ELECTRONIC TECHNICIAN / DEALER

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

JANUARY 1969 A HARBRACE PUBLICATION

FM Stereo Alignment

Solving Color Problems

Technician Incentive

The absolute end of an old fear.

ANNOUNCING: The new B&K Sweep/Marker Generator. Does for TV sets what no other instrument or instruments can do. It makes alignment of color as well as black & white TV sets simpler, easier than ever.

We've remembered all your old fears about TV alignment. Especially color. So now you can forget them.

In the past, a marker generator and a separate sweep generator were used with a marker adder and a bias supply. All four of these now are combined in one easy-to-use instrument.

(We've made benchwork so much simpler by doing away with the need for hooking together a lot of cables and costly instruments.)

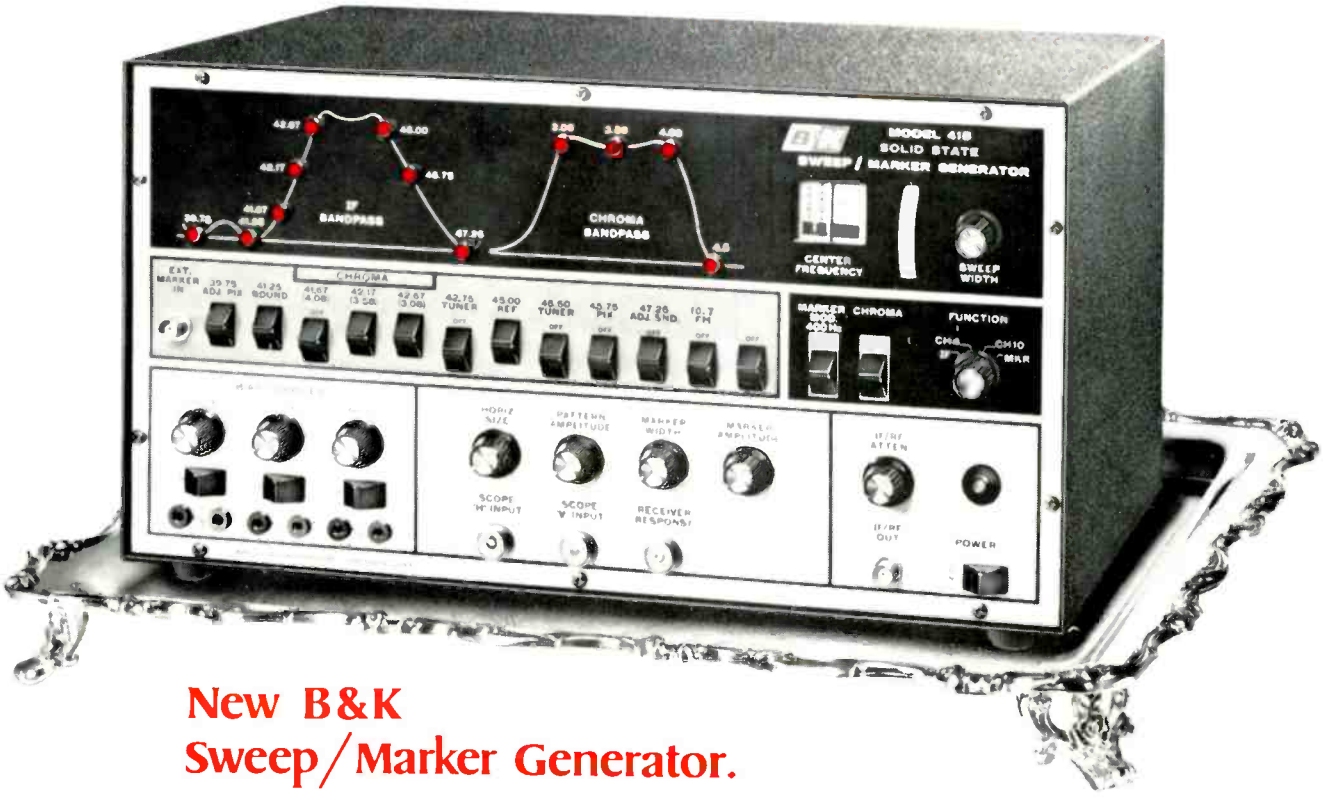
The Sweep/Marker Generator is both an instrument and a guide. As a guide, the bandpass and chroma bandpass curves are visually reproduced and the individual markers are clearly indicated by lights—right on the front panel—for quick, easy reference.

As an instrument, the Sweep/Marker Generator not only generates the marker frequencies (all crystal controlled), but also sweeps the chroma bandpass, TV-IF, and FM-IF frequencies.

See it soon at your B&K distributor or write us for advance information on the product that makes TV alignment procedures of old a fearless operation: simple, fast, accurate. The new Sweep/Marker Generator, Model 415.

B&K

A Division of DYNASCAN CORPORATION
1801 W. Belle Plaine · Chicago, Illinois 60613
Where electronic innovation is a way of life.



New B&K Sweep/Marker Generator.

ELECTRONIC
TECHNICIAN / DEALER

TEKFAX

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

GROUP 197

1199
ADMIRAL
TV Chassis TH3-1A, TH4-1A, T2H4-1A, T3H4-1A, T8H4-1A

JANUARY • 1969

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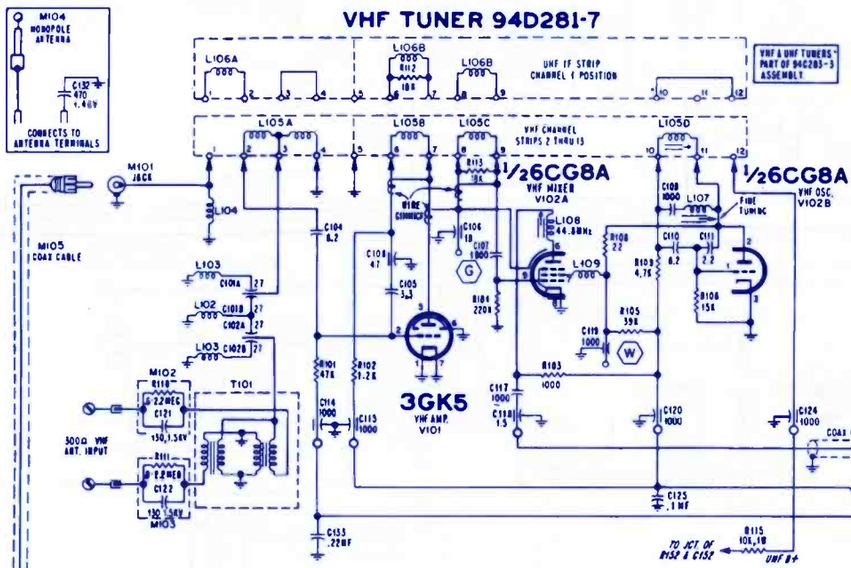
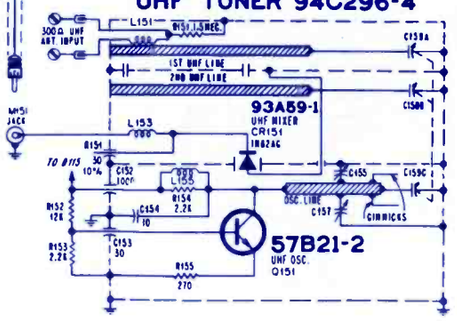
VHF TUNER 94D281-7



UHF TUNER 94C296-4



RUN CHANGES

(10) Start of production.

(11) To improve Horizontal Oscillator reliability (with variation of tubes) connection of R424 was transferred from $B+_2$ to pin 3 of V402B.

SCHEMATIC NOTES:

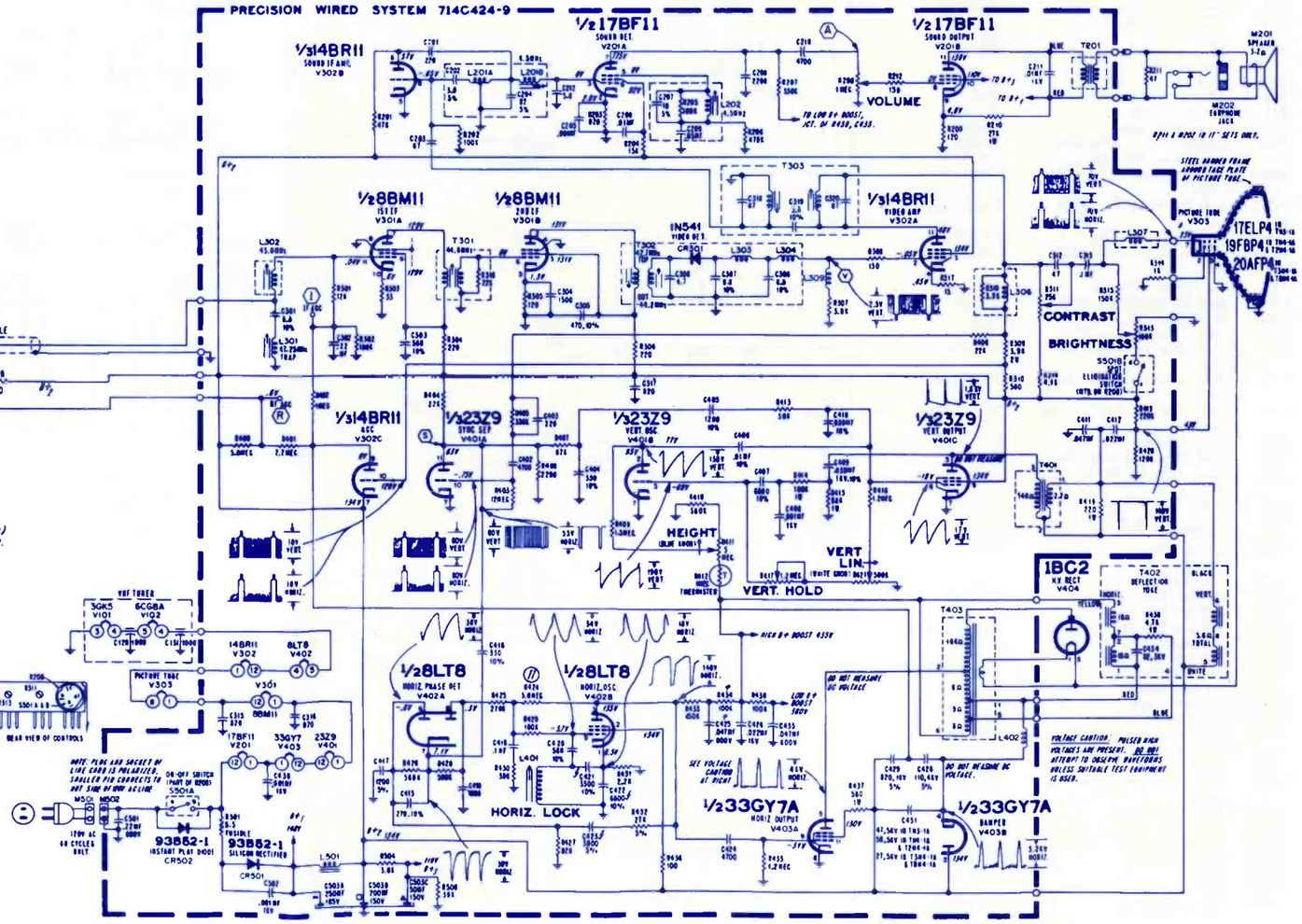
⏚ CHASSIS GROUND.

* PART NOT MOUNTED ON PRECISION WIRED SYSTEM.

+ VOLTAGE WILL VARY WITH SETTING OF CONTROLS. RESISTOR VALUES 1/2 WATT 10%, CAPACITOR VALUES IN MICROFARADS, UNLESS OTHERWISE INDICATED. DC VOLTAGES MEASURED AT 120V AC LINE, NO SIGNAL, MAX. CONTRAST & BRIGHTNESS, & MIN. VOLUME WITH VTVM.

§ COMPONENT MOUNTED AT UNDERSIDE OF PRECISION WIRED SYSTEM.

PRECISION WIRED SYSTEM 714C424-9



1200 MAGNAVOX Color TV Chassis T932

ELECTRONIC TECHNICIAN / DEALER **TEKFAX**

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

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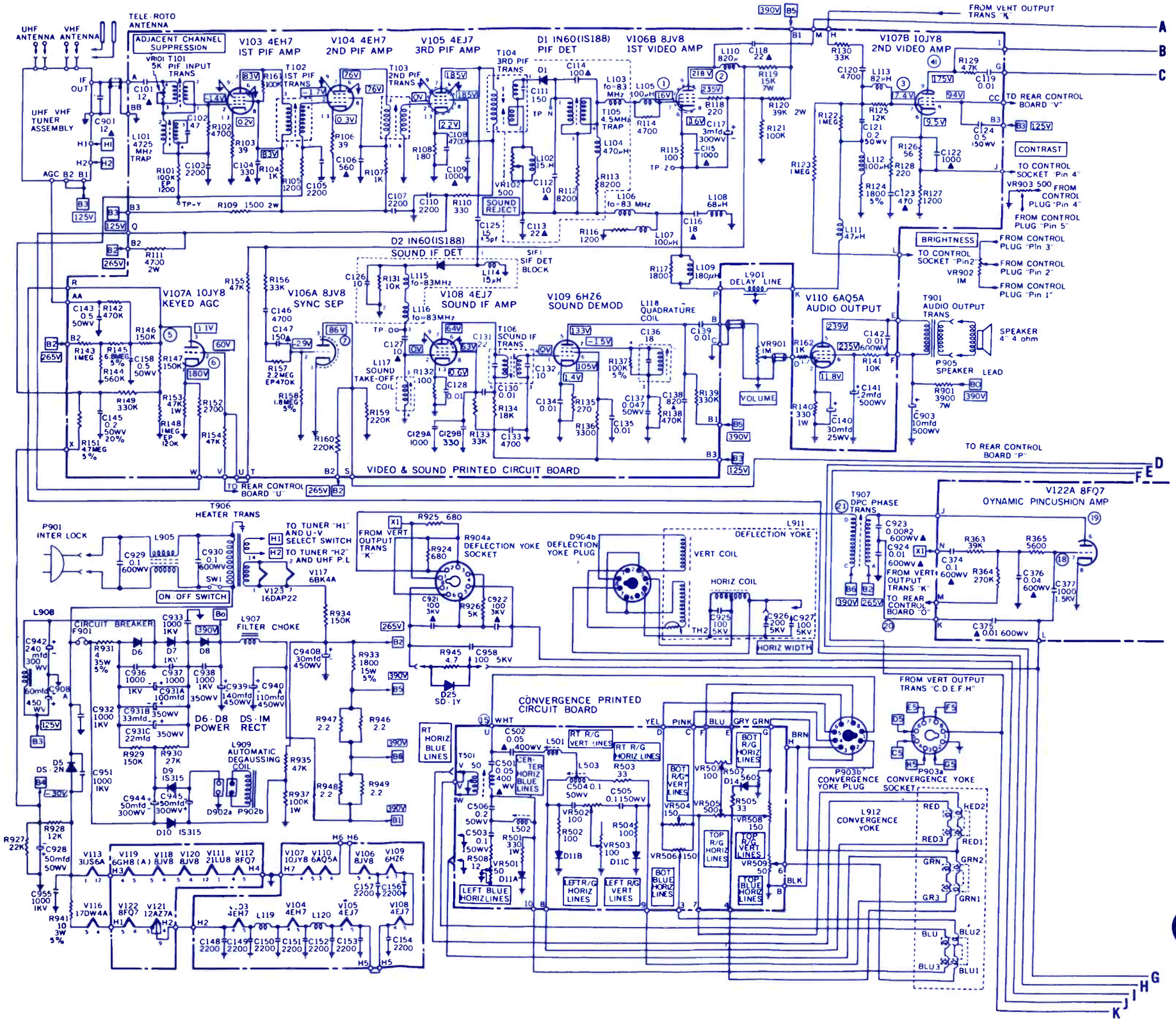
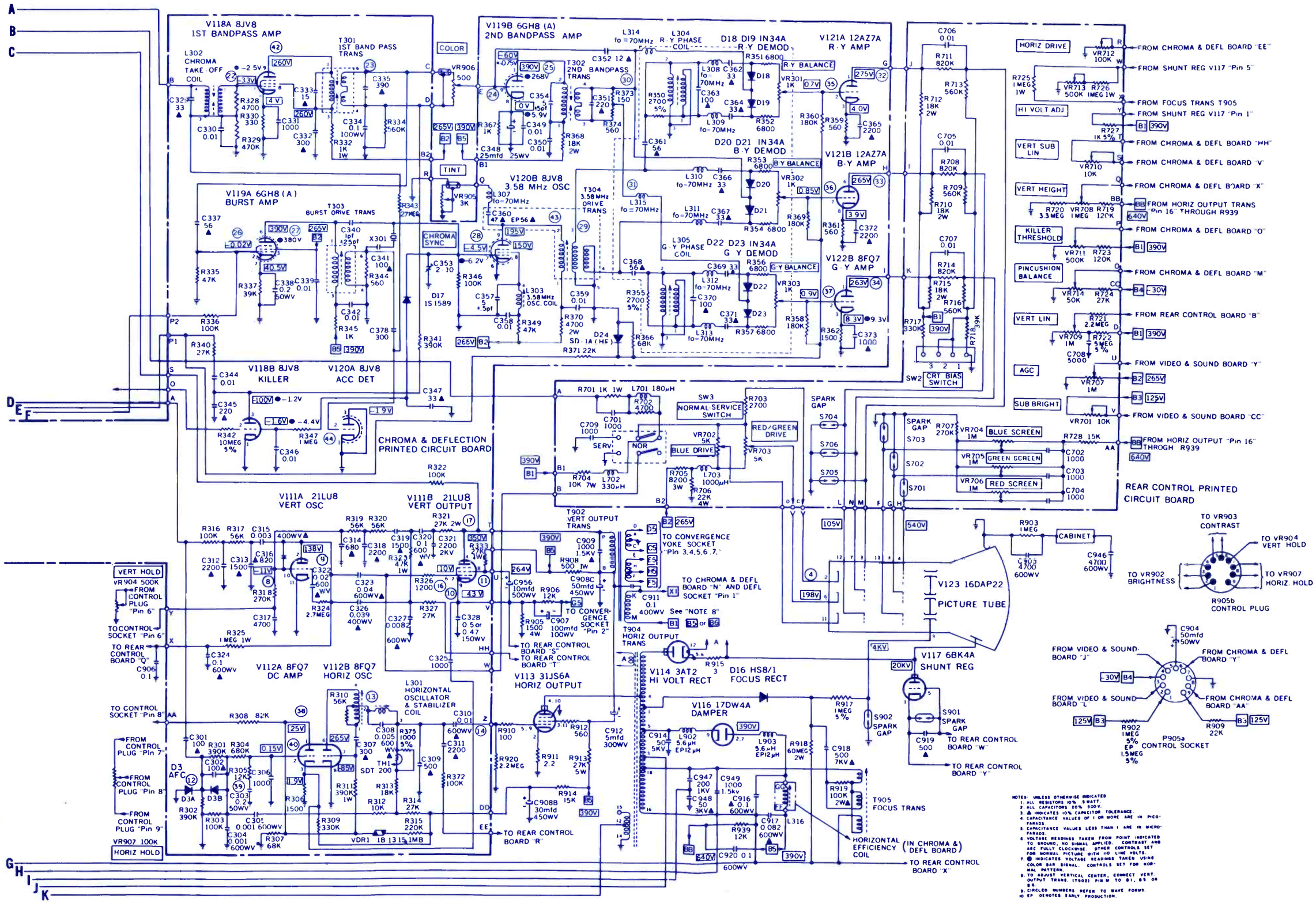
SYMBOL	DESCRIPTION	MAGNAVOX PART NO.
T101	PIF input xformer	36B043-1
T103	2nd PIF xformer	36B043-3
T106	sound IF xformer	36B043-6
T301	1st bandpass xformer	36B043-7
T302	2nd bandpass xformer	36B043-8
T303	burst xformer	36B043-9
T901	audio output xformer	32B011-1
T902	vert output xformer	32B012-1
T904	horiz output xformer	36B045-1
T905	focus xformer	36B043-12
T906	heater xformer	32B013-1
L101	47.25MHz trap	36B044-1
L102	15 µh peaking coil	36B044-2
L103	83MHz filter coil	36B044-3
L108	66 µh peaking coil	36B044-6
L109	180 µh peaking coil	36B044-7
L111	47 µh peaking coil	36B044-9
L112	100 µh peaking coil	36B044-5
L113	82 µh peaking coil	36B044-10
L117	sound-take off coil	36B044-11
L118	quad coil	36B044-12
L119	choke	36B044-13
L301	horiz osc/stabilizer coil	36B044-14
L302	chroma take-off/coil	36B044-15
L304	R-Y phase coil	36B044-17
L305	G-Y phase coil	36B044-17
L310	70MHz filter coil	36B044-18
L318	horiz efficiency coil	36B044-19
L503	right R/G horiz lines coil	36B044-22
L701	180 µh peaking coil	36B044-7
L702	330 µh peaking coil	36B044-23
L703	1000 µh peaking coil	36B044-24
L901	delay line	36B046-1
L903	12 µh peaking coil (early production)	36B044-25
L907	filter coil	32B013-3
L909	automatic degaussing coil	32B013-5
L911	deflection yoke	36B047-1
L912	convergence yoke	36B048-1
C303	lacquer .2µf 20% 50v	25B022-2
C321	cer 2200pf 20% 2kv	25B020-41
C503	metalized paper .1µf GMV 150v	25B024-2
C908A, B, C	elect 60/50/30µf 450v	27B033-10
C918	cer 500pf 10% 7kv	25B020-27
C931A, B, C	elect 100/33/22µf 350v	27B033-13
C932	cer 1000pf 20% 1kv	25B020-36
C939	elect 60/50/30µf 450v	27B033-11
C940	elect 60/50/30µf 450v	27B033-10
C942	elect 200/40µf 300v	27B033-12
R119	15K 10% 7w (metal oxide film)	230192-1539
R120	39K 10% 2w (metal oxide film)	230192-3939
R704	10K 10% 7w (metal oxide film)	230197-1039
R906	12K 10% 5w	230144-75
R918	60M 10% 2w (carbon film)	23B006-18
R919	100K 10% 2w (metal oxide film)	230192-1049
R931	4 5% 35w WW	24B008-3
R933	1.8K 5% 15w WW	24B008-2
R941	10 5% 3w WW	24B008-1
VR101	5K adjacent channel suppression	22B016-1
VR102	500 sound rejection	22B016-2
VR302	3K B-Y balance	22B016-7
VR502	100 left R/G vert lines	22B016-4
VR505	500 top R/G horiz lines	22B016-6
VR508	150 bottom blue horiz lines	22B016-5
VR701	10K cer sub bright	22B016-8
VR702	5K blue drive	22B016-9
VR704	1M blue screen	22B016-10
VR708	1M vert height	22B016-10
VR710	10K cer vert sub lin	22B016-8
VR711	500K cer killer threshold	22B016-11
VR712	100K cer horiz drive	22B016-12
VR713	500K cer HV adj	22B016-11
VR714	50K cer pincushion balance	22B016-13
VR901	1M off-on vol	22B016-14
VR902	1M bright	22B016-15
VR903	500 Ω contrast	22B016-18
VR904	500K vert hold	22B016-17
VR905	3K tint	22B016-18
VR906	500 Ω color	22B016-19
VR907	100K horiz hold	22B016-20
D2	sound detector diode (part of SIF 1 det block)	53B010-1
D3A, B	horiz AFC diode	53B010-2
D5	silicon filament rectifier diode	53B010-3
D6	silicon B+ rectifier diode	53B010-4
D16	silicon focus rectifier diode	53B011-3
D17	color killer diode	53B010-6
D20	B-Y demodulator diode	53B010-7
D24	silicon filter diode	53B010-8
D25	silicon horiz centering diode	53B010-9
X301	3.58MHz crystal	53B009-1
SIF1	sound detector block	36B043-15
TH1	thermistor	23B004-2
VDR1	varistor	23B004-1
SW2	CRT bias switch	16B019-2
SW3	normal service switch	16B019-3
S701	spark gap	18B024-1
F901	circuit breaker	18B023-1
	VHF tuner	34B004-2
	UHF tuner	34B004-1



MAGNAVOX
Color TV Chassis T932



1201
SETCHELL CARLSON
Color TV Chassis
Model U809/U810

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AND TECHNICAL INFORMATION FOR 6 NEW SETS

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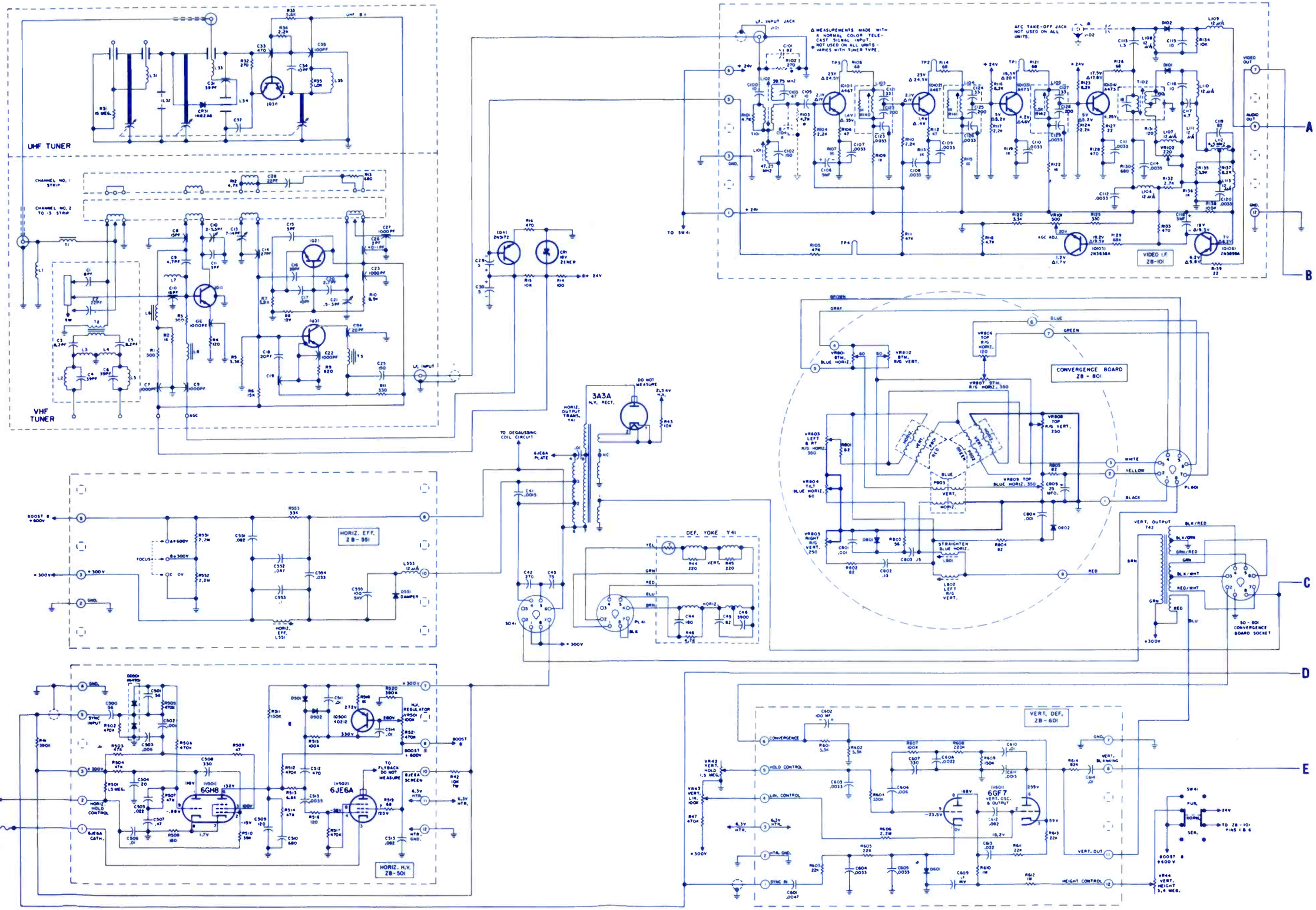
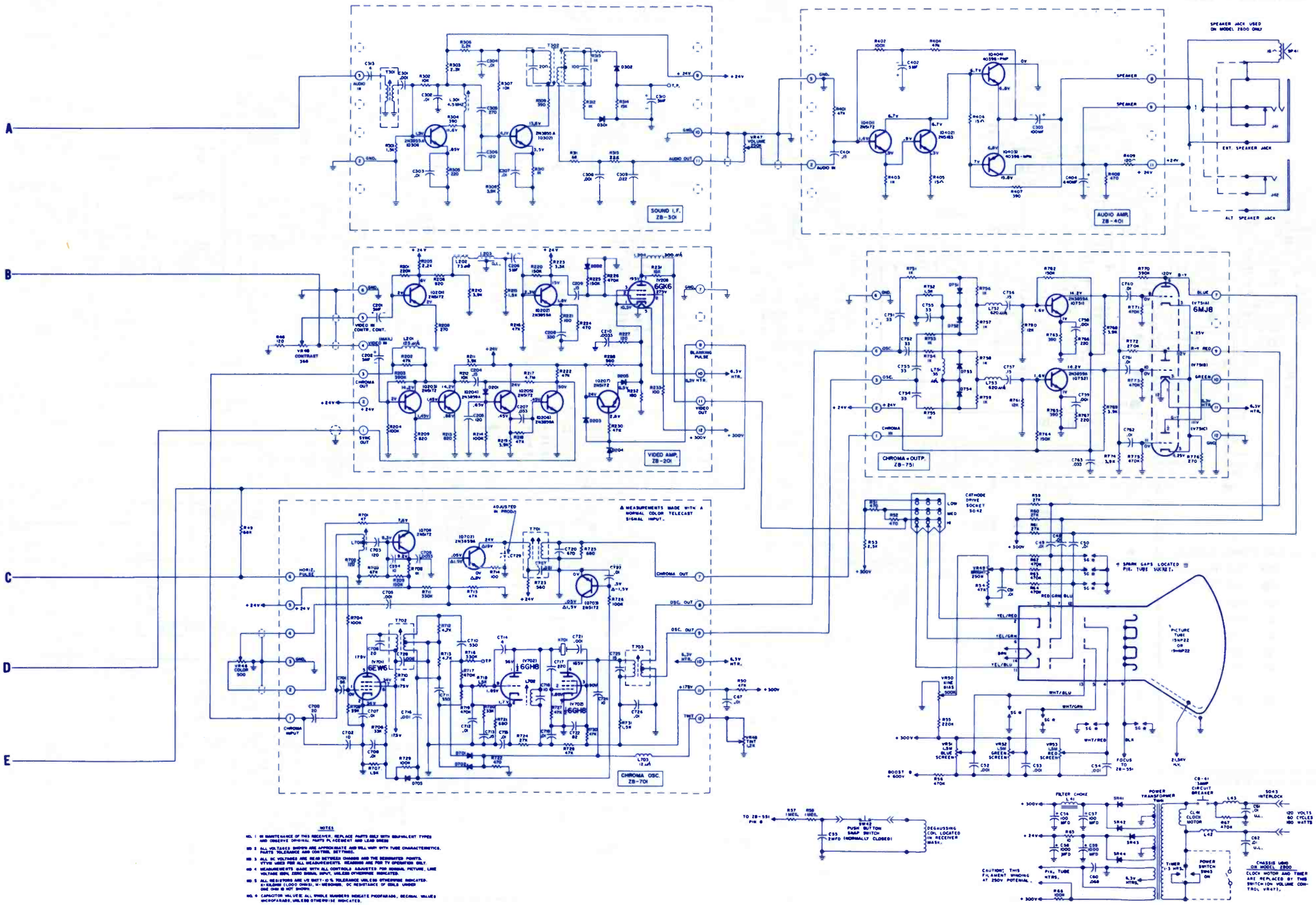


SETCHELL CARLSON
Color TV Chassis Model U809 /U810



NOTES

NO. 1 IN MAINTENANCE OF THIS RECEIVER, REPLACE PARTS ONLY WITH EQUIVALENT TYPES AND OBSERVE ORIGINAL PARTS PLACEMENT AND LEAD DRESS

NO. 2 ALL VOLTAGES SHOWN ARE APPROXIMATE AND WILL VARY WITH TUBE CHARACTERISTICS, PARTS TOLERANCE AND CONTROL SETTINGS.

NO. 3 ALL DC VOLTAGES ARE READ BETWEEN CHASSIS AND THE DESIGNATED POINTS. VTVM IS USED FOR ALL MEASUREMENTS. READINGS ARE FOR TV OPERATION ONLY.

NO. 4 MEASUREMENTS MADE WITH ALL CONTROLS ADJUSTED FOR NORMAL PICTURE, LINE VOLTAGE 120V, ZERO SIGNAL INPUT, UNLESS OTHERWISE INDICATED.

NO. 5 ALL RESISTORS ARE 1/2 WATT ± 10 % TOLERANCE UNLESS OTHERWISE INDICATED. K=KILOHMS (1,000 OHMS), M=MEGOHMS. DC RESISTANCE OF COILS UNDER ONE OHM IS NOT SHOWN.

NO. 6 CAPACITOR VALUES: ALL SINGLE NUMBERS INDICATE MICROFARADS, DECIMAL VALUES MICROFARADS, UNLESS OTHERWISE INDICATED.

1202
AIRLINE
TV Model
GEN-11469A

ELECTRONIC TECHNICIAN / DEALER **TEKFAX**

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

JANUARY • 1969

SYMBOL	DESCRIPTION	AIRLINE PART NO.
C708A,B,C	200μf/200μf/50μf @180v elect	TV32164
R219	500K pot AGC (9V120)	TV25234
R314	1M pot tone (9V149)	TV25235
R315 SW-701	1M pot vol w/on-off switch (9V151UL)	TV25236
R517	1M pot vert hold (9V117)	TV25237
R518	1M pot vert size (9V119)	TV25238
R519	1M pot vert lin (9V119)	TV25238
R628	50K pot horiz hold (9V121)	TV25240
R718	20K pot contrast (8V007)	TV2572
R719	250K pot bright (9V118)	TV25239
L201	coil 47.25MHz trap (2TIF487)	TV62248
L301	coil sound detector (TIF544)	TV62254
L601	coil horiz hold (TL23)	TV61174
T201	xformer 1st pix IF (TIF367)	TV62362
T202	xformer 2nd pix IF (TIF379)	TV62363
T203	xformer pix detector (TL99)	TV62290
T301	xformer sound IF (TIF378)	TV62364
T302	xformer audio output (7T179)	TV11215
T501	xformer vert output (8T192)	TV11216
T601	xformer horiz output (8FT648)	TV11217
T701	xformer sound IF & 4.5MHz trap (2TIF491)	TV62252
T702	xformer power (9T204)	TV11218
M501	capristor (PRC302)	TV3455
	tuner UHF (UT72U2)	TV35158
	tuner VHF (PT6JU2F)	TV35159
Q1	transistor 2SC387 osc	TV24387

UT7-2U2

Q1 2SC684 2SC387

PT6-JU2F UHF OSC. MPS6543 or T1S18

K-UNIT-61

K-UNIT-62

DC-184

PT6-JU2F

12CNP4A

VOLTAGE SYMBOL LEGEND

- 13KV (HIGH VOLTAGE)
- 350V (BOOST)
- 180V
- 145V
- 140V
- 135V
- 110V
- 70V
- 10.5V

DC VOLTAGE MEASUREMENTS ARE AT NO SIGNAL CONDITION.

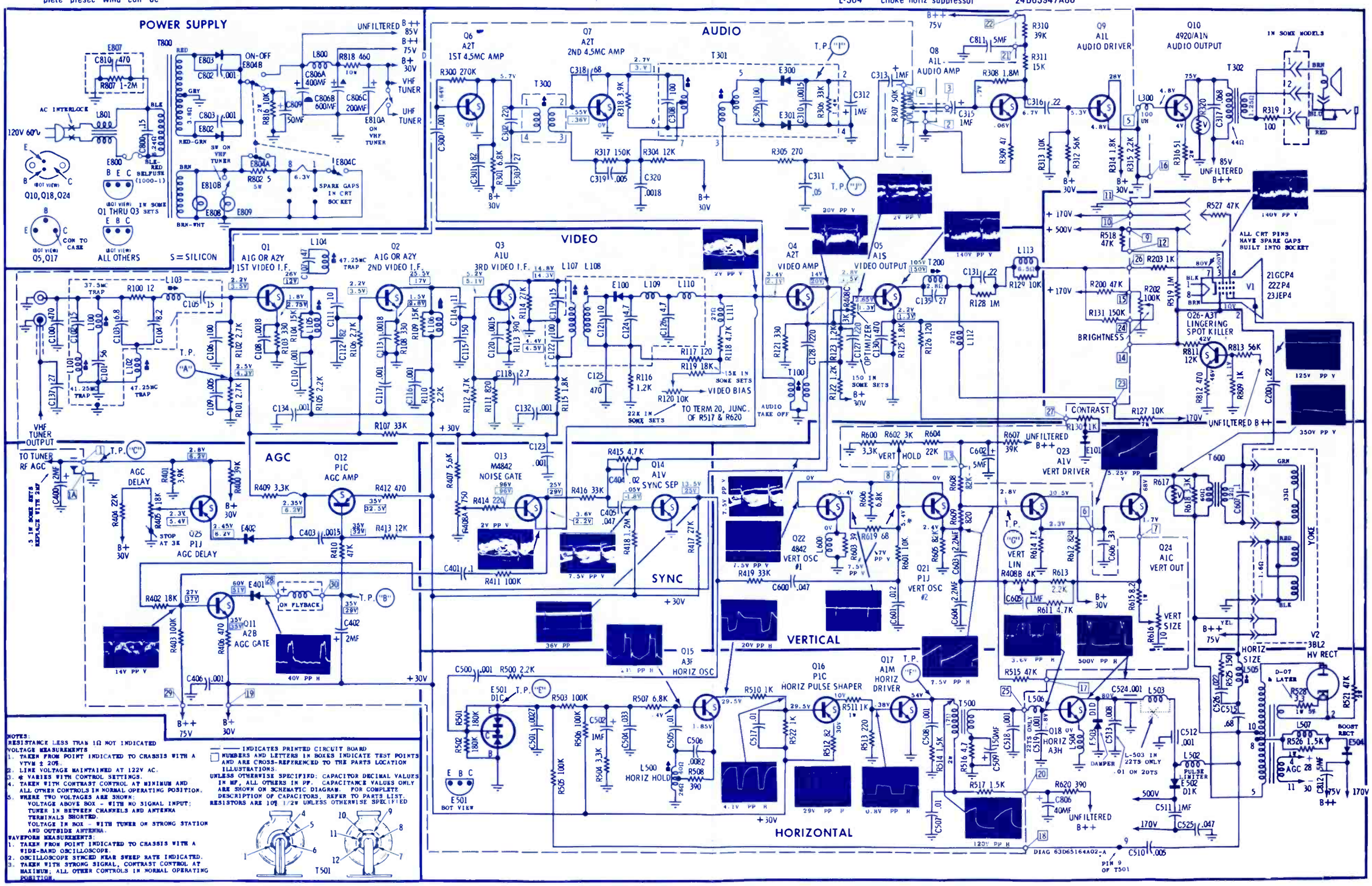
ELECTRONIC TECHNICIAN / DEALER **TEKFAX**

JANUARY • 1969

1203
MOTOROLA
TV Chassis
TS612A

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

SYMBOLS	DESCRIPTION	MOTOROLA PART NO.
L-506	horiz choke	24D6904403
L-507	compensating 1000 μh	24D68002A96
L-700	yoke deflection	24D68523A03
L-800	choke filter	25D67554A12
T-200	4.5MHz trap incls C135	24D68610A14
T-300	4.5MHz rap interstage	24D68822A01
T-301	ratio detector incls E300 E301 C308 C309 C310 R306	24V66550A80
T-302	audio output	25D67552A17
T-500	horiz driver	25D67440A03
	horiz output xformer complete presec wind can be purchased separately 21 & C21TS612	24D68804A07
T-600	vert output	25D65840B23
T-800	power xformer	25D68164A07
R-120	video bias 22K	18D66401A35
R-130	contrast 1K 20 21 & C21TS612	18D67502A14
R-202	bright 100K 20 21 & C2TS612	18D67637A63
	bright 100K 22TS612	18D67637A69
R-307	volume 50K 20 21 & C2TS612	18D67637A02
	volume 50K 22TS612	18D67562A10
R-405	RF AGC delay 18K	18D66401A20
R-408	vert line 4K noise gate 750Ω optimizer 3K	18D67678A05
R-602	vert hold 3K 21 21 & C21TS612	18D67637A64
C-806	400μf /125v 40μf /100v 600 μf /100v 200 μf /50v elect	23C65807A33
C-809	50 μf 150 v elect	23C65808A08
C-811	5 μf 50v elect	23C65282A37
C-812	5 μf 200v elect	23C65808A32
E-401	diode crystal AGC gate	48C67120A02
E-402	diode crystal AGC amp	48C65837A02
E-501	diode dual horiz phase det	48S134917
E-503	diode silicon D1D damper	48S134921
E-807	res - cap	51C67517A01
L-100	37.5 MHz trap incls core	24D67754A20
L-101	41.25 MHz trap incls core	24D67754A23
L-102	47.25 MHz trap incls core	24D67754A22
L-103	1st IF base incls core	24D67754A23
L-104	1st IF & 47.25 MHz trap incls C107 & core	24V68607A31
L-106	2nd IF interstage	24D67754A27
L-109	choke IF resonant 8.8 μh	24D68772A11
L-111	compensating 900μh	24D68002A38
L-300	compensating 100 μh	24D68002A28
L-500	horiz osc incls core	24D68130A03
L-503	choke horiz suppressor 22TS612 only	24D65947A86
L-504	choke horiz suppressor	24D65947A88
L-505	horiz size 20,21, & C21TS612	24D69163A02
	vert hold 3K 22TS612	18D67637A68
R-616	vert size 10Ω	18D68447A02
R-320	varistor audio output	6C66263A16
R-517	1500 10% 3w fixed mtl film	17S1013QB07
R-617	varistor vert	5A10053D60



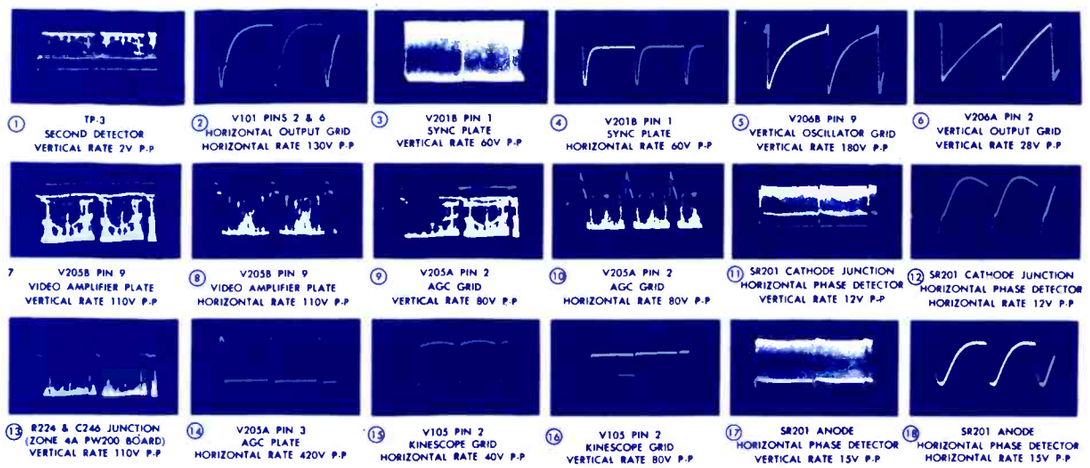
1204
RCA VICTOR
TV Chassis
KCS175 Series

ELECTRONIC TECHNICIAN / DEALER **TEKFAX**

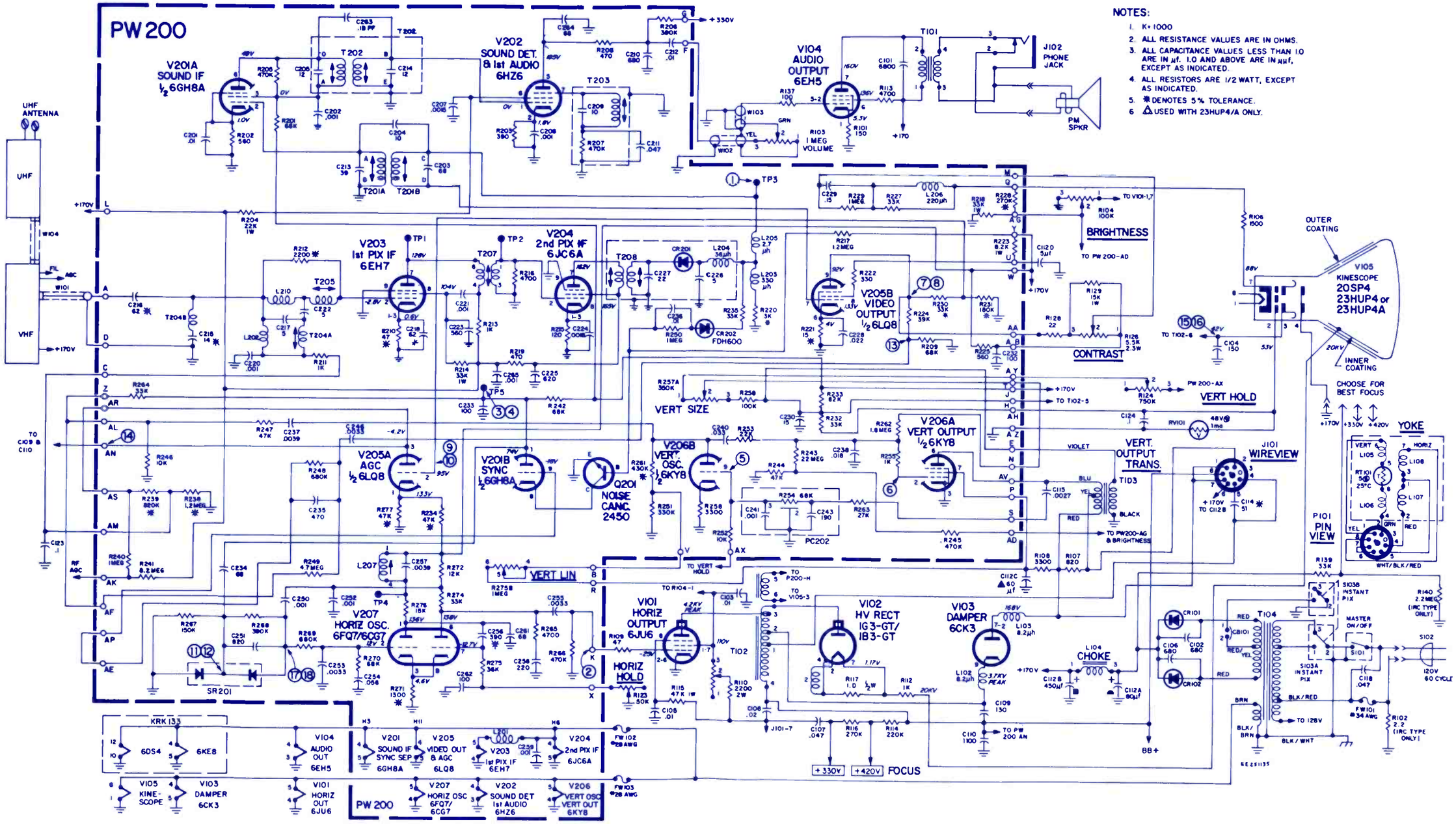
JANUARY • 1969

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

SYMBOLS	DESCRIPTION	RCA VICTOR PART NO.
C112	4 section elect	118401
C112A	80μf 200v	118401
C112B	450μf 200v	118401
C112C	60μf 175v	118401
C112D	5μf 175v	118401
C114	56pf 5% 2000v N1500 cer	119339
C115	0.0027μf 10% 1000v paper	124472
C222	5pf ± .5pf 500v NPO cer	104178
C256	390pf 5% 500v N750 cer	121227
CB101	breaker circuit	118400
CR102	diode 400 PIV 500ma	113998
L102	8.2 μh	107385
L104	choke	115426
L203	330μh	118710
L204	36μh	116056
L206	220 μh	115438
L207	2.7 μh	114486
L210	RF	114314
Q201	transistor 2450	116079
R111	control width	118704
R123	control horiz hold	118724
R124	control vert hold	118405
R126	control contrast	123796
R257	control vert size vert lin	118408
T101	audio output xformer	118409
T102	HV xformer	124463
T103	vert output xformer	118403
T104	power	124460
T201	4.5MHz xformer	114489
T202	sound IF xformer	118411
T203	quad xformer	118410
T207	1st pix IF xformer	109158
T208	2nd pix IF xformer	121779
RV101	varistor 48v 1ma	118506
	yoke deflection	124245



KCS175 CHASSIS VOLTAGE WAVEFORMS



NOTES:
1. K= 1000
2. ALL RESISTANCE VALUES ARE IN OHMS.
3. ALL CAPACITANCE VALUES LESS THAN 10 ARE IN μf. 10 AND ABOVE ARE IN μμf, EXCEPT AS INDICATED.
4. ALL RESISTORS ARE 1/2 WATT, EXCEPT AS INDICATED.
5. * DENOTES 5% TOLERANCE.
6. △ USED WITH 23HUP4/A ONLY.

$9.75

EFFECTIVE 8/1/67

GUARANTEED

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

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

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

"Prefer a replacement? Sarkes Tarzian universal replacements are only $10.45, customized replacements $18.25. Universal replacements shipped same day order received. On customized, we must have original tuners for comparison purposes, also TV make, chassis, and model number. Send orders for universal and customized replacements to Indianapolis."

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

Genuine Sarkes Tarzian universal replacement tuners with Memory Fine Tuning—UHF Plug in for 82-channel sets—Pre-set fine tuning—13-position detent—Hi gain—Lo noise—Universal mounting

FOR FASTEST SERVICE, SEND FAULTY TUNER WITH TV MAKE, CHASSIS, AND MODEL NUMBER, TO TUNER SERVICE CENTER NEAREST YOU

TSC

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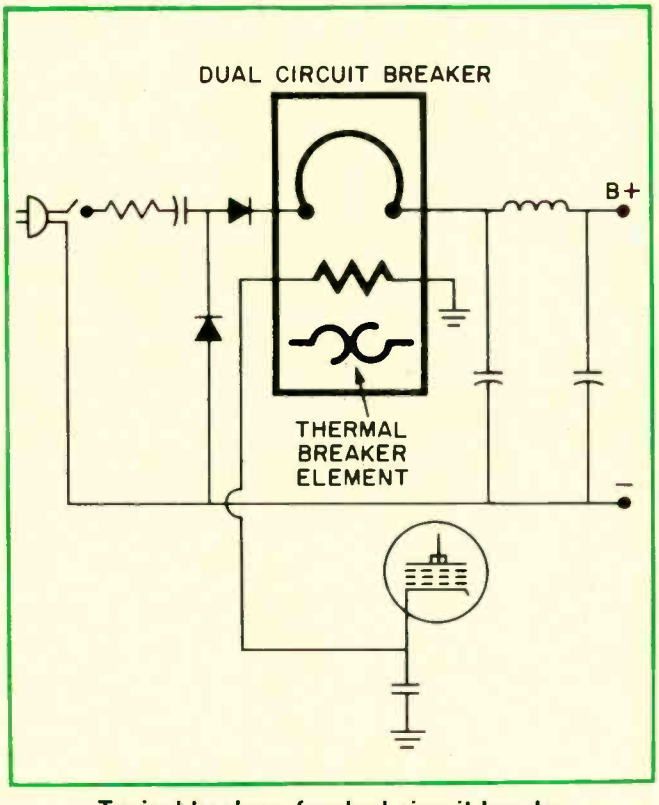
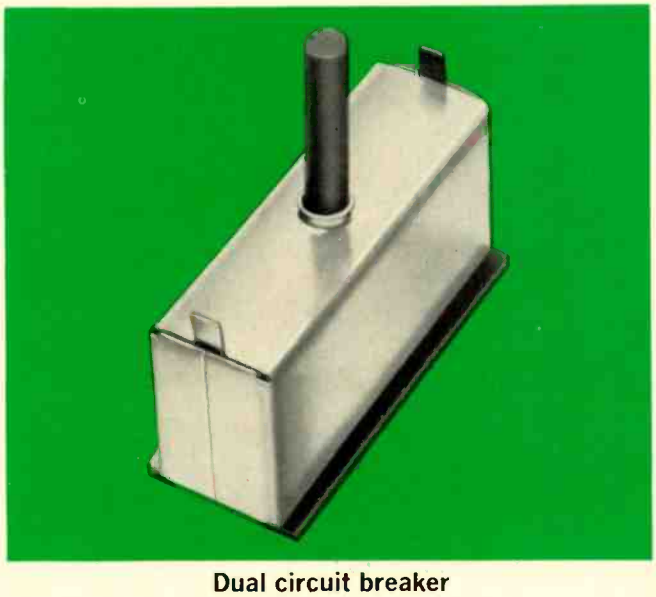
SOUTH-EAST	938 GORDON ST., S. W. Atlanta, Georgia	TEL: 404-758-2232
WEST	SARKES TARZIAN, Inc. TUNER SERVICE DIVISION 10654 MAGNOLIA BLVD., North Hollywood, California	TEL: 213-769-2720

New circuit breakers for color TV



Typical hook-up for dual circuit breaker



Dual circuit breaker

Practically all the new color TV sets have a new kind of dual circuit breaker in them which you may not have run into before. Here's the story.

Remember back when black-and-white television used two fuses—one in the power supply input, and one in the horizontal output circuit? Next, in the interest of economy, the fuse in the horizontal output was eliminated. Then the designers switched to re-settable breakers, in the B+ line.

Along came color. Overload protection became necessary, because the horizontal circuits are more complicated, and more expensive components including the flyback transformer could be knocked out by a defect in the horizontal circuit.

The answer: a dual breaker which pops out from excess current in *either* the B+ or the horizontal output . . . in a single breaker case. It has two electrically isolated but thermally connected circuits, either of which can cause the B+ contacts to open.

The diagram shows a basic hook-up for the breaker. The thermal breaker element goes directly in the B+ line. A resistor inside the breaker, usually about 1.3 ohms, is connected between the cathode of the horizontal output stage and ground. This resistor is located so it will heat up the thermal breaker element.

Along comes an overload in the B+. The thermal element pops the contacts open, in the usual manner. When there's excessive current in the horizontal output, the heating of the breaker's resistor has the same effect as a B+ overload, opening the contacts and removing voltage from the circuit.

Tip No. 1: breakers can fail because they get repeatedly reset into a fault. Check for gassy tubes and leaky capacitors before you replace the breaker, or you'll have the whole job to do over.

Tip No. 2: always replace with a Mallory breaker. We have three different dual breaker ratings in our line. They will replace the dual breakers in all existing color set applications. All are made to original equipment specifications. Your nearby Mallory distributor can supply you off the shelf. See him soon, or write to Mallory Distributor Products Company, a division of P. R. Mallory & Co. Inc., Indianapolis, Indiana 46206.

REMEMBER TO ASK—*"What else needs fixing?"*

ELECTRONIC TECHNICIAN / DEALER

JANUARY 1969 • VOL 89 No. 1

COVER
This month's cover depicts the widespread use of Citizen's Band radio which has found popularity among people of all ages.

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ADMIRAL: TV Chassis TH3-1A, TH4-1A, T2H4-1A, T3H4-1A, T8H4-1A
AIRLINE: TV Model GEN-11469A
MAGNAVOX: Color TV Chassis T932
MOTOROLA: TV Chassis TS612A
RCA VICTOR: TV Chassis KCS175 Series
SETCHELL CARLSON: Color TV Chassis Model U809/U810

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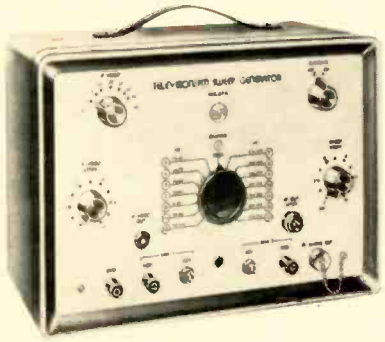
generate

The RCA WR-50B RF Signal Generator with sweep features is versatile, portable, and exceptionally well suited for alignment and signal tracing of AM, FM, hi-fi and citizen's band receivers and trouble-shooting in nearly all sections of TV receivers. IT'S ONLY $65.00.* Also available in an easy to assemble kit, WR-50B(K).

The RCA WA-504A Transistorized Sine/Square Wave Audio Signal Generator covers a frequency range from 20 Hz to 200,000 Hz with exceptional frequency stability. For use in audio, hi-fi and general electronics applications, as well as in electronics training, demonstrations and lab work. ONLY $95.00*



The RCA WR-69A Television/FM Sweep Generator is designed for lab, service, and production applications for sweep-frequency alignment of color and black and white TV receivers and broadcast FM receivers. It's also used to align VHF tuners, picture-and-sound IF amplifiers, video amplifiers and chrominance circuitry in color TV receivers. AND IT'S ONLY $295.00.*

The RCA WP-700A and WP-702A Power Supplies are extremely reliable, solid-state, constant voltage DC power supplies that provide 0 to 20 volts dc at current levels up to 200mA. WP-702A is actually identical to WP-700A, except it is a dual unit with two complete power supply sections. WP-700A IS ONLY $40.00* in quantities over five, and WP-702A IS ONLY $73.00* in quantities over five. Prices on less than five units are $48.00* and $87.00* respectively.

The RCA WR-70A RF/IF/VF Marker Adder is designed for use with conventional markers and sweep generators such as the RCA WR-39, WR-89 and WR-99 series calibrators and the WR-59 and WR-69 series sweep generators to produce clean, narrow markers on the sweep-response curve on an oscilloscope. AND IT'S ONLY $96.00.*

The RCA WR-99A Crystal-Calibrated Marker Generator combines in one compact, accurate, and stable instrument the functions of a multiple-marker generator, crystal calibrator and a heterodyne frequency meter. Ideal for servicing and aligning color and black and white TV receivers, communications and other equipment in the frequency range of 19 to 260 MHz ONLY $256.50.*

*Optional Distributor resale price.

For a complete catalog of descriptions and specifications for all RCA test equipment see your RCA Test Equipment distributor or write RCA Electronic Components, Commercial Engineering, Department No. A-46WA , Harrison, N. J. 07029.

LOOK TO RCA FOR INSTRUMENTS TO TEST/MEASURE/VIEW/MONITOR/GENERATE

RCA

color

The RCA WT-509A Picture Tube Tester is a precision instrument in the famous RCA tradition. It tests both color and black and white picture tubes for emission quality, interelectrode leakage, and shorted elements. It's all solid-state AND IT'S ONLY $118.00.*

The RCA WR-64B Color-Bar/Dot/Crosshatch Generator has for years been the finest instrument of its type. Exceptionally stable, portable, it's a precision instrument designed for use in the laboratory and factory as well as for servicing on-the-bench and in-the-home. AND IT'S ONLY $129.00.*

The RCA WR-502A "CHRO-BAR" color-bar generator has even more features than the famous WR-64B. It's all solid-state, battery operated. It provides color bars, dots, crosshatch, vertical lines, horizontal lines, blank raster. It has rock-solid stability. All new circuit design. THE "CHRO-BAR" IS ONLY $168.00.*

*Optional Distributor resale price.

For a complete catalog of descriptions and specifications for all RCA test equipment see your RCA Test Equipment distributor or write RCA Electronic Components, Commercial Engineering, Department No. A-46W, Harrison, N.J. 07029.

LOOK TO RCA FOR INSTRUMENTS TO TEST/MEASURE/VIEW/MONITOR/GENERATE

RCA

. . . for more details circle 127 on postcard

ET/D EDITOR'S MEMO

Don't Knock 'Em

As a technician or dealer facing the public, you represent not just your own shop, but the entire industry. Let's face it. If a customer gets stung by an unreliable service shop, who gets the blame? Just that particular man or shop? No! The whole industry gets a black eye. Suddenly, every TV shop in town is "crooked." Our industry doesn't need that kind of customer relations!

This situation is just an example—not uncommon and not impossible. It could happen to a reliable service-dealer with insufficient manpower. It could happen to an experienced technician who receives a defective supply of parts—or no supply at all.

You would be insulting the intelligence of your customer if you expected him to believe that your product or service is foolproof and completely flawless. Be honest. Not all of your customers are going to be 100 percent satisfied. But there are steps you can take to raise the percentage from what it is.

Most of you have heard of NATESA, TESA, TSA OR NEA. These are organizations devoted to the technician and dealer businesses. Their aim is to promote better communications between you, the manufacturer, reps, distributors and the customer. We aren't selling memberships in these organizations. If you don't care to have anything to do with them, that's your business. And that's just what you should care about—your business.

Part of that business—the part that makes money—depends on how well you do your job. It also depends on how the customer views your shop and those of your competition. Maybe you don't care about joining a large electronic association, but why not try communicating on a local level with other dealers and technicians? Learn what their problems are and tell them yours. Chances are that they will be similar and perhaps together you can iron out a few of the weak spots. Remember, even animals have enough sense to know there is safety in numbers. Communicate.

Paul L. Dressler

You can earn more money if you get a Government FCC License

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NOT SATISFIED with your present income? The most practical thing you can do about it is add to your Electronics know-how, pass the FCC exam and get your Government License.

The demand for licensed men is enormous. Today there are over a million licensed broadcast installations and mobile transmitters on the air, and the number is growing constantly. And according to Federal Law, no one is permitted to operate or service such equipment without a Government FCC License or without being under the direct supervision of a licensed operator.

This has resulted in a gold mine of new business for licensed service technicians. A typical mobile radio service contract pays an average of about $100 a month. It's possible for one trained technician to maintain eight to ten such mobile systems. Some men cover as many as fifteen systems, each with perhaps a dozen units.

Opportunities in Plants

And there are other exciting opportunities in the aerospace industry, electronics manufacturing, telephone companies, and plants operated by electronic automation. Inside industrial plants like these, it's the licensed technician who is always considered first for promotion and in-plant training programs. The reason is simple. Passing the Federal Government's FCC exam and getting your License is widely accepted proof that you know the fundamentals of Electronics.

So why doesn't everybody who "tinkers" with electronic components get an FCC License and start cleaning up?

The answer: it's not that simple. The Government's licensing exam is tough. In fact, an average of two out of every three men who take the FCC exam fail.

There is one way, however, of being pretty certain that you will pass the FCC exam. That's to take one of the FCC home study courses offered by the Cleveland Institute of Electronics.

CIE courses are so effective that better than 9 out of every 10 CIE graduates who take the exam pass it. That's why we can afford to back our courses with the iron-clad Warranty shown above: you get your FCC License or your money back.

Mail Coupon for Two Free Books

Want to know more? Send the coupon below for free copies of our school catalog, "How To Succeed In Electronics," describing opportunities in Electronics, together with our special booklet, "How To Get A Commercial FCC License." If coupon has been removed, just send your name and address to us.

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Thomas E. Miller, Jr., Engineer, Indiana Bell Telephone Company: "I completed my CIE course and passed my FCC exam while in the Navy. On my discharge, I was swamped with job offers from all over the country. My only problem was to pick the best one, and I did—engineer with Indiana Bell Telephone. CIE made the difference between just a job and a management position."

CIE Cleveland Institute of Electronics
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1776 E. 17th St., Cleveland, Ohio 44114

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1. Your 40-page book "How To Succeed In Electronics" describing the job opportunities in Electronics today and how your courses can prepare me for them.
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ET/D LETTERS TO THE EDITOR

Have Old Amps

I've been in the electronic business for 42 years. I read with interest the Letters to the Editor each month and find a great deal of useful information in ELECTRONIC TECHNICIAN/DEALER.

However, I have never heard anyone refer to a Langevin audio amplifier and so my letter to you. I have two Langevin Model 122 amplifiers—probably about 8w output. When the manufacturer moved, he disposed of all the information on these old units. Do you suppose that someone among your readers would have a schematic on this amplifier? If so, I would much appreciate a copy of it.

EDWARD SCRIBNER
311 Main St.
Schoharie, N.Y.

Electronic Technician/Dealer Misnamed

I have finished reading letters to the editor in the November 1968 issue of Electronic Technician / Dealer and I have to agree with Mr. Davis. I have been a subscriber to ELECTRONIC TECHNICIAN/DEALER for about three years. When I first received ads to subscribe to your magazine, I was informed that all fields of electronics would be covered.

To me the name Electronic Technician doesn't mean TV repairman. It seems that a magazine with that name would be more in the industrial field. TV Repairman/Dealer would be a more honest name than ELECTRONIC TECHNICIAN/DEALER for your magazine.

I have found that to keep current in all phases of electronics, you have to subscribe to several magazines in different fields because no single magazine covers everything. I like ELECTRONIC TECHNICIAN/DEALER though, and will probably continue to subscribe because it covers things other magazines don't. I wish you continued success.

JOHN J. PODPECHAN
Claremore, Okla.

Miscellaneous Schematics and Parts Wanted

Sometime ago I acquired an old Dumont scope, Model 304A. It needs repair and the circuit is completely unfamiliar to me. I have written the company twice and received no answer.

I wonder if you may have one in your files. If not, perhaps you can give me a reference where it might be obtained.

PAUL A. KRAGER
Rochester, Minn. 48063

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P.S. You can boost your business 7½% by participating in EIA's "What else needs fixing?" program. Ask your distributor or write to us for details.

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ET/D LETTERS TO THE EDITOR

I have a geiger counter, Model 1953 Detectron DG-2. It was made by a company in California and distributed by the Radiac Co. in the East. Unfortunately, I am unable to obtain a schematic from the Radiac Co.

I would appreciate your help in obtaining a schematic so I can repair the unit.

JOHN S. JACKSON
61 Woodchuck Hollow Rd.
Huntington, N.Y. 11743

I own a TEC Transistor stereo amplifier, Model S15 manufactured by Transi-Tronic, Inc. It is now out of business and I need an audio output transformer, part number P-43-ATC133. Maybe one of your readers can help me locate one.

JOSEPH GAYLIARDO
128 Clinton Ave.
Brooklyn, N.Y. 11205

I have a Superior Model 83-A CRT tester and a Superior Model 85 dynamic tube tester. However, I do not have instructions for them. I tried writing to Superior Instrument Co., but it seems to have liquidated and cannot supply the data I need.

The testers are useless without the instructions and I thought perhaps one of your readers might be able to help me.

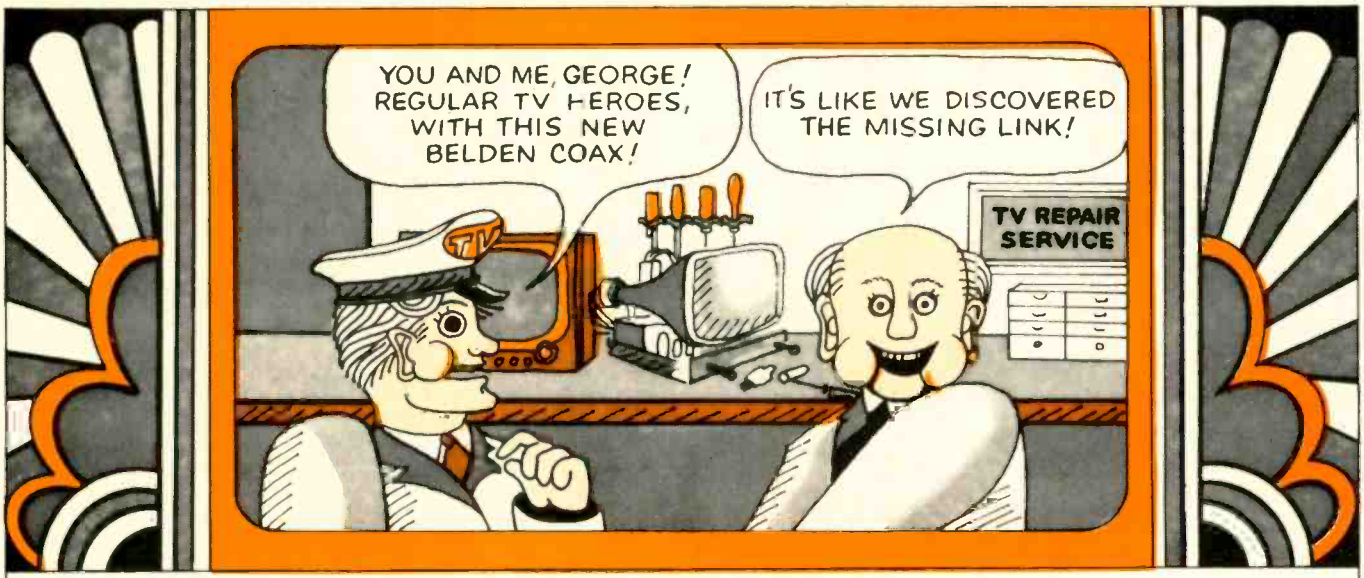
IRVING KOHN
300 Valley St.
Sausalito, Calif. 94965

We have a nice Philco color TV set that is old, but worked fine until the damper tube went out. We tried to obtain a replacement at the Philco parts house with a "no longer available" reply. Maybe one of your readers can help us get one. It is a 6M3 tube.

GRAVELY TV
977 Sebastopol Rd.
Santa Rosa, Calif. 95401

Could a fellow subscriber help me obtain information on the following units: Schematic for a Midgetscope Model 533 M made by Radio City Products Co.; schematic, power supply requirements and frequency coverage for an Abbott Instrument Model DK-3 Ultra Short Wave Transceiver.

KEN REUBEN
P.O. Box 142
Wallingford, Conn. 06492



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Black all-weather PVC .030 nominal wall with a .242" nominal O.D.

Dielectric
Low loss cellular polyethylene, .180" nominal O.D.

Conductor
18 AWG solid, annealed, bare copper.

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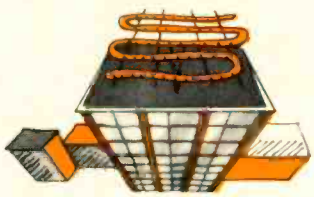

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100	2.1
200	3.1
300	3.8
400	4.5
500	5.0
600	5.5
700	6.0
800	6.5
900	6.9

Available in 100, 500 and 1000 ft. spools. See your local Belden Distributor for full details or to order. For a copy of the reprint article, "Electronic Cable," write: Belden Corporation, P.O. Box 5070-A, Chicago, Illinois 60680.

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

BELDEN

8-5-8

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ET/D BOOK REVIEWS

WORKING WITH THE OSCILLOSCOPE. *By Albert C. W. Saunders. Published by TAB Books. 104 pages, soft cover. $4.95.*

The first part of the book is a somewhat basic introduction to oscilloscope theory and works into usage of the scope in the "projects" section.

The book is 8½ x 11 in. with large, easy-to-read diagrams and drawings on almost every page. The text starts with several short lessons describing the theory of the oscilloscope, methods of obtaining patterns and time base circuits. Following this are about 27 scope "projects" aimed at giving the reader a practical demonstration of the use of a scope for various measurements. These applications include many useful "projects" such as measuring phase shift with lissajous patterns, measuring amplifier frequency response, checking transistor characteristics, checking bandpass amplifiers in color receivers and many other color TV service techniques.

The last pages of this book go into waveform analysis showing actual waveform photos with an explanation of the display and how it's used.

The book is well done in bold, easy-to-read type and should be of value to the technician wanting to learn more about his oscilloscope and its application in servicing modern equipment.

101 QUESTIONS AND ANSWERS ABOUT CATV AND MATV. *By Robert E. and Theodore B. Baum. Publisher, Howard W. Sams & Co. 96 pages, 5½ x 8½ in. $2.50. ($3.15 in Canada).*

This book explains the application of CATV and MATV. It goes into detail about systems used in schools, public safety, industry and home entertainment. The information is to the point and outlines typical installations in apartment buildings, hotels and motels. There are six parts to the book which carries system explanations from basics through future needs.

This book is well written and illustrated. It should be a handy source of information to the television technician and dealer working with CATV-MATV installations or considering these systems as part of future business.

PRACTICAL CB RADIO SERVICING. *By R. R. Freeland and Leo Sands, Published by Hayden Book Co. 192 pages, 6x9 soft paperbound $4.25.*

This book is written for the technician who needs a complete CB troubleshooting and repair guide. It is also of value to the CB user because it contains many step-by-step service procedures in chart form which he can follow to repair his own equipment within legal limits. The book is unique because it is so well detailed in each of the 12 chapters, that each chapter stands by itself. You don't have to hop around to get the full story. It gives full coverage to the receiver and transmitter circuitry and is written to be understood. It also covers power supplies, noise, TV interference and is comprehensively illustrated throughout. Any CB user, technician or student will find this book an indispensible reference source.

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The versatile "go everywhere" EICO 385 solid state color generator, packaged in an exclusive compact portable/storage case, has been designed to furnish the service technician with five essential functions. The generated patterns are the standard offset carrier-type 10 color bars, precision dots, crosshatch, and an individual series of vertical and horizontal lines.

Advanced computer-type circuitry, coupled with three temperature compensated crystals, provides the drift-free stability inherent in this instrument. A multipurpose color-coded gun killer with its convenient socket-adaptor assembly, (no more fumbling) stores in the case. Clips directly to TV antenna terminals (fast & sure!).

The EICO 385 is powered by six long-life "C" cells or the AC adaptor accessory. The economical package contains all you need to enable you to do a fast yet reliable job.

Easy-to-assemble Kit: $79.95
Wired: $109.95

EICO's complete Color TV Lab for the pro

Praised by the pros for laboratory precision at lowest cost

Model 369 Sweep/Marker Generator. For easiest, fastest visual alignment of color or b/w TV and FM RF and IF circuits. Five sweep ranges from 3-220 MHz. Four marker ranges from 2-225 MHz. Crystal marker oscillator. Post injection of markers. **$99.95 Kit, $149.95 wired.**

Model 435 Direct-Coupled Wideband Scope. Top-quality DC-4.5 MHz scope with 3" flat-face. CRT Zener calibrator: Outperforms 5" scopes, facilitates on-location color TV and other servicing. **$119.95 Kit, $169.95 wired.**

New Model 235 Professional VTVM. Designed especially for solid-state servicing. Accurate to as little as 0.01 volts on its ½-volt scale. RMS/p-p/DS/ohms in 7 overlapping ranges. Big six-inch meter, 200 ua movement. **$49.95 Kit, $69.95 wired.**

NEW EICO 633 Portable All-Solid-State CRT Tester and Rejuvenator. Rapidly tests and rejuvenates color as well as black and white picture tubes. Line adjustment control, 12 different filament voltages, individual voltages applied to two of the grids, accurate meter — all insure precise measurements. Continuity and leakage checked through transistorized VOM, read directly on meter. **$69.95 Kit, $99.95 wired.**

NEW EICO 635 Deluxe All-Purpose Portable Tube Tester. Thoroughly professional, full-range modern versatility. Tests all standard tubes and even the new decals, magnovals, 7-pin nuvistors, and popular TV picture tubes. "Take-it-anywhere" design expressed in a modern, rugged, scuff-proof, luggage case. Compact (4"H, 12½"W, 9"D) and lightweight, 4½ lbs. Quick, accurate, dependable and the price is modest. **$44.95 Kit, $69.95 wired.**

NEW EICO PSI-1 Solid-State Signal Injector Probe. Perfect for on-the-spot signal tracing in the field. Pen-size, self-powered, self-contained signal generator from 1,000 Hz with harmonics to 30 MHz. Ideal for trouble-shooting audio, IF & RF circuitry in any electronic equipment, transistorized or vacuum tube. Use it once — you'll never want to be without it! **$5.95 Kit, $9.95 wired.**

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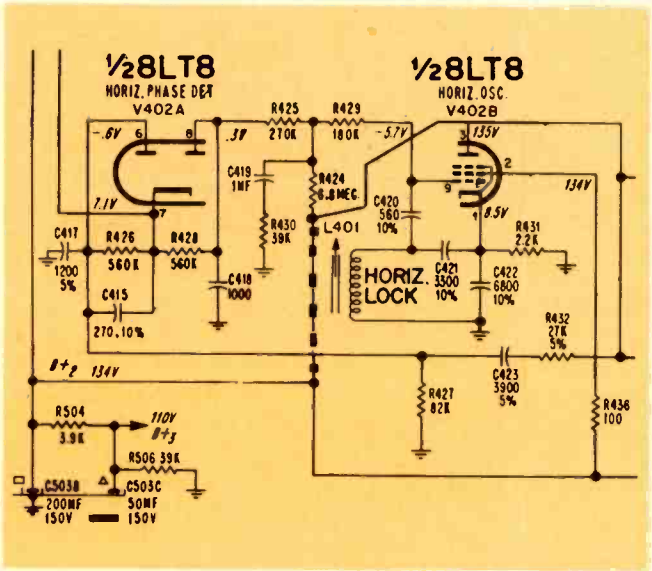
ET/D TECHNICAL DIGEST

ADMIRAL

TV Chassis H2, H3, H4, – Slow Starting Horizontal Oscillators

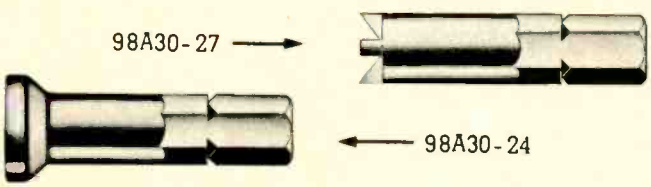
A number of 94D17-19 horizontal oscillator coils which have been returned as defective actually tested good. Investigation disclosed that these coils had been replaced in H1, H2, H3 and H4 chassis to cure slow-starting or intermittent horizontal oscillators. We suggest that you merely move the



end of R424, which is now connected to B+ 2, to the plate of V402B, the oscillator. This modification will provide more starting current. This revision has been made in production.

Special Tools for Commercial TV

Special tamper-proof screws are used to secure the cabinet backs on commercial (hotel-motel, ETV) TV sets. The screwdriver bits illustrated will fit standard ¼in. hex nut drivers or power tools. You will need a 98A30-27 male



bit for plastic backs where screwheads are recessed. However, the screwheads are exposed on most sets, so the 98A30-24 female bit will give you a better grip and guard against slipping. Order from your Admiral distributor.

Stereo Console — Chassis Removal

Most of Admiral's current console stereo models use a chassis design of two boards placed back-to-back. Removal of the chassis is often not easy; however, as on most jobs, the right tools and know-how make the job a lot easier.

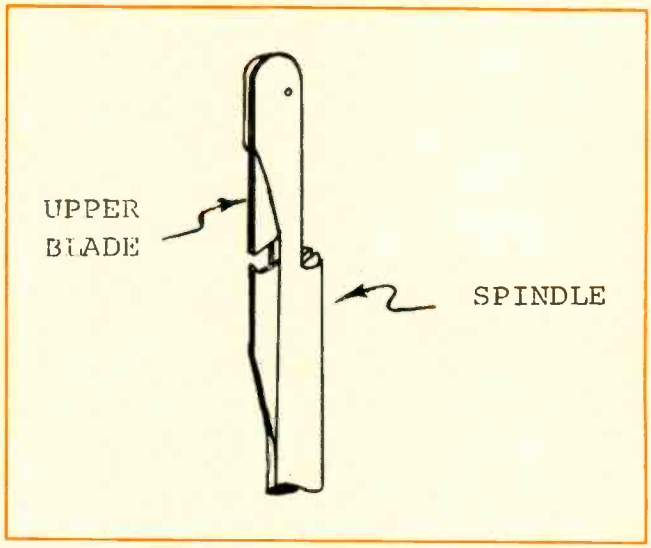
A ¼in. hex nut driver 9in. long, or longer (XceLite No. A8) does the trick. Some chassis are held by a metal cup and a 9/16in. nut on the control shafts; use a driver similar to XceLite HS18 for these and remove the chassis in the following manner: (1) Pull knobs off; (2) disconnect chassis connectors; (3) while supporting chassis, remove one screw in each corner of chassis that screws into the escutcheon; (4) When reinstalling chassis, reverse the procedure using beeswax, permagum or masking tape in the nut driver to hold the nut.

GENERAL ELECTRIC

Record Changer RD400/RD500 Series – Multiple Record Drop

Reports from the field indicate that an occasional complaint of multiple record drop exists on RD400 and RD500 series changers.

This problem occurs when the small blade in top of spindle does not move freely to select a single record. The blade movement may be restricted by the presence of small particles of solidified rust inhibitor remaining on the spindle.



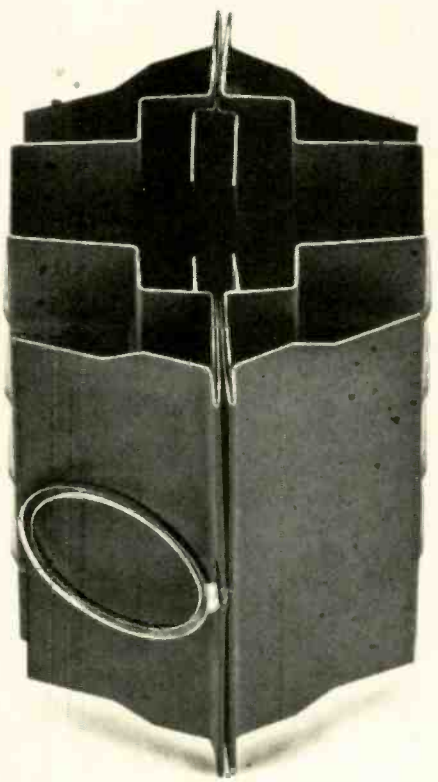
To dissolve the rust inhibitor particles, wipe the spindle with a soft cloth soaked in alcohol. Check the movement of blade for correct vertical travel; it must fall freely of its own weight. See illustration.

Radio/Phono Model T845 – Safety Modification

A safety modification must be applied to all Model T845's received for service previous to serial number 1250043. Because of the proximity of the ac line cord and the metal edge of the jack pack bulkhead, there is a possible safety problem.

The corrective modification is as follows: Remove back cover by removing 10 cover screws and two jack pack screws. Lay back cover flat on work bench. Do not remove ac line cord from strain relief. Tape (electrical) lip of cabinet frame at point A as shown in Fig. 1. Bend bottom

Introducing a cooling system for the 6JS6.



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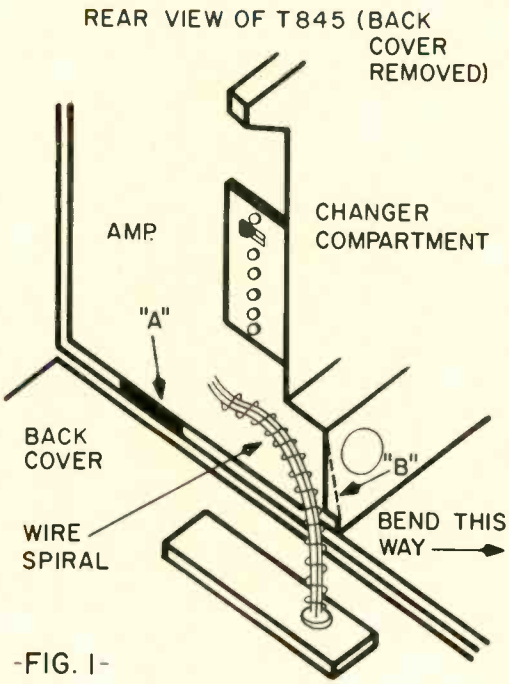
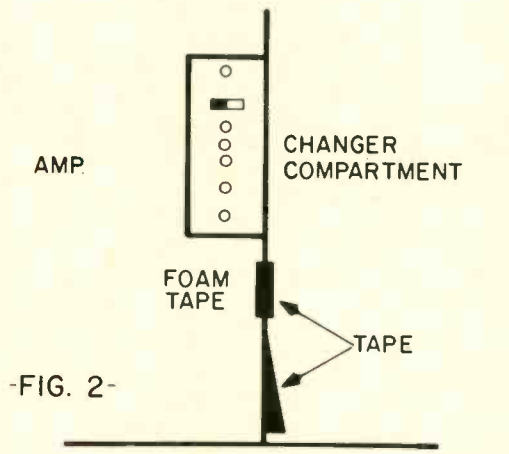
edge of jack pack bulkhead in toward changer compartment until frame edge is parallel with back cover. Bend should be made at point B as shown. Tape (electrical) frame edge as shown in Fig. 2. Install foam tape as shown. Install a piece of (plastic) wire spiral around the ac line cord between



-FIG. 1-



-FIG. 2-

ac line cord strain relief and wire bundle. Insure sufficient spiral is used to cover cord. Note: Insure wire tie holding wire bundle is secure (See Fig. 1). Reinstall back cover observing ac lead dress to make sure that ac cord is dressed by taped area. Perform this normal safety check as follows:

a. Inspect lead dress. Wires should not be pinched by chassis, and leads should be dressed and secured to prevent any possibility of being pinched by the changer or becoming entrapped in the changer mechanism.
b. Temporarily connect a jumper between the two blades of the line cord plug.

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ET/D TECHNICAL DIGEST

c. Measure the resistance (with unit completely assembled) from the two shorted blades of the power plug to exposed metal portions of the set. Must indicate an open circuit when using the R X 10,000 scale of VOM.
d. Should a reading other than an open circuit be obtained, locate and correct the cause and re-perform safety check.

General Electric Audio Products Dept. is shipping adhesive-backed tape and spiral material to make the above-mentioned safety modification. If you need additional material for performing these safety modifications, call or wire Fred Furnish 8-322-6313.

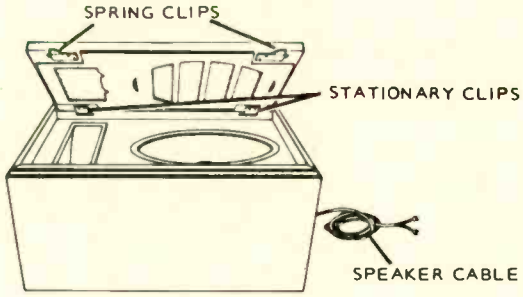
If you receive units for safety check and modification that are still in the unopened factory carton, it is not necessary to remove set from the carton. Turn carton upside down and open carton from the bottom—back cover of unit is now exposed—and perform corrective steps described above.

MAGNAVOX

Remote Speaker System Model 1S8716—Access to Speakers and Crossover Network

This speaker system uses a completely sealed acoustical enclosure. Access to the speakers and crossover network is provided through a removable front grill panel held in place by two nylon spring clips. The panel is released by depressing the clips.

With the speaker cabinet on its back as illustrated, insert a strip of stiff cardboard between the grill panel and the cabinet molding, about 3in. in from the top and bottom of the cabinet. Sliding this strip along the opening will release the spring clip and allow this side of the panel to be opened.



A dull-edged knife blade can also be used, but use care to avoid scratching the cabinet. The speakers are mounted from the front of the baffle board and sealed with caulking compound. The crossover network is mounted inside the cabinet. Therefore, the bass speaker must be removed to gain access to the network.

In some cases, the speaker leads had been reversed at the crossover network resulting in a loss of high frequencies. Proper connection is achieved with the green wire from the bass speaker going to the crossover capacitor, the gray wire from the horn going to the resistor, and the black (or common) lead going to the inductance.

Be sure to re-seal the speaker properly when it is replaced. Use ribbon caulking compound—Part No. 800313-1 or equivalent.

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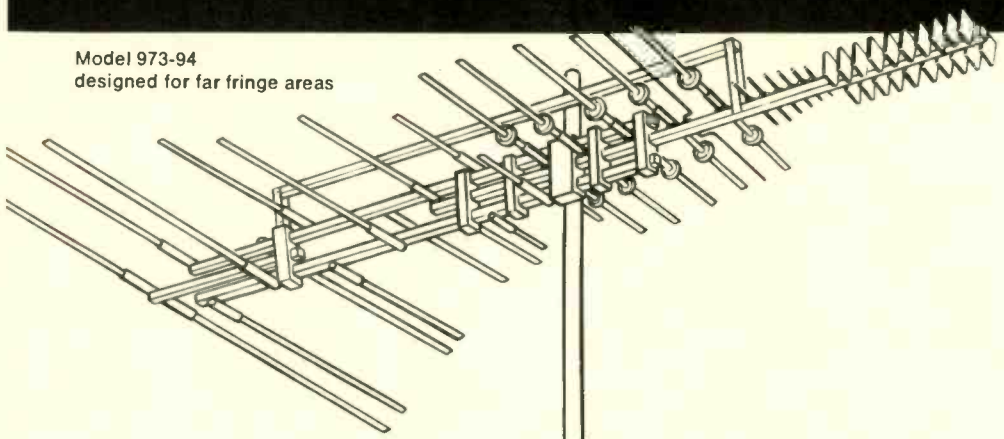

Model 973-94
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These features help a Zenith outdoor antenna provide the superior reception that makes for satisfied customers:

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YOU'VE COME A LONG WAY

In my travels around the country visiting with you and our other readers, I can't help but be impressed with the evolution that has taken place in TV and radio shops during the past 10 years.

As you well know, you've come a long way.

Not only are you servicing every TV and radio set sold—but you're also selling a heck of a lot of them.

The average TV-radio shop I see today has four or five times the floor space of a decade ago. Most have bright and inviting store fronts, show rooms with every conceivable type of home entertainment electronic equipment. Big and efficient service departments have inventories of replacement parts that would have staggered the imagination of the technician 10 years back.

Not only is today's shop owner a good technician, he's also a good salesman. As service dealers, your advice and recommendations are sought by consumers. Your customers have confidence in your technical knowledge.

In recognition of this evolution among TV-radio shops, we changed our name one year ago this issue. We added the word "DEALER" and became ELECTRONIC TECHNICIAN/DEALER. We feel this title more accurately reflects your role as TV-radio sales and service specialists.

Our goal was, and continues to be, to provide you with the best technical and servicing know-how available—but at the same time, to expand our information to cover your business in its widest definition . . . sales as well as service.

Your response to our program has been gratifying. We thank you. ELECTRONIC TECHNICIAN/DEALER today reaches more TV-radio shops than any other publication in the world.

We're proud of our readers—the owners and technicians of the TV-radio shops. We're proud of the fact too that last year more advertisers carried more advertising in ET/D than any other TV-radio servicing magazine in the world.

Thanks for making it all possible.

Cordially,

Scotty Wallace

Publisher
ELECTRONIC TECHNICIAN/DEALER

Hugh "Scotty" Wallace

ELECTRONIC TECHNICIAN / DEALER

JANUARY, 1969

Two-Way Radio on The Go

PART 1

■ New concepts in circuit design and more frequent use of solid-state components in CB transceivers warrant a general re-evaluation of service procedures and test instruments.

Because of the scope of two-way radio servicing, this article confines itself to CB transceivers and the test instruments necessary for service. Business/industrial two-way radio with its own special breed of test procedures and instruments, will be covered in subsequent articles.

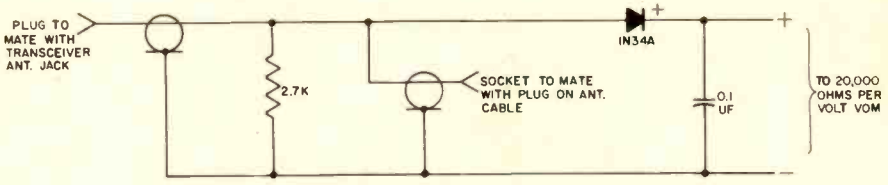
Johnson Messenger 323, a 23 channel solid-state SSB CB transceiver for two channel operation.

Who Can Service CB Radio?

The best man to service any two-way radio is the qualified, licensed (1st or 2nd class FCC radio telephone) and properly equipped technician. That's a line full of qualifications, but in actual theory, the best qualified service technician is not always the man who repairs the radio. This is especially true of CB radio because everyone and anyone can own a unit with no special requirements other than having a use for it, a license and money for equipment. Therefore as a service technician you may find yourself working on a CB transceiver which has been modified, incorrectly aligned or "operator repaired" with wrong parts and valves.

There are a number of legal maintenance repairs that an owner, without a 1st or 2nd class FCC license, can make to his transceiver. Generally, these repairs are those which do not affect the operation or legal tolerance of the transmitted signal. For example, a CB operator may replace defective parts in the receiver and power supply. He may replace fuses, lamps, transistors, capacitors and diodes even in the transmitter—providing that he does not tamper with adjustments which affect the legal transmitter frequency or power limits.

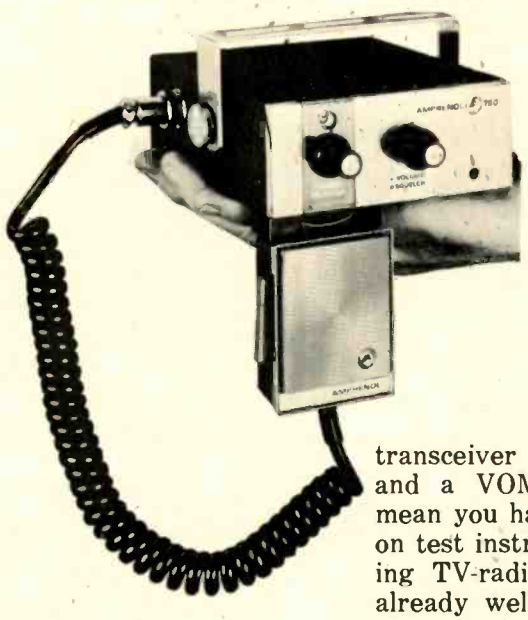
Transistor and coil replacements in most transmitter oscillator and power circuits require retuning of the transmitter. *Only properly licensed personnel make these adjustments.* How-



Schematic diagram of peak reading probe.

ever, don't be surprised if during repair you find the transmitter coils incorrectly aligned.

Test Instrument Requirements



Amphenol Model 750, six channel 5w AM transceiver for CB mobile or marine use with speaker mike combination

There is a great variety in test instruments — and test instrument budgets. We mentioned earlier that the new circuit designs in solid-state units required new test instruments. You can no longer service the modern CB transceiver with a wet finger and a VOM. But this doesn't mean you have to spend $10,000 on test instruments. Many existing TV-radio service shops are already well equipped with the basic needs such as an oscilloscope, ac meter, audio generator and dc power supply. Some inexpensive but helpful instruments for service might include a transistorized audio signal injector and a transistorized RF oscillator. An inexpensive battery-operated transistor oscillator can be obtained for on-channel receiver tests with crystals for any channel. Fig. 1 and 2 are schematics of two simple test jigs you may find useful.

Hallicrafters Model CB20, five channel, 5w solid-state AM transceiver features diode switching.

The bulk of the CB transceivers are AM, multi-channeled transistorized units. Some of these utilize frequency synthesis to obtain 23 channels using only 10 crystals, a couple of oscillators and a mixer. This provides "simplex" operation–the transmitter and receiver use the same crystals. Servicing transceivers of this type requires circuit knowledge and more sophisticated test instruments. The use of SSB (Single Side Band) transmission in some CB units also presents some interesting service techniques new to some of the AM boys, and again, requires additional circuit understanding.

A relatively complete test instrument list for AM multichannel, synthesized and SSB transceivers follows:

—RF signal generator with provision for 30 percent modulation at 1000Hz.

—RF wattmeter-0 to 5w normal ohm

—50 dummy load (may be built into wattmeter)

—Frequency counter or equivalent

—DC power supply-0 to 15v, 3a minimum, regulated and filtered

—DC-VTVM

—AC-VTVM

—DC ammeter 0-1a

—Audio generator (two required for SSB)

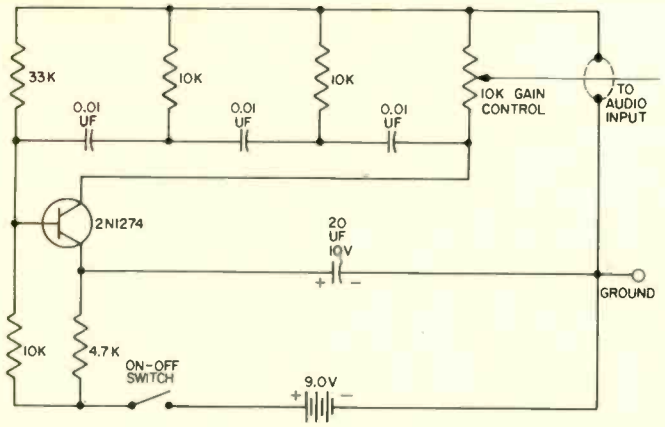
—VTVM with RF probe

—VOM-20k per volt

—Miscellaneous alignment tools

—Miscellaneous resistors, capacitors and clip leads

—50Ω 6db pad



Schematic diagram of simple audio generator.

Solid-State Servicing

Solid-state CB transceivers normally operate from 12 to 13.8 vdc sources with the exception of walkie-talkies. Tube type transceivers may operate from either 12 vdc or 117vac depending on the model. The difference in the operating voltages of tube and solid-state transceivers is only one factor. Solid-state circuits are normally mounted on an epoxy board with a thin layer of copper providing the circuit connections and care should be used during component removal and replacement to prevent lifting the copper from the board. The solid-state devices themselves are susceptible to extreme heat and also require some precaution when soldering. A low wattage soldering iron is generally acceptable.

When replacing diodes or other components subject to thermal damage, it is best to use a "heat sink." This can be an ordinary alligator clip attached to the component's lead between the soldering point and the component. Another useful tool for solid-state repair is a "solder sipper" for removing molten solder during component replacement.

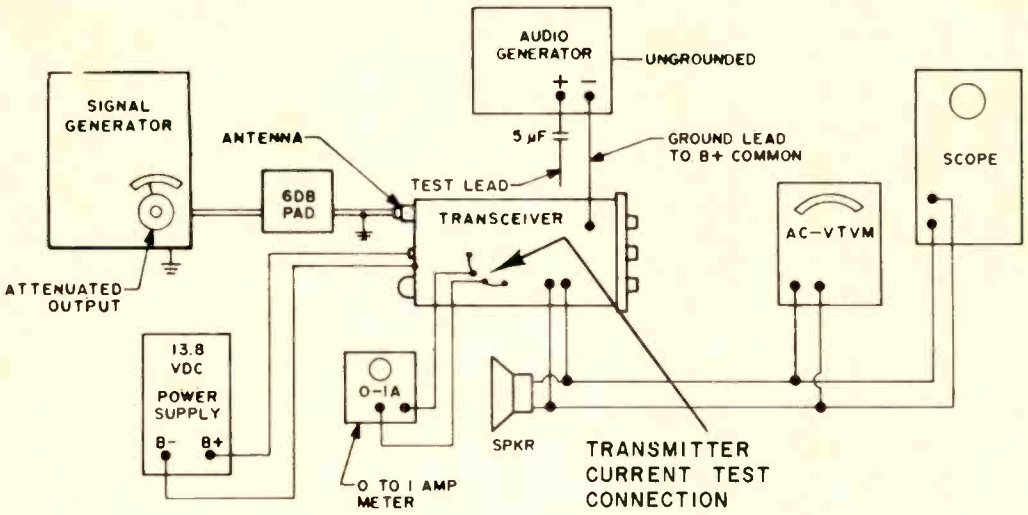
A common design in transistorized transceivers is "floating" circuit voltages. Many of the transistorized units which operate directly from 12vdc are designed with circuit voltages above common ground. One of the reasons is that it provides for operation from negative or positive dc ground. However, it also means that test instrument connections and polarity must follow certain precautions.

In many units, the circuit ground is B+ (+ 12vdc) and B- is the supply voltage. The metal chassis rails supporting the circuit board and the cabinet are both at common chassis ground. The point here is that there are two grounds: circuit ground (B+) and chassis ground.

Courier Traveller, 23 channel solid-state transceiver using frequency synthesizing networks

Test instruments may be of the grounded or ungrounded types. Your bench power supply normally provides minus and positive dc voltages, neither of which is common to chassis ground and you simply connect positive and negative leads to their respective inputs. However, the ground lead on an audio generator or VTVM may be at chassis ground potential and require isolation or connection to a particular test point in the transceiver. See Fig. 3 for typical test instrument connection to a transceiver with "floating" circuit potentials. Before making any connections to the transceiver, read the manufacturer's service instructions and look over the schematic diagram. Many schematics have test instrument connections listed as foot notes which may indicate that

Allied Radio Model A-2530 CB transceiver for ten channel AM operation includes ac and dc power supplies.



Block diagram of test instrument connections for receiver troubleshooting and alignment.

a signal generator ground lead must connect to an IF can shield, a part of the chassis mounting rail or to the metal ring of an earphone jack. It will pay you to observe the recommendations indicated in the transceiver's service instructions.

Transistor Tests

Transistor voltages, much like tubes, can frequently help to isolate a defective stage. If the transistor emitter voltage is higher than normal or there is no voltage difference between the base and emitter, chances are you have an open bypass capacitor or an open emitter resistor.

A low emitter voltage indicates an open transformer or defective transistor. If the collector voltage is low or equals the emitter voltage, it indicates a leaky or shorted transistor. Zero collector voltage could indicate an open transformer or decoupling resistor.

Receiver Troubleshooting

After you have familiarized yourself with the transceiver schematic and general circuit board layout, you can apply your troubleshooting skills.

Some of the major receiver problems you are likely to encounter are: receiver dead, no audio or audio distorted, no squelch action and low sensitivity.

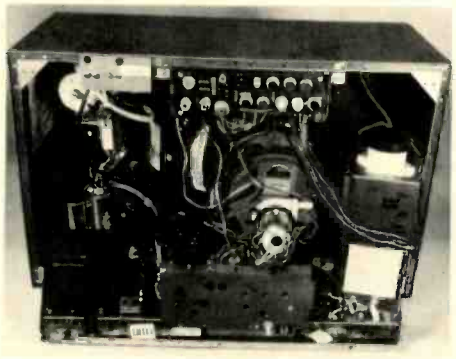
There are, of course, other common ailments such as "noisy" and "weak," but many times symptoms of this type are caused by poor connections, interference or defective antennas and installations.

Before troubleshooting a CB transceiver, it would be wise to first determine whether the problem is in the unit itself or in the installation. Connect the transmitter to a proper load or antenna with some means of checking transmitter power. Connect the dc power supply (if needed) and switch the transceiver on. Check for normal current drain, squelch, volume and transmitter output.

Once you determine what is wrong with the unit, you can make the necessary voltage, current and gain tests according to the manufacturer's specifications. Start with a visual inspection of the unit. Look for broken leads, cracked circuit boards, burned components and poor solder connections.

Most transceivers utilize some circuits which are common to both receiver and transmitter such as the audio, oscillator, antenna and power supply circuits.

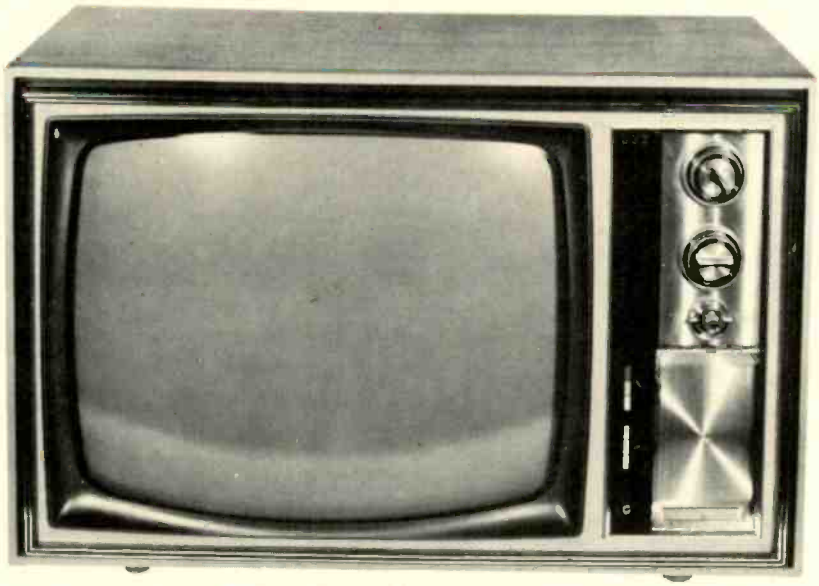
Knowledge of these can shorten troubleshooting service time. The synthesized transmitter and receiver circuits make use of common oscillators and a mixer stage to provide 23 channel operation. Part 2 of this series will continue CB servicing. ■



Rear view of chassis showing service controls.

One hour of circuit study could save you money and many hours troubleshooting

General Electric's KE Color Chassis



General Electric's Model M275EMP employing the KE color chassis.

■ Recently, we unpacked a model M275EMP General Electric TV with the new KE color chassis.

Looking at the front of the set, there was an obvious new feature—a new automatic fine-tuning control (AFC) which keeps all channels "locked-on" to the best picture. AFC is a solid-state electronic circuit which is customer controlled by the AFC switch ring located behind the volume control knob on the front panel.

The color controls on the front panel are positioned so that the knob pointers are always in the straight-up position (12 o'clock) for color reception. Some models have the pointers set at 3 o'clock position.

Once a color program is tuned in to suit the viewer, the secondary control knobs can be pulled off and re-installed on their respective shafts so the knobs all point in the same direction. This feature simplifies restoring correct knob adjustments for subsequent color programs.

Slightly more than 31 percent of all households in the U.S. had color television sets on November 1, 1968 according to estimates made by the National Broadcasting Co.

Every year we see the table and portable models taking a bigger percentage of the total color sets sold.

The small screen TV sets make color TV available to families who could never afford the larger consoles and many are buying the small screen as a second set.

To make the new circuits easier to understand we will look into a new table model color set.

The controls located on the chassis rear apron are: circuit breaker, Insta-Color switch, horizontal hold, HV adjustment, efficiency coil and pincushion phasing is on the chassis top between the horizontal centering and focus controls which protrude from the rear of the high voltage cage. All other controls are on an etched circuit board called the "Set-Up" board.

The vertical centering control replaces the fixed resistor in KD chassis which required changing wire connections to achieve vertical centering.

The KE chassis is used in all 1969 General Electric large screen color TV models.

Picture tube sizes are 18, 20 and 23 in. diagonal picture mea-

surement. All picture tubes have integral implosion protection and rare earth phosphors.

A new device called a "Griplet" is used in many of the component mounting holes in the circuit board (shown in Fig. 1). The Griplet looks like an eyelet but has a grip inside to hold certain components firmly in place during the automatic soldering operation at the factory.

If the component is replaced without removing the chassis from the cabinet, clip the component leads close and solder the new component leads to the leads remaining in the Griplet.

Most of the circuits employed in the KE chassis are the same as the preceding KD chassis.

We will cover some of the new circuit differences between the KD and KE chassis.

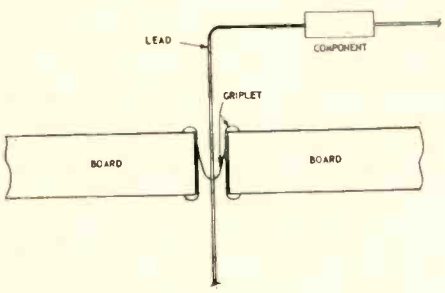


Fig. 1--The "Griplet," similar to an eyelet, has a grip inside holding components during the solder operation at the factory.

Automatic Fine-Tuning Control

The Automatic Fine-tuning Control (AFC) is a new feature in General Electric color television receivers. The purpose of the AFC circuit is to produce a correction voltage to adjust a mistuned local oscillator frequency in the tuner and place the picture carrier at 45.75MHz in the IF pass-band. A picture fine-tuned into sound (crystallization) will produce a positive dc correction voltage to increase the capacity in the tuner oscillator which lowers the frequency of the oscillator and places the picture carrier back at 45.75MHz in the IF passband. Likewise, fine-tuning the picture into smear will produce a negative dc correction voltage to return the picture carrier to 45.75MHz.

By analyzing the circuit of the AFC module it will be shown how the correction voltage is developed. The module consists of an amplifier and a discriminator.

IF energy is coupled from the plate of the 3rd IF amplifier V5 to the AFC input, or take-off coil, L350 by the capacity (.17pf) of R314, a 1M, 1/4w Allen-Bradley resistor. The capacity must be very small to eliminate interaction between the IF amplifier and L350. If the capacity were large, tuning of L350 would upset alignment of the IF passband. L350 is tuned near 46MHz to shape the overall discriminator curve.

The signal, through C351 to the base, is amplified by Q351 to the primary of the discriminator transformer T351 which is tuned to 45.75HMz. Inductive and capacitive coupling transform the signal from the primary to the secondary of T351 which is also tuned to 45.75MHz. Capacitive coupling is from the high impedance end of T351 primary to one end of T351 secondary through C357 and to the other end through C358.

At this point we could say that a discriminator is a form of phase detector comparing the phase of the signal at the primary with the phase of the signal at the secondary of the discriminator transformer. The phase relationships that exist in the circuit are very complex and beyond the scope of this analysis.

The secondary circuit is strictly ac as there is no dc supply or dc return although a dc voltage is developed. The two discriminator diodes CR351 and CR352 are connected back to back because their cathodes are connected by C359. With this configuration, when one diode conducts the other diode is cut off. Since there is no dc return, each of the diode loads R355, and R356 must be connected in parallel with the opposite diode so that electrons can flow through the entire secondary circuit when one diode is cut off.

With 45.75MHz energy fed through the circuit, and with the primary and secondary of T351 tuned to 45.75MHz, both ends of the secondary are in phase by capacitive coupling of the common signal source through C357 and C358. With no phase difference, no voltage is developed across the secondary winding, resulting in zero volts output from the discriminator.

If a higher frequency, say 46.0 MHz, is fed through the 45.75MHz tuned circuit, inductive coupling of the higher frequency signal from primary to secondary produces a phase shift which unbalances the phase relationship at the secondary in direction to produce a positive voltage which is rectified by CR351 while CR352 is cut off. Electron flow is from C359 through C351, T351 and R356 to the other plate of C359. C359, R357, C360, R358 and C74 (at the defeat switch) filter RF from the output and C74 becomes charged to act as an effective positive (relative to ground) bias battery across the variable capacitor diodes in the tuner.

If a lower frequency, 45.5MHz, is fed through the 45.75MHz tuned circuit, the process is reversed and a positive voltage is produced at the other end of the secondary winding which is rectified by CR352. Electron flow is from C359 through CR352, T351 and R355 to C359. C74 now has a negative (relative to ground) charge and becomes a negative bias source across the variable capacitor diodes in the tuner.

Now that the correction voltage has been developed it remains to see how this voltage

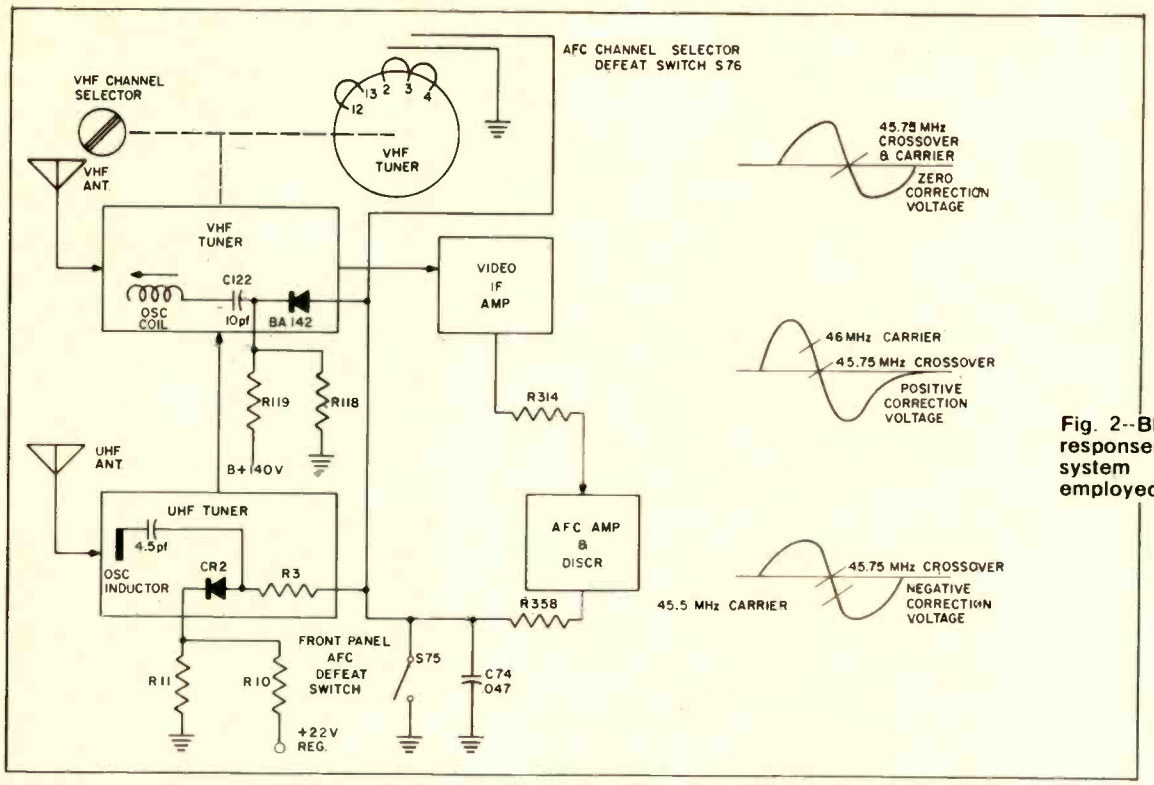


Fig. 2--Block diagram and response curves of the AFC system employed in the KE chassis.

corrects frequency error at the tuners.

Refer to the block diagram and response curves in Fig. 2. An incoming picture signal mixes with the local oscillator in the tuner to produce an intermediate frequency picture signal. This signal is amplified in the video IF amplifier. The signal is taken from the plate of the 3rd video IF amplifier V5 and fed through R314, a 1M 1/4w Allen-Bradley resistor with a capacity of .17pf., to the input of the AFC circuit just described. The output of the AFC circuit is a correction voltage used to correct the frequency of an incorrectly tuned oscillator. This correction voltage is fed to the back biased variable capacitor diodes: BA142 in the VHF tuner and CR2 in the UHF tuner.

If the fine tuning control has been adjusted properly for best picture, the tuner oscillator mixing with the incoming signal will produce a picture IF of 45.75 MHz at the crossover on the discriminator response and the correction voltage output is zero.

If the fine tuning is mistuned towards audio (crystallization), the oscillator is higher in frequency and will produce a higher picture IF, 46.0MHz. This is in the positive direction on the discriminator response curve and will produce a positive correction voltage. The positive voltage applied to the variable capacitor diode will decrease the voltage across the diode (the difference between the back bias and the correction voltage). The reduced voltage across the diode causes an increase in its capacity to lower the frequency of the tuner oscillator, since the capacity of the diode is connected to the tuner oscillator, to lower the picture IF to 45.75MHz.

In the same manner, if the fine tuning is misadjusted toward smear, a lower frequency IF picture carrier will be produced about 45.5MHz and a negative correction voltage will adjust the diode to a lower capacity which will increase the frequency of the tuner oscillator and increase the picture IF to 45.75MHz.

However, the system is not quite as ideal as it appears. In the mistuned conditions described above, as soon as the correction voltage retunes the oscillator to produce a 45.75MHz IF there is obviously no correction voltage and—with the tuner oscillator still mistuned—a correction voltage is again produced. In other words, when the oscillator is mistuned, the system "hunts" and the corrected oscillator never quite produces an IF of 45.75MHz. In fact, the more the oscillator is mistuned, the less will be the amount of correction.

Chroma Detectors and Color Difference Amplifiers

There are two main design changes in the circuits between the KE and KD chassis. These are the addition of low pass filters L711 and L712 in the grid circuits of the R-Y and B-Y color difference amplifiers, and the method of obtaining the G-Y color difference signal.

The low pass filters (shown in Fig. 3) have been added to remove any 3.58MHz in the picture and reduce 3.58MHz radia-

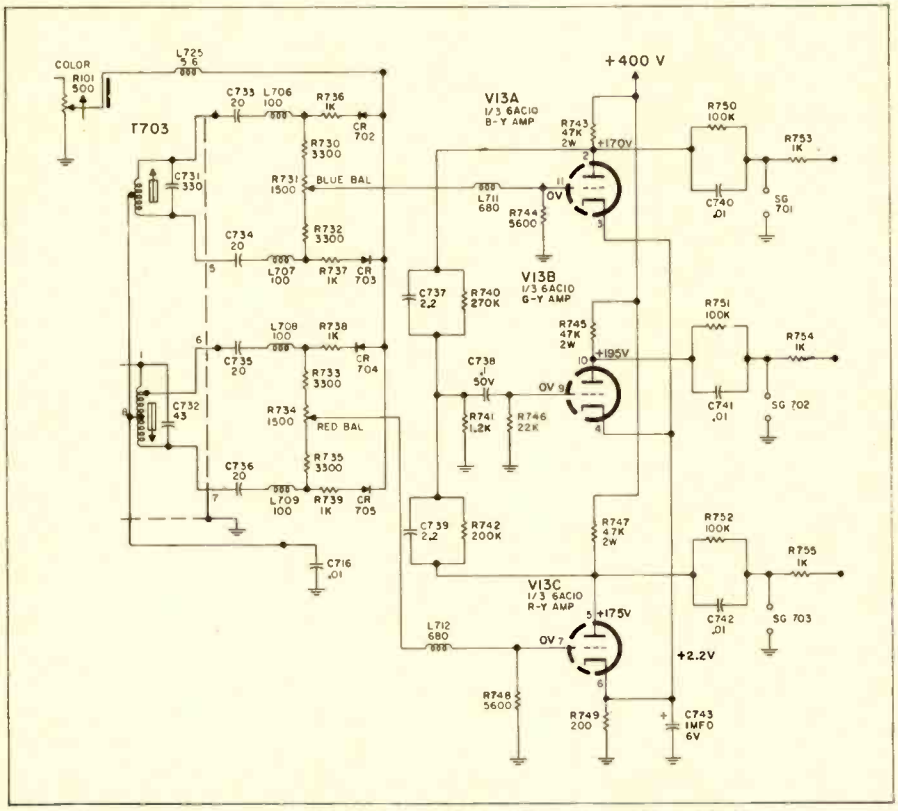


Fig. 3--Low pass filters are added in the grid circuits of the R-Y and B-Y color difference amplifiers.

tion from the chassis. The filters in the KD plate circuits were deleted in the KE chassis.

The method of obtaining the G-Y color difference signal in the KE chassis is different than the method used in the KD chassis. The G-Y demodulator has been abandoned in favor of matrixing the proper proportions of R-Y and B-Y to form -(G-Y) at the grid of the G-Y color difference amplifier. The -(G-Y) at the grid becomes G-Y at the plate. The actual proportions are: -(G-Y) =.51 (R-Y) + .186 (B-Y).

The R-Y and B-Y components are obtained from the plates of their respective color difference amplifiers and fed through RC networks to the matrix resistor R741. The proper proportions of R-Y and B-Y are determined primarily by the ratio of resistors R740 and R742. The matrixed signal is coupled through C738 to the grid of the G-Y amplifier.

Horizontal Output and High Voltage

There is only one change in these circuits. V14, the horizontal output tube, is a 6LB6. This tube has a greater reliability with its lower drive requirements, lower screen voltage and higher dissipation rating.

The thermostat CB102 (shown in Fig. 4) is mounted on the set-up board adjacent to the glass envelope of the horizontal output tube V14.

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

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

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

B + Power Supply

A new B+ power supply has been designed for the KE chassis. In the KD chassis, a bridge rectifier produced 400 vdc with lower voltages derived from high wattage, power consuming dropping resistors. In the KE chassis, the power transformer has been designed to accomodate three separate rectifier circuits to produce 400, 285 and 18v. Lower voltages are derived from taps in the filter networks. With this circuit, many of the power consuming resistors used in the KD chassis have been eliminated. Although more power is consumed in the KE operating circuits than in the KD, the power transformer supplies less power and runs cooler.

It was determined that a more efficient degaussing system would result if the currents through the coil were symmetrical—the same during each cycle.

The power supply is balanced for current through the degaussing coil. The power transformer features a secondary winding split at the center into two equal windings. A tap on each winding provides a source for full wave rectification of the 285v supply. This replaces the half wave system used in the first power supply. The degaussing circuit is connected between the center terminations of the two secondary windings.

A simplified schematic diagram of the balanced power supply is shown if Fig. 5.

The three dc power sources are all derived from full wave

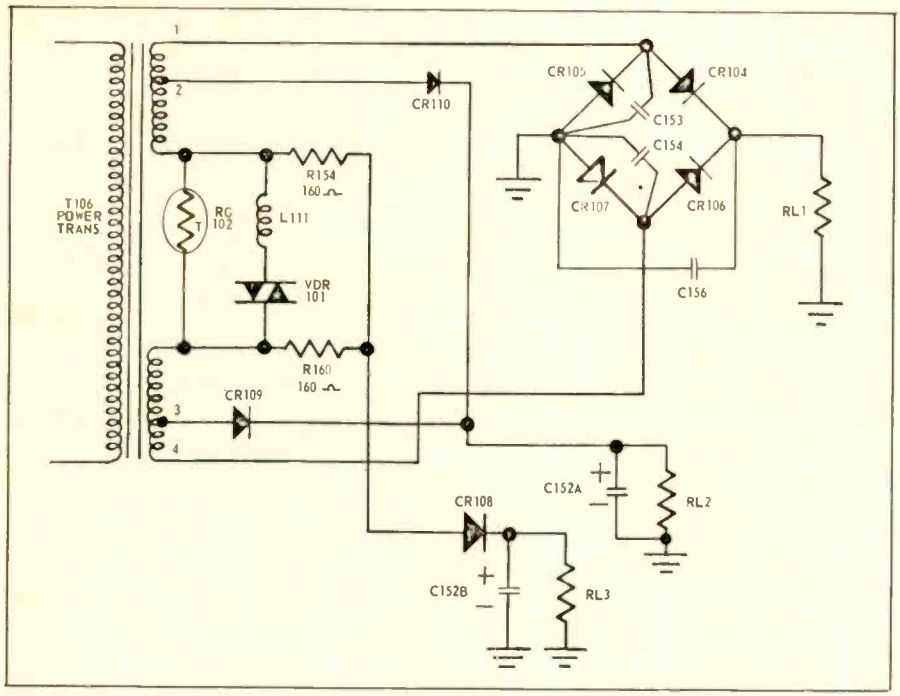


Fig. 5--Simplified schematic of the later balanced power supply.

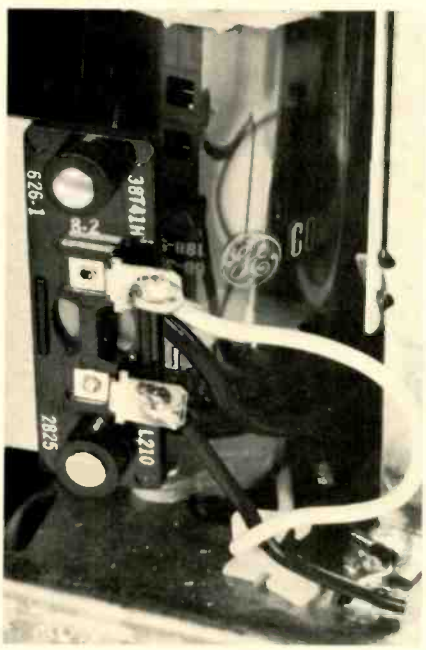
rectifier systems. Therefore, with the degaussing circuit connected in the center of the complete system at the junction of the two secondary windings, all of the current from both the negative and positive half cycles flows through the degaussing coil when the receiver is first turned on.

Two 160Ω resistors, R154 and R160, are connected in series across the degaussing coil L111 to connect the two secondary windings together and provide a connection for CR108 at the center of the secondary winding without creating a short circuit across L111.

When the receiver is first turned on, RG102 is cold. And at a high resistance, most of the current flows through the low resistance of the degaussing coil. The small current through RG102 causes it to heat and since it is a negative coefficient device, its resistance becomes lower and the current increases through RG102. Finally, the resistance of RG102 becomes so low that the small current flowing in L111 is switched off by VDR101. The low resistance of RG102 is now effectively a short circuit connecting the two secondary windings together and connecting R154 and R160 in parallel at 80Ω. This resistance is equal to the 80 Ω surge resistor R154 in the first power supply and serves the same function.

In the new power supply, 285v is obtained by full wave rectification. This full wave system operates in a different manner than a conventional center tapped system because the return circuit is through the bridge rectifier diodes. CR110 functions from the potential existing between terminals 1 and 3. Current flow for one half cycle would then be from terminal 2 through CR110, RL2 and CR107 to terminal 4. In like manner on the other half cycle, current flows from terminal 3 through CR109, RL2 and CR105 to terminal 1.

Fig. 4--The horizontal output thermostat is shown mounted on the setup board.



It appears that both CR109 and CR110 might conduct at the same time since both diodes are included in the circuit for each half cycle of rectification. This is true, but only for a short time when the power supply is initially turned on and no charge is on C152A. For instance, when CR110 is functioning as previously described, the potential between terminals 3 and 4 on CR109 is very small compared with the potential on CR110 Initially, both diodes do conduct at the same time with no charge on C152A. As C152A becomes charged, it reaches a potential which exceeds that between terminals 3 and 4 resulting in CR109 being cut off. C152A attains its full charge and CR110 continues to rectify one half cycle. The same conditions apply to the rectification of the other half of the cycle. ■

SOLVING COLOR PROBLEMS

Apply basic circuit knowledge and the scope for faster trouble shooting procedures

■ More and more color TV sets are being sold and records show that the ratio of color TV calls is often high in comparison to B/W sets.

In most cases the public will spend more money keeping color sets operating than on the B/W sets. So if the technician is not keeping up with color servicing, he is missing many business opportunities.

Many customers will call the color television service technician to service both their color sets and their B/W sets, rather than call their "old" serviceman who never learned to service color sets.

In order for a technician to effectively troubleshoot and repair a color TV, there are certain requirements that he must fulfill. First, he must have a basic knowledge of the circuits in a color chassis, then he needs the necessary tools and test equipment for proper servicing.

It is possible to repair color receivers without special equipment or perform convergence adjustments with the "eyeball" method, but with proper equipment the job can be done more accurately and faster.

The following actual color problems were solved in a short time by studying the circuits and using proper test instruments.

The Case of the Missing Green

A Motorola color chassis TS908/Y was brought in for service with the green color completely out. All tubes including the CRT were tested and all voltages checked normal with a VTVM.

A color bar generator was connected to the antenna terminals and set to produce a color bar pattern. A check of the color bar pattern confirmed the green color bars were missing and in their place were blue bars, but none of the blue bars appeared correctly.

Going through the color circuits, all of the key points were checked with the scope. At the cathode, pin seven of the 6BL8 Z blue demodulator, the 3.58MHz CW signal was missing. This normally is a 10v P-P CW signal. The waveshapes at the B-Y and G-Y amplifiers were identical. Checking pin four on the reference coil, we still didn't have signal. We then connected a .001μf capacitor from pin four and five of the coil (shown in Fig. 1) for a quick check and the green came in strong. A new coil was ordered, and when replaced and aligned, all colors were back to normal. Total bench time to isolate this trouble was five minutes. A good scope on your bench and the right know-how can be a money making combination. A VTVM was used to compare the voltages on both cathodes of the X and Z demodulators, the result both measured 1.5v, which was not much of a clue.

Fading Color and Brightness Level

You may have had a few intermittent problems like the one in this RCA Victor CTC16 color chassis. It would act up a few times a day and then again might perform perfectly for two or three days. The brightness and color level would both fade or dim at the same time. Voltages and resistance checks

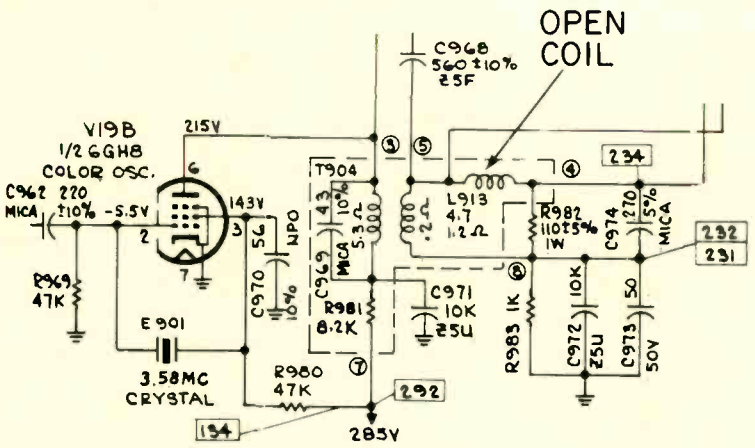


Fig. 1--Partial schematic of Motorola's TS908/Y color chassis showing open reference coil which caused no green color.

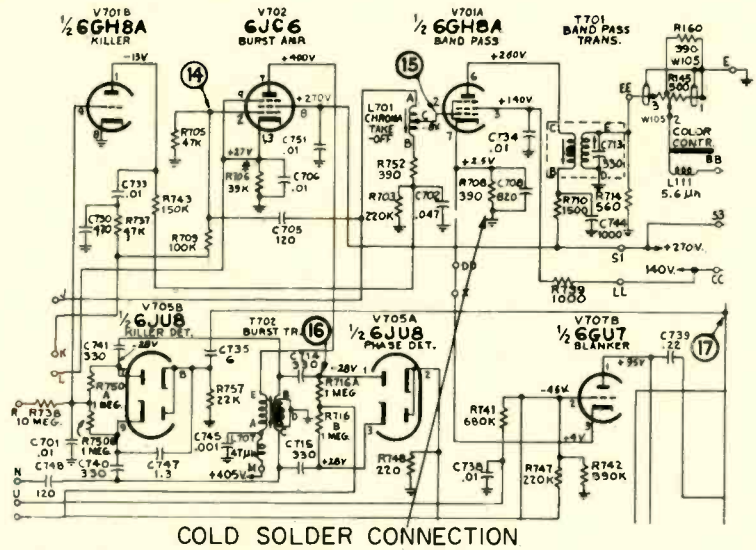


Fig. 2--The fading color and brightness level was caused by a poor ground connection in this RCA Victor CTC16 color chassis.

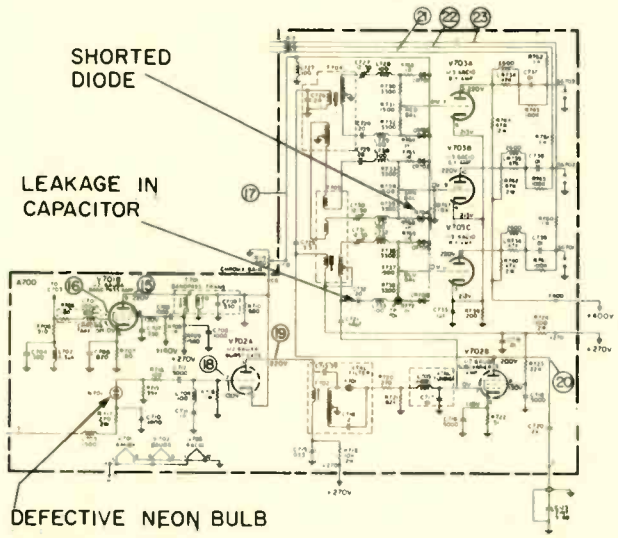


Fig. 3.--Partial schematic of the General Electric CB chassis showing the shorted diode which caused saturated green. The saturated red color was caused by a defective capacitor.

were made; then scope waveshapes were taken with no results. The circuit board was probed, heated and then cooled; still no clues.

If you will study the circuits in this color chassis that could cause both of these troubles at the same time, the problem could be simplified. Referring to the color section schematic Fig. 2 the cathodes of the blanker tube V707B and the color bandpass amplifier V701A cathode are connected.

You guessed it, a cold solder connection at the ground point was causing the color and brightness fade.

Saturated Green

The color service technician tackles problems from one extreme to another. This General Electric CB chassis partial schematic Fig. 3 found its way to the service shop saturated with green. The green screen control had little effect on the picture when gray scale tracking was attempted. With a problem like this, first measure all voltages at the CRT socket. We found pin 7 green control grid measuring about 100v too low. This clue told us the G-Y amplifier V703B was conducting too hard and the cathode and control grid were then measured. At the control grid a positive 6v was found, but which should have been at zero potential. A few resistance checks revealed that diode CR704 was shorted. Another General Electric color chassis CB was repaired a few days later that had too much red in the picture and again the red screen control had no effect. Low plate voltage was found on V703C R-Y color amplifier. This time about 35v positive was found on the control grid of V703C. The 20µf capacitor C732 had developed leakage. Notice 270v is applied to the RY transformer T703 see Fig 3. When making repairs on the color amplifiers of the color chassis, the red, green and blue balance controls should be adjusted to proper settings

SOLVING COLOR PROBLEMS...

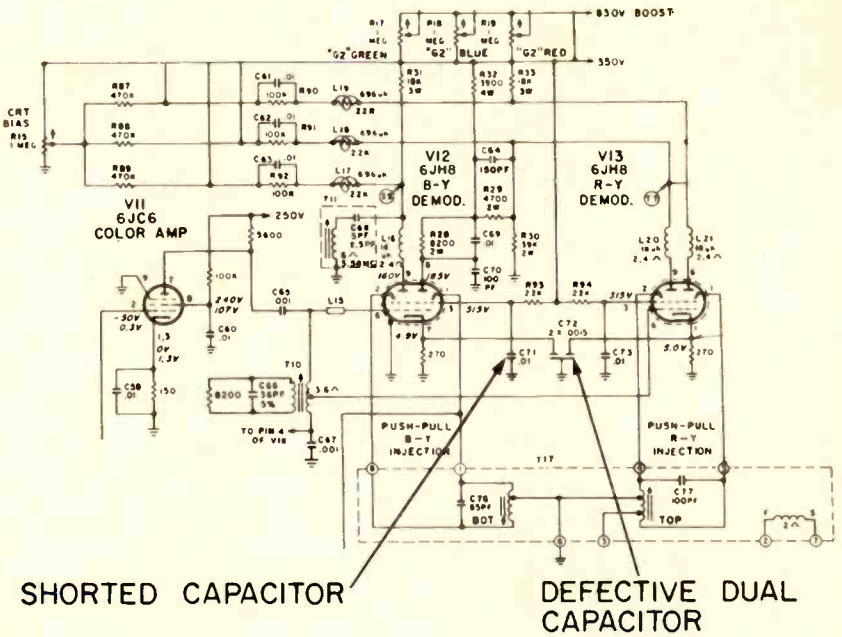


Fig. 4--The color section of a Zenith 24NC31Z chassis showing the defective dual capacitor causing weak red color reproduction.

as found in the service manuals.

A few General Electric CB color chassis developed intermittent color fadeout. Any color chassis that uses a neon bulb to feed the horizontal gate pulse to the burst gate amplifier can have this problem. See color section schematic Fig. 3, showing neon bulb N701. A close visual inspection should be made when the set is in operation to see if the bulb is firing and if there is any discoloration (darkness) of the bulb. These color chassis use synchronous detectors and are of the balanced diode type. The burst signal, if inductively coupled to the secondary of T702, excites the high Q resonant crystal circuit (T702, C714, Y701) into a sine wave oscillation. Since the burst "rings" the crystal circuit only during retrace time, the resulting wavetrain is decaying during trace time. Coil L705 adjusts the amplitude of this sine wave train output.

Zenith Sheet Beam High Level Demodulator Problems

Any shift in color or black and white tracking is normally found in the demodulator tubes or circuits. The following problems were found in a 24NC31Z Zenith color chassis shown in partial schematic Fig. 4. The same problems have been found in other Zenith color chassis with similar circuits.

All later chassis use a .01μf screen bypass capacitor on the demodulator tubes. If C71 shorts, the picture will be too blue and cannot be turned down by the blue screen control. Leakage in these capacitors can cause error in the B/W tracking. Should color roll vertically through the picture, and the B/W picture locks in, but has a hum bar, suspect heater to cathode leakage in one of the demodulator tubes. A normal B/W picture, but with color rolling up or down like a window shade, can be caused by a heater to cathode short in color phase detector.

This color problem gave us a merry chase and no doubt is rare, but it may give you a clue in finding other troubles. The set had a complaint of weak red color reproduction. A color bar test pattern confirmed this. Voltage and scope checks were then made but all appeared within tolerance. Next, a complete alignment of the color section was made, but with no results or improvements. All alignment adjustments gave the proper response and indications. A sweep alignment check was even made for the tuner and IF response again with negative results. All of the trouble seemed to be in the R-Y demodulator but everything seemed to check out. Then a scope check of the cathode, pin 7 of the R-Y demodulator tube V13 and the correct waveshape of about 4v P-P was found. Further checks revealed that one-half of the C72 a .0015 μf cathode capacitor (shown in Fig. 4) had opened. Now should these dual units short together (both cathodes are in effect tied to each other), the CRT screen will turn

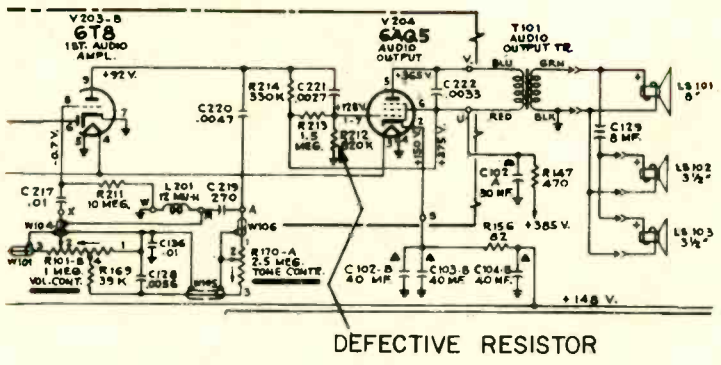


Fig. 5--Partial schematic of the audio section in the RCA Victor color chassis CTC5N showing the defective resistor causing audio distortion during color programs.

a greenish cast on black and white reproduction. Sometimes this trouble can be an intermittent condition. It is suggested that when this dual capacitor is replaced, use two separate capacitors. Always be on the lookout for those abnormal waveshapes with your scope.

Improper Color B/W Picture Normal

If adjustments do not respond as outlined in service manual, suspect a defective injection transformer. Also, suspect the transformer if adjustments do not stay accurate, or if set owner complains of poor color, especially on flesh tones, or yellows and browns. Misalignment of the injection transformer can also cause this type of trouble.

A 24NC312 Zenith chassis had weak blues and the flesh tones could not be adjusted properly. The injection transformer did not seem to respond correctly to the alignment procedures. A scope check at pins 1 and 2 deflectors of the B-Y demodulator for 3.58MHz CW drive revealed about 30v P-P. The correct drive should have been 111v P-P. The quadrature coil was found to have shorted turns and a new one was installed producing normal color.

Intermittent Color

If the color changes on the screen during a color telecast or intermittently cuts off and on and all components check out, do not overlook this possibility. If the set employs a plug connection from the color and tint controls like that found on a Zenith chassis 24NC31Z, the plug and socket with a direct wire. These sockets have caused some tough intermittent color problems that are hard to catch.

A defective or cold solder joint in the pin of the plug that connects the IF cable to the VHF or UHF tuners can cause all sorts of problems. The color will fade in and out, streaks and lines may run across the screen and sometimes you may think the tuner is defective. If you have any doubts, resolder this pin for a good connection. Also check for a good ground connection.

Color Signal Causing Audio Distortion

This problem occurred in an older model RCA color chassis CTC5N partial audio schematic (shown in Fig. 5). During B/W programs the audio was clear but when color information was received, the audio would be garbled and distorted. Thinking back to our B/W TV service days, it was recalled that voltage divider type audio output stages as found in this chassis can cause all sorts of strange troubles. It was noted with a VTVM that the plate voltage and also control grid voltage pin 1-7 of V204 would drop about five or ten volts during color programs. The set draws more current when the color stages are active. The resistors in this stage were checked out and a 820K resistor R212 had increased in value up to 2.50M. A new 820K resistor solved this problem. The increased resistor value and the drop in B+ voltage made enough change in the tubes characteristics curves to cause distortion of the audio amplified signal output.

Many color TV problems have interactions which are related and are caused by other sections of the receiver. This is why you will have to study the circuits to come up with a fast solution for these color problems.

Saturated Red Green or Blue Screen Controls Had No Effect

This trouble can be misleading and tricky. A Westinghouse color TV receiver and also several other brands had too much red, green or blue in the picture but the screen controls had negative control. All voltages right up to the CRT socket plug checked out okay, as did the CRT. This trouble can be caused by an open connection or cold solder joint in the CRT socket itself. Some have been found with one or more broken or open plug pin connections. The best solution is to replace the complete CRT socket and wiring harness. ■

FM STEREO ALIGNMENT

Today's standards of FM transmission require accurate alignment of the FM receivers. Avoid problems of inaccurate adjustment by using proper test instruments and procedures

■ A basic understanding of the signals transmitted by the FM station is important to FM stereo servicing.

The FCC required that a compatible method of transmission be developed to insure that existing FM monaural receivers could still receive the normal monaural FM with complete response over the 50-15,000Hz frequency range. The final solution to this problem was to combine the right channel with the left channel to produce a L +R signal and modulate the FM transmitter with this information (Fig. 1).

The right channel microphone, +R, and the left channel, +L, are introduced to an Adder amplifier with the resulting L +R, 50-15,000Hz signal modulating the reactance modulator up to 90 percent. This method meets the FCC requirement allowing the old non-stereo FM receivers to receive FM without distortion or loss of fidelity.

To introduce FM stereo, it is necessary to obtain a separate right channel and a separate left channel with 40db separation to compare with the channel separation of a stereo recording. Forty db of separation provides for almost no crosstalk between the channels.

Observing the polarity indications in Fig. 1, the L +R amplifier is being fed the left channel signal and the right channel signals in phase. The L-R amplifier is being fed the left channel and right channel signals, but by passing the +R channel through a phase inverter, the L-R amplifier is fed a +L and a -R, producing a L-R output signal. The resultant signal in both cases contains the same frequency components in the same amplitudes. Therefore they would sound the same to the ear.

The L-R, 50-15,000Hz signal is then used to amplitude-modulate a 38kHz carrier signal. Since this modulation occurs in a balanced modulator, the output from this stage is a double-sideband-suppressed carrier containing supersonic ac signals (Fig. 2) having frequency components in the range of 23 to 53kHz. By modulating the 38kHz carrier frequency with an ac signal of 50-15,000Hz, the sidebands produced would extend 15kHz above and below the carrier, or from 23 to 53kHz. None of these supersonic frequencies are audible, until they are detected from the transmitted signal in a FM MPX receiver.

The 38kHz carrier cannot be transmitted, as it would produce an undesirable beat interference in the receiver. Therefore, a balanced modulator is used where the output carrier is suppressed to less than 1 percent.

Fig. 1 shows the 19kHz oscillator. This is the pilot subcarrier signal; the 19kHz subcarrier is not audible in the receiver. The 19kHz is used to modulate the transmitter from 8 to 10 percent.

The multiplex modulating signal for an FM stereo broadcast consists of the monaural L +R audio ac signals, a 19kHz ac pilot subcarrier, and the sideband from 23 to 53kHz, but without the 38kHz carrier.

FM Stereo Receivers

Basically there are two types of stereo converters used in an FM receiver, the matrix type and the switching type. Fig. 3 and 4 show simplified block diagrams of these two circuits which will be explained separately.

The matrix type of FM multiplex signal is received by an FM receiver and is passed through the front end and IF circuits to the detector. The detected

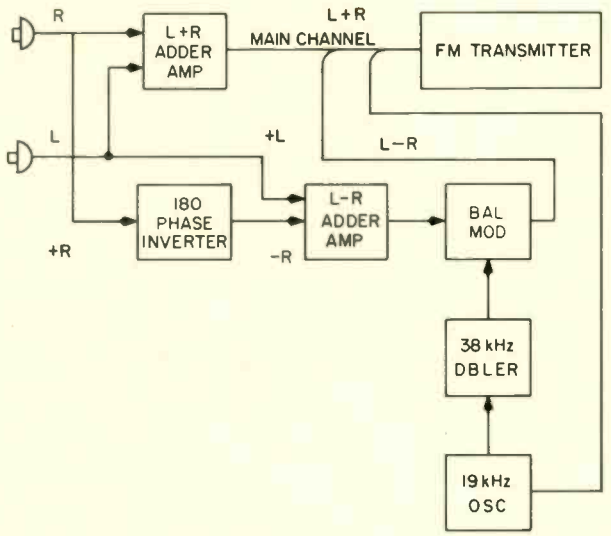


Fig. 1. Block diagram of an FM stereo multiplex transmitting system.

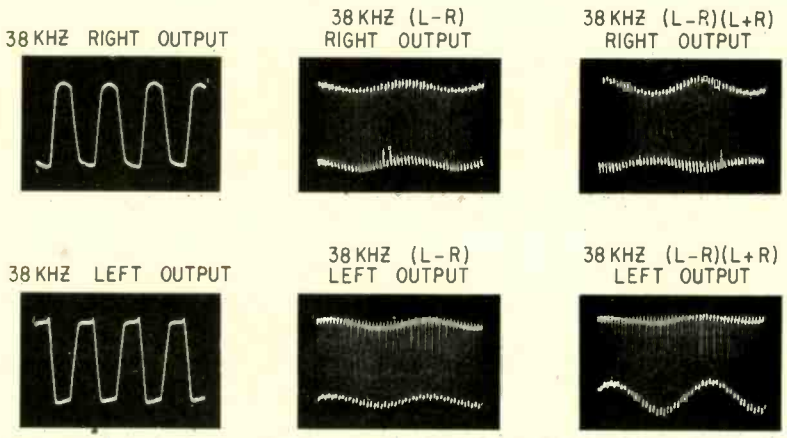


Fig. 2. Output of balanced modulator shows left and right channel outputs with 38kHz carrier.

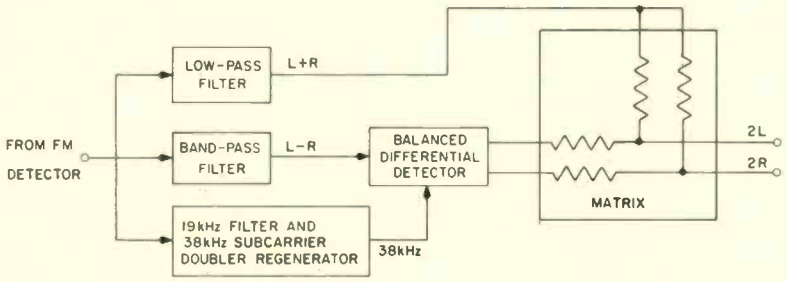


Fig. 3. Block diagram of a matrix type FM receiver.

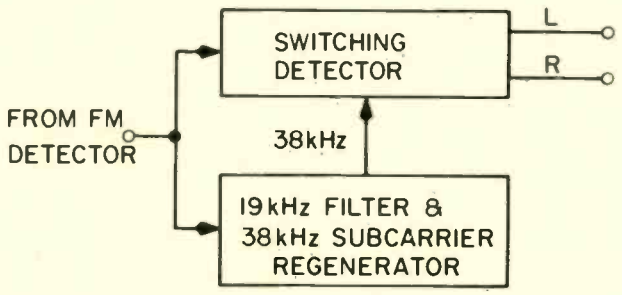


Fig. 4. Block diagram of a switching type FM receiver.

FM signal is applied to a de-emphasis network which rolls off all but the L + R part of the signal, to the monophonic circuits of the FM receiver. The detected signal, consisting of L +R and the 19kHz pilot subcarrier, is applied to the low-pass filter, a band-pass filter and to the desired 38kHz double R circuit. The low-pass filter permits only the L + R signal to pass through (Fig. 3). The L+ R double-sideband signal passes through the bank-pass filter and is applied to the balanced differential detector.

In the 19kHz filter and 38kHz doubler circuit, the 19kHz pilot signal is used to synchronize the 38kHz doubler circuit of the receiver with the suppressed 38kHz subcarrier used at the transmitter. The 19kHz pilot signal is then filtered out and the 38kHz doubler signal is applied to the balanced differential detector circuit.

In the balanced differential detector circuit, the 38kHz signal is mixed with the L-R double-sideband signal. The resulting signal is then demodulated to produce L-R and -L +R signals. The L-R, -L +R and the L +R signals are applied to the matrix circuit which combines the L +R and the L-R signals. The -R and +R signals cancel leaving a 2L signal for the left channel output. When the L +R and the -L +R signals are combined in the matrix network,

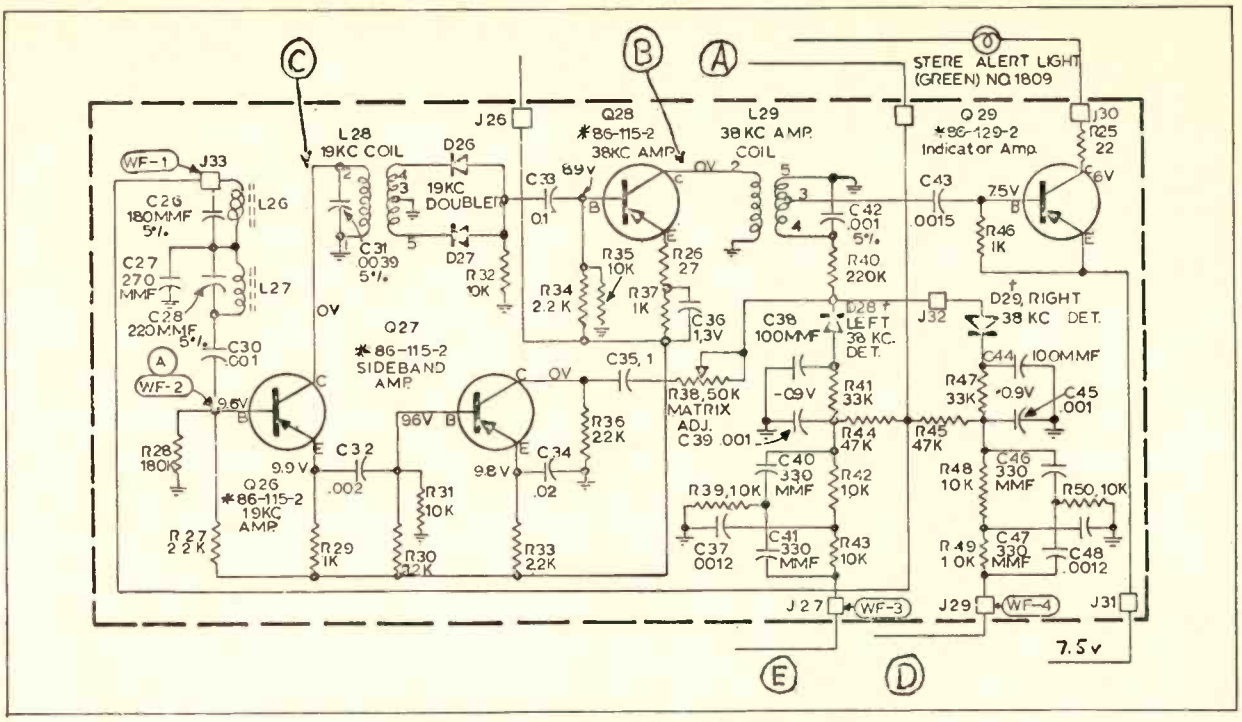


Fig. 9. Multiplex circuit of the matrix type.

FM STEREO ALIGNMENT...

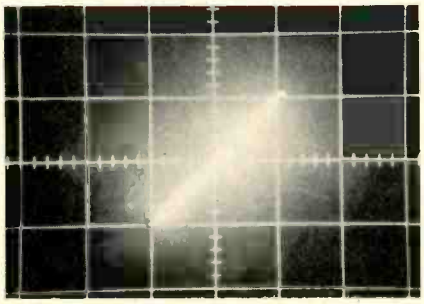


Fig. 5. Monophonic output at 45deg.

Fig. 6. Stereo output forms a circular pattern.

the + L and -L signals cancel leaving a 2 R signal for the right channel output.

Switching Type Receiver

In the switching type circuit, shown in simplified block diagram of Fig. 4, the signal from the FM detector (L + R, L-R double side-band, and the 19kHz pilot subcarrier) is applied to the switching detector circuit, the 19kHz filter and 38kHz doubler circuits. The 19kHz pilot signal is used to synchronize the 38kHz doubler signal of the receiver with the 38kHz subcarrier of the multiplex signal. The 19kHz pilot signal is then filtered out and the 38kHz subcarrier is applied to the switching circuit. Here it is used to synchronize the left and right channels, switching detectors with the incoming waveform. This causes the switching detectors to alternately turn on and off. The left channel detector operates only when the incoming waveform carries left channel signal information. Conversely, the right channel detector operates only when the incoming signal contains right channel signal information.

Measuring Channel Separation

The following test setup will allow you to measure the performance of your stereo system as it responds to a given recording. Connect the left channel of your pickup or left preamp output to the vertical input of your scope, and connect the vertical and horizontal inputs together. Adjust the scope so that both vertical and horizontal amplifiers are in the ac position. Set the horizontal gain to maximum. Play a recording. Adjust the vertical gain until the line on the scope appears at a 45deg angle. Remove the jumper between the two input connections. Connect the right channel of your pickup or preamp to the horizontal input. If you play a monaural record, the pattern on the scope should still be a 45deg line (Fig. 5). If the two outputs are unequal, the line will shift from the 45deg angle. A slight adjustment in the balance control of your preamp will compensate for most minor inbalances.

When a stereo record is played and the volume in both channels is equal, the pattern will appear as in Fig. 6. Notice that

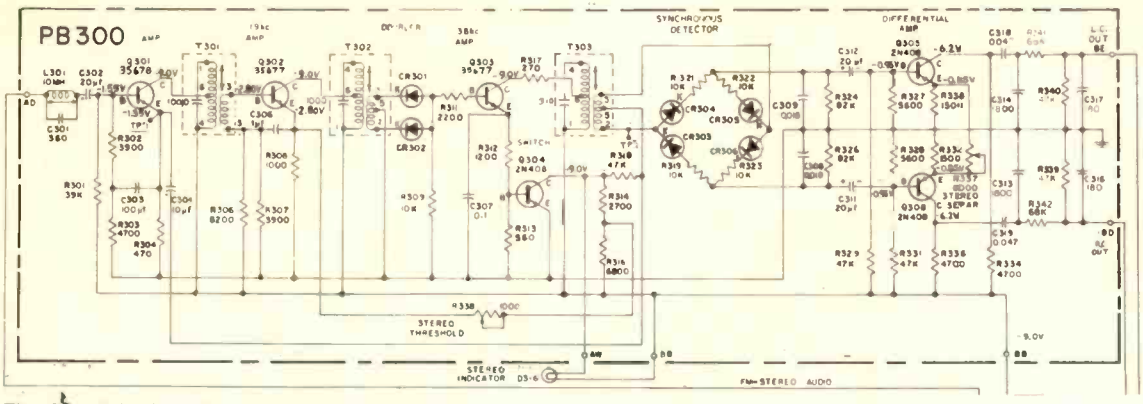


Fig. 10. Multiplex circuit of the switching type.

Fig. 7. (above) Left channel predominates in this display.

Fig. 8. (left) Right channel predominates in this pattern display.

the pattern is symmetrical around a center. If the record and the system have good separation with sound mainly in the left channels active, the pattern will look like Fig. 7, more height than width. Good separation with sound mainly in the right channel will make a pattern like Fig. 8, more width than height. These basic patterns can be used to align multiplex units and troubleshoot stereo equipment.

FM—Stereo Multiplex Alignment

The multiplex signal can be used to align the coils and controls of a multiplex receiver (Fig. 9 and 10). Since all stations do not broadcast stereo constantly, a check with your oscilloscope will tell you when you are receiving multiplex information. The scope is adjusted for a low-frequency sweep and the vertical amplifier connected to the output of the ratio detector (point A in Fig. 9). When a multiplex broadcast signal is received, the display will have the ribbon-like appearance shown in Fig. 11 due to the 19kHz and suppressed-carrier signals. The 67kHz signal for SCA will also display this pattern. You can identify these signals by trial alignment of the 67kHz trap.

In receivers, two types of multiplex carrier generators are used. Earlier types use a 19kHz oscillator whose output is synchronized with the station's pilot signal and then doubled to 38kHz. This type produces a visible heterodyne beat when adjusted off frequency. Later types merely amplify the 19kHz signal transmitted by the FM station and double it.

The first alignment step is adjustment of the 19kHz and 38kHz coils. The results of alignment are observed with the scope adjusted for a 9.5kHz sweep, or one-half that of the 19kHz pilot signal. Connect the vertical amplifier through a low-capacitance probe to the output of the 38kHz amplifier (point B in Fig. 9).

Adjust all of the coils except the 67kHz trap for maximum output as indicated by the pattern height on the scope. If a low-frequency beat is noticeable, one of the 19kHz coils must be readjusted for zero beat.

The 67kHz trap is the one with the smallest coil and should be adjusted for minimum out-

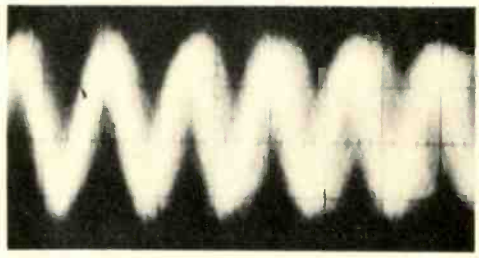


Fig. 11. Output of the ratio detector at points A and B, Fig. 9.

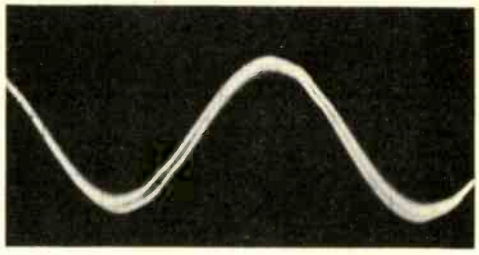


Fig. 12. Shows the 19kHz signal at point C in Fig. 9.

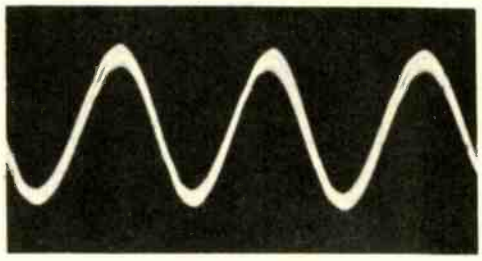


Fig. 13. Shows the 19kHz signal at point B in Fig. 9.

put when the receiver is tuned to a station broadcasting SCA. This trap prevents a heterodyne squeal that can develop between harmonics of the 19kHz receiver oscillator and the 67kHz SCA subcarrier.

At this point make sure the doubler is not tripling. Since the scope is already connected to point B, carefully adjust it to show a stable pattern of four sine waves with a low setting of the scope sync control. Then move the low-capacitance probe back to the output of the 19kHz stage (point C). If the stage is doubling in frequency, there will be a stable presentation of two sine waves at point C as shown in Fig. 12 and 13.

Next the coils are adjusted to produce exactly the correct phase of the 38kHz carrier. For this test, the scope is adjusted for external horizontal input at maximum gain. The horizontal and vertical inputs (no low-capacitance probe) are tied together and a single ac signal is applied to both. The vertical gain is adjusted to produce a 45deg line on the scope screen. Then the vertical and horizontal inputs are separated and the vertical input is connected to the output of the left preamplifier, point D. The horizontal input is connected to the output of the right preamplifier, point E.

If a monophonic signal is tuned in, the R and L signals are the same and a 45deg line (Fig. 5) will appear on the scope. To test this, turn the function switch to an AM station. If the line is not exactly at 45deg, the balance control on the receiver can be adjusted to compensate for the difference.

When a multiplex signal is tuned in, the oscilloscope pattern should appear as an expanding and contracting series of shapes. They start with a pinpoint on the screen during no-modulation periods and expand to circles and ellipses that are sometimes vertical, sometimes horizontal, and many times working around to the 45deg monophonic line (Fig. 6).

For this phase adjustment, a program with a full orchestra which will produce a large circular pattern as shown in Fig. 6 is desirable. If the phase of the 19kHz or 38kHz coil is not correct, the circle will be flat on one side of the 45deg area. Adjust each coil slightly to fill out the pattern equally on either side.

Adjustment of the coils at this point is not just a simple matter of tuning for maximum. The oscilloscope pattern may jump wildly. You should turn each slug slightly and watch for roundness.

If turned too far one way, the scope may make a straight 45deg line. If the pattern goes to an ellipse, the change is in the right direction. You try to make the ellipse a little wider and, if you turn too much, the ellipse may again collapse to a straight 45deg line.

Check the receiver by tuning in several multiplex stations and make sure the receiver is working equally well on all stations.

As with alignment jobs on any equipment, the technician has to develop a "know-when" sense. Most coil adjustments, take very little adjustment.

Multiplex circuits can be difficult to service, but using the oscilloscope servicing technique can make them somewhat easier and faster to troubleshoot and align. ■

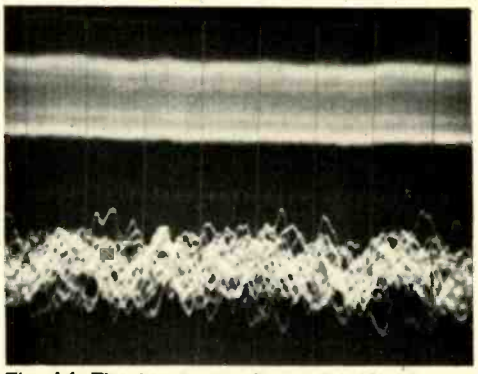


Fig. 14. The top trace shows the signal at the cathode of CR301 (Fig 10.). The bottom display is the audio output taken at point D in Fig. 9.

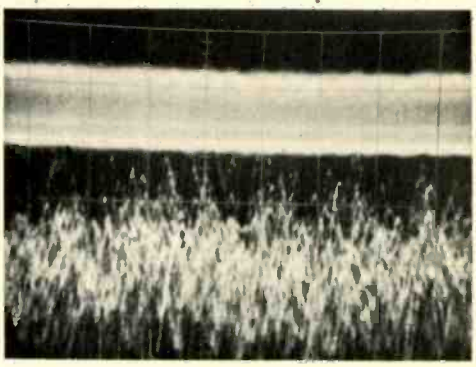


Fig. 15. The top and bottom traces are taken at the same points as in Fig. 14 except with the scope set to a faster scan rate.

TECHNICIAN INCENTIVE

Service-dealers must rely on their capable technicians for proper service support. And in many shops the technician is also in a good position to sell, whether it be antennas, accessories or providing leads toward new TV sales. Whatever the case, this situation can be improved by providing your technicians with an incentive--a bonus for doing better in both areas.

■Technicians and dealers alike realize that the TV-radio business hinges not only on the quality of the product being sold, but the availability of service after the sale. The technician, besides being an asset to the service business, can often be the source of additional sales if given the chance and an incentive. The incentive can apply to service as well as to sales, but sales would generally be the most rewarding and would include items such as antennas, accessories and TV-radio sets.

A program of this type was initiated by Gene Ware of West Park TV in Arlington, Tex. Ware started West Park TV working as a technician in his garage only five years ago and now has sales close to half a million dollars. He credits this impressive growth to his service department.

The Incentive Plan

"I am first of all a technician myself," Ware admits. "I know what a good technician should be and when I employ a man, I check not only his technical qualities, but his attitude, appearance and his past history. Once the man is put on the payroll he is on a 30-day trial period. During that time he is judged on his ability and honesty. Consequently, I consider my technicians among the best and believe in allowing them to make use of their abilities."

As an incentive for his technicians to do their best, Ware designed a plan to enhance a technician's income, status and self-confidence. One of these plans is an "incentive pay plan." "A technician earns a dollar for every compliment he gets from a customer. He also earns a 25 percent commission on the sale of antennas, service contracts and leads for the sale of new TV and radio sets when the total sales amount to more than three times his salary. In one two-month period alone, "Ware states, one technician's commission check grew from $10 to $100 a month.

"We also have a little fund in the store called the 'Dum Dum Fund' which applies to all employees including management. It lists a number of goofs which we call dum dums and provides a penalty for each one."

'Dum Dum Donations'

To all employees including President and Vice president:

1.	Failure to tie down and cover set during delivery or pickup	1.00
2.	Failure to lock truck or take out equipment	1.00
3.	Failure to keep promise to customer	.25
4.	Failure to notify customer if call can't be made	.10
5.	Failure to put away schematics, soft drink bottles, coffee cups, etc.	.10
6.	Failure to complete service, delivery or route sheet	.10
7.	Failure to keep backside of unit toward swinging door	.10
8.	Failure to follow service procedure (in shop)	.10
9.	Failure to get customer name for follow up	.10
10.	Failure to keep merchandise tagged	.10
11.	Failure to return borrowed tools (replace same)	.10
12.	Being late to any company function (without prior approval)	.10
13.	Failure to have check ready by 5:30 p.m.	.10
14.	Failure to turn prospect over to sales department	.10

15. Failure to make follow up on sales .10

Any Compliment Received of Customer $1.00

Technicians making house calls have their schedule made out each day by a telephone secretary who fills them out on a route sheet. "In addition, we require each technician to fill out a daily route sheet so we can determine how much time he has put in." Ware explains. "At the end of the week the sheet is tallied and used to figure the technician's commission."

The route sheet and incentive pay plan idea came about as the result of a management seminar put on by the National Appliance, Radio and Television Dealers Assn. (NARTDA) which Gene Ware and his partner, Jack Gregory attended. "Becoming members of the trade associations has played a big part in our success," Gregory admits. "We get involved in them, attend the meetings and use the advice they have to offer." He advises other dealers to participate in their own local trade associations.

Technicians Promote Good Customer Relations

West Park TV thrives on the theory that good customer relations is a vital part of its service program. "To promote this idea," Ware stresses, "all of our technicians are dressed in uniforms with the man's name, the firm name and the name of the Texas Electronic Assn. on his badge.

"This identification, plus the technician's uniform, has been of great value to them. It makes them appear more professional in the eyes of the customer. Our women customers feel safer when they recognize the uniform and because their identification is prominently displayed."

Apprentice Technician Training

The uniform alone does not make a technician. West Park TV realizes this and sees to it that its employees are sent to all of the training sessions held by manufacturers and trade associations—including those out of town.

In addition to keeping the present staff up-to-date and being selective in his employment of skilled technicians, Ware recently put into effect an apprentice training program. The program is in conjunction with the Industrial Cooperative Training program carried on by two of the local high schools. Ware indicates that the program has been very effective and that similar programs are in effect in many cities across the country.

Cardex System Backs Service

To back up its efficient service department, West Park TV has installed a special record system called "Cardex." Jack Gregory believes in the theory that "you can't sell from an empty wagon" and inventory control is one way to insure an adequate stock. "The Cardex system tells us what is in stock and when to reorder. It also indicates the date we received the merchandise, the invoice number of the bill, the date the bill was paid, serial number of the merchandise and whether it was sold, rented or used for demonstration."

Jack Gregory outlines some of the advantages of the system: "It tells us on a regular monthly basis what we have left on hand, what shortages exist in our lines and the turnover rate per item. Remember, you can make money buying as well as selling. We buy in half or full carlots and participate in some of the special package programs.

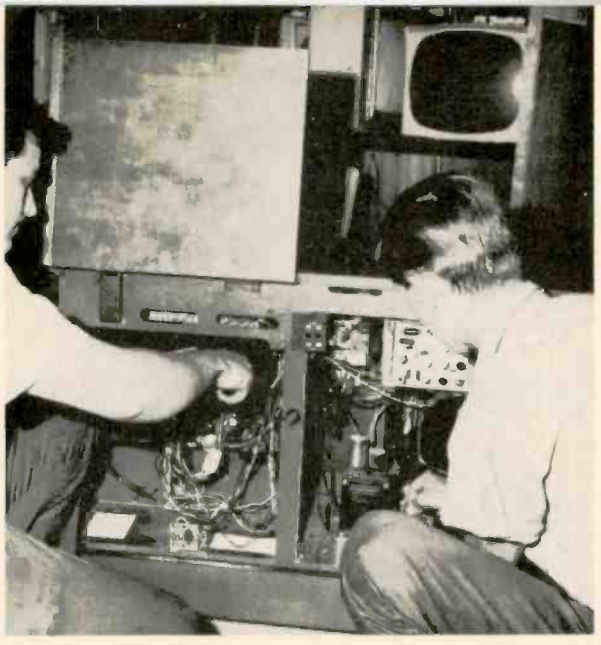
All of the technicians at West Park TV are carefully selected by Gene Ware. The men wear light gray uniforms bearing the Texas Electronic Assn. badge with the man's name and name of the firm on the shirt.

This also brings in additional revenue and helps the profit picture."

Inter-Dealer Analysis

"Ours is a competitive business," Gregory continues, and if the independent dealer doesn't stay ahead of the big chain and discount stores, he can fall by the wayside. For that reason we are willing to learn all we can from others in our business."

Going along with that line of thinking, Gene Ware and Jack Gregory joined with some of the dealers in other areas of Texas in a program of "dealer analysis." The dealers get together and spend a weekend looking over one dealer's store selected from their group. Often the dealers even bring their families to make a holiday of it. But this does not destroy the usefulness of their program which includes evaluation not only of the store layout and display, but the neatness and efficiency of the employees. The visiting team offers suggestions, criticism and recommendations. "We have learned a great deal from this inter-dealer analysis," Gregory claims. "It's a good program and anyone thinking of going into a similar one should do so with an open mind and accept criticism.



Clockwise starting below right:

One of West Park TV's vans is used for deliveries. There are four vehicles in its fleet, two are radio-equipped vans for service calls, the one pictured for delivery and one automobile for emergency transportation or delivery. Jack Gregory (left), vice president and sales manager, is delighted over the monthly sales report which shows the firm's expected goal of almost half a million dollars. Facing him is Gene Ware, president of West Park TV. Joining in their delight is the staff bookkeeper. The service department is readily accessible to customers. A customer bringing in a portable TV set for repair explains the symptoms to the technician. Customers are encouraged to visit the service shop and watch the work being done if they desire.

Service calls are taken by a telephone secretary. The service department manager checks the service requests which are then routed and filed in appropriately labeled boxes on the wall. Tight inventory control is accomplished with a Cardex system instituted by Jack Gregory. Mrs. Ware, secretary at West Park TV, is shown here with her husband, Gene, listing the serial number of newly received TV sets.

The technician apprentice training program is in full swing at West Park TV in cooperation with the Industrial Cooperative Training program carried on in two of the local high schools.

Reduce call-backs and get the best in performance by checking the cathode current of horizontal output tubes

ET/D **TEST LAB REPORT**

Seco Model HC-8 Pacer

■ Although current checkihg is not new, we should be again reminded of the importance of this measurement to prolong the life of horizontal output components and improve set performance.

The new Model HC-8 current checker provides the TV technician with a fast, positive, on-the-spot method of optimizing horizontal output circuits. The current checker can be placed in the output tube circuit in seconds without disconnecting the cathode and it will immediately indicate whether cathode current of horizontal deflection output tubes are within recommended limits.

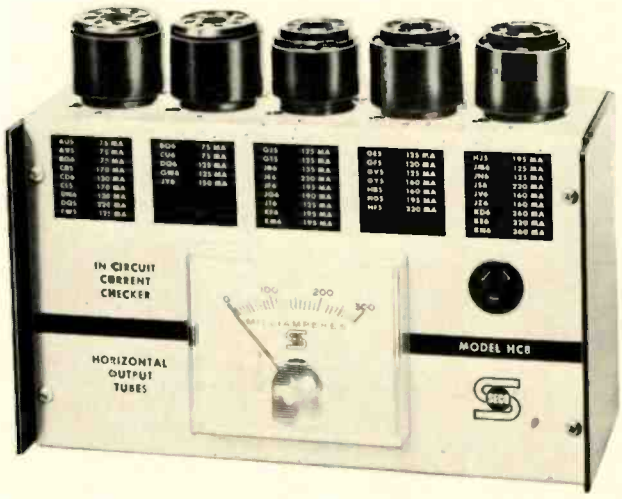
The unit is valuable as a fast, accurate indicating device while adjusting the horizontal drive and linearity in B/W sets and the efficiency coil in color sets. It insures good focus, proper linearity and stability with minimum cathode current.

The current checker virtually eliminates the most common cause of call-backs such as: unstable focus, shrinking picture, shifting convergence and a number of other problems. The current checker should be used on the horizontal output tube, transformer or yoke replacement jobs and before attempting convergence.

There are a number of service adjustments that reduce cathode current: (a) Loosening the driver trimmer will generally reduce the cathode current. (b) The width control will have varying degrees of effectiveness depending on the type of control and circuit location. (c) "Tuning" the linearity coil will reveal a dip in current at a particular adjustment. Leave adjustment at or near the dip. If a dip is not noted, adjust the slug to the lowest cathode current. Assuming the circuit is not defective in any way, linearity will automatically be optimum. (d) Color TV sets should have the linearity or horizontal effeciency coil adjusted for near minimum cathode current for maximum horizontal output tube life and prolonged convergence and focus effect.

If the usual service adjustments fail to bring the cathode current down to a satisfactory minimum, the following components should be kept in mind as possible sources of trouble: (a) defective screen voltage resistor. (b) open screen bypass capacitor, (c) open cathode bypass capacitor, (d) defective flyback transformer or yoke, (e) defective linearity or width coils or components, (f) weak oscillator or discharge tube, (g) circuits fed from the boost voltage.

When a new tube is installed, or before attempting convergenge of a color receiver, the cathode current of the horizontal output tube should be checked. The checker is priced at $34.50. ■



Seco Model HC-8 Pacer in-circuit current checker for horizontal output tubes.

TEST INSTRUMENTS

Change your approach to solid-state equipment servicing with specialized test instruments

Sencore Model FE16 Field Effect Meter

■ With more solid-state circuits, we have to change our approach and employ instruments with high input impedance on all voltage checks to simplify servicing and eliminate loading.

The Sencore meter combines a number of features in a single unit such as high input impedance on both ac and dc voltage range, true P-P ac ranges, zero center ranges for solid-state servicing, dc current ranges for general testing and steel construction for durability.

The meter has the flexibility of a VOM with all the advantages of a VTVM. The FE16 employs a balanced differential amplifier with Field Effect (FET) transistors.

Transistors TR1 and TR2 form the differential amplifier used for dc and ohms measurements. With no voltage applied to the input of TR1, the ZERO ADJ control (R31) is set so that the voltage developed across source resistors R14 and R22 are equal, and no current will flow through the meter. The DC BAL control is used to compensate for component tolerances. When a dc voltage is applied to the input of TR1, the balance between TR1 and TR2 is upset and the meter will indicate in proportion to the voltage applied. Seven dc and ac ranges are provided with the input divider R1 through R8. Capacitors C2 through C8 compensate the divider for ac voltages. The DC CAL control (R15) is an internal adjustment used

Sencore Model FE16 Field Effect Meter.

FE16 SPECIFICATIONS

DC VOLTS

Ranges: 0 to 1, 3, 10, 30, 100, 300 and 1000 full scale −.5 to .5, −1.5 to 1.5, −5 to 5, −15 to 15, −50 to 50, −150 to 150 and −500 to 500 zero center scale ranges. Input Resistance: 15M shunted by 14pf at jack or 37pf through cable. Accuracy: ±1.5%. AC Rejection: 50 to 300 times (30 to 50db).

AC VOLTS

RMS Ranges: 0 to 1, 3, 10, 30, 100, 300 and 1000 full scale. (P-P) Ranges: 0-2.8, 8.4, 28, 84, 280, 840 and 2800 full scale, frequency compensated. Input Resistance: 10M shunted by 29pf at jack or 118pf through cable. Frequency Response: Flat: 25Hz to 1MHz 3db points: 10Hz to 10MHz. Accuracy: ±3%.

OHMMETER

Ranges: 0 to 1K, 10K, 100K, 10M and 1000M. Accuracy: ±2 deg ARC.

DC CURRENT MEASUREMENTS

Ranges: 0-100μa, 1ma, 10ma, 100ma and 1a. Accuracy: ±3% full scale. Internal Voltage Drop: 200mv.

GENERAL SPECIFICATIONS ON FE16

Meter: 4½in. 100μa ±2% diode protected and isolated from input. Multiplier Resistors: ½%. Ohms Battery: 1.5v "C" cell, Eveready Type #1035 or equivalent. Power supply battery: 9v, Eveready Type #222 or equivalent. Weight (less batteries): 3¼ lb. Dimensions: 5in. w x 7-3/16in. h 3-1/16d. Accessories: HV probe (39A19) extends range to 30kv.

to calibrate the meter and a known dc voltage is applied to the input. When a very high voltage is applied to the gate of TR1 (range switch set incorrectly), diode CR7 will conduct and keep the voltage applied to TR1 to a safe level to prevent destruction of the transistor.

An 39A19 HV probe optional accessory can be used to extend the dc range of the meter to 30kv. It contains a 1485M 2 percent resistor to give a 100X multiplier for any range of the meter.

Up to 10a of dc current can be measured with the meter adaptor made from a double ¾in. banana plug and 2ft of #20 copper wire to form the shunt. The leads carrying the current to the shunt should be a #14 or heavier with heavy clips to connect into the circuit.

Very small currents nanoamps (.001μa) can be measured using the meter in conjunction with a 3v battery.

Leakage currents of transistors, diodes and leakage currents through paper or electrolytic capacitors can be measured.

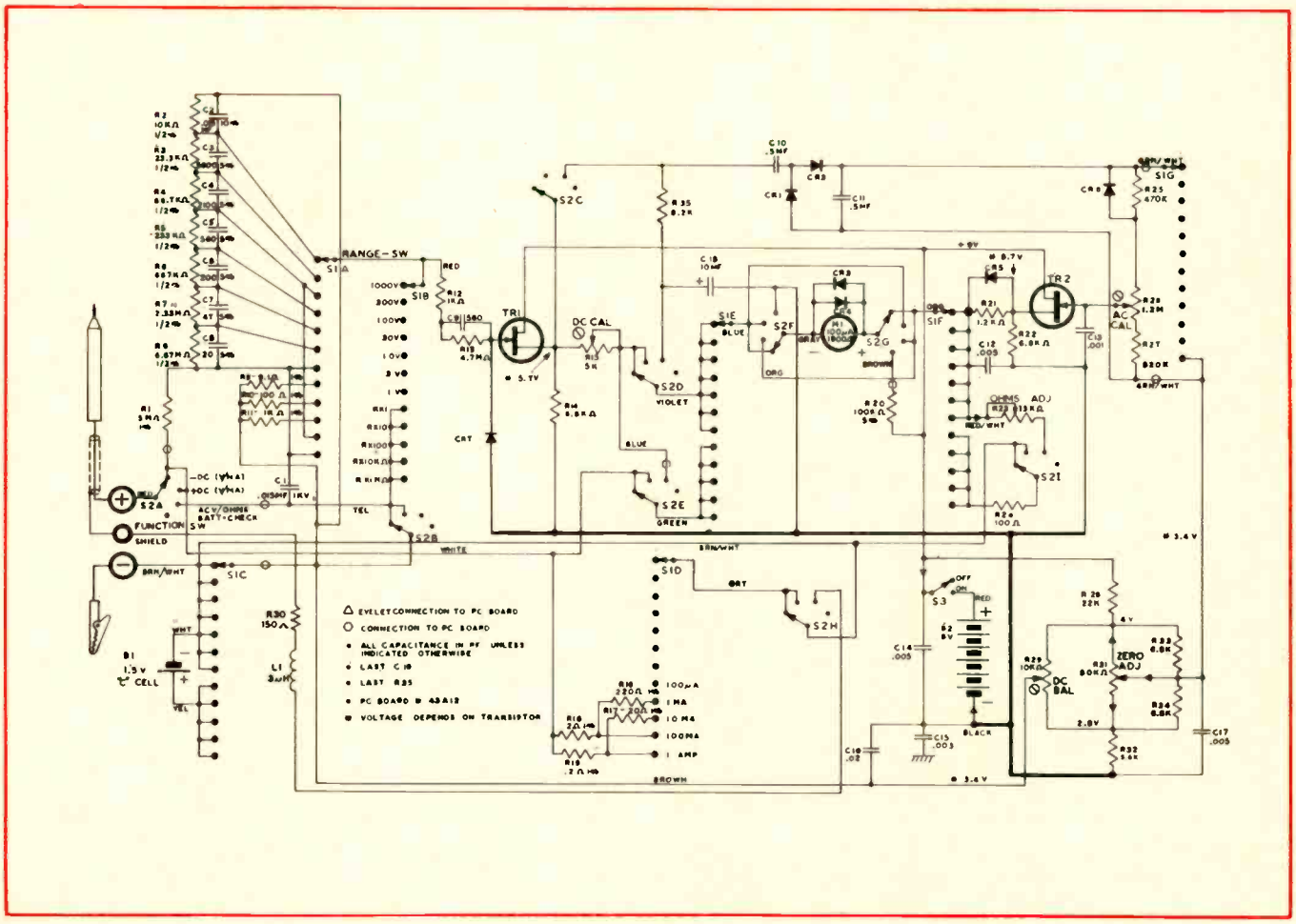
The meter is equipped with a shielded lead on the positive input lead so that accurate ac measurements can be made in the presence of strong electrostatic and magnetic fields. The shield, which is also effective on high ohms ranges, is only connected when using the ac volts/ohms functions and is disconnected when making dc measurements to prevent capacitive loading of the circuit being measured.

The meter is powered by batteries and can be easily replaced by removing a thumbscrew holding the battery plate in the back of the instrument. The battery plate will slip out exposing the batteries in the clips on the plate.

The 9v battery used in the meter can quickly be checked by switching the function switch to BATT CHK position and if the battery is good the meter will read in the green or BATT GOOD section.

The circuits and meter of the instrument are protected from accidental overloads and application of excessive voltages. A silicon diode protects the transistors and circuit from damage. The meter is protected by two diodes and a resistor. The diodes shunt excessive current around the meter and if the current is excessively high or is applied for too long a period of time, the fuse resistor R24 will burn protecting the meter and diodes. ■

Schematic diagram of the Model FE16 Field Effect Meter.



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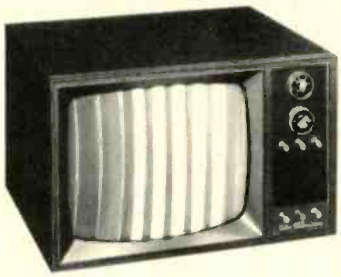

COLOR TV During this course you'll perform over 50 experiments—*and receive all parts and instructions to build your own color TV.*

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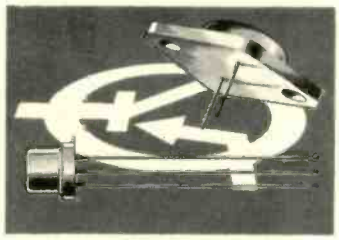
Course is based on the latest receiver circuitry and equipment.



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ET/D DEALER SHOWCASE

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

Tape Recordist Starter Kit 700

To attract new recordists and to make it easier for the neophyte to go deeper into tape recording, a packaged group of essential accessories in a vinyl attache case is introduced. To enhance the value of the kit, SKA-1 for the beginner, a copy of Robins' 28-page guide to successful tape editing and splicing is included. The basic accessories include 7in. reel with 1200ft of "Brand 5" 1.5-mil acetate tape, a 7in. take-up reel, a splicer with splicing tape, 75 tape clips, six 7in.

tape storage boxes, 2oz of head cleaner, 2oz of head and guide lubricant, 180 self-adhering white title labels and three tape editing and cueing pencils. Robins.

Casseiver Compact System 701

Announced is the new 2560 Compact Casseiver System. The new cassette/receiver is a single unit combining an AM/FM stereo receiver and a professional stereo cassette recorder. Included in the system are a matched pair of air-suspension speakers. With this system, the music lover can listen to AM, FM, FM stereo or prerecorded cassettes. He can also record on cassettes from records, stereo microphones, a reel-to-reel tape recorder or directly from the AM/FM stereo tuner. The receiver section of the unit features Field Effect Transistor front end circuitry. FET circuitry is also used in the tone control circuitry. Integrated circuits are utilized in the IF strip and in the preamplifier section. Glass epoxy printed circuit boards and solderless connectors are used to eliminate the possibility of malfunction from bad solder connections. The cassette mechanism features a precision synchronous ac motor for stability and to eliminate flutter and wow. Complete component controls include Bass, Treble, Balance, Loudness, Input Selector, Dual Record and Playback level meters, dual level controls, digital counter and stereo indicator light. Price is under $400. Scott.

Portable Color TV 702

Introduced is the first model in this new series (5062WA), called the Carry-Color, which has a 10in. diagonal picture tube and weighs 24lbs. The cabinet is styled to match walnut furniture and to fit in any setting. It has illuminated channel numerals, a dipole antenna, preset VHF fine tuning and convenient finger-tip tuning color controls. The molded plastic cabinet is 11 3/4in. high, 17in. wide

and 16 1/2in. deep. The set has a 3in. round speaker and 15kv of picture power. Retail price is $229.95. Philco-Ford.

Photo Batteries 703

Announced is a new showcase for photo battery assortment No. PF-22. The display can be used in three ways: as a "standup" showcase on sturdy metal legs; as a counter unit; or as a wall unit. At no charge, the dealer will receive 12 No. 222 blister packed Premium 9v radio batteries. The display has a contemporary design with simulated wood-grain finish. It includes a new improved tester, which

now tests radio and flashlight batteries, as well as photo, alkaline and mercury. There is a drawer to hold current inventory, plus non-blister packed batteries. Dealer assortment price $256.29. Union Carbide.

Cassette Recorders 704

A complete cassette line is introduced to compliment the existing line of reel-to-reel and 8 track cartridge units. One representative model weighs 5½ lbs., is all solid-state and equipped for AC/DC operation. It contains many of the features normally found only in higher priced reel-to-reel recorders, yet it is reportedly simple to operate.

Walnut enclosed stereo deck models, with and without AM/FM radio combinations, are designed to tie in

with home Hi Fi stereo components. Complete cassette recorder/AM-FM radio combinations in portables, walnut-finished for desk use, offer off-the-air music recording. Other features in-

Customer Relations Specialist.

That's you. When you turn on your B & K tester / rejuvenator. A real customer pleaser (even the tough ones). At the same time, it ups your income and quickly pays for itself. This has been proved time and again:

First, by showing your customer, right in the home, the true condition of his picture tube. And how long it will last. (New picture tube sales are easier to justify when your customer is right there to see for himself.)

Second, by rejuvenating the picture tube, while your customer watches, relieved that he's been temporarily spared a major expense. You can do this as a part of your service or for an additional fee which you can offer to apply toward later purchase of a picture tube.

Third, by being able to test and repair all black & white and all color tubes, imports as well as American, in a few minutes. Without removing the picture tube from the TV set.

For shop use, of course, it's a must—for your customer's sake, or to validate your claim on an in-warranty picture tube.

Special B & K time-controlled rejuvenation-process safeguards the picture tube. Adjustable heater voltage is metered and continuously variable from 0 to 13 volts. G-1 and G-2 voltages are completely and continuously variable. All this enables you to pinpoint the desired voltage and make the most accurate possible tests, even on future CRT types. (How's that for non-obsolescence in an era of planned obsolescence?)

Color picture tubes are checked by testing each color gun separately just as the manufacturer would do it. (In fact, this CRT tester has become the commonly used diagnostic tool of the industry.)

The B & K 465 is the professional serviceman's tester.

If you would like to enlist the aid of this "customer relations specialist," see your B & K Distributor or drop us a note and ask for Catalog AP-24.

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May we send you these three unique servicing handbooks as part of an unusual offer of a Trial Membership in Electronic Technician's Book Club?

New Ways to Diagnose Electronic Troubles

Now you can have at your fingertips, this brand-new book, written by noted servicing expert Jack Darr, especially written to show you how to locate troubles—FAST—in *any* kind of electronic circuit. You'll literally chop troubleshooting time to the bone when you put these new methods into action on your service bench.

The author, drawing upon his many years of analysis and experience, explains how almost any service job can be boiled down to a logical troubleshooting sequence. Using typical schematics for tube-type and solid-state radio and TV sets, he shows how you can develop a familiarity with almost any circuit. By analyzing typical schematics, you'll be able to find your way through even the most complicated-looking power supplies and associated circuits—regulators, filters, voltage distribution networks, etc., and you'll be amazed how simple horizontal sweep and high voltage circuits are! Even color sweep circuits—including high voltage supplies—will look much different after you read this book, as will vertical sweep, vertical oscillator, and output stages, video circuits (both B & W and color). You'll discover quick ways to check them and learn to spot actual defects. Color and B & W stages are simplified to the point that locating causes of picture smear, ringing, and other normally difficult troubleshooting jobs become as easy as 1, 2, 3.

The TV tuner, commonly avoided by many technicians because of its "complications," is exposed for what it is—a simple set of circuits, basically. The final two Chapters delve into those troublesome AGC and sync circuits, how they work, why they work (and don't), trouble symptoms, signal tracing, etc. What it all amounts to is, if you want to get to the root of radio and TV problems—FAST—you must have a copy of this book.

How to Use Your VOM, VTVM & Oscilloscope

Here is one of the finest, most practical books ever published on the subject—contains all the data you need to get the most of your test equipment. This ideal guidebook emphasizes the practical aspects of troubleshooting and servicing with these three most-used test units. Whether you want to know more about how these instruments work, or how to use them in everyday applications, this volume by noted author Martin Clifford, contains the answers. Moreover, it will be of tremendous value in helping you select the instruments best suited to your individual needs.

Part I deals with the volt-omn-milliammeter . . . explains how it works, even down to the meter movement, range multipliers, linear and nonlinear scales, VOM types, etc. Gives general guidelines for using a VOM, including many uses and how to care for the instrument, and tells how to use the VOM in troubleshooting all types of circuits, with step-by-step procedure charts you can refer to time and again.

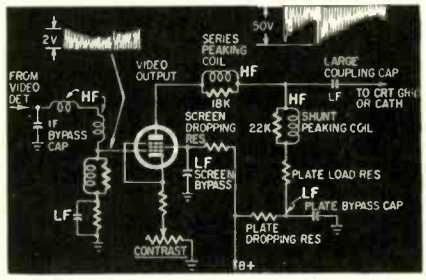
Part II is devoted to the VTVM. A complete description of VTVM types and functions is presented, including transistorized units. Lists VTVM applications in troubleshooting a broad range of circuit types, from simple to complex, and it specifies the care such an instrument should be given. Goes into servicing with the VTVM, pointing out applications where the VTVM is unique as a measuring device. Step-by-step servicing procedure charts are also included.

Part III discusses that versatile instrument, the oscilloscope. If you've never completely understood this instrument, you will after you've read this book. You'll acquire a thorough understanding of both basic and specialized scope circuits. Even if you have been using a scope for years, you will learn new applications, and perhaps truly understand the intricacies of scope measurements for the first time.

Written in easy-to-understand language, the 9 big Chapters are profusely illustrated with scores of drawings, schematics, and troubleshooting charts. Use of this book will really help to increase your test equipment knowledge and servicing efficiency.

Easy Way to Service Radio Receivers

Here is the answer to the need for proven, helpful techniques which show you how to diagnose and correct troubles in any kind of AM receiver—tube or transistor. Devoted exclusively to servicing standard AM broadcast receivers, the content details techniques for diagnosing and correcting troubles in any kind of tube or transistor set.



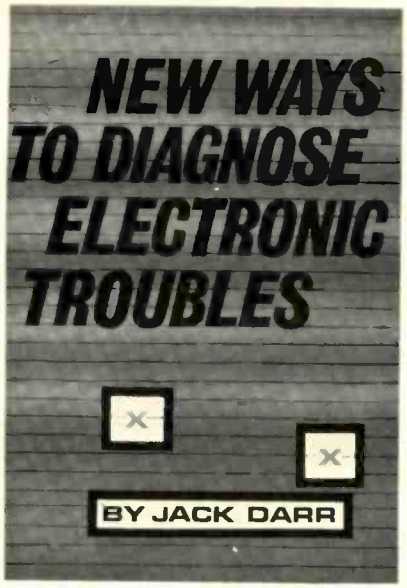
Literally scores of easy-to-use schematic diagrams are contained in all these new books. (Example shown greatly reduced in size)

Beginning with a description of typical receiver circuits and how they work, succeeding Chapters describe the many troubles that befall radio receivers, with step-by-step procedures on how to locate the defects most efficiently. Virtually every possible symptom and component fault is included—from dead set to intermittent operation, from noisy reception to distortion. To help you speed diagnosis, author Leo Sands has included numerous charts which list trouble symptoms and the most probable causes.

Other Chapters give complete details on alignment, special quick-check techniques, adding modifications such as tone-control circuits, extension speakers, headphones, tuning indicators, adapters for battery-operated sets, etc. The final Chapter is devoted to the equipment needed and how to use it. Special test procedures—such as the use of substitution parts, signal tracers, etc.—are also described. Keep this book within reach and you'll be able to quickly diagnose and repair any AM receiver on your service bench.

Truly a useful, needed text for all service technicians—contains just the kind of practical, down-to-earth information you can put to use *immediately!*

New Ways to Diagnose Electronic



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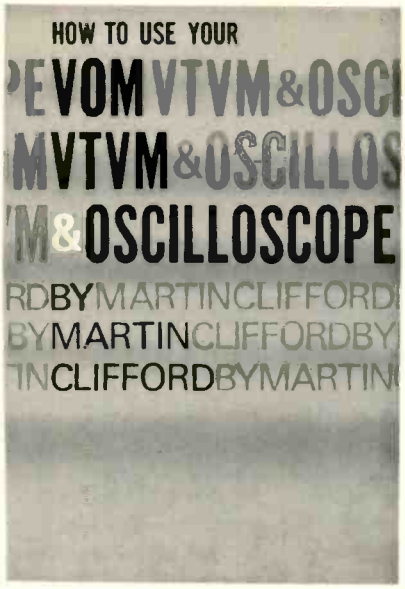

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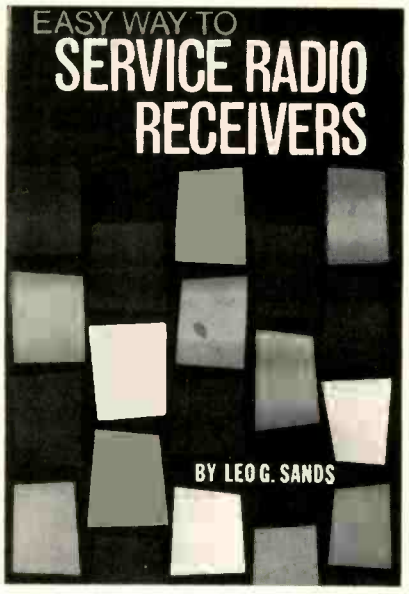

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• 10 GIANT Chapters

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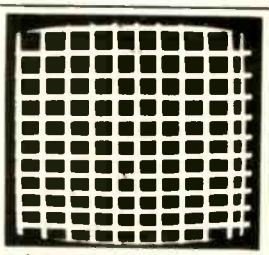

Example of numerous picture trouble photos used as a guide to circuit faults.

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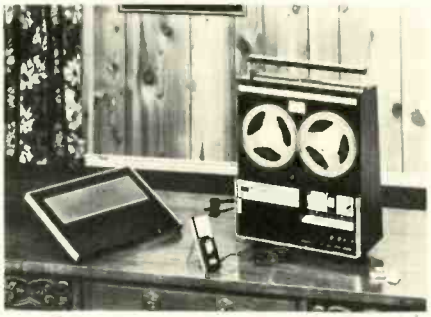
clude 3-digit tape counters, Stop/Start microphones, push button operation, large speakers—some with external speakers to make a complete stereo component system. The units are equipped with batteries, auxiliary cable, blank cassette, microphone and telephone pickup ready for immediate use. Prices start at $169.95. Roberts.

Tape Recorder 705

A new solid-state, upright portable tape recorder emphasizing style and performance is introduced. The Model 70L54-12 employs push-button controls for record, rewind, play, fast forward and stop—comparable to the type used on the more sophisticated recorder models. Amplification is provided by a solid-state chassis using six transistors, three rectifiers and three diodes. The unit employs a 2 3/4 x 4in. oval speaker. The recorder is finished in black and walnut wood-grain, and operates from either ac or six "D" cell batteries. The unit accommodates any size reel up to 5in. and plays or records at either 1 7/8 or 3 3/4 ips. The unit has an electrically operated speed selector control. Special features include a monitor-speaker switch to provide audio while recording, automatic recording level control to maintain audio intensity level, three-digit tape counter with reset button, record/battery indicator meter, separate volume and tone



controls, input and output jacks with earphone, remote switch microphone and a patch cord for recording directly from radio or phonograph. It measures under a foot wide, slightly more than a foot high and 5 3/4in. deep. The shipping weight is 12 lb. and the suggested retail price is $89.95. Arvin.

Sound Columns 706

Two portable sound columns designed for the music industry are introduced. The sound columns are ideal for all types of reproduction such as voice, music, bass guitar and PA systems. The Model SB-180 features six 8in. 15w speakers; 90w RMS; 180w peak music power; grained black vinyl exterior; heavy duty nickel-plated corners; black and silver grill cloth with silver piping on front molding. Size: 52 x 13 1/2 x 8in. The Model SB-250 features four 12in. 30w speakers; 120w RMS; 250w peak music pow-

er. The exterior is finished to the same specifications as the Model SB-180. Size: 56 x 16 x 12in. Retail price of the Model SB-180 is less than $100. The Model SB-250 is priced at $125. Sunburst

Clips and Insulators 707

A line of clips and insulators in three different compact bubble-pack card

sizes is introduced. The cards suggest 101 non-electric uses of clips or clamps. The line is expected to interest radio, audio, TV and Hi Fi fans, electrical and electronic experimenters. Mueller.

Stereo Tape Player 708

A new home entertainment center is introduced featuring an eight-track cartridge stereo tape player with matching walnut speakers. The entertainment

center is available in contemporary-look walnut finish with ivory color accents. Matching speakers measure 10 x 12 x 8in. Home cartridges are adaptable to the Automatic-8 car tape player. The tape player has a selector control for automatic shut-off and continuous playback. Playback speed is 3 3/4ips. Two auxiliary stereo inputs make it possible to play an AM or FM tuner through the entertainment center speakers. The unit features individual controls for volume, tone and stereo balance, with an amber program selector bar which is illuminated for fast, easy, album track selection. It also has an effective dust guard cartridge door. Other important features include vertical-parallel head tracking and double tape guides. Retail price $169.95. Orrtronics.

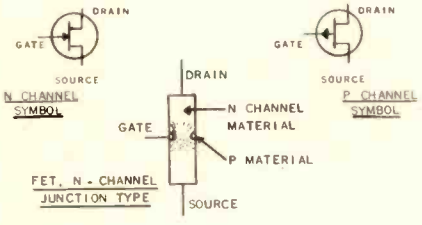
COLORFAX

ADMIRAL

Color Chassis K10—Field Effect Transistor

Field Effect Transistors (FET) have three internal elements called: Source (emitter of electrons), Drain (collector of electrons) and Gate (electron flow control). An FET is easier to understand if one imagines a garden hose with water flowing through it—this would be equivalent to electron flow from Source to Drain. By stepping on the hose, you would restrict or shut off the flow of water. Similarly, by applying a reverse bias to the Gate, which is a ring of the opposite type material, you would restrict the electron flow by creating an internal electrostatic shield.

FET channels can be made of N or P type material. The schematic symbol



arrow points in on the Gate for the N-channel type. FETs normally operate with reverse bias like a vacuum tube. The amount of reverse bias required to stop electron flow through the FET is called the Pinch-Off Voltage.

The Reactance Control stage, Q17, for the 3.58MHz color sub-carrier oscillator in the K10 color chassis is an N-channel, J (junction) FET. In servicing this type of transistor, check for the dc operating voltages given on the schematic. Check for a dc correction voltage at the Gate when the 3.58MHz oscillator is thrown off frequency.

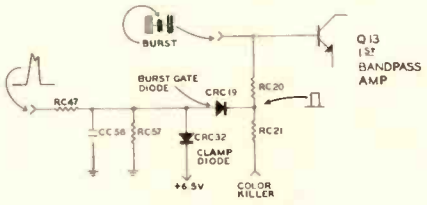
Remember that this type of transistor can be damaged by a static discharge or an arc, and that its amplification can decrease like that of a vacuum tube.

Color TV Chassis K10—Description of Color Circuits

Burst Assurance

The first bandpass amplifier Q13 must be turned on during each horizontal blanking pulse (retrace) of a B/W program so the set will automatically sense the presence of a 3.58MHz burst signal when it is transmitted. When a chroma signal is received, burst will be passed on to the burst amplifier base.

The circuit consists of a burst gating diode CRC19 and clamping diode CRC32. These diodes operate with a positive pulse from the horizontal out-



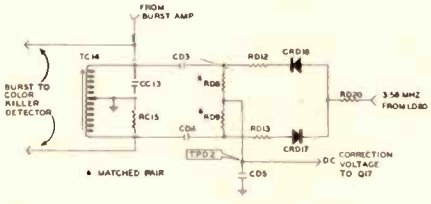
put transformer. The positive pulse will forward bias CRC19. CRC32 has its cathode connected to a 6.5vdc source causing horizontal pulses over 6.6v to forward bias it. The pulse amplitude above 6.6v is clipped off and is not passed by CRC19. The pulse that gets to the base of the 1st bandpass amplifier is sufficient to turn on the transistor.

Burst Amplifier

The burst amplifier, Q12, conducts only during the latter part of the horizontal retrace time. If a color burst signal is present, it will be amplified. Horizontal pulses are provided by the horizontal section and burst signal is provided by the first bandpass collector. TC14 (burst transformer) in the collector circuit is tuned to 3.58MHz, the burst frequency, to prevent the unwanted horizontal pulse from reaching the collector circuit.

Color Phase Detector

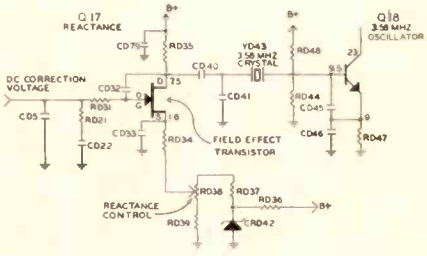
Because the color demodulators operate as precise electronic switches, the subcarrier must be re-established



to provide precise timing. Burst from the station is picked off by sampling the horizontal blanking pedestal with the keyed burst amplifier, Q12. When burst is present, it is amplified and drives phase detectors CRD16, CRD17. At this point, the incoming burst is compared in quadrature with the returning 3.58MHz sinewave from feedback amplifier, Q19. Any unequal conduction of these diodes will produce a dc correction voltage for the reactance control stage, Q17.

3.58MHz Reactance Control

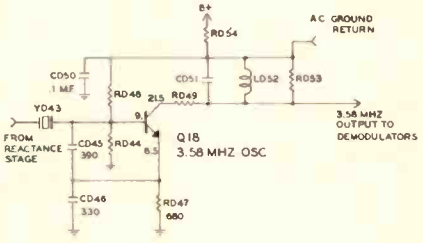
Q17 is an N-channel junction-type field-effect transistor operating as a



reactance stage to synch the phase and frequency of the 3.58MHz subcarrier oscillator with that of the station. As with any reactance stage, the device appears as a parasite on the main resonant circuit, in this case, the 3.58MHz crystal circuit. Varying either the feedback correction voltage from the color phase detector or the reactance control, RD38, will vary the conduction of Q17 and alter the "tuning" of this apparently resonant circuit. Thus, the oscillator's phase will be automatically corrected.

3.58MHz Reference Oscillator

A 3.58MHz sinewave signal of the exact phase and frequency as that of the transmitted signal is produced by the oscillator stage, Q18, and timed by crystal YD43.



The inductance of the crystal itself with CD41, CD45 and CD46 forms an oscillator tank circuit which resonates at 3.58MHz. Working together, these components comprise a step-up effect between emitter and base. Since the base-emitter circuit of Q18 behaves as an oscillator, the emitter-collector circuit will amplify the 3.58MHz base signal.

The oscillator operates continuously on B/W and color programs.

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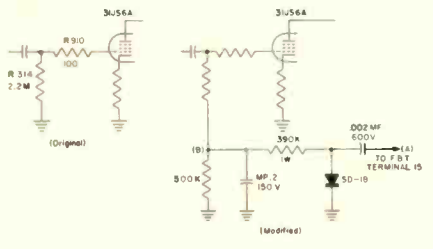
TRUETONE

Color TV Model 2DC4815—Circuit Modifications

Modification of Horizontal Output Circuit

This modification of the horizontal output circuit decreases X-ray radiation by 1/5, if the high voltage shunt regulator is not operating. In working condition the shunt regulators' (6BK4A) high voltage characteristics and other electrical characteristics are exactly the same as those of the original set.

The modified circuit shown works as follows: The AGC's horizontal pulse is rectified and added to the first grid of the horizontal output tube 31JS6A for control. When the shunt regulator is working, the voltage of point (B) is

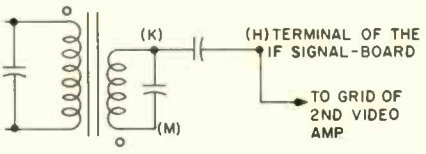


−40v. When the shunt regulator is not working, the voltage of point (A) increases. This voltage increase at point (A) causes the minus voltage at point (B) to increase.

This minus voltage controls the current of the 31JS6A and minimizes the X-ray radiation.

Modification of Vertical Circuit

This modification was made to eliminate the vertical retrace-line with normal brightness. A 600v .005μF paper-

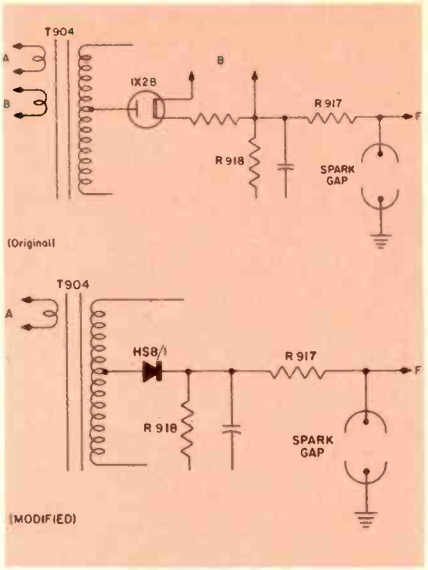


filled capacitor was added between the (K) terminal of the vertical output transformer and the (H) terminal of the IF signal board.

When this capacitor was included in the vertical circuit, it was necessary to reverse the terminal connections on the secondary of the vertical output transformer and the deflection yoke.

Modification of Focus Circuit

This modification was made to improve the serviceability of the set. The 1X2B focus rectifier tube was replaced with a high voltage selenium rectifier



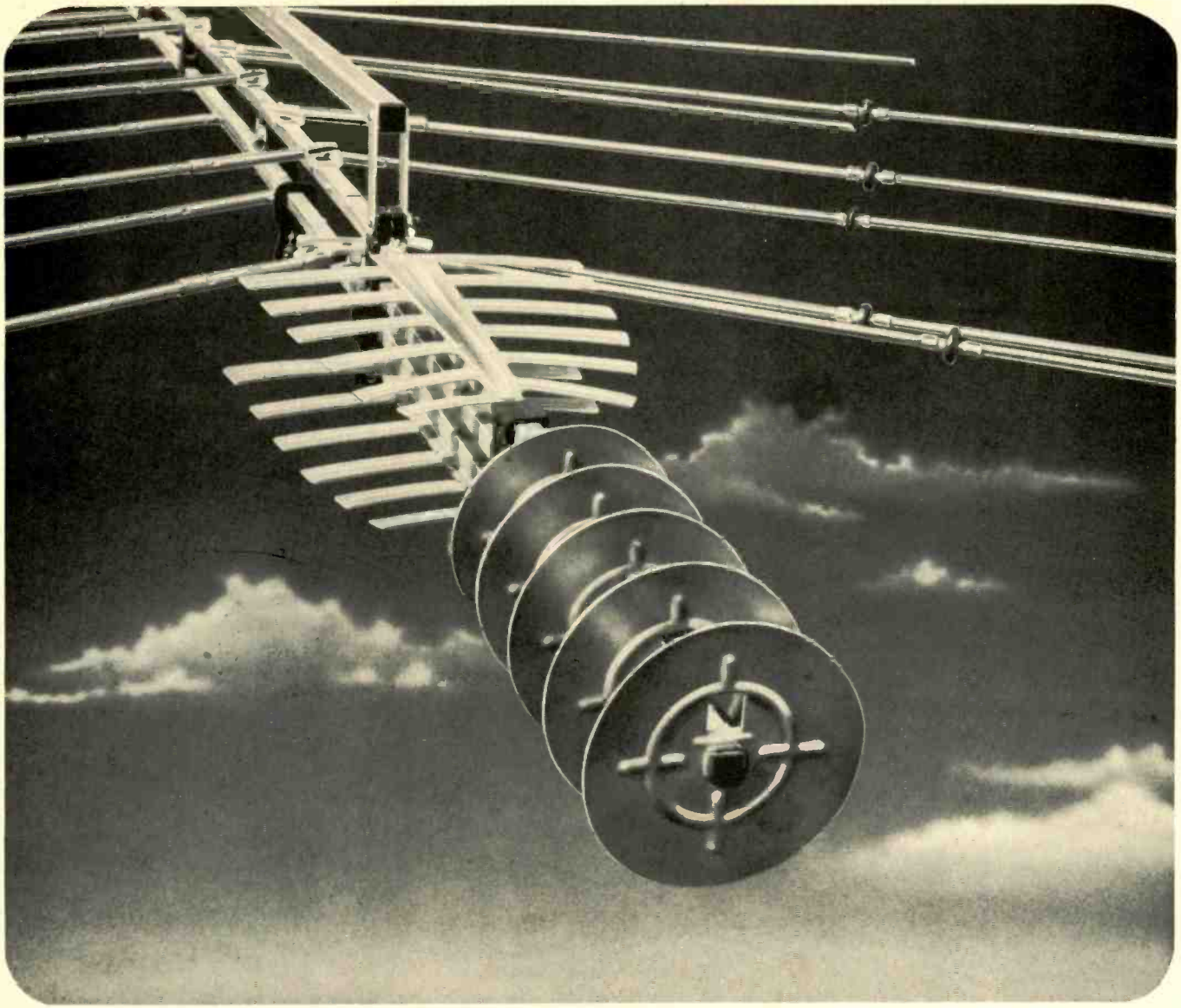
HS8/1. The remainder of this circuit remained the same.

The selenium rectifier is placed across the terminal board of the flyback transformer.

Change of CRT Type

The original picture tube used in this set was a 16CSP22 and was replaced with a 16DAP22. There are no electrical or mechanical differences in these tubes.

The change was made to obtain a truer red color and greater luminance.



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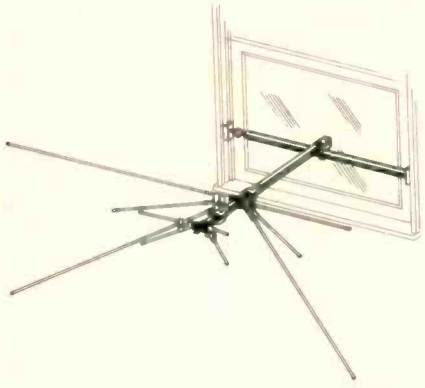
ET/D NEW PRODUCTS

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

Window Antenna 709

Announced is a conical VHF-UHF window antenna. The antenna is said to be a solution to 82-channel reception problems in apartment buildings or where a rooftop antenna cannot be



installed, but is necessary for improved reception. The antenna's swivel construction allows separate orientation of its VHF and UHF sections, reportedly achieving optimum ghost-free reception of all available VHF and UHF channels. This all-aluminum antenna with a gold corrosion-proof finish delivers optimum gain on VHF with four full-size elements plus two high-frequency elements, while four elements bring in sharp UHF. The antennas are mounted on sturdy extendable window frame mounts which span up to 42 in. and can be mounted either horizontally or vertically to fit any type of window. For wider or higher windows, two extension mount bars are available. Model FCW-VU (VHF-UHF) list price is $14.95. Model FCW (VHF only) list price is $11.95. Finco.

Solid-State Scope 710

A new portable oscilloscope weighing less than 7lb but containing almost all the features of its bigger brothers has been developed. Designated the Model 300, this solid-state unit features identical dc vertical and horizontal amplifiers and has a claimed sensitivity of better than 10mv P-P. The scope has been designed specifically for those assignments requiring a good, reliable laboratory-quality scope for use in the field. Complete with a convenient carrying handle which doubles as a stand, the scope can be taken on location as easily as an attache case. The display tube is a 3in. CRT with a 1/4in. divided graticule. The housing is aluminum with a brushed aluminum front panel and measures 3 H by 7 1/2 W by 12in. D. Vertical and horizontal amp. response is 0 – 100KHz (–3db) dc and 10Hz to 100kHz (–3db) ac.

Attenuation—both for the vertical and horizontal planes—is in three steps of approximately 20db plus 25db in gain control. Input impedance is 0.5M shunted by 100pf. The scope sweep is automatically synchronized and repetitive and is continuously adjustable from 10Hz to 20kHz in three steps. Power requirement is 115/230vac, 50 – 400Hz, 25w. Price is $169.50. Measurement Control Devices, Inc.

Sine Square Wave Generator 711

Announced is a solid-state sine square wave generator, Model IG-18. The generator has a sine wave output

range continuously variable from 1Hz to 100kHz using one multiplier, two selector switches and a vernier control. It features eight output voltage ranges from .003 to 10v RMS with an external load of 10K or more, and six output ranges from .003 to 1v RMS (–62 to +22 db) using the built-in 600Ω load on an external 600Ω load.

Sine-wave output reportedly has less than 0.1 percent distortion from 10Hz to 20kHz. The square wave section has a frequency range from 5Hz to 100kHz at 0.1, 1 and 10v (P-P) switch-selected outputs with a rise time of less than 50ns. Sine and square wave outputs are available simultaneously. The generator is equipped with a dual-primary transformer for 120/240vac operation and a three-wire line cord for added safety. It is styled to match the rest of the instrument line. Price is $67.50. Heath.

Power Supplies 712

Two new low-cost regulated power supplies are announced. The company states that the regulation and automatic current limiting factors of the PSR-12 makes this series ideal for transistor circuit design, development and experimental work, production line testing, as well as classroom experiments and demonstrations. Nearly constant

dc voltages are obtained at any output voltage setting regardless of ac input voltage or load changes. The power supplies are available in two models: PSR-12-25 with an output from 0 to 25vdc at 0 to 500ma, and the PSR-12-50 with an output of 0 to 50vdc at 0 to 250ma with an input of 105 to 125vac, 60hz. Line regulation is 0.01 percent + 2mv; load regulation is 0.01 percent. Ripple is less than 100μv. Fused primary circuit and automatic current limiting prevent damage from overloads and short circuits. Both units measure 5 1/32 x 3 7/32 x 8 3/32 in. deep with a recessed panel including dual voltage control knobs, D'Arsonal meter, meter range switch, on-off switch and neon pilot light. Cabinet is of dark wrinkle finish 18-gage steel. Weight per unit is 7lb. Electro.

Field Effect Meter 713

Introduced is a meter featuring simplified operation with new push-button design. The model FE149 is the company's top-of-the-line field

General Electric announces the end of the foreign tube replacement-run-around.

Now, head straight to your General Electric Tube Distributor for "Hard-to-get Off Shore Tubes" (H.O.S.T.). You'll cut down those embarrassing, costly delays spent hunting all over town for the tubes to fix the growing number of imported TV sets. Your GE Distributor now has the types you need most often. In one short visit you can save hours of job time . . . and that's worth money! The new H.O.S.T. selection at your GE Distributor's adds one more dimension to the "service designed" line — a line you can stake your reputation on for *whatever* needs fixing. Stock up today.

Replace Tubes in these TV Imports, Faster, Easier: Sony • Panasonic • Toshiba • Hitachi • Truetone • Coronado • Delmonico • Sharp • Standard • Silvertone • Airline • J. C. Penney • and many more. 288-20

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GENERAL ELECTRIC

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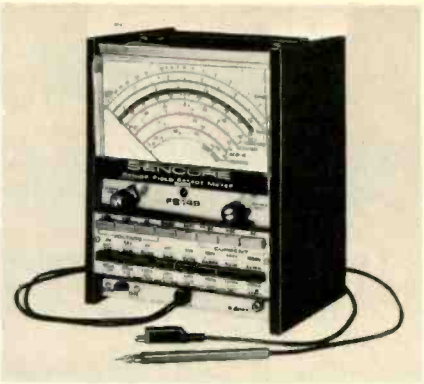
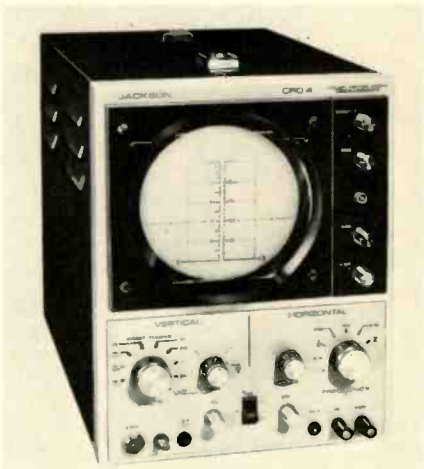
effect meter. By pushing one button in the top row to select the function, and one button in the bottom row for range, it is claimed that any circuit test can be made quickly and accurately. Designed for bench and laboratory work as well as in-the-home use, the instrument operates on ac power, on its self-contained rechargeable batteries, or on ac with the batteries plugged in, thus permitting operation anywhere at any time. With an accuracy of 1.5% on dc and 3% on ac, plus a large 7in. meter and mirrored scale to prevent reading errors due to parallax, accurate readings are said to be assured. The meter reportedly provides eight dc voltage ranges to 1500v. A special ½v low scale, with .25v either side, assures accurate measurements to less than 1/10v for transistor bias measurements. Eight ac ranges are also provided to 1500v.RMS and 4500v p-p. In addition to the voltage ranges, the meter also provides eight resistance ranges to 6000M; nine dc current ranges to 5a; eight decibel ranges for audio measurements; and three high voltage ranges, 5kv, 15kv and 50kv. The unit's high voltage probe, which plugs on to the end of the conventional probe, fits into a special bracket on the rear. The meter



is housed in a non-breakable, scuff-resistant vinyl-clad steel case. Priced at $149. Sencore.

Wide Band Oscilloscope/ Vectorscope 714

A new 5in. wide band oscilloscope/ vectorscope is introduced. It is claimed to be the only oscilloscope/vectorscope in the medium-low cost class which measures amplitude of waveforms (as in TV servicing) as easily as a VTVM or a VOM. Two design features of this oscilloscope offer ease of operation to the technician: (1) "Readabout" is an instant-removable graticule with two sets of calibrations exactly like a meter scaleplate, (2) Voltage range is selected on the "volts" switch and the magnitude of voltage (P-P), for example, is read directly on the calibrated graticule. Designated as Model CRO-4, the oscilloscope includes a vertical amplifier reportedly with a response out to 5.8MHz ± 3db, a sensitivity of 5.8mv RMS/Cm, and rise time of 0.06μs.

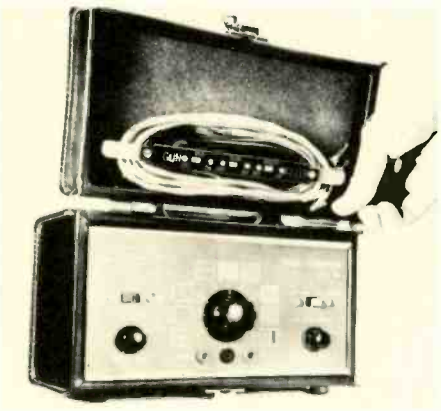


Acceleration voltage is 1500v and horizontal sweep-frequency range is 5Hz to 500kHz. In addition, it is a complete vectorscope with inputs at the front panel and with truly simplified vectorscope calibration facilities to insure the all important horizontal/vertical vectorscope pattern proportions. Rear inputs include Z-axis modulation and direct access to the deflection plates. Instruction manual includes extensive applica-

tion information with set-by-set vectorscope test instructions and pattern photograph. Model CRO-4 is 11¼in. h. x 9in. w. x 16in. l.; weighs 23 lb and is priced at $249.95. Jackson.

Color Bar Generator 715

An all solid-state color bar generator—designed to cut TV receiver alignment time by as much as 40 percent is announced. Known as Model 860 Amphenol Color Commander, the color bar generator is compact enough to fit easily into a standard tube caddy. Operationally, it offers nine test patterns, including three not normally found in low-priced generators. One of the new patterns displays vertical and horizontal crossbars, enabling the service technician to accurately center the raster before starting convergence alignment. The vertical and horizontal bars are generated in proper time placement, and compensated with delaying networks. This sequence insures that both bars appear in the electrical center of a properly adjusted raster.



With most existing color generators, the technician usually tries to make initial static convergence adjustments on selected center dots of a multiple-dot pattern. With the single center-screen dot pattern, however, initial static convergence is reportedly performed simply and precisely. Since the static convergence adjustments are made in the center of the raster, convergence adjustments can be swiftly made using a single, perfectly centered dot. If interactions of adjustments make it necessary to reset static convergence later in alignment procedure, the technician simply switches back to the single dot pattern and reconverges the three color guns. The color bar pattern is designed to simplify alignment procedures common to most existing generators. Three color bars are reproduced on the screen—R-Y, B-Y and -R-Y, in 90, 180 and 270deg color phases, respectively. Color adjustments can be made with or without an oscilloscope. Other patterns available on the new generator include the following: (1) Single horizontal and vertical line patterns for individual

convergence, (2) 15 horizontal bars for dynamic convergence and linearity, (3) 20 vertical bars for dynamic convergence and linearity, (4) 20 by 15 crosshatch for dynamic convergence and proportioning adjustments and (5) 300 multiple dots for inspection of convergence. The crosshatch is said to have many desirable features. With its four to three aspect ratio, which contains 20 vertical and 15 horizontal lines (4 to 3), service technicians can easily make linearity, height and width adjustments. The crosshatch pattern in the generator is accurately calibrated so it can be used for setting the fine tuning control. An important feature is its internal RF generator, making it possible to trace all nine CRT patterns through the set. The output of the generator is applied directly to the receiver's antenna terminals and then passes through RF and IF amplifiers. Color sync circuits, hue control ranges, color demodulators and color killer circuits can be tested with the generator, as well as the ability of the set to display correct color values. The generator timer is crystal-controlled employing highly stable silicon unijunction transistors in its countdown circuits; high-quality resistors and capacitors are used in external r-c timing circuits. The generator normally operates on battery power, but can be operated from an optional ac supply which fits into the battery holder. Nine mercury cells are said to provide 9 to 12 months of service. The color generator comes in a fitted leatherette case with carrying handle. Its outside dimensions are 9in. x 5in. x 4in., and it weighs 3½ lbs. Amphenol.

High-Voltage Tester 716

Accuracy, safety, calibration and a detachable meter are key features of the model HV-30 high-voltage tester introduced. This new instrument, called the "Dyna-Probe," is designed for use in TV service shops, industrial plants, schools and laboratories. With an accuracy of ±2% at 25kv and ±3% of full scale over-all, the tester is said to have ample accuracy for all high-voltage measurements on entertainment type equipment achieved through individual calibration of each instrument.

Use of a 50μ a meter movement assures high sensitivity. Housed in a triple-insulated probe with anti-corona

tip, the tester is reported to be ideal for use in making in-home adjustment of the high-voltage setting in color TV sets. A clip-on bracket permits the meter to be easily detached from the probe when desired for better visibility in close quarters. The unit, measuring 14½in. long, comes complete with all leads and insulated connectors attached and is supplied in a soft-lined protective carrying. Price with case $24.95. B&K.

FET and Conventional Transistor Tester 717

Announced is a combination FET tester and conventional transistor tester. The new tester, model TF151, fills the growing need for testing in circuits that use both regular transistors and FETs. It is difficult for the technician or engineer to know which is which by physical appearance, yet they are tested as two different devices, one for current gain and the other for voltage gain. According to the company president, this is the first tester on the market, either service type or industrial, to test both transistors and FETs. The tester is organized for easy use. Flip the large

function control knob in the middle to the left and the unit operates as an in-circuit/out-of-circuit transistor tester providing beta gain and Icbo out-of-circuit leakage measurements. Flip the large knob to the right and the unit becomes an in-circuit/out-of-circuit tester for the new field effect transistors. Each FET is tested for actual transconductance in or out of the circuit. Igss leakage is checked out of circuit. For the first time, an all new tansistor and FET book showing all of the setups expected of over 14,000 transistors and FETs is included free of charge with each TF151. The book will also be available for sale at approximately $10 for use with other transistor testers. The TF151 is housed in a vinyl case with a chrome panel and priced at $129.50. Sencore.

ET/D NEWS OF THE INDUSTRY

RCA First To Produce Three Billion Receiving Tubes

RCA today marked a new milestone in electronics—production of its three billionth receiving tube—on the same site purchased in 1881 by Thomas A. Edison for the manufacture of incandescent lamps.

RCA acquired the Harrison plant in 1930 and began making tubes for its early "Radiola" radio sets. The three billionth tube, which came off the plant's assembly line today, represents almost one-third of all the receiving tubes produced by the industry.

RCA also makes receiving tubes in Cincinnati, Ohio, and Woodbridge, N.J., as well as in Canada, Brazil and Chile.

Noting the receiving tubes today are meeting severe competition from transistors and other solid-state devices, John B. Farese, executive vice president, RCA Electronic Components, said, "Tubes will continue to be widely used because of their low-cost, high reliability and efficient performance." He said RCA alone markets more than 1000 different types of receiving tubes which are used for the amplification, detection and oscillation of radio signals.

Receiving tubes differ from picture tubes which are used to display electronic information in a home TV set of the video data terminal of a computer system.

Farese predicted that over the next five years industry sales of receiving tubes would approximate 1.4 billion units.

RCA's milestone receiving tube is a type widely used in both the 1969 model color and B/W television sets. It is designated as the RCA 6GH8A type.

The three billion receiving tubes made by RCA represent enough units to equip 150 million color television sets, each of which has an average of 20 tubes. Approximately 90 percent of the color television sets produced this year and 1969 will use receiving tubes, the executive stated.

In manufacturing three billion receiving tubes, Farese added, RCA consumed 187,000 tons of glass, 544,000 miles of tungsten wire and 2600 tons of mica. If laid end-to-end, the tubes would stretch approximately 140,000 miles.

When RCA began making its first "Radiotron" tubes in 1930, the death knell was sounding for the crystal set of the 1920s. New types of receiving tubes (types UV-199 and UV-200) were perfected which replaced the crystal detector in radios. These tubes were used in the first "Radiola" radio sets sold by the company.

EIA Announces Electronic Service Technician Film

Availability of a career guidance film for consumer electronics service technicians is announced by Electronic Industries Assn. Consumer Products Div. Chairman Charles N. Hoffman, of Warwick Electronics, Inc.

Titled "Futures Unlimited," the 14-min, color, 16mm film was produced by the H. G. Peters Co. with technical assistance from the Consumer Products Div. staff and the EIA Service Committee. It is part of the division's service technician development program.

The film is aimed primarily at high school students. It is intended to provide them with information and motivation for careers as consumer electronics service technicians. A career guidance brochure is being prepared to accompany the film.

"Futures Unlimited" will be distributed beginning this fall at no charge to high schools. It will also be distributed to television stations for use as a public service program, and will be available for special showings by industry groups.

ET/D CATALOGS & BULLETINS

Console Handbook 400

Announced is a new 1969 stereo console brochure titled "At Home with Stereo." This illustrated full-color 20-page booklet features the new line of stereo consoles in a collection of decorator-styled room settings. Included are many informative features on high fidelity, choosing the correct console to match individual room decor and complete explanations, in non-technical terms, of the more technical aspects of stereo consoles. Scott.

Coaxial Cable 401

To assist in the selection of coaxial cables and CATV cables for specific electronic applications a new catalog is announced. This 16-page booklet details the design considerations, conductor selection and properties of dielectric insulating materials. An RG/U table illustrates all the cable constructions and gives complete attenuation information. Index inside the back cover gives commonly used military and governmental wire specifications. ITT.

Cassettes 402

An illustrated consumer booklet describing the versatile uses of the cassette in school, business or at home is published. Titled "The Everything Thing," the booklet is designed to stimulate consumer interest in cassettes as an all-purpose, convenient and easy-to-use recording tool for memory or communications purposes. It is offered to retailers, without charge, as an aid to in-store merchandising activities. Audio Devices.

Instruments 403

A new line of precision industrial instruments is shown in a 12-page illustrated catalog. It lists prices and specifications of the new solid-state digital equipment, including a VOM, and a new electronic counter which is ±0.01 percent accurate up to 20MHz. The new model 2700 digital system is also shown. It features plug-in modules for voltage, current and resistance measurements as well as automatic ranging. Also included are three matching precision strip chart recorders, all mounting in just 3¾ x 3¾in. of space. The new model 2755 has ten event channels and records for over a month without changing chart paper. A multi-range milliohmmeter shown makes accurate ± percent readouts, and will measure down to 0.001Ω. Special leads are said to eliminate contact resistance errors, and allow fast checks of printed circuit boards. Multicorders have switch selection of up to 24 ranges providing both indication and records of ac volts, ac current, dc volts and dc current. All recorders described use inkless recording. Price $450 Simpson Electric.

Alarms 404

A new 24-page catalog of bells, buzzers, transformers and push buttons is now available.

Also listed is the new line of burglar alarm components and fire detection devices for installation in factories, institutions and homes.

Of particular note is the Tele-Dialer alarm for burglar detection, fire alarm, faulty boiler alert, etc. Lee Electric.

Integrated Circuit 405

A new eight-page booklet is available which describes the operation and applications of the company's MIC 0201 Integrated Circuit Audio Driver Amplifier for entertainment products and industrial communicatons equipment.

The 8 1/2 x 11in. booklet, form No. 15-4, features circuit diagrams and equations and describes several Class A audio amplifier circuits in which the MIC 0201 could be employed. These circuits, ranging from 1 to 6, have primary application in automobile radios, stereo tape players and mobile communications equipment. Mallory.

Electronic Kits 406

A new catalog, illustrating the world's largest selection of electronic kits, is now available. Over three hundred kits for every interest and budget are spread throughout the catalog's 116-pages, with 66 pages in full color. Both confirmed kit-builders and those who have never held a soldering iron will find something that interests them—stereo/Hi Fi components, ham radio equipment, test, service and lab equipment, citizen's band radio, shortwave listener's receivers, photographic aids, educational kits, electric guitar amplifiers and accessories, plus a wide range of home and hobby items, including B/W and color TV's, home protection system, stereo compacts, electronic organs, portable and table model AM, FM and shortwave radios, intercoms and automotive kits. All are available at up to 50 percent savings over comparable factory-built models. Heath.

A great name in publishing takes a great step in publishing.

Harcourt, Brace & World forms Harbrace Publications, Inc., a major entry in the business and professional magazine field.

Four business and professional periodical companies have combined to form Harbrace Publications, Inc. With 41 publications and 14 annuals and directories, Harbrace will reach some 704,000 readers in paper, building materials, housewares, electronics, gas, telephone engineering, food, apparel and toy distribution, plus serving management and professional needs of doctors and architects.

With the formation of this new subsidiary, Harcourt, Brace & World advances its concept of satisfying the need to know by broadening its scope to include specialized business and professional fields.

The publishers combined to form Harbrace (Ojibway Press, Byrum Publications, Brookhill Publishing Co., and part of Haire Publishing Corp.) will maintain their present offices. The headquarters offices for the new company, Harbrace Publications, Inc., will be in New York.

By combining these companies into one, Harbrace will bring stronger support to all in marketing, merchandising and research services. Our goal is to earn an increased share of audience in each market we serve by continued upgrading of editorial, design, circulation quality and advertiser services.

Harbrace—satisfying the need to know. A great new step in publishing.

BUSINESS PUBLICATIONS: Modern Converter, Office Products Dealer, Paper Sales, Roofing-Siding-Insulation, Flooring, Housewares Review, Electronic Technician Dealer, Hearing Dealer, Gas Age, Gas Appliance Merchandising, Industrial Gas, L-P Gas, Telephone Engineer and Management, Bakers Weekly, Drive-In Management, Hospital and Nursing Home Food Management, Kitchen Planning, Meat, Plant and Business Food Management, School and College Food Management, Snack Foods, Corset and Underwear Review, Hosiery and Underwear, Intimate Apparel, Toys and Novelties, American Fur Breeder, Business Screen, Communications News, Broadcast Daily, Top 50 Markets. MEDICAL PUBLICATIONS: Physician's Management, Blood: The Journal of Hematology, Metabolism: Clinical and Experimental, Arthritis and Rheumatism, Comprehensive Psychiatry, Seminars in Roentgenology, Seminars in Hematology, Progress in Cardiovascular Diseases, Journal of Pediatric Surgery, Seminars in Psychiatry, Proceedings of Transplantations.

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ET/D AD INDEX

The name of the game was hide and seek.

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

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

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

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

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

For complete information or new Autorotor write:

CDE **CORNELL-DUBILIER**

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"Remember to ask what else needs fixing"

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RCA HI-LITE respects and protects ...a well-earned service reputation

A good service reputation takes time to come by. It's put together call by call, customer by customer, day after day. So why shouldn't you expect the color picture tubes you rely on every day in your business to have earned a good reputation for themselves, too.

That's what you get when you specify RCA HI-LITE. It's the replacement picture tube with OEM specs . . . the same quality . . . the same tube that goes into original equipment sets. With all-new glass, gun, the works! And such technical advancements as PERMA-CHROME and Unity Current Ratios. Plus the broadest line of types in the industry.

Insist on HI-LITE, the picture tube that respects and protects your service reputation.

RCA Electronic Components, Harrison, N. J.

RCA