester, Anaheim, Calif. 92802
American Concertone, 9449 W. Jefferson Blvd., Culver City, Calif. 90230
American Electronic Labs., Inc., Colmar, Pa. 18915
American Geloso Electronics, 251 Park Ave., New York, N.Y. 10010
American Microphone Div., see Electro Voice
American Telephone & Telegraph, 195 Bdwy, New York, N.Y. 10007
American Trading Co., Blaustine Bldg., Baltimore, Md. 21201
Amp, Inc., 3822 Eisenhower Blvd., Harrisburg, Pa. 17111
Amperex Electronic, 230 Duffy Ave., Hicksville, L.I., N.Y. 11802
Ampex Audio, Inc., 934 Charter St., Redwood City, Calif. 94063
Ampex Corp., 25564 Willow Pond Lane, Los Altos Hills, Calif. 94022
Amphenol Distributor Div., 2875 S. 25th Ave., Broadview, Ill. 60153
Amprobe Instrument, 630 Merrick Rd., Lynbrook, N.Y. 11563
Analab Instrument, 30 Canfield Rd., Cedar Grove, N.J. 07009
Anasphone Corp., 10912 La Cienega Blvd., Inglewood, Calif. 90304
Andrea Radio, 27-01 Bridge Plaza N., Long Island City, N.Y. 11101
Antennacraft, 1215 Agency St., Burlington, Iowa 52601
Antenna Designs, Inc., 802 Washington St., Burlington, Iowa 52601
Antenna Products Co., Box 110, Mineral Wells, Tex. 76067
Antenna Specialists, 12435 Euclid Ave., Cleveland, Ohio 44115
Antronic Corp., 4942 W. Div. St., Chicago, Ill. 60651
Arco Electronics, Community Dr., Great Neck, N.Y. 11021
Arcturus Electronics, 420 Kearny Ave., Kearny, N.Y. 07032
Argos Products, 600 S. Sycamore, Genoa, Ill. 60135
Arkay Int'l, 88-06 Van Wyck Expressway, Richmond Hill, N.Y. 11418
Armco Steel Corp., 703 Curtis St., Middletown, Ohio 45042
Arrow Fastener Co., 201 Mayhill St., Saddle Brook, N.J. 07662
Arrow-Hart & Hegerman, 103 Hawthorn St., Hartford, Conn. 06105
Artisan Organs, 2475 N. Lake Ave., Altadena, Calif. 91001
Arvin Industries, Columbus, Ind. 47201
Astatic Corp., Jackson & Harbor Sts., Conneaut, Ohio 44030
Astron Corp., 255 Grant Ave. E., Newark, N.J.
Atlas Sound Corp., 10 Pomeroy Rd., Parsippany, N.J. 07054
Audax, Inc., 109-01 37th Ave., Corona, N.Y. 11368
Audio Devices, 444 Madison Ave., New York, N.Y. 10022
Audio Dynamics, 1677 Cody Ave., Ridgewood, N.J.
Audio Empire Div. Dyna Empire, 1075 Steward Ave., Garden City, L.I., N.Y. 11530
Audio Corp., 514 Bdwy., New York, N.Y. 10012
Audio-Master Corp., 17 E. 45th St., New York, N.Y. 10017
Audio Wave, Inc., 4541 Furman Ave., Bronx, N.Y. 10470
Audiotex Mfg., 400 S. Wyman St., Rockford, Ill. 61101
Audiotex Mfg., 3225 Exposition Pl., Los Angeles, Calif. 90018
Auricord Corp., 34-43 56th St., Woodside, N.Y. 11377
Automatic Electric Co., Northlake, Ill. 60164

B

B & B Electronic Products, 2120 S. Platte River Dr., Denver, Colo. 80223
B & K Instruments (Bruel & Kjaer), 3006 W. 106 St., Cleveland, Ohio 44111
B&K Mfg. Co., 1801 W. Belle Plaine, Chicago, Ill. 60613
BSR (Birmingham Sound Reproducers), Ltd., College Point, L.I., N.Y. 11356
Ballantine Labs, Boonton, N.J. 07005
Barber-Colman Co., Rockford, Ill.
Barker & Williamson, Bristol, Pa. 19007
Barry Electronics, 512 Bdwy., New York, N.Y. 10012
Bauchaine Sales Corp., 584 Union Ave., Laconia, N.H. 03246
Beckman Instruments Berkeley Div., 220 Wright Ave., Richmond, Calif. 94804
Belden Corp., 415 S. Kilpatrick, Chicago, Ill. 60644
Bell & Howell, 7100 McCormick Rd., Chicago, Ill.
Bell PA Products, 1209 N. 5th St., Columbus, Ohio 43212
Bell Telephone Labs, 463 West St., New York, N.Y. 10014
Benco TV Assoc., 27 Taber Rd., Rexdale, Ont., Canada
Bendix Radio Div., Industrial Electronic Prods., Baltimore, Md.
Berns Mfg., 9853 Chalmers, Detroit, Mich. 48213
Bird Electronics Corp., 30303 Aurora Rd., Solon, Ohio 44139
Birnbach Radio, 435 Hudson, New York, N.Y. 10014
Bliley Electric, Union Station Bldg., Erie, Pa.
Blonder-Tongue Labs, 9 Alling St., Newark, N.J. 07102
Bogen-Presto, PO Box 500,

Paramus, N.J. 07652
Boonton Radio, Boonton, N.J. 07005
Bosco Elec., Inc., Don Littell Rd., Hanover, N.J. 07936
Bourns Labs, Box 2112, Riverside, Calif. 92506
Bozak Co., Rt. Box 1166, Darien, Conn. 06820
Brach Mfg. Corp., 899 Main, Sayreville, N.J. 08872
Bright Star, Ind., Clifton, N.J.
British Ind., Port Washington, L.I., N.Y. 11050
Browning Labs, 100 Union Ave., Laconia, N.H. 03246
Brush Instruments, 37 St. & Perkins, Cleveland, Ohio
BSR (USA), Ltd., Route 303, Blauvelt, N.Y. 10913
Bud Radio, 4605 E. 355 St., Willoughby, Ohio 44094
Burgess Battery, Exchange St., Freeport, Ill. 61032
Burroughs Corp., 6072 2nd Ave., Detroit, Michigan 48202
Bussman Mfg., W. University St., St. Louis, Mo. 63107

C

Cabinart, Inc., 35 Geyer St., Haledon, N.J.
Cadre Ind., Box 150, Endicott, N.Y. 13760
Calbest Electronics, 4801 Exposition Bldg., Los Angeles, Calif.
Cannon Electric, 3208 Humboldt St., Los Angeles, Calif. 90031
Castle TV Tuner Service, 5710 N. Western Ave., Chicago, Ill. 60645
Castle TV Tuner Service, 41-92 Vernon, Long Island City, N.Y. 13476
Centralab, 900 E. Keefe Ave., Milwaukee, Wis. 53212
Channellock, Inc., S. Main St., Meadville, Pa. 16335
Channel Master Corp., Ellenville, N.Y. 12428
Charles Engineering, Inc., 3421 N. Kroll Dr., Los Angeles, Calif.
Chem Spray Corp., 67-27 Cadillac St., Houston, Tex. 77021
Chemical Electronic Engineering, Jackson & Ravine Dr., Matawan, N.J. 07747
Chemtronics, Inc., 1260 Ralph, Brooklyn, N.Y. 11236
Cinch Jones Div., Cinch Mfg., 1026 Homan Ave., Chicago, Ill.
Cisin Co., Harry G., Amagansett, N.Y. 11930
Clairex Corp., 19 W. 26th St., New York, N.Y. 10010
Clarostat Mfg., Dover, N.H. 03820
Clear Beam Antenna Corp., 9754 Deering St., Chatsworth, Calif. 91311
Cletron, Inc., 1974 E. 61 St., Cleveland, Ohio 44103
Cleveland Institute of Electronics, 1776 E. 17th St., Cleveland, Ohio 44114
Cohu Electronics Massa Div., 5725 Kearney Villa Rd., San Diego, Calif. 92123
Coe Inst. Div., 2034 Placenta, Costa Mesa, Calif.
Colman Tool & Electric Products, PO Box 2965, Amarillo, Tex. 79105
Colson Corp., 395 LaSalle, Chicago, Ill. 60603
Colorgrams, Inc., 58 Old Steward Ave., New Hyde Park, L.I., N.Y. 11040
Columbia Products Co., Rt. 3, Columbia, S.C. 29206
Columbia Wire & Supply Co., 2850 Irving Park Rd., Chicago, Ill. 60618
Commander, 133 North Jefferson, Chicago, Ill. 60606
Communications Co., 300 Greco Ave., Coral Gables, Fla. 33146
Communications Electronics, PO Box 1272, Scottsdale, Ariz. 85252
Communications Prod. Co., Rt. 79, Marlboro, N.J. 07746
Components Specialties, Inc., 101 Buffalo Ave., Freeport, N.Y. 11520
Conar Instrument, 3939 Wisconsin Ave., Washington, D.C. 20016
Conrac, Inc., 19217 Foothill Blvd., Glendora, Calif. 91740

Continental Electronics, 1050 N. Central Expressway, Dallas, Texas 75201
Courier Communications, Inc., 56 Hamilton Ave., White Plains, N.Y. 10601
Cornell-Dubilier Electronics, 50 Paris St., Newark, N.J. 07105
Creative Products, Inc., 8120 Blue Ash Rd., Cincinnati, Ohio 45236
Crescent Enterprises, 7301 Mission Rd., Prairie Village, Kan. 66208
Crown Int'l, Box 261, Elkart, Ind. 46514
CRT Equipment Co., Inc., 2740 Old Lebanon Rd., Nashville, Tenn. 37214
Cush Craft, 621 Hayward St., Manchester, N.H. 03103
Cutler-Hammer, 436 N. 12th St., Milwaukee, Wis. 53233

D

Dale Electronics, 1378 28th Ave., Columbus, Neb. 68601
Davies Molding Co., Harry, 1428 N. Wells St., Chicago, Ill. 60610
Darcy Industries, 1723 Cloverfield Blvd., Santa Monica, Calif. 49104
Daystrom, Inc., Archbald, Pa. 18403
DeJur-Amsco, 45-01 Northern Blvd., Long Island City, N.Y. 11101
Delco Radio Div., GMC, Kokomo, Ind. 46901
Delmonico Int'l, 120-20 Roosevelt, Corona, Ill.
DeWald Radio, 35-15 37th Ave., Long Island City, N.Y. 11103
Dialight Corp., 60 Steward Ave., Brooklyn, N.Y. 11237
Diamond Tool, 4602 Grand Ave., W., Duluth, Minn. 55807
Dickey, Inc., D. F., 4863 Rivoli Dr., Macon, Ga. 31204
Drake Mfg., 4826 N. Olcott, Chicago, Ill. 60656
DuKane Corp., St. Charles, Ill. 60174
DuMont Labs, Allen B., 750 Bloomfield, Clifton, N.J. 14431
Du Pont de Nemours, Wilmington, Del. 19801
Doutone Co., Locust St., Keyport, N.J. 07735
Dutch Brand Div., Johns-Manville, 78 S. Woodlawn Ave., Chicago, Ill.
Dymo Ind., 2725 10th St., Berkeley, Calif. 94710
Dynaco, Inc., 3912 Powelton Ave., Philadelphia, Pa. 19104
Dyna-Empire, 1075 Steward Ave., Garden City, L.I., N.Y. 11530

E

ECI Electronics Communications, 56 Hamilton Ave., Mount Vernon, N.Y. 10552
ELPA Ind., Ortofon Div., New Hyde Park, Ill.
E-Z Hook Products, 1536 Woodborn Ave., Covington, Ky.
E-Z Way Towers, Inc., PO Box 5797, Tampa, Fla. 33605
Eby Sales, 148-05 Archer Ave., Jamaica, L.I., N.Y. 11435
Eitel-McCullough, 301 Industrial Way, San Carlos, Calif. 94070
Eico Corp., M St., below Erie, Philadelphia, Pa.
Eico Electronic Instrument Co., 283 Malta St., Brooklyn, N.Y. 11207
Electric Auto Lite, 3529 24th St., Port Huron, Mich. 48060
Electric Storage Battery, 1717 E. 9th St., Cleveland, Ohio 44114
Electro Acoustic Prods., 2135 Beuter Rd., Fort Wayne, Ind.
Electro Products Labs, 6125 W. Howard St., Chicago, Ill. 60648
Electro-Voice, Inc., 663 Cecil St., Buchanan, Mich. 49107
Electronic Chemical Corp., 813 Communipaw Ave., Jersey City, N.J. 07304
Electronic Communications, Inc., 56 Hamilton Ave., White Plains, N.Y. 10601
Electronic Measurements, Lewis St. & Maple Ave., Eatontown, N.J. 07724
Electronic-Missiles & Communications, Inc., 262 3rd St., Mount Vernon, N.Y.
Electronic Organ Arts, 4949 York Blvd., Los Angeles, Calif. 90042
Electronic Prods. Div., Victoreen

Instrument, 111 E. 3rd St.
Mount Vernon, N.Y. 10550
Electronic Publishing, 133 N. Jefferson St., Chicago, Ill. 60606
Electronic Technician/Dealer, Harbrace Bldg., Duluth, Minn. 55802
Electrovert, Inc., 86 Hartford Ave., Mount Vernon, N.Y. 10553
Electro-Voice, Inc., 663 Cecil St., Buchanan, Mich. 49107
Elgin Advance Relays, 2435 W. Naomi St., Burbank, Calif.
Elpha Marketing, Thorens Building, New Hyde Park, N.Y. 11040
Eltec, 14 Alsop Ave., Middletown, Conn. 06457
EMC, 625 Bdwy., New York, N.Y. 10012
Emerson Radio & Phono, 14 & Coles, Jersey City, N.J. 07302
Empire Scientific, 1075 Steward Ave., Garden City, L.I., N.Y. 11530
Enterprise Development Corp., 5123 E. 65th, Indianapolis, Ind. 46220
Entron, 2141 Industrial Pkwy., Silver Spring, Md. 20904
Ercona Corp., 16 W. 46 St., New York, N.Y. 10036
Essex Wire, 1601 Wall St., Indianapolis, Ind.
Euphonics Corp., PO Box 2746 Rio Piedras, Puerto Rico, USA 00926
Eveready Batteries, see Union Carbide Co.
Exide Ind. Div., Electric Storage Battery, 52 S. 15 St., Philadelphia, Pa. 19102

F

Fanon-Masco, 439 Frelinghuysen Ave., Newark, N.J. 07114
Fidelitone, Inc., 6415 Ravenswood Ave., Chicago, Ill. 60626
Finney Co., 34 W. Interstate St., Bedford, Ohio 44146
Fischer Special Mfg. Co., 446 Morgan St., Cincinnati, Ohio 45206
Fisher Radio, 21-2444 Dr., Long Island City, N.Y. 11101
Foxboro Co., New Ponset Ave., Foxboro, Mass. 02035
Freed Transformer, 1718 Weirfield St., Brooklyn, N.Y. 11227

G

GAM Electronics, 138 Lincoln St., Manchester, N.H. 03103
G&W Electric Specialty Co., 3500 W. 127 St., Blue Island, Ill. 60406
Gator Probe Corp., 2751 San Juan Rd., Hollister, Calif. 95023
GC Electronics, 400 S. Wyman St., Rockford, Ill. 61101
Garrard Sales, 80 Shore Rd., Port Washington, N.Y. 11050
Gavin Instruments, Depot Sq. & Division St., Somerville, N.J. 08876
Gem City Tuner Repair, Box 6, Dabel Station, 2631 Mardon Drive, Dayton, Ohio 45420
General Dynamics/Electronics, 1407 N. Goodman St., Rochester, N.Y. 14609
General Electric Audio Products Div., Decatur, Ill.
General Electric Communications Products Div., Lynchburg, Va.
General Electric Receiving Tube Dept., Owensboro, Ky. 42301
General Electric Receiver Div., Utica, N.Y.
General Instrument, 65 Gouveneur St., Newark, N.J. 07104
General Precision GPL Div., Mount Kisco, N.Y. 10549
General Radio, West Concord, Mass. 01742
General Radiotelephone Co., 3501 W. Burbank Blvd., Burbank, Calif. 91505
Gertsch Products, 3211 S. La Cienega Blvd., Los Angeles, Calif. 90016
Grantham School of Engineering, 1505 N. Western Ave., Hollywood, Calif. 90027
Greyhound Package Express, 140 S. Dearborn, 10 S. Riverside Plaza, Chicago, Ill. 60606
Griffiths Electronics, 1301 E. Linden, Linden, N.J. 07036

H

H & H Equipment Co., Laotto, Ind. 46763
Hallamore Electronics, 714 N. Brookhurst St., Anaheim, Calif. 92801
Hallicrafters Co., 4401 W. 5 Ave., Chicago, Ill. 60624
Hallmark Electronics, 436 N. 31 St., Philadelphia, Pa. 19104
Hallmark Instruments, 2620 Freewood Dr., Dallas, Tex. 75220
Hammarlund Mfg., 53 W. 23 St., New York, N.Y. 10010
Harman-Kardon, Inc., 55 Ames Crt., Plainville, N.Y. 11803
Hartley Products, 521 E. 162 St., Bronx, N.Y. 10451
Hathaway Instrument, 5800 E. Jewell Ave., Denver, Colo. 80222
Heath Co., 305 Territorial Rd., Benton Harbor, Mich. 49022
Heintz & Kaufman Ltd., 3650 Hayden Ave., Culver City, Calif. 90230
Hewlett-Packard, 1501 Page Mill Rd., Palo Alto, Calif. 94304
Hickok Electrical Instrument, 10523 Dupont Ave., Cleveland, Ohio 44108
Hi-Lo Mfg., 1122 Newport St., Chicago, Ill.
Hitachi, see Sampson Co.
Hoffman Electronics Consumer Prods. Div., 3761 S. Hill St., Los Angeles, Calif. 90007
Hollywood Television Wuerth Surgitron Div., 1949 Moffett St., Hollywood, Fla.
Holub Industries, Inc., Sycamore, Ill.

Honeywell Commercial Residential Div., 2753 4th Ave., Minneapolis, Minn.
Hudson Lamp Company, 528 Elm St., Kearny, N.J. 07032
Hunter Sales R.N., 9851 Alburtus Ave., Santa Fe Springs, Calif. 90670
Hycon Electronics, 1030 Arroyo Pkwy., Pasadena, Calif. 91105
Hy-Gain Electronics, 8473 N.E. Hwy. 6, Lincoln, Neb.
Hysol Co., 322 Houghton, Olean, N.Y. 14760

I

I E H Manufacturing Co., 102 Prince St., New York, N.Y. 10012
IERC Div., Box 271, Burbank, Calif. 91503
Illumitronic Engineering, 680 E. Taylor St., Sunnyvale, Calif.
Injectorall Co., 4 N., Great Neck, N.Y. 11024
Institute of Electrical & Electronic Engineers (IEEE), 72 W. 45th St., New York, N.Y. 10036
Int'l Business Machines, 590 Madison Ave., New York, N.Y. 10022
Int'l Correspondence Schools, Scranton, Pa. 18515
Int'l Crystal Mfg., 18 N. Lee, Oklahoma City, Okla. 73102
Int'l Electronics, 316 S. Service Rd., Melville, L.I., N.Y. 11746
Int'l Rectifier, 233 Kansas St., El Segundo, Calif. 90245
IRC Inc., 401 N. Broad, Philadelphia, Pa. 19108
I-T-E Circuit Breaker, 601 E. Erie Ave., Philadelphia, Pa. 19134
IT&T, 320 Park Ave., New York, N.Y. 10022
IT&T Components, 100 Kingsland Rd., Clifton, N.J. 07013
IT&T Distributor Products, 250 Broadway, New York, N.Y. 10007

J

Jackson Electrical Instrument, 124 McDonough St., Dayton, Ohio 45402
J-B-T Instruments, 61 Hamilton, New Haven, Conn. 06511
Jensen Industries Div. Electrovoice, 633 Cecil St., Buchanan, Mich. 49107
Jensen Mfg., 6601 S. Laramie, Chicago, Ill. 60638
Jensen Tools, 3630 E. Indian School Rd., Phoenix, Ariz. 85018
Jerrold Electronics, 401 Walnut St., Philadelphia, Pa. 19132
Jersey Specialty Co., Box 576, Mountain View, N.J.
Jetronic Industries, 4312 Main St., Philadelphia, Pa. 19127
JFD Electronics, 1462 62 St., Brooklyn, N.Y.
Johnson Co. E. F., 6516 10th Ave. S.W., Waseca, Minn. 56093
Jonard Industries Corp., 3047 Tibbett Ave., Bronx, N.Y. 10463
Jones & Laughlin, 401 Liberty, Pittsburgh, Pa. 15222
Jones Div. Cinch Mfg., 1026 S. Homan, Chicago, Ill. 60624
J W Electronics, 1538 W. Jarvis, Chicago, Ill. 60626
J W Electronics, PO Box 51, Bloomington, Ind. 47401

K

KLH Research & Devel, 30 Cross St., Cambridge, Mass. 02138
KTV Tower & Com. Equip. Co., PO Box 294, Sullivan, Ill. 61951
Karg Laboratories, 162 Ely Ave. S., Norwalk, Conn. 06854
Karlson Assoc., 1610 Neck Rd., Brooklyn, N.Y. 11229
Kaar Engineering Co., 2998 Middlefield Rd., Palo Alto, Calif. 94306
Kay Electric, 14 Maple, Pine Brook, N.J. 07058
Kay-Towens Antenna Co., PO Box 593, Rome, Ga. 30162
Kenwood Electronics, 3700 S. Broadway Pl., Los Angeles, Calif. 90007
Kepco Inc., 131-38 Sanford Ave., Flushing, N.Y. 11355
Kester Solder, 4201 Wrightwood, Chicago, Ill. 60639
Klipsch & Assoc., PO Box 96, Hope, Ark. 71801
Kinematix Inc., 2040 W. Washington, Chicago, Ill. 60612
Knob Corp. of America, 469 Jericho Tpk., Mineola, N.Y. 11501
Koss Inc., 2227 N. 31 St., Milwaukee, Wis. 53208
Kraeuter Tools, 332 South Michigan Ave., Chicago, Ill. 60604
Krylon Inc., Ford & Washington St., Norristown, Pa.
Kwikheat Mfg., 3731 San Fernando Rd., Glendale, Calif. 91204

L

LA Turner Exchange, 4611 W. Jefferson, Los Angeles, Calif. 90016
Lafayette Radio Electronic, 111 Jerico Tpk., Syosset, L.I., N.Y. 11791
Lakeside Industries, 5234 N. Clark St., Chicago, Ill. 60640
Lambda Electronics, 515 Broad Hallow, Huntington, N.Y. 11743
Lampkin Labs, Bradenton, Fla. 33505
Lance Antenna, 1730 1st St., San Fernando, Calif. 91340
Lansing Sound James B., 3249 Casitas Ave., Los Angeles, Calif. 90039
Larsen Electronics Inc., 11611 N.E. 50th Ave., Vancouver, Wash. 98665
Lavoie Labs, Morganville, N.J. 07751
Leach Corp., 18435 Susana Rd., Compton, Calif. 90221
Leader Instruments Corp., 24-20 Jackson Ave., Long Island City, N.Y. 11101
Lectrotech Inc., 1221 W. Devon Ave., Chicago, Ill. 60626
Ledex Inc., 123 Webster, Dayton, Ohio 45402
Leeds & Northrup, 4907 Stenton, Philadelphia, Pa. 19144
Lesa of America, 11 W. 42 St., New York, N.Y. 10036
Littlefuse Inc., Des Plaines, Ill.
Litton Industries, 336 N. Foothill, Beverly Hills, Calif. 90210
Loral Distributor Products, Pond Hill Industrial Park, Great Neck, N.Y. 11022
Los Angeles Turner Exchange, 4611 W. Jefferson, Los Angeles, Calif. 90016

M

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Magnecord Div. Midwestern Instrument, PO Box 7186, Tulsa, Okla. 74105
Magnetrack Box, 147 Caroline, Puerto Rico, U.S.A.
Majestic Int'l, 743 LaSalle St., Chicago, Ill. 60605
Mallory & Co. P. R., PO Box 1558, Indianapolis, Ind. 46206
Marantz, 25-14 Bdwy., Long Island City, N.Y. 11106
Marconi Instruments, 111 Cedar Lane, Englewood, N.J. 07631
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Midland Industries Inc., 8219 W. Irving

Akron, Ohio 44308
Olympic Radio & TV, 34-01 37 Ave., Long Island City, N.Y. 11101
Ortron Electronics, 29 Lincoln Ave., Orange, N.J.
Oxford Transducers, 3911 S. Mich. Ave., Chicago, Ill. 60653

P

Packard Bell Electronics, 12333 W. Olympic Blvd., Los Angeles, Calif. 90064
Pace Communications Corp., 24049 Frampton Ave., Harbor City, Calif. 90710
Palmer Electronics Laboratories, Lowell Rd., Carlisle, Mass. 01741
Parker Metal Goods Co., 85 Prescott St., Wooster, Mass.
Parts Unlimited Inc., 1 State St., Bloomfield, N.J. 07003
Pearce-Simpson, PO Box 800 Biscayne Annex, Miami, Fla. 33152
Perma-Power Co., 5740 N. Tripp Ave., Chicago, Ill. 60646
Peterson Radio Company, Inc., 2800 West Broadway, Council Bluffs, Iowa 51501
Phaostron Instruments & Electronics, 151 Pasadena Ave. S., Pasadena, Calif. 91105
Phelps Dodge Communications Products Div., Route 79, Marlboro, N.J. 07746
Philco Corp., "C" and Tioga Sts., Philadelphia, Pa. 19134
Philharmonic Radio & TV, 235 Jersey Ave., New Brunswick, N.J. 08901
Pickering & Co., Sunnyside Blvd., Plainview, N.Y. 11803
Pilot Radio, 100 Electra Lane, Yonkers, N.Y.
Pioneer Electric & Research, Forest Park, Ill. 60130
Planet Mfg. Corp., 225 Belleville Ave., Bloomfield, N.J. 07003
Pocket Socket Inc., 17415 Ecorse, Allen Park, Mich. 48101
Polytronics Laboratories Inc., 900 Burlington Ave., Silver Spring, Md.
Pomona Electronics Co., 1500 E. 9th St., Pomona, Calif. 91766
Potter & Brumfield, 107 N. 10th St., Princeton, Ind. 46017
Precise Electronics, 76 E. 2 St., Mineola, L.I., N.Y. 11501
Precision Apparatus Div. of Dynascan, 1801 W. Belle Plaine Ave., Chicago, Ill. 60613
Precision Electronics Inc., 9101 King Ave., Franklin Park, Ill. 60131
Precision Tuner Service, PO Box 272, Bloomington, Ind. 47401
Pyramid Electronic Co., Darlington, S.C. 29532

Q

Qualitone Industries, 102 Columbus Ave., Tuckahoe, N.Y. 10707
Quam-Nichols, 234 E. Marquette Rd., Chicago, Ill. 60637
Quan-Tech Labs, 60 Parsippany Blvd., Boonton, N.J. 07005
Quietrole Co., 395 St. John St., Spartanburg, S.C. 29302

R

Radar Devices Mfg. Corp., 22003 Harper Ave., St. Clair Shores, Mich. 48080
RCA Components and Devices Div., 415 S. 5 St., Harrison, N.J. 07029
RCA Semiconductor Dist. Prod. Div., 415 S. 5 St., Harrison, N.J. 07029
RCA Parts and Accessories, 2000 Clements Bridge Rd., Deptford, N.J. 08096
RCA Set Div., 600 N. Sherman Dr., Indianapolis, Ind. 46201
RFS Industries, 102 Harbor Rd., Port Washington, N.Y. 11050
RMS Electronics Inc., 50 Autin Place, Bronx, N.Y. 10462
Radiart Co., 2900 Columbia, Indianapolis, Ind. 46205
Radio Receptor, 240 Wythe, Brooklyn, N.Y. 11211
Radio Shack, 730 Commonwealth, Boston, Mass.
Rauland Corp., 4245 N. Knox, Chicago, Ill. 60630
Rawn Co., Spooner, Wis. 54801

Ray-O-Vac Co., 212 E. Washington St., Madison, Wis. 53703
Raytheon Communications Prod., 213 Grand S., San Francisco, Calif.
Raytheon Distributor Products, Div., 55 Chapel, Newton, Miss. 39345
R-Columbia Products, 305 Waukegan Ave., Highwood, Ill. 60040
Recoton Corp., 52-35 Barnett, Long Island, N.Y. 11104
Record-O-Phone Div., Electrospace Corp., 408 Concord Ave., N.Y., N.Y. 10451
Reeves Soundcraft, Great Pasture Rd., Danbury, Conn. 06810
Regency Electronics, 7900 Pendleton Pike, Indianapolis, Ind. 46226
Rego Insulated Wire, 830 Monroe, Hoboken, N.J. 07030
Rek-O-Kut Co., 38-19 108 St., Corona, N.Y. 11368
Robert Electronics, 829 N. Highland Ave., Hollywood, Calif. 90028
Robert Bosh Corp., Blaupunkt Car Radio Div., 40-25 Crescent, Long Island City, N.Y. 11101
Robins Industries, 1558 127 St., College Pt., N.Y. 11356
Rockbar Corp., 650 Halstead, Mamaroneck, N.Y. 10543
Rohm Mfg., 1116 Limestone St., Peoria, Ill.
Rustrak Instrument, 130 Silver, Manchester, N.H. 03103

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S&A Electronics, 204 W. Florence St., Toledo, Ohio 43605
Sadelco Inc., 601 W. 26th St., New York, N.Y. 10001
Salch & Co., Herbert Marketing Div., Tompkins Radio Prod., Woodsboro, Texas 78393
Sampson Co., 2244 S. Western Ave., Chicago, Ill. 60608
Sangamo Electric, 1301 N. 11st, Springfield, Ill. 62702
Sansui Electronics Corp., 34-43 56th St., Woodside, N.Y. 11377
Sargent Gerkhe Co., 323 W. 15th St., Indianapolis, Ind. 46202
Sarkes Tarzian Tuner Service, 537 S. Walnut, Bloomington, Ind. 47401
Sarkes Tarzian Tuner Service, 547-49 Tonnele, Jersey City, N.J. 07307
Sarkes Tarzian Tuner Service, 10654 Magnolia N., Hollywood, Calif. 90028
Schematic Library, 809 N. 7th St., Phoenix, Ariz. 85006
Schober Organ, 43 W. 61, New York, N.Y. 10023
Scott Inc., HH 111 Powdermill Rd., Maynard, Mass. 01754
Seco Electronics, 1201 W. Clover Dr., Minneapolis, Minn.

Seco Electronics, 1001 Second Street South, Hopkins, Minn. 55343
Semitronics Corp., 265 Canal St., New York, N.Y. 10013
Sencore Inc., 426 S. Westgate Rd., Addison, Ill. 60101
Sentinel Inc., PO Box 336, Garland, Texas 75040
Sentry Electronics Inc., 707 S. Okfuskee, Wewoka, Okla. 74884
Setchell-Carlson, 530 5th Ave. N.W., St. Paul, Minn. 55112
Sherwood Electronic Labs, 4300 N. California Ave., Chicago, Ill. 60618
Shure Brothers, 22 Hartrey Ave., Evanston, Ill. 60202
Signalite, Inc., Neptune, N.J.
Simpson Electric, 5200 W. Kinzie St., Chicago, Ill. 60644
Singer Co., 3211 So. La Cienega Blvd., Los Angeles, Calif. 90016
Slep Electronic Co., Automotive Div., PO Box 178, Ellenton, Fla. 33532
Smith Inc., Herman H., 2326 Norstrand, Brooklyn, N.Y. 11210
Snyder Mfg., 22 Y Ontario, Philadelphia, Pa.
Sola Electric, 1717 Busse Rd., Elk Grove Village, Ill.
Sonar Radio, 73 Westman Ave., Brooklyn, N.Y.
Sonotone Corp., Elmsford, N.Y. 10523
Sony Corp. of America, 580 5th Ave., New York, N.Y. 10036
Sorensen Prods. Div., Raytheon S., Norwalk, Conn.
Soundolier Inc., PO Box 3848, St. Louis, Mo.
South River Metal Products, 377 Tpk. Rd., South River, N.J. 08882
Sprague Products, 65 Marshall St. N., Adams, Mass. 01247
Sprayon Products Inc., Bedford Heights, Ohio 44146
Stockpole Carbon Electronics Div., St. Marys, Pa.
Stancor Electronics, 3501 W. Addison, Chicago, Ill. 60618
Standard Instrument Corp., 657 Broadway, New York, N.Y. 10012
Standard Kollsman Industries, 2085 N. Hawthorne, Melrose Park, Ill. 60160
Stromberg-Carlson Div., General Dynamics, 1400 N. Goodman St., Rochester, N.Y. 14609
Sturtevant Co., PA, Addison, Ill. 60101
Superex Electronics Corp., 4 Radford Place, Yonkers, New York
Superior Electronics, 208-212 Piaget Ave., Clifton, N.J. 07011
Superior Tuner, 1377 N. Curry Pike, PO Box 368, Bloomington, Ind. 47401
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Switchcraft Inc., 5555 N. Elston, Chicago, Ill. 60603
Sylvania Electronic Products, 730 3rd Ave., N.Y., N.Y. 10017
Sylvania Electronic Tube Div., Seneca Falls, N.Y. 13148
Symphonic Radio & Electronic, 10 Columbus Circle N., New York, N.Y. 10023

T

Tab Books, Monterey & Pinola Ave., Blue Ridge Summit, Pa. 17214
TACO, Sherburne, N.Y. 13460
TRX Electronic Corp., 200 Park Ave. S., New York, N.Y. 10003
TV Tuner Service, 2103 W. 3rd St., Bloomington, Ind. 47401
TV Tuner Service, 118 3rd St., W., Twin Falls, Idaho 83301
Talk A Phone Co., 5013 N. Kedzie Ave., Chicago, Ill. 60625
Tandberg of America, 83 Ave., Pelham, N.Y. 10803
Tap A Line Mfg., PO Box 563, Pompano Beach, Fla. 33061
Tech-Master, 75 Front St., Brooklyn, N.Y. 11201
Techni-Parts Corp., 156 Hempstead Tpk., W. Hempstead, L.I., N.Y. 11552
Techpress Inc., Brownsburg, Ind. 46112
Tektronix Inc., PO Box 500, Beaverton, Ore. 97005
Telerad Div., Lionel Corp., Route 69-202, Flemington, N.J. 08822
Telex Inc., 3054 Excelsior, Minneapolis, Minn. 55416
Telex/Aemco Div., Telex Inc., Mankato, Minn. 56001
Teleonic Industries, 60 N. 1st Ave., Beech Grove, Ind. 46107
Telvac Instrument Co., 18531 Ventura Blvd., Tarzana, Calif. 91356
Tenatronics Ltd., 1011 Power Ave., Cleveland, Ohio 44114
Tenna Mfg., 19201 Cranbrook Pkwy., Cleveland, Ohio
Tennalab, 10 & State St., Quincy, Ill. 62301
Terado Co., 1068 Raymond Ave., St. Paul, Minn. 55108
Texas Crystals, 1000 Crystal Dr., Ft. Myers, Fla. 33901
Thomas & Betts Co., Inc., 36 Butler St., Elizabeth, N.J. 07207
Thomas Electronic Organs, 8345 Hayvenhurst Ave., Sepulveda, Calif. 91343
Thordarson-Meissner, 7 & Belmont, Mt. Carmel, Ill. 62863
Thorens Div., Atlantic & Steward Aves., ELPA Mktg., Ind., New Hyde Park, N.Y. 11040
Toshiba Mitsu & Co., 530 5th Ave., New York, N.Y. 10036
Tram Electronics, Lower Bay Rd., PO Box 187, Winnisquam, N.H. 03289
Trav Ler Radio, 571 W. Jackson, Chicago, Ill. 60606
Triad Transformer, 4055 Redwood Ave., Venice, Calif. 90291
Trio Mfg., Griggsville, Ill. 62340
Triplett Electrical Instrument, 286 Harmon Rd., Bluffton, Ohio 45817
Trippe Electronics, 133 North Jefferson, Chicago, Ill. 60606
Tuner Inc., 6302 5th Ave., Brooklyn, N.Y.
Tuner Service Corporation, 817 N. Pennsylvania St., Indianapolis, Ind.
Tuner Service Corporation, 547-49 Tonnele Ave., Jersey City, N.J.
Tuner Service Corporation, 938 Gordon St., S.W., Atlanta, Georgia
Tuner Service Corporation, 10654 Magnolia Blvd., North Hollywood, Calif.
Tung-Sol Electric, 1 Summer Ave., Newark, N.J. 07104
Turner Co., 918 17th St. N.E., Cedar Rapids, Iowa 52401

U

Ullman Devices, Ridgefield, Conn. 06877
Ungar Co., Sid, 1880 Rayford Dr., Los Angeles, Calif. 90045
Ungar Electric Tools, 2701 W. El Segundo Blvd., Hawthorne, Calif. 90250
Union Carbide, 270 Park Ave., New York, N.Y. 10017
Useco Div., Litton Industries, Inc., 13536 Saticoy St., Van Nuys, Calif. 91402
Utah Electronics, 1123 E. Franklin St., Huntington, Ind. 46750
U Test M Mfg., 4325 W. Lincoln, Milwaukee, Wis. 53219
United Transformer, 150 Varick St., New York, N.Y. 10013
University Loudspeakers Div., Ling Temco Vought, 9500 W. Reno St., Oklahoma City, Okla.
Up Right Towers, 1013 Pardee St., Berkeley, Calif. 94710
Utah Radio & Service Corp., 1123 E. Franklin St., Huntington, Ind. 46750
Utica Drop Forge & Tool, 2415 Whitesboro, Utica, N.Y. 13502
Utica Electronic Communications, 2714 W. Irving Pk., Chicago, Ill. 60618

V

V-M Corp., Territorial Rd., Benton Harbor, Mich. 49022
Vaco Products, 510 N. Dearborn, Chicago, Ill. 60610
Valley TV Tuner Service, 5641 Cahuenga Blvd. N., Hollywood, Calif. 90028
Vector Electronic, 1100 Fowler St., Glendale, Calif.
Victoreen Instrument, 5806 Hough Ave., Cleveland, Ohio 44103

Vidaire Electronics, 365 Babylon Tpk., Roosevelt, L.I., N.Y. 11575
Video Industries Co., 242 Madison Ave., Port Chester, N.Y. 10573
Viking Cable Co., 400 9th St., Hoboken, N.J. 07030
Viking of Minnesota, 9600 Aldrich St., Minneapolis, Minn.
Viking Electronics, 830 Monroe, Hoboken, N.J. 07030
Vitramon Inc., Box 544, Bridgeport, Conn. 06601
Vocaline Co. of America, 133 Colter St., Old Saybrook, Conn. 06475
Volkswagen of America, 476 Hudson Terrace, Englewood Cliffs, N.J. 07632

W

Waber Electronics, 200 N. 2nd St., Philadelphia, Pa. 19106
Walco Electronics, 60 Franklin St., East Orange, N.J. 07017
Waldom Electronics, 4625 W. 53rd St., Chicago, Ill. 60623
Wall Mfg. Co. P, Grove City, Pa. 16127
Waller Corp., Crystal Lake, Ill. 60014
Wallin-Knight Industries, 3321 McKinley St. N.E., Minneapolis, Minn. 55108
Walsco Electronics, S. Wyman St., Rockford, Ill. 61101
Ward Leonard Electric, 115 McQueston Pkwy., Mt. Vernon, N.Y.
Ward Products, Edsom St., Amsterdam, N.Y. 12010
Weathers Industries, 66 E. Gloucester Pike, Barrington, N.Y. 08007
Webcor Inc., 5626 Bloomingdale Ave., Chicago, Ill. 60639
Weller Electric, 601 Stone Crossing Rd., Easton, Pa.
Wells-Gardner, 2701 N. Kildare Ave., Chicago, Ill. 60639
Wen Products, 5810 Northwest Hwy., Chicago, Ill. 60631
Western Electric Co., Inc., 195 Bdwy., New York, N.Y. 10007
Western Tuner Rebuilders, 1140 N. Vermont Ave., Los Angeles, Calif. 90029
Westinghouse Electric Radio TV Dept., Metuchen, N.J. 08840
Westinghouse Electric Corp., Tube Div., PO Box 284, Elmira, N.Y. 14902
Wilco Co., 4425 Bandini Blvd., Los Angeles, Calif. 90023
Windsor Electronics, 999 N. Main St., Glen Ellyn, Ill. 60137
Winegard Co., 3019 Kirkwood, Burlington, Iowa 52601
Wire Products Co., 1215 South Ave., Syracuse, N.Y. 13207
Workman Electronic Products, Box 5297, Sarasota, Fla. 33579
Worner Electronic, Rankin, Ill. 60960
Wuerth Tube Saver Corp., PO Box 66, Hollandale, Fla.
Wurlitzer Co., N. Tonawanda, N.Y. 14150

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