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ELECTRONIC TECHNICIAN/DEALER

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Chicago, Illinois 60613

Model 415:
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ELECTRONIC TECHNICIAN/DEALER

TEKFAX

COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 5 NEW SETS

GROUP 233

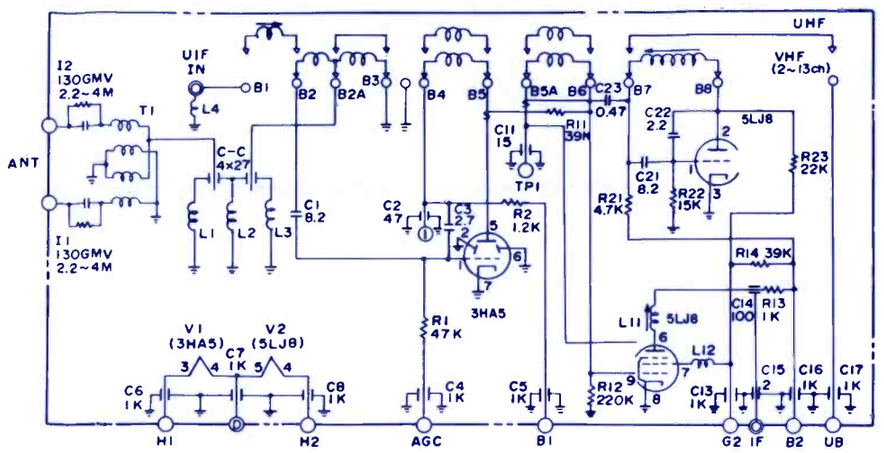
	SCHEMATIC NO.		SCHEMATIC NO.
GENERAL ELECTRIC TV Chassis U-1	1398	PHILCO-FORD Color TV Chassis 22QT79	1396
MAGNAVOX TV Chassis T961 Series	1394	ZENITH Color TV Chassis 19CC19	1397
MOTOROLA Color TV Chassis TS-938 Series	1395		

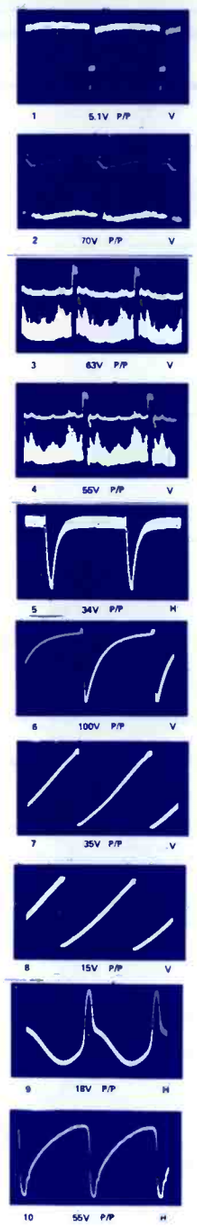
1394

MAGNAVOX
TV Chassis
T961 Series

JANUARY • 1972

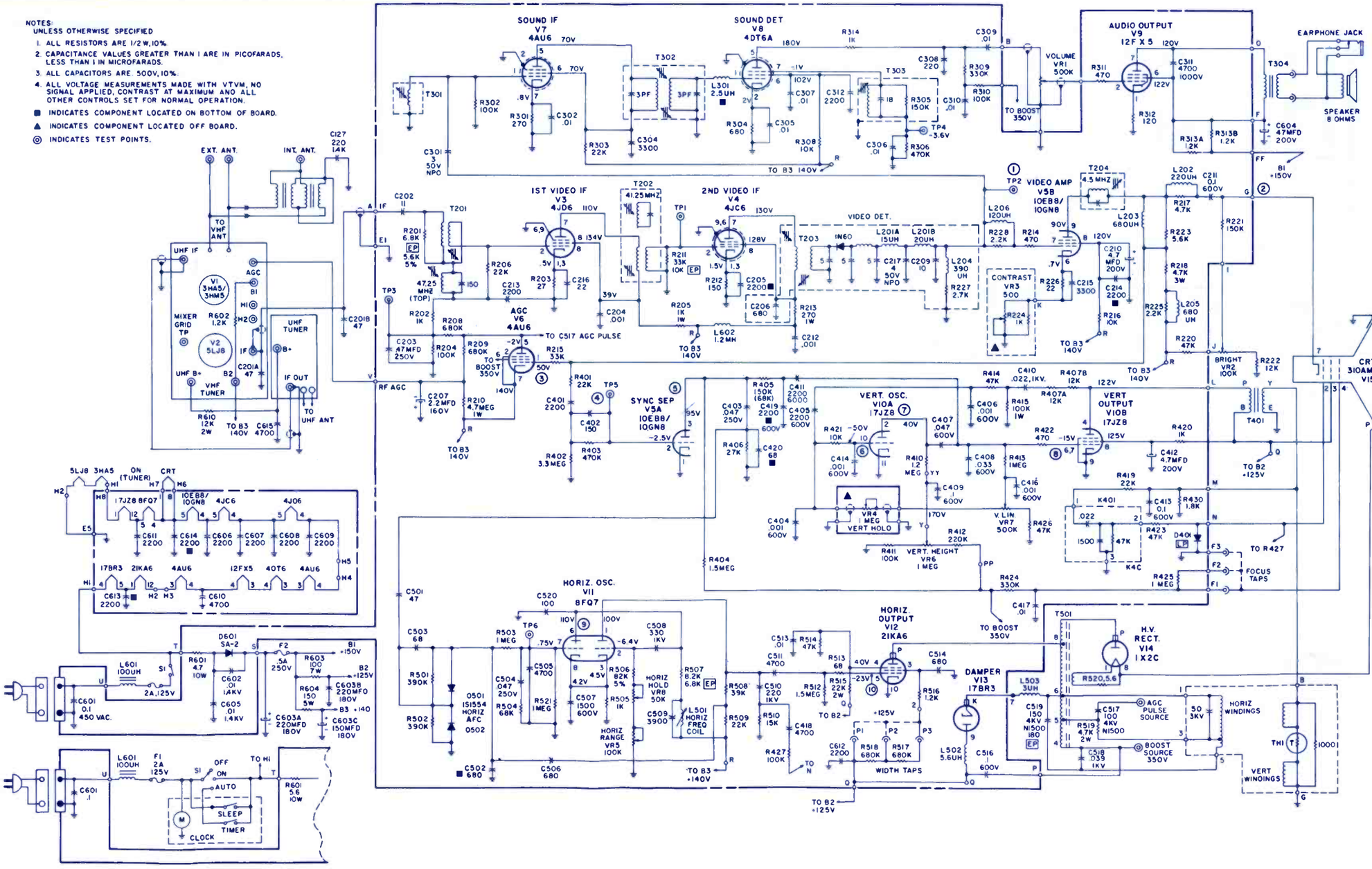
VHF TUNER SCHEMATIC





NOTES:
UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE 1/2W, 10%.
2. CAPACITANCE VALUES GREATER THAN 1 ARE IN PICOFARADS, LESS THAN 1 IN MICROFARADS.
3. ALL CAPACITORS ARE 500V, 10%.
4. ALL VOLTAGE MEASUREMENTS MADE WITH VTVM, NO SIGNAL APPLIED, CONTRAST AT MAXIMUM AND ALL OTHER CONTROLS SET FOR NORMAL OPERATION.

■ INDICATES COMPONENT LOCATED ON BOTTOM OF BOARD.
▲ INDICATES COMPONENT LOCATED OFF BOARD.
◎ INDICATES TEST POINTS.



1395
MOTOROLA
Color TV Chassis
TS-938 Series

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COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR 5 NEW SETS

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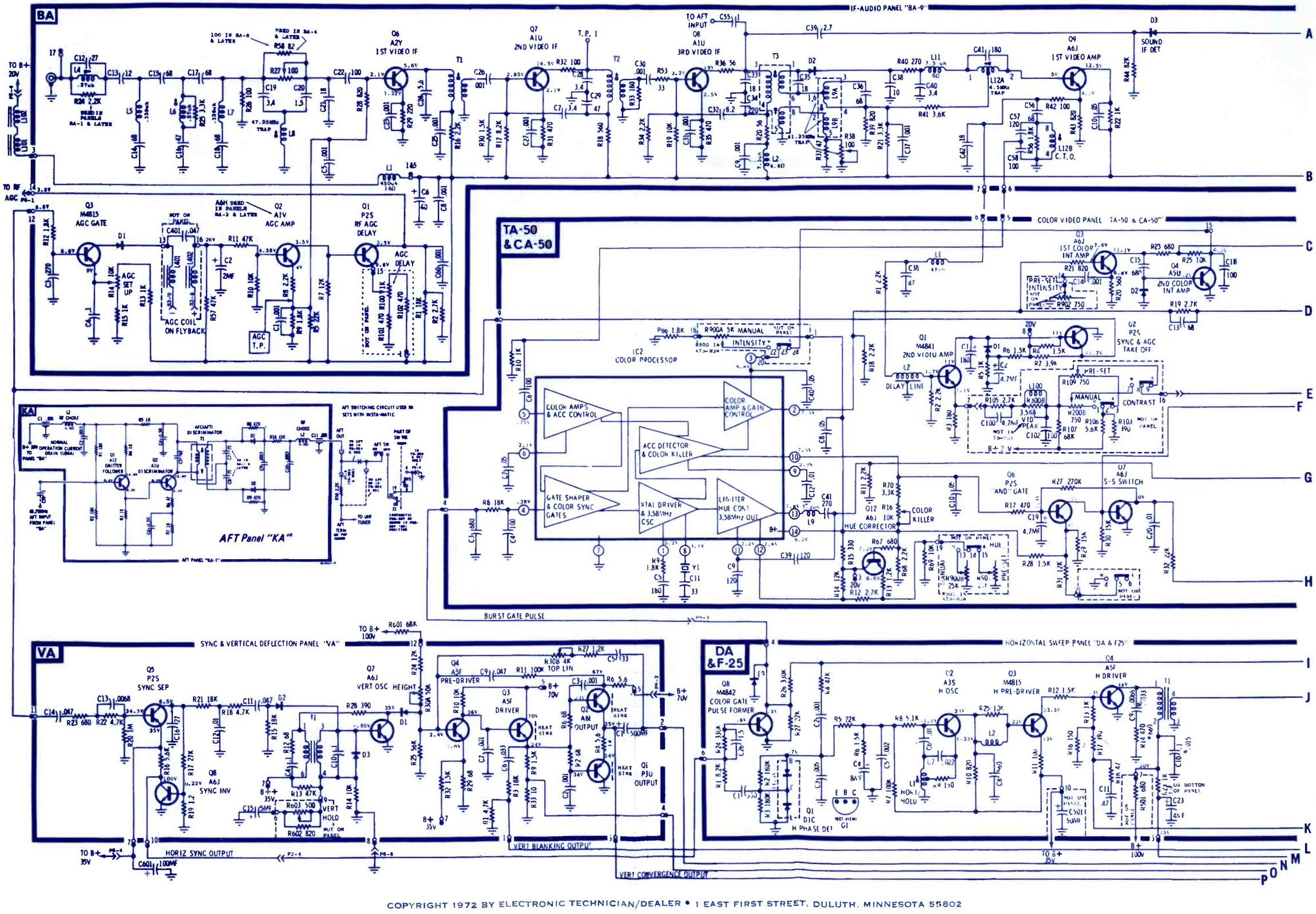
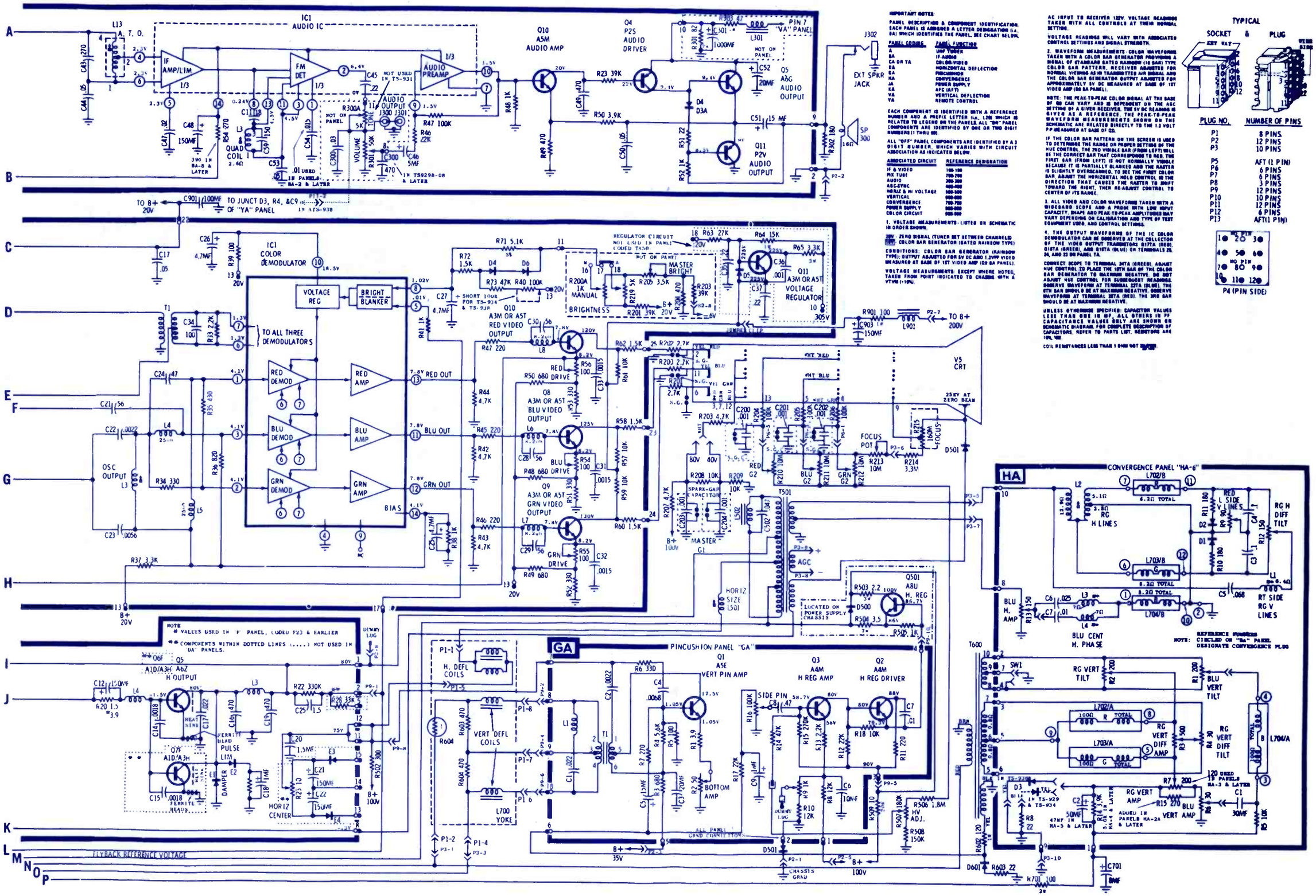


MOTOROLA
Color TV Chassis
TS-938 Series



IMPORTANT NOTES:

PANEL DESCRIPTION & COMPONENT IDENTIFICATION. EACH PANEL IS ASSIGNED A LETTER DESIGNATION (i.e., BA) WHICH IDENTIFIES THE PANEL. SEE CHART BELOW.

PANEL CODING	PANEL FUNCTION
A	UHF TUNER
BA	IF-AUDIO
CA OR TA	COLOR-VIDEO
DA	HORIZONTAL DEFLECTION
GA	PINCUSHION
HA	CONVERGENCE
JA	POWER SUPPLY
KA	AFC (AFT)
VA	VERTICAL DEFLECTION
YA	REMOTE CONTROL

EACH COMPONENT IS IDENTIFIED WITH A REFERENCE NUMBER AND A PREFIX LETTER (i.e., L28) WHICH IS RELATED TO LEGEND ON THE PANELS. ALL "BA" PANEL COMPONENTS ARE IDENTIFIED BY ONE OR TWO DIGIT NUMBERS (1 THRU 99).

ALL "OFF" PANEL COMPONENTS ARE IDENTIFIED BY A 3 DIGIT NUMBER, WHICH VARIES WITH CIRCUIT ASSOCIATION AS INDICATED BELOW.

ASSOCIATED CIRCUIT	REFERENCE DESIGNATION
IF & VIDEO	100-199
PIX TUBE	700-799
AUDIO	300-399
ABC-SYNC	400-499
HORIZ & HI VOLTAGE	500-599
VERTICAL	600-699
CONVERGENCE	700-799
POWER SUPPLY	800-899
COLOR CIRCUIT	900-999

1. VOLTAGE MEASUREMENTS LISTED ON SCHEMATIC IN ORDER SHOWN.

20V ZERO SIGNAL (TUNER SET BETWEEN CHANNELS 13-14) COLOR BAR GENERATOR (GATED RAINBOW TYPE)

CONDITIONS: COLOR BAR GENERATOR (RAINBOW TYPE); OUTPUT ADJUSTED FOR 5V DC AND 1.2VPP VIDEO MEASURED AT BASE OF 1ST VIDEO AMP (Q8 BA PANEL).

VOLTAGE MEASUREMENTS: EXCEPT WHERE NOTED, TAKEN FROM POINT INDICATED TO CHASSIS WITH A VTVM (+10%).

AC INPUT TO RECEIVER 122V. VOLTAGE READINGS TAKEN WITH ALL CONTROLS AT THEIR NORMAL SETTING.

VOLTAGE READINGS WILL VARY WITH ASSOCIATED CONTROL SETTINGS AND SIGNAL STRENGTH.

2. WAVEFORM MEASUREMENTS: COLOR WAVEFORMS TAKEN WITH A COLOR BAR GENERATOR PROVIDING A SIGNAL OF STANDARD GATED RAINBOW (10 BAR) TYPE COLOR BAR PATTERN, RECEIVER ADJUSTED FOR NORMAL VIEWING AS IS TRANSMITTED AIR SIGNAL AND THE COLOR BAR GENERATOR OUTPUT ADJUSTED FOR APPROXIMATELY 5V DC MEASURED AT BASE OF 1ST VIDEO AMP (Q8 BA PANEL).

NOTE: THE PEAK-TO-PEAK COLOR SIGNAL AT THE BASE OF Q8 CAN VARY AND IS DEPENDENT ON THE AGC SETTING OF A GIVEN RECEIVER. THE 5V DC READING IS GIVEN AS A REFERENCE. THE PEAK-TO-PEAK WAVEFORM MEASUREMENTS SHOWN ON THE SCHEMATIC ARE RELATED DIRECTLY TO THE 1.2 VOLT PP MEASURED AT BASE OF Q8.

IF THE COLOR BAR PATTERN ON THE SCREEN IS USED TO DETERMINE THE RANGE OR PROPER SETTING OF THE HUE CONTROL, THE 2ND VISIBLE BAR (FROM LEFT) WILL BE THE CORRECT BAR THAT CORresponds TO R-Y. THE FIRST BAR (FROM LEFT) IS NOT NORMALLY VISIBLE BECAUSE IT IS PARTIALLY BLANKED AND THE RASTER IS SLIGHTLY OVERSCANNED. TO SEE THE FIRST COLOR BAR, ADJUST THE HORIZONTAL HOLD CONTROL IN THE DIRECTION THAT CAUSES THE RASTER TO SHIFT TOWARD THE RIGHT, THEN READJUST CONTROL TO CENTER OF ITS RANGE.

3. ALL VIDEO AND COLOR WAVEFORMS TAKEN WITH A WIDEBAND SCOPE AND A PROBE WITH LOW INPUT CAPACITY, AND PEAK TO PEAK AMPLITUDES MAY VARY DEPENDING ON CALIBRATION AND TYPE OF TEST EQUIPMENT USED, AND CONTROL SETTINGS.

4. THE OUTPUT WAVEFORMS OF THE IC COLOR DEMODULATOR CAN BE OBSERVED AT THE COLLECTOR OF THE VIDEO OUTPUT TRANSISTORS Q17A (RED), Q16TA (GREEN), AND Q15TA (BLUE) OR TERMINALS 23, 24, AND 22 ON PANEL TA.

CONNECT SCOPE TO TERMINAL 24TA (GREEN). ADJUST HUE CONTROL TO PLACE THE 10TH BAR OF THE COLOR BAR GENERATOR TO MAXIMUM NEGATIVE. DO NOT ADJUST HUE CONTROL FOR SUBSEQUENT READINGS. OBSERVE WAVEFORM AT TERMINAL 22TA (BLUE). THE 6TH BAR SHOULD BE AT MAXIMUM NEGATIVE. OBSERVE WAVEFORM AT TERMINAL 23TA (RED). THE 3RD BAR SHOULD BE AT MAXIMUM NEGATIVE.

UNLESS OTHERWISE SPECIFIED: CAPACITOR VALUES LESS THAN ONE (1) MF, ALL OTHERS IN PF. CAPACITANCE VALUES ONLY ARE SHOWN ON SCHEMATIC DIAGRAM. FOR COMPLETE DESCRIPTION OF CAPACITORS, REFER TO PARTS LIST. RESISTORS ARE 10%, 1W.

COIL RESISTANCES LESS THAN 1 OHM NOT SHOWN.

TYPICAL SOCKET & PLUG

PLUG NO.	NUMBER OF PINS
P1	8 PINS
P2	12 PINS
P3	10 PINS
P5	AFT (1 PIN)
P6	6 PINS
P7	6 PINS
P8	3 PINS
P9	12 PINS
P10	10 PINS
P11	12 PINS
P12	6 PINS
P13	AFT(1 PIN)

1396

PHILCO-FORD

Color TV Chassis
22QT79

JANUARY • 1972

ELECTRONIC TECHNICIAN/DEALER TEKFAX

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 5 NEW SETS

SYMBOL DESCRIPTION	PHILCO-FORD PART NO.
CB200—power, ac	42-2136-10
F201—4a	45-2656-36
CR91—3.58MHz osc	34-8043-5
1C1—Act	46-5002-6
1C91—3.58MHz osc	46-5002-7
L4—1st IF	32-4957-3
L5—2nd IF	32-4957-2
L10—41.25MHz trap	32-4959-8
L41—horiz hold	32-4891-2
L92—sound TO	32-4936-1
L93—sound ratio det	32-4928-1
L94—tint control	32-4112-63
L99—chroma bandpass	32-4929-1
T200—degaussing	33-1376-6
RV55—horiz bias	33-1379-2
SW200—normal service	42-2163-4
T1—audio output xformer	32-10174-1
T2—filter choke xformer	32-10155-1
T3—vert output xformer	32-10157-1
T4—horiz output xformer	32-10130-5
T5—power xformer	32-10154-1
VR1—3K, RF AGC amp emit	33-5628-14
VR91—video drive	33-5632-1
VR92—color killer	33-5628-6
VR93—CRT bias	33-5628-12
VR201—12M, focus adj	33-5631-24
VR202—25K, volume (20QT80)	33-5648-11
VR203—500 Ω, color	33-5648-8
VR204—500 Ω, horiz hold	33-5642-23
VR205—750K, vert hold	33-5642-22
VR207—10 Ω, vert control	33-5609-1
VR208—500 Ω, brightness	33-5642-25
VR209—100 Ω, contrast	33-5642-24
VR211—100K, tone (20QT80)	33-5648-2
tuner, VHF (22QT79/80 LP)	76-14293-1
yoke assy.	76-14236-1

TRANSISTOR VOLTAGES

W/COLOR BAR GEN.

TRANSISTOR	FUNCTION	E	B	C
Q95	BURST AMP	48	0	38
Q96	1ST CHROMA	.17	.90	16.5
Q97	COLOR KILLER	1	1.5	19.5
Q99	BUFF AMP	.65	1.3	17.5
Q100	X DEMOD	1.8	1.44	13
Q101	Z DEMOD	1.8	1.44	12
Q102	2ND CHROMA	.80	1.0	18.5
Q103	BLANKER	.68	-1.6	16.5

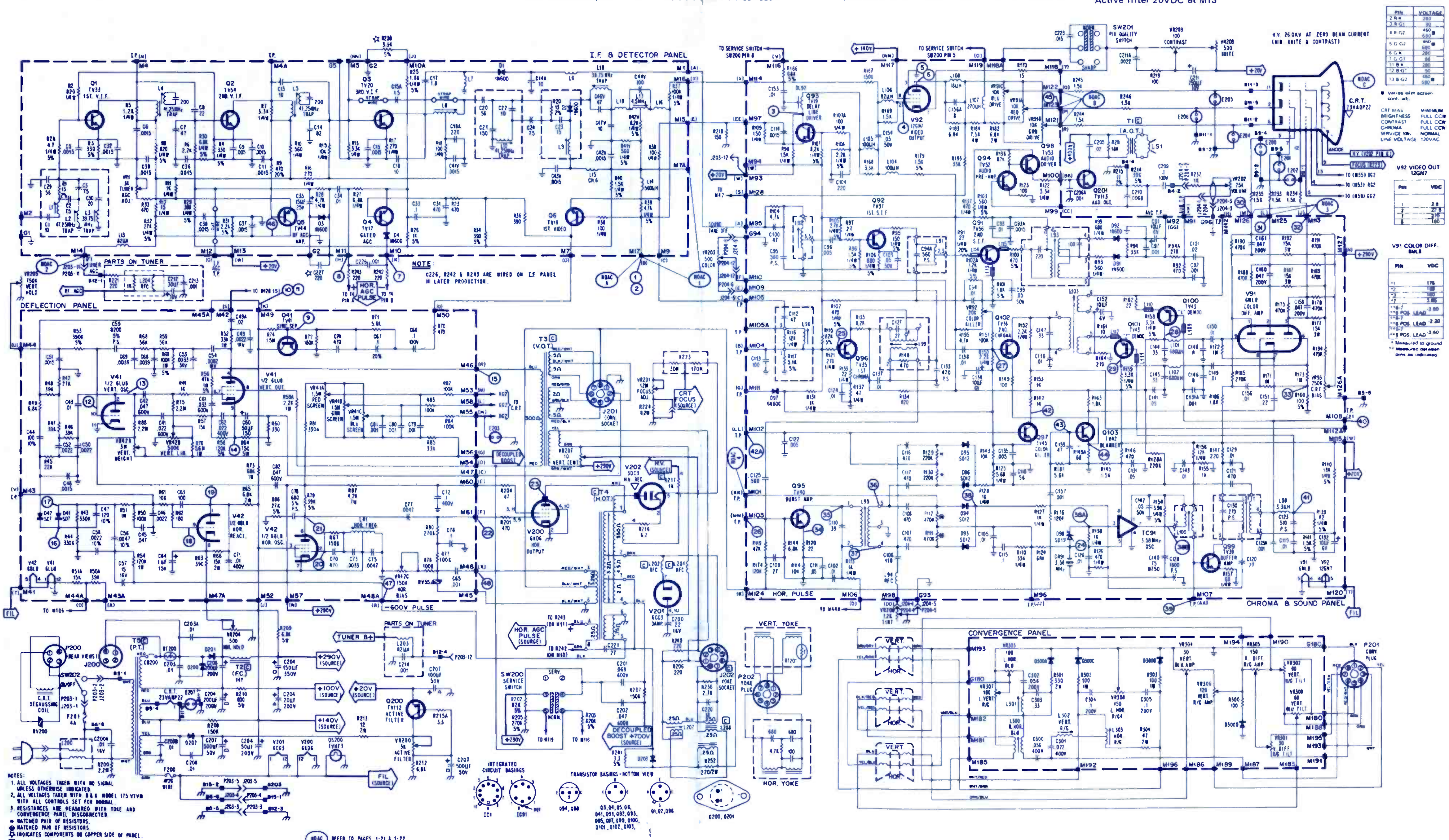
B & K 1245 GEN. set at ch. 4
IF AGC set at mid-range
Approx. 1.6VDC at tuner AGC
SEC. controls set for normal color bar pattern
Color bar gen. color amplitude set for 1.5VDC at M102
B & K meter 175
Line voltage 120VAC
Active filter 20VDC at M13

IC91 3.58 OSC.

W/COLOR BAR GEN.

PIN	VDC
1	11.4
2	-
3	1.5
4	0
5	1.55
6	-
7	11.4
8	12.0

NOTES
CRT BIAS - MIN.
BRIGHTNESS - FULL CCW
CONTRAST - FULL CCW
CHROMA - FULL CCW
SERVICE SW. - NORMAL



NOTES:
1. ALL VOLTAGES TAKEN WITH NO SIGNAL UNLESS OTHERWISE INDICATED.
2. ALL VOLTAGES TAKEN WITH B & K MODEL 175 VTVM WITH ALL CONTROLS SET FOR NORMAL.
3. RESISTANCES ARE MEASURED WITH YOKE AND CONVERGENCE PANEL DISCONNECTED.
✱ MATCHED PAIR OF RESISTORS.
● MATCHED PAIR OF RESISTORS.
☆ INDICATES COMPONENTS ON COPPER SIDE OF PANEL.
Ⓒ CRITICAL SAFETY (REPLACE WITH EXACT SPECIFIED PART AS INDICATED IN PARTS LIST).
▽ CRITICAL SAFETY (REPLACE WITH EXACT SPECIFIED PART AS INDICATED IN PARTS LIST) HIGH VOLTAGE COMPONENT.
(NOAC) REFER TO PAGES 1-21 & 1-22

1398

GENERAL ELECTRIC
TV Chassis U-1

ELECTRONIC TECHNICIAN/DEALER TEKFAX

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 5 NEW SETS

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SYMBOL	DESCRIPTION	GENERAL ELECTRIC PART NO.
R139	control-IF AGC, 2.5K	ES49X60
R147	control-RF AGC, 2.5K triple	ES49X60 ES49X61
R210	85K, height	
R215	16K, vert size	
R218	2K, vert lin	
R232	therm assembly	ES41X5
R233	therm, 650 Ω, 10%	ES14X27
R307	VDR (180-200v)	ES13X3
C403A	300 µf, electro, 175v	ES31X38
C403B	30 µf, electro, 150v	
C403C	300 µf, electro, 150v	
C403D	200 µf, electro, 50v	
L102	coil-41.25MHz trap	ES36X83
L103	coil-47.25MHz trap	EP36X13
L106	coil-44MHz trap	ES36X84
L108	coil-sound take off	ES36X86
L109	coil-4.5MHz trap	ES36X87
L251	coil-horiz osc	ES36X88
	deflection yoke	ES76X6
T101	video detector xformer	ES57X6
T201	vert output xformer	ES64X11
T251	horiz buffer xformer	ES64X12
T252	horiz output xformer	ES77X12
T301	audio output xformer	ES64X13
T401	CRT filament xformer	ES64X10
	fuse 4a, fast blow, pigtail, 250v, (F401)	EP10X52

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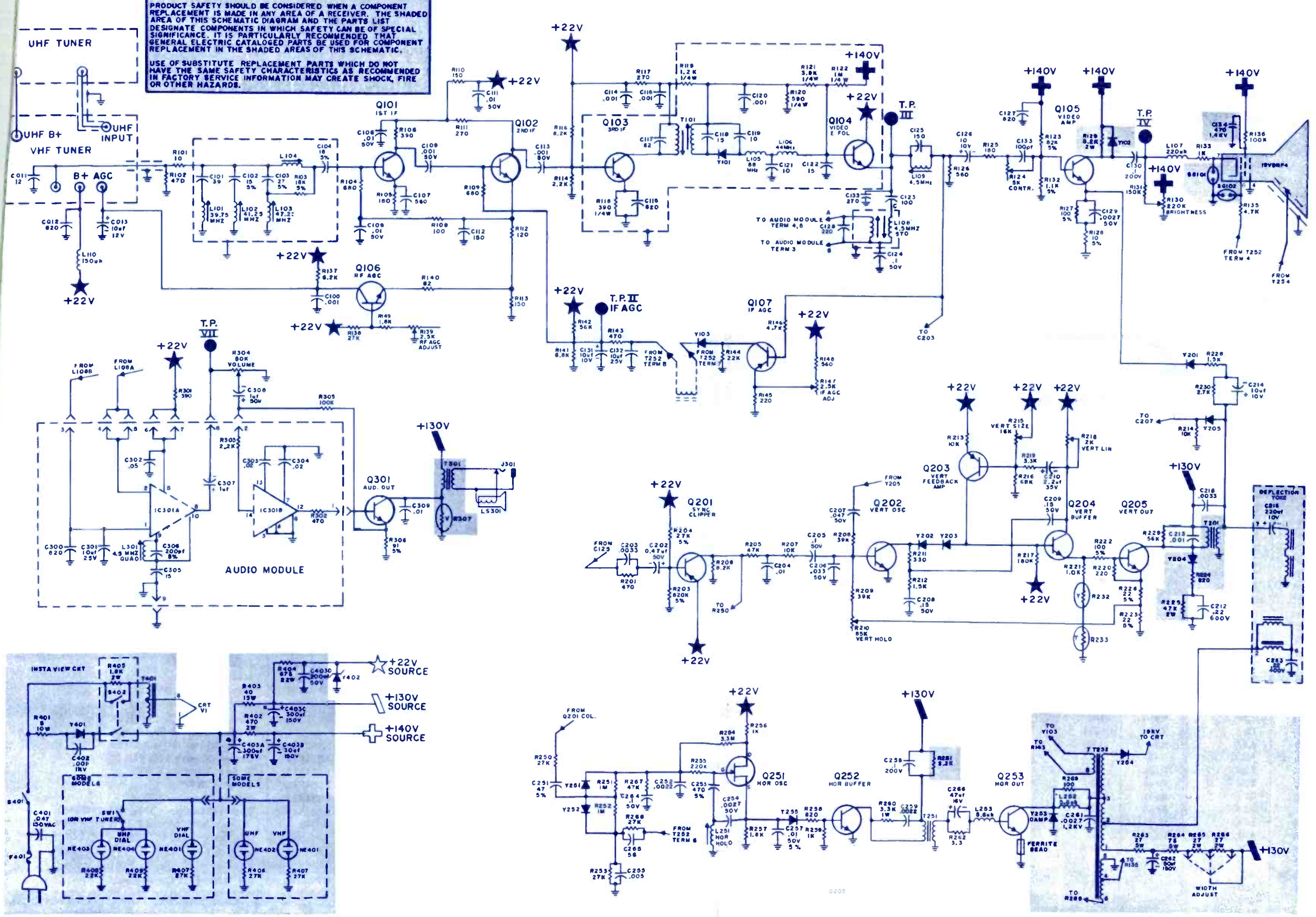
PRODUCT SAFETY NOTICE

PRODUCT SAFETY SHOULD BE CONSIDERED WHEN A COMPONENT REPLACEMENT IS MADE IN ANY AREA OF A RECEIVER. THE SHADED AREA OF THIS SCHEMATIC DIAGRAM AND THE PARTS LIST DESIGNATE COMPONENTS IN WHICH SAFETY CAN BE OF SPECIAL SIGNIFICANCE. IT IS PARTICULARLY RECOMMENDED THAT GENERAL ELECTRIC CATALOGED PARTS BE USED FOR COMPONENT REPLACEMENT IN THE SHADED AREAS OF THIS SCHEMATIC.

USE OF SUBSTITUTE REPLACEMENT PARTS WHICH DO NOT HAVE THE SAME SAFETY CHARACTERISTICS AS RECOMMENDED IN FACTORY SERVICE INFORMATION MAY CREATE SHOCK, FIRE OR OTHER HAZARDS.

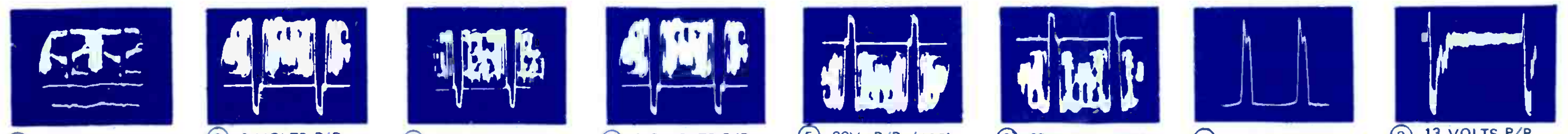


PHILCO-FORD
Color TV Chassis
22QT79

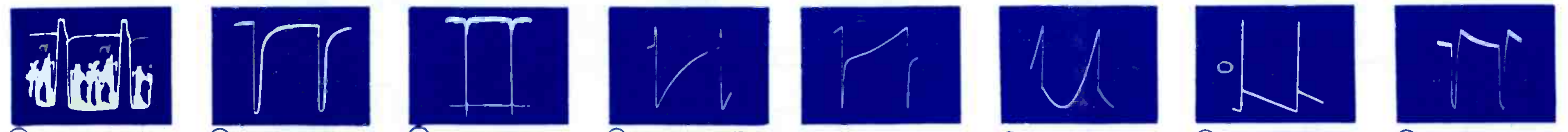
OSCILLOSCOPE WAVEFORM PATTERNS

These waveforms were taken with the receiver AGC control adjusted for an approximate peak-to-peak output of two volts at the video detector, using an air signal. Do not reset AGC control when using color bar generator. All monochrome voltages taken with average air signal and all chroma voltages taken with a color bar generator connected to the antenna input terminals. The chroma peak-to-peak voltages were taken with the chroma control set for 0.3V peak-to-peak at center tap of chrome control or M110 and the tint control set for proper color bars (approximately mid-range), all other controls set for normal viewing. The frequencies shown are those of the waveforms.....not the sweep rate of the oscilloscope. All voltages taken with a wide band scope having a 5MHz bandwidth similar to B&K Model 1450. Line voltage, 120V.

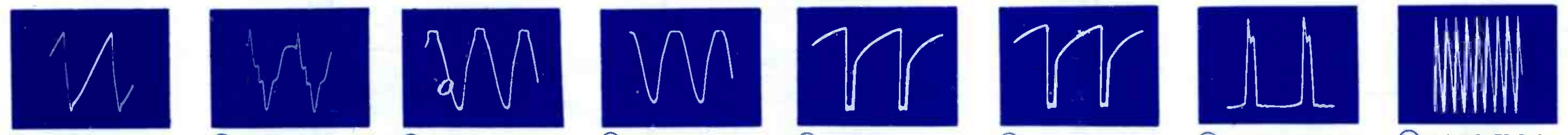
LINE VOLTAGE - 120 VAC
AIR SIGNAL - FOR MONOCHROME SIGNALS
COLOR BAR GEN. - B&K 1245 - FOR COLOR SIGNALS
ACTIVE FILTER AT 20 VDC



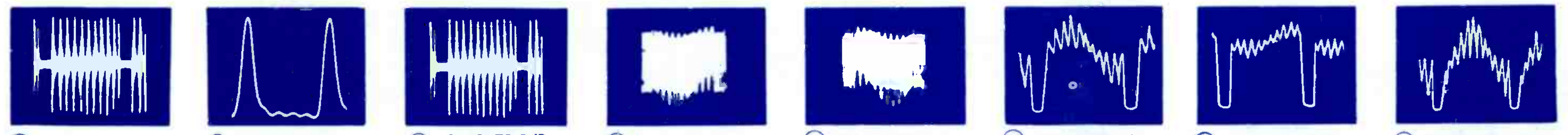
(1) 2 VOLTS P/P, 60 HZ (MAX. CONTRAST) M17
(2) 2 VOLTS P/P, 15,750 HZ (MAX. CONTRAST) M17
(3) 4.2 VOLTS P/P, 15,750 HZ Q93 COLL.
(4) 3.8 VOLTS P/P, 15,750 HZ PIN 2 V92
(5) 80V, P/P, (cont. at point of start of sync compression) 15,750 HZ Pin 7 V92
(6) 65V, P/P, (MIN. CON.) 15,750 HZ PIN 7 V92
(7) 40 VOLTS P/P, 15,750 HZ M10
(8) 13 VOLTS P/P, 15,750 HZ M11



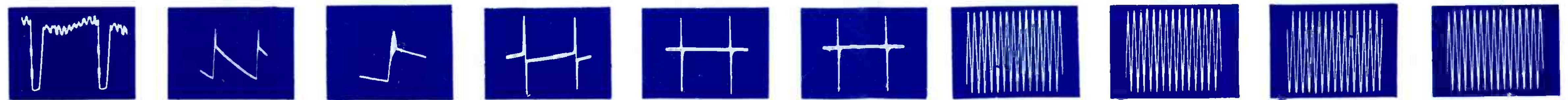
(9) 6.6 VOLTS P/P, 15,750 HZ BASE OF Q41
(10) 50 VOLTS P/P, 15,750 HZ M49
(11) 50 VOLTS P/P 60 HZ M49
(12) 85 VOLTS P/P, 60 HZ PIN 10 V41
(13) 110 VOLTS P/P, 60 HZ PIN 2, 6, 7
(14) 10 VOLTS P/P, 60 HZ PIN 9 V41
(15) 1KV VOLTS P/P, 60 HZ (SPIKE) 200 VOLTS P/P, 60 HZ (SAWTOOTH) M46, OR PIN 4 V41
(16) 12 VOLTS P/P, 15,750 HZ D41, D42



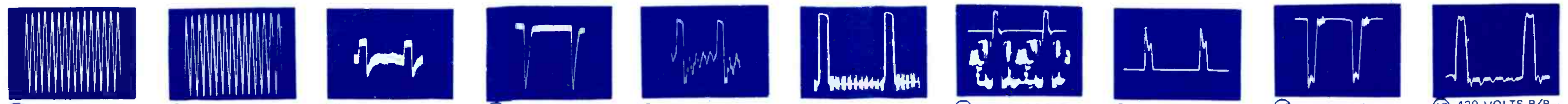
(17) 16 VOLTS P/P, 15,750 HZ D41 TOP END
(18) 6 VOLTS P/P, 15,750 HZ PIN 9 V42
(19) 45 VOLTS P/P, 15,750 HZ PIN 1 V42
(20) 150 VOLTS P/P, 15,750 HZ PIN 2 V42
(21) 200 VOLTS P/P, 15,750 HZ PIN 6 V42
(22) 200 VOLTS P/P, 15,750 HZ M61
(23) 15,750 HZ LOOSE COUPLED V200 PLATE
(24) 4.0 VOLTS P/P, 3.58 MHZ CR91, D98 & C124



(25) 0.1 VOLTS P/P, ± .05 15,750 HZ Q96 BASE
(26) 5.5 VOLTS P/P, 15,750 HZ M103
(27) .3 VOLTS P/P, 15,750 HZ Q102 BASE R150, R151
(28) 7 VOLTS P/P, 15,750 HZ Q100 COLL.
(29) 8.5 VOLTS P/P, 15,750 HZ Q101 COLL.
(30) 45 VOLTS P/P, (CHROMA) 70V P/P, (SYNC) 15,750 HZ M126
(31) 17 VOLTS P/P, (CHROMA) 70V. P/P, (SYNC) M125
(32) 50 VOLTS P/P, (CHROMA) 70V. P/P, (SYNC) M113



(33) 2 VOLTS P/P, (CHROMA) 25V. P/P, (SYNC) R160, R173 PIN 7 V91
(34) 0.7 VOLTS P/P, 15,750 HZ Q95 EMIT
(34A) EXPLODED VIEW OF BURST OF VIEW 34
(35) 70 VOLTS P/P, 15,750 HZ Q95 COLL.
(36) 12 VOLTS P/P, 15,750 HZ PIN 5 L95
(37) 12 VOLTS P/P, 15,750 HZ PIN 4 L95
(38) 6 VOLTS P/P, 3.58MHZ D93, D94
(38A) 0.8 VOLTS P/P, 3.58MHZ PIN 3 IC91
(38B) 16 VOLTS P/P, 3.58MHZ PIN 7 IC91
(39) 1.6 VOLTS P/P, 3.58MHZ M107



(40) 1.0 VOLTS P/P, 3.58MHZ PIN 4 L97 OR M108
(41) 1.0 VOLTS P/P, 3.58MHZ L98-R139
(42) 55 VOLTS P/P, 60 HZ Q97 COLL.
(42A) 0.85 VOLTS P/P 60 HZ M102
(43) 12 VOLTS P/P, 15,750 HZ Q103 BASE
(44) 3.5 VOLTS P/P, 17,500 HZ Q103 EMIT.
(45) 90 VOLTS P/P, 15,750 HZ, CONT SET JUST BELOW POINT OF SYNC COMPRESSION M123
(46) 30 VOLTS P/P, 15,750 HZ Q5 COLL.
(47) 660 VOLTS P/P, 15,750 HZ M45
(48) 420 VOLTS P/P, 15,750 HZ M48

TRANSISTOR RESISTANCES

Resistance measurements of transistors in circuit (power off) yoke & convergence not connected. All measurements are in ohms and taken with B & K Model 120 VOM with allowable tolerance ±20%. DC polarity switch in "REV" position. Transistor measurements (use X100 scale).

TRANS.	FUNCTION	E TO GRD.	B TO GRD.	C TO GRD.	C TO E + − (− +)	C TO B + − (− +)	B TO E + − (− +)
Q1	1ST V.I.F.	330	1180	1100	1460 (1250)	2300 (1500)	1500 (1500)
Q2	2ND V.I.F.	330	2100	1050	1400 (1350)	6.5K (1785)	1.8K (5.6K)
Q3	3RD V.I.F.	270	1700	675	950 (950)	3.1K (1.5K)	1.6K (3K)
Q4	GATED AGC	1100	1175	35K	35K (2K)	39K (1.4K)	1.4K (1.9K)
Q5	RF AGC	360	1500	1630	1875 (2.5K)	1.7K (3.6K)	1650 (1450)
Q8	1ST VIDEO	250	1K	1080	1.3K (1.3K)	4.5K (1.3K)	1.2K (4K)
Q41	SYNC SEP.	0	1475	25K	25K (22K)	190K (1360)	1450 *(170K)
Q91	2ND S.I.F.	1.8K	460	1360	3.1K (3.3K)	1.5K (1.3K)	1.5K (2.4K)
Q92	1ST S.I.F.	880	1K	800	1375 (1375)	1575 (1375)	1560 (1.8K)
Q93	DELAY & DRIVER	300	1475	1030	1360 (1360)	3K (1.4K)	1425 (2.3K)
Q94	AUD. PRE AMP	100	1725	2800	3K (18K)	*50K (1.5K)	1550 (42K)
Q95	BURST AMP	10K	4.5K	13K	9K (16K)	20K (1460)	1.5K (18K)
Q96	1ST CHROMA	65	1.9K	1050	1125 (1100)	4.6K (1725)	1825 (3.6K)
Q97	COLOR KILLER	2.9K	3.2K	1360	6K (4.4K)	*220K (1.4K)	1.5K *20K
Q98	AUD. DRIVER	6K	2.8K	780	3.2K (7K)	19K (1.5K)	1560 (30K)
Q99	BUFF AMP	75	1175	450	550 (560)	1.4K (1360)	1125 (1125)
Q100	X DEMOD	470	1.2K	1460	4K (1.8K)	5K (1.3K)	1.3K (1950)
Q101	Z DEMOD	480	1.2K	3.6K	4K (2K)	4.8K (1.3K)	1375 (1950)
Q102	2ND CHROMA	182	2K	1360	1580 (1660)	10K (1725)	1750 (8.2K)
Q103	BLANK	82	1800	2750	2.8K (2K)	8K (1660)	1.7K (5.5K)
Q201	AUD. OUTPUT	18	1.3K	28K	28K (3.4K)	*40K (1.1M)	1250 (10K)
Q200	ACTIVE FILTER	245	1360	3.4K	3K (1450)	3.3K (1060)	1100 (3.4K)

*RX10000
RX100

TUBE RESISTANCES

TUBE	FUNCTION	1	2	3	4	5	6	7	8	9	10	11	12
V41	VERT. OUT/OSC	F	*3.75M	—	17K	—	*2.5M	*2.5M	20K	1.6K	*800K	0	F
V42	HORZ. OSC/REACT	10K	*1.65M	12K	F	F	50K	0	580	*1.4M			
V91	COLOR DIFF. AMP.	30K	30K	30K	F	F	1.1M	150	*1.1M	*950K			
V92	VIDEO OUTPUT	700	*28K	700	F	F	F	22K	12K	725			
V200	HORZ. OUTPUT	0	0	20K	0	*900K	—	—	—	*900K	0	20K	0
V201	DAMPER	0	—	—	18K	—	—	*800K	—	—	18K	—	0

*RX1000

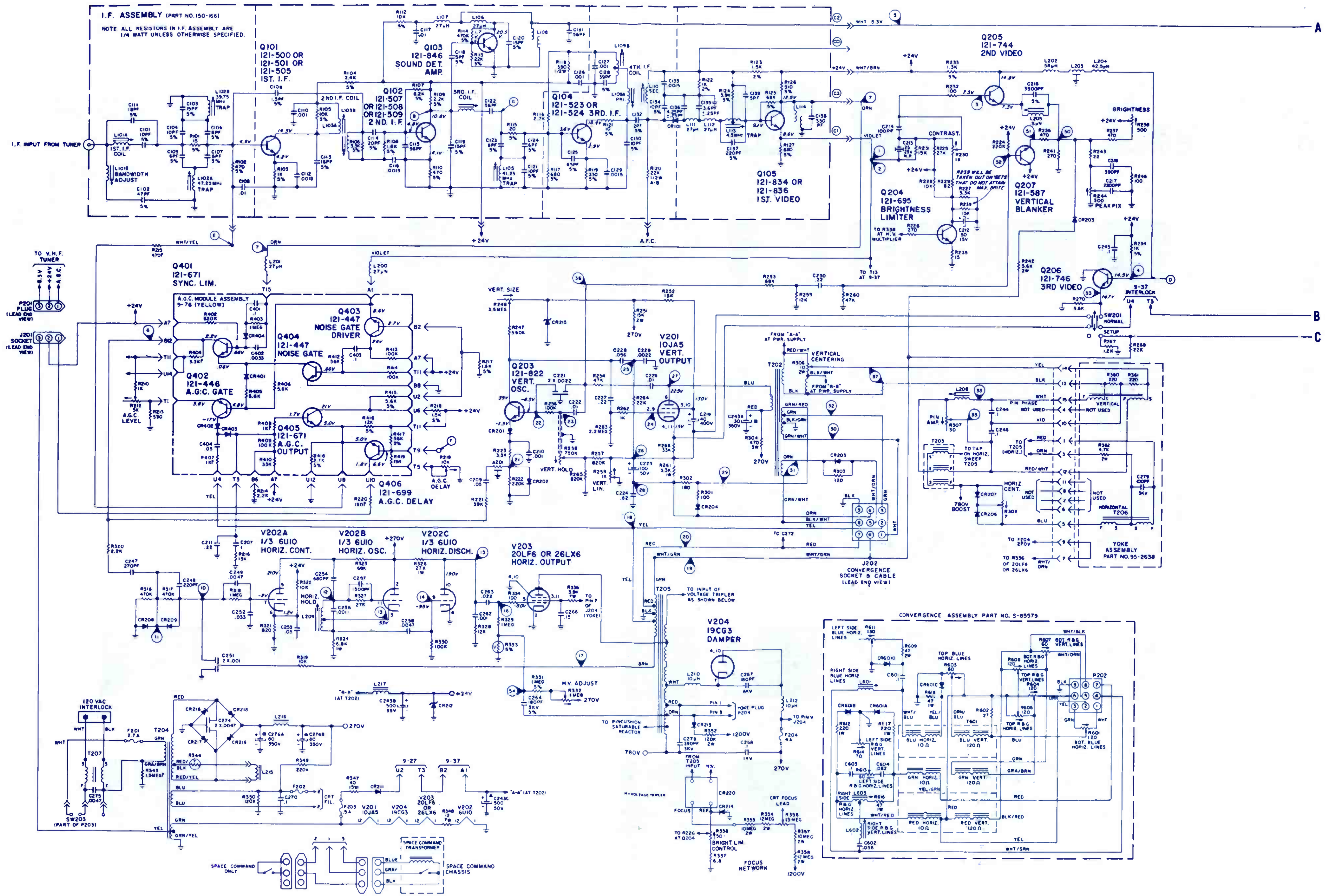
METER B&K 120
SCALE = RX100
RX10000

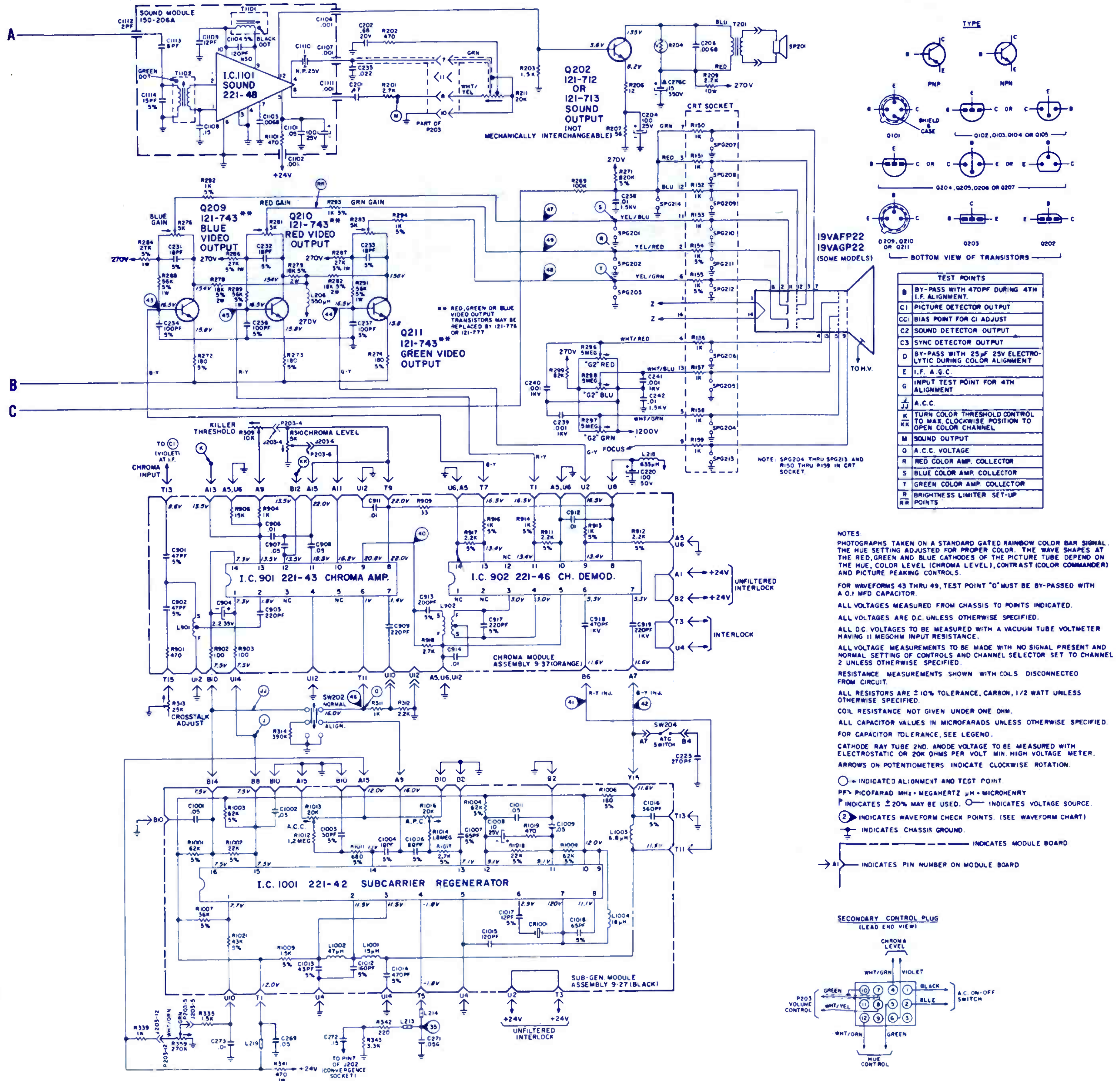
1397

ZENITH
Color TV Chassis
19CC19

ELECTRONIC TECHNICIAN/DEALER TEKFAX

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 5 NEW SETS





19VAFP22
19VAGP22
(SOME MODELS)

BOTTOM VIEW OF TRANSISTORS

NOTE: SPG204 THRU SPG213 AND R150 THRU R159 IN CRT SOCKET.

TEST POINTS	
B	BY-PASS WITH 470PF DURING 4TH I.F. ALIGNMENT.
C1	PICTURE DETECTOR OUTPUT
CC1	BIAS POINT FOR C1 ADJUST
C2	SOUND DETECTOR OUTPUT
C3	SYNC DETECTOR OUTPUT
D	BY-PASS WITH 25μF 25V ELECTROLYTIC DURING COLOR ALIGNMENT
E	I.F. A.G.C.
G	INPUT TEST POINT FOR 4TH ALIGNMENT
J / JJ	A.C.C.
K / KK	TURN COLOR THRESHOLD CONTROL TO MAX. CLOCKWISE POSITION TO OPEN COLOR CHANNEL
M	SOUND OUTPUT
Q	A.C.C. VOLTAGE
R	RED COLOR AMP. COLLECTOR
S	BLUE COLOR AMP. COLLECTOR
T	GREEN COLOR AMP. COLLECTOR
R / RR	BRIGHTNESS LIMITER SET-UP POINTS

NOTES:

PHOTOGRAPHS TAKEN ON A STANDARD GATED RAINBOW COLOR BAR SIGNAL. THE HUE SETTING ADJUSTED FOR PROPER COLOR. THE WAVE SHAPES AT THE RED, GREEN AND BLUE CATHODES OF THE PICTURE TUBE DEPEND ON THE HUE, COLOR LEVEL (CHROMA LEVEL), CONTRAST (COLOR COMMANDER) AND PICTURE PEAKING CONTROLS.

FOR WAVEFORMS 43 THRU 49, TEST POINT "D" MUST BE BY-PASSED WITH A 0.1 MFD CAPACITOR.

ALL VOLTAGES MEASURED FROM CHASSIS TO POINTS INDICATED.

ALL VOLTAGES ARE D.C. UNLESS OTHERWISE SPECIFIED.

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

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

RESISTANCE MEASUREMENTS SHOWN WITH COILS DISCONNECTED FROM CIRCUIT.

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

COIL RESISTANCE NOT GIVEN UNDER ONE OHM.

ALL CAPACITOR VALUES IN MICROFARADS UNLESS OTHERWISE SPECIFIED.

FOR CAPACITOR TOLERANCE, SEE LEGEND.

CATHODE RAY TUBE 2ND. ANODE VOLTAGE TO BE MEASURED WITH ELECTROSTATIC OR 20K OHMS PER VOLT MIN. HIGH VOLTAGE METER.

ARROWS ON POTENTIOMETERS INDICATE CLOCKWISE ROTATION.

○ = INDICATED ALIGNMENT AND TEST POINT.

PF = PICOFARAD MHz = MEGAHERTZ μH = MICROHENRY

P INDICATES ±20% MAY BE USED. ○— INDICATES VOLTAGE SOURCE.

(2)▶ INDICATES WAVEFORM CHECK POINTS. (SEE WAVEFORM CHART)

INDICATES CHASSIS GROUND.

INDICATES MODULE BOARD

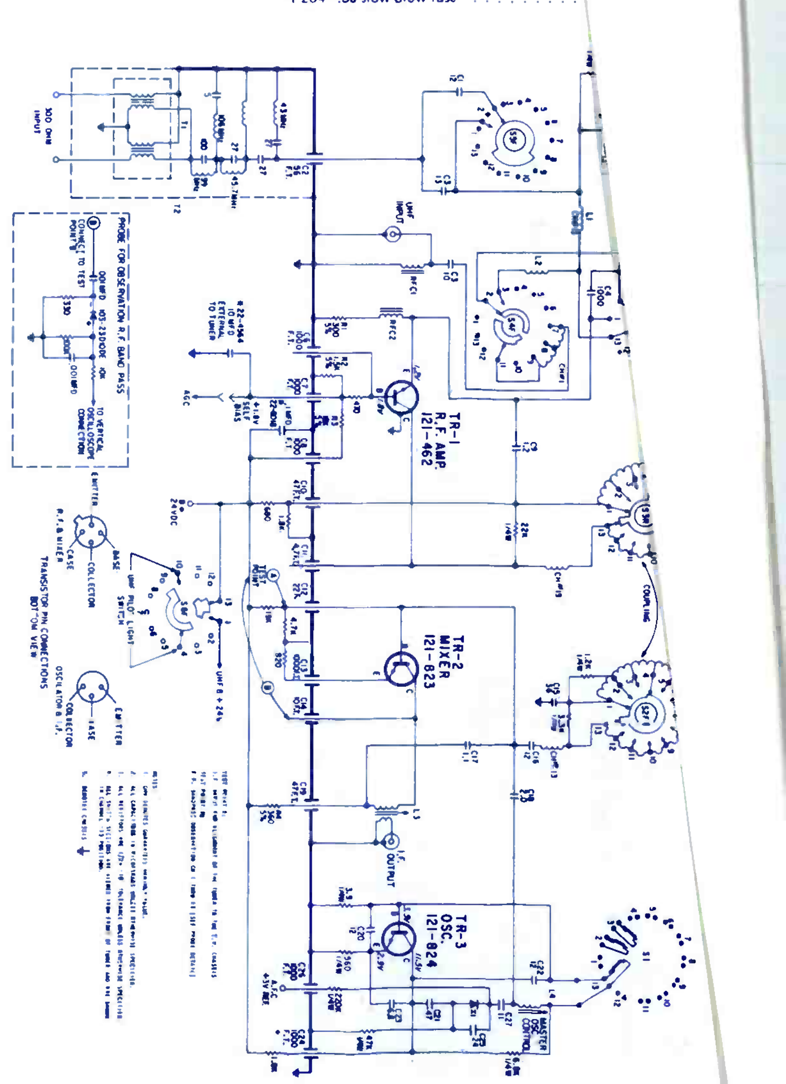
→A1 INDICATES PIN NUMBER ON MODULE BOARD

SECONDARY CONTROL PLUG
(LEAD END VIEW)

ZENI
Color
19CC1

SYMBOL DESCRIPTION

C243A—30 μf electro cap 350v
C243B—500 μf electro cap 35v
C243C—500 μf electro cap 50v
C276A—80 μf electro cap 350v
C276B—80 μf electro cap 350v
C276C—15 μf electro 350v
R204 voltage dependent resistor
R212—5K AGC level control
R219—10K AGC delay control
R230—contrast control
R238—500Ω bright control
R244—300Ω peak picture control
R248—3.5M vert size control
R258—750K vert hold control
R259—1K vert lin control
R306—10Ω vert cent control 2W
R308—7Ω horiz center control
R309—10K killer threshold control
R333—voltage dependent resistor 5%
R338—50Ω bright limit control
R344—thermistor
R1013—20K ACC control
R1016—20K APC control
L102—39.75MHz & 47.25MHz traps
L113—4.5MHz trap
L203—delay line
L209—horiz osc coil
L901—chroma take-off coil
L902—2nd chroma coil
T201—sound output xformer
T202—vert output xformer
T203—saturable reactor
T204—power xformer
T205—horiz sweep xformer
T206—deflection yoke
T207—ac line choke
T1102—4.5MHz input coil (part of 150-206
A201—Integrator unit
F201—2.7a bel-fuse
F202—heater fuse link
F203—.5a bel-fuse
F204—.5a slow blow fuse



PHILCO-FORD
Color TV Chassis
22QT79

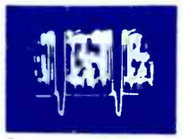
OSCILLOSCOPE WAVEFORM PATTERNS

These waveforms were taken with the receiver AGC control adjusted for an approximate peak-to-peak output of two volts at the video detector, using an air signal. Do not reset AGC control when using color bar generator. All monochrome voltages taken with average air signal and all chroma voltages taken with a color bar generator connected to the antenna input terminals. The chroma peak-to-peak voltages were taken with the chroma control set for 0.3V peak-to-peak at center tap of chrome control or M110 and the tint control set for proper color bars (approximately mid-range), all other controls set for normal viewing. The frequencies shown are those of the waveforms.....not the sweep rate of the oscilloscope. All voltages taken with a wide band scope having a 5 MHz bandwidth similar to B&K Model 1450. Line voltage, 120V.

LINE VOLTAGE - 120 VAC
AIR SIGNAL - FOR MONOCHROME SIGNALS
COLOR BAR GEN. - B&K 1245 - FOR COLOR SIGNALS
ACTIVE FILTER AT 20 VDC


1. 2 VOLTS P/P, 60 HZ (MAX. CONTRAST) M17

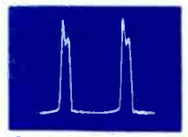

2. 2 VOLTS P/P, 15,750 HZ (MAX. CONTRAST) M17

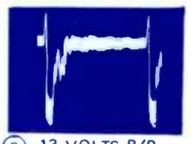

3. 4.2 VOLTS P/P, 15,750 HZ Q93 COLL.


4. 3.8 VOLTS P/P, 15,750 HZ PIN 2 V92


5. 80V. P/P. (cont at point of sync compression) 15,750 HZ Pin 7 V92


6. 65V. P/P. (MIN. CON.) 15,750 HZ PIN 7 V92


7. 40 VOLTS P/P, 15,750 HZ M10


8. 13 VOLTS P/P, 15,750 HZ M11


9. 6.6 VOLTS P/P, 15,750 HZ BASE OF Q41

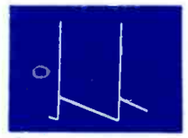

10. 50 VOLTS P/P, 15,750 HZ M49

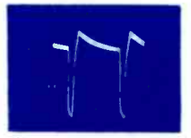

11. 50 VOLTS P/P 60 HZ M49

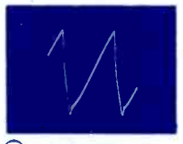

12. 85 VOLTS P/P, 60 HZ PIN 10 V41

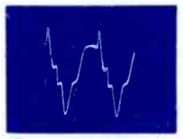

13. 110 VOLTS P/P, 60 HZ PIN 2, 6, 7

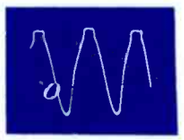

14. 10 VOLTS P/P, 60 HZ PIN 9 V41

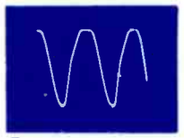

15. 1KV VOLTS P/P, 60 HZ (SPIKE) 200 VOLTS P/P, 60 HZ (SAWTOOTH) M46, OR PIN 4 V41

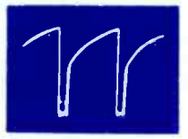

16. 12 VOLTS P/P, 15,750 HZ D41, D42


17. 16 VOLTS P/P, 15,750 HZ D41 TOP END

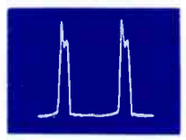

18. 6 VOLTS P/P, 15,750 HZ PIN 9 V42

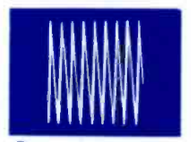

19. 45 VOLTS P/P, 15,750 HZ PIN 1 V42

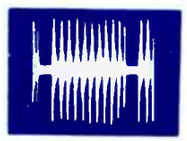

20. 150 VOLTS P/P, 15,750 HZ PIN 2 V42

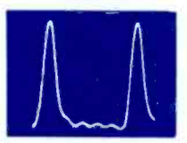

21. 200 VOLTS P/P, 15,750 HZ PIN 6 V42


22. 200 VOLTS P/P, 15,750 HZ M61


23. 15,750 HZ LOOSE COUPLED V200 PLATE


24. 4.0 VOLTS P/P, 3.58 MHZ CR91, D98 & C124

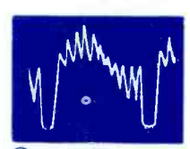

25. 0.1 VOLTS P/P, ± .05 15,750 HZ Q96 BASE

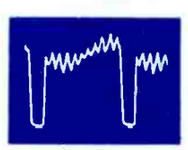

26. 5.5 VOLTS P/P, 15,750 HZ M103

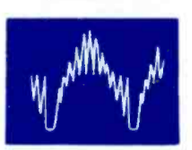

27. .3 VOLTS P/P, 15,750 HZ Q102 BASE R150, R151

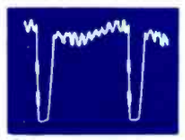

28. 7 VOLTS P/P, 15,750 HZ Q100 COLL.


29. 8.5 VOLTS P/P, 15,750 HZ Q101 COLL.

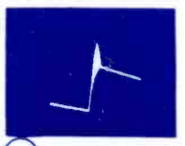

30. 45 VOLTS P/P, (CHROMA) 70 V P/P, (SYNC) 15,750 HZ M126

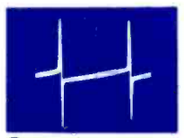

31. 17 VOLTS P/P, (CHROMA) 70 V. P/P, (SYNC) M125

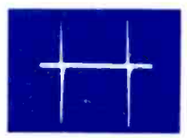

32. 50 VOLTS P/P, (CHROMA) 70 V. P/P. (SYNC) M113

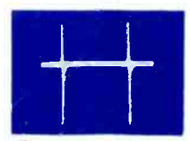

33. 2 VOLTS P/P, (CHROMA) 25 V. P/P, (SYNC) R160, R173 PIN 7 V91

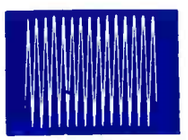

34. 0.7 VOLTS P/P, 15,750 HZ Q95 EMIT

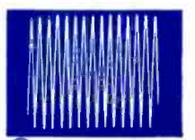

34A. EXPLODED VIEW OF BURST OF VIEW 34


35. 70 VOLTS P/P, 15,750 HZ Q95 COLL.


36. 12 VOLTS P/P, 15,750 HZ PIN 5 L95


37. 12 VOLTS P/P, 15,750 HZ PIN 4 L95


38. 6 VOLTS P/P, 3.58 MHZ D93, D94


38A. 0.8 VOLTS P/P, 3.58 MHZ PIN 3 IC91

38B. 16 VOLTS P/P, 3.58 MHZ PIN 7 IC91

39. 1.6 VOLTS P/P, 3.58 MHZ M107

40. 1.0 VOLTS P/P, 3.58 MHZ PIN 4 L97 OR M108

41. 1.0 VOLTS P/P, 3.58 MHZ L98-R139

42. 55 VOLTS P/P, 60 HZ Q97 COLL.

42A. 0.85 VOLTS P/P 60 HZ M102

43. 12 VOLTS P/P, 15,750 HZ Q103 BASE

44. 3.5 VOLTS P/P, 17,500 HZ Q103 EMIT.

45. 90 VOLTS P/P, 15,750 HZ. CONT SET JUST BELOW POINT OF SYNC COMPRESSION M123

46. 30 VOLTS P/P, 15,750 HZ Q5 COLL.

47. 660 VOLTS P/P, 15,750 HZ M45

48. 420 VOLTS P/P, 15,750 HZ M48

TRANSISTOR RESISTANCES

Resistance measurements of transistors in circuit (power off) yoke & convergence not connected. All measurements are in ohms and taken with B & K Model 120 VOM with allowable tolerance ±20%. DC polarity switch in "REV" position. Transistor measurements (use X100 scale).

TRANS.	FUNCTION	E TO GRD.	B TO GRD.	C TO GRD.	C TO E + − (− +)	C TO B + − (− +)	B TO E + − (− +)
Q1	1ST V.I.F.	330	1150	1100	1450 (1200)	2300 (1950)	1500 (1500)
Q2	2ND V.I.F.	330	2100	1050	1400 (1350)	6.5K (1785)	1.8K (5.6K)
Q3	3RD V.I.F.	270	1700	875	360 (950)	3.1K (1.5K)	1.8K (3K)
Q4	GATED AGC	1100	1175	35K	35K (2K)	39K (1.4K)	1.4K (1.9K)
Q5	RF AGC	350	1500	1630	1875 (2.5K)	1.7K (3.6K)	1850 (1450)
Q6	1ST VIDEO	250	1k	1050	1.3K (1.3K)	4.5K (1.3K)	1.2K (4K)
Q41	SYNC SEP.	0	1475	25K	25K (22K)	190K (1350)	1450 *(170K)
Q81	2ND S.I.F.	1.8K	450	1350	3.1K (3.2K)	1.5K (1.3K)	1.5K (2.4K)
Q82	1ST S.I.F.	880	1k	800	1375 (1375)	1575 (1375)	1550 (1.8K)
Q83	DELAY & DRIVER	300	1475	1030	1350 (1350)	3k (1.4K)	1425 (2.3K)
Q84	AUD. PRE AMP	100	1725	2800	3k (18K)	*50k (1.5K)	1550 (42K)
Q85	BURST AMP	10k	4.5K	13k	9k (16K)	20k (1450)	1.5K (18K)
Q86	1ST CHROMA	69	1.9K	1050	1125 (1100)	4.8K (1725)	1825 (3.6K)
Q87	COLOR KILLER	2.3K	3.2K	1350	6K (4.4K)	*220K (1.4K)	1.5K *20K
Q88	AUD. DRIVER	6K	2.8K	780	3.2K (7K)	19K (1.5K)	1500 (20K)
Q89	BUFF AMP	75	1175	45 0	550 (560)	1.4K (1350)	1125 (1125)
Q100	X DEMOD	470	1.2k	1450	4K (1.8K)	5K (1.3K)	1.3K (1950)
Q101	Z DEMOD	480	1.2k	3.6K	4K (2K)	4.8K (1.3K)	1375 (1950)
Q102	2ND CHROMA	182	2k	1360	1580 (1560)	10k (1725)	1750 (8.2K)
Q103	BLANK	82	1800	2750	2.8K (2k)	8K (1650)	1.7K (5.5K)
Q201	AUD. OUTPUT	18	1.3K	28K	28K (3.4K)	*40K (1.1M)	1250 (10K)
Q200	ACTIVE FILTER	345	1350	3.4K	3.3K (1450)	3.3K (1050)	1100 (3.4K)

*RX10000
RX100

TUBE RESISTANCES

TUBE	FUNCTION	1	2	3	4	5	6	7	8	9	10	11	12
V41	VERT. OUT/OSC	F	*3.75M	—	17k	—	*2.5M	*2.5M	20k	1.6K	*800K	0	F
V42	HORZ. OSC/REACT	10k	*1.85M	17k	F	F	50K	0	680	*1.4M			
V91	COLOR DIFF. AMP	30k	30k	30k	F	F	1.1M	150	*1.1M	* 950k			
V92	VIDEO OUTPUT	700	*28k	700	F	F	F	22k	12k	725			
V200	HORZ. OUTPUT	0	0	20k	0	*800k	—	—	—	*900k	0	20k	0
V201	DAMPER	0	—	—	16k	—	—	*800k	—	—	16k	—	0

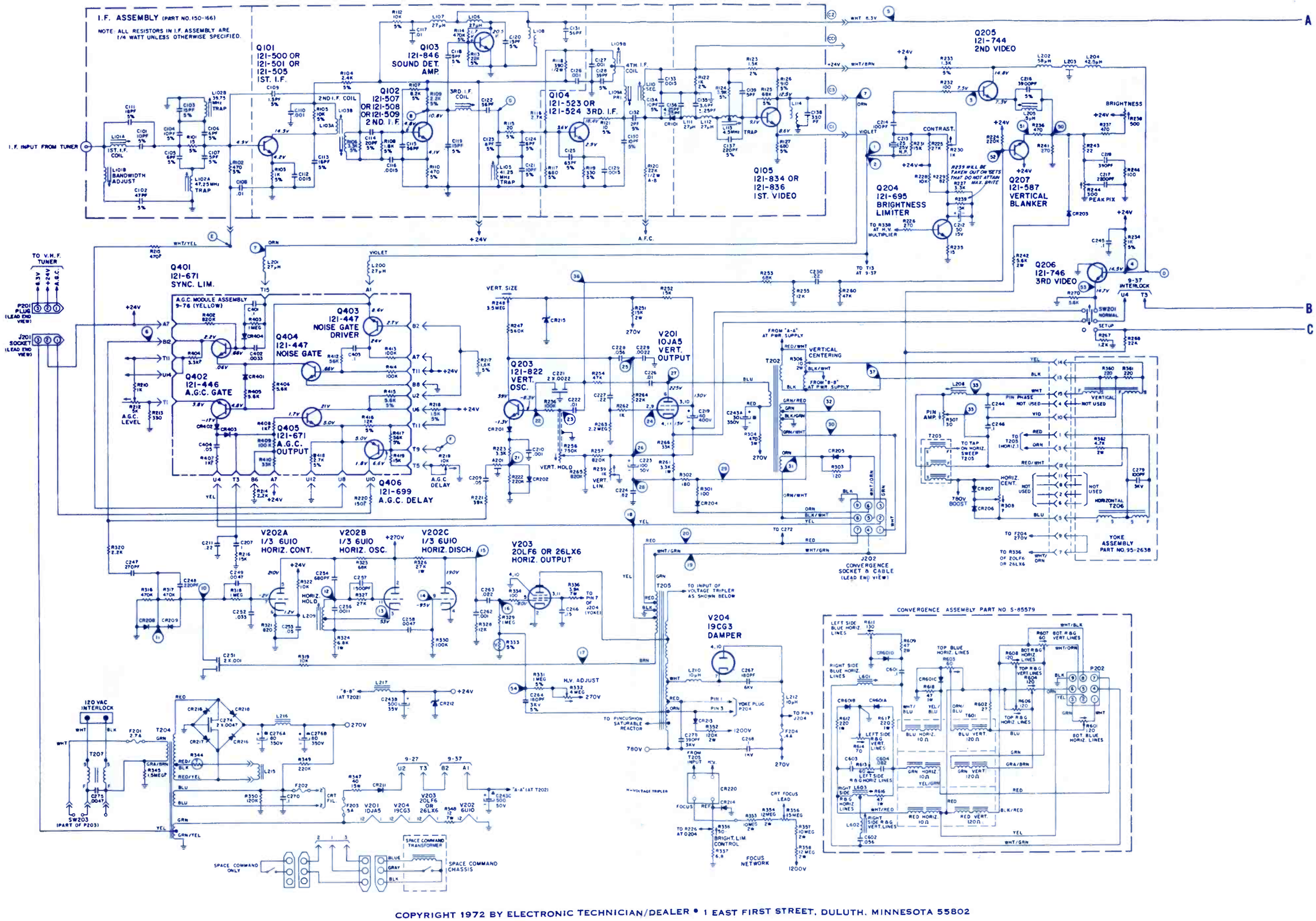
*Rx1000

METER B&K 120
SCALE = Rx100
Rx10000

1397
ZENITH
Color TV Chassis
19CC19

ELECTRONIC TECHNICIAN/DEALER **TEKFAX**

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR 5 NEW SETS



1398
GENERAL ELECTRIC
TV Chassis U-1

JANUARY • 1972

ELECTRONIC TECHNICIAN/DEALER TEKFAX

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 5 NEW SETS

SYMBOL	DESCRIPTION	GENERAL ELECTRIC PART NO.
R139	control-IF AGC, 2.5K	ES49X60
R147	control-RF AGC, 2.5K triple	ES49X60 ES49X61
R210	85K, height	
R215	16K, vert size	
R218	2K, vert lin	
R232	therm assembly	ES41X5
R233	therm, 650 Ω, 10%	ES14X27
R307	VDR (180-200v)	ES13X3
C403A	300 µf, electro, 175v	ES31X38
C403B	30 µf, electro, 150v	
C403C	300 µf, electro, 150v	
C403D	200 µf, electro, 50v	

L102	coil-41.25MHz trap	ES36X83
L103	coil-47.25MHz trap	EP36X13
L106	coil-44MHz trap	ES36X84
L108	coil-sound take off	ES36X86
L109	coil-4.5MHz trap	ES36X87
L251	coil-horiz osc	ES36X88
	deflection yoke	ES76X6
T101	video detector xformer	ES57X6
T201	vert output xformer	ES64X11
T251	horiz buffer xformer	ES64X12
T252	horiz output xformer	ES77X12
T301	audio output xformer	ES64X13
T401	CRT filament xformer	ES64X10
	fuse 4a, fast blow, pigtail, 250v, (F401)	EP10X52

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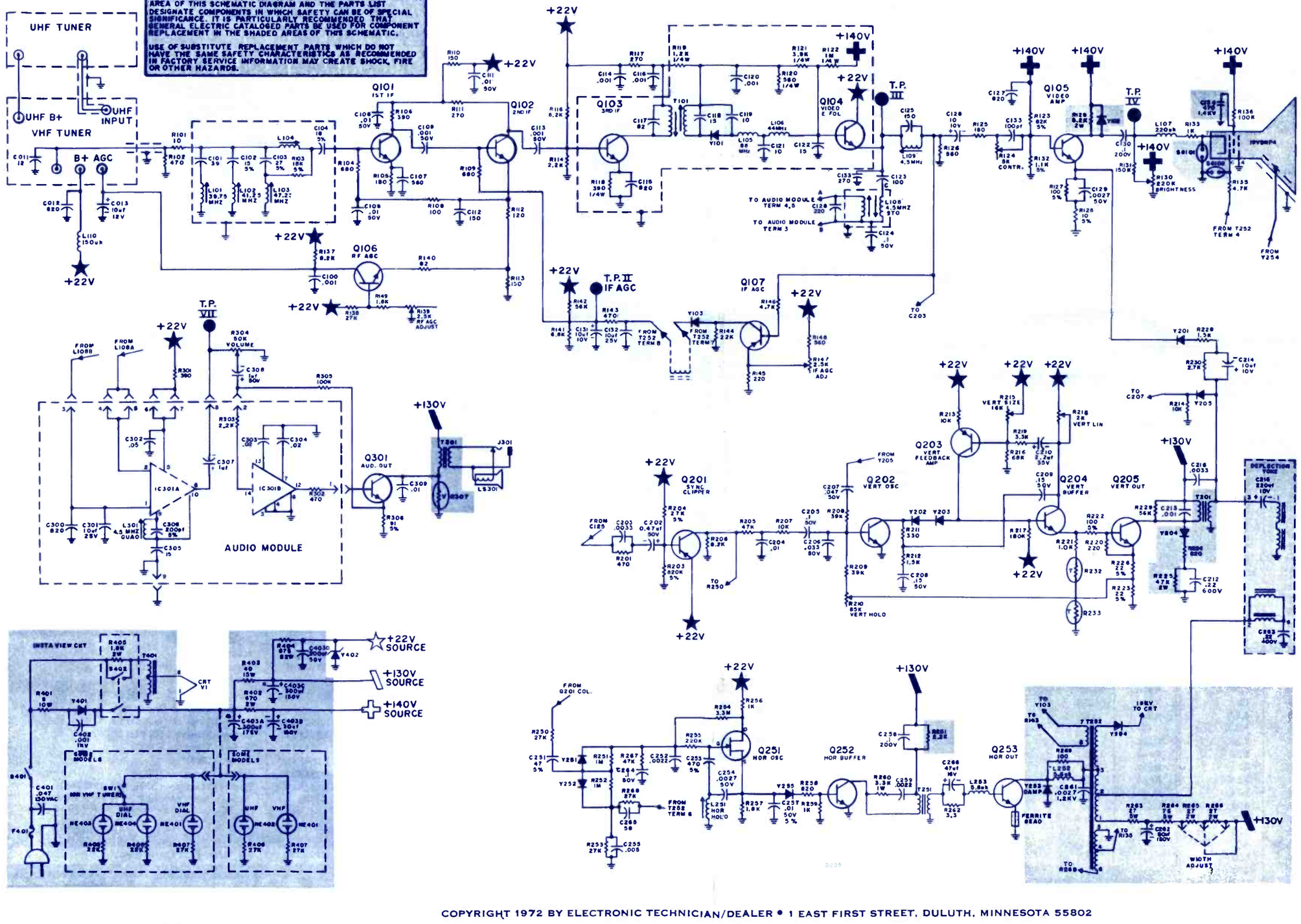
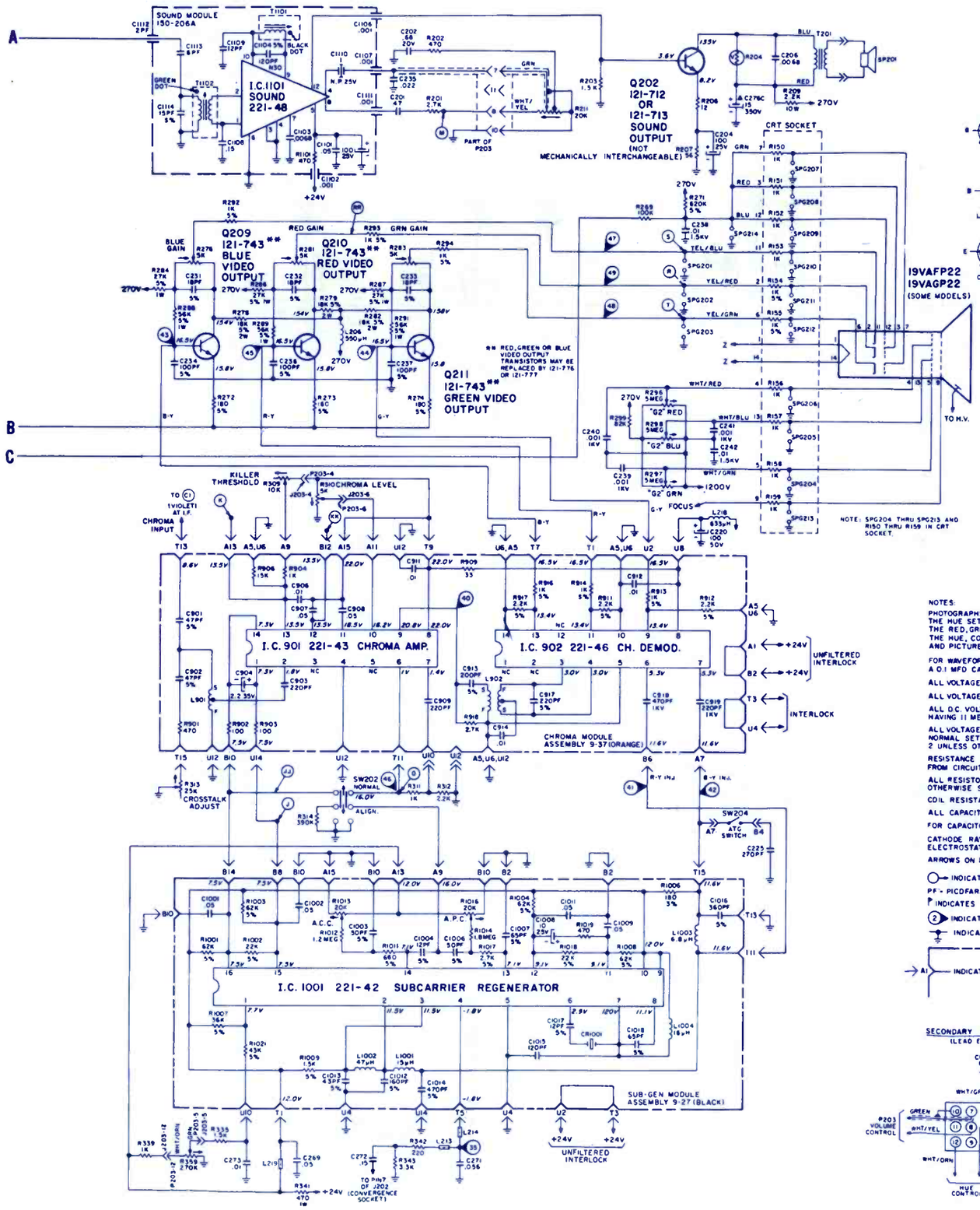


ZENITH
Color TV Chassis
19CC19

SYMBOL	DESCRIPTION	ZENITH PART NO.
C243A	30 µf electro cap 350v	
C243B	500 µf electro cap 35v	22-6071
C243C	500 µf electro cap 50v	
C276A	80 µf electro cap 350v	
C276B	80 µf electro cap 350v	22-6073
C276C	15 µf electro 350v	
R204	voltage dependent resistor	63-5440
R212	5K AGC level control	63-8492
R219	10K AGC delay control	63-8491
R230	contrast control	63-8979
R238	500Ω bright control	63-8785
R244	300Ω peak picture control	63-8496
R248	3.5M vert size control	63-8497
R258	750K vert hold control	63-8963
R259	1K vert lin control	63-8529
R306	10Ω vert cent control 2W	63-7009
R308	7Ω horiz center control	63-8474
R309	10K killer threshold control	63-8491
R333	voltage dependent resistor 5%	63-8688
R338	50Ω bright limit control	63-8989
R344	thermistor	63-8687
R1013	20K ACC control	63-8576
R1016	20K APC control	63-8576
Lf02	39.75MHz & 47.25MHz traps	20-3396
L113	4.5MHz trap	20-3289
L203	delay line	S-85998
L209	horiz osc coil	S-56877
L901	chroma take-off coil	S-85761
L902	2nd chroma coil	S-86109
T201	sound output xformer	95-2854
T202	vert output xformer	95-2850
T203	saturable reactor	95-2867
T204	power xformer	95-2912
T205	horiz sweep xformer	S-86159
T206	deflection yoke	95-2638
T207	ac line choke	95-2920
T1102	4.5MHz input coil (part of 150-206)	95-2620
A201	integrator unit	87-4
F201	2.7a bel-fuse	136-76
F202	heater fuse link	91-2061
F203	.5a bel-fuse	136-84
F204	.5a slow blow fuse	136-89



TEST POINTS	
B	BY-PASS WITH 470PF DURING 4TH I.F. ALIGNMENT.
C1	PICTURE DETECTOR OUTPUT
CC1	BIAS POINT FOR C1 ADJUST
C2	SOUND DETECTOR OUTPUT
C3	SYNC DETECTOR OUTPUT
Q	BY-PASS WITH 25µF 25V ELECTROLYTIC DURING COLOR ALIGNMENT
E	I.F. A.G.C.
G	INPUT TEST POINT FOR 4TH ALIGNMENT
J, JJ	A.C.C.
K, KK	TURN COLOR THRESHOLD CONTROL TO MAX CLOCKWISE POSITION TO OPEN COLOR CHANNEL
M	SOUND OUTPUT
Q	A.C.C. VOLTAGE
R	RED COLOR AMP. COLLECTOR
S	BLUE COLOR AMP. COLLECTOR
T	GREEN COLOR AMP. COLLECTOR
R, RR	BRIGHTNESS LIMITER SET-UP POINTS

NOTES:
PHOTOGRAPHS TAKEN ON A STANDARD GATED RAINBOW COLOR BAR SIGNAL. THE HUE SETTING ADJUSTED FOR PROPER COLOR. THE WAVE SHAPES AT THE RED, GREEN AND BLUE CATHODES OF THE PICTURE TUBE DEPEND ON THE HUE, COLOR LEVEL (CHROMA LEVEL), CONTRAST (COLOR COMMANDER) AND PICTURE PEAKING CONTROLS.

FOR WAVEFORMS 43 THRU 49, TEST POINT "D" MUST BE BY-PASSED WITH A 0.1 MFD CAPACITOR.

ALL VOLTAGES MEASURED FROM CHASSIS TO POINTS INDICATED.

ALL VOLTAGES ARE D.C. UNLESS OTHERWISE SPECIFIED.

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

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

RESISTANCE MEASUREMENTS SHOWN WITH COILS DISCONNECTED FROM CIRCUIT.

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

COIL RESISTANCE NOT GIVEN UNDER ONE OHM.

ALL CAPACITOR VALUES IN MICROFARADS UNLESS OTHERWISE SPECIFIED.

FOR CAPACITOR TOLERANCE, SEE LEGEND.

CATHODE RAY TUBE 2ND. ANODE VOLTAGE TO BE MEASURED WITH ELECTROSTATIC OR 20K OHMS PER VOLT MIN. HIGH VOLTAGE METER.

ARROWS ON POTENTIOMETERS INDICATE CLOCKWISE ROTATION.

○— INDICATES ALIGNMENT AND TEST POINT.

PF = PICOFARAD MHz = MEGAHERTZ µH = MICROHENRY

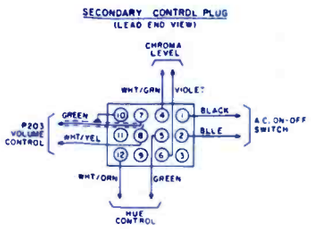
INDICATES ±20% MAY BE USED. ○— INDICATES VOLTAGE SOURCE.

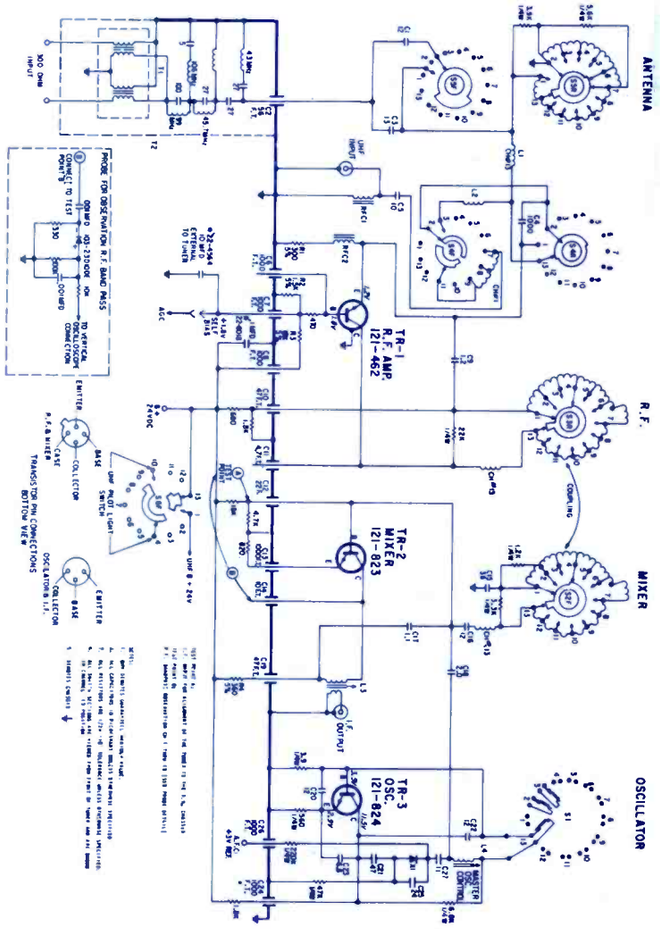
(2) INDICATES WAVEFORM CHECK POINTS. (SEE WAVEFORM CHART)

INDICATES CHASSIS GROUND.

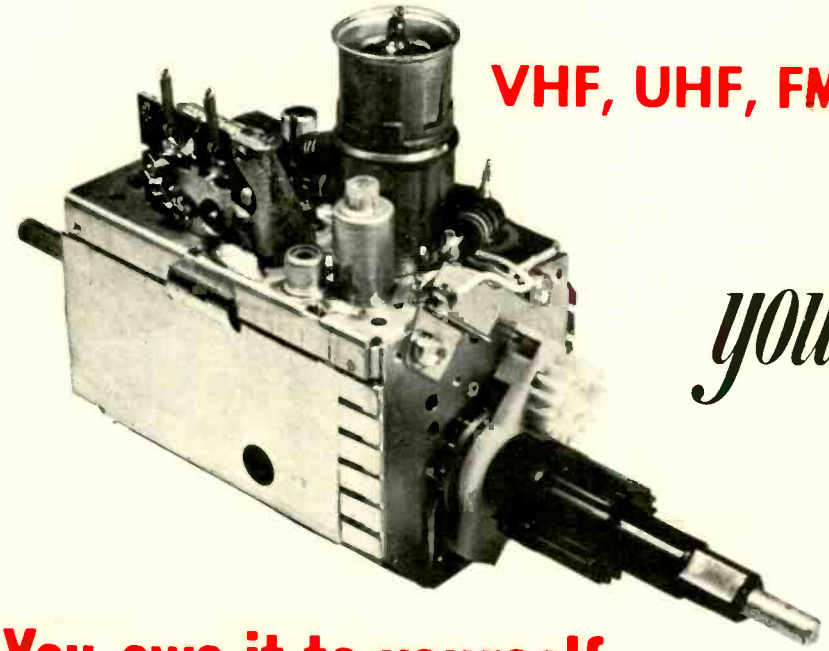
———— INDICATES MODULE BOARD

A1 — INDICATES PIN NUMBER ON MODULE BOARD





TV TUNER SERVICE



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ELECTRONIC TECHNICIAN/DEALER

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PHILLIP DAHLEN
Editor
1 East First Street
Duluth, Minn. 55802
(218) 727-8511

ALFRED A. MENEGUS
Publisher
757 Third Avenue
New York, N.Y. 10017
(212) 572-4829

TOM GRENEY
Publishing Director

JOSEPH ZAUHAR
Managing Editor

BERNICE GEISERT
Associate Editor

GAYNELLE DAVIDSON
Production Manager

BOB ANDRESEN
Graphic Design

LILLIE PEARSON
Circulation Fulfillment

JOHN KESSLER
Manager, Reader Services

MANAGERS

DEAN GREENER
43 East Ohio Street
Chicago, Ill. 60611
(312) 467-0670

CHUCK CUMMINGS
Ad Space South/West
613 North O'Connor
Irving, Texas 75060
(214) 253-8678

KEN JORDAN
DONALD D. HOUSTON
1901 West 8th Street
Los Angeles, Calif. 90057
(213) 483-8530

CHARLES S. HARRISON
CY JOBSON
57 Post Street
San Francisco, Calif. 94104
(415) 392-6794

ROBERT UPTON
Tokyo, Japan
C.P.O., Box 1717

The advent of space travel and solid-state electronics has done much to shrink our planet. Photo courtesy of GTE Sylvania ECG Replacement Semiconductors.

FEATURES

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Why Modular TV Circuits?

Two letters in this month's Letters to the Editor Column reflect a concern held by many technicians frightened by the increased popularity of modularly designed TV sets. They fear that the increased use of plug-in circuits will either make servicing so easy that the public will do its own servicing—leaving the technician without a job—or that these circuits will make servicing so difficult that they will be unable to handle the job—forcing them out of business.

Several years ago I personally purchased one of the very first Motorola Quasar color-TV sets produced. This TV set had originally been obtained for our Teklab Report (September 1967, page 43; November 1967, page 49). Being an early model, it had no AFC tuner or regulated ac power supply. This earlier design even required the use of a high-voltage rectifier tube. But, I was pleased with the TV set—it worked well and produced an extremely good color-TV picture.

By now nearly everyone knows that, like tubes, with time transistors can require replacement. And I have serviced more than one of these plug-in modules, replacing a defective transistor with either a universal replacement or a spare that I pulled from some unused circuit board. I have found that in-circuit transistor testers work well on these boards, that these boards can be made to function outside the TV set, and that it is much easier to solder a module that has been removed from the chassis than it is to attempt to work deep within a chassis.

I have more frequently used another technique when working on my TV set—complete module replacement. Motorola has a module exchange program, replacing defective modules with updated ones for but a small fee.

It is hard to believe how flexible the design of a TV set can be when it is of modular construction. Being an individual who enjoys playing with circuits just to see what can be done, I replaced my VHF tuner and the IF module—substituting Motorola updated versions that gave my TV set AFC capability. (This was the only circuit change that required any mechanical modifications. Since I wanted to deactivate the AFC whenever fine tuning the set, and there was no AFC defeat switch on the front panel, I glued a permanent magnet to the tuner gear assembly. When the fine-tuning gears engage, the magnet activates a G C Calectro proximity reed switch, shorting out the AFC. This technique is fully automatic and works fine—no manual switch being required.)

Although the high-voltage supply worked fine, I wanted to have the TV set contain entirely solid-state circuitry (except for the picture tube—and someday maybe even that will go). Soon after Motorola's solid-state, high-voltage rectifier was developed, I substituted a new module containing it. No schematic was required for this modification, the new module fit fine, chassis connector wiring was the same, and I am now able to get a picture the moment I press the power switch.

The next major development was a new regulated ac power supply. The older one worked fine, but these modifications were fun to make and improved the design of the TV set. The "works in the drawer" were plugged into the new supply the same as before—although a different degaussing coil was required.

As you can see, Motorola has made many improvements in the design of their original Quasar color-TV set. If I had waited until all of these improvements had been made before purchasing my TV set, I would not have been able to start enjoying the high-quality reception that it provided until this past year—rather than four years ago.

Owning this TV set has proven to be an educational experience. It has shown me that a modular design can permit greater serviceability and easier upgrading than any other type of chassis design. It has also helped me increase my understanding of solid-state color-TV circuitry.

Each TV set described in our Teklab Report has actually been examined here in the ELECTRONIC TECHNICIAN/DEALER lab. We have personally examined the Heathkit Model GR-270 (December 1970, page 31), RCA's Argosy (January 1971, page 33; February 1971, page 33), Zenith's Titan 110 (September 1971, page 35; October 1971, page 41) and Motorola's second generation Quasar (this and our next issue). All of these color-TV sets are of modular design, using virtually solid-state circuitry. Including this last TV set, which just left our lab, we personally know the owners of each of these TV sets. And if any of these TV sets do require servicing (many of them haven't), this is done by Joe Zauhar, our Managing Editor.

From such first-hand experience, we can conclude that these color-TV sets contain signal and bias feedback circuits which function well in compensating for temperature changes and component aging. And the modular, solid-state construction of color-TV sets is becoming increasingly popular (no criticism being intended against color-TV tube circuitry—we also know the owners of most of the other color-TV sets that have been covered in our Teklab Reports, and they also have excellent service records).

The modular, solid-state, color-TV sets that we have had in our lab are definitely not designed for consumer maintenance. They are instead designed to make servicing easier for the electronic technicians that are working hard to keep up with technological advances. Manufacturers can no more afford to give you color-TV sets as instructional aids than they can us editors. But with a lot of hard work and study, we can maintain our technical competency.

Phillip Dahlen

LETTERS

Reader comments concerning past feature articles, Editor's Memos, previous reader responses or other subjects of interest to the industry.

New York Consumer Legislation

Can you hear it? Maybe you can, but for those who may not, let me explain the sound.

It's the sound of changing times. It's a wave—maybe a little larger than the others.

This wave is being caused by irresponsible accusations that are directly affecting the consumer electronic repair industry.

According to an article in the NEW YORK TIMES, Harry Smith, the assistant district attorney of Queens, in charge of consumer frauds, declared, "We're not talking about an occasional bad apple. The whole barrel stinks."

How about that; I'm rotten—and didn't even know it! All those TV service technicians that I thought were good guys, are all bad guys.

This name calling is designed to cast doubt on the professionalism of the whole repair industry in order that certain individuals can more quickly create a situation whereby the consumer will think he is being protected regardless of what type of legislation is pushed through.

It seems to be that the method and end result could be disastrous and unfair for both the consumer and the service technician.

The bill, No. 5582, the one getting its push by the tactics mentioned above, and the same one that Phillip Dahlen wrote about in the editor's memo in the November 1971 issue, was opposed by TSA. Many of us closed our shops in order to be present at the November 16, 1971 hearing in Albany, N.Y. TSA, rather than just coming out in total opposition to Bill 5582, injected in its statement [*printed at the conclusion of this letter*], prepared by an attorney, constructive criticism of the bill and also offered assistance by the association. TSA is only opposed to this bill alone, not one which carries with it proper provisions for regulation.

It is interesting to note that TSA's hearing statement made no reference to the rest of the mud-slingers, who must justify their existence by spreading false rumors. The point in question concerned the bill, and that is what TSA concerned itself with.

Regardless of the outcome of the bill, there will be plenty of work for TSA.

So, technicians in New York State can hear the wave. If the wave is heading in your direction, try to be on top of it, not under it.

JOHN W. KOZUBAL, OWNER-MANAGER
TV CLINIC

Statement of Television Service Association, Inc. of Northeastern New York Presented to the Joint Legislative Committee on Consumer Protection

Mr. Chairman, committee members, and interested parties. My name is William M. McCarthy, counsel to the Television Service Association, Inc. of Northeastern New York. Today we come before you to voice the position of the Television Service Association on the registration of television repair shops when taken in conjunction with the idea of consumer protection.

Perhaps it would be appropriate to familiarize you with our organization which was formed in 1953. The members of the group are qualified and competent technicians who strive to serve the public in an honest and forthright manner. These members endeavor to serve the public according to its needs. Members attempt to perform satisfactory work on electronic equipment in consideration for a fair and reasonable fee. The prices charged by our members are geared to allow the members to cover the cost of operation and to receive a fair and equitable return on their investment.

In order to gain the consumer's confidence and to maintain a high level of competence, our members have participated in certain activities. In order to better understand and service consumer appliances, our member technicians have attended accredited learning institutions. Our people are constantly attending instructional seminars sponsored by the industry and by manufacturers to remain abreast of complex innovations of the said industry.

Let us ask why Television Service Association members, who are established businessmen, would attend such seminars. The answer is simply that to serve the consumer public, members must fully know and understand such highly sophisticated electronic servicing aids as oscilloscopes, generators, and sweep alignment equipment, to mention only a few. Naturally, the consumer benefits because servicing time is minimized and, consequently, the customer's out-of-pocket expense is less. It might also be noted that some customers' satisfaction or happiness is directly proportional to the amount of time a technician has a machine in his shop.

Our membership consists of honest and decent men who have voluntarily attempted to control and regulate their own industry in this upstate geographical area. The very purpose for the formation of this association was for the protection of the consumer and the public image of the service technician. However, we would be remiss at this time if we did not recognize that there are some not-so-honest, not-so-desirable and not-so-competent men in this industry. The aforementioned people who make up a small percentage of the technical force are the culprits who create public distrust of the competent and very able industry personnel. Thus, because of the current state of affairs, created, we believe, by a small group of incompetents, legislation in the area of consumer protection is a current issue.

It is our understanding that the honorable chairman of the committee sponsored a bill in the assembly to amend the general business law. It is our further understanding that Senator Gioffre introduced an identical or similar bill in the senate which provides for the registration of electronic repair dealers. However, we must point out that the Television Service Association membership feels that the composition of the aforementioned bills as introduced last session is completely inadequate to regulate the television repair industry or the broader electronic repair industry. Let us not be misunderstood in this opposition. Our association is united and feels there should be some form of regulation or licensing. Through such regulation, it is our wish that the incompetents and dishonest parties would be rendered inoperative and be removed from the industry. An acceptable law would elevate the professional technician to such a level that the non-desirable service repairman could not be compared to them at any time.

At this time we do not propose to present a new or alternative law. We would merely like to take this opportunity to make several constructive suggestions based upon the bill introduced during the last legislative session:

1. There is a lack of provisions for determining a technical level of competence.

2. There is an apparent dearth or lack of administrative machinery for registration or revocation hearings.

3. There is little or no assurance that the secretary of state would appoint an industry representative as bureau chief.

4. The advisory board would have very little voice in administration of the area of governmental operation.

continued on page 26

WITH AN RCA ICTJ SYSTEM, YOU CAN SERVICE ALMOST ANY COLOR SET FROM A TO Z (ADMIRAL TO ZENITH)

And just about everything in between. Andrea. Catalina. Curtis Mathes. Sharp. (Plus RCA, of course!)

Over 5000 models from 36 manufacturers.

RCA's complete Industry Compatible Test Jig system allows you to service more than 90% of the color TV consoles now on the market. Fast and easy.

The RCA ICTJ system includes the test jig itself (in bench or portable models), your choice of 102 adaptor cables and a cross-reference manual that matches the right adaptors to the right set. Order the adaptors you need, and keep ordering others as you need them. After your Distributor registers your purchase of the test jig, you will receive your copy of the manual, and periodic mailings of new inserts to keep the manual up to date.

If color TV servicing is your business, RCA's ICTJ belongs on your bench.

Talk to your RCA Parts and Accessories Distributor today for full information.

. . . for more details circle 126 on Reader Service Card

Deptford, New Jersey

RCA Parts and Accessories

LETTERS...

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5. There is a lack of definitive terms vis a vis good moral character. Gentlemen, we submit that the courts of New York State have been attempting to define this term for years.

Let us further inquire into another term. Who is a potentially dangerous person? The bill leads us to believe that a summary investigation will be utilized to define these awesome terms. But nowhere does the bill specifically define what a summary investigation is. It is interesting to note that the secretary shall investigate only after the accused registrant has had a reasonable opportunity to reply. Said term is really not specific enough to advise an accused of anything. Therefore, honorable chairman and committee members, it becomes apparent that once a discerning eye is cast upon specifics in the bill, it becomes a maze of hazy terms and unclear words. The bill obviously cannot fulfill the job for which it was created.

Nevertheless, we would like this committee to be cognizant of the fact that our association stands ready to advise and assist any interested legislator in the preparation of a regulatory bill. In the past we have participated in consumer seminars in cooperation with local legislators. We have also established information services at home shows in an effort to alert the public to our desire for high standards and levels of performance. In an effort to regulate our own industry on a local level, we have cooperated with the Albany Chamber of Commerce in answering valid public complaints. The state's attorney general has also received our cooperation on all requested matters. And, finally, in the past we have cooperated to our fullest extent with any public-service or community-minded group to develop an understanding of this tremendously complicated industry. In closing, we would like to offer our professional assistance to you at any time and to thank you for this opportunity to address this committee today and to express our views as a reasonable service-minded organization.

Thank you. Good morning.

TELEVISION SERVICE ASSOCIATION, INC.

Manufacturer Help Wanted

Having operated an independent radio/television service shop for over 20 years, and having attempted to keep it as up-to-date as I could afford, with the best instruments that I could afford, and keeping myself well read and ahead of the new developments, I have some questions, facts and thoughts to offer.

I have read in ELECTRONIC TECHNICIAN/DEALER about the new modular transistorized TV sets being offered by several manufacturers for the 1972 season. While modular construction is not new, having been used in commercial equipment for years, it is new in its miniature form—using integrated circuits and micro-sized transistors.

I note that some of these circuits are very closely tuned, the frequencies and voltage waveforms being critical. Since transistors change with use, heat and voltage operating changes, several of these circuits will become out of adjustment at best and inoperative at worse, after just a few short months of use.

With some consumer groups crying for reform in the service industry, it is a poor time for manufacturers to start experimenting with the public. While some complaints against the service industry are justified, the main reason for slow service has been poor design and the inavailability of replacement parts. At the present time there are hundreds of tubes, transformers and phono parts listed. And for economic reasons, few if any distributors carry all of them in stock.

Are we to expect the same jungle of parts as these new advances in electronics come out? Will these boards be available? Will they be easy to remove and accessible?

Now is the time for manufacturers to wake up to these problems—before this new generation of products also reaches a confused state. Now is the time to standardize parts, to come to an agreement on the location and layout of stages in TV sets—now before confusion sets in. It is the independent service dealer who must repair these products, usually after three years of use, after all warranties have ended.

I am afraid that they will repeat the types of problems that once faced us with the advent of printed circuits —when these boards started to fail due to cracking, damage from heated tubes, arcing and other failures. We were snowed under with a lot of nonsense about printed-circuit techniques and reams of alignment instructions—instead of being aided in the repair of the burned wrecks on our work benches. Already this year one manufacturer has sent me literature on what amounts to defects in his past sets.

I would suggest that each manufacturer exhaustively test each product before he turns it loose on the public, and not expect the technician to finish the job that he should have done. Each manufacturer should make available to every qualified service shop a set of circuits in his new product, instructions, schematics and any other helpful information concerning them —free of charge—so that the men who must repair them three years from now will be familiar with them and be able to service them quickly, thus preserving the manufacturer's name.

Those who have kept abreast of the new theory will have little difficulty understanding the new circuits. But the physical appearance, location of boards and method of holding them will no doubt differ from one set to another, and these differences should be made known.

Having a circuit to study with its schematic and descriptive material in the hands of each man who will work on it would save the industry the much greater cost of a retraining program.

I would suggest in the Tekfax schematics (which I make great use of) that you print a layout of tube and part locations—both top and bottom view—on all TV schematics instead of just some of them.

I think that others will agree that the few points I have made here are well founded.

DAVID S. HYDE

Please refer to the answer given to the following letter, which is concerned with basically the same problem. My reply to that letter, plus this month's Editor's Memo, represent our publication's attitude toward this problem. Ed.

Fears 'Do-It-Yourself' Repair

I was reading last night's paper and I noticed a big article about RCA's new module set. The article went on to say how the consumer will be able to go into the back of his set and change these modules without, "having an expensive technician service his set." It also told how this set will be designed to last 10 years.

I am in the service business, and my partner and I are licensed technicians. We pay for a new license every year. Just where does this leave the future of television repair? Is the great RCA trying to do away with the service man? Please answer this letter if you can.

G. A. SUFFRIN

After receiving this letter, I wrote Mr. Suffrin and he was kind enough to supply me with a copy of the original newspaper article. The article, by John Pinkerman of the Copley News Service, seemed to be an imaginative description of RCA's Argosy Chassis, described in detail in our January and February issues.

Having personally examined this

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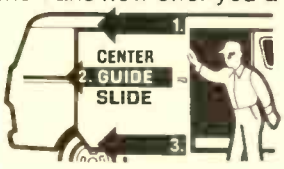
Now Ford gives you a choice of swinging or sliding doors.

Sales leader for 11 straight years.

Only Ford vans have so many better ideas that make vans easier to drive, to service, to use.

New Econoline Vans now offer you a choice of conventional swinging doors or a new gliding side door for cargo handling in cramped alleys and beside loading docks. Three separate tracks, at top, bottom and center, give bridge-like support for solid, smooth, one-hand operation, tight seal.



Shorter outside, easier to park. Compared to other makes with similar loadspace, Econoline Vans have significantly less overall length. This means easier parking and better maneuverability in city-delivery operations—time saved on every trip.

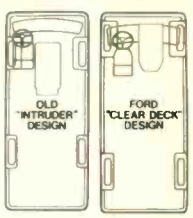
Easy, out-front servicing. Routine service points are right at hand under hood: water, oil, battery, wiper motor, voltage regulator, plus many others.

Strong, Twin-I-Beam Independent Front Suspension—Ford's exclusive design smooths the going for both load and driver. Two forged steel I-beam axles provide strength and durability; wide wheel stance means stability in cross winds.

Wider at top for built-ins. Body sides are more vertical, wider apart at top than other vans. Built-in units fit better and leave more aisle.

Biggest payload. E-300 Series hauls over two tons of payload; 4,285-lbs. to be exact—biggest of any van.

Engine clear forward. In Ford's clear-deck design, engine is forward—all the way out of cargo area. Over 8½ ft. clear floor space behind driver's seat . . . over 10 ft. in the SuperVan. Driver can easily step from seat into rear cargo area.



FORD ECONOLINE VANS

Ford

. . . for more details circle 113 on Reader Service Card

LETTERS . . .

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TV set while it was in the ELECTRONIC TECHNICIAN/DEALER *lab, I can honestly say that the average customer will be unable to repair it. Why? Because he isn't adequately trained to know how these modules function. How is he going to test the module? And who is going to loan him a spare so that he might attempt a substitution?*

No, this chassis is not designed to ease your customer's job, it is designed to ease your *job. Like a number of other progressive TV set manufacturers, RCA has gone to considerable expense to eliminate some of the fears described in the previous letter. TV-set manufacturers found too many electronic technicians lacking the necessary skills to maintain solid-state circuits. They therefore decided to make the job easier for the technician.*

Yes We Must Eat!

The letter, "Technicians Must Eat Too," is beautifully done and hits the nail right on the head.

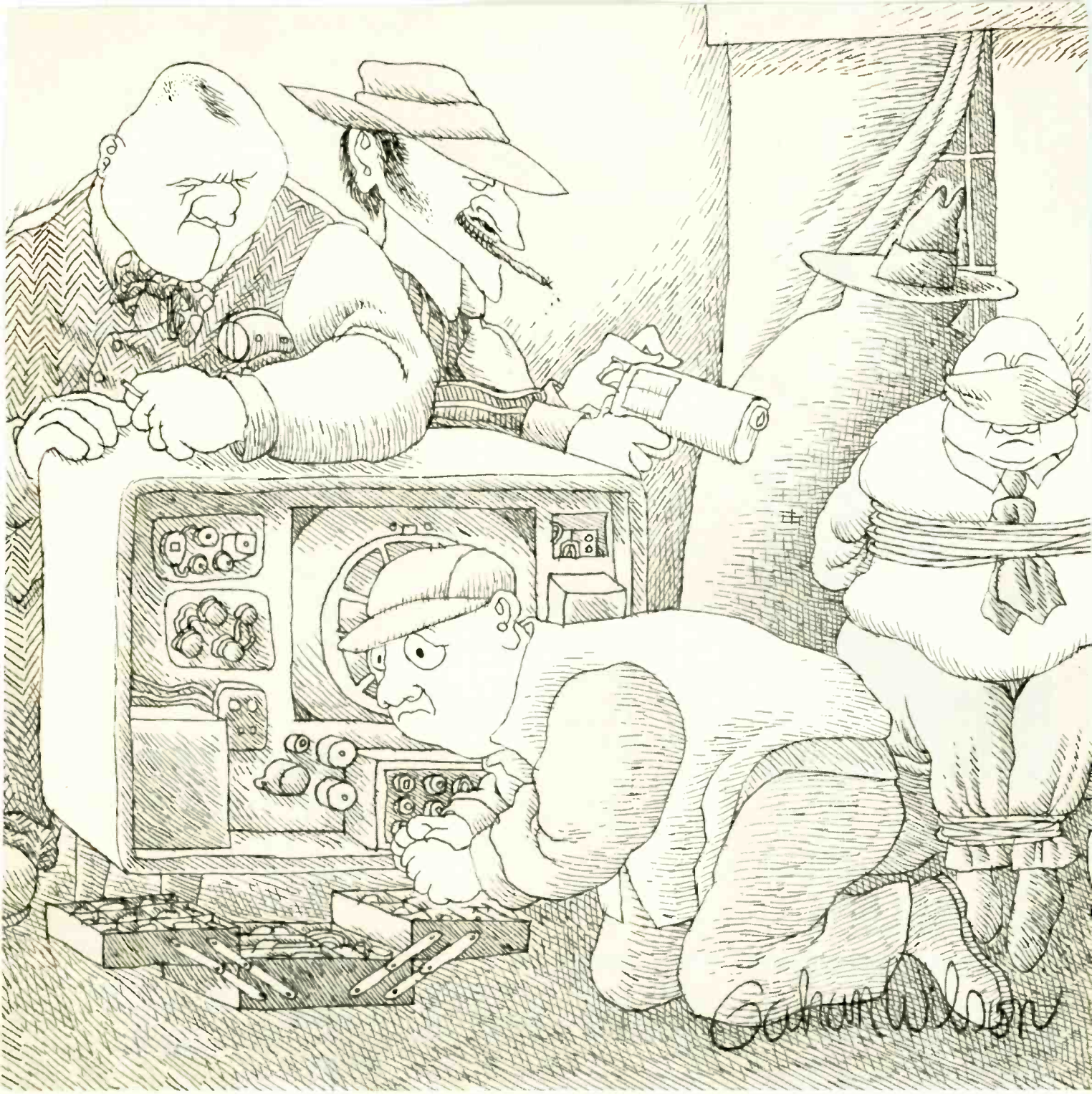
I agree. How else can the electronic technicians establish a wage per hour if they don't get together and unionize?

What good is your seniority, if the feedback from your boss is; "Any time I can get someone just like you to do your work for less pay, then I'll fire you and hire him. Why bother to train the senior men on new products if a younger man will cost less per hour to train? Seniority and 15¢ might get you a cup of coffee—if they are selling it at 15¢."

I keep on admiring the electrical trade. If you enter a wholesale shop in our area, you can't even make a purchase without an electrician's license. Within a year or two, their pay will better than double mine.

Name of CET withheld upon request

"Oh, good, it has stopped raining,—goodbye, and thanks for the demonstration!"



When you're in a hurry, it's nice to know GTE Sylvania has the parts.

Only 34 tubes and ECG solid-state components will solve practically all of your high-voltage rectifier replacement problems.

And they're all available from your Sylvania distributor.

Because tubes are tubes, we can't promise to reduce the number you'll have to carry. But, with the Sylvania line, your distributor will have the tube you need when you need it.

In semiconductors, the story is different. Just 124 ECG solid-state devices including transistors, diodes and integrated circuits will replace over 41,000 different types. In the high-voltage section alone, only 8 ECG rectifiers and triplers will take care of almost every job.

And they save a lot of space in your tube caddy.

When your distributor is stocked with Sylvania receiving tubes and ECG semiconductors you'll have the parts you need. And you'll get them fast.

It's like having a complete warehouse built into your telephone.

And that should help you make a fast getaway.

GTE SYLVANIA

READERS' AID

Space contributed to help serve the personal needs of you, our readers.

Instructions Needed

I acquired a CRT Checker—Reactivator tester with no instructions. It is made by EBCO "Electronic Beam Corp." of Yonkers, N.Y. I would like a copy of the instructions and will pay the cost of copying and mailing.

JOHN J. FIORINO
518-85 Street
Brooklyn, N.Y. 11209

Transformer Needed

I am in need of an audio output transformer, part no. E8971, for a Fleetwood Hi Fi, chassis no. 2072B. I will pay required price plus handling and mailing cost.

ROGER HALL
721 N. Gaffey Place
San Pedro, Calif. 90731

Tekfax Requested

I appreciate the Tekfax diagrams I receive each month in my ELECTRONIC TECHNICIAN/DEALER. I have them from 1229 of May, 1969 up to 1384, October, 1971. I would like to acquire the Tekfax from 607 to 1228. Please advise availability and cost.

GEORGE E. BEAL, SR.
Look & Listen T-V
7115 N. 54th Drive
Glendale, Ariz. 85301

Information Requested

Could anyone tell me who manufactures a tube tester by the name of E-T-A Model 1000/3000, Serial No. 5110?

WILLIAM TURNER
979 Arlington Avenue
Oakland, Calif. 94608

Information Needed

I am having a problem finding information on a tape recorder and player. I need parts, schematics and name of service center for Dokorder Tape, manufactured by Denki Onkyo Co., Ltd., Series 7000, Serial no. 0576, Model 7010, DOK-207, Japan. This tape was purchased overseas 5 or 6 years ago and the instruction book, parts list and schematics were lost.

WALDON B. THIBODEAUX
7 Putnam Avenue
Orange, Texas 77630

For Sale

I have a Lampkin frequency meter, Model 105-B, and a Heath Audio generator, Model IG-72, for sale.

DUANE WILSON
Radio and T.V. Service
Rt. 2
Guymon, Okla. 73942

Schematic Needed

I need a schematic for a Sylvania TV, Model 17M191F3, Chassis 547-104-402-3190. I believe this dates back between 1960 and 1965. I will pay for any expenses if needed.

CLAUDE LEDUC
137 Place Grasset
Vimont, Ville De Laval
Quebec Province
Canada

I need a schematic and operating manual for a VOCA 101 meter made by Demolab Corp., Los Angeles. I will gladly pay for expenses.

GARY L. MILLS
Wiley-Mills T.V. Services
1511 7th St.
Parkersburg, W. Va. 26101

I need schematics for the following: Knight 620-A voltmeter, and a Thordason Electric Mfg. Co. oscilloscope Type 11k16. I will pay for cost of copies.

A. A. FOORD
670 Wilcox Rd.
Rochester, Mich. 48063

Parts and Cements Needed

Does anyone know of a national firm where I may order speaker parts and cements direct?

HENRY R. FOGG
Box 153
Morrisville, Vt. 05661

"At these prices, young man, I'll thank you to admire yourself on your own time!"

NEWS OF THE INDUSTRY

Electronic Industry Council Discusses Mutual Problems

The fourth Electronics Industry Council meeting was held on October 22nd in the Board Room of the Howard W. Sams Co. in Indianapolis, Ind. Morris L. Finneburgh, Sr., EHF, served as chairman; while Dick Glass, executive vice president of NEA, served as secretary. Although there were 29 in attendance, all voting was restricted to participating association representatives which included: Tom Surber, Electronic Industries Assn. Distributor Products Div.; Joe Groves, Electronic Industries Assn. Consumer Products Div. (not voting); John Leedom, National Electronic Distributors Assn.; John Gooley, National Appliance-Radio-TV Dealers Assn.; Bob Flanders, Society of Broadcast Engineers; Sid Sabel, National Electronic Associations; Bob Hallihan, National Association of Broadcasters; Ron Crow, International Society of Certified Electronics Technicians; and Frank Moch, National Alliance of Television Electronic Service Associations.

This photo of the Electronic Industry Council meeting was supplied through the courtesy of Dick Glass, NEA.

Sid Sabel, TRIP chairman [*project TRIP was described on page 64 of our November issue*] reported that this program has thus far received a very good response from all elements of the industry. He outlined a pilot program that the service association in Houston, Texas, undertook to attempt to involve all trade elements in that town. They were immediately able to interest all six TV stations, as well as distributors and dealers. The copy content that the pilot program was suggesting to its area stations included: TV lead-in considerations (choice of lead in), new broadband antennas, advantage of an outside antenna, a "snow free" picture, professional installation, choosing a TV system, outdated installations, and rotors.

Bob Hallihan outlined NAB plans concerning copy for 10-, 20- and 30-second spots to be put on by local stations. Presently the FCC reports that it will consider these spots non-paid commercials.

S. I. Neiman of the Electronics Information Bureau noted that the major problem we have is that the service technician is the scapegoat for bad reception problems and this is the real reason that we must get down to business and solve the reception problem. The public must know that they are only getting 30 to 40 percent of the TV signal available. He also noted that the public understands that their auto will need sparkplugs and tires, etc. . . . because they have been educated by the auto makers, etc. We need the same type of program to show that electronics equipment also needs service and upkeep. The public does not understand us now.

Parts Availability Project chairman, Joe Groves, submitted a report based on 222 dealer responses which indicated that 11 had no parts availability problem; 48 complained about slowness; 12 had problems with 1969-71 model TV sets; 34 were concerned with electrical parts on 1966-68 equipment; 21 responses concerned electrical problems on 1960-66 equipment, 1 being concerned with appearance problems on this age equipment; and 71 responses were general complaints.

During discussion, it was reported in the minutes that it is next to impossible for the independent technician to get parts from Sears, Wards, Western Auto Stores, White Stores, etc.

On the subject of FM interference, Bob Flanders noted that some progress is being made. [*One of his earlier reports was discussed at length on page 24 of our April issue.*] The FCC has issued an inquiry to ask how to solve the problem. It has asked for information concerning the amount and types of interference now causing problems. Findings nearly always show the receiver at fault, and the EIA has replied that it wants more time to study the problem and make recommendations. The main problem for the EIC to consider is that educational TV stations are not being allowed on the air because of interference—to a degree depriving the country of this media.

Tom Cooper reported that with the New Orleans joint convention of NATESA, NEA, ISCET and ETA of Louisiana now definitely scheduled for August [*August 9 through 13, 1972 at the Jung Hotel in New Orleans, La.*], prospects for further service association cooperation now look good.

John Gooley reported on plans for the next National

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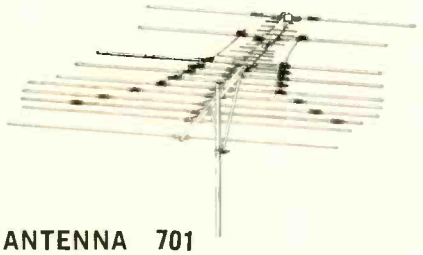
NEW AND NOTEWORTHY

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

SECURITY ALARM 700

Designed for continuous use

The Spacemaster security alarm is designed for use with all rear loading showcases and can be quickly and easily installed without tools on sliding or hinged doors. Unlike some other devices, there is no shut-off switch, and the double circuitry combined with stand-by power supply provides positive, full-time protection. The anti-theft alarm is plugged into a 110v ac outlet, which is not turned OFF when the store is closed—a heavy-duty long-life battery being supplied for use during a power failure. The alarm is said to be complete with a Master Unit and battery, two floor mats, magnetic contacts for doors, contact cement, wire, wire-terminal connectors, and instructions for installing. The alarm sounds when the door is opened (unless sales person is standing on either of the two floor mats) when wiring is cut or disconnected, when the power is disconnected or interrupted, or when any un-authorized attempt is made to open showcase doors. Reflector Hardware Corp.



ANTENNA 701

Designed for fringe area reception

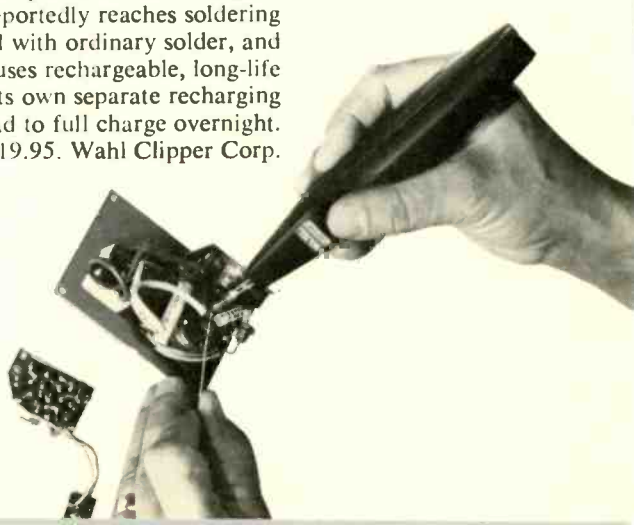
The "Ultron" series, all-channel TV antenna, Model No. 32-1204, is designed for fringe area reception. Construction design permits its satisfactory installation by customers who might not be able to afford your professional services, but prefer to do their business through you.
Price: $24.95. GC Electronics.

FOR MORE NEW PRODUCTS SEE PAGE 60

SOLDERING IRON 702

Cordless, rechargeable

The ISO-TIP is a cordless, rechargeable, portable soldering iron designed for use on printed-circuit boards, normal home and industry wiring repairs and hard to reach jobs. The tip performance is reportedly equivalent of up to 50w and up to 60 joints per charge depending on size of work. The unit has pushbutton operation with both pilot and work lights. It reportedly reaches soldering temperature in 5 sec, can be used with ordinary solder, and has replaceable tips. This tool uses rechargeable, long-life nickel cadmium batteries, has its own separate recharging stand and recharges from dead to full charge overnight. Price $19.95. Wahl Clipper Corp.



NEWS . . .

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Electronics Service Conference to be held at the Chicago Sheraton, Chicago, Ill., from 10:00 a.m. to 5:00 p.m. on Saturday, January 29, 1972. It will be sponsored by NARDA and subjects to be covered include: licensing, the uneasy band of warranty partners, the future of the service technician, and a service technician protection plan.

Dick Glass will serve as chairman of the next EIC meeting to also be held at the Chicago Sheraton. This meeting is scheduled to begin at 10:00 a.m. on Friday, January 28, 1972.

Both meetings precede the NARDA School of Service Management, to be held from January 30, through February 1, 1972.

Finney Financially Supports Both Association Membership Campaigns

During the past year ELECTRONIC TECHNICIAN/DEALER has included many extensive news items, letters and Editor's Memoes stressing the importance of joining the national trade associations and benefiting from their insurance programs, training programs, government involvement and moral support. In fact, we believe so strongly in these associations that we have even begun giving them free ad space in our publication.

But, we must humbly admit that these efforts are small as compared to the continued support given these associations by The Finney Co. Although previously giving financial support to the membership campaigns of both the NEA and NATESA, this year they are offering support unheard of in the past—more support than *any* company has offered them in the past—a $59,500.000 program! [*In fact, the offer is so generous that when Morris L. Fineburgh, Sr., EHF, chairman of the board of The Finney Co., first mulled the idea over with your editor during one of the national association conventions last summer, I considered it a beautiful idea, but of such magnitude that it could never become a reality.*] In this program, the NEA and NATESA will distribute $35.00 wholesale merchandise certificates to the first 500 paid members that join the NEA or NATESA between January 1, 1972, and March 31, 1972 (1000 total new members). [*It is our publication's belief that both associations will go well over that figure in their membership drives this year—so join now to be certain that you are among the first 500!*]

Morris L. Finneburgh, Sr., EHF,

The rules for this Finney Co. promotion are as follows:

1. Membership drive: January 1, 1972 through March 31, 1972.
2. All new members must be solicited, signed-up and approved by either NEA or NATESA ($35—first year dues paid by new member).
3. For the *first* 500 new approved members (NEA or

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Reliable Electronic Assembly Production

Here is one of those rare books which successfully bridges the gap between design and production technologies, thereby providing guidelines for choosing the best design to achieve the least expensive and most reliable product. The content provides information on material and methods employed in mass production, giving the designer in-depth knowledge of the broad range of processes he should consider in evolving a final product concept. Not only does the content define the best materials for each given application, and detail the best choice for fabricating but it also points out incompatibilities which may evolve between design and production. 208 pages. Hardbound.

List Price $12.95 ● **Order No. 287**

Electric Motor Test & Repair

A guide to maintenance practices for all types of small horsepower motors. While many of the larger motor repair shops find it more expedient to replace low horsepower units, rewinding of small electric motors is still a wide-spread and profitable practice. This practical guide contains a wealth of information on testing and rewinding small motors of every type, including fan, starter, polyphase, capacitor, induction, synchronous, etc. Early chapters tell you how to set up a motor test panel, make general tests and measurements, and advise you about the tools and equipment necessary (such as an armature winder, wedge driver, cutting and gauging board, coil taper, puller plate, etc.). 160 pps., 102 illus. Comb-bound with soft cover.

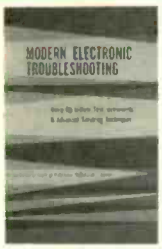
List Price $6.95 ● **Order No. T-97**

Pinpoint TV Troubles in 10 Minutes

A MAMMOTH, quick-answer guide to over 700 TV circuit troubles. If you service TV receivers, this book offers you more practical help for the money than any other ever published. Using 63 large-size photos of different picture-troubles, keyed to trouble-finding charts which identify over 700 probable defects, you can pinpoint almost any TV circuit or component defect in minutes. 50 detailed charts pinpoint the most probable defect causes in every circuit or major component—from tuner to picture tube, from sound and audio to power supply. A 5-page trouble-symptom chart allows you to find the appropriate reference chart. Contains over 160 waveform photos to compare with those on your scope—in each case explanations tell you the most likely causes for improper waveshapes. 372 pps., 394 illus. Hardbound.

List Price $8.95 ● **Order No. 428**

Modern Electronic Troubleshooting



A down-to-earth handbook that deals with today's electronic servicing problems on a practical level, using modern test instruments and advanced troubleshooting procedures to cope with the special problems created by printed boards and solid-state circuitry. It is hard to conceive of a book that encompasses monochrome and color TV, multiband radio receivers, hi-fi equipment, tape recorders, two-way communications equipment, and test instruments for servicing all this equipment. Yet this book does! By getting right to the subject of how to service the equipment without the usual wordy theoretical discussions of how the circuits work. An all-inclusive servicing guidebook service technicians have been asking for. 256 pps., over 100 illus., 5 big sections, 24 chapters.

List Price $7.95 ● **Order No. 474**

Electronic Circuit Design Handbook

New Third Edition—A brand-new, enlarged edition of the ever popular circuit designer's "cookbook," now containing over 600 proven circuits, for all types of functions, selected from thousands on the basis of originality and practical application. Now you can have, at your fingertips, this carefully-planned reference source of tried and tested circuits. Selected from thousands submitted by distinguished engineers, these "thought-starters" are a collection of original circuits selected on the basis of their usefulness. This detailed compilation of practical design data is the answer to the need for an organized gathering of proved circuits . . . both basic and advanced designs that can easily serve as stepping stones to almost any kind of circuit you might want to build. 384 pps., 19 big sections, over 600 illus., 8½" x 11".

List Price $17.95 ● **Order No. T-101**

How to Use Test Instruments in Electronics Servicing

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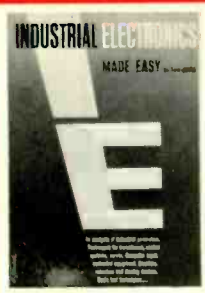

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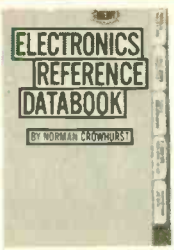

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TEKLAB REPORT

Motorola's Model TU945HS Color-TV

by Joseph Zauhar

The new power supply provides regulation for all output voltages and has self-protection through automatic shut off when overloaded

■ It is generally agreed by many in the television industry that the future trend of color-TV chassis will be toward more plug-in panels or modules. Motorola has employed plug-in panels in practically all circuits of the color-TV chassis and for 1972 they have extended this application to include much of the power supply.

Upon unpacking the Motorola Model TU945HS, employing the ATS-938-A06 color-TV chassis with Insta-Matic color tuning, we gave it a quick once over and found that it looked very similar to the early TS915 solid-state chassis introduced in 1967—with "the works in a drawer" for easier servicing. Only the essential customer controls appear on the front panel, and the secondary controls, which are less important, are enclosed behind the panel door for a neat uncluttered appearance.

After removing the back cover by compressing six clips and loosening one screw, some important new circuit modifications were noted. A separate power supply chassis is used (Fig. 1), which includes the horizontal-sweep DA panel, power supply JA panel, horizontal output transformer, focus block and high-voltage rectifier. The horizontal and power supply panels are both plugged in for easier servicing. The voltage-doubler diodes are mounted on a plug-in card for ease of servicing and fit only one way into the socket. By removing four screws, the complete power supply can be removed or tipped up for servicing.

A smaller, lighter flyback-type transformer (Fig. 2) is used in the new power supply, replacing the heavier iron-core transformer previously used. With the higher power-supply frequency, it is also possible to use filter capacitors that are substantially smaller in both size and capacitance. The oscillator, shaper, driver, overload-shut-off switch and regulator circuits are all placed on the plug-on panel (designated the JA panel) along with the power transformer. The total weight of this panel is approximately 1¾ lb as compared with the conventional Motorola heavy iron-core power supply which weighed 13 lb.

Electronic control circuits are used to automatically adjust for load demands, to regulate output voltages and to automatically shut-off when overloaded.

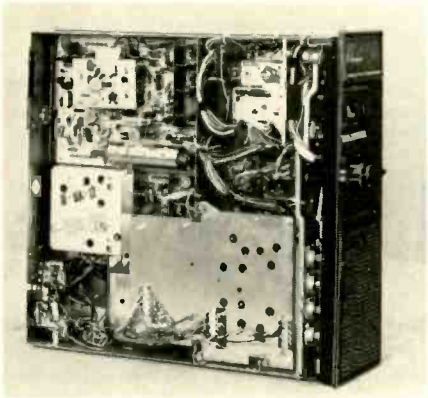
The power supply operates at a high frequency—15,750Hz—while the conventional power transformer

Motorola's Model TU945HS Color-TV set employing the ATS-938-A06 chassis with a simplified, one-panel remote-control system.

operated at a line frequency of 60Hz. By increasing the frequency, an important reduction in iron content is achieved, since less iron is required to maintain the same primary-to-secondary efficiency.

A new vertical panel eliminates the vertical output transformer, the vertical oscillator, drivers and complementary symmetry output feeding the deflection yoke directly.

An external speaker jack (Fig. 3), located on the antenna terminal board, allows the sound output to be played through an additional speaker system by utilizing phono plug connectors. Two additional standard phono-type receptacles permit the customer to play the monaural TV sound output through a high impedance amplifier and its associated speaker system for better sound reproduction.



Motorola's ATS-938 color-TV chassis is similar to the early TS915 "works-in-the-drawer" color-TV chassis. *Courtesy of Motorola.*

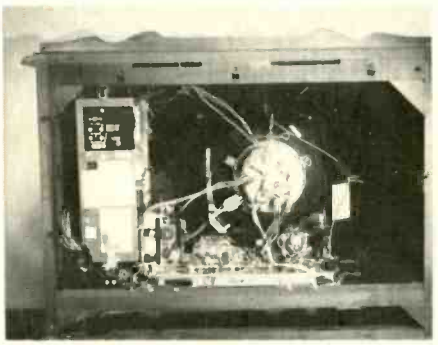


Fig. 1—Rear view of the color-TV set containing a separate power-supply chassis behind the picture tube.

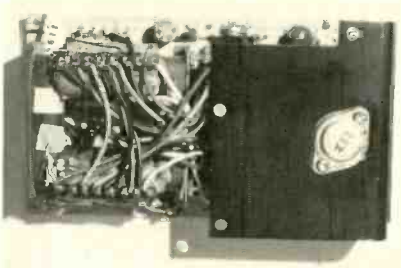


Fig. 2—A new JA power supply panel is used, replacing the heavier iron-core conventional transformer.

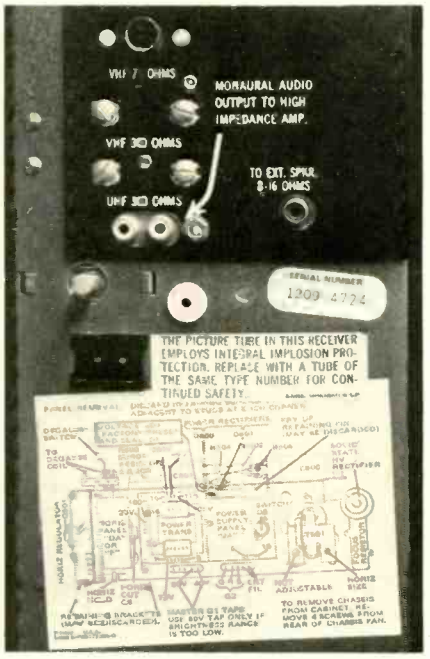
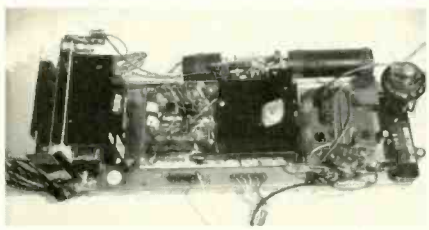


Fig. 3—An external speaker jack is located on the antenna terminal board, which allows the sound output to be played through an additional speaker system.

Only the essential customer controls appear on the front panel, the less important secondary controls being hid behind the panel door.



After removing four screws, both the horizontal output and the complete electronic power supply can be removed.

Fig. 4—The TV set ac line voltage was reduced to 85v and still we obtained a full-screen color raster.

Also, provisions are made for a 300Ω or 75Ω antenna input for VHF reception and a 300Ω input for UHF reception.

Power Supply Operation

We were curious concerning the amount of regulation this new electronic power supply really provided and a check was made with the following instrument set-up:

The input ac voltage to the TV chassis was varied with a voltage regulator and monitored with a Simpson 460 Digital VOM, while the output voltage obtained from the 200v source, Terminal No. 14 of the JA power supply panel was monitored with a Hickok Model DP100 Digital Voltmeter.

Upon fluctuating the TV chassis ac input voltage between 110v and 120v, we noted only a small variation of 1v to 2v from the 200v dc output voltage source—good voltage regulation being noted on the raster with virtually no shrinkage. Then we reduced the line voltage to 85v and were amazed with the full raster and color obtained (Fig. 4).

From these various bench checks, it is apparent that the electronic power supply maintains a fairly constant regulated voltage. (The complete schematic showing the power supply and other circuits can be found in this month's Tekfax Schematic No. 1395). An electronic switch to ground (Fig. 5) supplies dc voltage to the transformer primary. This switch is turned ON and OFF at the horizontal scan frequency, developing interrupted dc voltage in the primary similar to the vibrator action in early car radios. This 15,750Hz transforms the same power to the secondary as the conventional transformer but is substantially smaller and lighter.

The three stages needed to activate the switch at the required 15,750Hz rate are shown in Fig. 6. (The same period of time between each waveform is represented by the shaded areas.) The oscillator is locked at the horizontal scan frequency by a pulse obtained from the horizontal sweep circuit. Converting the oscillator signal to a square wave is accomplished by the shaper, and the driver amplifies the square wave to a switchable level for turning ON the switch transistor. If the square wave to the switch transistor is absent, the switch transistor will not turn ON and when the switch is open there is no primary current—the supply remains OFF.

Power Supply Load Changes

When the TV receiver brightness level is increased, the demand for power rises. The additional power taken from the low-voltage supply secondary must be supplied by the primary, the primary power following the secondary power demands.

Fig. 7 illustrates the regulation of dc voltage applied to the primary. When the secondary winding demands more power, the required increase in the primary current is accomplished by closing the switch for a longer time. This allows the primary current to increase, satisfying the secondary demand. To increase

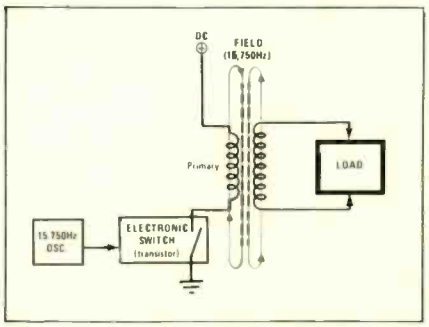
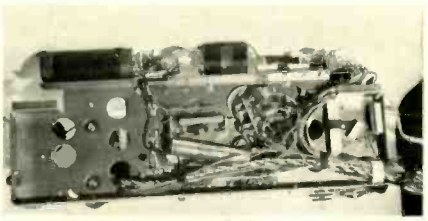


Fig. 5—The power supply uses the horizontal scan frequency generated by a separate oscillator to operate the switching transistor. *Courtesy of Motorola.*



Very few of the component parts are located under the power supply chassis.

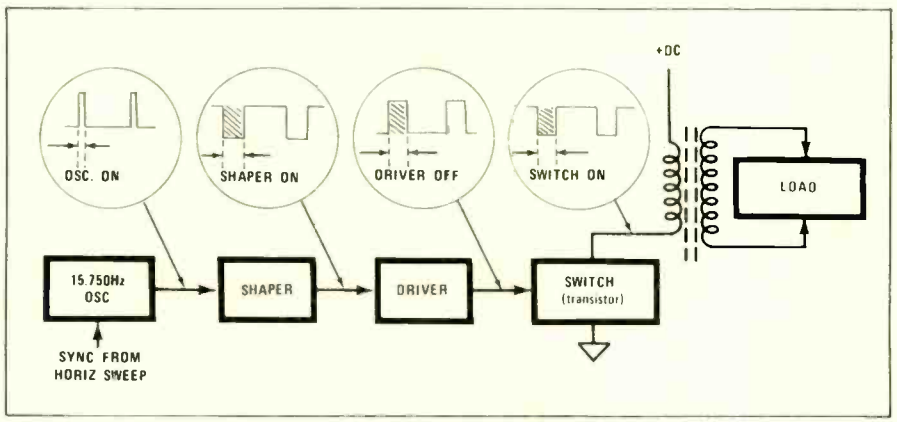


Fig. 6—Three stages are required to develop the square wave used to turn ON the transistor switch. *Courtesy of Motorola.*

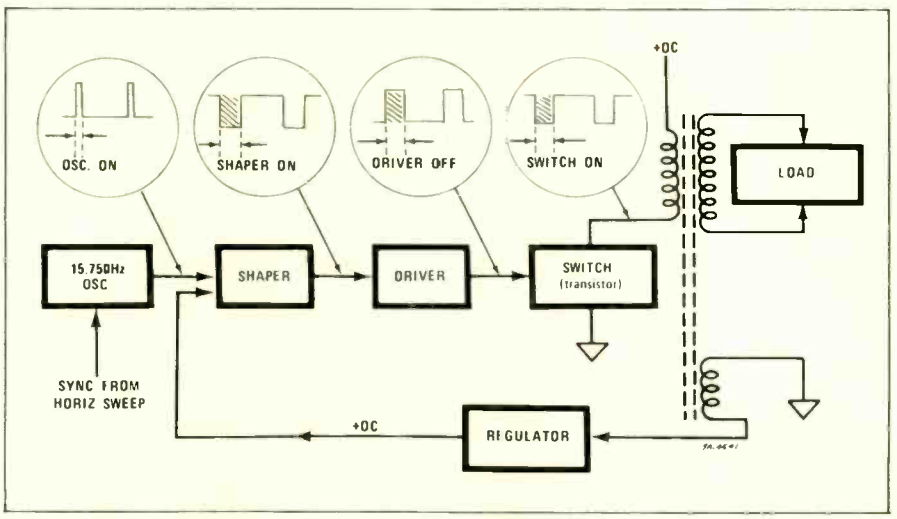


Fig. 7—Voltage regulation in the power supply to meet load changes. *Courtesy of Motorola.*

this time interval, the square-wave switching signal must be altered by applying a control voltage to the shaper.

Square-wave alternation is initiated by a separate secondary winding. As the load increases, the secondary voltage decreases. The decrease in voltage is sensed by the regulator which, in turn, acts on the shaper to alter the square wave. The square wave switching signal now turns ON the switch transistor for a longer duration (commonly referred to as the duty cycle). The frequency of the square wave does not change, remaining locked at the horizontal scan rate. The width increases and turns the switch ON longer, allowing the primary current to increase.

From the waveforms (Fig. 8) we see that for an increase in power demand, the regulator causes the shaper to conduct longer, the driver conducts less and the switch conducts longer. The increase in power demand is now satisfied by increasing the width of the turn-on signal for the switch. This action can be seen by comparing the width of the shaded areas of each waveform in Fig. 8 to those in Fig. 7.

The opposite action occurs when the load decreases—now the secondary voltage rises. The rise is sensed by the regulator, which in turn acts on the shaper to alter the switching square wave. The shaded portion of each waveform in Fig. 8 reduces in width and the duty cycle of the switch is less, reducing the primary current. This in turn reduces the secondary power, and we have compensated for the reduced load. Since the regulator senses secondary voltage changes, the net result is a maintained constant secondary voltage.

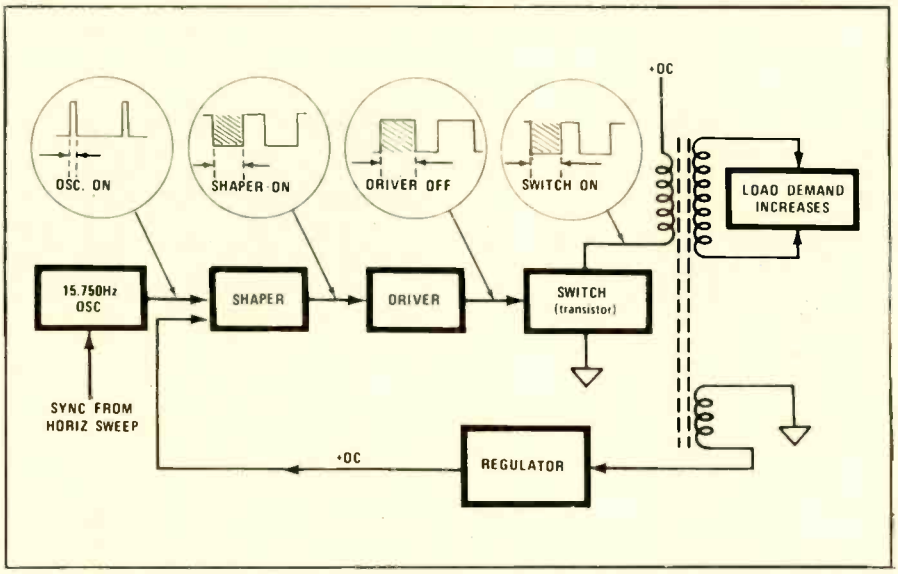


Fig. 8—The regulator responds to the increased load and increases the width (duration) of the signal supplied to the switching transistor. This increases the primary field current to satisfy the load demand. *Courtesy of Motorola.*

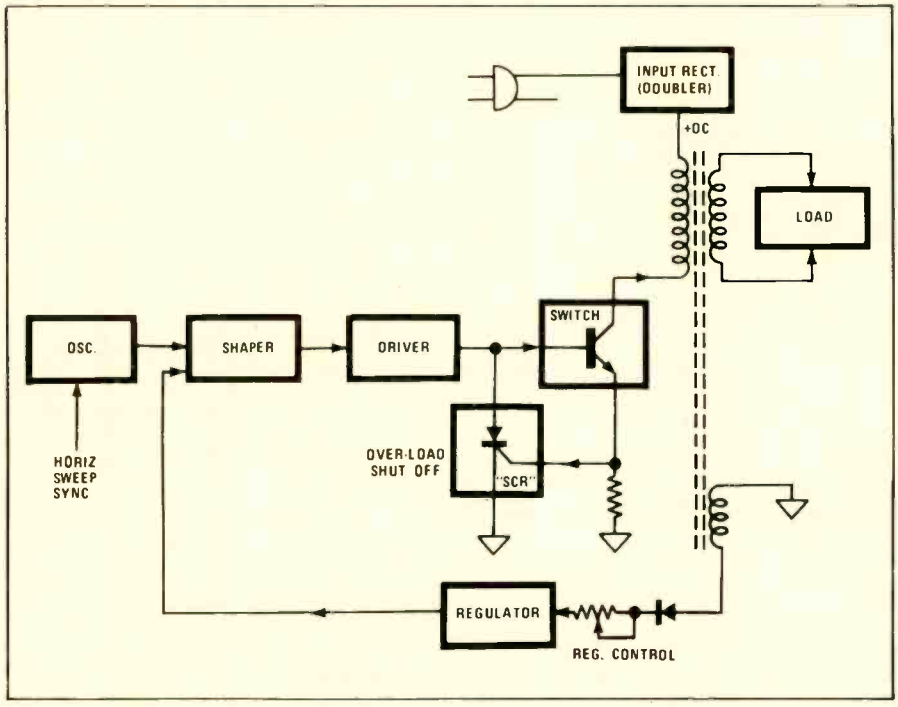


Fig. 9—A silicon controlled rectifier shuts OFF the switch, should a damaging overload occur. *Courtesy of Motorola.*

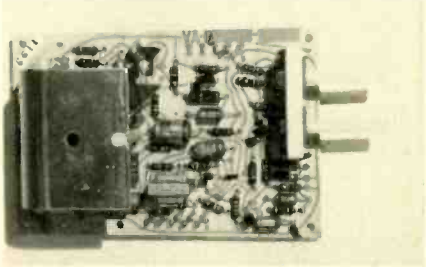
Line Voltage Changes

When the line voltage changes, the same voltage compensation occurs as when the secondary voltage changes with load. If the line voltage increases, the secondary voltages will rise. However, the regulator senses the voltage increase and reduces the ON time (the width of the square wave at the shaper and switch). With the switch ON for a shorter period, the primary current is reduced. This reduces the field and lowers the induced secondary voltage. We now have compensated for the ac line voltage increase.

Overload Shut Off

The overload shut-off stage (Fig. 9) employs a silicon controlled rectifier (SCR) which samples the switch transistor emitter resistor voltage. When overload occurs, causing the switch emitter voltage to reach a pre-determined level, the SCR fires or turns ON. After the SCR fires, the

continued on page 67



The vertical VA panel, with two vertical output transistors, makes use of complementary symmetry and provides direct output to the deflection yoke, thus eliminating the vertical output transformer.

Working with Commercial-Audio Equipment

by Jack Hobbs

Part I—Expand your audio-equipment knowledge and increase your skill value

In one typical intercom/music/paging system located in a high-class restaurant, the bar attendant can flash pickup orders to waitresses or page a guest who receives a telephone call.

■ Commercial audio is recognized as a specialized business, like color TV, for example, which requires special knowledge and experience. But it is not the sole province of "audio specialists" because many TV-radio technicians and service dealers, especially those operating in medium-sized cities and suburban areas of large cities, have successfully diversified into this fast growing business during the past two decades.

The Business

The audio communications equipment business encompasses public address (PA), home- and business-intercommunications (intercom), audio paging, private telephone systems, music distribution, electronic music instruments and audio-visual equipment. And it should be understood by now that "audio-visual" covers not only conventional teaching-lab equipment but also closed-circuit TV (CCTV) and video-tape recording (VTR) equipment. For the information of the TV-radio service dealers, however, it should be pointed out that expansion into CCTV and VTR equipment sales, installation and service, requires a well-healed, well-staffed, well-instrumented organization. But, as a TV-radio technician, you can move into the overall audio business by expanding your knowledge somewhat—including the proper application of a few additional test instruments. The basics will be outlined in the course of this article series. It is beyond the scope of these articles, however, to cover some of the aforementioned areas—including home- and business-intercom, audio-visual and private telephone systems. Let us begin by taking a look at some equipment used.

Basic Audio Components

The basic components employed in ordinary audio communications systems may include: amplifiers, speakers of various types, microphones, distribution transformers, cabling, connectors and other hardware. Auxiliary equipment may include phonograph turntables, tape players, AM/FM tuners and perhaps combination preamp/mixing/control units— the latter being used mostly as separate components in larger more elaborate, higher-powered installations. Additionally, we will also be using a few test instruments for installation and repair work.

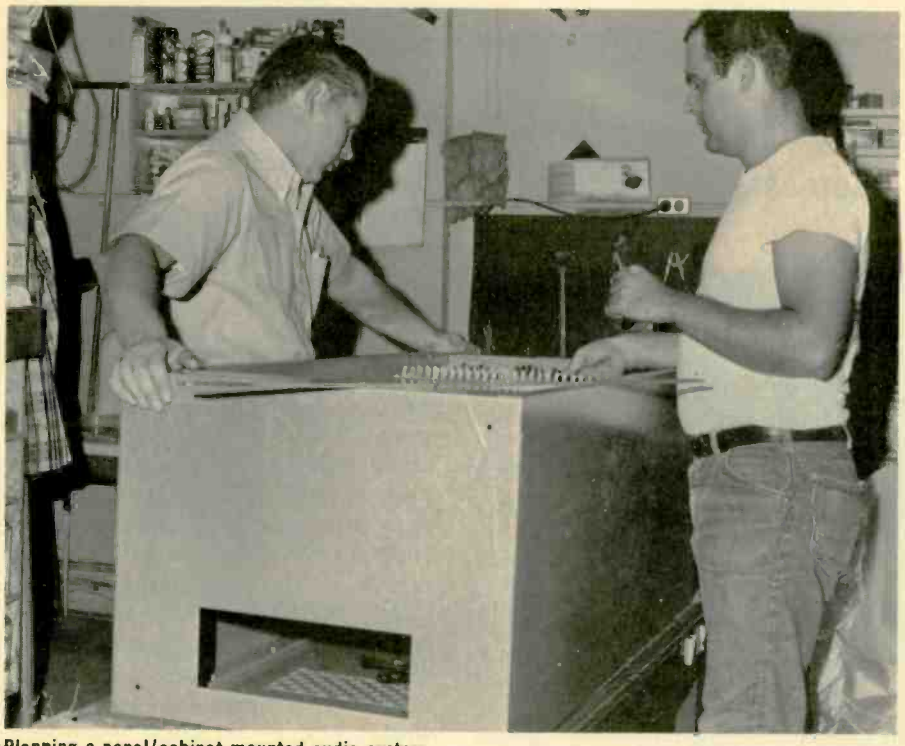
Although electron-tube type commercial amplifiers are still being made, especially in the high-powered category, many solid-state amplifiers are now available and research and development in this area is moving swiftly toward practical, higher-powered units.

The larger number of low- and medium-powered general purpose installations made today employ combination preamp/mixer/amplifier units built in one chassis. As previously mentioned, a separate preamp/mixer/control unit is often used with a separate high-powered amplifier. Almost any type of combination, to satisfy the most unique application needed, is available in power ratings ranging from 10w to 200w. Separate amplifier types are common from about 30w to 300w and higher.

You will find it necessary to "design" most installations to fit particular application needs. These custom-designed installations may be in console- or rack-mounted form,

containing a preamp/mixer/control unit, plus one or more power amplifiers, input equipment (turntable, tape player and AM/FM tuner), and one or more microphones.

A wide variety of portable-type amplifiers and speakers, designed for both fixed and mobile service, operated on ac or batteries, are also available. These units are generally ruggedized and easy to transport from one location to another. The mobile systems are usually designed to operate on 12v, negative-ground battery hookups. Solid-state amplifiers, having modularized preamps, remote master VOLUME controls and other items are becoming popular.



Planning a panel/cabinet mounted audio system.

You may find it necessary on some jobs to design and assemble special equipment.

This is also true of highly efficient, direct-coupled, transformerless, solid-state amplifiers.

It is difficult to place the tag "typical" on any existing audio communications systems, because the broad flexibility inherent in these systems allow "tailor-making" installations to fit any need. Hence, each installation is usually different —especially when considering particular location.

But one basic system, in great demand today by restaurants, stores, group-practice dental and doctors' offices, business offices, schools, hospitals and even homes, is the combination intercom/music/paging system.

Some time ago we checked on a simple installation of this type located in a high-class restaurant and cocktail lounge, which had an overall seating capacity of about 120 people. The system used a 20w amplifier and two microphones—one located at the table-service end of

Kitchen attendant at microphone where pick-up orders can be dispatched to waitresses anywhere in the restaurant dining-room floor or in the cocktail-lounge area.

A handy and inexpensive slide rule by Jensen is an aid in calculating speaker sound-pressure levels for various powers at different distances.

the beverage bar and the other mike in the kitchen at the rear of the restaurant. Although waitresses give their orders directly to the kitchen and bar, pickup instructions, which speed the process, can be flashed to waitresses from both microphone locations via flush-mounted ceiling speakers throughout the restaurant.

A simple number system is employed for pickup orders to the waitress: "Kitchen three" (waitress number three, your order is ready in the kitchen) "Bar three" (waitress number three, your order is ready at the bar). But these orders are used primarily during peak rush periods.

Customers can be paged from the bar microphone when they receive telephone calls. A regular telephone is located behind the bar, and a dialess extension is easily accessible to the customer near the service end of the bar.

Continuous dinner-type music is piped in through telephone lines (Muzak system) from a central distribution point in the city and fed at low level to an amplifier input. In many installations of this type, however, background music is provided either through an FM station subcarrier or locally by either continuous cartridge- or cassette-type automatic tape players. Music to the speakers is set at a very low level (background music is heard, not listened to)— just slightly above the full-house background noise. The microphone order and paging level is set somewhat higher.

Audio Installation Design— First the Survey

As previously mentioned, it will be necessary to "tailor" each system to fit individual locations. And this fact makes it necessary to begin installation design with a survey to determine the component characteristics required for a particular location. Among other things, a pre-system-installation survey determines the amplifier type and power; speaker types, power rating and number of units needed; distribution system type and a few additional installation details. Of course, to some extent, the customer will help you in the beginning when he tells you what he wants the system to do. So listen to him carefully. After that, your job is to find out what equipment you'll need to provide satisfaction. But if you're a modern, wide-awake, sales-engineer, you will have already "cased" the place and will go there fully prepared to sell your product on the basis of its providing a profitable service to the prospect's business.

Last, but not least, the total survey will yield intelligence upon which you must base a major portion of the installation cost estimate that you must present to the prospective customer.

In some cases, it will not be easy to make the components fit the location. But when you have completed a few satisfactory installations and kept detailed records, you will soon get the "feel" of the business and find that you can skip around a lot of "cut-and-try" experimental corners. Until you reach this point, however, you may have to do a bit of on-the-spot checking. The "typical" system described here will usually be a straight-forward design job presenting few problems. This is true for a number of reasons.

First, the "typical" system is usually installed in a new, renovated or redecorated area which has a low ceiling and a considerable amount of sound-absorbing materials on the ceiling, walls and floor. Although an area of this type may be more acoustically "dead" than "alive," it certainly won't present any difficult reverberation problems. Under these conditions, you need only determine by experimentations the types and number of speakers required, their individual and total power requirements, and then select an amplifier having sufficient power output to drive the speakers.

Checking Acoustics

A practical way to sense the acoustical qualities of a location of this type—and hence an idea of the number of speakers required and their placement—is to walk through the area while carrying on a conversation with another person at various distances apart. If the conversation can be maintained intelligible at varying distances merely by raising and lowering the voice levels slightly, you probably have a near-ideal situation. If not, you may have a problem. In the "typical" system example described here, only four low-wattage speakers were needed for the entire area—one in the kitchen, one in the bar and cocktail-lounge area, and two others spaced in the dining area. With speakers mounted in the ceiling, distribution of audio intelligence is omnidirectional and generally uniform over a circular area.

On many pre-installation surveys, you will find it helpful to use a specialized electronic tool—variously called "sound" level, "noise" level or "audio" level meter. This instrument is useful in making background noise measurements under full-house, full-activity conditions. Let's remember that the background noise level is a major factor which determines speaker power and, in turn, amplifier power requirements. Human bodies and clothing absorb considerable audio power, too. But this is not a major consideration in the small seating capacity area specified in the "typical" system described here. In a larger place, with a much greater seating capacity and similar sound-absorbing walls, ceiling and floor, a proportionately larger amount of power would be required.

Another important tool in making pre-installation surveys is a medium-power portable audio system with a microphone and speaker. It is also desirable that the amplifier have 70.7v of audio output. In this manner, a few matching transformers will make it easy to check speaker input power accurately. A tape recorder or straight player having a pre-recorded music tape will also prove helpful if the system is to include music distribution.

The pre-installation survey also provides an opportunity to measure the entire area dimensions to determine the length of individual speaker runs and the total amount of distribution cable needed. The wire size will depend on the type of distribution system used, line impedance and length of runs between amplifier and speakers. For example, a 16Ω low-impedance pair made from size 20 B&S gauge wire is good for up to about 100 ft in a direct-con-

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Servicing with a Color-TV Test Jig

by Joseph Zauhar

Taking a console color-TV set into the shop can be a relatively simple one-man job—if you leave the cabinet and picture tube behind

■ Most of us forget the color-TV test jig when expanding our service facilities, but when properly used it can be one of the most valuable tools for troubleshooting and eliminates many hours of time and guesswork. Not only does it make color-TV shop work physically lighter, it has a number of features that simplify troubleshooting color-TV problems.

Many of the hardest to locate troubles in color-TV set servicing can be caused by the picture tube itself, and unfortunately some of these defects cannot be detected by even some of the better color-picture-tube testers. To remove or replace a color picture tube for testing purposes can be an expensive practice, and one mistake can more than pay for a test jig. With the jig we know that the picture tube and other jig components are good, and suspected components in the defective TV set can be checked by substitution with but a few simple connections.

Econo-Jig Components

Universal 90° yoke	Convergence yoke
Blue lateral magnet	Yoke extension
90° picture tube extension	Metal Cabinet
Convergence load	Anode extension
Ground lead	

Actual well proportion picture obtained on the color-TV test jig when connected to the Admiral 1K18-1A color-TV chassis.

A shorted yoke winding or defective dampening components, which cause loss of high voltage or insufficient vertical and horizontal sweep, are other problems which can be isolated with the jig. Convergence-board problems are also among the many troubles that can be diagnosed with the color-TV jig, since it employs only static convergence for rapid servicing—eliminating troublesome dynamic convergence adjustments.

We obtained a TeleMatic Model EJ190 19-in. color-TV test jig kit for evaluation. It contained all the necessary components—less the picture tube. We found the step-by-step assembly instructions quite easy to follow. This exact procedure should be followed or you will find yourself installing screws in hard-to-reach locations. The three wood-grained metal sides are bolted together, the adjustable deflection yoke brackets being bolted to a ⅜-in. plywood bottom panel. Three eyebolts are installed on the plywood-reinforced metal top, which permits hanging the jig if desired.

After assembling the jig frame, we installed a 490AJB22 19-in. color-TV picture tube within the jig, securing to it the static convergence and yoke assemblies. This is a rebuilt tube that we obtained through the courtesy of Griffiths Electronics Inc. (Any other 19-in. color-TV picture tube could have been substituted.)

The color-TV jig was used with an Admiral 1K18-1A color-TV chassis. Referring to Telematic's color-TV test jig accessory cross reference, we found that the "K" series Admiral color-TV set calls for a YA12 yoke extension adapter, which was supplied with the jig. (This guide lists virtually all chassis and is available free of charge from the manufacturer.) In connecting the TV set to the jig, we attached this octal yoke extension adapter between the jig's yoke assembly and the yoke leads on the TV-set chassis —no additional adapters were required.

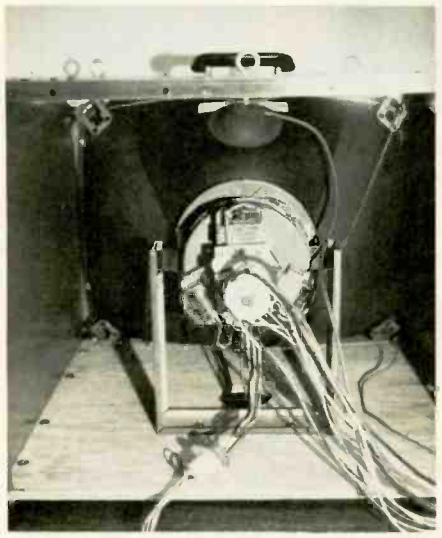
Next, we connected the color-TV anode extension between the TV-set chassis anode lead and the anode of

the jig tube. A sturdy anode contact button, anchored into a shockproof housing, is well designed to prevent corona leakage.

A convergence load is required to properly load a portion of the vertical-output circuit—replacing the convergence board. The color-TV jig uses a static-type convergence for faster servicing, while the cross reference calls for a CD52 convergence load. (In a few Motorola models this load is instead accomplished by connecting a 50μf, 150v electrolytic capacitor from pin 3 of the vertical amplifier to ground.)

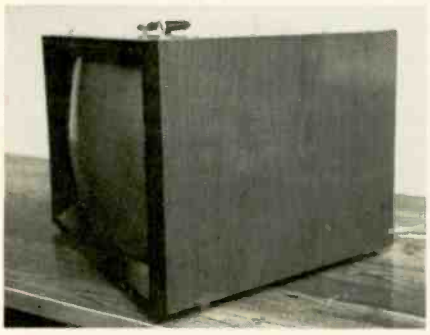
After completing all of these connections, the color-TV set was turned ON. A good color picture was then produced on the jig, although the gray scale was a little on the blue side due to a difference in color picture tubes. (This gray scale could have been corrected by making chassis adjustments, but then the controls would have had to have been returned to their original settings when going back to the original picture tube.) The picture was very well proportioned. The dc or static convergence was good—the vertical and horizontal dynamic convergence being only off a little (and this doesn't matter during bench servicing).

We were very impressed with the test jig and consider it a very useful service tool. ■

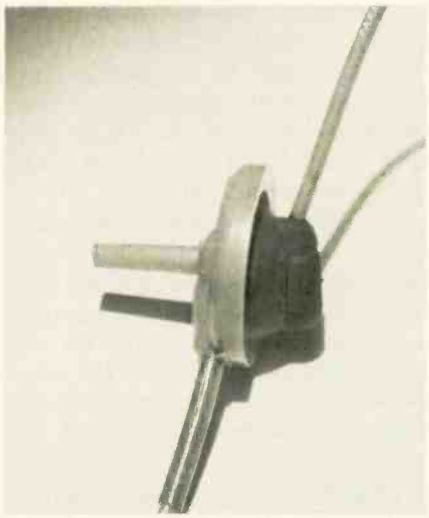


Inside view of the complete TeleMatic Model EJ190 color-TV test jig when used with a rebuilt 490AJB22 19-in. color picture tube supplied by Griffiths Electronics Inc. The extension leads are connected to the color-TV chassis.

The octal socket yoke extension adapter supplied with the jig has ample length and is common to many color-TV chassis yoke sockets.

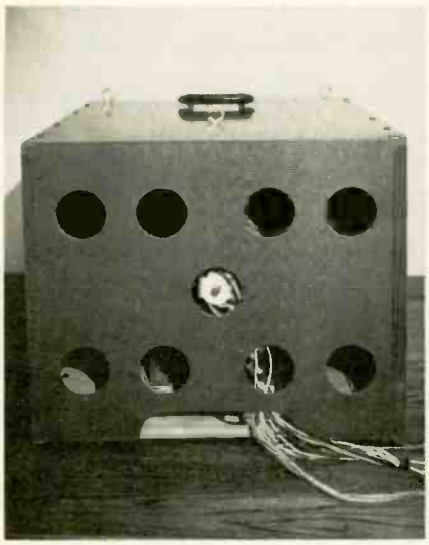


Side view of TeleMatic's color-TV test jig showing the wood-grain metal sides.

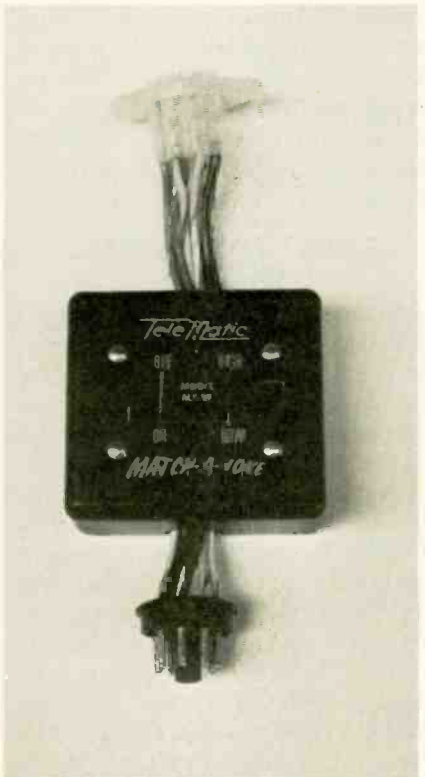


The design of the anode contact button on the color-TV anode extension allows for very little chance of any corona leakage and includes an easy-grip handle.

TeleMatic's convergence loads have sockets to match most color-TV chassis. The one at the right is supplied with the test jig.



Rear view of the color-TV test jig with the back cover in place. The leads can also be placed through a hole in the bottom of the cabinet.

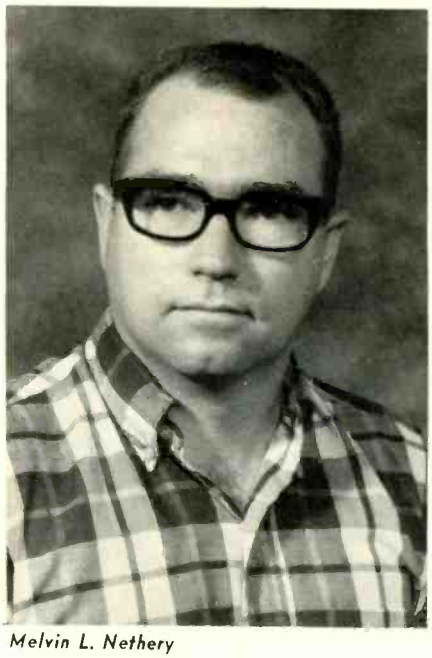


TeleMatic's Match-A-Yoke Model MY-99 is a switchable yoke impedance matching box. It corrects for variations in yoke inductances of different chassis under test.

Diagnosing Power Supply Circuits

by Melvin Nethery

Most electronic technicians and engineers will agree that a TV set, especially one for color-TV reception, contains complex circuitry—the power supply being no exception



Melvin L. Nethery

■ A technician in today's electronics cannot memorize each trouble as related to each specific make and model TV set. He must diagnose defects, taking into account the information gained from certain symptoms, tests and past experience. Sometimes plain old luck plays a hand, but remember, close analysis of a lucky hit can aid in future troubleshooting.

A power supply may seem to be simple enough from a theoretical standpoint, but in a TV set it can produce some of the most elusive troubles you can encounter. Most of them occur for one reason: The filtering and distribution circuits of the dc power supply also perform decoupling tasks, as well as reducing ripple.

BRIDGE AND FILAMENT CIRCUITS

When looking only at the rectifier circuit, a technician should be able to determine the ripple frequency. Ripple frequency is an important measurement to make. If, for instance, the TV set uses a bridge rectifier, the output of the rectifier should have a ripple frequency of 120Hz. To measure this frequency, place the scope probe on a hot filament lead, via a blocking capacitor, and set the scope for two complete cycles. The filament, of course, contains a 60Hz ac voltage, and your scope is now referenced at 60Hz. Next, place the scope leads at the rectifier output, and you should observe four cycles of ripple voltage. If only two cycles are displayed (indicating 60Hz instead of 120Hz), the bridge has an open diode.

In some TV sets, an open diode in a bridge circuit will not greatly affect its operation—other than upsetting degaussing operations. This can be a tough one for the technician who has not had the occasion to attend service clinics or previously experienced this particular problem, for once the set is turned OFF, the screen will be magnetized instead of being degaussed. Once manually degaussed, the TV set will operate satisfactorily again until it is once more turned OFF.

Many times a technician will just unplug the automatic degausser, manually degausse the TV set and move on. This is not an acceptable repair method. Although the TV set may appear to work fine, it will usually work better and be more stable if the defective diode is replaced.

If a diode shorts within any power rectifier circuit, the safety overload device (circuit breaker, fuse, etc.) will open. It shouldn't be necessary to go into the various diode configurations, the main thing to remember is the bridge circuit.

As far as hum is concerned, it is relatively easy to isolate by checking ripple amplitude with a scope. Always observe the scope waveforms to note if there are two hum peaks or just one. If there is just one hum peak and the TV set uses full-wave rectification, then the hum probably originates from the filament source. There may be either a heater-to-cathode short within a tube or a bad ground connection. One exception might be an open diode in the bridge configuration, although in a good quality TV set, the filtering networks will filter 60Hz almost as well as it will 120Hz, thus hiding the symptoms of an open diode. However, anything is possible.

GROUND CONNECTIONS

Virtually all currents, ac and dc, flow within the ground foils of a printed-circuit board of the TV-set chassis. Unstable ground connections, especially in printed-circuit boards, can drive a technician up the wall. Here is what can happen: A low resistance develops between the ground foil and metal chassis. Constant temperature changes cause the solder to crack where the foil eyelet is soldered to the metal chassis tab. Chemical changes take place within the cracked connection; and before you know it, a resistance has been formed where there had been a solid ground.

In Fig. 1 we can see that all signals developed on the ground foil will interact and upset each circuit's operation. The symptoms will depend upon what circuits are involved and the degree to which the ground connection has deteriorated. Remember: Relatively heavy currents flow in these ground foils and only a small resistance is needed to develop a signal voltage on the ground foil.

Most bad grounds will cause symptoms of an intermittent nature and are usually heat sensitive. Here

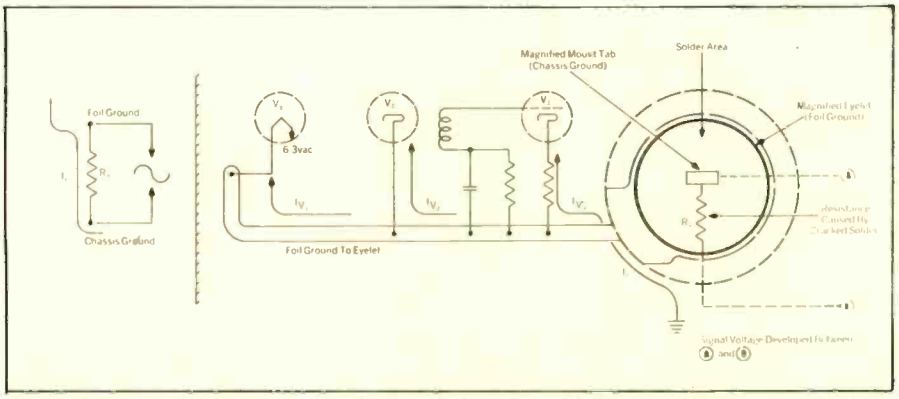


Fig. 1—Current (I_t) flowing from chassis ground through cracked solder resistance (R_x) develops unwanted signal voltages on the ground foil. This current (I_t) contains 60Hz filament current from tube V_1, along with cathode signal current from tubes V_2 and V_3.

is a partial list of symptoms caused by bad grounds:

- Intermittent red, blue or green hum bar (60Hz)
- Reduced high voltage—caused by bad ground in video amplifier—upsets bias on CRT, causing great current demands in the high-voltage circuits
- Picture goes black intermittently —high voltage normal
- Intermittent horizontal pull
- Intermittent streaking and picture waver
- AC modulation of picture and raster

CASE HISTORIES

Let's look at a few case histories, their symptoms, analysis and cure.

Sweep-Circuit Modulation

An inexpensive portable TV set came across our bench with its raster bending at a 60Hz rate (Fig. 2).

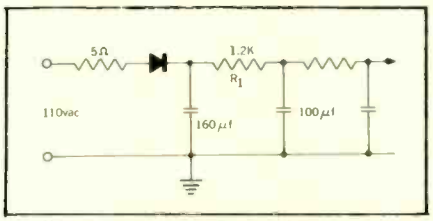


Fig. 2—By changing value, resistor R_1 caused an objectionable raster bend in an economy TV set.

The tubes were good, the filters were okay, and the grounds were sound as a rock.

The raster bend persisted and the only clue was a slightly higher than normal voltage on the low side of resistor R1. This resistor had heated and changed to a very low value, causing improper filtering.

I had a similar case where a filter choke was used instead of the 1.2K resistor. The choke had burned and lost some of its reactance, causing raster bend. This defect will not cause severe bending, but it will certainly be objectionable. Also be on the lookout for components that have been changed to an improper value when previously replaced by a less experienced person.

Apparent Sync Buzz

A B/W-TV set came into the shop with what appeared to be sync buzz. The first step in our analysis was to pull the vertical tube while the BRIGHTNESS control was turned down. The buzz stopped. This one check told me that the problem was not sync buzz—it was vertical buzz, which is at the same frequency as the sync. (Another check that will tell you the same thing is to turn the VERTICAL-HOLD control to unlock the vertical oscillator. If the buzz changes pitch, the trouble results from vertical spikes feeding into the audio from the vertical stages within the TV set itself.)

The cause in this case was a filter capacitor common to both the vertical circuit and the audio B+. (Note that this can also be caused by yoke leads being too close to the audio input circuit.) In this particular case, there was no evidence of hum, so this filter served primarily to decouple these signals to ground—along with whatever other ac may or may not have been present. *Don't always associate power-supply circuits with hum only.*

Slight Picture Twist

Another B/W-TV set found its way to our bench on an exasperating day. The symptom was a slight picture twist that seemed to twist according to picture content. This seemed to indicate the presence of video in the sync signal. Applying a scope to the sync output verified that video was getting into the sync. It was also noted that the AGC control didn't act quite right—one of those things you know isn't right, but just can't put your finger on.

After several hours of looking

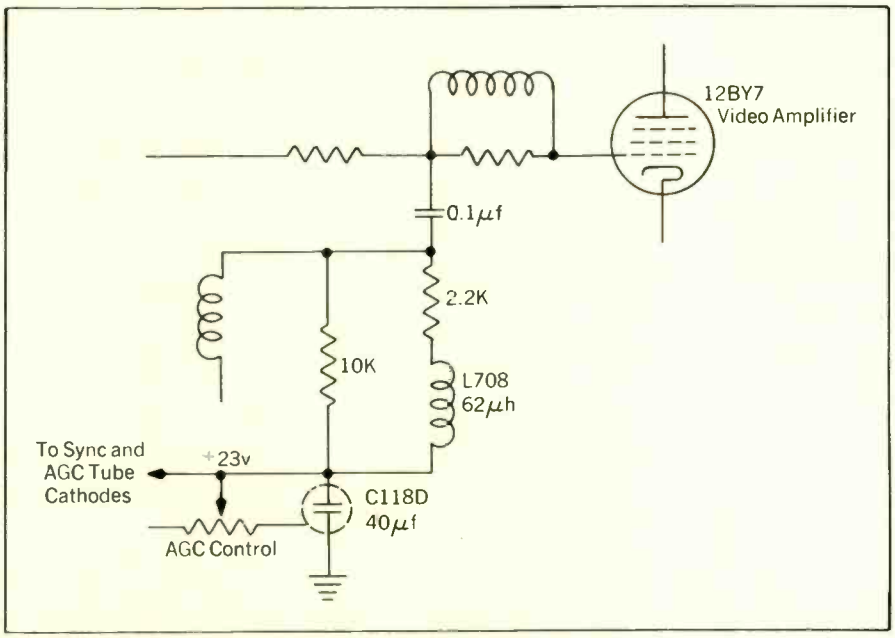


Fig. 3—Video ringing and some loss of the AGC resulted when capacitor C118D opened—failing to shunt to ground ac signal voltages present at the peaking coil.

Many seemingly unrelated problems may actually all be the result of but a single open electrolytic capacitor

things over, I decided to apply the scope probes to the filters in search of unwanted "hash." Sure enough, an open filter capacitor was found connected to one side of the AGC control. And this capacitor was also common to the sync circuit.

Vertical Roll, Pinched Vertical Sync

I have had many different makes and models of TV sets that have shown these symptoms—vertical roll, pinched vertical sync. Connecting the scope to the output of the sync separator shows the vertical sync pulses "sucked" up into the horizontal "hash" (I call it hash since it cannot be distinguished as horizontal sync pulses when your scope is set to the vertical sync sweep rate).

About 90 percent of the time this symptom is caused by a defective 2-to-5μf capacitor connected to the screen of one of the video amplifiers. This capacitor can be checked with a scope. If it is open, you will see a composite video signal developed at the screen. This deteriorates the vertical sync, which will not be amplified through the sync separator.

Video Ringing

A familiar chassis came across our bench with not so familiar a problem. It had video ringing, the multiple ghosts not being tunable. This indicated that the video stages were the source of trouble. However, all components checked okay. Peaking coils were checked first as they are forever going open. The delay line was substituted, even though it checked good.

Suddenly something caught my eye. According to the diagram (Fig. 3), a peaking coil with its associated network should be at signal ground —via a filter capacitor. A sneaky way of grounding a peaking coil, but acceptable as far as the signal is concerned. Sure enough, substituting a new capacitor cured the ringing and also improved the AGC action —even though the AGC circuit showed no apparent defects beforehand. At first the symptoms seemed far from being related to the power supply, but not if you are thinking in terms of ac signals, rather than merely dc leads straight to the power-supply filter.

SOME GENERAL PRINCIPLES

Remember to consider the "probability of occurrence." Try to determine the things that are most likely to happen—checking these first saves time. In the case of the TV set with vertical roll, many things could be checked before you work back into the video stages, looking for vertical trouble. But why bother checking all of these other things in depth when filter capacitors have a high failure rate and you know that they can cause so many different symptoms?

If the horizontal oscillator runs considerably off frequency, our knowledge of theory tells us that the circuit time constant is not right. Usually if a horizontal oscillator circuit is so far off frequency that it squeals and no raster is present—everything from the tubes to the HORIZONTAL control knob having been tested—the cause is probably the filter capacitor on the B+ line supplying power to the oscillator circuit. This trouble manifests itself in many TV sets. When the filter opens, the B+ is no longer decoupled and the horizontal oscillator waveform rides on it. This action sets up feedback within the oscillator as well as other circuits that may be common to the same B+ voltage source.

Any time a TV set is infested with some "odd-ball," hard-to-pin-down symptom, or multiple symptoms, it is a good practice to use a scope to check all filters in the power supply, plus any other large-value capacitors. Observe the AGC line on the scope and check for bad grounds —the medium through which current must flow.

When checking filters with a scope, look for signals that should not be present—such as video, sync, vertical or horizontal spikes, etc.—as well as excessive ripple. Also look for unwanted signals on the AGC line. These signals can cause weird symptoms.

If bad grounds are suspected, solder copper wire from the printed-circuit ground foils directly to chassis ground. Sometimes the foil grounds themselves cannot be reliably repaired. Some designs incorporate very unstable grounding methods, and this is where we should use copper wire to insure a proper ground. Although I have never encountered them, be on the look-out for ground loops when tieing ground foils back to the chassis. A good rule is to use as short as possible lengths of wire.

CONCLUSION

Remember! Use your scope to check the filters and AGC line. Also check for bad grounds on those "hard-to-pin-down" symptoms. I advise these three checks since they take little time to perform, and they relate to problems high on the list of troublemakers—areas where most circuit interaction takes place. So take a few minutes and put a "tough dog" in its place.

It is easy to cite example cases after hours have been spent curing a trouble. The only hope is that technicians can benefit from examples. The lesson to be learned from the cases given here is that it can be difficult to isolate a symptom to a definite circuit when the defective circuit upsets several other stages along with it. The problem seems to carry a person in circles. ■

GUEST AUTHOR

Receiving Tubes Take a Look at Solid State

by Morris Lewis

Morris Lewis received a B.A. degree in Economics from Brooklyn College and took post-graduate courses at the College of the City of New York, George Washington University and Rutgers University. He joined RCA in 1944 as a sales correspondent at the electron tube plant in Harrison, N.J., and subsequently advanced through various sales and marketing positions. In 1957, Mr. Lewis became manager of Distributor Products Administration and two years later he was named manager of Merchandising Coordination. In 1960 he was appointed manager of Merchandising, Picture Tubes for Distributor Products and since 1961 he has been manager of Distributor Receiving and Picture Tube Merchandising.

From time to time we hear distributors, service dealers and technicians express some concern about the future of the TV Service business, particularly as it relates to the sale of entertainment receiving tubes.

■ Service dealers and technicians are naturally concerned about the future for a product (tubes) which has contributed heavily to their sales and profits and for which the sales outlook is changing. While the use of receiving tubes in new TV-set production is declining and the pace of solid-state usage is on the increase, the outlook for sales of receiving tubes for replacement is far from bleak—in fact, it is still very promising.

We recognize, of course, that the total number of receiving tubes used as replacements has declined, at a very moderate rate, in recent years. Despite this fact, however, the demand for replacement receiving tubes will remain at a high level throughout this decade.

Furthermore, and importantly, as the color portion of the replacement market continues to grow, the dollar value of tubes sold will continue to increase, as has been the experience of the last five years. Moreover, the trend to more solid state in TV does not mean that the TV service business will disappear.

Solid-state components will induce technological changes in the service field and the total number of sets in use will continue to increase each year. Thus, only the character of servicing will change, creating new business opportunities for the enterprising service dealer. In essence, we foresee continuing high-volume replacement tube sales (accompanied, incidentally, by a growing picture tube business) as the use of solid-state devices in TV sets continues to expand.

Let's look at a few facts. Since there is no published data on actual receiving tube usage, we'll use industry statistics on receiving tube sales, published by the Electronics Industry Association, as the best indicator of such usage.

These reports disclose that manufacturers' sales of entertainment receiving tubes for replacement use still exceed 100 million units per year. Sales amount to 108 million tubes in 1969, 104 million in 1970, and our estimate is 102 million tubes for this year. As already indicated, the coming years will see a gradual decline, but sales will still be as high as 90 million units in 1975.

Translating this into dollars, we foresee an even more promising outlook. Industry replacement volume, calculated at published list prices, amounts to $423 million in 1969 and $439 million in 1970. The estimate for this year is $446 million, and 1975 is projected at $465 million. So, from the dollar standpoint alone, the service industry can expect to attain high volume and profits on receiving tubes for the foreseeable future.

Now, what about solid-state components in TV sets? Solid state is here, it's growing, and none of us can ignore it. But, we must ask, what kind of dent is it making in today's replacement tube business? Where is it heading? And, above all, does it represent a hindrance or an opportunity to the service dealer?

Best estimates indicate that less than 10 percent of the color-TV sets produced in the U.S.A. in 1969 and 1970 contained only solid-state devices, and for 1971 the figure may go as high as 20 percent. After 1971, the percentage will increase more rapidly.

On the other hand, these numbers mean that more than 90 percent of the color-TV sets produced in 1969 and 1970 still contain tubes! And 80 percent of the TV sets to be made this year will still use tubes! When viewed in the light of growing TV-set sales, it can be seen that the receiving tube replacement potential will remain high for a long time to come.

Putting all of this together, we come up with a double-barreled conclusion: First, the service dealer can expect to replace receiving tubes, in volume, at a good profit, for the foreseeable future.

Secondly, we must be realistic and take into account the dynamics that characterize our industry. Technology is changing and the demands of the service technician will also

continued on page 63

TEST INSTRUMENT REPORT

California Instruments' Digital Multimeter/Counter

by Phillip Dahlen

Provides the advantage of two instruments in one

■ Earlier reports have stressed the importance of having access to a digital frequency counter for precise signal-frequency measurement, just as they have stressed the importance of measuring voltages and currents with the greater degree of accuracy permitted with digital readout. But we have been wondering why, when both instruments can use so many common components, some manufacturer has not provided you with the savings of combining both instruments in one. California Instruments Co. has done just that, and in doing so the manufacturer has provided the bonus of offering 4½-digit multimeter readings, as opposed to the 3½-digit readings generally found in other instruments.

Additional manufacturer specifications for the Model 8420 Digital Multimeter/Counter include the following:

California Instruments' Model 8420 Digital Multimeter/Counter. For more details, circle 900 on the Reader Service Card.

DC Measurement

Range:	1v, 10v, 100v and 1000v
Accuracy:	0.01% of reading, ±1 digit
Resolution:	0.01% of full scale
Input Impedance:	10M
Normal Mode Rejection:	40dB at 60Hz
Common Mode Rejection:	100dB, dc to 60Hz 80dB, dc to 60Hz, 100Ω unbalance
Overrange:	50% of full scale or 1000v maximum
Overload Capability:	10,000% of full scale, not to exceed 1000v
Reading Rate:	Three per second

AC Measurement

Range:	1v, 10v, 100v and 1000v
Accuracy:	0.1% of reading, ±3 digits, 60Hz to 10kHz 0.5% of reading, ±10 digits, 30Hz to 50kHz 1% of full scale, 50kHz to 100kHz
Resolution:	0.01% of full scale
Input Impedance:	1M paralleled with 50pf
Common Mode Rejection:	60dB at 60Hz
Overrange:	50% of full scale or 500v maximum
Overload Capability:	10,000% of full scale, not to exceed 500v
Reading Rate:	Three per second

Resistance Measurement

Range:	1K, 10K, 100K, 1M and 10M
Accuracy:	0.02% of reading, ±1 digit, 1 through 100K range 0.1% of reading, ±1 digit, 1 and 10M range
Resolution:	0.01% of full scale
Overrange:	50% of full scale
Overload Capability:	200v dc or peak ac
Nominal Source Current:	1K scale, 6.2ma 10K scale, 620μa 100K scale, 62μa 1M scale, 6.2μa 10M scale, 620na
Reading Rate:	Three per second

Frequency Measurement

Range:	10kHz, 100kHz, 1MHz and 10MHz
Accuracy:	0.02% of reading, ±1 digit, to 1MHz 0.05% of reading, ±2 digits, above 1MHz
Resolution:	0.01% of full scale, above 50Hz
Input Impedance:	500K paralleled with 75pf
Overrange:	50% of full scale or 10MHz maximum
Overload Capability:	250v rms maximum
Reading Rate:	One every 2 sec
Maximum Sensitivity:	0.1v rms, to 1MHz 0.25v rms, 1MHz to 10MHz

Physical Specifications

Size: 3½ in. H by 12 in. W by 8 in. D
Weight: 11 lb net

Power Requirements

115 or 230v ac ±10%, 50 to 400Hz, 18w maximum

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NEWS...

continued from page 33

NATESA)—1,000 total—The Finney Co. will underwrite the total cost of each membership ($35.00).

4. Each approved new NEA or NATESA member will receive from The Finney Co. a gift certificate good for $35.00 worth of FINCO antennas at the *service dealer wholesale price (40 percent off the regular retail list price)*.
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12. All unused Finco antenna gift certificates shall become void as of May 1, 1972. Gift certificates must be submitted to an authorized Finco antenna wholesale distributor *on or before May 1, 1972*.

RCA to Close ServiceAmerica Test Operations Immediately

RCA has announced the closing of its ServiceAmerica operation established in three test markets last year to service all makes of TV sets and other home entertainment products.

The operation had a total annual volume of approximately $1.5 million, RCA said. The company added that its results in the test markets do not justify the investment of manpower and other resources required to expand ServiceAmerica nationally.

The ServiceAmerica centers were located in the Philadelphia, San Francisco and Miami areas; and were reportedly closed by December 31, 1971.

RCA said that all customer obligations of ServiceAmerica will continue to be met.

ISCET Report Stresses Technician Pride

There are thousands of electronic technicians, most of whom service home entertainment equipment. Some are poor, some are excellent, and others are in-between. Now, I don't propose that each one be identified by his attributes on a scale from 1 to 1000. But I do think that it is a very good thing for the industry to set some minimum standards. This not only places a label of "qualified" on the technician, it gives him dignity of accomplishment and provides those coming up with a goal to shoot for. There are, of course, many other desirable reasons and, to my knowledge few, if any, objections.

The CET program has filled this need and is rapidly spreading throughout the world. There should be just under 3000 so qualified by this time. It has taken over 5 years to reach this point. I venture that this figure will double in the next 12 months. Beyond that, I wouldn't guess, but you get the idea. The test is constantly being revised and improved. Along with the proof of 4 years of practical training, it is a good indicator of a man's (or woman's) basic under-

standing of electronics.

In the near future, programs will be available to test advanced levels of achievement. This may give technicians the opportunity to qualify as a specialist in various branches of electronics, as well as advanced home entertainment equipment servicing. Actually, there is no limit to the heights of these achievements, only to the extent of man's mental capabilities.

Ed Schon, CET

Now, you may ask, why should anyone bother with such an inconvenience? Well, it's "pride." This is what makes a "professional," as set apart from an ordinary workman. Not only does the employer and the customer gain from a "professional" trade, but the technician himself gains self esteem, self respect and self improvement. His income will be higher and therefore his family will also benefit.

Beyond the point of seeking and attaining certification and its many benefits, where can one go? *That's why ISCET was created!* It is truly an International Society of Electronic Technicians, who come together for mutual aid and comfort. It is so beautiful to have the haven of mutually interested people where common problems can be aired and often solved. A place where your personal knowledge can be extended to help others. A place where, if you choose, you may instruct or assist younger heads in the business. Whether it be on a local basis or international, you will make lifelong friends and learn a bit yourself. But most of all, you will make known to the industry who you are, what you are, and contribute your piece to the growth of your chosen field, electronics.

There are several local chapters being formed and you may want to be the sparkplug to get one started in your area. Why not? We did it quite spontaneously here in Oregon last July. It's a little work, but well worthwhile. If you need some help, we'll give it gladly. But first, send in your application for ISCET. Be forewarned, however, that acceptance is *not* automatic. Your character must *first* be approved by a local NEA affiliate group. If you are interested in ISCET, get going! Remember—think, act and work as a "professional." It pays.

Ed Schon, CET
Public Relations Committee, ISCET

Jerrold reports that 62 TV dealers and technicians attended its recent two-day basic MATV school, conducted at the Hyatt Lodge in Minneapolis, Minn. The first day of the school covered decibels, signal-to-noise ratios, minimum signal requirements, path loss, equipment parameters and applications. The second day started with a demonstration of MATV system layout techniques, class participation in typical layouts, head-end calculations, amplifier selections adding CCTV and accepting CATV feeds. According to Wendell Woody, Jerrold midwestern regional manager, the school was unusually effective in helping Minnesota technicians cope with MATV problems.

Color-TV Set Sales Continue to Climb

U.S. manufacturer sales to dealers of TV sets, radios and phonographs were ahead last September over sales during the same month a year ago, according to the Electronic Industries Association's Marketing Services Department.

More details concerning their report are shown in the table.

TOTAL U.S. MANUFACTURER SALES

	September			Year-to-Date		
	1971	1970		1971	1970	
Television Sets						
B/W-TV Sets	542,108	492,388	+10.1%	3,437,674	3,171,341	+ 8.4%
Color-TV Sets	746,617	585,447	+27.5%	4,074,502	3,236,842	+25.9%
Total TV Sets	1,288,725	1,077,835	+19.6%	7,512,176	6,408,183	+17.2%
Radios						
AM	434,326	560,934	−22.6%	3,358,255	3,407,289	− 1.4%
FM	407,394	352,440	+15.6%	2,647,225	2,144,820	+23.4%
Total Home Radios	841,720	913,374	− 7.8%	6,005,480	5,552,109	+ 8.2%
Automobile Radios	1,070,568	707,892	+51.2%	7,638,874	6,336,381	+21.3%
Total Radios	1,912,288	1,621,266	+18.0%	13,694,354	11,888,490	+15.2%
Phonographs						
Portable Phonographs	362,734	322,902	+12.3%	2,254,462	1,830,084	+23.2%
Console Phonographs	116,757	131,725	−11.4%	668,078	760,672	−12.2%
Total Phonographs	479,491	454,627	+ 5.5%	2,922,540	2,590,756	+12.8%

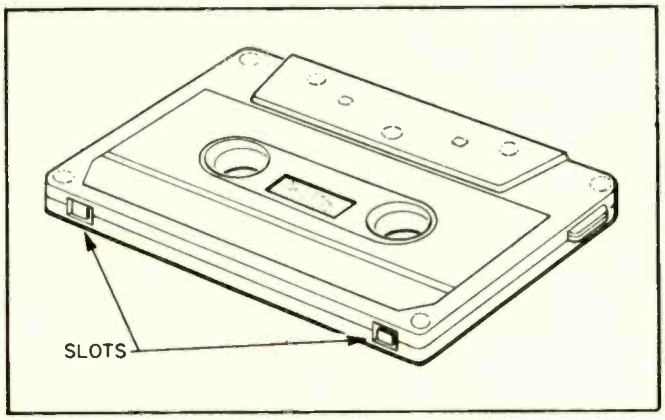
TECHNICAL DIGEST

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

ADMIRAL

Tape Cassette—Service Hint

Tape cassettes have tabs in small slots (see drawing) that can be removed by the user to prevent accidental erasure or re-recording of the tape.



Some tape recorders are brought to service shops with a complaint of "will not erase or record" because the user removed the tabs.

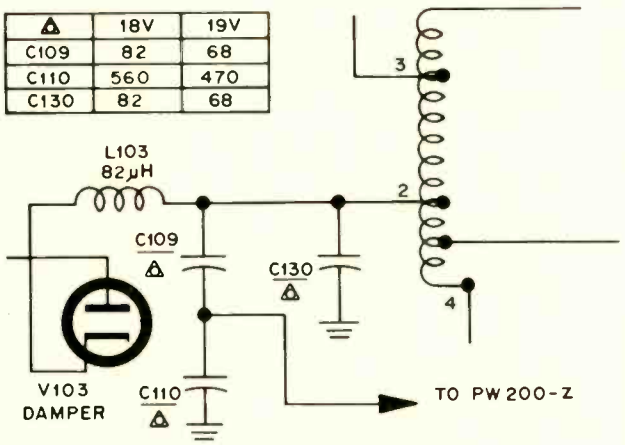
If you get a tape recorder to service, first look for the tabs on the user's cassettes! If the tabs are removed try a known good cassette before looking for further troubles.

RCA SALES CORP.

TV Chassis KCS171—Circuit Modifications

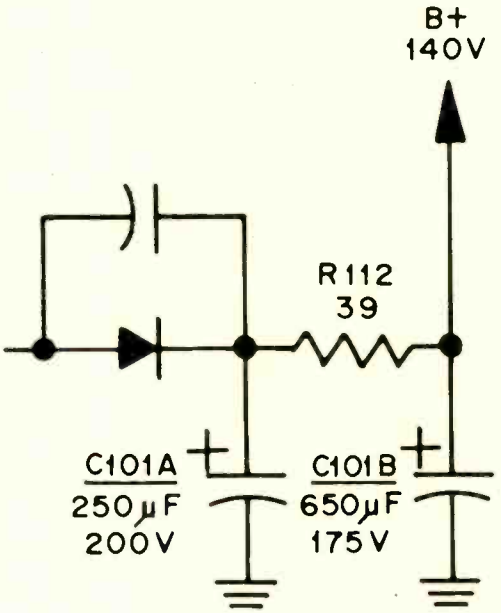
The vertical mounted tube-type KCS171 chassis has been continued in portable B/W-TV sets employing an 18-in. diagonal screen. A KRK148 tuner is used for VHF tuning and a KRK152 tuner is used for UHF tuning. Although the chassis continues with minimum changes, some horizontal sweep circuit modifications have been incorporated in this version of the KCS171AB chassis.

Δ	18V	19V
C109	82	68
C110	560	470
C130	82	68



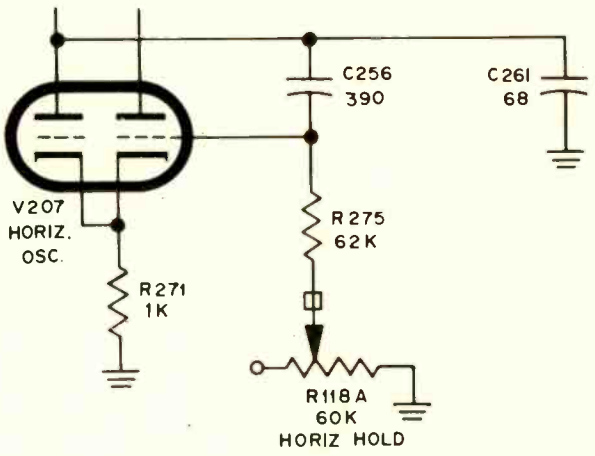
The capacitive voltage-divider network in the flyback circuit is changed by connecting a capacitor (C130) to the junction of C109 and Terminal No. 2 of the flyback transformer. With this capacitor arrangement, the high voltage cannot exceed the specified maximum voltage under a failure of an open capacitor in the voltage divider network. Early versions of this chassis had a capacitor connected to the junction of C109 and C110. With that arrangement, an open C109 capacitor could have caused the high voltage to exceed the maximum limits. The value of these capacitors vary for 18-in. to 19-in. diagonal screen. The appropriate value is given in the table accompanying the schematic diagram.

The low-voltage filter capacitor (C101) is a new high-reliability type specially designed to prevent internal shorting of the positive plates. As a further precaution against



shorting, heat shrinkable tubing is used on the capacitor terminals to prevent external wiring shorts.

Another significant circuit change is the connection of one end of the HORIZONTAL HOLD control to ground. In



some earlier KCS171 chassis, this side of the hold control was connected to a horizontal oscillator disable circuit, which produced a non-viewable picture should a failure occur. Since these changes prevent the high voltage from increasing above the specified limits, the disable circuit is no longer required. Should the need arise to replace any of the specially designed components mentioned, do so with an exact replacement type.

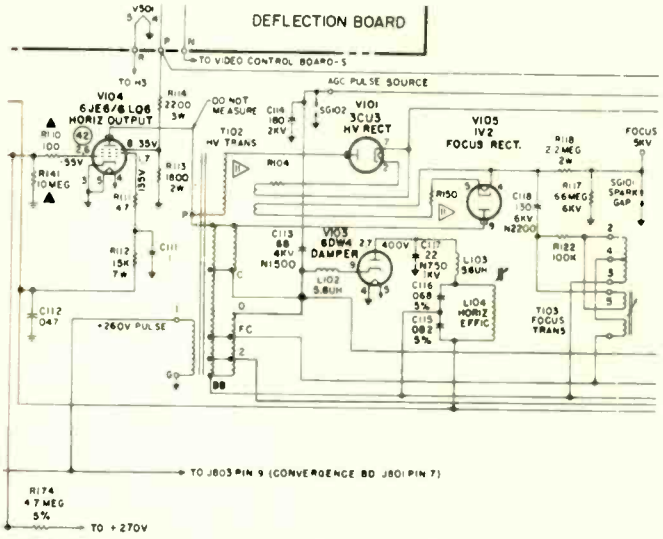
COLORFAX

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

MAGNAVOX

Color TV Chassis T938—Installing Replacement High-Voltage Transformer 361328-1

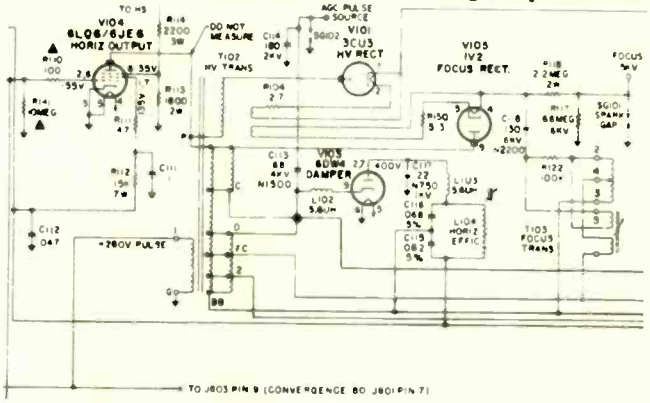
Transformer No. 361328-1 is the recommended replacement for the 361241 transformer used in the early production chassis. When installing this transformer, be sure that terminals C and D on the transformer are connected through a jumper wire.



The chassis employs a Horizontal Centering circuit (Diode and Resistor with solderless connectors for adjustment). These may not be shown on your copy of the T938 schematic diagram; if so, please add them. Failure to make the proper connection between terminals C and D will result in apparent normal operation, however, the transformer will be operating at excessive temperatures.

Color TV Chassis T918—Installing Replacement High-Voltage Transformer 361328-1

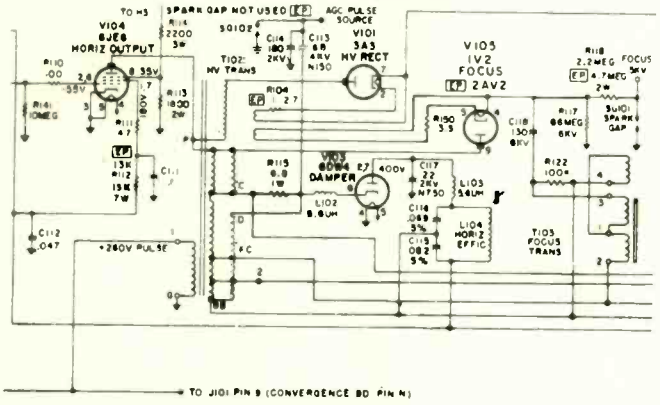
Transformer 361328-1 is the recommended replacement for the 361241 transformer used in the original production



CIRCUIT WITH HORIZONTAL CENTERING

chassis. When installing this transformer be sure that terminals C and D on the transformer are connected through either a jumper wire or a 6.8Ω, 1w resistor.

- If the chassis employs a Horizontal Centering circuit (Diode and Resistor with solderless connectors for adjustment) terminals C and D must be connected with a short jumper wire.
- If the chassis does not employ the centering circuit, terminals C and D must be connected through a 6.8Ω, 1w resistor.

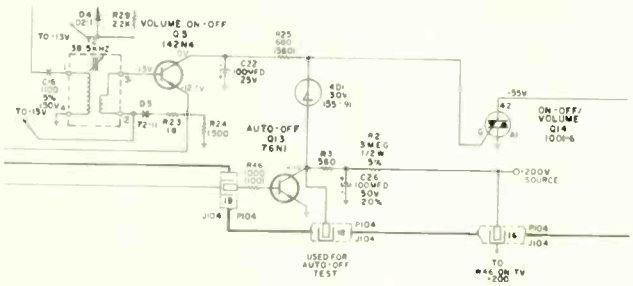


CIRCUIT WITHOUT HORIZONTAL CENTERING

These connections may not be shown on your copy of the T918 schematic diagram; if so, please add them. Failure to make the proper connection between terminals C and D will result in apparent normal operation, however, the transformer will be operating at excessive temperatures.

Remote-Control Receiver Model 704069—Addition of Current Limiter Resistor

It has been found that an arc in the picture tube of a color-TV set with a 704069-1 remote control receiver can cause a high-amplitude transient pulse to appear at the base circuit of transistor Q13 in this receiver. In some instances, the current produced by such a transient is sufficient to destroy the transistor. Because of this, a current-limiting resistor is installed in series with the base of Q13 in all late production units. If an early production remote control not



having such a resistor in series with the base of Q13 is encountered, one should be installed. This can readily be accomplished by cutting the foil between the base of Q13 and Pin 19 of the edge connector and then bridging the cut with a 1K resistor.

The exact value of the resistor is not critical. Individual values of 100Ω and 1K have been used for this application in production; however, for field modification, the 1K value is preferred.

Color-TV Chassis T946—AGC Control Added

An AGC control has been added to the T946 chassis, B production. The control, Part No. 220217-5, is a 1.5K potentiometer with a blue adjustment wheel. The control

continued on next page

COLORFAX . . .

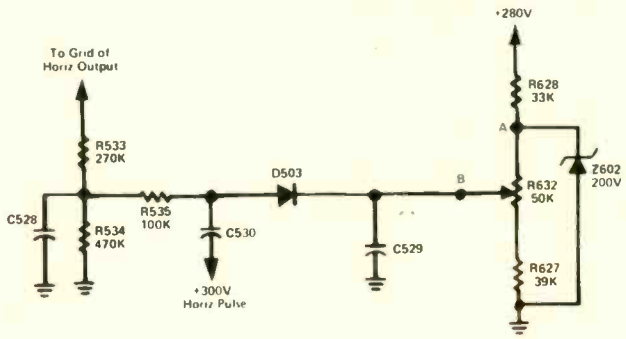
continued from page 57

physically replaces the fixed resistor (R50), which was used in earlier production chassis. This control should be adjusted to produce minimum snow on the weakest channel available. The strongest station should then be observed to insure that AGC overload is not present. If overload is present, readjust the control to just eliminate the overload condition.

Color-TV Chassis T924/T939/T950—Reduced High Voltage Caused by Leaky Zener Regulator Diode

The illustration is a simplified diagram of the high-voltage regulation circuit used in color-TV receiver chassis T950. Except for the circuit symbol numbers, this circuit is the same as that used in color-TV chassis T924 and T939.

A regulated 200v reference potential at the HIGH-VOLTAGE control (point A) is maintained by zener diode Z602 —this potential variable over a range from about 88v to the full 200v present at the cathode (point B) of diode



D503. The voltages present at the cathode of D503 determines the amount of the negative charge developed at its anode by capacitor C530 during each horizontal pulse. The resulting negative voltage is divided across resistors R534 and R535, and applied as negative bias to the horizontal output tube grid. The amount of this bias determines the conduction of the tube and as a result the amount of high voltage. As the bias at the horizontal output tube grid becomes more negative, the high voltage reduced and vice versa.

If diode Z602 becomes defective, the high voltage is affected. If the diode opens, the potential at point A rises slightly and results in a very slight increase in high voltage. However, if the diode becomes leaky or shorts, the potential at point A decreases, causing an increase in negative bias at the horizontal output tube grid. An increase in this negative bias results in reduced high voltage, accompanied by decreased screen brightness and a narrower raster. The degree of reduction of high voltage, brightness and raster width can range from very slight to severe, depending on the degree of leakage in diode Z602.

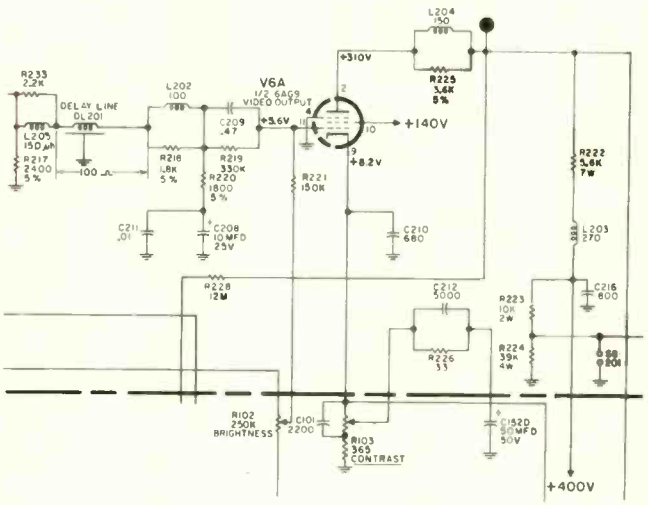
GENERAL ELECTRIC

Color-TV Chassis KE—Low-Resistance Contrast Control

In the KE and KE-II chassis there is a 6AG9 video amplifier tube (V6A) which upon failing can produce excessive cathode current. This may burn a spot on the CONTRAST control (R103) changing its resistance to 200Ω and 300Ω with a corresponding reduction in cathode bias.

Past practice has been to change only the 6AG9, since

control R103 was not suspected of being defective. When only the 6AG9 is changed, the picture will bloom and pull in at the sides at maximum brightness and contrast—even with the picture tube bias at minimum. The pull-in is caused by the loss of high-voltage regulation. Even under these conditions, a reasonably good picture usually can be attained by readjusting the picture-tube bias and gray scale, but the adjustments are critical.



The correct procedure, when replacing the 6AG9 video amplifier tube, is to measure the value of the CONTRAST control (R103), replacing the control if it measures 290Ω or lower.

One possible cause of 6AG9 tube failure is the position of a wire support. A stiff steel wire support extends upward from the KE circuit board near Pin 12 of the 6AG9. This steel wire has a loop at the top which supports an insulated lead. In many cases the steel wire support touches the glass envelope of the 6AG9 and causes an extremely small hole in the glass, resulting in loss of vacuum. This type of failure may account for the excessive current through the 6AG9 and the burned spot on the CONTRAST control.

Whenever you service a KE color-TV chassis or replace a 6AG9, bend the steel wire support away from the 6AG9 so that no part of the support touches the glass envelope.

Remember a high-voltage power supply fault can create a problem similar to that caused by the defective CONTRAST control, with respect to blooming and picture pull-in or poor regulation. This of course can involve improper drive, the hold-down circuitry, poor regulator tube efficiency, high-voltage adjustment, and so on.

A good indication of the overall condition of the high-voltage power supply can be obtained by measuring the regulator cathode current and adjusting the high voltage to that recommended in the service manual. If the regulator cathode current is less than 0.9ma with the BRIGHTNESS, CONTRAST and CRT BIAS controls at minimum, then you can suspect that there is a problem in the high-voltage power supply.

Comments from our readers are always welcome. Address your letters to:

Phillip Dahlen, Editor
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NEW PRODUCTS

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TUBE TESTER 703

Features 10 pin elimination switches

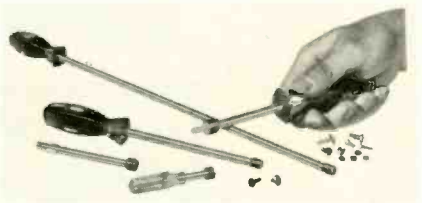
The Mighty Mite VII tube tester features 10 pin elimination switches. With the pin elimination switches, up

to 10 pins can be isolated from test by setting the switches for the pin or pins to be isolated. Grouped together for maximum convenience, the switches are of the simple slide type, and may be set and reset individually, or all at once by pressing a reset slide. The TC162 unit is housed in a brushed steel and vinyl-clad case, and includes a complete setup book. Price: $99.50. Sencore, Inc.

MAGNETIC NUTDRIVERS 704

Magnet in the socket holds fasteners firmly

A magnetic feature is being offered on midget pocket clip, regular, extra long, and super long fixed handle drivers and also on interchangeable shanks for use with all Xcelite Series 99 handles, both regular and ratchet types. An Alnico permanent magnet inserted in the socket holds most fasteners firmly for easy, one-hand starting, driving, or retrieving hex screws, bolts, and nuts, in close quarters and

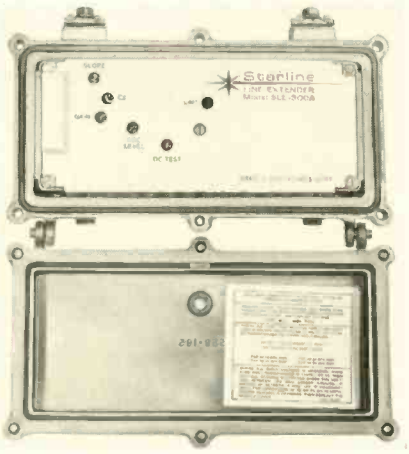


hard-to-reach places. The magnet is insulated so that the tool socket itself remains unmagnetized and will not attract extraneous matter or be deflected by nearby metal surfaces. Nutdriver sockets are reportedly specially treated and hardened to withstand severe service, such as the driving of hex head self-tapping screws. They are finished in black oxide for dimensional control as well as for quick identification as magnetic tools. Fixed handle drivers have color-coded plastic handles in a new comfort-contour design. Xcelite Inc.

CIRCUIT LINE EXTENDER 705

Employs hybrid circuitry for improved performance

The new SLE-300A is a push-pull line extender that employs hybrid integrated circuitry for improved performance in both 30v and 60v systems. It reportedly achieves 25dB amplification over the frequency spectrum from 40 to 300MHz. Specified for 30 channel operation, the line extender has a minimum rated output capability of +44Bmv per channel at —57dB cross mod. At 46dBmv out, specifications indicate that the second



order beat is —66dBmv, while the triple beat is —70dB. In addition, the SLE-300A contains AGC circuitry for sloped automatic gain control. Price: $245.00. Jerrold Electronics Corp.

PLUGS AND CABLES 706

Designed to fit many European phonographs

A series of plugs and cables has been designed to fit many European phonographs. The plugs and cables, known as Series W-HOS, consist of three types. Model W-HOS-1 is a 5 pin DIN European plug to 4 RCA

phono plugs. The 3 pin DIN European plug to 2 RCA type phono plugs is model W-HOS-2. W-HOS-4 is the 72-in. pin plug to 3 pin plug. All three in the series are compatible for use with Norelco, Telefunken and many other European lines. Weltron Co.

PHONO CONNECTORS 707

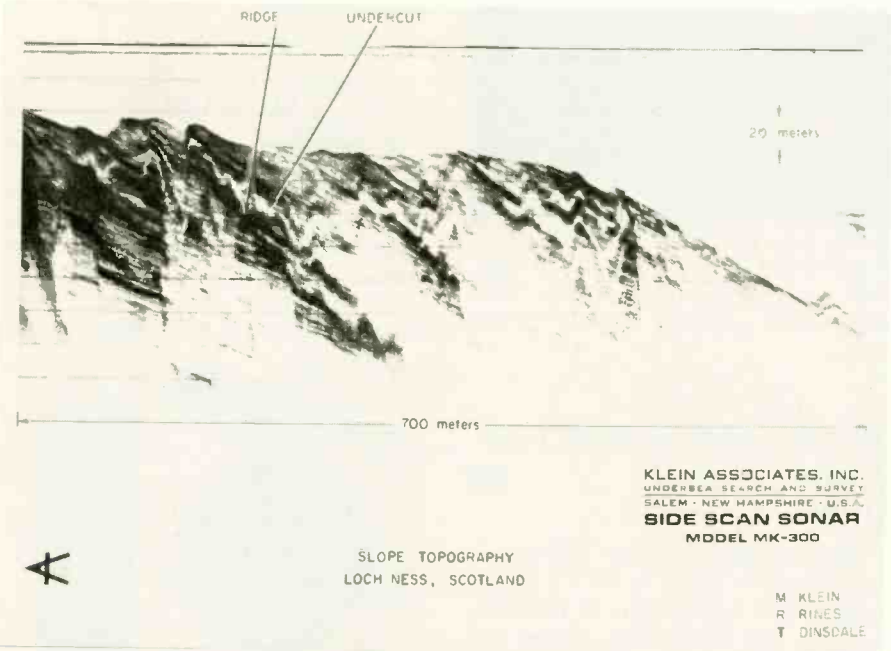
Designed to simplify your printed-circuit maintenance

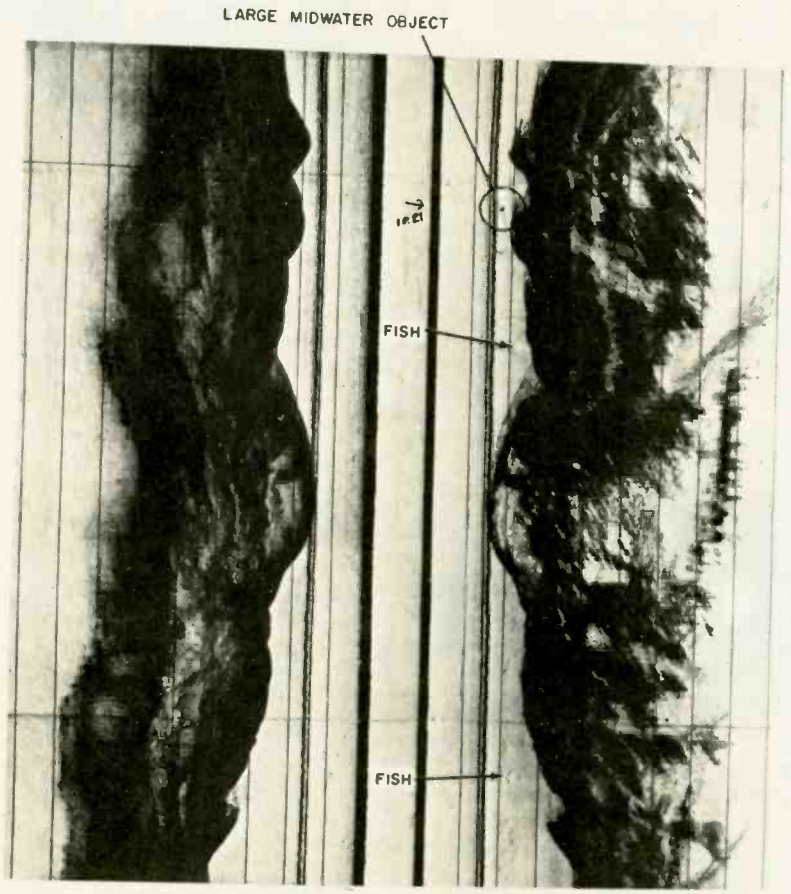
There may be occasions when you will encounter printed circuit boards in TV sets or audio components which contain a loose or defective phonograph-type socket. In anticipation of such circumstances, you may wish to stock a supply of these sockets for replacement use. These sockets, available at parts distributors across the country, are said to be designed for

continued on page 62

Search Continues for Loch Ness Monster

Many of our readers have in the past indicated an interest in sonar, those near the ocean, large rivers and lakes having sold and serviced units designed to measure water depth or indicate the presence of fish. Recently Martin Klein, president of Klein Associates, Inc., prepared a paper telling of another very interesting sonar application—the search for Scotland's elusive Loch Ness monster.





■ The use of sonar is not new to Loch Ness. In 1968, a group from the University of Birmingham used an experimental digital sonar system, which detected a possible moving object in the Loch. In 1969, Robert Love used a mechanically scanned mobile sonar and again detected a possible large moving object.

Although it cannot produce an actual picture of a target at long range, side scan sonar has had an enviable record of success in locating objects on the sea floor. It uses high-intensity, low-frequency sound, projected in the water in a beam that is narrow in the horizontal plane and wide in the vertical plane. The sound pulses echo off objects in the water or on the bottom, and the echo energy returns to the transducers, where it is converted to electrical signals, which are continuously and permanently recorded on a strip chart.

Using a standard Klein Associates, Model MK-300 Side Scan Sonar, which uses a 50kHz audio frequency, 0.1ms pulse length and 2° horizontal scan width, some passes were made across the Loch and others parallel to the walls of the Loch—the transducer assembly being towed about 100 ft under water to get beneath the thermocline.

The resulting records reveal some of the spectacular geology of the steep walls of the Loch. The photos in this article shows some of the more interesting traces. Note that the long dark sections are apparently highly reflective ridges, while the long light sections are areas where there is a depression or undercut, which gives no signal return. Unfortunately, the actual depth of these depressions cannot be determined, but they appear to be certainly wide enough to be able to harbor large animal life.

In some areas the sonar picked up echoes above the bottom that

continued on next page

LOCH NESS . . .

continued from page 61

appeared to be fish. Sometimes these echoes appeared in "clouds" which were apparently schools. On a few occasions they indicated larger objects in midwater, but it is difficult to judge the nature of these objects. They are, however, real echoes, so they are presented here as observations without further comment.

The brief side scan sonar tests produced three important discoveries: There are large moving objects in the Loch; there is abundant fish life in the Loch, which could support a large creature; and there are large ridges in the steep walls of the Loch, which could conceivably harbor large creatures.

In his paper, Martin Klein expresses indebtedness to The Academy of Applied Science for supporting the work at Loch Ness and to Tim Dinsdale, Robert Love and other members of the Loch Ness investigation team for their open-mindedness and their enthusiastic cooperation. ■

NEW PRODUCTS . . .

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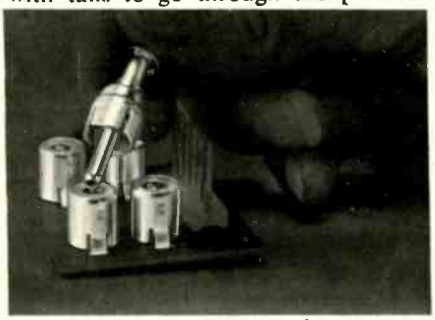
simplicity and to consist of merely an outer shell, an insulator and an inner shell—the outer shell being designed with tails to go through the printed-



circuit board to allow maximum spacing between the center hole and tabs, thus preventing solder bridging. Waldom/Molex products, Molex Products Co.

REPLACEMENT PICTURE TUBE 708

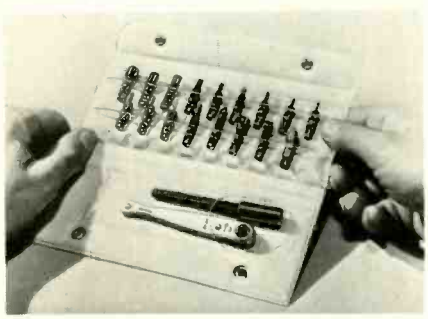
90° RIM band, Einzel gun tube

A new Hi-Lite color TV-picture tube has been added to RCA's line of replacement tubes. Type H-19VBQP-22 is a 90°, RIM band, Einzel gun Matrix tube. The price is $178.00 each. RCA Distributor Products.

MIDGET RATCHET KIT 709

Precision made to insure proper fit

A 20 piece reversible ratchet set designated as No. 4320 contains a 20 tooth ratchet, an extension, 12 Allen-hex drivers from .050 in. to 5/16 in., two regular slotted-head drivers in ¼-in. and ⅜-in. sizes, two Phillips-type drivers in sizes 1 and 2, and a square

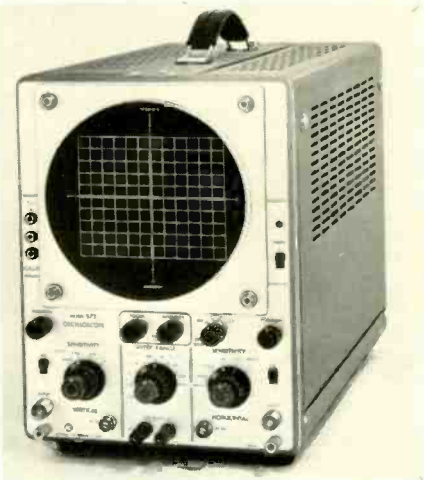


adapter for ¼-in. drive sockets. The drivers are reportedly constructed of chromenickel molybdenum alloy steel. They are said to be precision made to insure proper fit. Dual-purpose knurled spinner tops allow for quick finger tightening of threads. A special pop-out feature quickly ejects drivers from the ratchet. The ratchet is made of stainless steel, and its short 18° arc makes it desirable for working in close quarters. Reverse action is obtained by simply turning the ratchet over. The kit is packaged in a vinyl pocket-sized soft pouch with snap closure. Price: $11.00. Jensen Tools and Alloys.

OSCILLOSCOPE 710

Enables precise interpretations

The Model 572 oscilloscope is intended for special applications where high legibility is a critical requirement. It reportedly contains carefully matched, highly sensitive dc amplifiers and balanced attenuators for each axis, permitting phase comparisons and measurements with small error. The scope has a large viewing area of 10cm by 12cm on a 7-in. CRT display tube.

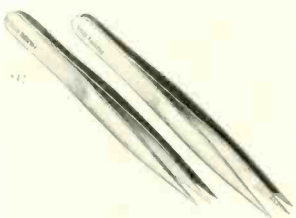


Sensitivity is better than 20mv/cm with a bandwidth of about 2Hz to 600kHz —3dB, plus a sweep range of 1Hz to 100kHz. The model weighs 30 lb with physical dimensions of 9½-in. W by 13½-in. H by 20-in. D. Price: $589.00. Kikusui Electronics Corp.

PRECISION TWEEZERS 711

Made of non-magnetic stainless steel

Tweezers of non-magnetic stainless steel with heavy strong points are



available in two styles—one made with serrated points, the other of smooth points. The overall length is 4¾ in. EREM Corp.

GUEST AUTHOR...

continued from page 51

change. So, just as the wise technician prepared for color in the heyday of B/W-TV servicing, so must he now prepare for solid-state servicing.

While I am not in the habit of advising service dealers as to how they should run their business, good business judgment dictates that now is the time for the ambitious service technician to update his solid-state knowledge, or to get some basic instruction—if he hasn't done so already. In this way, he will be preparing to meet the changing needs of tomorrow as he reaps the benefits of today's business potential.

Several avenues are available for this purpose. For example, TV-set manufacturers offer solid-state servicing seminars on their own products. For beginners, the Electronics Service Committee of the Electronics Industry Association offers workshops, which include solid-state circuitry.

Service associations frequently offer training sessions or seminars for their memberships. A wide variety of literature on many phases of solid-state electronics is available from the technical publishing industry, and periodicals such as ELECTRONIC TECHNICIAN/DEALER frequently publish helpful articles on the subject.

From personal knowledge I can tell you of solid-state handbooks, manuals and audio-visual instructional aids now available from authorized RCA distributors as well as service meetings sponsored by them from time to time. I am sure that other manufacturers also make available their own versions of solid-state instructional material.

In summary, I am reminded of a Latin phrase that has stayed with me through the years—"Carpe Diem!"—"Grasp the Opportunity!" For the opportunity is here and now.

As I see it, the smart service dealer or technician will continue to do all he can to get a good share of today's available business at a profit. And, if he is really on the ball, he is preparing for the day when solid-state components will be a big part of the big servicing business. He is grasping the opportunity, "making it" in today's market—and getting ready to keep on "making it" in the markets of tomorrow and beyond. ■

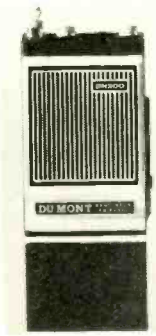
DEALER SHOWCASE

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

RADIO TRANSCEIVER 712

Designed for rough treatment in all-weather

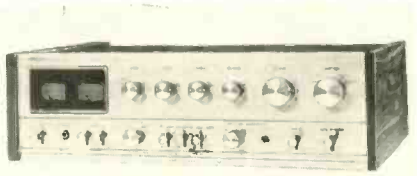
A rugged hand-held radio transceiver, this solid-state unit is reportedly fully compatible with all high-band VHF-FM two-way radio communications system over a frequency range of 132 to 174MHz. Weighing only 30 oz with battery and encased in high-impact Lexan, the water-resistant transceiver is designed especially for rough treatment by men on the move in all-weather outdoor jobs. Front and back access covers of the unit are die-cast high-strength aluminum. The radio is said to provide the user with immediate and direct voice contact with base stations, mobile units and other portable transceivers. The radio's circuitry is segmented into solid-state, plug-in modules for high-reliability operation and for fast, easy maintenance. A problem circuit can be pulled out and a fresh module plugged in, with an average repair time of approximately 8 min. Designed for low battery drainage, the transceiver can operate off either a 15v nickel cadmium battery or a 16.8v mercury battery. Standard options reportedly offered with the new hand-held radio include up to five transmit and receive channels, external mike-speaker, head-set, a choice of three antennas—telescopic (standard), flexible whip or railroad spiral. Hammarlund-DuMont Mfg. Co.



AMPLIFIER 713

Serves as a sound mixer and comparison device

In addition to its primary function as an ultra-low-distortion stereophonic control amplifier, the Hitachi IA-1000 serves as a sound mixer and a comparison device for associated components. It employs silicon transistors and integrated circuits in the equalizer stages for low noise, linearity and stability. Its total harmonic distortion measured at full rated output of 140w is said to be 0.1%, feeding into an 8Ω load. The preamplifier/control section includes a front panel INPUT and GAIN control for a dynamic microphone, permitting mike mixing with other program sources. Switch-step-type TONE controls, separate for bass and treble, operate within a range of ±12dB, boosting and attenuating the frequency extremes while leaving the



center range unaffected. Rear panel outputs include four pairs of main speaker terminals. Two front panel switches permit the use of two sets of speakers, separately or simultaneously. The unit measures 17⅝ in. W by 5⅜ in. H by 13 in. D. Suggested list price is $319.95. Hitachi Sales Corp.

TURNTABLE 714

Eight-pole synchronous motor contributes to low wow and flutter

The PL-41D is a two-speed, belt-driven stereo turntable utilizing a static balance pipe tonearm. The heart of the unit is an eight-pole hysteresis synchronous motor whose speed, half that of a conventional four-pole motor, is said to contribute to the turntable's low wow and flutter, with practically

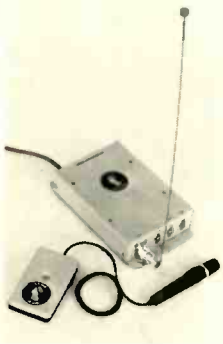
complete freedom from vibration. The tonearm is an S shaped pipe type, performing at both vertical and horizontal angles with a rated tracking error of 0.17°cm and a tracking force range of 0.4 to 12 grams. Another important feature is an overhang indicator,

which allows the user to match the tip of the stylus to the correct record position, preventing distortion and inadequate channel separation of stereo recordings. The PL-41D has an induced magnet type cartridge with a rated wide frequency range of 10Hz to 25kHz. Price $220.00. U. S. Pioneer Electronics Corp.

WIRELESS RADIO MIKE 715

Full-fidelity sound free of mike booms

The ORATOR model wireless microphone system reportedly provides full-fidelity sound amplification free of mike booms, stands or trailing wires. The system consists of a battery-powered microphone / transmitter and a small receiver. The receiver has 3 outputs for compatibility with any PA system, tape recorder or microphone mixer. In use, the 3 oz microphone may be hand-carried or placed in lavalier position. The 8 oz transmitter has a clip for attachment to a belt or sash, or it can be placed in a shirt pocket or taped to the body. The receiver, with its antenna, is easily concealed behind a partition or drape. Vega Electronics.



RECORDER 716

Low-noise cassette recorder with glass and crystal ferrite head

The GXC-40D, a new cassette stereo tape recorder, represents AKAI's commitment to the crystal ferrite head in recorders. In addition to playing regular tapes, a special bias switch allows the unit to pick up the broader frequency response (with higher signal to noise ratio) of the new chromium dioxide tapes. An over-level switch activates a low-noise circuit that reportedly cuts distortion to 1.5%. The unit is equipped with piano key controls, a PAUSE button for editing tape, left and right VOLUME slide pot controls, a TONE control, a three-digit counter and two VU meters. It also has a hysteresis synchronous outer-rotor motor giving stable tape travel and ideal starting torque. A newly designed flywheel and capstan shaft is said to reduce wow and flutter to a new low in cassette machines. AKAI America, Ltd.

TAPE CONTROL SYSTEM 717

Automatically turns OFF at end of any tape

The Model 550 Servo-Matic is a servo-mechanism that reportedly turns OFF all Hi-Fi components at the end of any tape, turns OFF all components if a tape stalls or jams during operation, and turns itself OFF when the tape stops. A miniature low-voltage switch can be installed inside any tape recorder to feed the motion sensing circuit, while the Servo-Matic monitors the operation of the tape recorder or deck. The unit comes in a molded case with an in-line control group that is recessed in a vinyl walnut wood grain plate. Price of kit: $22.50, factory wired: $35.00. Cymax Audio Accessories.

TWO-WAY ANTENNA SYSTEM

Designed for easy attachment 718

The Model DFG "Double-Talk" antenna system is designed for easy attachment to current and new style rain gutter trim without drilling, and accommodates style and change where many 1972 car designs dictate limited antenna mounting locations. Dual antennas reportedly offer superior signal coverage and extended range. The two copper armored, white-vinyl-covered 43-in. antennas, come complete with mounting hardware and special coaxial phasing harness. New-Tronics Corp.

TECHNICAL LITERATURE

Kit Catalog

The new 1972 Heathkit catalog describes Color-TV sets with built-in service equipment, organs, ham radio gear, service and testing instruments, kitchen appliances, a table-top road racing layout and modular electronic workshops—designed for children. Highlighting this catalog is the AR-1500 AM/FM/FM-stereo receiver. Heath Company, Benton Harbor, Mich. 49022.

General Catalog

Approximately 10,000 catalog items are described in a new 64-page general catalog. Among the items described are batteries, capacitors, controls, resistors, semiconductors, switches and timers, plus new security systems, cassette recorders and cassette recording tapes. Mallory Distributor Products Co., 101 South Parker, Indianapolis, Ind. 46201.

Test Equipment Catalog

Dynascan Corp. has a catalog of B & K precision test equipment for electronic servicing, school, laboratory and industrial applications. It presents 21 instruments encompassing a wide range of equipment from a 100% mutual conductance tube tester to a dc to 10MHz triggered-sweep scope. Numerous accessories such as probes and adapters are also featured. Each product page provides full descriptive details of applications and specifications along with charts and patterns. Copies of the BK2 catalog are available from Dynascan Corp., 1801 W. Belle Plaine Ave., Chicago, Ill. 60613.

Components Catalog

A 19-page catalog of sockets, accessories, plastic components, transistor pads, socket adapters, miscellaneous plastic products, heatsinks, and heat transfer washers, plus price list is offered by Jermyn Products, Bordeaux Industries Inc., 712 Montgomery St., San Francisco, Calif. 94111.

Replacement Parts Catalog

A 20-page catalog of replacement capacitors contains descriptive information and rating charts for electrolytic, paper/film, ceramic, and mica capacitors. Listings include the values for the servicing of radio and TV sets, hi-fi stereo components and other audio equipment, amateur radio and hearing aids. Also included is a section on popular decade boxes featuring four resistance decades, three capacitance decades and four inductance decade units. Aerovox Corp., 740 Belleville Ave., New Bedford, Ma. 02745.

Radio Antenna Catalog

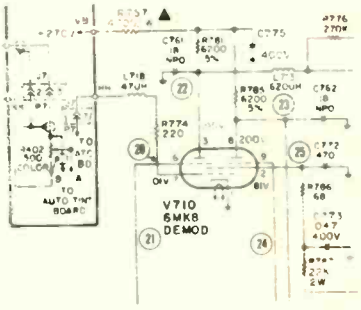
A new business radio antenna catalog contains a number of antenna systems designed to meet the growing requirements of the two-way radio market. Hy-Gain Electronics Corp., R.R. No. 3, Lincoln, Nebraska 68505.

Transistor Catalog

A 130-page transistor catalog provides data for NPN and PNP small-signal transistors, field effect transistors and pro-electron types. In addition to specifications, the catalog provides process design/application data and test limit information. A glossary of terms and package outlines is also provided. National Semiconductor Corp., 2900 Semiconductor Drive, Santa Clara, Calif. 95051. Atten: Marketing Services.

ERATTA

The Magnavox Automatic Tint (ATC) circuit described in the November Teklab Report, page 41, was in error. This circuit, shown in Fig. 4, is employed in the T958 chassis. The ATC circuit used in the T962 chassis is basically the same deluxe circuit that was used with the T951 chassis—without the transistor in the cathode circuit of the color demodulator tube. The



function of this circuit does not effect the gray scale setting; therefore, the chromatone circuit used with the T951 chassis is also used in the T962 chassis.

The correct ATC circuit used in the T962 color-TV chassis is shown in the partial schematic.

TEKLAB REPORT . . .

continued from page 42

switch signal is removed and the switch shuts OFF to protect the power supply from damage.

The SCR will remain ON until all power is removed, which means the TV set will have to be turned OFF with the ON/OFF switch. The SCR will then be non-conductive and will allow the power supply to operate when again turned ON.

Power Supply Adjustments

There are two adjustments on the power supply panel which are factory pre-set, requiring no field adjustments. The "pot" type regulator control adjusts the proper output voltage and the regulator sync level coil adjusts the sync level to the oscillator stage.

Sync and Vertical Sweep Circuits

The sync separator on the vertical VA panel recovers the necessary sync pulses from the incoming composite video signal and stabilizes the vertical oscillator. A sync inverter stage applies the horizontal sync to the horizontal circuits.

The vertical blocking oscillator output is coupled to the pre-driver stage and direct coupling is used from the predriver to the vertical output. The two output transistors make use of complementary symmetry circuits and provide output direct to the deflection yoke, eliminating the vertical output transformer.

Some of the vertical output is coupled to the small vertical convergence transformer, which supplies the HA convergence panel with energy for dynamic convergence.

Horizontal Sweep and High Voltage Circuits

Horizontal sync pulses from the sync inverter stage on the VA vertical panel continue to the pulse former and horizontal AFC circuit on the DA horizontal panel. With both sync and flyback pulses present, the pulse former stage develops a properly timed gating pulse, which is applied to the TA color video panel. The horizontal AGC circuit compares the horizontal sync with the flyback pulse and stabilizes the horizontal oscillator.

The horizontal pre-driver, driver and output stages couple the energy to the horizontal output transformer. The high voltage is rectified by a solid-state rectifier, then applied to the picture tube anode and divided down to provide the focus voltage.

Energy from the horizontal sweep yoke winding is transferred to the GA pincushion panel and corrects the vertical pincushion errors. The horizontal regulator amplifier and driver receive a driving voltage from the vertical convergence transformer to correct side pincushion errors by controlling the regulated dc to the horizontal output stage. A winding on the horizontal output transformer supplies the necessary voltages to the HA convergence panel.

Next month we will review Motorola's new simplified remote control system, which includes only two push buttons on the remote control transmitter. Most of the remote receiver is placed on a single plug-in panel. ■

ERATTA

The Phase Corp. Audio Sweep Generator described on page 34 of our November 1971 issue has an output of 0 to 6v p-p rather than merely 0.6v p-p as indicated in the description of this instrument.

AUDIO . . .

continued from page 45

nected hookup. The length of microphone cables should also be carefully estimated during the survey period.

Finally, the type of speakers needed, their power and the approximate location of each should be determined. Likewise, with the approximate location of the amplifier and microphone or microphones.

On large, new-construction installations, many audio service dealers work closely with building contractors and the customer—farming out the survey work to audio consultants. Cable-pulling work goes to electrical contractors. The service dealer, in these cases, confines his job primarily to furnishing the equipment, putting it together, installing and connecting it, checking it out and providing future maintenance.

Part II in this series will cover important points in selecting amplifiers, speakers and microphones. ■

Make plans now to attend the first joint service convention. Jung Hotel, New Orleans, La., August 9-13, 1972.

READERS SERVICE INDEX

ADVERTISER'S INDEX

NEW PRODUCTS

TEST INSTRUMENT

BOOK REVIEWS

INSURANCE CHECKLIST FOR SMALL BUSINESS, Small Marketers Aid No. 148, Small Business Administration, Office of Management Assistance, Washington, D.C. 20416 *by Mark R. Greene, 16 pages, free.*

Proper insurance for protecting your business is a *must*. However, according to this book you may find that you have more insurance than you would be able to collect, or you may have unknowingly violated certain conditions of your insurance policy, making it worthless. These and many other important factors that you should consider are included in this easy-to-read checklist. Essential business insurance coverages discussed include fire insurance, liability insurance, automobile insurance, and workmen's compensation insurance.

This book is a must for all independent businessmen, and the results of your checklist should be discussed with your insurance agent.

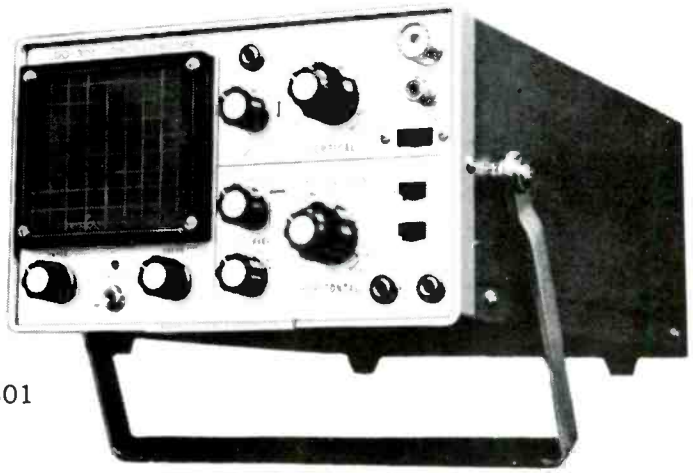
RESULTS OF THE 1970 MICROWAVE OVEN SURVEY *prepared by the U.S. Department of Health, Education and Welfare, Public Health Service, Food and Drug Administration and published by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 Stock No. 1715-0023, 160 pages, paperbound $1.25.*

Microwave ovens represent a new consumer electronic product that requires servicing, and we have received reader comments concerning the great future business potential for marketing and servicing these products, plus a concern for technician and customer safety. The analysis of this report indicates that their radiation leakage is a function of oven design, user maintenance and frequency of service. The most frequently observed cause of excess radiation leakage is interlock maladjustment. Proper maintenance on the part of the user and improved servicing, including microwave emission measurement, will continue to play an important role in controlling microwave oven leakage. There is a need for continued surveillance of microwave ovens.

The book includes a report on how the survey was planned and the procedures carried out. It includes a general analysis of the results and then goes into detail, specifying the results for the many models of the various brands of microwave ovens now on the U.S. market. A summary of accomplishments is also included.

LEADER

HAS THE ONLY LAB GRADE 3" TRIGGERED SCOPE WITH



MODEL LBO-301
$334.50

10 MVp-p SENSITIVITY
3" PORTABILITY
VERTICAL & HORIZONTAL CALIBRATION

The Model LBO-301 has the compact size, the professional grade sensitivity and the ease of use to make it one of your greatest buys! Let these plus features speak for themselves:

- DC to 7MHz bandwidth.
- 5x magnification (max. 0.2μs/div.)
- 70 nanosecond rise time.
- 0.5Vp-p; sq. wave calib. voltage.
- Vectorscope and Z-axis modulation.
- Easy to use horizontal panel design.

In all, the LBO-301 is big enough to solve your color TV service problems and small enough to use anywhere! Prove it to yourself. See your distributor. And make it a point to ask for Leader performance-rated accessories.

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Send for catalog.

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Prices subject to change without notice.

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

You can make more money selling the Sylvania color bright 85XR®.

And Olive Oyl will look just as beautiful.

Beauty is in the eye of the beholder.

And the beauty of the *color bright* 85XR is that its picture is in the same league as the more expensive "black surround" and "black matrix" color tubes.

Our bright phosphors make the *color bright* 85XR real competition for any picture tube on the market.

And our simplified manufacturing process lets us sell it to you at a lower price than any "black surround" tube.

The picture will look beautiful to your customer.

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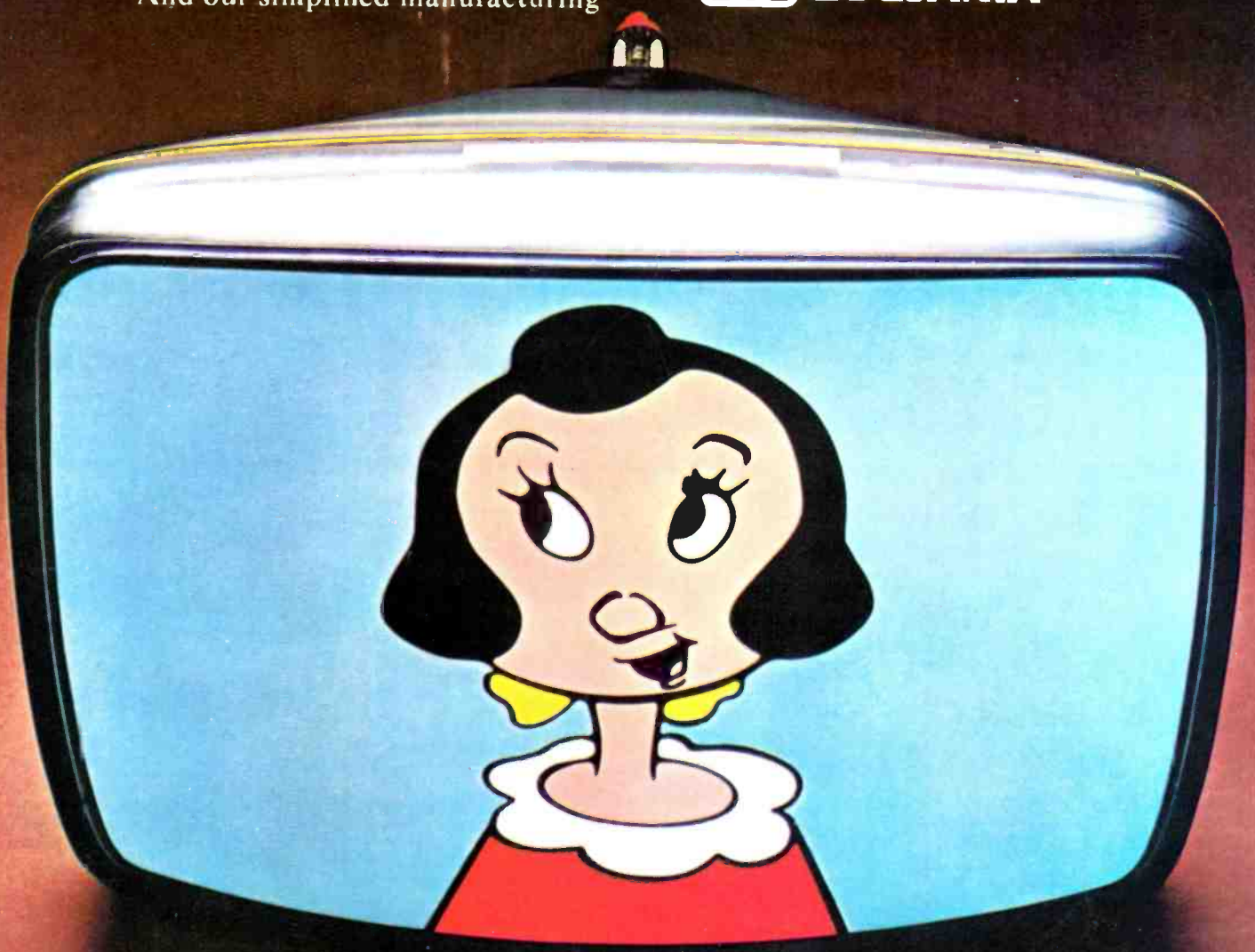
If that isn't beauty, what is?

GTE SYLVANIA



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