ELECTRONIC TECHNICIAN / DEALER

WORLD'S LARGEST TV-RADIO SERVICE & SALES CIRCULATION

MAY 1969 A HARERACE PUBLICATION

SIGNAL STRENGTH METERS

COLOR SYSTEM TROUBLESHOOTING

SOLID STATE CURVE TRACER

The Seven-Year Itch.

Remember when we introduced you to our Television Analyst (model 1076)? That was over seven years ago, and she's still the only diagnostic tool of her kind. But now there's a new number. A smart looking, professional model (1077) with designs on your heart.

Sure your old model still works. Why not? It was made by B&K.

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Where electronic innovation is a way of life.

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. . . for more details circle 106 on postcard

ELECTRONIC TECHNICIAN / DEALER

TEKFAX

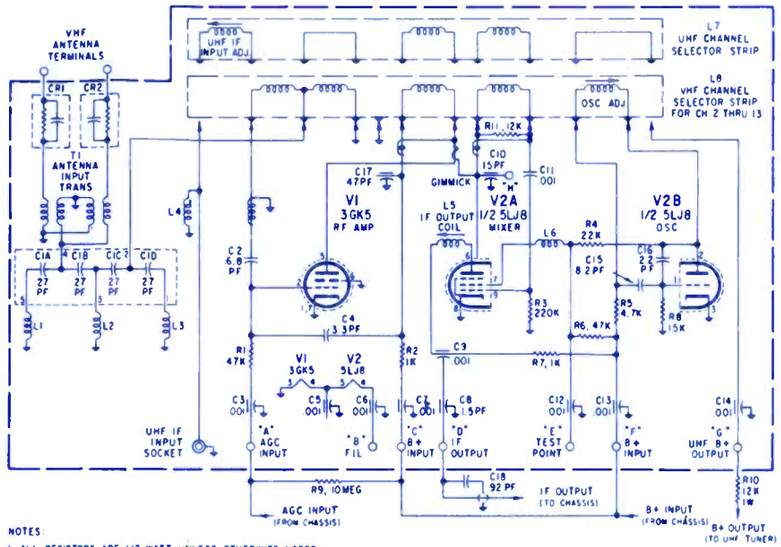
COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 6 NEW SETS

GROUP 201

1223

AIRLINE
TV Model
GHJ-14549A

MAY • 1969



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

VHF Tuner Schematic Diagram

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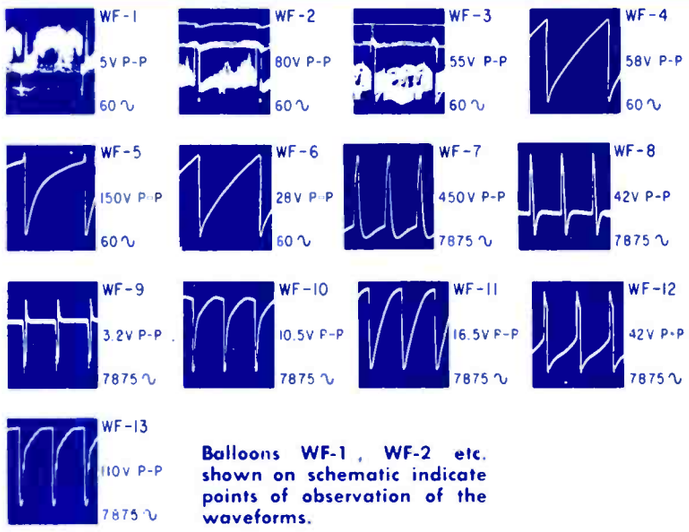
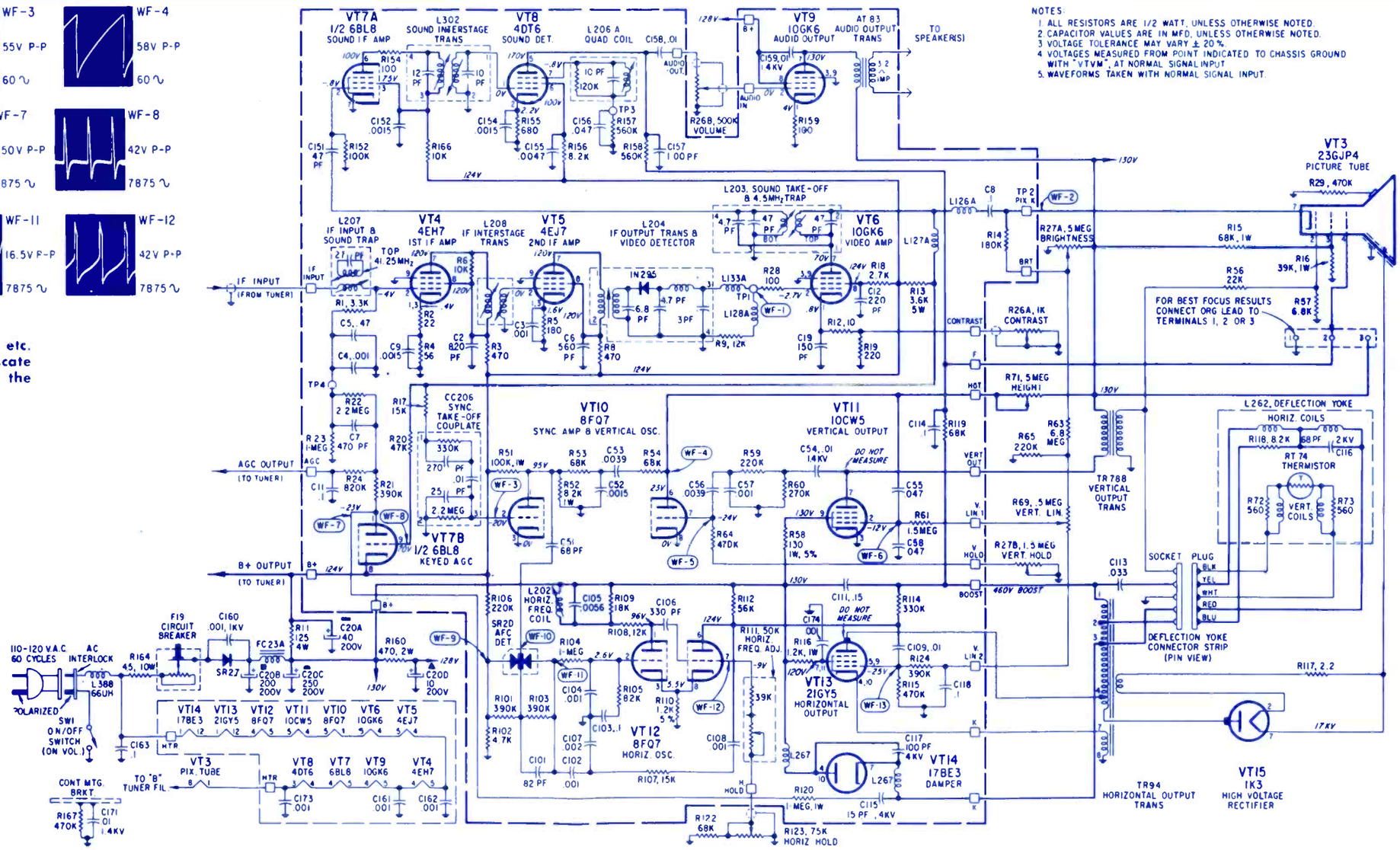


Balloons WF-1, WF-2 etc. shown on schematic indicate points of observation of the waveforms.

SYMBOL	DESCRIPTION	AIRLINE PART NO.
C20A,B,C,D	40-200-250-10µf 200v elec	034-018800
C106	330pf 500v 5% mica	045-007200
C115	15pf 4KV 10% disc cer	825-150016
R11	125Ω 4w 10%	054-059500
R13	3,600Ω 5w 10% WW	053-362510
R164	4.5Ω 10w 10%	053-458110
RT74	9.6Ω thermistor	057-056500
R26A,B	contr, 1000Ω (A); vol, 500K (B) w/on-off switch	055-051600
R27A,B	bright 5M (A); vert hold, 1.5M (B)	055-051700
R69	vert lin 5M	055-035000
R71	height 5M	055-035100
R111	horiz freq adj 50K	055-041700
R123	horiz hold 75K	055-032000
SR20	diode sel AFC det	033-002000
SR27	rectifier silicon 1.0a 900PIV	004-003500
AT83	xformer audio output	031-008301
FC23A	filter choke	032-002301
L126A	coil video peak	111-012600
L127A	coil video peak	111-012700
L128A	coil peak	111-012800
L202	coil horiz freq	110-020200
L203	xformer sound take-off & 4.5MHz trap	109-020300
L204	xformer IF output & video det	109-020400
L206A	coil sound quad	109-020601
L208	xformer IF interstage	109-020800
L262	def yoke	027-026200
L267	coil choke 2 used	111-026700
L388	coil line filter	111-038800
TR788	xformer vert output	033-007802
TR94	xformer horiz output chassis brd assy	033-009400 073-041100
F19	cir brkr 1.75a	099-001900
CC206	couplate sync take-off	134-020600
	tuner, VHF	066-017300
	tuner, VHF	006-020500



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

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MAGNAVOX
Color TV
Chassis T933

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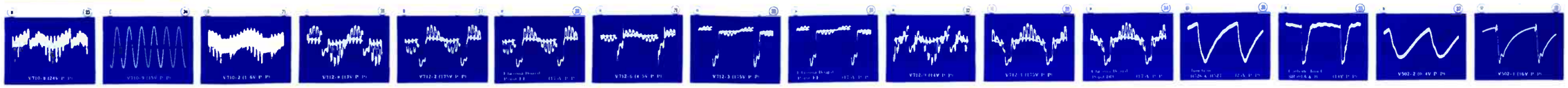
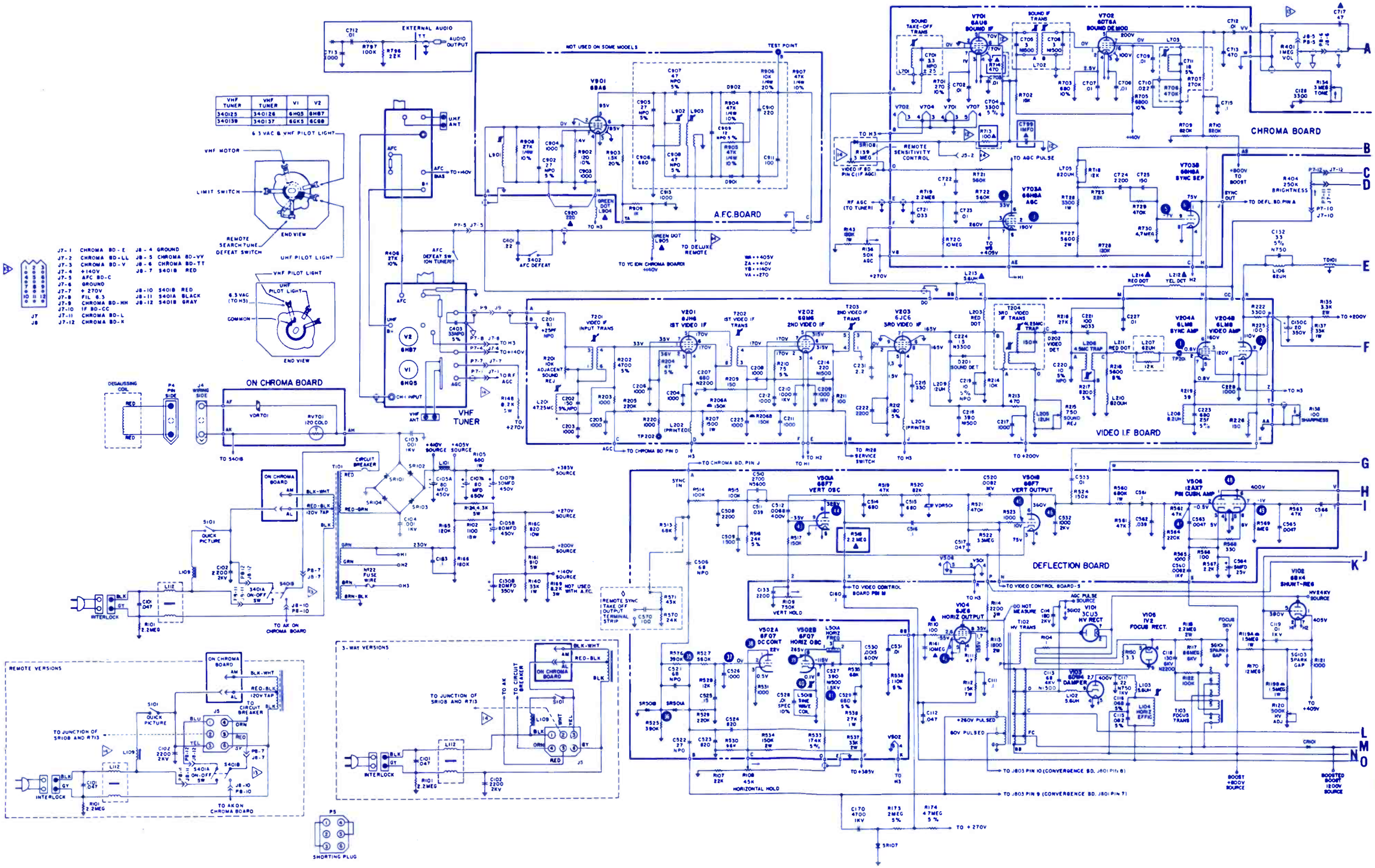
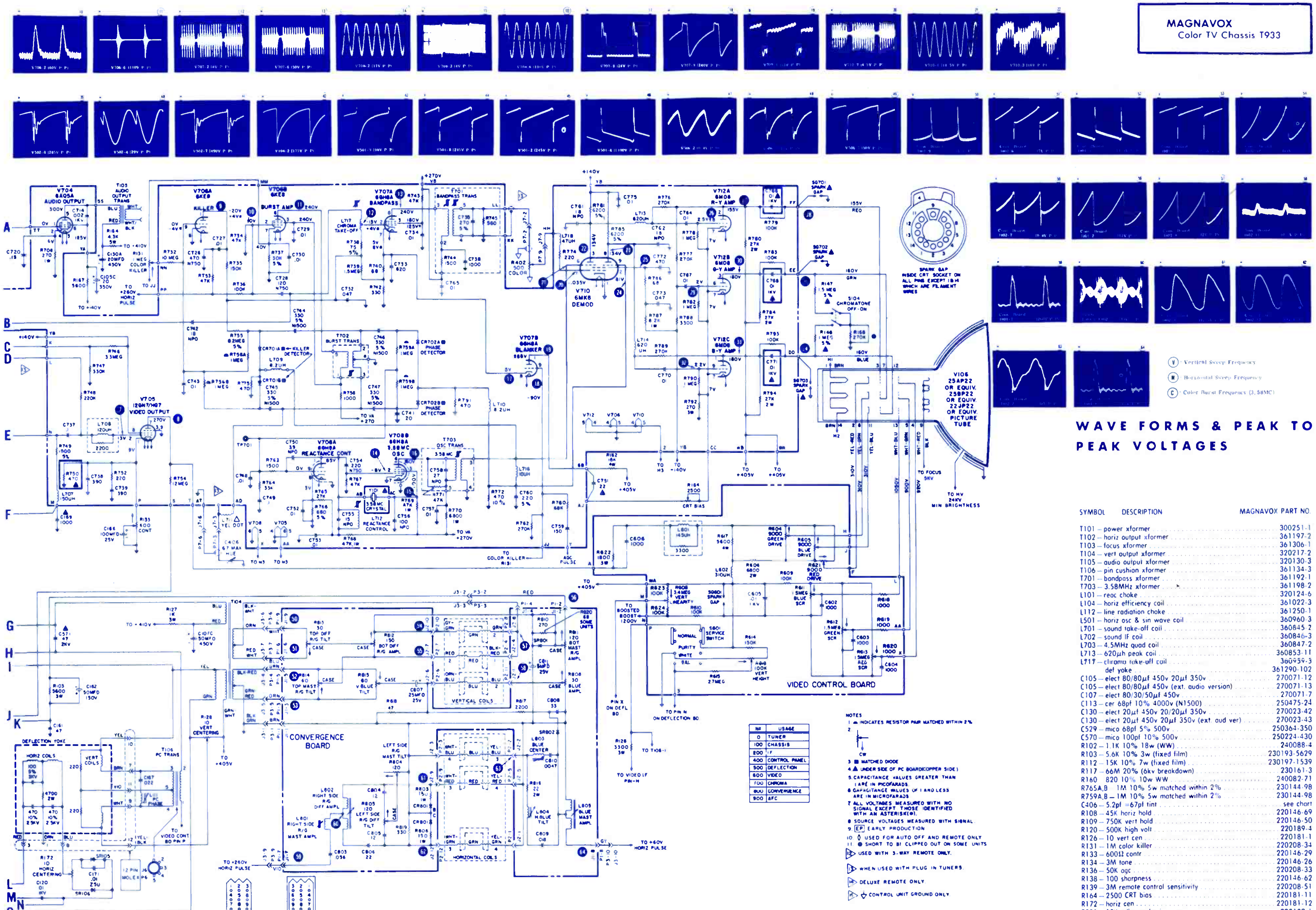




MAGNAVOX
Color TV Chassis T933



WAVE FORMS & PEAK TO PEAK VOLTAGES

Ⓥ Vertical Sweep Frequency
Ⓗ Horizontal Sweep Frequency
Ⓒ Color Burst Frequency (3.58MC)

VIDEO CONTROL BOARD

CONVERGENCE BOARD

NO	USAGE
0	TUNER
100	CHASSIS
200	IF
400	CONTROL PANEL
500	DEFLECTION
600	VIDEO
700	CHROMA
800	CONVERGENCE
900	AFC

NOTES
1. ▲ INDICATES RESISTOR PAIR MATCHED WITHIN 2%
2. CW
3. ■ MATCHED DIODE
4. ▲ UNDER SIDE OF PC BOARD(COPPER SIDE)
5. CAPACITANCE VALUES GREATER THAN 1 ARE IN PICOFARADS
6. CAPACITANCE VALUES OF 1 AND LESS ARE IN MICROFARADS
7. ALL VOLTAGES MEASURED WITH NO SIGNAL EXCEPT THOSE IDENTIFIED WITH AN ASTERISK(*).
8. SOURCE VOLTAGES MEASURED WITH SIGNAL.
9. [EP] EARLY PRODUCTION
10. USED FOR AUTO OFF AND REMOTE ONLY
11. ● SHORT TO BI CLIPPED OUT ON SOME UNITS

12▷ USED WITH 3-WAY REMOTE ONLY.
13▷ WHEN USED WITH PLUG IN TUNERS.
14▷ DELUXE REMOTE ONLY.
15▷ CONTROL UNIT GROUND ONLY.

SYMBOL	DESCRIPTION	MAGNAVOX PART NO.
T101	power xformer	300251-1
T102	horiz output xformer	361197-2
T103	focus xformer	361306-1
T104	vert output xformer	320217-2
T105	audio output xformer	320130-3
T106	pin cushion xformer	361134-3
T701	bandpass xformer	361192-1
T703	3.58MHz xformer	361198-2
L101	reac choke	320124-6
L104	horiz efficiency coil	361022-3
L112	line radiation choke	361250-1
L501	horiz osc & sin wave coil	360960-3
L701	sound take-off coil	360845-2
L702	sound IF coil	360846-3
L703	4.5MHz quad coil	360847-2
L713	620µh peak coil	360853-11
L717	chroma take-off coil	360959-3
	def yoke	361290-102
C105	elect 80/80µf 450v 20µf 350v	270071-12
C105	elect 80/80µf 450v (ext. audio version)	270071-13
C107	elect 80/30/50µf 450v	270071-7
C113	cer 68pf 10% 4000v (N1500)	250475-24
C130	elect 20µf 450v 20/20µf 350v	270023-42
C130	elect 20µf 450v 20µf 350v (ext. aud ver)	270023-43
C529	mica 68pf 5% 500v	250364-350
C570	mica 100pf 10% 500v	250224-430
R102	1.1K 10% 18w (WW)	240088-4
R103	5.6K 10% 3w (fixed film)	230193-5629
R112	15K 10% 7w (fixed film)	230197-1539
R117	66M 20% (6kv breakdown)	230161-3
R160	820 10% 10w WW	240082-71
R765A,B	1M 10% 5w matched within 2%	230144-98
R759A,B	1M 10% 5w matched within 2%	230144-98
C406	5.2pf =67pf tint	see chart
R108	45K horiz hold	220146-69
R109	750K vert hold	220146-50
R120	500K high volt	220189-4
R126	10 vert cen	220181-1
R131	1M color killer	220208-34
R133	600Ω contr	220146-29
R134	3M tone	220146-26
R136	50K agc	220208-33
R138	100 sharpness	220146-62
R139	3M remote control sensitivity	220208-51
R164	2500 CRT bias	220181-11
R172	horiz cen	220181-12
R201	10K adj sound rej	220182-1
R215	750 sound rej	220166-4
R401	1M vol	see chart
R402	500 color	see chart
R404	250K bright	see chart
R605	9000 blu dr	220166-24
R611	1.5M blu scr	220166-17
RV701	thermistor	230170-2
TD101	delay line	360949-5
VDR501	varistor	230167-5
VDR701	varistor	230175-2
	cir brkr	180723-2

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MOTOROLA
Color TV Chassis
TS924B,C

ELECTRONIC TECHNICIAN / DEALER **TEKFAX**

MAY • 1969

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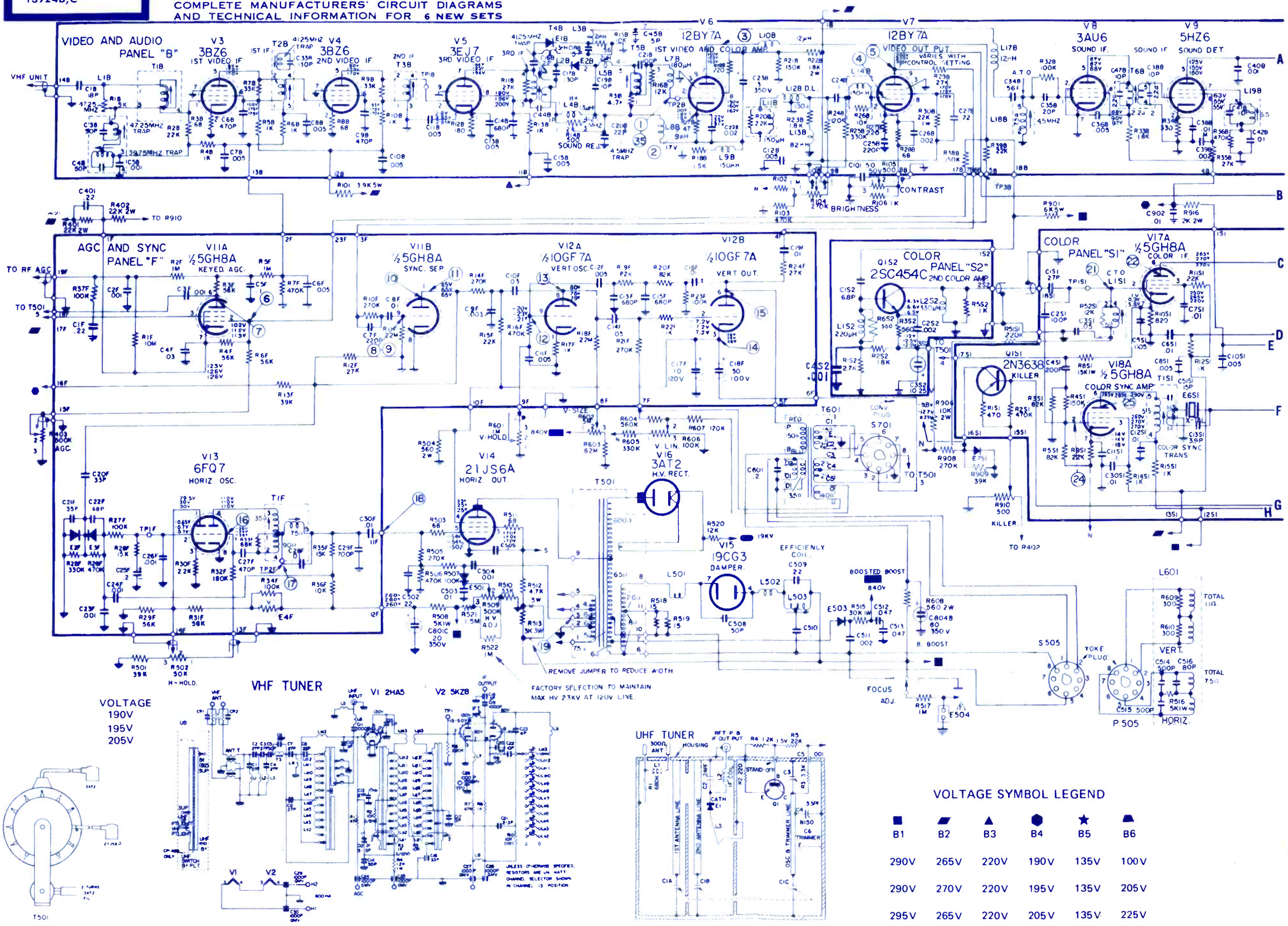
AND TECHNICAL INFORMATION FOR 6 NEW SETS

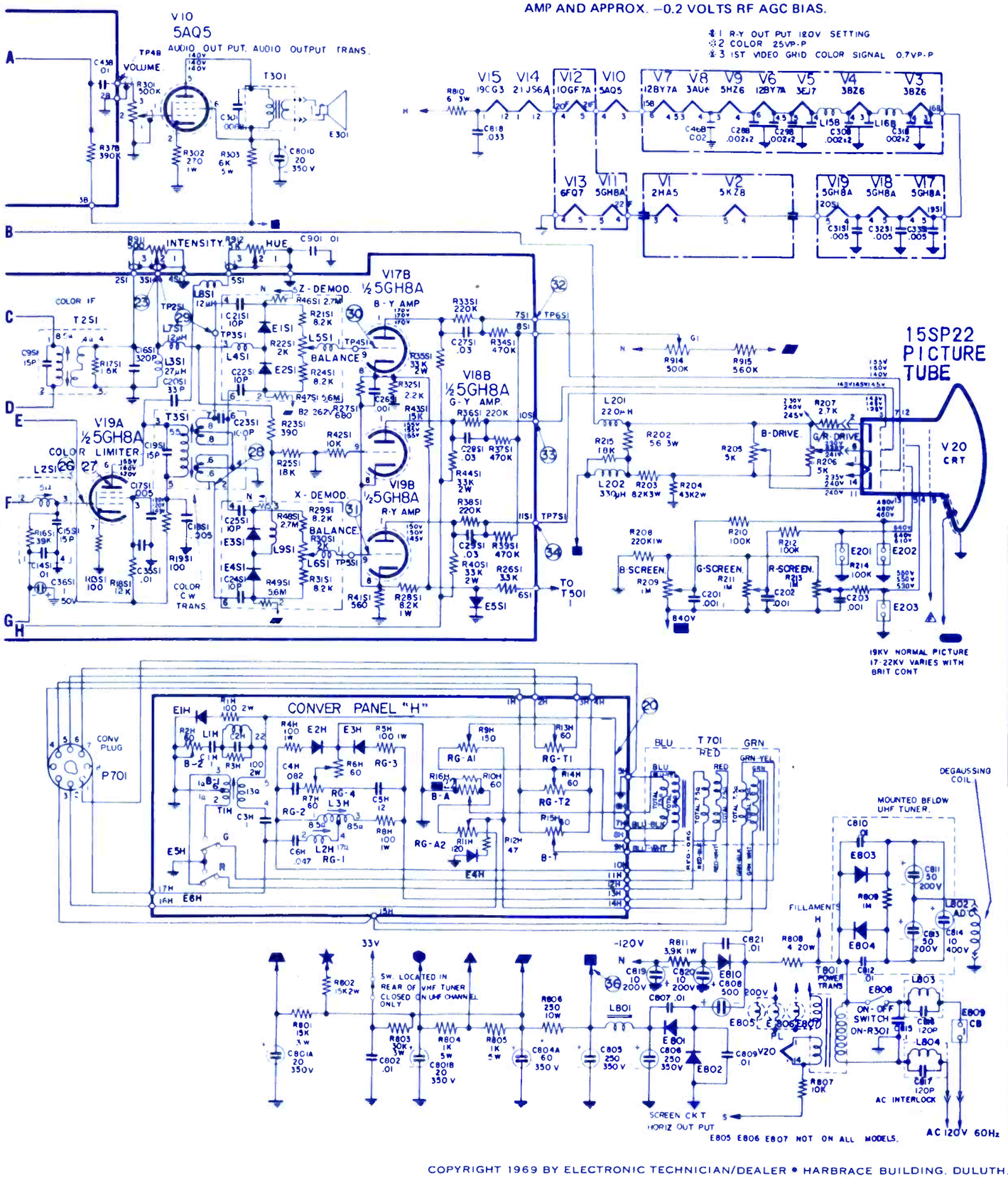


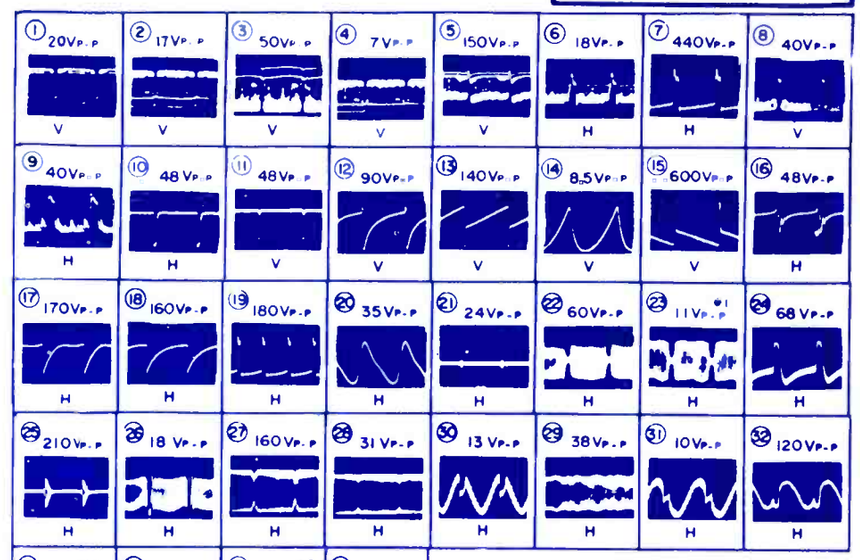
■ B1	▰ B2	▲ B3	⬢ B4	★ B5	▰ B6
290V	265V	220V	190V	135V	100V
290V	270V	220V	195V	135V	205V
295V	265V	220V	205V	135V	225V

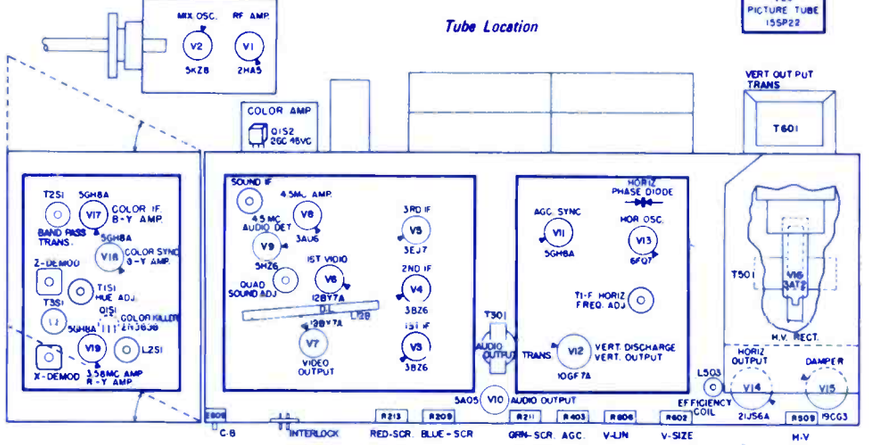
MOTOROLA
Color TV Chassis TS924B,C

TYPE OF SIGNAL AND ORDER OF LISTING.
VOLTAGE ZERO SIGNAL (TUNER SET BETWEEN CHANNELS).
NORMAL SIGNAL (AIR COLOR PROGRAM).
STANDARD COLOR BAR GENERATOR.

NOTE :
CONDITIONS OF NORMAL AIR SIGNAL . −5 VOLTS PEAK TO PEAK MEASURED FROM GRID TO CATHODE OF FIRST VIDEO AMP AND APPROX. −0.5 VOLTS RF AGC BIAS.
CONDITIONS OF COLOR BAR GENERATOR −1 VOLT PEAK TO PEAK MEASURED FROM GRID TO CATHODE OF FIRST VIDEO AMP AND APPROX. −0.2 VOLTS RF AGC BIAS.







SYMBOL	DESCRIPTION	MOTOROLA PART NO.
C27F	470pf 10% 500v silver mica	21S10052A38
C508	50pf 10% 5kv	21D90161A08
C514	500pf 10% 3kv	21D90161A13
C515	500pf 10% 3kv	21D90161A13
C516	56pf 10% 5kv N1500	21S180A73
C801	C801A/20µf C801B/20µf C801C/20µf C801D/20µf 350v lytic	21D90161A35
C804	C804A/60µf C804B/60µf 350v lytic	21D90161A36
E1B	crystal diode 1N60	48C65837A02
E6a&B	dual diode	48D90066A01
E4F	varistor	6B90069A01
E809	circuit breaker	80C66390A15
	vert pincushion phase	24P65171A45
	vert pincushion corrector	24P65171A46
L8B	compensating 2µh	24B90083A01
L12B	delay line	24B90094A01
L15B	choke, RF	24B90128A01
L18B	audio take off	24B90093A01
L19B	quad incls. C41B	24B90163A01
L1S1	peaking incls. R52S1	24B90216A01
L3S1	filter	24B90154A01
L252	compensating 330µh	24B90129A01
L503	horiz efficiency	24B90084A01
L801	filter choke	25C90097A01
L802	deg coil: CRT	24B90130A01
Q1S1	color killer 2N3638	48B90165A01
Q1S2	2nd color amp 2SC45AC	48C90172A01
R1B	IF trap 5K	18B90056A02
R14B	sound reject 500Ω	18B90056A03
R2H	B2 60Ω	18B90062A01
R6H	2 60Ω	18B90160A01
R11	A2 120Ω	18B9016A02
R14H	T2 60Ω	18B90160A01
R22S1	balance 2K	18B90056A01
R140	bright 270K	18B90123A01
R10S	contr 500Ω	18C90058A01
R205	B-drive 5K	18C90059A01
R211	G-screen 1M	18C90060A01
R301	vol 500K inds on/off switch E808	18A90051A01
R403	agc 500K	18B90057A02
R502	horiz hold 50K	18A90050A01
R509	HV adj 500K	18B90049A01
R601	vert hold 1M	18B90053A01
R602	vert size 5M	18B90061A01
R606	vert lin 100K	18A90057A01
R910	color killer 500Ω	18B90122A01
R911	intensity 500Ω	18A90052A01
R912	hue 5K	18B90055A01
T1B	1st IF interstage	24B90074A01
T4B	video det	24B90081A01
T5B	4.5MHz trap incls C21B, R16B & R31B	24C9022A01
T1F	horiz osc incls C28F	24B90082A01
T1S1	burst xformer incls C51S1	24B90218A01
T2S1	color IF incls C9S1 & R17S1	24B90072A01
T3S1	phase incls C19S1 & C23S1	24C90219A01
T301	audio output	25C90220A01
T501	HV xformer complete in TS924C & later	24P65171A49
T601	vert output	25C90099A01
T701	conv yoke	24C90092A01
T801	filament CRT C14TS924	25C690100A01

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PHILCO-FORD

TV Chassis 19P22

MAY • 1969

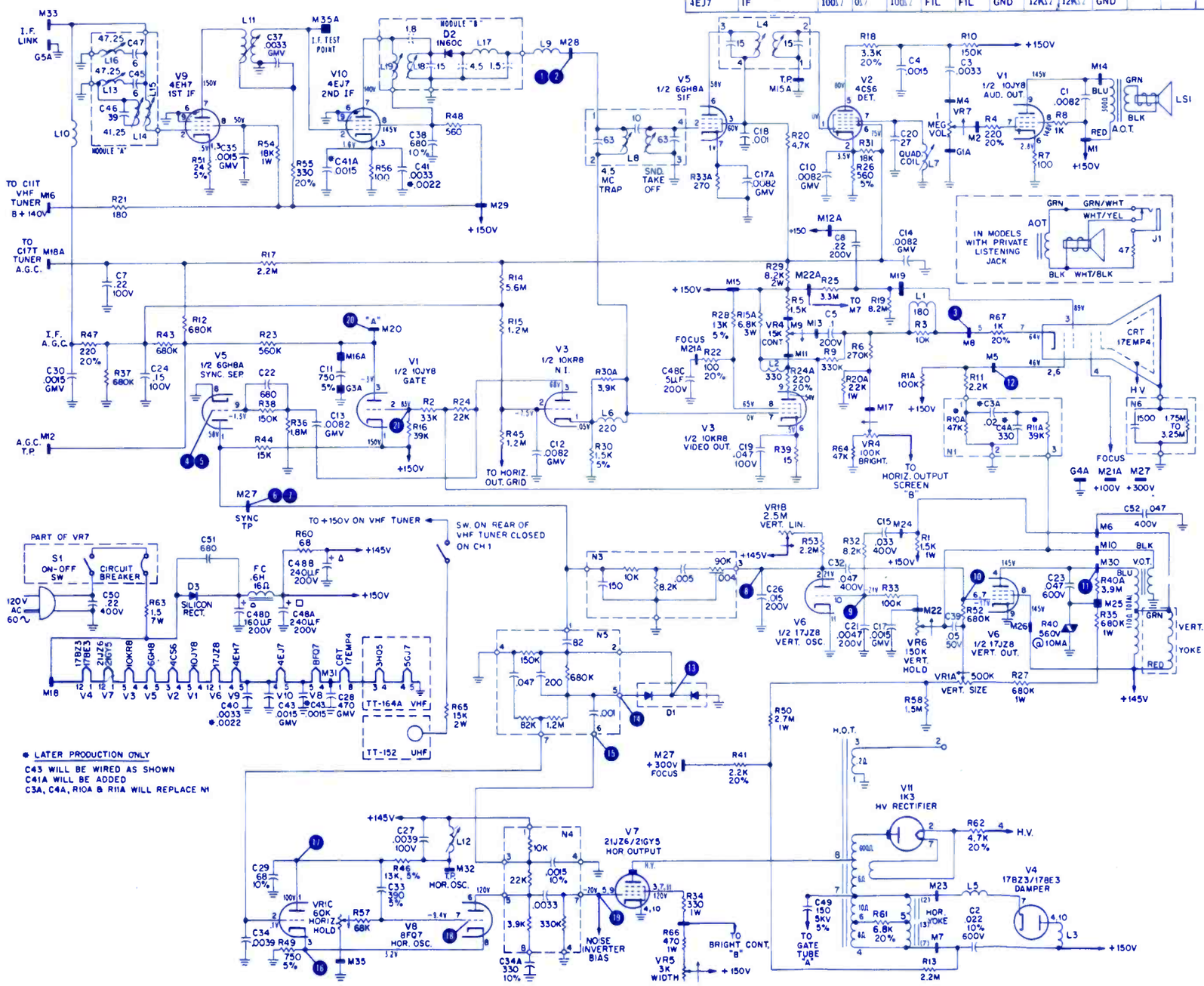
ELECTRONIC TECHNICIAN / DEALER TEKFAX

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

SYMBOL	DESCRIPTION	PHILCO-FORD PART NO.
C48	160/240/240/5 @ 200v elec fil	30-1293-43
C49	150pf 5kv, gate cplg	30-1246-31
D1	dual phase comp	34-8037-1
D2	1N60C, 2nd det	34-8022-6
L5	60MHz damper cath	32-4112-62
L6	noise inv. cath	32-4762-8
L7	quad snd det	32-4876-1
L8	4.5MHz trap & snd take-off	32-4688-14
L12	horiz stabilizer	32-4754-3
N1	retrace supp	30-6024-9
N3	vert integrator	30-6030-12
N4	horiz osc	30-6057-1
N5	phase comp	30-6035-2
N6	CRT isolation	30-6058-2
R15A	6.8K 3w video plate	33-1363-46
R40	varistor vert yoke	33-1373-6
S1	on-off w/cb (part of VR7)	
AOT	audio output	32-10013-2
FC	filter choke	32-10010-3
HOT	horiz output	32-10008-7
VOT	vert output	32-10012-6
VR1	500k vert size 2M v line 60KH hole	33-5595-8
VR4	100K bright 15K contr	33-5618-17
VR5	3K width	33-5620-1
VR6	150K vert hold	33-5619-9
VR7	1M vol on-off w/cb	33-5625-1
	VIF det assy w/comp (module "B")	38-19392

VOLTAGE AND RESISTANCE CHART

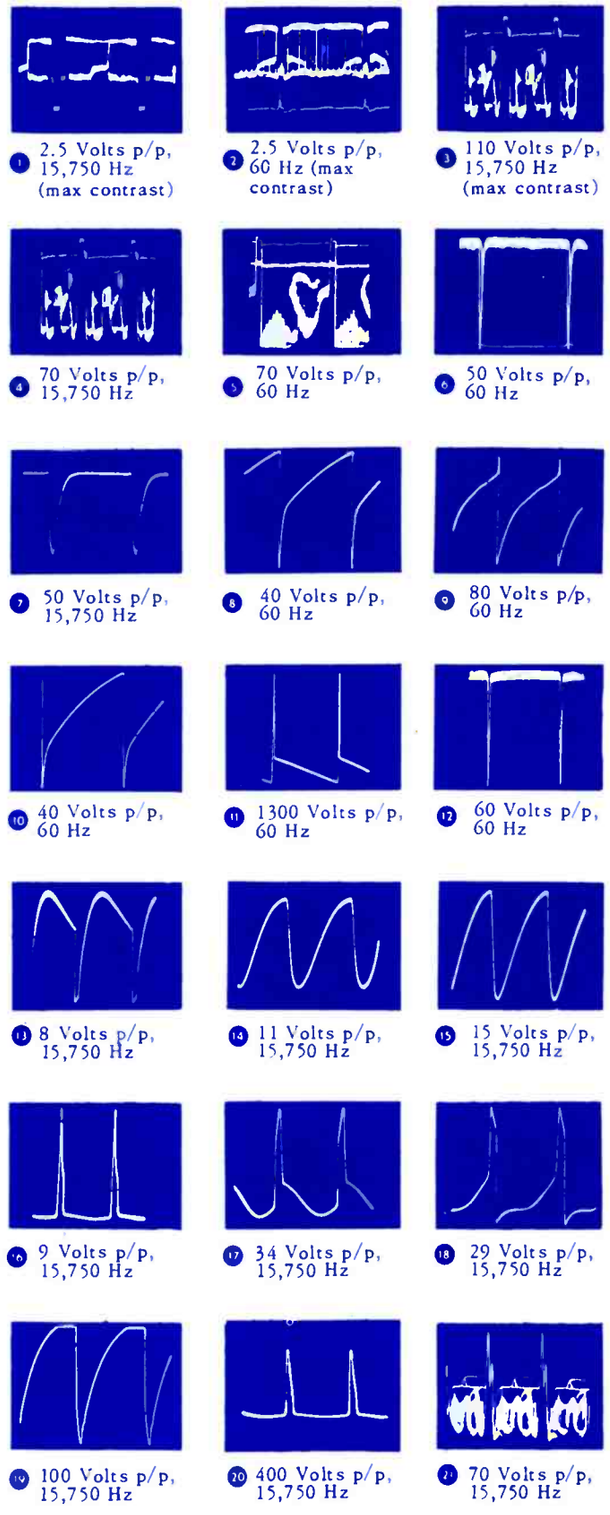
TUBE	USE	PIN NUMBERS 1	2	3	4	5	6	7	8	9	10	11	12
V1 10JY8	Aud. Out. & Gate	150V 12KΩ	83V 36KΩ	-3V 1.3MΩ	FIL	FIL	2.8V 100Ω	0V 260Ω	148V 12KΩ	145V 12KΩ			
V2 4CS6	Sound Detector	0V 6Ω	3.5V 500Ω	FIL	FIL	80V 200KΩ	75V 12KΩ	0V 3.5Ω					
V3 10KR8	Video Out. & N.I.	.05V 300Ω	-7.5V 900KΩ	68V 35KΩ	FIL	FIL	.5V 15Ω	0V 300Ω	65V 25KΩ	54V 12KΩ			
V4 17BE3	Damper	FIL	INF	INF	150V 12KΩ	INF	INF	HV 9MΩ	INF	INF	150V 12KΩ	INF	FIL
V5 6GH8	Snd. IF & Sync. Sep.	58V 12KΩ	0V 2Ω	60V 12KΩ	FIL	FIL	58V 12KΩ	1V 270Ω	GND	-1.3V 1.9MΩ			
V6 17JZ8	Vert. Osc. & Output	FIL	21V 3.8MΩ	INF	145V 12KΩ	INF	-17V 1.8MΩ	-17V 1.8MΩ	145V 12KΩ	GND	-21V 200KΩ	GND	FIL
V7 21GY5	Horiz. Output	FIL	INF	120V 12KΩ	0V GND	-20V 300KΩ	120V 12KΩ	120V 12KΩ	120V 12KΩ	-20V 300KΩ	0V GND	120V 12KΩ	FIL
V8 8FQ7	Horiz. Osc.	100V 25KΩ	1V 2.2MΩ	3.2V 750Ω	FIL	FIL	120V 45KΩ	-9.4V 95KΩ	3.2V 750Ω	GND			
V9 4EH7	1st Vid. IF	.5V 24Ω	0V 420KΩ	.5V 24Ω	FIL	FIL	GND	150V 12KΩ	50V 20KΩ	GND			
V10 4EJ7	2nd Vid. IF	1.6V 100Ω	0V 0Ω	1.6V 100Ω	FIL	FIL	GND	150V 12KΩ	145V 12KΩ	GND			



● LATER PRODUCTION ONLY
C43 WILL BE WIRED AS SHOWN
C41A WILL BE ADDED
C3A, C4A, R10A & R11A WILL REPLACE N1

OSCILLOSCOPE WAVEFORMS

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



1. 2.5 Volts p/p, 15,750 Hz (max contrast)
2. 2.5 Volts p/p, 60 Hz (max contrast)
3. 110 Volts p/p, 15,750 Hz (max contrast)
4. 70 Volts p/p, 15,750 Hz
5. 70 Volts p/p, 60 Hz
6. 50 Volts p/p, 60 Hz
7. 50 Volts p/p, 15,750 Hz
8. 40 Volts p/p, 60 Hz
9. 80 Volts p/p, 60 Hz
10. 40 Volts p/p, 60 Hz
11. 1300 Volts p/p, 60 Hz
12. 60 Volts p/p, 60 Hz
13. 8 Volts p/p, 15,750 Hz
14. 11 Volts p/p, 15,750 Hz
15. 15 Volts p/p, 15,750 Hz
16. 9 Volts p/p, 15,750 Hz
17. 34 Volts p/p, 15,750 Hz
18. 29 Volts p/p, 15,750 Hz
19. 100 Volts p/p, 15,750 Hz
20. 400 Volts p/p, 15,750 Hz
21. 70 Volts p/p, 15,750 Hz

ELECTRONIC TECHNICIAN / DEALER **TEKFAX**

1227

TRUETONE
TV Model 3912

MAY • 1969

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

SYMBOL	DESCRIPTION	TRUETONE PART NO.
R219	Control AGC	15-167009
R314(SW701)	control SW & vol	15-167010
R505	carbon (Spec.) 1.2M ±10% ½w	15-140004
R517	control vert hold	15-167011
R518	control vert size	15-167012
R519	control vert lin	15-167012
R626	control horiz hold	15-167014
R718	control, contrast	15-167015
R719	control, bright	15-167016
C705	cer 6.8pf ±0.5% 500v	13-130064
C708A	elec 200µf/200	15-138002
C708B	µf/50µf ±20%	15-138002
C708C	180v	15-138002
C712	special 0.1µf ±20% ul	15-139002
M501	copristor	15-139001
L201	47.25MHz trap coil	15-094008
L301	SIF det coil	15-094009
L601	horiz stabi coil	15-094007
T201	1st VIF & 50.35MHz trap trans	15-094003
T202	2nd VIF trans	15-094004
T203	VIF det trans	15-094005
T301	1st SIF trans	15-094006
T302	audio output trans	15-097002
T501	vert output trans	15-097003
T601	horiz output trans	15-097004
T701	SIF take-off & 4.5MHz trap trans	15-094002
T702	power choke trans	15-097005
D201	diode IN87A	15-085061
F701	fuse 1.6a	15-204001
	def yoke	15-097006
	VHF tuner	15-078001
	UHF tuner	15-078002

VOLTAGE SYMBOL LEGEND

- 13KV
- 350V
- 180V
- 145V
- 140V
- 135V
- 110V
- 70V

DC VOLTAGE MEASUREMENTS ARE AT NO SIGNAL CONDITION.

1228

ZENITH
TV Chassis 13Z12, 13Z12S

MAY • 1969

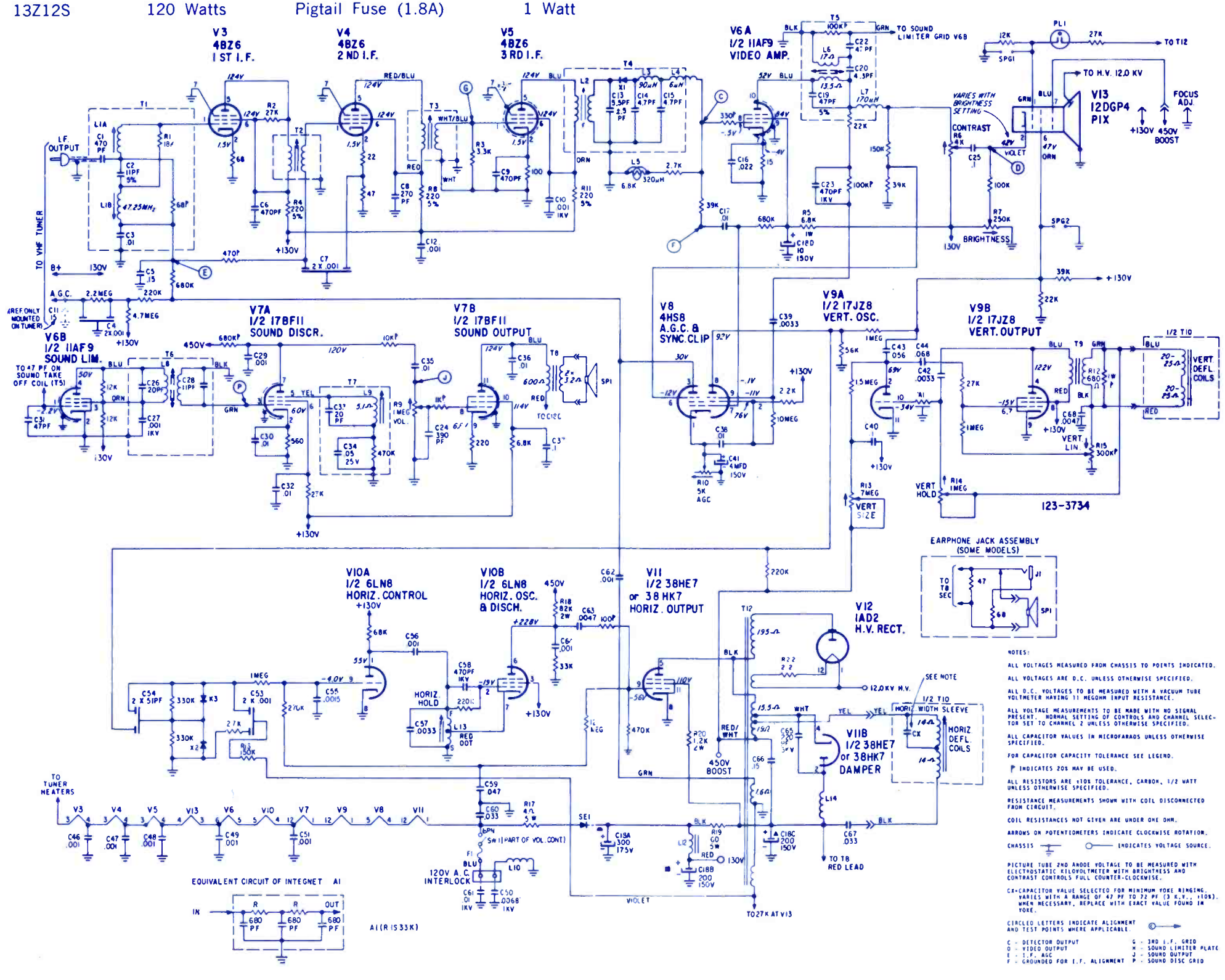
ELECTRONIC TECHNICIAN / DEALER **TEKFAX**

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

SPECIFICATIONS

CHASSIS	POWER USED AT 120V 60 CYCLES	OVERLOAD PROTECTION (AC LINE)	SOUND POWER OUTPUT
13Z12	120 Watts	Pigtail Fuse (1.8A)	1 Watt
13Z12S	120 Watts	Pigtail Fuse (1.8A)	1 Watt

SYMBOL	DESCRIPTION	ZENITH PART NO.
C18A	300µf elec cap 175v	22-5506
C18B	200µf elec cap 150v	22-5506
C18C	200µf elec cap 150v	22-5506
C18D	10µf elec cap 150v	22-5506
R6	4K contr cont	63-6463
R7	250K bright cont	63-5419
R8	220Ω 5% ½w	63-7236
R9	1M vol cont	63-7458
R10	5K AGC cont	63-7082
R13	7M vert size cont	63-6433
R14	1M vert hold cont	63-6915
R15	300K vert lin cont	63-7522
L3	det series peaking coil	20-2013
L4	choke coil	20-2004
L5	det shunt peaking coil	20-2520
L6	sound take-off coil winding assy	Part of T5
L9	quad coil winding assy	Part of T7
L10	line filter coil	20-1424
L12	filter choke	95-2567
L13	horiz osc coil assy	S-56875
T2	2nd IF xformer assy	S-66852
T3	3rd IF xformer assy	S-66853
T5	sound take-off coil assy	S-60558
T7	quad coil assy — wiring	S-79340
T8	sound output xformer	95-2499
T9	vert output xformers	95-2518
T10	yoke	95-2676
T12	horiz sweep xformer & width sleeve	S-80850 199-491
A1	integrator	87-4
F1	1.8a fuse	136-65
SW1	on-off switch	Part of R9



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.

ALL CAPACITOR VALUES IN MICROFARADS UNLESS OTHERWISE SPECIFIED.

FOR CAPACITOR CAPACITY TOLERANCE SEE LEGEND.

P INDICATES 20% MAY BE USED.

ALL RESISTORS ARE ±10% TOLERANCE, CARBON, 1/2 WATT UNLESS OTHERWISE SPECIFIED.

RESISTANCE MEASUREMENTS SHOWN WITH COIL DISCONNECTED FROM CIRCUIT.

COIL RESISTANCES NOT GIVEN ARE UNDER ONE OHM.

ARROWS ON POTENTIOMETERS INDICATE CLOCKWISE ROTATION.

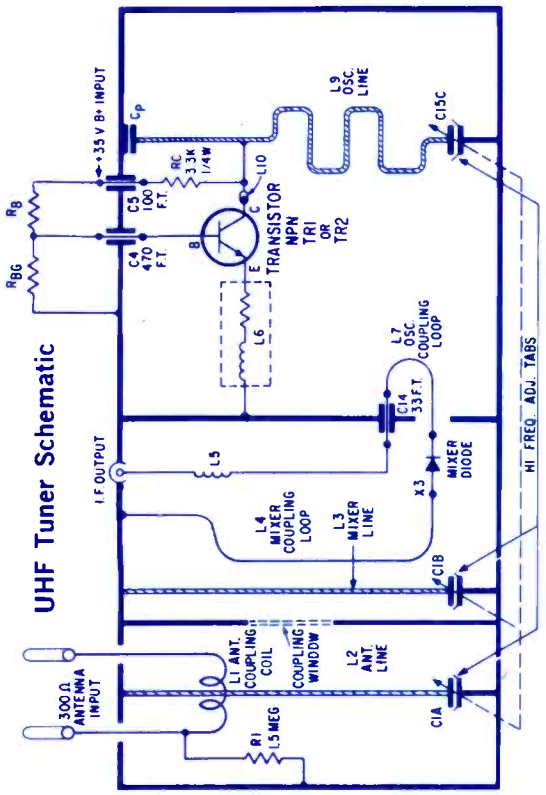
CHASSIS ⏚ ○ INDICATES VOLTAGE SOURCE.

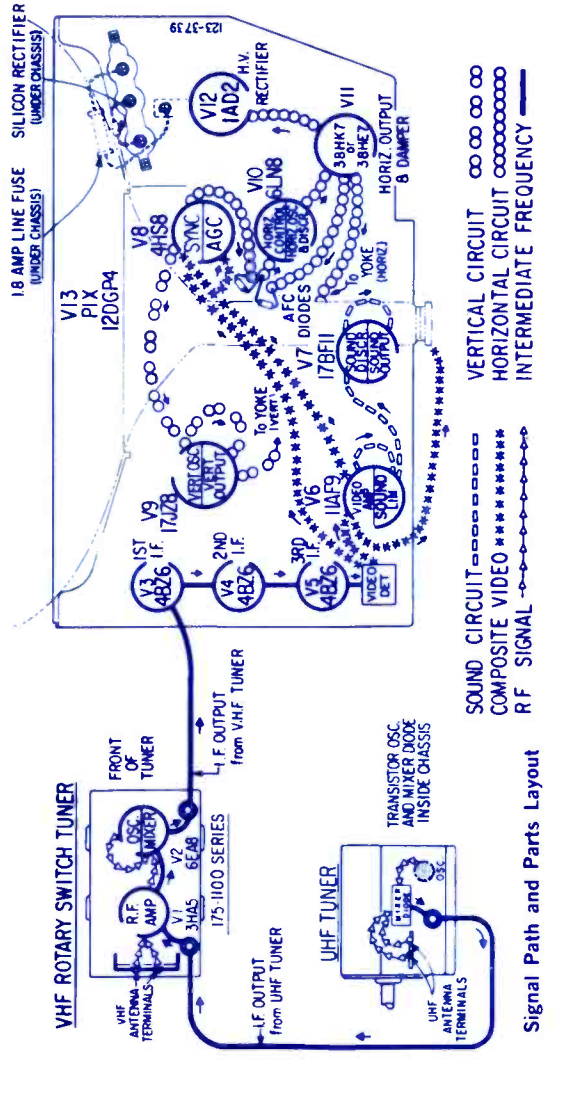
PICTURE TUBE 2ND ANODE VOLTAGE TO BE MEASURED WITH ELECTROSTATIC KILOVOLTMETER WITH BRIGHTNESS AND CONTRAST CONTROLS FULL COUNTER-CLOCKWISE.

CX=CAPACITOR VALUE SELECTED FOR MINIMUM YOKE RINGING. VARIES WITH A RANGE OF 47 PF TO 72 PF (3 K.V., 1105). WHEN NECESSARY, REPLACE WITH EXACT VALUE FOUND IN YOKE.

CIRCLED LETTERS INDICATE ALIGNMENT AND TEST POINTS WHERE APPLICABLE. ⊙→

C - DETECTOR OUTPUT
D - VIDEO OUTPUT
E - I.F. AGC
F - GROUNDED FOR I.F. ALIGNMENT
G - 3RD I.F. GRID
H - SOUND LIMITER PLATE
J - SOUND OUTPUT
P - SOUND DISC GRID





Signal Path and Parts Layout

OVERHAUL $9.75 GUARANTEED for 1 Year

OVERHAUL $9.75 • REPLACEMENT TUNERS . . . $10.45

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

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

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

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

ORDER TUNERS BY PART NUMBER, AS FOLLOWS:

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

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

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

TSC

TUNER SERVICE CORPORATION *FACTORY-SUPERVISED TUNER SERVICE*

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

WATCH FOR NEW CENTERS UNDER DEVELOPMENT

MALLORY **Tips for Technicians**

Versatile Sonalert® Signal makes a great ingenuity tester

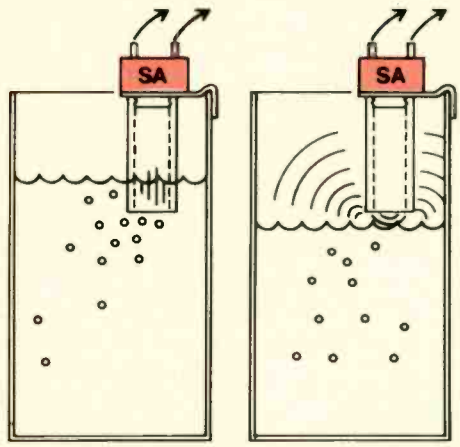


Fig. 1—Trapped Sound System

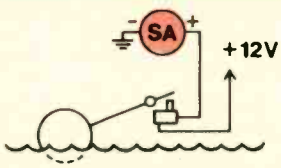


Fig. 2—Mechanical System

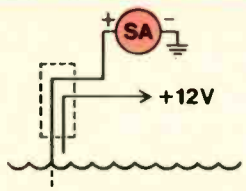


Fig. 3—Simple Electronic System

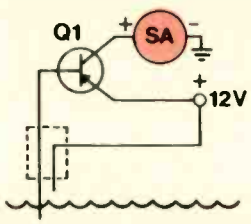


Fig. 4—High Output Electronic System

Crank up your inventive powers and put them to work with Sonalert®, the low-drain, solid-state tone signal that gives a big sound with just a few milliamp drive. More than likely you can come up with some great ideas for your shop, home or car. Ideas for fun, safety—and, perhaps, profit.

Just to give you a few clues, let's take a look at the way would-be Edisons turned Sonalerts into interesting ideas. We've picked four ways in which others have used this new signaller for one application: liquid level alarm.

One of the simplest is a compact system that requires no trigger circuits or complex mechanical devices. All you have to do is install a glass or plastic tube on the unit's nose cone, and hook the Sonalert to a power source. (See figure 1.) Insert the tube into the liquid to the level required for alarm. Since the tube is immersed, no sound can escape. Once the fluid falls below the critical level, out comes a loud, clear, unmistakable signal. Here's an ideal system for use in explosive atmospheres; Sonalert produces no arcs or sparks.

Figure 2 shows a mechanically actuated system—float and switch. It's made up by mounting a float ball on a lever arm that actuates a plunger switch in series with the Sonalert and power source. Reliability might be a problem because of mechanical failures.

For greater reliability, the simple electronic system (figure 3) is hard to beat. Fluid acts as the switch to close the circuit between Sonalert and the source. Just one problem presents itself. The sound level from Sonalert is proportional to current flow. If the liquid is not a good conductor, current flow may be too low.

To overcome this limitation, a high output electronic signal system was developed (refer to figure 4). Here transistor Q1 acts as a low resistance switch; and current flow to the Sonalert is maximum as long as there is enough base current flowing through the fluid to hold Q1 ON.

Here are four variations on one theme. Bet you can come up with some great ideas on your own. Try. If you can't, we've got more tips for you in booklet No. 9-406 that's yours for the asking at your Mallory Distributor's. It's chock-full of information: how Sonalert works, ratings, specs, mounting instructions and more tips. You can write for a copy, if you prefer. Mallory Distributor Products Company, a division of P. R. Mallory & Co. Inc., Indianapolis, Indiana 46206.

DON'T FORGET TO ASK 'EM— ***"What else needs fixing?"***

. . . for more details circle 128 on postcard

ELECTRONIC TECHNICIAN / DEALER

WORLDS LARGEST ELECTRONIC TRADE CIRCULATION

MAY 1969 : VOL. 89 NO. 5

COVER
Transistors and digital circuits in everything from model planes to test instruments is the theme of this month's cover which shows the Hickok digital test instrument and solid-state scope, the Darcy digital voltmeter, Setchell Carlson's move to transistor plug-in boards for color TV and the latest Heath digital proportional radio control system for model enthusiasts.

TEKFAX • 16 PAGES OF THE LATEST SCHEMATICS • **GROUP 201**
AIRLINE: TV Model GHJ-14549A
MAGNAVOX: Color TV Chassis T933
MOTOROLA: Color TV Chassis TS924B,C
PHILCO-FORD: TV Chassis 19P22
TRUETONE: TV Model 3912
ZENITH: TV Chassis 13Z12, 13Z12S

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ET/D EDITOR'S MEMO

TV Helps Sets NBS Time Standard

The National Bureau of Standards scientists and engineers have borrowed from commercial television in Denver to design a system whereby the clock that controls the broadcasts from station WWV in Fort Collins, Colo., may be kept within a millionth of a second of the atomic clock in Boulder.

The technique uses the television synchronizing pulse on the TV carrier wave.

This is how it works. A TV table model set is operated at the NBS atomic clock end in Boulder, and another at the NBS broadcast station end in Fort Collins. Both TV sets are tuned to the same Denver TV channel and both are connected to sensitive electronic equipment which records the arrival of the periodic pulses on the carrier wave. The sync pulses are a known distance apart and are easily identified by electronic devices which "tag" them as they arrive at the location of each recording device. In the present case, the distance from crest to crest of succeeding pulses is about 11.8 miles.

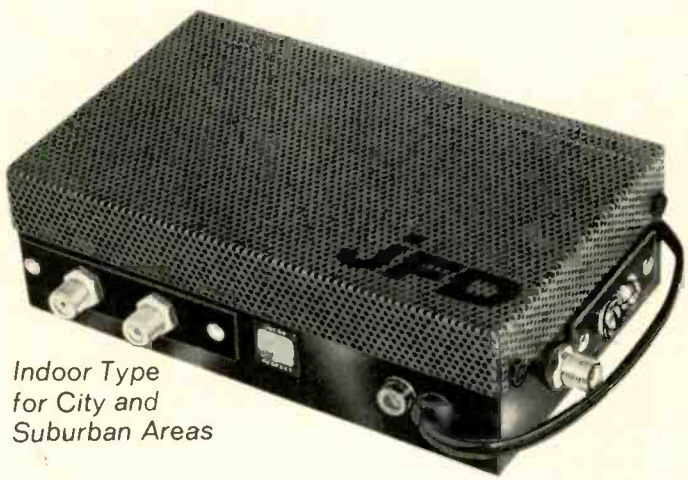
The equipment records the time of arrival of these pulses at the "atomic clock" in Boulder and at the radio stations in Fort Collins. The time delay between the TV transmitter near Denver and the Boulder and Fort Collins receivers is accurately known to a tenth of a millionth of a second. From this information NBS scientists calculate the time difference between two clocks. Once the difference is known, even if it is only a few millionths of a second, corrections may be made to synchronize the Fort Collins radio station clock with the atomic clock in Boulder.

The absolute accuracy of the measurement is conservatively set at plus or minus a millionth of a second.

Paul J. Schneider

New reliable profitable JFD Program Center Amplifiers

Outdoor Type for Fringe and Weak-Signal Areas



Indoor Type for City and Suburban Areas

JFD Program Centers — the result of three years of research and development — are here! Now you can equip **any** home with a complete entertainment system!

- **Operate up to 4** (or more) TV sets and FM receivers from **one** antenna.
- **Solid state** silicon overlay transistors with silicone sealed printed circuitry provide higher gain, less noise . . . ultra-reliable performance.
- Deliver **true-to-life color** . . . crisp black and white pictures.
- Available for **300** ohm or **75** ohm VHF and VHF/UHF/FM installations.

The ONLY amplifiers so RELIABLE in performance that they are backed by an exclusive SIX (6) MONTH INSTANT REPLACEMENT GUARANTEE! **With this performance (and insurance), how can you miss?**

JFD

Program Center and Snow Plow INSTANT REPLACEMENT GUARANTEE

This unit is guaranteed 100% for a period of six months. If, within a period of six (6) months after it was purchased, it does not operate for any reason whatsoever (including lightning strike, line surge or static build-up,) or otherwise fail to perform satisfactorily we will replace it with a brand new unit instantly — absolutely *FREE! NO QUESTIONS ASKED!*

Write today for your Program Center promotional kit and home antenna systems manual

JFD ELECTRONICS CORP. 15th Avenue at 62nd Street, Brooklyn, N. Y. 11219

"See us at the NEW Electronics Show, Booth C100, Suite 4120-4122, Hotel Sahara, Las Vegas, May 21-23."

ET/D LETTERS TO THE EDITOR

Readers' Aid

Perhaps one of your readers can help me locate a schematic or instructions on a Philco Model 7030 Dynamic tester. I think it is used for signal tracing, but the people at Philco say that manuals are no longer available. If someone can send me a copy I will be glad to pay the cost.

IRVING KOHN
Anchor Electronics
300 Valley St.
Sausalito, Calif. 94965

I enjoy your magazine very much and I am writing in hopes that one of your readers can help me. I am trying to obtain the latest roll chart and/or operating manual for a Simpson Model #330 tube tester. I am willing to pay a reasonable price.

JOHN D. TRIPLETT
39474 Blue Fin Way
Fremont, Calif. 94538

I have been a subscriber to ELECTRONICS TECHNICIAN/DEALER for many years and found it very helpful. But now I have a special problem. I need a schematic and manual for an Eico Model 400 scope. I have tried everywhere. Maybe one of your readers has information on this unit.

R. BERTRAN
425 W. 25th St.
New York, N.Y. 10011

I have a Test-O-Matic tube checker made by Shell Electronics Mfg. Corp. of Westbury, N.Y. There are no numbers on it, but a supplementary chart showed Model 18. As this corporation is no longer in business, perhaps you or one of your readers can help me get a tube chart for it.

WILLIAM A. GRAUNKE
5933 Old Redwood Hwy.
Santa Rosa, Calif. 95401

I hope one of your readers can help me. I have been looking for a schematic of an old GE AM/FM/SW radio receiver, Model X415 built in 1948. I am also looking for a schematic of a Japanese AM/FM transistor radio, Royal-Model 300. Any help would be appreciated.

JAMES WAHL
414 Superior Ave.
Crystal Falls, Mich. 49920

We have a Schaub-Lorenz radio in for repair and cannot obtain parts for it. The manufacturer is located in West Germany. Possibly you or your readers can supply us with information on this unit. Your assistance is deeply appreciated.

STANLEY J. PEPERA
Video TV & Appliance
717 Gratiot Ave.
Saginaw, Mich. 48602

I have a Hi Fi system I would like to sell and to do so, I need some information on it. It was made by Stan White, purchased from Leonard Radio in New York and called the Esquire. It was built in 1957 or 1958. I would appreciate any information your readers can furnish on this system.

RICHARD G. RAPP
33 Wyoming St.
Commack, N.Y. 11725

Perhaps one of your readers can help me obtain a schematic for the Weston Model 983 oscilloscope. A reply from the company indicates that it no longer makes scopes and cannot furnish any data. Also, my compliments on a magazine unsurpassed in its field.

THOMAS E. HAMBLIN
P.O. Box 82
King George, Va. 22485

We would like to obtain a schematic of the following TV sets and information on where we can get parts near the Chicago area. The set is a Rocket TV, Model No. 8-HL, Egawadenki Kenkyusho; Tokyo, Japan.

GEORGE KALEC
9033 S. Meade Ave.
Oak Lawn, Ill. 60453

I have a Webcor Model 152-5 phono player and I need a motor, part #15X229-5. It was ordered from Webcor but they said it was no longer available. Could one of your readers help me?

RICHARD WOLF
Box 155
Wishek, N.D. 58495

I would appreciate any circuit information on a Superior Model TV 50. Some tubes are missing and after writing several letters, I learned that Superior is no longer in business.

W. EVERETT SWIFT
160 Maskwonicut St.
Sharon, Mass. 02067

For window-size blow-ups, send 10c to Sprague Products Co., 65 Marshall St., North Adams, Mass. 01247, to cover handling/mailing. Order yours now, so you'll be able to display it well before July 4th.

EVERY DAY IS INDEPENDENCE DAY

FOR YOU AND YOUR INDEPENDENT TV SERVICE DEALER

Your independent TV Service Dealer is in business for himself because he too wants to exercise his independence just as you do. You purchased your TV or radio set where you wanted to . . . when you wanted to . . . and at the price you decided was right.

Your TV service dealer is also an independent in the things he buys in his day-to-day work. He buys repair parts where he can get the highest quality and the best service. And, he trained himself in his own way, on his own time, at his own expense, to be able to do the very best for YOU.

He stands or falls on what you think of him and his work. He has to do good work to keep your business . . . and he knows it!

We're lucky in these United States that every day is Independence Day. Independent buying, selling, and servicing is the very lifeblood of American business. Let's keep it that way.

THIS MESSAGE WAS PREPARED BY SPRAGUE PRODUCTS COMPANY,
DISTRIBUTORS' SUPPLY SUBSIDIARY OF SPRAGUE ELECTRIC COMPANY, NORTH ADAMS, MASSACHUSETTS FOR . . .

YOUR INDEPENDENT TV-RADIO SERVICE DEALER

ET/D LETTERS TO THE EDITOR

My problem is obtaining a schematic for a Triplett TV-FM signal generator/marker Model 3434. Triplett was unable to supply it. Possibly one of your readers has one to loan me which I could have copied.

AVON BAUMAN & SONS
3255 Magnum Lanes
Atlanta, Ga. 30311

I would appreciate any information you can give me on finding a schematic for a GE Model OFM-1 oscillograph.

CHARLES F. BERRY
19202 2nd Ave. S.
Seattle, Wash.

Public Image

In my opinion the radio and TV technician has one of the worst jobs in the world. I am speaking from experience. My education began in high school when I took correspondence courses in communication electronics, communication engineering, black and white TV servicing, color servicing and built my own black and white and color sets. I have a first class radiotelephone license.

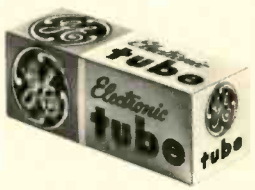
Fortunately I worked for the Post Office for the required number of years to enable me to retire. My pension is ample for my needs. However I love electronics and still do servicing, but only sets that are brought to me.

What burns me up is the public's image of the TV technician. The average person equates us on the same level as a grease monkey in a gas station. The nearest comparison of the type of work would be that of an electrician. However, the comparison in pay is pitiful. The electrician draws a wage of $5 to $10 an hour. He has no money invested in expensive testing equipment, he does not need schematics on every job he does and he does not need to keep up with the newest developments by reading technical magazines and books.

There is hope on the horizon with the new black and white and color sets using more and more solid state devices at the home, service will be confined to only the simplest troubles. Eventually the day of the half-trained tube technician will end. He will have the choice then of either upgrading himself through further study or find another job.

MATHEW RUSKOSKI
Pittsburgh, Pa.

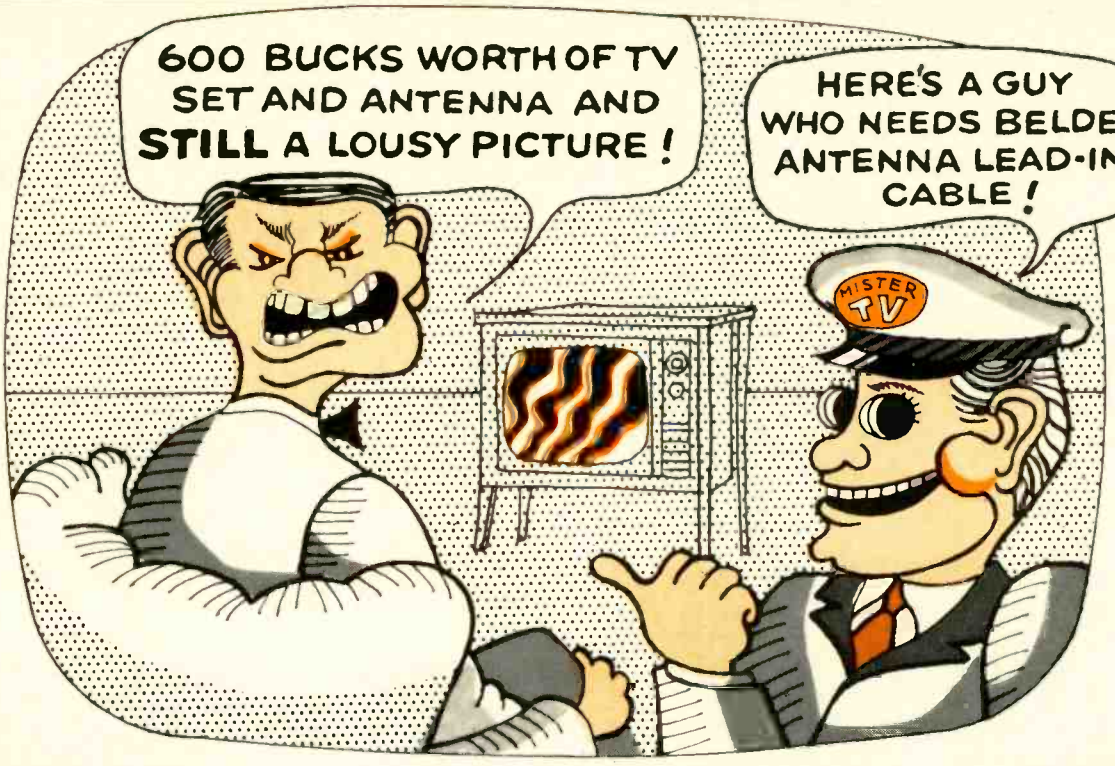
GE redesigns tubes to satisfy these tough customers before you get them!



Reach for this when you ask, "What else needs fixing?"

Tube designers at General Electric work for a real *tough customer*. He's our design chief Chris McCool — a stickler for longer life and greater reliability in tubes for replacement use. If a production type can be made better, he'll see to it. His GE designers found a way to dissipate plate heat for less operating fatigue . . . resulting in longer life. They pioneered an improved cathode coating that resists flaking which used to cause shorts. Microphonics in horizontal output tubes were eliminated in another design. These are just a few examples of tubes redesigned by GE for your replacement needs. They're part of the "service designed" line — dependable tubes you can stake your reputation on. Stock up now at your GE distributor. 288-25

GENERAL ELECTRIC



Color or UHF set perfect? Antenna perfect? Then obviously there's a missing link. Check that antenna lead-in cable. Old, worn-out, weather-beaten cable, or the ordinary flat ribbon kind designed for black and white VHF, causes more fuzzy, distorted pictures than you can count. It's your opportunity to upgrade these customers to a cable matched to their particular signal reception situations. One of Belden's Big Four—the link to perfect reception.

FOR CONGESTED AREAS...

8290 SHIELDED PERMOHM®

In congested, in-city areas, stray electrical interference and noise are at their worst. For perfect, all-82 channel reception—color or B/W—replace old cable with Belden's 8290 Shielded Permohm. Its aluminum Beldfoil® shielding prevents pickup of ghost signals and electrical noise by the lead-in. Weather-proof and water-proof. You can tape it right to the mast. Or install it underground, in conduits—even in rain gutters.

AWG & (Stranding)	Color	Nom. O. D. (inch)	Nom. Velocity of Propagation	Nom. Capacitance (mmf/ft.)	Nom. Attenuation per 100' mc	db	Standard Package Lengths in ft.
22 (7 x 30)	Brown	.305 x .515	69.8%	7.8	57 85 177 213 473 671 887	1.7 2.1 3.2 3.5 5.4 6.6 7.7	50', 75', 100' coils have terminals attached. Available in counter dispenser. 250', 500' spool.

Copperweld, 2 conductors, orange polyethylene insulation and web between conductors, cellular polyethylene oval insulation, Beldfoil shield, stranded tinned drain wire, polyethylene jacket.

FOR FRINGE AREAS...

8285 PERMOHM®

Antenna cable in uncongested or fringe areas picks up little electrical interference. But does get a lot of weathering, which degrades an already weak signal. These customers need encapsulated cable. Belden 8285 Permohm. Its special polyethylene jacket protects the energy field, regardless of weather conditions. It delivers the strongest signal of any unshielded twin lead under adverse conditions. Requires no matching transformers and connectors. For all 82 channels, color or B/W.

AWG & (Stranding)	Color	Nom. O. D. (inch)	Nom. Velocity of Propagation	Nom. Capacitance (mmf/ft.)	Nom. Attenuation per 100' mc	db	Standard Package Lengths in ft.
22 (7 x 30)	Brown	.255 x .468	73.3%	5.3	100 300 500 700 900	1.4 2.8 3.8 4.8 5.6	50', 75', 100' coils have terminals attached. Available in counter dispenser. 250', 500' coils and 1000' spool.

Copperweld, 2 conductors parallel, orange polyethylene insulation and web between conductors, cellular polyethylene oval jacket.

FOR LOCAL BLACK AND WHITE...

8275 CELLULINE®

Cracked, corroded, weathered cable, full of dirt and moisture, loses signal strength; prevents any TV set from delivering a quality picture. Upgrade B/W VHF and local UHF customers to Belden 8275 Celluline. Performance is improved because all possible moisture between conductors has been eliminated. Abrasion-resistant and weather-resistant for a long, long service life. And, it requires no end sealing.

AWG & (Stranding)	Color	Nom. O. D. (inch)	Nom. Velocity of Propagation	Nom. Capacitance (mmf/ft.)	Nom. Attenuation per 100' mc	db	Standard Package Lengths in ft.
20 (7 x 28)	Brown	.300 x .400	80%	4.6	100 200 300 400 500 700 900	1.05 1.64 2.12 2.5 2.98 3.62 4.3	50', 75', 100' coils in counter dispenser. 250', 500', 1000' spools.

Bare copperweld; 2 conductors parallel, polyethylene jacket with inert gas filled unicellular polyethylene core.

FOR MATV AND CATV...

8228 DUOFOIL® COAX

Got an apartment or townhouse complex in your area? Motels or hotels? Or is CATV coming? Use Belden's new 75 ohm coaxial cable—8228 Duofoil. Shielding is 100%—sweep tested 100%. Spiral wrapped drain wires provide long flex life. Small diameter saves space in conduit installations. Use Duofoil for all coaxial color and B/W VHF, UHF and CATV applications.

AWG & (Stranding)	Color	Nom. O. D. (inch)	Nom. Velocity of Propagation	Nom. Capacitance (mmf/ft.)	Nom. Attenuation per 100' mc	db	Standard Package Lengths in ft.
18 Solid, Bare	Black	.242	78%	17.3	50 100 200 300 400 500 600 700 800 900	1.5 2.1 3.1 3.8 4.5 5.0 5.5 6.0 6.5 6.9	100', 500', 1000' spools.

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

See your local Belden distributor for full details or to order. For a free copy of the recent reprint article, "Electronic Cable," write: Belden Corporation, P.O. Box 5070-A, Chicago, Illinois 60680.

BELDEN

8-6-8A

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ET/D TECHNICAL DIGEST

ADMIRAL

Polyester Film Capacitor Identification

Many current Admiral electronic products use a rectangular green plastic capacitor with both leads at the bottom. Polyester film such as Du Pont's Mylar is used as the dielectric.

Some capacitors of this type have the value printed on the case (.01, 0.02, etc.); others have the value printed in code. The code consists of the first two digits of the picofarad value plus a digit indicating the number of zeros that follow. For instance: 223 is 22000pf or .022μf, 103 is 10000pf or .01μf, etc.

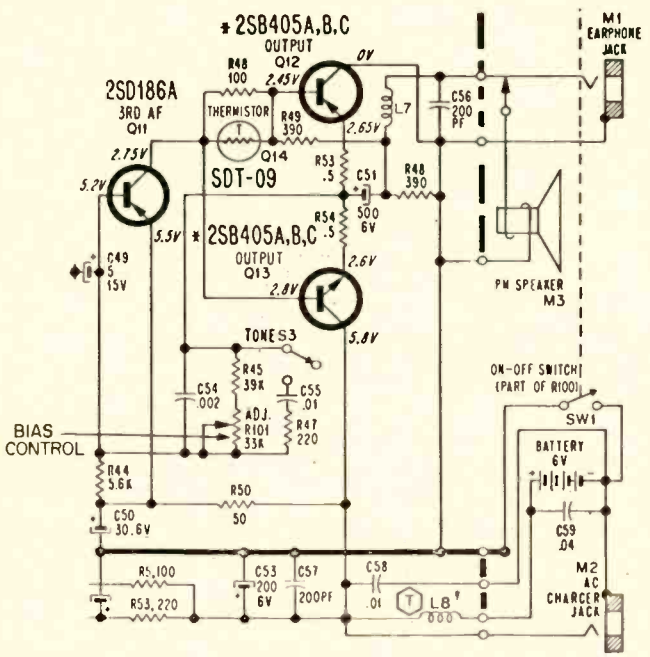
The letter M or K indicates tolerance: M is 20 percent, K is 10 percent. The working voltage and vendor code also appear on many. Most of this type that we have seen have this information arranged on four separate lines.

Radio Chassis 24A5/24A5A—Overheating Resistors

Increasing the tolerances of components and high line voltage can cause failure of resistors R48, R100, R106 and CR2. If you find these resistors overheating, replace R106 with a 47Ω, 1w, 60B14-470; R100 with a 220Ω, 1w, 60B14-221; R48 with an 82Ω, ½w, 60B8-820. Check CR2 and replace if shorted. All three resistors must be changed at the same time. Kink the leads to hold them off the board.

Radio Chassis 13H1—Audio Distortion

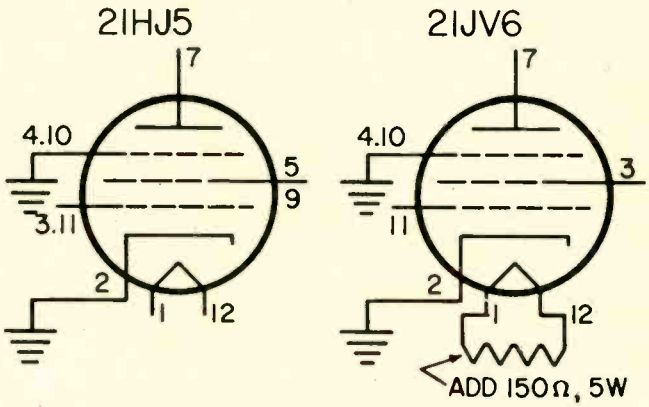
Audio distortion on the model Y847R radio using the 13H1 chassis may be caused by a defective bias control, R101, 2075B89-50. This small control is located on the



circuit board just to the left of the speaker magnet. If the control is defective, moving it usually causes the distortion to be intermittent. The problem is a poor connection where the lug is riveted to the control element—we suggest replacement of the control. The replacement control must be adjusted according to the procedure given in service manual S1214—if it isn't, you may still have distortion or high current drain.

21HJ5 Horizontal Output Tube Replaced by 21JV6

The 21HJ5 tube used for horizontal output in the monochrome TV chassis covered by service manuals S924, S955, S956, S957 and S971 is no longer available. The



13GB5 tube, which replaced the 21HJ5 in later runs of these chassis, has been suggested as a substitute. However, this substitution required changing the tube socket and other components. We can now supply the 21JV6 which will replace the 21HJ5 with only slight rewiring of the original socket and the addition of a resistor across the heater.

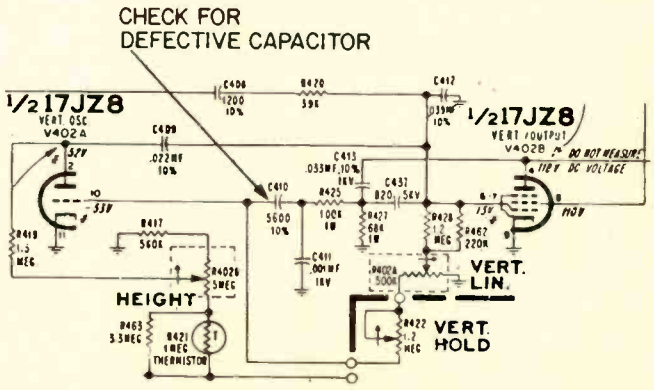
To replace the 21HJ5 with a 21JV6: (1) Remove leads from pin 3 and connect to pin 11. (2) Remove leads from pins 5 and 9 and connect to pin 3. (3) Add a 61C20-44 (150Ω, 5w) resistor between pins 1 and 12. In areas with low line voltage, this resistance may be increased to 180Ω (do not exceed 180Ω).

The following chassis may have used the 21HJ5: 16L3B,C; 16UK3B,C; 16UA4C,D; 16UE4C,D; 16UL3B,C; 16M3B,C; 16B4C; 16F4U; 16P3B; 16UM3B,C; 16UB4C; 16G4U; 16K3B,C; 16A4C,D; 16E4C,D.

The 21JV6 tube is available through an Admiral distributor.

TV Chassis TG2-2/9in. TV—Vertical Hold Problem

If the picture in a 9in. TV set will not roll down with the vertical hold control and it acts like a linearity control, check for a defective C410, a 5600pf capacitor in late



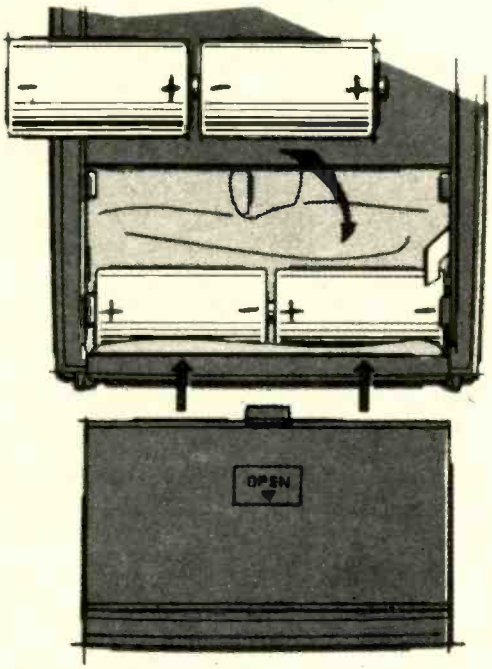
production models, connected to the vertical oscillator grid.

The part number of this capacitor is incorrectly listed in S1044E as 65C80-56; please change it to 65C80-78. We are temporarily substituting the previously used capacitor, 65C80-25 (4700pf).

MAGNAVOX

Tape Model 1V9022—Battery Installation Recorder

Reports indicate the "C" size battery cells have been installed incorrectly in the field as a result of misreading the

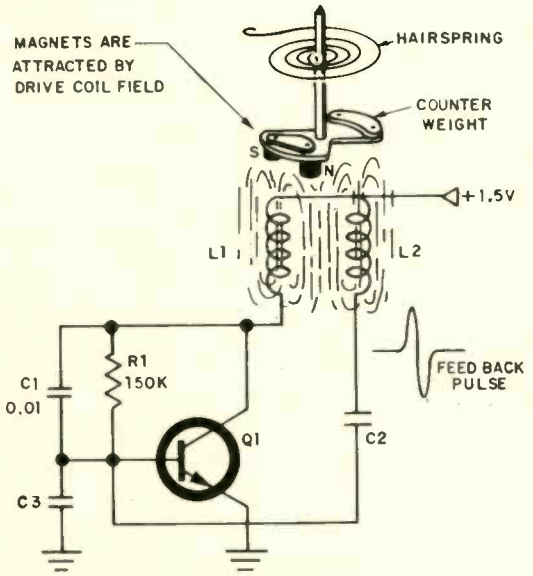


battery outline provided on the plastic pull-out tab. This will result in jamming of the tape in the PLAY or RECORD positions.

RCA VICTOR

Portable Clock Radio Model RZS—Transistor Clock Circuit

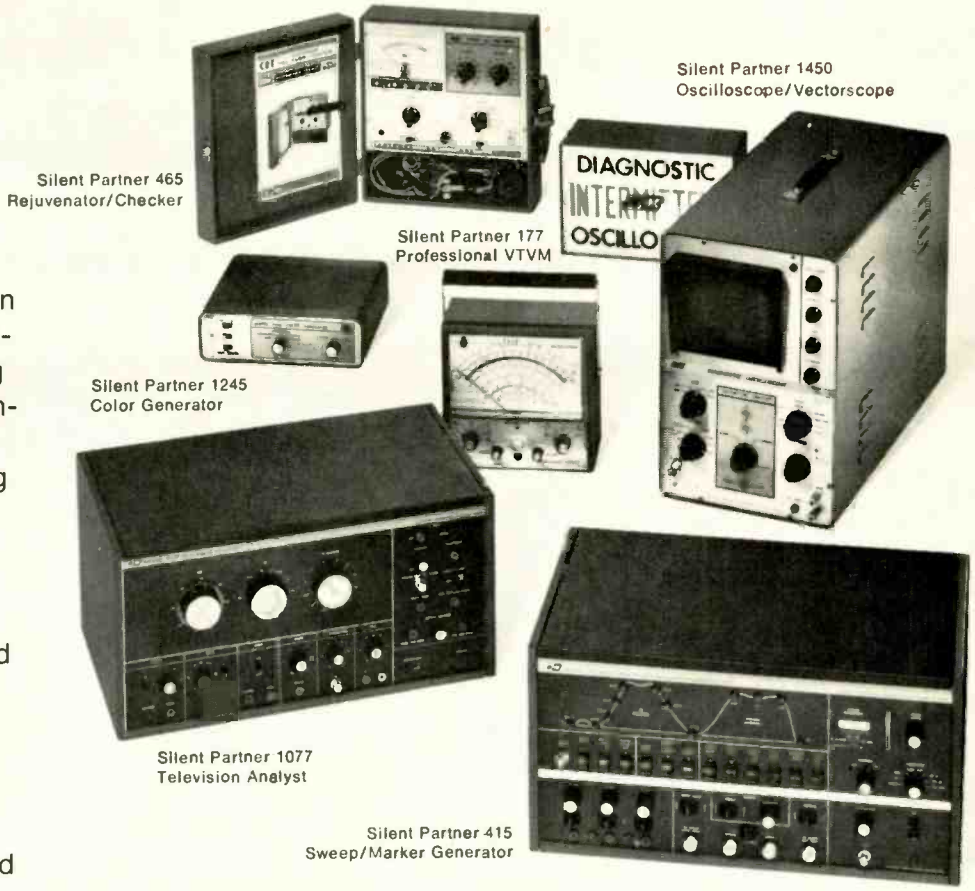
Two portable clock radios in this year's product line, the RZS 43 and RZS 45, employ an interesting transistor



circuit to drive the clock mechanism. The transistor clock circuit closely resembles a blocking oscillator. In place of

Continued on page 88

B&K puts an end to test equipment.



We've developed Silent Partners.

Business today has become an extremely complex, sophisticated operation. From mining to space research, man continually strives to develop more advanced methods for getting the job done faster, easier, better, and economically.

To keep pace with these developments, B&K has stopped making test equipment. In its place, we've developed "Diagnostic Silent Partners" ...a series of professional equipment that opens up a whole new concept in the field of electronic servicing. The "Silent Partners" are more than just ordinary pieces of test equipment. They're Insurance Analysts, Marketing Consultants, Customer Relations Specialists, Stockbrokers, Profit Coordinators *...they're everything you need to make your business a success!*

For years now, B&K has been hailed by service engineers everywhere as the leader in electronic servicing equipment. We like that kind of reputation—*and we aim to keep it!* But we're realistic. We know that in order to maintain our reputation, we have to do more than just manufacture top-quality test equipment. We know that our diagnostic equipment must not only work flawlessly, but must also stimulate your sales and promote customer confidence in your abilities as a professional service engineer. That's why we designed the "Silent Partners."

Look at the B&K 465 CRT Rejuvenator/ Checker, for example. We call it the "Customer Relations Specialist." Why? Because of its special ability to consistently create repeat customers. It actually *shows* the customer, right in his own home, the true condition of his picture tube. This not only boosts new tube sales; but it also instills confidence in your integrity and ability. The result...*a satisfied customer for life!*

So, if you're looking for just ordinary test equipment, don't bother with B&K. But, if you're looking for outstanding diagnostic equipment that will improve your service *and* make it more profitable, get in touch with your nearest B&K distributor.

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ET/D BOOK REVIEWS

99 WAYS TO IMPROVE YOUR TV RECEPTION, *by Len Buckwalter, published by Howard W. Sams & Co. 128 pages, 5½ x 8½. $2.95.*

This book discusses antennas, lead-ins, boosters, rotators, couplers, interference and improvements. It explains ways of improving on the basic antenna installation and covers such things as proper grounding, antenna orientation and interference. The chapter on lead-ins explains the various types, when they should be used, why and how to install them with subsequent information detailing installation practices and improvements to the TV, antenna and lead-in. The book covers most of the areas concerned with proper TV reception including some practical hints on color adjustments. Since the information is aimed toward the customer, the dealer may find it a welcome addition to his book sales rack as a customer education work.

ADVANCED AND EXTRA-CLASS AMATEUR LICENSE HANDBOOK *by Howard S. Pyle, W7OE, published by Howard W. Sams & Co., Inc. $3.95 paperbound.*

This timely handbook answers the needs of amateurs with General, Conditional and Technician class licenses for a study guide to higher class licenses. The book is written by a man who knows what amateur radio is about because he has been at it for 60 years. It is divided into 13 chapters covering all of the necessary subjects such as RF oscillators, power supplies, modulation, advanced RF theory and many others. The later chapters get into actual study material for the advanced and extra class licenses with a section devoted to typical questions and answers. Amateurs and technicians alike will find this handbook a useful reference for communications electronics.

ELECTRONICS REFERENCE DATABOOK *by Norman H. Crowhurst, published by TAB Books, Inc. 232 pages, over 100 illustrations, 45 tables. $7.95 hardbound, $4.95 paperbound.*

In going through this reference book, the ten chapters devoted to everything from basic units to transmission lines appear quite thorough. In most cases the charts are preceded by a brief explanation of applications, background information and source. It does get deep in one particular area where the book discusses the "J" operator used in design calculations, and most likely a technician would find this portion of no interest. However, for the most part the tables, graphs and formulas are pertinent to electronic technicians. The book also includes tables of line losses, information on FET's, IC's, vacuum tubes and other material not normally found in one source.

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

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

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

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

Why You'll Earn Top Pay

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

This means that the available licensed expert can "write his own ticket" when it comes to earnings. Some work by the hour and usually charge at least $5.00 per hour, $7.50 on evenings and Sundays, plus travel expenses. Others charge each customer a monthly retainer fee, such as $20 a month for a base station and $7.50 for each mobile station. A survey showed that one man can easily maintain at least 15 base stations and 85 mobiles. This would add up to at least $12,000 a year.

How to Get Started

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

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

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

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

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

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

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

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Accredited Member National Home Study Council ET-51

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

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

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

Every minute is longer up there.

You can save as many as 20 or 30 of those long minutes when you put up one of our larger antennas, because they're pre-assembled. Our snap-joints take only seconds to lock in place.

Sylvania antennas are equipped with a double boom (for strength and rigidity).

All have strong, seamless, half-inch tubular elements (not rolled-over strips of aluminum).

All aluminum parts are gold-alodized inside and out (not sprayed, but dipped).

Even more care goes into the electronics.

We've peaked our antennas for flat response over the entire 6 MHz bandwidth of each TV channel. Flat response is absolutely necessary for good color reception. Otherwise, color rendition may be lost.

You also need high gain—that's obvious. But coupled with high directivity to knock out interference. Polar patterns from our antennas show almost complete rejection of signals from the rear and sides.

We designed our antennas so you wouldn't have to (1) climb back up there or (2) fiddle around up there.

We know that the fiddler on the roof is just fiddling his own money away.

For more information on our line of antennas see your Sylvania distributor.

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Here's where we can save you time.

ELECTRONIC TECHNICIAN / DEALER

MAY 1969

Signal Strength Meters

If you install antennas, MATV systems or troubleshoot TV 'front-ends,' you should consider the use of a signal strength meter (SSM) as a basic aid to increase efficiency and profit

■ The installation of a TV antenna has for years followed a rather standard pattern--not referring to the nuts and bolts of putting up towers, guy wires and the like, but in the method used to aim the antenna for the best signal. The technician normally turns the antenna for the best picture and the customer is happy. Some technicians use a portable TV on the roof and this system works fine--for a simple home TV installation.

But if you install MATV systems, you need an instrument that will tell you when you have the antenna set for the best possible signal. MATV systems are gaining popularity with motel operators, hotels, resorts and now, home owners. It's a big market and one that many service-dealers are getting into because it is a natural for an existing TV sales and service business.

USES FOR AN SSM

However, a typical MATV installation can cost hundreds of dollars. When you sell one, you want to be sure it is installed correctly. That means you will need the proper tools -- a portable signal strength meter is one of the most useful. Besides using it to set antenna for maximum signal direction, it is invaluable in checking distribution amplifier gain, line losses and other branches of the installation critical to an efficient system.

The signal strength meter can also be used when bidding on complex MATV systems, such as used in motels and apartment buildings. First use the meter to take an initial survey of the signal strengths available in the area. This can be done by taking a reading of the available channels with the meter connected to an existing antenna or by using a portable antenna of your own. Some service-dealers have crank-up antennas and towers mounted right on their service vehicles for this purpose. With an idea of the local signals, you can then take the antenna combination you propose to install and establish amplifier, tap-off and splitter requirements with nothing left to guesswork.

In your shop, an SSM can be used to measure hum modulation in TV amplifiers, preamplifiers and front-ends. You will be able to determine noise figures, signal-to-noise ratio and gain. You can also make performance and frequency response evaluations in other passive and active equipment operating in the VHF, FM and UHF ranges. And since SSM units are portable, their applications easily extend to field use.

In the customer's home you will find a signal strength meter invaluable for precisely tuning 300Ω twinlead traps for the elimina-

TEKLAB REPORT . . .

The Packard Bell color tv set scheduled for coverage in this month's Teklab report was not received in time to permit the report to be included in this issue.

tion of frequency interference. The meter will also provide a rapid and positive indication of whether a problem of signal loss is in the TV set, the antenna, preamplifier or the distribution system. This is easily checked by comparing readings on the meter with the values in db that you know should exist at specific locations in the system.

HOW AN SSM WORKS

Basically, an SSM (signal strength meter) is a sensitive tunable RF microvolt meter. For TV applications it is normally calibrated to indicate microvolts or decibels (dbmv) of average composite signal developed across a 300 or 75Ω load. (Fig. 1) Not all SSM meters indicate average signal, some read peak.

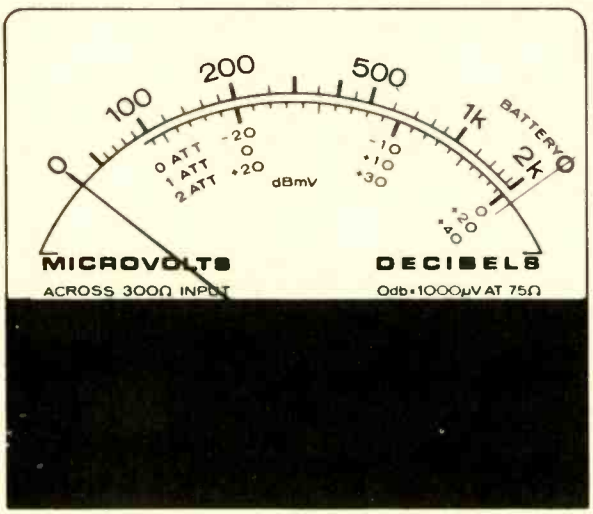


Fig. 1--Typical signal strength meter face reads dbmv and microvolts.

In simplified form, the SSM has a receiving antenna, a tuning circuit and a diode detector in series with a microammeter. (Fig. 2)

Capacitor, C2, would be of such value that the RC time constant resulting from its discharge through the internal resistance of the meter would provide an indicated average of the detected composite signal level. However, this simplified circuit alone would not be adequate for accurate measurements of low signal levels. Amplification is required and the non-linearity of the diode would tend to produce erroneous meter readings. More elaborate SSM circuits of precision signal strength meters are shown in Fig. 3 and 4. The UHF and VHF sections have calibrated input attenuators to allow signal measure-

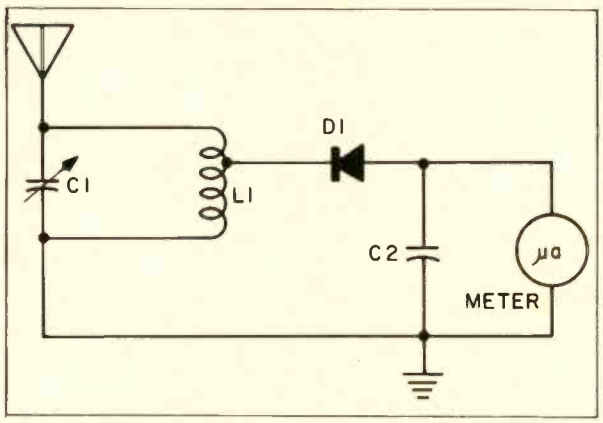


Fig. 2--Simplified schematic diagram of SSM circuit.

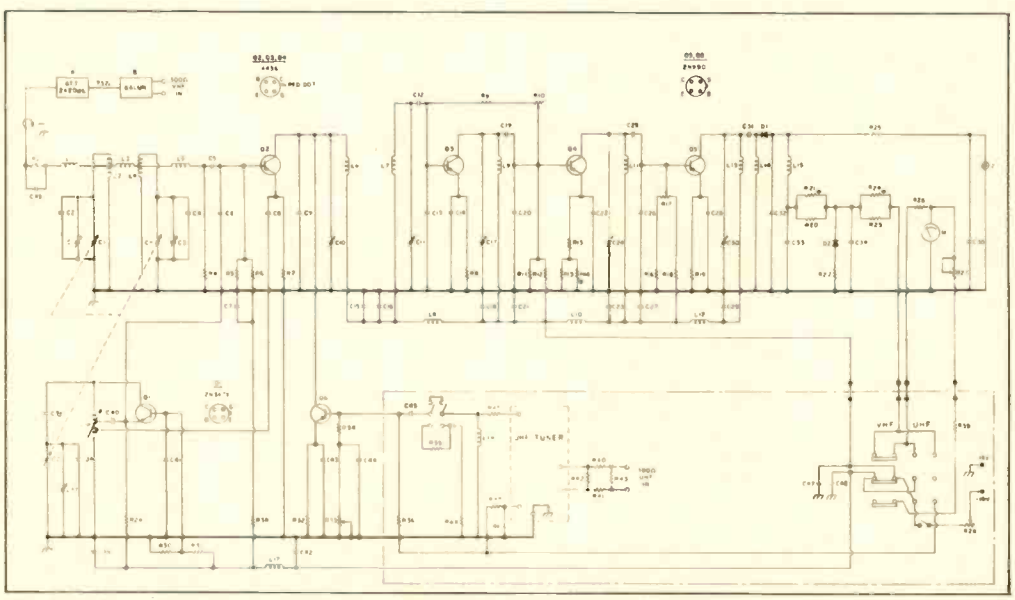


Fig. 3--Schematic diagram of SSM model 718 (Courtesy Jerrold).

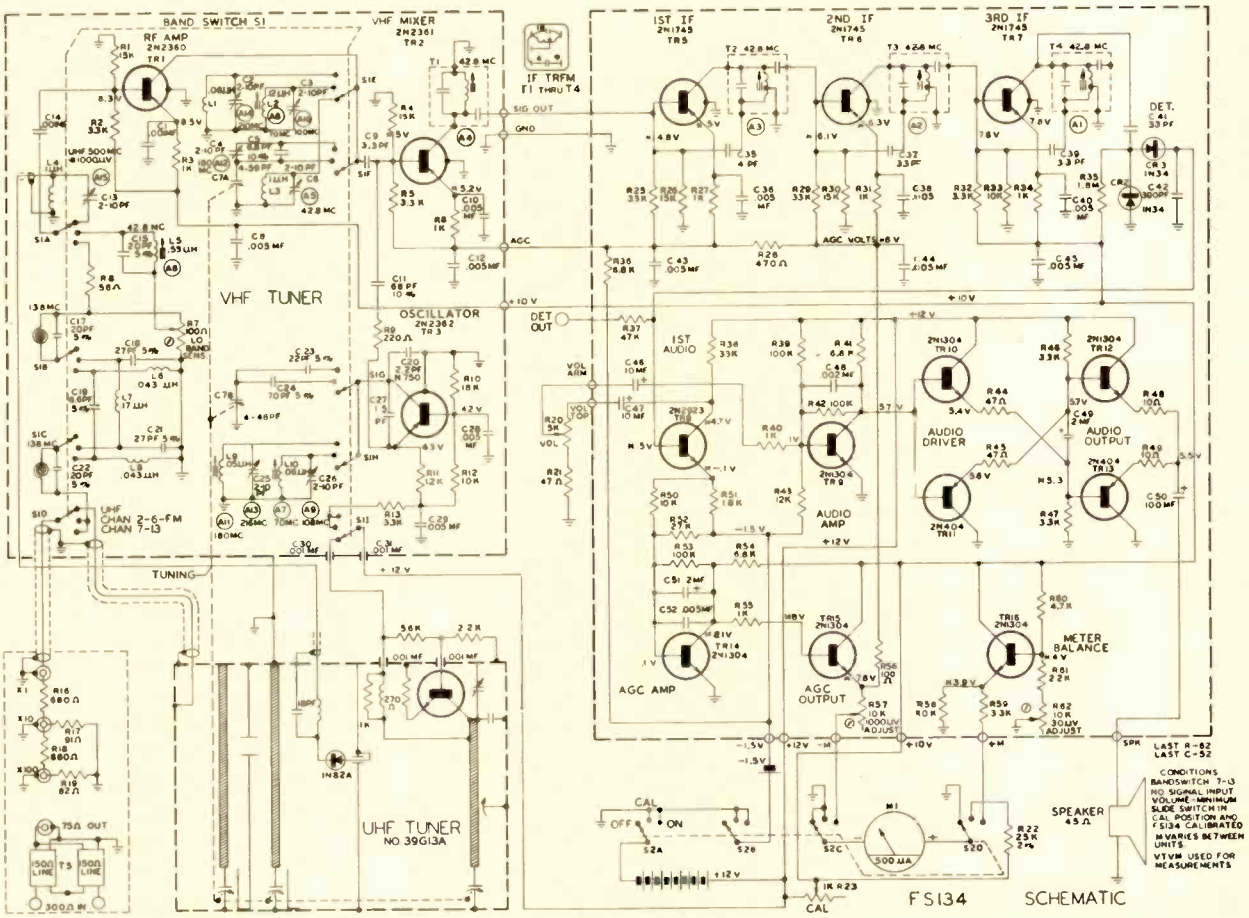


Fig. 4--Schematic diagram of SSM Model FS134 (Courtesy of Sencore).

ments over a greater range. Refer to Fig. 3 for the following circuit description.

The VHF input to the base of Q2 is through an impedance matching bandpass filter composed of L1 through L5, C1 through C4, Cx and Cy. Q1 is the oscillator transistor in a modified shunt--Hartley circuit. Oscillator tracking is provided by the ganged capacitor, Cz. Oscillator injection to the mixer is through C6 to the base of Q2. The 30MHz component at the output of Q2 goes to the first IF amplifier through a tuned bandpass filter comprised of C9, C10, L6, L7, C11, C15 and C16.

This filter is tuned by C10 and C11 to the 30MHz IF and has a passband of 0.5MHz. Following Q3, transistors Q4 and Q5 provide the second and third stage of IF amplification. The output of the RF detector diode, D1, is converted to a logarithmic form for the meter by compression diode, D2. An audio output jack is provided for monitoring the TV sound of FM band. A speaker is not used because the additional stages of amplification necessary to drive it would decrease battery life and would not practically enhance the meter's usefulness.

The UHF front-end is preceded by a fixed pad consisting of R40, R41, R42 and R43 to reduce spurious signal radiation from the UHF mixer/tuner and improve the input VSWR (voltage standing wave ratio) characteristics. The 30MHz output of the UHF tuner/mixer section goes to the base of Q6 through a switchable attenuator comprised of R35 and R44 in the X10 (20db) attenuation position and through a short in the Odb attenuation position. Transistor, Q6, operates as a buffer amplifier between the UHF section and the following IF stages.

Calibration is provided by placing the VHF/UHF switch in the center position, thus permitting front panel adjustment of the battery current (by turning potentiometer R28) to cause deflection to a meter "CAL" marking. This procedure ensures accurate read-

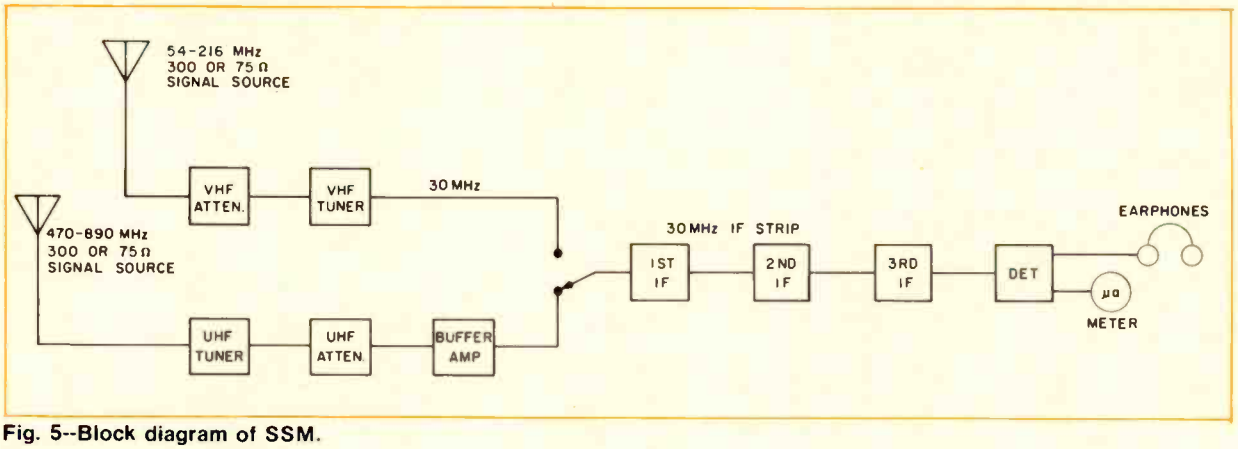


Fig. 5--Block diagram of SSM.

ings of the UHF and VHF average composite signal strength.

When using an SSM to check gain and loss in a MATV system, coaxial cable or twin lead is normally connected directly to the instrument and requires no special accessories. Some units have built-in matching transformers and input jacks for connecting either type of lead-in, others provide an external matching device.

However, for other measurements a probe is often necessary and can be easily made by attaching a standard test probe to one end of a low-loss shielded 75Ω cable and terminating the other end in a suitable connector.

To install the probe, a 1/2 in. section of shielding should be exposed, unwoven and all but a small group of adjacent strands eliminated. To these remaining strands of shielding solder a length of insulated wire with an alligator clip at the other end. This will serve as the ground connection to the chassis being tested.

The remaining free end of the test cable should be trimmed back and an F59 or equivalent connector attached to it as shown in Fig. 6. This will permit insertion of the test assembly into the 75Ω VHF or UHF input terminal of the SSM. Some signal strength meters have a readily accessible detector output jack. After determining what type of plug it takes, an assembly can be made for visually monitoring this detector output with your oscilloscope. The connector for the scope end would, of course, depend upon the type of scope input.

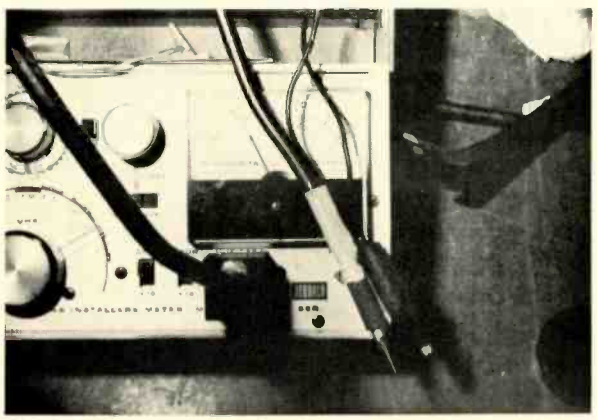


Fig. 6--Shows completed probe used for signal tracing.

UNDERSTANDING THE DECIBEL

The true amplification and gain of RF amplifiers and preamps with 300 or 75Ω input and output impedances such as used in MATV can be determined by doing a little figuring. But before you get excited about complicated formulas, bear in mind that a signal strength meter reads in dbmv and microvolts directly, so all of the data required for figuring voltage amplification, voltage gain and power gain is readily available. All you have to do is plug in the values.

You don't have to be a mathematician to handle the decibel, but you do have to start thinking with numbers of a different kind.

The most important thing to know about the decibel (db for short) is that it doesn't say "how much" or "how many" like the"10" in 10 dollars, it says "so many times." It's something like the word "twice." And, like "twice," it doesn't have any meaning in terms of quantity ("how much") unless you specify "so many times" *something*. For example, 6db always means (in voltage) "two times" or "twice as many."

The funny thing about the db is the non-linear relationship as shown in these examples.

6 db = 2 x	20 db = 10 x
10 db = 3.14 x	30 db = 31.4 x
12 db = 4 x	40 db = 100 x
18 db = 8 x	60 db = 1000 x

Notice that while 10db is approximately 3 x, 20db = 10 x. The gain is about three times greater by doubling 10db. But if you double 20db to get 40db, you get 100 x, which is 10 times greater. All this comes from the way the db is derived. And because of its behavior, it makes all kinds of systems figuring simple. It's best that you try to follow the reasoning behind the db. We will start with the following formula--and don't let it scare you.

$$db = 20 \log \frac{E1}{E_2}$$

Saying it in English, it goes like this: The db is equal to 20 times the common logarithm of the major (larger) voltage divided by the minor (smaller) voltage. Solving it goes like this. Suppose we have an amplifier and want to find its voltage gain in db. Being an amplifier, its output will be larger than its input, so the output voltage is the "major" voltage. Divide the output by the input, the formula says, so let's assign some values. Say the output voltage is 100 and the input 10, then 100 ÷ 10 equals 10. Now the formula is reduced to:

$$db = 20 \log 10$$

Now we have to find the common logarithm of 10. This is what causes most TV repairmen to gulp--they forgot their logarithms as soon as possible after leaving high school. But there's no mystery about the common log. The common log, or logarithm to the base 10, is only that little number that goes above and to the right of a number, the exponent, like in 10^2; but when used as the log, it is the exponent required to raise 10 to the number we have in mind.

As an example, 2 is the logarithm of 100, since 10 raised to the second power (10^2) equals 100. Now, every number we know can be expressed as a power of 10, and mathematicians have spent years compiling log tables to the tenth decimal place. In our particular problem, we have to find the exponent which makes 10 equal to the base of the common logarithm, which is also 10. This one's easy--it's 10^1, so that the common log of $\frac{E1}{E_2}$ equals 1. The formula now looks like this:

$$db = 20 \times 1, \text{ and db (gain)} = 20$$

We have found out that the amplifier's gain is 20db. Of course, if we'd found a fractional number, like 18.5 when we divided E_1 by E_2, we'd need a log table to find the common log of 18.5. This you will never need as long as you have a conversion chart handy which converts the ratio expressed by $\frac{E_1}{E_2}$ directly to db.

One of the puzzling things about the db is 0db. 0db isn't "nothing"--it's something. It's the same as saying "there is a relationship of one to one"--in other words no gain--no loss. It works out like this, and we can use the amplifier we had before, but now we find the input is 10v and the output 10v. The formula then looks like this:

$$db = 20 \log_{10} \frac{E_1}{E_2}$$

$$= 20 \log \frac{10}{10}$$

$$= 20 \log_{10} 1,$$

since 10 divided by 10 is 1.

The question now is what exponent will raise 1 to 10? This is a funny one, the logic of which has escaped mathematicians--they only know it works--look:

$$10^2 = 100$$
$$10^1 = 10$$
$$10^0 = 1$$
$$10^{-1} = .1$$

We can see the sense behind the first, second and fourth expression, but the third only makes sense because it fits *and* works. Let's put it into the formula: db = 20x0, and therefore the amplifier's gain is 0db.

This boils down to the fact that when we say 6db, we mean that we are talking about something which is twice as great as 0db, since 0db is one times and 6db is two times. The question always comes--"What's 0db?" The answer is--0db is anything you choose to make it! In audio, committees of engineers have assigned a value to 0db which they agreed upon. In TV systems you can specify what you like. It can be the antenna signal, for instance, or you can choose 1000 μv read across 75Ω impedance. This is a pretty good signal for a TV set.

The great advantage of using the db is that

Continued on page 90

Low Cost Solid-State 'Curve Tracer'

Build this tester to simplify servicing transistorized equipment

■For a small cost, this transistor "curve tracer" can be built and connected to your present scope. This "go-no-go" test will save you many hours of servicing time. However, do not confuse this device with an instrument called a dynamic characteristic curve tracer which will give you the family of characteristic curves for operation of transistors.

To service transistor devices rapidly and positively, a scope tracer is employed to provide in-circuit as well as out-of-circuit testing of solid-state components. This is not a new testing method, only the application for fast servicing is proposed.

Basically, we are sweeping the junction of a transistor with 6.3vac so that it may be viewed on the scope conducting or not conducting during alternate plus or minus portions of the ac sinewave. This display can be observed on a regular service oscilloscope with no power applied to the transistor unit under test.

We are not so concerned about the intricacies of the waveforms obtained as we are in a "go" or "no go" type of check. Shown in Fig. 1 are some sample drawings of basic waveforms that will be obtained from pure circuit loads.

In Fig. 2 note the typically good semi-conductor wave shapes -- sharp, crisp trace junc-

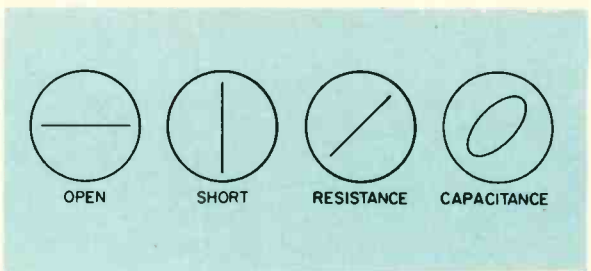
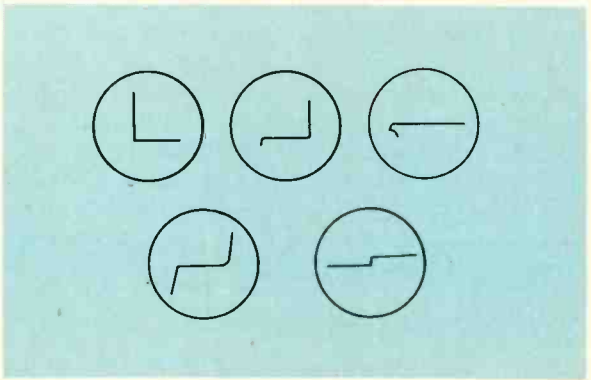


Fig. 1--Basic waveforms that are obtained from pure circuit load checks.

Fig. 2--Good semiconductor waveforms as they appear on the "curve tracer" CRT with sharp, crisp trace junctions.



tions, or twins of the waveforms on the CRT.

In actual circuit applications, a combination of these two waveforms will be seen. Fig. 3 shows in-circuit waveforms. Capacitance and resistance may mask the true response; however, in the waveforms of a good transistor there will be a clue to a sharp junction or a current change. This is your clue to identify

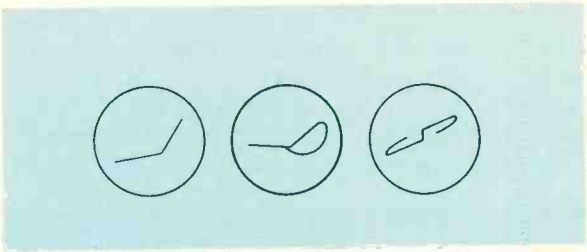


Fig. 3--In-circuit checks will display waveforms shown for a good semi-conductor or diode.

a good transistor or diode from a defective one.

A defective transistor will display three basically different scope patterns illustrated in Fig. 4. Notice the unsharp or rounded corner junction for a transistor that exhibits some leakage.

To completely check the transistor with a two-lead tester, three checks are made. Polarity of the leads is not important and the checks can be made very rapidly, from the emitter to collector, base to collector, or base to the emitter. You don't have to determine which test points are E, B, or C of

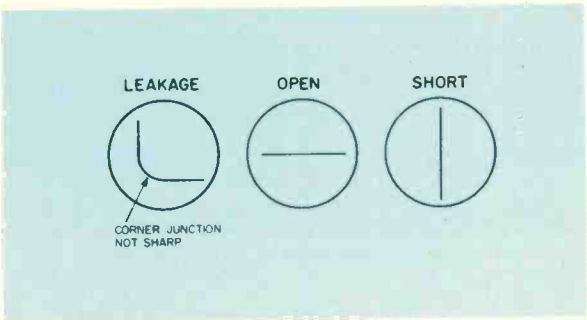
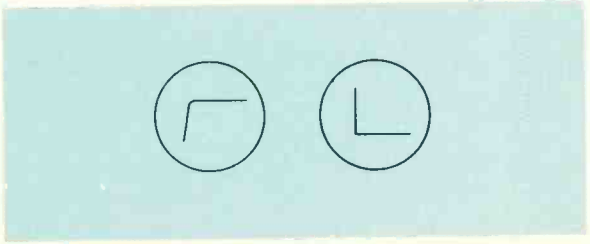


Fig. 4--Three basic waveforms produced by a defective transistor.

Fig. 5--Tests from the base to emitter or collector of a good transistor will produce typical diode waveforms shown.



the transistor. Most base to emitter or collector tests of a good transistor will indicate a typical diode pattern as shown in Fig. 5.

At times, emitter to collector patterns may look like the displays depicted in Fig. 6 or the scope pattern may appear as an open condition as shown in Fig. 7, but the transistor will be good. Check as many different types of good transistors, so that you will know what waveforms to look for.

As you gain proficiency, it will be very easy

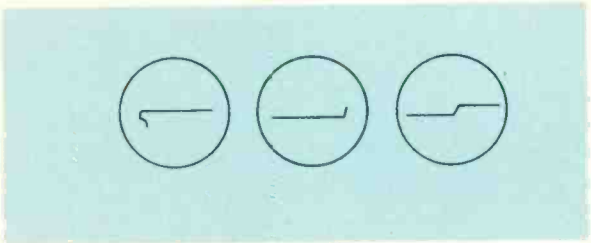


Fig. 6--Some emitter to collector waveforms will look like this.

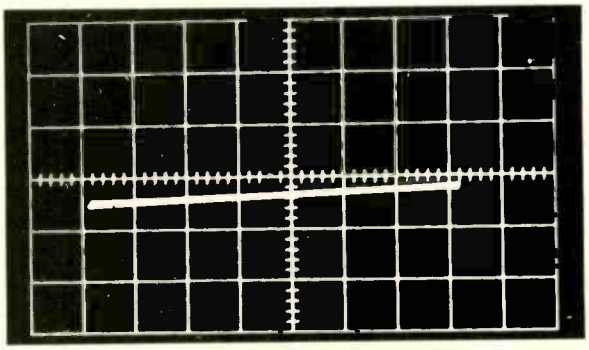


Fig. 7--A normal waveform taken from the emitter to collector of transistor.

to pick up the very difficult service problems, caused by installation of a wrong type transistor or the correct type installed incorrectly. A circuit test, emitter to collector, indicating a base to emitter or collector type pattern would expose this error.

Caution should be used on tests made on the unijunction transistor (G.E. type 5E29); a good device may look like a defective transistor with a leakage. The waveform will have a rounded curve. This tester would not be of value for unijunction checks and FETs would be ruined.

APPLICATION OF THE CURVE TRACER

The following are some advantages of the in-circuit quick tester: (1) enables the testing of equipment without power applied, (2)

rapid accurate servicing by a semi-skilled technician, (3) servicing without reference schematics is possible in many instances, (4) checks and confirms performance (except beta) of all semiconductors with only an additional equipment cost of less than $8, (5) enables the service technician to repair equipment that he may not be familiar with, as well as equipment without technical information, (6) Diode checks can be made in the circuit along with the transistors (one defective diode can cause as much equipment malfunction as a defective transistor).

A speed check was made with this tester on a Motorola TS-915 solid-state color chassis. It contains more than 60 transistors and over 26 diodes but it took less than 20 minutes to check them all. One defective transistor was located and replaced, putting the set back into proper operation.

Fig. 8 shows the simple schematic for the in- or out-of-circuit transistor or diode tester.

To calibrate this unit, without a load across

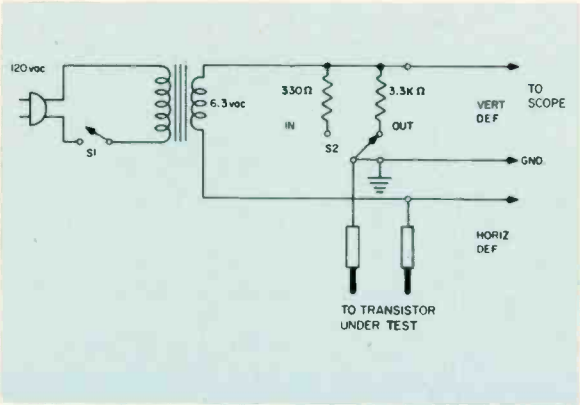
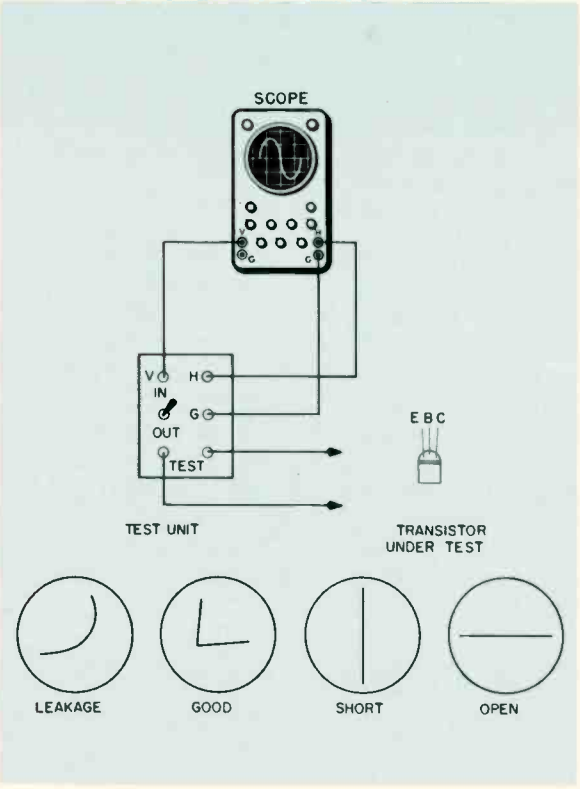


Fig. 8--Schematic of the transistor or diode tester.

Fig. 9--The complete setup of the oscilloscope and "curve tracer."



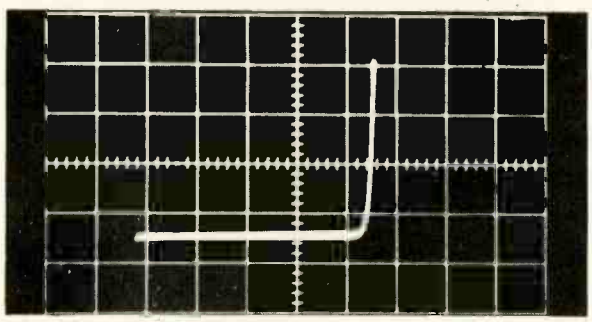


Fig. 10--Actual oscilloscope waveform showing a good transistor with probes connected from emitter to collector.

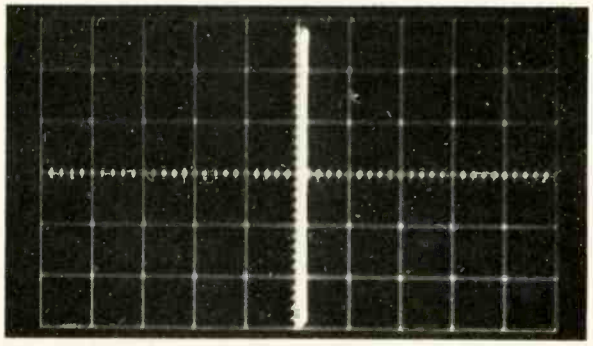
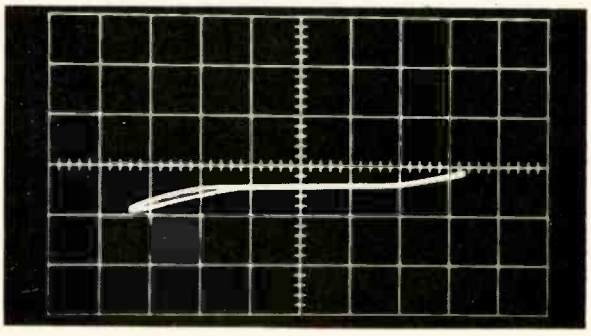


Fig. 11--Waveform showing a shorted transistor.

Fig. 12--Waveform showing an open emitter to base of the in-circuit transistor with a slight loop indicating capacitance in the circuit.



the test leads, adjust the scope's horizontal amplifier to scan about 3 in. of width. With the two test probes shorted, adjust the scope's vertical amplifier gain to scan a line about 3 in. high. Fig. 9 shows the complete setup of the oscilloscope and curve tracer.

The following are actual waveforms of transistors checked in the circuit:

In Fig. 10 a good transistor trace is shown with probes connected from emitter to collector, and a shorted transistor waveform is shown in Fig. 11. In Fig. 12 the waveform denotes an open emitter to base of the in-circuit transistor with a slight loop indicating some capacitance in the circuit being checked.

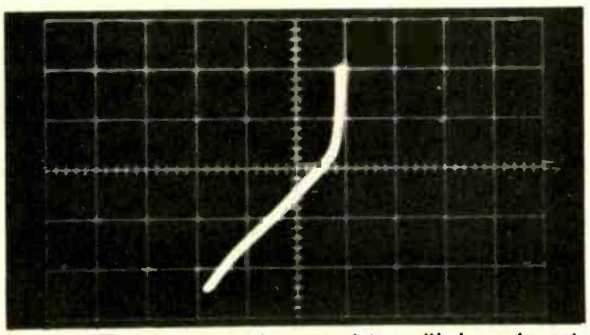


Fig. 13--Waveform showing transistor with base to collector leakage.

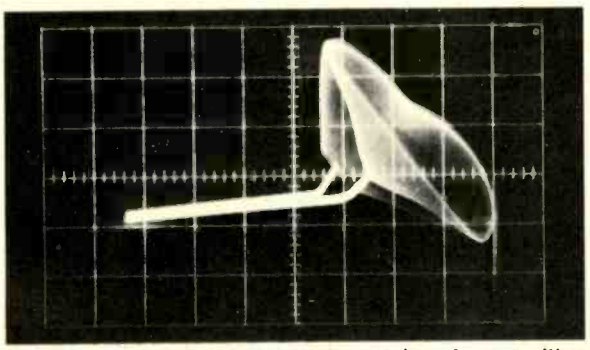
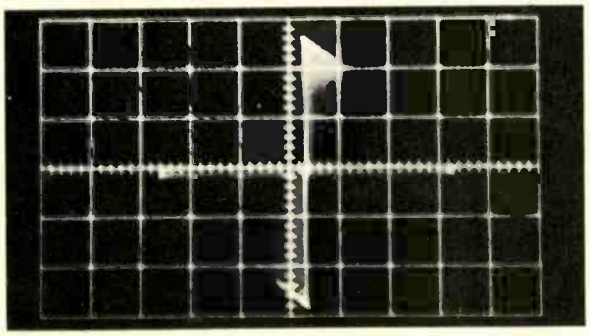


Fig. 14--A weird looking waveform taken from emitter to collector of a good transistor with inductance and capacitance in circuit.

Fig. 15--Waveform showing an intermittently shorted transistor producing a cross pattern waveform.



Leakage is shown in the waveform of Fig. 13 measured from the base to collector of this transistor. However, the oscilloscope waveform in Fig. 14, showing a sharp bend, proved this transistor to be good. This semiconductor was in a circuit that contained both inductance and capacitance, but was detected by this tester. An intermittently shorted transistor is illustrated in Fig. 15 showing cross pattern waveform effect.

SERVICING SOLID-STATE STEREO EQUIPMENT

In most cases, a stereo amplifier will have two relatively identical channels. If the transistors are "even numbered" in the left channel then the same transistor should be found in the right channel with an even type number.

Troubleshooting this equipment can be done by comparing each "twin stage" response, enabling even an inexperienced technician to make a rapid diagnosis of either transistor or circuit component failure.

All stages of the amplifier can be checked and repaired before reinstalling the unit. In many cases, the repairs will be complete and a limited power test can be made with confidence. If the amplifier does not operate, use a scope, preferably with a dual-trace plug-in amplifier and signal trace, by comparing the left and right channel waveshapes.

MAKING STEREO CHECKS

(1) Always make a complete visual check for burnt parts. (2) Use the touch and smell technique for indications of excessive heat even though burnt parts are not evident. (3) Make a complete visual check for indications of previous service repairs or damage. (4) Remember, always check transistors before installing and recheck transistors in-circuit after installation. Transistors can be damaged during installation or removal. (5) All diodes can also be checked rapidly along with the transistors. (6) Check the service tickets for other tips and clues as to what the trouble may be or call your stereo customer should more information be needed.

The "curve tracer" can also be used for continuity checks of the printed circuit foil for cracks or defective solder joints. Flex the board and watch the scope waveform for your point to point continuity test. Even shorted or open capacitors and coils can be located with this test method. ■

Color System Trouble Shooting

Familiarize yourself with the IC or 'chip'--you will be seeing more of them in the future

■One of the most used controls on a color receiver is labeled HUE or TINT. This control is a part of the color synchronization circuit. The function of the control is to shift the phase of the 3.58MHz oscillator in the receiver so that the demodulator axes occur at the proper phase angles. This is accomplished by controlling the phase of the CW feed to the phase discriminator. By controlling the phase of the separated burst signal in the burst amplifier we can obtain hue control. In some circuits the plate tank coil of the burst amplifier is tunable. If the plate tank is tuned to 3.58MHz, the phase shift in the amplifier is zero (or 180deg). Tuning may be accomplished by a variable capacitor in shunt with the plate tank, or by a variable resistor in series with the tuning capacitance.

To adjust the tint control properly, the viewer looks at the picture and adjusts for proper flesh tones. When proper flesh tones are obtained, the demodulation axes are proper and the phase shift between the 3.58MHz oscillator and the transmitted burst signal is approximately correct.

With the NTSC (National Television System Committee) system a shift of more than 3 deg of the 3.58MHz color subcarrier could cause a noticeable shift in the flesh tones of a color picture.

Let's review a few troubleshooting and alignment methods to keep that color picture in normal balance.

THE COLOR BURST SIGNAL

The TV station transmits (during a color program) a minimum of 8Hz of 3.58MHz on the back porch of the horizontal sync pedestal. To produce good stable color, the TV receiver must retrieve a clear 3.58MHz color burst signal. This is the function of the color burst separator and amplifier stages. We will use a Zenith 20Y1C38 (Fig. 1) color chassis for most of these checks.

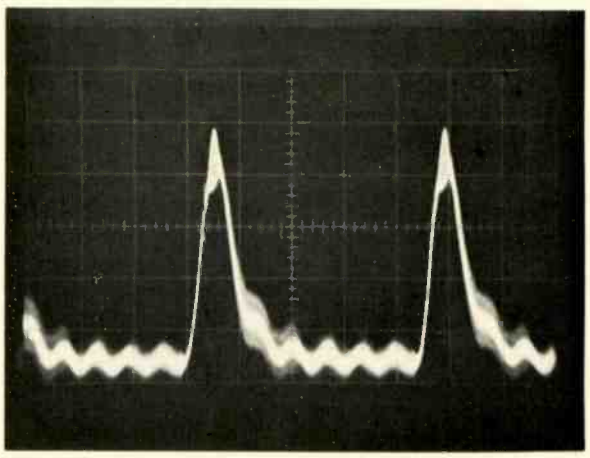


Fig. 2--A normal color burst signal taken from pin 2 of the burst amplifier tube.

The proper color burst signal is shown in Fig. 2, riding on the tip of the horizontal keying pulse. This waveform was taken at pin 2 of V16 burst amplifier tube. An improper scope waveform expanded for detail is illustrated in Fig. 3. The 3.58MHz burst signal

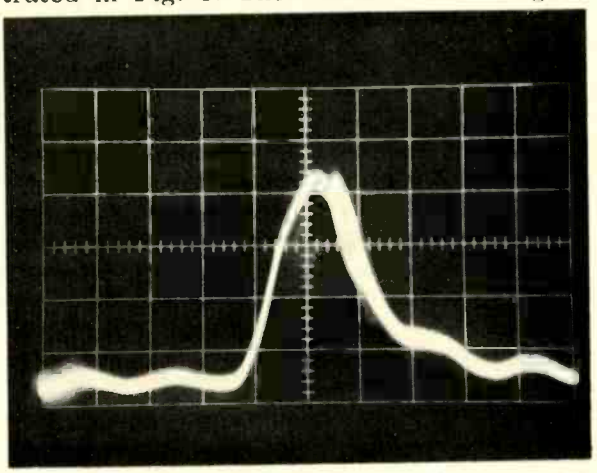


Fig. 3--An improper color burst signal waveform expanded for detail. The 3.58MHz burst signal is shown riding on the side of the keying pulse.

is shown riding on the side of the keying pulse and the result would be poor color sync or no color at all. This condition could be caused by a faulty coupling capacitor feeding blanking pulses from the sweep transformer. However, do not overlook circuit trouble in the horizontal oscillator AFC and sync amplifier stages.

A dual-amplifier triggered scope is very useful in checking these color circuits. The

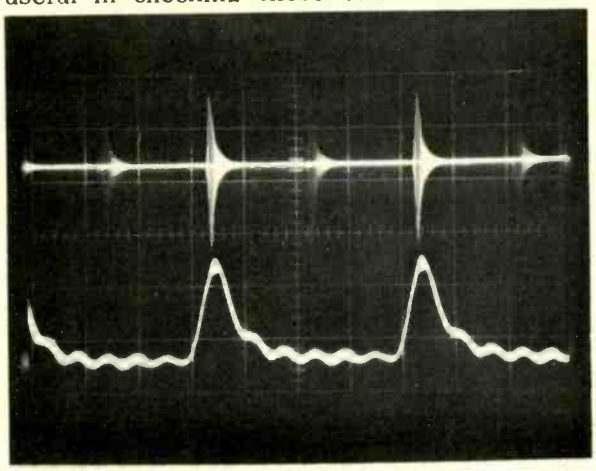


Fig. 4--The proper timing of the color burst and keying pulse is shown in the oscillograph waveform. The top trace is color burst information at V16 burst amp plate, while the bottom trace is simultaneously compared with the keying pulse at pin 2 of the same tube.

proper timing of the color burst and keying pulse in this stage is shown in Fig. 4, oscil-

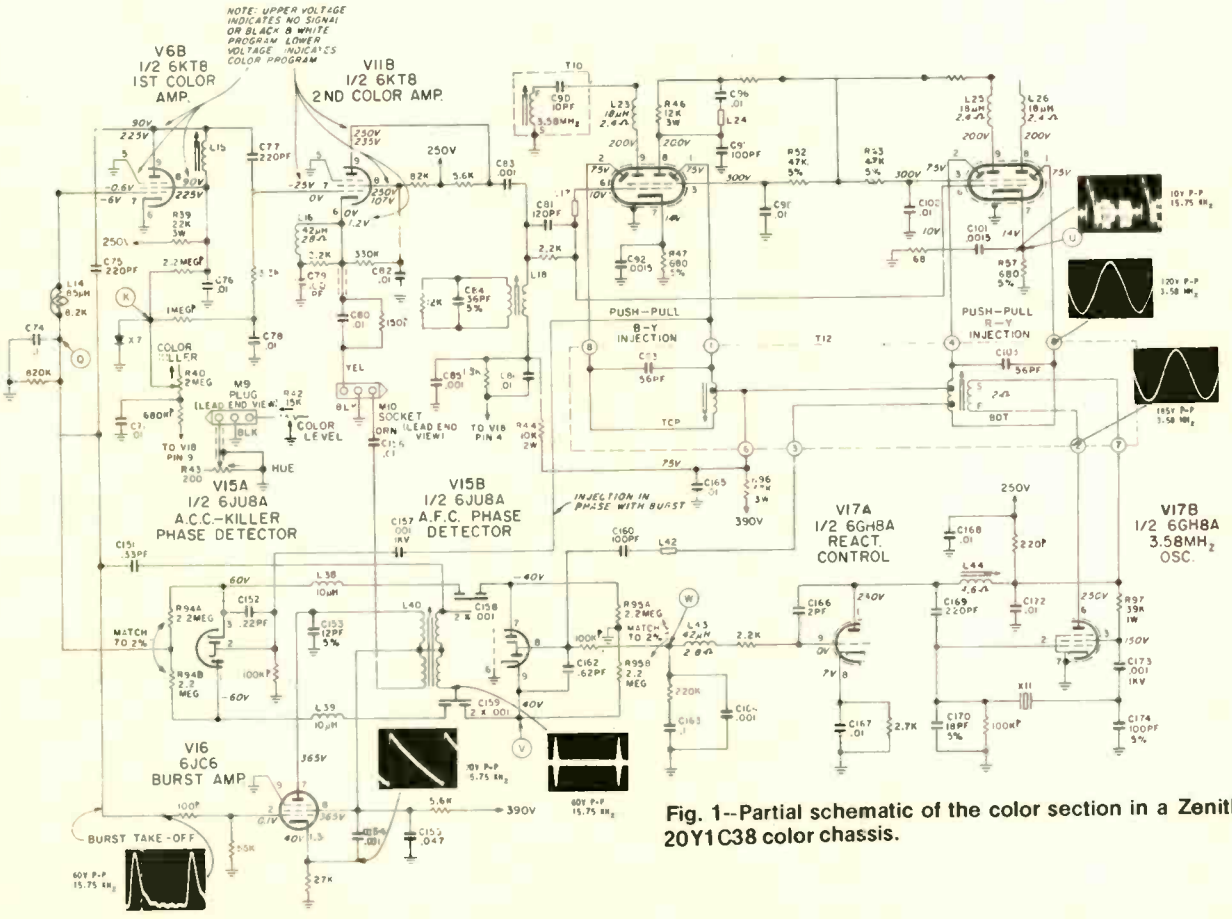


Fig. 1--Partial schematic of the color section in a Zenith 20Y1C38 color chassis.

lograph wavetrace. The top trace is color burst information at V16, burst amp plate pin 7, while the bottom trace is simultaneously compared with the keying pulse at pin 2 of the same tube.

A balanced 3.58MHz color burst signal will be taken at the secondary of L40, AFC and ACC phase detector transformer. The dual-trace oscilloscope waveform that should be found at this stage is shown in Fig. 5 and this

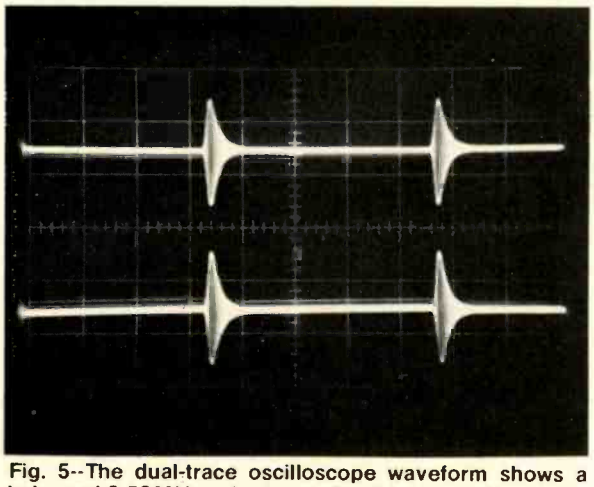


Fig. 5--The dual-trace oscilloscope waveform shows a balanced 3.58MHz color burst signal taken at the secondary of the AFC and ACC phase detector transformer.

burst pulse should measure 60v P-P. If this pulse is unbalanced, check the following components, C158, C159, R95A, R95B and the phase transformer, L40. Check other scope waveforms (Fig. 1) for proper operation.

TROUBLESHOOTING AND ALIGNMENT OF THE COLOR AFC CIRCUIT

The following "time saving" service techniques should be used for alignment of the 3.58MHz color oscillator in Zenith color sets.

Voltage measurements should be taken at test point "W" (color AFC circuit)--refer to Fig. 1.

If the receiver has AFTC (automatic fine tuning control) provisions, turn AFTC switch to the OFF position while making these adjustments.

A properly operating color set will generally read about zero voltage when measured with a VTVM at test point "W" under no signal condition (tuner set between channels). Should this voltage exceed 1v (positive or negative), several different symptoms may appear as follows: (1) complete absence of color information; (2) intermittent loss of color sync; (3) color dropout; (4) critical fine tuning range for color and (5) delay in color "lock-in" when changing from one channel to another.

Some of the probable causes for voltages in excess of 1v at test point "W" under no signal conditions are as follows: (1) a faulty 3.58MHz CW oscillator and control tube; (2) a defective AFC phase detector (tube or solid-state diode)--one diode may be conducting considerably more than the other; (3) an open or leaky section in one of the two dual .001μf capacitors in the AFC phase detector circuit; (4) a defective 42μh choke at test point "W"--this choke is important for stability of the oscillator; (5) component leakage or value change in the anti-hunt network (from test point "W" to ground); (6) incorrect setting of the 3.58MHz color oscillator frequency adjustment, L44 and (7) the 2.2M resistors have changed value (not matched) in the AFC phase detector circuit--these resistors must be matched to within 2 percent of each other.

The range of correction voltage at test point "W" to maintain color sync for the 3.58MHz color oscillator with color signal should be approximately 5v (positive or negative) for optimum pull-in range. The inability to develop this range of voltage may result in several varied troubles as will now be noted.

The following information can be used to check the pull-in range (voltage correction range) at test point "W": (1) feed a color signal to the tuner antenna terminals, (2) connect a VTVM from test point "W" to ground, (3) ground test point "K," killer voltage can be measured at this point (ground to open color channel), (4) adjust the slug of the color oscillator frequency coil (L44) by turning it clockwise as viewed from the bottom of the chassis. Check the voltage reading on the VTVM. About 5v negative should be present with the color pattern remaining in sync. Adjust the slug counter clockwise. The negative voltage should slowly approach zero, then reverse polarity and approach about 5v positive with the color pattern remaining in sync. Change polarity of your VTVM. This range (approximately $\pm$5v) is considered normal and correct for consistent color sync.

If this range is considerably less than $\pm$ 5v, circuit troubleshooting is then necessary. The following service tips are suggested: (1) Check or replace the color oscillator and AFC phase detector tubes; (2) Check all components from test point "W" to ground. A prime suspect would be the .1μf capacitor C163; (3) Check the 42μh choke at test point "W," L43; (4) With the oscilloscope, check for presence of burst signal at the phase detector coil, L40; (5) Check the dual .001μf capacitors (two are used) in the color AFC phase detector circuit, and also capacitors or cold solder joints in the screen grid circuit of the burst amplifier tube; (6) The 3.58MHz crystal may also be defective (replace and align oscillator for zero beat); (7) Oscillator coil,

L44, may be faulty (substitute with new coil).

The adjustment of the 3.58MHz oscillator must be made correctly.

The procedure for adjusting the 3.58MHz CW oscillator to "zero beat" with an "on the air" color program is as follows: (1) Tune in a color program and observe color on the CRT. (2) Ground test points "K" and "W" on the chassis. Should the color be "running" across the screen at a rapid rate, it is an indication that the 3.58MHz oscillator requires tuning for a "zero" beat condition. (3) Adjust the core of the color oscillator frequency coil, L44, until the color band movement comes to a near standstill. Continue to tune the 3.58MHz oscillator coil while noting colors on the screen. Tune until the color on the screen becomes a solid hue. At this point, all color has come to a standstill.

Use caution when making this adjustment as an error can easily be made. It is possible to adjust the core until two or more "red" and "blue" wide diagonal bars are seen to be at a standstill. This is not "zero" beat, but can easily be mistaken for it. Proof of "zero" beat can be made by removing the ground from test point "W" and connecting a VTVM from this point to ground. A reading of up to ±2.5v may be present. When the 3.58MHz oscillator is correctly set for "zero" beat, the voltage measured at test point "W" will be virtually zero (or less than ±1v). Remove the VTVM and again ground test point "W" if further adjustment is necessary.

Proper alignment of the 3.58MHz color oscillator will solve many color sync and fade out complaints.

IC 'CHIP' COLOR DEMODULATOR

Some new Zenith color chassis employ an IC "chip" (IC 221-37) for the color demodulator.

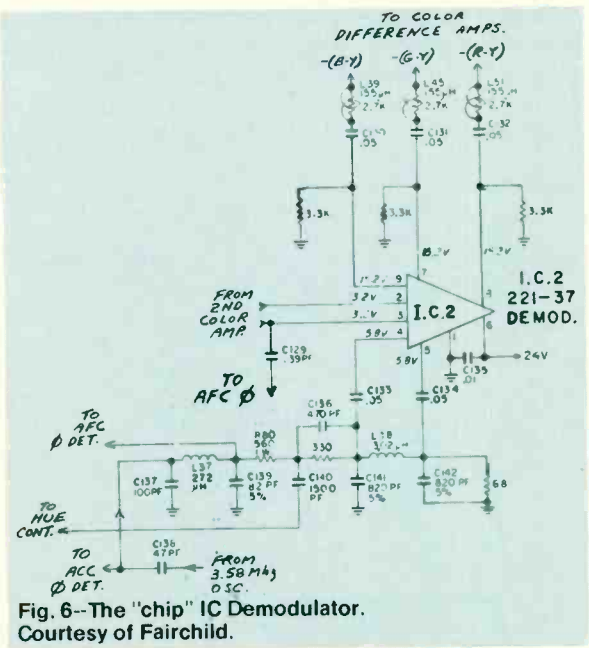


Fig. 6--The "chip" IC Demodulator. Courtesy of Fairchild.

This IC contains two double-balanced synchronous detectors that are coupled to a matrix system where the desired color difference signals are developed. Shown in Fig. 6, the output of the second color amplifier is coupled to an IC stage or "chip". This "chip" is designed to plug into a conventional 9-pin miniature socket and is keyed accordingly.

Two chroma signals of opposite polarity are coupled to terminals two and three. The dual-trace scope waveform (Fig. 7) shows the color difference signals of -(R-Y), -(B-Y)

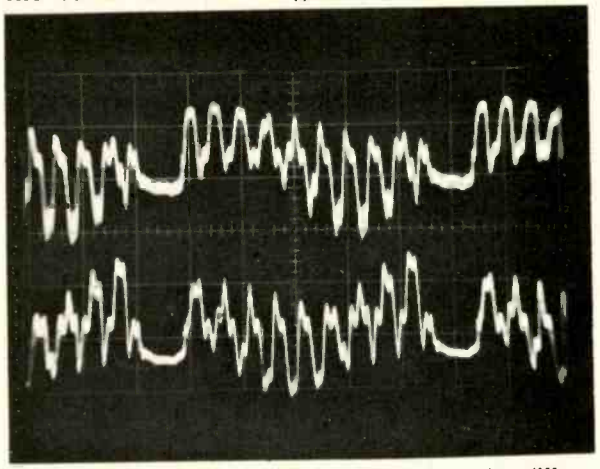


Fig. 7—The dual-trace waveform shows the color difference signals of -(B-Y) top waveform and -(R-Y) bottom waveform which will appear at terminals eight and nine of the IC demodulator.

chroma signal output which will appear at terminals eight and nine of the "chip." Oscillator injection reference (3.58MHz-CW) is injected at terminals number four and five. A dual-trace triggered scope signal waveform of this CW signal is shown in Fig. 8. Please note the 3.58 MH_Z CW signal has been superimposed on the scope for an exact phase check of the 104deg signal shift.) The oscil-

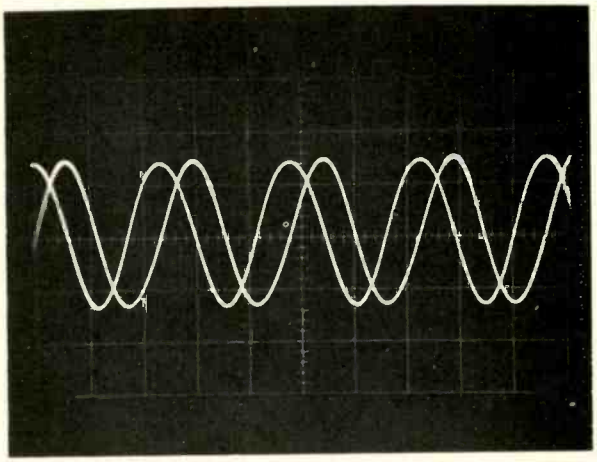


Fig. 8--A dual-trace triggered scope waveform of the CW signal. The 3.58MHz CW signal had been superimposed on the scope for an exact phase check of the 104deg signal shift.

Continued on page 92

Contrast Now--Tomorrow What?

Bob tells Scoot about filters for CRTs--and a little of what's to come in this business

■"I've seen some crazy gimmicks foisted on the public, but this 'black-screen' gimmick is the worst yet."

Scoot was talking mostly to himself, but Bob took the cue and, in his usual fashion, came to the manufacturer's defense.

"You and a lot of others seem to think that everything a manufacturer trys to sell the public is some kind of gimmick. Scoot, for the most part, the engineers have to sell the marketing people on new ideas and the ideas have to be sound or they won't budge."

"Oh boy! Me and my big mouth. OK, bright guy--defender-of-the-great-American-manufacturer--what does a dark glass in front of a CRT do to the picture besides cut down on the light?"

"Well, as you know, several TV makers have picked up the dark filter idea, Scoot. Now, it should seem reasonable to you that if it were only a gimmick, the other manufacturers would say that it was only a gimmick and go about their business. Right?"

"I'm not convinced."

"And I'm not through. To answer your question, I'll only say that the dark filter increases the contrast."

"How can you say that? I know that the blacks will be 'blacker' but the whites will be darker, too."

"Not so, Scoot. At least, not quite. Although the blacks will be 'blacker' and the whites darker, too, the difference between the two will be greater. In other words, there will be more contrast."

"That's double-talk if I ever heard double-talk."

"Then keep quiet and I'll explain. The darkest object you can have in a picture cannot be any 'blacker' than the screen itself. What makes it appear black, even though it is relatively light, is the contrast between the screen and the lighter picture elements.

"Now, the reason you see the phosphor on the screen when the set is switched off,

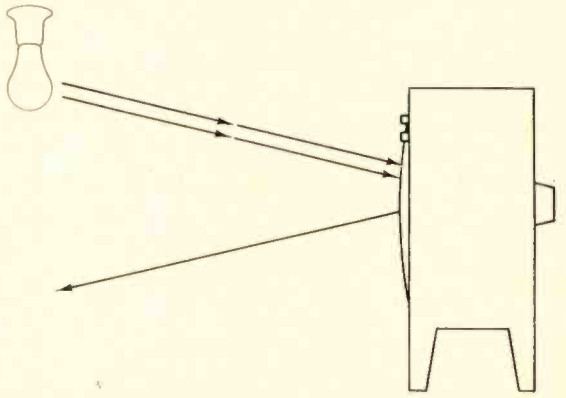


Fig. 1--Reflected light allows you to see the screen when there is no light from the set itself.

is because the light hitting the phosphor is reflected to your eyes. Look here."

Bob scribbled a picture on the scratch pad on Scoot's bench (Fig. 1).

"Light coming from the phosphor when the set is on follows the same paths to the eye, but it is not reflected."

Bob drew another sketch (Fig. 2).

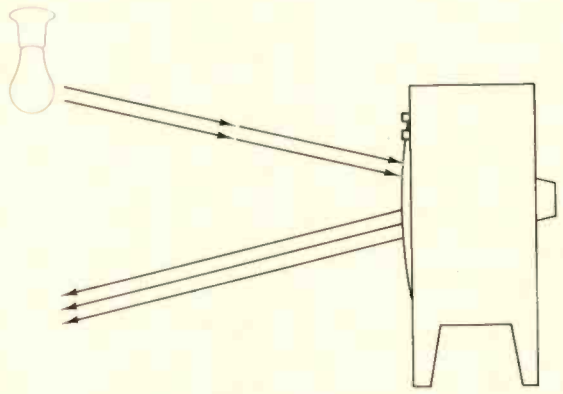


Fig. 2--When the set is turned on, light from the phosphor overpowers the reflected light and makes the screen appear black.

"The reflected light is not as strong as the light emitted by the phosphor so the eye sees a contrast: black and white.

"In a very bright light, like sunlight, still another factor is involved. The sunlight not only reduces the contrast, it overloads the CRT phosphor and reduces the phosphor output."

"That all sounds good, Bob. But what about the dark glass, what does it do for the picture?" "Well, for one thing, it can reduce external light reaching the CRT and may prevent 'overloading' the CRT phosphor. But the really big effect is that the external light must go through the filter twice while the light emitted by the tube only goes through it once."

Bob drew another sketch, adding a filter to the TV set as shown in Fig. 3.

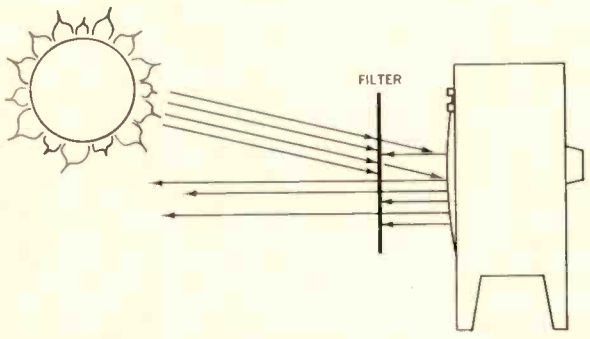


Fig. 3--A 50 percent transmission filter demonstrates how only 25 percent of the reflected light is seen but 50 percent of the phosphor light is seen.

"I think I'm beginning to see the light, Bob."

"Good, let's make an example just to make sure. Let's look at a few rays of light and see how this filter works. Just for the sake of this example, let's say that the filter will transmit 50 percent of the light that strikes it and absorbs 50 percent.

"If four rays of light strike the filter, then only two go through. OK? And when the CRT reflects these, only one will get through to the eye. In other words, only 25 percent of the light that strikes the filter is reflected to the eye. That's what makes it look dark.

"On the other hand, two of the four rays emitted from the CRT will pass through the filter to the eye. So, what would be a four-to-four ratio without a filter--a perfect wash-out--becomes a two-to-one with the filter. Of course, this ignores a few minor points and the ratio only holds true for a filter with a 50 percent transmission characteristic."

"I'll be darned. I never thought of it that way."

"Obviously, jug-head. While we're at it, we may as well get you acquainted with polarized filters, too. We're going to be using them on that CCTV job at the steel mill.

"We don't have to discuss all the angles of linearly polarized light. Let's just say that there are two kinds: left polarized and right polarized. Normal light, like we're working in, is about 50-50."

Bob pulled a cheater cord from a bench drawer and tied one end to the handle. Then he slid it between the back rungs of an old chair and with a flick of his wrist produced a wave motion (Fig. 4).

"See, Scoot, the chair doesn't block the cord's motion when I swing it up-and-down. But, when I swing it sideways the rungs hit

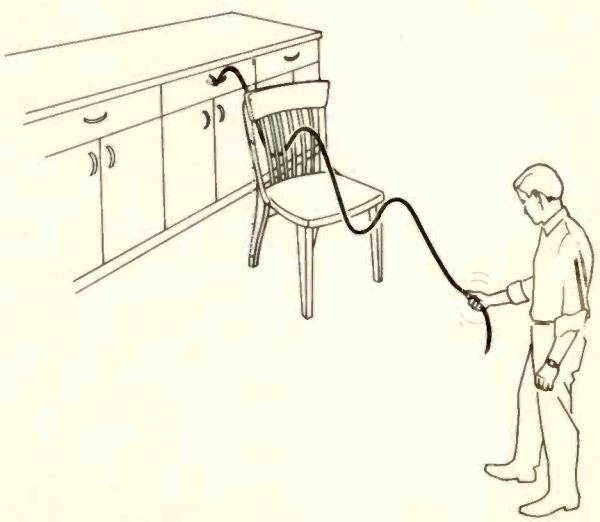


Fig. 4--A swinging cheater cord and the rungs of a chair can be used to demonstrate the function of polarizing filters.

it and don't let the waves form. They can pass through in only one direction or plane.

"If we put a polarized filter in front of ordinary light, we get only polarized light out--like so."

Bob took a book from the shelf behind his desk, brushed off the dust, opened it at a faded yellow marker and pointed to a drawing at the top of the page (Fig. 5).

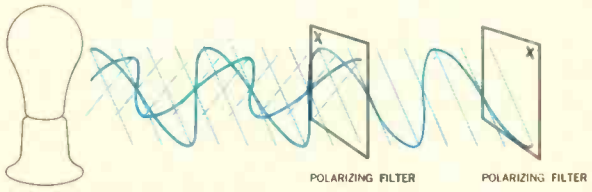


Fig. 5--Polarizing filters can be employed to stop virtually all light when they are rotated out of phase.

A thin smile appeared on Scoot's face. "I'm really in for it now."

"As I was saying, Scoot, we assume that half the light is left polarized and the other half right polarized. The material in the first filter--like the chair rungs--permits only the light waves polarized in one direction to pass through--the others are stopped by the filter.

"The second filter is like the first one except it's rotated 90deg--I'll use a little reference-'X' on the two filters to show it. Now the imaginary rungs in this second filter are in a direction that would allow the waves already blocked to pass through--if they were still around. Instead, these 'rungs' block the remaining light waves."

"Oh, I get it now--it sounds simple, Bob. And, I suppose any smooth surface--like the face of a CRT--will reverse the polarized light traveling through this filter--the filter catching what's left--the reflected light--the second time through. You know--if left polarized light got through the filter, it would become right polarized light when reflected and the filter would block its return."

"It sounds like a good idea, Scoot, but you're wrong. A single polarized filter--like the ones we've been talking about--wouldn't do any more good than the regular filters we just talked about--the fact that the light becomes polarized wouldn't help much."

"Then why have you been talking about polarized filters when I've got TV sets to fix--those polarized filters are just some other 'gizmos' to help increase sales."

"You're just getting ahead of me, Scoot, we'll see why your idea doesn't work and what can be done to make it work. Here, look at the next page in the book (Fig. 6)--then you'll see that a smooth surface, or even a mirror, doesn't reverse the polarity of left or right polarized light. While you're studying that, I'll set up a simple demonstration of some principles you'll have to learn before we can go any further."

Bob connected the sinewave output of an audio signal generator to both the horizontal and vertical inputs of a scope (Fig. 7).

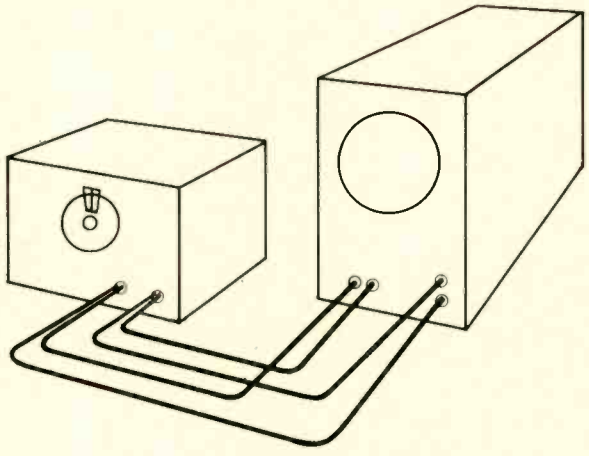


Fig. 7--An audio signal generator and scope are used to demonstrate the effective components of polarized light.

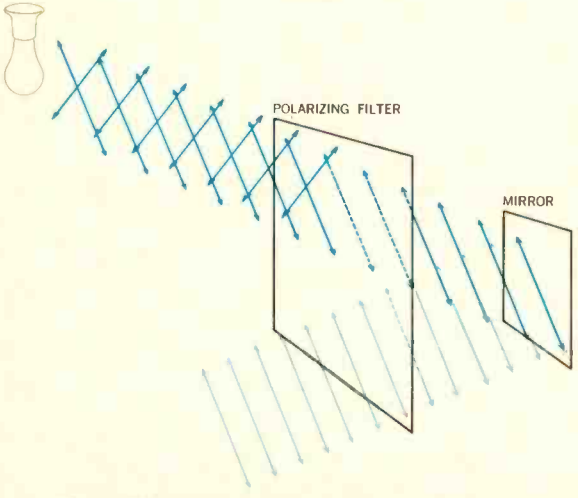


Fig. 6--When light is reflected from a smooth surface, the angle of polarization is not reversed.

"Now look at the screen, Scoot. When I turn the scope's phase control so that the little green dot moves left-and-right in phase with its up-and-down motion, then we have a single diagonal line (Fig. 8 phase=0°). The two motions cause the dot to move diagonally up-and-down--like a wave of right polarized light.

"By turning this phase control knob some more, I can change the horizontal and vertical signals so that they are 180deg out of phase. Now the dot--instead of moving to the right when it moves up--is moving to the left when it moves up. This motion forms another diagonal line (Fig. 8 phase=180°) resembling

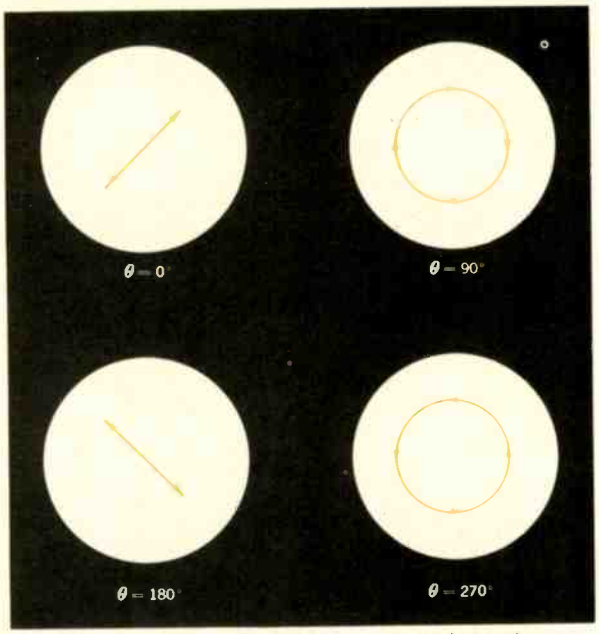


Fig. 8—Patterns formed on the scope are dependent on the phase relationship between the horizontal and vertical sinewaves.

a wave of left polarized light. Although for both diagonals the dot moves in a straight line, its movement along that line is a combination of movements up-and-down and right-and-left. One combination of movements can be said to exist for right polarized light--a different combination can be said to exist for left polarized light.

"You see, Scoot, though the dot appears to be moving only along one diagonal line or the other, we can think of it as also being a combination of horizontal and vertical motions from the two inputs on the scope."

"No comment."

"Well, Scoot, it's the phase angle between the two motions that determines whether the dot's motion forms a right or left diagonal line. When the horizontal and vertical waves are in phase, they form a right diagonal line--when the horizontal wave is 180deg behind the vertical wave, a left diagonal line is formed.

"By adjusting the phase control knob so that the horizontal motion is 90deg behind the vertical motion, the dot appears to rotate clockwise (Fig. 8 phase = 90°)--turning the knob further makes the horizontal motion 270deg behind the vertical motion--now the dot appears to be rotating counterclockwise (Fig. 8 phase = 270°)."

"So am I."

"Turn to the next page marked in the book-there's a couple of diagrams there that might clear up what I'm trying to get through your thick head.

"Let's say that the polarizing filter in the first diagram (Fig. 9) permits only right polarized light to pass through it. But directly behind this filter is a retarding element."

"A what?"

"A retarding element--its a thin piece of transparent material that is able to slow up waves traveling in one plane, while not those in another plane. The filter shown here slows up the horizontal component waves of the right polarized light, while allowing the vertical component to travel through at the normal rate. This, in effect, alters the phase angle between the two component waves."

"You don't say."

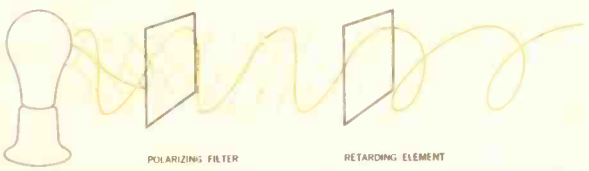


Fig. 9—Circular polarizers contain a linear polarizing filter and a quarter-wave retarding element.

"Look--the right polarized light is like that right diagonal line that we had on the scope--its horizontal component was in phase with its vertical component. The retarding element is able to slow down the horizontal component--once the polarized light has passed through the retarding element the horizontal component is 90deg behind the vertical component--the retarding element having changed the right polarized light into circular polarized light--rotating clockwise."

"Oh I get it, Bob, then the light from the lamp travels to the polarizing filter--only right polarized light traveling through. The retarding element changes this right polarized light to circular polarized light, which is rotating clockwise."

"Good for you, Scoot--you may get this yet!"

"Now, once we get through the next figure (Fig. 10), we may have you understanding these circular polarizers.

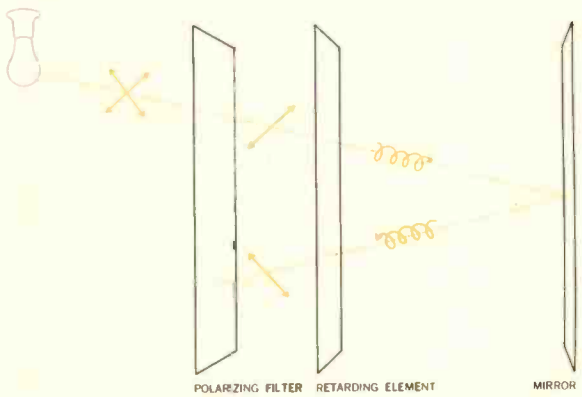


Fig. 10--The phase shift of light in the retarding element permits the virtual elimination of reflected light in the linear polarizing filter.

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ET/D **TEST LAB REPORT**

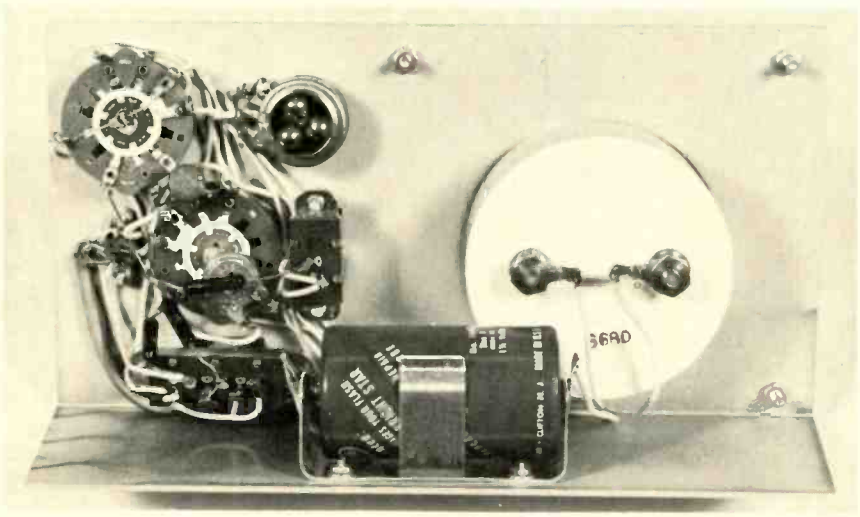
HEATH MODEL IT-18

A Heath Model IT-18 in-circuit/out-of-circuit transistor tester is assembled and evaluated by our ELECTRONIC TECHNICIAN/DEALER lab technicians

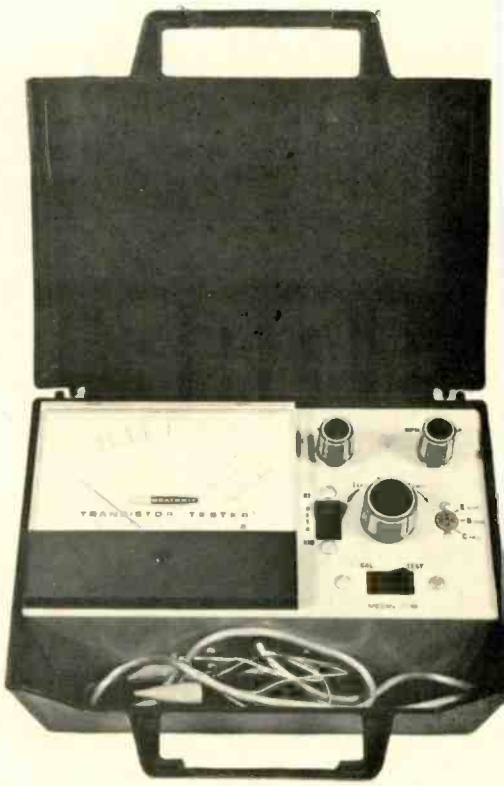
■The Model IT-18 was assembled in about two hours. The entire circuit wires to the five operating controls and one test socket on the metal chassis. A sensitive, easy-to-read microammeter takes up more than half the space of the unit which is relatively simple to construct.

The tester is a bi-polar device using a single "D" cell for power and weighs only 2 1/4 lb. We tried the tester on several transistors, some which we knew were good and others defective. The unit provided practical gain (Beta) values for the good transistors which were plugged into the test socket. However, as the manufacturer states, in-circuit tests for gain are dependent on the shunt resistances in the transistor circuit. So if you need accurate beta values, remove the transistor from the circuit and measure it. The IT-18 tester will not check special purpose devices such as FET's zener diodes or other high leakage units. Also, do not make in-circuit transistor tests with power on the circuit.

This tester will also tell you whether a transistor is an NPN or PNP by using the polarity switch and BETA CAL controls. The meter circuit is designed to calibrate only when the polarity switch is in the proper position; if you have the wrong polarity selected, it will not calibrate. The instructions with the tester are complete to the point of explaining how beta and ICBO or ICEO leakage tests are accomplished and works very well for normal shop measurements. If you do transistor work, as most technicians do today, it can save you valuable time by telling you when you have a normal or defective transistor before you go to all the trouble of unsoldering it. The Model IT-18 is priced at $24.95.■



Model IT-18 in-circuit/out-of-circuit transistor tester measures gain (beta) and leakage. The circuit is basically a low impedance, common-emitter amplifier using the transistor being tested to complete the circuit.



for more details circle 900 on postcard

EICO MODEL 385

Construct this solid-state color bar generator and get a professional unit at a low cost

One of the features noticed first was the compact design of this color bar generator. The small size makes it useful for in-home testing and it will fit the normal tube caddy. The case is made of steel and comes with a convenient handle.

This color generator may not have all the test features of the higher-priced units but it does have the essential patterns such as: (1) horizontal and vertical test patterns for dynamic convergence adjustments, (2) crosshatch and dot patterns for both static and dynamic convergence adjustments, (3) color bars, brightness-keyed for troubleshooting and alignment of the chroma circuits.

All five patterns are crystal-controlled which is necessary for good color reproduction.

This gated rainbow generator is completely solid-state (13 transistors and 6 diodes) which eliminates warmup time and is self-powered by six "C" cells.

We tested the color generator on a late model color TV and the unit produced normal test patterns. Although the generator is adjusted for a display on channel 3 (61.25 MHz), a strong local signal on that frequency did produce some co-channel interference. Another channel on the generator would be desirable.

The generator features a socket type gun killer for the 90 deg CRT which allows one color or any combination of two or more colors to be eliminated from the display on the CRT. The socket stores in the case when not in use. Adapter sockets are also available for the 70 and 110 deg CRT.

The over-all circuit employed in this generator is shown in the block diagram. Basic pattern timing starts with a crystal-controlled (187.2kHz) oscillator Q1. The square wave output of this stage drives a divide-by-12 counter (Q2, Q3 and Q4). A con-

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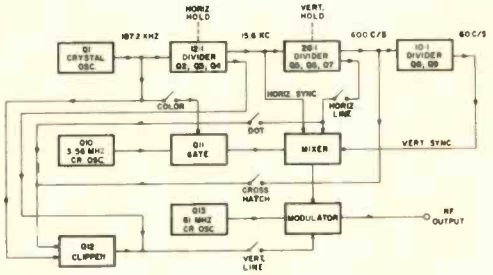
Eico Model 385 solid-state color bar generator.

Block diagram of circuits employed in the Eico color bar generator.



Radios for Radiomen

Using two-way radio for field communication can increase service efficiency and sales

■ "That color TV set of mine went on the fritz right in the middle of a ball game," the unhappy customer said over the phone to his dealer. "Can you send a repairman over here right away?"

"Well, it might be a while," the dealer said. "The service truck is out on calls."

"How long will it take?"

"Well, sir, I don't rightly know."

"What do you mean, you don't know . . . get hold of him and find out!"

"He had a whole list of job orders when he left the shop," the dealer pointed out. "By nowI don't know where he is."

"Well, call him and ask!" the customer demanded. "You've got two-way radio communication like everybody else in the service business, haven't you?"

"W-e-e-l-l, no."

"What! And you're in the radio business?" the customer snorted. "I've heard about the shoemaker whose children have no shoes, but this is ridiculous." He slammed down the phone and dialed a competitor.

Fireside TV Service, whose ad in the Chicago classified phone book features the line, "Radio Dispatched," is one of the rapidly growing number of electronics service organizations who are turning to two-way radio as a control tool and service facility.

"We average a couple of dozen calls a day which we facilitate by radio," says Howard Perlstein, Fireside's shop manager. "We figure that seven out of ten 'cold' calls come in as a result of that ad in the phone book about our service trucks being radio dispatched for faster service. Considering how much better service we can give our customers and how much more efficiently we can make use of a service man's time, we find that the limited use of two-way radio by our competition is downright incredible."

Utilization of two-way radio within the electronics service industry itself is below the norm in most other service industries, according to a spokesman for a leading manufacturer. "Most of the radio and TV people at the consumer level are still missing the boat," he says. "And it's their own boat."

However, many technicians and dealers feel that this situation is partly attributable to the manufacturers themselves. "They confuse us," a Houston shop owner avers. "Sure, I've considered two-way, but you should see all the literature about it I've got on my desk. Field communications equipment, Citizens Band radio, business band, high band, low band, UHF band, FM, paging units . . . all claiming that they've got the best answer."

Although the subject is complicated by the diversity of equipment available, it becomes less confusing when it is noted that broadcast communication for commercial use is still a comparatively new field and that many of the equipment salesmen have a tendency to become over-enthusiastic. Loading up users with far more equipment than they can possibly use is common, and much of it is unnecessarily complex, too.

Some of the claims can be pretty wild. One manufacturer even claims that two-way radio will cut down on phone bills, which is exaggerated when total costs are considered. The industry is also fond of proclaiming the fact that there are now more than two million users of two-way radio, but often neglects to add that this figure includes police cars and taxi-cabs.

Two-way radio is a tool that costs money and its cost can be justified only by the firm that needs it -- just as a dealer who specializes in selling new sets would seldom have much need for any elaborate testing equipment. Or the shop specializing in hotel and hospital work, where the men go to the same job every day until quitting time, would have little use for a field communications setup. Many electronic technicians and dealers do not need two-way radio. But the ones who do, need it badly.

Competition is so keen and technology so standardized in most parts of the country today that two-way radio can often be the competitive edge that makes the difference. When a customer calls for service and the repairman rings the door bell before the customer gets a chance to hang up the phone, as sometimes happens, word of that kind of service gets around the neighborhood fast.

Instant communication can also increase the working productivity of a busy truck,

especially when new calls come in for stops in the neighborhood where the truck is already operating. The shop can often "fill the slots" by catching the truck between stops for interim job orders in what can be the most flexible of schedules. When an order is occasionally canceled, the shop can notify the truck accordingly to save an unnecessary trip.

Accidents happen, too. Trucks or other equipment can break down. Or the wrong tools or parts may have been taken to a job, which can be run out by a delivery man. Wrong or illegible addresses on work orders are not unknown in the service industry, either.

In residential neighborhoods, in particular, a man in the field may find getting to a phone difficult, or at least time consuming. And how does the shop reach him when he's needed?

"The means to keep in constant contact with our three trucks in the field simplifies administration when all the shopman has to do is 'call up' the man on the job for progress reports," says Jim Lyons, the service manager for Fireside TV. "This can even mean that our operating costs per job ticket are lower than if we didn't have that kind of field control. We definitely use two-way radio as a competitive weapon, which is all the more meaningful because most of the other radio and TV servicemen not only don't have two-way radio of their own for field communication, they don't even know everything about it."

The vast majority of electronic technicians and dealers neither sell nor service two-way communications equipment, and a capsule rundown may be in order.

Simplest of all is Citizens Band radio, universally known as CB. The FCC has set aside 23 channels in the AM wave length for the exclusive use of "all ordinary citizens" and no other broadcasting is allowed within their frequency range. No license is required for the purchase or operation of CB radio with an input power of 100 milliwatts or less.

Higher-powered CBs require an FCC license which now costs $9.25 including a book of regulations, but no tests are required and the licensing is actually little more than a registration. The license is good for five years and renewable on request. Application blanks are available from any FCC office, or from many many of the specializing distributors.

The height of a transmitting tower is limited by law, but the regulations allow the user to install an antenna on his existing TV antenna.

All 23 CB channels are shared by other CB users. This chummy setup makes each channel almost like a telephone party line. The CB transceiver can be anything from a walkie-talkie type model to a full-scale three-unit base station.

CB desk-top models, or units designed for installation under the dash in a truck or car, are easier to use than walkie-talkies because all the operator has to hold is the palm microphone. Biggest advantage of desk-top models, though, is the fact that they are higher powered than walkie-talkies and can be hooked into a rooftop antenna. The higher the antenna, the more distance (watt for watt) the signal will go.

The cheapest mike models, even some at 5w with 12-channel capabilities, cost less than the best walkie-talkies. Lower-priced ones may have crystals for only one-channel operation, but better models include the full 23

channels. Additional refinements get the prices up to around $300 for a good set that approaches amateur equipment in transmission and reception quality.

The biggest trouble with CB is its success. It is relatively new. But in just a few years, it has also become one of the most crowded networks. A large city, for example, might have 10,000 CB users all looking for an open "party line" at the same time. . .and with only 23 channels to select from, CB is all but choking itself to death.

In most of the heavily populated sections of the country, about the only hope for a fighting chance with CB is in single sideband equipment.

Sideband transceivers usually incorporate all the best features available for CB, and most of them sell in the $275 to $325 bracket. As of now, users of sideband enjoy a relatively uncluttered field, but only because the development is so new. The CB field is just too wide open, and there are not many parts of the country left where a businessman can still operate with relative freedom.

CB compared to FM is like playing golf on a municipal course compared to playing at a private country club. Most "serious" users of two-way radio prefer FM for five reasons:

1. The choice of operating frequencies is wider.

2. The field itself is not as crowded, and although many FM users do share channels, their use and selection of channels is more strictly regulated by the FCC.

3. Input power can go up to 330w--66 times more powerful than CB's maximum allowable wattage.

4. An FM user can put up higher transmitting towers and communicate over distances far beyond the capabilities of CB.

5. Frequency modulation itself normally reduces the noise and interference from vehicle ignition systems, roadside power lines and other man-made noise sources which can make messages on AM (including CB) difficult to understand.

Getting a license to operate an FM station is tougher than CB and not available to the casual applicant. Prospective users are considered only after proving their need as well as their responsibility. They can expect to wait several months for an okay and assignment of individual channel rights.

Not counting the expense of putting up the tower, costs for a base station can start in the neighborhood of $500. The average cost is more likely to be closer to $1000. FM is split into low band, high band and UHF band operations in a range from 25 to 470 MHz. High band is the most crowded.

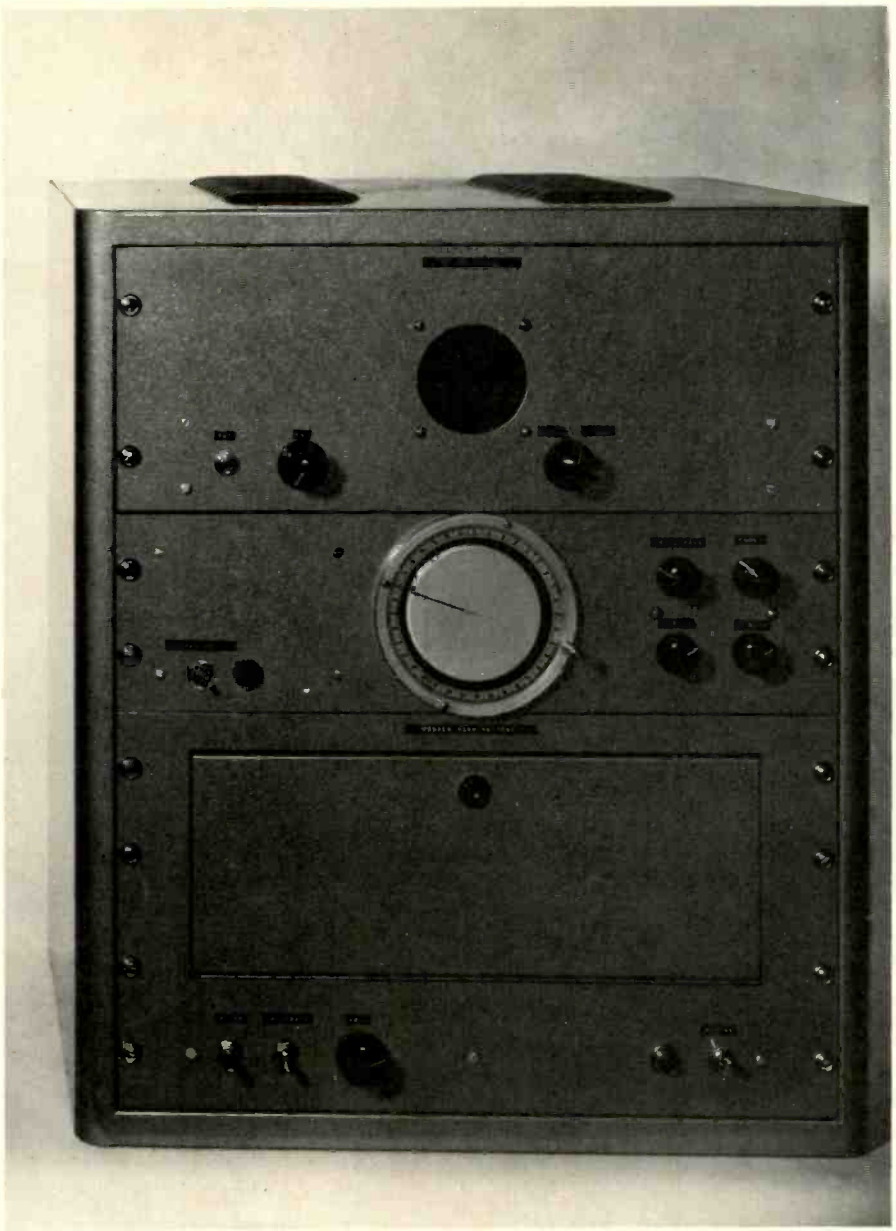
Terrain characteristics, local congestion and the usual interference factors all go into determining how expensive a system the user will need. Lower-watt units cost less to operate than high-powered stations, and the more complicated the system, the more maintenance it is likely to need. Lightly powered low-band mobile units start at about $300, while transistorized models for medium range are usually around $500 or $600.

Powerful portable units, which a serviceman can carry around like an over-sized lunch pail, are also available at prices all the way up to $685.

Paging units small enough to be worn in a shirt pocket and which do no more than signal the wearer with a beep tone to get to the nearest telephone are in wide use because of their selective signaling - - only one man hears the beep. Other pagers, which can cost up to $190 each, permit the reception of "private line" voice messages through the use of a special one-way transmitter that can cost from $250 up.

One of the best two-way radio communications is through Mobilephone facilities operated by local telephone companies. They not only provide the ultimate in transmission equipment and facilities, but also take care of maintenance. Mobilephones are not cheap, though. The user usually pays a minimum of $40 a month, which entitles him to 100 "unit calls." This means that each call costs at least 40 cents - - not counting anything against the cost of the handset-equipped transceiver itself, which runs around $1500 in many parts of the country.

But as one southside service-dealer says, "I couldn't care less about what's going to happen five years from now, our two-way radio system paid for itself easily during the first six months we had it, not only in extra business but in cutting costs as well. We have a $150 walkie-talkie in each of our two trucks and another in the shop. Nobody is ever any further away than the button on the transceiver. The total investment of less than $500 at current bank rates is actually 'worth' less than $40 a year - - and we can save that much in wasted gasoline alone. Sure, we have our troubles with walkie-talkie equipment, but it is certainly a lot better than no communications at all."■



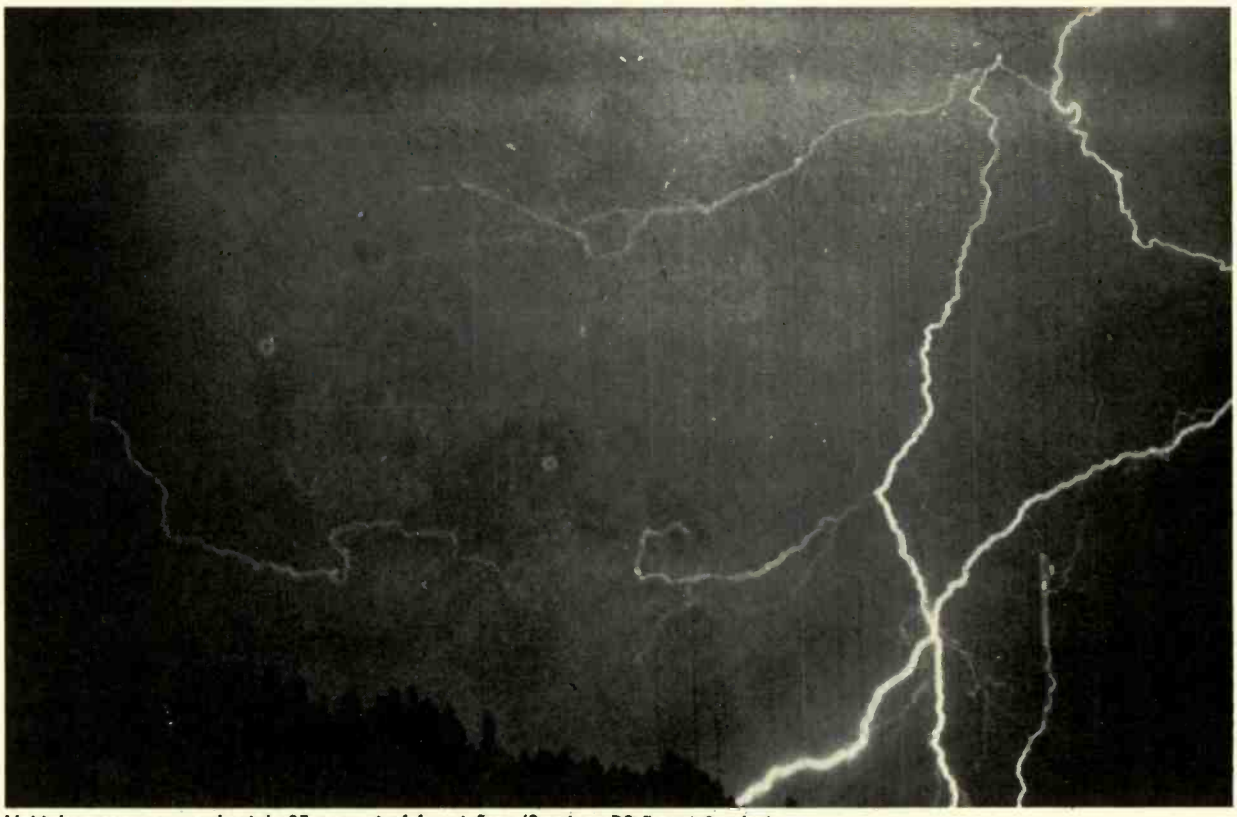
Cathode ray tube lightning detector (Courtesy British Columbia Forest Service)

Electronic Lightning Detector

■ Lightning is a dread enemy of the forest, a fact well known by the people who must depend on forest resources for a living. Lightning accounts for approximately 35 percent of the forest fires, and poses a difficult situation because hard-to-locate "sleeper" blazes can smolder for some time before suddenly bursting into flame.

But the threat of fire by lightning may be coming to its long-lived conclusion. Alex Stewart, a member of the IEEE for about 35 years, has developed an electronic device which can trace the striking path of lightning. As a technician with the British Columbia Forest Service, he began experimenting with a cathode ray tube direction finder which can track the path of electrical storms.

After two years of development his idea was put to the test and proven able to show where



Lightning causes approximately 35 percent of forest fires (Courtesy BC Forest Service)

lightning was causing a fire. The value of the device naturally lies in the fact that fire fighting could be rushed to the newly formed blaze—before it had time to build and destroy millions of acres of valuable timber. The unit has a built-in alarm system which makes it unnecessary for the "look out" men to constantly monitor the scope face. The lightning detector features a dual track tape system which is used to tie the observer's reading of a bearing on the scope to a fixed time scale to coordinate observations from other stations.

The method of operation is to record WWV time signals on one tape track while recording the observer's voice reading bearings from the scope on the other track. Then two tapes from two stations are then played back together and bearings at any fixed point in time are plotted to give a position for the lightning stroke. ■

A giant fir tree struck by lightning could have caused widespread fire if not located in time.

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

Two-Way Radio 700

An all solid-state Messenger Model 123 citizens two-way radio is introduced. The unit features full 23 channel operation and includes a special compression circuit that puts maximum audio into the radiated signal to extend the communication range. Power input to the final amplifier is the maximum allowable 5w. The receiver reportedly has 0.4μv sensitivity with sharp filtered 7kHz selectivity to pull in distant stations while rejecting interference from adjacent channel users. A noise limiter reduces ignition and other forms of radiated noise interference. The solid-state circuitry is temperature compensated to operate from —22° to +140° F. A variable squelch control is provided to reduce background noise by silencing the receiver until a message is broadcast. Other features include automatic volume control to keep the receiver output nearly constant regardless of incoming signal strength and a panel meter to monitor both incoming signal strength and transmitter output power. Only 2½in. high by 6 3/16in. wide by 8¾in. deep, this radio can be installed in many small, under-the-dash areas. The unit weighs 5 lb and is priced at $169.95. E. F. Johnson.

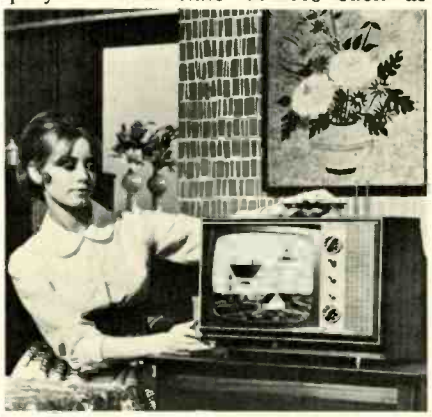
Cassette Receiver 701

Introduced is the 2560 Compact Casseiver System, combining an AM/FM stereo receiver and a stereo cassette recorder with a matched pair of air-suspension speakers. With this system, the audio enthusiast can listen to AM, FM, stereo FM, or pre-recorded cassettes. He can also record onto cassettes from records, stereo microphones, a reel-to-reel tape recorder, or directly from the system's own stereo AM/FM tuner. The receiver section of the Cassette system features a patented Field Effect Transistor front end circuitry, reportedly resulting in virtual elimination of all cross modulation and drift for increased sensitivity. FET circuitry is also used to provide a wider range of tone control. Integrated circuits are employed both in the IF section and in the preamplifier for higher gain and lower distortion. The cassette mechanism is powered

by a synchronous ac motor, which is claimed to eliminate annoying flutter and wow. Control features of the 2560 Compact Casseiver are as follows: (Receiver Section) LOUDNESS; BALANCE; TREBLE; BASS; Power ON/OFF: Speakers ON/OFF: TUNING knob; Power light; Stereo indicator light: Input selector; Tape monitor. (Recorder Section) LEFT and RIGHT RECORD LEVEL controls; Left and Right record level meters; Dual microphone inputs; Headphone output; Resettable digital counter; and individual controls for opening the cassette section, RECORD, STOP, PLAY, REWIND and FAST FORWARD. The net price is $399.95. Scott.

Portable Color TV 702

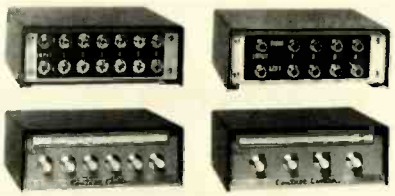
Introduced are three lightweight 12in. diagonal measurement portable color television receivers with transformer-powered 22kv chassis that employ 49 solid-state devices such as



transistors and diodes in 80 percent of the circuitry. The new 12in. models are reportedly the first color sets of this size produced in the United States. In the portables, important signal processing circuits such as the tuner assembly, 3-stage amplifier, low voltage power supply and color amplifier are all transistorized. The new models carry the company's three year replacement warranty on the color picture tube. The color sets, which can be easily moved from room to room, are available in black, white and walnut grained cabinets. They include such features as automatic gain control, automatic degaussing, dipole telescopic antennas, super scope VHF/UHF tuning system, front mounted speaker and 75sq. in. of viewing area. The 2017P in a deluxe walnut cabinet has a suggested list price of $269.95. Admiral.

Audio Control Centers 703

A series of control centers allowing selection of up to four or six stereo speaker systems for simultaneous operation is introduced. The unit provides sound in every room throughout the house with push-button operation.



The "push-ON and push to RELEASE" switches allow the user to optionally place the speaker systems of his choice—from one to six speaker pairs—in operation. The control unit has a black metal case with the appearance of leather, contrasting brushed aluminum escutcheon plate, ivory white push buttons identification plate and easily accessible rear panel connectors to suit the particular system. Requiring no external power for operation and containing no internal resistors that may affect impedance matches, it is claimed ideal for stereo or monaural speaker distribution, microphone input mixing or receiver monitoring. The Model CC4 controls up to four channels and the Model CC6 up to six channels. Size: 5⅝in. x 2⅛in. x 3 9/16in. Alco.

Stereo Music System 704

Introduced is the Model 35-140, a 40w stereo music system in contem-

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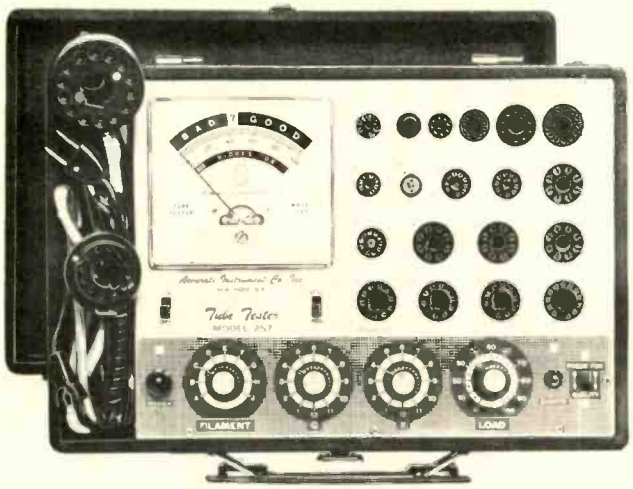

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STANDARD TUBES:

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- Employs new improved 4½" dual scale meter with a unique sealed damping chamber to assure accurate, vibration-less readings.
- Complete set of tube straighteners mounted on front panel.

BLACK AND WHITE PICTURE TUBES:

- Single cable used for testing all Black and White Picture Tubes with deflection angles 50 to 114 degrees.
- The Model 257 tests all Black and White Picture Tubes for emission, inter-element shorts and leakage.

COLOR PICTURE TUBES:

- The Red, Green and Blue Color guns are tested individually for cathode emission quality, and each gun is tested separately for shorts or leakage between control grid, cathode and heater. Employment of a newly perfected dual socket cable enables accomplishments of all tests in the shortest possible time.

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porary cabinetry. This unit features all of the elements necessary for stereo reproduction in a pre-assembled compact design. The receiver-amplifier delivers sound on AM/FM and stereo FM and through its Garrard automatic changer with a magnetic cartridge to reproduce mono or stereo records. The unit, featuring two acoustically suspended speaker systems, is finished in an oiled walnut cabinet and brushed aluminum control panel. Speakers measure 17⅞in. x 10in. x 5½in. depth. Specifications: 40w music power at 8Ω reportedly less than

1% H.D. at listening levels; 40db channel separation. Frequency response 25-25,000Hz. Separate bass and treble controls. Built-in overload protection. Tuner section: 3.5μv for 20db S/N on FM. 300Ω FM antenna and built-in ferrite loop for AM. Has stereo headphone jack and tape-in tape-out jacks. Turntable: Garrard with 4 pole shaded "Induction Surge" motor with magnetic cartridge and diamond stylus. Automatic cutoff turns off all power on last record. Claricon.

Turntable 705

Introduced is the Model 600 top-of-the-line turntable. The base incorporates an illuminated power switch that permits the complete receiver system to be shut off automatically by the turntable after the last record has been played. The turntable comes

complete with a base and dust cover ready to plug into a system. The unit has a cast turntable and an adjustable control which applies a continuously corrected degree of compensation to neutralize the inward skating force and eliminate distortion caused by unequal side wall pressure on the stylus. In addition, the turntable has a MICROMETER STYLUS PRESSURE adjustment which permits ⅓g settings from 0 to 6g; it also has a STEREO MUTING switch for complete silence during the record change cycle. Another feature is the CUEING and PAUSE control lever, which allows the listener to raise or lower the pickup arm at any time and return it to the same grove. BSR.

Communications Microphone 706

Introduced is the "level-limiter" microphone which is claimed to eliminate overload distortion resulting from excessive input while increasing the average level on normal speech. The Model 500-PS is readily adapted to two-way radio and is suited for public safety, as land, maritime or airmobile operation. The microphone contains a silicon solid-state circuit, which reportedly provides 40db

Continued on page 72

How do you "install" confidence when you install an RCA color picture tube?

The surest way to compliment a customer is to agree with his opinion. This is pretty easy to do when it comes to deciding which brand of replacement color picture tube to install in his set.

Here both set owner and service technician agree—and by a wide margin—on RCA! And for one very good reason: RCA's reputation...for experience, quality, and proven performance...over the years. More years than anyone else in the business.

Place your confidence in the company that perfected the color TV system in use today. Introduced more technical innovations than any other company. Stays on top of the state-of-the-art not just in technology, but in tube sizes as well.

Whether it's an all-new RCA HI-LITE or the popular priced quality rebuilt RCA Colorama—when you recommend RCA—you'll not only flatter your customer, you'll also be protecting your own hard-earned service reputation. That's because RCA picture tubes are designed to protect the biggest reputation in the COLOR TV industry.

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The transistor portion begins with Section 5, which contains a complete listing of popular American types and the most readily-available, popularly-priced substitutes. Section 6 lists American substitutes for the most often encountered foreign transistors. Section 7 is a listing of general-purpose replacements for popular original equipment types. Section 8 includes base diagrams which are keyed to the original type listings.

You'll find this guide to be one of the most practical everyday aids you've ever used. It will enable you to repair many sets for which replacement tubes and transistors are not available. 160 pps., 8 Sections. Long-life, flexible simulated leather cover for lasting convenience.

TV Servicing Guidebook: Problems & Solutions

Here's a new book for professional TV Service Technicians—a benchman's handbook detailing shop-proven service procedures which will pinpoint ALL TV circuit troubles—monochrome and color!

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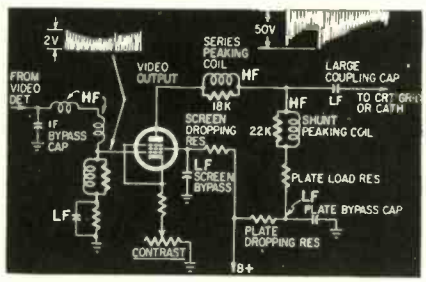
Chapter 1 details initial setup procedures for color TV receivers, including gray-scale tracking, color screen adjustments, purity, degaussing, convergence, etc. Chapter 2 is devoted exclusively to color problems—no Y signal; no color; excessive red, green, or blue; incorrect colors; pastels; "confetti"; "worms"; etc. An entire chapter is devoted to the CRT and its trouble symptoms. To eliminate unnecessary replacement, many repairs are suggested. Chapter 4 lists seven video troubles, what causes them, and tells how to correct them. Chapter 5 analyzes the 13 basic high voltage faults, including flyback, yoke, and the oscillator circuits. Horizontal and vertical deflection circuits are explored for defects in Chapter 6. Chapter 7 exposes elusive sync and AGC troubles, from sync takeoff to integrator and AFC circuits. Chapters 8 and 9 encompass troubles peculiar to sound and power supply circuits.

In all, there isn't a TV trouble you won't be able to cure with the information presented in this book. 176 pps.; over 100 illustrations, including numerous waveform photos; 9 Chapters. Hardbound.

Semiconductors From A to Z

All you need to know about the entire range of transistors and semiconductors used today. Written in language anyone can understand, this book explains how various semiconductor devices work and how they are used, with complete descriptions of all the common and unique circuits used in modern technology. With the wealth of knowledge incorporated in this book you'll be eminently qualified to service any type of solid-state equipment.



Literally scores of easy-to-use schematic diagrams are contained in all these new books. (Example shown greatly reduced in size)

The content begins with a review of how basic semiconductors work, including types and function, how a transistor conveys a signal, transistor biasing and self-biasing techniques, effects of temperature on operation, factors limiting transistor frequency response, etc. Succeeding chapters delve into the mystical arena of field-effect transistors by explaining the differences between FETs and regular transistors. You'll understand junction FET applications, frequency response, temperature effects, and the treatment given depletion-type and enhancement-type MOS FETs in the most down-to-earth explanation you'll ever find.

Considerable attention is given to integrated circuit applications—variable-current and constant-current sources, unbalanced differential amplifiers, IC applications in FM and TV receivers, TV sound circuits, discriminator circuits, and cascade amplifier networks. The use of varicaps is also covered, as well as unijunction transistors, field-effect diodes, zener diodes, SCR diodes, 4-layer diodes, diacs, and triacs. The final chapters deal with constant current and voltage regulating systems and DC-to-AC-to-DC converters. Hardbound.

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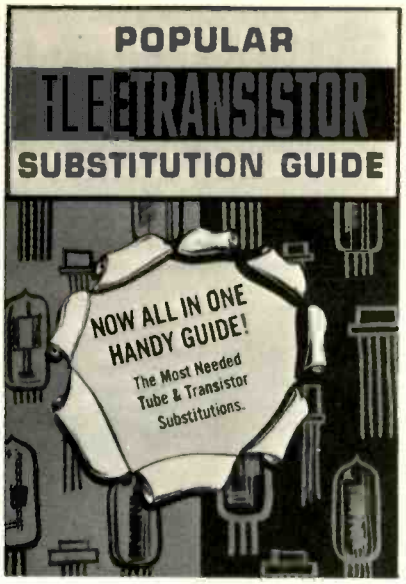

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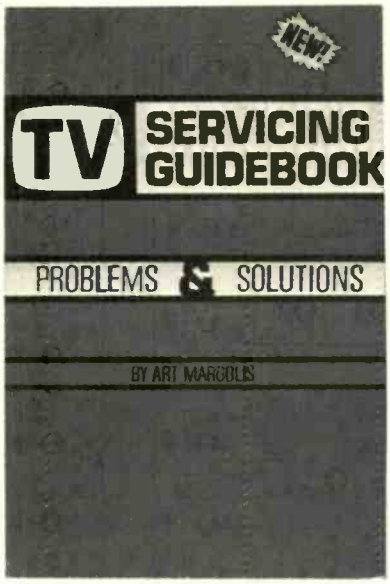

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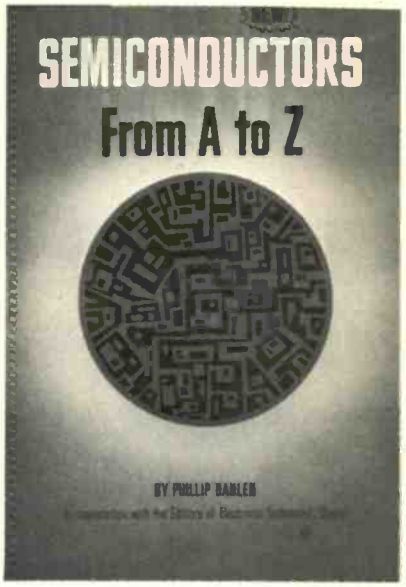

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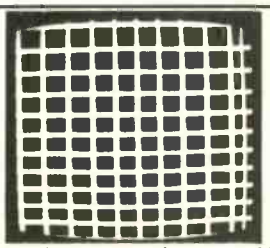

Example of numerous picture trouble photos used as a guide to circuit faults.

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Electronics Reference Data Book
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Digital Computer Analysis
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How To Test Almost Everything Electronic
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ET/D DEALER SHOWCASE

Continued from page 66

dynamic range low distortion compression. Frequency response is automatically controlled by voice level to prevent garbling and allow optimum

intelligibility. The standard model operates from 10.5 to 18vdc between −30 and +65°C, and has attack time of 1ms, released time of 0.25s and harmonic distortion of less than 5% over full compression range. Vega Electronics.

Portable TV 707

Announced is the Model 6912 B/W TV with a 75sq in. screen. The set offers a tuner which employs frame grid circuitry for VHF and solid-state circuitry for UHF. This tuner, plus the signal amplification provided by three

IF stages is said to insure reception in fringe areas. The cabinet, two-tone green with a recessed aluminum handle, contains a 4in. speaker and built-in antennas. Other features include: keyed automatic gain control; earphone jack for private listening; 18 tubes, 4 diodes and 1 transistor. The picture tuoe operates from a 13 kv supply and is claimed to eliminate dust buildup. The unit measures 11½ in. high, 16½ in. wide and 11⅜ in. deep. List price is $99.95. Broadmoor.

Krylon® Crystal Clear is standard equipment for all installation and service work. It prevents many of the causes of picture fading and high voltage losses and keeps lead-in connections tight. It's the repairman's handiest repaircan.

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COLORFAX

ADMIRAL

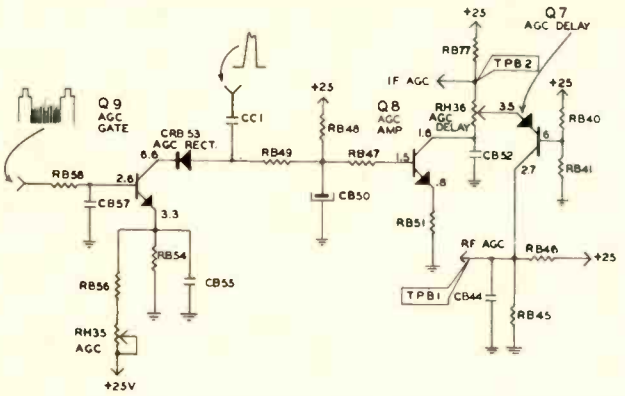
Color TV Chassis K-10—Service Note

Before removing or installing an 8AC10 or 12AC10 color amplifier tube in the current 12, 14 and 16in. hybrid color television models, pull the ac cord! If you don't, transistor Q20 or Q21 is almost sure to be ruined. Make a habit of disconnecting power before making or breaking any connections on transistorized equipment. Surges, arcs and transients can instantly ruin transistors. Please note this information in your S1225 service manual.

Color TV Chassis K-10—Keyed AGC Circuit

The AGC system employs three transistors and one rectifier; two NPN transistors are used for the AGC gate and AGC amplifier, and a PNP for the RF delayed AGC. The chassis has a "keyed forward" type of AGC applied to the RF amplifier and first IF.

A composite signal is taken from the emitter of the first video amplifier and fed to the base of transistor Q9 through



an RC isolating network. The base emitter junction is reverse biased but the sync pulses are of sufficient positive amplitude to drive the base positive and cause the transistor to conduct.

The sync pulses are directly proportional to the strength of the signal and using them as the source for AGC control will give control of the IF and RF sections proportional to the signal strength at the first video amplifier stage.

The emitter of AGC gate transistor, Q9, is attached to the 25v B+ by the 2K AGC control. Adjusting this control varies the positive voltage across the emitter resistor which in turn controls the conduction of Q9 during sync time and reverse biases it during scan time.

The collector receives a positive-going, horizontal pulse through rectifier CRB53. Transistor Q9 conducts in direct proportion to the signal blanking pulse on the base. Rectifier CRB53 conduction builds up on capacitor CC1 and charging capacitor CB50. A positive voltage is also present at CB50 through resistor RB48 from a 25v source. The balance is at a voltage lower than the positive 25v, depending on the signal strength. This voltage is applied to the base of Q8.

IF AGC: Assuming the signal level has increased, the following will occur. As the voltage is decreased on the base of Q8, it decreases the current flow through the collector which reduces the voltage drop across the load resistor RB77. This increases the AGC voltage applied to the base of transistor Q1 causing an increased flow of current through it. This in turn does two things: (1) It increases the voltage drop across the extra high resistor RA17, thus lowering the voltage of the collector of Q1 and reducing the amplification. (2) It changes the impedance relationship of LA20 and LA2 to Q1 causing an impedance mismatch further reducing the stage gain.

RF AGC: The collector of the AGC delay transistor Q7 is connected to ground through RB45. With no current flow through Q7, a residual bias supplied through RB46 keeps the RF amplifier at maximum gain. The base of the AGC delay transistor Q7 is supplied by a voltage divider network, consisting of RB40 from the 25v positive voltage supply and RB41 to ground. This holds the base to about 6v positive.

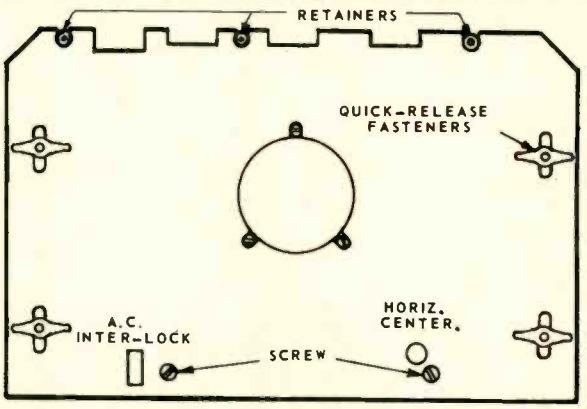
The emitter of the AGC transistor Q7 is connected to the positive power supply through resistor RB77 and the control RH36. As the incoming signal strength increases, the dc amplifier Q8 will conduct less. The collector voltage will become more positive and this potential will be applied to the emitter of Q7. With very weak signals, the AGC delay control RH36 is adjusted so that the base emitter junction of Q7 is reverse biased. To make this stage conduct, increase the voltage drop between the base and the emitter until it reaches its conduction voltage (emitter 6.5v). It will be increasing the emitter voltage in a positive direction. This would be equivalent to moving the base voltage in a more negative direction. Notice that this is a PNP operating inverted. Once forward bias is established, it will induce collector current flow through RB45.

The over-all effect will be seen as an increasing positive voltage at its collector which is the RF AGC source. This positive voltage will forward bias the RF transistor Q51 and the over-all gain of the system will be reduced. For weak signals, the RF amplifier is biased to full efficiency through RB46.

GENERAL ELECTRIC

Color TV Chassis KE—Quick Removal of Cabinet Backs

In the near future it will be possible to quickly remove the masonite backs from KE line color television cabinets by removing only two screws instead of the usual nine. To accomplish this, the masonite cabinet backs have been redesigned to use four quick-release fasteners (two at each side) and three permanently positioned retainers at the



top rear of the cabinet. One screw is located adjacent to the ac interlock and the other screw is near the HORIZONTAL CENTERING control. To remove the back: (1) Remove the two screws. (2) Rotate the quick-release fasteners until they are vertical (parallel with opening). (3) Remove the masonite back by pulling out at the bottom to disconnect the ac interlock and then carefully pull down about ½ in. to release the top of the cabinet back from the three retainers. Now pull the back straight out and away from

the cabinet. Precaution: ALWAYS HOLD THE CABINET BACK FIRMLY DURING DISASSEMBLY TO PREVENT THE BACK FROM DROPPING AND HITTING THE PICTURE TUBE NECK. THIS PRECAUTION APPLIES TO THE DISASSEMBLY OF ANY CABINET BACK. To replace the back: (1) Push the back under the three retainers at the top of the cabinet. (2) Push in at the bottom and connect the ac interlock. (3) Rotate the four quick-release fasteners to a horizontal position (across the holes). (4) Replace the two screws.

Color Chassis KE—Service Information
KE Chassis-Power Supply Diode Failures

Whenever a CR109 or CR110 power supply diode failure occurs, you should add .001μf, 1kv (ET22X58) capacitors across diodes CR109 and CR110. A capacitor is packed with each replacement diode. This provides added protection against voltage surges which may damage the diode.

These capacitors were added to production sets starting with Ser. No. OS4E.

Preset Fine Tuning Adjustment Shifts

Investigation has shown that some complaints of this nature are caused by interference between the channel selector and fine tuning knobs because of the selector knob being pushed on too far.

At present, the production line is adding a thin washer between these knobs to prevent interference. In later production, the knobs will be revised to prevent the condition and eliminate the washer.

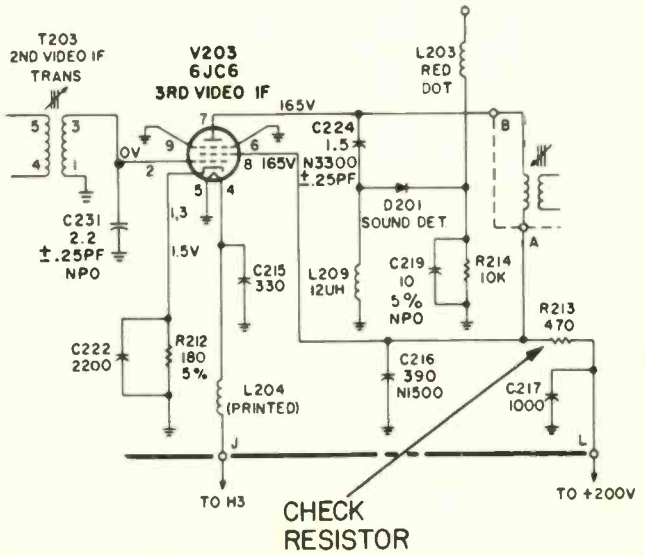
The simplest solution is to pull the selector knob out slightly so that it does not rub on the fine tuning knob. You may be able to eliminate some service calls by instructing the customer to do this.

In the event that you find cases where the problem reoccurs, contact your General Electric television distributor for washers to be placed between the knobs.

MAGNAVOX

Color TV Chassis T931/T933/T938—Defective 6LM8 Video/Sync Amplifier and 6JC6A 3rd Video IF Amplifier

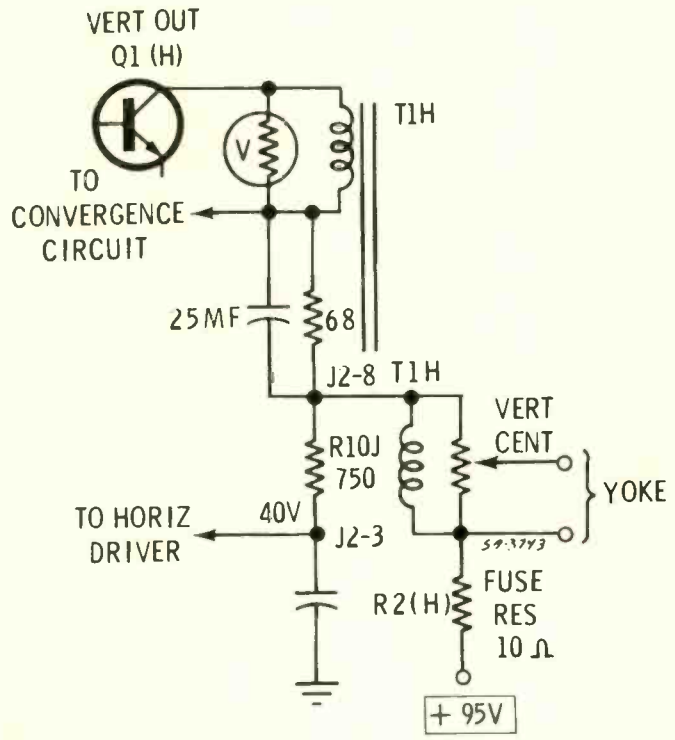
Low contrast, deterioration of picture quality, low chroma output and poor sync are all possible symptoms of a defective 6LM8 tube. The symptoms may be more or less pronounced depending upon the condition of the tube. Check the 6LM8 tube as a possible cause when these symptoms are noted. Sometimes the failure of the 6JC6A 3rd video IF tube will result in failure of the plate/screen load resistor, R213. Check the condition of this 470Ω, ½w resistor when replacing a defective 6JC6A tube.



MOTOROLA

Color TV Chassis TS-915—No High Voltage

Symptom: No raster and a check reveals there is no high



Continued on page 93

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.

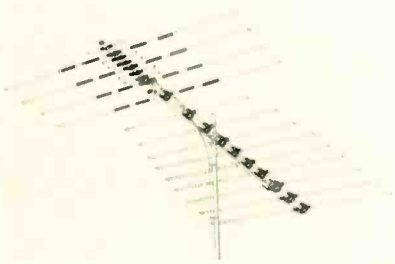
VHF Broad Band Amplifier 708

Announced are solid-state VHF broad band distribution amplifiers, Models M-104 and M-105, designed for color and monochrome installations. The systems are intended for small apartment houses and multiple installations of approximately 25-30

outlets such as TV dealer showrooms. The split band design of the amplifier presents greatly improved signal ability and a reported 24db gain in the low-band and 26db in the high-band. Electrical specifications are the same for both models except that the M-105 has separate low-band and high-band inputs at 75Ω. The M-104 features a low noise input circuit to offer the installer a choice of 300 or 75Ω input with separate level controls on each band for maximum flexibility. Noise figure on the low-band is 5.5db and on high-band is 6.5db. Finco.

Antennas 709

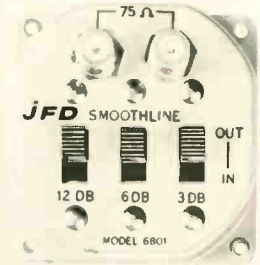
Introduced is a new series of television antennas that provide improved



color and monochrome reception on all TV channels—VHF and UHF—as well as radio reception on the FM band. An optional extra UHF element is available which is claimed to increase gain an average of 35 percent on difficult channels. The five antenna models in the series, available for direct 300Ω installation and convertible to 75Ω operation by means of snap-on transformers, are designed for use in areas classified from "local" to "deep fringe" in signal strength. The antennas are compact, lightweight and factory preassembled for easy mast mounting. List price is from $21.95 to $64.95. Jerrold.

MATV Attenuators 710

A line of fixed and variable attenuators has been designed specifically for 82 channel cable powered MATV systems. The Model SL-6801 is vari-



able from 0 to 21db in 3db steps. The "F" type connectors are used for input and output with attenuation selected by heavy-duty slide switches. The Models SL-6803, SL-6806, SL-6812 and SL-6820 are fixed at attenuations of 3db, 6db, 12db and 20db, respectively. All attenuators in the new line pass UHF as well as VHF, providing uniform attenuation across the entire TV-FM spectrum. They also pass ac and dc power for cable powering applications. The Model SL-6801 variable lists for $22.50 and the fixed attenuators list for $5.95 each attenuator. JFD.

VOM Kit 711

A new VOM in kit form for technicians features 38 measuring ranges. The meter has 5000 ohms/volt ac-dc sensitivity with input protection on all voltage, current and db ranges. Precision 1 percent resistors are used throughout. Operating controls include a ZERO/OHMS adjust, RANGE switch and FUNCTION switch to provide full scale readings on a 4½ in. two-color meter. The VOM has eight scales: ac-dc volts at 0-1, 5, 10, 50,

100, 500 and 5K; ac-dc current at 0-1, 10, 100ma, 1a; ohms at 0-5K, 50K, 500K and db readings from −20 to +76db in six ranges. The unit measures 6¾ in. x 5¼ in. x 2¾ in. and comes with a battery, test leads, carrying strap and operating manual. Price is $19.95. Allied.

VTVM 712

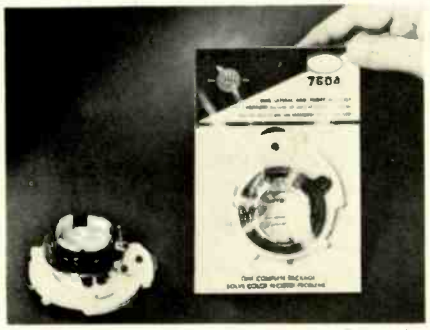
Announced is the Model LV-76A Vacuum Tube Voltmeter, a multipurpose instrument suitable for laboratories, service shops and schools.

Its construction makes it particularly adaptable for field use. The instrument has seven dc and seven ac ranges from 1.5v to 1500v. The re-

sistance ranges cover from 10Ω midscale to 1GΩ full scale. The input impedance is 1M and the frequency response is 20Hz to 4MHz. Accuracy is ± 5 percent full scale. Only one test probe is used for all measurements which permits maximum operating ease. The dc polarity reversing switch makes it unnecessary to reverse the test leads when making transistor circuit tests. Price is $54. Leader.

713
Blue Lateral and Purity Assembly

A single unit, blue lateral and purity assembly is introduced as a replacement for similar assemblies on any size American rectangular color picture tube. The 7604 assembly registers blue, red and green beams simultaneously within .06in. A single



wheel rotates two magnetic rings in opposite directions to provide blue beam lateral convergence. Purity correction is accomplished by individual adjustment of the two purity rings. The magnets are said to compensate for misregistration up to .005in. in any direction. Net price $3.96. Miller.

Service Kit 714

Introduced is an attractive, lightweight, durable service kit in an attaché case. The kit is designed to assist you in servicing color television

receivers in the home. It consists of one complete set of PC boards with tubes (not including convergence board assembly) at a price less than you would pay for the "boards" alone. The boards provide a quick, effective

Continued on page 84

ET/D NEWS OF THE INDUSTRY

Chemtronics To Introduce New Contact Cleaner

Chemtronics Inc., a leading manufacturer of chemicals for the electronic industry, plans to celebrate its 12th year in business by introducing a new contact cleaner. The product is formulated specifically for gold and silver plated contacts. The cleaner employs a foaming action to clean and polish precious metal contacts, then leaves a permanent lubricant claimed to prolong contact life, reduce friction, and maintain low contact resistance. Based in Brooklyn, N.Y., Chemtronics' product line includes a variety of tuner cleaners and lubricants, contact cleaners, high voltage insulators, clear insulating sprays, tape recorder and record player cleaners, glass and plastic cleaners, penetrating and lubricating oils, solders, glues, rubber drive wheel, belt and cord restorers, and component coolers for locating thermal intermittents.

Clad Metal Parts Improve Color TV Sets

Clad metal parts that bend with temperature change are said to be helping RCA television sets provide optimum color performance from cold turn-on to full warm-up. The thermostat metal components, a key part of RCA's "Perma-Chrome" system, allow the picture tube to compensate continually and automatically for temperature changes associated with set warm-up. It is claimed that the viewer gets an optimum picture immediately and consistently instead of having to wait until the set is fully warmed up, which generally takes over an hour. A picture tube equipped with "Perma-Chrome" reportedly can be accurately adjusted for optimum color reproduction within minutes. This simplifies adjustments at the factory and eliminates the possible need for readjustment in the home.

Thermostat metal is one of the oldest clad metals—two or more metals bonded together for a combination of properties. It is the critical element in home and auto temperature-control systems in which its characteristic of changing shape with changing temperature is useful for opening and closing electrical switches.

Texas Instruments Inc., one of the producers of the RCA components, sees a trend toward employing this characteristic to compensate for troublesome temperature changes in various instruments and machines.

Objective of the system and its thermostat metal components is to keep energy particles—electrons—accurately aimed at the appropriate red, green and blue phosphor dots they excite to produce color images. The electrons emanate from one of three electron guns located in the neck of the picture tube and are orientated in such a manner to excite one of the three types of phosphor. Colors other than red, green and blue are produced by varying the number of electrons that strike each of the phosphor dots in a given trio. True color reproduction depends on each phosphor dot being struck only by electrons from the proper electron gun. This is accomplished by inserting a shadow mask between the electron guns and the face of the tube.

The shadow mask is a thin steel sheet with hundreds of thousands of tiny holes to permit the passage of electrons. When properly positioned, it will permit the passage only of those electrons aimed at the center of the correct phosphor dot. As the tube heats up during normal operation, however, the mask expands. The former resulted in

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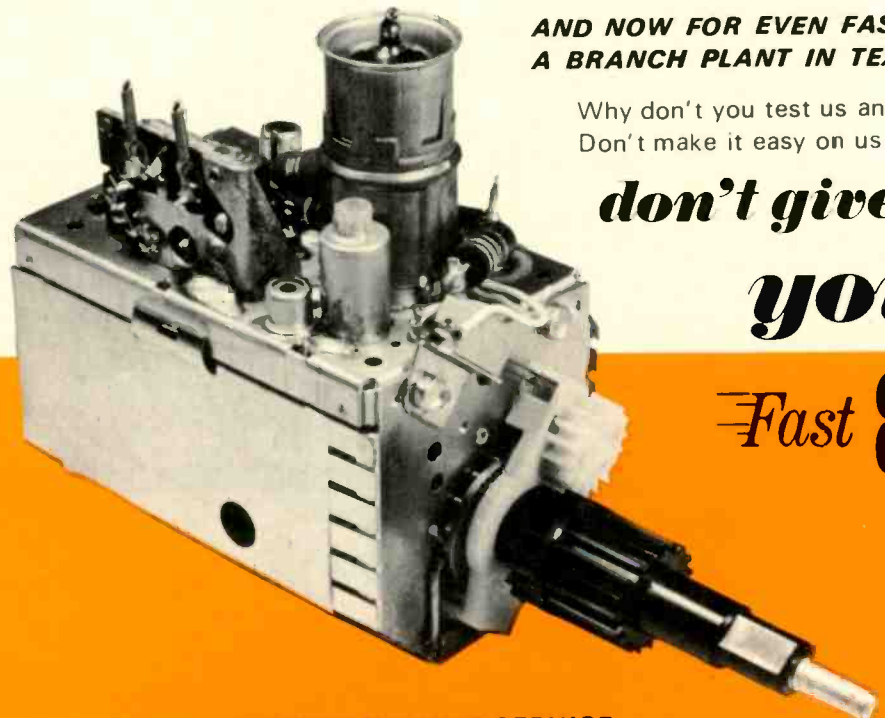

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good color near the center of the tube and poor color—or "misregister"—around the edges where displaced holes in the shadow mask caused electrons to strike phosphor dots improperly.

RCA's solution to this problem in the system is a shadow mask mounted at four points on thermostat metal brackets supplied by Texas Instruments. Instead of restraining the shadow mask at its mounting points, the clad metal brackets themselves change shape and let the mask move evenly toward the face of the tube. This keeps the holes in the mask aligned with the phosphor dots and electron beams that must coincide.

Proper register and true color reproduction are achieved everywhere on the tube regardless of elapsed time from turn-on.

The Thermostat Metals Branch of Texas Instruments produces the mounting brackets from B-1 thermostat metal, a 50-50 combination of low-expansion "Invar"—36 percent nickel and 64 percent iron—and a high-expansion material consisting of 22 percent nickel, 3 percent chrome and 75 percent iron.

The clad metal brackets, which measure 1 x 2 x 0.040in., are spotwelded between the shadow mask frame and alloy steel cantilever springs at four symmetrical mounting points at the top, bottom and sides of the tube. The brackets are made with a longitudinal fold between two flat areas which are spot-welded to the mask frame and the cantilever springs. The brackets change shape with temperature along the folds. Cantilever springs attach to the tube by means of bosses in the glass. Clad metal brackets help provide an economical solution to the expansion problem.

Finco Mobile Display Unit Begins National Tour

The fully equipped FINCO Mobile Display and Research Laboratory from the Finney Co. of Bedford, Ohio, has begun a tour of the country which will eventually take it to all 50 states. The 30ft. self-contained unit brings demonstrations of FINCO MATV systems products and design techniques directly to FINCO distributors, staffs and technicians.

In addition to demonstrating the operation of system components, the mobile unit is equipped to research and solve individual problems which might arise in the actual installation of a MATV system.

In charge of the unit is Roger Priebe, FINCO MATV systems field representative. As the unit moves from territory to territory, Priebe will work with each regional manager in his respective area. Demonstrations will be attended by an estimated 7500 industry persons.

The Finney Co., a nationally recognized leader in the electronics industry, manufactures FINCO antennas for color and black-and-white television, FM, stereo and monaural reception and electronic components and accessories as well as master antenna systems (MATV).

FOR MORE INFORMATION
ON ADS AND NEW PRODUCTS,
SEE READERS' SERVICE, PAGE 95.

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Continued from page 55

"Only right polarized light passes through the polarizing filter. The horizontal wave component of this light is in phase with the vertical component. When passing through the quarter-wave retarding element a phase shift occurs--the horizontal wave component then lagging 90 deg behind the vertical--the light wave rotating clockwise. This light wave is still rotating clockwise after it has been reflected off the mirror and re-enters the retarding element. After again traveling through this element, the horizontal component lags an additional 90 deg behind the vertical component--it is then a total of 180 deg behind the vertical wave component--this being the phase angle of left polarized light. Left polarized light can't travel through this polarizing filter and so the reflected light is stopped."

"I get it now, Bob. Only right polarized light passes through the polarized filter--right polarized light has horizontal and vertical wave components in phase with one another. After first traveling through the retarding element the horizontal component lags 90 deg behind the vertical component, and upon returning it lags an additional 90 deg or a total of 180 deg behind the vertical component--this relationship of components forms left polarized light, which is absorbed by the filter."

"Good for you, Scoot! By traveling twice through the retarding element, the right polarized light becomes left polarized light--the polarizing filter being positioned for removing left polarized light."

"What's this gray piece of plastic doing near the back of the book?"

"That's a sample of the circular polarizer we've been talking about.

"The linear polarizer is on one side, Scoot, and the quarter-wave retarding element is bonded on the other side of the filter--that's why it looks like only one piece of plastic."

Scoot removed the polarizer from the book and, with the bench light shining over his shoulder, held it in front of the screen of a TV set.

"Just as I told you, Bob, an hour's lesson and the 'gizmo' doesn't even work!"

"Turn it over, Scoot. You probably have the retarding element facing you instead of between the polarizer and the CRT. I can just see it now--you'll have all the circular polarizers on that CCTV job facing the wrong side out."

Scoot turned the filter over.

"Say, it does make the CRT look black!"

"Yes, Scoot, and when you get around to fixing that TV set, you'll see that since the light from the CRT isn't polarized, it can come out through the polarizer. The filter may polarize that light, but it won't remove it as it gets rid of the reflected light.

"And speaking of fixing TV sets--that reminds me, Scoot--you've missed another coffee break and had better get started fixing this set." ■

Eico . . .

Continued from page 57

trol in this divider (HORIZ HOLD) determines the frequency of the horizontal sync pulses and vertical lines displayed on the CRT. The output of Q1 also drives clipper Q12 when the function switch is in the crosshatch or dot position.

The output from the divide-by-12 counter drives a divide-by-26 counter (Q5, Q6 and Q7). A control in this circuit (VERTICAL HOLD) determines the frequency (number) of the horizontal lines as well as controlling the vertical sync frequency.

The output from the 26:1 counter then drives a divide-by-10 counter which generates the actual vertical sync.

Transistor Q10 is a crystal-controlled 3.56MHz oscillator that generates a rainbow color signal which is passed to gate Q11. The gate circuit is driven to produce the color bars.

Transistor Q13 is a crystal-controlled oscillator operating on TV channel 3 (61.25MHz). The block diagram also shows the various interconnections made by the pattern selector switch to create the horizontal lines, vertical lines, crosshatch, dot and color-bar patterns.

Kit construction is simplified by employing printed circuit boards with "reference designation" letters representing the part stamped on the board. Next month's testlab report will cover the Darcy DM330 digital multimeter and the B & K Model 1077 Analyst. ■

Specifications: RF Output: 10,000-μv into 300Ω on TV channel 3. Horizontal Lines: 7 visible lines. Vertical Lines: 8 visible lines. Crosshatch: 7 horizontal by 8 vertical lines. Dots: 56 medium-sized dots (two scanning lines thick). Color Bars: 8 stable and distinct standard color bars. Master Pattern Oscillator: 187.2kHz, crystal-controlled. Chroma Oscillator: 3.65MHz, crystal-controlled. RF Oscillator: 61.25MHz (TV channel 3), crystal-controlled. Crystals: All crystals accurate to 0.005%. Size: 8 1/2in. wide, 3in. high, 8 1/2in. deep. Weight: 4 1/2 lb. Power Supply: Six "C" cells (1 1/2v).

Continued from page 77

method of troubleshooting. Boards are currently used in the color portables and will be incorporated into production of future models. Included in the cover is a convenient pouch to carry your service data, order blanks, schematics, etc. Setchell Carlson.

Knobs Antenna 715

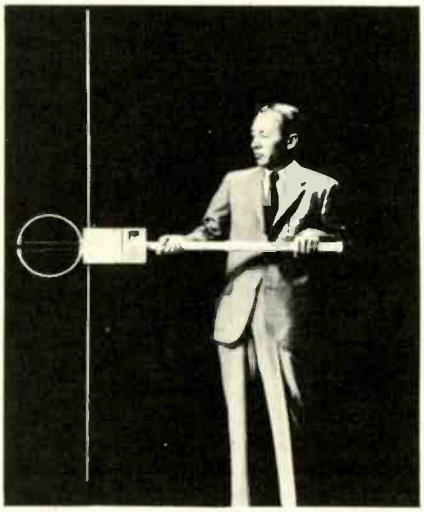
Four different knob styles are introduced. Depending on the style, the series is suitable for commercial product applications such as stereos, Hi Fi components and intercoms or on instrument and control panels. In standard form the knob is flat with a molded recess on top. A second style may be specified with a metallic ring around the top. A third version has a spun aluminum inlay inserted in the recess. Another variation is provided with a spun aluminum cap covering the top of the knob. All knobs in the series have serrated sides. Each of the styles in the 900 series is available in six new sizes: ½, ¾, ⅞, 1⅛ and 1¼ in. Depending on the diameter, knobs vary in height from ⅝ to 13/16in. All but the smallest sizes are furnished optionally in two brass insert shaft sizes: ¼ and ⅛in.; a single set screw is standard. Kurz-Kasch.

Transcription Turntable 716

Introduced is a transcription turntable, model TD-125. The unit incorporates an electronic transistorized drive system to reduce the motor rotation speed which the manufacturer claims results in reduced audible rumble. Other features include an electronic speed selector and pitch control, three speeds—16, 33, 45 rpm —dynamically balanced 12in. diecast turntable and replaceable tonearm board for mounting your choice of tonearm. Elpa.

Noise Source Locator 717

Introduced is the model TNL2, a lightweight, self-powered noise source locator. With this instrument, it is reportedly possible to tell without triangulation, the direction from which noise impulses are being propagated along any given power line. The unit pinpoints sources of interference to TV and communications reception. Price $595. International.



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ET/D CATALOGS & BULLETINS

Consumer Electronics Annual 400

A 36-page booklet devoted exclusively to consumer electronics is available. It can be used by employees to answer consumer inquiries. The 1969 edition will not be published until midyear. However, a limited quantity of 1968 booklets are still available at reduced prices as follows: 1-10 copies, 50 cents each; over 10 copies, 25 cents each. EIA.

Instruments 401

A 68-page catalog describes instruments for research and development, in industry as well as for educational purposes. Included are full specifications, illustrations and many schematics for: Malmstadt-Enke spectroscopy system, instrumentation laboratory chart recorders, recording pH electrometers, polarography system, Berkeley Physics Laboratory, and Heath oscilloscopes, power supplies, voltmeters, signal generators, testers, bridges, etc. This catalog also introduces a major new development, the Heath/Malmstadt-Enke Modular Digital System. Among other new products is a Log/Linear Current Recording System. It reportedly can resolve currents as low as 1 picoampere, such as those used in spectrophotometry or gas chromatography.

A Heath/Solartron Oscilloscope System is also shown for the first time, featuring true double beam, DC-15MHz bandwidth and 100μV/cm sensitivity. Heath Co.

Soldering Iron Tips 402

A 28-page, two-color soldering iron tip catalog is available. Featuring drawings of tips in diameters from ⅛ to 1⅛ in., the new file folder style catalog is designed to enable tip users to specify diameter, length, point shape, shank style and point tinning requirements when ordering. A complete selection of diamond, cone, chisel, screwdriver, bevel, turned down and tapered tips is illustrated, as well as plug, sleeve and threaded shank styles. Leading brands and models of soldering irons for these tips are also listed. The soldering iron tips are iron plated to resist corrosion and pitting. They also feature the patented shank

plating which eliminates heat induced scaling and corrosion, and are warranted not to stick or seize in the soldering iron barrel. Cuprox tips, available in the same sizes and configurations, are nickel plated over a core of high quality copper. Plato.

Correspondence School 403

Offered is a 384-page manual explaining the function, operation and objectives of ICS. It also lists and explains the 266 study courses with a synopses of the more than 1500 instruction texts used in these courses. This manual is an informative reference for use in building programs of study. It is also used by ICS sales representatives in designing training programs for industry. ICS.

Antennas 404

A four-page brochure introduces a line of antennas designed for maximum sensitivity on Monitor Radio. The line includes three groups of fixed and mobile antennas. There are three mobiles and one base (MR-3) antenna in the high band (130-174MHz)

group. The mobile antennas differ in mounting method—MR-1 is a roof mount, MR-2 is a trunk lip mount and MR-9 is a magnetic mount antenna. In the low band (25-50MHz) there are 2 antennas—MR-4, a fixed antenna, and MR-5, a mobile antenna that includes a heavy-duty, stainless steel whip and the chrome-plated "low ball" mount. Three antennas cover both ranges: MR-6, a cowl mount that replaces AM auto antennas; a receiver mounted model (MR-7) and a dual range fixed antenna MR-8. All antennas are factory pretuned across all bands specified. Hy-Gain.

USE ZIP CODE

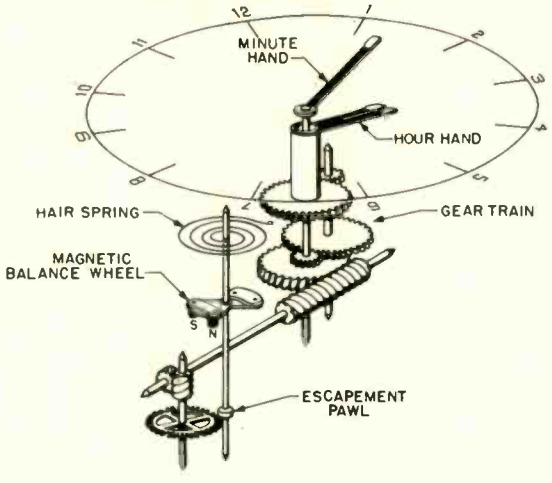
ET/D TECHNICAL DIGEST

Continued from page 31

the blocking oscillator transformer, the clock drive circuit uses two air core coils wound together and positioned in proximity to the balance wheel in the clock.

The transistorized drive circuit provides pulses of magnetic energy that alternately attract and repel the magnets mounted in the balance wheel assembly, causing it to oscillate. The reciprocating motion of the balance wheel can be compared to its counterpart in an ordinary clock or wrist watch.

When battery voltage (1.5v) is applied to the clock drive circuit, transistor Q1 is slightly forward biased by resistor R1 (150K) causing a small collector current. This collector current creates a magnetic field about coil L1. The polarity of the magnetic field produced by L1 is such that it attracts the magnet in the balance wheel, causing it to rotate in a direction that brings the magnet closer to the



coil assembly. The moving magnet induces a pulse of voltage in coil L2 which is part of a feedback network connected to the base of transistor Q1. The positive feedback pulse developed by coil L2 tends to increase forward bias on transistor Q1, causing magnetic energy and further deflection of the balance wheel.

As the balance wheel pivots toward the L1-L2 coil assembly, mechanical energy is stored in the hair spring and the balance wheel, letting it rotate past the magnetic coil assembly. Further rotation of the balance wheel causes the south pole of the magnet to cross the L1-L2 coil assembly. The polarity of the magnetic field produced by the balance wheel magnets reverses, and the polarity of the voltage induced in coil L2 also reverses, creating a voltage pulse of opposite polarity on the base of transistor Q1. The reverse bias afforded by the feedback pulse cuts off transistor Q1 and the mechanical energy stored in the balance wheel assembly drives the wheel back to its original position—allowing the cycle to be repeated at a rate of approximately 5 pulses per second. The exact period of balance wheel oscillation is determined by the mechanical resonance of the hair-spring/balance wheel assembly—not by the electrical components—just as in a conventional clock.

The mechanical energy produced by the oscillation of the balance wheel is transmitted by a small pawl located on the end of the balance wheel assembly. The back and forth motion of the pawl moves the first gear (in the gear train) one tooth at a time—as the balance wheel moves back and forth. The illustration details the mechanical coupling between the balance wheel and the hands of the clock.

ET/D CATALOGS & BULLETINS

Audio Connectors 405

A new catalog describes a line of audio connectors, standard microphone connectors, adapters, RF connectors, Y connectors, AC receptacles and phone jacks. The catalog includes specifications, detailed drawings, application hints and prices for single and multiple conductor models. It provides engineers and designers with an up-to-the-minute guide to the latest in audio connectors and related components. Switchcraft.

Automotive Speakers 406

A new automotive loudspeaker replacement guide is available. Covering model years 1960 through 1969 inclusive, the guide lists replacement loudspeakers for all American and foreign automobiles and reportedly is the most up-to-date reference and replacement guide now available to electronic distributors and service technicians. Printed in an easy-to-use 8½ x 11in. format with "universal" punching, the new guide is available without charge. Jensen.

Tools 407

A 24-page catalog of hard-to-find tools describes each tool and its application. The catalog contains a collection of useful tools rarely sold by industrial distributors or stores, such as electronic pliers, jewelers' tools, sensitive drillers, precision tools, flexible shaft machines, unusual solders, soldering jigs, hard-wire cutters, screw and nut starters, glass drills, miniature files, rifflers and reamers. Also shown are soldering machines, endless hacksaws, divider setters, diamond glass cutters and rust remover devices. Brookstone.

Microphones 408

An eight-page microphone and accessory brochure is offered. The brochure includes the complete line of professional and entertainer series of microphones, stands, bases, mixers and accessories. Geloso.

MATV Systems 409

An MATV planning manual, a basic text of systems design and planning, is offered. Written for technicians who want to educate themselves in the MATV business, the booklet describes MATV systems products, as well as the fundamentals of system design and design calculations. Also included in the manual are sample VHF and all-channel systems, a db to voltage multiplier chart, coax cable and transmission line guide, TV channel assignments and a glossary of the most used MATV terms. Finney.

Instruments 410

A 12-page catalog describes the company's complete line of advanced electronic test equipment. The new catalog, Form No. 458, features five new test instruments, including a sweep and marker generator, combination oscilloscope/vectorscope, color generator and two transistor/FET testers. Other instruments included are field effect meters, tube testers, CRT testers, field strength meters and special purpose instruments, all with performance data and prices. Sencore.

411 Switches and Panel Components

An eight-page catalog features a line of miniature switches and front panel components. The catalog lists an expanded line of miniature switches, keyboard switches, push-button modules, machined aluminum knobs, ceramic terminal strips, readout indicators, pilot light assemblies and miniature lamps. Product descriptions,

Continued from page 43

you can add and subtract numbers in db when computing a system, and the numbers stay small. Otherwise, you would have to divide or multiply at each step, and your computations would involve large, complex numbers.

CALCULATING GAIN IN MATV SYSTEMS

Since the data for calculating voltage amplification, voltage gain and power amplification is readily available, all you have to do is plug the values into the formulas.

The formulas to determine true amplification or gain of RF amplifiers and preamps with 300 or 75Ω input and output impedances are:

(1) Voltage Amplification (Av)= E out/E in

(2) Voltage Gain or Power in db=dbmv out - dbmv in

(3) Power Amplification (Av)= Antilog (.1 [dbmv out - dbmv in]).

Remember that stage gain measurements made with very small input signals may yield results different from those you might get with a larger input signal. This is because of amplifier efficiency characteristics.

To determine voltage amplification (Av) in a typical MATV installation using the above formulas, we will assume that your measured input signal (E in) was 1000μv and the output signal (E out) was 2000μv. According to the formula, Av=2000μv/1000μv=2.

Voltage gain and power gain are easily computed from a reading in db. Going back a little, we indicated that a 2 times amplification was equal to 6db. From formula (1) we found that the voltage amplification was 2, or 6db. Therefore, formula (2) tells us that voltage or power gain is dbmv out - dbmv in. Plugging in our values, 6db (dbmv out) - 0db (dbmv in) = 6db.

To determine power amplification we will again assume that the input signal was 0db and the output signal was 6db. From the formula Power Amplification (Av) = Antilog (.1 [6dbmv - 0dbmv])=Antilog = (.1 [6]) = 4. In this formula, .1 times 6 = .6. To find the Antilog of .6 you will have to consult a table of common logarithms. The table indicates that the Antilog of .6 is approximately 3.98 which is rounded off to 4.

If the input impedance (Zin) of the device you are measuring is approximately equal to the output impedance (Zout), but not equal to 75 or 300Ω, amplification measurements (either power or voltage) will be reasonably accurate, although the actual dbmv or μv meter indications will be in error. When Zout is not equal to Zin, the presence of a signal can be detected, but determination of gain would require a knowledge of the circuit and the signal strength meter.

A porcelain isolation/coupling capacitor may be used between the probe tip and the test point to reduce the effects of circuit loading by the SSM. A typical low-capacity probe is shown in Fig. 7. A low-capacity probe is

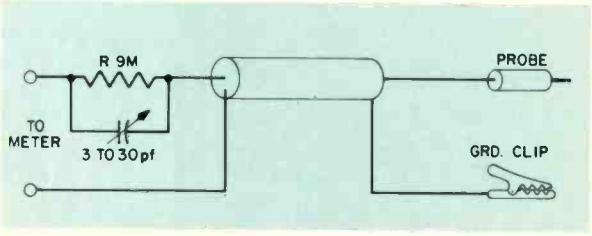


Fig. 7--Schematic diagram of low capacity probe which can be used to reduce circuit loading.

generally designed with a 10 to 1 attenuation factor, so if the meter has an input impedance of 1MΩ, a 9MΩ resistor will provide the 10 to 1 ratio.

The trimmer capacitor is used to compensate for frequency response. As a rule of thumb, the trimmer is selected so that its reactance at the test frequency is equal to ten times the lower of the two impedances (Zout and Zin) of the equipment under test. Actual dbmv and μv readings will be off. But with this technique it is generally possible to make relative gain checks without fear of circuit detuning, overloading or upsetting AGC bias.

SIGNAL TRACING TV FRONT ENDS

Signal tracing essentially has the same objective as the stage gain measurements previously described. The main difference is that signal tracing does not normally require specific gain computation but concerns itself with the presence or absence of a signal and its relative gain or loss in a passive device. Fig. 8 shows a block diagram of a typical TV RF section. The troubleshooting procedure should provide you with some helpful techniques that can be used in the shop or the customer's home.

First, tune the SSM and TV receiver to a given channel. Then check the signal level at the tuner input (antenna terminals). For an accurate reading, connect the downlead directly to the SSM. The minimum acceptable reading should be close to 1000μv or

illustrations and prices are included. Alco.

Semiconductors 412

A 64-page transistor and diode catalog lists a complete line of semiconductor discrete devices. The catalog presents key parameters and package outline dimensions along with a numerical index that quickly locates the device of interest. The listings are grouped by applications for the reader's convenience. They include diodes, small signal transistors, dual transistors, Field Effect Transistors, power transistors, communication devices, silicon-controlled rectifiers, specialty diode products and electro-optical devices. Fairchild.

Microphones 413

A 20-page catalog describes a line of microphones, including several recently developed models. Included in the catalog are professional cardioid dynamic, mobile and transistorized mobile, base station, paging, public address and tape recording microphones, plus microphone cartridges, stands and accessories. The publication includes technical sections and product descriptions, specifications, photographs and list prices on each microphone. Turner.

Tape Recorder 414

A new 16-page illustrated catalog describes the portable cassette and reel-to-reel models, cassette, 8-tract and reel-to-reel tape decks, Radiocorders and stereo tape systems. Applications, features and specifications of the complete line are included in the tape recorder catalog. Concord.

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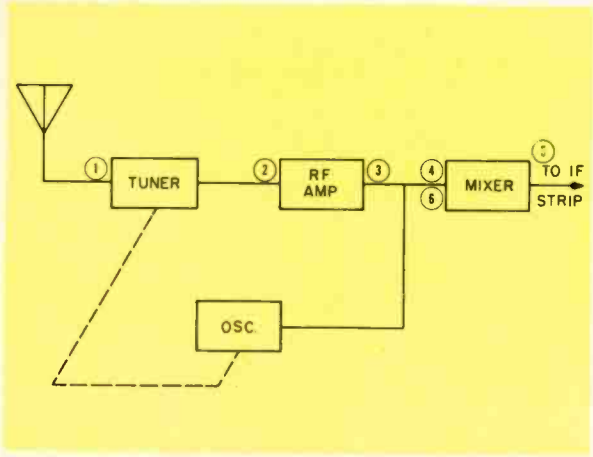

Fig. 8--Block diagram of typical TV RF section.

Odbmv. If this is satisfactory, reconnect the antenna to the antenna terminals and again check the input signal level. This time use the test probe assembly (impedance mismatch may result in a lower reading).

Note the reading across the antenna terminals, then move the probe to the grid (or base) of the RF amplifier. A standard tube t st-adapter socket will provide access to the tube pins if necessary. The probe readings at the antenna terminals and the RF grid are normally within 25 percent of each other. The reading at the grid will be lower because of circuit detuning by the tube adaptor.

Lack of signal at the RF grid would indicate a problem in the antenna balun (RF transformer), coupling capacitors or the appropriate section of the tuning switch assembly.

Next, check the collector or plate (if cascade stage, check output plate) signal. This reading should show a higher reading than that measured at the grid. A relatively strong signal indicates satisfactory interstage coupling (via the tuner). The signal should also be detected at the mixer plate (although a nonlinear device, the mixer's component input frequencies will be present at the output).

The mixer grid can then be checked for presence of the oscillator injection signal. This may be done by tuning the SSM approximately 41MHz up from the channel center frequency. For example, channel six covers from 82 to 88MHz. Channel center is 85MHz. Tuning the SSM to about 126MHz should bring in the oscillator signal. If alignment of the tuner is necessary a standard sweep-marker generator and scope should be used. Future articles on the signal strength meter will cover its use in making receiver sensitivity, frequency response, noise figure, signal-to-noise and antenna tests. ■

Color System . . .

Continued from page 51

loscope will tell you if it is the IC or other circuit components which are defective. Also, if the "chip" is defective, incorrect voltage readings at the terminals should reveal if replacement is necessary.

Although the chroma output of the second color amplifier (at the collector) is approximately 6v P-P, the step-down for impedance matching of L34 (2nd color amplifier transformer) to the "chip" input results in approximately 0.75v P-P input to terminals two and three. A power supply input of 24v is applied across terminals one and six. Amplification through the "chip" is greater than 10 times, providing adequate signal amplitude to the color difference amplifier grids. The operation of the "chip" (similar to the switch-type tube operation) is such that the 2nd harmonic (7.2MHz) of the 3.58MHz must be trapped in the output circuit. (The 3.58MHz fundamental is automatically canceled within the "chip.") This is provided by the coils L39, L45 and L51 in the output circuit which provides a high impedance to this frequency (7.2MHz). In addition, these coils also aid in providing the necessary response of the color-difference signals.

The transmission line which couples the color oscillator reference signals to the "chip" is similar to other color chassis.
However, the phase of the signals at various take-off points is slightly different and component values also differ. It should be noted that the values of components are rather critical and although failure of any one is unlikely, the exact replacement should be made when necessary. When servicing these "chip" circuits, do not substitute or use components that are only "close" in value.

The hue control is connected to the transmission line so that only the injection signals to the "chip" are affected. The AFC and ACC reference signal are unaffected.

A small capacitor (.39pf) is connected from one of the chroma inputs of the demodulator to the AFC phase detector. This capacitor provides a feedback of the burst signal from the AFC phase detector which eliminates any tendency toward 3.58MHz radiation.

The TV technician must become more proficient in troubleshooting these IC's as we will be seeing many more "chips" in electronic products in the near future. ■

ET/D BOOK REVIEWS

SERVICING THE SOLID STATE CHASSIS *by Homer L. Davidson. Published by TAB Books, Inc., 256 pages, 200 illustrations. $7.95 hardbound, $4.95 paperbound.*

This book discusses a number of solid state equipments including TV, pocket radios, ac-dc, AM-FM, auto and multi-band receivers. It also covers auto tape players, phonographs, tape recorders and stereo amplifiers. These subjects fill all but two of the 12 chapters. A preliminary chapter on general transistor testing and the ending chapter on troubleshooting tips round it out. The chapters are all complete in their particular analysis of circuit problems and they are backed up with appropriate schematics, diagrams and waveforms. In most cases the writer attempts to provide a general view of the circuit then plugs in circuit defects with typical causes and cures. The troubleshooting procedures are for the most part sound, but in a few instances they include some very general and broad statements. However, the service technician who finds his labors divided among a variety of solid state equipments will appreciate much of the knowledge and technique this book provides.

Colorfax . . .

Continued from page 75

voltage. Possible Cause: Open vertical fuse resistor, R2(H). The fuse is located on convergence panel door. Procedure: Use voltmeter to check for 95v at both terminals of the resistor. Do not jumper fuse terminals. If resistor is open, check for a short at the load end. Suspect a shorted vertical transistor. See illustration for details on how this open resistor causes loss of high voltage. Analysis: The fuse resistor protects the vertical output transformer and associated parts should the transistor short. A 40v supply (was 26-28v in previous models) is secured from this circuit through R10J at terminal J2-3. This 40v supplies the horizontal driver stage. Thus, if the fuse opens, there will be no raster because of no high voltage. The fuse not only protects the vertical output transformer, but it avoids a horizontal line if the vertical transistor shorts and blows the fuse.

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ET/D AD INDEX

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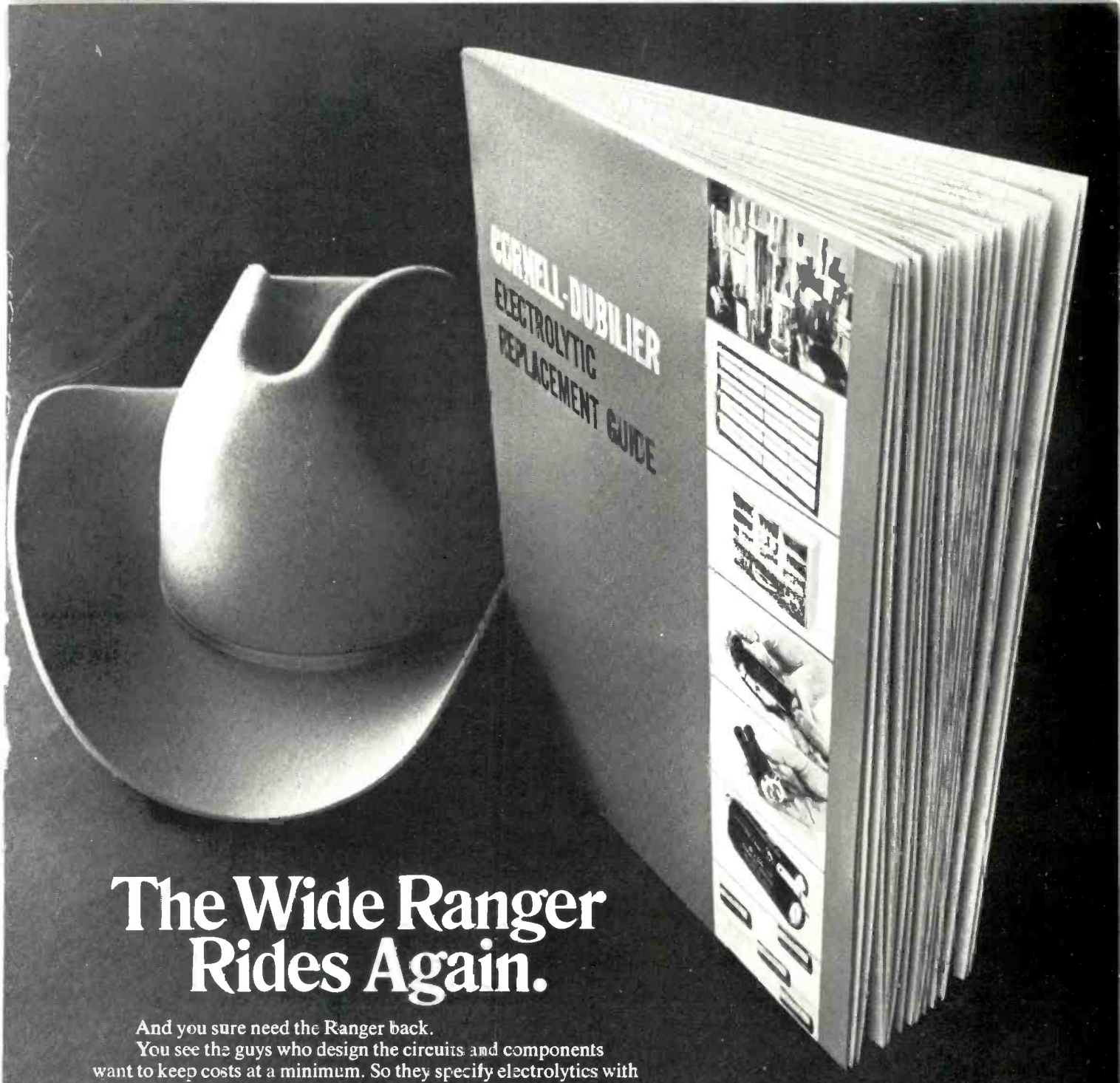

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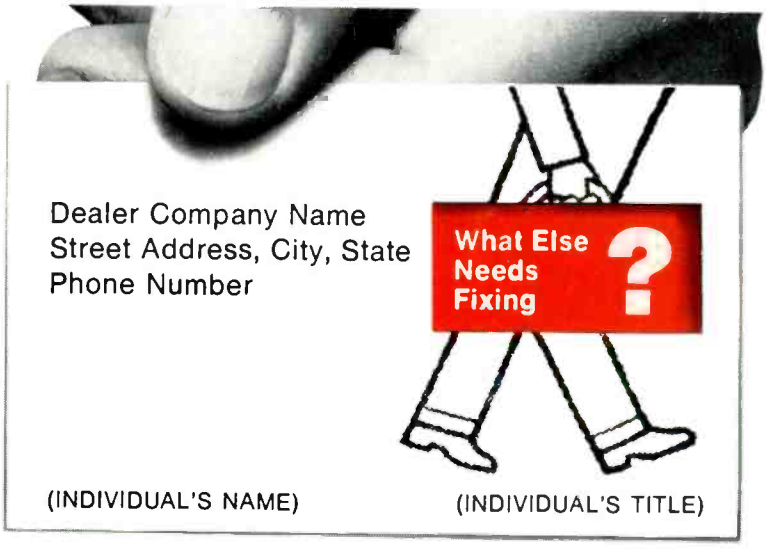

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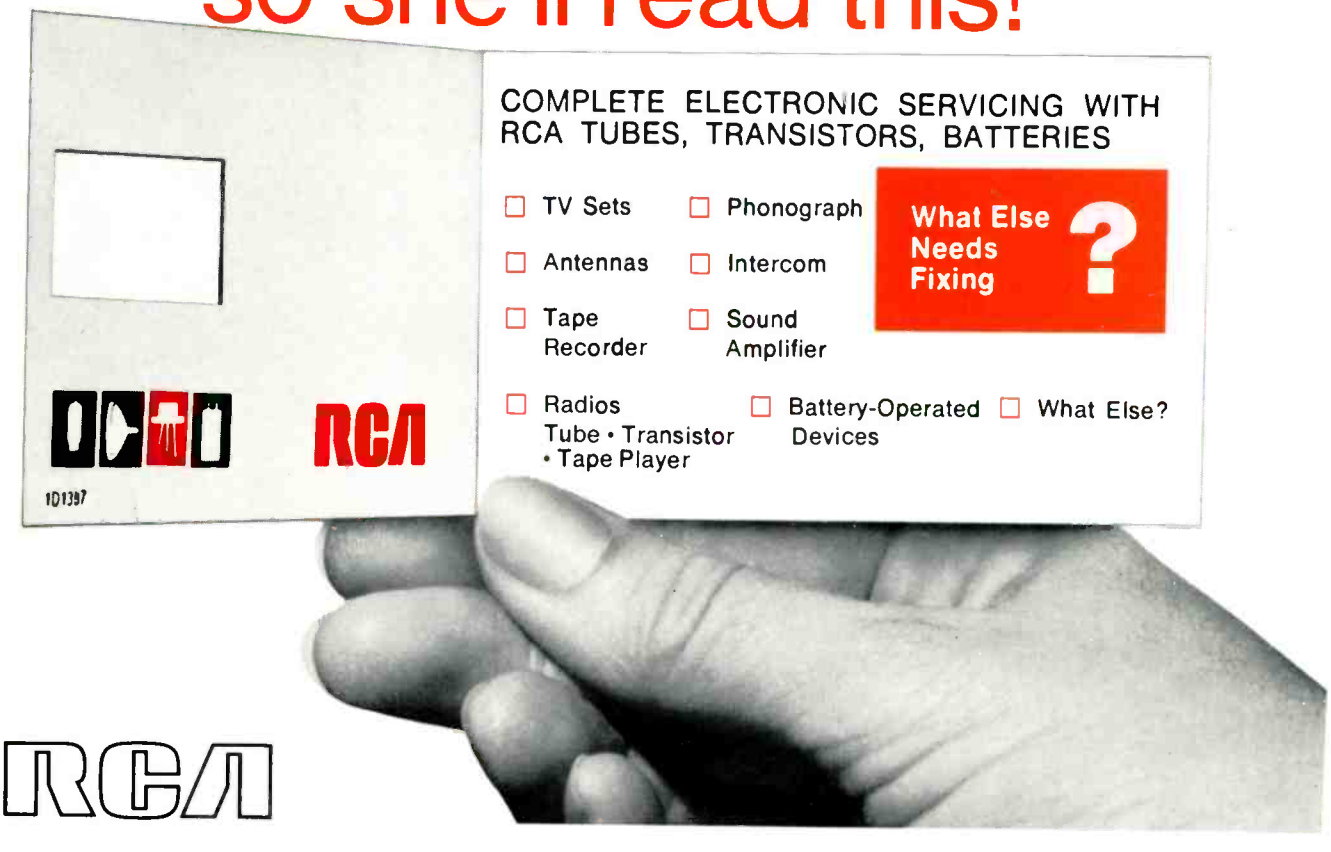

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