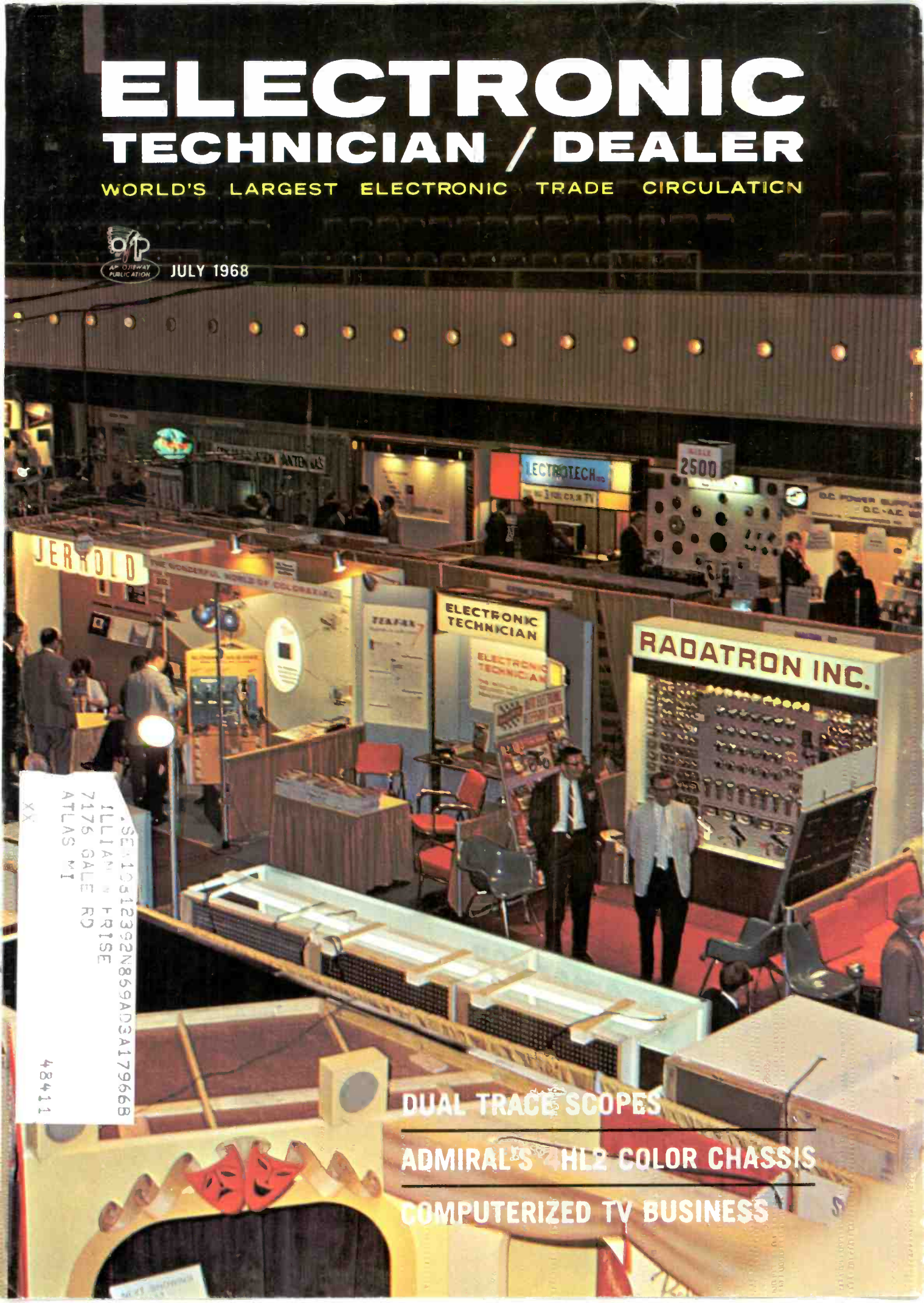
ELECTRONIC TECHNICIAN / DEALER

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

AP OTTAWAY PUBLICATION

JULY 1968



DUAL TRACE SCOPES

ADMIRAL'S HL2 COLOR CHASSIS

COMPUTERIZED TV BUSINESS

breakthrough

B&K Model 1450 first and only service-designed oscilloscope with "intermittent analyzer" and "electronic memory"

That elusive intermittent . . . how many hours have you spent trying to locate the source of the problem—how much time was wasted testing each circuit when you could have been doing more productive work? Now, B&K know-how and engineering genius have come through for you.

Result . . . the intermittent analyzer in the Model 1450 Diagnostic Oscilloscope. It will tell you *if* and *where* an intermittent occurs—even without your being there! The electronic memory will keep the intermittent indicator "on" until you return. Think of the time and money it saves.

The easiest to use 'scope ever built, its unique screen gives error-free direct readings of peak-to-peak voltages—it syncs automatically at any signal level—easily displays color reference signal. Convenient for use as a vectorscope too, all inputs and controls are on the front panel.

Deluxe in every respect, the 1450 is another B&K innovation that will make your time more profitable in solid state and color TV service. Years-ahead planning for present and future use . . . the best-value all-around 'scope you can buy. With probe. Net, **$279.95**

INTERMITTENT MONITOR. Designed to supplement the indicators on the 1450, this plug-in monitor can be placed anywhere in your shop. It flashes and buzzes when an intermittent occurs . . . and projects a professional image to your customer. Net, **$24.95**

DIAGNOSTIC
OSCILLOSCOPE

B&K Division of Dynascan Corporation
1801 W. Belle Plaine Avenue • Chicago, Illinois 60613

B&K

Where Electronic Innovation Is A Way Of Life

. . . for more details circle 101 on postcard

ELECTRONIC TECHNICIAN / DEALER

TEKFAX

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

GROUP 191

	SCHEMATIC NO.		SCHEMATIC NO.
AIRLINE Color TV Models GEN-12078A, GEN-12448A, GEN-17148A, GEN-17158A	1165	SILVERTONE TV Models 81401, 411, 421	1167
GENERAL ELECTRIC TV Chassis AC	1164	TRUETONE TV Model 2DC3819	1168
HOFFMAN Color TV Chassis 913-000366, 386	1166	ZENITH TV Chassis 14Y21, Z	1169

1164
GENERAL ELECTRIC
TV Chassis AC

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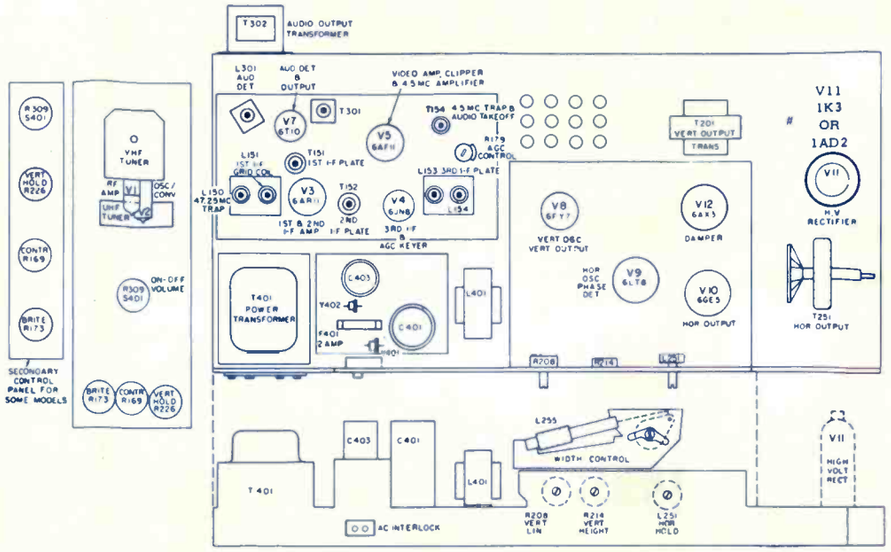
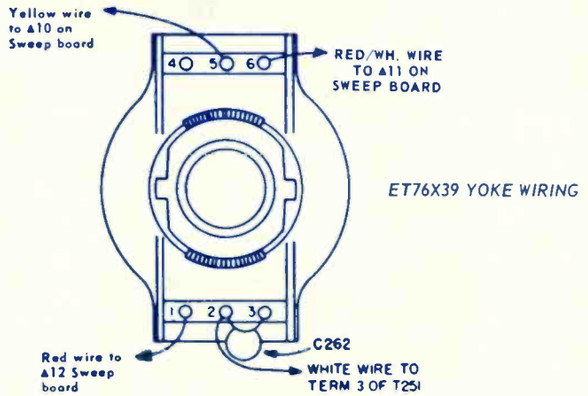
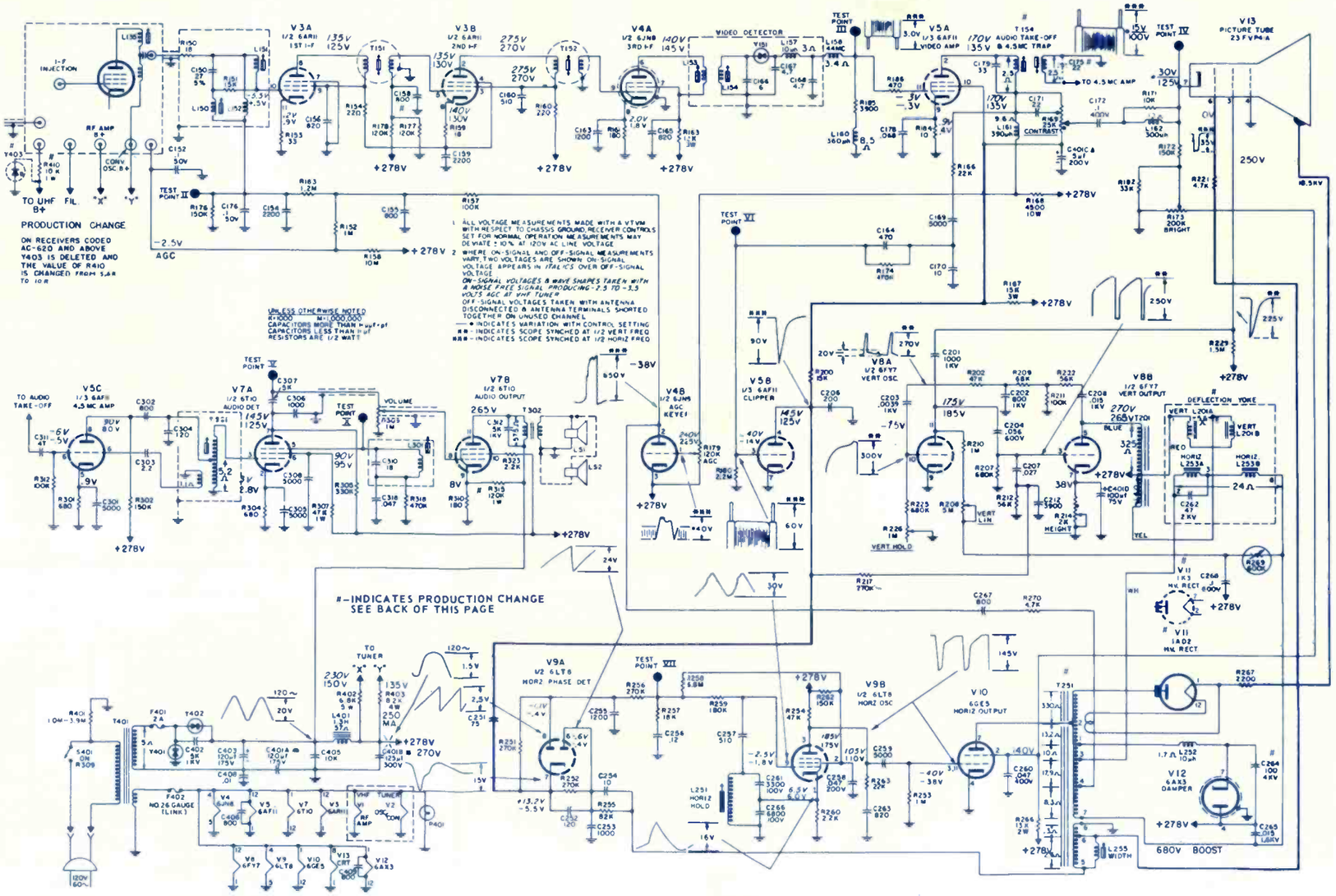


TUBE AND ADJUSTMENT LOCATIONS



ET76X39 YOKE WIRING

SYMBOL DESCRIPTION	GEN. ELECTRIC PART NO.
R163 — 12K 10% 7w gloss	ET14X104
R167 — 15K 10% 3w gloss	ET14X145
R168 — 4.5K 10% 10w WW	COMMON
R269 — 600K 25% thermistor	ET14X192
R403 — 8.2K 10% 7w gloss	ET14X142
R169 — 25K w/stop @22K contrast	ET49X518
R173 — 200K 20% bright	ET49X516
R179 — 120K 30% AGC	ET49X608
R208 — 5M 30% vert lin	ET49X519
R214 — 2K 10% vert height	ET49X604
R226 — 1M 20% vert hold	ET49X517
R309 — 1M volume w/push-pull Switch S401	ET49X386
C401A — 120μf +100—10% @175v	ET31X237
C401B — 125μf +100—10% @300v	
C401C — 5μf +100—10% @200v	
C401D — 100μf +100—10% @75v	
C257 — 510pf 5% 500v mica	ET19X86
C264 — 100pf 10% 4kv N1600 cer	ET18X600
C264 — 120pf 10% 4kv N1600 cer	ET18X519
L150 — 47.25MHz trap w/core coil	ET36X742
L151 — 1st IF grid w/core coil	ET36X682
L152 — choke IF coupling coil	ET36X837
L153 — 3rd IF plate w/core coil	ET36X586
L154 — video det secondary coil w/core	ET36X587
L201, 253 — deflection yoke w/wires	ET76X51
L201, 253 — deflection yoke less centering ring and retainer	ET76X39
L251 — horiz osc coil w/core	ET35X51
L252 — damper choke coil 10μh 10%	ET36X105
L301 — audio det coil w/core	ET36X732
L401 — B+ filter 1.2hy reactor	ET63X58
T151 — 1st IF plate xformer w/core	ET61X158
T152 — 2nd IF plate xformer w/core	ET61X148
T154 — audio take-off & 4.5MHz trap xformer w/cores	ET36X684
T154 — audio take-off xformer 4.5MHz trap w/cores	ET36X854
T201 — vert output xformer	ET64X99
T251 — horiz output coil w/cap & lead	ET77X96
T251 — horiz output coil w/cap & lead	ET77X108
T301 — 4.5MHz interstage coil w/core	ET36X778
T302 — audio output xformer	ET64X90
T401 — power xformer	ET88X79
fast blo 2 amp 250v F401 fuse	ET10X41
horiz raster correction (blue mark) magnet	ET42X44
tuner UHF	ET85X54
UHF tuner (replace w/ET85X54)	ET85X57
VHF tuner	ET86X267



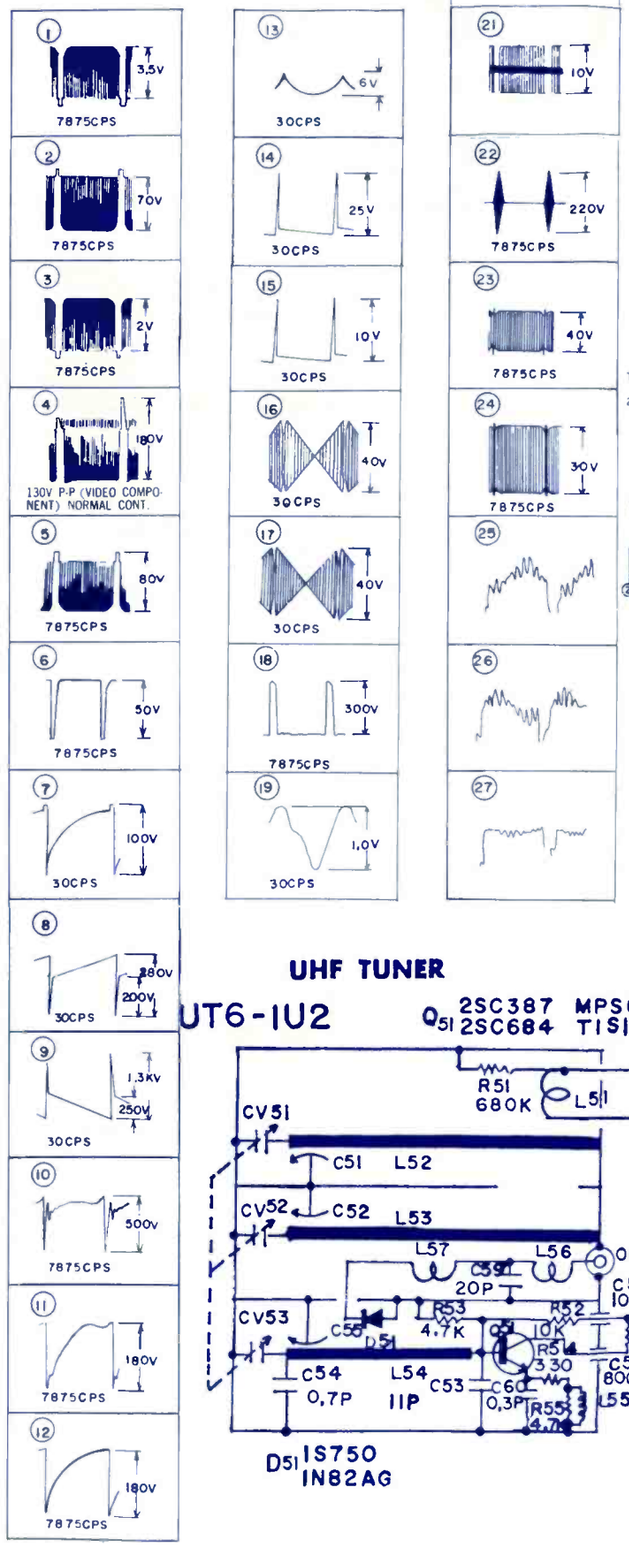
1165
AIRLINE
Color TV Models
GEN-12078A, 448A,
GEN-17148A, 58A

ELECTRONIC TECHNICIAN / DEALER **TEKFAX**

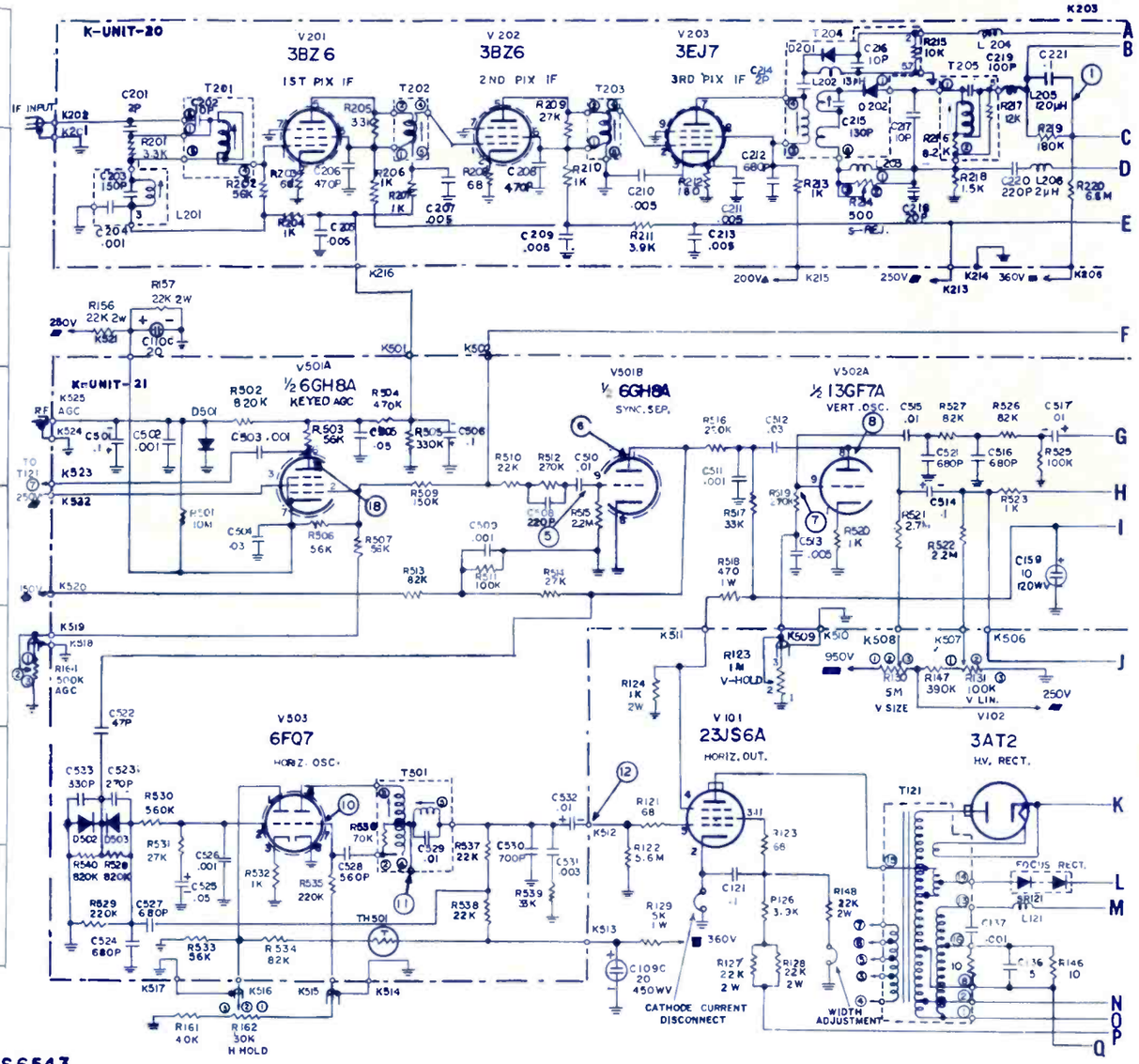
COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 6 NEW SETS

JULY • 1968

WAVEFORM DIAGRAMS



SYMBOL	DESCRIPTION	AIRLINE PART NO.
C107A, C107B		
C108A, C108B	100µf/100µf @450v elect	TV32131
C109A, C109B, C109C	60µf/60µf/20µf @450v elect	TV32135
C110A, C110B,		
C110C, C110D	20µf/20µf/20µf/20µf/ @450v elect	TV32114
C241, C242, C243	.002µf 500v dual discap	TV3484
C528	560pf 750v 10% film mica	TV3195
C530	700pf 500v 5% tubular mica	TV3196
C531	.003µf 400v 10% tubular oil	TV33261
R102	6Ω 30w 10% resin	TV23100
R105	850Ω 20w 10% resin	TV23114
R122	5.6M ½w 10% carbon	CB1556
R132	60M 5000v 10% special	TV2351
R153	12K 4w 10% carbon	TV2338
R160	4K 5w 10% carbon	TV23118
R211	3.9K 4w 10% carbon	TV23120
R123	1M pot. vert hold (8V-172)	TV2575
R130	5M pot vert size (9V-103)	TV25203
R131	100K pot vert lin (9V-104)	TV25204
R137	500K pot HV adjust (8V-069)	TV25170
R142	10K pot pincushion (8V-098)	TV25198
R151	1K pot bright (9V-101)	TV25201
R152	500Ω pot contrast (8V-171)	TV25141
R154	1.5K pot color (8V-055) GEN-12078A & GEN-12448A	TV25137
R154	1.5K pot color (8V-068) GEN-17148A & GEN-17158A	TV25186
R155	1.5K pot tint (8V-055) GEN-12078A & GEN-12448A	TV25137
R158	500K pot volume w/on-off SW-101 Switch (9V-100UL)	TV25200
R162	30K pot horiz hold (8V-099)	TV25199
R164	500K pot AGC (9V-105)	TV25205
R214	500Ω pot sound reject (8V-095)	TV25195
R720	2K pot X demodulator balance (8V-096)	TV25196
R724	2K pot Z demodulator balance (8V-096)	TV25196
R801	150Ω pot B-2 (8V-034)	TV25134
R804	60Ω pot RG-4 (8V-032)	TV25132
R808	120Ω pot RG-A1 (8V-033)	TV25133
R809	30Ω pot B-A (8V-031)	TV25131
R811	60Ω pot RG-T1 (8V-032)	TV25132
R905	500K pot picture tube bias (8V-059)	TV25140
R906	5K pot green drive (8V-057)	TV25138
R911	1M pot green screen (8V-058)	TV25139
L101	coil ADC (2TL-915)	TV61351
L102	coil power choke (9T-177)	TV11162
L121, L122	coil snivet (TL-601)	TV61175
L123	coil horiz efficiency (2TL-904)	TV61344
L201	coil 47.25MHz trap (TIF-336)	TV62336
L206	coil peaking (TL-297)	TV61403
L208	coil delay line (2TL-936)	TV61405
L212	coil 1st sound IF (TIF-341)	TV62341
L213	coil quad (TIF-546)	TV62346
L701	coil chroma take-off (2TL-945)	TV61445
L702	coil series resonance (2TL-946)	TV61446
L703	coil chroma peaking (2TL-200)	TV61400
L901	coil video peaking (2TL-205)	TV61407
T101	xformer power (5T-186)	TV11187
T121	xformer horiz output (8FT-625)	TV11185
T122	xformer focus (2TL-908)	TV61348
T124	xformer pincushion (9T-199)	TV11189
T151	xformer audio output (7T-167) GEN-12078A & GEN-12448A	TV1185
T151	xformer audio output (7T-171) GEN-17148A & GEN-17158A	TV11171
T152	xformer vertical output (8T-182)	TV11145
T181	xformer convergence yoke (TL-82)	TV61299
T201	xformer 1st PIX IF (TIF-337)	TV62337
T202	xformer 2nd PIX IF (TIF-338)	TV62338
T203	xformer 3rd PIX IF (TIF-339)	TV62339
T204	xformer video detector assembly (2TL-935)	TV61435
T205	xformer 4.5MHz trap (TIF-340)	TV62340
T206	xformer 2nd sound IF (TIF-342)	TV62342
T501	xformer horiz osc (2TL-942)	TV61442
T701	xformer burst (2TL-947)	TV61447
T702	band pass xformer (2TL-944)	TV61444
T703	phase xformer (2TL-943)	TV61443
T801	control B-1 xformer (2TL-950)	TV61450
M101, M102	filter (2TL-951)	TV61451
SR101, SR102	power rectifier (S1-Rect-56)	TV24236
SR121	focus rectifier (Selen-32)	TV24165
SR122	boosted boost rectifier (S1-Rect-44)	TV24167
TH501	thermistor	TV24231
Y701	crystal 3.58MHz (Crystal-800)	TV24228
F101	fuse 4 amp 125v pigtail (slo-blo)	315004
	VHF tuner	PT5-HU2W & PT5-5U2W
M1, M2	Capristor (PRC-365)	TV3465
	UHF tuner	UT6-1U2
Q51	transistor 2SC387 osc	TV24387

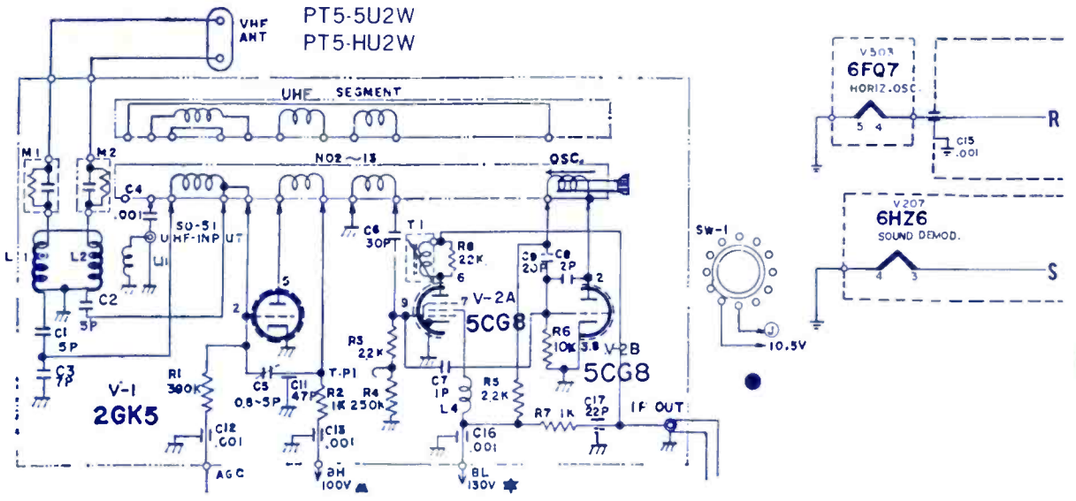


UHF TUNER

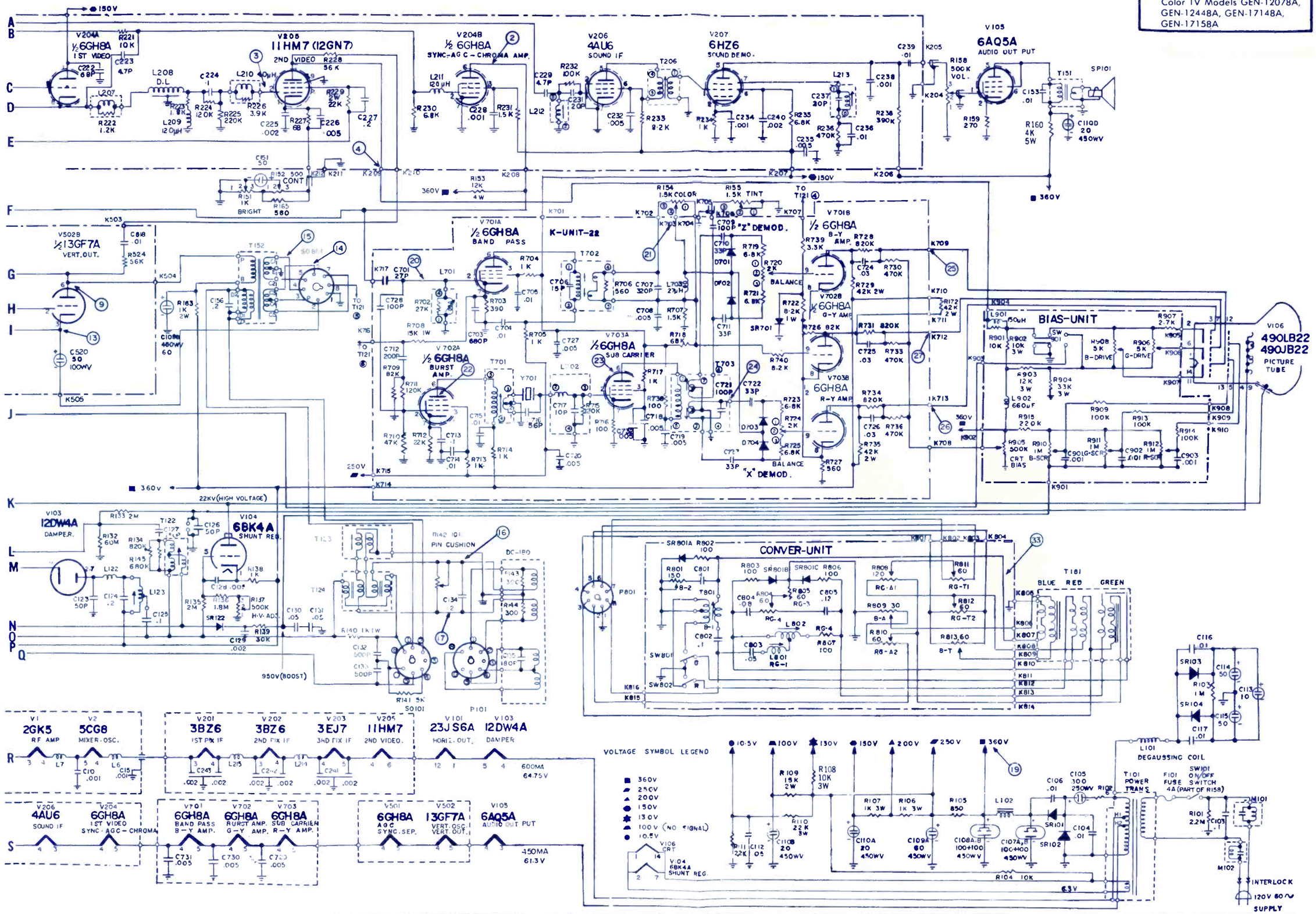
UT6-1U2 Q_{51} 2SC387 MPS6543 2SC684 TIS18

VHF TUNER

PT5-5U2W
PT5-HU2W



AIRLINE
Color TV Models GEN-12078A, GEN-12448A, GEN-17148A, GEN-17158A



ELECTRICAL SPECIFICATIONS

ANTENNA INPUT IMPEDANCE	300 ohms balanced
CONVERGENCE	Magnetic
FOCUS	Electrostatic
AUDIO POWER OUTPUT RATING	1.0 watts max.

INTERMEDIATE FREQUENCIES

Picture I-F Carrier Frequency	45.75 Mc.
Sound I-F Carrier Frequency	41.25 Mc.
Color Sub-Carrier Frequency	42.17 Mc. (Nominal)

PICTURE SIZE	Approx. 171 sq. in.
POWER INPUT	120 volts AC, 60 cycles
POWER RATING	340 watts total
SPEAKER SIZE	2¾" × 4⅝" PM, 1.0 oz. Mag.

VOICE COIL IMPEDANCE	8.0 ohms @ 400 cycles
SWEEP DEFLECTION	Magnetic
TUNING RANGES	
VHF-Channels 2 thru 13	
UHF-Channels 14 thru 83	

1166

HOFFMAN

Color TV Chassis
913-000366, 386

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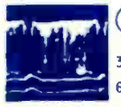
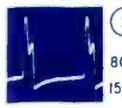
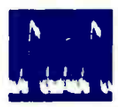
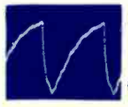
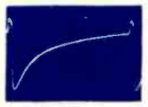
SYMBOL	DESCRIPTION	HOFFMAN PART NO.
C101, 102	530pf 10% 2.5kv N2200	035-043600
C103	100pf 5% 3kv (part of yoke)	
C105, 108	.01µf +80 −20% 1.4kv cer	837-103896
C107	130pf 20% 6kv cer N2200	035-033300
C109A	dual paper (matched pair)	047-018700 &
B	.022µf and .033µf 10% .6kv	047-018900
C110	22pf 20% 1kv cer N750	882-220726
C113	68pf 10% 4kv cer N1500	886-680017
C116	.0033µf 10% 2kv paper	046-019800
C118A	80µf 450v	
B	30µf 450v	
C	20µf 450v elect	034-025900
D	40µf 150v	
C124A	80µf 450v	
B	50µf 450v	
C	20µf 250v elect	034-019200
D	50µf 50v	
C136A	80µf 450v	
B	2µf 350v elect	034-025800
C	25µf 25v	
C147	.03µf GMV 50v cer	835-303406
C309, 310	.001µf +100 −0% 1kv tubular	858-102706
C514	.0082µf 20% 1kv paper	046-015700
C524	680pf 5% .5kv mica	045-007300
C714, 715, 740, 741	330pf 5% .5kv mica	045-007200
C728	200pf 5% .5kv mica	045-008500
L105, 106, 109, 110, 111	coil reactor 5.6µh	111-021200
L107	coil filter choke	032-002600
L108	coil peaking 72µh	111-021500
L112, 115	coil peaking 390µh	111-021800
L114	coil vert pincushion phase	111-032400
L116, 117	coil degaussing	111-032600
L201	coil snd take-off	109-029700
L202	coil snd det	109-029900
L301	coil 47.25MHz trap	109-022200
L303	coil 1.8µh	111-021000
L305	coil 12µh	111-021300
L306	coil 4.5MHz trap	109-023400
L310	coil peaking 620µh	111-022800
L311	coil peaking 680µh	111-021900
L501A, B	coil horiz sine wave freq	109-021600
L512	coil 5.6µh RF reactor choke	111-021100
L701	coil chroma take-off	111-023500
L702	coil reactance	111-023700
L703	coil peaking 10µh	111-022700
L708	coil peaking 62µh	111-022600
L709	coil reactor 120µh	111-021400
L710	coil horiz eff	111-032300
L802	coil red/grn rt horiz lines	111-031700
L803	coil blue horiz shape	111-031900
T101	xformer focus	111-032200
T102	xformer horiz output	033-013000
T103	xformer audio output	031-009400
T104	xformer vert output	033-010300
T105	xformer power	033-011900
T107	xformer vert pincushion phase	033-010400
T201	xformer snd IF	109-029800
T301	xformer grid 1st pix IF	109-022100
T302	xformer plate 1st pix IF	109-022400
T304	xformer 3rd pix IF	109-023300
T701	xformer bandpass	109-023100
T702	xformer burst phase	109-023600
T703	xformer 3.58MHz osc	109-024500
R101	4.7K 20% 2w (in deflection circuit)	051-823110
R106A, B	1.5M 20% 1w (matched pair)	052-000700
R109	4.7M 20% 2w	051-475221
R114	13K 10% 7w fixed film	054-135710
R117	3.3K 10% 3w fixed film	054-332310
R122	3.3K 10% 10w WW	053-332110
R126	680Ω 10% 4w fixed film	054-681410
R127	1.4K 10% 20w WW	053-142310
R128, 171	820Ω 10% 7w fixed film	054-821710
R132	6.8K 10% 3w fixed film	054-682310
R135	680Ω 10% 1w	051-681110
R142	10K 10% 10w WW	053-103110
R146	2.7K 10% 3w fixed film	054-272310
R149	5.6K 10% 4w fixed film	054-562410
R150	6.8K 10% 2w fixed film	054-682210
R162	1K 10% 3w fixed film	054-102310
R172	1.2K 10% 7w fixed film	054-122710
R306A, B	150K 20% ½w (matched pair)	052-000800
R330	47K 5% 2w	051-473251
R527	33K 10% 2w fixed film	054-333210
R530	110K 5% ½w	051-114551
R706	39K 5% ½w	051-393550
R716A, B, 750A, B	1M 10% ½w (matched pairs)	052-000500
R723A, B	3.9K 10% 1w (matched pair)	052-000600
R728	270Ω 10% 3w fixed film	054-271310
R732, 734, 736	27K 10% 2w fixed film	054-273210
R735	22K 10% 2w fixed film	054-223210
RT101	thermistor 1.25Ω 25% hot	057-001200
RT102	thermistor temp compensating 5Ω cold (part of yoke)	
VR101	varistor 175v 15% 1ma	057-001501
VR102	varistor 110v 10% 1ma	057-001600
VR103	varistor 20v 20% 67ma	057-001300
VR501	varistor 1.48kv 15% 10ma	057-000200
CR101	rect selenium	004-003100
CR302	diode 1N87	003-005400
CR801A, B, C, D	rect selenium	004-003700
Q101, 102	tr color caster	002-009900
SR105	rect silicon color caster	004-003500
SR501A, B	rect horiz phase	004-002900
R112	control horiz centering 10Ω	055-039100
R119A, B	control on-off volume contrast	055-054400
R120	control bright 250K	055-055800
R123	control cinema	055-056100
R130	control AGC 6K 2w	056-037800
R131	control horiz hold 35K	055-047500
R133	control vert hold 750K	055-047600
R134	control vert lin 3.4M	055-037200
R137	control height 100K	055-036600
R141	control tone	055-047100
R143	control intensity	055-055900
R144A, B	control killer/color caster	055-056200
R152	control pix tube bias 6K 2w	056-037800
R153	control blue drive 6K	055-036800
R154	control grn drive 6K	055-036700
R155	control grn screen 1.5M	055-037000
R156	control red screen 1.5M	055-036900
R157	control blue screen 1.5M	055-037100
R178A, B	control dual hi voltage adj 500K pincushion top and bot 15K	055-049500
R190	control tint	055-056000
R301	adjacent snd rej adj 10K 2w	055-037900
R315	snd rej adj 750Ω ½w	055-038000
R801	control horiz left blue #2 60Ω 3w	056-046800
R804	control vert left red/grn 150Ω 2w	056-047300
R805	control horiz left red/grn 120Ω 2w	056-047200
R814	control bot red/grn vert lines 60Ω 3w circuit breaker	056-046800
		099-002500
M101, 102	couplate 2.2M 100pf	134-039400
Y101	crystal 3.58MHz	136-000100
DL101	delay line	111-023800
F104	fuse 400ma slo-blo	099-002800
SW101	switch on-off (rear of volume control)	
SW103	switch video peaking	146-007800
	VHF tuner	006-018300
	UHF tuner	006-018400
	yoke convergence assem	027-032700
	Yoke deflection	027-032800

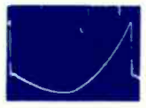


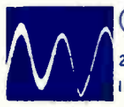


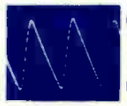


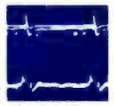


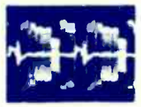


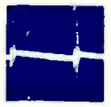


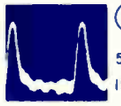


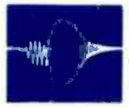


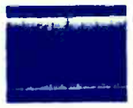


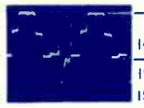


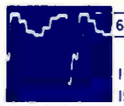


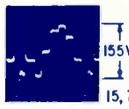


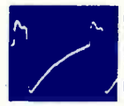


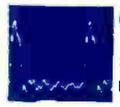












ELECTRICAL SPECIFICATIONS

ANTENNA INPUT IMPEDANCE	300 ohms balanced
CONVERGENCE	Magnetic
FOCUS	Electrostatic
AUDIO POWER OUTPUT RATING	2.5 watts max.
INTERMEDIATE FREQUENCIES	
Picture I-F Carrier Frequency	45.75 mc.
Sound I-F Carrier Frequency	41.25 mc.
Color Sub-Carrier Frequency	42.17 mc. (Nominal)
POWER INPUT	120 volts AC, 60 cycle
POWER RATING	350 watts total (70-80 watts with set "OFF", INSTANT-ON switch to "ON")
SPEAKER SIZE AND TYPE	See Parts List
SWEEP DEFLECTION	Electro Magnetic
TELEVISION R-F FREQUENCY RANGE	
All 12 television channels	54 mc. -88 mc., 174 mc. -216 mc.
Any of 70 UHF channels	470 mc. -890 mc.

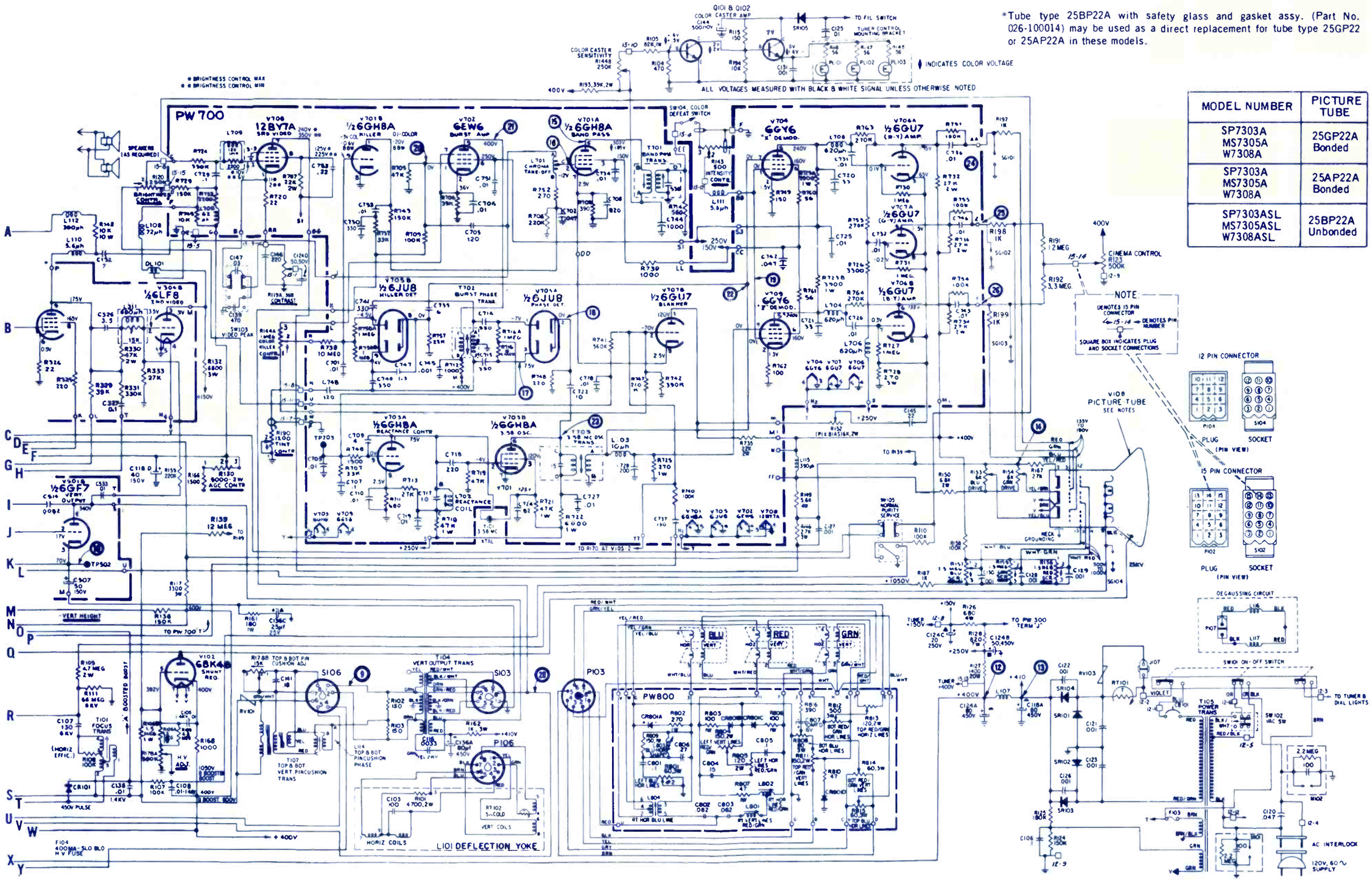
TUBE AND TRANSISTOR COMPLEMENT

V1	6HQ5	RF Amplifier
V2	6HB7	VHF Oscillator & Mixer
Q51	GMO380	UHF Oscillator-Transistor (006-018400)
Q51	S2020	UHF Oscillator-Transistor (006-018401)
V101	3A3A	High Voltage Rectifier
V102	6BK4B	Shunt Regulator
V104	6DW4B	Damper
V105	6JE6A	Horizontal Output
V108	25AP22A, 25GP22A, 25BP22A*	Picture Tube
V201	6AU6A	Sound IF Amplifier
V202	6DT6A	Sound Demodulator
V203	6BQ5	Audio Output
V301	6JH6	1st Picture IF Amplifier
V302	6GM6	2nd Picture IF Amplifier
V303	6EJ7	3rd Picture IF Amplifier
V304A&B	6LF8	1st & 2nd Video Amplifier
V501A&B	6GF7A	Vert. Osc. & Vert. Output
V502	6FQ7	Horizontal Oscillator
V503A&B	6KA8	Keyed AGC, Noise Inv., Sync. Sep.
V701A&B	6GH8A	Band-Pass Amplifier & Killer
V702	6EW6	Burst Amplifier
V703A&B	6GH8A	3.58 mc. Osc. & Reactance Control
V704	6GY6	"X" Demodulator
V705A&B	6JU8	Phase Detector & Killer Detector
V706A&B	6GU7	R-Y Amplifier & B-Y Amplifier
V707A&B	6GU7	G-Y Amplifier & Blanker
V708	12BY7A	3rd Video Amplifier
V709	6GY6	"Z" Demodulator

*Tube type 25BP22A with safety glass and gasket assy. (Part No. 026-100014) may be used as a direct replacement for tube type 25GP22 or 25AP22A in these models.

HOFFMAN
Color TV Chassis 913-000366, 386

MODEL NUMBER	PICTURE TUBE
SP7303A MS7305A W7308A	25GP22A Bonded
SP7303A MS7305A W7308A	25AP22A Bonded
SP7303ASL MS7305ASL W7308ASL	25BP22A Unbonded



1167 SILVERTONE

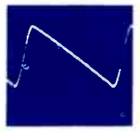
TV Models 81401, 411, 421

ELECTRONIC TECHNICIAN / DEALER TEKFAX

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

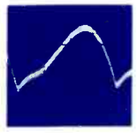
JULY • 1968

WF-1



18V P-P 30∿

WF-2



60 V P-P 30∿

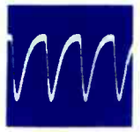
WF-3

48V P-P 30∿

WF-4

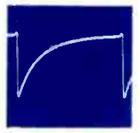
2.4V P-P 7875 ∿

WF-5



5V P-P 7875 ∿

WF-6

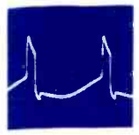


180V P-P 30 ∿

WF-7

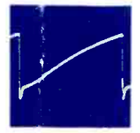
110V P-P 7875∿

WF-8



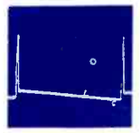
28V P-P 7875∿

WF-9



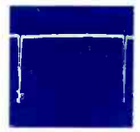
21V P-P 30∿

WF-10



1000V P-P 30 ∿

WF-11

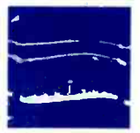


140V P-P 30 ∿

WF-12

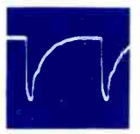
8V P-P 30∿

WF-13



70V P-P 30 ∿

WF-14



110V P-P 7875∿

SYMBOL	DESCRIPTION	SILVERTONE PART NO.
C105A,B,C,D	elect 200µf 175v (A) 300µf 175v (B) 20µf 150v (C) 20µf 150v (D)	18-186-5
C271	disc 150pf 5% 500v NPO	20-619-0
C325	disc .0068µf +80–20% 1kv Z5U	12-682874-6
C341	polyfilm 820pf 5% 500v	20-327-1
C362	disc 170pf 10% 3kv N1500	12-171566-0
C363	disc 240pf 10% 3kv N1500	12-241566-6
R101	4.5Ω 10w WW	61-191-0
R102	circuit breaker (lamp)	43-23-2
R103	300Ω 5% 10w WW	61-299-0
R104	40Ω 10w WW	61-295-0
R243	4.7K 5w	63-47251
R314	6.8M	63-68501
RC101	470pf cap and a 2.2M resistor	13-88-3
T29	audio output xformer	80-266-1
T31	vert output xformer	80-30-2
T35	assem horiz output xformer base socket R111	84-17576
T241	coil 4.5MHz trap & sound take off	10-347-1
T261	coil ratio detector	10-318-1
L33	horiz stabilizer coil	10-75-5
L102	filter choke	80-47-6
L121	yoke & plug deflection	80-49-4
L211	input & 41.25MHz trap coil	10-114-3
L221	filament coil	10-156-1
L232	peaking coil (60µh)	10-148-1
L242	peaking coil (620µh)	10-236-1
L361	choke coil (10µh)	10-124-1
D331	dual selenium diode	86-9-1
	circuit bd w/components (except tubes)	35-19100
	VHF tuner	95-500-1
	UHF tuner	95-570-4
R24	contrast 800Ω control	24-749
R27	volume on-off 1M control	24-860
R31	vert hold 2M control	24-794
R33	control horiz hold 8K	24-877
R121	bright control 3.4M	24-750
R313	vert height control 3.0M	24-817
R325	vert lin 500K control	24-816
R344	60K control horiz freq	24-828

NOTES:
1. RESISTANCE IS SHOWN IN OHMS K 1,000 MEG 1,000,000.
2. ALL RESISTORS 1/2 WATT, UNLESS OTHERWISE NOTED.
3. CAPACITANCE VALUES ARE MFD, UNLESS OTHERWISE NOTED.
4. VOLTAGES READ WITH "VTVM" FROM POINT INDICATED TO CHASSIS GROUND TUNER ON UNUSED CHANNEL, CONTRAST & BRIGHTNESS AT MINIMUM, -4.5 VOLTS BIAS ON AGC LINE ON TEST POINT (B), OTHER CONTROLS AT NORMAL LINE VOLTAGES 120 VOLTS, ANTENNA TERMINALS SHORTED TOGETHER, BUT NOT TO GROUND.
5. ALL WAVEFORMS MEASURED WITH STRONG SIGNAL INPUT AND WITH CONTRAST SET TO GIVE NORMAL PICTURE, AGC LINE OPERATING NORMALLY.
6. J1, J2 ETC. INDICATE CONNECTION TERMINALS ON CIRCUIT BOARD.
7. VOLTAGE TOLERANCES ±20%.

***Picture Tube 23HFP4 – 23 HFP4A

ELECTRONIC TECHNICIAN / DEALER **TEKFAX**

JULY • 1968

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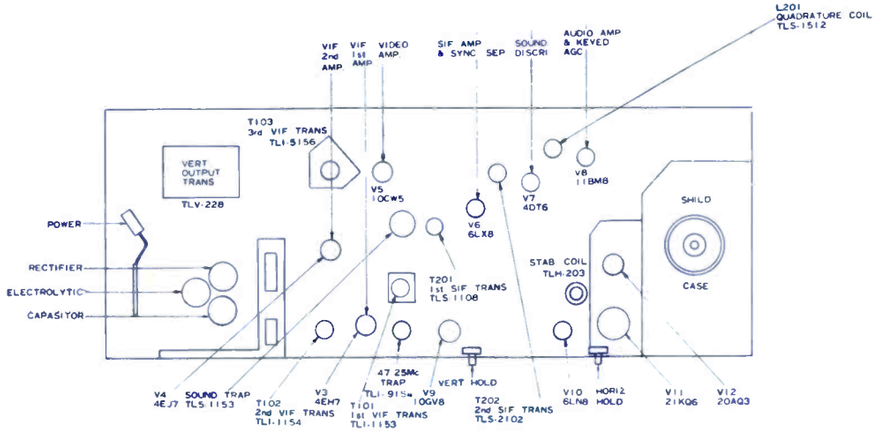
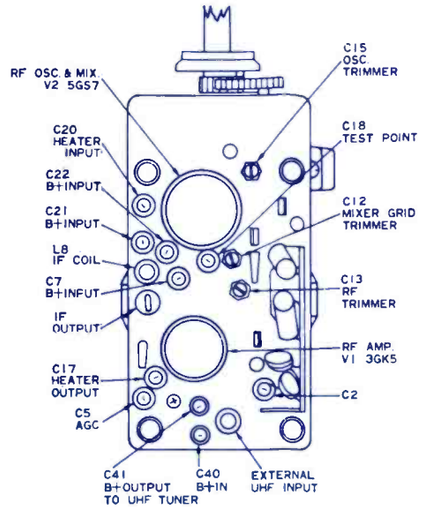
TRUETONE
TV Model 2DC3819

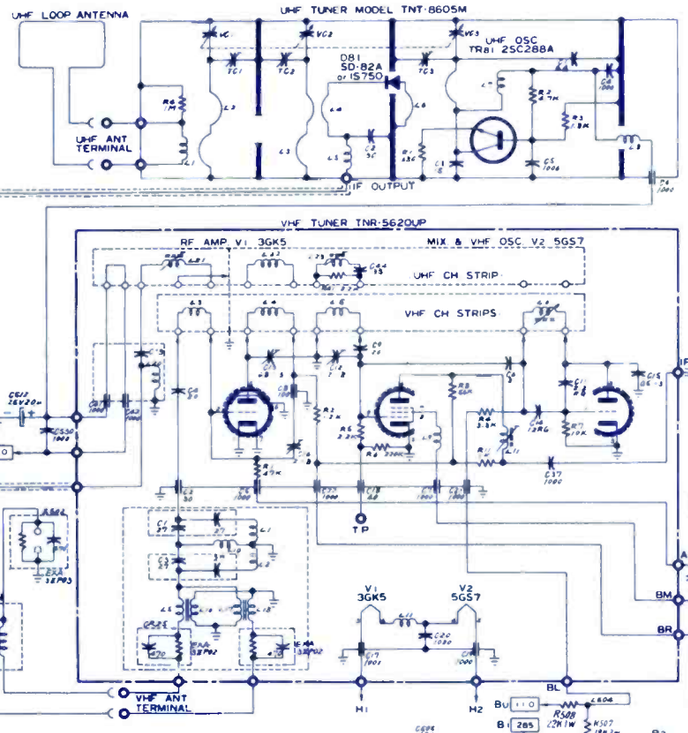
COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 6 NEW SETS

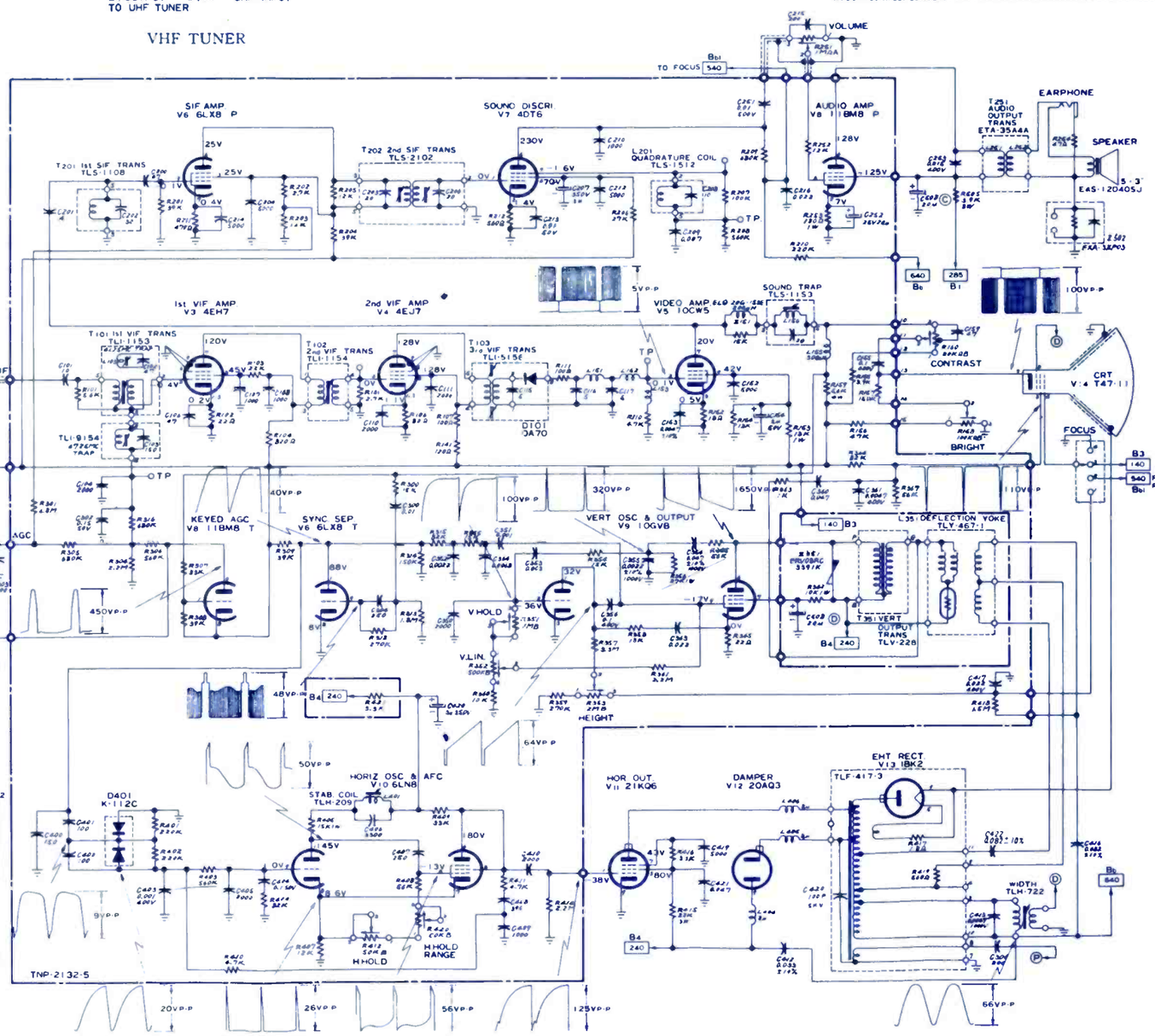




VHF TUNER

SYMBOL	DESCRIPTION	TRUETONE MODEL PART NO.
R159	metal oxide 5.6K ±10% 3w	ERG-3PSK562
R415	metal oxide 22K ±10% 3w	ERG-3PSK223
R417	1.8Ω ±10% WW ½w	ERW-12LK1R8
R501	fusible 4.7Ω 10% 10w	ERU-10P4R7
R502	18Ω ±10% 6w	ERM-6P180
R503	1.8K ±10% 20w WW	ERM-20H182
R504	220Ω ±10% 20w WW	ERM-20H221
R505	3.9K ±10% 8w WW	ERM-8P392
C207	elect 3µf 350v	ECE-C350V3
C413	.0047µf ±10% 1kv paper	ECN-X10472K
C503	elect 200µf 200v	ECE-M200H200C
C507	elect 200µf 350v	ECE-M350V200A
C508	elect 150µf ±20% 350v	ECE-M350VBX2A
	1st IF trans	TLI-1153
	2nd IF trans	TLI-1154
	VIF det trans	TLI-5156
	47.25MHz trap coil	TLI-9154
	4.5MHz trap coil	TLS-1153
	1st IF trans	TLS-1108
	2nd IF trans	TLS-2102
	SIF det trans	TLS-1512
L151	peaking coil	TLQ-100-999
L152	peaking coil	TLM-053-999
L153	peaking coil	TLE-351-999
L501	peaking coil	TPLQ-201D999F
L405	peaking coil	TLM-080-999
L401	horiz stabl coil	TLH-209
	horiz width	TLH-722
	flyback trans	TLF-417-3
	vert output trans	TLV-228
	audio output	ETA-35A4A
L502	filter coil	TLP-412
	transistor	TVS-2SC288A
	deflection yoke	TLY-467-1
R158	control brightness	EVV-M0AL26B15
R251	control SW & volume	EVC-B08L26A16
R351	vert hold control	EVD-06AS20B16
R352	vert lin control	EVT-V0AA00B55
R353	vert height control	EVT-V0AA00B26
R412	horiz hold control	EVD-06AS20B54
R420	horiz hold range control	EVT-V0AA00B54
R160	contrast control	EVE-DDAL26B24





(NOTES)

1. RESISTANCES ARE SHOWN IN OHMS: K=1000, M=1,000,000.
2. CAPACITANCE VALUES LESS THAN (1) ARE IN MFD AND MORE THAN (1) IN MMFD UNLESS OTHERWISE NOTED.
3. COIL RESISTANCE VALUES LESS THAN (1) OHM ARE NOT SHOWN.
4. NUMERALS AT CONTROLS TRANSFORMERS INDICATE NUMBER OF THOSE TERMINALS.
5. D.C. VOLTAGES ARE READ WITH VACUUM TUBE VOLT METER AND ALL CONTROLS SET FOR NORMAL PICTURE; NO SIGNAL INPUT.
6. ALL WAVEFORMS ARE PEAK TO PEAK VOLTAGE WHEN VIDEO INPUT IS SET TO 5Vp-p AND CONTRAST, BRIGHTNESS CONTROLS ARE SET FOR MAXIMUM.
7. NUMERALS BESIDE SUPPLY VOLTAGES INDICATE NUMBER OF THOSE SUPPLY POINTS ON SCHEMATIC.
8. MARKS —③— INDICATE JUNCTION POINT OR TERMINAL OF THE PRINTED CIRCUIT BOARD, TUNER & FBT.

1169

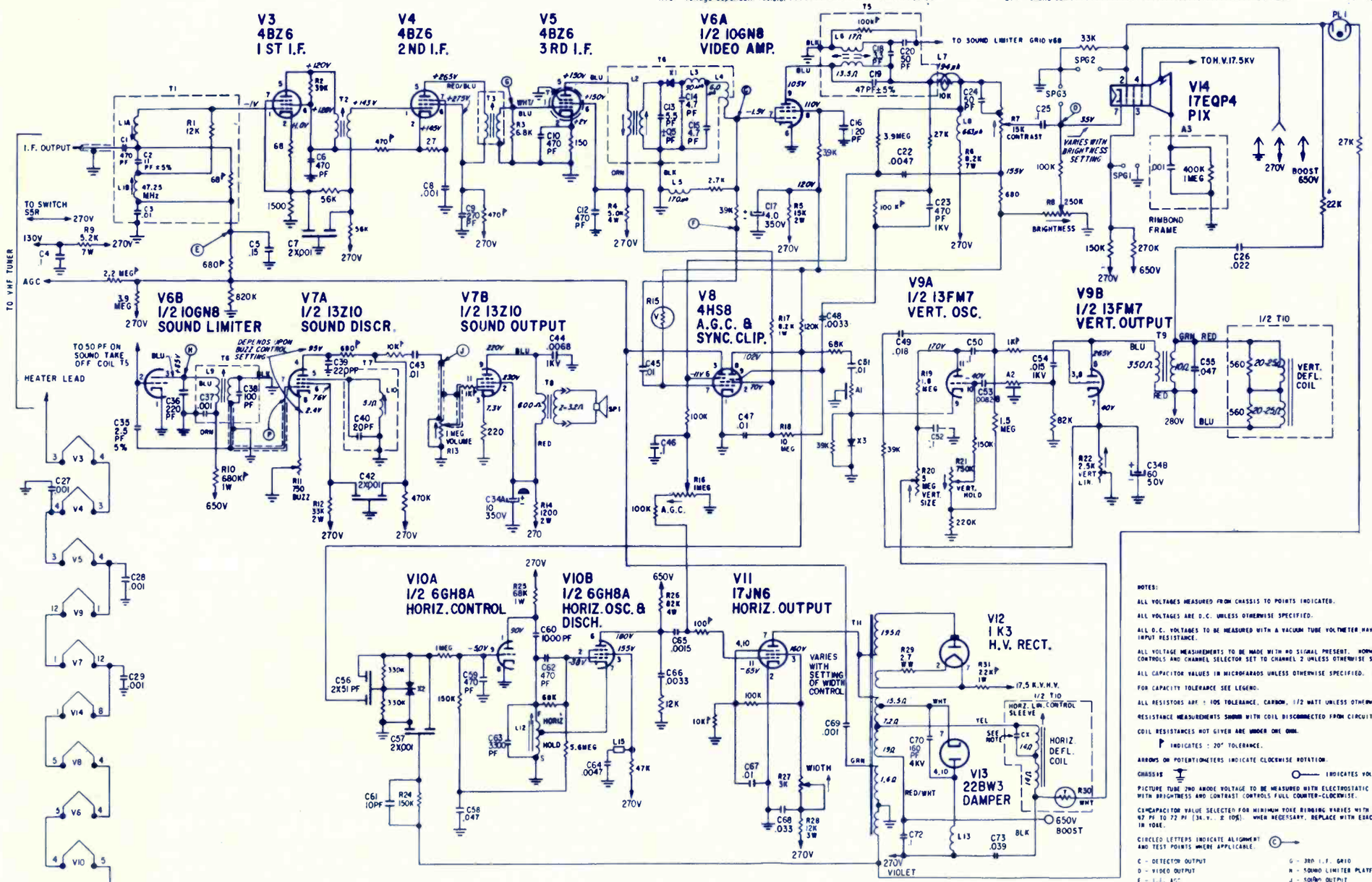
ZENITH
TV Chassis 14Y21, Z

ELECTRONIC TECHNICIAN / DEALER TEKFAX

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

JULY • 1968

SYMBOL	DESCRIPTION	ZENITH PART NO.
C7	2 x .001µf disc ±10% 500v	22-21
C34A	10µf elect 350v	
C34B	60µf elect 50v	22-4503
C34C	150µf elect 350v	
C34D	100µf elect 350v	
C36	220pf mico cap ±10% 500v	22-2926
C38	100pf mico ±10% 500v	22-5106
C56	2 x 51pf disc ±15% 500v	22-25
C58	.047µf molded 100v	22-3627
R7	15K contrast control	
R8	250K brightness control	63-5033
R11	750Ω buzz control	63-5408
R13	1M vol control	63-6961
R15	voltage dependent resistor	63-5314
R20	5M vert size control	63-5030
R21	750K vert hold control	63-5032
R22	2.5K vert lin control	63-5029
R24	150K t.r.c. only 10% ½w	63-4844
R30	thermistor supplied with yoke	63-6331
L3	det series peaking coil	20-2013
L4	choke coil	20-2004
L5	det shunt peaking coil	20-2014
L6	snd take-off wind assy (part of T5)	S-58348
L8	video shunt peaking coil	20-2017
L10	quad coil wind assy (part of T7)	S-45229
L11	filter choke	95-2039
L12	horiz osc coil	S-56875
L13	spook coil	20-2005
L14	choke coil	20-1260
L15	iron core	149-333
T1	1st IF & trap coil assy	S-63533
T2	2nd IF xformer	S-65172
T3	3rd IF xformer	S-57624
T4	4th IF xformer	S-69988
T5	snd take-off coil	S-73791
T6	intercarrier coil	S-73789
T7	quad coil	S-77405
T8	snd output xformer	95-2144
T9	vert output xformer	95-2564
T10	yoke	95-2157
T11	horiz sweep xformer	S-75306
A1	integrator unit	87-4
A2	integrator unit	87-7
A3	R/C network	105-79



NOTES:

ALL VOLTAGES MEASURED FROM CHASSIS TO POINTS INDICATED.

ALL VOLTAGES ARE D.C. UNLESS OTHERWISE SPECIFIED.

ALL D.C. VOLTAGES TO BE MEASURED WITH A VACUUM TUBE VOLTMETER HAVING 11 MEGOHM INPUT RESISTANCE.

ALL VOLTAGE MEASUREMENTS TO BE MADE WITH NO SIGNAL PRESENT. NORMAL SETTING OF CONTROLS AND CHANNEL SELECTOR SET TO CHANNEL 2 UNLESS OTHERWISE SPECIFIED.

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MFT-3	41.25 mc Sound 45.75 mc Video	2GK5	5CG8	Series 600 MA

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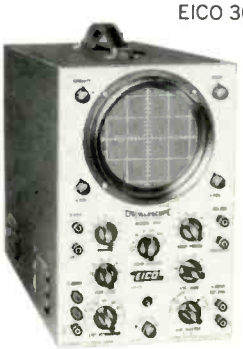

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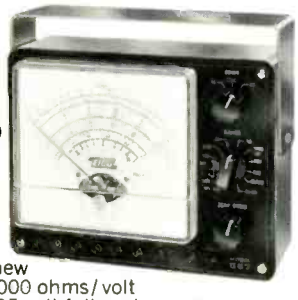

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JULY 1968 • VOL. 88 No. 1

COVER

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ET/D EDITOR'S MEMO

The 'Unemployables'

We hear a lot of griping these days from business and industry about the lack of skilled technicians.

There is a possible cure for some of this shortage — the hiring and training of the so-called "hard-core unemployables." There are plenty of them around: President Johnson places the figure at 1.3 million.

Perhaps as a businessman and employer you are not concerned about this problem. The government is concerned; it has asked for 2.1 billion dollars to finance programs to help the hard-core unemployed. Maybe that wakes you up. It should — the money is going to come out of your pocket, so let's face the facts.

Why not take the initiative as a few (very few) companies have. Hire and train some of these "hard-core unemployables." Some TV-radio service-dealers provide on-the-job training for high school students who attend school mornings and work the rest of the day. Many of these apprentices work as full-time technicians at the completion of school, some continue on to become engineers.

Why not a similar program for the uneducated man from a poor family or one of the handicapped?

How does a high school drop-out with little education from a poor family get into a skilled trade? He either goes to school, which he can't afford, or he goes to work as an apprentice — *if* he is given the chance.

One TV-radio service-dealer we visited had hired a handicapped man as a bench technician. The man was crippled, but skilled with his hands and his head. A man doesn't have to be able to run the mile to be a good technician — he does need a job, a chance to become a productive member of society.

A good example of this is the true story of a Negro who recently called a radio station over which people could voice their opinions. He said, "I'm in a telephone booth, my wife is a diabetic, I don't even have shoes, and I want a job." He had been on welfare for months and was fed up with handouts. He made the call in desperation — thousands of people heard it. The next day he had a job. His new boss says he's a good worker; the man's future is much brighter. But, he would still be one of the unemployables if someone hadn't heard his plea and given him the chance to work.

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ET/D LETTERS TO THE EDITOR

Scope Schematic

I need a schematic and manual for an Eico scope, Model 400. I have tried everywhere — maybe one of your ET/D readers has information on this unit.

PETER J. GOLUMBUS
64 Coolidge St.
Irvinton, N.J. 07111

Need Obsolete Cartridge

I am in desperate need of an obsolete cartridge head for a Markel No. 75 changer phonograph. The cartridge is listed as an Astatic MDL, MD-1 or MD-5. It uses a set of two needles. Astatic N39-1D. Greatly appreciate help from any ET/D reader.

GRAHAM HOLZHAUSEN
New York, N.Y.

Collector's Item

I have a Precision Electrometer, series 600. It is a tube analyzer and volt-ohm-milliammeter of 1936 vintage in good working condition. If an ET/D reader is interested in this unit or sealed tubes of the same year, I can be contacted by mail or telephone.

GEORGE WARSHOWER
586 Remsen Ave.
Brooklyn 36, N.Y.

Service in Australia

Perhaps an ET/D reader can help me, since it is read by many service technicians. I am leaving for Australia this summer with hopes of starting a TV service business there. I have about 20 years' experience in TV and radio. I would like to correspond with any ET/D readers who could give me some first-hand information about the opportunities, taxes, licenses, types of equipment and problems of starting a business there. I would also appreciate knowing of a parts wholesale and/or retail trade.

HENTRY SOMMERS
420 S. Broadway
Hicksville, N.Y. 11801

Triumph Scope Manuals

The Model 840 Triumph scope was designed by my father in 1941. He wrote the manuals for it and assisted in its construction for the Triumph Mfg. Co., which was located in Chicago. The company went out of business shortly after the war. We still

have a good supply of manuals for the scope models 840, 841, 830 and Navy Model OBL3, CTU60018 and other Triumph units. If any ET/D reader is interested, we will supply the 840 manual for $2 and send it postage paid upon receipt of check or money order. We will supply any other Triumph manual at the original manufacturer's cost or photostats if necessary, at a minimal additional charge. The manuals include parts lists.

HENRY F. KENNEDY
6554 W. Imlay
Chicago, Ill. 60631

Wants an Injection

When is ET/D going to have schematics of electronic organs, transistor radios, garage door openers, AM-FM stereo sets, reverberation equipment, CB and marine units, solid-state TV and other needed schematics?

I made a survey of 7 recent issues of ET/D only to find that TV has monopolized the schematic section. Of 41 schematics, 28 were B/W TV, 14 were color and only one transistor TV! These facts prove to me that your schematic section needs an injection badly. I would appreciate it if your staff would look into this matter.

PAUL J. ROSA
No Address

You are correct on the number of schematics Mr. Rosa. We usually average two color and four B/W schematics each month. We do include material on door openers, organs, CB and marine equipment in the feature sections. In fact, a complete series on CB, marine and industrial two-way radio has been running since January. However, TV schematics are the object of TEKFAX and of major interest to most of our readers. And reader interest is our major concern. — Ed

Reiner Scope Anyone?

I have been a subscriber to ET/D for four years now and just renewed my subscription to your fine magazine. I have an old Reiner Oscilloscope, Model 550. A number 444 appears under the model number. I need a schematic on this instrument and the only address I have is Reiner Electric Co., New York, U. S. A. It is a fine 5 in. scope and I would appreciate any help your readers can offer.

RICHARD ECKERT
Middlesex, N. J.

• *Sorry we were not able to find the address of the Reiner Electric Co. from our sources. If an ET/D reader has some information on Mr. Eckert's scope we would be happy to pass it on to him.—Ed.*

MOTOROLA

TV Chassis TS594 — Noise Gate Circuit Description

The AGC system samples the signal strength only during horizontal sync time, immune to noise interference at all other times. A properly adjusted noise gate circuit will help make the AGC system immune to noise even during horizontal sync time and will remove noise signals from the sync separator stage as well.

Basically, the noise gate (sometimes called a noise inverter) is a transistor stage that is reverse biased so that normal amplitude video signals do not switch it on. When a noise pulse is received larger in amplitude than the video signal, the stage conducts and makes an amplified negative going pulse from the noise. This negative pulse is fed to both the sync separator and the AGC stage and cancels the noise burst.

The Q10 emitter is connected directly to the 1st video amplifier stage base and has the same potential or approximately 2v when a signal is being received. The Q10 base is connected to an adjustable voltage source which is adjusted to provide approximately 1.5v to the base for normal operation. With these conditions, the stage is reverse biased or cut off. The negative going video signal from the 1st video stage will switch the noise gate stage on if the amplitude becomes large enough.

The noise gate control is adjusted so that the stage is reverse biased and the negative going horizontal sync pulses

MAGNAVOX

Transistor TV Chassis T908 — Troubleshooting the Horizontal Circuits

Horizontal circuit defects can often be analyzed by observing the pattern on the screen. As an example, suppose the set had sound but no raster. The first step would be to check for high voltage. If there is no high voltage, check for presence of ac at the cap of the high voltage rectifier. If the ac component is missing, any one of the three horizontal stages could be at fault. Voltage measurements, starting with the horizontal output and working back toward the oscillator, should be the next step.

Unlike its tube counterpart, the horizontal output circuit in the solid-state receiver does not draw excessive current when signal drive is lost, but instead becomes cut off. This is also true of the horizontal driver stage (Q602). There are, however, several unique symptoms which may be obtained on this receiver due primarily to the design of the horizontal output circuit.

For example, high voltage can be developed with the horizontal yoke windings open. This condition produces a straight vertical line on the CRT.

Another condition unique to the output circuit is that in most cases the circuit will continue to function with the damper diode (D605) open. This is because the horizontal output transistor has the ability to function as the damper should D605 become open. An open damper diode, however, usually causes poor horizontal linearity having its greatest effect on the left side of the screen.

In addition, the 500v "boost" supply is not a rectified voltage because of damper diode action, as is the case in most tube type receivers. Instead a separate boost diode, SR601, rectifies the horizontal pulses from the collector of the output to supply the boost voltage.

The boost voltage connects to only three points. These are the focus control, brightness control and the LDR range control.

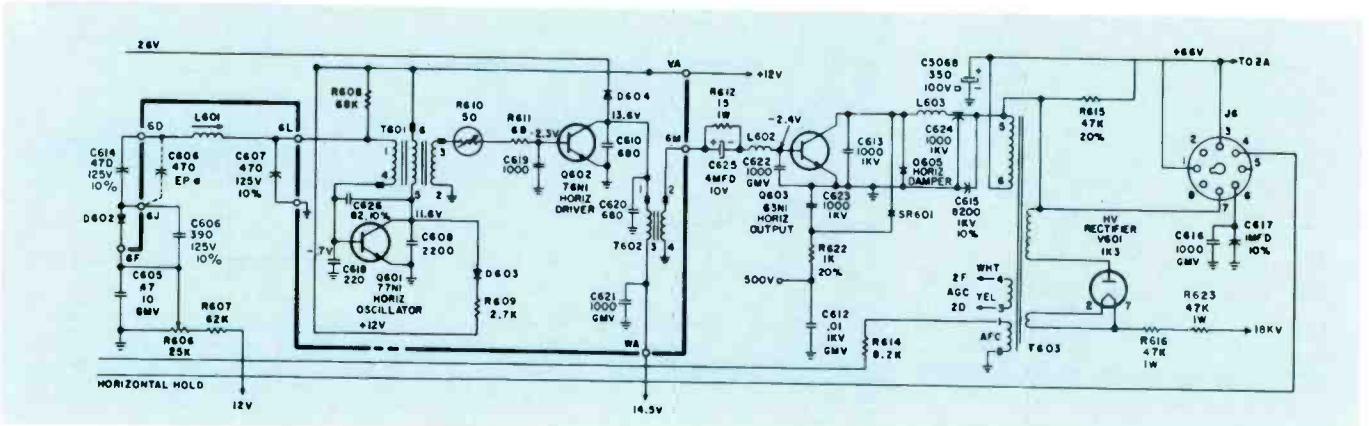
The horizontal AFC circuitry is very similar to that used in tube type receivers. However, the dc correction voltage developed by the AFC diodes is not directly applied to the horizontal oscillator. Instead, this voltage is applied to a varicap (D602) which forms part of the horizontal oscillator resonant frequency. The AFC voltage applied to D602 varies its effective capacitance and maintains the oscillator "on frequency."

Should loss of horizontal sync occur, while vertical sync remains normal, the AFC diodes and their associated circuitry, as well as the varicap, should be checked. Normally, if the horizontal hold control varies the oscillator frequency around its correct point, the varicap can be discounted.

A good indication of the condition of the AFC diodes is to measure the dc voltages at the high side of the 47K resistors R601, R602, connected to these diodes (these voltages should be measured with no signal).

If this voltage measures low, check the amplitude of the flyback pulse applied to the cathode-anode side of these diodes (normal 15v P-P).

Another good checkpoint would be the sync signals applied to the AFC diodes through capacitors C602 and C603 (these should measure 12 to 15v P-P).



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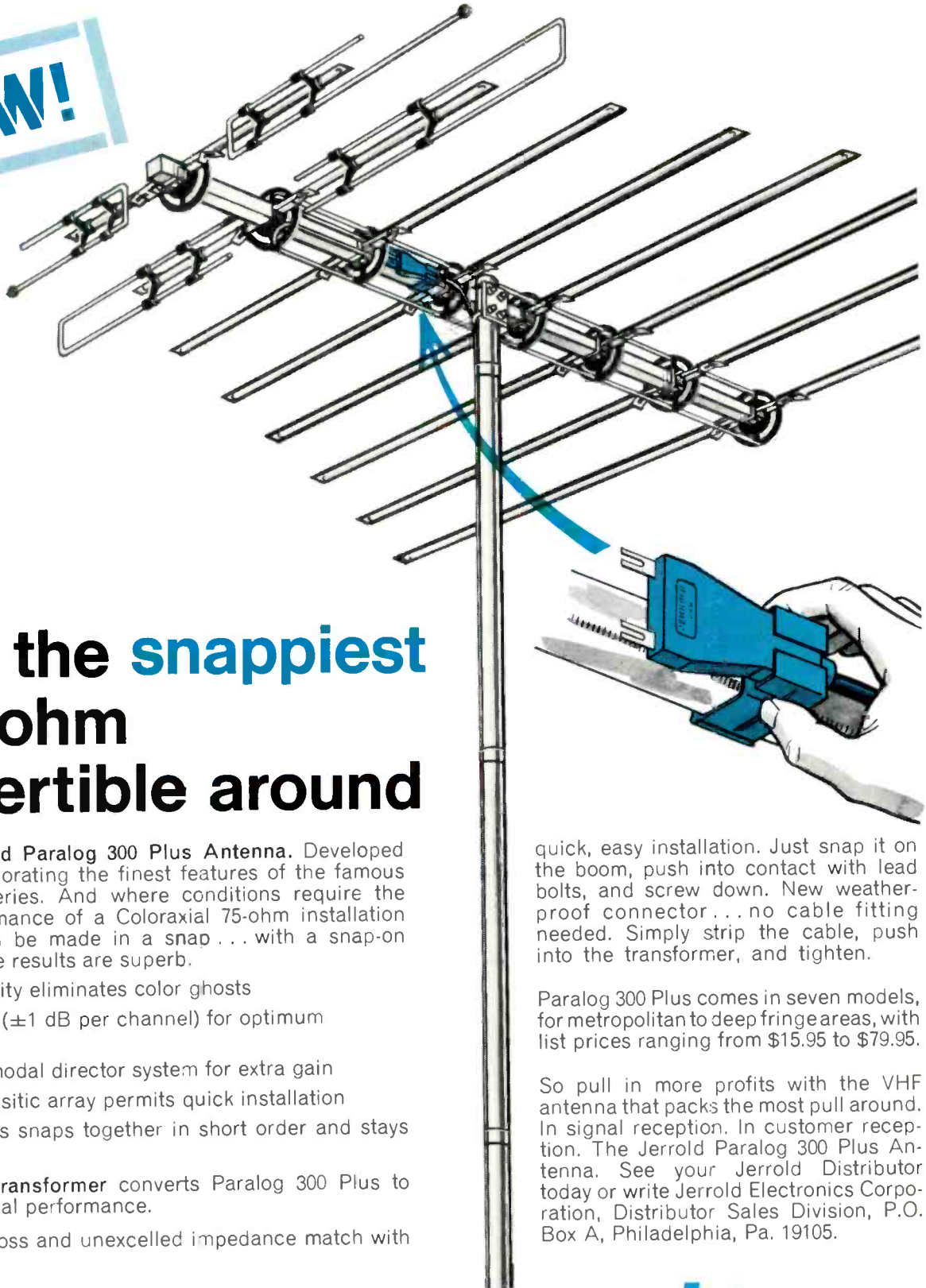

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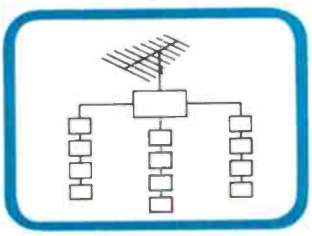

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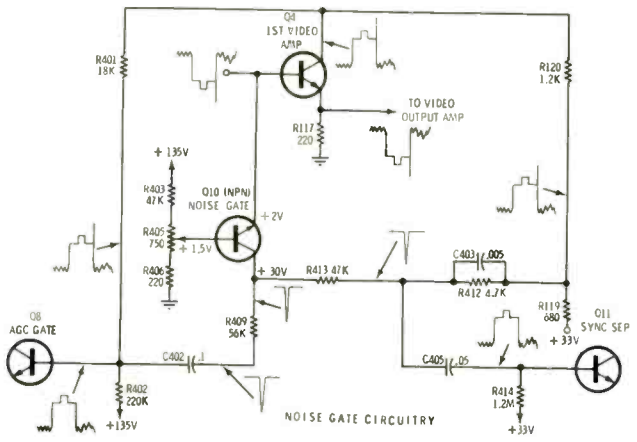
fed to the emitted do not have sufficient amplitude to switch the stage on. Any noise present on the sync pulse larger in amplitude than the pulse will drive the transistor on. The noise pulse will be amplified only in the collector circuit. The circuit configuration is common base, hence no phase inversion occurs and the noise pulse in the collector circuit is negative going also.

The negative noise pulse is coupled through C402, .1 μf to the base of the AGC gate where it cancels the positive noise pulse in the signal from the 1st video amplifier collector.

A reduced value of the negative noise pulse is developed at the junction of R413 and R412 which cancels the positive noise pulse in the signal from the 1st video amplifier collector circuit.

Canceling out noise pulses provides a measure of noise immunity for the AGC and sync separator stages.



Adjustment of this circuit is very simple. The receiver should be correctly tuned to the strongest channel to be received. Starting with the noise gate control maximum counter-clockwise (off), slowly rotate it clockwise until the picture starts to bend or fall out of sync. Then back up until the picture is stable.

Malfunctions in this circuit can cause picture tearing or bending that can easily be confused with AGC or sync trouble. Also a defect in the noise gate circuit can prevent proper setting of 1st video amplifier bias.

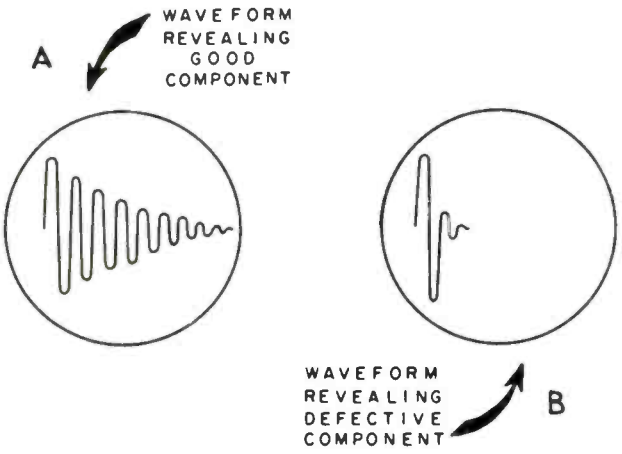
To eliminate the noise gate transistor as the source of a problem, it can be removed from the circuit by cutting the wire test loop in its emitter circuit. If the problem clears up, the noise gate circuitry (and adjustment) should be checked. If the problem persists after the test loop has been cut, other circuits should be analyzed and checked.

If the problem is in the noise gate circuitry, it can be checked as follows. After reconnecting the wire test loop, the noise gate transistor can be checked for its ability to turn on and off as forward bias is increased or removed. Shorting the base and emitter together should provide a slight increase in collector voltage indicating the transistor is not shorted and capable of being turned off.

The forward bias can be increased by bridging a resistor (approximately 27K) from 135v to the arm of the noise gate control and noting a decrease in collector voltage indicating that the transistor is not open and is capable of being turned on. However, this check is generally unnecessary since an open noise gate transistor will not generally be apparent in the picture performance on most signals and the only effect will be impaired noise immunity on noisy fringe signals.

Using the Scope for Horizontal Circuit Testing

A defective component in the horizontal deflection circuit of a television receiver can often be difficult to diagnose. (Sometimes substitution with a good component is



the only sure method.) An open winding is easy to check, but shorted turns can be evasive — resistance measurements are not always a conclusive test.

Test Procedure

The following test is based on the ability of a tuned circuit to "ring" when a pulse is applied; it provides a means of detecting even partially shorted turns in horizontal deflection coils. With this procedure it is not necessary to remove the components from the chassis. The test circuit employs a pulse which is picked up from the cathode of the sweep oscillator tube in the oscilloscope and applied to the suspected coil or transformer. The waveform developed on the screen of the oscilloscope will reveal the condition of the winding under test. If the coil is good, the waveform will appear as a wave-train — shown in illustration A. If the coil is defective, the waveform will be heavily damped as shown in illustration B.

The sweep rate of the oscilloscope should be adjusted to produce a single waveform, such as shown in illustration A. Table 1 lists the approximate sweep rate recommended for various components that may be readily tested in this manner.

Table 1

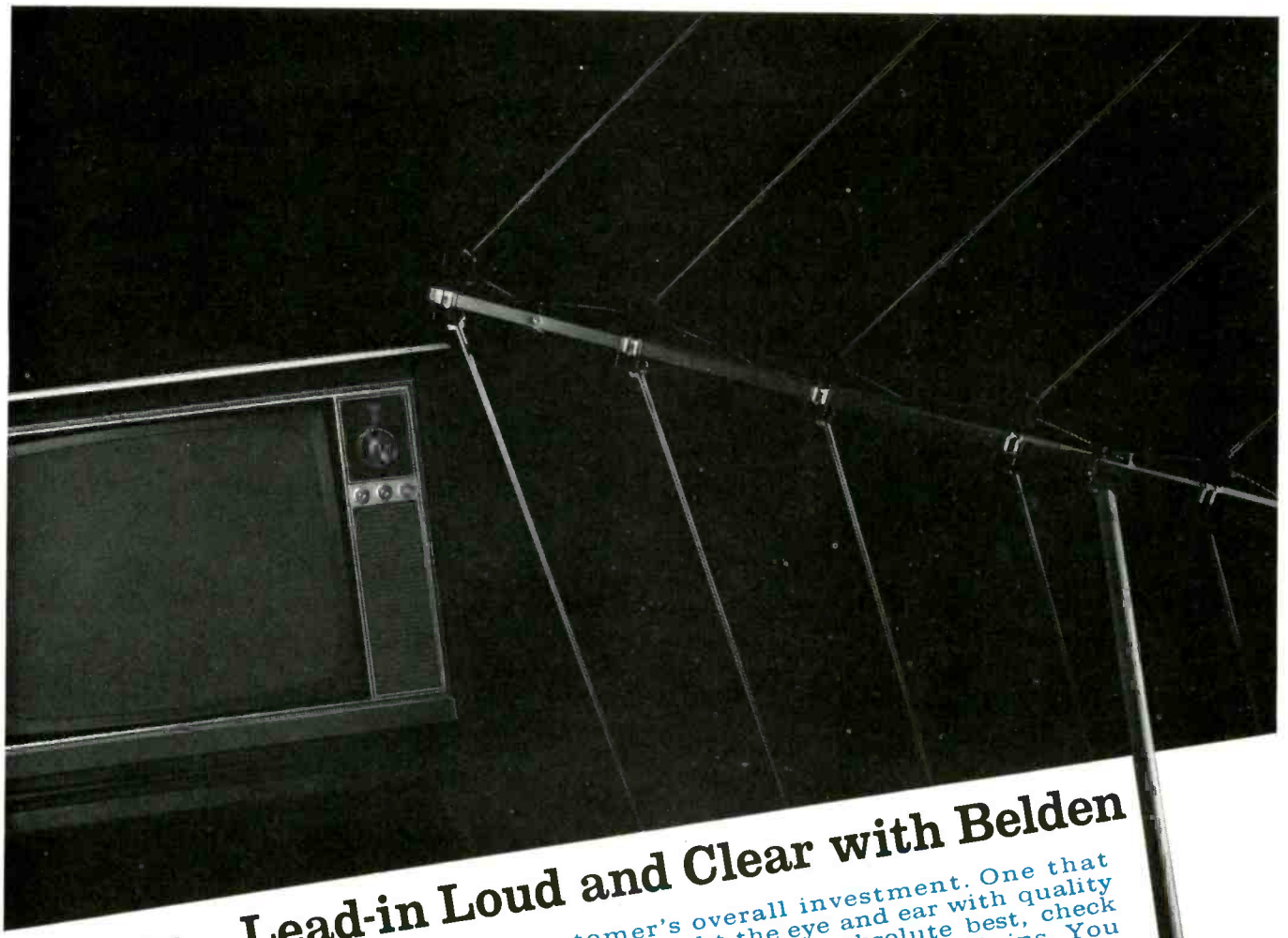
Component	Sweep Rate
Width coil	2500/5000 Hz
Horizontal linearity coil	2500/5000 Hz
Horizontal output transformer	500/1000 Hz
Deflection yoke*	2500/5000 Hz
Receiver deflection circuit with yoke connected	2500/5000 Hz
Receiver deflection circuit with yoke disconnected	500/1000 Hz

**Check auxiliary components before discarding yoke if test indicates a defect — internal capacitors, etc.*

System Check

The complete horizontal output system, including the transformer and yoke, may be checked with the "ringing pulse" by removing the plate cap of the horizontal output tube and connecting the oscilloscope probe and the "Sweep" lead to the plate cap lead of the transformer. Con-

Continued on page 62



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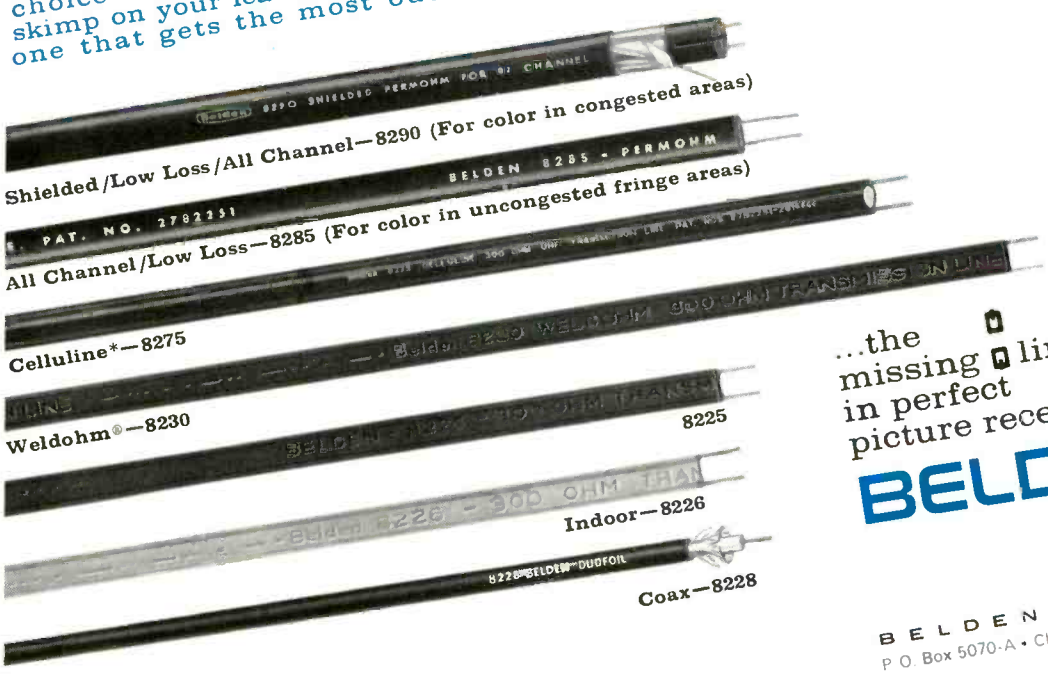

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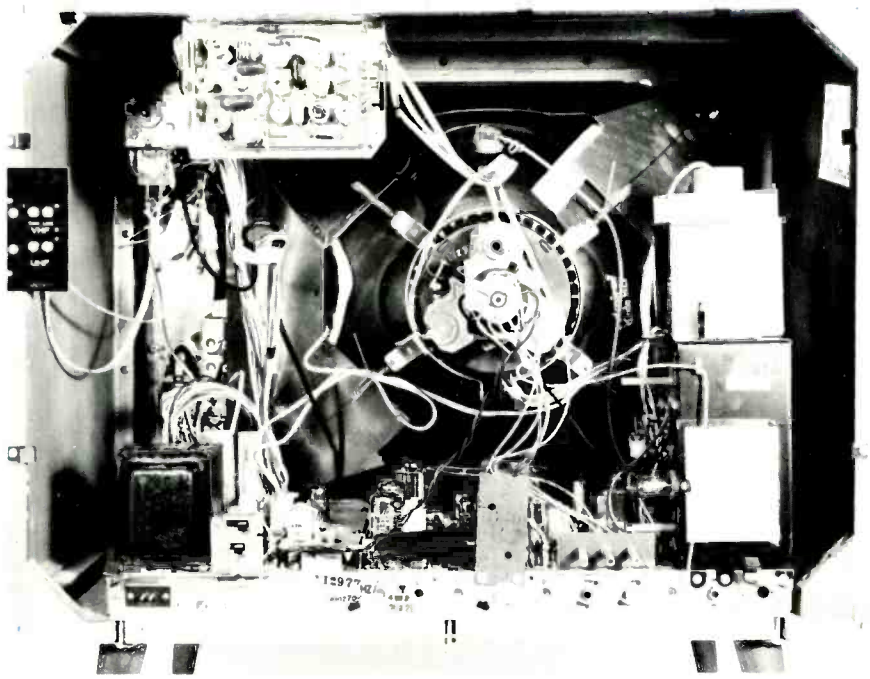
JULY 1968

LET'S TAKE A LOOK AT ADMIRAL'S 4H12 COLOR CHASSIS

Understand the new circuits you'll eventually be called upon to service

TEKLAB REPORT

Looking in from the back of the Admiral model 3121L TV receiver.



■ The moisture had hardly disappeared from the box that this Admiral model 3121L was packed in before we started digging in and uncrating it. When we started to adjust the set, we noticed the customer controls were conveniently located on the front panel with the exception of the HORIZONTAL hold, INSTANT PLAY and PEAKING controls which were located in back.

We did not have to use the familiar ¼ in. nutdriver, a hex wrench or a screwdriver to remove the back cover. Nine captive spring clips make panel removal very easy.

The chassis is held by six screws. The tuner, control panel, convergence panel, degaussing coil and yoke are all connected to the chassis with sockets.

Looking over the chassis we noticed a number of new features: automatic color saturation, automatic degaussing, automatic frequency control (AFC) and instant play.

We will now go a little deeper into the various interesting circuits used in the 4H12 chassis.

Automatic Frequency Control

The chassis features an automatic frequency control system which completes the fine tuning once the customer has 'roughed it in.' Its operation is similar to the AFC used on FM tuners.

The discriminator section samples the IF signal through a 0.47pf capacitor, C704 (see schematic Fig. 1). Capacitor C801 couples the signal to input coil L801. The LC circuits

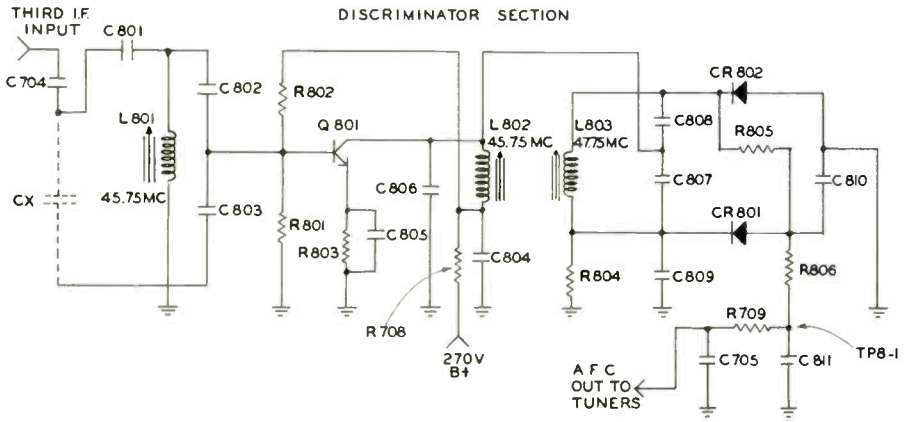


Fig. 1—Simplified schematic of the automatic frequency control circuit.

centering on L801 form the resonant circuit. Capacity divider C802, C803 affords a low input impedance to transistor Q801 while at the same time decoupling the transistor input resistance and capacitance from L801.

After amplification in Q801, the signal is fed into the FM discriminator primary coil, L802. The output of Q801 is also sent to the junction of C807 and C808. These capacitors perform essentially the same function as the tertiary winding in a standard ratio detector.

Each detector diode is detecting the ac sum of two signals. The first signal is coupled from the output of Q801 through C807 and C808 to their respective diodes. The second is derived by magnetic coupling between L802 and L803. Notice the coils are not wound on the same form and are lightly coupled. At 45.75MHz both diodes are detecting equal signals. The diode load resistors are connected to add their outputs, therefore the AFC correction voltage will be zero at the proper fine tuning frequency of 45.75MHz.

If the channel is not tuned carefully, or if the tuner drifts, a phase shift change at L803 occurs. If the picture carrier changes to 45.25-MHz, diode CR801 will conduct more and CR802 will conduct less, resulting in a negative voltage appearing on the AFC line.

Because separate VHF and UHF tuners are used, each must have its own AFC components. In the VHF tuner, AFC voltage is applied to the base of an NPN transistor. The emitter is left disconnected and the collector is connected to the oscillator tank. This collector-to-base junction serves as the AFC diode. As the AFC voltage varies, the transistor acts as a capacitor. The correction voltage changes the capacity of the junction and thus corrects the oscillator error. In the UHF tuner, the AFC diode performs a similar function. As with the FM AFC, the correct way to tune in a TV channel is with the AFC switch on the control panel in the OFF position, then switch it to ON for drift-free, correctly tuned color programs. This should be done for each VHF channel at installation since the tuner has preset fine tuning.

It would be of value here to study the proper AFC field adjustment so we will proceed with a step-by-step installation check and adjustment.

AFC Installation Check

1. Switch off the AFC (some models have a toggle switch; some have a 'push-pull button').

2. Properly adjust preset fine tuning for each active VHF channel. (Fine tune until you observe familiar 'diamond' pattern color/sound beat, then back off until pattern just disappears. This is the only correct fine tuning point.)

3. Now switch to AFC. If the tuning is not affected, AFC is correctly set. If switching on AFC detunes set, perform TV AFC field adjustment.

4. Check operation on AFC on UHF channels, if any, in a similar manner (tune with AFC off—switching AFC on should not detune).

5. Instruct customer on proper adjustments of this new feature.

AFC Field Adjustment

1. Remove cabinet back and apply power to the set with a cheater cord.

2. Repeat step 2 of AFC installation check.

3. Switch on AFC—If AFC is mis-set, receiver will detune—do not retune. Proceed to step 4.

4. The AFC subassembly is located below the chassis, between the power transformer and IF strip. However, adjustments can be made from top of chassis through adjustment holes in chassis pan. Second-

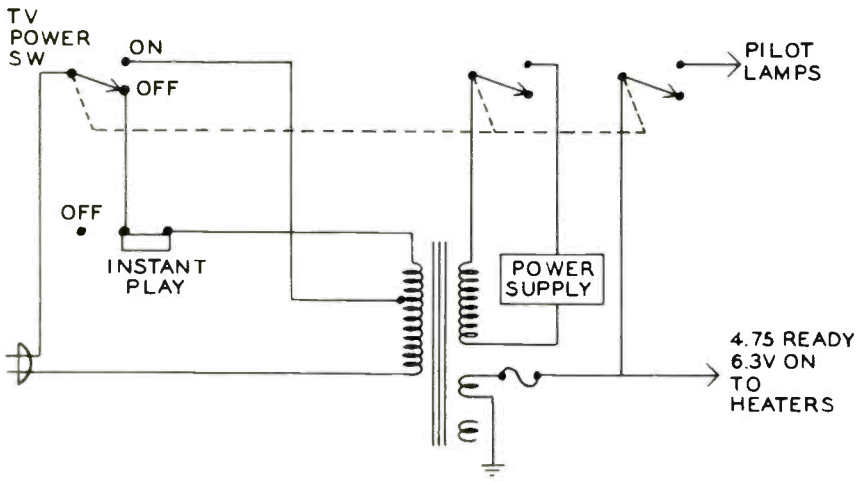
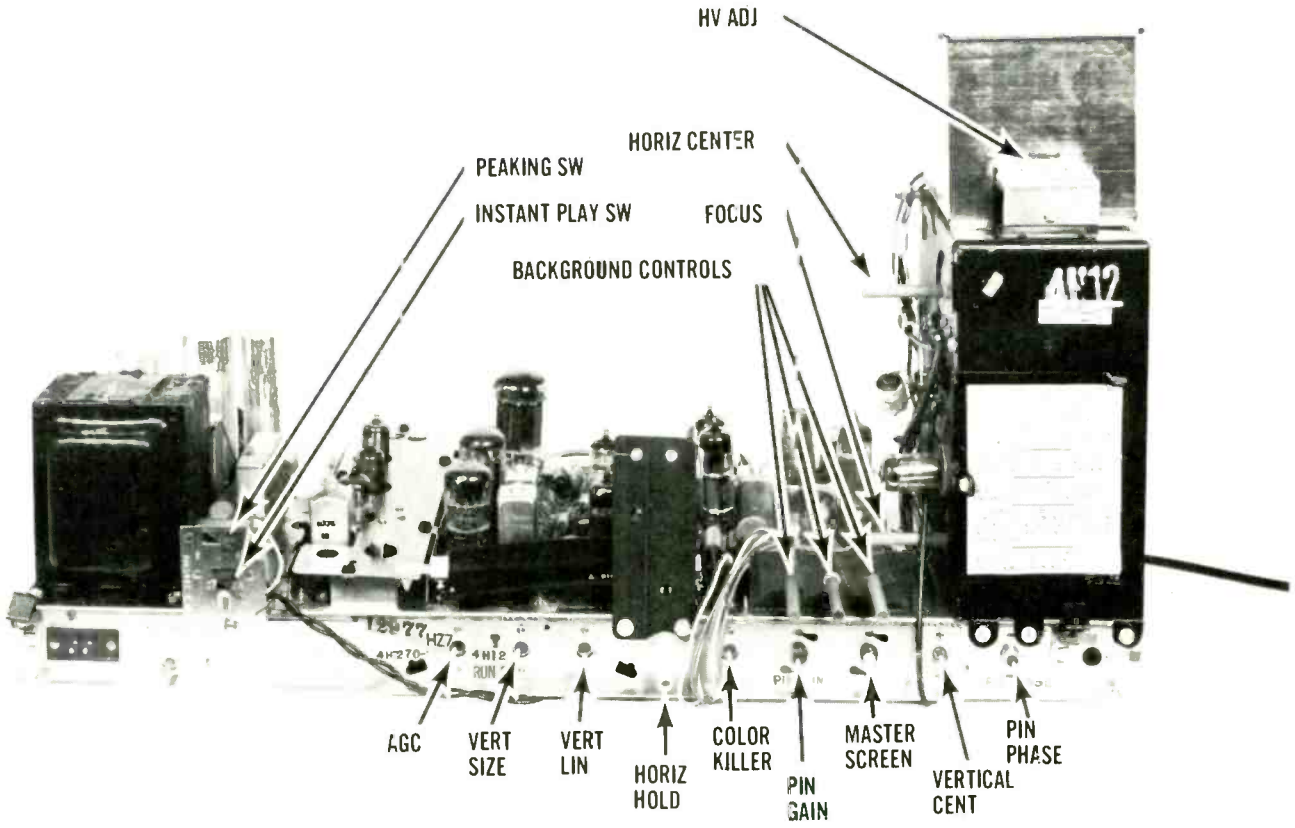
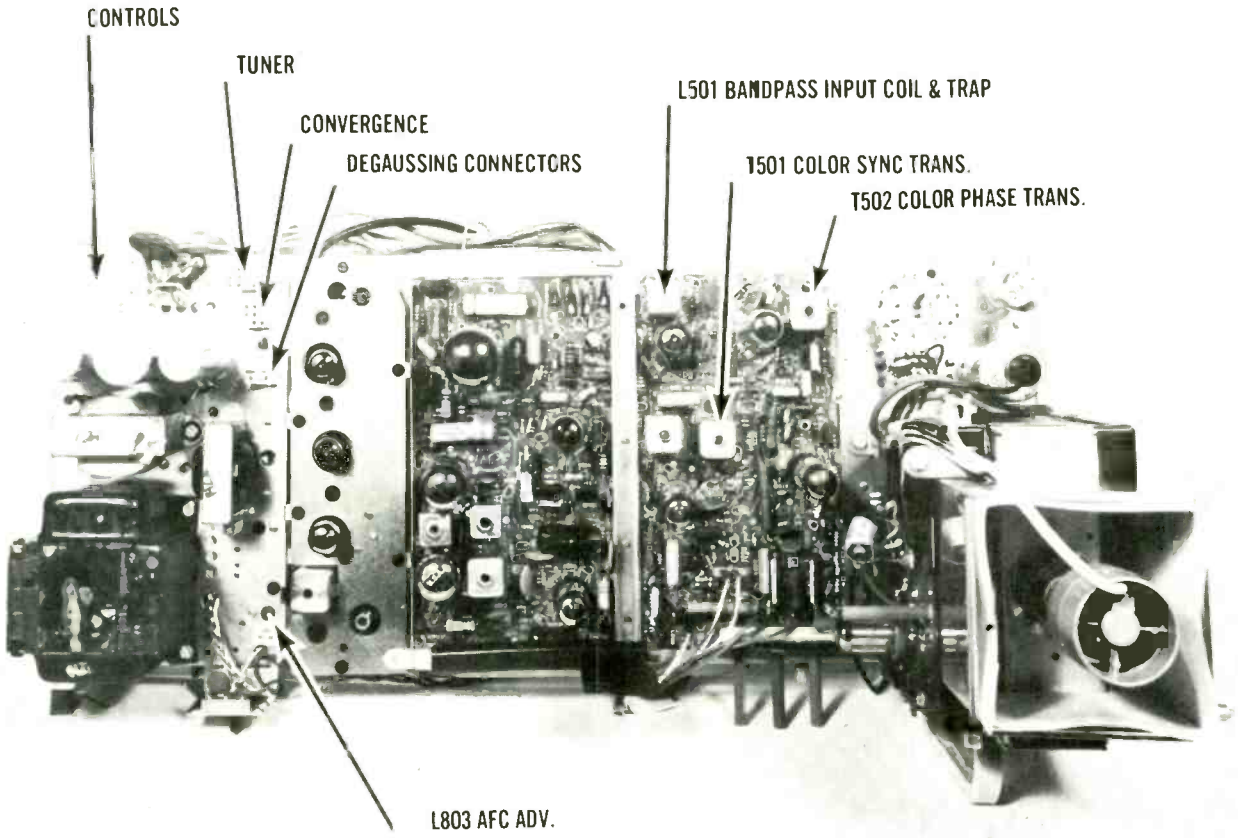


Fig. 2—The instant play switch circuit.



Rear view of chassis showing service adjustments.



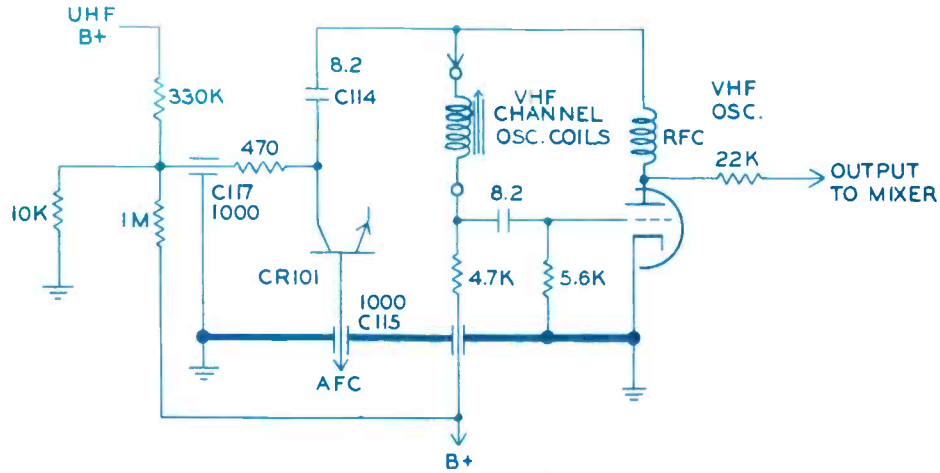
Top view of chassis showing connectors for easy chassis removal, the AFC adjustment and important color coils and transformers.

ary coil L803 is AFC coil having yellow form and is close to back of chassis. Make sure you know exactly where this is located.

5. Adjust L803 very slightly (no more than ⅛ turn) until detuning ceases. Do not adjust any other coil in this area.

If AFC does not respond with this slight adjustment, do not attempt further adjustment—repair is indicated. If L803 is mis-set, it will be easy to restore proper operation when the trouble is found and corrected.

6. Recheck AFC action on UHF channels per step 4 of AC installation check. It may be necessary to compromise L803 adjustment slightly between VHF and UHF.



Schematic of VHF tuner AFC circuit.

Instant Play

Models using the 4H12 chassis have a new 'instant play' feature (see schematic Fig. 2). The power transformer has a special primary winding, only a part of which is used during normal operation. When the ON/OFF-VOLUME switch is pushed to the OFF position, the ac line is connected across the entire primary, thus reducing the voltage and current in the secondary. At the same time, the B+ and dial light circuits are opened, leaving only the tube heater circuit operating at reduced voltage and current.

A separate switch in the ac line is located at the back of the cabinet so the set can be switched off completely for periods of inactivity.

Automatic Color Saturation Circuit

The 4H12 chassis employs a new circuit to adjust automatically the 1st chroma bandpass amplifier gain, providing a relatively constant chroma level at the CRT grids.

Automatic color saturation circuit (ASC) diode CR501 detection is determined by the amount of chroma information at V501A 1st bandpass amplifier plate (see schematic Fig. 3). The chroma information between 3 and 4MHz is at a much higher level than the accompanying luminance information at this point. To prevent excessive color in scenes having only a small amount of color, a burst referenced dc voltage limits the amount of maximum gain of V501A.

CR501 conducts on the positive half of the chroma signal and the rectified dc signal is filtered by R570 and C549. R571 and C549 filters the dc from the chroma oscillator. The resulting varying dc corrective voltage appears at the V501A grid through R504 and L501. The correction voltage causes the gain of V501A to increase when the chroma level decreases or to decrease when the chroma level increases. Monitoring the grid of V501A with a VTVM will show about—1.5v with low chroma signal and −3.5v with high chroma level signal. With larger screen receivers, a change in color level is more noticeable to the eye than on small screen sets. To overcome this characteristic the ASC voltage is delayed. Resistor R572 supplies the clamping voltage to the 1st bandpass grid providing the necessary hold off.

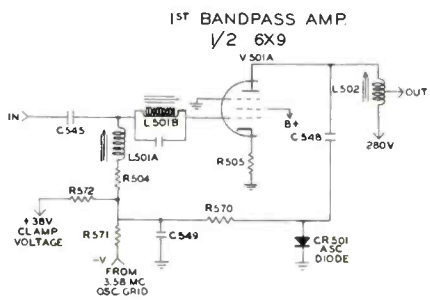


Fig. 3—Simplified schematic of the automatic saturation circuit.

Automatic Degaussing

An electronically switched automatic degaussing circuit is used in this chassis. This circuit eliminates the periodic service call to demagnetize or degauss the CRT which can become magnetized by electrical fields from vacuum cleaners and other household appliances.

When the set is switched ON, thermistor R722 has a high resistance (see schematic Fig. 4). This permits a series connection with the ac side of the power supply bridge rectifier.

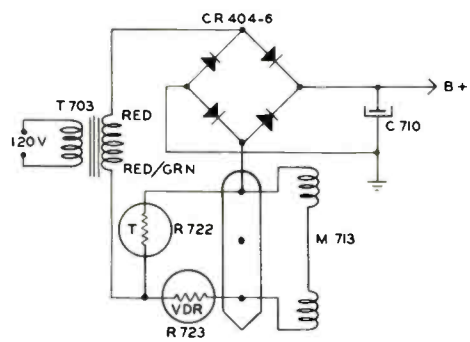


Fig. 4—Simplified diagram of the automatic degaussing circuit.

As a result, the initial charging current and voltage for the filter capacitors will appear across R722. The voltage dependent resistor (VDR), R723 and the degaussing coils are in parallel with R722.

Because of this initial charging voltage, R723 will assume a low resistance and current will flow in the degaussing coils. Since these current waveforms are symmetrical, the ac magnetic field of the coils will neutralize any permanent magnetization of the CRT shadow mask and brackets.

As the electrolytics charge, the voltage impressed across R722, the VDR R723 and coils, will decrease. R723 then becomes an open circuit. A bit later R722 will heat because of current flow. Its resistance will decrease, completely shorting out the degaussing coils.

We have now covered the most important new features. ■

Move Up to a Triggered-Sweep Dual-Trace Scope

Cut your troubleshooting time by using advanced serving techniques

Part Two (Conclusion)

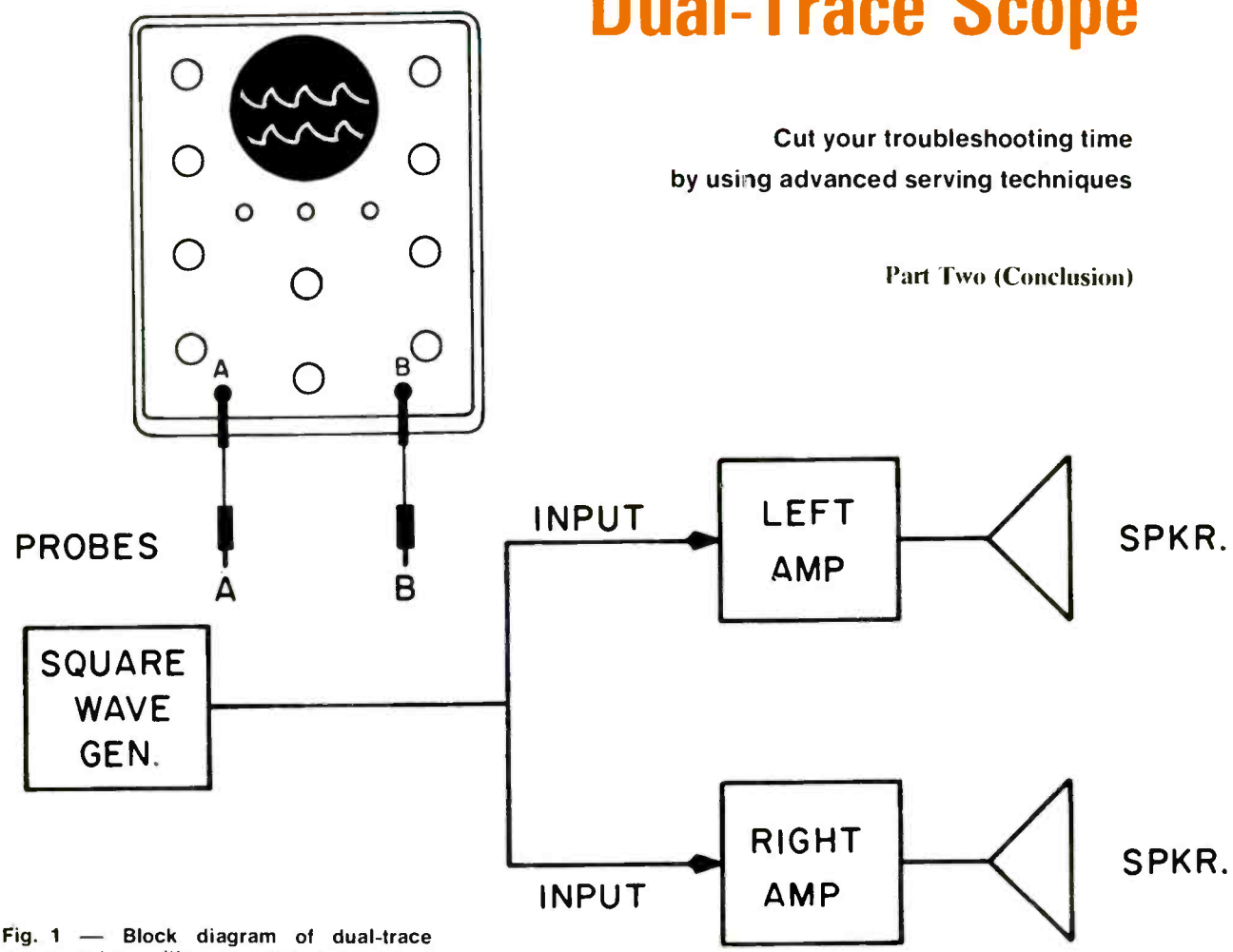


Fig. 1 — Block diagram of dual-trace scope setup with squarewave generator for checking stereo amplifiers.

■ The first article in this series (ET/D May 1968) introduced the lab-type, dual-trace triggered-sweep scope and the single channel triggered scope. We now go into troubleshooting techniques using the dual-trace triggered scope.

Troubleshooting Techniques

For fast, accurate stereo-amplifier troubleshooting, the dual-trace scope is a natural. This scope is actually a "magic wand" for this type of equipment.

The basic concept of applying a dual-trace scope to checking stereo amplifiers means comparing the normal operative channel with the defective, inoperative channel. By using this method, a fast troubleshooting procedure can be employed to isolate defective components in stereo amplifiers. A block diagram of the setup is shown in Fig. 1 and includes the dual-trace scope and a squarewave audio generator.

You begin by injecting a squarewave signal into both the left and right amplifier inputs. Now the scope probes from the "A" and "B" channels are placed at the two stereo amplifier outputs. The squarewave trace from the defective channel is now compared with that from the normal channel. You can also superimpose them for exact analysis. Even a minor distortion can readily be detected.

Stage Gain Checks

Triggered scopes' vertical amplifier gain controls are calibrated in volts/centimeters. The two vertical channels are identical so it's easy to check from one test point to another to compare the signal gain of each stage. Gain per stage can be checked throughout the amplifier at various stages.

With this technique, you can quickly isolate the trouble down to the stage and frequently to the defective component. As a final check,

Fig. 2 — Hash (bottom trace) was noted at the collector of the right-channel predriver. The signal was good at the base (top trace).

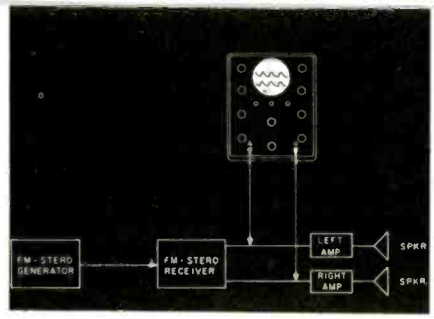


Fig. 3 — Test setup using FM/stereo generator and dual-trace scope for checking FM/stereo receivers.

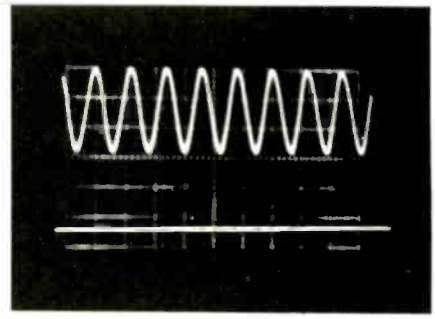


Fig. 4 — Adjust the receiver's separation control for minimum left-channel information (bottom) at the right-channel output. Only left-channel signal is transmitted (top trace).

or if the original symptom was insufficient frequency response, the squarewave generator frequency can be adjusted throughout the entire audio range for a response check. It's a good idea to check the frequency response at 1kHz intervals — taking the patterns of the input of both speakers simultaneously. You can readily see what the amplifier's frequency response capability is.

What can be done with this technique? Take the case of a solid-state stereo which the owner said had a "noisy right channel." A squarewave signal was injected into both channels and the scope was switched on to warm. Starting at the AF amplifier and moving on to the predriver, "hash," or "grass," was noted at the collector of the right channel predriver (see Fig. 2 bottom). The probe was moved back to the transistor base and a clean squarewave was observed (Fig. 2 top). A defective transistor was located in minutes.

When you interpret the squarewave signal on a high-performance scope, do not expect to see a perfect squarewave trace from the properly operating stereo amplifier. You must consider the design and amplifier quality. Check the amplifier's data specifications regarding frequency response and component quality. In some lower-cost amplifiers you will notice an overshoot or a rounded waveshape caused by slow rise-time which indicates poor high-frequency response. Some lower cost amplifiers have a rise time 6 to 10 μ s. Also note the effect of tone control adjustment on squarewave response.

FM/Stereo Checks

When conventional methods are employed to align or check an FM/stereo receiver, you feed the FM stereo signal from a generator into the receiver and connect a VTVM or scope to the right channel output. Then you make a few checks and adjustments and disconnect from the right channel. Then you connect to the left channel.

This procedure will get you no place fast. It's a different matter when you use a dual-trace scope. Just connect it as shown in Fig. 3 and in no time, check and align the receiver. With this method you can check and align separation between L and R channels. The system also provides an excellent way to monitor individual channels.

A brief outline for essential stereo checks: For specific instructions for a particular tuner, refer to the manufacturer's service manual. Connect the equipment as shown in Fig. 3 and allow the instruments to warm for 30 minutes. Set the balance control to the center position. Observing the dual-trace scope screen, adjust the receiver's separation control for minimum left-channel information at the right-channel output (Fig. 4 bottom). Left-channel signal only is transmitted (top trace). Now set the stereo generator for right-channel only signal. Again adjust the stereo receiver for minimum right-channel information (see Fig. 5, top) at the left-channel output (bottom). Ideally, at this point, no signal would be displayed — indicating perfect separation. On some stereo receivers you cannot obtain complete separation and the dual-trace scope may show waveforms like those illustrated in Fig. 6. For this check, a signal was injected only into the left channel. In the event of insufficient separation, some 1kHz of audio information will be present. The ideal signal separation ratio is 30db, or approximately 30:1.

The output obtained at either the L or R channel may consist not only of a 1kHz audio signal, but also some 19kHz and 38kHz signals and harmonics of these frequencies. In well-designed stereo receivers, however, these signals will be low amplitude and, if not excessive, will not interfere with listening pleasure as they are above the audible range.

Fig. 8 — Mistracking sinewave pattern.

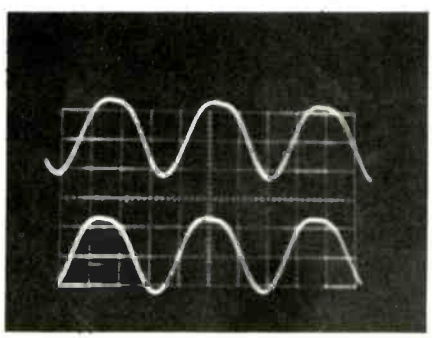


Fig. 9 — Waveforms of properly tracking styluses.

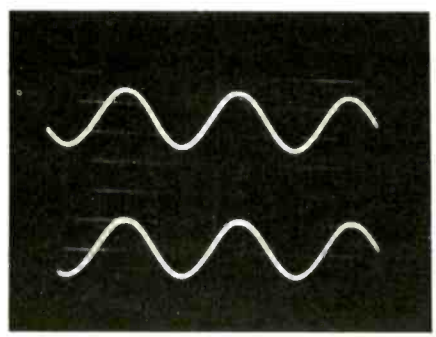
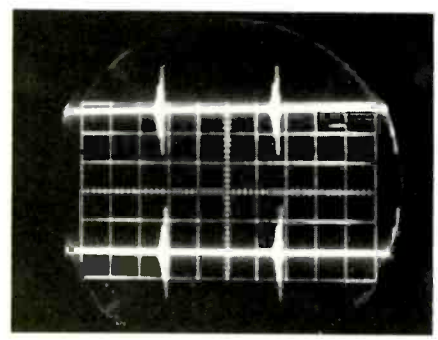


Fig. 11 — Balanced burst pulses at color phase detector.



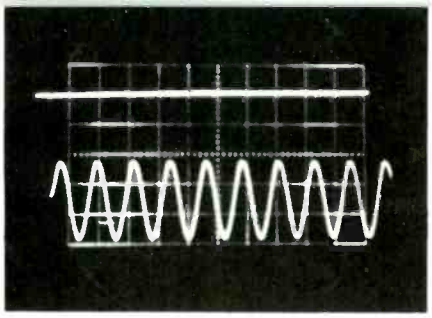


Fig. 5 — Adjust the stereo receiver for minimum right-channel information (top) at the left-channel output (bottom). Ideally, at this point, no signal would be displayed — indicating perfect separation.

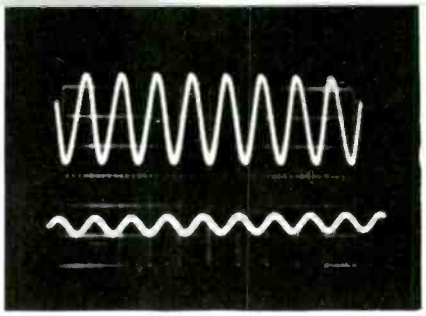


Fig. 6 — On some receivers you cannot obtain complete separation and the dual-trace scope may show waveforms like these.

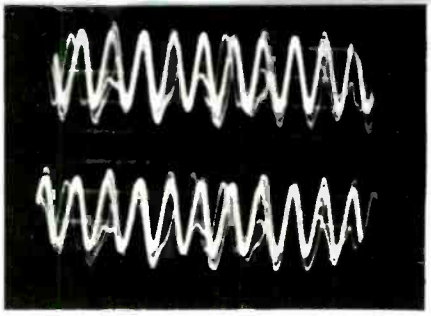


Fig. 7 — Distorted audio sinewaves and insufficient separation.

They could be detrimental if tape recordings are made, however.

Insufficient separation and the distortion that results are shown in Fig. 7. This was caused by incorrect phase of the re-inserted 38kHz subcarrier relative to the received sidebands.

Using Stereo Test Recording

The dual-trace scope can be used to obtain a fast evaluation of the complete stereo system. Connect the left speaker to "A" channel and the right speaker to "B" channel. Put a stereo test record on the turntable, clear the stylus carefully and switch on the stereo amplifier while observing the scope sinewave patterns. Stylus tracking, cartridge output and channel separation can be checked in this manner.

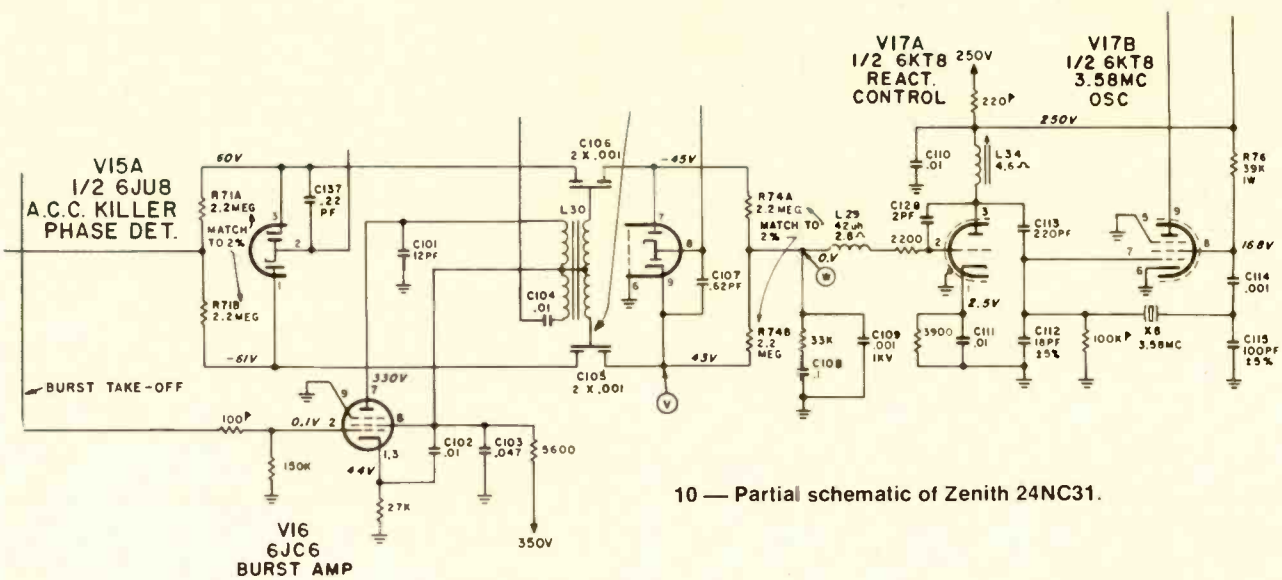
For checking stylus tracking, begin with the lowest-velocity band on the test record. If proper tracking is observed, move on to a more difficult band. Once mistracking is observed, try to correct it at this time. Scope waveforms indicating stylus mistracking are shown in Fig. 8. Correct sinewaves are shown in Fig. 9.

To check cartridge output, first balance the stereo amplifiers for equal gain. Then select the 1kHz band on the test record with right and left recording and note if both scope sinewaves are the same shape and amplitude. If they are not, the cartridge or stylus is defective.

Now the channel separation check: Disconnect the right-channel lead to the amplifier and use the 1kHz left-channel modulated band on the test record. Note on the scope if any 1kHz signal is coming from the amplifier's right-channel output. If none, use the test record's 1kHz right-channel modulated band for separation of the left-channel amplifier. RCA has recently issued test record No. 12-5-105 which has facilities for making these checks.

Chroma TV Trouble Diagnosing

We'll use a Zenith 24NC31 color TV chassis here and see how a dual-trace scope can be used for fast chroma troubleshooting. A partial schematic of this set is shown in Fig. 10. The color burst can be observed simultaneously at tube socket terminals 3 and 1 or 7 and 9 of the 6JU8 (V15A), a color control phase detector tube. With the "A" and "B" scope channels connected to tube terminals 1 and 3 or 7 and 9, the burst pulse should appear as shown in Fig. 11. Both signals should have the same amplitude. The waveforms



10 — Partial schematic of Zenith 24NC31.

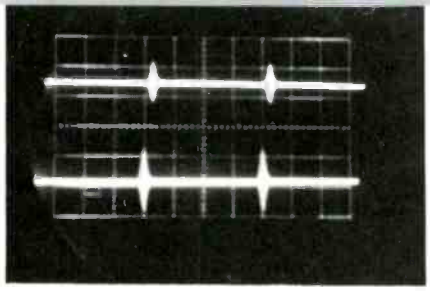


Fig. 12 — Unbalanced burst pulses.

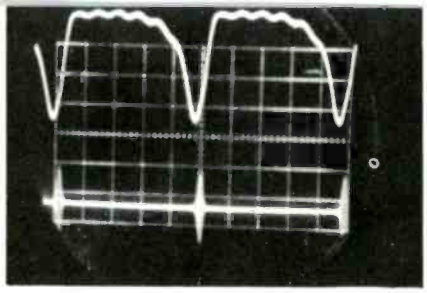


Fig. 13 — Correct burst (top) and keying pulses (bottom).

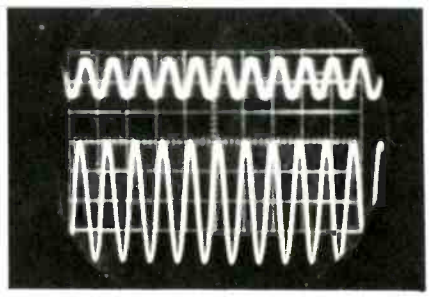


Fig. 14 — Scope waveform of 3.58MHz color sub-carrier.

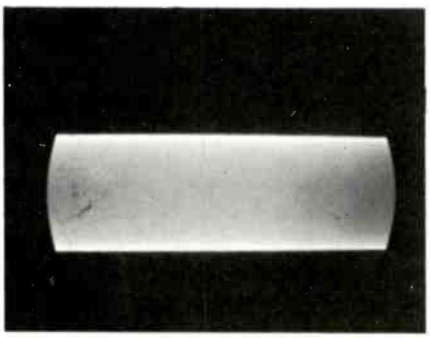


Fig. 15 — How 3.58MHz color subcarrier waveform appears on a typical "service-type" scope.

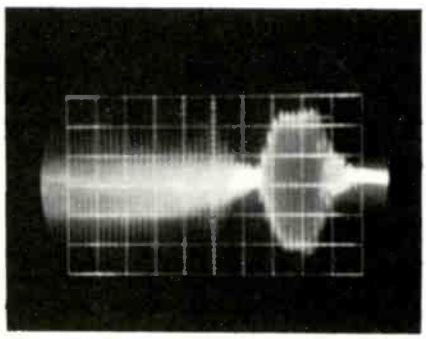


Fig. 16 — Color burst signal expanded 5X on triggered scope.

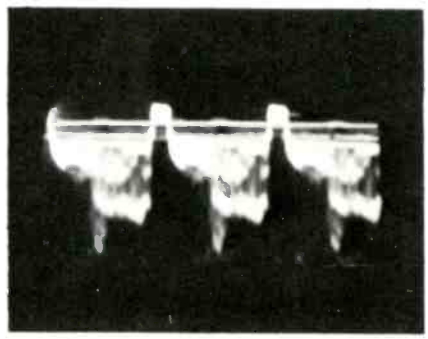


Fig. 17 — Same color burst as seen on a service scope. Can you find it?

Dual Trace Scope . . .

shown in Fig. 12 indicate color phase trouble — insufficient color burst signal amplitude.

The burst amplifier can be checked in this manner. Connect the scope's "A" channel to tube socket terminal 2 (keying pulse) of V16 burst amplifier and the "B" channel to terminal 7 of V16 (color burst separation). Now all at the same time, observe pulse amplitudes and timing of the keying pulse and burst signal for coincidence. If these pulses are not timed, usually because of component tolerance changes, loss of color or unstable color sync may result. A correct burst amplifier scope waveform is shown in Fig. 13.

Now check the 3.58MHz color subcarrier oscillator circuit. Connect the "A" probe of the scope to terminal 7 (grid) of V17B and the "B" probe to terminal 9 (plate) of this same tube. Note if any oscillation is present and check for proper amplitude or signal ratio. The plate amplitude should be about six times that of the control grid for proper operation. See Fig. 14 for correct waveforms. The lab scope's horizontal rate was set on the 0.2 μ s range for this check. We can actually count each sinewave with this type scope and can check the actual frequency of the 3.58MHz oscillator. On a regular service scope the waveform will appear as shown in Fig. 15.

To illustrate what a good triggered scope can do, let's look at the color burst signal which rides on the back porch of the horizontal sync pedestal. The FCC specifies at least 8 cycles of 3.58MHz for the color burst pulse. Look at Fig. 16. Okay, how many do you count? This trace was obtained with the 5X magnification sweep. Now for the same color burst as observed on the typical service scope, a wideband one at that (see Fig. 17).

Other Uses for the Dual-Trace Scope

Other uses for a dual-trace scope include:

1. Checking for leakage in printed circuit boards.
2. Checking for shorts, opens or leakage in coaxial cable.
3. Checking horizontal phase detectors in TV receivers.
4. Aligning injection demodulator transformers in Zenith color TV receivers.
5. Troubleshooting horizontal and vertical sweep sections in TV sets.
6. Monitoring two points simultaneously in any electronic equipment that has an intermittent malfunction.
7. Checking at various input and output test points of IC units for proper waveshapes or distortion and correct signal amplification levels.

When you take a look at the large schematic of Motorola's TS915/919 solid-state color chassis, you cannot help but see the rows of scope patterns at the bottom of the sheet. You'll see 56 of them. Because of the many pulse-type currents and voltages in solid-state equipment, the dual-trace, triggered scope becomes a must on your service bench.■

CHROMA CIRCUIT TROUBLESHOOTING TIPS

Isolate chroma problems with a little 'know-how' and specialized test instruments

■Basically, color TV is similar to the BW set except for the chroma circuits. Servicing the chroma circuits will separate the "tube puller" from the professional, unless he has an idea of how chroma circuits function and how to employ specialized test instruments. So if you haven't joined the peacock parade, some of the chroma circuit troubleshooting tips will be of great value.

After you have checked all tubes, made a visual inspection, pressed on the circuit board and resoldered all connections, where do we go from here? That could be a loaded question unless we have a logical approach.

First, we will cover some of the problems found in the color TV set such as: (a) weak color-low in saturation or a light tint; (b) no color-normal BW picture during a color program; (c) incorrect color-strong colors, but incorrect flesh tones that appear purple or green with missing hues; (d) no color sync or lock-images that change color rapidly and colors that may break up into horizontal bands that run across the picture; (e) distorted color—color appears only in large spots and incorrect colors appear at edges of vertical lines in picture; and (f) colors that run or smear.

Many stages can cause loss of, or poor color reproduction. Any stage or circuit that the color signal must pass through can be at fault. The antenna lead-in wire or CATV cable system can cause color problems.

Misalignment of the tuner or video IF amplifiers will also cause weak or no color reproduction. A trap coil in the video IF and tuner section which is not tuned properly can cause a "suckout effect" on the signal response and loss of resolution in the picture.

A functional block diagram of a Zenith color set is illustrated (Fig. 1) to assist in stage troubleshooting. Now to localize the previously described color problems to a stage in the color section that processes the separated color signal. For these tests a simplified schematic (Fig. 2) showing key scope test points and a schematic of the Zenith 25MC30 chassis color section will be used. The same tests will work on any color chassis. The test instruments used for these checks were a gated-rainbow colorbar generator, a wide band scope and a VTVM to detect defective parts and take voltage measurements.

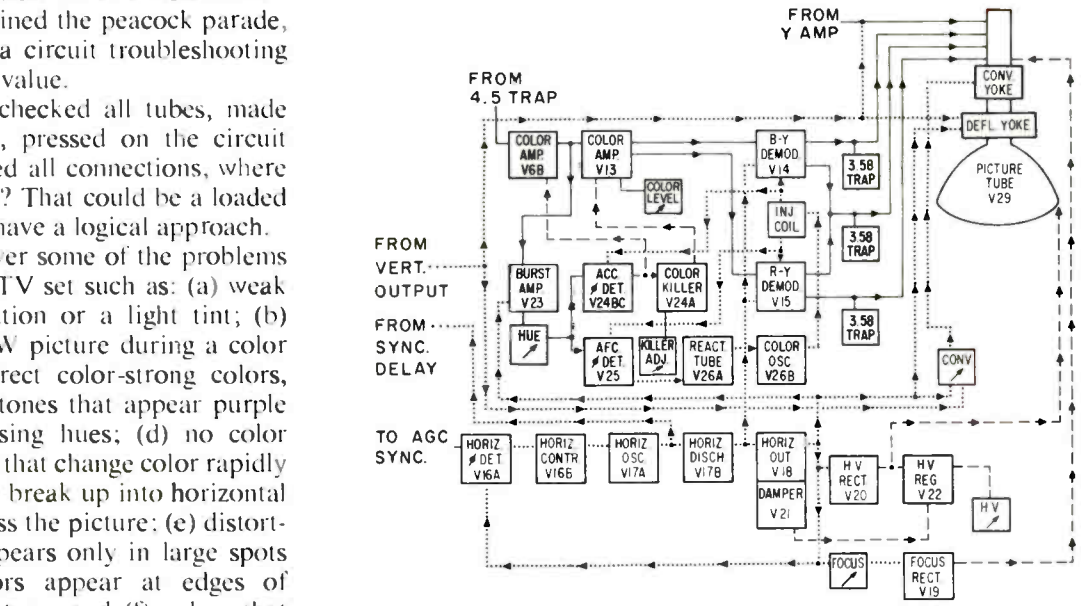


Fig. 1 — Functional block diagram of the color section in Zenith's 27KC20 color chassis.

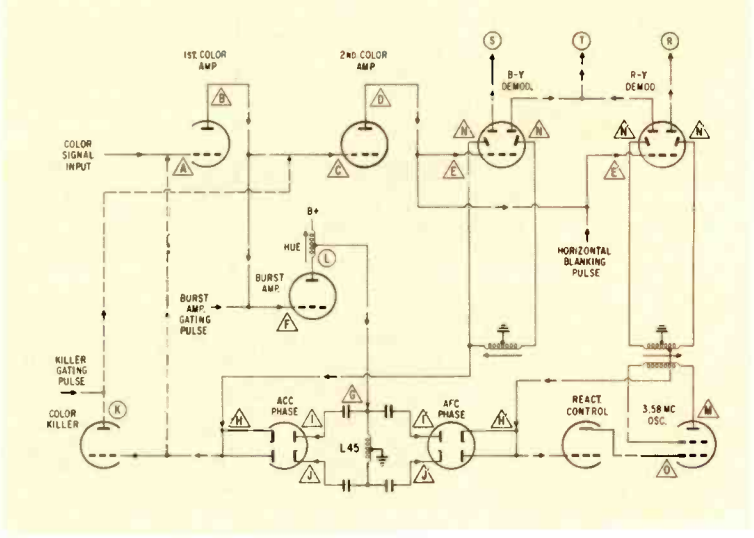


Fig. 2 — Simplified schematic showing key scope test points in Zenith's 25MC30 color chassis.

Snow Check

A useful quick check is made by observing a snowy raster. Switch to an unused channel and turn up the color level control. Turn the color killer control fully clockwise or ground test point K to open the color channel and note any "colored" snow in picture. (Check the service notes to make sure which direction the killer control must be turned to disable the color killer.) If no color snow is observed, the trouble is in the chrominance circuits. If "colored" snow is present, the color circuits are working, but they may have other problems.

Color Bar and Scope Checks

The color bar generator connected to the antenna terminals and the scope probe at test point A is shown in the simplified schematic (Fig. 2); a properly operating color set will have the waveform shown in Fig. 3. This waveform indicates color signals are present at the video detector output.

Scope Signal Tracing

The simplified diagram (Fig. 2) shows the signal path through the color stages. The triangular and circled points refer to the key test points where P-P voltages can be measured and correct waveforms are shown for a normally operating set. Several factors contribute to the actual shape and amplitude of waveforms at various points: line voltage, warmup time of receiver and type of test instruments used, etc. The waveform P-P values have been given as nominal for this reason. The TV technician must use some discretion in determining the accuracy of the waveform being measured. The relative signal amplitudes are important. Those in the demodulators must be correct to reconstruct the color difference signals. In most cases you will find P-P amplitudes given with the waveforms in service data. For best results you must duplicate the operating conditions

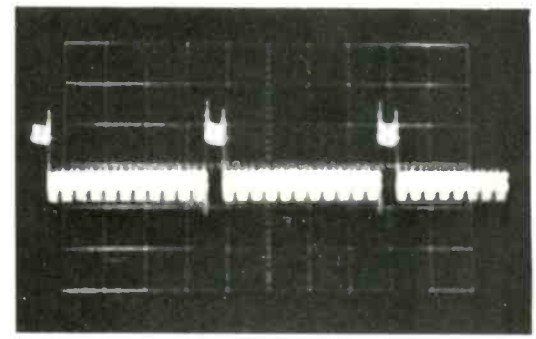


Fig. 3 — Waveform indicating color signals are present at the video detector.

used by the manufacturer when the voltages were measured. Check with the service notes for any setup instructions.

The scope waveform at test point B will appear as shown in Fig. 4. At test point D the same waveform as shown in Fig. 5 should be observed, but at a greater amplitude. Remember, a malfunction in the color killer circuits can cut off the 2nd color amplifier stage. A defect in the ACC (automatic chroma control) circuits can cause loss of color and/or attenuation of the color signal in the last color amplifier stage. The last check on the modulated color signal is made at test points E, grids of the B-Y, R-Y demodulator tubes. This waveform is illustrated in Fig. 6. All waveforms and P-P voltages checked out normal, but we still have no color.

Localizing Loss of Color Problems in the Chrominance Section

Since all color is missing, the defect will be found at some point which prevents signals from appearing at all three control grids of the CRT. A defect in one color difference amplifier (for RCA type sets) or one of the demodulators will not cause this condition. Loss of color is therefore localized to the color amplifiers, color killer and the 3.58MHz CW oscillator.

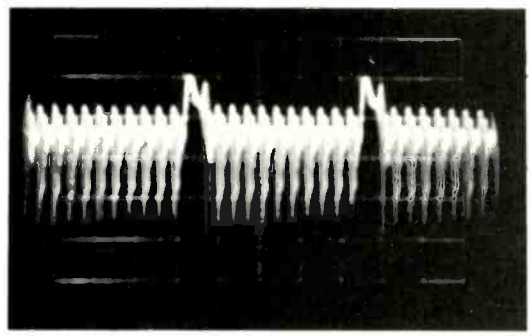


Fig. 6 — The modulated color signal at test points E.

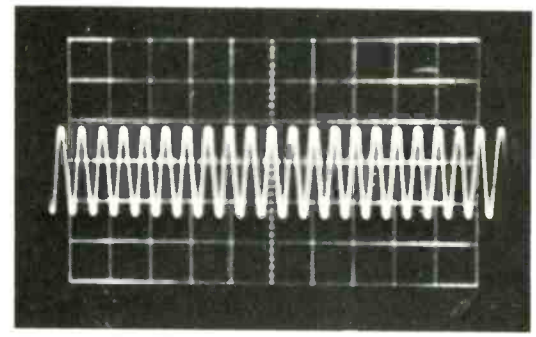


Fig. 7 — CW Waveform found at point O (expanded trace).

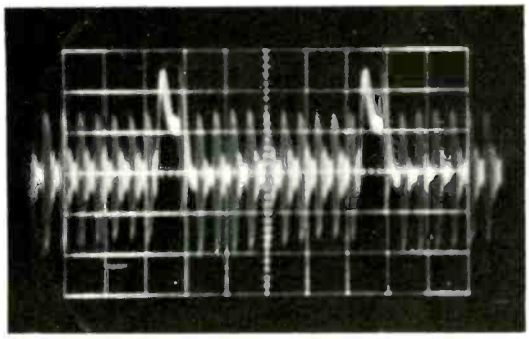


Fig. 4 — Scope waveform taken at test point B, the 1st color amplifier plate.

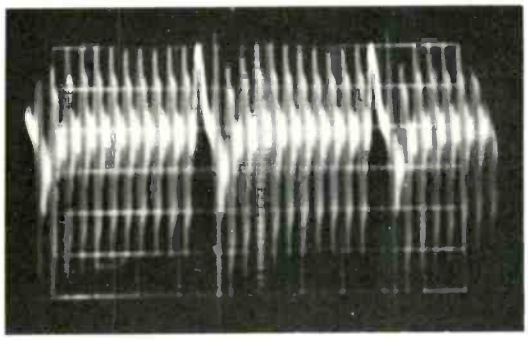


Fig. 5 — Scope waveform at test point D, 2nd color amp plate at a greater amplitude than test point B.

A dead or off-frequency 3.58MHz color oscillator can cause complete loss of color. A VTVM can be used to check the 3.58MHz oscillator. If a negative grid leak bias is developed, the oscillator is functioning. A scope is a good way to check the 3.58MHz color oscillator. The correct CW waveform found at test point O) is shown in Fig. 7. Proper 3.58MHz operation and CW drive is shown in waveform Fig. 8. The top trace is taken at test point M, the 3.58MHz oscillator plate, while the bottom trace is again taken at test point 0 at the 3.58MHz oscillator grid for comparison. There should be about a 6 to 1 ratio between these waveforms. (Note: these are expanded waveforms). To set the 3.58MHz to the correct frequency, ground test point W (AFC detector), test point K (killer voltage) and test point Q (ACC). The trick is to make the color bars stand up or slowly float across the screen. When this occurs the oscillator is on frequency or at zero beat. If the color will not stand up and the color again runs in strips with the clip lead at test point W, the disconnected color AFC circuits are at fault. This section can also cause the 3.58-MHz oscillator to be out of frequency and causing loss of color sync.

Color Killer

Although one of the first steps in checking for loss of color was to disable the color killer stage by adjustment of the threshold control or grounding, the problem could still be in the color killer. A grid-cathode short in the killer tube will hold the killer in conduction regardless of killer control adjustment. The bias developed by the conducting killer stage is used to hold the color amplifier in the cutoff state. A check of the color amplifier control grid bias voltage showing 10v or more is normally sufficient bias to cut off the color amplifier. A gating pulse will be found at the plate (test point K) of the color killer at about 20v P-P.

Color Sync Problems

Problems in the color sync of the AFPC circuits can result in color that breaks up into horizontal bands or changes in hue. This problem is solved in much the same way as the horizontal AFC section of a B/W TV receiver.

For color sync problems a scope check at test point F (burst amplifier grid) should reveal a burst gating pulse as shown in Fig. 9 bottom trace. Test points L or G will reveal the separated burst as shown in the top waveshape of Fig. 9, if no malfunction is present. The next scope tests are taken at

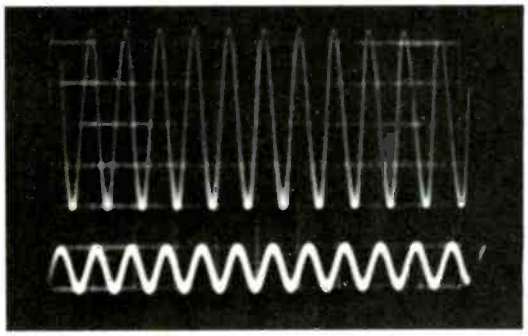


Fig. 8 — The top waveform was taken at test point M, the 3.58MHz oscillator plate, while the bottom trace was taken at test point O, the 3.58-MHz oscillator grid, for comparison.

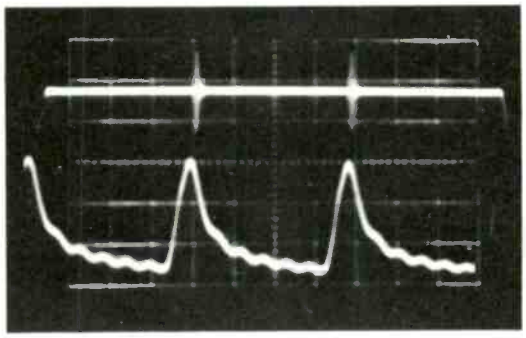


Fig. 9 — The top waveform shows the separated burst pulse and the bottom trace shows the burst gating pulse.

test points I' and J' of the AFC phase detector. They are top and bottom traces illustrated in Fig. 10. The two waveshapes at these points should be the same amplitude or balanced. The most common troubles in this circuit are unbalanced resistors R56A, R56B, leakage in capacitors C92 and C93, or shorted phase detector coils. Some color receivers employ solid-state phase detector diodes. Be sure they are properly matched and balanced. This same procedure is also used for checking the ACC killer phase detector circuits. Waveforms at test points I and J of the ACC phase detector should appear similar to a sawtooth and be balanced. A 3.58MHz CW signal approximately 70v P-P should be found at test point H (as shown in Fig. 2) of the color killer tube plate.

Weak or Unsaturated Color

Signal tracing provides the best approach to these problems. A complaint of weak or tinted colors, even when the receiver is properly tuned and the color control is turned to maximum, is isolated in the same way as a "no color" condition. However, you are looking for a lack of signal gain and not a complete loss of color.

Demodulators

Trouble in the color demodulators may cause incorrect color reproduction. The set may have a good B/W picture, strong color and will oversaturate by turning up the color control, but the colors appear incorrect. Flesh tones appear too greenish or purple. Some hues are missing, but cannot be corrected by adjustment of the hue control. These symptoms indicate a problem in the circuits that produce and/or amplify the color-difference signals. In a Zenith color receiver these circuits are referred to as the Sheet Beam Demodulators. These circuits in an RCA color system are the X or Z demodulators, or the R-Y, B-Y and G-Y amplifiers.

Phase errors are caused by incorrect phasing of the 3.58MHz CW signals applied to the demodulators. Phase errors that cannot be corrected with the hue control have the following results: all colors and hues appear in the picture, but all colored objects are shown with incorrect hues, flesh tones appear green, purple, blue or some other unnatural hue.

A lack of color difference signals can cause the color picture to lose one of the primary colors regardless of the hue control setting. This condition will be quite obvious when a color bar pattern is observed on the screen. Zenith demodulator test points N, N', E, E', S, T, and R should be checked for proper waveforms. The 3.58MHz CW (illustrated in Fig. 11) is shown at test point N. The waveforms for test points R, S and T can be compared to the service data of the set under test or a vectorscope can be used.

If correctly phased signals of the correct relative amplitudes are found at the previously mentioned test points, then check the signals at each of the CRT grids.

If the CRT color control grid signals indicate clipped or distorted waveforms, or incorrect relative amplitudes, the problem might be caused by signal distortion in the color difference amplifiers (RCA color set).

When testing the color sync circuits (AFPC) it may be helpful to disable the 3.58MHz color sub-carrier oscillator. Remove the 3.58MHz oscillator tube or disconnect B+ to the tube plate. This eliminates false burst pulses from feeding back into the color sync circuit and giving erroneous scope waveforms. Check the reactance tube voltages with a VTVM or make resistance checks. A problem in these circuits will pull the 3.58MHz oscillator off frequency or make it shift. ■

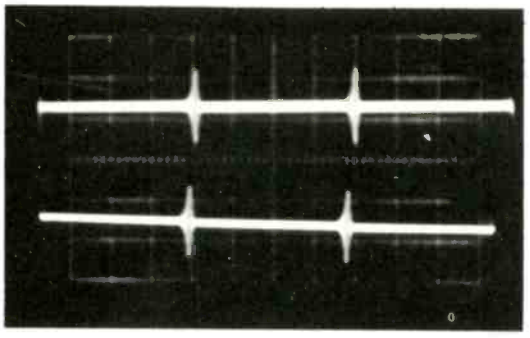


Fig. 10 — Balanced burst pulse waveform at the phase detector.

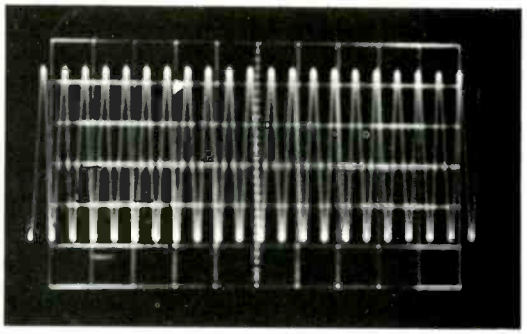


Fig. 11 — Demodulator 3.58MHz CW driver waveforms (expanded range).

Antennas— Sans 'Bafflegab' and 'Bushwa'

Learn how to solve near-to deep-fringe reception problems

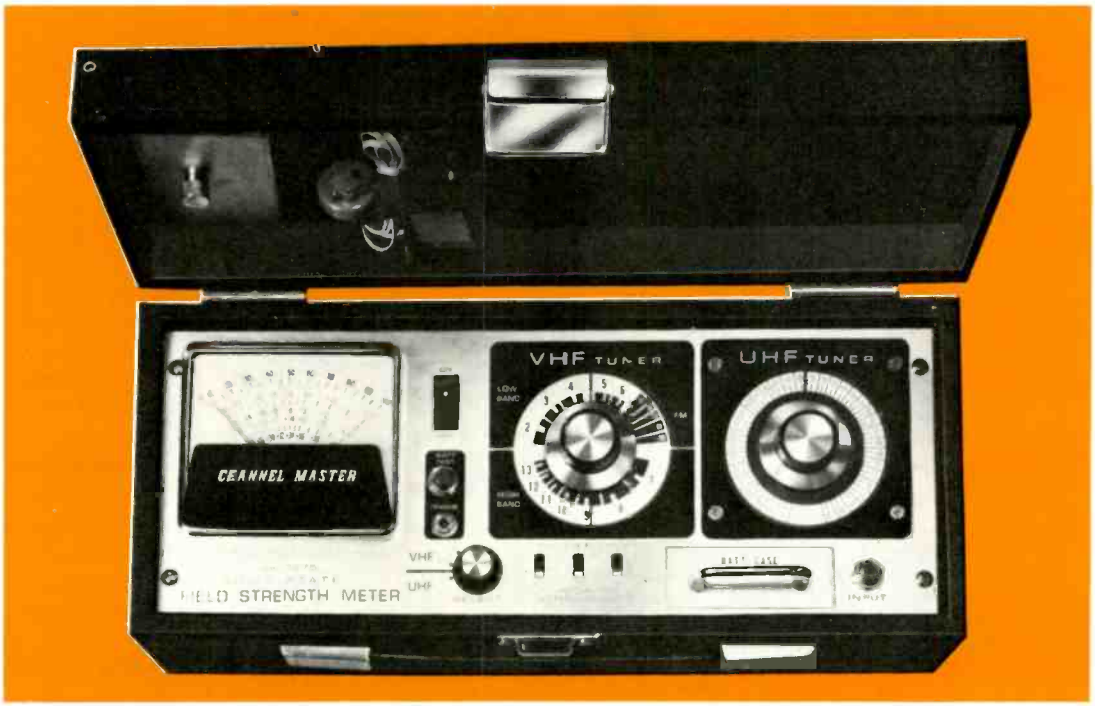
Part four of a series

■ The third article of this series (ELECTRONIC TECHNICIAN/DEALER, May 1968), dealt with a number of factors involved in selecting the proper antenna for a specific job or location, other than polar patterns, gain charts, VSWR and front-to-back signal ratios which were covered in part two of this series (ET/D April 1968). We will now explore additional special problems which frequently confront service-dealers and technicians, especially in near-to deep-fringe reception areas.

FS Measurements and Records

If you do even a modest amount of antenna work from near- to deep-fringe areas (and you certainly cannot sustain sales without at least installing or employing an expert to install antennas for each set sold), the job is strictly guess-work unless you own and use a good field-strength meter. And this instrument should be completely portable to avoid loss of time in unrolling and rolling up a lengthy extension power cable. In many cases you will be using the FS meter at quite some distance from a power outlet. Of course, you can power one from an auto or truck battery with proper accessories.

A number of approaches are possible in making FS measurements, depending on the amount of antenna installation experience you have had in a given reception area and also on the amount of recorded information you already have in your files regarding past antenna installations in a given reception area. These records are very important—frequently saving time when installing a new antenna. This data is normally recorded on a file card which is made out for each antenna installation, listing the type and model number of the antenna, height above ground, signal strength in microvolts for each channel, type of lead-in, its length and other pertinent information.



Channel Master VHF/UHF field-strength meter.

Amphenol field-strength meter has plug-in units for both UHF and VHF TV frequencies.

UHF/VHF field-strength meter by Blonder-Tongue

A glance at a few of these file cards can frequently tell you what you need to know about average conditions over a given small area and you may not have to waste time probing with different antennas. At any rate, no matter what antenna you select for a first-try in probing at a new location, a file card should be completed for every installation and should contain all the previsously mentioned information.

Of course, for this kind of work, you do not use a halfwave reference dipole with your FS meter. You merely run up a regular antenna temporarily, with lead-in attached and orient the antenna for maximum signal strength for each channel to be received. This particular case assumes that the signals are all originating from the same point or near the same point. Sometimes the antenna is oriented for a mean-position between two or even three not to widely spaced transmitting towers.

One approach to making FS measurements requires a portable antenna rig attached to the service truck, with crank-up mast. The idea is to run the mast to whatever height that yields at least 1k μ v of signal for each channel at the end of a lead-in cut to the exact length to be used in the installation. And some allowance should be made for wet-weather losses in the event regular 300 Ω leadin is used. Of course, it goes without saying, you can use a portable TV to check out reception on the spot but you will not be able to figure signal strengths and leeways required. And many service-dealers use this method when replacing old antennas, demonstrating results to the customer merely by attaching the lead-in temporarily to the owner's set.

Theory and Practice

Some pseudo-scientists frequently take the very unscientific position that a thing "may be true in theory but not work in practice." The implication here is that a theory can be true and yet not work. Of course, this is a scientific impossibility. A theory is not to be confused with a hypothesis. If a theory does not work in practice, then the theory is either false or it has not been applied or followed precisely. Like the electron theory, for example, any theory is a *proven* method, or formula, used to arrive at exacting results. Theories grow out of research, development, practice. And all theories develop to higher orders, become refined through practice.

In this connection, we frequently think of VHF and UHF signals traveling only in a straight line from transmitting antenna to receiving antenna. The general concept is: the higher the antenna, the stronger the signal. Once again, this is an oversimplified generality and is not precisely true.

We already know about and have discussed "ghost" reflections which are received via high points to the right or left of the direct signal path. But what about the ground-reflected waves, a variation of the direct-path wave, which we sometimes encounter? These waves reflect off the earth's surface and then into the receiving antenna. Like ghost reflections from right or left, these earth-reflected waves "bounce" into the receiving antenna and usually arrive with less strength than the direct wave because the earth ab-

sorbs most of the energy. But these signals are sometimes rather strong — depending on the type of earth surface involved. And these signals can be either in phase or out-of-phase when they arrive at the receiving antenna — depending on terrain, antenna height and some other factors. The direct wave will be reinforced when the ground-reflected wave is in phase. But if the ground-reflected wave is out of phase with the direct wave, it will cancel out a portion of the direct wave — in effect, it will attenuate the direct signal. This is one reason why the height of a VHF or UHF antenna will sometimes become very critical.

So, we cannot rely on "theory" unless we consider all the factors involved in the theory. We have seen many cases where raising the antenna reduced signal strength, and lowering it increased the signal strength and hence, the picture quality—because of incoming ground reflections. Movement of the antenna only a few feet, forward or backward, right or left, will also make a considerable difference in reception quality at times.

We must also consider, under certain circumstances, such things as beyond the horizon reception problems on both VHF and UHF sometimes caused by atmospheric refraction. A station two or three hundred miles away, far beyond the line of sight, well below the horizon, can easily interfere with a local channel (co-channel interference) Also, certain temporary changes in one or more layers of the ionosphere (especially the sporadic-E layer) can cause trouble on low VHF channels well beyond 100MHz and many hundreds of miles away—especially in a north-and-south direction. Co-channel interference cannot be eliminated with band pass filters unless the local signal is very strong. Other methods must be used.

Believe it or not, all of the aforementioned considerations, together with some others we have not mentioned, belong in your repertory of reception problems to be solved.

Quality Equipment and Workmanship

All knowledgeable and alert service-dealers and technicians know that it does not pay to do "slip-shod" work and use "reject, job-lot" type material in antenna installations. And this includes those antennas which have elements made from thin, rolled, butted-seam stuff that falls off like autumn leaves with the weight of the first winter ice-up. And avoid using that 300 Ω lead-in covered with "reclaimed-quality" poly that cracks up like clay in modestly varying temperatures the first year and then leaks like a sieve thereafter.

And what about those 20-gage "steel" masts that turn red with a coating of iron oxide (otherwise known as rust) after a

Continued on page 64

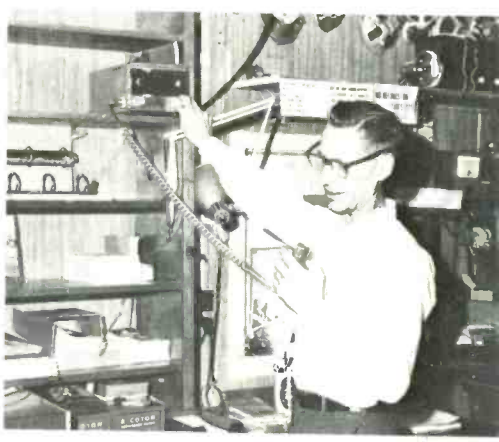
Portable field-strength meter by Sencore.

Don's TV grand opening — 1961.

Don's TV — 1968.

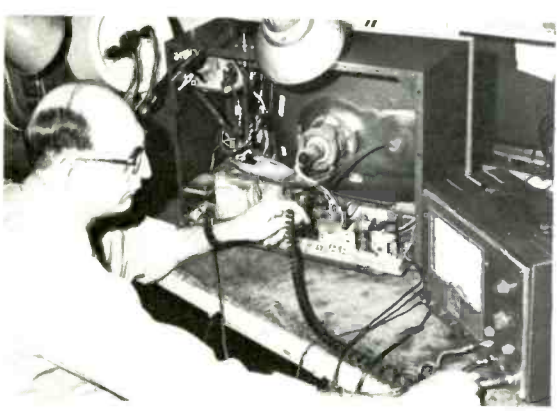
Full- and part-time office girls take care of filing and mailing.

Don Wernli points out features of new color TV.



Don checks with service technician out on call via two-way radio.

Lloyd Olson takes a voltage reading on a table model B/W set.



Don attends the needs of a customer in the TV service department.

COMPUTERIZED TV BUSINESS

A computerized TV business and an active training program tell the story of this untypically small town TV service-dealer

■ Perry, Iowa, with its 7000 people, is home for Don's Radio & TV — decidely not a typical small town service-dealer. Don's TV is a progressive, computerized business enjoying a profitable income and actively engaged in helping young people prepare for the future.

Clark Pohl and Don Wernli, partners in Don's Radio and TV in Perry, Iowa, are technicians. They set out to build a successful TV and appliance business through modern business practices and customer satisfaction. To prove they were on the right track, the men started as partners in 1958 doing TV-radio servicing. They grossed $18,000 their first year. Now they gross over $380,000. Part of this growth took place through business sense. A big step forward was the installation of a computerized billing system. In addition, Don and Clark encourage and hire part-time students from the local high school to work in the shop under a school program. This includes young men interested in learning a trade, and girls desiring office experience.

Started with Service

Don's Radio & TV, Inc. was originally started in 1953 by Don Wernli in the basement of his home. "I had more service work than I could handle," Don states. "When Clark was released from military service in 1956 he entered technical school and upon graduation in 1958 we decided to become partners and really build the business. We moved to my garage and operated from there the first two years doing TV-radio service work.

"By 1960 we had outgrown the garage and purchased another one — larger and with more land. We remodeled it, then added TV sales to our business. At that time we sold only color TV sets — no radios or stereos. We grossed $43,000 that year and won a trip to the RCA factory.

"We had a 50 x 110ft lot next to the garage," Clark fills in as Don left to talk to a customer. "In 1961 we put a new 30 x 60ft building on the lot right next to our old store. We moved everything into the new store and rented the old one. At the same time we added a full line of TVs (still staying with one brand), radios and phonographs. Our grand opening was in September of 1961 with a staff of one technician and an office girl. In 1962 our annual gross business exceeded $85,000. About one-third of this was from service and installation work."

Adds Appliances

Don returned bringing us some fresh coffee. After deciding it was too hot to drink, Clark put his cup down and continued. "We did a good business in 1962 and 1963, but we wanted to do better. We had been debating for some time about adding either two-way radio or appliances to the business. We decided on the appliances because we felt that the two-way market in our area would have to cover a large territory to be profitable and there would be the added expense of extra test instruments. Also, we figured that we could obtain more of the local market with the addition of appliances — people buying appliances would be more apt to come back and buy a TV or radio and vice versa. So, in 1964 we joined our two buildings, the one we had been renting and the one we were in. It proved to be the correct move. We increased our gross to $185,000 in 1965, and in 1967 it was over $350,000."

Computerized Billing

Our ET/D reporter was anxious to hear about the computer. Don quickly finished the last of his coffee and proceeded to give our reporter the details.

"The system we use here is called a 'Total Systems Computer.' Every item in the store, every employee, each job function and each customer has a special code number. When Mr. Jones buys a transistor radio, the cash sale or charge is rung up on a special cash register with all the appropriate code numbers punched in on keys which the clerk selects. These code numbers are then recorded on a large tape inside the register. The clerk selects the keys which indicate the code number for the salesman, a number for the radio, the price and a number for the customer, if he has an account. If it is a charge and he has no account or number, a new number is assigned. At the end of the week the tape is sent to the computer and each month we receive a tabulation sheet. It tells us how much inventory was sold, what it cost, the profit, who sold it, if we need to re-order. It even makes out the billing and automatically adds a 2 percent service charge to accounts over 30 days old. It also tells us who is on a 30-60-90 day account and on these accounts after 90 days we get a print-out of the customers name, address and phone number. Then we can call the customer and, if necessary, send a second statement. The 2 percent service charge pays for the computer billing system which costs about $70 to $80 per month for statements and management reports.

"The management report we get from the computer includes things like total sales from each department, gross profit in percent and monthly inventory on hand. On larger merchandise it gives us the number of

months of inventory we have on hand or the supply we have left based on current usage. It also tells each man's labor cost on service income, all his parts sales, and it gives us call-back and warranty labor plus initial installation costs. The warranty is even broken down as to total and amount of work done per man.

"The computer is useful, too, when we receive a call from a customer who claims a long line of TV problems and repair costs over a period of time. We simply go to the computer file and pull his cards. The cards are coded with information that tells us exactly when the item was purchased, what has been done to it and also what correspondence took place. The system is invaluable to us in inventory of small parts, too."

Guaranteed Satisfaction

"Don and I primarily sell now," Clark adds. "Julie Davis, our sales clerk, is a big help in that department, too. Actually, when we added Julie, our sales costs dropped 3 percent and our sales volume increased 15 percent. We push our service — we know that our customers can drive to the big city and buy cheaper, but we can provide one-day service and instant delivery and installation of TV or appliance.

"In every case we try to satisfy. We give 90 days free service and the normal factory warranty on TV and radio. We feel we have built customer confidence and if we can gain a better customer relationship by bending sometimes on our warranty, we do it. The customer gets guaranteed satisfaction and a five-day free trial period. If the customer's new TV or stereo doesn't go as well with the decor or fit the way he thought it would, he doesn't have to worry about it. He can return it within the five days for something that does satisfy him. Only about 1 out of 100 will return an item and not purchase another from us to replace it. One of the advantages of being in a small town is that we already know most of our customers. Either their friends or relatives have purchased a TV or appliance from us at one time."

After getting his third cup of coffee, Don joined in. "We rent out TV sets and tape recorders, too. The rental TVs are strictly B/W transistor units. We rent them for an indefinite period with a minimum charge of $2.50 for one to five days. Then it's 50 cents each day after the five days. We rent mostly to hospitals, but some to private homes where they just want an extra TV for a few days, or perhaps while their own TV is being repaired. If the TV is rented to a customer who has his own TV in our shop for repair, he pays rent for only the first five days. If his own set is not repaired in that time, he continues to use the rental unit at no charge until he gets his own set back."

Antenna Sales

Our reporter asked the boys about TV reception in Perry, since it is some distance from the nearest large city.

"We generally sell a new antenna with each color TV set" Clark explains. "Our closest TV station is 35 miles away, the farthest is 65 miles. Channel 13 is the highest channel frequency we get — and the weakest. When we install a TV antenna, we line it up for the best reception on channel 13 and the other two channels come in with good signals. All three stations are, fortunately, in about the same direction. Because of that, we sell very few rotators.

"We always try to sell the customer a better antenna than he can get by with. We don't sell the one that will just barely do the job — we sell the next one up. We do this because past experience has shown that most of our color TV customers end up buying a second B/W set later. When they do, they already have an antenna to take care of both sets. The antennas and installation are always sold separately from the TV set."

Clark looked over at Don and said. "Don, why don't you tell about the first home MATV system you put in?" Grinning sheepishly, Don explains, "I put it in a new home. The people had just moved in. I remember running up and down the ladder from the attic to the living room and the lady of house finally asked me what I was doing. I told her I was trying to measure my lead-in hole so I wouldn't drill through the ceiling — I missed. She met me as I walked into the living room. As we stared up at this horrible hole in her new ceiling she said, 'Well, what do we do now?' I told her I didn't know much about plastering, I was the TV antenna expert. She was pretty decent about it though and we had a carpenter go out and repair the damage at our expense."

When Clark and Don finished laughing about Don's MATV job, which was not so funny at the time, Clark continued, "Our first large MATV system was installed in a local motel. The owner didn't want antennas sticking out of his roof so we had to put conicals in the attic. We used one antenna for two sets but it didn't work out. Finally, we put up a 30ft tower, distribution amplifiers and set couplers with 300 Ω lead-in all through the system. It worked great, fortunately, because at the time we didn't know anything about figuring db losses. Now we know what we are doing, and use all coax systems."

Two Service Departments

"We have two service departments," Don Wernli says. "One for TV-radio, the other for appliances. Each department is in a separate room with a central service entrance convenient to both areas from the side street parking ramp. We have full-time men in both departments and some of these men can double in both departments if necessary. Besides that, we have three "econoline" vans for house calls and a one-ton truck with a hydraulic hoist which we use for delivery of appliances and TV sets. The econolines are equipped for TV service and antenna installation with a small stock of parts. Sets that need a lot of work are brought back to the shop immediately. Usually we take only the chassis.

"We charge $7 for the first half-hour on a service call and $2 each 15 minutes after that. Antenna labor is based on a minimum of $7.50 per hour for an antenna on a one-story structure. TV bench service is $12.50 minimum for B/W sets and $17.50 for color. This usually takes care of the labor charges. We set up the minimum bench rate because it establishes a cost that the technician can give the customer when a set has to

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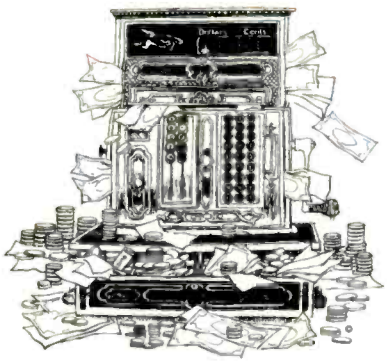
How To Make More Money and Live Better

Increase your profit margin by using these tested formulas

Part Two (Conclusion)



■ The first article of this two-part series (ELECTRONIC TECHNICIAN/DEALER) covered some basic fundamentals regarding the operation of a successful service-dealer business. These points included the marketing program, establishing realistic goals, budgeting and the break-even point. The article ended by touching on the need for organizing everyday business activities.

Once the business is functioning efficiently on a daily basis, it is ready for the next phase of the marketing plan. This can be called "service mix analysis" — a term derived from the manufacturer's "product mix analysis."

Service Mix Analysis

Basically, what we want to do is find out what aspects of the business yield the greatest margin of profit for the same investment. (Incidentally, return on investment — what you get back for what you've put in — is the only accurate reflection of a business' profitability.)

Measuring profit simply by gross volume less expenses does not really indicate anything. Certainly, it looks good, but it fails to account for the growth of the businessman's capital investment. We are presently discussing "service mix," however, and to this extent, several things must be kept in mind. First, there are areas in any business that bring in a greater share of profit. This is so because we can simply do certain fixed dollar jobs at a lower cost.

If we charge the same for two jobs, but can buy the parts for one cheaper, we can make more money. (This assumes the same amount of time to do both jobs.) Conversely, if the cost of parts for two jobs is the same, and we can charge the same for both, but can do one of the jobs in less time, then we can make money in terms of time invested.

Let's look at this in terms of dollars and cents. First, let's assume we have two jobs that will take the same amount of time to do, and that we can charge the same amount for each.

Example No. 1 — Bench job — 1 hour — $30.

Your Cost	*Bill Customer*
$10 — Parts	
4 — Labor	
2 — Misc.	
$16	$30

Your gross profit $14 (before operating expenses)

Example No. 2 — Color Antenna Installation — 1 hour — $50.

Your Cost		*Bill Customer*
Antenna —	$19.00	
Mast —	1.00	
Mount —	1.50	
Lead —	1.50	
Misc. Hdwe.	.50	
Labor —	4.00	
	$27.50	$50

Your gross profit $22.50 (before operating expenses).

As you can readily see, example No. 2 represents $8.50 in additional profit for the *same* time investment. This being so, the marketing oriented service-dealer will immediately see which job is more profitable, and will seek to do more of these jobs.

This, of course, deals with an ideal situation. If we could do only the most profitable jobs, we would have nothing to worry about. Such is not the service-dealer's lot, however. You have to do all of the jobs to satisfy all your customers. This does not mean though, that you must sit idly by and let good money blow away. Not by any means. You must try to schedule your activities so you do more profit-building jobs. Although this is difficult, it is not impossible.

By actively soliciting the profit builders, you can expect an increase in this area. At the same time, your regular and so-called courtesy jobs will remain fairly constant. By properly scheduling your workers and your work, you'll find that you have capabilities for handling more. These additional jobs you take on will be the true profit builders. They will help immeasureably to improve your profit position.

To summarize then, what we want to accomplish with a "service-mix" analysis is to:

1. Determine which jobs yield more profit for the same investment, in terms of both time and money.
2. Attempt to place emphasis on the so-called profit builders.
3. Try to reschedule our work and our workers so more can be done.

Cost and Pricing Analysis

An integral part of "service-mix" analysis is computing and outlining your cost structure for each different job. This does not refer to individual jobs, but more precisely, to different kinds of jobs. These would include major repairs, minor repairs, (changing fuses, tubes, speakers, etc.), set tune-up, radio repair, FM stereo and amplifier repair, air-conditioning work, antenna work, two-way radio work and auto radios. Not all service-dealers do all of the jobs outlined here. But many do all of these and more. In any case, the individual will have to decide just what his job categories are, and will have to set them down.

The next step is to roughly compute the cost of doing each job. In this connection, we must bear in mind that not all expenses and costs will be obvious. Many hidden costs exist in any business, and especially in a sales-service business. Service-dealers should be aware of contribution to overhead (by each job done), amortization of shop equipment, depreciation of vehicles and obsolescence. That's right, Mr. Service-Dealer — obsolescence. It is unfortunate that service-dealers continue to hold onto outdated or discontinued parts. While collecting dust, these take up valuable shelf space, and represent an investment that could have otherwise resulted in usable merchandise. This must be figured as an expense when setting up your price structure.

Once all costs have been taken into account, a reasonable margin of profit should be added, and a price set for each job. This schedule should then be employed and adhered to for every job. The less you deviate from it, the better will be your chances of showing a greater profit.

What we want to look for, then, are all of the costs and expenses connected with any particular job. Among these are:

1. Cost of parts.
2. Labor costs.
3. Operational costs.
4. Hidden costs of:
   a. contributions to overhead
   b. amortization of shop equipment and test instruments
   c. depreciation
   d. obsolescence

Advertising and Sales Promotion

Also included under the heading of marketing, are advertising and sales promotion. Most service-dealers do have these programs in effect, and are aware of their worth. Basically, a good advertising program will help improve the dealer's image and generate new business. The amount spent on advertising, however, is usually limited. This is because the average service-dealer has limited promotional funds. In this connection, efforts should be made to work with distributors and manufacturers in co-op programs. Service-dealers should also use all promotional materials made available to them by suppliers. It just does not make sense for a service-dealer with a limited promotional budget to throw away materials which have been given to him at little or no charge. The smart service-dealer will ask for all promotional materials his suppliers may have available.

We again used Frank Moch's generous cooperation and wide range of experience in the service field. We asked him to comment on the role of advertising in the service business, and here are his remarks:

"On the subject of advertising, here again a great variation exists. It appears that direct mail is the most productive and cost justifiable method for servicers."

Mr. Moch's comments make good sense, and tie in perfectly with what has been said previously. Mailing pieces are readily available to you from manufacturers and distributors. All you need to do is pay the postage. If you are not doing this, you may not be getting your share of the service market in your area. It is entirely possible that in trying to save pennies, you have lost dollars. Try to re-evaluate your own advertising program. Remember, the marketing conscious service-dealer is constantly striving for ways to bring in new business and increase profits.

Probably the best and least expensive advertising program that you can engage in is simply to become an active member of your community. Seek new friends and new people. Attend community meetings and participate in community activities. The more people you know, the more people who know you, and the better your chances for new customers. It is no longer true that people regard the TV service-dealer as a thief or, at least, as an overcharging businessman. People are becoming more aware that service technicians are trained specialists who, like doctors, are entitled to fair payment. Take advantage of this new image, and seek to enhance and build upon it.

One very easy way to enhance your image is to create a good impression in the eyes of your cus-

Continued on page 65

Two Corporations Operate as One

The one-shop operation of combined TV-radio and appliance businesses can be profitable

Don Becksted discusses delivery of new color TV set as Don Wilkowski looks on with approval.

■ South Suburban TV and Don's Appliance are individual corporations operating under one roof. It is one of many businesses which make up the Penn 66 shopping center in south Minneapolis.

Situated on a main street, it is close to four larger shopping centers and gains the exposure of traffic to these centers from a nearby superhighway complex.

Don Wilkowski is the owner of both corporations. He originally owned Don's Appliance and about one-half of South Suburban TV. He purchased the remaining portion of the TV business in 1958 from Don Becksted, who has worked at Suburban TV as a technician since 1954 and now manages the TV-radio part of the business. South Suburban TV and Don's Appliance were strictly TV-radio and appliance service centers until 1963. In 1963 they added TV and radio sales. At the end of the first year TV sales and service alone totaled $52,000, climbing to $205,000 in 1967.

Share Operating and Advertising Costs

As separate corporations under one roof, the TV and appliance stores share office girls, office space, advertising, rent and utilities. The sales and service areas for each store divide the 22 x 150ft building. There are two girls in the office — one full time and one part time. The girls take care of the books, billing and answer phone calls for both departments.

Mr. Wilkowski explains their advertising methods this way: "We have a fortunate situation for advertising. Our TV-radio manufacturer gives us a good deal of co-op advertising and so do the appliance people. Regardless of what we advertise, the other department derives benefit from it. The reasons are simple: both TV-radio and appliances are in the same store and customers coming to the store see both.

"One of our advertising tools is an identifying border around our ads, correspondence and business cards. People seeing this border associate it immediately to South Suburban TV and Don's Appliance whether they see it in a TV ad or an appliance ad.

"We also consider our large ad in the Yellow Pages as one of our prime advertising mediums," adds Don Becksted. "Because we sell and service TV-radio and appliances, we are listed in about 28 places in the Yellow Pages. We are listed several places as a TV-radio service shop, appliance service and in many places as dealers of these items. We are also listed in each of the suburban phone books in the areas we service.

"We also send mailers to new people in the neighborhood telling them about a discount they'll get on

their first TV service call. About 50 percent of the customers purchasing new TV sets are previous service customers or from the ranks of people who have purchased an appliance from us.

Double Sales Potential

"We have a double sales potential," Don Becksted tells our ET/D reporter. "People who come in to buy an appliance are exposed to the TV and radio merchandise. It works both ways.

"We sell only one brand of TV. And we believe the one brand has a wide enough variety and price range to meet most of our customer needs. Either of us can, and does, sell TV sets and appliances if one or the other is busy elsewhere."

"We don't give home demonstrations. But, the customer has a three-day trial which is written on the sales slip or contract. Whether a customer buys a TV or a deep freeze, he has to be satisfied or he can bring it back. The trial period is somewhat flexible, depending on circumstances."

"Anything we sell that goes on the books for more than 30 days is by contract. The contracts are written through the Appliance Buyers Credit Corp. (ABCC) which is nationwide. It's designed for people who want to buy TVs, radios, washers or dryers on time payments."

Wide Service Coverage

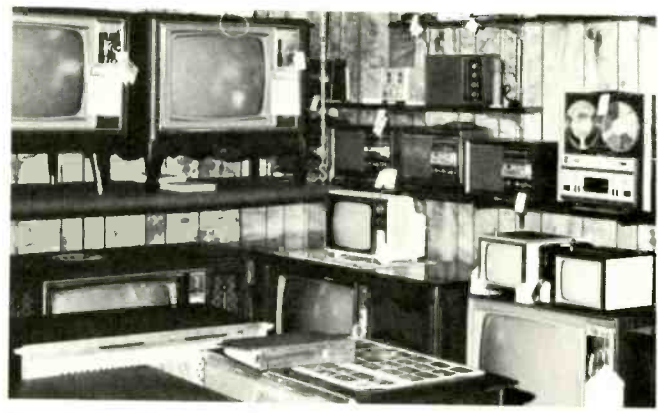
Suburban TV and Don's Appliance both feature service departments. Mr. Becksted states, "Thirty percent of our gross business is from service. Because of our sales volume, much of our service is warranty. In the TV department we probably take care of 15 to 20 service calls a day and normally run two or three days behind schedule. All service work is done on a first come, first served basis.

"We have no fixed bench rate as such. There is a minimum rate of $4.50 for a tube replacement repair on B/W sets brought in by the customer. Labor costs on TV sets brought in for bench repair which requires the chassis to be pulled will average between $17 and $20 minimum.

"Bench work in a color TV chassis has a minimum of $24 to $29. Service calls are $7.50 for B/W and stereo units and $9.95 for color TV—this includes the time it takes to troubleshoot a simple defect. If the chassis has to be pulled, the service call rate covers that, too.

"The charge for work on a second set on the same service call is $4.50 extra. There is a re-installation fee after bench repair of $3.50 for B/W and stereo, and $4.50 for color. We stock most of the parts we normally need for service repair, and other small parts depending upon how hard they are to obtain locally.

"We have two panel trucks for the TV department. Both are equipped with tubes, test instruments and small parts for service calls." ■



Veneer paneling and chain suspension shelving combine for pleasant, versatile use of showroom area.

Technician adds final touches to control panel before delivering repaired set to customer.

Technician adjusts color TV while another checks the linearity of a B/W table model.

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ET/D DEALER SHOWCASE

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

Video Tape Recorder 700

A video tape recorder having electronic editing capabilities is announced. This feature is said to provide a smooth transition between scenes on a video tape. This is accomplished

automatically and electronically by a push-button control on the VTR620. Another major feature includes ferrite video heads which are said to increase the expected head life to 1000 hours and boost the S/N ratio to produce a sharper video image on the monitor screen. A helical-scan, dual rotating head system employing ½ in. video tape is used. Price $1050. Concord.

Solid-State CB 701

A new 23-channel CB transceiver is announced. The Messenger 320 is solid-state throughout with 23 transistors and 15 diodes. It measures 2½ in. high by 8in. wide by 9in. deep. Accessories include ac and portable power supplies and a tone alert selective calling system. The unit employs a double conversion superheterodyne receiver. The manufacturer claims a receiver sensitivity of 0.5μv for a 10db S/N ratio with a full 5w RF input transmitter section. The mobile mounting bracket and transceiver are ready for 12vdc operation on all 23 channels and can be removed in seconds for base or portable use. Rechargeable power pack furnishes power for eight hours of operation. Other features include a built-in combination "S" meter and RF power output meter, squelch and volume controls, a

built-in 3w PA system (requires an external speaker for operation) and a rugged ceramic microphone. It is said to meet all FCC and DOT standards. E. F. Johnson.

Solid-State CB 702

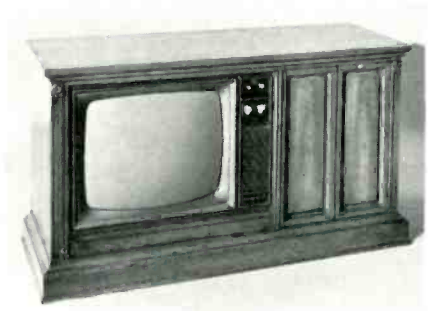
A solid-state 23 channel 2-way radio transceiver guaranteed for 10 years is introduced. The Classic is said to carry every known feature that could be built into a CB transceiver including power output of 3.2w at 12.6vdc with 100 percent modulation, push-pull adjustable noise limiter and fail-safe relay. A zener diode "safety circuit" is also provided to protect against mismatched antenna, incorrect polarity and overload. Panel controls include single knob tuning, built-in PA system, illuminated chan-

nel selector and S meter. A compact 6½ x 8½ x 2½ in. Unit comes complete with noise-canceling microphone, mounting bracket and crystals for all 23 channels. Price $199. Courier.

Color Slide Theater 703

A home entertainment product that presents color television programs, color photography slides, or prerecorded and home made tapes on the instrument is introduced. It is said the unit can be operatd as a B/W or color TV set; an 'all-in-one' slide projection system with the photographs showing on the screen of the TV set, or as a tape recorder and player. The tape recorder and slide projection system can be synchronized to present slides with taped narrations. The slides may be cued electronically or manually with a remote control switch held by the viewer.

The slide system uses a circular slide tray which can accommodate 80 2x2in. color or B/W slides. A small cathode ray tube, called a "flying spot scanner," is used to transmit the pho-



tograph from the slide to the screen of the TV set. The scanner reads each slide with a rapidly moving spot of light breaking down each slide into the three basic TV colors — blue, green and red. Other components in the slide projection system convert these colors into video signals which are then fed into the TV set and displayed on the screen. The unit has a factory-adjusted fixed focus. The objective lens is set at 50mm, f3.5. Focusing of the slide is done automatically by the spot scanner. The unit can be changed from TV to slide projection operation by a simple push-pull switch. A microphone provided with the unit permits users to produce a coordinated slide-tape presentation. The cassette-type cartridge tape recorder contains record and playback features, a recording level meter, a microphone, and a control to change slides electronically. Price $995. Sylvania.

Stereo Phono 704

Introduced is the model 1212 offering several of the design and operating features used in the high end of the line. These include a balanced tone arm, variable pitch-control, direct-dial tracking force, antiskating, automatic cueing, constant-speed motor and a nonferrous cast platter. Price $74.50. Dual.

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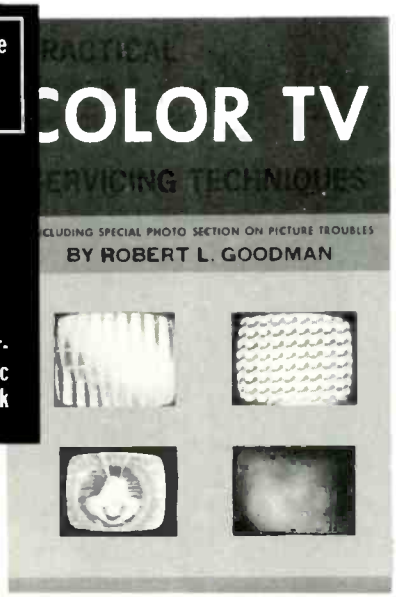

PARTIAL LIST OF CONTENTS

PRACTICAL COLOR TV SERVICING TECHNIQUES is chock-full of new and helpful techniques for servicing color TV. Shows how to cut service time to the bone — even on tough-dog problems — using a dual-trace scope or an electronic switch/scope combination to speed trouble diagnosis in signal, sweep, sync, and high-voltage circuits — in fact any circuit in the set. Also included are ways to use a vectorscope for chroma circuit alignment, a pulse generator for PC board leakage tests, and more efficient uses for the standard color bar generator, VTVM, and ohmmeter.

A special color photo section is included — with dozens of full-color illustrations — to show clearly what the author is talking about in his discussions on troubleshooting, alignment, convergence adjustments, etc. Each chapter is profusely illustrated (over 230 in all) to further explain the troubleshooting techniques involved. No color TV technician should be without a copy of this book! 304 pps., with 8-page foldout section containing two complete receiver schematics; 230 illus.

CONTENTS: Chroma Tips & Countermeasures — Sync & AGC Troubleshooting — Chroma & IF Alignment — Troubleshooting Horizontal Sweep & High-Voltage Circuits — ADG & Power Supply Circuits — Convergence Problems & Cures — Use of the Square-Wave Generator — Testing Printed Circuits — Portable TV Troubles & Solutions — Solid-State Circuit Tests. Index.

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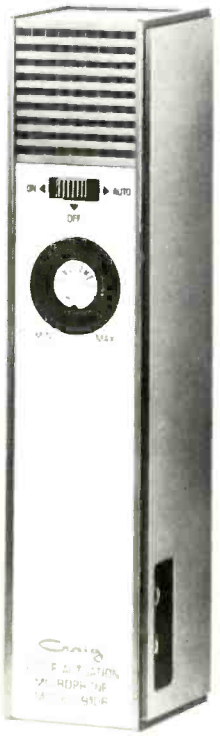
ET/D DEALER SHOWCASE

Voice Actuated Microphone 705

Announced is an accessory voice-actuated microphone for use with all Craig portable tape recorders. Adjustable sensitivity control is said to eliminate response to unwanted background noise and make for more efficient use of tape. The six-transistor unit has input jacks for extension microphones or other pickup, plus control switch for automatic or manual operation. Dimensions are 5¾ x 1¼ x 1⅝ in.; weight 8oz. List price $15.95. Craig.



Radio/Cassette Tape Recorder 706

Announced is a model TPR101 portable radio/cassette tape recorder featuring a three-band radio: FM/AM/Marine band. It has push buttons for all radio and tape recorder functions with direct monitoring and recording provisions. This ac-dc 15 transistor unit includes remote control microphone, earphone, blank cassette, batteries and ac line cord. Price $104.95. Aiwa.

Portable TV 707

A series of 9in. picture (diagonal measurement) monochrome TV sets has been introduced. The receivers have been designed with complete solid-state tuning, front directed speakers, front-mounted fold-down monopole antenna and panel controls including an ON/OFF flip switch with a separate volume control. The cabinets

are said to have high impact, textured polystyrene fronts and backs, with molded fold-down carry handles. Colors available are teal blue, red, gray and avocado. Size 12 ½ in. wide, 9¾ in. high and 10¼ in. deep. Weight 10.5 lb. General Electric.

Speaker Horns 708

Announced are two 15w horns to fill the gap between 7½ and 30w horns for paging, background music and talk-back applications. Design of the compact models AP15 and

AP15T horns is said to feature a sound level of 121db and a dispersion radius of 110 deg. The horns require only a screwdriver to mount and connect with diaphragms which may be replaced in the field without soldering. The horns reportedly carry a lifetime guarantee against electroacoustical failure. Model AP15 has an 8Ω impedance, while the model AP15T is a 25-70v transformer unit. Price $43.25. Atlas.

Microphone 709

A new supersensitive, unidirectional dynamic microphone is introduced. The model F67BS is reported to be perfect for the stage, bandstand and recording studio with sharp cardioid directional characteristics to cancel unwanted noise and provide maximum protection from acoustical feedback. Excellent sensitivity enables an entire group to use one microphone. It is

said to be practically unbreakable and able to withstand extreme abuse. The microphone comes with a heavy-duty metal holder to fit any standard ⅝ in. x 27tpi microphone stand. The microphone includes a conveniently positioned silent ON/OFF switch and 20ft of shielded cable. Finish is a nonreflecting satin chrome. Price $59.50. Ercona.

For more information on
DEALER SHOWCASE
See pages 67& 68
READERS SERVICE

COLORFAX

OLYMPIC

Color TV Chassis CTC19/21 — Spark Gap Functions and Causes of Failure

Chassis CTC19/21 employs a high voltage regulation system controlling the grid bias drive characteristic of the horizontal output tube in proportion to the high voltage requirements. The flyback transformer ringing pulse is used as one of the reference controls since its amplitude is proportional to the high voltage developed. CRT cathode voltage is also used to control regulator conduction since it varies according to CRT beam current.

In this system the 6FQ7 tube triode section acts as the regulator.

Operational parameters of this design allow for a wide variation in high voltage. As much as 4kv deviation is normal and it becomes necessary to provide a means of focus tracking to maintain accurate focus throughout the normal range of operation. The focus voltage is a secondary product of the high voltage developed and must be equal to approximately 20 percent of the total CRT anode voltage at all levels of operation.

The network consisting of focus tracking resistors R174, R193, spark gap F102, Part No. FU35370 and their associated filter C131, together with a "split" flyback winding, forms the components of the focus tracking circuit. In a brief analysis, focus tracking is accomplished by the voltage drop across the two resistors because of CRT beam currents. With an increase in CRT conduction, more current is drawn through the resistors which results in an increased voltage drop appearing across them. Consequently, this drop is added to the output of the focus rectifier to adjust focus according to changes in beam current. Filter capacitor C131 forms a long time constant that acts to smooth out variations across the resistors. Spark gap F102 provides protection from overloads which would result in increased voltages beyond the capacities of components.

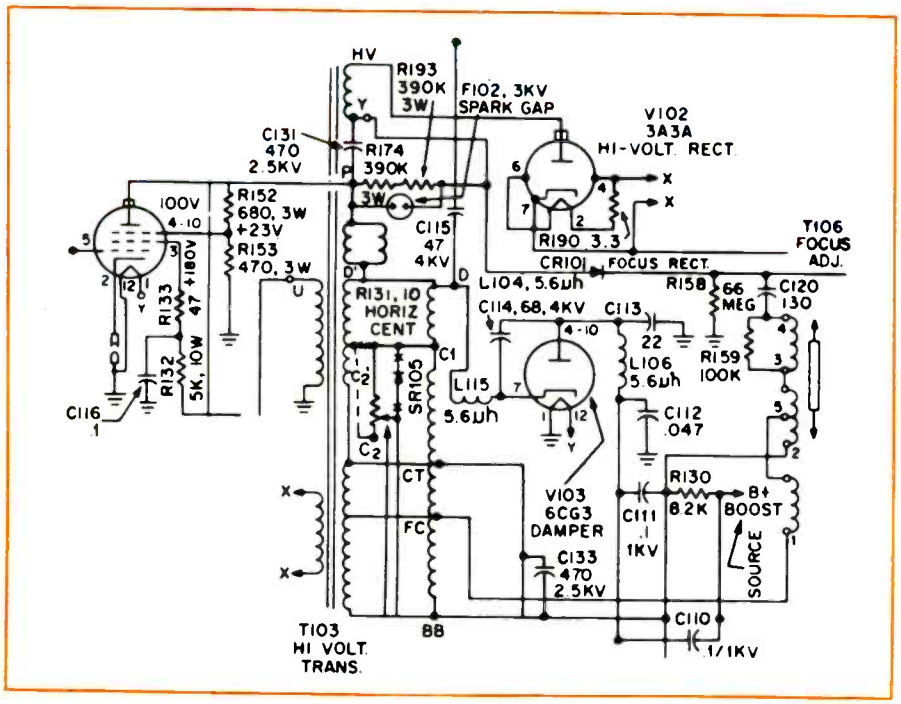
Any defect which would cause the CRT to conduct too heavily might result in spark gap arcing, such as:

1. Video amplifier failure, lowering plate voltage. (shorted 6JT8 tube drawing excess grid current, would cause the CRT cathode voltage to be low).
2. CRT defect (internal short).
3. CRT screen setting too high, resulting in excessive brightness.
4. Blanker defect causing heavy conduction (defective 6BN11 tube, or trouble in blanker circuit could cause excessive brightness, result in arcing).
5. Kine bias, or AGC controls set for too much brightness.

Increased current through the focus tracking resistors R174 and R193 will cause the voltage drop to exceed the rating across the protective spark gap.

This leakage condition can be determined by positioning the service switch to the "service" position. This in turn applies B+ directly to the CRT cathodes and if arcing ceases, the cause was obviously a video amplifier defect.

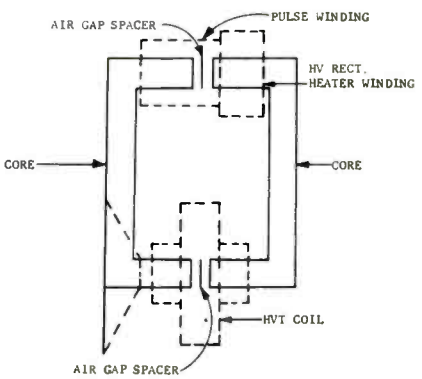
There is also the possibility of the original spark gap part No. FU35370, breaking down and no apparent circuit trouble. Replace, when necessary, with an improved type No. CO-34853-1, which Olympic has been supplying for the past 6 month. Part No. CO34853-1 is a combination of spark gap F102 and capacitor C131.



GENERAL ELECTRIC

Color TV Chassis KC/KD—Core Spacers in HV Transformers

If the horizontal output transformer T104 becomes defective, the correct service procedure is to separate the ferrite core halves and replace the defective coil instead of replacing the complete transformer. In making the repair, certain precautions should be



taken to make sure the rebuilt transformer will operate properly and reliably, thus preventing callbacks.

It is absolutely essential that the air gap spacers are replaced when the transformer is reassembled.

If you lose the spacers, replace only with the correct spacers since the dimensions are critical. Order (GE No. ET41X52) spacer-air gap.

Failure to replace the air gap spacers will create the following problems:

1. The transformer will be mistuned and retrace timing will be incorrect.
2. Excessive heat will be generated.
3. The width of the picture may be too narrow.
4. A white vertical line or bar may appear in the center of the picture or raster.

After the transformer is reassembled, apply a coating of silicone grease (GE ET90X23) to the sides of the transformer core where contact is

made with the metal high voltage compartment. This helps in dissipating heat to the outside of the compartment.

Tighten the mounting nuts securely, so the sides of the transformer core make good contact with the sides of the metal compartment (make sure the grease is applied). This dissipates the heat efficiently to the outside.

Finally, make a good ground connection to the ground end of the pulse winding T104A. If this connection is not made, there is a possibility of excessive high voltage if the HV regulator tube V17 should become defective.

Portable Color Model M235GWD-1 — 15MP22 CRT Modification

During early production of Model M235GWD-1 portable color receivers, a 15MP22 CRT was used which requires a potential of 640v on the red, blue and green screen grids.

Later, a 15MP22 with a modified gun assembly was introduced. This newer type tube requires a 450v potential on the screen grids.

Both types of CRTs are presently being used in production, but the early type is gradually being phased out.

When servicing a G-1 chassis receiver, it is important to apply the proper screen grid potential for the type of CRT in the set. Early and late CRTs are both designated 15MP22, but may be identified in the following manner.

Look at the neck of the CRT near the socket base. There are colored glass rods supporting the electron guns, inside the neck of the tube.

Early 15MP22 tubes have blue support rods — proper screen voltage setting is 640 volts.

Later 15MP22 tubes have green support rods — proper screen voltage setting is 450 volts.

Field replacement CRTs will be the later type 15MP22 with green support rods.

Color TV Chassis KD — Thermostat Added

Beginning with chassis date code OA2E, the KD chassis features a new safety thermostat.

The thermostat, CB102, is mounted adjacent to the horizontal output tube V14 glass envelope and directly above the rear apron as illustrated.

The thermostat is connected in series with the grounded cathode lead of V14. The cathode is connected to the top terminal of CB102 and the bottom terminal is connected to chassis ground.

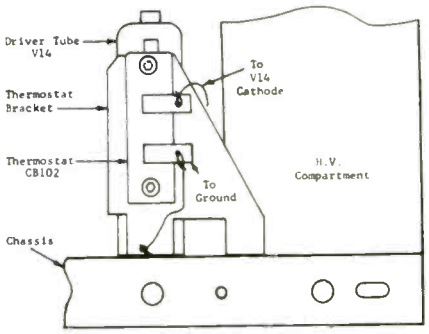
Abnormal heat from the glass envelope will cause the thermostat to open and V14 will become inoperative because of its open cathode circuit. Abnormal heat would be caused by excessive plate and/or screen current. This also could be caused by either a failure of V14 itself or a malfunction in its input or output circuits such as loss of grid drive from the horizontal oscillator, a defective regulator tube, sweep transformer, etc.

When the temperature of V14 returns to normal, the thermostat will close and activate the horizontal output circuit. The thermostat will continue to cycle on and off until the trouble in the horizontal circuits is corrected.

Observe the precautions and suggestions listed when troubleshooting a KD chassis that has a thermostat.

1. To keep V14 cathode circuit closed while troubleshooting, clip a jumper lead across the thermostat terminals. Do not try to reset an open thermostat manually, since this is a true thermostat and operates only on temperature changes. Any attempt to reset the thermostat manually will ruin the original temperature calibration and destroy the safety feature. Make sure the clip lead is removed after completing work on the set.

2. If an operating chassis is tipped up on its front edge, the thermostat will open since it will be oriented horizontally above V14 and receiving its full heat, even on a correctly operating chassis. When this happens, clip a jumper lead across the thermostat terminals to activate the horizontal circuit. Make sure the clip lead is removed after completing work.



BACK VIEW

3. When the thermostat is open, the terminal connected to the cathode of V14 has a dc potential to ground of 200 to 300 volts. This terminal should be treated with the same respect given other B+ points in the chassis receive.

Two thermostats are used in the KD Chassis:

ET10X62 Thermal Cutout (Thermostat) in 22kv Chassis.

ET10X63 Thermal Cutout (Thermostat) in 25kv Chassis.

Neither thermostat should be substituted for the other.

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

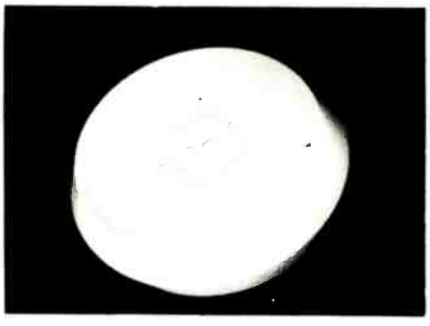
Three-Head Tape Deck 710

A new solid-state stereo tape deck featuring three separate tape heads for record, play back and erase is introduced. The tape deck, which may be operated in either the horizontal

or vertical position, was designed for use with home stereo music systems. The model 450 is enclosed in a grained-wood cabinet and incorporates preamplifier output presets, sound-with-sound, 3¾ and 7½ ips speeds, built-in tape cleaner, equalization switch, three digit counter, two VU meters, pause control, automatic stop and tape source monitor. It includes dust cover. Price $200. Roberts.

Audio Transducer 711

A small audio transducer, said to be so powerful that it can transform an entire room into an omnidirectional speaker, is introduced. The Rolen-Star transducer converts electrical signals into mechanical vibrations. Unlike Hi Fi and stereo speakers which must be strategically placed and ballanced, the unit can be hidden from view—between walls, in attics, or closets—yet produce quality sound that totally blankets areas larger than 1000 sq ft. According to the manufacturer, the unit has an operational impedance of 8 Ω and a frequency response of 20Hz to 20kHz with power inputs as low as 1w sufficient to maintain "background music." An input



up to 30w will produce dynamic sounds for high entertainment levels. The transducer is encased in 4in. dia. shell molded of polycarbonate resin, weighing 2 lb. Price $39.95. G. E.

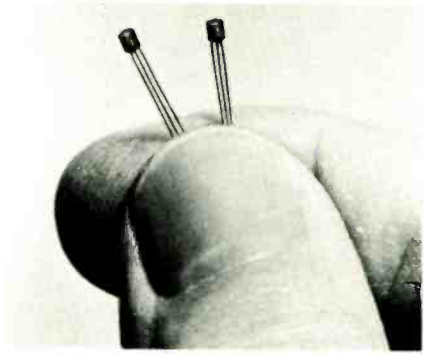
Color-Bar Generator 712

An all solid-state portable color-bar generator for TV servicing is announced. The RCA WR502A "CHRO-BAR" color-bar generator is battery operated and has all of the features of the former RCA WR64B generator with the addition of stability, portability, more patterns, "instant-on" operation and simplified field maintenance, claims the manufacturer. The patterns generated include color bars, dots, crosshatch, vertical lines, horizontal lines and blank raster. The crystal-calibrated circuitry is said to be especially designed to provide stability and includes

slide switches for shorting out the CRT control grids. The color-bar pattern provides ten bars simultaneously including R-Y, B-Y and Q signals spaced at 30deg. phase intervals. Narrow brightness pulses are added at the edges of each color bar to aid in checking the "fit" or registration of the brightness and color signals. A crystal-controlled 4.5MHz sound carrier is added to the color-bar pattern producing beats in the color-bar signal for accurate fine tuning adjustment. The generator is powered by a 4.2v mercury battery with a meter provided on the front panel to indicate battery condition. The generator is attractively styled in a rugged die-cast aluminum case measuring 6½ x 7 x 4in. Weight 4 lb. Price $168. RCA.

Audio Transistors 713

A line of microminiature NPN silicon epitaxial audio transistors has been introduced. Designated the A141, A142 and A143, these new devices are said to offer low noise and high gain for audio products in which space and weight are at a premium. Noise figure for the group is typically 1.5 to 2db from 30Hz to 15kHz with



a minimum h_{FE} of 80 for the A141, 140 for the A142 and 280 for the A143. Leakage current is 10ma and collector saturation .1v typical in consideration for circuits operated at low battery potentials. All three devices are of identical size and shape with a .070in. dia cylinder .070in. high. A 10 by 10 array of these devices would cover less than .5sq in. Amperex.

Solid-State Digital Frequency Meter 714

The model 460 solid-state digital frequency meter with a crystal time base aging rate of two parts in 10^6 per month ± nine parts in 10^6 (0° to 50° C) is announced. Designed with gate times in decades from 1ms to 10sec, it is said that the meter makes four digit measurements with eight digit resolution, covering a range of 5Hz to 10MHz with an input sensitivity of 100mv to 150v RMS as standard. Extended input frequency to 15MHz, 10mv sensitivity, 5th and 6th digits, standard 19in. relay rack adapter and a switch selectable 1MHz external

oscillator/100kHz external time base are all available as options. Selection from five different internal time bases (1,10, 100ms and 1,10sec) is facilitated by push buttons on the front panel of the meter, which employs ICs for over 90% of its circuit functions. Price $470. Darcy.

Cassette Tape Recorder 715

A fully miniaturized receiver circuit with a self-contained battery is introduced. Just snap the radio cassette into your recorder or player, press the

play button, turn the dial to the station you want and you have an AM radio. The unit plays directly through the amplifier and speaker system of your recorder or player. It is said to have a high impact break-resistant case, measuring 4 x 2½ x ⅜ in., comes in charcoal black and weighs 2 oz. Keystone.

Solid-State CB Transceiver 716

Announced is a 23-channel, solid-state CB transceiver model CB88 featuring an FET front end. It is said to have .1μv sensitivity, high reliability integrated circuits, full 5w input,

100% modulation and a speech compressor. Provisions for two reserve channels are provided. Other features include solid-state T/R switching and a built-in "S" meter. A push-to-talk mike and crystals are included. Size: 6in.W x 2in.H x 7in.D. Operates on 12vdc neg gnd. All crystals included. Price $149.95. Olson.

TECHNICAL DIGEST . . .

Continued from page 29

nect the ground lead of the probe to the receiver chassis. One shorted turn on the horizontal output transformer will produce the short, damped waveform characteristic of a defective component. The effect of shorted turns may be seen by shorting the filament winding of the horizontal output transformer while checking it with the oscilloscope.

How To Obtain The Test Pulse

To obtain the test pulse, simply connect one end of a 680pf, 600v capacitor to the cathode of the sweep oscillator in the oscillocope, and terminate the other end at an insulated binding post mounted on the front panel. Table 2 indicates the correct connection point for this capacitor in RCA scopes.

Table 2

RCA Oscilloscope	Connect Capacitor to —
WO-91A, B	Pin 3 (or 8) of V9 12AX7
WO-88A	Pin 3 (or 8) of V8 12AU7
WO-78A, B	Pin 3 (or 8) of V14 6BQ7
WO-58A	Pin 3 (or 6) of V8 6SL7GT
WO-56A	Pin 3 (or 8) of V10 12AU7

After installing this binding post be sure to label it "Sweep." *Courtesy of RCA Victor Sales Corp.*

COMPUTERIZED TV . . .

Continued from page 48

be taken to the shop. The technician doesn't have to guess and the customer knows about what it will cost ahead of time. If the set has to come into the shop for work, there is an additional re-installation charge of $3.50. Therefore, a customer with a B/W TV set, who calls for home service work which then has to come into the shop, will be charged $7 for the house call, $12.50 for the minimum bench labor (plus parts) and $3.50 for the re-installation — $23 plus parts. We have serviced the same brand of TV sets for some time, and we know from experience what it takes to solve almost any problem. That's why we say that the minimum bench rate plus the service call will generally take care of the labor charges."

Training Program

The part-time high school student employees hired and trained at Don's Radio & TV work under two different programs. The office girls go to school mornings and work afternoons under the Office Education Program. The young men have the same schedule, but work under the Trade and Industry Program.

"It's good training for these young people and a satisfactory situation for us, too," admits Clark Pohl. "These young ladies and gentlemen have been a big help to us and we feel we have contributed something to them."

The students participating in these programs are strongly in favor of it. The school publishes a newssheet in which the students in these programs air their views of their particular jobs. One of the trainees at Don's TV, Rex Wilkins, writes, "I've been working at Don's TV for six months in both the television and appliance service departments. I have gained a wealth of experience, or at least I've had the opportunity to. I

worked in the appliance service department for two months — just long enough to know that my chosen field is electronics. Don and Clark were kind enough to let me work on TV-radio from then on. I can't intelligently locate the trouble in a TV set unless it's tubes, but at least I realize how much more I have to learn for the future."

Progress

Clark Pohl tells our ET/D reporter of their plans for the future and some of the changes they have already made toward achieving their goals. "We have to expand." Clark points out. "We've had our eyes open for another possible location for some time. Our expansion program got under way when we bought out several smaller TV shops in the surrounding area and incorporated. There is a new four-lane bypass going in near the edge of town and we are speculating on a choice location there. We have definitely outgrown our present facilities and we could use a lot more room if we had it. We have a warehouse full of merchandise we can't even show. In spite of that, our sales average approximately $137 per sq ft."

Don and Clark are both seasoned businessmen now. Clark is an active member of the local Chamber of Commerce and vice president of the state chapter of TSA. Both men attend sales and service conferences and all the business management courses they can. They obviously know their goals. Their plans for expansion, their modern business techniques and desire to improve their management skills is paving the way toward achieving those goals. ■

ANTENNAS . . .

Continued from page 45

weak and buckle in a 40-mile wind? Good 14- and 10-gage material is available and it won't begin rusting for years. Also, there are telescoping masts and *telescoping* masts. Some are usable, some are laughable.

And not all copper used in coax and 300 Ω twin-lead is worthy of the name. Some is good and some is "gyp" stuff — by whatever name. The same with guy wire. The best guy "wire" we ever saw on a mast was "surplus" 3/16in. nylon purchased at a reasonable price in large rolls. The next best perhaps is hardened aluminum (not soft stuff) about the same diameter as the nylon. Most "galvanized," stranded guy wire is good only for the short term — unless heavily coated. Otherwise it will rust out in a year or two — depending on the protective coating thickness. And the thinly coated wire isn't worth unrolling and tying around a mast. Although difficult to work with, standard telephone wire, like that used by the telephone companies in rural lines, is also good. It has powerful tensile strength and won't rust. Heavy gage, stranded phosphor-bronze wire, like that used in long-wire antennas, makes good guy wire also but it's hard to work with and also expensive.

Once you have the best material you can buy at hand, then you put the material together so it won't fall apart soon after you leave the installation scene. This requires some standard rules of procedure, plus additional precautions to make up for certain deficiencies which crop up in even the best material obtainable. We will mention only a few of the rules and precautions.

For example, it is always desirable to treat all uncoated non-aluminum parts (steel rivets, reinforcing material, mounting brackets, etc.) with a good weather-proofing spray. Otherwise, they will rust out in a short time and allow the antenna to fall apart during winter icing or heavy winds.

The connecting terminals on most antennas also need protection. If 300 Ω lead-in is used, the two connecting points at the feed element should be sprayed and then taped securely with electrical tape (not friction tape) making certain that a few inches of the individual lead-in wires are taped securely to the feed element to prevent strain at the two bare-wire connecting points.

If snap-on stand-off insulators are used, tape them securely to the mast with friction tape in a criss-cross manner around the clamp end and mast—ending the wrap on the stand-off shank.

Base mounting against brick or masonary walls should have two heavy-gage mounting clamps spaced at least 2ft apart (one above the other) mounted to 2½ in.-long by ¼ in. diameter "stud-ins" sunk at least 1¾ in. into the wall. "Plug-type" mounted screws should not be used for this purpose And do not mount antennas to chimneys. Concentration of soot and heat can quickly lower the efficiency of the installation.

Any antenna over 10ft high (15 or more feet) should have three guy wires attached to the mast but not closer than 5 ft below the antenna. A 30 or 40ft mast should be double guyed—8 ft below the antenna and a foot or two above the midpoint of the mast. Three wires should be used in each case. In many areas FAA rules require special precautions on high masts. Check with your local government also for ordinances covering high antenna structures and mounting regulations. ■

MAKE MORE MONEY

Continued from page 50

tomers. This is readily accomplished by having a neat, clean and well-organized shop. See that outside technicians are cleanly shaven, their clothing or uniforms clean and neatly pressed. The old theory that says a dirty uniform signifies a hard worker just doesn't hold water any more. Remember, you are beginning to be viewed by your customers in the same way they view their doctors or dentists. Would you be satisfied if your doctor appeared in a blood-stained, dirty robe? I think you get the point. A little effort, in this case, can go a very long way.

Now you know what a service-dealer marketing program is. It can, and should, help you become a more successful and more respected businessman. Like any other program of this nature, it will vary from one operation to another. The points covered here should serve as the basis or foundation upon which an individual business can build a complete and total marketing program — a program which will be geared to your particular business — one which will be based on sound marketing and management techniques. ■

ET/D CATALOGS & BULLETINS

Telecommunication Equipment 400

A catalog featuring a complete line of telecommunication equipment includes telephone operators' headsets, telephone handsets, special headsets, and an extensive selection of carbon and dynamic microphones, magnetic and dynamic earphone units, booms, switches, headbands and various other component parts. Audiosears.

Sound Equipment 401

A eight-page catalog lists a complete line of amplifiers, boosters, tuners, tape players, accessories and systems. Bell.

Electronics Books 402

A 16-page catalog describes over 100 current and forthcoming books covering broadcasting, basic technology, CATV, electric motors, electronic engineering, electronics service, Hi Fi stereo, test instruments and transistors. Tab.

Circular Slide Rule 403

A handy circular slide rule for engineers, plant and office executives is available at no cost. General Industrial Co.

Semiconductors 404

A 53-page catalog describing major electrical specifications for more than 3500 individual semiconductor types is now available, including ordering information on some 12,000 total devices. Located at the beginning of the reference guide, the listing aids in the quick identification of device types, and helps to locate more complete component information about a particular device. A five-page section contains complete device outline dimensions for the more than 93 different cases in which semiconductors are packaged. The cover illustration features the magnified cross section of a

multicolored, geometry-bedecked ingot of silicon, symbolizing the unlimited opportunities still to be uncovered in the semiconductor state-of-the-art. Motorola.

Electronic Components 405

A 120-page book completely describes and catalogs an entire product line — capacitors, filters and relays. It includes Application Charts, Type Selector Charts and Standard Rating Tables arranged to guide the designer /purchaser to easy selection of the proper device and rating. CDE.

Intercom System 406

A four-page folder describes a push-button, touch-dialing intercommunications system for hospitals, nursing homes and general administrative use. Altec.

Test Instruments 407

A 12-page, two-color catalog, fully illustrates and details the electrical and mechanical characteristics of a test instrument line. Triplett.

Audio Amplifiers 408

Five 4-page specification, installation and operating instruction sheets cover one 10w, two 20w, one 35w and one 75w audio amplifiers. Bell.

Resistors/Pots 409

A 32-page illustrated catalog of potentiometers, field-assembled controls, power rheostats and resistors is released. Included are photographs, engineering drawings and descriptions of field assembled controls, audio system attenuators, theater speaker controls, precision decade boxes, shafts, bushings, rotary selector switches and high-voltage couplers. Complete technical specifications and dimensional information are also included. Clarostat.

Electronic Equipment/ Instruments 410

A 32-page catalog lists a wide variety of electronic equipment/instrument kits and factory-assembled products. Covers test instruments, stereo, CB, amateur radio, hobby kits, automotive electronics and educational training aids. EICO.

Power Outlets 411

A 15-page catalog lists prewired "pick-a-strip" standard outlet boxes, deluxe and heavy-duty standards, rack mounts, "U" ground, "string-bean" and other outlet box types. Includes motor speed controllers, mobile wire racks, replacement parts, scope carts and other special accessories. Waber.

Color TV Coils 412

A four-page cross-reference guide for 12 new color TV coils is available. The 12 coils are said to provide exact replacements for 550 video and chroma coils for TV sets produced by virtually all manufacturers. Miller.

PA Speakers 413

A 12-page catalog and installers guide covers points on speaker selection, dispersion characteristics and general information on various types of speakers, where used and why. University.

Wire and Cable 414

Over 250 new items are included in a 48-page illustrated catalog listing lead-ins, microphone cable, audio and intercom cable, hook-up wire, coaxial cable, guy wire, power supply cords and allied products. Among the items added to the line are instrumentation control and telemetering cable, shielded neoprene microphone cable, heavy-duty 18 AWG twin lead, 72 Ω transmission line, metal jacketed aluminum CATV cable and 59/U type semi-rigid aluminum co-ax. International.

Record Changer Rack 415

A specification sheet describes a record changer repair rack. Certified.

Personal Two-Way Radio for Two-Way Promotion 416

A pamphlet describes the convenience and safety the public enjoys in using personal two-way radio. The pamphlet explains how two-way radio transceivers are designed with sending and receiving units in the same "package" and tells how simple it is to get a CB license. E.F. Johnson.

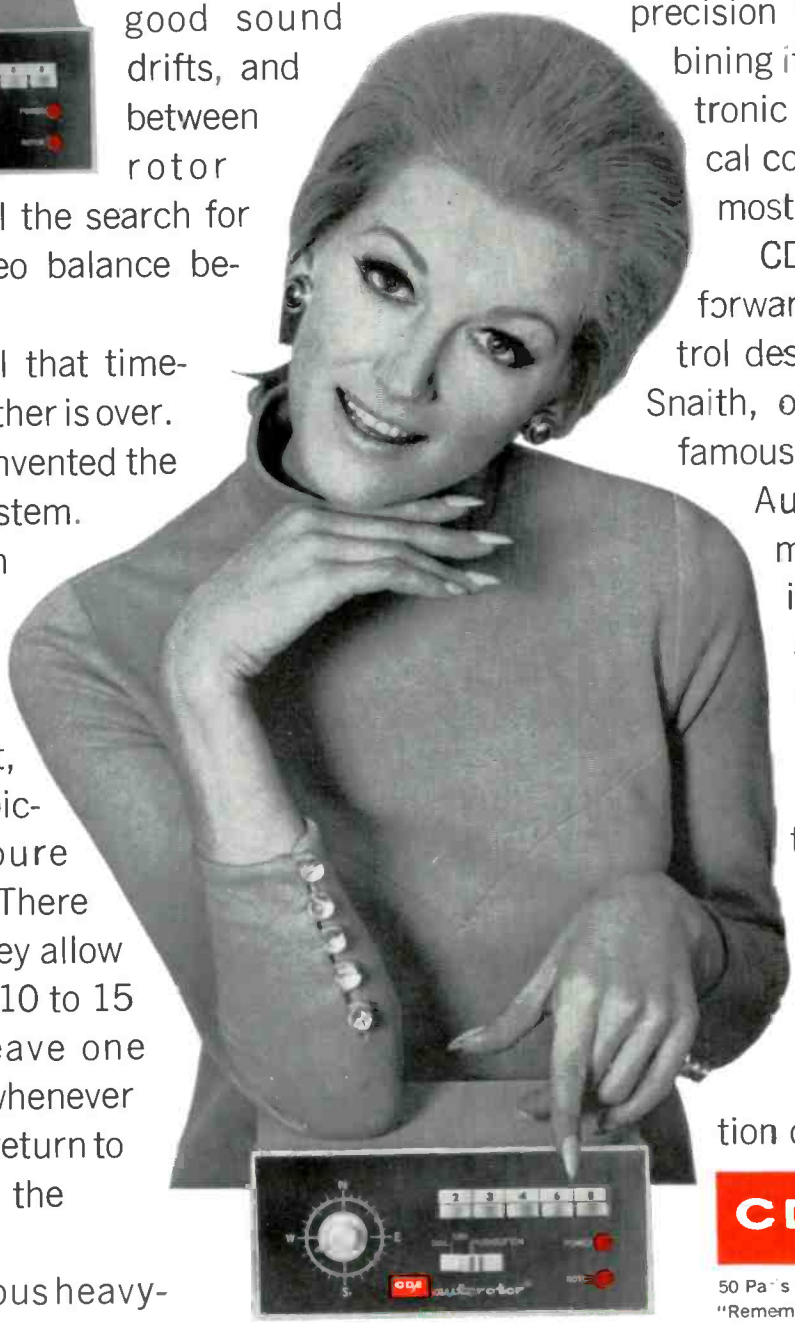
ET/D AD INDEX

The name of the game was hide and seek.

The good color picture hides. The viewer looks for it. And sometimes it takes quite a while to find. The good sound drifts, and between rotor and tuning dial the search for a perfect stereo balance begins again.

Well now all that time-wasting and bother is over. Because CDE invented the Autorotor™ system. It's more than an ordinary rotor. Buttons are easily set for clear, bright, perfect color pictures. And pure stereo sound. There are five and they allow you to pre-set 10 to 15 channels. Leave one channel and whenever you choose to return to it, just press the button again.

CDE's famous heavy-duty Bell Rotor gives you high repeatability and no antenna drift. It's an all-solid-state, silent operation. The Autorotor system's precision is within 1° and combining it with pushbutton electronic control, not mechanical control, makes it today's most advanced rotor.



CDE took another step forward in the Autorotor control design. They had William Snaith, of Loewy-Snaith, world famous designers, create the Autorotor console. He made it attractive. Made it so you can place it on a table top or shelf without it being an eyesore.

This is the story you can tell your customers to sell the top-of-the-line in rotors. The latest advance from the quality house of rotors — Cornell-Dubilier.

For complete information on new Autorotor write:

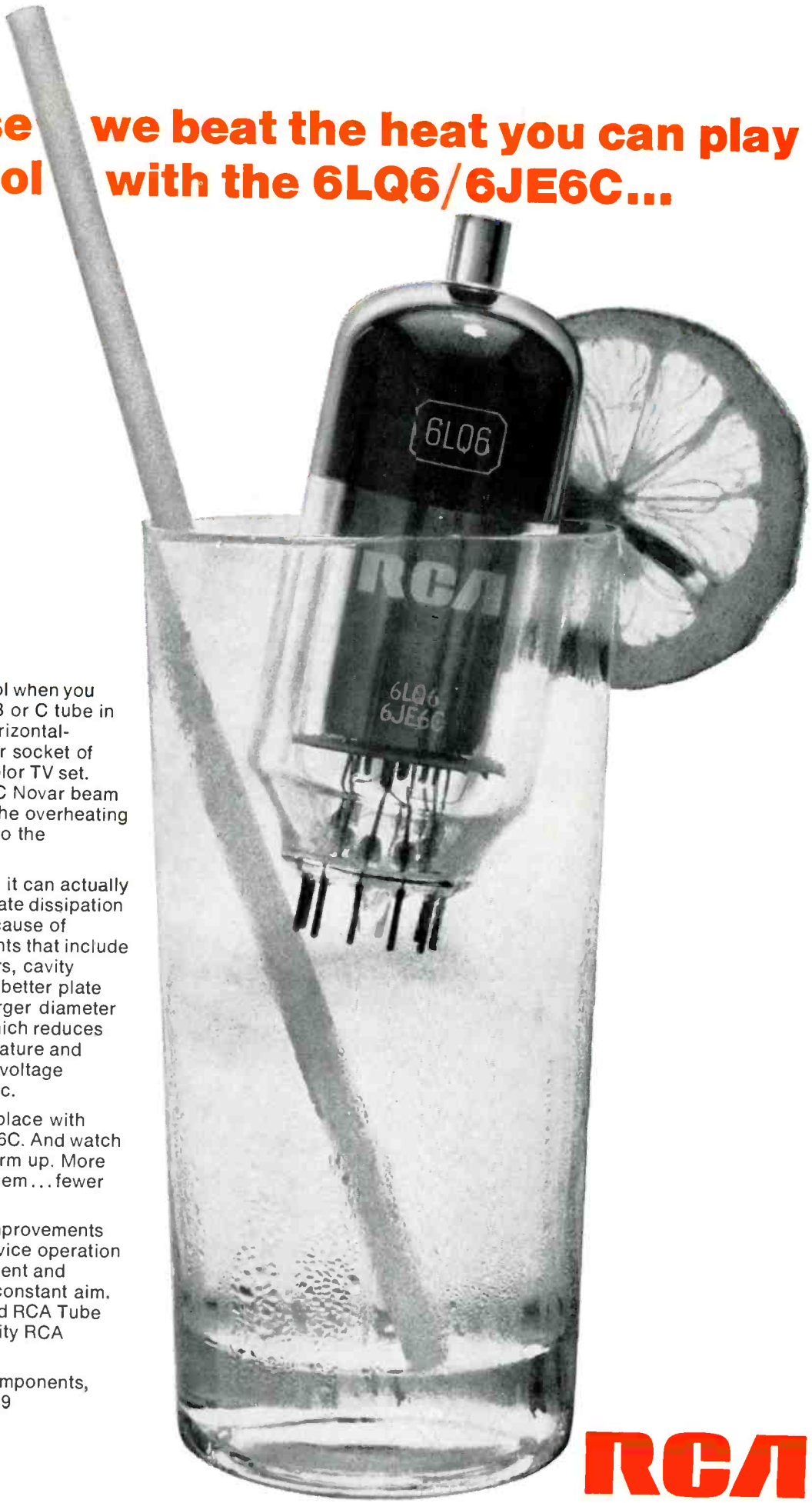
CDE CORNELL-DUBILIER

50 Paris Street, Newark, New Jersey 07101

"Remember to ask what else needs fixing"

. . . for more details circle 102 on postcard

Because we beat the heat you can play it cool with the 6LQ6/6JE6C...



Yes, you play it cool when you replace a 6JE6A, B or C tube in the demanding horizontal-deflection-amplifier socket of your customer's color TV set. RCA's 6LQ6/6JE6C Novar beam power tube beats the overheating problem common to the other tubes.

As a matter of fact, it can actually withstand 200 W plate dissipation for 40 seconds because of design improvements that include repositioned getters, cavity plate designed for better plate dissipation, and larger diameter screen grid wire which reduces screen grid temperature and improves the high voltage cutoff characteristic.

So play it cool. Replace with the RCA 6LQ6/6JE6C. And watch your customers warm up. More confidence from them... fewer call-backs for you.

Innovations and improvements that make your service operation more reliable, efficient and profitable are our constant aim. See your Authorized RCA Tube Distributor for quality RCA receiving tubes.

RCA Electronic Components, Harrison, N.J. 07029

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