JUNE 1971 A HARCOURT BRACE JOVANOVICH PUBLICATION

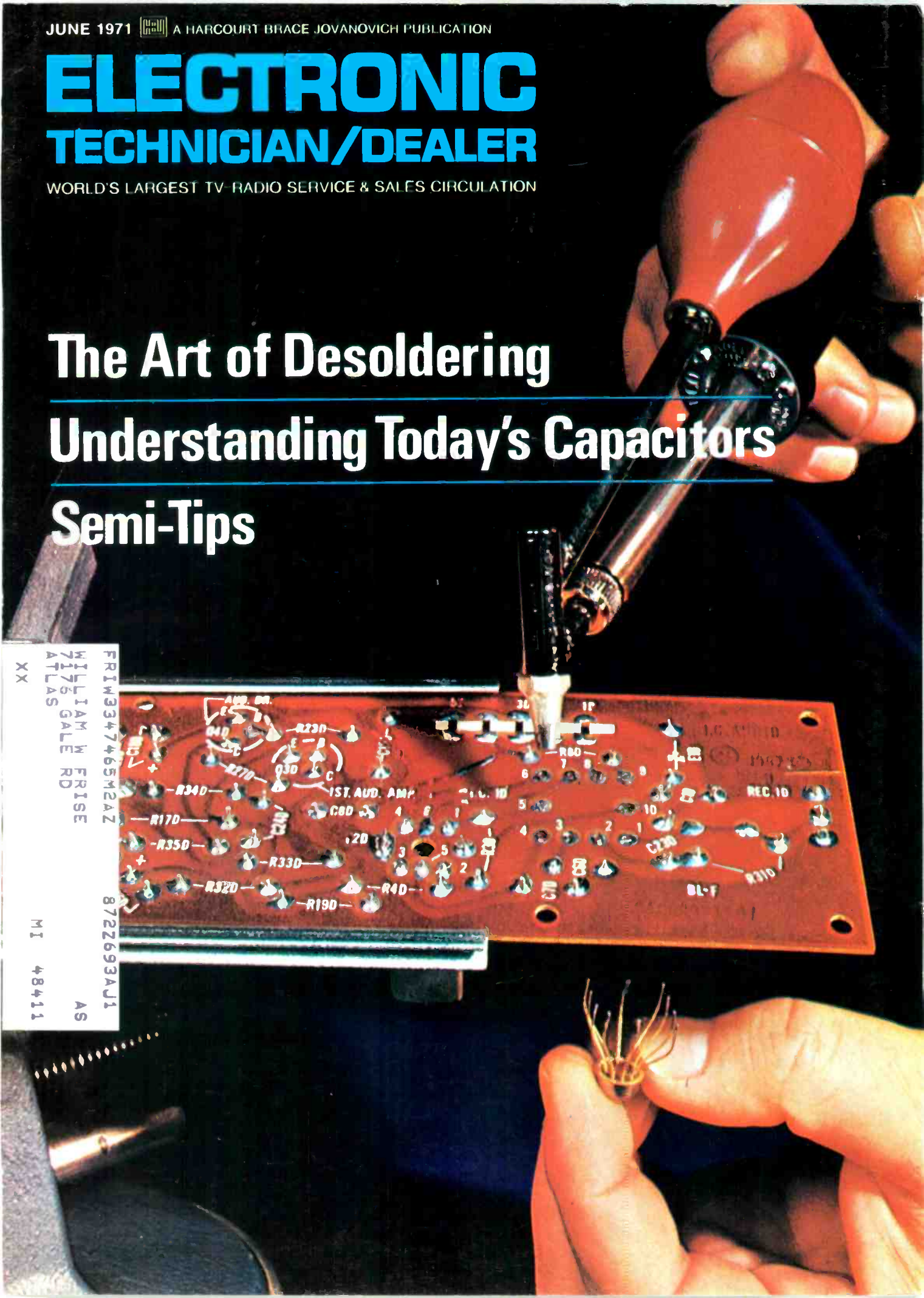
ELECTRONIC TECHNICIAN/DEALER

WORLD'S LARGEST TV-RADIO SERVICE & SALES CIRCULATION

The Art of Desoldering

Understanding Today's Capacitors

Semi-Tips



NOW you can measure resistors accurately

IN CIRCUIT !

in solid state devices

FE20 HI-LO
with hi-voltage probe and large six-inch meter $129.50

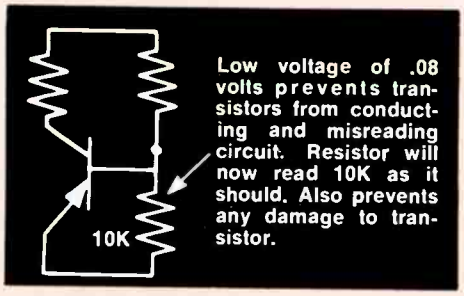
FE21 HI-LO with 4½-inch meter $99.50

WITH THE NEW HI-LO FIELD EFFECT MULTIMETERS

USES ONLY .08 VOLTS TO POWER OHMMETER TO PREVENT TRANSISTORS FROM CONDUCTING AND UPSETTING READINGS

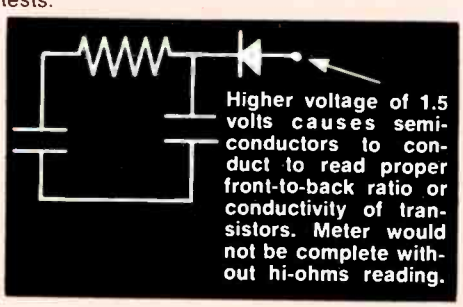
Look at these extra features to see why the Hi-Lo meter belongs on your want list:

- Unbelievable specifications of 15 megohm input impedance on DC and 12 megohms on AC
- Laboratory accuracy of 1.5 percent on DC and 3 percent on AC
- 9 DC voltage ranges from as low as .1 volts full scale to 1000 volts
- 3 hi-voltage ranges of 3 KV, 10 KV and 30 KV
- 9 DC zero center ranges from .05 volts to 500 volts . . . a must for delicate transistor bias measurements
- 7 resistance ranges from 1000 ohms full scale to 1000 megohms
- 9 DC current ranges from 100 microamps to 1 amp
- Automatic built-in battery test . . . never a worry about rundown batteries, just push the switches under the meter and read.
- Standard .6 amp fuse to protect the ohms and milliamps scales if voltage or overload is accidentally applied. No more need to return the meter to factory for repair . . . just replace the fuse.
- Special probe with 100K isolation resistor in probe to prevent AC pickup or to prevent loading oscillator circuits. Leave in normal position for most tests.



Low voltage of .08 volts prevents transistors from conducting and misreading circuit. Resistor will now read 10K as it should. Also prevents any damage to transistor.

Here is why you should have both Hi and Lo battery voltages for correct in-circuit resistance measurements in solid state circuits:



Higher voltage of 1.5 volts causes semiconductors to conduct to read proper front-to-back ratio or conductivity of transistors. Meter would not be complete without hi-ohms reading.

SENCORE INC. 3200 Sencore Drive • Sioux Falls, South Dakota 57107

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

1364

MAGNAVOX

TV Chassis
T944 Series

ELECTRONIC TECHNICIAN/DEALER **TEKFAX**

JUNE • 1971

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

SYMBOL	DESCRIPTION	MAGNAVOX PART NO.
L12	4.5MHz sound take-off coil	360845-1
L13	4.5MHz sound IF coil	360846-3
L14	quad coil	360847-2
L203	horiz osc coil	361171-2
T202	audio output xformer	320333-2
T203	vert output xformer	320328-1
T204	horiz output xformer (T944-01 thru 04)	361378-1
T204	horiz output xformer (T944-05 thru 08)	361378-2
	deflection yoke (19 in. CRT)	361096-2
	deflection yoke (23 in. CRT)	361096-3
C204	elect, 200 µf/200v, 200 µf/150v, 40 µf/150v	270071-18
R46	thermistor (NTC)	230130-2
R47	3.5M (vert lin), 2M (vert height), 2.5M (focus)	220218-1
R101	1M (vol on-off) (T944-01,02,05,06)	220135-31
R101	1M (vol on-off) (T944-03,07)	220135-30
R101	1M (vol on-off) (T944-04,08)	220232-13
R204	375Ω (contrast) (T944-03,07)	220232-11
R204	375Ω (contrast) (T944-all others)	220232-10
R205	200K (bright) (T944-01,04,05,08)	220208-52
R205	200K (bright) (T944-02,06)	220208-48
R205	200K (bright) (T944-03,07)	220208-46
R206	1M (vert hold) (T944-02,06)	220208-50
R206	1M (vert hold) (T944-01,04,05,08)	220208-53
R206	1M (vert hold) (T944-03,07)	220208-47
VDR1	voltage dependent resistor	230167-2
	circuit breaker	180723-3

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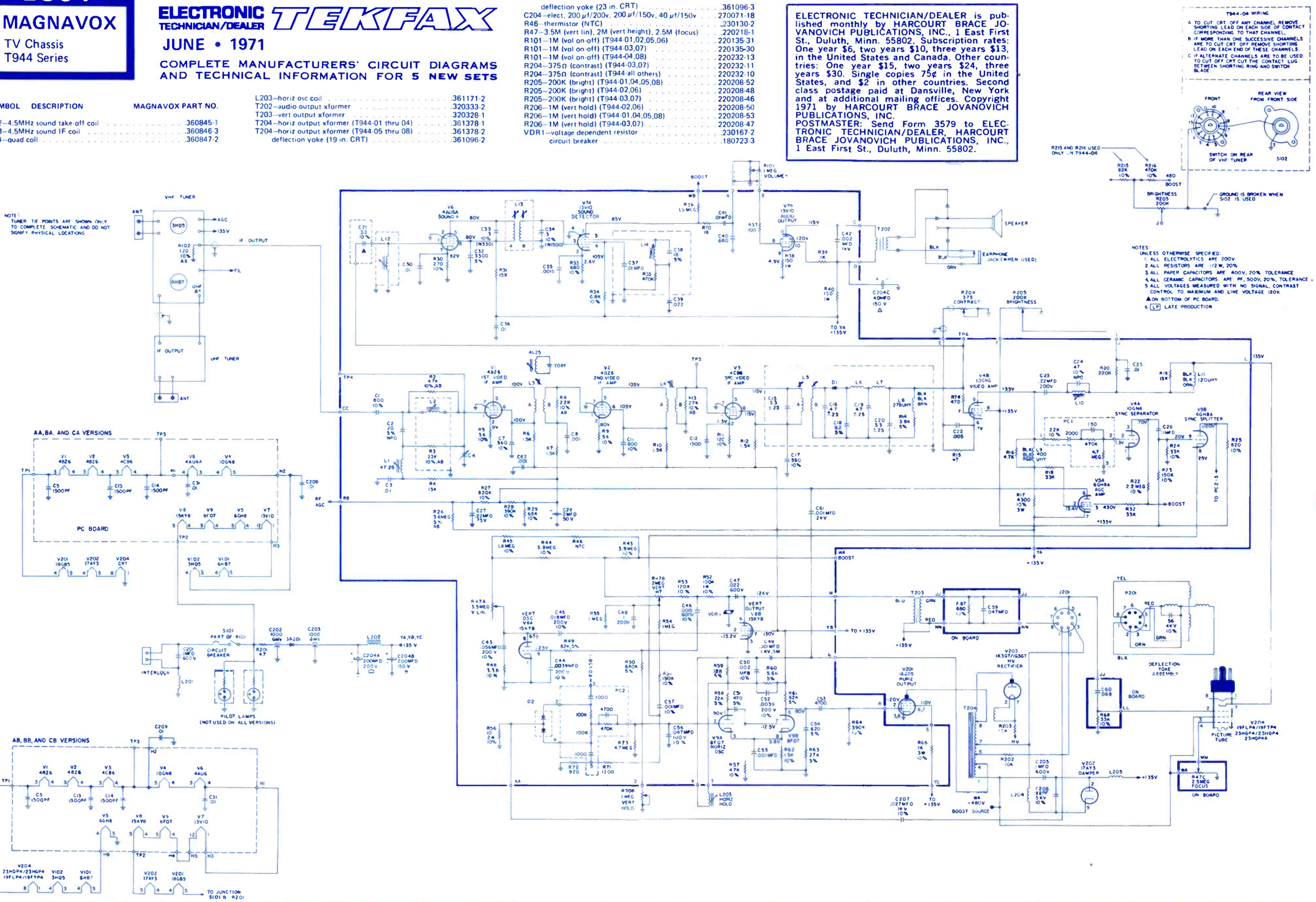
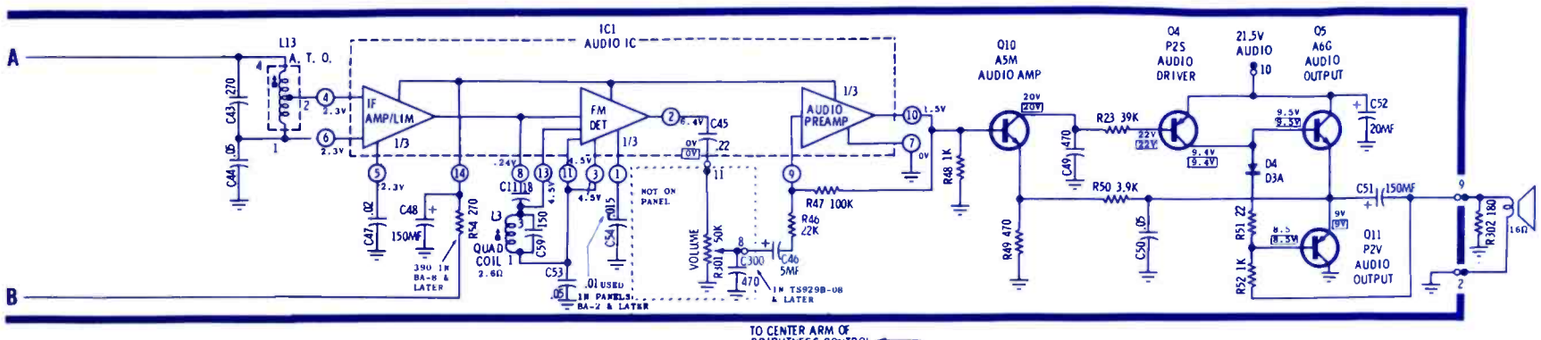
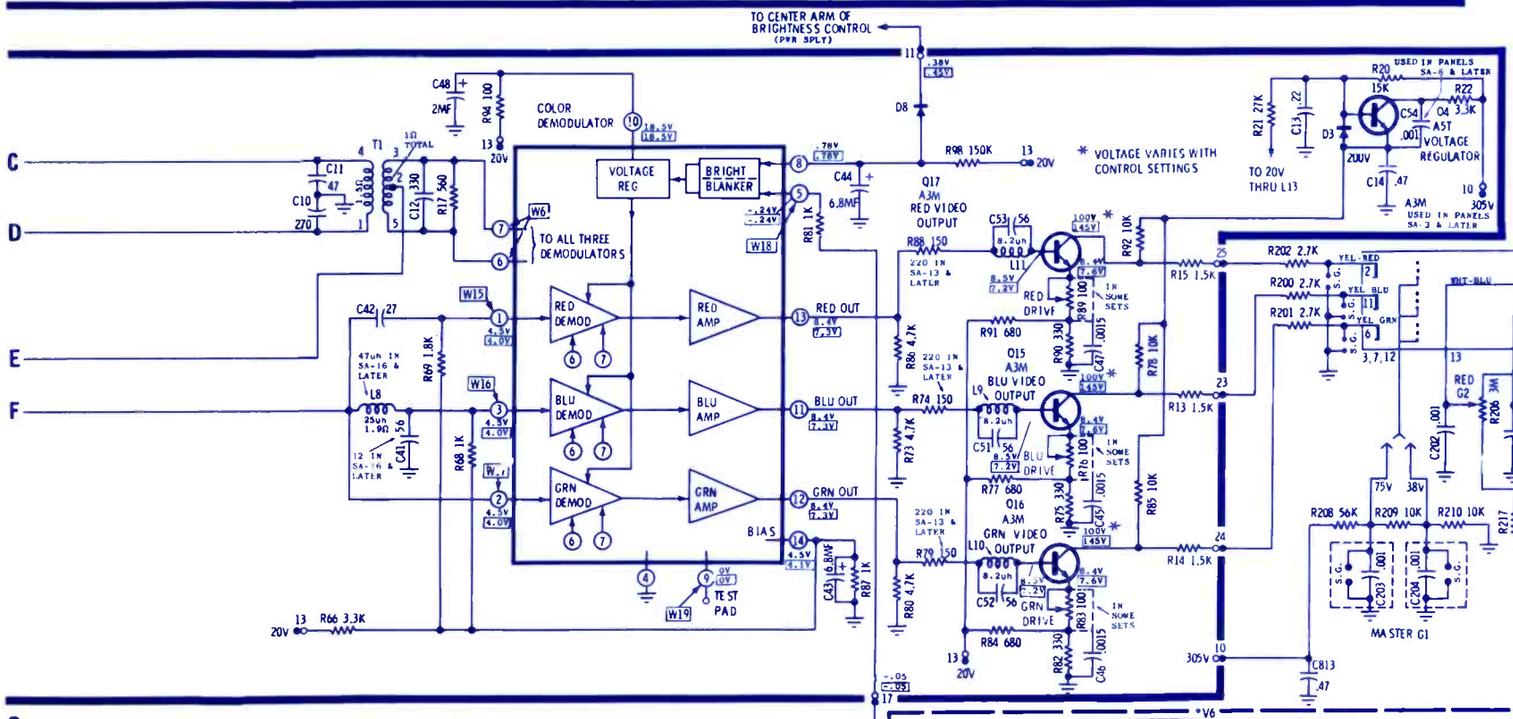
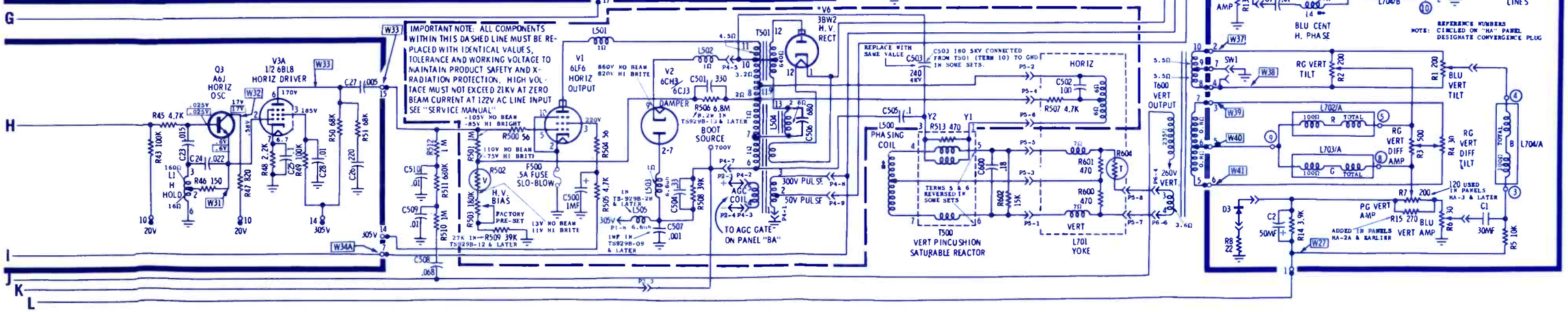


MOTOROLA
Color TV Chassis
TS-929







IMPORTANT NOTES

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

PANEL CODING	PANEL FUNCTION	PANEL CODING	PANEL FUNCTION
BA	IF AUDIO	AA	AFC (AFT)
CA	COLOR VIDEO WITH INSTA MATIC PRIVET		
FA	REGULATOR	EA	COLOR VIDEO WITHOUT INSTA MATIC PRIVET
HA	CONVER GENCE	ZA	H REGULATOR

EACH COMPONENT IS IDENTIFIED WITH A REFERENCE NUMBER AND A PREFIX LETTER (i.e. L201 WHICH IS RELATED TO LEGEND ON THE PANELS. ALL "ON" PANEL COMPONENTS ARE IDENTIFIED BY ONE OR TWO DIGIT NUMBERS (1 THRU 99.

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

ASSOCIATED CIRCUIT	REFERENCE DESIGNATION
IF & VIDEO	100 199
PIX TUBE	200 299
AUDIO	300 399
AGC SYNC	400 499
HOR. OSC & HI VOLTAGE	500 599
VERTICAL	600 699
CONVERGENCE	700 799
POWER SUPPLY	800 899
COLOR CIRCUIT	900 999

1. VOLTAGE MEASUREMENTS LISTED ON SCHEMATIC IN ORDER SHOWN.

20V ZERO SIGNAL (TUNER SET BETWEEN CHANNELS) (16V) COLOR BAR GENERATOR (GATED RAINBOW TYPE)

CONDITIONS: COLOR BAR GENERATOR (RAINBOW TYPE) OUTPUT ADJUSTED FOR 5V DC AND 13VPP VIDEO MEASURED AT BASE OF 1ST VIDEO AMP (Q3 BA PANEL)

VOLTAGE MEASUREMENTS TAKEN FROM POINT INDICATED TO CHASSIS WITH A VTVM (±10%).

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

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

2. WAVEFORM MEASUREMENTS: COLOR WAVEFORMS TAKEN WITH A COLOR BAR GENERATOR PROVIDING A SIGNAL OF STANDARD GATED RAINBOW (10 BAR) TYPE COLOR BAR PATTERN. RECEIVER ADJUSTED FOR NORMAL VIEWING AS IN TRANSMITTED AIR SIGNAL AND THE COLOR BAR GENERATOR OUTPUT ADJUSTED FOR APPROXIMATELY 5V DC MEASURED AT BASE OF 1ST VIDEO AMP (Q9 BA PANEL).

NOTE: THE PEAK TO PEAK COLOR SIGNAL AT THE BASE OF Q9 CAN VARY AND IS DEPENDENT ON THE AGC SETTING OF A GIVEN RECEIVER. THE 5V DC READING IS GIVEN AS A REFERENCE. THE PEAK TO PEAK WAVEFORM MEASUREMENTS SHOWN ON THE SCHEMATIC ARE RELATED DIRECTLY TO THE 1.3 VOLT P-P MEASURED AT BASE OF Q9.

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

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

4. THE OUTPUT WAVEFORMS OF THE IC COLOR DEMODULATOR CAN BE OBSERVED AT THE COLLECTOR OF THE VIDEO OUTPUT TRANSISTORS Q15SA (RED), Q16SA (GREEN), AND Q10SA (BLUE) OR TERMINALS 25, 24, AND 23 ON PANEL SA.

CONNECT SCOPE TO TERMINAL 24SA (GREEN). ADJUST HUE CONTROL TO PLACE THE 1ST BAR OF THE COLOR BAR GENERATOR TO MAXIMUM NEGATIVE. DO NOT ADJUST HUE CONTROL FOR SUBSEQUENT READINGS. OBSERVE WAVEFORM AT TERMINAL 23SA (BLUE). THE 6TH BAR SHOULD BE AT MAXIMUM NEGATIVE. OBSERVE WAVEFORM AT TERMINAL 25SA (RED). THE 3RD BAR SHOULD BE AT MAXIMUM NEGATIVE.

UNLESS OTHERWISE SPECIFIED: CAPACITOR VALUES LESS THAN ONE IN MF, ALL OTHERS IN PF. CAPACITANCE VALUES ONLY ARE SHOWN ON SCHEMATIC DIAGRAM. FOR COMPLETE DESCRIPTION OF CAPACITORS, REFER TO PARTS LIST. RESISTORS ARE 10%, 1/2W.

COIL RESISTANCES LESS THAN 1 OHM NOT SHOWN

TYPICAL SOCKET & PLUG (KEY WAY, WIRE SIDE)

PLUG NO.	NUMBER OF PINS
P1	8 PINS
P2	12 PINS
P3	10 PINS
P4	3 PINS
P6	6 PINS
P7	5 PINS
P8	3 PINS

ALTERNATE TRANS USED IN SOME SETS

1363

MOTOROLA

Color TV Chassis
TS-929

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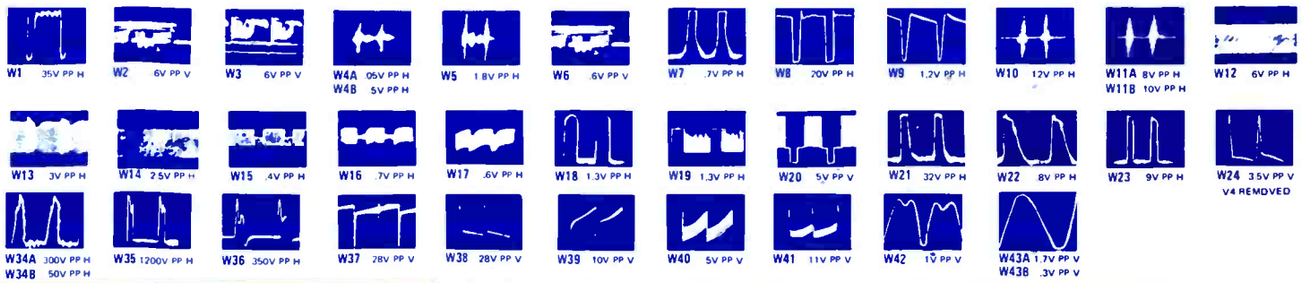
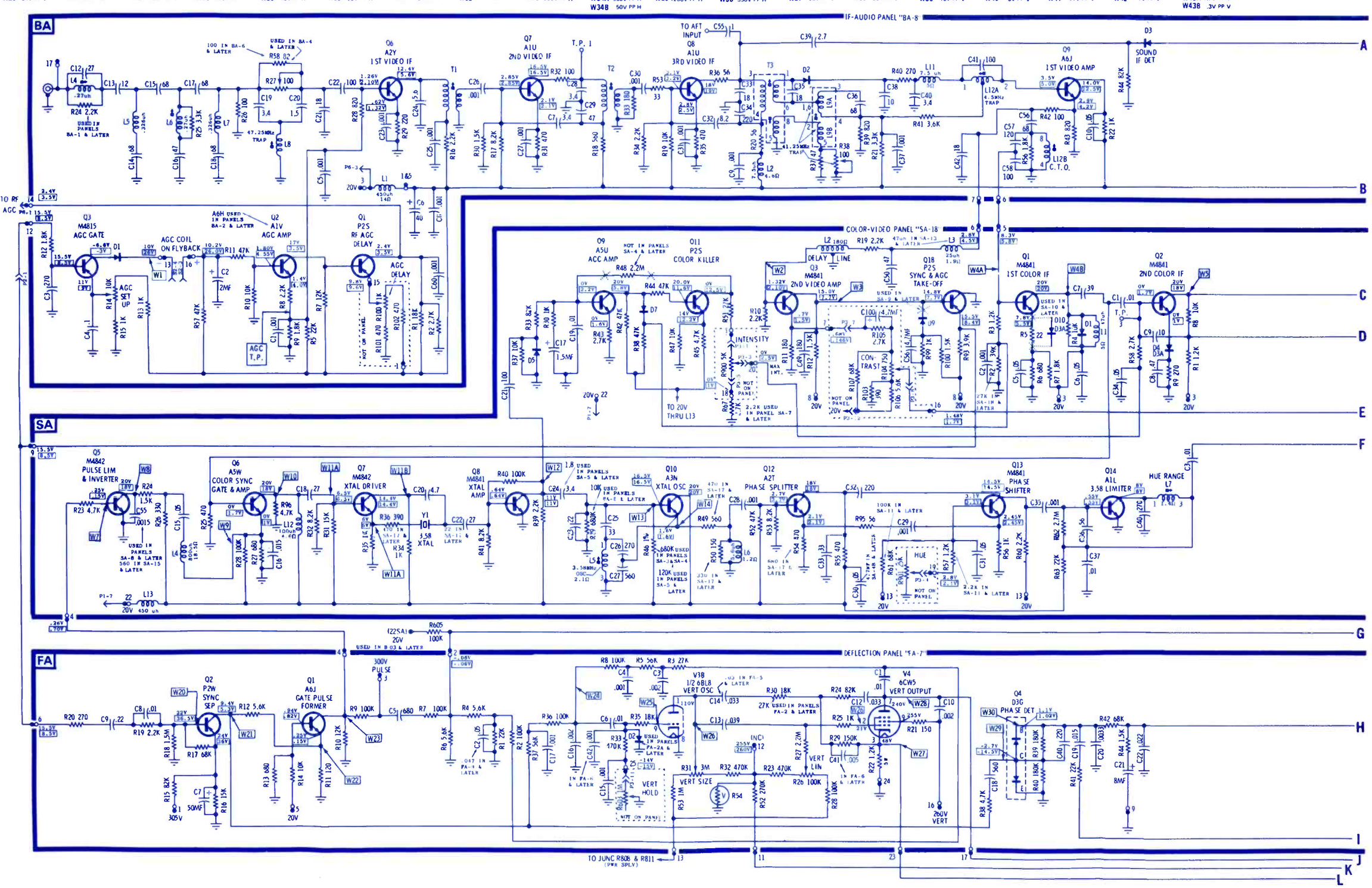
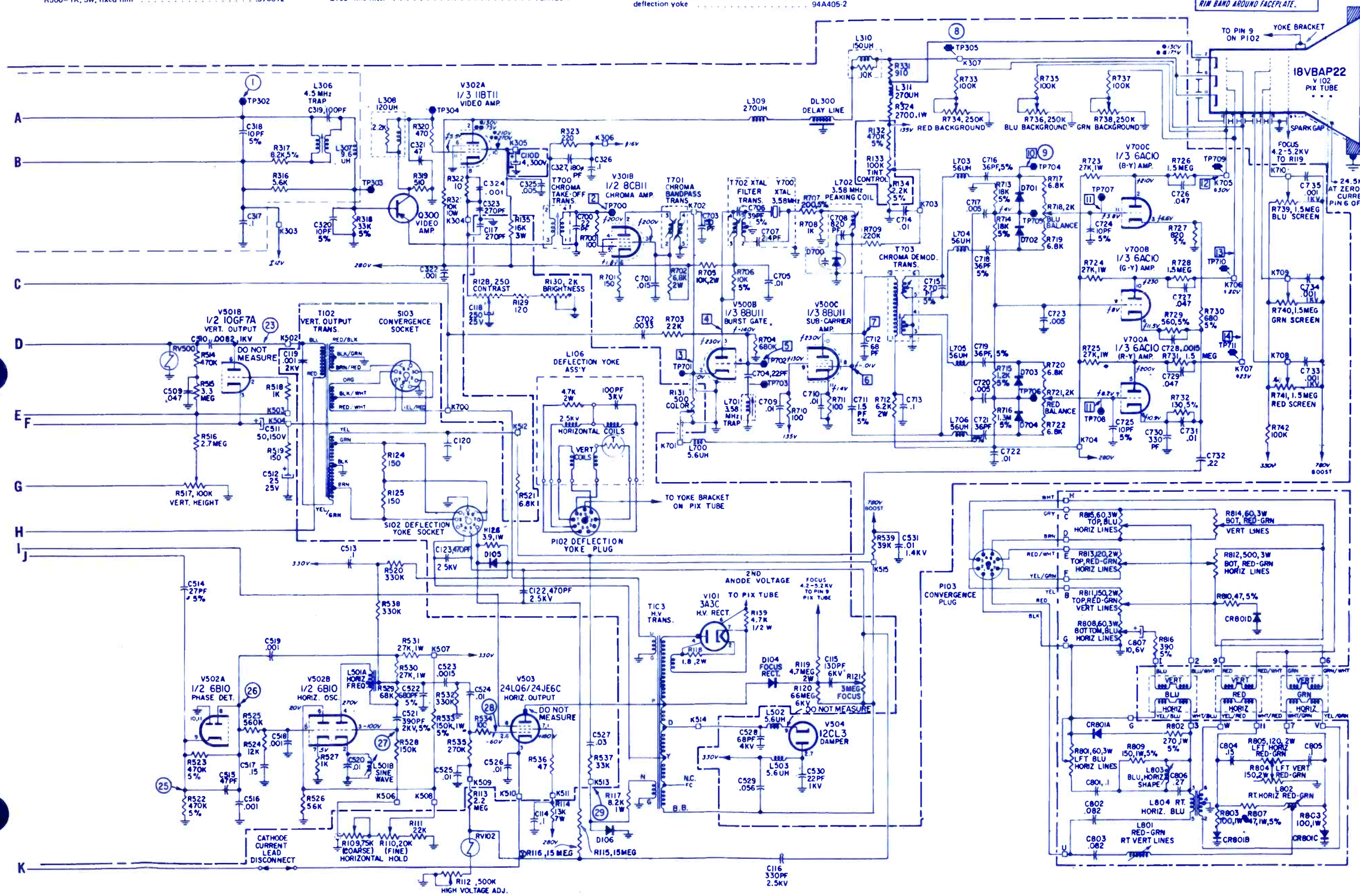




EMERSON
Color TV Chassis
920

SYMBOL	DESCRIPTION	EMERSON PART NO.
R109	75K horiz hold control (coarse)	75A156-1
R110	20K horiz hold control (fine)	75A156-1
R112	500K high voltage adjust control	75C159-2
R120	66M, 6kv	60A30-5
R121	3M focus adjust control	.970807
R127	1M, on-off volume control	.970808
R128	250Ω contrast control	75A158-1
R131	500Ω color control	75A160-2
R133	100K tint control	75A160-3
R135	16K, 3w, fixed film	.970809
R136	240M focus bleeder	61A63-1
R321	10K, 10w, fixed film	.970810
R325	12K, 3w, fixed film	.970811
R327	40K AGC control	75A155-6
R506	1K, 3w, fixed film	.970812
R508	1K, 3w, fixed film	.970812
R509	3.4M vert lin control	75A155-5
R517	100K vert height control	75A155-5
RT101	thermistor, degaussing	61A60-1
RV101	voltage dependent resistor, degaussing	61A62-1
RV102	2ma/95v VD resistor	61A61-1
RV500	1ma/870v VD resistor	61A65-1
C109A	80 µf, 175v elect	67A76-1
C109B	100 µf, 400v elect	67A76-1
C109C	30 µf, 400v elect	67A76-1
C109D	10 µf, 150v elect	67A76-1
C110A	120 µf, 400v elect	67A75-1
C110B	20 µf, 400v elect	67A75-1
C110C	100 µf, 150v elect	67A75-1
C110D	4 µf, 400v elect	67A75-1
L103	line filter	73A126-1
L201	quad coil	72A366-1
L501A	horiz osc coil	72A373-1
L501B	horiz osc coil	72A373-1
DL300	delay line	72A372-1
T101	power xformer	80A114-1
T102	vert output xformer	79A153-1
T103	horiz output xformer	79A154-1
T200	sound take-off & 4.5MHz trap	72A361-1
T201	audio output xformer	79A151-1
T700	chroma take-off	72A368-1
T701	chroma bandpass	72A358-1
T703	chroma demodulator xformer	72A357-1
Q300	video amp transistor (NPN)	57A174-8
CB101	circuit breaker	84A31-1
F101	fuse, 7a, 125v	84A30-1
	VHF tuner	94A416-3
	deflection yoke	94A405-2

REPLACE PICTURE TUBE WITH SAME TYPE AS ORIGINAL. 18VBAP22 HAS RIM BAND AROUND FACEPLATE.



1362

EMERSON

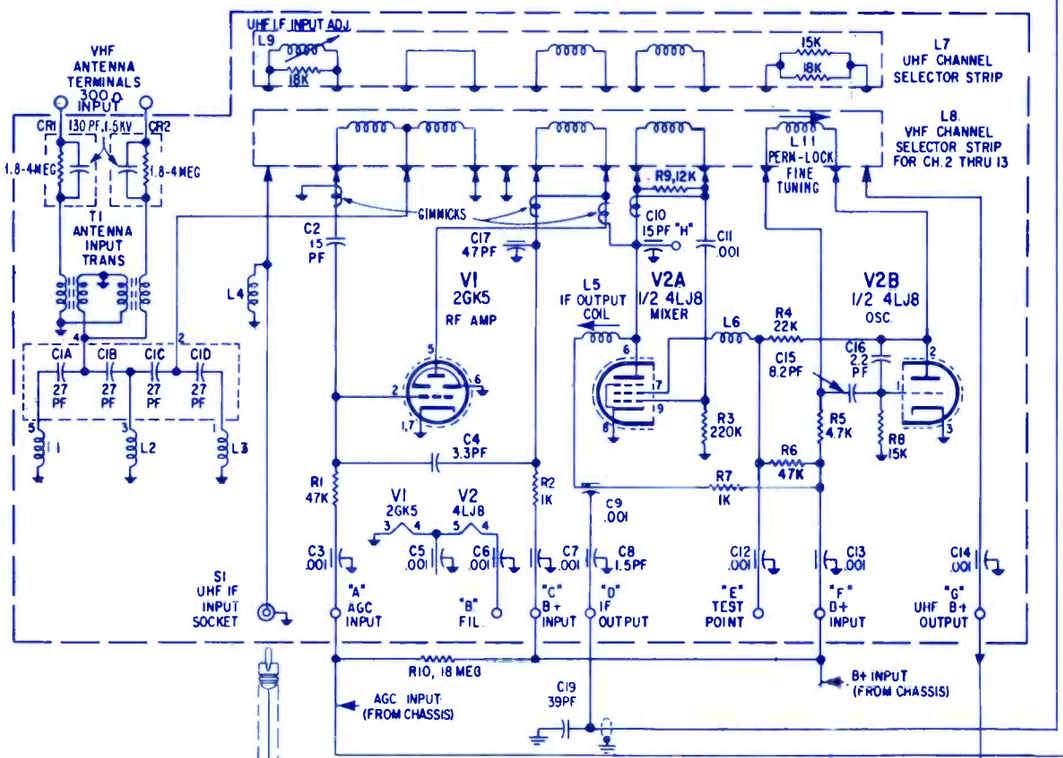
Color TV Chassis
920

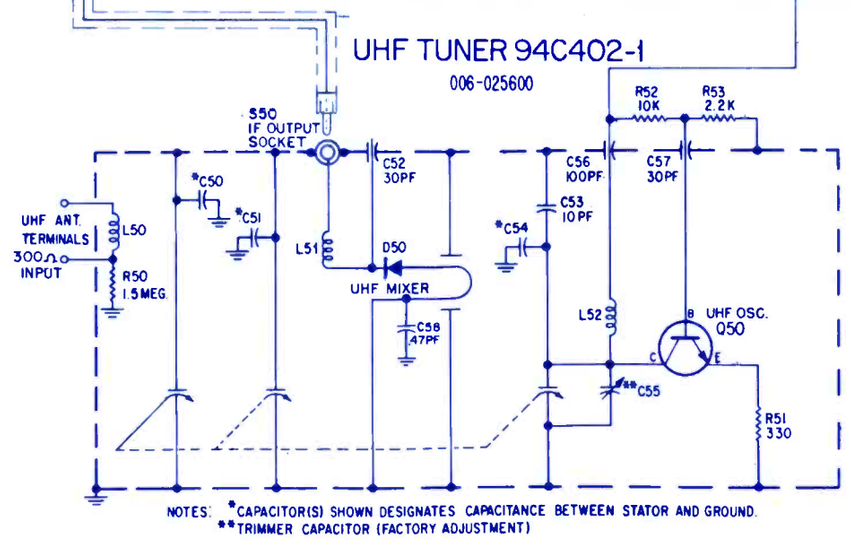
ELECTRONIC TECHNICIAN/DEALER TEKFAX
JUNE • 1971

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

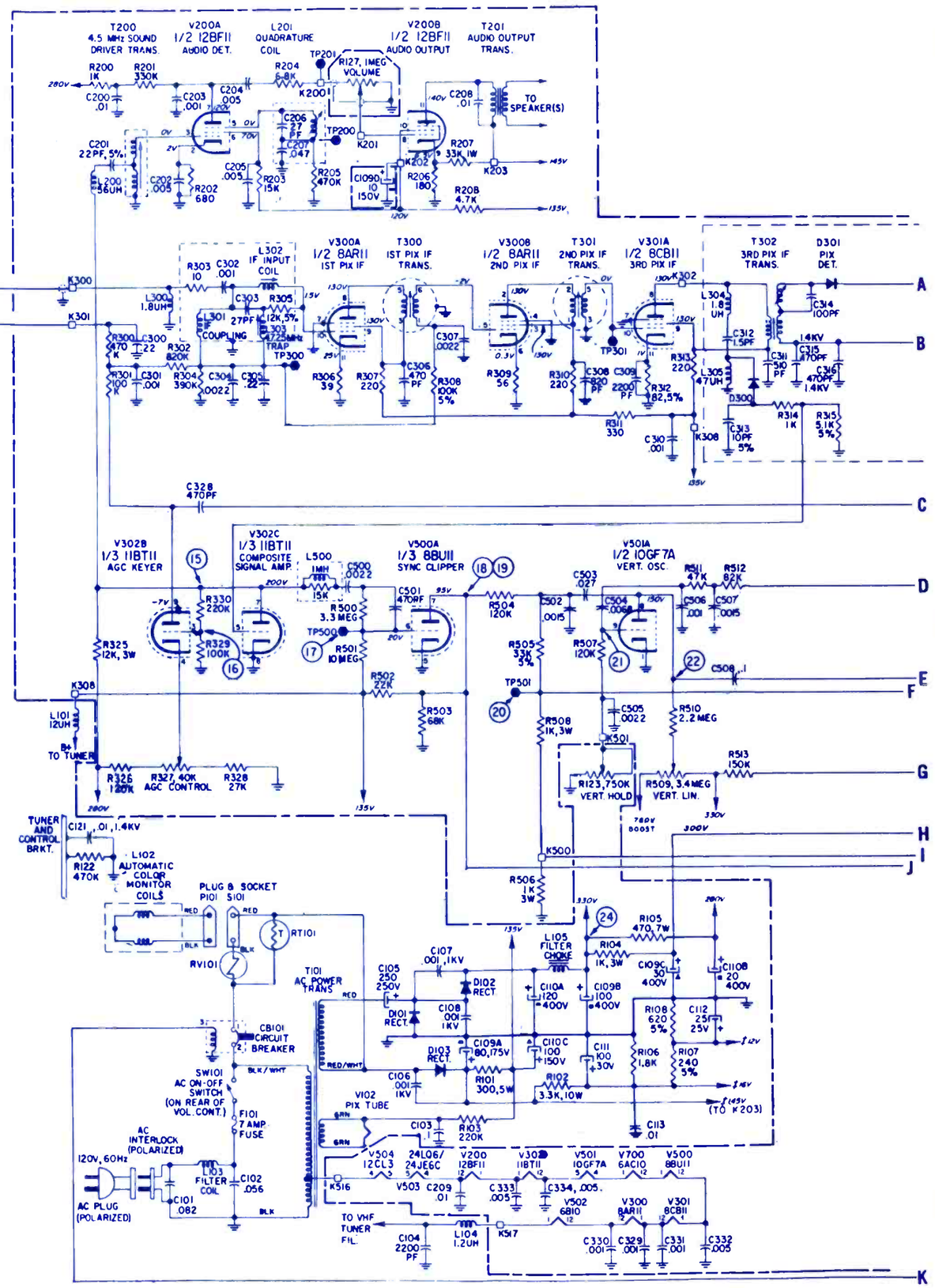
NOTES

1. ALL RESISTORS ARE 1/2 WATT, 10%, UNLESS OTHERWISE NOTED.
2. ALL CAPACITORS ARE IN MFD, UNLESS OTHERWISE NOTED.
3. CAUTION: USE ISOLATION TRANS WHEN WORKING ON CHASSIS.
4. DC VOLTAGES MEASURED WITH "VTVM" PLACED BETWEEN POINTS INDICATED & CHASSIS GND, WITH NORMAL SIGNAL INPUT
(*) INDICATES VOLTAGE READINGS TAKEN WITH BRIGHTNESS CONT. AT MAXIMUM ROTATION (FULLY CW).
(**) INDICATES VOLTAGE READINGS TAKEN WITH BRIGHTNESS CONT. AT MINIMUM ROTATION (FULLY CCW).
ƒ INDICATES VOLTAGE READINGS TAKEN WITH COLOR SIGNAL.
5. WAVEFORMS ARE TAKEN WITH NORMAL SIGNAL INPUT.
6. LINE VOLTAGE INPUT SET AT 120 VAC.
ƒ INDICATES THESE VOLTAGES WILL VARY WITH VIDEO CONTENT OF THE PICTURE BEING RECEIVED AND ARE AVERAGE READINGS.
(0) INDICATES THESE VOLTAGES WILL VARY WITH BACKGROUND CONTROL SETTINGS.





NOTES: *CAPACITOR(S) SHOWN DESIGNATES CAPACITANCE BETWEEN STATOR AND GROUND.
**TRIMMER CAPACITOR (FACTORY ADJUSTMENT)



ADMIRAL
Color TV Chassis
2K16

SYMBOL	DESCRIPTION	ADMIRAL PART NO.
R315	750Ω sound reject control	75A101-3
R401	60K, AGC control	75A101-9
R468	300K, vert lin control	75A101-10
R474	thermistor, NTC	61A50-3
R475	varistor	61A51-1
R704	3.4M, vert size control	75A96-20
R710	master bright	75A135-24
R724	VDR	61A46-13
R731A, B	focus rectifier	700A871-4
R732	15M, focus control	75A108-2
R739	VDR, 2K16, 3K16	61A46-2
R745	3Ω thermistor in yoke	61A27-1
C705A	200 µf, 350v elect	67A15-392
C705B	80 µf, 350v elect	67A15-392
C705C	120 µf, 350v elect	67A15-392
C706A	20 µf, 200v elect	67A15-394
C706B	10 µf, 350v elect	67A15-394
C706C	50 µf, 50v elect	67A15-394
C706D	20 µf, 200v elect	67A15-394
L401	sound takeoff coil	72A287-4
L402	quad coil	72A287-3
L502	bandpass coil	72A269-4
L701	line choke	73A31-16
L702	filter choke	74A18-62
L703	horiz coil	94A268-4
T401	sound IF xformer	72A314-2
T503	bandpass input coil	72A302-1
T701	audio output xformer	79A33-112
T702	vert output xformer	79A106-5
T703	power xformer	80A104-4
T704	horiz output xformer	79A146-3
T705	PC xformer	79A127-1
CR702	focus rectifier module	700A871-3
CB701	circuit breaker, single	84A17-11
DL701	delay line	72A217-3

NC2063-29 Tuner Cluster

R258	1M, vol control	75C131-13
R703	color control, 500Ω	75D127-6
R713	tint control, 1100Ω	75D127-7
	tuner, VHF	94E286-10

Control Assembly-3C3401/06/11

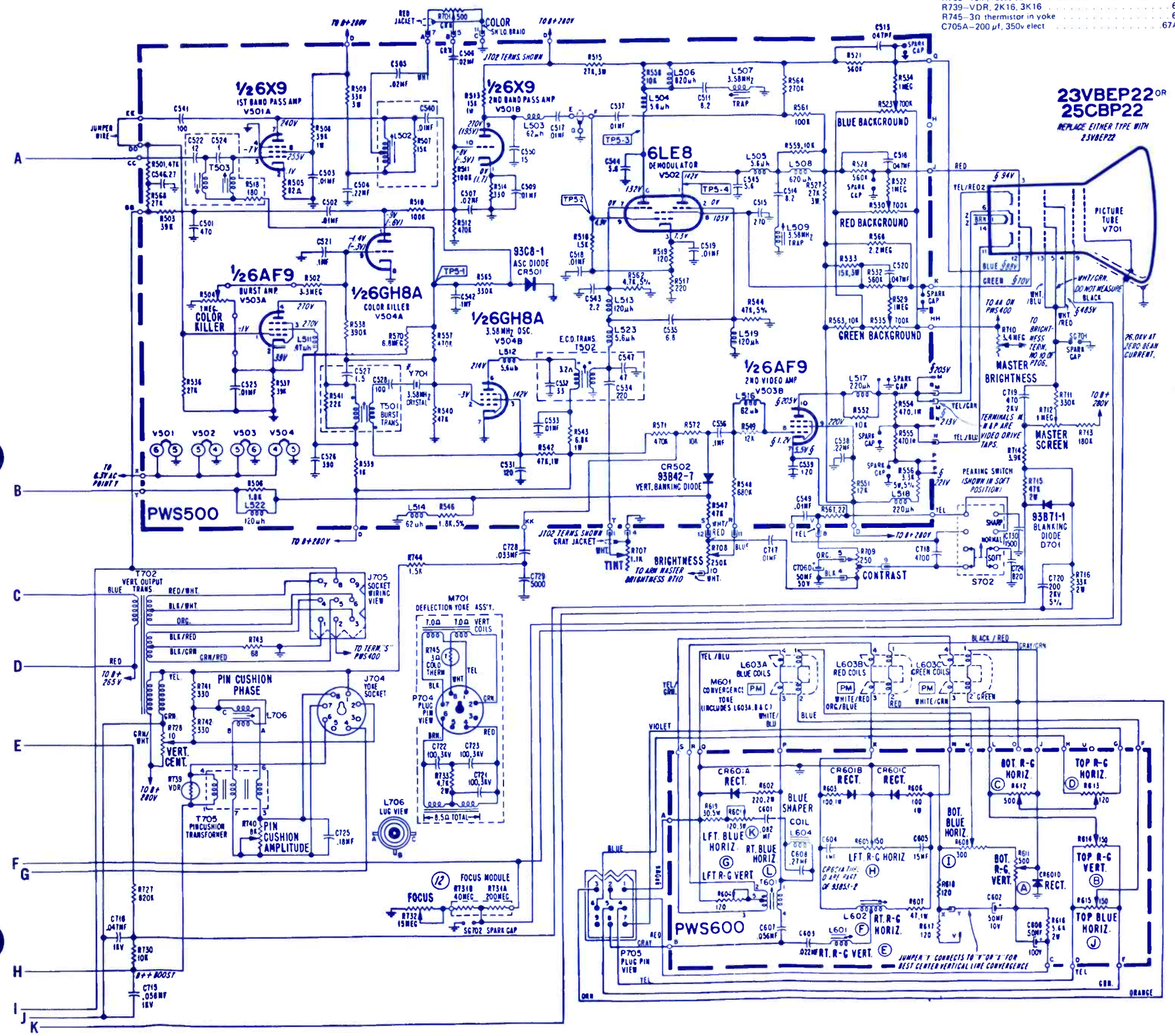
R702	2.5M, tone control	75A134-12
R703	100K, vert hold control	75A134-6
R708	250K, bright control	75A134-5
R709	250Ω, contrast control	75A134-4

NC2573-14 Tuner Cluster and Control Assembly

R258	1M, vol control	75C151-10
R703	color control, 500Ω	75D127-6
R713	tint control, 1100Ω	75D127-7
R714	bright control	75D134-5
R715	contrast control	75C134-4
R724	vert hold control	75C134-6
R740	tone control	75C134-12
	tuner, VHF	94E330-3

NC2573-26, NC2573-11 Tuner Clusters

R258	vol control NC2573-11	75C127-14
R258	vol control NC2573-26	75A151-10
	tuner, VHF	94E330-3



MODEL CHART

MODEL	NAME	COLOR	SIZE	TUNER CLUSTER	TUNER	CHASSIS
3C3401	Dayton	Walnut	*23''	NC2063-29	94A286-10 VHF	2K1663-29
3C3406	Rylander	Brown			94A280-11 UHF or	
3L3411	Clarendon	Walnut			94A296-11 UHF	
3L761	Avery	Walnut		NC2573-14	94A330-3 VHF	3K1673-14
3C3351	Benton	Walnut			94A334-3 UHF or	
3L3361	Lockholm	Walnut			94A333-3 UHF	
3L3421	Ridgeland	Walnut		NC2573-11	94A330-3 VHF	3K1673-11
3L3425	Baytown	Maple			94A334-3 UHF or	
3L3428	Alhambra	Pecan			94A333-3 UHF	
3L3511	Fullerton	Walnut			94A330-3 VHF	3K1673-26
3L3515	Amsterdam	Maple			94A334-3 UHF or	
3L3518	Monaco	Pecan			94A333-3 UHF	
5L5101		Walnut	*25''	NC2573-26	94A330-3 VHF	3K1673-26
					94A334-3 UHF	

*Picture tube diagonal measurement.

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ADMIRAL

Color TV Chassis
2K16

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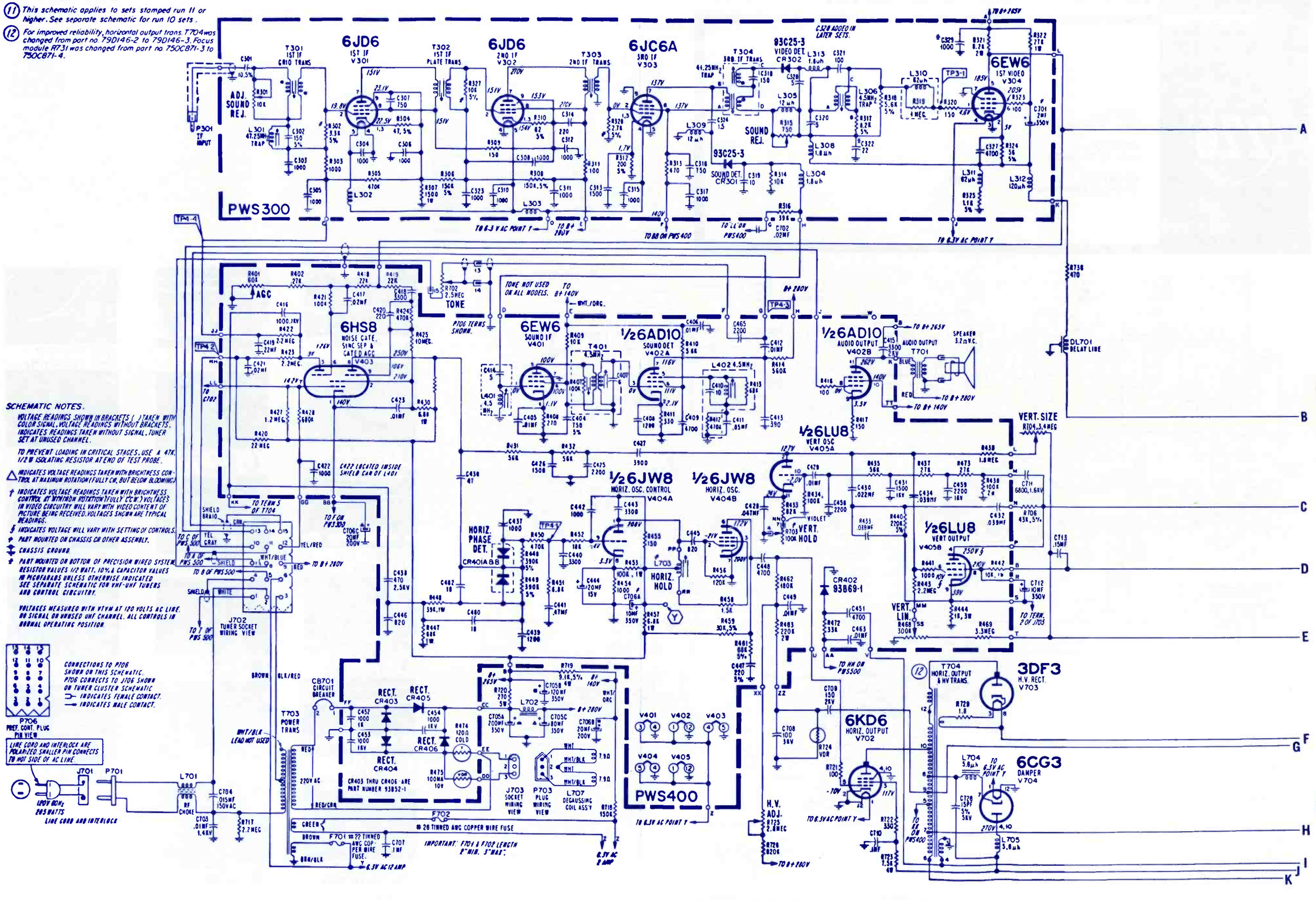
RUN CHANGES

(11) *This schematic applies to sets stamped run 11 or higher. See separate schematic for run 10 sets.*

(12) *For improved reliability, horizontal output trans. T704 was changed from part no. 79D146-2 to 79D146-3. Focus module R731 was changed from part no. 750C871-3 to 750C871-4.*



SCHEMATIC NOTES.

VOLTAGE READINGS SHOWN IN BRACKETS ( ) TAKEN WITH COLOR SIGNAL. VOLTAGE READINGS WITHOUT BRACKETS, INDICATES READINGS TAKEN WITHOUT SIGNAL. TUNER SET AT UNUSED CHANNEL.

TO PREVENT LOADING IN CRITICAL STAGES, USE A 47K, 1/2 W ISOLATING RESISTOR AT END OF TEST PROBE.

△ INDICATES VOLTAGE READINGS TAKEN WITH BRIGHTNESS CONTROL AT MAXIMUM ROTATION (FULLY CW), BUT BELOW BLOOMING.

† INDICATES VOLTAGE READINGS TAKEN WITH BRIGHTNESS CONTROL AT MINIMUM ROTATION (FULLY CCW.) VOLTAGES IN VIDEO CIRCUITRY WILL VARY WITH VIDEO CONTENT OF PICTURE BEING RECEIVED. VOLTAGES SHOWN ARE TYPICAL READINGS.

§ INDICATES VOLTAGE WILL VARY WITH SETTING OF CONTROLS.

PART MOUNTED ON CHASSIS OR OTHER ASSEMBLY.

⏚ CHASSIS GROUND.

PART MOUNTED ON BOTTOM OF PRECISION WIRED SYSTEM.

RESISTOR VALUES 1/2 WATT, 10% & CAPACITOR VALUES IN MICROFARADS UNLESS OTHERWISE INDICATED. SEE SEPARATE SCHEMATIC FOR VHF-UHF TUNERS AND CONTROL CIRCUITRY.

VOLTAGES MEASURED WITH VTVM AT 120 VOLTS AC LINE. NO SIGNAL OR UNUSED UHF CHANNEL. ALL CONTROLS IN NORMAL OPERATING POSITION.

ELECTRONIC TECHNICIAN/DEALER

TEKFAX

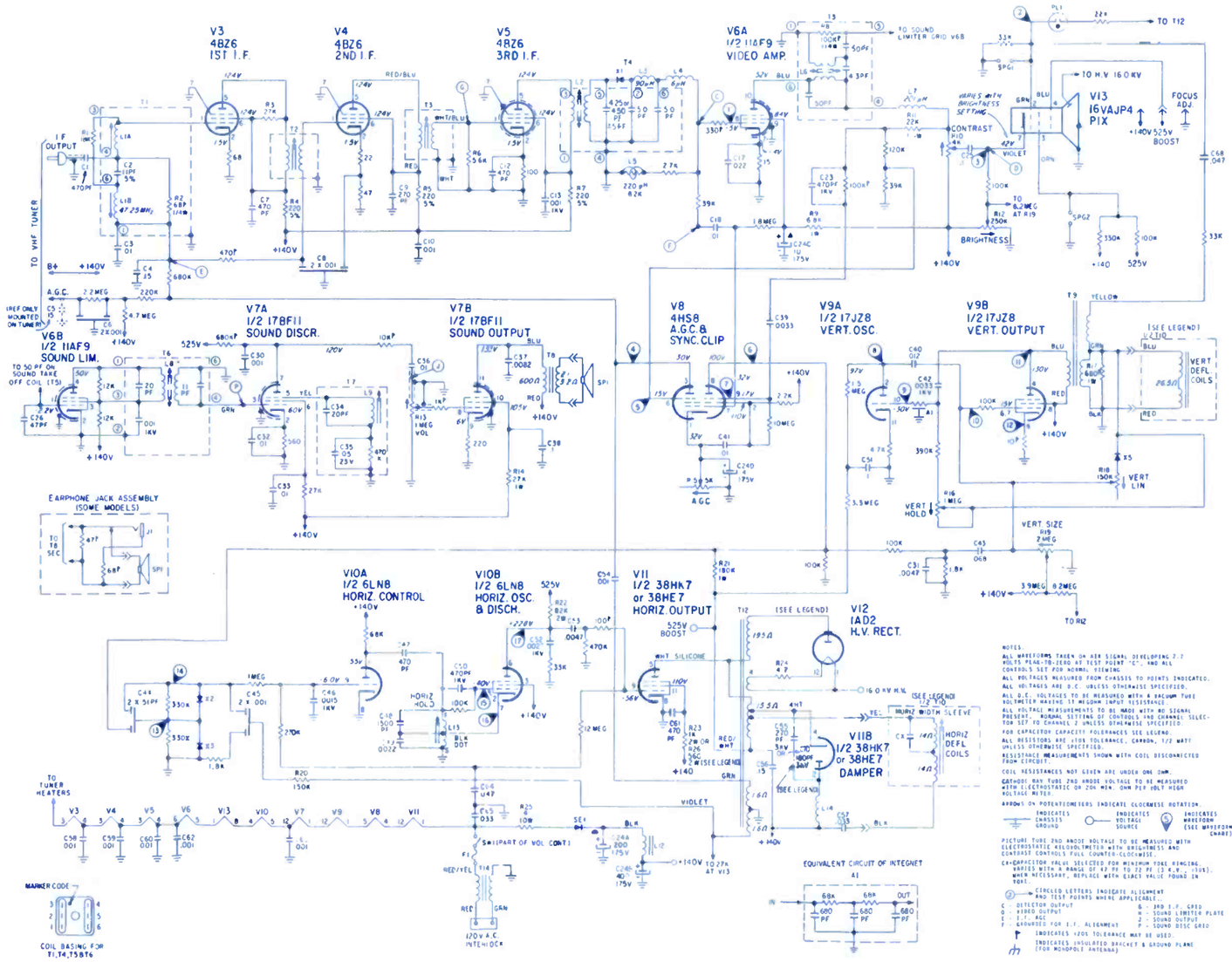
COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 5 NEW SETS

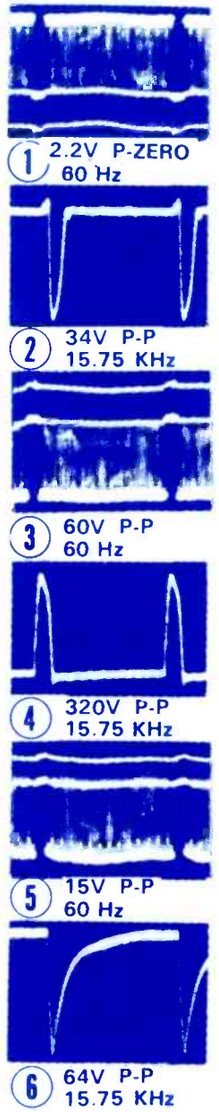
GROUP 226

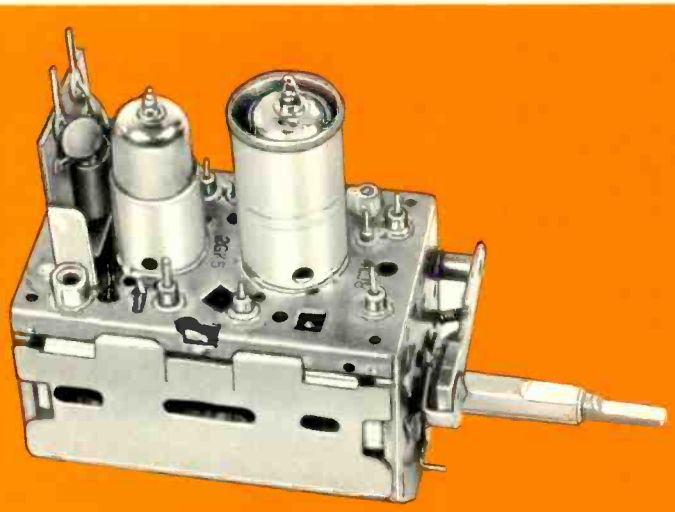
1360
ZENITH
TV Chassis
13A16,M,S,Z,MZ,SZ

JUNE • 1971

SYMBOL DESCRIPTION	ZENITH PART NO.
C24A—200 μf/175v elect	22-5892
C24B—400 μf/175V elect	22-5892
C24C—10 μf/175v elect	22-5892
C24D—4 μf/175v elect	22-5892
R10—4K contrast control	63-8222
R12—250K bright control	63-8221
R13—1M vol control	63-8219
R15—5K AGC control	63-8224
R16—1M vert hold control	63-8170
R18—150K vert lin control	63-6914
R19—2M vert size control	63-7454
L6—sound take-off coil xformer	95-2712
L9—quad coil assembly	S-83648
L13—horiz osc coil winding assembly	S-56876
T5—sound take-off coil xformer	95-2712
T7—quad coil assembly	S-83648
T8—sound output xformer	95-2739
T9—vert output xformer	95-2740
T10—yoke (13A16, M,S)	95-2746
T10—yoke (13A16Z, MZ, SZ)	95-2891
T12—horiz sweep xformer	S-83565 or S-85251
T13—horiz sweep xformer (13A16Z, MZ, SZ)	S-86962
A1—integrator	87-7
F1—1.8a fuse	136-65







$9.75

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PROVIDES YOU WITH A COMPLETE SERVICE FOR ALL YOUR TELEVISION TUNER REQUIREMENTS AT ONE PRICE.

TUNER REPAIR

VHF Or UHF Any Type $9.75.
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In this price all parts are included. Tubes, transistors, diodes, and nuvistors are charged at cost.

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Replacement Tuner $9.75.

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Parallel 6.3V
Series 450 mA
Series 600 mA

All shafts have the same length of 12".

Characteristics are:
Memory Fine Tuning
UHF Plug In
Universal Mounting
Hi-Gain Lo-Noise

If you prefer we'll customize this tuner for you. The price will be $18.25. Send in original tuner for comparison purposes to our office in INDIANAPOLIS, INDIANA.

TSC

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EAST . . . . . 547-49 TONNELE AVE., Jersey City, New Jersey . . . . . TEL: 201-792-3730
SOUTH-EAST . . 938 GORDON ST., S. W., Atlanta, Georgia . . . . . TEL: 404-758-2232
WEST . . . . . SARKES TARZIAN, Inc. *TUNER SERVICE DIVISION*
10654 MAGNOLIA BLVD., North Hollywood, California . . . TEL: 213-769-2720

. . . for more details circle 127 on Reader Service Card

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I.P.O., Box 5056

This month's cover, courtesy of Enterprise Development Corp., depicts removal of an IC from a Motorola Quasar circuit board with an ENDECO desoldering tool, Model 300. More details are provided in the article beginning on page 43.

FEATURES

A HARCOURT BRACE JOVANOVICH PUBLICATION

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EDITORIAL

The Son of a Dealer

Many well prepared speeches were presented at the recent National Appliance and Radio-TV Dealers Association (NARDA) Convention in Chicago, concerning the projection of a better image to the customer, handling credit, community responsibility, salesmanship, and maintaining a proper working relationship between manufacturers, distributors and dealers. Valuable coverage was also given to service contracts and how they can increase your working capital.

Although each of these topics was well presented and provided information of merit to our industry, information gleaned from "off the cuff" comments also proved invaluable.

During the convention, it became apparent that many businesses in our field tend to remain in the family, their control eventually passing from father to son (or if not the business, then at least the skills). Many convention speakers—including C. W. Conn, Jr., president of NARDA—were introduced as being "the son of a dealer." And during one of the luncheons, I had the privilege of sitting next to a young gentleman who was also the son of a dealer. As we ate, he asked if I could supply some information concerning a problem that may be of vital significance to you. (Although he probably was not from your shop, I believe that too many of our readers will suspect that he was.)

Although Sam (not his real name) is a college graduate, his main aptitude was in business administration and the little college electronics that he took came hard. Sam did not claim to be an electronic technician, but relied on those hired to work in the shop.

The shop's head electronic technician is a very close friend of his father. They have worked together for a good many years. However, during the last few years the son has begun to fear that the technician has been taking advantage of his father's friendship. Sam has been observing that this man is quick to fix the easy jobs—like those requiring only a new tube—while he doesn't seem to do much of anything when the hard jobs come around. Those jobs just seem to sit—or at least until a young, part-time technician (who is employed during the day for an electronics manufacturer) can come in and "give them a going over."

As the conversation continued, it became apparent that this head technician is not really the "leech" that Sam seemed to think he was. This man is instead suffering from technical obsolescence. His skills are no longer matched to the job. As a faithful employee, during the past several years this man has on only a "handful of occasions" taken time off work to attend one-day training seminars.

This technician is in trouble. Although the father will probably be willing to keep him indefinitely on the payroll, I suspect that unless these conditions change, he will be fired once the son gains control of the company.

The situation described has reached a critical stage, just as it may have in your shop. But at least Sam now knows that no one is trying to take advantage of him and that this is a situation that can probably be rectified in a constructive manner.

It is extremely important that all electronic technicians—and if they don't work for themselves, the shop management as well—realize that a constant upgrading of technical competency is required (no matter how brilliant the technician) in order to keep up with the astonishingly rapid pace at which our technology is progressing. This must be the responsibility of both the shop—concerned with maintaining an adequate staff—and the technicians—concerned with maintaining their jobs. Despite busy schedules, time must be taken for this task—we simply can't afford to do otherwise.

There are many ways to maintain one's level of technical competency: ☐ If you are not familiar with a new semiconductor, purchase a few samples from your distributor and experiment with them. Breadboard them into working circuits similar to those encountered in the circuits serviced. Since these components are generally rather inexpensive, little is lost by burning a few out. ☐ Take time to read closely the technical material presented in your professional publications, such as ELECTRONIC TECHNICIAN/DEALER. Current electronic textbooks can also be of value. ☐ Attend seminars and training sessions offered by instrument and consumer product manufacturers. Study their literature. ☐ Attend refresher courses at local technical institutes or universities. ☐ Take an advanced correspondence school course.

Any combination of these activities will help keep you from becoming technically obsolete. There should be no need to fear the son of a dealer.

Phillip Dahlen

Now, your choice- 1 or 2 year warranty on all RCA color picture tubes

A big business builder for you with the industry's most complete line.

1. RCA offers an extended warranty, for a second year, on all Hi-Lite and Colorama color replacement tubes.

2. The second year is optional. You can still offer the customer RCA's one year warranty. Or for a modest extra charge there's a whole additional year of protection. It's your choice!

3. This extra protection will help you sell many customers on replacing the tube instead of the set.

4. It will keep them coming back to you for service on their TV sets and other equipment.

5. You can sell with extra confidence. There's added protection on the quality name picture tube line designed to enhance your professional reputation.

That's why the RCA extended warranty is your most powerful new sales tool for 1971! Get full details from your local RCA Distributor.

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

RCA

LETTERS

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

Serving the Industry

Today I received my April issue of your fine magazine, which I have enjoyed and profited from for so many years. Your articles in the past dealing with Business Management have been helpful. This is probably the area that most of us that were technicians and became business men need the most guidance in. Let's have more like those you ran a few years back.

In regards to the request about Depth & Fish Finding: Yes . . . we would like to see service information on them, especially in-shop servicing, testing and calibration. Many are used here in "Sunny Florida."

As chairman of the National Consumer Affairs Committee of the National Electronics Association (NEA), I would like to say that much has been done in behalf of the professional electronics technicians and the electronics service dealers by this NEA committee. For example: We have sent proposals to Mrs. Virginia Knauer about meaningless amplifier ratings. A recommendation to the FTC for a simple, plain warranty and guarantee has been made. And a complete list concerning the regulations of cable TV systems was made to the FCC for their consideration.

NEA has worked hard and diligently with the manufacturers of sets and parts, distributors, publishers, broadcast and factory representatives on behalf of the consumer and professional electronics technicians and service dealers—without much fan-fare or publicity.

Your magazine should plan to attend the NEA National Convention in Portland, Oregon, in July and meet the "Cream of the Crop" in technicians and dealers who want to serve the consumer and manufacturers with maximum efficiency and satisfaction.

CHARLES R. COUCH, JR., CET
COUCH'S INC.

Thank you for the invitation to attend the July NEA convention in Portland. I hope to be able to see you and a great number of our other readers at that convention. Ed.

Grab the HOT LINE in color TV lead-in sales!

BELDEN

They're "market-engineered" to dominate color reception lead-in sales. Metro-Color™ for congested viewing areas. Maxi-Color™ for the suburban viewing market. Real sales grabbers. Created to bring home a better color picture . . . more profit for you. Colorful eye-stopping packages. Long warranties. Flexible, small size for easy installation. Competitive pricing. And a "Hot Line" display, too! That's the program. Grab it while it's hot. See your Belden DISTRIBUTOR today. 8-3-C

Belden Corporation, P. O. Box 5070-A, Chicago, Illinois 60680.

Metro-Color and Maxi-Color also available in bulk

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. . . for more details circle 102 on Reader Service Card

READERS' AID

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

Needs Transformer

I have a Pyramid capacitor-resistor analyzer, Model CRA-1, in which the power transformer has burned out. Since this company is out of business, can anyone tell me where I can get a transformer?

LANDON'S ELECTRIC SHOP
Wayne, W. Va. 25570

Needs Service Aids

I am starting to accumulate "Walkie-Talkies" with various brand names. I would appreciate help in securing parts and service aids.

THOMAS E. DIXON
Harvard Appliance Repair
Box 454
Harvard, Neb. 68944

Needs Schematic

I have two VHF Hartman business radio telephones for 152.3MHz. If anyone has any information on where I can obtain schematics or service information, I will be glad to pay for making copies.

ART HORSTMIER
Two Way Radio Sales
4387 No. West Avenue
Fresno, Calif. 93705

I have a Westrex TV Model 8-PIA that needs repairs and I need a schematic for it. Also I need a schematic and any other information available on a Dumont, Type 208-B oscilloscope. If anyone can supply me with the information for these instruments, I will pay for any expense incurred.

JIM BLAINE
978 Belgrave
Reno, Nev. 89502

I need a schematic and service information on the Bell 360 tape recorder. I will gladly pay for making the copy I need.

RUSSELL E. BLADING
1706 Walnut St.
Prospect Heights, Ill. 60070

I am in need of a schematic for a Philco color bar/dot generator, Model 7100.

J. W. BUNN
Kenoza Lake, N.Y. 12750

continued on page 31

GTE Sylvania has the lines that lay it on the line.

Only GTE Sylvania gives you a choice of three different price lines in color picture tubes.

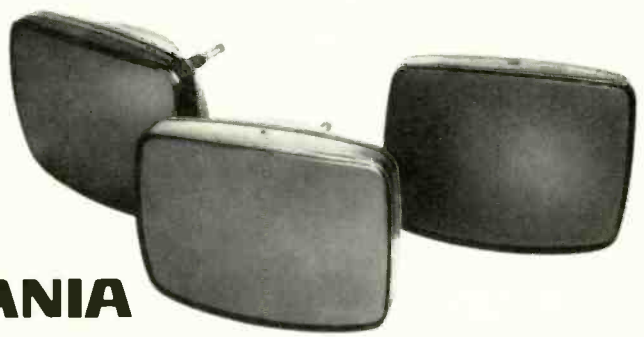
And GTE Sylvania tells you and your customer exactly what you are getting in each line.

That makes Sylvania tubes easier to sell.

You can tell your customers the advantages of the top-line *color bright* 85® XR. You can show them where the savings come from in the economy *color screen* 85 line. And you can tell them exactly what they're getting for their money in the middle-line *color bright* 85® RE.

The way we see it, if we lay it on the line with you, you can lay it on the line with your customers.

Instead of just handing them a line.



GTE SYLVANIA

	color bright 85® XR	color bright 85® RE	color screen 85
Sylvania rare earth red phosphors	yes	yes	yes
Other manufactured rare earth phosphors	no	no	yes
All sulfide phosphors	no	no	no
X-ray inhibiting glass	yes	no	no
New glass	yes	some	some
Reused glass	no	some	some
Regunned	no	no	some
Screen blemish specs	OEM	OEM	slightly wider than OEM
White field uniformity	OEM	slightly wider than OEM	slightly wider than "RE"
Cut off; purity currents; beam shield leakage	OEM	OEM	slightly wider than OEM

NEWS OF THE INDUSTRY

Annual Convention Plans Announced By National Electronic Associations

The National Electronic Associations, Inc., plans to hold its seventh annual convention at the Sheraton Motor Inn in Portland, Oregon, on July 12 through July 18.

During the early part of the week those attending the convention will be learning the business practices of others in the industry in an informal manner while at the same time taking part in family fun, deep sea fishing, bowling, golf tournament, Indian Bar-B-Que and sight seeing trips.

On July 15 and 16 a business management school will be held. Dr. Amo DeBernardis will open the session with "The Introduction to Business Management." John Sperry will cover "Shop Layout"; Roger Meyer, "The Law and the Service Company"; John Sperry, "Practical Financial Management"; and Jerry Canter, "The Why's and Wherefore's of Service Contracts." The Thursday luncheon will be held at the Portland Community College and there will be a trip through its Electronics Department.

For those interested in improving their local or state associations, workshop seminars will be held covering the following topics: "Membership Recruitment," "College of Convention Knowledge," "Association News Letter Editors," "Financing State and Local Associations," "Better Board Meeting Planning," and "Educational Meeting Planning."

The business meetings will be held on July 17 and 18.

Those wishing either to register or obtain more information may write: National Electronic Associations, Inc., 1309 West Market St., Indianapolis, Ind. 46222.

TV-Radio-Phonograph Sales Up in First Month of 1971

Distributor sales to dealers in all major consumer electronics areas were ahead in sales in January, 1971, over sales in the same month a year ago, the Electronic Industries Assn.'s Marketing Services Dept. reports.

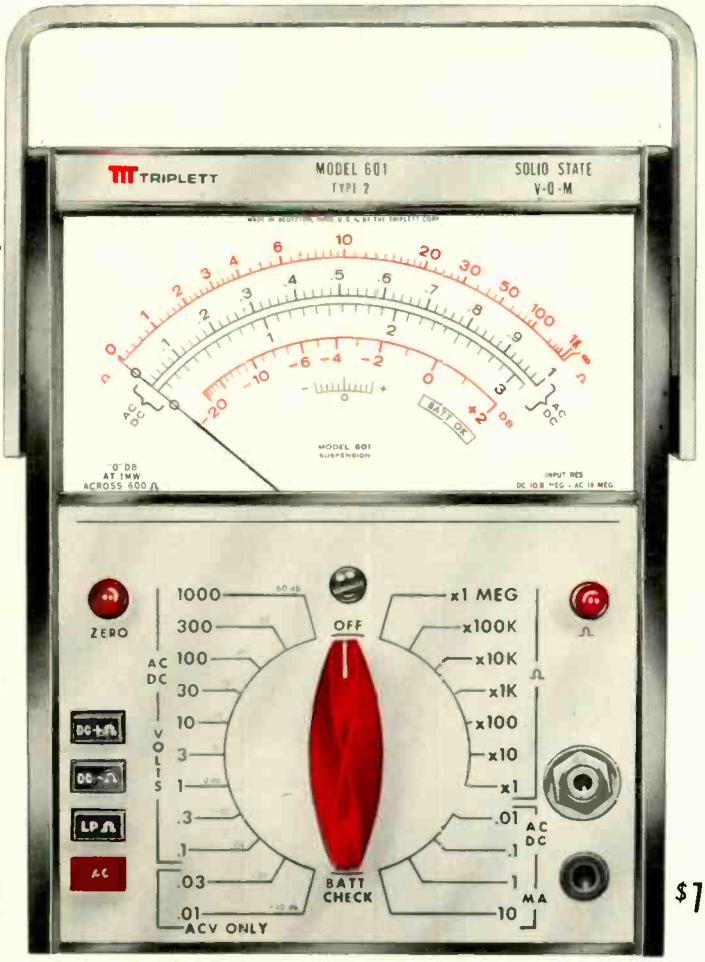
Distributor sales of color-TV sets to dealers were up 7.5% during January, 1971, over January, 1970. B/W-TV sales in January, totaling 357,636 sets were 6.0% ahead of the 337,429 sets sold the same month last year. Total TV sales to dealers were up 6.8%; 767,007 in January, 1971, to 718,270 in January, 1970. Total radio sales to dealers were 1,354,967 units in January, 1971; up 4.8% over the 1,293,051 units sold in January, 1970. Total phonograph sales to dealers were up 23.9% in January, 1971, over the first month last year.

British Company Sells Two Out of Three Record Changers in Japan

At a time when some American and European manufacturers of home electronics are feeling the effects of the tremendous resurgence of Japanese exports, a British company is said to be selling two out of every three record changers used in Japan. That company is BSR.

"The Japanese hi-fi industry has become a dominant factor in competitively priced quality stereo components," said John Hollands, vice-president and general manager of BSR (USA) Ltd., sole U.S. distributor for British-based BSR.

If your problem is in-circuit testing of transistorized and integrated circuits . . . Solve it with Triplett's 601



Model 601 — $166

1. Low power ohms — 7 ranges with 75 mV power source.
2. High sensitivity — 10 mV AC full scale at 10 megohm input impedance; 100 mV DC at 11 megohm input resistance.
3. Simplified scale — only 4 arcs for all 53 ranges.

It has 7 low-power resistance ranges that apply only 75 mV to the device under test . . . does not activate or damage solid-state component . . . full-scale DC measurements down to 100 mV and 10 μA and AC as low as 10 mV and 10 μA, it's obvious the Model 601 was designed for in-circuit testing.

Add such features as 10 megohm input impedance on AC and 11 megohm input resistance on DC, voltage readings to 2% DC and 3% AC (current: 3% DC and 4% AC), separate range-selection and function-selection switches, and a simplified dial on which all 53 ranges are read on only 4 scales, and it's equally obvious that here's a V-O-M that has what you need to do the job better, faster and more easily.

See the capable Model 601 — priced at $166 — at your local Triplett distributor. For more information, or for a free demonstration, call him or your Triplett sales representative right away. Triplett Corporation, Bluffton, Ohio 45817.

TRIPLETT

The World's most complete line of V-O-M's . . . choose the one that's just right for you

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

READERS' AID

continued from page 26

I am in need of a schematic for a Swimming Pool Monitor-Alarm, Model 400-A, made by Sonus Corp. Assistance from anyone would be greatly appreciated.

J. T. COMBS
2602 Larwood Drive
Charleston, W. Va. 25302

I need a schematic for a Sonarette depth finder which was made by the General Electronic Control Inc.

ERNEST HUETTMANN
Box 5
Wisner, Nebr. 68791

Needs Manuals and Schematics

I need the manuals and schematics for the following instruments: Baird Associates, Transistor Test Set, Model GP; Solar EXAM-ETER; and General Radio Co., Twin-T Impedance Measuring Circuit.

WILLIAM MISIEK
405 Royalton Road
Silver Spring, Md. 20901

I am in need of a schematic and parts manual for a Lowery Organ, Model 07, installed in a Story and Clark Piano. I would purchase a photo copy or purchase the schematic.

RUSSEL H. MAYES
R.D. #1
Hornell, N.Y. 14843

Needs Manual

I need a service manual with a schematic or just a schematic for a Precise Development Corp. scope, Model 300, Serial No. 3135.

LEE. V. MCKINNIS, JR.
P.O. Box 1225
Bloomington, Ind. 47401

For Sale

I have for sale the following: John F. Riders Television Manuals, Perpetual Trouble Shooters Manuals, and Sam's Photo-Fact Folders.

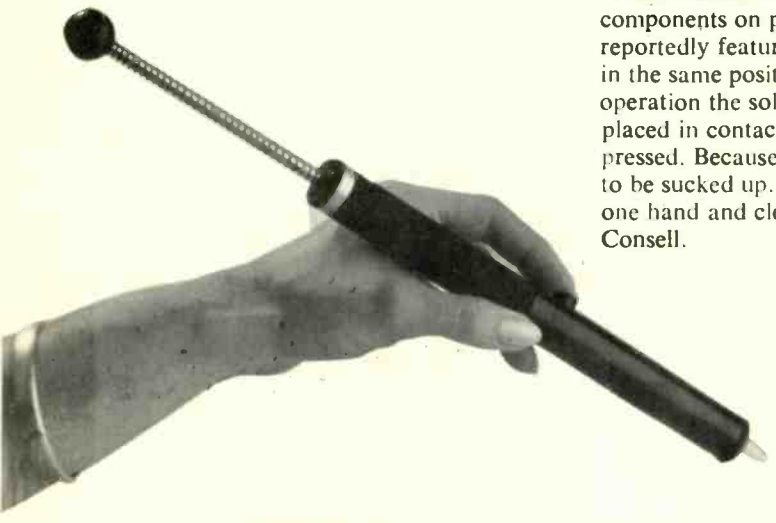
J. E. HERMAN
Rt. L, Box 929
Sequim, Wa. 98382

I have for sale a CRT Picture Tube Rebuilding Machine which has been used one year.

FRED R. FOUNTAIN
211 Forrest Avenue
Valdosta, Ga. 31601

NEW AND NOTEWORTHY

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



SOLDER VACUUM 700

Cleans itself automatically when reloaded with replaceable tip

A self-contained vacuum tool is designed for desoldering of components on printed-circuit boards or terminal strips. This tool reportedly features a captive plunger-rod which, after loading, remains in the same position when the tool is fired, preventing eye injury. In operation the solder is first melted, then the suction tip of the tool is placed in contact with the molten puddle and the trigger button is pressed. Because of a very high onset of vacuum, all the solder is said to be sucked up. Specifications indicate that the tool is operated with one hand and cleans itself automatically when reloaded. Price $10. Consell.

TELEPHONE ANSWERING SYSTEM 701

Automatically answers unattended telephone

An automatic telephone answering system, the Ansafone, Model 540, is designed to use tape cassettes to automatically answer an unattended telephone, play a prerecorded message to the caller and record callers' messages. Specifications indicate that four announcement cassettes are available with varying length of cycle times: 45, 60, 90 and 120 sec. These cassettes may easily be transcribed using a standard cassette transcriber. Price $275. Dictaphone.

FOR MORE NEW PRODUCTS SEE PAGE 60

DIGITAL MULTIMETER 702

Low cost with 21 switch selectable ranges

A solid-state three-digit multimeter is designed with 21 switch selectable ranges—eight ac voltage and current ranges, eight dc voltage and current ranges, and five resistance ranges. Specifications indicate the unit measures 10mv and 10μa steps on the lowest voltage and current ranges. Other features reportedly include linear readings, accuracy of 1% with a 10% over-range on all scales and a non-blinking panel display. The unit measures 5¼ in. H by 6⅞ in. W by 2⅜ in. D and weighs 2½ lb. Price $195.50. Esterline Angus.

23EG's without tears!

Replacing a 23EG CRT used to be a tearful experience, what with the trouble in finding one, paying through the nose for it...and then going through all the grief of installing it. Many tears have been shed in the name of the 23EG!

Well, Channel Master is taking care of the problem with our new 25EGP22. For Motorola chassis models 908 and 914 we've got a high quality, **rare earth** phosphor replacement picture tube in our 2 year warranty Color-Lux line.

They all come with preassembled hardware and harnesses for easy front end mounting...and they go for under 90 bucks.

Now, with all the color sets out there just crying for a new 23EG, here's your chance to dry a lot of tears...and land a lot of service business with the Channel Master 25EG series!

CHANNEL MASTER

Division of Avnet, Inc., Ellenville, N.Y. 12428

PICTURE TUBE HEADQUARTERS

. . . for more details circle 105 on Reader Service Card

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May we send you your choice of any three books on the facing page as part of an unusual offer of a Trial Membership in Electronics Book Club?

Here are quality hardbound volumes, each especially designed to help you increase your know-how, earning power, and enjoyment of electronics.

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Whatever your interest in electronics—radio and TV servicing, audio and hi-fi, industrial electronics, communications, engineering—you will find that Electronics Book Club will help you.

With the Club providing you with top quality books, you may broaden your knowledge and skills to build your income and increase your understanding of electronics, too.

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This special offer is just a sample of the help and generous savings the Club offers you. For here is a Club devoted exclusively to seeking out only those titles of direct interest to you. Membership in the Club offers you several advantages.

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2. Guaranteed Savings: The Club guarantees to save you 15% to 75% on all books offered.

3. Continuing Bonus: If you continue after this trial Membership, you will earn a Dividend Certificate for every book you purchase. Three Certificates, plus payment of the nominal sum of $1.99, will entitle you to a valuable Book Dividend which you may choose from a special list provided members.

4. Wide Selection: Members are annually offered over 50 authoritative books on all phases of electronics.

5. Bonus Books: If you continue in the Club after fulfilling your Trial Membership, you will receive a Bonus Dividend Certificate with each additional Club Selection you purchase. For the small charge of only $1.99, plus three (3) Certificates, you may select a book of your choice from a special list of quality books periodically sent to Members.

6. Prevents You From Missing New Books: The Club's FREE monthly *News* gives you advance notice of important new books . . . books vital to your continued advancement.

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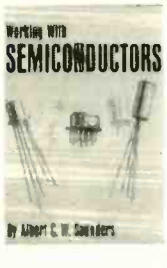

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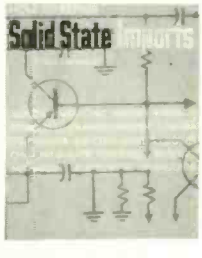

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TEKLAB REPORT

By pushing a button, a solid-state switch goes into action, controlling the color demodulators for better flesh tones; and the automatic color circuit monitors the chroma signal keeping it at a predetermined level.

Motorola's Insta-Matic Color TV Tuning

by Joseph Zauhar

■ As we view our color TV receivers, we sometimes find variations in the channels or stations, and they often need color adjustments for a natural looking color picture.

The TV stations monitor the programs and give considerable attention to correcting color variations, but we still find some differences of color quality from local to network and between tape, film and camera programs. We also find changes of color in transmission paths and antenna systems which vary with the location of the TV set.

A great deal of work already has been done, but until we come up with a standard constant signal, we need a method to compensate for signal differences. TV manufacturers have come up with new circuits to satisfactorily correct for signal variations and simplifying the customer color controls.

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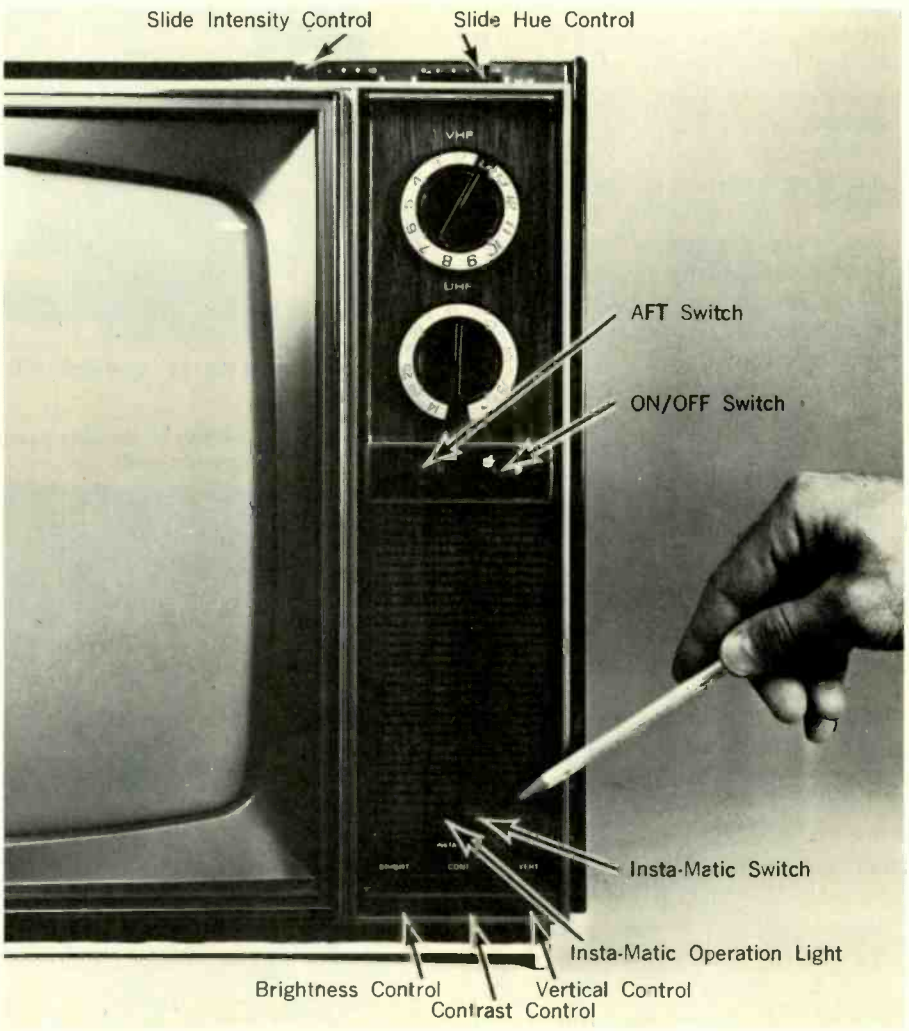


Fig. 1—The front control panel showing the customer controls and the Insta-Matic switch.

Insta-Matic color tuning is Motorola's latest circuit to achieve a more uniform color picture. To satisfy our curiosity concerning this circuitry, we obtained a Quasar II, Model WP563GWA, employing the TS-929 chassis with Insta-Matic color tuning. The new circuit proved to be different from the automatic color circuits reviewed in the past.

By pushing a button on the front panel, the preset circuitry is activated. The circuit shifts the picture background toward red, increasing the color demodulator phase angle and controlling color intensity.

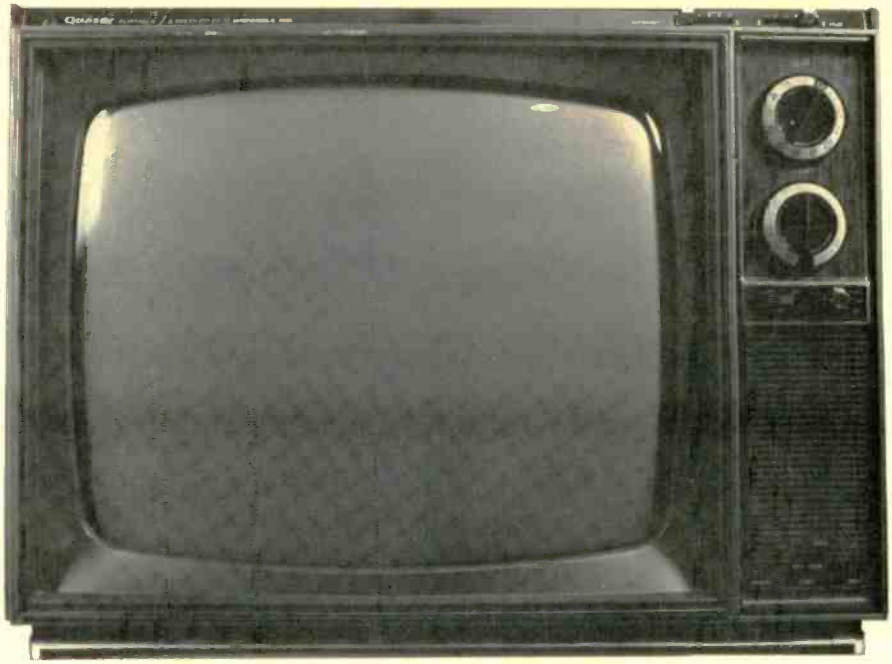
We found this circuit capable of producing an acceptable color picture automatically on all channels without manual adjustments of the front panel controls (HUE, INTENSITY, CONTRAST and BRIGHTNESS).

A green light, located on the front panel of the TV set (Fig. 1), glows when the Insta-Matic color tuning feature is activated. Should the owner desire a manual setting, he can push the Insta-Matic color tuning button to the OFF position and manually adjust the picture as desired.

The new circuitry is located on the Insta-Matic color preset panel "PA," as shown in Fig. 2. This circuit has been mounted "piggy back" (and connected by a plug and eight wires) on the top of the "SA" color panel in TV sets that feature the automatic circuit.

In other Motorola TV sets the two panels are integrated, the combined panel being designated "CA." This second version of the circuitry (Fig. 3) eliminates the need for the "piggy back" section, because an additional IC condenses the circuitry, providing sufficient space for all of the circuits. These panels are coded CA-50 and up.

The CA panel is essentially an SA panel, so it may be used in a set without Insta-Matic tuning. However, the Insta-Matic circuits on the panel will be inoperative and cannot improve the performance of the set over an SA panel. The reverse is not true—an SA panel cannot be substituted for a CA panel. Although the Insta-Matic set would operate normally on manual, you would not have color on Insta-Matic. It is recommended that only



Motorola's Quasar II, Model WP563GWA, employing the TS-929 chassis with Insta-Matic tuning.

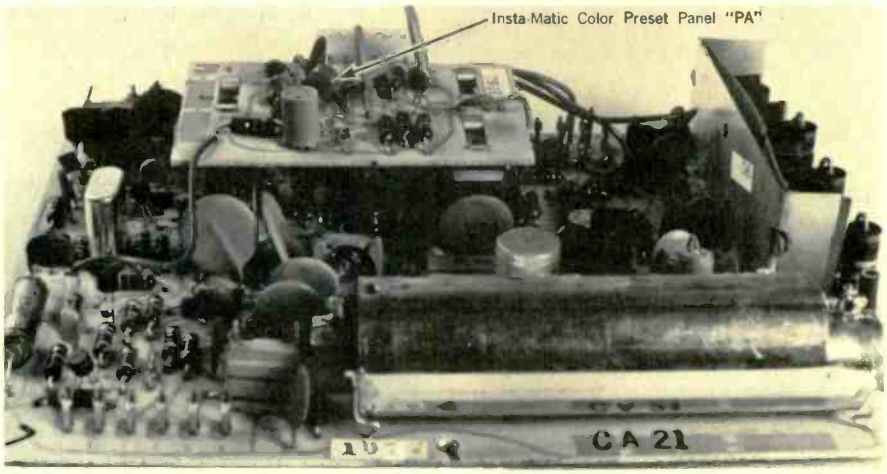
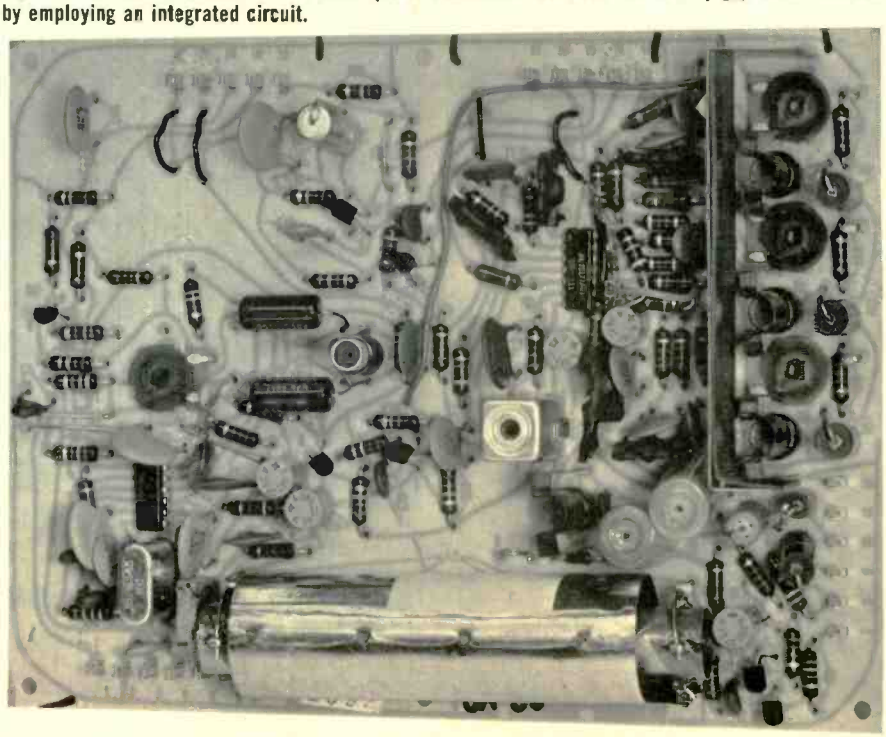


Fig. 2—Side view of the "SA" color panel with the "PA" Insta-Matic color preset panel added in a "piggy back" style.

Fig. 3—The second version of the color panel eliminates the need for the "piggy back" section by employing an integrated circuit.



CA panels be carried in your panel caddy and used as a CA or SA substitute.

On this particular chassis, the preset controls are located on top of the chassis frame (Fig. 4). Holes in back cover permit adjustments without dismantling the TV receiver. The CONTRAST and HUE controls are duplicates of the front panel controls. However, the manual brightness control has a 1K value while the preset brightness control has a 5K resistance, and the manual intensity control has a 5K resistance while the preset intensity control has a 750Ω resistance—this latter control also being associated with an automatic intensity circuit.

The complete schematic for the Motorola TS-929 chassis can be found in this month's TEKFAX schematic No. 1363.

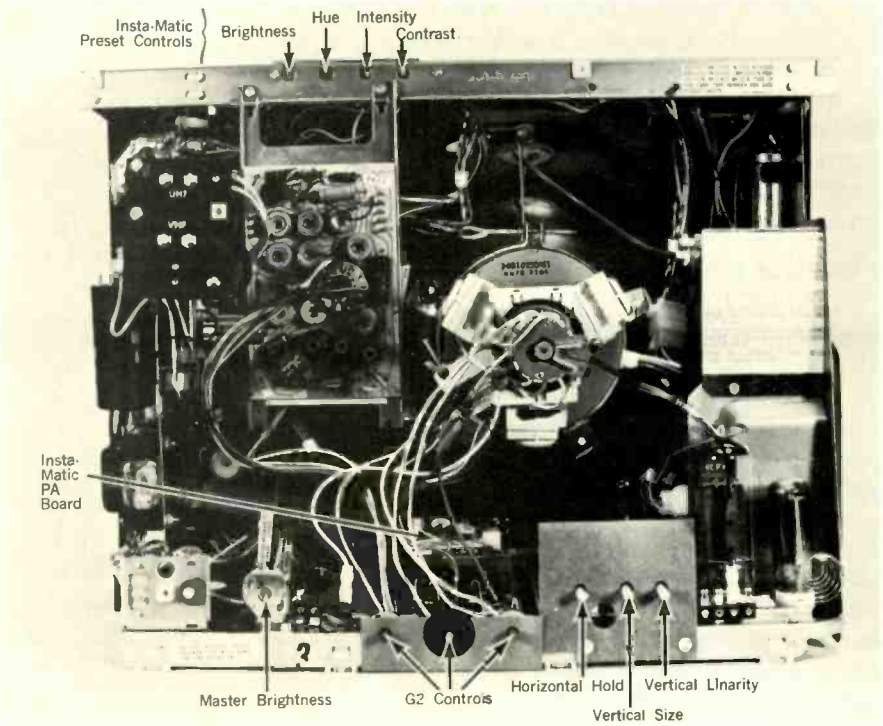


Fig. 4—Rear view of Motorola TS-929 chassis showing the Insta-Matic preset and service controls.

Hue and Tint (Background Circuit)

The solid-state switch shown in Fig. 5 operates as an "AND GATE." If both switches are closed, one end of the 33pf capacitor and one end of the 22K resistance are grounded, and two separate actions take place:

The demodulation system is altered to favor flesh tones, by placing the 33pf capacitor in parallel with the phase-shifting capacitor in the color oscillator input to the blue demodulator. Any flesh tone error in the station or program material is reduced to a minimum and the color programs now have acceptable flesh tones.

By placing the 22K resistor in parallel with the red video transistor's emitter resistor, it increases transistor conduction. This lowers the red video transistor's collector voltage and the CRT red gun cathode voltage, resulting in a warmer background color.

The solid-state switch employs two transistors, Q3 and Q4, as shown in Fig. 6. When the Insta-Matic circuit is switched to manual operation, Q3 is biased OFF with its base grounded and the switch is open.

When the circuit is in automatic operation (switched left), the bias from the 20v supply turns Q3 ON, causing the transistor to go into saturation and effectively shorting the collector to the emitter.

If color sync is present at the same time, color killer transistor Q11 conducts and a positive voltage appears at the upper end of the resistor R67. Transistor Q4 is then biased into saturation and the collector of Q3 is grounded through both transistors. Phase shifting capacitor C4 is then in parallel with capacitor C41, and resistor R4 is in parallel with resistor R90. The phase angle of the blue demodulator

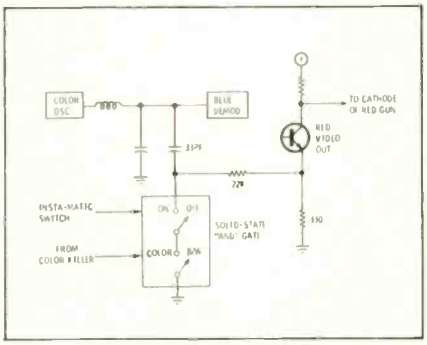


Fig. 5—The solid-state switch used in the hue and tint background circuit operates as an "AND GATE." *Courtesy of Motorola Inc.*

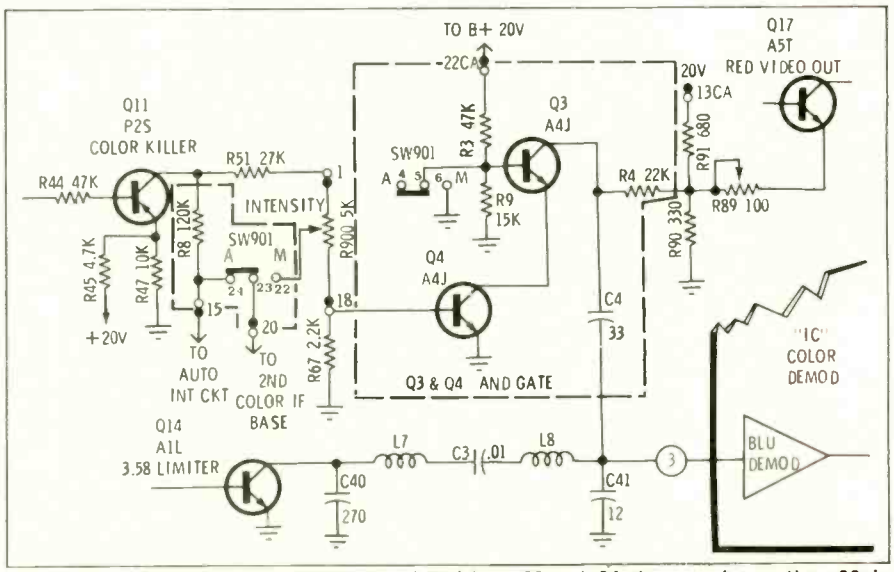


Fig. 6—The solid-state switch employs two transistors, Q3 and Q4. In manual operation, Q3 is biased OFF. *Courtesy of Motorola Inc.*

has now shifted and the CRT red gun voltage is increased as desired.

If there is no color sync present, or if the Insta-Matic switch is OFF, the solid-state "AND" gate cannot operate without conduction and the flesh tone (or hue) and dc background are unchanged.

Automatic Intensity Circuit

Two independent automatic gain controls for the color IF signal are shown in the block diagram (Fig. 7). The first, the ever-present ACC signal, is applied to the first stage and acts to maintain a constant signal level with color sync changes.

A second gain-control circuit is activated in the second color IF stage, when placed in Insta-Matic operation. A second IF total chroma output signal is applied to a two-stage amplifier and rectified to a negative-going dc voltage. This voltage is applied as the second color IF transistor bias control and maintains a constant chroma level. With gain control for changes of either color sync or chroma level, the intensity stays constant for all input signals.

The bias control circuit for the second color IF stage is shown in Fig. 8. The chroma output sample is applied to a conventional two-stage amplifier and the output is then rectified in a double-diode circuit to provide a negative dc voltage, which represents the chroma level.

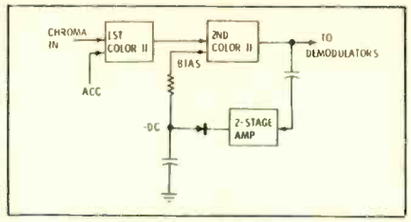


Fig. 7—Block diagram showing the two automatic gain controls of the color IF signal. *Courtesy of Motorola Inc.*

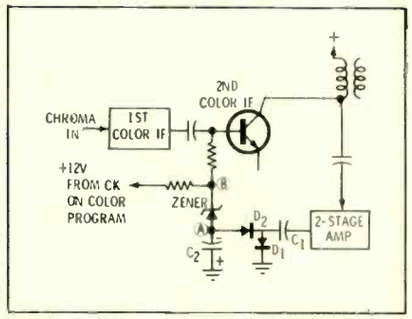


Fig. 8—The bias control circuit for the second color IF stage. *Courtesy of Motorola Inc.*

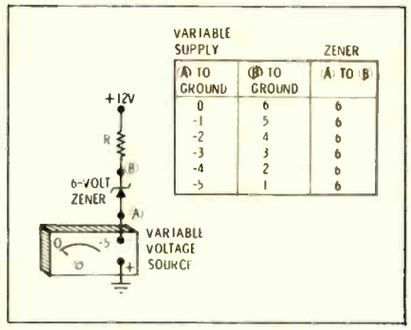


Fig. 9—The basic zener diode circuit. *Courtesy of Motorola Inc.*

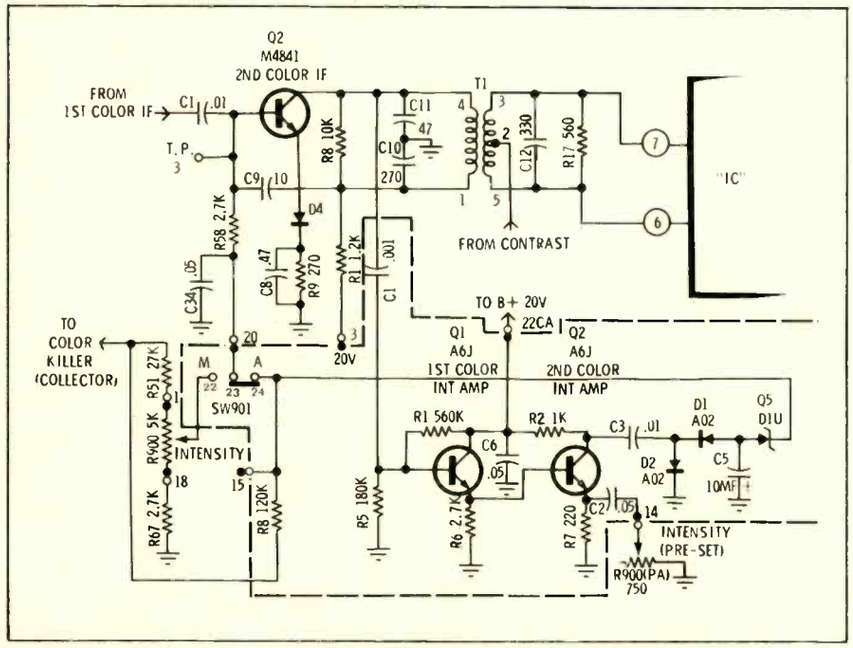


Fig. 10—Schematic of the complete automatic intensity circuit. *Courtesy of Motorola Inc.*

At point A, negative dc voltage is applied through a zener diode to the color IF amplifier base-bias circuit. Although the upper end of the zener is positive, and the transistor base is forward biased by the color killer circuit, any increases in the output level of the color IF will increase the negative voltage at point A, which in turn will cause a corresponding change at point B. This lowers the transistor's forward bias and maintains a constant output level.

The basic zener diode circuit shown in Fig. 9 consists of a resistor, a zener diode and a variable series voltage supply. Regardless of the changing voltage, the 12v biases the diode in its zener mode and its voltage remains a constant 6v.

Assume the variable voltage is 0v and point A is at ground potential while point B is +6v above ground. As the variable voltage is made negative, point A becomes negative and point B less positive. The change at B is the same as that at A —except that B is 6v more positive due to the constant 6v across the zener.

The Insta-Matic switch connects the base of the second color IF stage to the operator's intensity control during the manual operation and the automatic circuit becomes inactive.

During Insta-Matic operation, the color IF amplifier bias is switched to the automatic circuit as shown in Fig. 10. The bias is then supplied from the color killer through resistor R8. However, this bias also depends on, and is varied by, the negative voltage of the doubler output capacitor (C5). The emitter and base of Q5 are now connected as a zener diode. Transistor Q1 and Q2 are the two amplifiers, and the intensity is now determined by a control at the emitter of Q2. This determines the amplifier gain, the voltage of C5 and the bias of the color IF. Capacitor C1 (0.001) couples the second color IF output to the input of the first control amplifier.

Next month we will cover field readjustment, troubleshooting the Insta-Matic circuits and what happens to the various circuit voltages when placed in automatic tuning. ■

The Art of Desoldering

by Ronald L. Kopernak

Today's skilled electronic technician can quickly remove even the most delicate components from printed-circuit boards without damaging either the parts or the boards

■ Probably every electronic technician has labored to remove a soldered component by heating and pulling or by cutting, then cleaning with a metal pick or wire brush. The results have been largely disastrous. Excessive heat damages printed-circuit boards and components during this awkward and time-wasting process.

Some recent breakthroughs include "bar" and "braid" desoldering. (A bar is simply a specially designed soldering tip that can melt solder on several connections simultaneously.) This frees the solder bond as long as the heat is present, and thus enables the component to be lifted out. The bar method has proven its worth in certain industrial situations, but is generally too expensive and likely to cause heat damage or contamination to be a practical method for most technicians.

In most cases, braid desoldering is much better. Tinned copper shield braid wire is dipped in flux and pressed against a connection. When heat is applied, melted solder is drawn to the braid by capillary action. This technique is especially good for the amateur or hobbyist, who encounters few desoldering problems. But the technician may find serious complications again resulting from heat damage, time lost or having to use both hands. (Occasionally the braid will adhere to the printed circuit, damaging the board.)

The introduction of vacuum has finally made desoldering a reliable technique. One of the first applications of vacuum was the use of a rubber bulb with a short teflon tube to suck melted solder from a connection. This relatively inefficient method led to the development of the vacuum desoldering iron. This one-hand tool is readily available on the market and is capable of quickly and safely removing solder from heretofore difficult, if not impossible problem situations (Fig. 1).

The author is general manager of Enterprise Development Corp.

Since successful desoldering requires a basic understanding of soldering, let us quickly review basic soldering techniques.

Fig. 1—A desoldering kit designed to quickly and safely remove solder from heretofore difficult, if not impossible problem situations.

The Art of Soldering

Good soldering requires cleanliness. Tips should be well tinned (most are pre-tinned by manufacturers) and kept free of contamination by wiping with a moistened sponge.

Connections must also be cleaned prior to soldering. This, of course, is the purpose of the flux present in rosin-core solders. When these solders are heated, flux flows ahead of the solder, cleaning the metal so that the solder can effectively alloy with the connection. Modern fluxes are only active in the presence of heat, but prolonged exposure to heat may cause burning. Therefore, solder is never applied to an iron tip and allowed to flow from the tip to the connection. Such a procedure risks the probability that the flux will burn up before it can travel to the connection to perform its cleaning function. Failures of flux, caused by the improper use of heat (usually not enough), are the biggest source of "cold solder" problems.

Solder and heat should be applied simultaneously to the same portion of the connection (Fig. 2). Flux

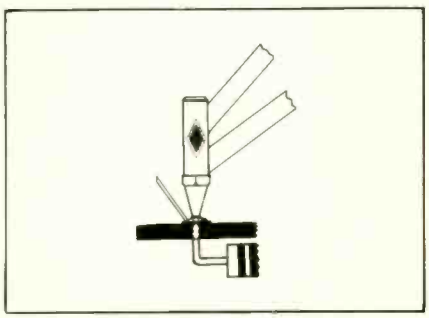


Fig. 2—Solder and heat should be applied simultaneously to the same portion of the connection.

will then immediately begin cleaning both the tip and connection, allowing solder to flow freely and thereby creating a very efficient heat transfer from the iron to the connection. (Good heat transfer is crucial —dirty or oxidized surfaces will not allow maximum transfer.)

It is very important to remove the iron or heat source at the proper time. Too little heat (usually resulting from a dirty tip or poor heat transfer) may result in the flux failing to clean properly. Too much heat, or prolonged heat, can burn the flux and cause contamination. Both result in poor solder joints.

Generally, the iron should be removed as soon as the solder flows around the connection. The key is in watching. When the active flowing reaches the entire connection, the flux will retrace the solder, giving it a very bright mirror-like appearance. At this instant the iron should be removed.

We exclusively recommend the use of rosin core solders having a 60 percent tin to 40 percent lead or 63/37 composition. This composition (eutectic) eliminates the plastic

stage—allowing the solder to immediately change from a solid to a liquid. Eutectic solder thus eliminates the possibility of cold joints forming during a plastic stage. Most authorities recommend heating soldering-iron tips to between 510° and 750°F when using eutectic solders.

Damage caused to heat-sensitive components and printed-circuit boards has long been the primary problem encountered in desoldering. Like soldering, artful desoldering requires careful attention to the previously mentioned factors—including a clean tip, good heat transfer and timely removal of the iron.

How to Desolder

Once again, the secret is in careful observation. Your eyes will tell you when and where to act.

Let's illustrate the basic desoldering technique with reference to a simple soldered connection. (We are using an ENDECO Model 300 Desoldering/Resoldering unit—Fig. 3. This unit features one-hand operation, the required desoldering temperature—about 700°F—and tips of various sizes which are plated for good wetting.)

Fig. 3—Applying a desoldering iron to a simple soldered connection.

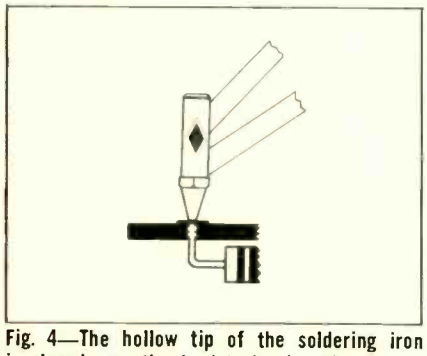


Fig. 4—The hollow tip of the soldering iron is placed over the lead to be desoldered.

After the iron has been heated and tinned, the bulb is depressed by either index finger or thumb. The tip is then placed over the lead to be desoldered (the objective is to obtain maximum surface contact between the hollow tip and the solder—Fig. 4). As soon as the solder liquifies or flows, the bulb is released—creating a vacuum which actually picks up the melted solder. The iron must be removed while the vacuum is still in effect.

Some situations may require a longer vacuum duration. That duration can be easily regulated by simply controlling the release of the bulb with one's finger or thumb. A slower release, of course, provides a longer vacuum duration.

Timely iron removal is crucial. If the tip remains on the connection after the vacuum has ceased, gravity (the primary factor) and capillary action will tend to cause some solder to remain when the iron is removed—this solder naturally being found where you want it least.

Cold Solder Problems

As had been previously indicated, "cold" solder joints are the results of either too much or too little heat, including problems caused by poor heat transfers. Generally, when desoldering cold solder joints, at least one of three situations are encountered:

- Poor heat transfer has never allowed the flux to clean the connection so that solder could effectively alloy.
- Good heat transfer has been extended to the point that the flux has been burned and has formed an oxide or carbon contamination.
- Occasionally a connection will be so dirty that the flux is unable to flow properly.

In desoldering cold solder fillets, one should first attempt the standard desoldering technique just described—being careful to get the best heat transfer possible and promptly removing the iron. If this fails to remove all the solder, then fresh rosin-core solder should be applied to the connection. The addition of new flux will permit the solder to flow again and thus facilitate vacuum removal.

Choosing the Best Tip

Whenever a vacuum is required, some attention is usually given to the problem of forming a vacuum seal. The better this seal, the better the desoldering.

The most important factors here are tip plating and tip orifice size (assuming adequate temperature). Tips should be plated with a metal that wets with solder (nickel, silver and iron are all very efficient). Of course, strategic tip placement is also important and closely related to tip orifice size. Generally, the inside diameter of the tip should be just large enough to permit placing it over a lead (we consider a 0.063-in. inside-diameter tip standard—Fig. 5).

However, in the case of very large leads or terminals, a smaller tip is

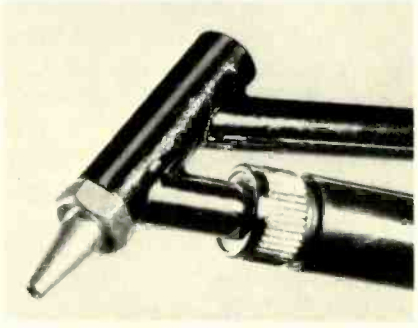


Fig. 5—This 0.063-in. inside-diameter tip is considered standard for a desoldering iron.

preferred for more efficient use of the vacuum. This method usually requires two or three removals from various sides of the connection in what we call a "mopping action" (Fig. 6). Careful regulation of the vacuum (with finger or thumb) will

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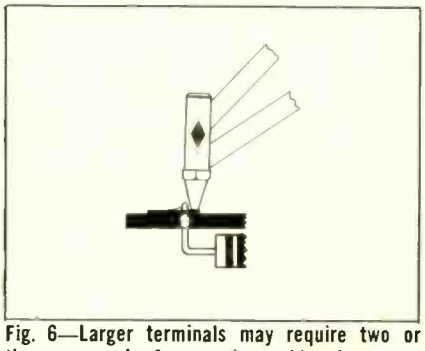

Fig. 6—Larger terminals may require two or three removals from various sides in a sort of "mopping action."

New Kinds of Ground Problems

by Norman Crowhurst

Those familiar with traditional tube amplifiers encounter something entirely different when checking semiconductor amplifier grounds

■ It seems like quite a long time ago since some of us have serviced traditional tube circuits, but many of these audio amplifiers are still around and encountered more frequently by some technicians than the rest of us. For these amplifiers, ground was always predictable—the negative side of the high-voltage supply. In a good tube amplifier the chassis ground would generally be connected at the signal input while the negative output of the power supply was connected to the opposite end of the ground bus—by the output stage (Fig. 1).

But semiconductors have changed all of this simplicity so that ground arrangements are far less predictable. In fact, in some circuits what you would call ground may be difficult to identify since it would depend on whether you happen to be thinking of dc ground or signal ground.

Then in some transistorized amplifiers, audio output circuits further complicate matters by containing a ground which is connected to neither the positive or negative power-supply output. The usual way of achieving this is with a balanced power supply, using the same transformer winding to provide both halves of the power supply, with separate rectifiers and filter capacitors (Fig. 2).

Usually this is all balanced up neatly so that both halves of the power supply are equal in voltage and the output stage works quite symmetrically. However, failure in this equality between "halves" can cause trouble. If the two halves are supposed to contain equal voltages but do not, this is probably the result of something happening to the load on one side, due to a fault that has caused the imbalance.

This could result from either of two conditions—an excessive load across the "half" that is low in voltage, or some of the load having "fallen off" the portion of the circuit containing the higher voltage. If the load has fallen off, some of the components have probably "blown," opening the circuit and resulting in signal failure or severe signal loss with very high distortion.

If the imbalance is due to an excessive load across the other half of the circuit, this may also be due to a circuit fault, but it may not immediately result in circuit failure. One half of the output stage (the half containing the low voltage) may have too high a static or quiescent current due to a change in component values, a failure of a quiescent stabilizing current (such as that flowing through a diode) or some failure of a similar nature (Fig. 2).

So far we have not considered the ground connection in transistor circuits as such. The fact that the ground is positive, negative or somewhere in between—from a voltage measuring point of view—and that voltages may deviate to indicate a fault in the power section is one thing. What can happen to ground connections themselves is something else again.

"Front ends"—preamplifier sections, tuners, IF sections, etc., usually operate with single-polarity power supplies—the other side being grounded. But there are different ways of operating transistors using power supplies with alternative polarities, unlike the simple, familiar, universal way that could be relied upon in tube circuits.

There are two transistor polarities (NPN and PNP transistors) and two polarities from a power supply. And the two pairs can be used in several combinations, yielding four possible combinations of ground connections (Fig. 3).

In most instances failure results because the dc supply to part of the circuit is broken and thus that part of the circuit ceases to operate. So you get your voltmeter to check things out.

Maybe, for example, you find a transistor that shows the same voltage at its collector as at the supply point from which it draws current (or should be doing so) through a resistor, indicating that there is no voltage drop in the collector resistor, and causing you to deduce that there is no collector current (Fig. 4). Perhaps you also find a similar volt-

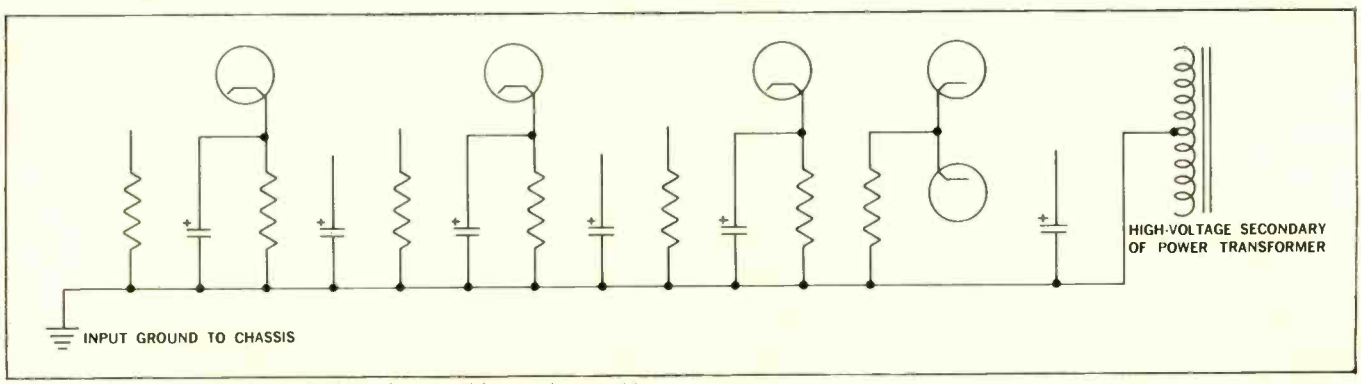

Fig. 1—The arrangement of a ground bus in a traditional tube amplifier.

age on the transistor's base and are inclined to deduce that the transistor is "shot"

But as a double check, because you hesitate to unsolder a transistor without being sure that it is bad, you switch OFF the amplifier and check the transistor in place. Then upon checking it with an ohmmeter or an in-circuit transistor checker you find that the transistor is okay. Perhaps, when making voltage checks, you failed to note that the emitter also had the same voltage reading as the collector and base.

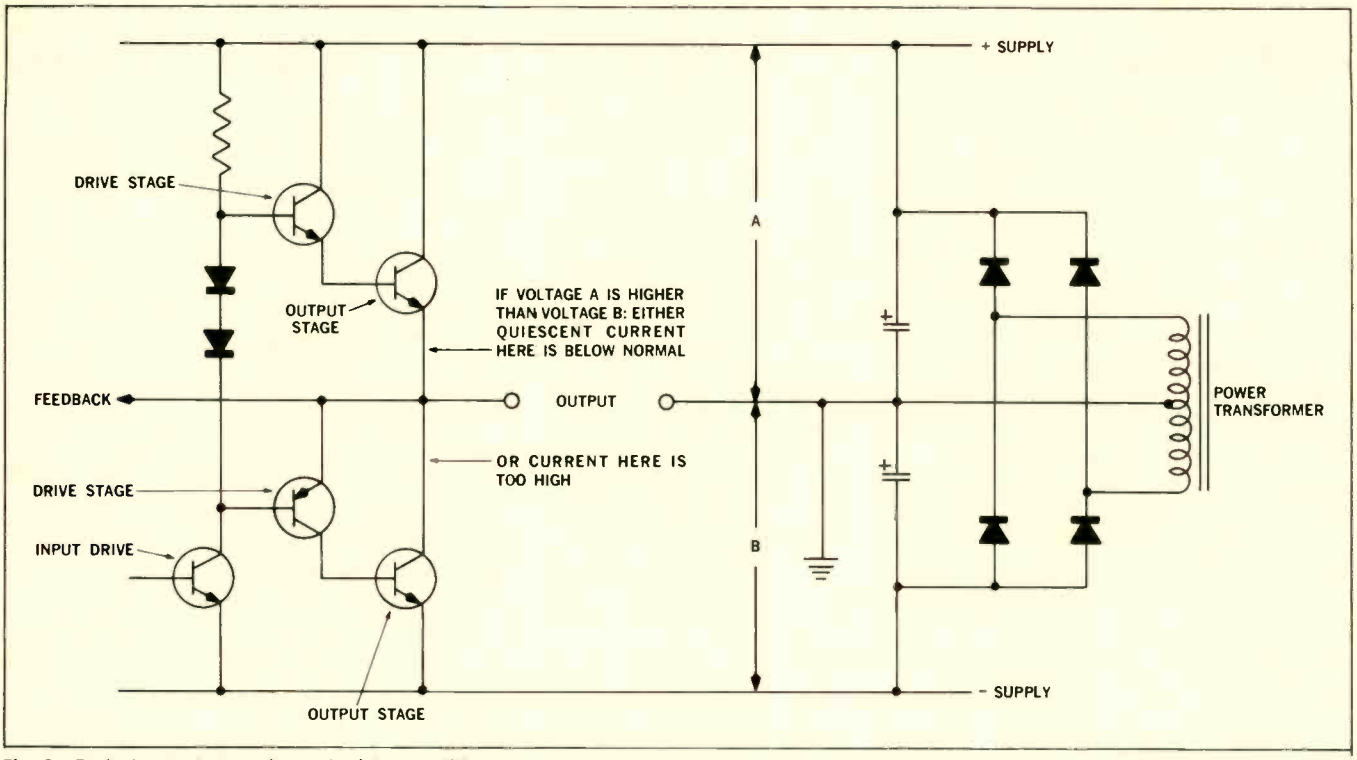

Fig. 2—Typical output stage in a transistor amplifier using a split supply voltage. If the two voltages are not equal, this may indicate that a fault has developed in the circuit.

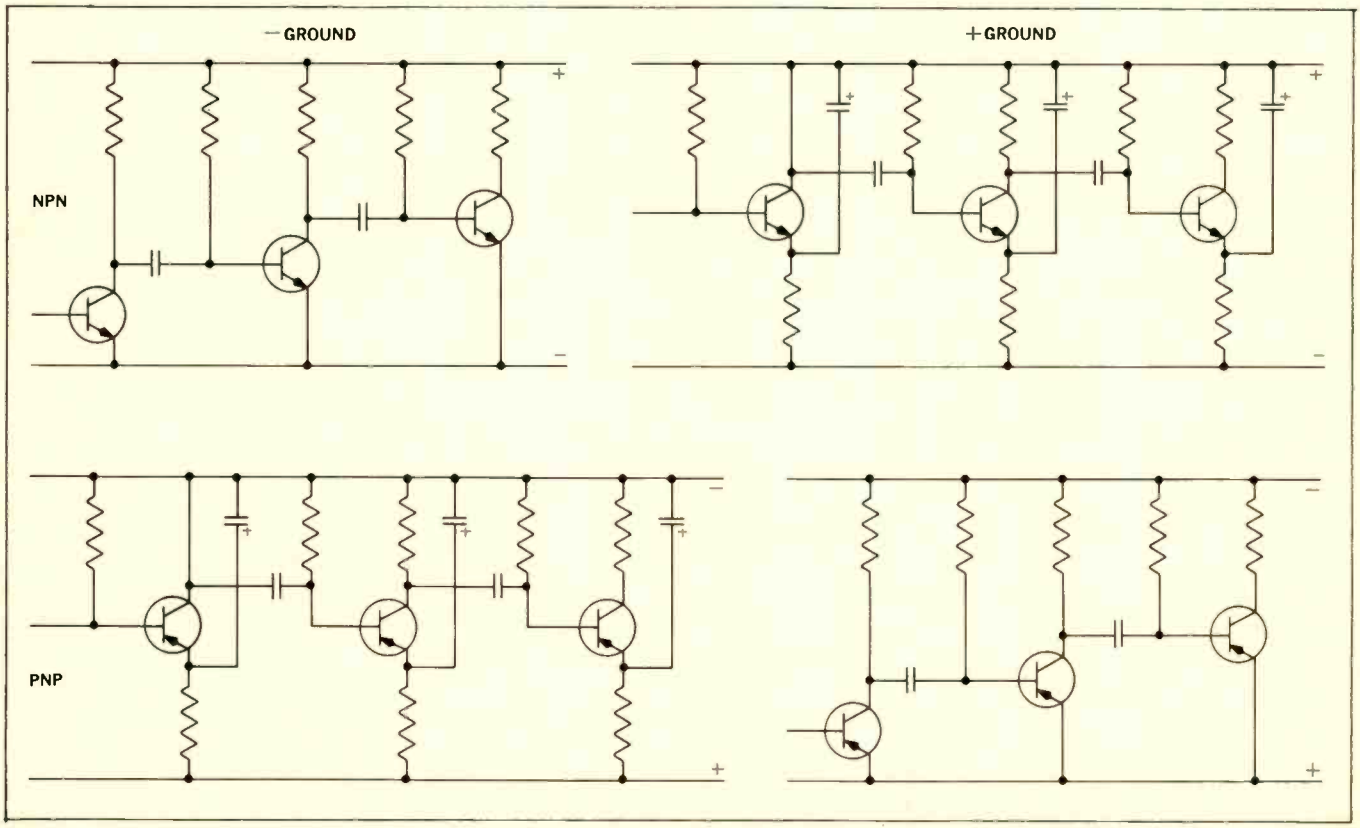

Fig. 3—Four basic grounding configurations in "front end" transistor amplifiers. The circuits shown represent resistance-coupled audio stages.

That was the mistake, because it was not grounded—not any more! The ground bus was blown. That is the kind of thing that can be "a Tough Dog," until you become aware of the possibility. When anything strange happens, like this, it is a good idea to check the ground bus.

Clip one side of your voltmeter to the power supply lead that is connected to the ground bus and probe points along the bus (which you can follow visually on an etched circuit board, Fig. 5) to make certain that the same voltage (0v) reaches all of them. As a double check, an ohmmeter can be used between the same connections while the power supply is OFF.

If you suddenly get a voltage that should not be there, or cease to get continuity, the ground bus has blown. You can find out where by using the same techniques in checking.

This is fine, once you have determined which side is ground, how the transistors are wired and their polarity (NPN or PNP transistors). What can sometimes complicate matters a little more is a composite circuit in which opposite sides of the power supply are used as "ground" for different sections of the circuit being tested.

Why would a designer do this? It is a good trick to provide separate grounds for the individual sections, thus easing decoupling problems. More than this, the engineer can get a bonus in the switching (function selection) circuits. For example, if the phonograph preamplifier uses a positive ground while the tuner uses a negative ground, switching can merely transfer a common point (an interconnected, but voltage switchable "ground") from one side of the voltage supply to the other, thus deactivating one unit and activating the other, with only one simple changeover set of contacts (Fig. 6).

But with this kind of circuit, even more things can happen to your multiplicity of ground busses. Either one of them can "blow," and the voltages can go even crazier when you change the position of the function switch. The trick, once again, is to know what is supposed to happen and then deduct why it does not; and why the crazy, different things you observe happen.

When you have tracked down the break in the circuit, whether of the simpler or more complicated variety, it is a very good idea to spend a little more time trying to find out why it blew, preferably before you repair or replace the defective connection or circuit board. Failure to do this can prove expensive since the same thing may then happen again.

The cause may be a faulty shield connection, or a ground that goes to an unprotected or inadequately protected point in the circuit. In the older tube circuits, such a fault would usually have been easy to "smell out"—literally—since a short in the high-voltage supply caused some burning, which left a characteristic odor and the visual charring of some component. But in the lower-voltage transistor circuits, a temporary or unwanted ground may not even result in visual charring, much less smell!

This calls for careful continuity testing with an ohmmeter, along with some deduction based on where the ground bus blew, which will tell something about where the excess

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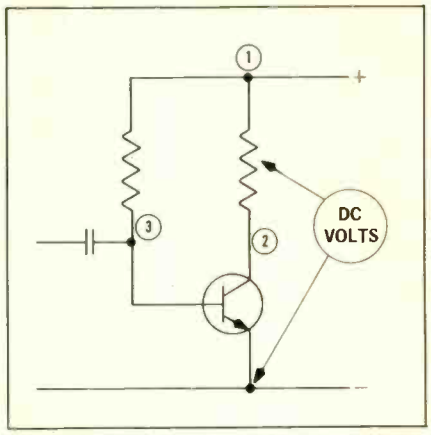

Fig. 4—An instance where a blown ground line can lead to misleading conclusions.

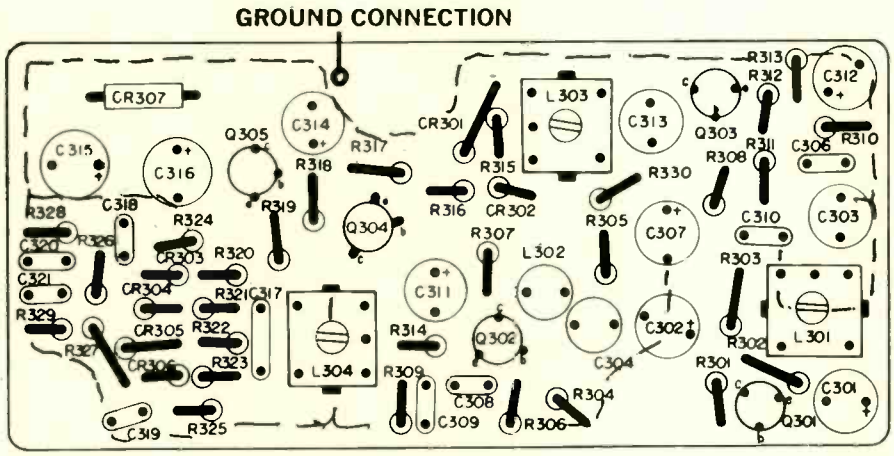

Fig. 5—The ground line on the circuit board of a multiplex decoder (shown as a dashed line over the etched circuit outline). Continuity should be checked both ways around the edge of the board.

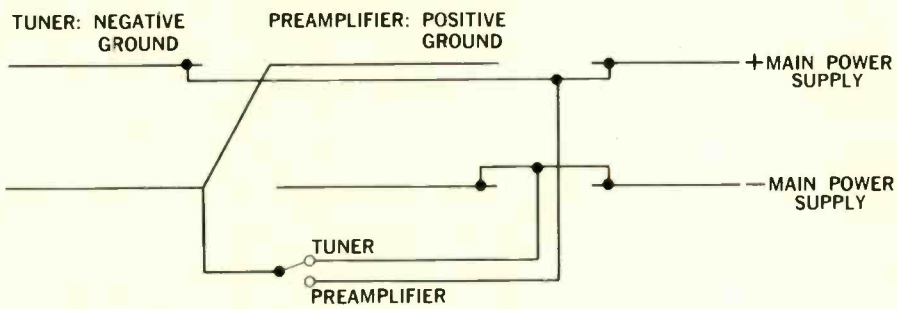

Fig. 6—Function switching is achieved by changing the voltage on the ground from supply positive to negative, or vice versa.

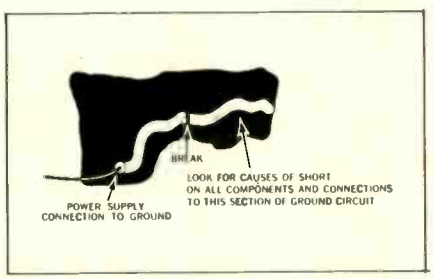

Fig. 7—Check the segment of the ground bus that has become isolated from the power supply to see what caused the excessive current, which resulted in the break.

Understanding Today's Capacitors

by Richard Marsh

There are as many types of capacitors in use today as there are varieties of food on the shelf in the grocery store. Each one of these types was designed for a particular purpose and to perform under certain demanding conditions.

■ Today's electronic technicians are faced with a parts availability problem that is unprecedented in the industry. Many of these problems are aggravated by the task of servicing electronic products manufactured off shore—the replacement parts either differing from those produced domestically or unavailable from foreign sources.

A better understanding of the components used in electronic equipment makes it possible for technicians to substitute standard, readily available parts for those that would normally be difficult to procure. Although some modern electronic consumer products require precise and carefully selected replacement parts, this is not true in many applications—particularly in the field of capacitor replacement.

Two Families of Capacitors

There are two distinct families of capacitors. They can be divided easily and identified as either *electrolytic* or *electrostatic*. It is most important that the technician realize the basic difference in both the construction and application of these two types of capacitors.

I often compare the two types of capacitors to the two basic types of batteries. There are storage batteries and dry batteries—not that capacitors function in this manner, but the means of classifying are similar. (Engine starting and emergency power equipment are good examples.) Electrolytic capacitors are also capable of handling relatively large currents. Dry batteries are used in many types of portable devices where small currents are required and intermittent operation is usually encountered. Electrostatic capacitors could be so compared.

These two types of batteries are not generally interchangeable—nor are electrolytic and electrostatic capacitors. When an electronic technician understands these facts, he can make better use of capacitors and employ flexibility in substitution that he never before felt possible.

Electrolytic Capacitors

A very thin film of aluminum oxide is formed on the surface of an aluminum anode, where it functions as a dielectric in most electrolytic capacitors. This dielectric is much thinner than any man-made dielectric. By etching or roughing the surface of the anode, the contact area (or dielectric surface) can be multiplied many times. The thickness of the dielectric depends on the voltage at which it was formed. (Contrary to many beliefs, the dielectric will not change if operated at a lower voltage.) An aluminum cathode is employed to make contact with the electrolyte and can either be the container of the capacitor or more often another aluminum foil somewhat like the anode.

The modern electrolytic capacitor is manufactured by employing two thin strips of aluminum, separated by absorbent papers saturated with electrolyte. The anode is pre-etched and preformed. This laminated strip is rolled into the form of a tube and placed in a container. Preformed aluminum tabs are attached to the aluminum strips and brought out to either wire leads or solder lugs.

Two popular types of electrolytic capacitors are the tubular axial lead or tubular single-end printed-circuit types, and the very familiar twist prong "can" employing one or more sections sharing a common cathode. It is important that the container of the capacitor be sealed from the air to prevent evaporation or leakage of the electrolyte. The best method employs an aluminum can and hermetic sealing. Other methods—such as cardboard sleeves with wax-filled ends, plastic, and dipping processes—have been somewhat successful, but are not as reliable as the aluminum can.

The maximum practical voltage limit for electrolytics is 450v. However, by special processes and careful selection of materials, capacitors rated at 475v, 500v and as high as 525v have been manufactured. The maximum operating temperature must be reduced from 85°C (185°F) to 65°C (149°F) for these higher voltages. (It is helpful to know that a capacitor rated above 450v at 150°F can be operated at 185°F when used at 450v or less.)

Standard electrolytic capacitors are polarized, due to the fact that the formation of the oxide dielectric film is not reversible. In the event that an electrolytic capacitor is incorrectly installed and exposed to a reversed polarity, a new cathode will attempt to form. The capacitor will then experience an immediate and often disastrous temperature rise—causing the safety vents to blow, permanently damaging the component, and often other adjacent circuitry.

The shelf life of modern aluminum-cased electrolytic capacitors is extremely long, as compared to electrolytics manufactured many years ago. And the stabilities of the electrolyte and purity of the aluminum used prevent them from deforming to lower voltage ratings when either idle or operating at voltages

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lower than those specified for the capacitor.

Capacitor Tolerances

Some of the most misunderstood facts about electrolytic capacitors concern their tolerances. Due to the electro-chemical processes used in manufacturing electrolytic capacitors—coupled with the variation in yield of the etch—it is almost impossible to build an electrolytic capacitor close to its intended capacitance. Fortunately, the circuits designed to use electrolytic capacitors will generally tolerate at least 50 percent excess capacitance and in many cases several hundred percent.

As an example: A circuit designed to use a 60μf capacitor could easily accept a 100μf to 120μf capacitor—usually even much greater values. It makes little difference to a filter circuit how great the capacitance is, as long as it is a sufficient amount. It is never recommended to substitute a capacitor having lower rated capacitance.

The rated voltage of an electrolytic capacitor, like that of most other capacitors, should never be exceeded. If the original capacitor was rated at 450v, then a capacitor rated at 475v or 500v will be acceptable, while capacitors rated at only 350v or 400v would not be satisfactory. When the applied voltage exceeds the capacitor rating, there is a dramatic increase in leakage current and the capacitor's life will either be drastically shortened or immediately terminated.

A rule of thumb in replacing electrolytic capacitors is to use one with a capacitance rating at least as high as the old one and a voltage rating at least as high as before. Many electronic technicians spend needless time and suffer undue frustration—costing untold dollars and customer dissatisfaction—by seeking a so-called "exact" replacement electrolytic capacitor. The original electrolytic capacitor was not exactly what was said on the label in the first place.

I have personally checked thousands of electrolytic capacitors in original equipment and so-called "exact" replacement electrolytic capacitors, and have found them to measure up to 300 percent over their labeled capacitance.

In one instance I did some checking concerning a specific 160μf, 250v electrolytic capacitor used as an original part in a color-TV set produced by a reputable manufacturer. Its capacitance was actually measured on a capacity meter as being 450μf. Many others in this same group were found to measure between 250μf and 375μf, plus even some higher values. This in no way affected their performance or the performance of the TV set. And capacitors having these higher values will last longer and provide good or better service.

There are as many as 25,000 different twist-prong type electrolytic capacitors in use today, representing an almost unsurmountable replacement dilemma for the electronic technician. Since most of these are multi-section types, this even further complicates the problem. In most all cases the diameters are either 1 in. or 1⅜ in., while the lengths vary anywhere from 1½ in. to as much as 5⅝ in. A capacitor of greater physical length can always be substituted if room permits.

EIA Specifications

Some manufacturers of replacement electrolytic capacitors have adopted a *"wide range"* labeling system for their products. This employs the application of the EIA tolerance to a suggested range of use for the capacitor. (As an example, a capacitor that was designed and produced as a 100μf 350v component could be labeled 60 to 100μf, up to 350v.) If the capacitor was actually measured, it would in almost all cases be at least 100μf and could be as much as 200μf.

The manufacturers that use this system do so on the conservative side, and you are always getting a capacitor that is at least the maximum rating shown on the label. By employing this system, it is possible to replace many capacitors with only one. This drastically reduces inventories and makes available many more possible replacements that would normally be considered special.

Cross-references and indexes have been produced showing original part numbers and recommended replacements, as well as descriptions and recommended replacements. This makes the process of choosing a wide-range capacitor extremely simple.

Remember that a wide-range electrolytic capacitor is just as good or better than the original component. The label on the original electrolytic capacitor merely means that the circuit was designed to require at least that much capacity.

Common Misconceptions

At this point I would like to mention a few of the comments that I have received from some electronic technicians concerning the substitution of electrolytic capacitors:

One common belief is that the input filter circuit will experience an increase in voltage if a higher value capacity is used. However, the purpose of the filter capacitor is to smooth out the ripple. There is nothing you can do by increasing the capacity to cause it to go higher than the peak ac voltage.

In many instances, when a new capacitor is substituted for a weak or defective one, the voltage will increase to its specified value. The capacitor did raise the voltage, but only to the proper value.

Some think that the substitution of a higher capacity will increase the leakage. But a new capacitor, even of higher capacity, will have less leakage than an old one "on its last legs." With the exception of some coupling circuits, this is not an important factor.

Others complain that the substitution of higher capacities in certain coupling circuits has caused them to operate improperly. This is possible in rare instances, where the inductance of the capacitor has increased because of the larger size and more layers of electrolyte. With new processes, employing hard aluminum foils, it is possible to reduce the size of the capacitor for the same value to such a fraction of the old one that this is no longer a factor.

The misunderstanding about electrolytic capacitors deforming at lower voltages or when on the shelf stems from the fact that until 10 or 15 years ago capacitors were manufactured with those characteristics.

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Semi-Tips

by Jack Jaques

Introducing a new series of articles written to promote a better understanding of the most common types of semiconductors in use today

■ Each article in this series will attempt to "clear the smoke" on some of the most common problems encountered with one specific type of semiconductor. And this introductory Semi-Tip deals specifically with power rectifiers—*not* including what is termed small-signal diodes, such as RF mixers, detectors, etc.

The phenomenon of rectification is based on the physics and chemistry related to the junction of dissimilar conductors, or in this case, semiconductors. The basic theory states that when two dissimilar conductors are joined together to form a junction, that conduction through this junction will be greater in one direction than in the other.

The first junctions of this type to receive much actual attention consisted of copper and cuprous oxide, but due to high cost their use was limited almost totally to industrial applications. The next rectifier, one that really saw broad applications, was the so-called selenium rectifier. They were first constructed of selenium/iron and later of selenium/aluminum. These devices are called *poly*-crystalline, because they are actually formed by millions of individual crystal junctions in parallel. Most of today's rectifier applications are conducted by single-crystal junctions made from germanium or silicon and known as *mono*crystalline devices.

Polycrystalline devices are characterized by moderate forward voltage drops per cell, fairly low reverse breakdown voltage and a forward-to-reverse current ratio of about 10-to-1. To obtain higher reverse voltage capability, cells are connected in series. However, this method also increases the forward voltage drop and thereby reduces efficiency.

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Monocrystalline devices are characterized by moderate forward voltage drops, high reverse breakdown voltages and a forward-to-reverse current ratio of about 10,000-to-1 for germanium and almost a million-to-1 for silicon. Due to these high reverse voltage capabilities, it is not necessary to series-connect cells, so that the forward voltage drop is not a significant factor. From this information, it can be readily seen that the monocrystalline diodes offer far greater efficiency as well as significant size and temperature reductions.

Although germanium offers a slightly lower forward voltage drop than silicon, its use is limited by its temperature capabilities (about 100°C or 212°F) and its inherent sensitivity to transient voltage and current peaks. The ability of silicon to accept these adverse conditions, plus its temperature capabilities (up to 200°C or 392°F), makes it by far the most widely used and accepted semiconductive element.

Ignoring such matters as electron-hole theory, atomic structure, impurities, doping, etc., it is sufficient to say that a rectifier is made by taking a small ultra-pure silicon wafer and coating one side of it with a material that has a surplus of electrons and the other side with a material that has a deficiency of electrons. The wafer is then placed in a furnace and the heat causes these materials to be diffused into the silicon. Thus, by attaching a lead to each side of the wafer and encapsulating it in the proper housing, a rectifier is produced—one lead representing the cathode and the other lead the anode. The inherent characteristics of the rectifier are controlled by the types and amounts of materials, the physical size of the wafer, how the actual diffusing process is carried out, and the rectifier housing itself.

Heat is by far the worst enemy of any semiconductor device. Since there is an inherent resistance in all P-N junctions, ohmic heating is produced when a current passes through the junction, and the higher the current, the higher the temperature.

Rectifier systems go all the way from the fairly simple low-current, axial-lead devices, where the heat is dissipated into the surrounding air via the case and leads; to the medium-current, chassis-mounted device, where the heat is transferred into the surrounding chassis or heat sink; to the high-current devices where forced air, water or coolant is used to carry away the heat.

Some tips regarding heat dissipation are as follows:

Axial-Lead Rectifiers

- Keep the leads as short as possible (invariably the tie points are much larger and will dissipate much more heat), *but always put a small kink in each lead to compensate for expansion and contraction.*
- Locate the rectifier away from

high-heat areas and in a manner that allows the maximum amount of free air to circulate around it.
- Test-run all circuits under worst-case conditions to ascertain whether or not there is adequate heat dissipation.

Stud-Mount Rectifiers

- *Always* use silicone grease between the rectifier and the mounting surface.
- Locate the rectifier and/or chassis and heat sink away from high-temperature areas in a manner that allows the maximum amount of free air to pass across the chassis or through the heat sink.
- Test-run all circuits under worst-case conditions to ascertain whether or not there is adequate heat dissipation.

Force-Cooled Rectifiers

- If air cooled, make certain that the flow of air is directed in the proper manner (some systems blow the air directly at the rectifier or heat sink while other systems pull the air across).
- Make certain that there is an adequate volume of air (checking blower-motor speed, size of blade and pitch of blade).
- Be certain that the air is exhausted into a free area and is *not* recirculated.
- If water or coolant cooled, make certain that the rate of flow is in accordance to the manufacturer's specifications.
- Check for any possibility of line restrictions.
- Some of these systems are thermostatically controlled. This should be checked.
- Test-run all circuits under worst-case conditions to ascertain whether or not there is adequate heat dissipation.

Many rectifier failures are attributed directly to the device itself—when the real culprit is unknown, or unnoticed, transient spikes that have been introduced onto the line or generated by other components (relays, for example, are noted for this and should have a suppression rectifier across the coil). To guard against transient difficulties, make certain that the peak current-voltage (PIV) rating of the rectifier is high enough to tolerate these conditions, and/or include an adequate suppression network.

The PIV rating can easily be increased by connecting two or more rectifiers in series. The rectifiers do not have to be matched, or even close to the same PIV rating—since these ratings are additive (a 200v, 3a rectifier in series with a 400v, 1a rectifier will form a 600v, 1a device). It must be noted that the current capabilities are not altered and that the maximum forward current will be that of the lowest rated rectifier used. Also, the forward voltage drop is additive, but for just a few rectifiers this condition is relatively unimportant and easily ignored (figure about 1v per rectifier).

The current-handling capabilities of a rectifier are defined as its maximum forward current rating. Whenever a rectifier has failed, or when it operates much hotter than normal, the current flowing in the circuit should be checked against the manufacturer's specifications. This condition can usually be traced to some other circuit defect such as open, shorted or leaky components.

As a matter of expediency, rectifiers can be operated in parallel. In this case, the forward current ratings should be matched, but the lowest PIV of each rectifier must be equal to the minimum circuit requirements (a 200PIV, 1a rectifier in series with a 400PIV, 1a rectifier and a 600PIV, 1a rectifier, would form a rectifier rated at 200PIV, 3a). Since the forward voltage drop of a rectifier is a function of the internal resistance, parallel devices would reflect a lower voltage drop, based on Ohms Law.

Selenium rectifiers are similar to vacuum tubes in that they deteriorate and the resultant output voltage drops. Silicon rectifiers, however, are not affected in this manner and certainly offer the ideal replacement. But, due to the much higher efficiency of the silicon rectifiers, a voltage-dropping resistor should be installed in series with the rectifier output. In most cases a 2w, 5Ω to 10Ω resistor will be satisfactory. However, the resultant output voltage should be checked against the equipment manufacturer's specifications in order to assure optimum performance.

It is sincerely hoped that the information presented in this article will prove beneficial to the many and varied endeavors to which they can be readily applied. It is also hoped that it will prove that the universality of the silicon rectifier is perhaps a little broader than many people have realized. Any comments, adverse, converse or otherwise, will be greatly appreciated. ■

DESOLDERING...

continued from page 44

also aid this mopping procedure. (Since a smaller tip orifice cannot admit solder as fast as a large opening, releasing the bulb slowly will increase the vacuum duration and allow us to remove most of the solder.)

Bent or Wrapped Leads

Leads are often wrapped around terminals or bent close to circuit boards. These connections should first be desoldered, like the large leads just described, (Fig. 7). The

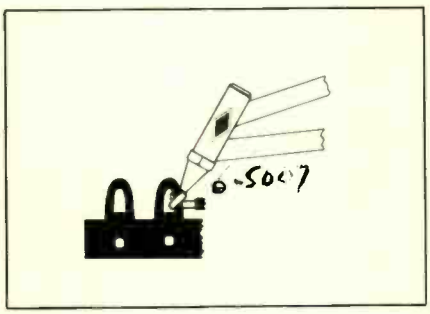


Fig. 7—Solder can also be "mopped" away from leads wrapped around terminals. These leads can then be reheated and straightened with a small soldering aid or knife.

wrapped or bent wires can then be easily removed with the use of a small soldering aid or knife while applying heat.

In conclusion, once again we say that desoldering is an art. The electronic technician must be familiar with the latest tools and techniques. He must understand what he is doing—every situation is a little different.

We believe that the methods just described will solve 90 percent of your desoldering problems. If not, write us, and we will take a closer look. ■

GUEST AUTHOR

TV Dealers Can Mine the High-Profit Accessory Market

by Stephen Hennigan

How often must a customer spend some time standing in your store—either to be waited on for a TV-set purchase or for a technician to pull his set off the shelf and bring it to the counter? If your answer is "30 percent of the time," then you certainly have potential to build additional sales volume with a variety of self-sell items that *every* customer wants.

■ Self-sell display racks are not a new idea—what is new is the idea of aiming attractively blister-packaged electronic accessories at the lay consumer market. Items specifically selected for high consumer sales appeal, with descriptions and instructions clearly printed on the back of the packages, have been building self-service sales in shops across the country.

Stephen Hennigan is vice-president of Sales and Marketing at GC Electronics, a division of Hydrometals, Inc. As such, he is responsible for handling the hundreds of new electronic items that are introduced into the GC line each year. Prior to joining GC Electronics, Mr. Hennigan was general manager of Crown Industrial Products, which specializes in industrial and consumer, aerosol and chemical products.

What TV customer is not interested in getting better reception? These display racks can show everything from new antennas to installation hardware—and even such relatively big-ticket non-TV items as wireless intercoms. Typically, such displays include a variety of other TV-related accessories: silent viewing control extensions with headphones, interference filters, multi-set couplers, wall-mounting plates for antenna lead-ins and connecting cables.

Other parts of the display should sell fast-moving accessories items for stereo and tape equipment—such as tape and record care materials and kits, empty tape reels, head-cleaning tape, degaussers, stereo headphones, extension speakers and aerosol sprays of various kinds for electronic equipment. Smaller items can be shown on pegs on a small countertop turntable near the cash register for "instant impulse" sales.

Very often a new TV-set customer or a service customer may be an excellent candidate for a new antenna. Such customers may possibly balk at the cost of having an antenna installed, and this is where it is possible to cash in on the do-it-yourself craze that is sweeping the country.

The old disclaimer, "A new antenna would cost too much right now," no longer is valid if you take the customer's side, showing him how he can save 50 to 60 percent of the cost by using his own labor. Point out how easy it is and how other customers (whom he may know) bought an antenna and installed it just a week (or a month) before. Suggest that a neighbor help, since four hands are always better than two.

The antenna display can include over-the-counter retail prices as well as installed prices. Point out the advantages of the new antenna designs over the "museum piece" he now has—the greater sensitivity and the all-channel features if the area is served by UHF. If your customer can handle a pair of pliers, there is no reason why he cannot tackle his own installation. Sell him the antenna he needs, the mast sections, guy wires and turnbuckles (if needed) and all the other mounting hardware. Tell him how to run two TV sets and his FM stereo from one antenna and how simple it is to install a multi-set coupler. In this manner, you can immediately ring up $50 or so in extra sales that might otherwise be lost entirely if you pushed only for the installation job.

The secret to selling this way is to have the needed items prominently displayed and ready for delivery. A customer should be shown that the antenna package includes printed instructions. Emphasize that if you were to install the antenna, you would use exactly the same materials he sees on display.

All that is needed is a little imagination and some willingness to convince the customers of their own abilities, especially those who have been turned off by the high price of labor. The TV service and installation business is just one of many that have made the do-it-yourself fad so popular. Others are home improvement stores, which today do an enormous business in parts and hardware for weekend plumbers, electricians and carpenters. ■

RCA's Type WR-508A Chro-Bar Generator

RCA's Type WR-508A Chro-Bar Generator. For more details circle 900 on Reader Service Card.

by Phillip Dahlen

Especially designed to provide stable patterns without flicker.

■ RCA has developed a color-bar generator that is designed to be powered by a single 4.5v long-life alkaline battery. A slide-out compartment is said to be located on the rear panel for convenient battery replacement; and an accessory ac-power adapter (type WG-425A) is reportedly available for operating the generator from a standard 120v, 60Hz power-line outlet.

According to the manufacturer, the new crystal-controlled solid-state circuitry, including IC components, is especially designed to provide stable, flicker-free patterns. Special pattern adjustments are reportedly provided on the rear panel; and if the circuit should require readjustments, these controls are said to be quickly and easily reset using only a properly operating TV receiver.

Specifications indicate that 10 color bars are provided simultaneously in the color-bar pattern—including R−Y, B−Y, G−Y, I and Q signals, spaced at 30° phase intervals. This pattern is said to be used for checking color phase and matrixing circuits, and adjusting the automatic frequency phase control (AFPC). Narrow brightness pulses are said to be added at the edges of each color bar to aid in checking the color "fit" or registration of the brightness and color signals.

In addition to the impressive manufacturer specifications that have been given, the following specifications are also of significance:

RF Carrier	61.25MHz picture carrier (Channel 3).
Output Voltage	Approximately 10mv.
Horizontal Sync	15804Hz.
Color Subcarrier	3563.741kHz ±20Hz, keyed at 189kHz.
Output Impedance	Approximately 300Ω
Test Patterns	Color bars (variable chroma level). Dots. Cross hatch. Blank raster.
Dimensions	3 in. H × 6½ in. W × 4 in. D.
Weight	19.5 oz.

COLORFAX

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

GENERAL ELECTRIC

Color TV Chassis N-2—Troubleshooting Guide

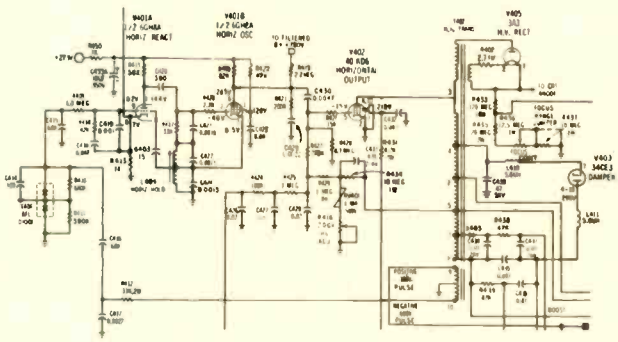
The N-2 chassis can be followed in May 1971 TEKFAX schematic No. 1357.

SYMPTOM	POSSIBILITIES
No raster	Defective tubes (Horizontal Output, Damper, High-Voltage Rectifier) 15v source out of order (open resistor R401 or shorted diode Y203). Transistor Q204 shorted base to emitter. NOTE: Anytime replacement of fuse F402 or F403 restores operation of the receiver, be suspicious of the horizontal output tube, 21LG6, it may be intermittently arcing.
Poor or intermittent focus	Resistors R241, R242, R243, or focus spark gap. The resistors can open or develop arc circuits to chassis ground through the focus module container walls. (Do not attempt to repair the focus module. Replace it!) Microscopic particles within the focus spark gap can produce corona, causing focus problems. Clean the gap with a soft rag or cotton-tipped applicator soaked in alcohol (with the receiver de-energized).
Continuous arcing of focus spark gap	Resistor R243—open
No sync	Capacitor C311—open
Negative picture with full contrast setting	Capacitor C159—shorted
No video	Delay line—open (usually broken leads at mounting terminals)
No vertical sweep	Capacitor C272—shorted
Intermittent or drifting horizontal oscillator	Capacitor C207—leaky or shorted
Driveline center of screen	Transistor Q204—excess leakage
Scallop pattern across top of raster	Capacitor C523—shorted (transistor Q502 functions as an amplifier)
Vertical jitter (sensitive to line voltage fluctuation)	Change resistor R251 to 68K and capacitor C251 to 0.015μf/400v
AGC trouble	Check for cracked copper pattern in left front corner of signal board. (Keying pulse circuit.)
Blooming (slight) (N2 Chassis)	Diode Y155 (dc restoration) and/or diode Y156 (CRT cathode current limiting diode) may cause B+ fuse to fail.
Blown fuse F402	Check B+ input to UHF tuner for solder bridges.
Gray scale tracking	Check CRT emission.
Very low brightness (N2 Chassis)	Resistor R410 open. 15v line being energized by tube V5C video amplifier cathode.

WESTINGHOUSE

Color TV Chassis V2655, V2656—Horizontal and Output Circuit

SYMPTOM	POSSIBILITIES
No raster, high cathode current on 40KD6 (horizontal output)	Check "Q" of coil L409, also wave form at grid of horizontal oscillator V401B.
One bar similar to blanking bar on left	Try replacing L409 (horizontal oscillator coil). A low "Q" coil may not phase properly.
Several bars on screen of CRT	Check value of capacitor C434 (.01μf, 2kv) and capacitor C437 (.01μf, 2kv), there may be mismatch between C434 and C437.
No high voltage	Capacitor C421 shorted. This is a .0015μf polystyrene capacitor in the horizontal oscillator circuit. When working with polystyrene capacitors, it is very important to keep heat away from the outside plastic, or capacitor failure may occur. Replace C421.
Intermittent picture	Shorted cable from flyback transformer terminal number 10 to R412, a 33K, 2w resistor in the horizontal AFC circuit. Moving the cable causes the problem to disappear. The problem reappears after operating the set a few hours. Replace cable.
Insufficient width	Check if resistor R430 (10M, 1w) changed value.
Insufficient width	If slightly more width is required for a full screen, change capacitor C438, 47pf 5 kv to 82pf 5kv.
Poor drive or no high voltage	Changed value or open R422, a 47K resistor.
Foldover in center	Leaky capacitor C420, 390pf.



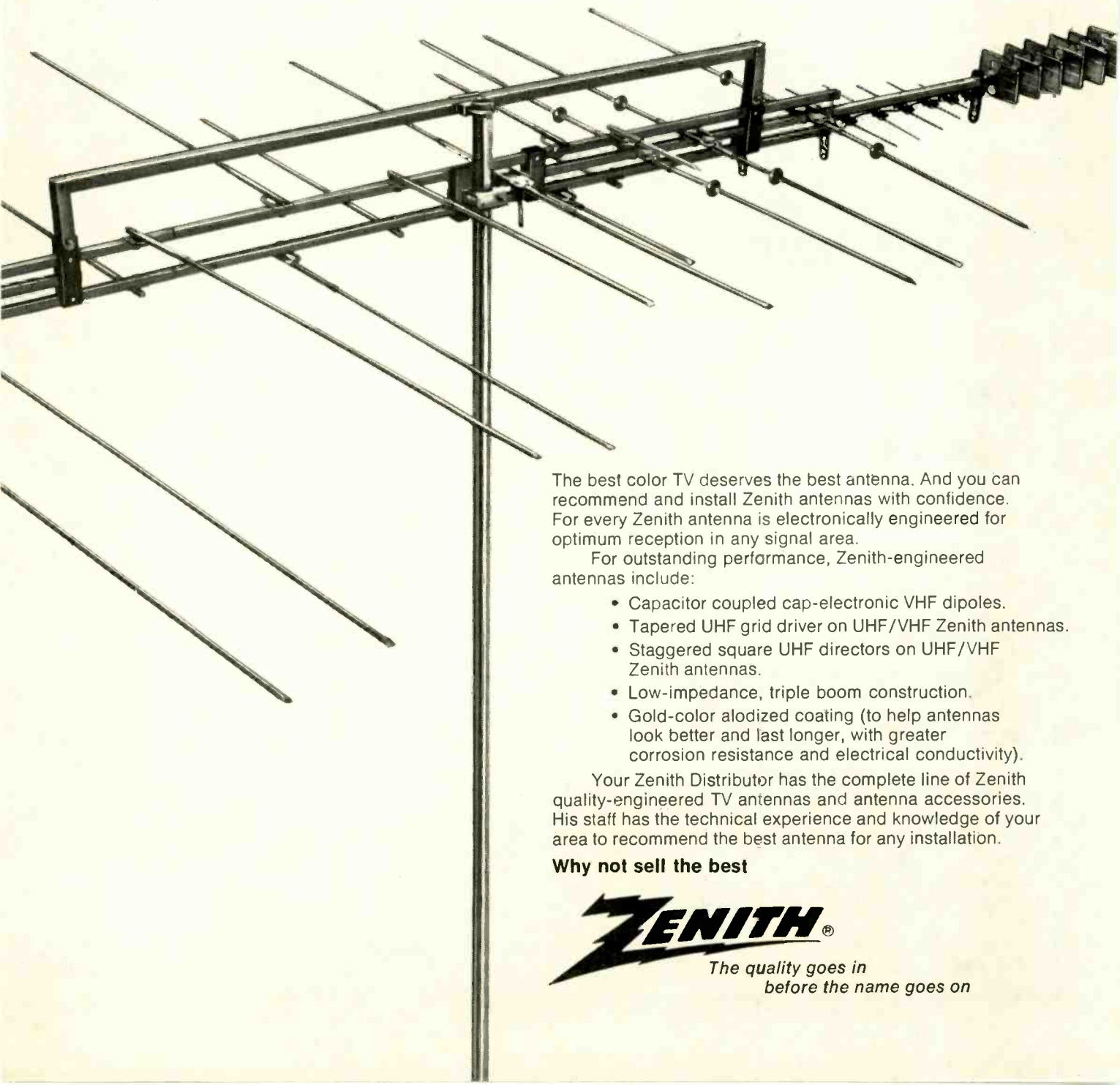
MAGNAVOX

Color TV Chassis T940/T951—Reducing "Nuisance" Opening of Fuse F3

As the current flows across the junctions of the fuse clips and metal ferrules on the ends of Fuse F3, a substantial amount of heat is developed because of the resistivity of the junction. This heat lowers the opening current value of the fuse and it may subsequently open for no apparent reason. The application of a small amount of silicone grease to the fuse ferrules will aid in the dissipation of the heat and reduce the "nuisance" opening of the fuse. Do not bend the fuse clips to attempt to establish firmer contact between clip and ferrule as this results in less clip resiliency and an increase in contact resistance.

Engineered for outstanding reception–

Zenith outdoor antennas for Color TV!



The best color TV deserves the best antenna. And you can recommend and install Zenith antennas with confidence. For every Zenith antenna is electronically engineered for optimum reception in any signal area.

For outstanding performance, Zenith-engineered antennas include:

- Capacitor coupled cap-electronic VHF dipoles.
- Tapered UHF grid driver on UHF/VHF Zenith antennas.
- Staggered square UHF directors on UHF/VHF Zenith antennas.
- Low-impedance, triple boom construction.
- Gold-color alodized coating (to help antennas look better and last longer, with greater corrosion resistance and electrical conductivity).

Your Zenith Distributor has the complete line of Zenith quality-engineered TV antennas and antenna accessories. His staff has the technical experience and knowledge of your area to recommend the best antenna for any installation.

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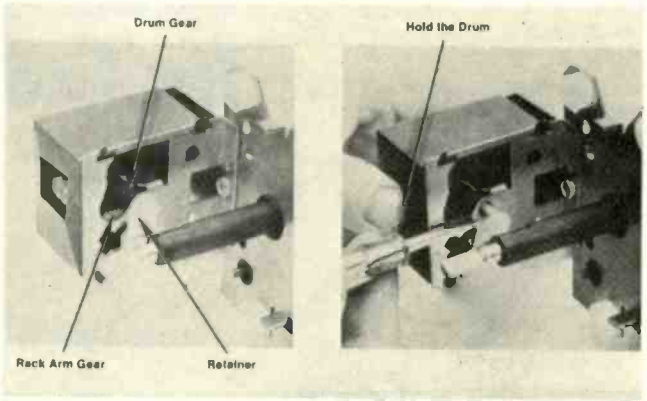
COLORFAX

RCA SALES CORPORATION

Color TV Chassis Employing U Tuner (KRK170)—UHF Channel Indicator

In areas of multiple UHF channel reception (where the TV station channels used are relatively close together), some difficulty may be encountered identifying specific channels on instruments utilizing the six-detent U tuner (KRK170).



Optimum channel identification can be achieved by either of the following methods. Both require removal of the tuner mounting assembly.

First, if the error is slight and the instrument is non-remote:

- Tune the mechanism so that the lowest channel in the area is indicated on the drum.
- Loosen three ¼-in. U tuner mounting screws and slide the tuner (holes are slotted) until that channel is received, then tighten the screws.

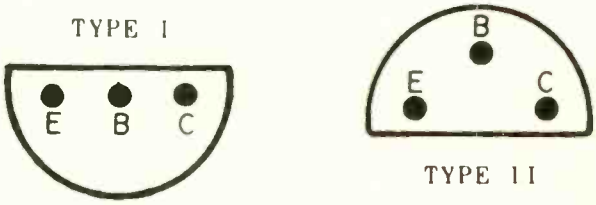
If the error is greater, or the instrument is a remote type:

- Tune the KRK170 for reception of a known channel, preferably one between channels 45 and 55.
- While holding the indicator drum, spring the nylon retainer out until the teeth of the drum gear are disengaged from the teeth of the rack gear arm.
- Turn the U drum until the indicator shows the channel being received.
- Mesh the teeth of the drum gear and the rack gear, then return the nylon retainer to its original position.

ADMIRAL

Color Chassis K10, K20—Replacement Transistor 57A159-12

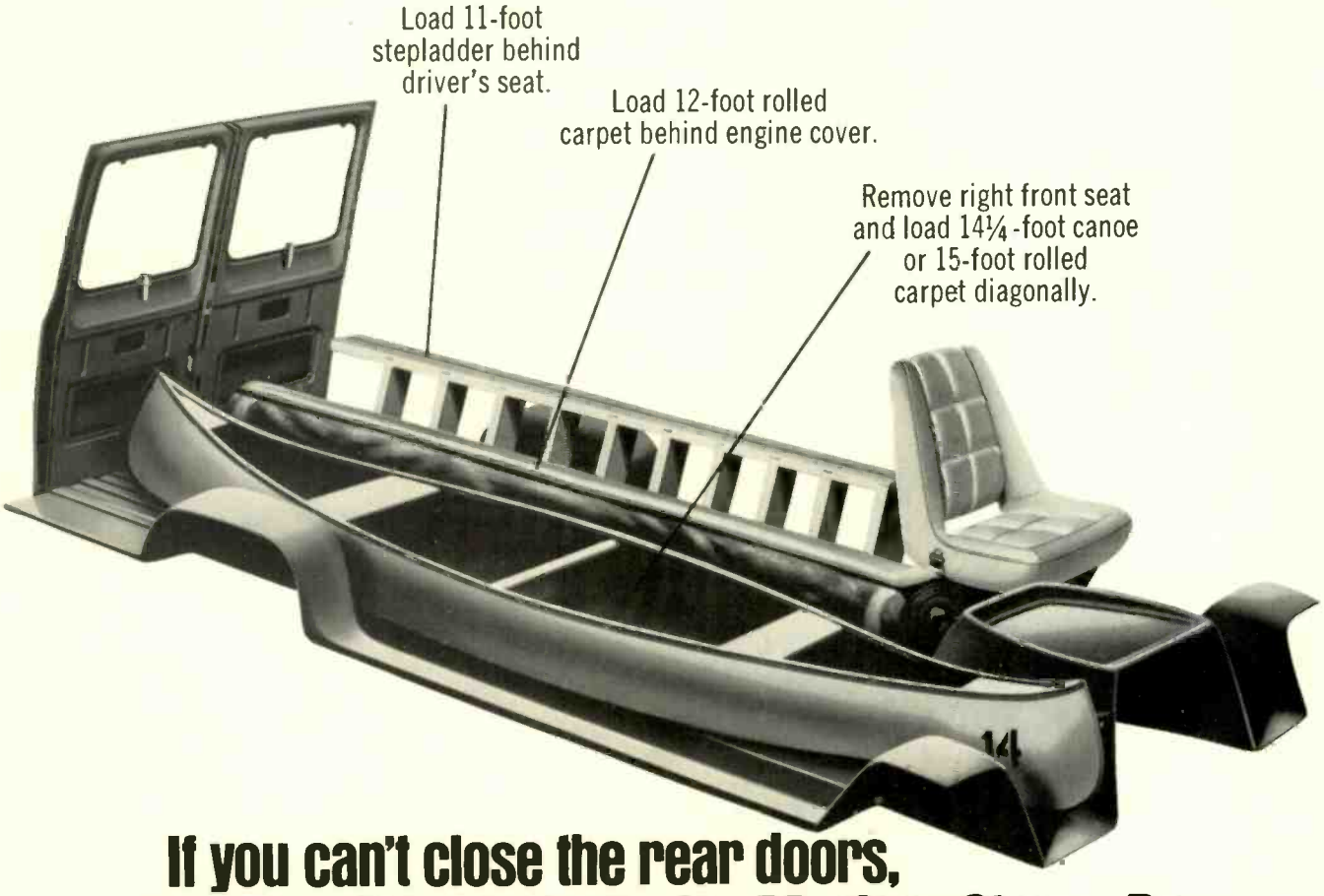
Transistor 57A159-12 may be obtained with two different basing configurations. Orient the transistor as shown in the drawings to determine the elements. Notice that the



leads are in a straight pattern on Type I and in a triangle pattern on Type II. An instruction sheet will be packed with future shipments of this transistor.

How to tell which is the largest compact van built in America.

(No matter how you look at it.)



If you can't close the rear doors, you haven't loaded a Dodge Maxivan Strong Box.

And you'd better get one.

Dodge Strong Boxes give you a lot more than just more room: Independent front suspension and longer 127-inch wheelbase mean better handling and ride. ☐ Shorter turning circle. Even with a 127-inch wheelbase, you have greater maneuverability. ☐ Wind-tunnel body and curved windows reduce wind-sway effect. ☐ Front wheels can be inexpensively aligned on passenger-car equipment. ☐ Biggest V8 engine offered. 360 cubic inches.* ☐ Three-speed TorqueFlite automatic transmission* with a choice of three engines available on all models. ☐ Integral power steering.* ☐ Power brakes.* ☐ Fresh Air air conditioning* and exclusive Fresh Air heater provide even flow of clean air. Air is not recirculated. ☐ High-level air intake helps keep incoming air cleaner. ☐ Front passenger's seat does not block side cargo door entrance. ☐ Both front seats are easily adjustable. ☐ Concealed side safety-step offers firm footing since it doesn't collect ice or snow. ☐ Wider front doors and door steps and less wheelhouse intrusion make for easier ins and outs. ☐ Full-foam padded bucket seats up front give softer ride and more comfort. ☐ Two-stage door checks conveniently hold doors in two positions. ☐ Biggest gas tank. 26 gallons. ☐ Smaller engine cover is easy to remove for servicing. Also, easier for driver to reach back seats. ☐ Extra rust protection on undersides, doors, and panels. ☐ Large hood opening. Battery, dipstick, and radiator are easy to reach. ☐ Engine can be removed quickly and easily through the front. ☐ And the list continues at your Dodge Dealer's.

CHRYSLER MOTORS CORPORATION

Dodge

Dodge Trucks

Dodge Maxivan takes the "packed" out of compact vans!

*Optional at extra cost.

. . . for more details circle 107 on Reader Service Card

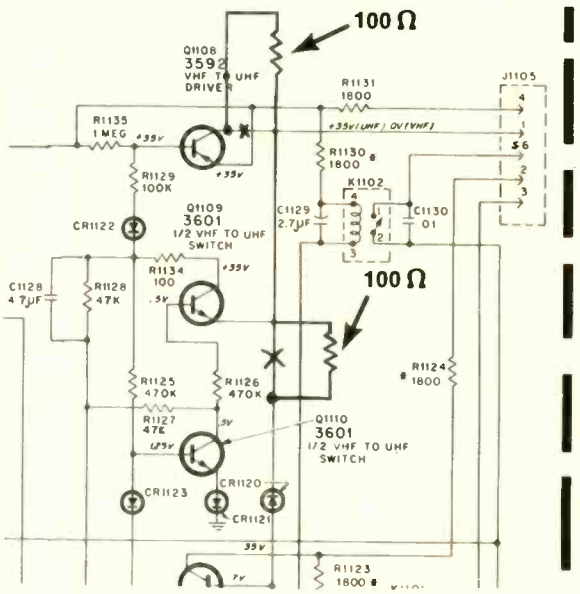
TECHNICAL DIGEST

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

RCA SALES CORPORATION

Remote Amplifier CTC44/CTP19A—Service Tips

If the VHF to UHF driver transistor Q1108 in the CTP19A remote amplifier fails (shorts), the instrument will go to the UHF function only. Should this failure occur in early-production versions of this chassis, the following circuit changes will improve reliability. Later-production chassis have these changes incorporated. • Add a 100Ω, ½w resistor (Stock No. 502110) in series with the collector lead when replacing transistor Q1108. • Unsolder diode CR1120 cathode lead and add a 100Ω, ½w resistor (Stock No. 502110) in series.

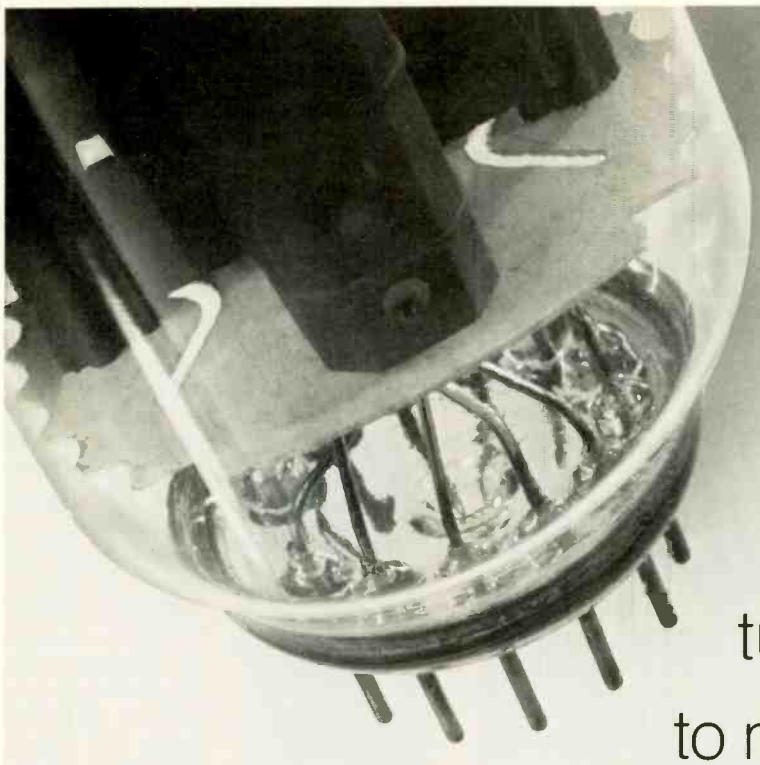


Mechanical buzz or hum in instruments utilizing the CTC44/CTP19A chassis may be from the remote power transformer mounting. The buzz will be evident any time the MASTER switch is ON. In those specific instruments exhibiting a buzz, tighten and then solder the remote power transformer T1102 mounting tabs.

MAGNAVOX

TV Chassis T946—Hum Bars When the VHF Tuner is Set to the UHF Position

Some receivers may have 60Hz hum bars on the screen when the VHF tuner is set to the VHF position. This symptom can be caused by 60Hz radiation from the UHF neon indicator lamp circuit. The problem can be corrected by moving the UHF indicator lamp ground lead from its present grounding point on the control unit and reconnecting it at a grounding point on the main chassis. A convenient grounding point is the grounded terminal pin (AC-2) located adjacent to the Vertical Hold Control (R73).



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GENERAL ELECTRIC

NEW PRODUCTS

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

TUNER LUBRICANT AND CLEANER 703

Continually polishes tuner contacts

An aerosol has been developed to foam away corrosion, dirt and oxidation. It is said to clean, lubricate and restore while continually polishing tuner contacts on all types of tuners. This highly concentrated cleaner and lubricant will reportedly not cause drift or detuning. Electronic Chemical Corp.

TRANSVERTER 704

Plugs into the cigarette lighter

A plug-in power transverter is designed to permit running portable electronic devices on automotive electrical systems. The unit is said to eliminate frequent battery replacement in transistor radios, portable tape recorders and other such devices when they are used in the car. The transverter plugs into the cigarette lighter socket and is said to provide the precise voltage required. Specifications indicate

that Model 30-3131 has an output of 7.5v, and is designed to operate from a 12v negative-ground electrical system. Price $6.85. GC Electronics.

OSCILLOSCOPE 705

Low cost with solid-state circuitry

A general purpose scope, Model 557A, is designed for use in the field or on the bench. The vertical amplifier is reportedly ac/dc coupled with a sensitivity of 20mv/cm over a dc to 5MHz bandwidth. The sweep frequency is reportedly from 10Hz to 100KHz in 4 ranges and continuously variable. It is also said to contain a 5-in. flat-faced CRT for extra sharp traces, solid-state circuitry and 3 calibration

voltages. Physical dimensions are 8 in. W by 12 in. H by 17½ in L. Weight 22 lb. Price $249.00. Kikusui Electronics.

TUNER DEGREASER 706

Cleans switches, relays and contacts of all types

An aerosol cleaner and degreaser, called Tuner Cleaner, has been developed primarily for restoring the contacts of tuners that have been fouled by build-ups of lubricants, dust, dirt and corrosion. The cleaner is said to be a very high powered spray which dissolves and flushes away all foreign material, leaving no residue. The cleaner is also recommended for switches, relays and contact devices. It is said to be excellent for removing soldering flux from printed circuit boards. The manufacturer indicates that unlike ordinary tuner degreasers, the cleaner spray does not frost contacts and components, since it uses a blend of Freon 12 and other propellants to produce a relatively warm spray. 24 oz can $3.25. Channel Master.

TAPE HEAD CLEANER 707

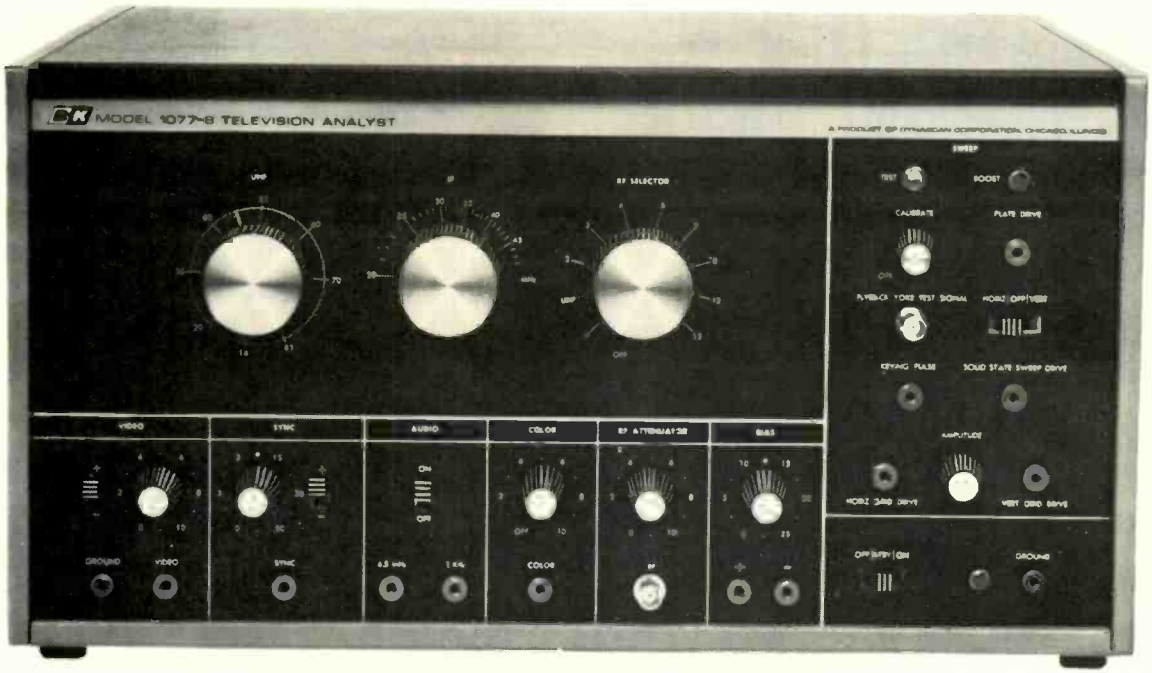
For use on cassette, video, 8-track and reel-to-reel tape recorders

An aerosol cleaner specifically formulated for cassette, video, 8-track and reel-to-reel tape recorders is designed to remove dirt, film and oxide build-up from heads, tape guides, capstan rollers and all other critical parts. The manufacturer indicates that the cleaner will penetrate into the tightest spaces, help to preserve heads and tapes, minimize noise and improve high frequency response. It is said to be guaranteed to be non-abrasive, safe for all plastics, non-flammable, non-toxic and non-conductive. A 6-in. spray extender is said to be included with each standard 6-oz. spray can. Chemtronics, Inc.

CIRCUIT ANALYZER 708

A self-contained, dynamic and static portable test device

A complete, self-contained portable field test device is designed to facilitate the servicing of all types of electronic equipment. The Model E-C Serviset is ultra-compact and can be carried in a coat pocket. The absence of mechanical switches and the use of only one test reportedly permits rapid selection of functions and eliminates moving bulky test equipment. Simply select function; plug test lead and phone if required into appropriate jack and make test. Indications are visual, audible or both. A special HV adapter is supplied for checking TV HV supplies (RF, pulse, or flyback type up to 20 kv) with slim insulated extension tip. The AF signal tracer test is said to permit checking audio, video, sync and sweep amplifiers. Also, provided are three ranges for continuity, leakage and short circuit tests on coils, capacitors, resistors, etc. A fabric pouch is said to be provided for carrying all accessories. Price $29.95. Lee Electronic Lab.



Who said B & K couldn't improve the only complete Television Analyst?

Now there is a new model... the 1077-B, with solid state sweep drive.

The B & K Television Analyst has become standard equipment in repair shops everywhere. And for good reason. It's the quickest, simplest way to test every stage of any TV.

But even classic instruments have to keep up with the times.

That's why we've added a solid state sweep drive in our latest model. It can check any new transistorized color set on the market today.

It's so easy, too. Because the unique B & K signal substitution technique eliminates the need for external scopes or wave-form interpretation.

Whether it's tubes or transistors, VHF or UHF, simply inject the appropriate test pattern or any other known signal. The new Model 1077-B, with its exclusive flying spot scanner, checks everything from the antenna terminals to the input of the picture tube.

Ask your distributor about the new Television Analyst. Only B & K makes it. And now B & K makes it even better.

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DEALER SHOWCASE

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

AUDIO CABLE AND ADAPTER DISPLAY 709

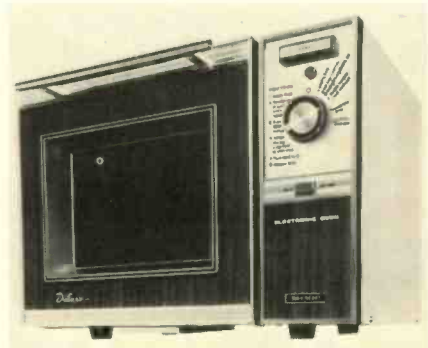
Contains 17 audio cables and 8 audio adapters

A display, Model No. ACA, is said to contain 17 different audio cables and eight different audio adapters. Reportedly available are connectors for RCA plugs and jacks, some with alligator clips; 3.5mm phone plugs to RCA jacks and plugs and to regular phone plugs. The pegboard is 24 in. by 32 in. and supplied with hooks. All items for the board are identified by permanent labels for the purpose of reorder and pricing. Workman.

MICROWAVE OVEN 710

Offers 650w of output power

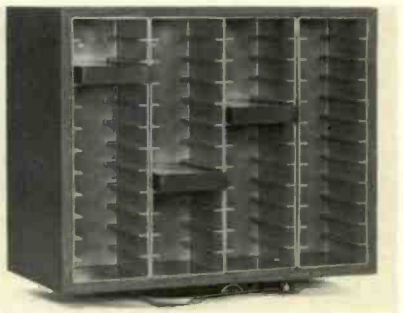
The Model R-500-C microwave oven operates on 120v 60Hz current, features a forced air cooling system and dial/timer, and is rated at 650w output. It reportedly has a woodgrain-finished front and measures 22 in. W by 15¾ in. H by 17¾ in. D with a cavity measuring 8¼ in. H by 13¾ in. W by 14½ in. D. Great Lakes Equipment Co.



CASSETTE STORAGE UNIT 711

Stores up to 96 cassettes

A modular, walnut unit, Model 1518, has been developed for storing cassettes. It features molded plastic compartment trays that can hold up to 96 cassettes. This turntable model revolves on a ball-bearing swivel base for easy selection of tapes. Price $19.95. RMS Electronics, Inc.



PHONO 45-RPM SPINDLE ADAPTOR 712

Replaces almost 50 round and flat adaptors

A universal adaptor for 45-RPM records is designed to eliminate inventory and identification problems. The "Omidaptor" reportedly fits more than 90 percent of all automatic record changers currently in use in the United States and Canada. It is said to be fully automatic and employs a gentle dropping motion. It is reportedly molded of high-impact styrene. Retail price $3.95. Aldshir.

Only one van gives you all these better ideas. Ford Econoline

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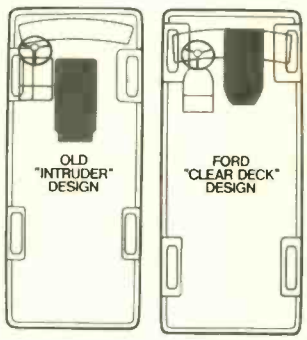
Engine clear forward

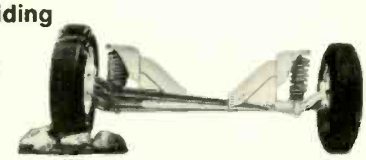
The engine is moved forward in Ford's clear-deck van—all the way out of the cargo area. Clear floor space behind driver's seat measures over 8½ ft. in Econoline Van . . . over 10 ft. in the Supervan.



Easy, out-front servicing.

Simply raise the convenient outside hood and your routine service points are right at hand: radiator, oil level, battery, windshield washer reservoir, voltage regulator, wiper motor, brake master cylinder. Better ideas make servicing fast, easy.

Strong, smooth-riding Twin-I-Beam



The independent front suspension that has revolutionized truck riding qualities. Two forged steel I-beam axles give it strength . . . big coil springs give it a smoother ride.

Shorter outside, easier to park.

Overall length of Econoline Vans is significantly shorter than other makes. This means easier parking and better maneuverability in city delivery operations—time saved on every trip.

Biggest payload of all

Husky construction and high capacity axles allow you to carry a heavier load than any other van. Maximum payload of 4320 lbs. is largest in industry.

Model	Max. Payload	Max. GVW
E-300	4320 lbs.	8300 lbs.
E-200	1800 lbs.	5400 lbs.
E-100	1120 lbs.	4500 lbs.

Wider at top for built-ins

Body sides are more vertical, wider apart at top than other vans. So built-in units fit better and leave more aisle. Modular units, designed to fit and work together allow you to custom design almost any interior you need. Job packages, such as insulated florist's van, are also available.

Driver's "walk-thru" to rear

Econoline's forward engine position clears the deck for the driver, too. He can easily step from his seat into the rear load area and exit through side or rear doors.

See your Ford Dealer and see all the better ideas in America's best-selling van—Ford Econoline.

FORD Ford

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BOOK REVIEWS

This month's Editor's Memo discusses the importance of keeping up-to-date with technological developments in order to maintain job security. Among the many suggested ways of doing this, I mentioned studying books and breadboarding basic circuitry incorporated in the electronic products serviced. With this in mind, three books have been selected for review which contain fundamental circuit descriptions that can be applied to basic construction projects.

THE RADIO AMATEUR'S HANDBOOK, 48th Edition, *by the Headquarters Staff of the American Radio Relay League, 688 pages, paperbound, $4.50.*

Once, while visiting with the owner of a successful one-man shop, I asked him if he was a ham. Turning red, he advised me that he was a professional.

Whether or not you choose to be licensed to broadcast on the amateur bands, the material presented by the American Radio Relay League can prove to be of value to all electronic technicians—however professional or sophisticated their electronic backgrounds. Each year the staff that assembles this book see that it is updated to include current electronic communications technology. Although this book does not cover TV circuitry and devotes some attention to transmitters, which are not serviced by some of our readers, a significant portion of this book does cover subjects that are of considerable importance to all electronic technicians.

Some of these topics include: Electric and magnetic fields, frequency and wavelength, series and parallel resistances, time constants, reactances, impedance-matching circuits, UHF resonant lines, vacuum-tube amplifiers, interelectrode capacities, transistor characteristics and practical circuit details, types of integrated-circuit amplifiers, detection and detectors, heterodyne and product detectors, solid-state mixers, improving oscillator stability, noise reduction, improving receiver selectivity, reducing broadcast station interference, active filters, solid-state receivers, power-line considerations, testing old coaxial cable, dipole antennas, directive arrays with parasitic elements, VHF and UHF receiving, plus many other topics too numerous to mention. If constructing some of the related circuitry will help improve your technical competence, then you can use the construction details provided—which include both parts lists and mechanical considerations.

This handbook is a must for any electronic technician that wishes to increase the depth of his technical competence.

RCA LINEAR INTEGRATED CIRCUITS *published by RCA Solid State Div., paperbound $2.50.*

Integrated circuits are becoming increasingly common components in the electronic products that must be serviced. Unlike transistors, these semiconductors contain many subcomponents that permit them to perform several circuit functions simultaneously in a single electronic product. They typically represent the "last straw" for the technician that has already become overwhelmed by technological advances.

This book—if studied closely, as one must to gain value from any technical publications—can be an excellent aid in overcoming these hurdles. After providing a description of the physical composition of integrated circuits, the book progresses to "Basic Circuit Elements" where simplified schematics are used to compare each portion of the integrated circuit with its transistor equivalent. The book then goes on to describe differential-amplifier circuits, operational voltage amplifiers, operational transconductance amplifiers, multipurpose amplifiers, special-purpose amplifiers (such as automatic fine tuning circuits), plus transistor, diode and amplifier arrays. Tables, graphs and waveforms are frequently used to help explain circuit functions; and many schematics include component values should you choose to experiment with some of the circuits described.

This book deals more in mathematical theory than the others, but also includes information of considerable value to electronic technicians striving to keep abreast of our changing technology.

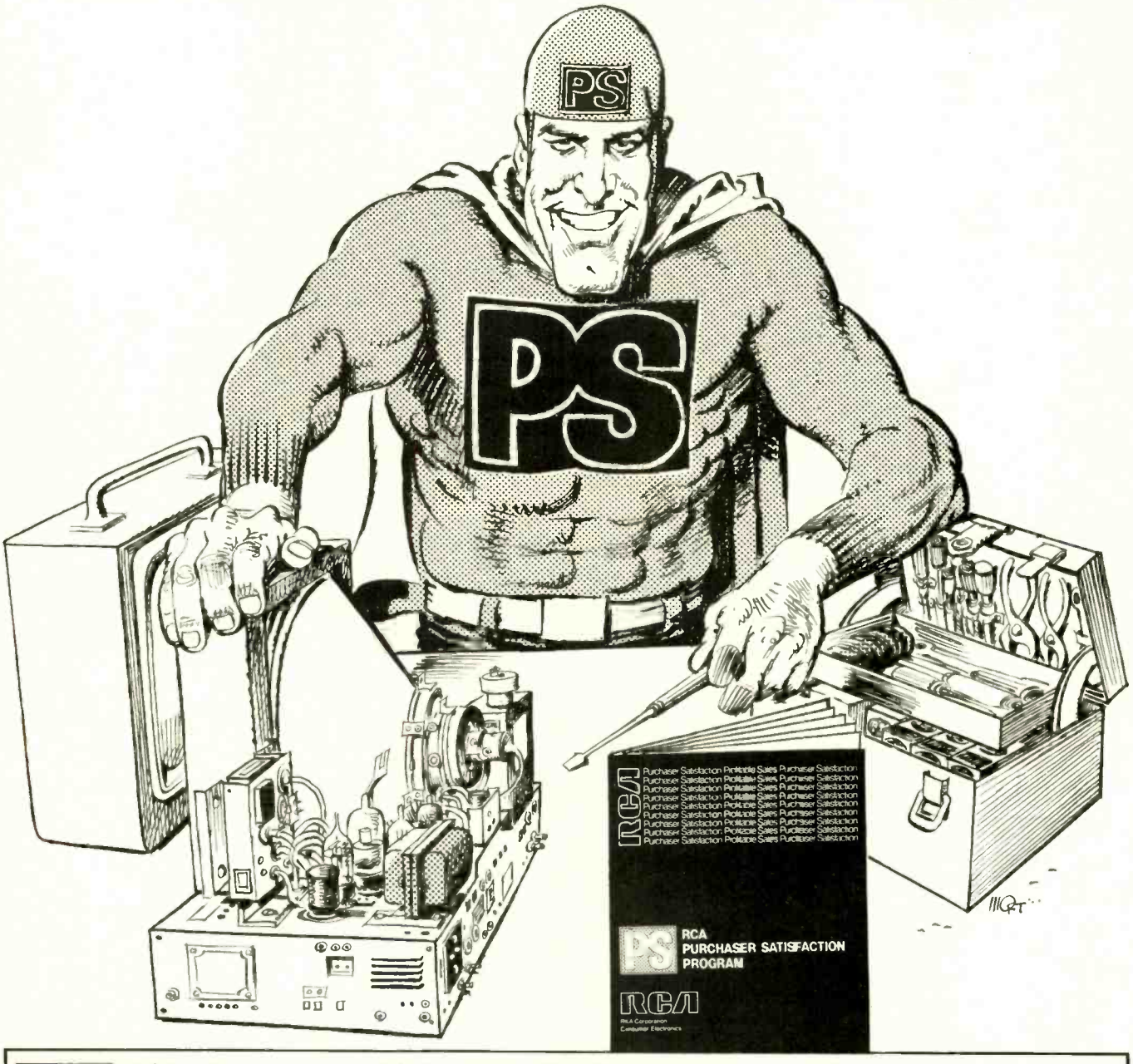
125 ONE-TRANSISTOR PROJECTS *by Rufus P. Turner, published by Tab Books, hardbound $6.95, paperbound $3.95.*

Even an entirely solid-state color-TV set (ignoring the CRT) can be considered a combination of many, many one-transistor circuits, which together perform the desired function. If you understand each of these one-transistor circuits and the basic prin-

continued on page 67

RCA's PS Warranty Program is at your service.

Just because we were #1 in 1970 color TV sales to consumers doesn't mean we've forgotten you today. We created "PS", a warranty program which backs you up as well as every AccuColor® TV. PS means Profitable Servicing for two reasons: First, because AccuColor owners can select any service agency they want. And, second, because RCA pays your going rate for warranty service rendered. Sound good? For details, read on.



RCA's Symbol of Purchaser Satisfaction.

AccuColor Parts and Labor Basic Warranty Provisions. For **one full year** from the date of purchase, RCA Corporation warrants to the first retail purchaser that it will pay all labor charges for repair of defects in 100% solid state AccuColor models (**90 days** on AccuColor models with "New Vista" chassis) and will make available replacements for any defective parts. (If the picture tube becomes defective within **two years,** it will be exchanged for a rebuilt picture tube.) On portable models RCA will make available replacements for defective parts and pay labor charges only on a "carry-in" basis; transportation to and from the service agency is the purchaser's responsibility. Installation and set-up, foreign use, antenna systems, and adjustment of customer controls are not included. To obtain warranty benefits, contact your RCA dealer or the service agency of your choice with your Warranty Registration Card.

For a copy of the PS booklet which covers all of our products, and the name of your field representative, write RCA Sales Corporation, Dept. 634, 600 N. Sherman Drive, Indianapolis, Indiana 46201.

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TECHNICAL LITERATURE

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

Test Instruments 400

A 1971 test-instruments catalog contains photographs, condensed specifications and prices for tube testers, transistors testers, scopes and signal generators. Both bench top and portable test-instrument models are shown. Hickok Electrical Instrument.

TV Line 401

A 20-page booklet describes low- and medium-priced products for closed-circuit TV applications. Both B/W and color cameras are covered, including a unique "convertible" camera which reportedly may be purchased for monochrome use and modified for color at any time. Live and film cameras and related film, tape terminal and switching equipment are illustrated and described. RCA.

Pressure Sensitive Decals 402

The 16-page catalog shows identification decal products for shops and trucks. The catalog includes stock designs, stock numerals and letters, special designs for cab doors, do-it-yourself kits in vinyl decals and bin and self markers. Prest-On.

Diamond Line Catalog 403

A new 16-page catalog lists transistors, photocells, rectifiers, triacs, diacs, capacitors, heat exchangers, controlled rectifiers and many more solid-state components. Many of these are indexed on the front cover for easy reference. An easy-to-use cross-reference of selected items is also included. IR.

New Product Catalog 404

A new general catalog, N. FR-71-72, lists over 14,000 products from all of the company's various operations. The 312-page catalog includes chemicals, servicing tools, printed circuit materials, servicing aids, automotive connectors and hardware, accessories, replacement parts, electronic hardware, replacement knobs and replacement antennas, as well as many other items. GC Electronics.

GROUND PROBLEMS...

continued from page 47

current could have come into the circuit. Try all false-ground possibilities, which could have resulted in applying the wrong supply voltage to the ground bus (which is usually fatal to the latter), that can be found on the "other side" of the break in the ground bus—the side no longer connected to the power supply circuit (Fig. 7).

Do not be easily satisfied with the notion that it was some erratic fault that may have "gone away" if you cannot find a definite cause. A ground bus does not blow with normal current, and excessive current must have come from somewhere. Keep looking and explore all possibilities of undue mechanical stress breaking through insulation, and things like that. ■

For more information on
DEALER SHOWCASE
See page 69
READERS SERVICE

CAPACITORS...

continued from page 49

Modern electrolytic capacitors are stable and will work at lower voltages without deforming and changing capacity.

A survey of electronic technicians revealed that less than 5 percent of those interviewed knew what the EIA tolerances were for electrolytic capacitors. Approximately 10 percent were close and the remaining 85 percent were far off. A popular answer was "±10 percent." This belief stems from the tolerances shown on most electrostatic capacitors—such as paper-mylar, ceramic, mica, etc.

Good judgment, coupled with a sufficient knowledge of the capacitor, will result in time savings and better performance in servicing electronic products.

The next article in this series will deal with electrostatic capacitors. ■

BOOK REVIEWS...

continued from page 64

ciple of what a color-TV set does when converting an antenna signal into a colored picture, then you should be able to understand this set and be capable of maintaining it.

This book offers the technician a good start in understanding basic circuitry—not only in solid-state color-TV sets but almost any other solid-state electronic products. In addition to including a schematic and description of each circuit, the book provides a complete parts list. If merely studying the circuitry proves insufficient, then you can actually construct it, observe it function, and then observe what happens when changes are made in the circuitry.

A few of these circuits include: germanium common-emitter amplifier, silicon common-emitter amplifier, FET source follower, inductor-capacitor-tuned bandpass amplifier, RC-tuned bandstop amplifier, conventional 455kHz IF amplifier, wideband (video) amplifier, multi-frequency crystal oscillator, self-modulated RF oscillator, carrier-failure alarm RF signal comparator, tuned AF analyzer, dc voltage regulator, constant-current adapter, electronic filter, autodyne converter, plus many others.

We feel that this book can provide valuable assistance in learning circuit functions.

READERS SERVICE INDEX

ADVERTISER'S INDEX

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105	114	123	132	141	150	904	913	704	713	722	731	740	749	404	413	422
106	115	124	133	142	151	905	914	705	714	723	732	741	750	405	414	423
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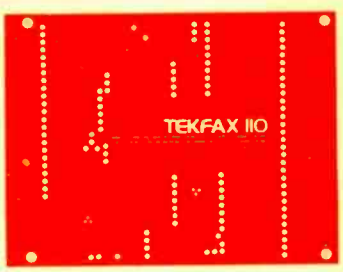

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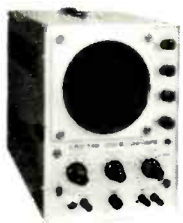

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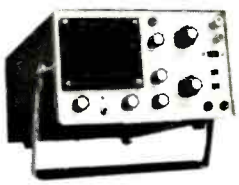

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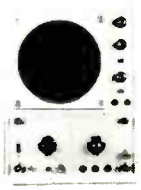

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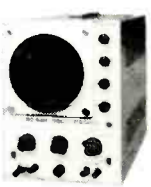

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