JULY 1970 A HARCOURT BRACE JOVANOVICH PUBLICATION

ELECTRONIC TECHNICIAN / DEALER

WORLD'S LARGEST TV-RADIO SERVICE & SALES CIRCULATION

Installing a Mobile Transceiver

Teklab Report on Emerson 26C56

Servicing Solid-State Stereo—Part II

The easy outlet for MATV installers

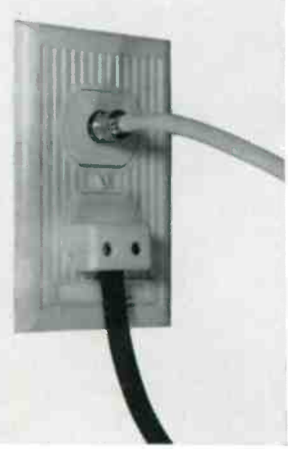
Channel Master variable isolation wall tapoffs offer such speed, convenience and utter accuracy of installation that you're bound to feel guilty about using them. They're so quick and easy to connect, inspect and set, you'll be amazed at how little time it takes to finish the most complex MATV system professionally!

You'll also be amazed at how they simplify inventory and end up saving you time, money and trouble.

So please, don't feel guilty about taking the easy outlet.

CHANNEL MASTER

DIVISION OF AVNET, INC. Ellenville, New York 12428



. . . for more details circle 104 on Reader Service Card

ELECTRONIC TECHNICIAN / DEALER

TEKFAX

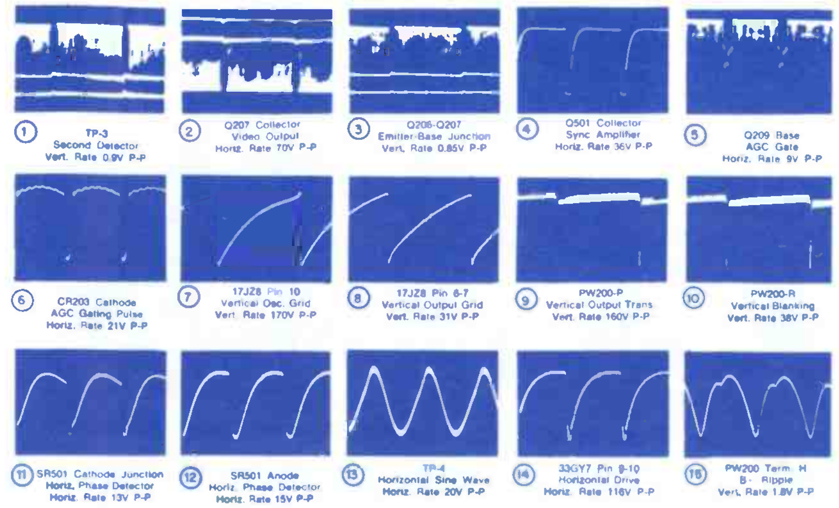
COMPLETE MANUFACTURER S' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 5 NEW SETS

GROUP 215

1306

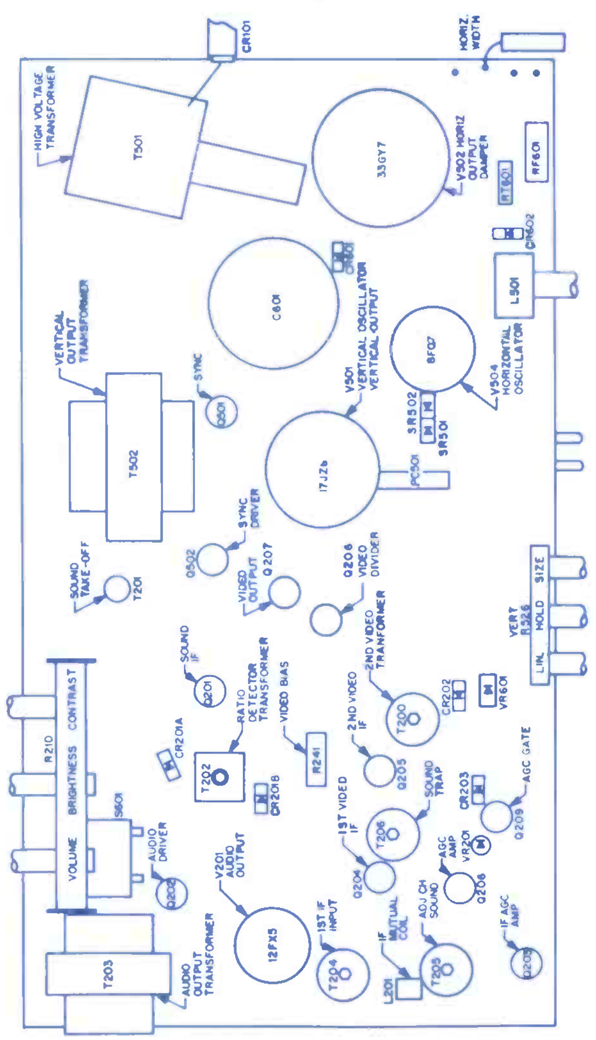
RCA VICTOR
TV Chassis KCS169X Series

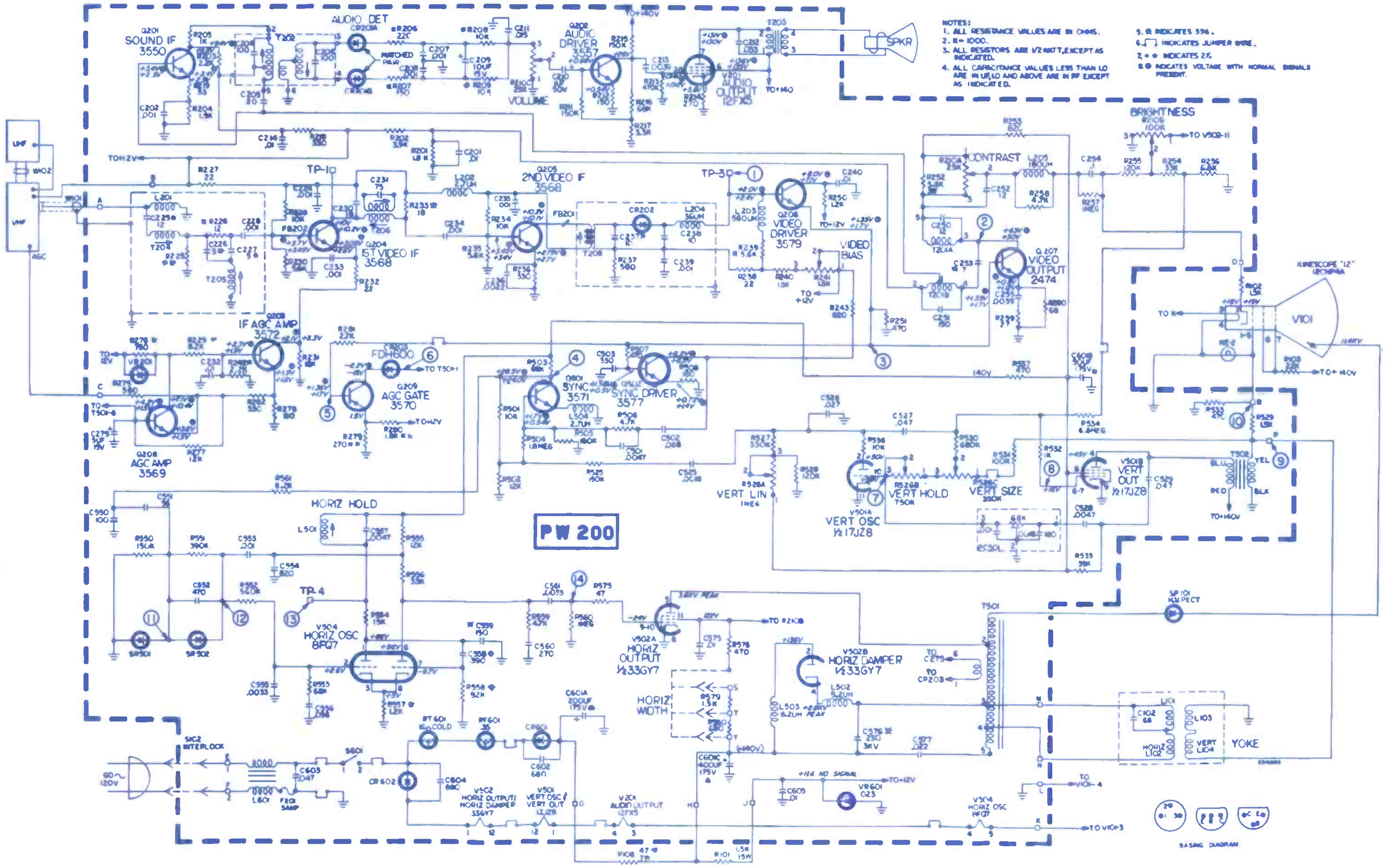
JULY • 1970



SYMBOL	DESCRIPTION	RCA VICTOR PART NO.
C601	3 section electrolytic	125989
C601A	200μf, 175v	
C601B	50μf, 175v	
C601C	400μf, 175v	
F201	Fuse — 5a	118969
L201	RF	114314
L202	2.7μh	107463
L501	horiz hold	125129
L502	RF Choke	107385
L503	RF Choke	107385
L601	reactor — filter	127043
R101	1500Ω 15w	125120
R106	47Ω 5%, 7w, WW	121229
R210	control, contrast/bright/vol	125123
R241	control, video bias	122768
R526	control, vert lin vert size vert hold	125122
RF601	fuse — 0.35Ω	124263
RT601	therm — 16Ω cold	128492
T201	audio trap-band pass	125114
T202	ratio det	125115
T203	audio output	125116
T204	IF input	113097
T205	IF input	113097
T206	1st pix IF	116115
T208	2nd pix IF	116116
T501	horiz output	129708
T502	vert output	125117
	Yoke — deflection	130636

Chassis Layout





1307

GENERAL ELECTRIC

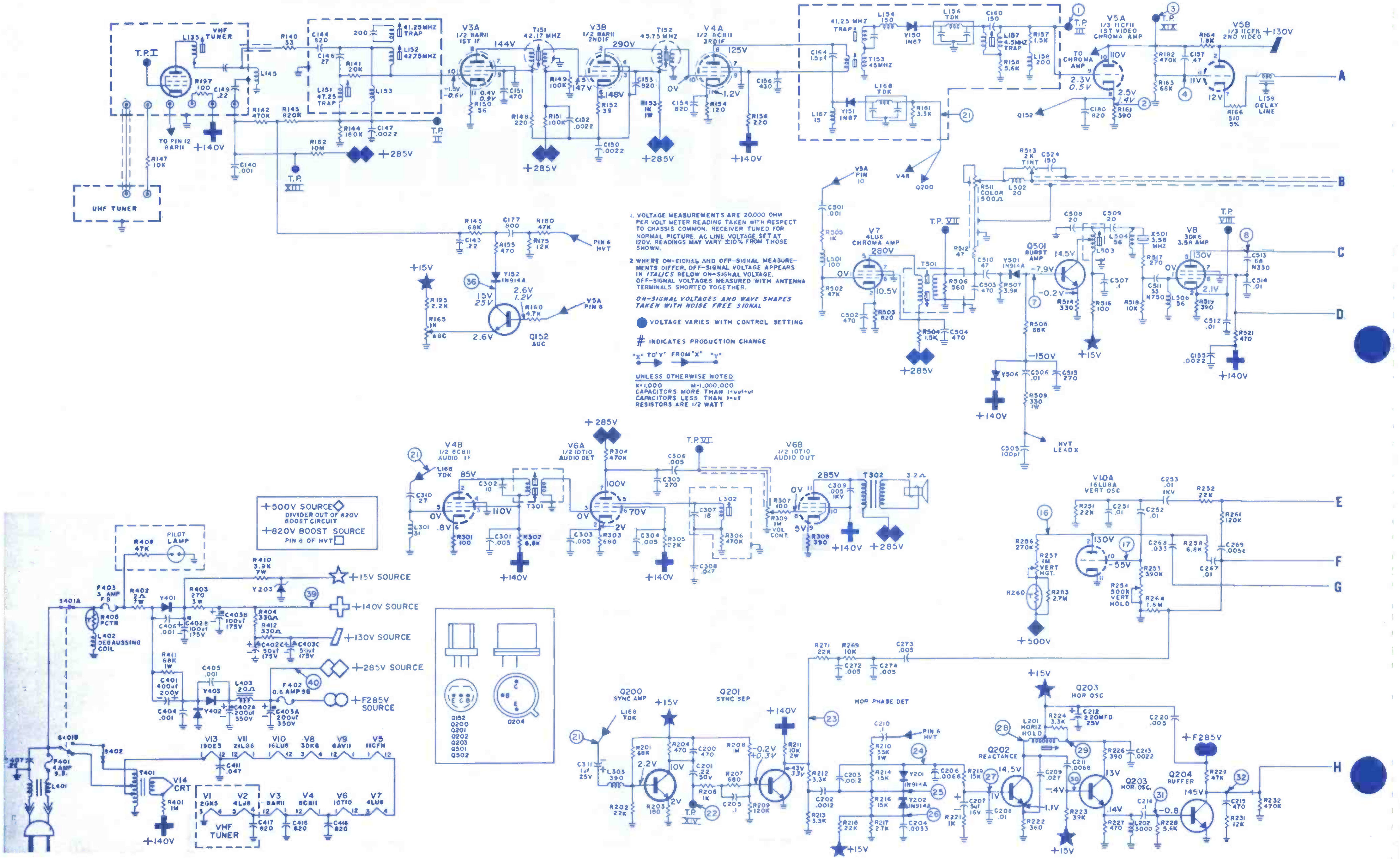
Color TV Chassis N-1

JULY • 1970

ELECTRONIC TECHNICIAN / DEALER TEKFAX

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

SYMBOL	DESCRIPTION	GENERAL ELECTRIC PART NO.
X501	Quartz, Crystal, 3.58MHz	EP41X1
C402A	200μf, +100% −10%, 350v electro	EP31X18
C402B	100μf, +100% −10%, 175v, electro	EP31X18
C402C	50μf, +100 −10%, 175v, electro	EP31X18
C403A	200μf, +100% −10%, 350v, electro	EP31X18
C403B	100μf, +100% −10%, 175v	EP31X18
C403C	50μf, +100%, −10%, 175v electro	EP31X18
Q152	trans, NPN, silicon, AGC keyer	EP15X7
Q200	trans, NPN, silicon, Sync amp	EP15X3
Q201	trans, horiz, afc	EP15X7
Q202	trans, horiz react	EP15X9
Q203	trans, horiz osc	EP15X9
Q204	trans, horiz driver	EP15X10
Q501	trans, NPN, silicon, burst amp	EP15X5
Q502	trans, NPN, silicon, blanking driver	EP15X9
R165	control, AGC, 1K	EP49X44
R171	control, triple contrast, 500K, 20%	EP49X50
R176	contr, trip brite, 200K, 30%	EP49X50
R177	contr, 50K, brite limit adjust	EP49X52
R236	contr, HV adjust, 350K	EP49X46
R242	contr, 20M, focus adjust	EP49X51
R254	contr, triple V hold, 500K, 30%	EP49X50
R257	contr, dual, V height, 1M	EP49X45
R309	contr, on-off vol., 1M(WM25 1NBG-1)	EP49X3
R511	contr, color, 500Ω (WM253NWD-1)	EP49X54
R511	contr, color, 500Ω (WM251NBG-1)	EP49X16
R513	contr, tint, 2KΩ (WM253NWD-1)	EP49X55
R513	contr, tint, 2KΩ (WM251NBG-1)	EP49X56
R542	contr, triple, red screen, 1M	EP49X43
L151	coil, 47.25 trap	EP36X13
L152	coil, IF xformer	EP36X42
L156	coil, LC filter	EP36X51
L157	coil, 4.5MHz trap w/core	EP61X3
L159	coil, delay line	EP36X50
L201	coil, horiz, osc	EP36X55
L302	coil, quad	EP36X52
L402	coil, degaussing	EP36X62
L403	filter reactor	EP63X3
T151	xformer, 1st IF plate	EP61X9
T152	xformer, 2nd IF plate	EP61X7
T153	xformer, 3rd IF plate	EP61X8
T201	xformer, horiz output	EP77X7
T202	xformer, vert output	EP64X7



1. VOLTAGE MEASUREMENTS ARE 20,000 OHM PER VOLT METER READING TAKEN WITH RESPECT TO CHASSIS COMMON. RECEIVER TUNED FOR NORMAL PICTURE. AC LINE VOLTAGE SET AT 120V. READINGS MAY VARY ±10% FROM THOSE SHOWN.

2. WHERE ON-SIGNAL AND OFF-SIGNAL MEASUREMENTS DIFFER, OFF-SIGNAL VOLTAGE APPEARS IN *ITALICS* BELOW ON-SIGNAL VOLTAGE. OFF-SIGNAL VOLTAGES MEASURED WITH ANTENNA TERMINALS SHORTED TOGETHER.

ON-SIGNAL VOLTAGES AND WAVE SHAPES TAKEN WITH NOISE FREE SIGNAL

● VOLTAGE VARIES WITH CONTROL SETTING

\# INDICATES PRODUCTION CHANGE

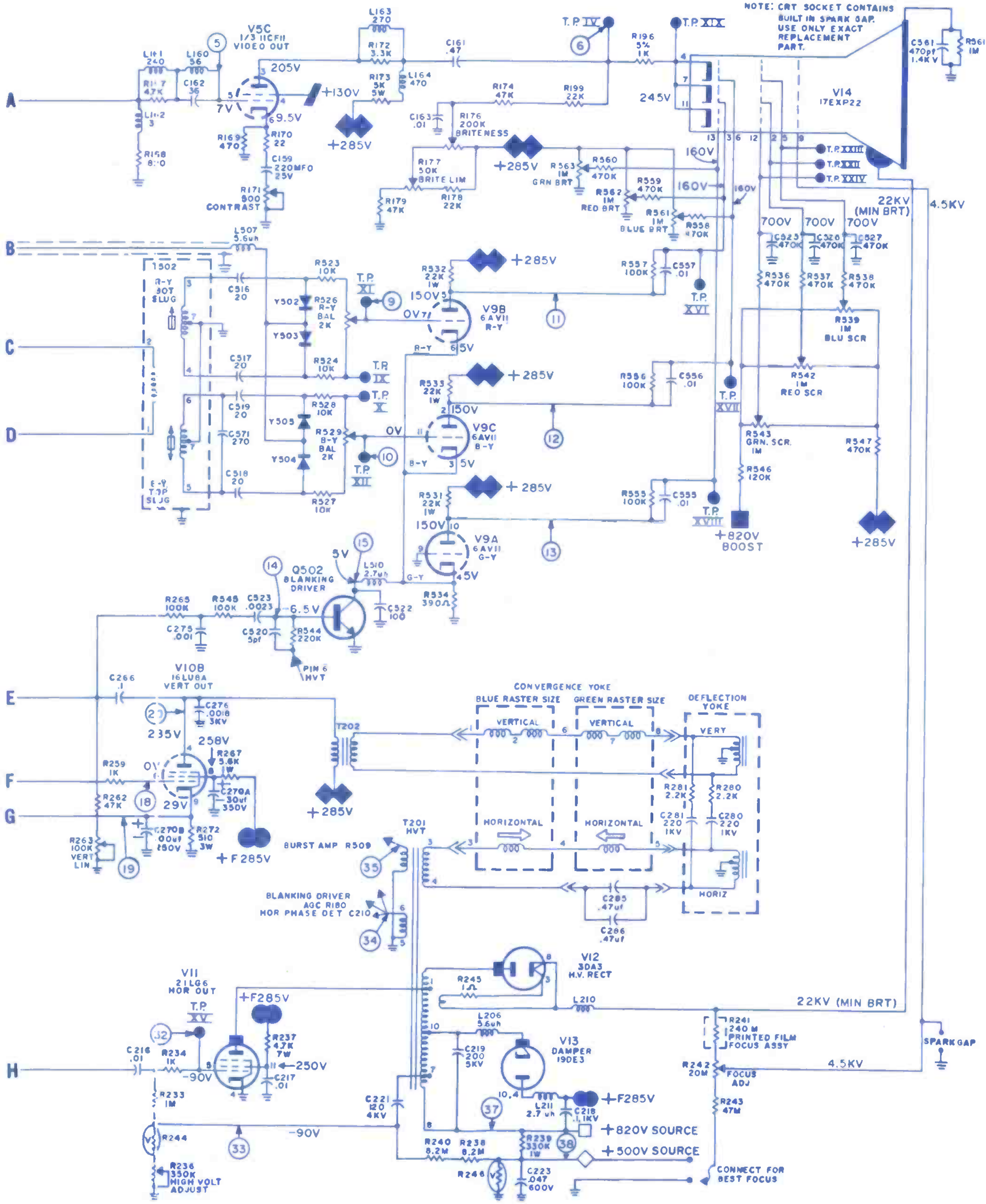
"X" TO "Y" FROM "X" "Y"

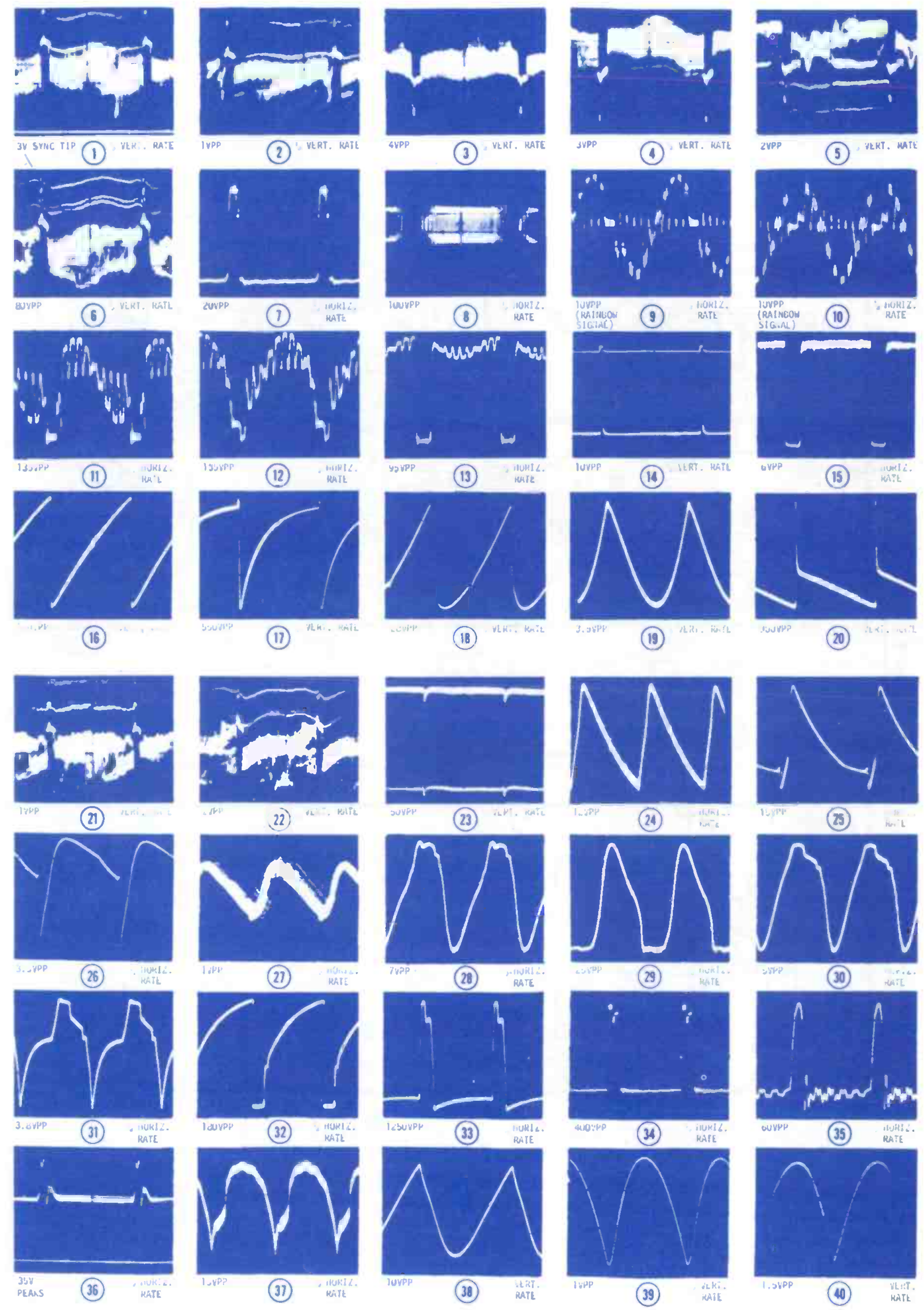
UNLESS OTHERWISE NOTED

K=1,000 M=1,000,000
CAPACITORS MORE THAN 1=uuf=uf
CAPACITORS LESS THAN 1=uf
RESISTORS ARE 1/2 WATT

T302—xformer, audio output	EP64X8
T401—xformer, filament	EP64X9
T501—coils, chroma bandpass	EP36X2
T502—xformer, chroma demod	EP36X65
R173—5K, ±10%, 5w, carbon film	EP14X19
R237—4.7K, ±10%, 7w, WW	EP14X6
R241—focus, voltage dropping	EP41X2
R243—47M, ±10%, 1.5w, 4kv	EP14X1
R244—varistor, 1ma, ±15% @850v	EP13X2
R246—varistor, 1ma, ±15% @575v	EP13X3
R260—therm, 500K, ±10%, @25°C	EP14X20
R402—2, ±5%, 7w WW	EP14X21
R403—270, ±10%, 3w WW	EP14X22
R410—3.9K, ±10%, 7w, WW	EP14X26
fuse, 4a slow-blo (F401)	EP10X7
fuse, 6a slow-blo (F402)	EP10X5
fuse, 3a fast-blow (F403)	EP10X4
yoke, deflection	EP76X5
CRT socket assembly	EP34X11

GENERAL ELECTRIC
Color TV Chassis N-1





1308

RCA VICTOR

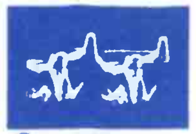
Color TV Chassis
CTC43 Series

JULY • 1970

ELECTRONIC TECHNICIAN / DEALER TEKFAX

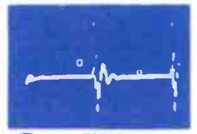
COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 5 NEW SETS

(6) PW500-F 200V P-P Horiz. Rate Output AGC Keyer

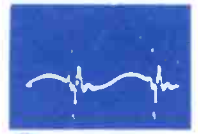


(7) TP501 7.5V P-P Horiz. Rate Output Sync Amp

(8) TP501 7.5V P-P Vert. Rate Output Sync Amp

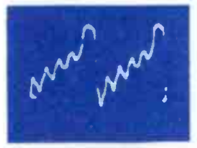


(9) TP503 300V P-P Horiz. Rate Center Tap L501-B

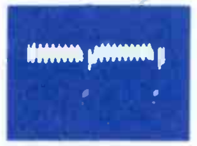


(10) TP502 45V P-P Horiz. Rate Cathode Horiz. Oscillator

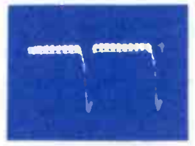
(11) V502-9 90V P-P Vert. Rate Grid Vert. Oscillator



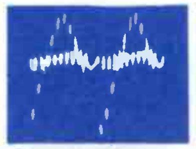
(20) V705-9 115V P-P Horiz. Rate Grid Blanker



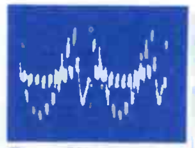
(21) CR706 Cathode 5V P-P Horiz. Rate



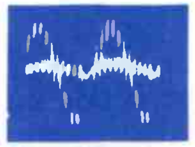
(22) V706-2 18V P-P Horiz. Rate Grid Video Output



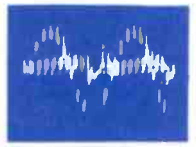
(23) PW700-12 150V P-P Horiz. Rate B-Y Amp Output



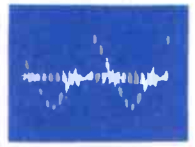
(24) PW700-7 36V P-P Horiz. Rate G-Y Amp Output



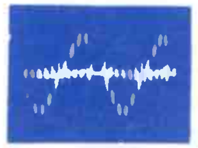
(25) PW700-3 130V P-P Horiz. Rate R-Y Amp Output



(26) V701-9 3V P-P Horiz. Rate Grid G-Y Amp

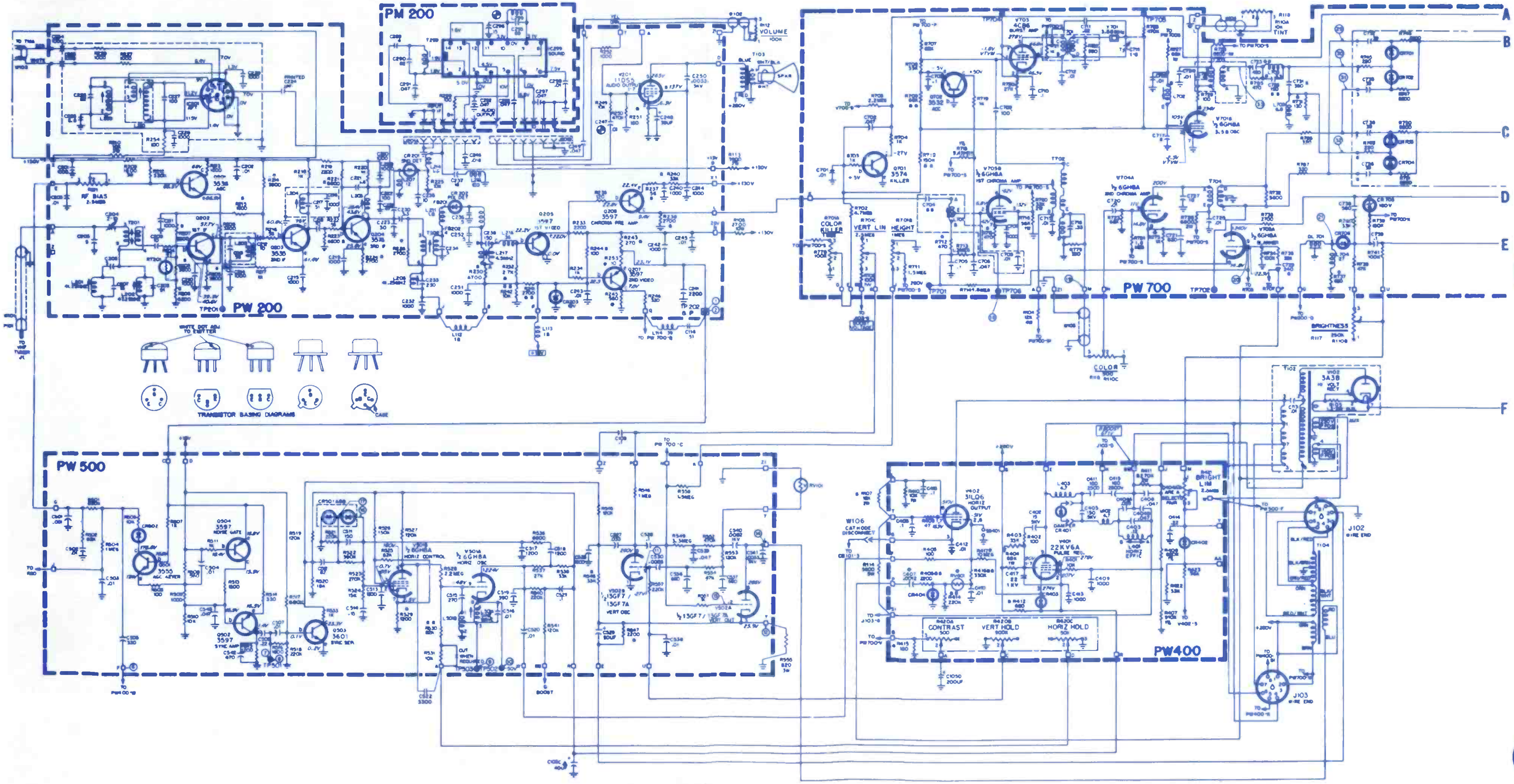


(27) V702-1 6V P-P Horiz. Rate Grid B-Y Amp



(28) V704-2 6V P-P Horiz. Rate Grid R-Y Amp

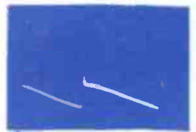
(29) A701 - 1 and 9 9V P-P Horiz. Rate Chroma Input to Demod



RCA VICTOR
Color TV Chassis CTC43 Series


(12) V502-3 (Term. T) 14V P-P Vert. Rate Cathode Vert. Output


(13) V502-2 400V P-P Vert. Rate Grid Vert. Output

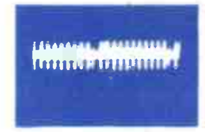

(14) V502-6 (Term. L) 1200V P-P Vert. Rate Vertical Output

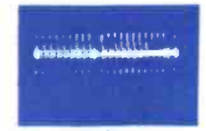

(15) V502-8 400V P-P Vert. Rate Plate Vert. Oscillator


(16) CR501-Anode 22V P-P Horiz. Rate Horiz. Phase Detector

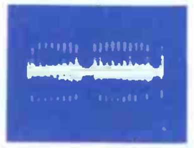

(17) CR501 Cathode 12V P-P Horiz. Rate Horiz. Phase Detector


(18) Term. C 2.5V P-P Vert. Rate Sync Input

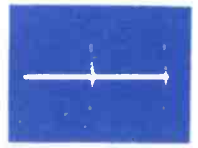

(18) TP706 1V P-P Horiz. Rate Grid 1st Chroma Amp

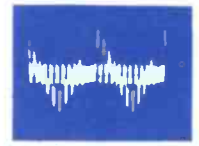

(19) PW700-M 5V P-P Horiz. Rate Input 2nd Chroma Amp

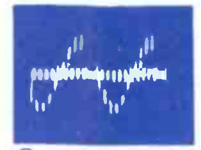

(30) A701-2 10V P-P Horiz. Rate Demod Reference


(31) A701-3 and 7 8V P-P Horiz. Rate Chroma Input to Demod


(32) A701-8 10V P-P Horiz. Rate Demod Reference

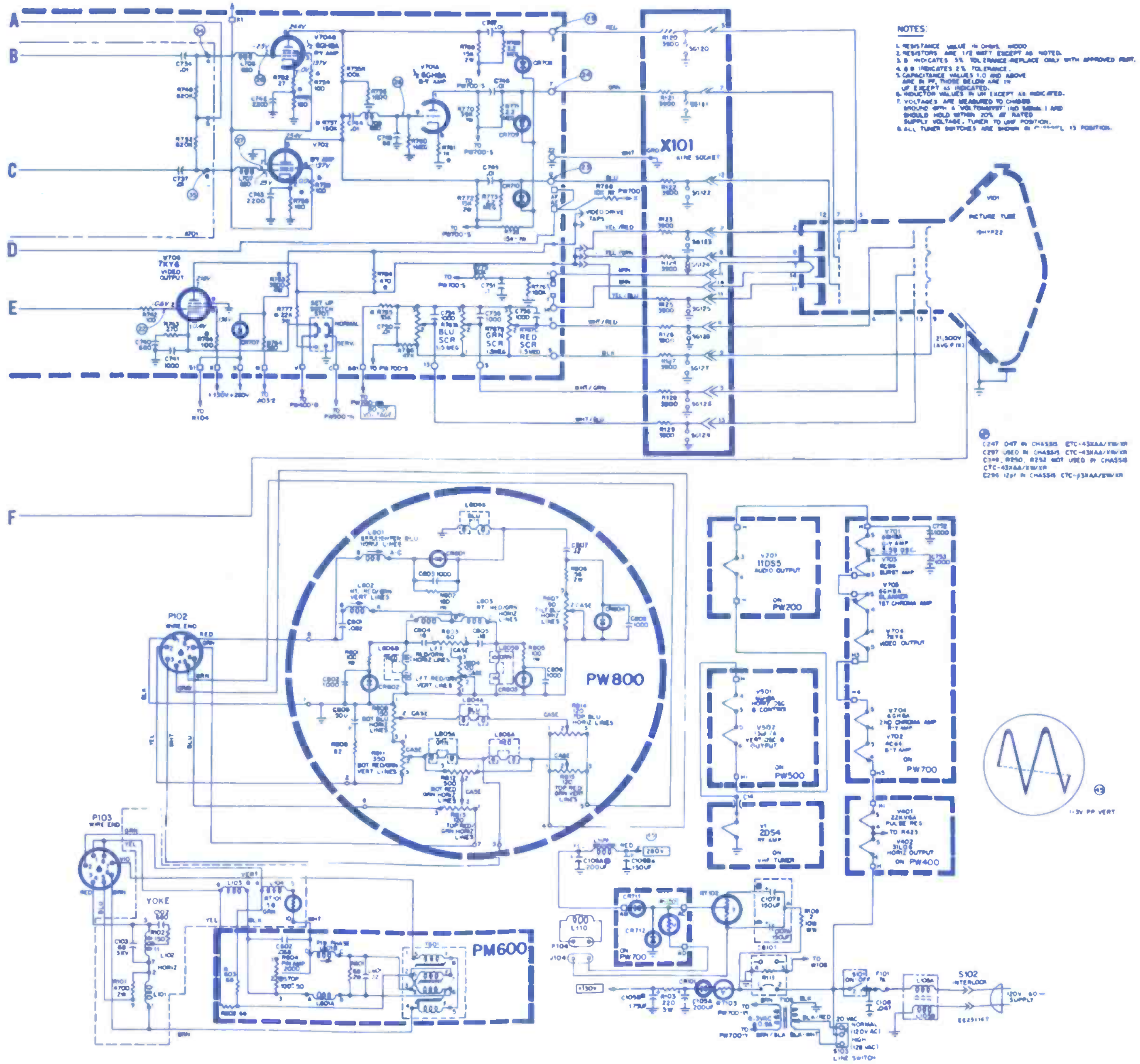

(33) T703-E 60V P-P Horiz. Rate Chroma Reference Output

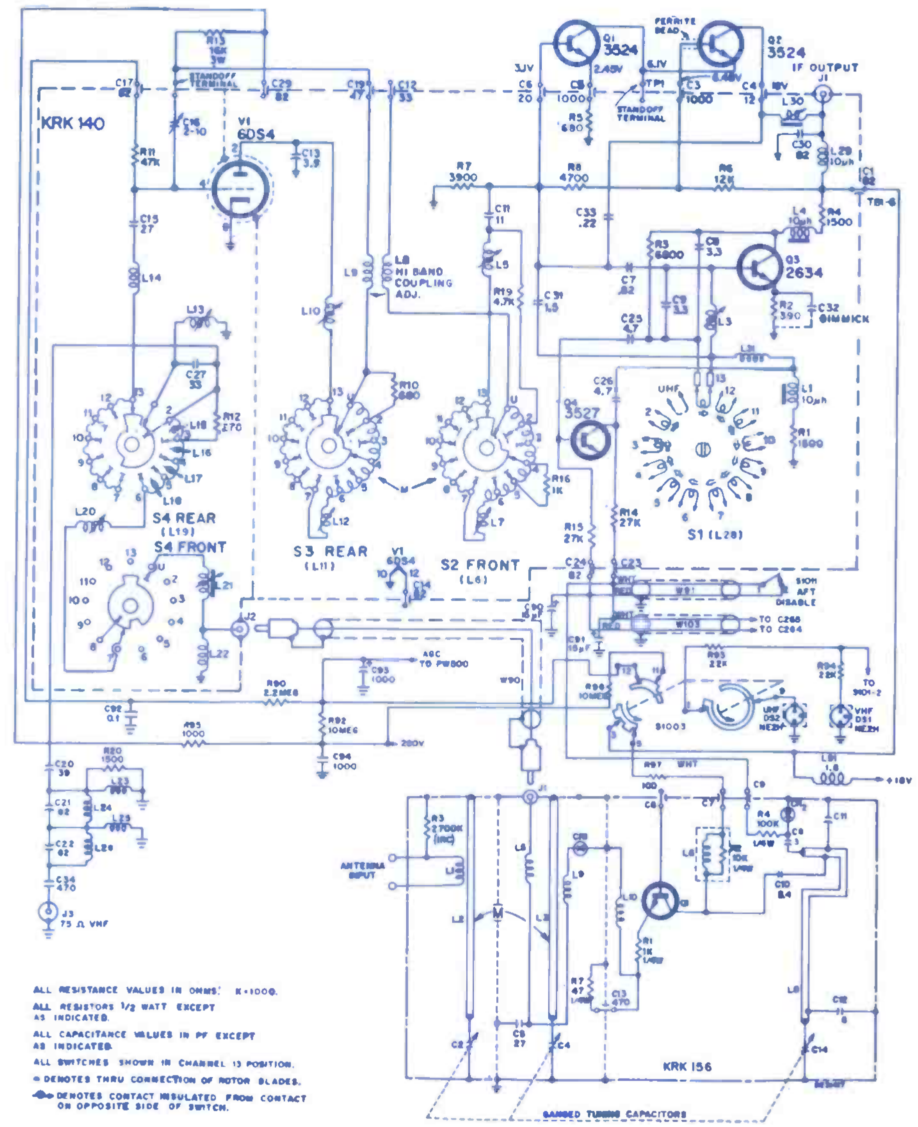

(34) A701-4 7V P-P Horiz. Rate Demod Output


(35) A701-6 6V P-P Horiz. Rate Demod Output

SYMBOL — DESCRIPTION	RCA VICTOR PART NO.
C105—4 section electrolytic	130821
C105A—200µf, 200v	130821
C105B—175µf, 175v	130821
C105C—40µf, 300v	130821
C105D—200µf, 10v	130821
C106—2 section electrolytic	126340
C106A—200µf, 350v	126340
C106B—150µf, 350v	126340
C107—2 section electrolytic	130769
C107A—150µf, 175v	130769
C107B—150µf, 175v	130769
CB101—breaker—circuit	130077
CR401—damper	120818
CRM1—module—color	130058
F101—Fuse—7a	120785
1C201—circuit—integ. AFT, CTC, 43XT, XU, XR	130130
IC299—circuit—integ. CTC 43A, XT, XU	130122
IC299—integ sound, CTC 43XR	130751
L105—AC line filter	126602
L299—discriminator	130121
L401—horiz eff	129453
L501—horiz	109947
L702—osc strength	121591
L709—reg mutual	115427
Q201—AGC	124753
Q202—1st pix IF	124757
Q204—3rd pix IF	124754
Q205—1st video	130139
Q206—chroma preamp	130139
Q207—2nd video	130139
Q501—AGC keyer	126712
Q502—sync amp	130139
Q503—sync sep	129899
Q504—noise gate	130139
Q701—killer	124755
Q702—acc	123941
R106—2700Ω 10%, 10w, film	130082
R108—2Ω 10%, 10w, WW	126360
R130—910,000Ω 5%, ½w, special CTC 43XR	131041
R420—control, contrast/vert hold/horiz hold	130108
R421—control, bright limiter	125076
R701—control, killer/vert height/vert lin	130107
R767—control, blue/green/red screen	126763
RT102—therm 240Ω cold	127227
RT103—therm 17Ω cold	131164
RT201—therm 4300Ω cold	124813
RV401—varistor hold down	124811
RV501—varistor 635v	130147
RV701—varistor degauss	126424
RV1101—varistor	130042
T102—horiz output	131044
T103—audio output	120822
T104—vert output	130092
T105—filament	130624
T105—filament	130090
T701—burst	130104
T703—oscillator	121559
T704—2nd chroma	130101
T1101—driver	130041
RT101—therm, temp comp, 3.8Ω	115942
yoke deflection	131772

NOTES:
1. RESISTANCE VALUE IN OHMS. K=1000
2. RESISTORS ARE 1/2 WATT EXCEPT AS NOTED.
3. ◎ INDICATES 5% TOLERANCE-REPLACE ONLY WITH APPROVED PART.
4. ◎◎ INDICATES 2% TOLERANCE.
5. CAPACITANCE VALUES 1.0 AND ABOVE ARE IN PF, THOSE BELOW ARE IN UF EXCEPT AS INDICATED.
6. INDUCTOR VALUES IN UH EXCEPT AS INDICATED.
7. VOLTAGES ARE MEASURED TO CHASSIS GROUND WITH A "VOLTOHMYST" (10 MEGA.) AND SHOULD HOLD WITHIN 20% OF RATED SUPPLY VOLTAGE. TUNER TO UHF POSITION.
8. ALL TUNER SWITCHES ARE SHOWN IN CHANNEL 13 POSITION.





ALL RESISTANCE VALUES IN OHMS. K=1000.
ALL RESISTORS 1/2 WATT EXCEPT AS INDICATED.
ALL CAPACITANCE VALUES IN PF EXCEPT AS INDICATED.
ALL SWITCHES SHOWN IN CHANNEL 13 POSITION.
● DENOTES THRU CONNECTION OF ROTOR BLADES.
◆● DENOTES CONTACT INSULATED FROM CONTACT ON OPPOSITE SIDE OF SWITCH.

1309

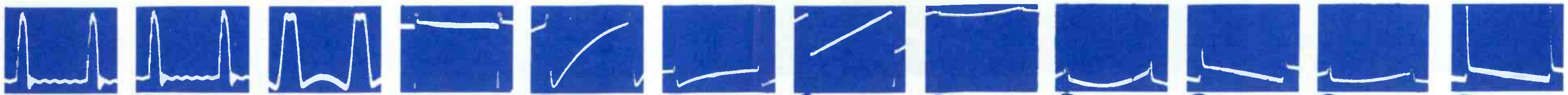
ZENITH
Color TV Chassis
14A9C29/14A10C29

JULY • 1970

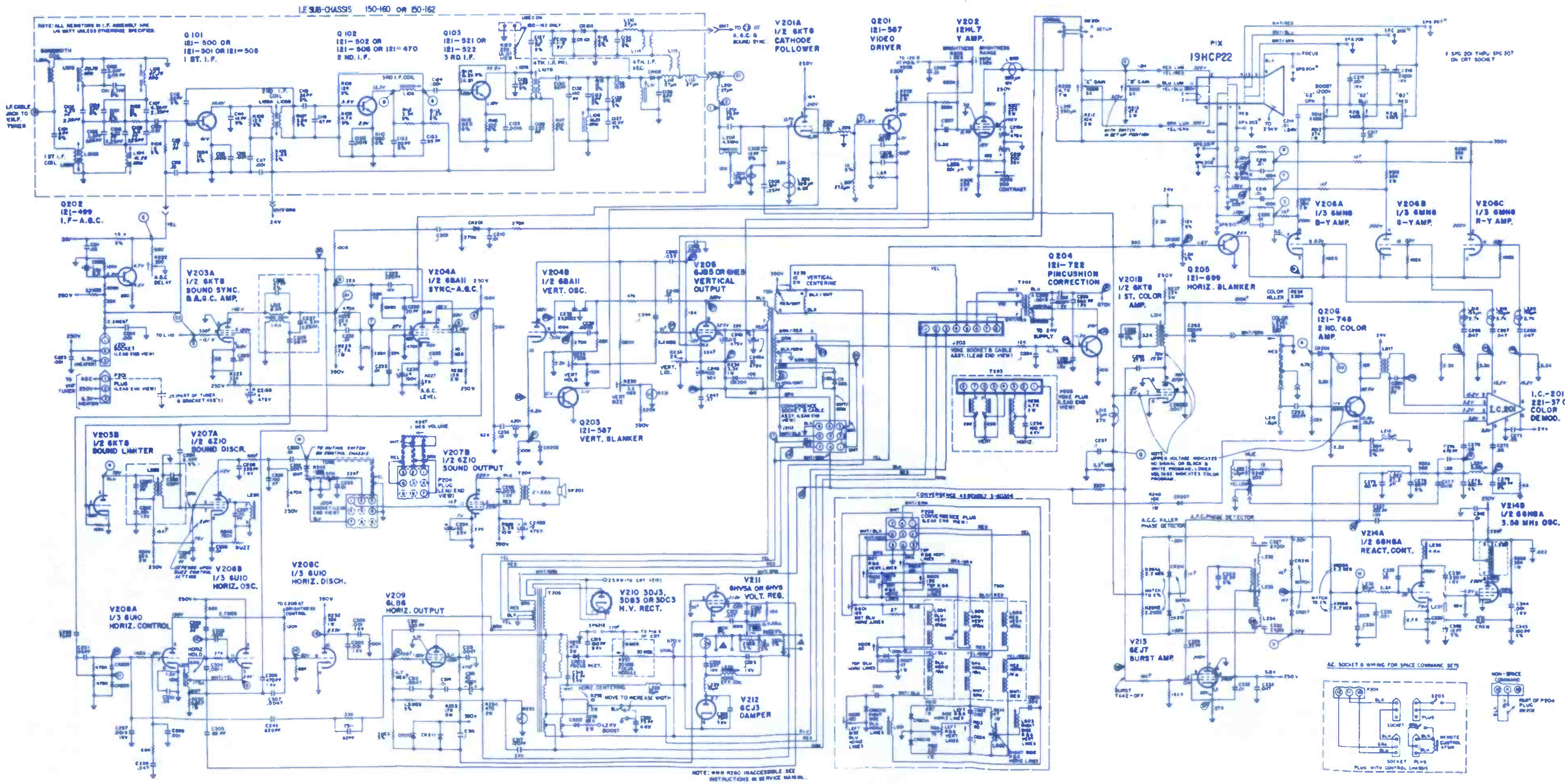
ELECTRONIC TECHNICIAN/DEALER TEKFAX

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

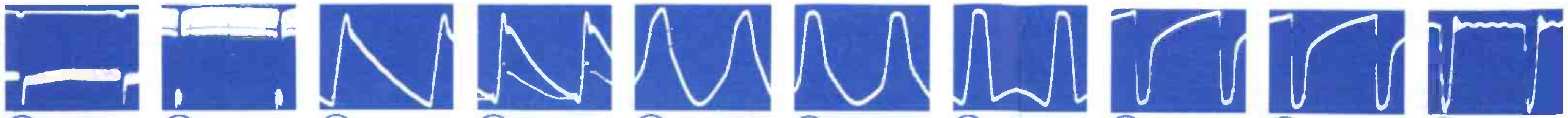
(1) 1.6V P-P 60 Hz
(2) 1.6V P-P 15.76 KHz
(3) 1.7V P-P 60 Hz
(4) 35V P-P 60 Hz
(5) .9V P-P 60 Hz
(6) 44V P-P 60 Hz
(7) 7.3V P-P 60 Hz



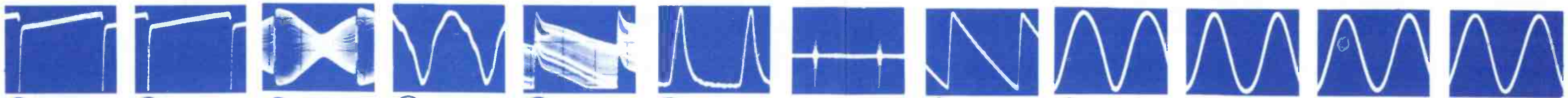
(18) 8V P-P 15.75 KHz
(19) 240V P-P 15.75 KHz
(20) 145V P-P 15.75 KHz
(21) 10V P-P 60 Hz
(22) 84V P-P 60 Hz
(23) 420V P-P 60 Hz
(24) 70 V P-P 60 Hz
(25) 60V P-P 60 Hz
(26) 26V P-P 60 Hz
(27) 1350V P-P 60 Hz
(28) 24V P-P 60 Hz
(29) 95V P-P 60 Hz



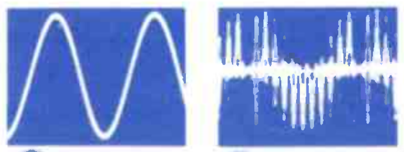
ZENITH
Color TV Chassis
14A9C29/14A10C29



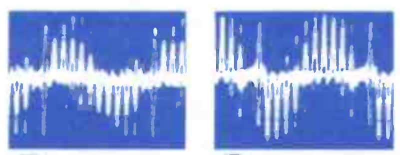
8 — 37V P-P, 60 Hz
9 — 70V P-P, 60 Hz
10 — 21V P-P, 15.75 KHz
11 — 30 V P-P, 15.75 KHz
12 — 420V P-P, 15.75 KHz
13 — 260V P-P, 15.75 KHz
14 — 150V P-P, 15.75 KHz
15 — 250V P-P, 15.75 KHz
16 — 230V P-P, 15.75 KHz
17 — 19V P-P, 15.75 KHz



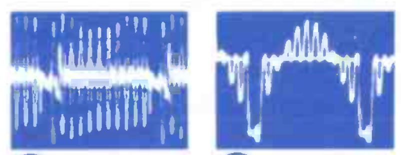
30 — 11V P-P, 60 Hz
31 — 44V P-P, 60 Hz
32 — 42V P-P, 60 Hz
33 — 60V P-P, 15.75 KHz
34 — 25V P-P, 60 Hz
35 — 54V P-P, 15.75 KHz
36 — 75V P-P, 15.75 KHz
37 — 14V P-P, 15.75 KHz
38 — 180V P-P, 3.58 MHz
39 — 40V P-P, 3.58 MHz
40 — 56V P-P, 3.58 MHz
41 — 1.1V P-P, 3.58 MHz



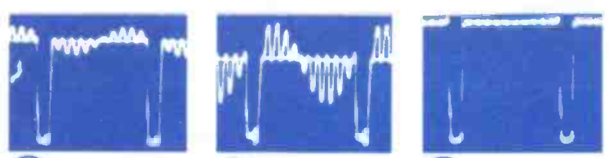
42 — 1.0V P-P, 3.58 MHz
43 — 6.2V P-P, 15.75 KHz



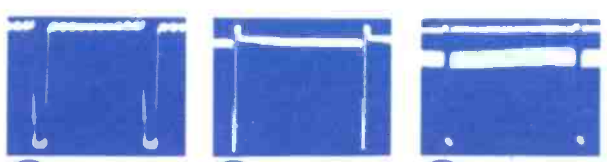
44 — 2.4V P-P, 15.75 KHz
45 — 6.4V P-P, 15.75 KHz



46 — .2V P-P, 15.75 KHz
47 — 170V P-P, 15.75 KHz

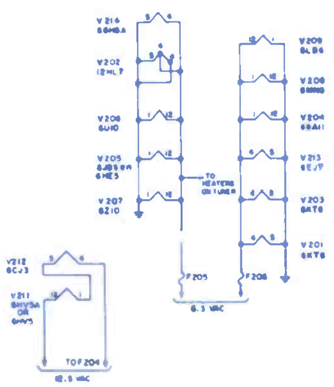


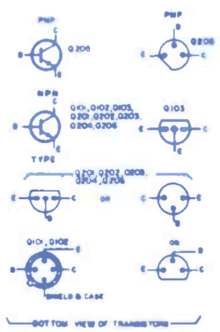
48 — 120V P-P, 15.75 KHz
49 — 160V P-P, 15.75 KHz
50 — 3.4V P-P, 15.75 KHz



51 — 3.2V P-P, 15.75 KHz
52 — 12V P-P, 60 Hz
53 — 2.4V P-P, 60 Hz

54 — NOT USED
55 — NOT USED
56 — NOT USED





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 GRIDS OF THE PICTURE TUBE DEPEND UPON THE HUE SETTING.

ALL VOLTAGES MEASURED FROM CHASSIS TO POINTS INDICATED.

ALL VOLTAGES ARE D.C. UNLESS OTHERWISE SPECIFIED.

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

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

RESISTANCE MEASUREMENTS SHOWN WITH COILS DISCONNECTED FROM CIRCUIT.

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

COIL RESISTANCE NOT GIVEN UNDER ONE OHM.

ALL CAPACITOR VALUES IN MICROFARADS UNLESS OTHERWISE SPECIFIED.

FOR CAPACITOR TOLERANCE SEE LEGEND.

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

ARROWS ON POTENTIOMETERS INDICATE CLOCKWISE ROTATION.

○— INDICATES ALIGNMENT & TEST POINT.

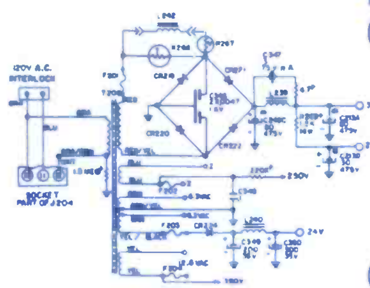
PF = PICOFARAD   MHz = MEGAHERTZ   μH = MICROHENRY

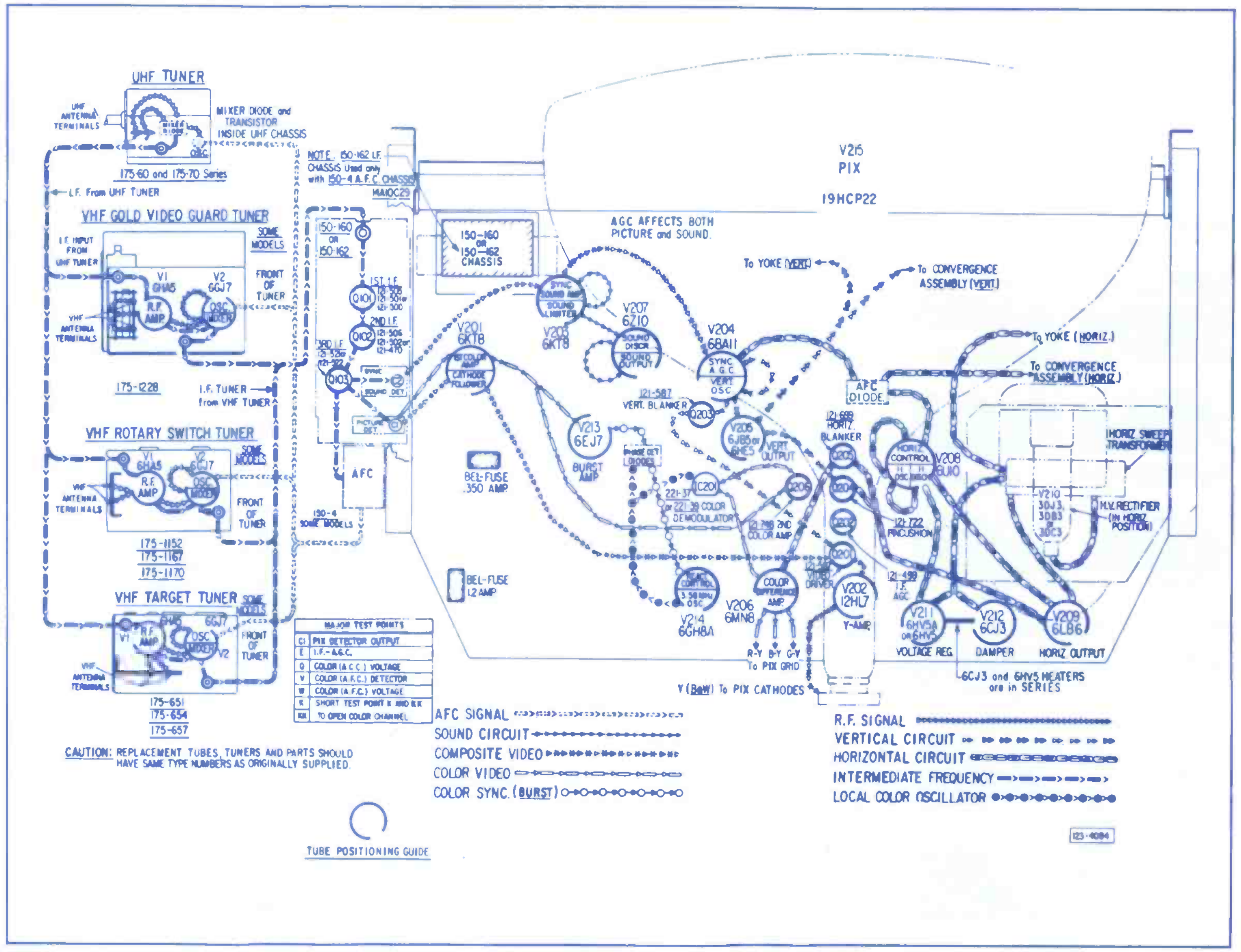
INDICATES ± 20% MAY BE USED.   ○— INDICATES VOLTAGE SOURCE.

INDICATES CHASSIS GROUND.   (2)▷ INDICATES WAVEFORM CHECK POINTS. (SEE WAVEFORM CHART)

TEST POINTS:

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





SYMBOL	DESCRIPTION	ZENITH PART NO.
C213A	4μf electrolytic cap 475v	22-5360
C213B	4μf elect cap 475v	22-5360
C213C	80μf elect cap 475v	22-5360
C213D	30μf elect cap 475v	22-5360
C249A	30μf elect cap 475v	22-5513
C249B	10μf elect cap 475v	22-5513
C249C	80μf elect cap 475v	22-5513
R204	3M bright range control	63-7101
R206	500Ω contrast control	63-6980
R214	5M green G1 control	63-6976
R215	5M blue G1 control	63-6977
R216	5M red G1 control	63-6978
R222	500Ω AGC delay control	63-8308
R227	7KΩ AGC level control	63-8235
R229	750KΩ vertical hold control	63-6979
R230	3.5M vert size	63-8443
R231	voltage dependent resistor	63-5058
R233	2KΩ vert lin control	63-6951
R235	10Ω vert centering control	63-7009
R238	250KΩ color killer control	63-8449
R245	750Ω buzz control	63-6950
R246	1M tone control	63-7351
R255	voltage dependent resistor	63-7658
R257	20M focus module control	63-7145
R258	10Ω horiz centering control	63-7211
R260	3M high voltage adjust control	63-8460
R262	voltage dependent resistor	63-8161
R267	voltage dependent resistor	63-7146
R268	therm	63-7346
L202	4.5MHz coil	S-77669
L206	delay line	S-80475
L212	sound take off coil assy	S-77414
L225	intercarrier coil	S-74445
L226	quad coil	S-80480
L227	horiz osc coil	S-56877
L230	horiz efficiency coil	S-77975
L233	burst amp and phase det coil	S-80590
L236	color freq adjust coil	S-66627
L239	filter choke	95-2702
T201	vert output xformer	95-2663
T203	deflect yoke	95-2667
T204	audio output xformer	95-2660
T206	power xformer	95-2748
A201	integrator	87-4
P203	plug, yoke assembly	43-873
F201	1.2a bel-fuse	136-63
F203	.35a bel-fuse	136-75

MAGNAVOX TV Chassis T949 Series

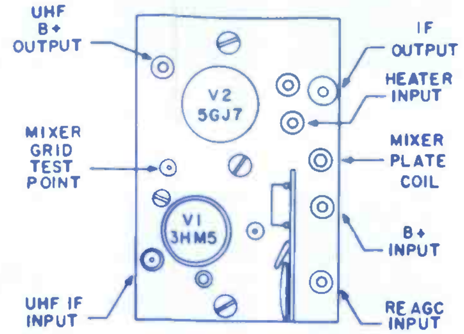
ELECTRONIC TECHNICIAN / DEALER TEKFAX

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

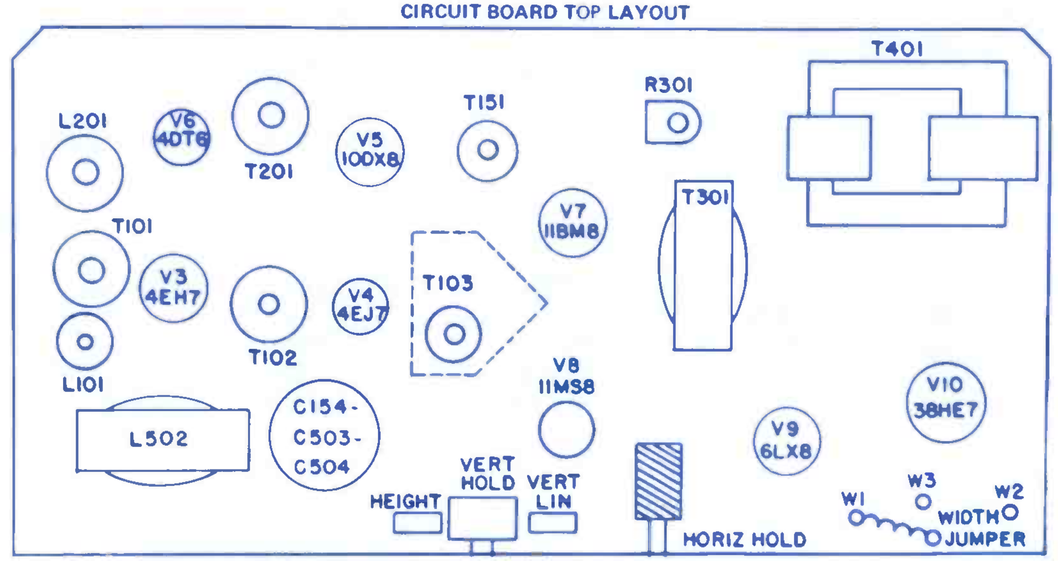
JULY • 1970

SYMBOL — DESCRIPTION	MAGANAVOX PART NO.
L101 — 47.25MHz trap coil	36C011-2
L103 — peaking coil	36C011-13
L201 — quad coil	36C011-8
L401 — horiz osc coil	36C011-17
T101 — VIF xformer	36C011-3
T102 — VIF xformer	36C011-4
T103 — VIF xformer	36C011-5
T151 — sound take-off xformer	36C011-6
T201 — SIF xformer	36C011-7
T202 — audio output xformer	32C001-1
T301 — vert output xformer	36C011-18
T401 — horiz output xformer	36C011-19
T402 — deflection yoke	36C012-1
C412 — ceramic, 120pf, 10%, 5kv	25X009-1219
C504 — electrolytic, 250µf 200µf 10µf, 180v	27C020-1
R410 — 1000, 10%, 2w, metal oxide	23C004-2
R154 — contrast, 20K	22C007-2
R157 — bright, 200K	22C007-3
R209 — vol, (includes switch) 1M	22C007-1
R301 — AGC, 1K	22C007-7
R354 — vert hold, 1.5M	22C007-4
R350 — vert lin, 2M	22C007-6
R360 — height, 500K	22C007-5
Z102 — VIF pac	25C027-1
Z201 — SIF pac	25C027-2
Z203 — SIF pac	25C027-3
Z301 — sync sep pac	25C027-4
Z302 — vert int pac	25C027-5
Z402 — horiz osc pac	25C027-6
Z501 — isolation pac	25C026-1
D101 — germanium diode	53C001-1
D401 — dual diode	53C008-1
D501 — silicon diode	53C005-3
M3 — UHF tuner	34C002-3
M4 — VHF tuner	34C002-2
X501 — 2a fuse	18C014-1

VHF TUNER LAYOUT



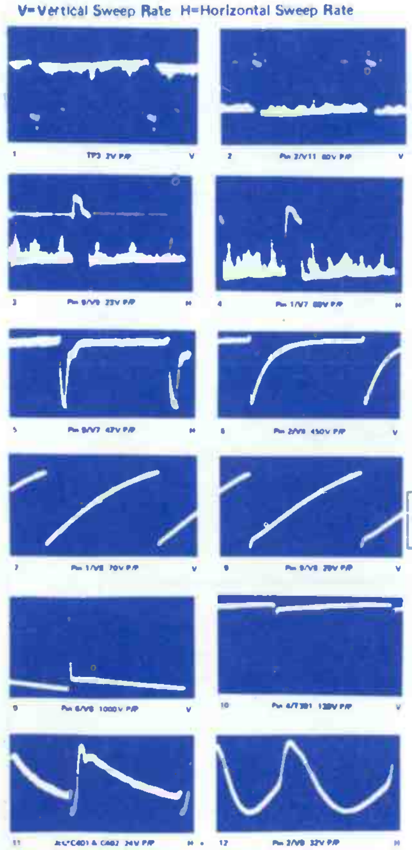
CIRCUIT BOARD TOP LAYOUT

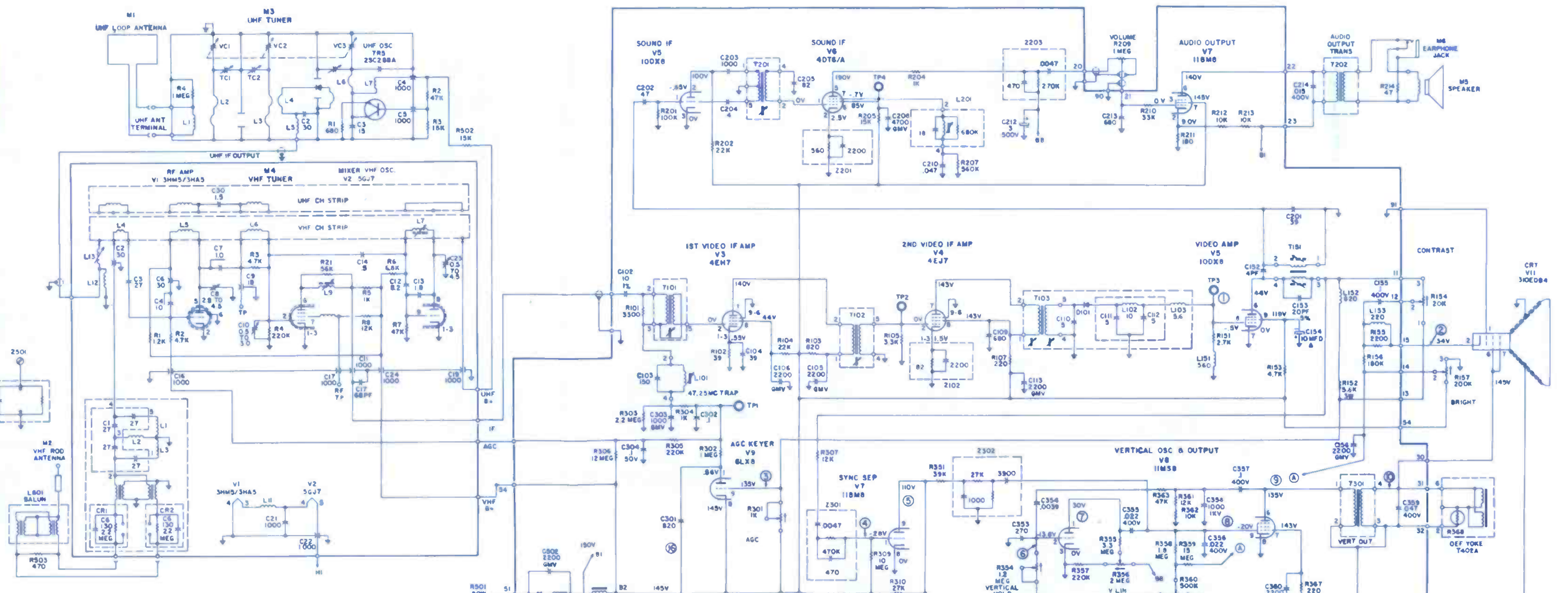


WAVEFORMS

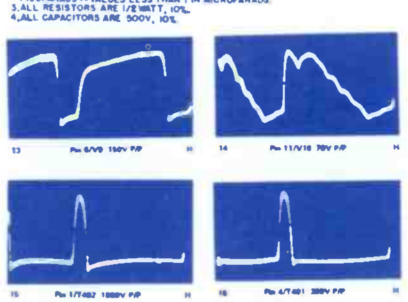
Waveforms measured with signal, controls set for normal operation, and 5.5 VDC at TP1.

V=Vertical Sweep Rate H=Horizontal Sweep Rate





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



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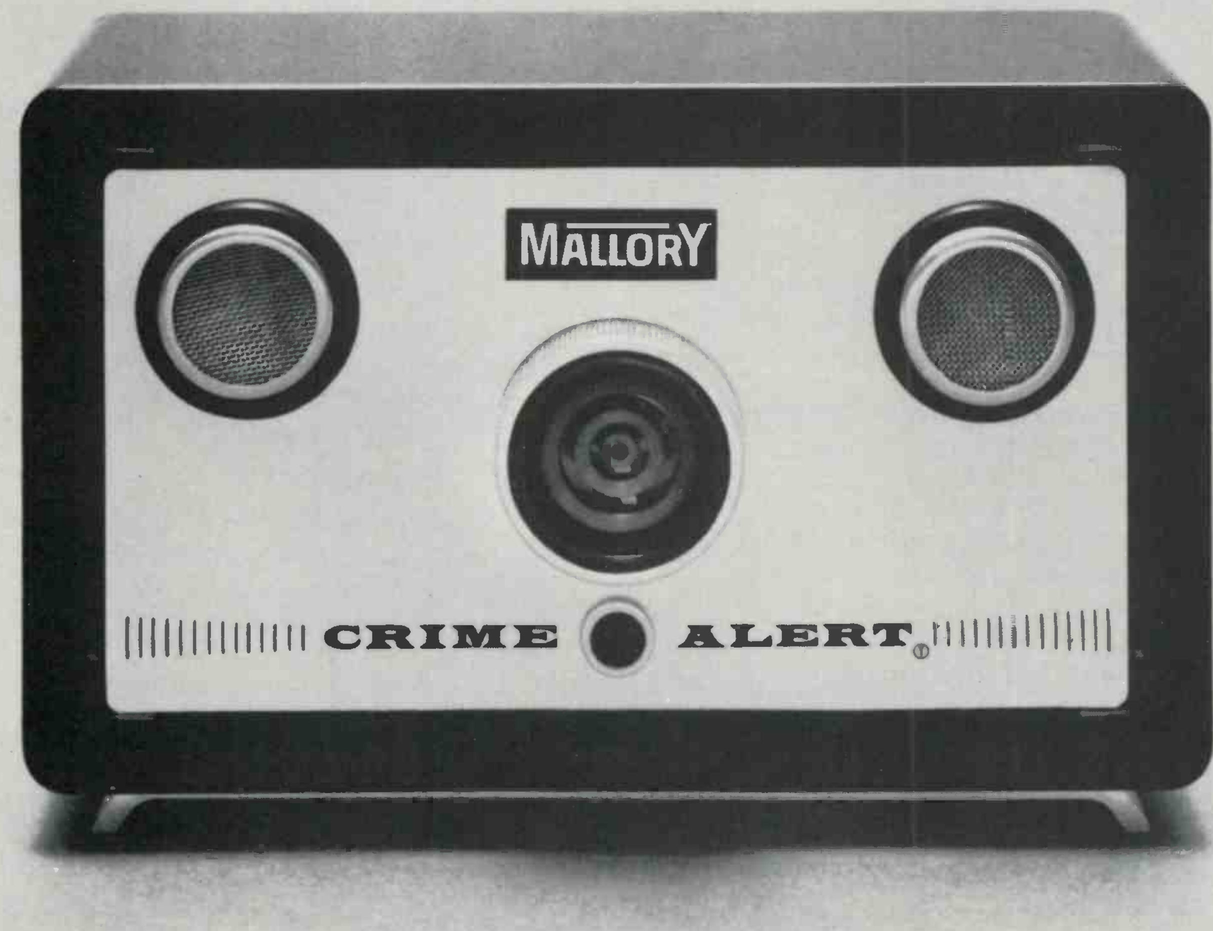
ACTUAL SIZE



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WORLD'S LARGEST TV-RADIO SERVICE & SALES CIRCULATION

JULY 1970 • VOLUME 91 NUMBER 7

COVER

Paul and Joe checking out the final adjustments on the Drake TR-4 transceiver that they installed in Paul's 1970 Chevrolet Townsman station wagon. A pictorial account of their installation procedures is given in the article beginning on page 46.

TEKFAX • 16 PAGES OF THE LATEST SCHEMATICS • **Group 215**
GENERAL ELECTRIC: Color TV Chassis N-1
MAGNAVOX: TV Chassis T949 Series
RCA VICTOR: Color TV Chassis CTC43 Series
RCA VICTOR: TV Chassis KCS169X Series
ZENITH: Color TV Chassis 14A9C29/14A10C29

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ET/D EDITOR'S MEMO

Everyone seems to have an eye on the stock market—even many of us without money to invest. And the frequent downward trends observed have been a cause of great concern.

This threat of a coming depression has also been reflected in the sudden drop in color-TV sales. At least one major manufacturer has closed down its color picture tube plant, laying off virtually all plant employees. Newspaper accounts tell of other manufacturers laying off hundreds and then thousands of employees.

Does such talk of gloom mean that we should close shop and prepare to stand in food lines, as did many well trained men during the depression of the 1930's? Quite the contrary.

Although an economic recession may result in reduced income from the sale of consumer electronics, this simply means that more people will be having their radios, TV sets and phonographs repaired rather than replaced —and for many of you, electronic maintenance is where the money is.

Instead of preparing to give up, electronic technicians should be "boning up" on their basic tube and transistor circuits so that they can handle these increased work loads with greater efficiency—resulting in even greater profits as the economy declines.

ELECTRONIC TECHNICIAN/DEALER will continue to provide you with technical articles, written to supply you with the information needed for effective servicing. This will be done with the many original articles that Joe Zauhar and I plan to write, supplemented with any service tips that you, the reader, can provide.

We are always interested in learning what you are doing. And if you feel inclined to send us details concerning some helpful or unique servicing techniques that you have developed (with sketches or photos), we are interested in publishing this material as a feature article. You need only supply us with a clear explanation of what you have been doing—stating specifically your interest in the material being used as a feature article on a free-lance basis—and we will be glad to rewrite it, as necessary, paying you for your efforts.

Phillip Dahlen

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ET/D LETTERS TO THE EDITOR

Comments on Articles

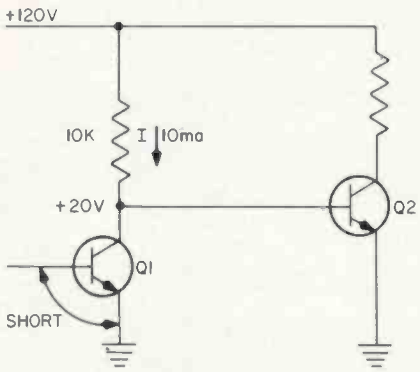
I would like to bring to your attention an error in the May 1970 issue of ELECTRONIC TECHNICIAN/DEALER. In the article entitled "Electronic Depth Finders" it was stated in the calibration of the dial that the time it took the pulse to reach bottom was 50 times 0.000208 or 0.0104 sec. It was then erroneously stated as 104ms. The figure should have been 10.4ms.

I would like to take this opportunity to say that I find the articles in ELECTRONIC TECHNICIAN/DEALER interesting and knowledgeable.

RALPH E. MACLEOD

I am writing concerning the comments of Ronald B. Lorbecki in April 1970's "Letters to the Editor." I agree with him 100%, however I feel a note of caution should be voiced.

In short, it is not always okay to short the base to the emitter of a transistor. I have noted a number of cases where the collector supply is dropped from a high voltage source. Removing forward bias will do two things: the collector voltage will rise, thus produc-



ing "punch through" in the transistor. If the transistor in question is directly coupled to the base of another stage, it will probably "fail" that transistor too.

I enclose a diagram to illustrate.

VICTOR CASTENS

In reading the article on selling CCTV in your March 1970 issue, I noticed that it said (page 50) to pass the Q-Tip past the head in an up-and-down motion.

I am an owner of a Sony CV-2200A, and the owner's manual and service manual say to press the tip of the cleaner lightly against the head and clean by moving the tip horizontally. I have talked to the Sony technicians in Tokyo, and they say that cleaning the rotary heads vertically can cause them to get out of alignment.

Always check the service manual to see how the heads are to be cleaned. Not all are cleaned the same way.

TERRELL E. MARKLAND

A few years ago you ran an article on garage door operators. It sounded good to us. Now we are distributor in Boca Raton for the Alliance garage door operators. We do quite a service business in all makes of control units. Anything too complicated we send back to the factory. Most of them just need new tubes and alignment, which is no problem. Transistorized ones we haven't gotten so involved in outside of open filters in the Alliance.

This is just to let you know that your articles don't go unnoticed.

GERALD VANCE ELECTRONICS

I have just read your article on servicing cassette recorders by Homer Davidson.

I would like to say that I feel it was an excellent article.

Should you ever run an article on auto-tape players, this may be of interest to you:

Most of my friends and myself, who have auto-tape players, usually leave our tapes in the car—under the seat or in the trunk. I have found that when it is cold outside the tapes will tend to bind up or play slower than normal, indicating a tight or loose pulley drive. I feel that they must be kept at a reasonable temperature.

FRANKLIN ROBINSON

I read your article "Color Service Case Histories" with great interest. Would you consider repeating it more often and perhaps cover equipment other than TV sets?

The article showed the technique of the technician's trouble shooting process, which can be added to my own store of experiences as indelibly as if I had done it myself.

Very clear shop talk like this really stays with me. Thanks a lot.

PAUL P. WATSON

I have now been a subscriber to ELECTRONIC TECHNICIAN/DEALER for almost two years, and I have only praise for the good work that your staff does in keeping myself and other service technicians up-to-date on electronics. I have read letters that have been quite critical of the material that you have printed. As for myself, I en-

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ET/D LETTERS TO THE EDITOR

joy reading all of the articles, even the ones slightly over my head or, I should say, slightly out of my line of work.

One of the articles I especially liked was "The CAT Game." In my opinion, an article of this nature would be helpful and of interest to any technician in the service business. I would like to see more articles of this nature. I would like to see more articles like "Stereo Servicing with a Scope" which appeared in March and April issues.

JOHN L. DANTZLER

Information Needed

I have a Gray 50w power amplifier, Model AM-50, manufactured by the Gray Research and Development Co., Inc., of Manchester, Conn. I need a schematic in order to repair it.

I wrote to the manufacturer and my letter was returned, stamped removal order expired. Would you have information about whether or not this company is still in business? If so, let me have their present address; and if they are out of business, could you tell me how I could obtain a schematic for the above amplifier.

THOMAS GRAHAM
RADIO TV REPAIR SHOP
BOX 366 TC
BRIDGEWATER, MASSACHUSETTS 02324

I would appreciate it very much if some reader would loan me a manual for a DuMont 304-A Oscillograph, which I would photocopy and return.

I also need to copy the manual or schematic for Webcor Tape Recorder Model No. EP2711-1.

Perhaps I can return the favor.

R. L. TROTT
1690 SHARKEY STREET
TALLAHASSEE, FLORIDA 32304

The May article about MATV cables written by Robert Sharp and Paul Miller was a really good one.

When I recently installed some shielded twin lead it occurred to me that the shield should be terminated. However, my search for this information has been fruitless. I have asked several technical people and their replies are not positive.

I should appreciate hearing from you.

E. W. BLAU

The twin lead shield should be grounded in the same manner as the antenna mast. Ed.

I have been an avid ELECTRONIC TECHNICIAN/DEALER reader for years, and I wish to commend you for all the service you have given me in the past through your magazine. Keep up the good work!

Recently I was given a Timex record-making and phono player Model No. 40-1. It is in very good condition. I wrote to Timex, and they were very good in answering. But they do not have parts or the disc to make recordings. Now my big question is where can I get these discs?

I hope you or your readers can help me.

ANTHONY BOCHICHIO
45 ANDREWS STREET
STATEN ISLAND, NEW YORK 10305

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ET/D LETTERS TO THE EDITOR

to-date parts and instruments. The property is available as a whole: the lot (100 ft by 96 ft), the building and a large parking area. Full particulars will be given on request.

I have enjoyed your magazine for a great many years. I think it is tops in the field.

W. C. POPE
POPE'S RADIO & TV SERVICE
312 ANASTASIA BOULEVARD
ST. AUGUSTINE, FLORIDA 32084

I have the Sams Photofact Albums listed by number: 46, 47, 70, 85, 87, 100, 113, 132, 171, 179, 184, 189, 199, 223, 227, 234, 237, 245, 249, 258, 277, 282, 283, 284, 286, 291, 300, 307, 322, 354. I will give them to anyone who sends a postpaid envelope, or I will provide more detailed information on what models are covered in each album.

MRS. FRED MAGNUS
7403 MAPLE AVENUE
TAKOMA PARK, MARYLAND 20012

I would like to let you know how much I enjoy reading ELECTRONIC TECHNICIAN/DEALER. It is one of the best trade magazines available. Keep up the good work.

I have for sale Riders Television Manuals Volumes 1 through, and including, Volume 27, also four volumes of RCA Victor Service Data. These cover RCA radios from 1923 to 1948.

No reasonable offer for the volumes will be refused.

BILL METZ, JR.
Metz TV Sales and Service
Box 362
Augusta, Wisc. 54722

I want to take this opportunity to express my appreciation for the informative service articles you publish in ELECTRONIC TECHNICIAN/DEALER. Since I am a young technician just out of technical school and only in business for a short time, I appreciate all the experience I can pick up. Since working with an older technician is not possible, I appreciate the tips passed on in your journal.

I would like to make available to other readers the following used equipment that I have for sale: I have a B & K color analyst 850, a Hickok 191X RF generator and a Gertsch FM-3 frequency meter. If any readers are interested or would like to make an offer on these pieces of gear, they can contact me.

R. D. ZAGRABELNY
Route 4
Marshall, Mo.

Overwhelming Response

Thank you for printing our request for schematics in the Readers' Aid Department.

Directly above our request was a letter headed "Overwhelming Response."

We have received a tremendous number of replies and copies of the information we requested, so our experience has been the same as that of Mr. Watkins.

Please pass on our thanks to all of those who responded. It is encouraging to realize that people in the electronics service industry are so willing to help one another. Once again, our sincere thanks to you and our fellow readers.

G. M. BOYES

Helpful Suggestion

Two points always present in alignment instructions for TV IF stages are:

- Disable the oscillator section of the mixer-oscillator.
- Connect the high side of the signal generator to the ungrounded tube shield over mixer-oscillator tube, low side to ground.

There is no such thing anymore as a removable tube shield over the mixer-oscillator tube, so how is it possible to replace it with an ungrounded shield?

I made an insert from a width control sleeve, which is used between the yoke and the neck of some picture tubes, to insert between the present grounded tube shield and the tube. The high side of the generator can then be connected to the extended portion of this insert with a cliplead or alligator clip.

The most common way to disable the oscillator section of the mixer-oscillator tube is to cut off a tube prong of a good tube. This is expensive, and the dehorned tube should be kept for the next job using the same type of tube. Why not ground the control grid of the oscillator section or connect it to the oscillator cathode if, as in some cases, the cathode is grounded?

In lieu of all this, why doesn't the test instrument manufacturer provide for accomplishing these things with the equipment?

Perhaps if you print this the manufacturers will do something about it.

GEORGE W. THOMPSON

ET/D TECHNICAL DIGEST

by JOSEPH ZAUHAR

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

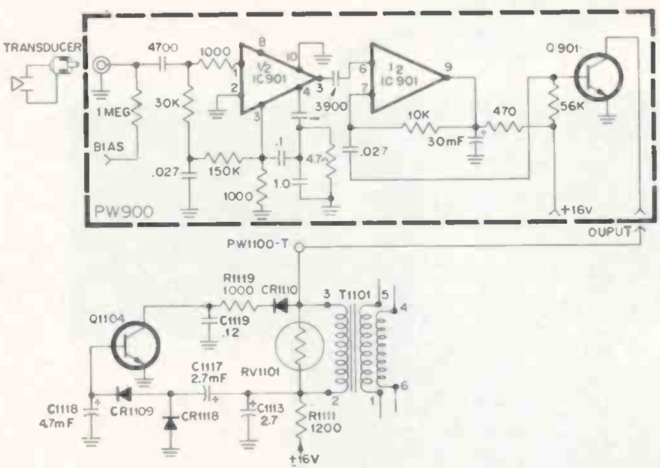
RCA VICTOR

Color TV Chassis CTC42XR—Remote On/Off and Channel Functions

The CTC42XR remote control system uses an integrated circuit preamplifier and transistor driver stage (PW900) to amplify ultrasonic command frequencies emanating from the CRK13 four-function remote hand unit. The amplified signals of the PW900 board are applied to the primary of driver transformer T1101, located on the PW1100 remote board. The secondary voltages of this transformer drive tuned circuits that trigger the appropriate controlled functions.

Noise Immunity Circuit

Shown in the illustration is the noise immunity circuit, transistor Q1104, that serves to minimize the possibility of the remote circuits being triggered by extraneous noise

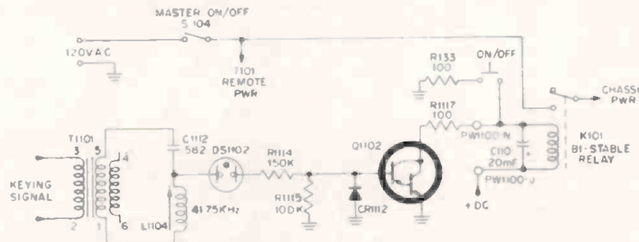


pulses, such as jingling coins, etc. Under normal conditions (when a valid remote signal is processed through the system) a steady dc voltage proportional to the amplitude of the ultrasonic signal will be developed across capacitor C1113. The noise immunity transistor (Q1104) is inactive at this time because it has no base current. When noise pulses occur, the voltage at C1113 will vary in relationship to the low-frequency amplitude changes of the noise. An ac signal appears at this point and is coupled through a capacitor, C1117, to be rectified by diode CR1109. The rectified ac produces a dc charge on capacitor C1118. When this noise-induced voltage exceeds approximately +0.6 to +0.7v, transistor Q1114 is biased into conduction. The load across the primary of transformer T1101, caused by the conduction of transistor Q1104 (through CR1110 and R1119), reduces the T1101 secondary voltage sufficiently to preclude erroneous remote control operation.

An additional component—voltage dependent resistor (RV101)—serves to limit the amplitude of the pulse on the collector of the driver transistor (Q901) to prevent breakdown.

Function Circuits Operation

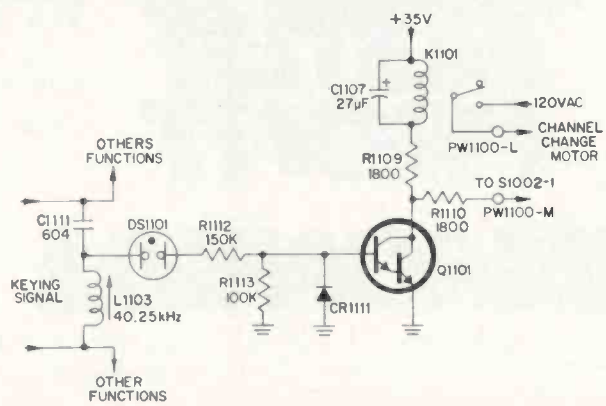
The On/Off circuit responds to a 41.75kHz command signal—as shown in the illustration. When a signal of that frequency appears across the series resonant circuit, consisting of capacitor C1113 and coil L1104, a neon bulb (DS1102) is ignited and acts as a low resistance path to



the base of a Darlington transistor, Q1102. Base current for this transistor is provided by the positive portion of the signal voltage obtained from the resonant circuit—through the conducting neon bulb and current limiting resistor, R1114 (150K). Diode CR1112 serves to conduct the negative portion of the signal voltage to ground.

The Darlington transistor is actually two transistors connected so that the individual betas of the transistors are compounded. This compounded transistor has an amplification capability (beta) of 1000 or more. A small base current at its input produces substantial collector current. The collector circuit of Q1102 controls a bi-stable relay (K101), which is powered from the —35v remote power supply that remains operative while the instrument master switch is on.

When the receiver is remotely turned ON, the Darlington transistor conducts, causing the bi-stable relay contacts to latch closed to complete the 120vac power circuit to the chassis. When the receiver is turned OFF, the bi-stable activates and latches to the OFF position. Manual ON/OFF is provided by a "push-push" switch on the front panel, which completes the ground path for the bi-stable relay by means of resistor, R133, a 100Ω resistor.



Remote Channel-Change, shown in the second illustration, is accomplished in a similar manner. The channel-change circuit responds to 40.25kHz signal. This causes Darlington transistor Q1101 to conduct, closing the contacts of the channel-change relay (K1101) to apply 120vac to the channel-change motor. Once the motor is activated by depressing the channel-change button on the remote hand unit (see illustration), the pull-in engagement of the

continued on page 64

With all that free loot, no wonder the chips are starting to fly.

Nearly everybody who uses Sylvania receiving tubes (and that's nearly everybody in the business) is saving those Sylvania chips. And why not? Everybody can come out a winner. You can redeem the chips for blenders, broilers or binoculars; toasters, tools or TV sets; cameras, clothing, or cutlery. If you haven't seen Sylvania's "In the Chips" catalogue yet, ask for one at your local participating Sylvania distributor. And don't wait for Christmas for the gift you've wanted.

"In the chips" promotion. SYLVANIA
GENERAL TELEPHONE & ELECTRONICS

COLORFAX

by JOSEPH ZAUHAR

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

GENERAL ELECTRIC

Color TV Chassis C-1—Troubleshooting "No High Voltage" Problems

"No High Voltage" problems in C-1 chassis receivers can be easily solved if a systematic troubleshooting procedure is used and one important point is remembered.

The point to remember is that the drive signal to the horizontal output tube grid cannot be measured with a dc voltmeter. The dc grid voltage is a combination of the voltage produced by grid rectification of the drive signal, and the feedback voltage developed by the high-voltage regulation system. A fault in the horizontal output stage may result in less feedback voltage and consequently less dc voltage on the grid. Therefore, using this dc voltage as a measure of drive signal can lead to false conclusions.

The easiest troubleshooting method is to systematically isolate the horizontal output stage from its various load circuits, making use of the plugs and sockets incorporated in the receiver design. During this procedure, connect a high-voltage meter to the CRT second anode to continuously monitor the high voltage. If disconnecting a component restores the high voltage, the trouble is obviously in that component or its associated circuitry.

Troubleshooting Procedure

- Change the tubes; V10, horizontal output; V11, damper; V13, HV rectifier.
- Disconnect the CRT socket. This checks the possibility of a shorted CRT. Leave the CRT socket disconnected while performing the following step. Otherwise, should the high voltage be restored with the yoke disconnected, the undeflected beams may permanently damage the CRT screen.
- Disconnect the yoke plug. With the yoke and CRT disconnected, the normal high voltage is 10 to 12kv. The boost voltage will remain normal at 750 to 860v. If the trouble is not in the yoke, reconnect the yoke, and CRT.
- Disconnect the convergence plug. If the problem is in the convergence assembly, all voltages will return to normal.
- Check the drive voltage to the horizontal output tube

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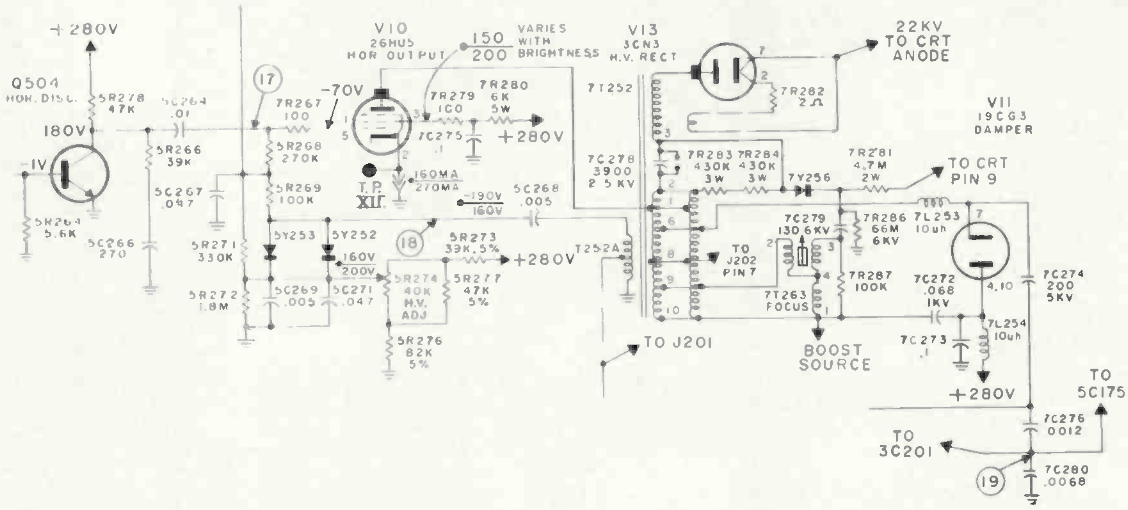

CONDITION	HORIZONTAL OUTPUT SIGNAL GRID P-P VOLTS	HORIZONTAL OUTPUT SIGNAL GRID DC VOLTS	HORIZONTAL OUTPUT SCREEN GRID DC VOLTS	B+ BOOST VOLTS	HV, CRT SECOND ANODE	FOCUS VOLTS	JUNCTION 5C268 T252A, P-P VOLTS
Normal receiver	270	—70	150 to 200	740	22kv	4kv	560
Convergence plug disconnected	280	—82	155 to 200	680	20kv	4kv	560
Yoke plug disconnected	250	—54	70 to 75	860	10 to 12kv	3kv	380
Focus coil and rectifier disconnected	270	—76	160 to 200	725	25kv	68v	580
Junction 5C268, T252A shorted to chassis	220	—44	90	625	20kv	5kv	0
5C268 open	240	—46	90	720	26kv	4.5kv	600
5C268 shorted	240	—46	90	700	26kv	4kv	600
7C280 shorted	270	—88	160 to 200	750	22kv	4kv	560
7C276 shorted	270	—74	155 to 200	700	22kv	4kv	520

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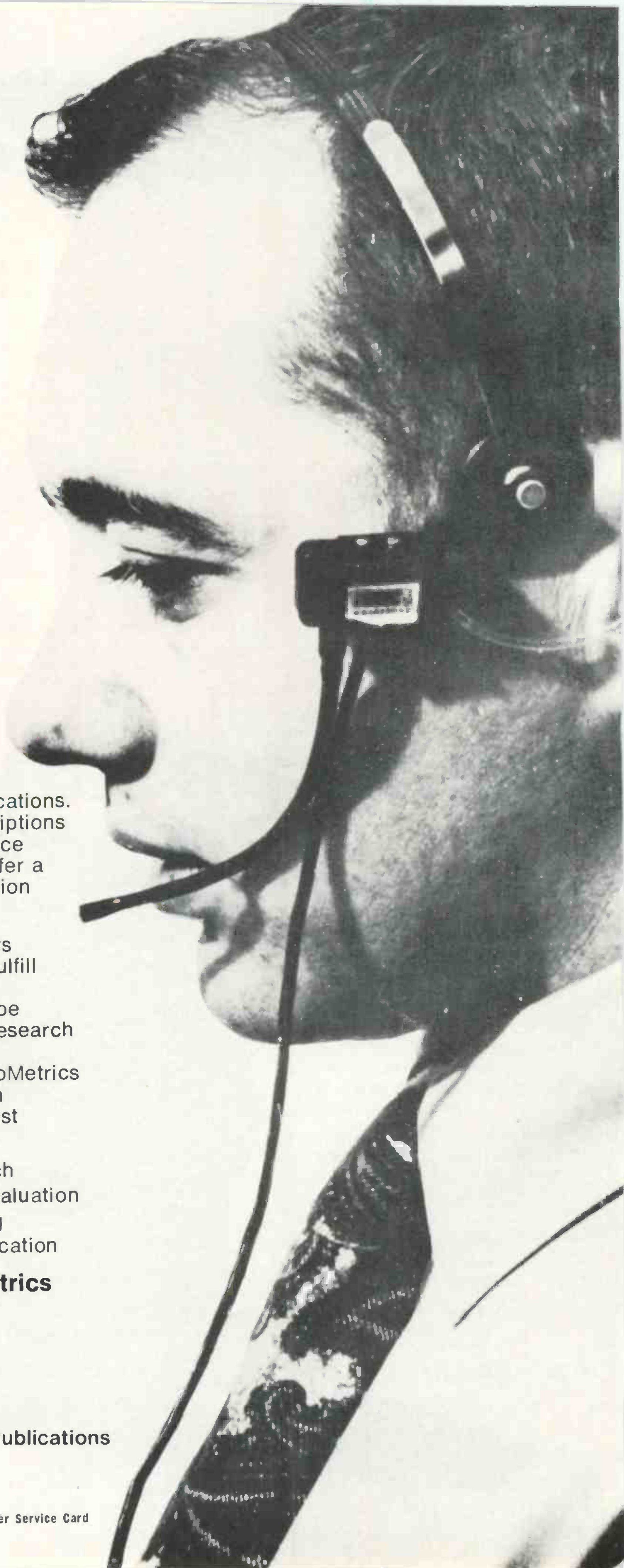
RCA Electronic Components, Harrison, N. J. 07029.

* Optional Distributor resale price.

RCA

. . . for more details circle 123 on Reader Service Card



continued from page 32

with a scope connected to the junction of 5C264. The P-P voltage should be 200v or more.

- Check the screen voltage of the horizontal output tube. Use a socket adaptor or measure at the terminal board adjacent to the socket. (The third terminal from the side of the receiver is the screen connection. It is accessible from the top of the chassis.) The voltage is normally 150 to 200v. It will drop to 70 to 90v if the yoke is disconnected or if the high-voltage regulation system is not operating.
- Unsolder the focus coil and the focus rectifier. If the problem is in this circuit, all voltages will return to normal, except there will be no focus voltage.

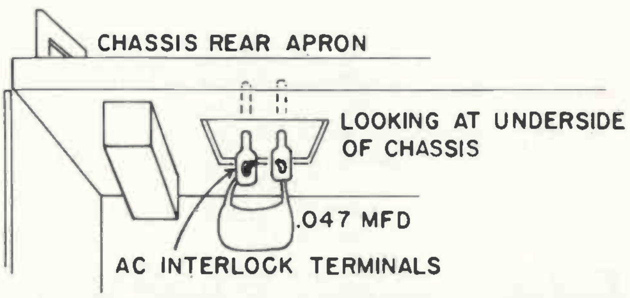
This procedure checks all the major components in the horizontal output circuit except for the high-voltage transformer. Before concluding that the transformer is defective, check the miscellaneous small components in the circuit—capacitors, resistors, choke coils, etc.

The voltages in the chart were taken at the points indicated, using a normal receiver with faults introduced as noted. It illustrates the effect that output circuit faults have upon horizontal-output-tube-screen and control-grid voltages and may be an additional aid in troubleshooting C-1 receivers.

RCA SALES CORPORATION

Color TV Series "G"—AC Line Capacitor

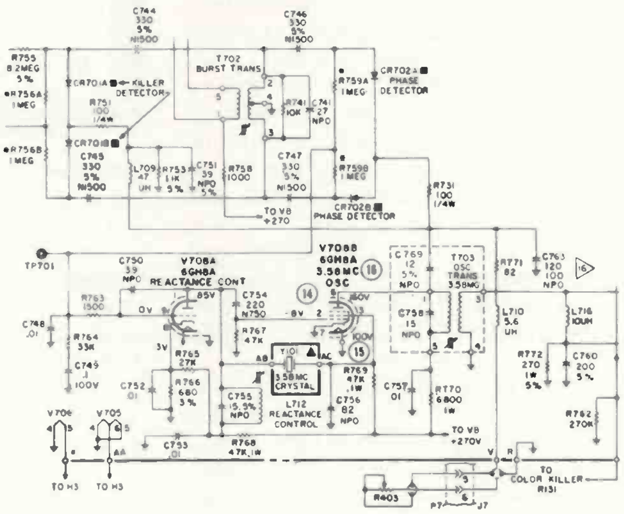
The color television receivers referenced have a .047μf filter capacitor connected across the ac input line. Due to its physical location (wired directly across the ac interlock terminals), the capacitor can easily be checked and/or replaced in the home using the following guidelines and illustration: (1) Remove rear cover and chassis retaining bolts; slide chassis slightly rearward to inspect capacitor across interlock terminals. (2) If the approved capacitor, identified by its white color and stamped with drawing number 90097-221 or 1442487-221 is used, secure chassis and restore receiver operation. No further action is necessary. (3) If the capacitor viewed is brown or reddish-brown in color, it should be replaced with the approved type. The RCA Stock Number of the approved capacitor is 111286. It is recommended that all service technicians carry this approved type capacitor.



MAGNAVOX

Color TV Chassis T931/T933/T940—Color Sync Problems

The mentioned chassis as well as earlier chassis—such as the T920,T919,T918 and T911—use a matched pair diodes in the color killer and phase detector circuits. You



are reminded to include these diodes in your troubleshooting checks whenever you are working on a color sync problem. Either the color killer detector diodes (CR701A and CR701B) or the color phase detector diodes (CR702A and CR702B) can be the cause of intermittent loss of color sync, poor color sync or in some cases even loss of color. These diodes are specified as matched pairs, meaning they have identical characteristics. If one of the diodes in these matched pairs should suffer a change in characteristics, operation of the circuit will be impaired. The usual resistance checks will not be satisfactory in determining if the suspected diode has changed characteristics. If you suspect that either the killer detector or phase detector circuits are at fault, the following check is suggested:

Connect a color-bar generator to the receiver and set it for a normal color-bar display. Remove the 3.58MHz Oscillator tube (V708) and ground the junction of R756A and R756B in the color-killer detector circuit. Using a VTVM, measure the dc voltage to ground at each outside terminal of a diode pair—for example, at the anode of diode CR701A and cathode of CR701B. The voltage at the anode should be negative, while positive at the cathode. The exact value of the voltages measured at these points will vary from set to set and also with the level of the burst signal. (Typical values might be +55v at the cathode and —55v at the anode.) The important point is the difference, if any, between the voltages measured across each of the diode pairs. Under ideal conditions there should be no difference. However, a 10 percent variation is allowable. If a voltage difference in excess of 10 percent exists across either diode pair, replace the pair with a matched pair, Part No. 170733-1.

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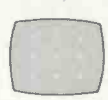
Color Bars


Dot Pattern

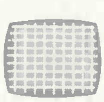

Horizontal Bars


3x3 Color Bars


3x3 Dot

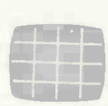

3x3 Horizontal


Shading Bars


Cross Hatch


Vertical Bars


3x3 Shading


3x3 Cross Hatch


3x3 Vertical

IO-101 SPECIFICATIONS — PATTERNS — Purity: Produces a snow-free raster for purity adjustments. **Dots***: 9 x 9 produces a display of 110 small dots. 3 x 3 produces a display of nine dots for convergence adjustments. **Crosshatch***: 9 x 9 produces a display of 11 vertical and 10 horizontal lines. 3 x 3 produces a display of three vertical and three horizontal lines for convergence and linearity adjustments. **Horizontal Lines***: 9 x 9 produces a display of 10 horizontal lines. 3 x 3 produces a display of three horizontal lines for vertical linearity and pin-cushion adjustments. **Vertical Lines***: 9 x 9 produces 11 vertical lines. 3 x 3 produces a display of 3 vertical lines for horizontal linearity and convergence adjustments. **Color Bars***: 9 x 9 produces a display of ten standard color bars. 3 x 3 produces a display of three standard color bars. A visual finger-print (voltage pattern) of all ten color bars in the form of a petal pattern is displayed for color circuit servicing. **Gray Scale**: Provides a wide bar crosshatch pattern with six shades of brightness for color gun level adjustments. **OUTPUT SIGNALS — Video**: Greater than ±1 volt peak-to-peak composite signal for composite signal injection beyond the video detector. **RF**: Variable to approximately 25,000 uV output, channels 2 through 6, for composite signal injection into the TV receiver antenna input terminals. **Sync**: Greater than 3.5 volts peak-to-peak signal for servicing sync circuits without video, or sets having separate video and sync demodulator phase adjustments. **GENERAL — Power Requirements**: 105-125 or 210-250 VAC, 50/60 Hz, 20 Watts. **Cabinet Dimensions**: 6¾" W x 9¼" H x 14½" D. **Net Weight**: 9½ lbs.

*The number of dots, lines, and bars indicated for a 9 x 9 display is the number displayed if the receiver under test has no overscan.

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TE-222

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publisher's memorandum from Scotty Wallace

SCOTTY WALLACE

I am happy to announce the following promotions and additions to the Editorial Staff of ELECTRONIC TECHNICIAN/DEALER. These changes are part of our program to keep our publication in the number one position in the Electronic Industry. Phillip Dahlen has moved up to Editor, with Joseph Zauhar moving to Managing Editor. We have also added the talents of Emily Wilson as Associate Editor, all of whom are based in our Duluth, Minnesota, office. I am certain all of our readers and advertisers will appreciate the following outline of their backgrounds and join me in welcoming them to their newly appointed positions.

Phil first worked in electronics as an apprentice in a Fairport, New York, TV repair shop; and his electronic background was further improved in college where he majored in Physics, graduating from HAMLINE UNIVERSITY in 1959.

After teaching a year, Phil was drafted into the Army where, with his electronics background, he was assigned an Electronic Instrument Repair MOS. While on duty he assisted in the development of electronic instruments designed for detecting biological organisms, while during his free time Phil worked in a Frederick, Maryland, TV shop.

PHILLIP DAHLEN

Prior to coming to Harbrace Publications, Phil invented the Needleless Phonograph that was described a couple of years ago in this publication, and for which Phil has obtained personal U.S. and foreign patents. Designed for playing conventional stereo records with an optical system rather than a needle, he feels that it is capable of a frequency response high enough for TV-type images. By the way, he is currently looking for a manufacturer interested in a favorable licensing agreement.

Just about as soon as Phil came to this company, he began writing the "Semiconductors from A to Z" series. Reader response was so great that the series was later published in book form, which is now in its second printing.

Editorial demands at Harbrace required Phil's transfer to two other company publications for which he was editor prior to being transferred back to our publication.

JOSEPH ZAUHAR

After two years in Korea as an Army squad leader, Joe enrolled in the Duluth Area Institute of Technology for a two-year course in radio and television, and then an advanced course with the CLEVELAND INSTITUTE OF ELECTRONICS. His first job in electronics servicing, one of three offered, was part time while finishing his schooling. He then worked twelve years in this field prior to joining Harbrace Publications. During the past four years, Joe has served as Technical Editor of the publication, preparing a number of staff-written articles, as well as preparing the Tekfax, Colorfax, Technical Digest and the New Products listing.

Despite the fact that Joe is employed full time on our publication, there are still customers who remember the quality of his work prior to coming to Harbrace and who still "bug" him into fixing their electronic equipment. As a result of these continuing service contacts, Joe is kept well abreast of new innovations from the service viewpoint.

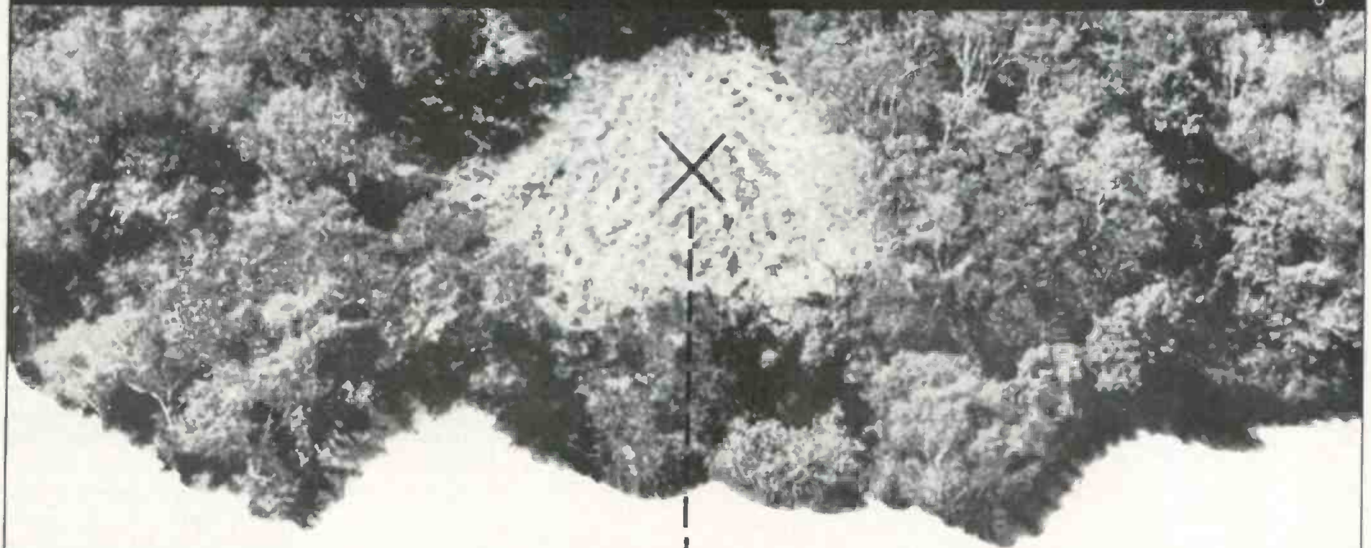
EMILY WILSON

Emily is the newest member of our editorial staff. A 1969 graduate of the UNIVERSITY OF MINNESOTA, she has just recently come to us from American Heritage Publishing Company in New York, a subsidiary of McGraw-Hill, where she was involved in both promotion and circulation for the American Heritage Society's official publication, AMERICAN HERITAGE MAGAZINE.

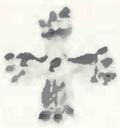
Scotty Wallace

The hunt is on!

(Beware of the Grope.)



How to head the hunt away from the Grope. Draw your prospect a map.



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ET/D TEKLAB REPORT

Troubleshooting an Automatic Fine Tuning circuit employing an integrated circuit is easy if you understand the circuit and use the checking procedure described

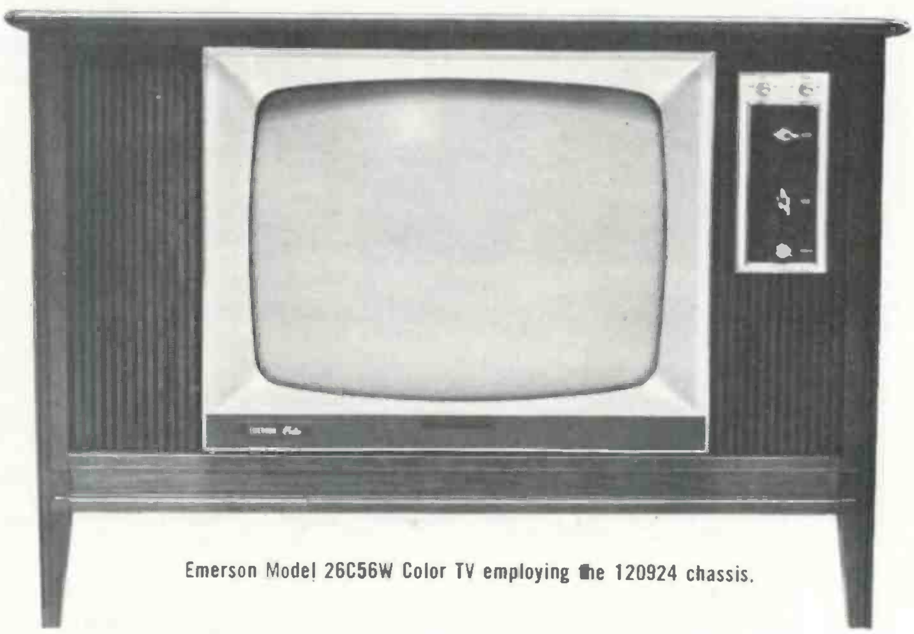
Emerson Model 26C56 Color TV-Part I

by JOSEPH ZAUHAR

■ The Emerson Model 26C56W color TV set received for this report employs a 120924 chassis, which is similar to the chassis employed in Models 26C45, 26C47 and 26C48. This chassis employs a number of previous field proven circuits, modified by the addition of a few new circuit improvements.

Taking a look at the schematic we found a number of important features incorporated. The receiver retains all of the features found in previous full powered transformer models, which include the following: Three Video IF Stages, Three Video Amplifiers, Shunt Regulated 25kv High Voltage Supply, X and Z Color Demodulators with separate R-Y/B-Y/G-Y Amplifier and Phase Detector—Reactance tube—AFPC.

A number of new circuits will be found on this chassis which include: (1) quick-on provisions, (2) improved Automatic Fine Tuning (AFT) employing integrated circuitry, (3) improved Automatic Color Control circuit with two stages of chroma amplification, (4) increased burst amplification, and (5) diode horizontal centering for cooler and more reliable HOT chas-



Emerson Model 26C56W Color TV employing the 120924 chassis.

sis operation. All of the customer controls are located on the front panel and the control shafts, except the quick-on, pull out about 1 in. for ease of adjustments.

There were a number of things that we felt could be improved to shorten the technician's service time, such as: wing type fasteners on the back cover panel, a removable panel on the bottom of the cabinet exposing the components without chassis removal, and an easier means of removing the front control panel.

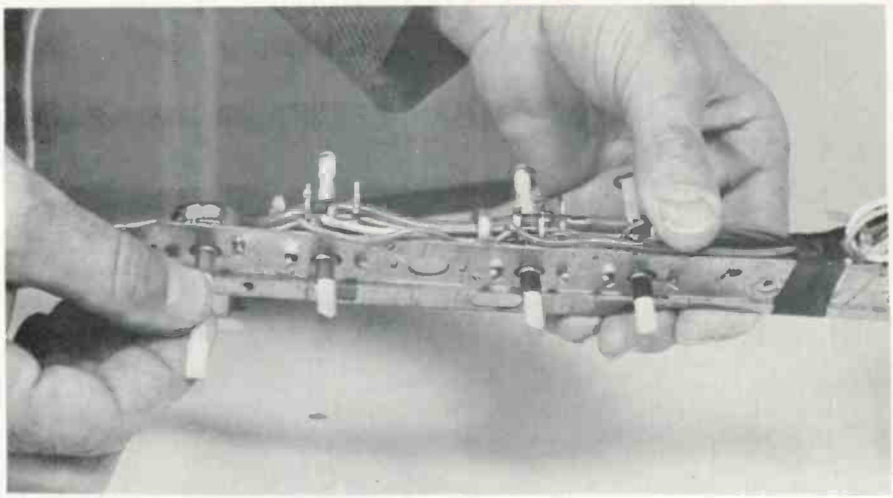
The physical chassis layout is similar to the previous "U" shaped chassis, which consumes less cabinet space. The brace through the center of the chassis not only strengthens the chassis but makes a convenient carrying handle when removed.

The circuit boards are well road-mapped, making components and test points easy to locate when service or alignment is required.

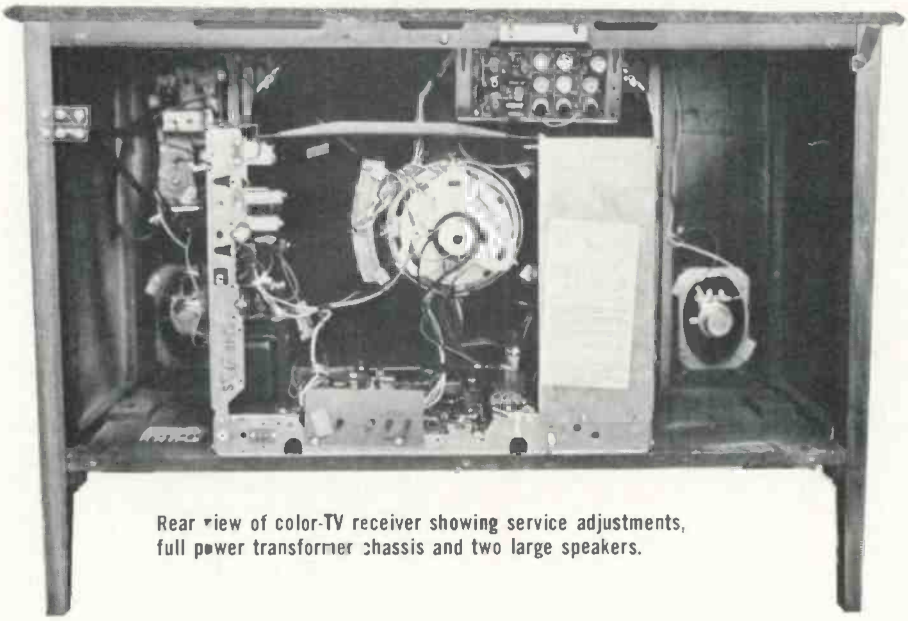
The shunt-regulator tube and the high-voltage-rectifier tube are shielded by the high-voltage cage, and the cover should be kept in place when servicing an energized chassis.

The high voltage specified for this receiver is 25kv. The adjustments in the horizontal output circuits are similar to previous chassis and precautions should be taken to make sure all adjustments are properly set.

Picture tube type numbers 25XP22 and 25ZP22 are employed



All knobs, except the Quick-On, may be pulled out approximately 1 in. for ease of adjustment.



Rear view of color-TV receiver showing service adjustments, full power transformer chassis and two large speakers.

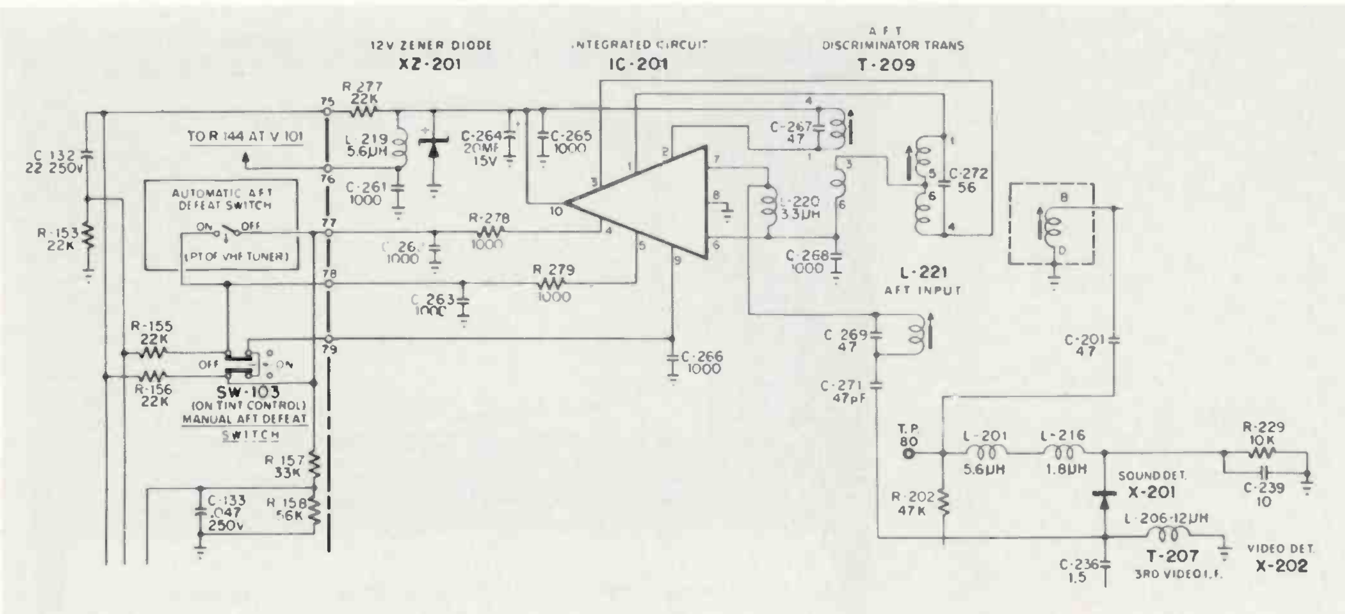
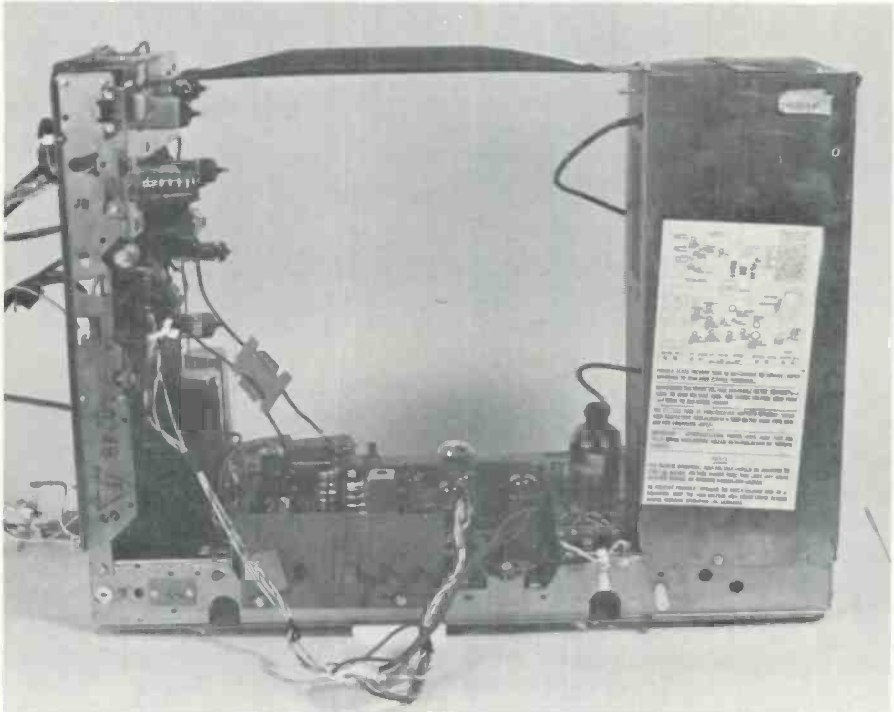


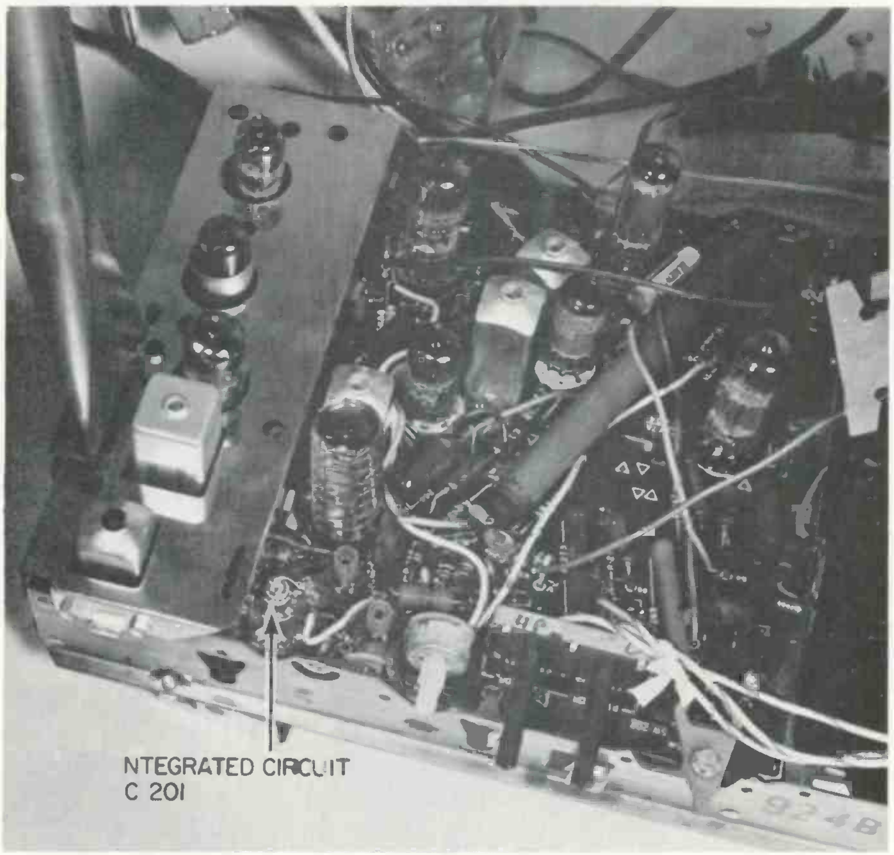
Fig. 1—Schematic of the Automatic Fine Tuning circuit employing an Integrated Circuit IC201.

in these models. These tubes are interchangeable with type number 25AP22, which was used in previous models.

Most technicians are familiar with many of the circuits employed, which have been proven in the field for a number of years. The article is therefore limited to a review of the new circuits and modifications.



The "U" shaped chassis includes a rigid brace that can be used as a carrying handle.



The Integrated Circuit IC201, with shield removed, is located on the video and sound printed board.

AUTOMATIC FINE TUNING (AFT) CIRCUIT

The AFT circuit shown in Fig. 1 contains an integrated circuit, IC-201, which is located on the video and sound printed-circuit board, PC2. The dc voltage for powering IC201 is obtained from the cathode of the vertical output tube. A resistor connected to the 6JE6 horizontal-output tube supplies an additional bias voltage to terminal 76 of this printed circuit and terminal 10 of IC201—zener diode XZ-201 regulating this 12v supply.

The video IF carrier signal is obtained from the third video IF plate circuit amplifier stage. The signal passes through capacitor C236 (1.5pf) and C271 (.47pf) to a tuned input circuit consisting of capacitor C269 (47pf) and coil L221. This tuned circuit is adjusted to 41.25MHz and serves as a sound rejection trap.

The video IF carrier signal is applied to terminal seven of IC201. This IC operates in a manner similar to the previous AFT circuitry using transistors and diodes. The video IF carrier signal is then applied to a discriminator circuit, which in turn provides error control voltages. Transformer T209 is the AFT discriminator and is tuned to 45.75MHz.

The control voltages are obtained from terminals four and five of the integrated circuit. When the set is properly tuned and the video IF carrier is at 45.75 MHz, both terminals will develop 6v, which is supplied to the voltage dependent capacitor (varactor) in the VHF tuner oscillator circuit. If not tuned properly, the voltage potential of terminals four and five will change and in some instances terminal four will increase above 6v while terminal five will decrease to a voltage below 6v. This in turn will apply a voltage across the voltage independent capacitor (varactor) correcting the oscillator for proper tuning.

The circuit employs an automatic AFT defeat switch on the VHF tuner, fine tuning shaft plus a manual AFT defeat switch. When the manual switch, SW103, is placed in its off position, terminals four and five of IC201 are connected togeth-

continued on page 77

Installing A Mobile Transceiver

by PHILLIP DAHLEN

With the fantastic variety of automobiles on today's market, custom fitting becomes a necessity if a really good job is to be done installing two-way communications equipment

■ There are very few alternatives available when determining the location of a mobile transceiver and its power supply. Most manufacturers require that the power supply not be located in front of the engine fire wall since it will then be exposed to excess dampness and corrosive or oily vapors. High-power requirements from the vehicle's 12v system requires positioning the power supply as near the fire wall as possible, since any excess length of power cable—leading to say the trunk—will result in an excess voltage drop through the cable, unless it is of unreasonably large gauge.

Accessibility restricts the choice of locations for mounting the transceiver chassis. The trunk of the vehicle is a fine, out of the way location for the transceiver if provision is made for its remote control operation, but then transmission is limited to predetermined frequencies. For amateur use, unless you have a chauffeur, the entire transceiver must be within easy reach of the driver.

Since every installation is different, and space does not permit a description of all possible installations, the balance of this article includes only the procedures carried out when Paul Dorweiler, the previous Editor of ELECTRONIC TECHNICIAN/DEALER, and Joe Zauhar, now Managing Editor, installed a Drake TR-4 mobile transceiver in Paul's 1970 Chevrolet Townsman station wagon.

The Drake TR-4 was obtained with two power supplies—one designed to operate at line voltage for stationary or bench use and the other designed for 12v mobile operation. We found that the most convenient location for the mobile supply was on the floor behind the cartridge tape recorder. Once this location had been selected, a soldering iron was used (Fig. 1) to burn holes in the carpet. These holes marked the location of the holes to be drilled into the fire wall for securing the power supply (Fig. 2) and eliminated the need for drilling through the carpet itself (the carpet may have otherwise become twisted around the drill bit, tearing or otherwise hindering drilling).

Fortunately an extra unused rubber grommet was found extending through the fire wall, permitting easy

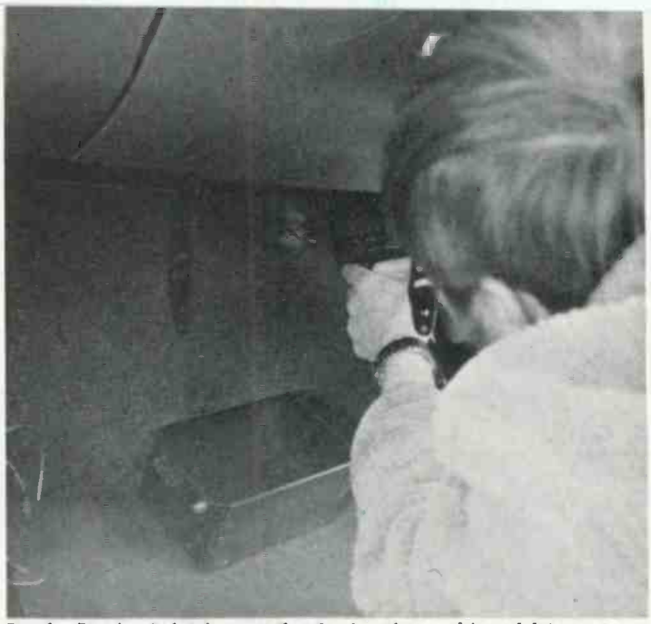


Fig. 1—Burning holes in carpeting for locating position of future power-supply bolts.

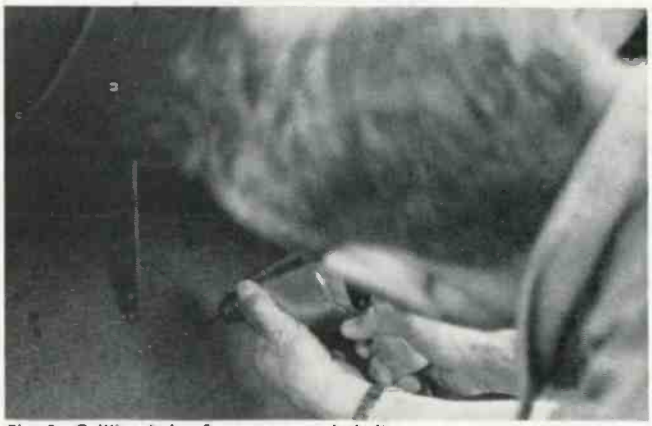
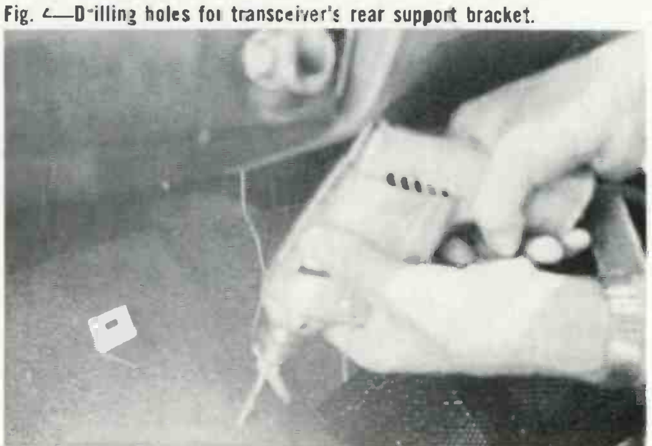


Fig. 2—Drilling holes for power-supply bolts.

Fig. 3—Bolting fused power line to positive terminal of battery.

Fig. 4—Drilling holes for transceiver's rear support bracket.



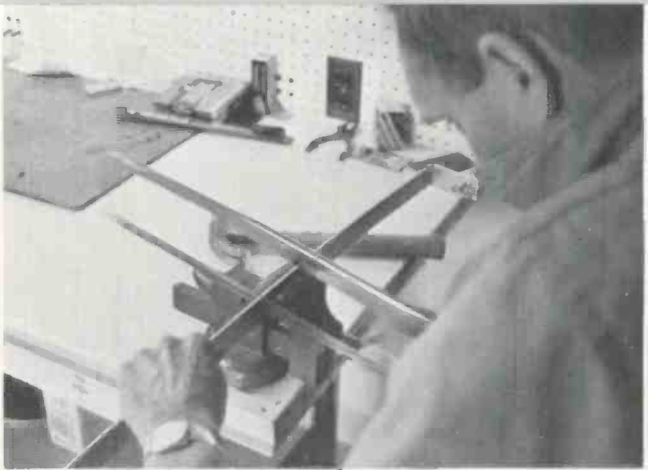


Fig. 5—Cutting side-support brackets to length.

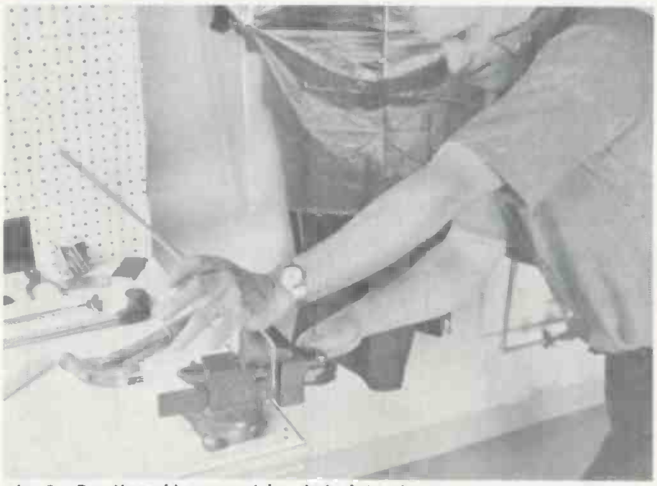


Fig. 6—Bending side-support brackets into shape.

Fig. 7—Sanding a rounded edge at the top of each side-support bracket.

passage of the power line. After bolting a fuse holder in place under the hood, the fused power line was bolted to the positive terminal of the battery (Fig. 3). (To some readers this battery may appear a little unusual without its terminals at the top. However, batteries in 1970 General Motors vehicles have bolt-on terminals on the side to eliminate the former problem of battery-acid corrosion.)

For ease of operation, the hump in the floor above the station-wagon transmission was selected as the location for mounting the transceiver. It was positioned just far enough back on the hump to permit moving the car seat fully forward.

After having determined the location for mounting the transceiver, its rear support bracket was placed in proper position on the hump, the location of its mounting holes were marked with a soldering iron, holes were drilled (Fig. 4), and the bracket was bolted into position.

Once positioned on its back supporting bracket, the front of the transceiver was lifted to a convenient elevation; and the distance between the floor and the transceiver's forward mounting holes was measured. With these dimensions, Joe was able to cut the side-supporting brackets to length (Fig. 5). He then bent the bottom portion of each bracket (Fig. 6) to match the contour of the floor.

To add an additional touch of professionalism to the installation, Joe ground rounded edges at the ends of each side support (Fig. 7), using a 7-in. rotary industrial-type sander. Mounting holes were then drilled (Fig. 8) in the side-support brackets.

The transceiver was originally equipped with rubber

Fig. 8—Drilling mounting holes in legs of side-support brackets.

feet for base station use, but since they would serve no practical function once the unit was mounted in the station wagon, they were removed to permit the attachment of an additional support to the bottom of the transceiver. (This brace had originally been supplied by the manufacturer for securing the front of the transceiver to the dash of some cars.) Paul drilled holes in the transceiver's bottom plate (Fig. 9) for mounting this bracket, after having bolted the mate to the rear support bracket onto the same plate. The additional bracket was then riveted to the plate.

When again placing the transceiver into position on the rear pair of supporting brackets, it was found that these brackets failed to adequately secure the transceiver, any forward motion pulling them apart. To solve this problem, a hole was drilled into the protruding lip of one bracket and a pin was inserted after the two brackets were again coupled together—thus assuring additional stability.

After bolting the side-support brackets to the floor of the car and securing them to the side of the transceiver (using special bolts and washers supplied by the manufacturer), the side brackets were again drilled (Fig. 10); the new holes matching those in the additional bracket beneath the transceiver.

Paul decided that since he had a rather large antenna, he would prefer to have it mounted near the back of the station wagon, on the lower right-hand side. Using a portion of the antenna mount as a template, Paul marked this location with a pen (Fig. 11), and Joe then marked them more permanently with a center punch (Fig. 12). After drilling the holes (Fig. 13), the central hole was enlarged with a file (Fig. 14) so that the central bolt could pass through freely and no arcing would occur between the bolt and ground.

Paint, tar and other material inside the spare-tire storage compartment were then sanded away (Fig. 15) so that the ground lead to the antenna bracket could be well grounded.

Probably one of the most difficult jobs in the entire installation was the task of running the coaxial cable between the transceiver and the antenna. It was not too difficult getting the cable beneath the front- and back-seat carpeting, but Joe and Paul had to practically tear the car apart (Fig. 16) in order to run the coaxial cable further back to the antenna mount. But once the cable was pulled through and secured to the antenna mount (Fig. 17), the job was nearly complete. All that remained to do was bolt the antenna to the mount (Fig. 18).

After a few minor electronic adjustments were made in the transceiver, the job was complete. And we feel that it was quite a success. Both the transceiver and power supply were very securely mounted in place, and Paul was able to DX other ham radio operators in several parts of the country. ■

Fig. 9—Drilling holes for mounting additional support brackets to base of transceiver.

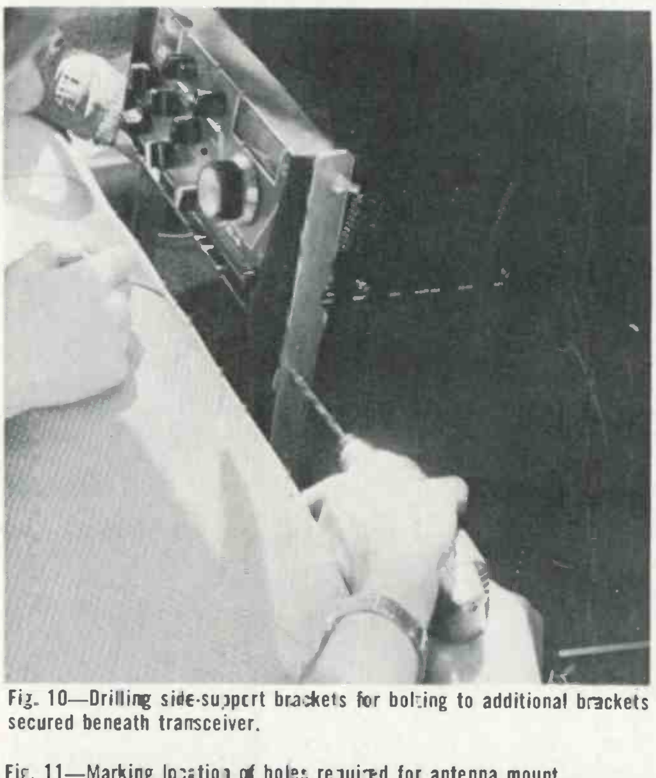
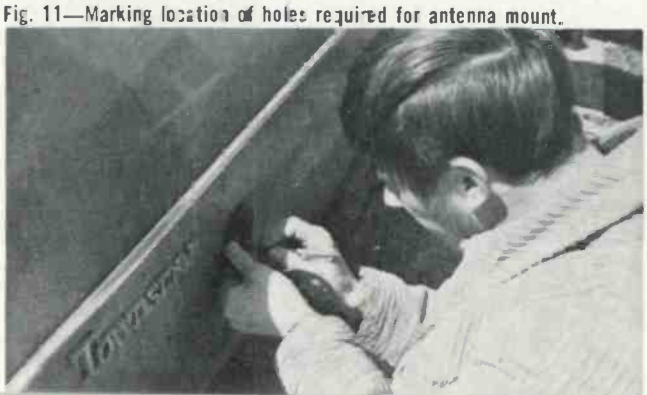


Fig. 10—Drilling side-support brackets for bolting to additional brackets secured beneath transceiver.

Fig. 11—Marking location of holes required for antenna mount.



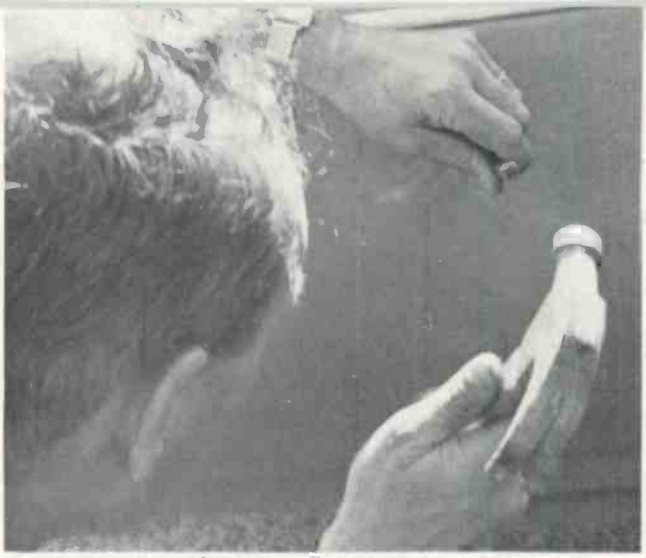


Fig. 12—Center punching antenna-mount holes for drilling.

Fig. 13—Drilling antenna-mount holes.

Fig. 14—Enlarging central hole for antenna mount.

Fig. 15—Grinding away protective coating for better antenna ground.

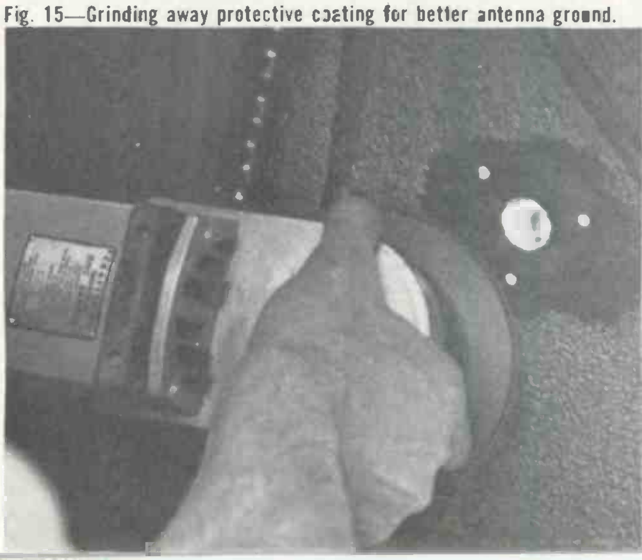


Fig. 16—Running antenna coaxial cable from front to rear.

Fig. 17—Completing job with coaxial cable bolted to antenna mount.

Fig. 18—Viewing mounted antenna in position for transmission

Servicing Solid-State Stereo

by Norman H. Crowhurst

Part II—Applying more basic electronics to improve servicing techniques and prevent call backs

■ Transistors are more easily damaged than tubes, generally requiring the use of more protective circuits. To understand all aspects of transistor protection, it is necessary to keep in mind the different damages to which they can be exposed.

Excess currents can destroy them. And, as mentioned in the previous article, circuits are now in rather common use for protecting transistors against these currents. Reverse voltage is another danger that has also been covered. Still another possibility is excess voltage of the normal polarity.

EXCESS AUDIO POWER

But voltages and currents alone do not cover the entire problem. While an excessive current can "blow" a transistor junction and an excessive voltage can break it down, making sure that both current and voltage always stay within these limits does not completely ensure its safe operation. A combination of voltages and currents can result in heating, which if not properly dissipated, may cause transistor breakdown and failure. Every transistor has a maximum power dissipation rating—possibly more than one, depending on its mounting or provisions for conducting heat away.

It might seem as if excess-current protection would also guard against excess heat-producing power across the transistor. In some instances it does, but in others such circuits aggravate the problem.

When the current through the output transistor is allowed to rise, there is a greater voltage drop across the load, resulting in a lower voltage drop across the transistor and a smaller amount of power (W = I × V) dissipated across the transistor (such voltage, current, power relationships are shown in Fig. 6 of the previous article). Limiting the current to less than maximum through the transistor and load also limits the voltage developed across the output load, thus increasing the voltage across the transistor at maximum current and the power dissipated in the transistor.

This does not mean that removing the current limitation would avoid the danger, because then the transistor would blow for a different reason—excess current rather than excess power dissipation.

The important factor is the transistor voltage when the current reaches its limiting value. If the transistor is close to saturation so

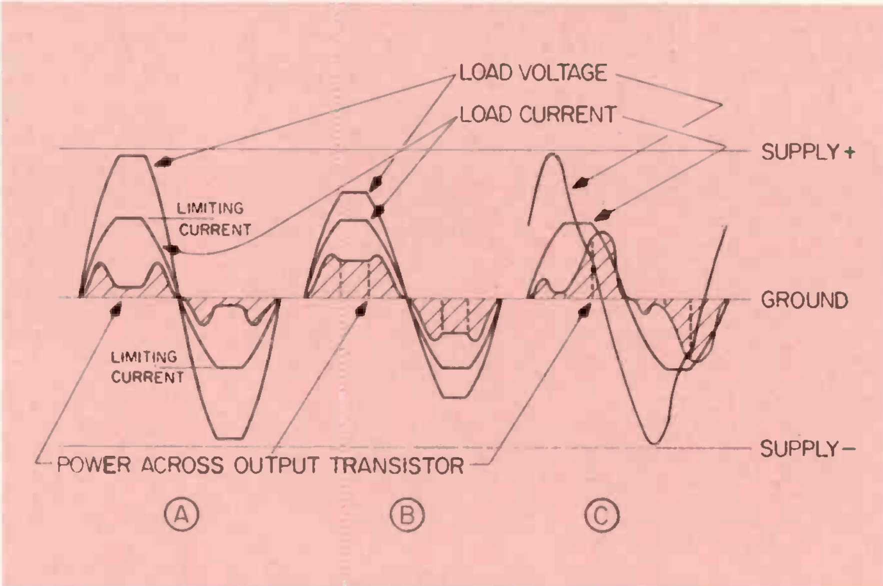
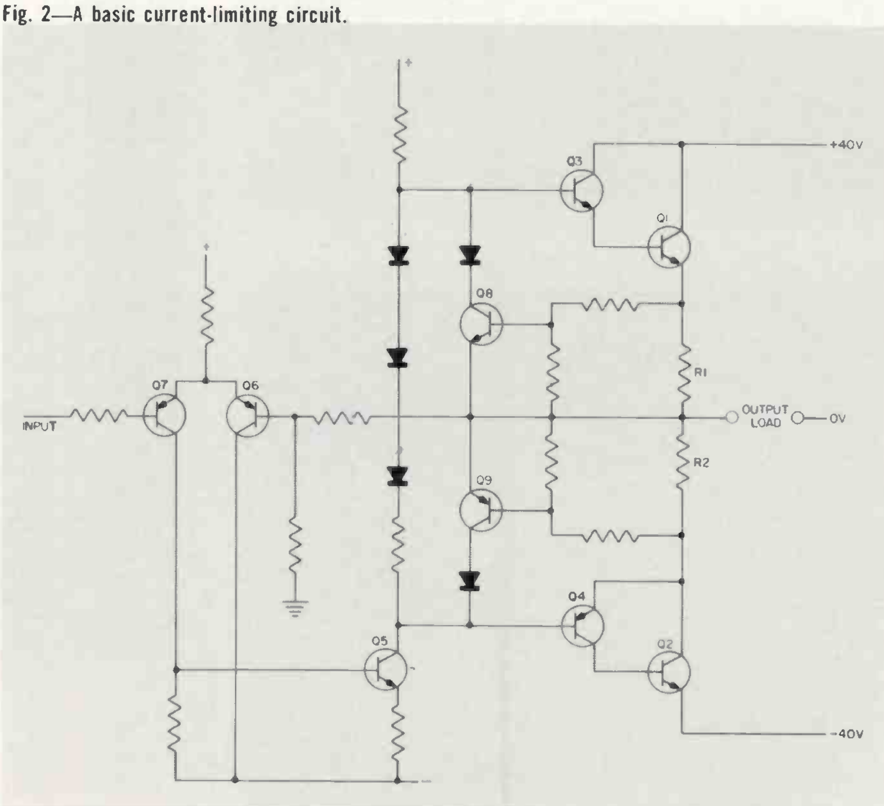


Fig. 1—Some waveforms associated with current limiting; (A) when the load is resistive and of near normal value; (B) when the load is resistive and lower than normal value; and (C) when the load is reactive but of nearly normal impedance.

Fig. 2—A basic current-limiting circuit.



that the voltage across it is small, most of it appearing across the load, there is no power problem (Fig. 1A). But, if the voltage across the load is substantially below the maximum available when the current is limited, the rest of the voltage results in a greater power dissipation in the transistor (Fig. 1B).

Two factors can result in excess transistor voltage at maximum current: Either the load resistance is too low for the amplifier, or it is nearly the correct value but too reactive, the maximum current not completely coinciding with the maximum load voltage (Fig. 1C).

BASIC PROTECTIVE CIRCUITS

Fig. 2 contains basically the same schematic as that shown in Fig. 5 of the previous article. In this output section, voltages less than maximum swing are harmful to the circuit only if they coincide with the maximum current, causing current limiting to come into effect. What is needed is a device that will detect what the output voltage is when the current reaches its maximum. A circuit that will "do something about it" if the transistor voltage exceeds a safe value during maximum current.

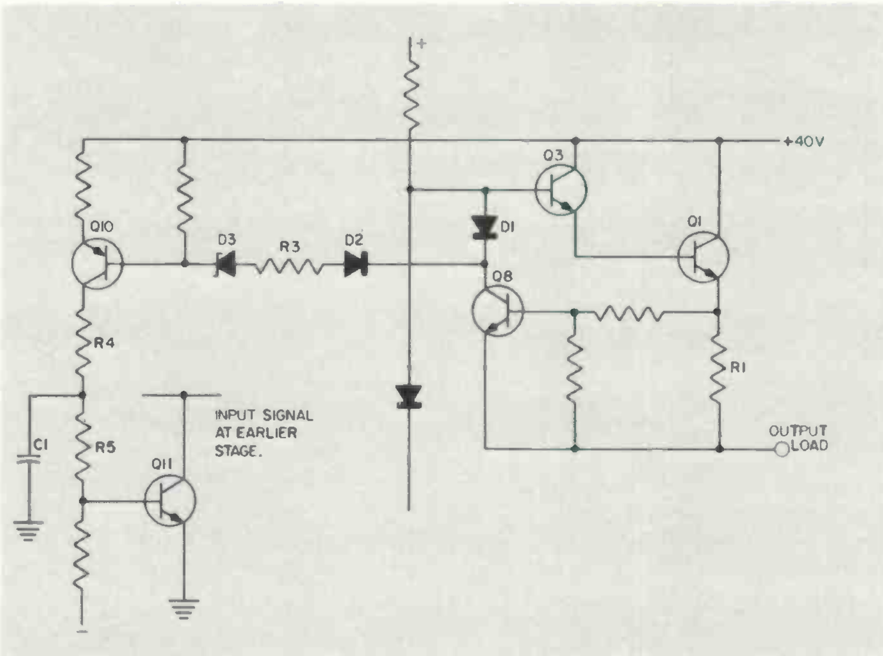


Fig. 3—Additional circuit features for providing protection against excess voltages across the output transistor when current limiting occurs.

Fig. 3 shows an essential portion of such a circuit applied to half an output stage. When there is no current limiting, transistor Q8 and diode D1 are not conducting and they do not affect the transistor's collector voltage. But as soon as current limiting occurs, the transistor and diode both conduct, the collector voltage then being nearly equal the output voltage.

If the voltage across the output transistor (Q1) is low, it will not reach the zener voltage of diode D3, and transistor Q10 will remain in its normal non-conducting state. But, if the voltage across transistor Q1 exceeds the zener voltage of diode D3, current limiting occurs and transistor Q10 will be switched on, charging capacitor C1 through resistor R4 and causing transistor Q11 to conduct.

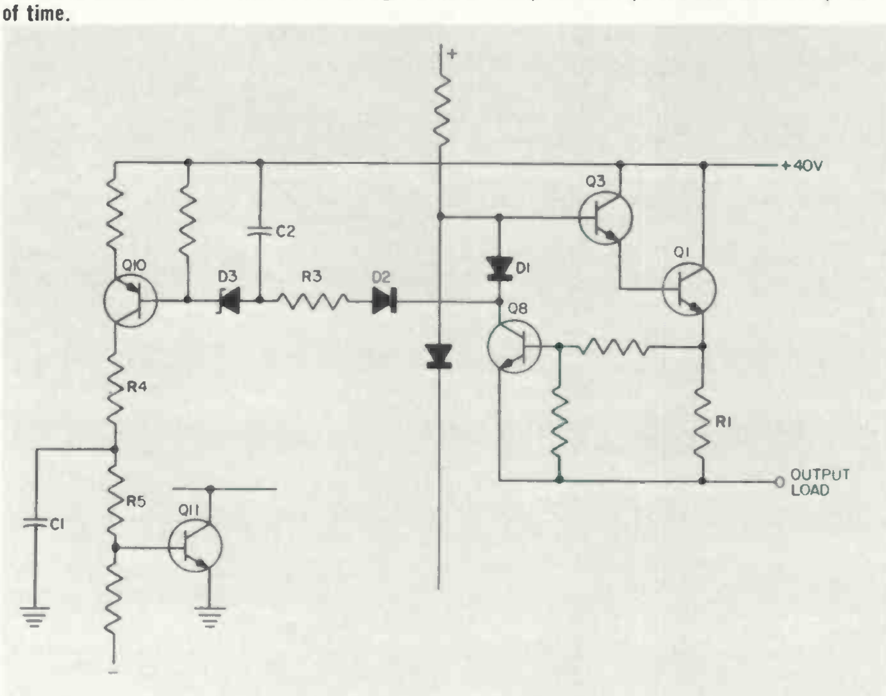
When conducting, transistor Q11 short circuits the positive audio input signal, restoring the output transistor to a safe condition. It takes a few moments for the voltage across capacitor C1 to discharge through resistor R5, allowing the input signal time to change from its harmful condition and the output transistor time to cool off.

Although a definite improvement over no voltage protection at all, there are two problems with this simple circuit. The most obvious is the fact that only half the output is voltage protected. If the signal waveform is asymmetrical in such a way that the upper output transistor (Q1) is not overloaded while the lower one (Q2) is, then the lower one may burn out without triggering the protective circuit.

The other problem relates to the duration of the harmful signal. A signal burst of dangerous waveform will trigger the shorting of the input signal just as it would a harmful continued waveform. In fact, the circuit has no means of telling the difference since it either triggers the shunting transistor or it does not, depending on the precise voltage waveform present during current limiting conditions.

Obviously, if the voltage chosen (by the selection of a zener voltage

Fig. 4—One simple addition to the circuit (capacitor C2, with appropriate changes) enables the circuit to discriminate between various degrees of excess power dissipation over different periods of time.



for diode D3) is such that the output transistor is protected from a power level that might require a second or more to burn it out; a signal burst of the same power level, but a shorter duration, would not endanger the transistor; though the protecting circuit would still be unnecessarily triggered.

Conversely, if the signal level chosen offered protection only under conditions that could produce almost instant burn out, a slightly lower signal level would not trigger it and, if sustained for a second or so, could destroy the transistor. Some compromise is needed that will take into consideration the duration of the excessive power dissipation, so that the protected circuit will be triggered at a lower power dissipation level for a sustained signal than it will for a more powerful, sharp audio pulse in the circuit.

This can be achieved by putting a time constant ahead of the zener diode (Fig. 4) with the use of a capacitor, C2. The series resistor (R3) must now be of a different value since it must now charge the capacitor as well as turn transistor Q10 on when the zener voltage is exceeded.

A similar circuit can be used to protect the other half of the audio output circuit. The semiconductors in this second circuit are of opposite polarity but function in the same manner as those shown in Fig. 4. Excess signal power turns transistor Q12 on (in the circuit shown in Fig. 5) in the same manner excess signal power turns transistor Q10 on (in the circuit shown in Fig. 4). When transistor Q12 is turned on (Fig. 5), its collector current turns transistor Q10 on.

One additional circuit refinement is still required for adequate protection of *both* output transistors. In Fig. 3, transistor Q11 shunts the positive audio input signal to ground to reduce the excess power applied to transistor Q1. This transistor (Q11) cannot operate at a reverse polarity to shunt a negative audio input signal to ground when excess power is applied to transistor Q2.

Fig. 6 shows a circuit that has been designed to handle this function. When excess voltages are applied to either transistor Q1 or Q2, transistor Q10 conducts current (as described with Fig. 5). As a result, a positive voltage is developed across capacitor C1, and the base of transistors Q11 and Q13 becomes forward biased. Transistor Q11 can then conduct excess positive input signals to ground as it did in Fig. 4, diode D8 preventing a damaging negative signal voltage from developing across the transistor.

As transistor Q13 conducts current, it forward biases transistor Q14, which in turn is also able to conduct current—excess negative signal voltages then being shunted through the two transistors (Q13 and Q14) to the positive supply.

FINAL PROTECTIVE CIRCUIT

The complete circuit, shown in

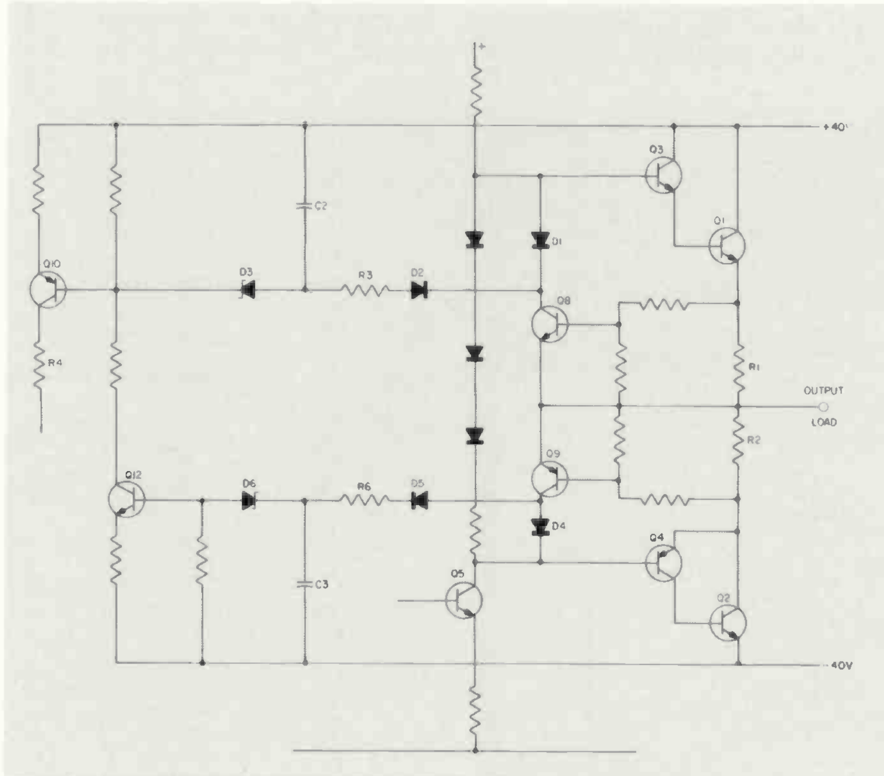


Fig. 5—Another addition to the circuit enables it to protect both output transistors equally.

Fig. 6—A two-way clamp circuit, used to provide protection for both halves of the audio output.

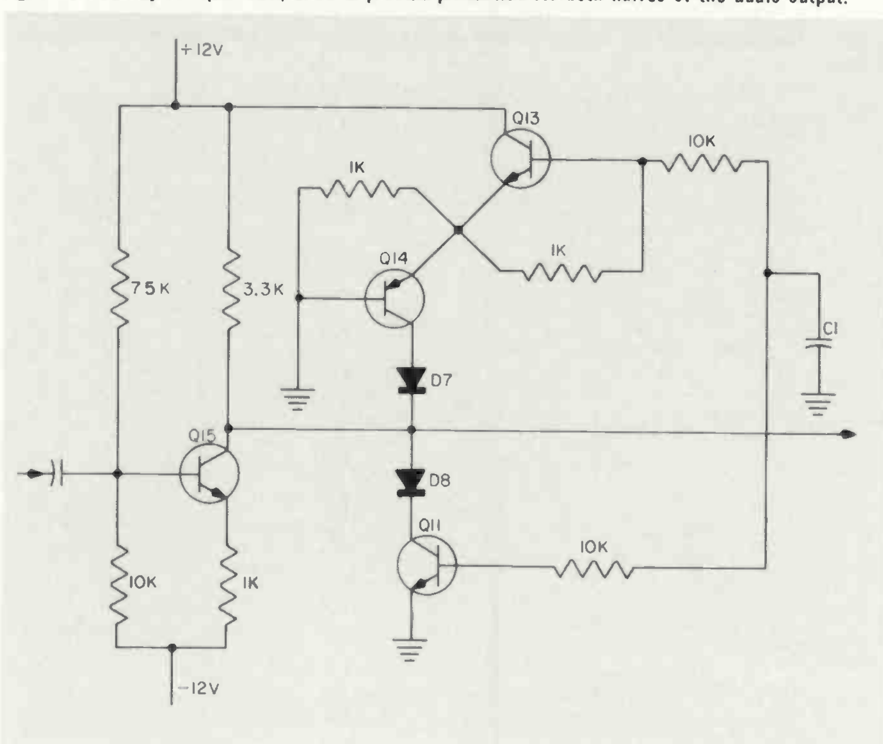


Fig. 7, illustrates the various properties of a circuit designed for output transistor protection. There, a burst of audio signal may momentarily exceed the circuit's power rating, triggering the protective circuit for but a second or two. This can occur when the audio burst is of too short a duration for capacitor C1 to become fully charged. Although this charge turned on transistors Q11, Q13 and Q14, it was relatively small and dissipated rapidly, the three transistors then ceasing to shunt the input signal.

A really serious signal overload—either short and sharp, or of lower amplitude but sustained—may trigger the protective circuit for 10 to 15 seconds, the time it takes a maximum charge across capacitor C1 to dissipate. If the signal is still dangerous when the circuit restores amplification, it will immediately trigger again. The circuit will continue to be triggered until the input signal returns to normal, thus indefinitely maintaining protection.

The circuit can also protect against an increase in output transistor power dissipation resulting from reactive load (Fig. 1C). The impedance of the load might not be too low if it were merely resistive; but due to its reactance, the resulting voltage across the output transistor may become excessive. During a portion of this time the current-limiting segment of the protective circuit is functioning, and as a result the protective circuit starts to work, shunting the input signal as described previously.

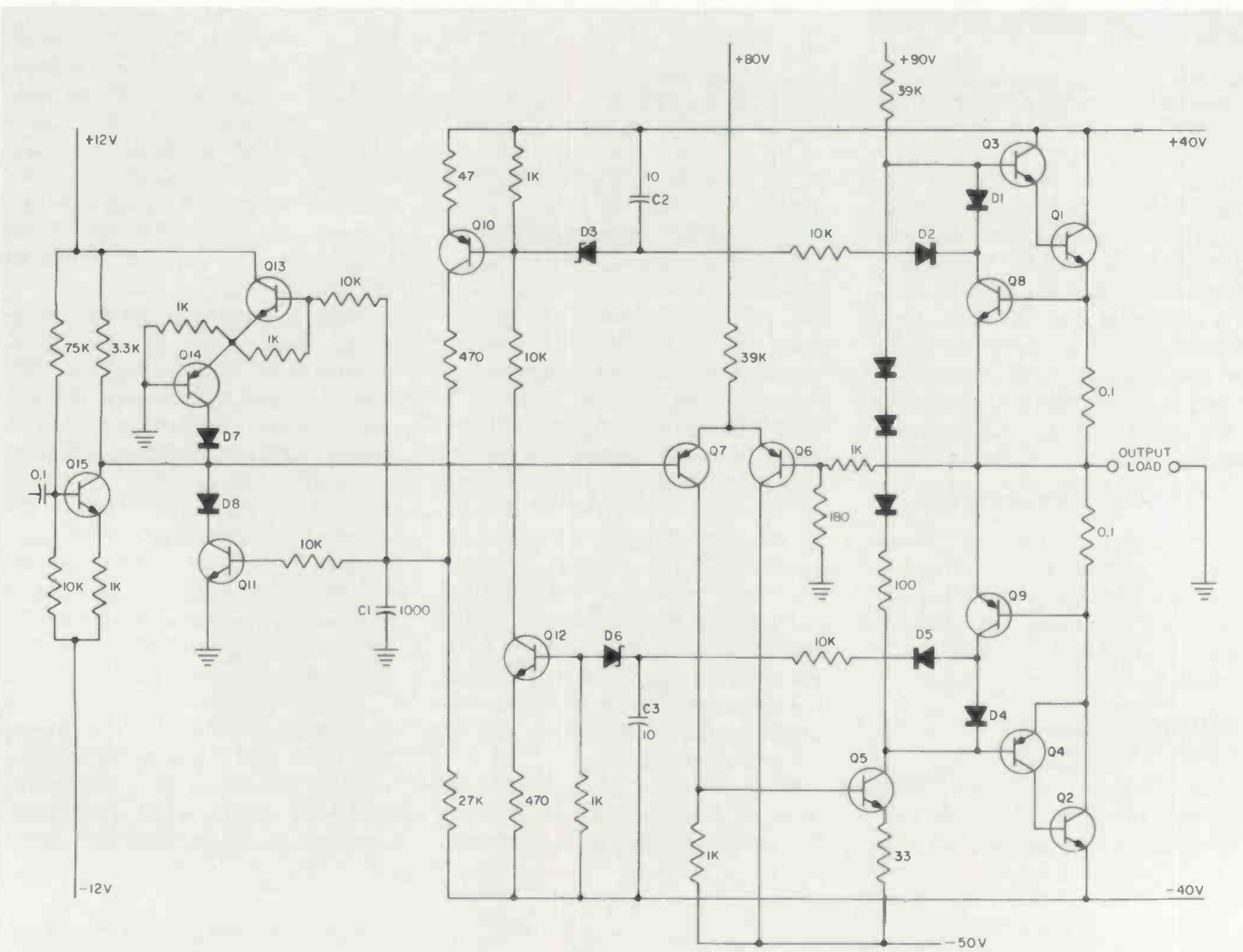
CIRCUIT MAINTENANCE

This is a typical, fairly sophisticated circuit. But as with the simpler current-protection circuit described in the previous article, an understanding of how it is designed to function is a major part of fault tracing it—any fault can then be deductively analyzed.

The most obvious protective circuit failure would occur in the zener diodes. However, since the circuit is designed to keep them within their power dissipation ratings, when they exceed their zener voltages, the failure of any one of these diodes usually means that something else was wrong, which caused the diode to fail (i.e., failure may have been caused by a resistor that had changed value through overheating).

With a failure of this type, try to determine the prime cause of the failure and see that it is remedied. This is as important as replacing the component that eventually failed as a result of the problem. The same basic theory applies to all the other semiconductors in this type circuit. Whatever component has failed in this protective circuit, check to see what was the first cause of the failure. ■

Fig. 7—One version of a complete circuit, using the techniques developed in this article. Although a typical circuit, it may differ from any particular circuit being serviced.



ET/D TEST LAB REPORT

EICO Model 379 Signal Generator and Model 150 Signal Tracer

by Phillip Dahlen

Solid-state instruments designed for assisting in the maintenance of audio circuits

EICO's Model 379 signal generator (left) and Model 150 signal tracer (right). For more details circle 900 (generator) and 901 (tracer) on Reader Service Card.

■ The maintenance of audio circuits can be simplified with the use of EICO's Model 379 sine/square-wave generator and its Model 150 signal tracer. Built in matching cabinets with solid-state circuitry, these instruments are designed to inject and detect signals in all audio stages of circuits under test, and thus assist in the job of locating defective components.

SIGNAL GENERATOR

The circuit used in EICO's Model 379 signal generator is shown in Fig. 1. Its function can be more readily understood by seeing what happens when a portion of a sine wave passes through it.

OSCILLATOR SIGNAL AMPLIFICATION

When the gate of the field-effect transistor (Q1) becomes more positive (Fig. 2), it "pinches off" the current flowing through the semiconductor, reducing the voltage drop across the source resistor (R4).

Since the base of transistor Q2 is connected directly to the source of FET Q1, this voltage change reduces the transistor base forward bias, and the transistor conducts less current. Being a zener diode, the voltage drop across diode D1 remains virtually unchanged as the transistor (Q2) emitter current changes—the entire change in voltage drop occurring across emitter resistor R5. In this manner, the diode permits the emitter of transistor Q2 to be biased at a different potential than the base of transistor Q3 without any resulting signal loss. Capacitor C1 shunts across the diode any small signal that might have still developed across it.

Since the base of transistor Q2 becomes less forward biased with less current flowing through resistor R5, the voltage drop across that resistor (R5) is reduced, reducing the forward bias at the base of transistor Q3. That transistor (Q3) in turn conducts less collector-to-emitter current, resulting in a lower voltage drop across its collector and emitter resistors—the collector becoming more positive and the emitter becoming more negative.

Diodes D2 and D3 serve to provide a relatively constant voltage drop between the bases of transistors Q4 and Q5. Although the base of each transistor is biased at a different potential, the diodes maintain virtually constant voltage drops so that any change in transistor Q4 base bias voltage will result in the same amount of voltage change at the base of transistor Q5.

With the reduced voltage drop across resistor R6, as a result of transistor Q3 conducting less current, the base of transistor Q4 becomes more forward biased and there is a smaller resulting collector-to-emitter voltage drop across it (Q4). However, since transistor Q5 is an NPN rather than a PNP transistor like the others in the circuit, it (Q5) is less forward biased when its base becomes more positive; and there is a greater resulting collector-to-emitter voltage.

In the manner just described, a more positive voltage at the gate of the FET (Q1) results in a more positive voltage at the instrument's sine-wave output, while a less positive voltage at the gate will result

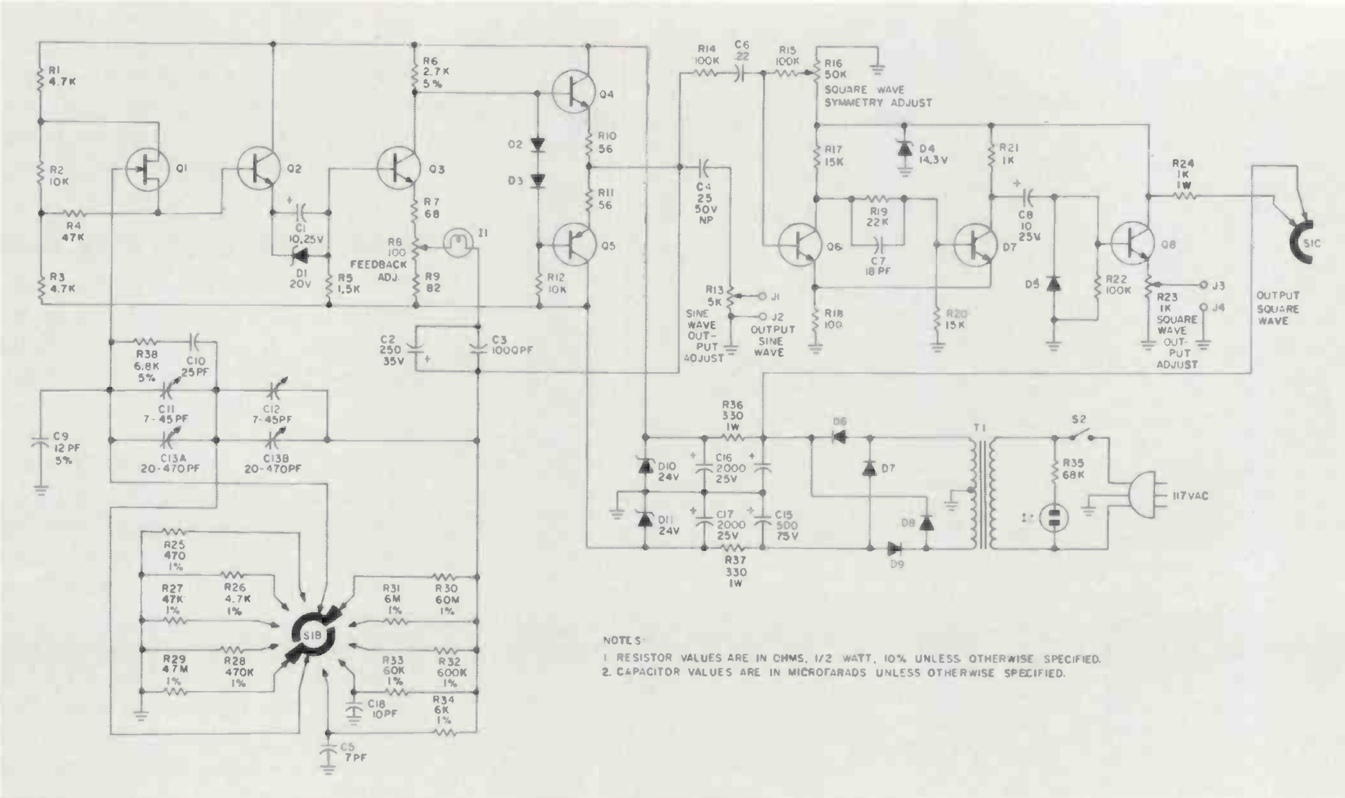


Fig. 1—Manufacturer's schematic of the EICO Model 379 signal generator.

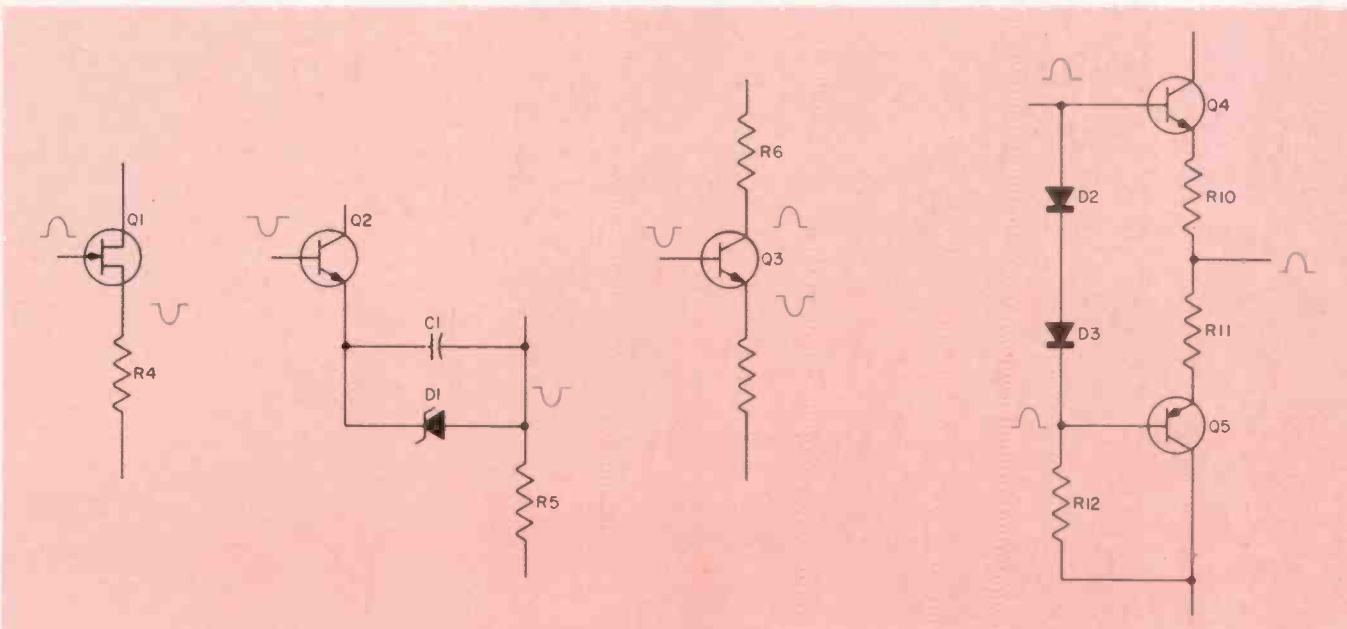


Fig. 2—Signal amplification in various stages of the oscillator circuit.

in a less positive output voltage—the change in voltage resulting in a sine-wave signal at the output.

OSCILLATOR TUNING CIRCUIT

A bridge "T" network (Fig. 1) is connected between the output of the oscillator circuit and the gate of FET Q1. It is composed of 1 percent precision resistors and a large two-gang tuning capacitor (C13A and C13B).

By tuning the two-gang capacitor and using series and parallel resistors to vary capacitor time constants, the "T" network (Fig. 3) functions by changing the phase angle of all but the desired frequency signal. Sine-wave signals of the desired frequency return from the output to the FET gate, producing positive feedback and causing the circuit to oscillate at the desired frequency. Stray signals of other frequencies experience a phase shift in the bridge "T" network; and at these frequencies a positive signal output voltage will result in a negative signal voltage at the FET gate —the positive and negative signal voltages being cancelled out or neutralized.

INCREASING OSCILLATOR GAIN

A second positive feedback circuit (Fig. 4) is also included in the instrument to increase the gain in the final stages of sine-wave amplification. When the positive portion of a sine wave passes from the oscillator output to the transistor Q3 emitter circuit, it makes the transistor's emitter more positive. If at the same time the voltage applied to the transistor's base remains unchanged, there will be a reduction in the base-to-emitter voltage. This positive emitter pulse thus has the effect of reducing the transistor's base forward bias, reducing the transistor's collector-to-emitter current and the resulting voltage drop across resistor R6. In this manner, the circuit functions as a common-base amplifier, with the positive feedback signal applied to the emitter circuit of transistor Q3 being amplified.

In an earlier description of the portion of the circuit containing transistor Q3 (Fig. 2), it was indicated that a negative signal voltage applied to the base of the transistor

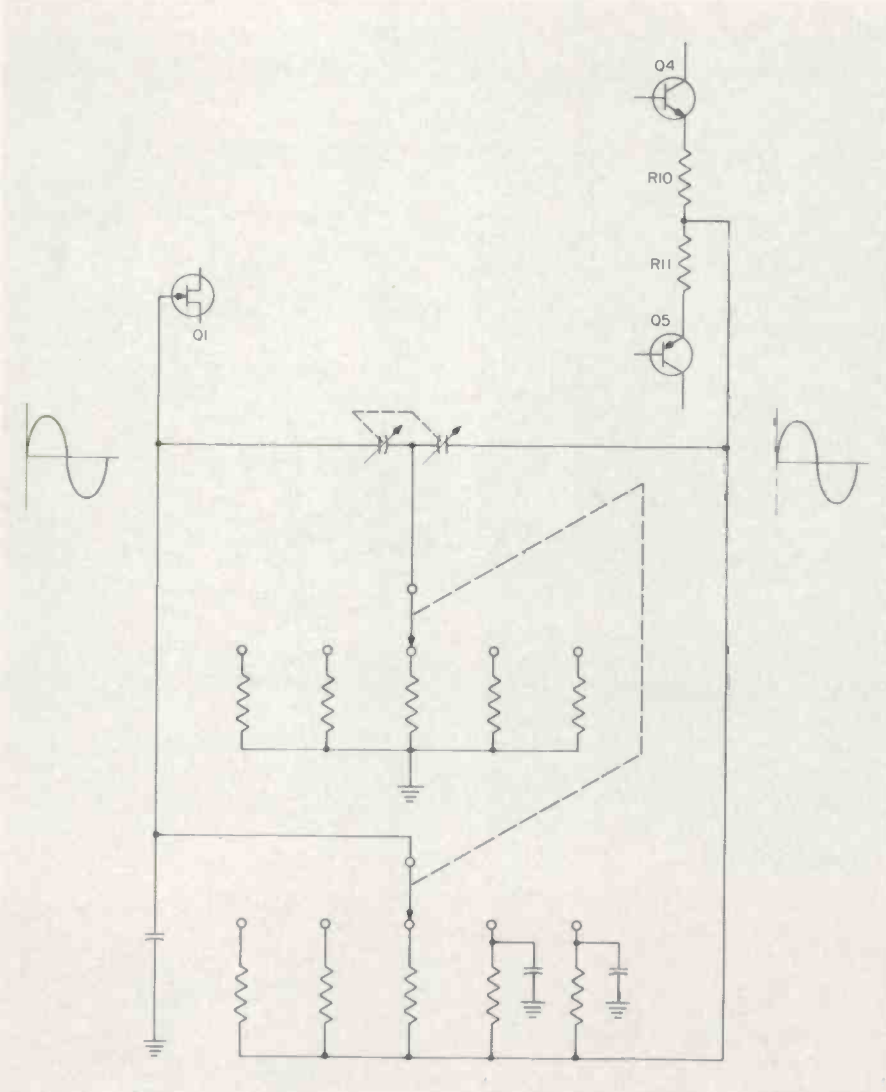


Fig. 3—Simplified diagram of the "T" network used to tune the oscillator circuit.

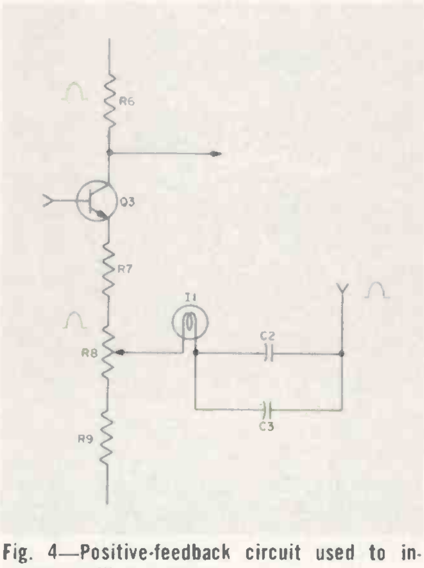


Fig. 4—Positive-feedback circuit used to increase oscillator output.

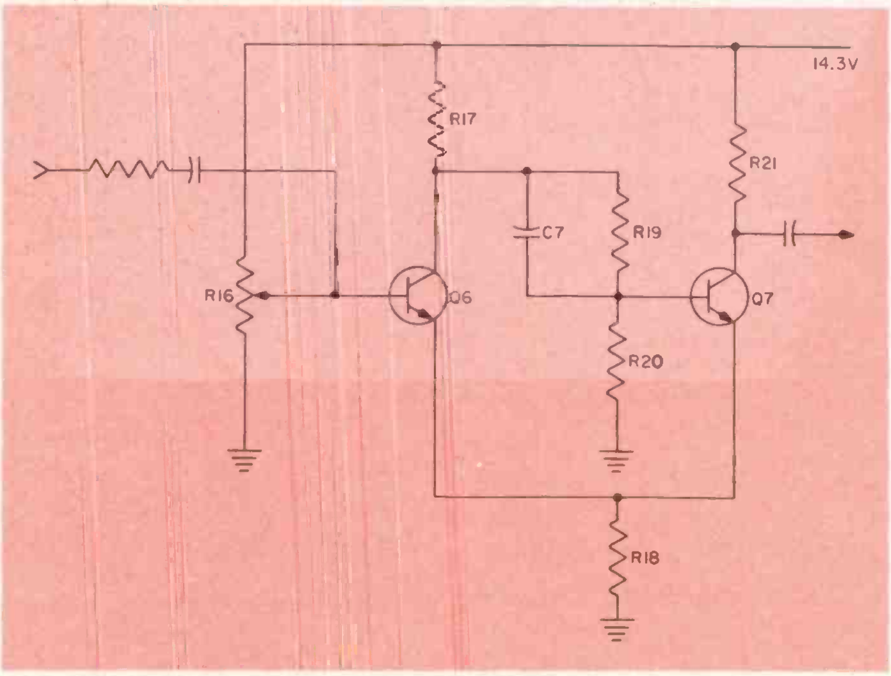


Fig. 5—Switching circuit converts sine-wave to square-wave signal.

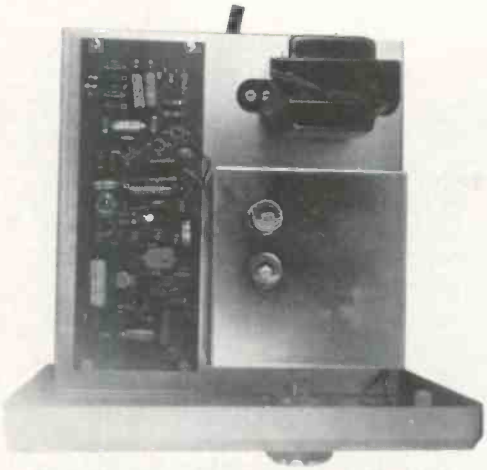
will result in a negative signal voltage at its emitter. This negative signal emitter voltage is overridden by the positive signal-feedback emitter voltage. Thus, as feedback produces a positive signal voltage at the transistor's emitter while a negative signal voltage is applied to its base, there is an even greater reduction in the base-to-emitter voltage, even more greatly reducing the transistor's collector-to-emitter current and further increasing the positive signal voltage developed across resistor R6.

This second feedback circuit contains a 250mf capacitor (C2) for low-frequency feedback, while a smaller capacitor (1000pf, C3) conducts the higher-frequency signals that electrolectic capacitors are typically unable to handle due to the nature of their design. The negative resistance characteristics of the filament lamp (I1) protects transistor Q3 from excessive signal voltages that may develop as the band switch is turned. (Under normal operation this lamp glows dimly, glowing much more brightly as the band switch is turned. At one intermediate switching position this glow was seen to vary noticeably at a frequency of about 5Hz.)

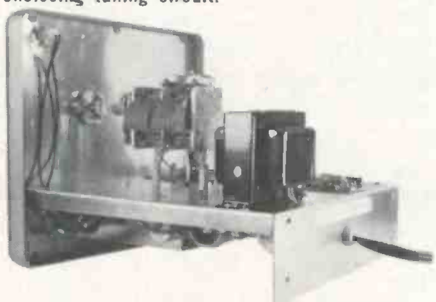
OSCILLATOR-FREQUENCY SWITCHING

Signals from the sine-wave output (Fig. 1) are fed to a switching circuit (Fig. 5). The positive portion of a sine-wave signal applied to the base of transistor Q6 will increase the transistor's forward bias, increasing the transistor's collector-to-emitter current and the voltage drop across resistor R17. As a result of this voltage drop, the base of transistor Q7 is less forward biased, it has less collector-to-emitter current, and there is a smaller voltage drop across resistor R21.

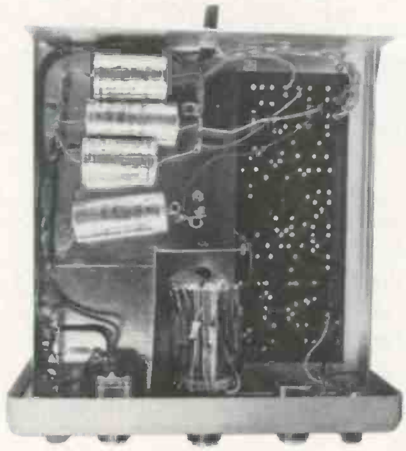
Since transistor Q7 provides additional amplification to the signal amplified by transistor Q6, the signal change in its emitter current is greater than the signal change in transistor Q6 emitter current. As in the sine-wave oscillator's second feed-back circuit (Fig. 4), emitter voltage changes from the higher stage of amplification (transistor Q7) will override those from the earlier stage (transistor Q6). Transistor Q6 then functions as both a common-emitter and common-base amplifier, and produces positive feedback at the input frequency, increasing circuit gain.



Top inside view of signal generator with shield enclosing tuning circuit.



Insulated two-gang capacitor used in signal-generator bridge "T" tuning network.



Bottom inside view of signal generator.

Sine-wave voltage changes at the base of transistor Q6 are amplified so greatly by this positive-feedback circuit that the two transistors (Q6 and Q7) will in effect act as switches, alternately turning on and off to provide a square-wave signal at the frequency of the applied sine wave.

IMPROVING SWITCHING CHARACTERISTICS

Capacitor C7 helps improve the circuit by shunting higher frequencies across resistor R19, peaking the frequency response of the switching circuit. Resistor R16 also helps improve the circuit by adjusting the base bias of transistor Q6 so that it will more-or-less readily conduct current as the sine-wave signal alternates between positive and negative voltages. If the base bias is too low, only the positive peaks of the applied sine wave will switch transistor Q6 on, transistor Q7 being on during a longer time interval. And if the base bias is too high, transistor Q6 will conduct until negative peaks of the applied sine-wave signal have adequately reduced the bias voltage, transistor Q6 conducting during longer time intervals than transistor Q7. For the positive and negative portions of the square wave to be of the same length (symmetrical), the bias adjustment must be such that each transistor alternately conducts current during equal time intervals.

Although most technicians use only symmetrical square waves, others also make use of non-symmetrical ones. By adjusting this control, positive square-wave pulses may be shortened so that they appear the same as positive symmetrical pulses normally produced at much higher frequencies, while the negative square-wave pulses correspond to negative symmetrical pulses normally produced at a slightly lower frequency—the complete square wave (both positive and negative pulses together) still being produced at the sine-wave frequency.

SQUARE-WAVE OUTPUT CIRCUIT

Transistor Q8 (Fig. 6) supplies additional gain and stability by amplifying the square-wave signal,

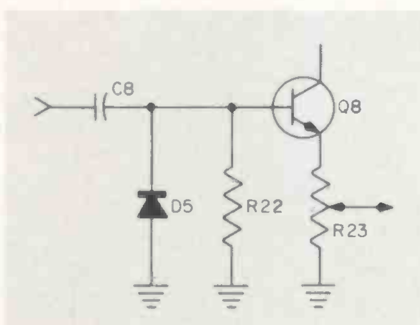


Fig. 6—Emitter-follower output circuit reduces square-wave distortion.

somewhat isolating the switching circuit from the output, and reducing the output impedance.

When the capacitor (C8) is positive with respect to ground, it forward biases the transistor (Q8), increasing its emitter current and the voltage drop across resistor R23. But when it is negative with respect to ground, diode D5 shorts the negative voltage to ground, thus protecting the transistor base from any damage resulting from a reverse base-bias voltage supplied by the capacitor, eliminating differentiation.

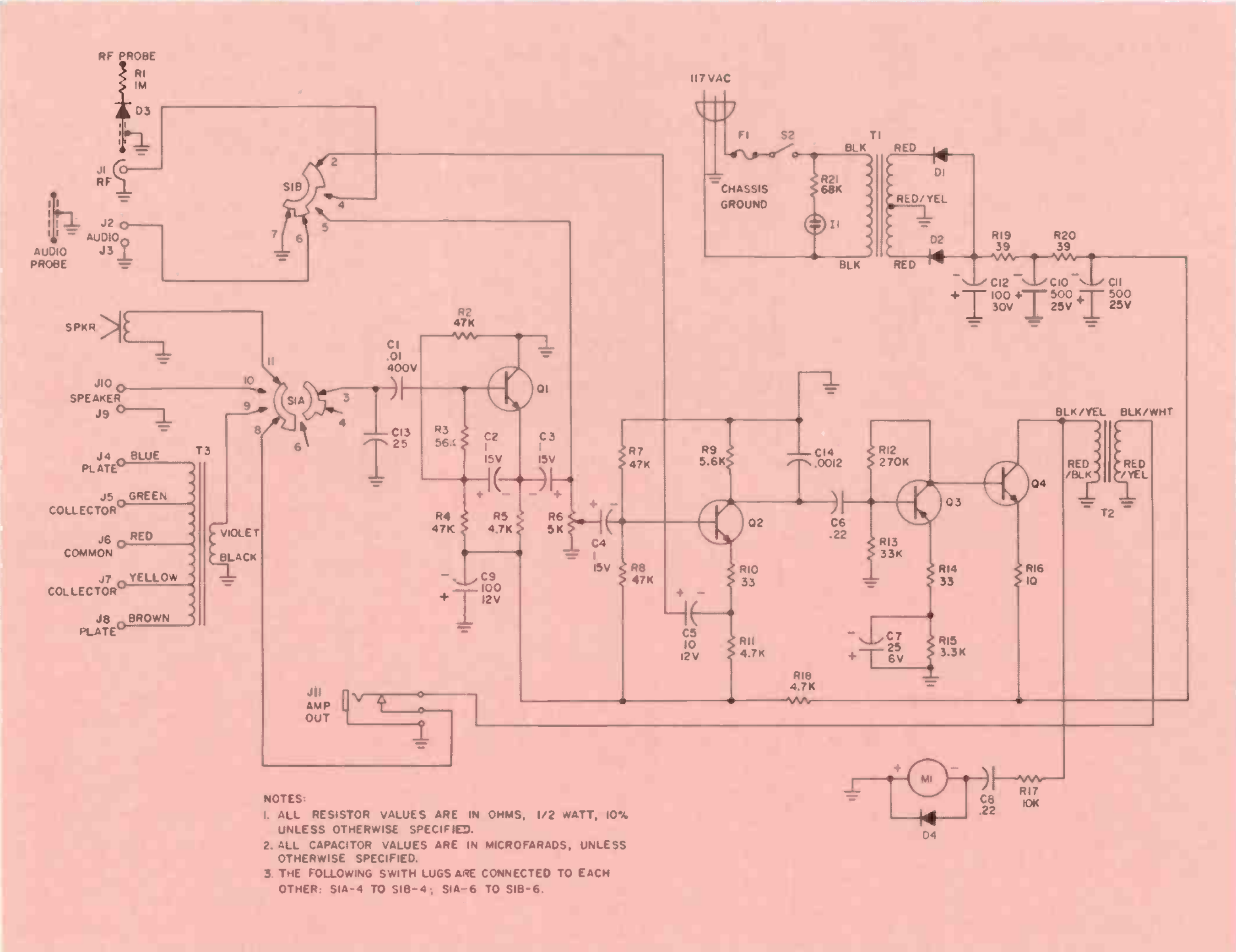
When the capacitor is negative with respect to ground, electrons (which flow from negative to positive) flow from the capacitor through the diode to the more positive ground, depleting the capacitor's supply of electrons. Then during the positive portion of the square-wave cycle, the positive voltage at the capacitor forward biases the transistor (Q8). The capacitor is of a large enough value (10mf) to permit the flow of electrons from both the base of transistor Q8 and resistor R22, without a significant reduction in the base-bias voltage, before the square wave returns to a negative voltage—the transistor remaining switched fully on during the entire positive half cycle. Without the diode, there would not be sufficient flow of electrons out of the capacitor to maintain a sufficient positive voltage and keep the transistor fully on during the entire positive half cycle. A similar problem would occur during the negative half cycle. The "drooping" effect that would result is called differentiation.

Unlike the sine-wave output, which is obtained through a capacitor (C4), the square-wave output is obtained directly from the emitter resistor (R23). This low-impedance signal source is not subject to the problems of differentiation just described.

SIGNAL GENERATOR SPECIFICATIONS

The signal generator has a 20Hz to 20MHz sine-wave frequency range on five bands and simultaneously a 20Hz to 200kHz square-wave frequency range on four bands—the square-wave generator being automatically turned off on the 200 kHz to 2MHz band. The instrument reportedly has a calibrated accuracy of ±5 percent from 20Hz to 100Hz and from 1MHz to 2MHz, with ±3 percent accuracy between 100Hz and 1MHz. At 20kHz, square-wave

Fig. 7—Manufacturer's schematic of EICO Model 150 signal tracer.



rise time is said to be less than 0.1μ sec.

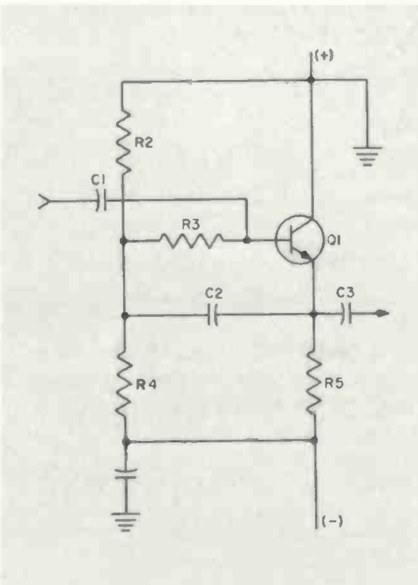
SIGNAL TRACER

The circuit used in EICO's Model 150 signal tracer more closely resembles those with which the average electronic technician is familiar (Fig. 7).

BOOTSTRAPPED INPUT CIRCUIT

The first stage of amplification uses a "bootstrapped" circuit (Fig. 8) in which positive feedback is used to reduce the effective input impedance. When the positive portion of a signal is applied to the base of transistor Q1, it is more forward biased, conducts more collector-to-emitter current, and there is a greater voltage drop across resistor R5. This positive signal voltage across the resistor (R5) is fed through capacitor C2 back to the base of transistor Q1, the positive-feedback signal current being reduced by resistor R3 to prevent the circuit from going into oscillation. By reducing the amount of input signal current required to provide the same output signal across capacitor C3, the circuit, in effect, reduces its input impedance.

Fig. 8—"Bootstrapped" circuit used to increase signal-tracer input impedance.



Top inside view of signal tracer.

OTHER AUDIO CIRCUITS

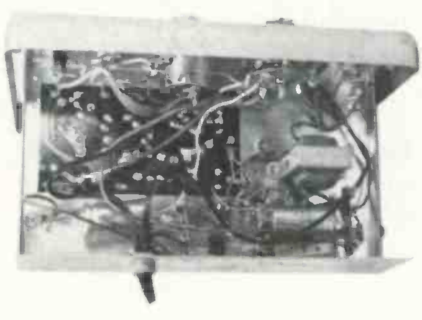
Additional amplification is provided by transistor Q2, which obtains its signal through a capacitor (C4) from the volume control (R6). Any RF signals remaining after this stage of amplification are shunted to ground through capacitor C14, while other signals pass through capacitor C6 to the two following stages of amplification.

As the voltage drop across transistor Q3 varies with the signal applied its base forward bias, a change in voltage occurs at the transistor's collector and emitter. By shunting some of the emitter's signal to ground with capacitor C7, more signal voltage must develop at the transistor's collector during each change in collector-to-emitter voltage. Thus as resistor R15 reduces the dc emitter current to match the dc characteristics of the transistor to the circuit, capacitor C7 increases amplification by reducing the corresponding signal emitter current.

CHANGING CIRCUIT FUNCTION

The signal generator contains a four-position function-selection switch. When turned to the RF position, capacitor C5 is connected to ground and the RF terminal is connected to capacitor C1. With one lead grounded, capacitor C5 functions like capacitor C7 (described previously) to increase the amount of amplification in the circuit's second stage. After the final stage of amplification, the signal may be either taken directly from the amplifier to improve scope or other instrument sensitivity, or to drive the internal speaker when the amplifier jack is not used. The relative strength of the amplified signal is indicated by a handy meter.

Bottom inside view of signal tracer.



Since less gain is generally required in amplifying signals applied to the audio terminal, turning the function-selection switch to the audio position disconnects capacitor C5 from ground, while connecting the audio input terminal to capacitor C1. Disconnecting the capacitor (C5) allows a signal voltage to develop across resistor R11, reducing the remaining signal voltage developed across resistor R9 and applied to the following stage of amplification. The signal is then amplified as was the audio signal applied to the RF terminal. (If greater gain is required, the audio signal may be applied to the instrument's RF terminal since the RF probe converts RF signals to audio signals before they enter the RF terminal.)

The selector switch grounds the audio input terminal and RF input terminal until they are selected—the audio input being grounded when the RF input is selected and vice versa. To eliminate any stray signals when the internal speaker is used either alone or through the substitute output-transformer circuit, the selector switch grounds not only signals present at the RF and audio input terminals but also those present at the volume control (R6), while disconnecting the amplifier from the speaker.

SIGNAL TRACER SPECIFICATIONS

The signal tracer's audio output is rated at 400mw with a 1mw RF input or a 65mw audio input. The meter reportedly contains a 200μa movement, and the substitute transformer included is designed to match the speaker impedance with the impedance of typical amplifier output tubes or transistors. Specifications indicate that the hum is better than 60dB below 400 mw. ■

ET/D DEALER SHOWCASE

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

CLOSED-CIRCUIT CAMERA 700

Built-in automatic light compensator

Introduced is the Model MC920 Mini-Pro Camera, a reported breakthrough in the development of surveillance cameras. Entirely of solid-state, module construction, the camera comes in an attractive gray aluminum case, approximately half the size and weight of other transistorized cameras. Featured is the automatic light compensator, which is built in directly behind the lens and responds to changing light conditions. Other features are said to include switchable RF and Video output, rear electronic focus for ultra sharp image adjustment, and thermally compensated circuitry for continuous operation. Simplicity of installation and operation are other features of the camera. The camera weighs 4 lb and measures 2⅝ by 4¾ by 7 in. Net price under $200. Javelin

STEREO HEADPHONE 701

Listening level from 50 to 16,000Hz

Introduced is the Model 10R200 stereo headphone set which features extremely high sensitivity, reportedly capable of delivering over 100dB of sound with as little as 10mw input.

The frequency response of the headphone set yields a listening level from below 50Hz to beyond 16kHz. The soft, foam ear pads enhance the bass response and affords greater listening comfort. Freedom of movement is provided for the listener by a 6½-ft. cable. The standard stereo plug allows universal application to stereo amplifiers equipped with the usual headphone jacks. The price of the headphone set is $19.95. RCA

CITIZENS BAND SCANNER 702

Visually monitors all CB channels

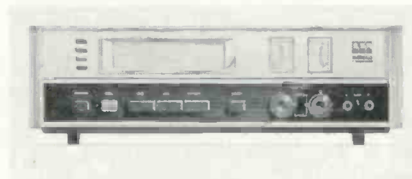
A 23 channel Citizens Band scanner has been designed to permit visual identification of all CB channels in use. This unit is designated Scanalyzer 23, Model 779. This solid-state scanner reportedly allows continuous and simultaneous visual monitoring of all 23 channels and permits the instant determination of the channels in use. It reportedly can also be used to determine the signal strengths of all 23 channels by the use of an adjustable sensitivity control, which can be used to visually indicate each channel having a signal exceeding the pre-select sensitivity level. The response time of individual channel indicators is reportedly less than 10ms. Sensitivity is

said to be better than $0.5\mu v$ with selectivity rated at $-80dB$ at $\pm 10kHz$. Another control is designed to permit adjusting the RF sensitivity over a range of from $0.5\mu v$ to $100\mu v$. The scanner is an all solid-state unit employing 38 semi-conductors. Price $149.95. Commander

RECORD/PLAYBACK DECK 703

Pre-select the amount of tape you want to hear or record

A Model RD8S eight-track record/playback tape deck is introduced. Incorporated in the deck is an exclusive operating feature that allows the user to pre-select how much of the tape he wants to hear or record. The deck will play the entire tape continuously or automatically eject the tape after the

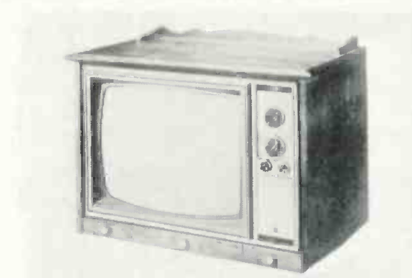


first or fourth program. This feature overcomes the most common cause of eight-track cartridge damage. The deck is of particular interest to the customer who already owns an eight-track playback system for his car. With this deck, he can record his own tapes at home and by doing so can quickly amortize the cost of the deck by making his own tape library. The deck comes complete with a factory-installed walnut cabinet and 3 ft. patch cord. BSR

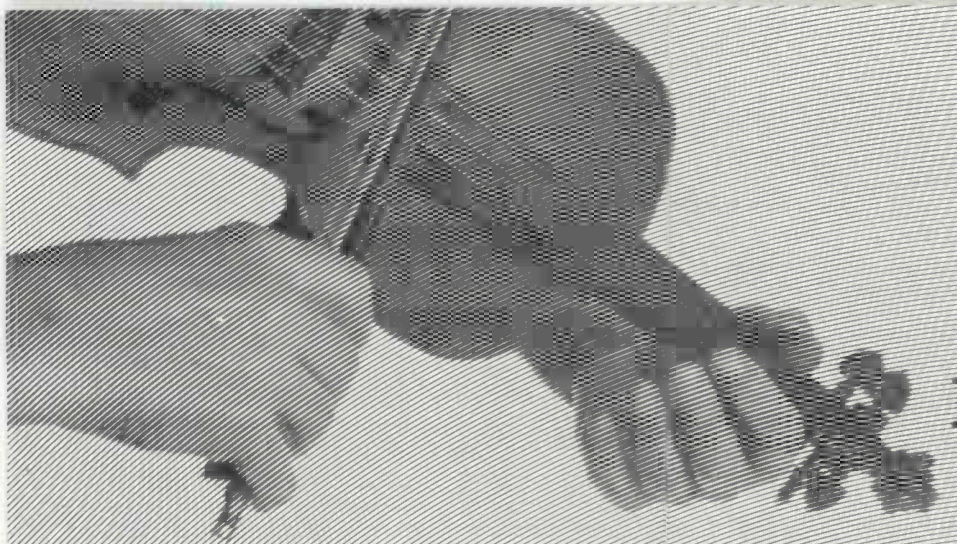
COLOR-TV SET 704

Table model of Early American design

Introduced is a table-model color-TV set of Early American design, complete with top gallery rail. The Colonial, Model CT-391E, has an 18 in. diagonal screen. Features include Panalock (AFT), which is designed to allow the viewer to instantly lock in the best picture electronically with a touch of a button. Another feature is



the Auto-Color, a new feature where pre-setting at the factory is said to automatically lock in color on every channel. The use of "Speed-O-Vision" eliminates a "warm-up" period by offering instant picture and sound. The set also includes dipole and bowtie antennas, separate UHF and VHF channel selectors plus a 5 by 3 in. oval speaker. Retail price $419.95. Panasonic



professional hands require years of training

professional TV service dealers insist on GE ULTRACOLOR picture tubes

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TUBE DEPARTMENT
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ET/D CATALOGS & BULLETINS

Semiconductor and Components 400

A condensed semiconductor and components catalog is available. This 60-page booklet, CC300, provides information on new products as well as a listing of semiconductor product lines. A 10-page section highlights recently introduced semiconductors, ranging from TTL/MSI integrated circuits through discrete optoelectronic devices. Preferred semiconductors recommended for current and new designs are easily identified in this publication. Condensed listings are given for TI's integrated circuits, silicon transistors, optoelectronic devices, germanium transistors, diodes, rectifiers, resistors, microwave components, thyristors, trigger diodes and power transistors. Electrical parameters, mechanical data, product features, application information and circuit diagrams are provided. Seven pages are devoted to case outlines of discrete devices and a military device selection is featured. Texas Instruments.

Electronic Test Accessories 401

A 56-page catalog of electronic test accessories is offered. The edition contains 420 items—50 of which are new this year. The general catalog contains the entire line of ¾ and ½in. spaced molded test accessories, molded patch cords, cable assemblies, test leads, connecting leads, test socket adapters, "Black Boxes" and other electronic test accessories; all designed to meet rigid industrial and military specifications. Catalog provides complete engineering information on all items, including product photographs, dimension drawings, schematics, specifications, features and operating ranges. Pomona.

Electronic Hardware 402

A catalog No. 2570 containing wire, cable, tubing and hardware to the electronics industry is offered. The new catalog is a distillation of the full-line catalog and contains those products most in demand by distributors. The catalog will make it easier for most customers to find what they are looking for quickly. Birnbach.

Power Supplies 403

Nine lines of dc power supplies are introduced in a catalog supplement now available. Described are a new LV series of high efficiency, low-ripple power modules designed to power TTL, ECL, DTL, RTL and HTL logic. This series offers ripple as low as 10mv RMS. An LW series of dc power modules, designed to power transistor circuitry, relays, motors, lamps and solenoids, are also introduced. Other new products include an LXD-3-152 dual output tracking power supply, designed to power operational amplifiers and an integrated circuit regulated laboratory power supply with built-in tracking overvoltage protection, and an LCS-A package modular power supply that is IC regulated and available in 19 fixed voltage models to 150vdc and up to 3a, and 5 wide range models to 120vdc, up to 2a. Lambda.

Instructional TV Fixed Service 404

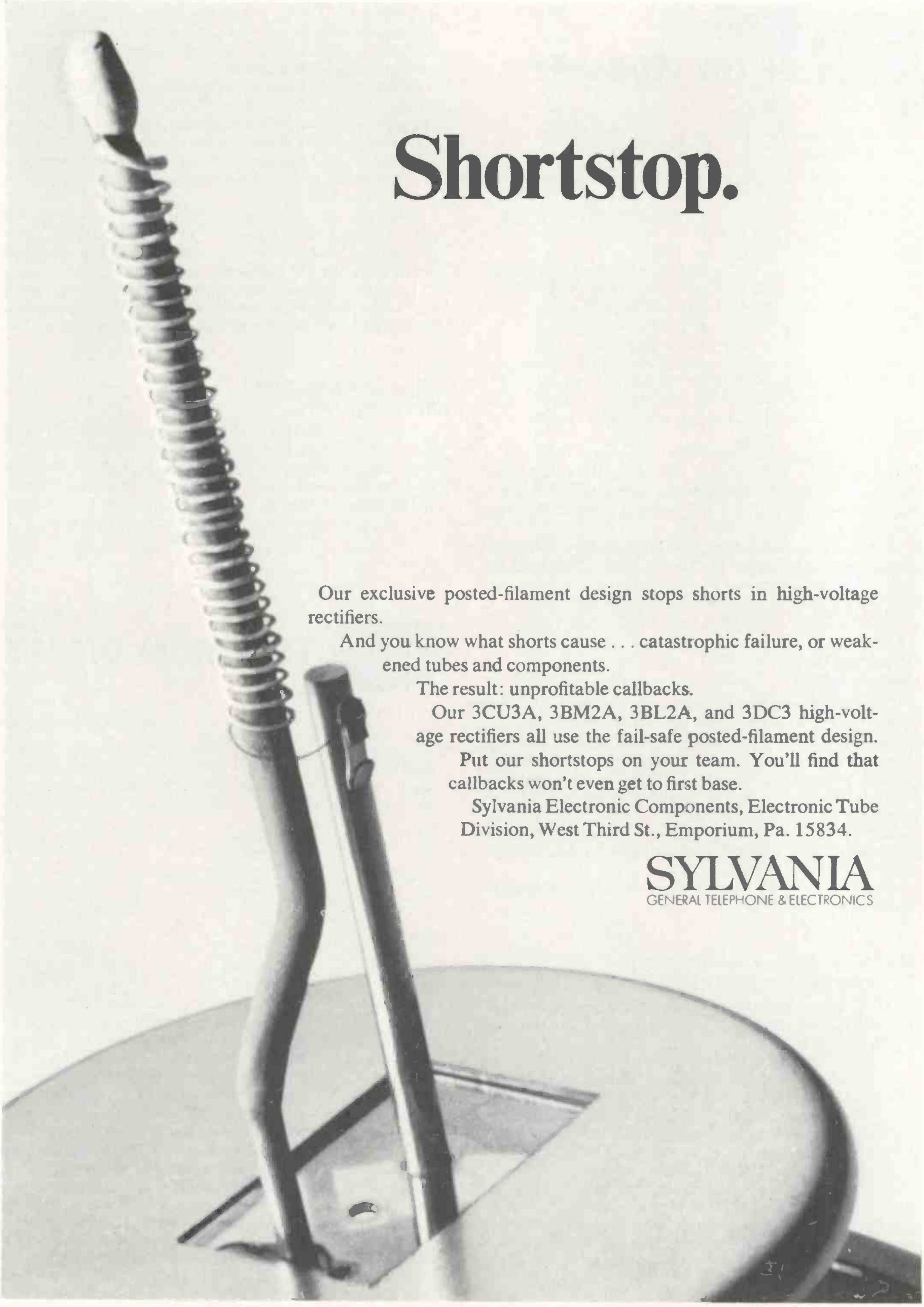
An 8-page catalog of hardware for equipping school districts and individual schools with complete Instructional Television Fixed Service (ITFS) 2500MHz micro-wave systems is issued. Available to educators and ETV system contractors on request, the new catalog covers 10w transmitters, mini-power transmitters, micro-power transmitters, repeaters, receiving systems, down converters, distribution systems, transmitting and receiving antennas, accessories and calibration equipment. Using this equipment, a school district may originate one to four instructional TV channels and transmit them to all schools within the district. JFD.

Recording Tape 405

Offered is a confidential distributor cost sheet which lists distributor cost and suggested resale prices for all of the company's audio tapes, cassettes and accessories. It now combines three previous pricing sheets into one easy-to-use reference. The new distributor pricing sheet also spells out terms and conditions, standard packaging, prepaid freight, assorting privileges and cash discount. Irish Recording Tape.

Clips/Insulators 406

An 8-page catalog No. 350 containing electric clips and insulators for quick, temporary electrical connections is offered. Complete specifications are given for each clip and the line is fully illustrated: miniature clips, alligator clips, completely insulated alligator clips, crocodile clips, "Pee-Wee" clips, general purpose test clips, heavy-duty test and battery clips, welding ground clamps, a general ground clamp, plier-type clips for automotive battery booster cables and battery chargers and testers, complete battery booster cable sets, ignition cable assemblies, also a twin-ended test clip and a needle clip. Mueller.


Shortstop.
Our exclusive posted-filament design stops shorts in high-voltage rectifiers.
And you know what shorts cause . . . catastrophic failure, or weakened tubes and components.
The result: unprofitable callbacks.
Our 3CU3A, 3BM2A, 3BL2A, and 3DC3 high-voltage rectifiers all use the fail-safe posted-filament design.
Put our shortstops on your team. You'll find that callbacks won't even get to first base.
Sylvania Electronic Components, Electronic Tube Division, West Third St., Emporium, Pa. 15834.
SYLVANIA
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NEWS OF THE INDUSTRY

Jerrold Offers MATV Course

The second in a series of comprehensive courses on master antenna television (MATV) presented by Jerrold Electronics Corp. was held recently at the O'Hare Concord Motel in Chicago and attended by dealers and distributors from a wide midwest regional area.

Sponsored mostly for Jerrold representatives, the three-day course, conducted by Jerrold's senior systems engineer Allen Pawlowski, included discussions on decibels, antennas, amplifiers, system layout, headends and J-Jacks.

"Through these concise and to-the-point courses we intend to build a nationwide cadre of representatives updated in the state-of-the-art and able to provide fast and quality service," reported Bert Wolf, manager of Jerrold's Distributor Sales and Educational and Communication Systems Divisions.

MATV courses are scheduled for other U.S. cities, three of which will include discussion on instructional television (ITV). A separate class on instructional television fixed service (ITFS) was held in Philadelphia, June 24-26.

Courses are scheduled for New Orleans, July 14-16; Salt Lake City, September 17-18; San Francisco, September 21-23, and Atlanta, October 27-29. A one-day summary seminar will be held in Denver on September 15.

Precision Tuner Service Moves

Precision Tuner Service announced its move to a new modern air conditioned plant at 5233 South Highway 37, Bloomington, Ind. The plant covers 4800 sq. ft, with offices for company executives, a large lounge for employees, and a huge, well planned area for receiving and shipping.

Repair positions have been laid out carefully to provide excellent lighting and generous work space for each technician. The company currently has 14 positions in operation, and plans to open 10 more positions as soon as equipment becomes available.

About half of the floor space is devoted to storage of spare tuners and parts.

First Single Tube, Black-and-White TV Camera Convertible to Color

RCA announced the television industry's first single-tube, black-and-white TV camera that can be converted to full color operation.

Basically a high-resolution monochrome camera, the new PK-430 produces color pictures when a special color-encoding optical system is added and a small package of color processing electronics is plugged in, according to Gordon W. Bricker, Manager, RCA Professional Electronic Systems.

He said the new design permits educators, industrial trainers, cable TV operators and other closed-circuit TV users to invest in black-and-white program equipment without risking camera obsolescence when they decide to switch to color. Changeover to color operation normally requires the purchase of color cameras to replace monochrome models.

The convertible camera, scheduled for deliveries beginning this fall, is priced at $5995 and the equipment needed to modify it for color operation at $4755. Factory-built color-TV cameras range in price from approximately $10,000 to more than $80,000.

In the one-tube system, color information is obtained by passing light from the televised scene through two striped filters before it reaches the pickup tube. This technique also produces other essential information about picture detail, content and brightness. The information is gathered on the face of the single tube and processed electronically to produce the color picture.

When the camera is converted for color, it employs this optical system in conjunction with an electronic color processor. The latter occupies only about 10 in. of space in the standard TV equipment rack.

The basic black-and-white camera includes a 10:1 zoom and a type 8507 vidicon tube, which is said to provide a horizontal resolution of 600 lines for detailed pictures.

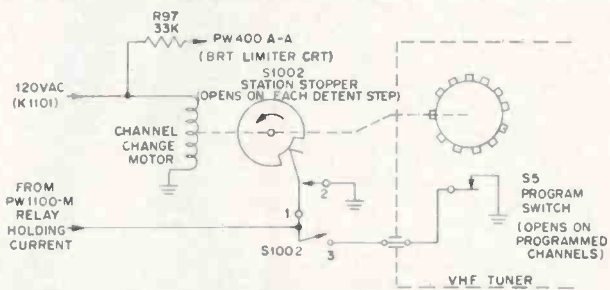
Supreme Publications Increases Staff

Supreme Publications of Chicago and Highland Park, Ill., announced its continued activity in supplying service manuals with releases planned for early Fall on new and separate black-and-white and color TV manuals. Almost doubling its publication staff, Supreme plans to introduce a unique production technique in manual preparation.

TECHNICAL DIGEST

continued from page 30

armature closes contacts 1-3 on S1102 (station stopper switch), and they remain closed while the motor is activated. The rotation of the tuner shaft closes contacts 1-2 on S1102 to complete a path to ground for the channel-



change relay. This relay holding current path connects to PW1100-M and the collector of transistor Q1101 through resistor R1110 (1800Ω), furnishing sufficient current to hold relay K1101 in an activated mode. The motor will continue to run after the keying signal is removed. Just prior to every detent position of the tuner, contacts 1-2 on S1002 open so that if the next channel is programmed "in," the motor stops—since the holding current path for the channel-change relay is opened. If the next station is programmed "out," just prior to the opening of contacts 1-2 on S1002, the programming switch closes to furnish a holding current path for the channel-change relay through contacts 1-3 on S1102 and the programming switch. This action maintains the motor activated and prevents the tuner from stopping on an unwanted (unprogrammed) channel until desired channel is reached.

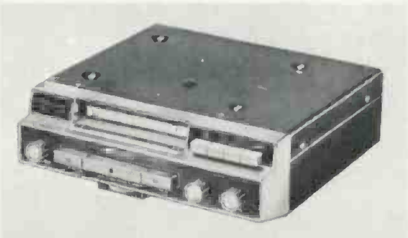
ET/D NEW PRODUCTS

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

CASSETTE RECORDER/FM MULTIPLEX RADIO 705

Has direct stereo record feature

A Model TPR-2011 cassette stereo-recorder/FM-multiplex radio combination features mode controls, automatic volume control for recording, mono-stereo, FM multiplex, left and right balance, tape record and tape playback, fast forward and reverse—plus automatic cartridge pop-out, when the music program is completed. A mounting bracket, four-prong connector, fuse and head cleaner are reportedly standard accessories. The unit operates from a 12v system, weighs 7 lb and measures 9¼ by 9¼ by 3 in. List price is $199.95. Aiwa



UHF BROADBAND AMPLIFIER 706

Built-in output UHF/VHF multiplexer

The Model CUB-50 solid-state broadband UHF amplifier is used to amplify UHF-TV signals for direct "on-channel" distribution in MATV systems, eliminating the need for headend UHF-to-VHF converters. The unit reportedly features low-noise and high-output capability obtained through the exclusive use of silicon transistors. A control on the front panel reportedly permits adjusting the UHF gain over a 21dB range. The unit also has a built-in output UHF/VHF multiplexer. This feature permits the use of the amplifier with a companion VHF amplifier, without the need for any external mixing equipment. Manufacturer's specifications: Gain—41.5dB. Bandpass—± 0.7dB flatness at full gain. Gain Control Range—20.5dB to 41.5dB gain. Noise Figure—10.0dB. Maximum Input, Per Channel (gain controls at minimum gain)—37dB (70,000μv) single channel for less than 1dB gain compression; 28dB (25,000μv) for three channels. Maximum Output Per Channel (for —46dB crossmodulation products)—+59dB (0.9v) single channel and 50dB (0.3v) each channel for three channels (at threshold of perceptible interference). Output Test Jack—30db ±2dB, minimum return loss 14dB (1.50VSWR). Output Multiplexer—VHF through loss—0.75dB. VHF return loss—23dB (1.15 VSWR). Size—8¾ in. L by 5¼ in. W by 3⅜ in., universal slotted mounting. Blonder-Tongue

VHF MONITOR RADIO 707

Automatically receives any combination of both high- and low-band signals

The Hi/Lo Monitoradio Scanner is designed to automatically receive any combination of both high- and low-band signals. The radio is capable of scanning any mixture of frequencies in the 30 to 50MHz and 144 to 174 MHz ranges, through eight crystal-controlled channels. The receiver can reportedly cross-band monitor police, fire, radio telephone and marine signals in either band. The unit searches for a signal with the process detailed by read out lights for each channel. Upon detection of a high- or low-band signal, the receiver stops to monitor the entire transmission. At completion

continued on page 72

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

Motorola Color TV Service Manual

This brand-new all-in-one handbook covers all models using the TS-907 through TS-924 chassis — including the all-transistor TS-915/919 chassis — all the information you need to know about setup, alignment troubleshooting, etc., slanted specifically to unique Motorola characteristics. In addition to general data, there's specific information on each chassis, detailing special features, test-point locations, individual alignment procedures, setup kinks unique to each chassis, CRT replacement instructions, troubleshooting tips and modifications, etc. Also, there's a BIG 18-page foldout section with complete schematic diagrams for ALL Motorola Color chassis. 160 pps., BIG 8½" x 11" size, plus 18-page schematic foldout section. Long-life vinyl cover.

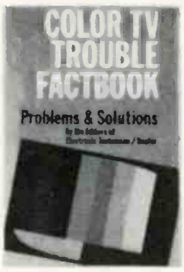
List Price $7.95 ● Order No. 509

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

Color TV Trouble Factbook



Here's a complete guide to color TV troubles and solutions, arranged by make and model, a low-cost, all-in-one reference handbook every TV service technician should own. The information it contains may easily save you hours of time repairing a "tough-dog" color TV. Included are details concerning repetitive troubles, field-factory changes, new and unusual circuits and descriptions of how they work, special adjustment procedures and other such pertinent service information. The content is arranged by brand names, covering every major make of color TV receiver produced in the past several years. Models and chassis covered are arranged in alpha-numerical order. 176-pps. Hardbound.

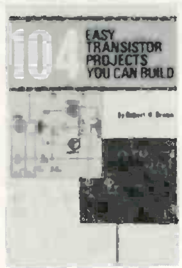
List Price $6.95 ● Order No. 519

Audio Systems Handbook

Complete reference and guide to audio system design, encompassing home entertainment, commercial sound and studio installations. Chapter 1, covering amplifiers and amplification, explains db and impedances, level limitations, insertion gain, plus a host of other basics necessary for practical system design. The author goes to great lengths to impart an understanding of these vital ingredients as they apply to overall operation. The same may be said of the treatment in succeeding Chapters on equalizers, mixers, filters, distribution systems, program sources, commercial systems, studios, and loudspeaker systems. 192 pps., 125 illus. Hardbound.

List Price $7.95 ● Order No. 494

104 Easy Transistor Projects You Can Build



How would you like to have a high-gain telephone pickup, a wireless mike, an electric megaphone, a CB receiver, light dimmer, fence charger, or any one of 104 such useful devices? You can build them yourself, at very little cost, and have a lot of fun in the process. What's more, you're bound to learn a lot about transistor circuits (including FETs and SCRs). A complete schematic diagram is included for each device, along with a parts list, plus a brief description of its operation and application, and notations concerning any critical points. All of the devices have practical application in the home, on the repair bench, in the ham shack, on your car, boat, airplane, etc. 224 pps. Hardbound.

List Price $6.95 ● Order No. 462

Handbook of Semiconductor Circuits

Contains 124 examples of standard transistor circuits, complete with operational data for amplifiers, oscillators, logic and switching circuits, power supplies, and various nonlinear circuits. The broad range of circuits included were selected on the basis of application and practicality. A design philosophy section is included with each group of circuits, thereby providing a basis for understanding circuits other than those selected as examples. This is not a handbook of "preferred" circuits, but rather a collection of practical circuits which have wide application and exemplifying good engineering design. Each circuit description includes data concerning any unique design or operational data, along with schematic diagrams. Hundreds of illustrations and diagrams. 448 pps., 6" x 9". Hardbound.

List Price $8.95 ● Order No. G-30

Digital Computer Theory

Whether you are a technician or engineer who needs comprehensive knowledge of computer operation, or simply a hobbyist with a passing interest in the subject, this outstanding text is for you. In the first section you are acquainted with basic computer technology, including computer codes and language programming. The second section presents a detailed study of modern computer logic circuits, such as AND, OR, NAND, and NOR gates. In addition, thorough explanations of basic circuit blocks are discussed—bistable, monostable, and astable multivibrators, Schmitt trigger circuits, etc. Finally, the third section covers memory, control, arithmetic, and input-output units. 320 pps. Hardbound.

List Price $7.95 ● Order No. 276

Semiconductors From A to Z

Here it is—everything you need to know about semiconductors — from basic diodes and transistors to FETs, MOS FETs, tunnel diodes, integrated circuits, varicaps, photoFETs, light-sensitive and light-emissive devices, incandescent and luminescent optic-electronic circuits, unijunction transistors, field-effect diodes, SCR and zener diodes, etc. Explains how these various devices work and how they are used, with descriptions of all the common and unique circuits used in modern semiconductor technology. Attention is given to integrated circuit applications — variable-current and constant-current sources, unbalanced differential amplifiers, IC applications in FM and TV receivers, TV sound circuits, discriminator circuits, and cascade amplifier networks. 272 pps., over 300 illus., 26 Chapters.

List Price $7.95 ● Order No. 493

AN EXTRAORDINARY OFFER...

ET/D NEW PRODUCTS

continued from page 66

of the message, the search process resumes automatically. The computer patch board matrix contains eight high- and eight low-terminal programmers in addition to eight crystal sockets. A plug-in crystal for the frequency of the user's choice is inserted and the terminal lead wire is connected to the corresponding high- or low-band terminal programmer. The process is repeated in any high/low sequence for the remaining seven crystal positions. Front panel push buttons for each channel enable the receiver to scan all eight positions, or a choice of any combination of them. Sensitivity is rated at 0.5μv for low-band channels and 0.7μv for high. Specifications indicate a selectivity of 50dB @ ±15kHz and a 5w audio output. Price is $169. Regency

RADIATION METER 708

Detects both x-ray and gamma radiation

A Model 499 VIC-CHEK Survey Meter has been designed to answer the need of TV servicemen wishing to check the amount of radiation emitted from color-TV sets. Although primarily designed for TV servicemen, the unit is also a quick and sensitive radiation survey meter. A single pushbutton switch activates the circuitry to provide almost immediate indications of the relative radiation intensity. Power is supplied by one 9v transistor-radio battery, and power is drawn only when the pushbutton is depressed. The meter detects both x-ray and gamma radiation. It is said to have a range of from 0 to 1000 counts per minute, with a reported accuracy of ±20 percent of full-scale reading. The detector, contained within the chassis, is a Geiger-Mueller counter tube with organic quench and a 10 sq. cm aluminized mylar radiation window. The circuits are reportedly all solid-state for lower power consumption and increased reliability. The 1 lb instrument is 3 in. wide by 5 in. high by 2½ in. deep. Price $79.50. Victoreen

INVERTER 709

Output Capacity of 600w

Announced is a solid-state inverter for the operation of 117v 60Hz ac equipment from 12vdc storage battery power. This Inverter Model 12U-S6M has an output capacity of 600w continuous and 650w intermittent while maintaining frequency at 60Hz with varying load or input voltage. The inverter is reportedly well filtered and comes complete with battery cables ready for operation. Net price $249.75. ATR.

TV SWEEP/MARKER GENERATOR 710

Fundamental sweep output on all VHF TV channels

A color-TV alignment test instrument has been designed to combine features normally found in three or four separate pieces of test equipment. The TV Sweep Chanalyst, WR-514A, is said to have the combined features of a TV sweep generator, marker generator, marker adder, and special "ChromAlign" system for color bandpass alignment. This instrument reportedly provides RF, IF and video output sweep signals for alignment of VHF tuners; IF, video and color bandpass amplifiers. When used with an

oscilloscope, the instrument reportedly provides a continuous-trace display of the bandpass characteristics of TV receiver circuits. Specifications indicate that some of the features include: Fundamental sweep output on all VHF TV channels—for sweep alignment of VHF tuners. Sweep output on all IF frequencies for stage-by-stage or overall IF alignment. Video sweep output from 50kHz to 5MHz for alignment of video amplifiers and chroma circuits. Special signal for color bandpass alignment. Built-in marker-adder function. Seven crystal-controlled IF markers for checking IF response of sound, picture and chroma carriers. FM sweep output from 88 to 108MHz for FM tuner alignment. In addition, the instrument has been redesigned to incorporate BNC connectors throughout and comes equipped with new basic output cables and snap-on alignment adapters. Price with cable accessories is $375. RCA

CONNECTORS 711

Competitively priced and intermateable

A new line of competitively priced audio connectors which are constructed of durable plastic is introduced. The connectors are durable, lightweight, and fully intermateable with all industry standard latchlock types.

The connectors are ideally suited for use in audio frequency and other low-level, high impedance circuit applications.

Known as Excellite audio connector, a new line includes straight cord plugs and wall mounting receptacles offering both plug and socket inserts in three-, four- or five-contact configurations. Features include durable, molded ABS (acrylonitrile butadiene styrene) bodies; nickel plating throughout; convenient pushbutton lock/release; positive gripping cable clamps; unitized, removable inserts molded of high impact type six nylon; silver plated brass screw-machine contacts, with positive grounding provision when contacts engage/disengage; black neoprene rubber cable relief.

Immediate applications include public address sound systems, studio broadcast systems, recording equipment, test instruments, two-way radio communications gear, computer peripheral equipment and a host of similar high-performance uses.

Excellite cord plugs feature a single conventional, right hand, self-forming thread insert screw. For cable installation, connector disassembly requires only that the insert screw be turned counterclockwise, releasing the one-piece insert assembly.

Once the insert screw has been removed, the assembly easily slides from the connector shell.

After cable termination to solder cup contacts, the insert assembly is simply aligned with the shell and inserted. The insert screw is then replaced and tightened clockwise.

The three-pin version uses #12 contacts and is current rated at 15a; the four-pin connector uses #16 contacts at 10a; the five-pin version uses #20 contacts, rated for currents to 7.5a.

Straight cord plugs with socket contacts measure ¾ in. diameter (socket end) by 3 3/16in. long (tip-to-tip). Pin contact straight cord plugs are the same diameter at pin end; their length is three inches. Wall mounting receptacles with pin contacts are also ¾ in. diameter, but are only ⅞ in. deep with a mounting plate measuring 1 7/16in. high by ⅞ in. wide. Socket contact wall mounting receptacles are 15/16 in. diameter by 1 1/16in. long, with mounting plate measuring 1 7/16in. high by 1 1/16in. wide. Amphenol.

ET/D NEW PRODUCTS

SERVICE EXTENSIONS 712

Cables speed equipment servicing

A full line of service extensions is announced. Service extensions are designed to speed servicing of television sets, high fidelity equipment and appliances equipped with Molex interconnectors.

All service extension cables are 36 in. long, and are available in 15, 9, 6, 3, 2, 1 contact configurations.

A kit of four of the most popular cables (PA-396/PA-496) is also available.

Prices of Molex service extensions range from $5.80 for the 15 contact to $.50 for the 1 contact. The kit prices are $9.95. Telematic Div. of U.X.L. Corp.

MARINE ANTENNA 713

Rotated 360 degrees from inside the boat

A collapsible rotating all channel TV/FM RMA-1 Marine Antenna designed for use on power cruisers, houseboats, sailboats and auxiliaries is introduced.

The unit consists of an all channel, VHF-UHF-FM Color Spectrum Antenna mounted on a telescoping mast and manual motor mechanism. When in use it is telescoped up to 10ft and can be rotated by a full 360 degrees from inside the boat. When not in use the antenna telescopes down and collapses, without disassembly, into a neat package that is covered by a nylon reinforced vinyl cover.

The all weather 75Ω shielded coaxial cable transmission line system reportedly wards off any unwanted noise or distortion from metal boat parts, operating generators or motors. Combined with a 75-300Ω set matching transformer/splitter, the antenna assures fine television reception.

The antenna is easily mounted in minutes with simple tools. Gold Corodizing protects the antenna and all its parts from fresh water and salt water corrosion. Manufacturer's list price: $89.95. Finney.

SOLID-STATE DAMPER TUBE REPLACEMENT 714

Replacing such damper tubes as 6AX4 and 6AU4

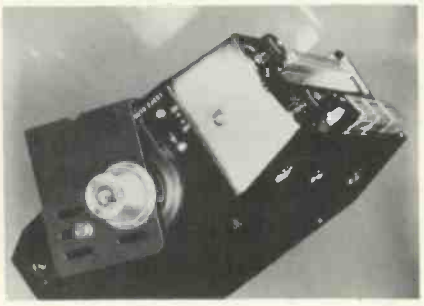
The solid-state, octal based plug-in rectifier updating the set and directly replacing such damper tubes as 6AX4 and 6AU4 is introduced. The rectifier reportedly provides greater voltage at less current than conventional electron tube dampers and generates much less heat. Electrical characteristics, at 15.7kHz, include ratings of 5kv peak inverse voltage at 210ma, with a maximum peak current limit of 1300ma. Expressed with an IF of 20mv and a

recovery to an IR of 200μa, maximum recovery time is 4μs. Maximum ambient temperature rating is 85°C (188°F). The unit is designed for parallel filament circuits only. The Model XP405 rectifier sells for $6.60. Sarkes Tarzian.

ELECTRONIC EQUIPMENT LOCK 715

Free spinning and wrench resistant

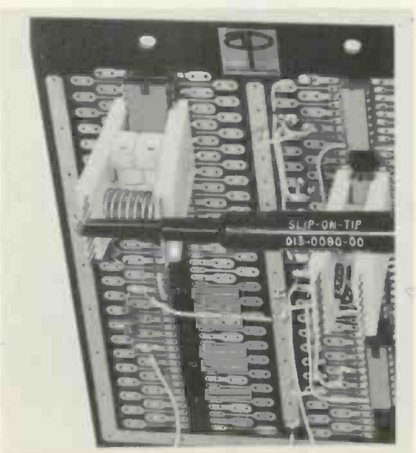
The Model 200 Security Lock is introduced. The lock is a seven-pin tumbler cylinder lock that foils would-be thieves by securing the equipment to the desk, table or panel and cannot be removed without the owner's key. This steel device is both free spinning and wrench resistant and the owner has one of 25,000 key combinations and therefore has the "pick-resistant" quality which the authorities recommend. Priced at $10.95. Bolen.



TEST CLIP 716

Uses gold plated phosphor bronze fingers

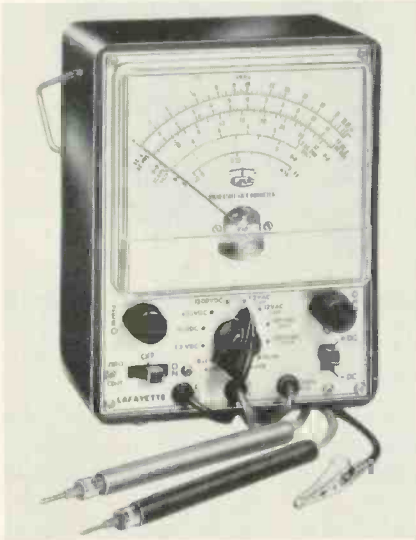
Easy accessibility to hard-to-reach DIP pins is provided by a new IC Test Clip. The clip is ideal for field service work and for lab and production circuit checking, particularly for use with oscilloscope probes. It can also be used for easy damage-free removal of dual in-line packages. A "contact comb" assures positive short-proof positioning of the wiping-action gold plated phosphor bronze fingers with a helical spring to provide the correct contact tension. The new clip fits all dual in-line packages with leads on .5 and .6 in. centers. Price $7.50 in quantities of one to nine. AP Incorporated.



FET VOLT-OHMMETER 717

Meter and transistors are protected against burnout

Introduced is a solid-state FET volt-ohmmeter in both kit and wired form.



The FET VOM features meter and transistors which are protected against burnout. The VOM has 11M input impedance on dc and 1M impedance on ac to reduce circuit loading and a large 4½ in. 200μa meter for accurate readings. Ranges: dc and ac volts: 0-1.2, 12, 120, 1200. P-P ac volts: 0-3.33, 33, 330, 1200. Resistance: 0-1K, 100K, 10M, 1000M. DB: —24 to +56 in 4 ranges. The unit is housed in a high-impact bakelite case with handle. Size: 5¼ x 7 x 2¾ in. Complete with batteries, leads, and complete instructions. Kit stock No. 38-0115; price $29.95. Wired stock No. 38-01164; price $39.95. Lafayette.

TAPE DECK 718

Three motors with automatic reverse

A three-motor, reverse, custom stereo tape deck, Model 650XD, is introduced. Among the features are automatic reverse for 12.8 hours of playback or record, three-speed hysteresis synchronous capstan motor without belt shifting, two 6-pole eddy-current reel motors, automatic shutoff, sound-on-sound, 30 to 23,000 Hz frequency response, slide-pot controls, twin VU meters, Cross Field head which records in the high frequency spectrum, and digit counter with push-button reset. The unit is designed for use with home stereo music systems, and is priced at $399.95. Roberts.

TUNER DEGREASER 719

Warmer and faster cleaning action

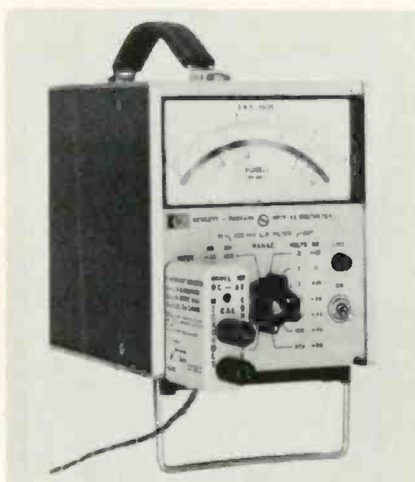
Announced is the development of a degreaser for cleaning and restoring tuner contacts. The tuner spray is said

to be warmer, reducing detuning recovery time, while more powerful in its cleaning action. Called WARM TUN-O-WASH, the new tuner degreaser uses a blend of Freon 12 plus ingredients that reportedly make the spray approximately 25°F warmer than earlier sprays. Contacts and components sprayed with the tuner degreaser reportedly do not frost up and dry more rapidly. The tuner degreaser is available in 24 oz. cans for $3.25. Chemtronics

DC MICROVOLTMETER 720

Transforms any AC millivolt meter into a direct reading DC microvolt meter

Introduced is a low-cost Model 100dc microvolt converter. This instrument will reportedly transform any ac millivolt meter into a direct reading dc microvolt meter with zero drift and one microvolt resolution. One percent accuracy is accomplished by the use of an ultra linear dc to ac converter. Other features are 10M input impedance and auto polarity—no ac millivolt meter modifications are required and sells for $49.50. Electronic Applications.



TEKLAB REPORT . . .

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er. At the same time a 6v regulated control voltage is obtained from pin nine of IC201, which is connected to resistor R155 and R156—providing control voltage for the voltage dependent capacitor in the VHF tuner.

The UHF tuner is also provided with an AFT voltage, which is obtained from terminal four of the IC-201 through resistors R278, R157 and R158.

The circuit configuration of IC-201 is fairly complex and it is not possible to make resistance measurements to determine if the integrated circuit is defected. Any accidental shorting of the integrated-circuit pins can destroy it.

PRODUCTION CHANGES INCORPORATED

The following production change is incorporated in this chassis:

In the AFT circuits, the lead from Pin 9 of IC201 to SW103 has been removed. The leads from Pins 77 and 78 of PC2 to the tuner have been shielded.

TROUBLESHOOTING THE IC

Troubleshooting the integrated circuit is accomplished by checking the terminal voltages with an FET meter or VTVM. In this way, a defective unit can be quickly detected. With the AFT switch in an on position and accurately tuned, the voltages should read as follows:

Terminal		Terminal	
1	+2.5v	6	+2.5v
2	+12v	7	+2.4v
3	+2.5v	8	0v
4	+6v	9	+7v
5	+6v	10	+12v

To identify the terminals of IC-201, count the terminals from the bottom of the circuit board. The lead adjacent to the tab is terminal 10, and the terminal numbers decrease in a counter-clockwise direction.

With AFT defeat switch in the off position, the voltage at VHF tuner terminal "A" will be 9v, while terminal "B" will be 3v. This is due to the voltage divider consisting of resistors R277, R155, R156 and R153, which are connected in series.

It is also important that external checks be made up to the integrated circuit. The 12vdc obtained from the Zener diode, XZ201, should be present at terminal 10 of IC201. The video carrier signal should be present at terminal 7 and the AFT discriminator transformer should be adjusted to 45.75MHz. The discriminator transformer should be adjusted for a symmetrical "S" curve. ■

Next month we will discuss the Automatic Color Control Circuit (ACC), Quick-On Circuit, and various adjustments related to this chassis.

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TEST INSTRUMENTS

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NEW PRODUCTS

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709	710	711	712	713	714	715	716	717
718	719	720	721	722	723	724	725	726
727	728	729	730	731	732	733	734	735

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128	129	130	131	132	133	134	135	136
137	138	139	140	141	142	143	144	145
146	147	148	149	150	151	152	153	154

TEST INSTRUMENTS

900	901	902	903	904	905	906	907	908

NEW PRODUCTS

700	701	702	703	704	705	706	707	708
709	710	711	712	713	714	715	716	717
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727	728	729	730	731	732	733	734	735

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The brilliance of our new color replacement tube is matched only by the sharpness of its pictures

RCA MATRIX

Now it's easier to sell up to the best. RCA has added brightness without sacrificing sharpness!

Here's how and why:

To produce the brightest color picture tube in RCA's history, we developed a new phosphor-dot screening process that incorporates a jet-black matrix. But we didn't stop there. We wanted a tube that could deliver sharp, vivid pictures even in strong room light. So, we added the brilliance of new phosphors and deposited each red, green and blue phosphor-dot within the black matrix. Result: brighter pictures with no loss of contrast. Thanks to the matrix technique, combined with our new high resolution gun and greatly improved phosphors, the Matrix is also the *sharpest* color picture tube in RCA's history. Matrix owners can turn up brightness *without* "turning down" color!

Will your customers see the difference? You bet! What's more, they'll be pre-sold on the difference—every time they see the 1970 big-screen color sets people are talking about! So when they need a replacement tube, satisfy their appetite for brighter, sharper pictures. Give their sets new brilliance and more vividly detailed pictures with RCA Matrix. The Matrix Tube is 100% brighter than any previous color picture tube manufactured by RCA.

For complete details, call your RCA Distributor.

RCA Electronic Components, Harrison, New Jersey

RCA

The RCA 25BCP22 Matrix Tube can directly replace 25XP22, 25BAP22 and also the following types: 25ABP22, 25AFP22, 25ANP22, 25AP22, 25AP22A, 25AQP22, 25BMP22, 25CP22, 25CP22A, 25GP22, 25GP22A, 25SP22, 25WP22, 25XP22/25AP22A and 25ZP22.