

DECEMBER 1971  A HARCOURT BRACE JOVANOVIICH PUBLICATION

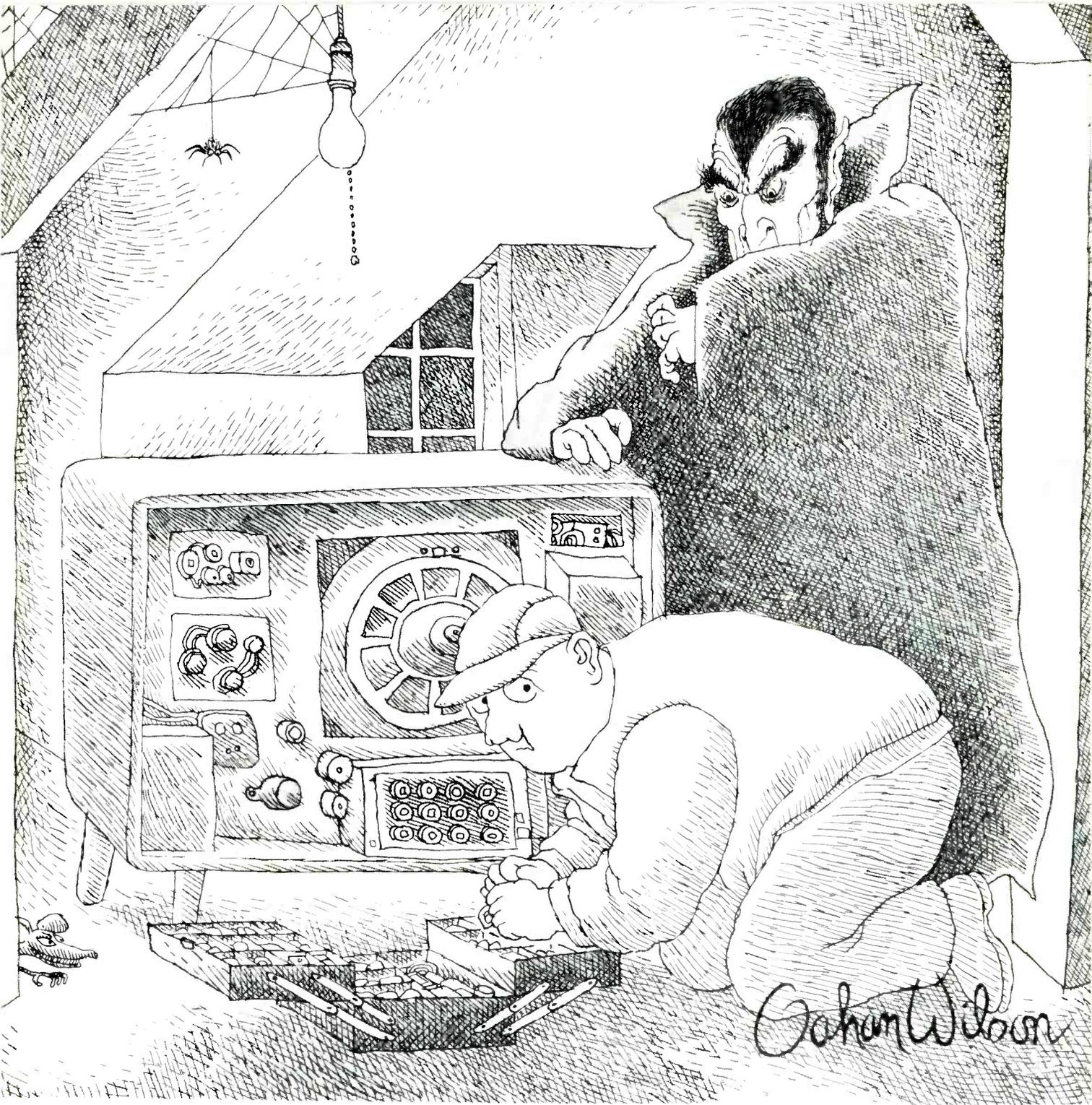
ELECTRONIC TECHNICIAN/DEALER

WORLD'S LARGEST TV-RADIO SERVICE & SALES CIRCULATION



273270

Admiral's Color-TV Chassis K18
Epoxies and the Electronic Technician
1971 Article Index



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

Only 15 tubes and ECG solid-state components will solve practically all of your damper replacement problems.

And they're all available from your Sylvania distributor.

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

In semiconductors, the story is different. Just 124 ECG solid-state devices including transistors, diodes and integrated circuits will replace over 41,000 differ-

ent types. In the damper section alone, only 3 ECG solid-state devices will take care of almost every job.

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

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

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

And that can save you from a real pain in the neck.

GTE SYLVANIA



MODEL	SCHEMATIC NO.
ADMIRAL Color TV Chassis 1K18-1A, 2A	1391
EMERSON TV Model 12HP02	1390
GENERAL ELECTRIC TV Chassis S 3	1393
MAGNAVOX Color TV Chassis T958	1392

COMPLETE MODEL CHASSIS INDEX FOR ALL CIRCUIT DIGESTS AND TEKFAAX FROM JANUARY 1961 THROUGH DECEMBER 1971

MONTH IN WHICH SCHEMATIC APPEARS

Model	Month	Year
614-613	Jan.	1961
614-620	Feb.	1961
621-627	Mar.	1961
628-633	Apr.	1961
634-636	May	1961
637-643	June	1961
644-650	July	1961
651-656	Aug.	1961
657-662	Sept.	1961
663-669	Oct.	1961
670-675	Nov.	1961
676-680	Dec.	1961
681-686	Jan.	1962
687-692	Feb.	1962
693-698	Mar.	1962
699-705	Apr.	1962
706-709	May	1962
710-716	June	1962
717-723	July	1962
724-729	Aug.	1962
730-735	Sept.	1962
736-743	Oct.	1962
744-749	Nov.	1962
750-755	Dec.	1962
756-761	Jan.	1963
762-766	Feb.	1963
767-772	Mar.	1963
773-779	Apr.	1963
780-784	May	1963
785-790	June	1963
791-797	July	1963
798-805	Aug.	1963
806-811	Sept.	1963
812-817	Oct.	1963
818-822	Nov.	1963
823-828	Dec.	1963
829-833	Jan.	1964
834-838	Feb.	1964
839-843	Mar.	1964
844-850	Apr.	1964
851-853	May	1964
854-858	June	1964
859-863	July	1964
864-870	Aug.	1964
871-875	Sept.	1964
876-881	Oct.	1964
882-887	Nov.	1964
888-893	Dec.	1964
894-900	Jan.	1965
901-908	Feb.	1965
909-916	Mar.	1965
917-923	Apr.	1965
924-926	May	1965
927-934	June	1965
935-942	July	1965
943-950	Aug.	1965
951-953	Sept.	1965
954-961	Oct.	1965
962-969	Nov.	1965
970-975	Dec.	1965
976-982	Jan.	1966
983-988	Feb.	1966
989-995	Mar.	1966
996-1001	Apr.	1966
1002-1009	May	1966
1010-1015	June	1966
1016-1022	July	1966
1023-1028	Aug.	1966
1029-1035	Sept.	1966
1036-1041	Oct.	1966
1042-1047	Nov.	1966
1048-1054	Dec.	1966
1055-1060	Jan.	1967
1061-1067	Feb.	1967
1068-1073	Mar.	1967
1074-1080	Apr.	1967
1081-1086	May	1967
1087-1092	June	1967
1093-1098	July	1967
1099-1104	Aug.	1967
1105-1110	Sept.	1967
1111-1116	Oct.	1967
1117-1122	Nov.	1967
1123-1127	Dec.	1967
1128-1133	Jan.	1968
1134-1139	Feb.	1968
1140-1145	Mar.	1968
1146-1151	Apr.	1968
1152-1157	May	1968
1158-1163	June	1968
1164-1169	July	1968
1170-1175	Aug.	1968
1176-1181	Sept.	1968
1182-1187	Oct.	1968
1188-1193	Nov.	1968
1194-1198	Dec.	1968
1199-1204	Jan.	1969
1205-1210	Feb.	1969
1211-1216	Mar.	1969
1217-1222	Apr.	1969
1223-1228	May	1969
1229-1234	June	1969
1235-1240	July	1969
1241-1246	Aug.	1969
1247-1252	Sept.	1969
1253-1258	Oct.	1969
1259-1264	Nov.	1969
1265-1269	Dec.	1969
1270-1275	Jan.	1970
1276-1281	Feb.	1970
1282-1287	Mar.	1970
1288-1293	Apr.	1970
1294-1299	May	1970
1300-1305	June	1970
1306-1310	July	1970
1311-1315	Aug.	1970
1316-1320	Sept.	1970
1321-1325	Oct.	1970
1326-1330	Nov.	1970
1331-1334	Dec.	1970
1335-1339	Jan.	1971
1340-1344	Feb.	1971
1345-1349	Mar.	1971
1350-1354	Apr.	1971
1355-1359	May	1971
1360-1364	June	1971
1365-1369	July	1971
1370-1374	Aug.	1971
1375-1379	Sept.	1971
1380-1384	Oct.	1971
1385-1389	Nov.	1971
1390-1393	Dec.	1971

SCHEMATIC NO.

19M3U	816
19R3U	816
19T3U	816
10UB8B	686
10UD8B	686
20A7/B	644
20A47	644
20C7	644
20A47/B	644
24A2	808
24B2	808
24C2	808
24D2	808
24UA2	808
24UB2	808
24UC2	808
24UD2	808
24UE2	808

AIRLINE

1078 233, 243, 1078U233, 243	766
10 116-254U	847
1174-184, 117U-184, 1188-184	831
12-124-24U, 12-124-34U	909
GCI-12420A, B	1295
GCI-12460A	1337
GCI-13668B	1282
GCI-14821A, 41A, 51A	1389
GCI-17821A, 41A, 51A	1371
GEN-12440C	1312
GEN-13460A	1304
GEN-173A Radio	787
GEN-1225A Trans. Radio	753
GEN-1266A	945
GEN-1866A	1003
GEN-1867A	1036
GEN-1967A	1081
GEN-2485A	902
GEN-8077A, GEN-8447A	1106
GEN-1160A	1274
GEN-1269A	1208
GEN-1460A	1256
GEN-1461A, GEN-1481A	1330
GEN-1469A	1202
GEN-1760A	1279
GEN-1769B	1220
GEN-1960A	1292
GEN-1961	1354
GEN-2069A	1273
GEN-12078A	1266
GEN-12348A	1294
GEN-12448A	1205
GEN-13160A	1281
GEN-13166A	1170
GEN-13469A	1291
GEN-13768B	1238
GEN-17148A	1165
GEN-17158A	1165
GHJ-1466A	978
GHJ-1566A	978
GHJ-1786A	978
GHJ-4516A	978
GHJ-4546A	978
GHJ-3067A	1042
GHJ-3367A	1042
GHJ-8247A	1100
GHJ-8257A	1100
GHJ-14098A	1128
GHJ-14148A	1128
GHJ-14158A	1128
GHJ-14549A	1223
GHJ-14829A, GHJ-14849B, GHJ-14859B	1229
GHJ-17949A, 59A	1189
GMW-1447A	1068
GMW-1457A	1068
GMW-14447A	1087
GMW-14457A	1087
GTC-1684A	831
GTC-1684A	831
GTC-2664A	831
GTC-3914A	847
GTC-3944A	847
GTC-3954A	847
GTC-4015A	909
GTC-4415A	909
GTC-4445A	909
GTC-4455A	909
GTC-4914A	847
GTC-4944A	847
GTC-4954A	847
GTM-1583A	784
GTM-1827A Clock Radio	814
GTM-2583A	784
GVC-9019A Reverb	800
WG-1683A	778
WG-2313A AM/FM Console	746
WG-2343A	778
WG-2373A, BB	778
WG-2343B	778
WG-2373B	778
WG-2683A	746
WG-2785A	888
WG-4225A	823
WG-4234A	823
WG-4325A	823
WG-4334A	886
WG-5220A	655
WG-5226A	1317
WG-5230A	816

SCHEMATIC NO.

WG-5320A	665
WG-5326A	665
WG-5330	665
WG-6050B	713
WG-6051B	713
WG-6052B	713
WG-6150B	713
WG-6152B	713
ANDREA	
Chassis:	
M3H5, M4H5	1211
VT119	890
VTT323-5	818

AUTOMATIC RADIO

Auto Radio 1959, 1960 Chev

3G1155-2, 3	918
3H10, 4H10, 5H10 Series	1082
4D6	903
4D11	890
4D44-3	883
4D1160-7	890
4D1161-1, 3, 4	890
4D1161-7	890
4D4115-3	883
4G640-1	936
4G641-1	936
4G645-1	936
4H5	1070
7D43-1	1152
Beaucourt	841
Chancellor	841
Kalmar	726
Kimberly	726
Orlando, U. C.	874
Safari, U	854
Sekirk	617
Vermont	841

CURTIS MATHES

Chassis:

TV-17-17-1	1057
TV-19-1	937
DELCO	
Model:	
7276605 Auto Radio	684
7264742 Reverb Unit	804
7294893 Reverb Unit	804
7296315 Cadillac Auto Radio	804
980134 Auto Radio	815
980484 Auto Radio	682
980655 Auto Radio	777
980886 Auto Radio	826
9821137 Radio	864
982687 Auto Radio	793
985332 Auto Radio	707
985694 Auto Radio	769
985944 Auto Radio	833
986414 Auto Radio	650
P59 and T 59 12V Geveig Duo, Opener Transmitter/Receiver	724

DELMONICO

Chassis:

120507A, 8B	1362
120515C, 16D	695
120528 Trans. Radio	624
120530C	648
120541C, 42D	695
120549C	648
120550D	648
120551C	648
120552E	648
120553E	648
120555E	648
120556E	648
120557E	648
120572C	718
120573D	718
120587A	670
120588B	670
120589C	670
120592A	670
120642-42 Chroma Board	775
120655 Trans. Radio	775
120664A Radio	775
120667A	872
120673	872
120692A	791
120698	872
120702	872
120708	830
120712	830
120725	830
120732 AM/FM Tuner	880
120743	872
120744	872
120753	872
120758	929
120759	929
120760	929
120771	938
120779	946
120780	946
120781	946
120782	946
120783	946
120784	946
120785	946
120786	946
120787	946
120788	946
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120790	946
120791	946
120792	946
120793	946
120794	946
120795	946
120796	946
120797	946
120798	946
120799	946
120800	946
120801	946
120802	946
120803	946
120804	946
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120806	946
120807	946
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120810	946
120811	946
120812	946
120813	946
120814	946
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120830	946
120831	946
120832	946
120833	946
120834	946
120835	946
120836	946
120837	946
120838	946
120839	946
120840	946
120841	946
120842	946
120843	946
120844	

1390

EMERSON

TV Model
12HP02

DECEMBER • 1971

ELECTRONIC
TECHNICIAN/DEALER

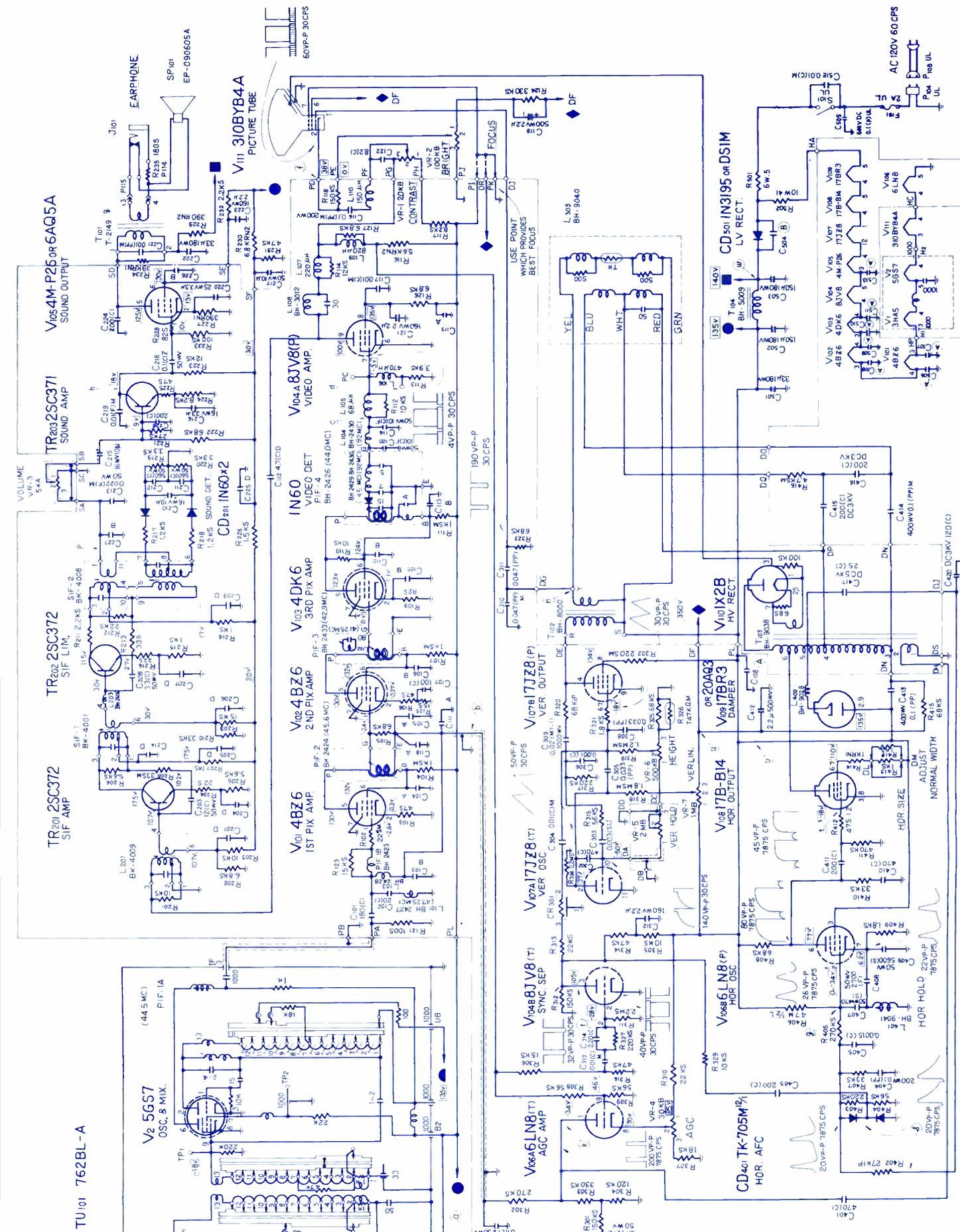
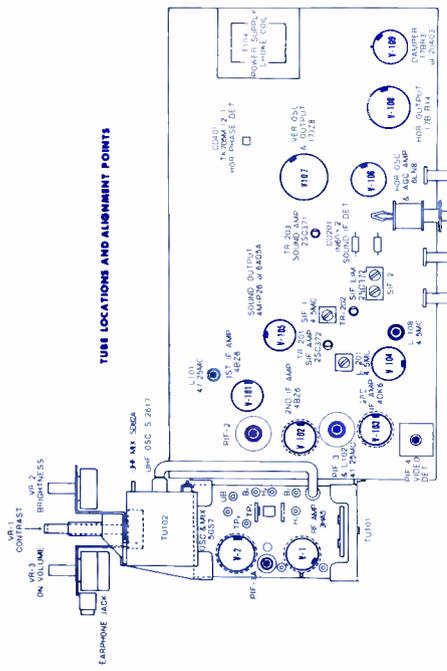
COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR 4 NEW SETS

RESISTANCE READINGS

SYMBOL NO.	TUBE TYPE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9	PIN 10
V-1	3HA5	280K	0	(FILAMENT)	*1.2K	0	0	0	...	...	...
V-2	5G57	10K	250K	0	(FILAMENT)	*1K	0	0	220K	...	...
V-101	4BZ6	700K	47	(FILAMENT)	*1K	*1K	0	...	...	...	...
V-102	4BZ6	700K	47	(FILAMENT)	*1K	*1K	0	...	...	...	...
V-103	4DK6	0	82	(FILAMENT)	*1K	*1K	0	...	...	...	...
V-104	8JVB8	0	3.9M	26K	(FILAMENT)	*620	*2.2K	0	120	0	*4.7K
V-105	4M-P26 or 6A5A	100K	390	(FILAMENT)	*620	*2.2K	0	...	...	...	...
V-106	6LN8	450K	330K	0	(FILAMENT)	*68K	1.8K	1.8K	1.8K	1.8K	56K
V-107	17JZ8	(FIL)	1.8M	NC	*150	NC	1.2M	1.2M	*220	0	500K to 2.5M
V-108	17B B14	470K	470K	0	(FILAMENT)	*1K	*1K	0	NC	...	...
V-109	17BR3	NC	0	NC	(FILAMENT)	NC	NC	NC	NC	0	...
V-110	1X2B	INF	INF	INF	INF	INF	INF	INF	INF	INF	...
V-111	CRT 310BYB4A	68K	1.8K	(FILAMENT)	280K	67K	260K	...	...	...	...

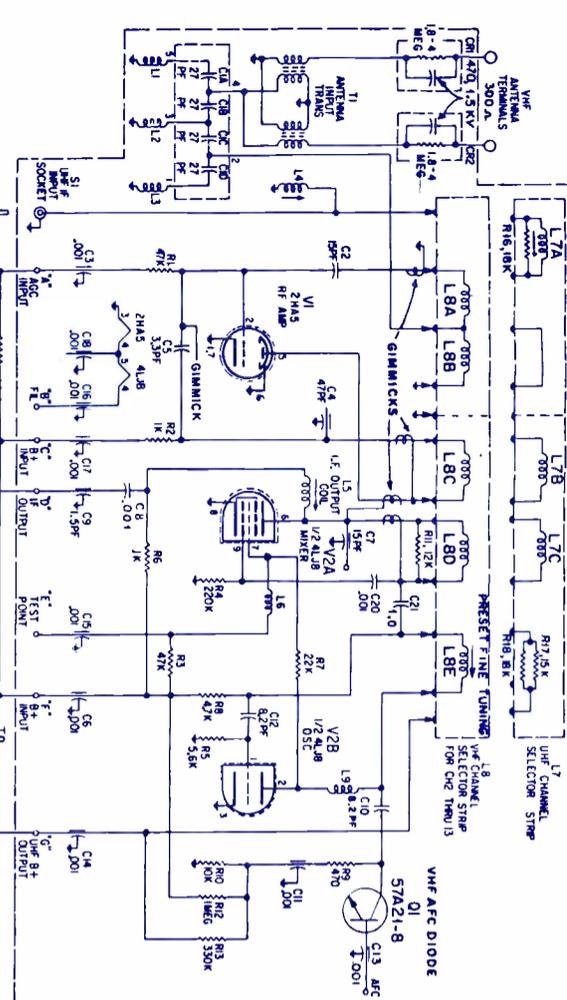
SYMBOL	DESCRIPTION	EMERSON TV PART NO.
TR 201	202-transistor	983742
TR 203	203-transistor	983743
SIF-2	sound detector xformer 4.5MHz	983750
L203	sound take off coil 4.5MHz	983759
L303	deflection yoke assembly	983760
L401	horiz osc coil with knob	983761
T102	vert output xformer	983762
T103	horiz output xformer	983763
T104	filter choke-power supply	983764
C417	ceramic capacitor:25pF ± 10% 5kV	983765

C222	501-502-electrolytic capacitor:150+150+33	983771
503+33	µf at 180V	039001
CR301	condenservent integrator	983778
VR 1	control-contrast	983779
VR 2	control-bright	983780
VR 3	control-on volume	983781
VR 4	control-AGC	983782
VR 5	control-vert hold	983783
VR 6	control-vert lin	983784
VR 7	control-vert h	983785
TU101	VHF tuner 762BL-A	983786
TU102	VHF tuner U-1001 TM-A	983786

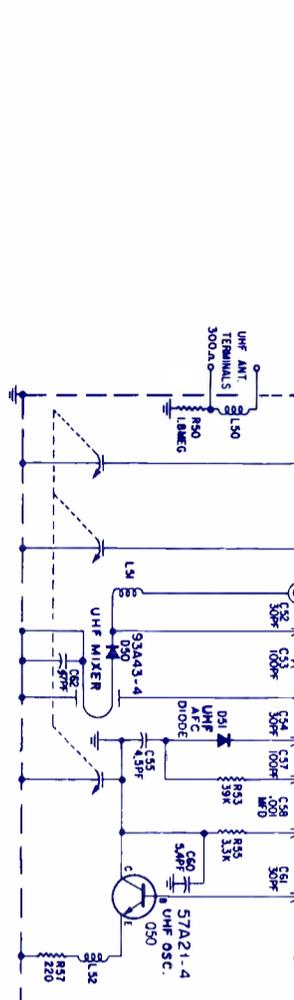


COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR 4 NEW SETS

VHF TUNER 94C421-1



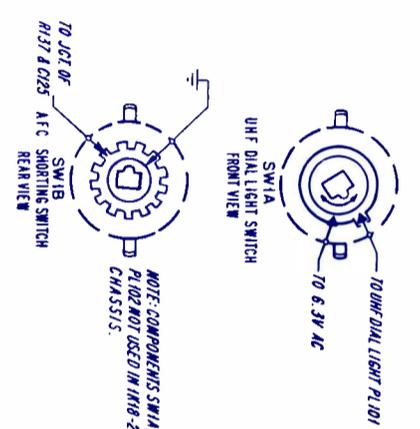
UHF TUNER 94C333-3



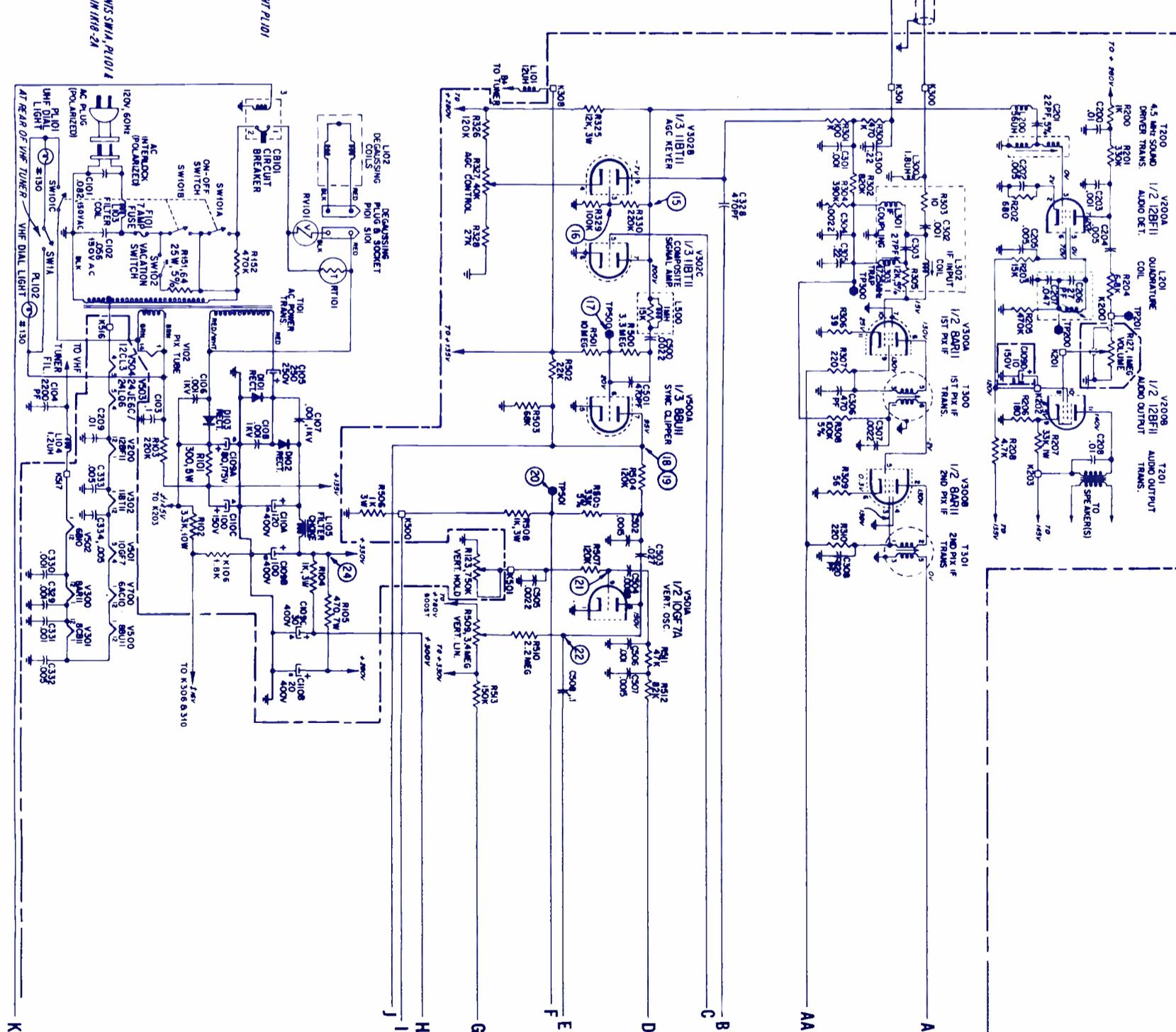
TUNER IS SHOWN IN UHF CHANNEL 13 POSITION.
PUSH IN A.F.C. SHORTING
SWITCH REAR PANEL. TUNER TERMINALS
SELECTING CHANNELS.

RUN CHANGES

Start of production.

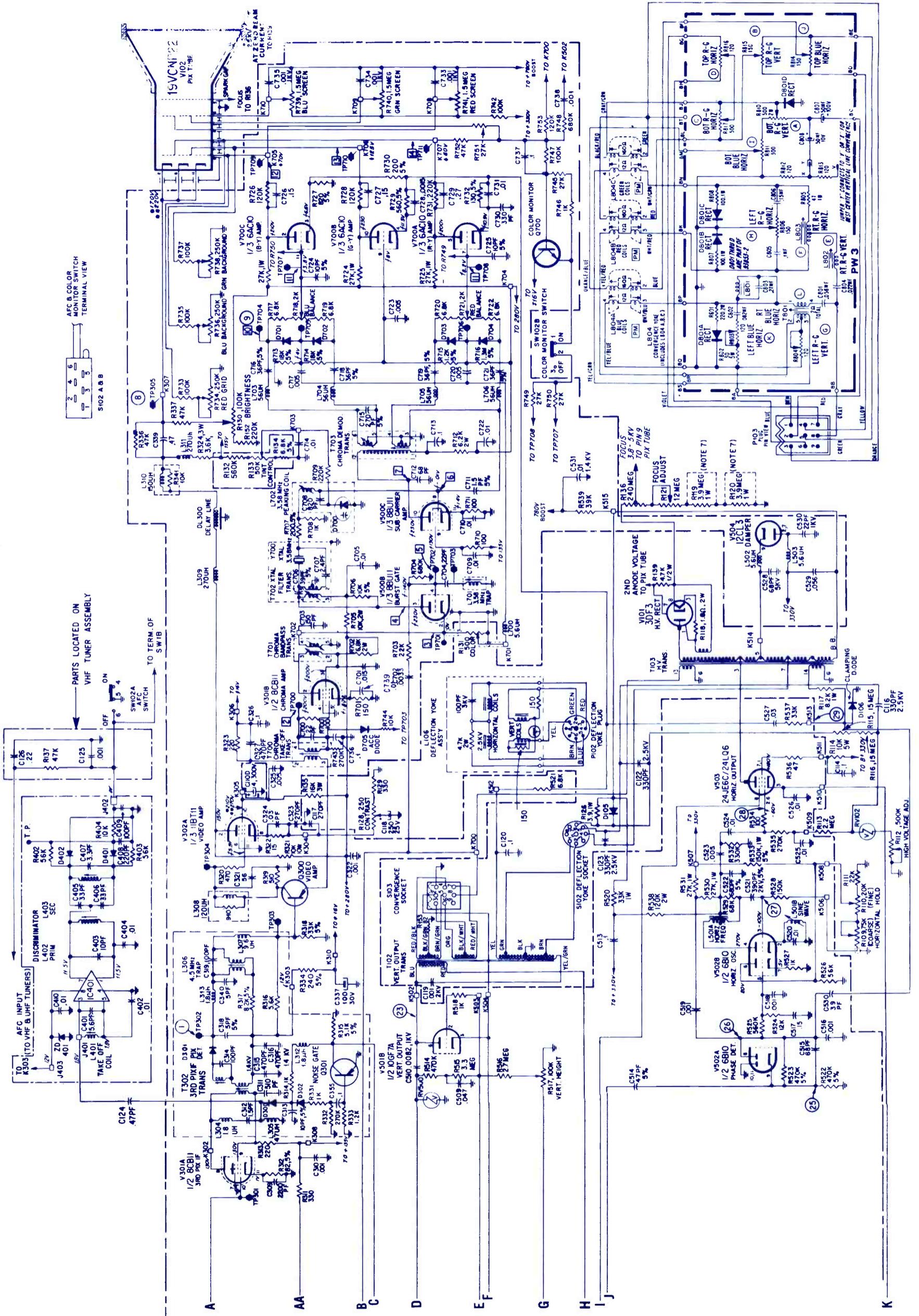


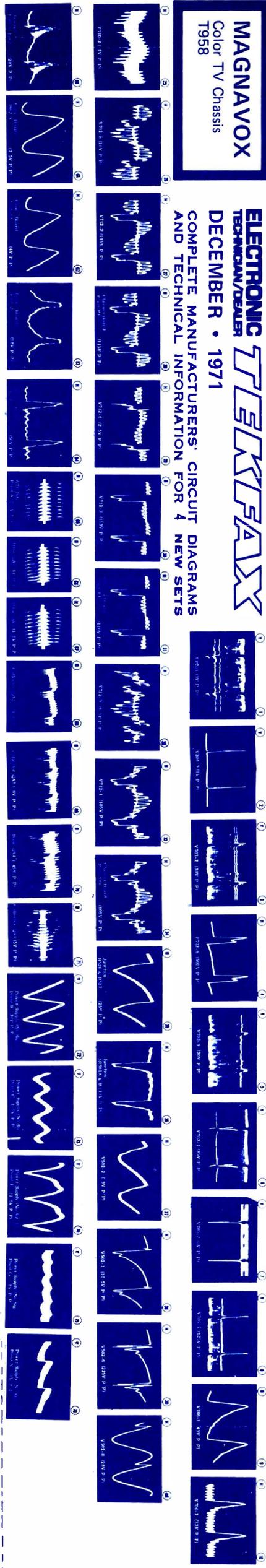
- NOTES: VHF & UHF DIAL LIGHTS NOT IN 1K18-2A CHASSIS.
1. ALL RESISTORS ARE 1/2 WATT, 10% UNLESS OTHERWISE NOTED.
 2. ALL CAPACITORS ARE IN MFD. UNLESS OTHERWISE NOTED.
 3. CAUTION: USE ISOLATION TRANS WHEN WORKING ON CHASSIS.
 4. DC VOLTAGES MEASURED WITH "VTVM" PLACED BETWEEN POINTS INDICATED & CHASSIS GND. WITH NORMAL SIGNAL INPUT.
 5. (*) INDICATES VOLTAGE READINGS TAKEN WITH BRIGHTNESS CONT. AT MAXIMUM ROTATION (FULL CW).
 6. (**) INDICATES VOLTAGE READINGS TAKEN WITH BRIGHTNESS CONT. AT MINIMUM ROTATION (FULL CCW).
 7. (†) INDICATES VOLTAGE READINGS TAKEN WITH COLOR SIGNAL.
 8. WAVEFORMS ARE TAKEN WITH NORMAL SIGNAL INPUT.



9. LINE VOLTAGE INPUT SET AT 120VAC
10. INDICATES THESE VOLTAGES WILL VARY WITH VIDEO CONTENT OF THE PICTURE BEING RECEIVED AND ARE AVERAGE READINGS.
11. (O) INDICATES THESE VOLTAGES WILL VARY WITH BACKGROUND CONTROL SETTINGS.
12. (J) INDICATES THE VOLTAGE WILL VARY WITH FOCUS CONTROL RANGE.
13. (L) INDICATES THE VOLTAGE WILL VARY WITH FINE TUNING SETTING FROM 0V TO +3V
14. NUMBERS IN CIRCLES OR SQUARES IDENTIFY WAVEFORM OBSERVATION LOCATIONS. CONDITIONS FOR TAKING WAVEFORM MEASUREMENTS ARE GIVEN WITH WAVEFORM PHOTOGRAPHS.

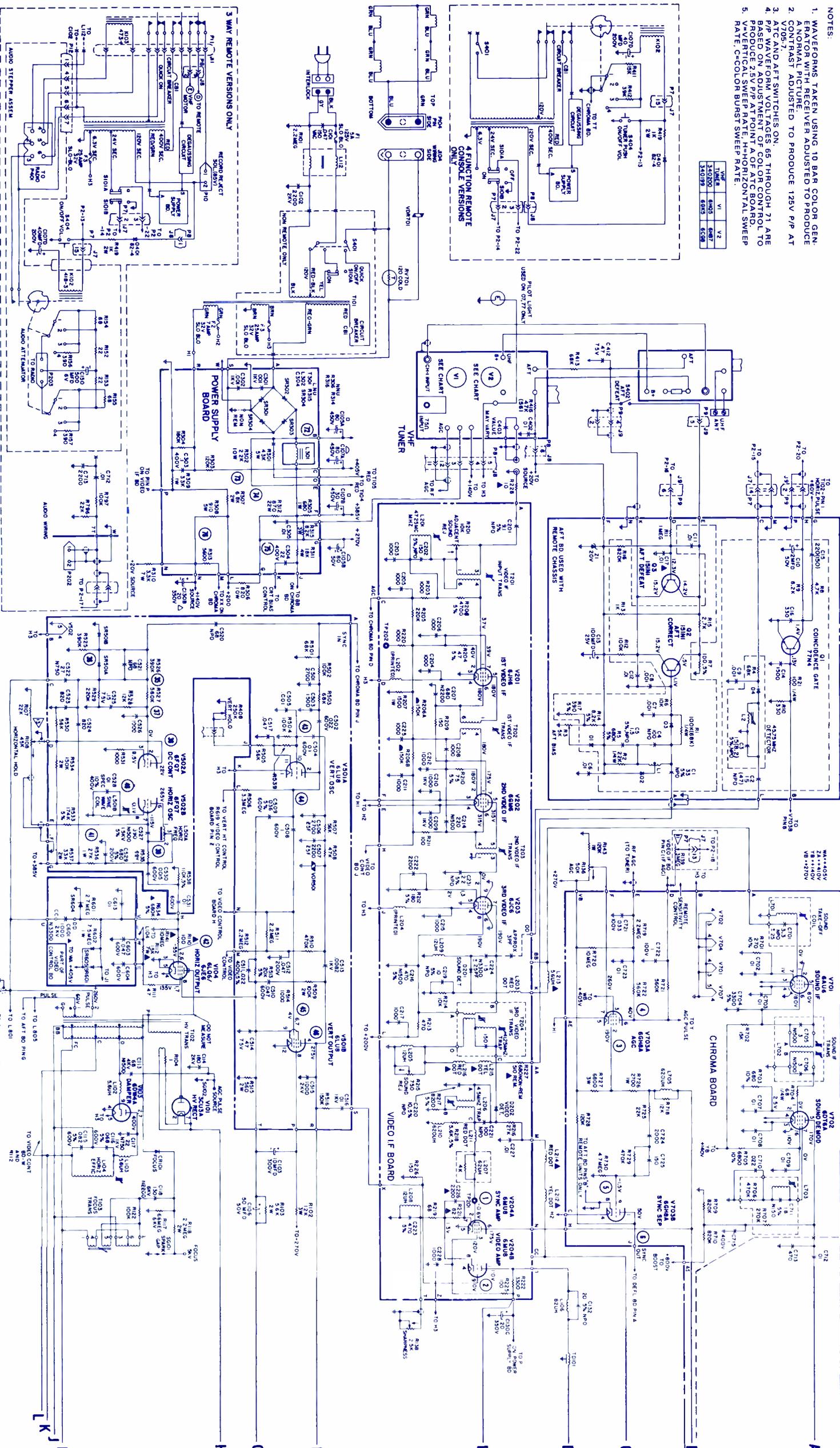
ADMIRAL
Color TV Chassis
1K18-1A,-2A



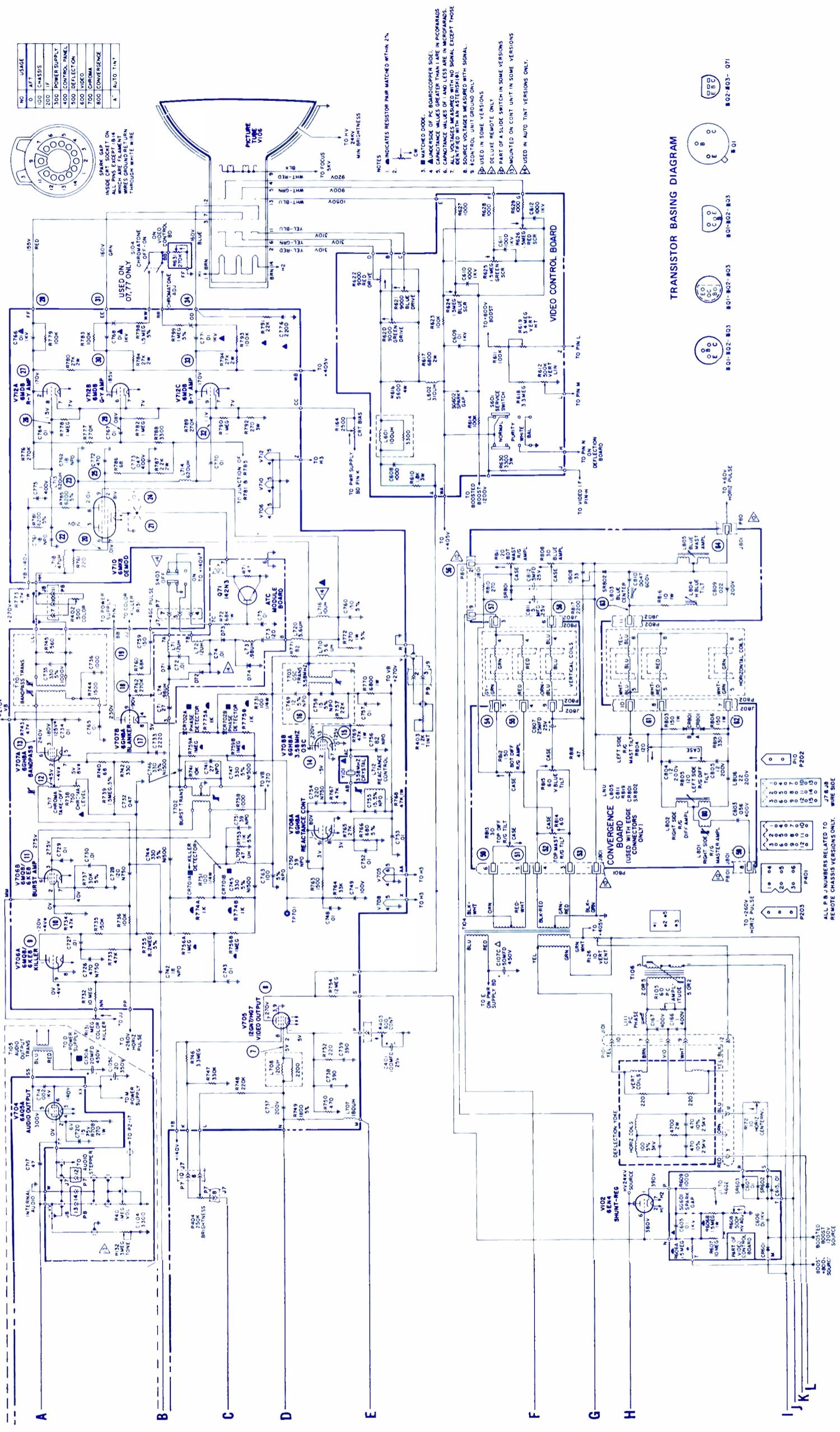
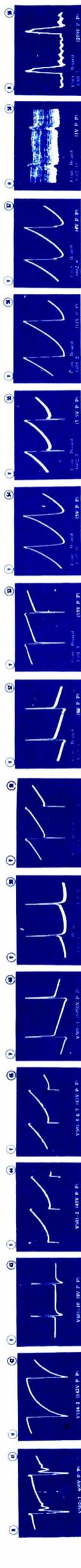
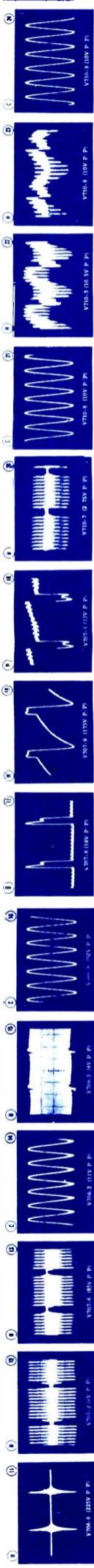


- NOTES:
1. WAVEFORMS TAKEN USING 10 BAR COLOR GENERATOR WITH RECEIVER ADJUSTED TO PRODUCE A NORMAL PICTURE.
 2. POINTS MUST BE ADJUSTED TO PRODUCE 125V P/P AT V205.
 3. A.T.C. AND A.F.T. SWITCHES ON.
 4. P/P WAVEFORM VOLTAGES 65 THROUGH 71 ARE BASED ON ADJUSTMENT OF COLOR CONTROL TO PRODUCE 2.5V P/P AT POINT A OF A.T.C. BOARD.
 5. *VERTICAL SWEEP RATE; **HORIZONTAL SWEEP RATE; ***COLOR BURST SWEEP RATE.

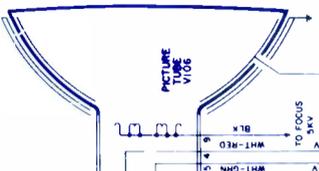
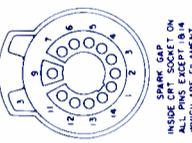
VOLTS	TIME
100	100 NS
10	10 NS
1	1 NS



MAGNAVOX Color TV Chassis T958



NO	USAGE
0	ATF
100	CHASSIS
200	IF
300	POWER SUPPLY
400	CONTROL PANEL
500	DEFLECTION
600	VIDEO
700	CONVERGENCE
A	AUTO TINT

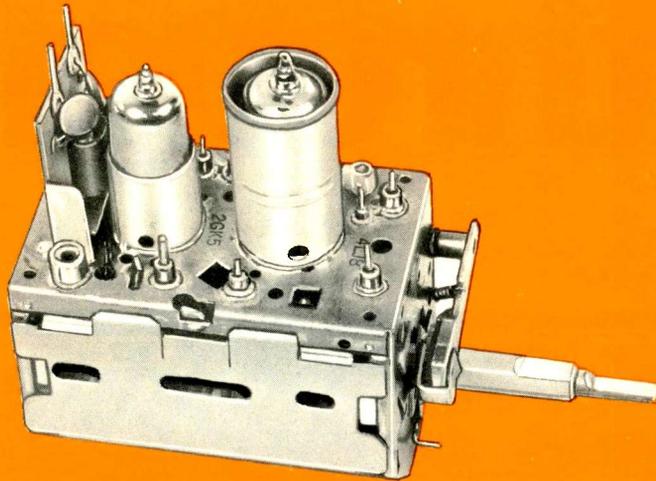


- NOTES
- INDICATES RESISTOR PAIR MATCHED WITHIN 2%
 - MATCHED DIODES
 - CAPACITANCE VALUES GREATER THAN 100 MICROFARADS
 - CAPACITANCE VALUES 1 AND LESS ARE IN MICROFARADS
 - ALL VOLTAGES MEASURED WITH NO SIGNAL EXCEPT THOSE SOURCE VOLTAGES MEASURED WITH SIGNAL
 - CONTROL UNIT GROUND ONLY
 - USED IN SOME VERSIONS
 - DELUXE REMOTE ONLY
 - PART OF A SLIDE SWITCH IN SOME VERSIONS
 - MOUNTED ON CONT. UNIT IN SOME VERSIONS
 - USED IN AUTO TINT VERSIONS ONLY.

TRANSISTOR BASING DIAGRAM



ALL P, J NUMBERS RELATED TO REMOTE CHASSIS VERSIONS ONLY.



\$975

TUNER SERVICE CORPORATION

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

TUNER REPAIR

VHF Or UHF Any Type \$9.75.
UHF/VHF Combo \$15.00.

In this price all parts are included. Tubes, transistors, diodes, and nuvistors are charged at cost.

Fast efficient service at our four conveniently located service centers.

1 year guarantee backed up by the largest tuner manufacturer in the U.S.—SARKES TARZIAN, INC.

All tuners are cleaned inside and out, repaired, realigned and air tested.

TUNER REPLACEMENT

Replacement Tuner \$9.75.

This price buys you a complete new tuner built specifically by SARKES TARZIAN INC. for this purpose.

The price is the same for every type of universal replacement tuner.

Specify heater type

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.



TUNER SERVICE CORPORATION

FACTORY-SUPERVISED TUNER SERVICE

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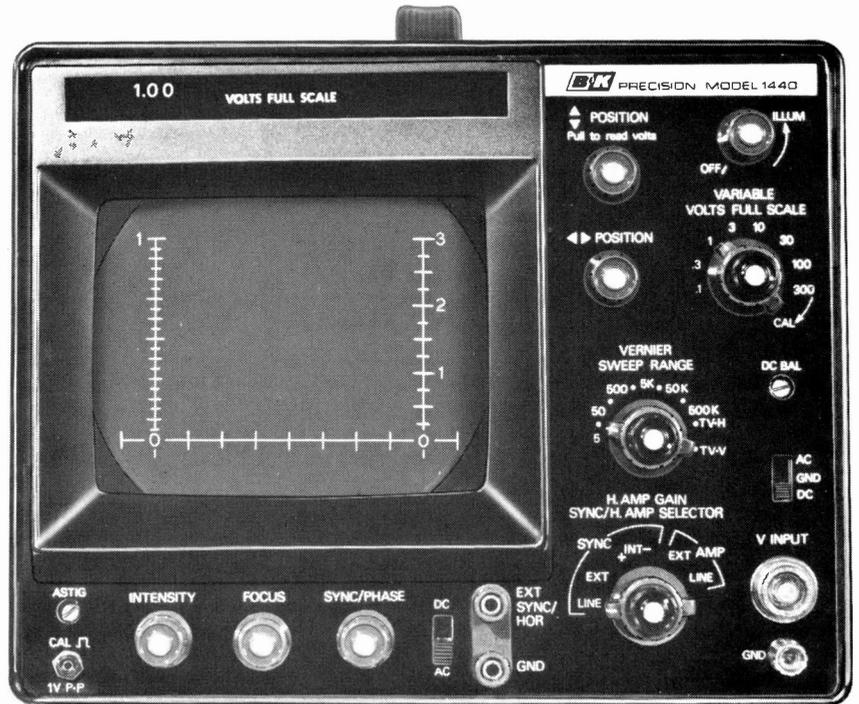
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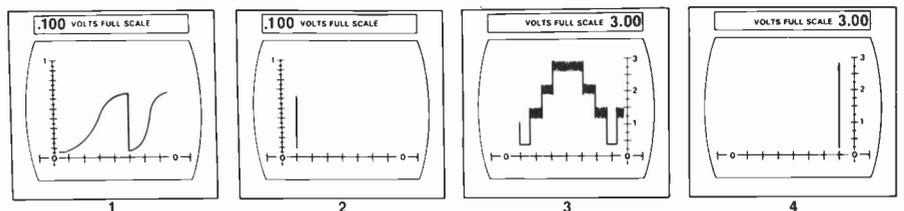
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ELECTRONIC TECHNICIAN/DEALER

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This month's cover photo, courtesy of Sencore, shows our editor observing circuit conditions in Admiral's Color-TV Chassis K18 with the aid of Sencore's FE160 Senior Field Effect Meter and PS163 Dual-Trace Trigger-Sweep Scope.

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“A month-long poll, showed us that 1/3 of our customers found us in the Yellow Pages.”



“We double-checked the findings by having our sales people question customers coming into the store and got just about the same results,” explains Sam Marder, of Radio Electric Service Company of Mount Holly, New Jersey. “Our company has been using the Yellow Pages since 1934 with great results. We’re primarily a wholesale industrial

distributor plus a retail hi-fi, commercial sound, and dealer sound shop. So we take full advantage of the Yellow Pages’ multiple listings. We also carry a few lines that aren’t widely handled, so we make them stand out in our ads. All in all, I’d say the Yellow Pages really helps bring in the business.” Let the Yellow Pages do your talking. People will listen.

**3 out of 4 prospects
let their
fingers do the walking.**



One Hundred Percent Professional



How many of you, when picking up some groceries for your wife, have passed the magazine stand and spotted an issue of ELECTRONIC TECHNICIAN/DEALER? Or, while waiting in line at your local wholesale parts distributor—who recently began catering to the do-it-yourselfer, and takes time to tell the man off the street how to do your job—how many of you have glanced through the racks of old and new magazines and picked up a copy of ELECTRONIC TECHNICIAN/DEALER? No one ever has!

Just recently Joe Zauhar, our Managing Editor, brought to my attention a magazine article printed earlier this year that told how to replace color picture tubes. I was shocked with the article!

In the article the author suggested that if the serviceman offers you an estimate indicating that your color picture tube needs replacement, don't cry over the cost, do the job yourself! He indicated that such a job **does not** require any "great skill or special tools."

Using the photos provided in the article as a guide, you are told to remove the picture tube while writing a detailed diary of what you have done. Then all you have to do is read the diary backwards and you have the new tube in. One of the photos shows the man with the face of the picture tube pressed flat against his chest, the unprotected neck of the tube extending into the box. For all we know, this round tube is the old defective one. Have they buried any of your customers lately?

After printing three pages of "helpful" information, the concluding portion of the article is carried over into the back of the book. In the last two paragraphs of the article, they indicate that you might happen to need a "dot generator" for convergence adjustments. The article did not tell you where to get such an instrument. I suppose you should just borrow one from your friendly electronic technician or service dealer. Or why not just ask him to converge it for you as a favor . . . after all, it won't cost him anything.

Frank Moch, Executive Director of NATESA, sent me a copy of some correspondence that he recently had with the editor of another newsstand publication (by coincidence, that editor also happens to work on the newsstand publication that had been concerned with picture tubes).

A portion of Frank's letter reads as follows:

"Inasmuch as you say you have electronic service experience, you should have recognized that servicing a TV set by merely replacing tubes is not really restoring to like-new condition that which was purchased, but could even be dangerous and very costly.

"Every service shop can cite endless cases where the D.I.Y. switched tubes in sockets and caused actual troubles. Next is the fact that NO drug store tube checker is a tester. Some merely indicate filament continuity. Few make checks of interelectrode shorts and leakage. All are compromises. The problem is complicated by the store trying to sell universal replacements, which often do NOT produce optimum results. Replacement of horizontal sweep circuit tubes without resetting the drive is an invitation to short tube life, possible burned-out transformers, and yes, x-radiation."

Those of us associated with ELECTRONIC TECHNICIAN/DEALER are of the opinion that the servicing of consumer electronic products is a professional matter, not to be handled by do-it-yourselfers. For hobby information, and most of us are also interested in non-professional electronic applications, those publications available down the street are great! I read them too.

But, we feel that it would be just as irresponsible for us to sell ELECTRONIC TECHNICIAN/DEALER at the corner store as it would be to sell THE AMERICAN MEDICAL JOURNAL there. And due to that concern for professionalism, we refuse to sell our publication to just anyone. That is the reason why, when first subscribing to our magazine, you received a questionnaire asking about your electronic background. Had you given the wrong answer, our circulation department would have automatically stopped your subscription and refunded your money. That is how concerned we are about being a publication exclusively for you, the professional! We do not want to tell the man down the street how to make your life more complicated—you already have enough problems with the non-professional.

Possibly, due to the restrictive nature of our circulation, a few of your newer professional associates are not even aware of our publication. How about showing them a copy?

Phillip Dahlen

LETTERS

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

Agrees with Editorial

I have read and reread the copy of your forthcoming superb editorial [the November Editor's Memo] that you sent Dick Glass. I cannot find words to express my personal appreciation of such a great editorial. It should go down in electronic history as one of the truly great editorials.

Every electronic service dealer and professional electronics technician is greatly indebted to you and your great publication for such a great, just and sincere stand. It is too bad such a great newspaper as the NEW YORK TIMES would dare publish such false and unjust statements that all radio and television dealers are crooked and dishonest.

On behalf of every member of NEA and every electronics service dealer and professional electronic technician, I thank you from the bottom of my heart and am proud to have you as a member of our profession.

CHARLES R. COUCH, JR., CET

Agrees on Need for Safety

William Felscher, that ole Navy man (October Letters to the Editor), is so right about safety.

I first stopped wearing a ring after the time I had to hit a friend who was drunk in order to make him behave. My ring cut a gash on his face and immediately I decided to never wear another, that if I must use my fist on someone, at least I didn't have to wear gadgets that will do unnecessary damage.

So, may I offer a generalization about this aspect of safety: PERSONAL ADORNMENT, BEYOND BEING NEAT AND CLEAN, IS NOT FOR WORKING PEOPLE!

I think that is one of the main reasons why, when women stopped being "kept" people and started holding down jobs outside the home, they—most of them, at least—cut off their long hair. But, female vanity being what it is, few have been able to eliminate all the hanging, swinging, dangling, stuck on, sewed-on, pinned-on dodads.

And it is noticeable that the current longhair styles for men are adopted mostly by those who are either "kept men," unemployed, or else employed in types of jobs commonly held by women.

So, please do give us a column of "Safety Tips," plus, maybe, a column of "Look What Happened to Joe" case histories. Help us to do more "wondering" about safety and safe ways of doing things and less "wandering" into hazardous situations.

BILL WELLS

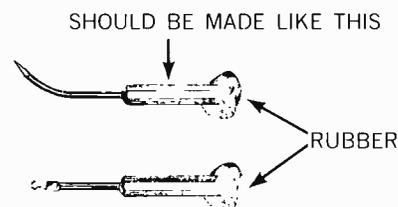
Safety First

Yes! Mr. William Felscher makes you really think. We all learn from experience.

I would like to add my comments concerning an eye hazard. About 15 years ago, I was probing with a long tool—a picket and steel brush, one on each end. While I was probing, I accidentally jabbed the steel brush part in my eye. I was seeing lines for months.

I wrote to the manufacturer and suggested that they make up a new probe kit—fork, point and steel brush with rubberized ends. They said they were very sorry and thanked me, but this tool is still being made today.

A few years later I heard of a young student in electronics who lost his eye with the same picket tool.



I suggest that all electronic technicians cut this tool in half right now, for it may be too late tomorrow.

I also feel that your great magazine should print Mr. William Felscher's story on a full page once a year—the story being sent to manufacturers of dangerous products.

P.S. Also, proper shoes are important. Gum soles are the best—no nails in heels since they are very dangerous on damp floors.

ANTHONY ANNELLI

Employer Ignores Hazards

I read the "Safety First" letter in the October issue of ELECTRONIC TECHNICIAN/DEALER and realize that safety does seem to be overlooked.

It is not only ignorance on the technician's part but also something which is overlooked by those who should know better.

At the present time I am employed by a nationally known company with

service departments operated from retail stores [*we have withheld the name*]. Requests for all sorts of safety devices are ignored. For example: protective clothing for changing older type picture tubes, isolation transformers for hot chassis sets, rubber floor mats over the cement floor and regular maintenance of service vehicles.

I believe that a good place to start would be with the board that is responsible for licensing technicians. An annual visit by a board member to make sure that the shop conformed to minimum safety standards would make me feel I was getting something out of paying my yearly fee, which in my case must be paid to both Massachusetts and Connecticut. Why not establish certain requirements for the shops and not just the technician.

Although the writer of this letter included both his name and that of his employer, we decided to withhold both for his protection. Ed.

Tells of Dangerous Encounter

In agreement with the article titled "Safety First," let me be one of the first to add "Amen" to the thought behind the article. You cannot be too careful when working with electricity.

Let me tell you of one experience I had:

About seven years ago, I had about 100 mobile units and five base stations for the county radio system. In the course of keeping them all working, one unit was brought in with a slip stating, "smells of smoke."

I put it on the bench, hooked up the power cables to it and waited. Lo and behold, I did smell smoke, but where was it? This was a Motorola T51GGV. The cage around the high-voltage area was unscrewed and once again the unit was turned on. Smoke started to seep out and the smell of burning was more pronounced.

I then (and I'll never do it again) bent over to smell around the high-voltage area where the smell was coming from. I had the microphone in my hand and keyed it. THAT IS ALL SHE WROTE! My nose touched the bare cap of the 6146 and the next thing I knew, I picked myself up off the floor.

You are right. My nose had touched the cap of the 6146, and being keyed by the microphone, it was hot. About 600v.

To say the least, I never did it again.

I hope that someone can benefit by this story. It couldn't happen to me, but it did.

Your magazine is very good.

JOHN BUMBALEK
continued on page 26

The replacement picture tube no other color tube can replace!



ZENITH
CHROMACOLOR[®]

Simulated TV picture

Now you can install the revolutionary Chromacolor picture tube in almost any brand of 23" (diag.) color TV. And let your customer see the difference: a new, sharper Chromacolor picture with greater brilliance, contrast and color definition.

Zenith pioneered, developed and patented (U.S. Patent No. 3146368) the Chromacolor picture tube. And only Zenith has Chromacolor.

Chromacolor is an easy sale because people already know of Chromacolor's superiority. (Last year, after the revolutionary new Chromacolor system was

introduced, Zenith giant-screen color TV sets became the No. 1 best-seller!)

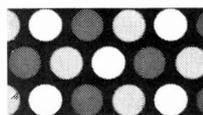
Full two-year warranty.

Here's your sales clincher: Chromacolor replacement color tubes are warranted for two full years. Exactly double the warranty period for most other replacement color picture tubes.

Give your customers the best — Chromacolor replacement color tubes. Only your Zenith Distributor has them.

TWO-YEAR WARRANTY

Zenith Radio Corporation warrants the replacement CHROMACOLOR picture tube to be free from defects in material arising from normal usage for two years from date of original consumer purchase. Warranty covers replacement or repair of picture tube, through any authorized Zenith dealer; transportation, labor and service charges are the obligation of the owner.



Zenith Chromacolor picture tube pinpoints the color dots on a jet black background and for the first time fully illuminates every dot.

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LETTERS . . .

continued from page 24

Getting to the Nitty-Gritty

It has been my observation that whenever you assemble a group of qualified electronic technicians, the subject eventually gets around to transistors . . . transistor troubleshooting . . . and transistor replacement.

It appears that this is still a very big and mysterious "bug-a-boo" to a number of otherwise capable and experienced technicians.

And rightly so . . .

We keep getting called upon to service new equipment in the consumer field that uses the "little monster" in all types of new circuits, and just to keep abreast with a working knowledge of the new circuit designs is laboring!

Since more of our service time is now devoted to troubleshooting and replacing these devices than ever before, I find technicians constantly "keeping an ear cocked" for any new "technique" or "hint" that they can pick up and put to use in order to save them valuable time in their daily repairs of consumer equipment.

I cannot help but get that "gutty" feeling that there is still a great number of these technicians . . . that wouldn't admit to it . . . but who themselves believe that troubleshooting and the replacement of transistors (in sophisticated equipment) is too much of an overwhelming subject to master.

I believe that some technicians are "running scared" and as they approach these transistor chassis to repair them, it becomes a chore and a dreaded experience.

Let's consider some of the poor technician's reasons for frustration.

He has in his hand a three- or four-legged device with some number on it. It may or may not have traveled thousands of miles and crossed oceans just to get to him, and then it shows its hostility by not performing. It may or may not have legible markings that are of any use. It may be so obscured or buried so deep in tight quarters that it took three hands, a cool head and all types of tools and ingenuity of the highest order to remove it from its grave.

But the technician prevails. It's out and it's identified. It's tested but it won't tang. Off to the replacement shelf . . . but its "big brother" is not on the shelf.

The poor technician now realizes that he is going to have to play "James Bond, Master Sleuth" for the rest of the day until he can solve his problem.

The problem: To come up with a replacement device that not only will fit but will do the job intended without major circuit changes.

In pursuing the overall problem of replacing the thing, consider this: When are we, who are in the service end of the business, going to really get more than just adequate help? Where is this help coming from? Or is help really needed? I for one say . . . indeed it is!

Of course, the key words are *informed* and *information*.

I ask you this:

How many manufacturers identify or designate in *their* service literature: "Caution, special transistor with special characteristics, use exact replacement device"?

How many manufacturers help with a 2N . . . number (where feasible) for cross-reference purposes?

How many manufacturers *try* to use the same device (where feasible) in different circuits within the same chassis?

How many manufacturers actually list a recommended replacement device that is readily available? After all, I don't always use his brand of tubes in order to make his merchandise function properly.

Replacing transistors (and soon IC's) has been much too much of a headache for the technician. It has been too costly to the service dealer. More importantly, it has caused more public relations problems to the servicer than just about anything I have thus far seen in this business.

Why shouldn't we crack the information barrier?

The products are good and the technicians are good.

Provide the technician with just *enough information* and I'll guarantee you he will be able to do justice to the servicing of today's (and tomorrow's) highly sophisticated consumer products.

Who knows, we might even be able to get the public to smile back at us.

TOM THOMAS, CET

This month in Semi-Tips, Jack Jaques of Motorola offers some helpful techniques for selecting replacement transistors. Ed.

Upset by Editorial

I just got through reading your editorial in the October 1971 issue of ELECTRONIC TECHNICIAN/DEALER and I would like to make a few comments.

You always mention meetings after they happen, never any advance notice—so only the few who run these organizations know what goes on and they become self-service clubs.

Who are these manufacturers that

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

you talk about. You sound like a Broadway columnist who drops a lot of mystery remarks but never any facts.

I notice on the back cover of the October issue a list of 185 color picture tubes. What a waste of time, talent and materials. No wonder U.S. sets cost so much. And I wouldn't be surprised if the unknown manufacturers [those not mentioned by name in my October Editor's Memo] buy their complete line of components or sets in Japan, and then put their name on it, fooling the public and worsening our balance of trade deficit.

I have often wondered in the past years why no letter critical of a large TV manufacturer has ever been printed. Don't tell me there never has been one letter sent in. That I don't believe.

Sometimes I think you should change the name of your magazine to TV MANUFACTURERS PROTECTIVE.

I never have seen an article in your magazine decrying the waste in TV designing. I maintain that 95 percent of the changes are just cotton picking, dot changing, and a bigger burden to everybody trying to keep up with the changes and maintain an adequate stock. As you pointed out in defense, one has to specialize.

HARRY GOLDMAN

As you can see from the preceding letter, we do not restrict this column to but complimentary letters.

The two most recent national conventions for electronic technicians and dealers were announced a month ahead of time in our publication—the July NEA Convention (at which the ISCET convention was also held) having been announced on page 28 of our June issue, and the August NATESA Convention (at which the National Service Conference was held) having been announced on page 24 of our July issue. Unfortunately, as indicated in my February Editor's Memo, we do not receive sufficient advance notice of most state conventions to publish the information before the convention occurs. This is partly due to the amount of time required to print a publication of our size, and partly due to the fact that the officers of most of these state associations are shop owners—like you—and with their busy schedules they are unable to make definite plans too far in advance. However, if you or any other readers wish, we will be glad to give your name and address to the appropriate associations so that they can advise you personally of coming meetings.

As mentioned in my October Editor's Memo, the manufacturers sup-

porting the technicians and dealers in our industry generally are the same ones advertising and providing technical information featured in our publication. You can get their specific names by paging through past issues of the magazine.

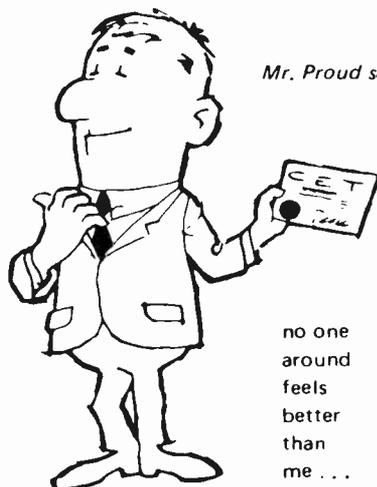
The RCA ad on the back page of our October issue was a good one. Why complain when you can replace 185 bad color picture tubes with but one of three? This is great!

We are now living in a time of rapid change—just think, not many years ago there wasn't such a thing as a transistor, and now many color-TV sets are almost entirely transistorized. Many a technician fell by the wayside with this change—like blacksmiths who couldn't become auto mechanics. Some were personal friends, and I regret their loss. Being a competitive nation, each manufacturer has attempted to outdo the other in accomplishing this and other current transitions. This is one of the main reasons why we currently lack standardization. But with the help of the National Service Conference, manufacturers are becoming more aware of this need and are beginning to make plans to do something about it.

We do occasionally receive letters
continued on page 68

Secure a better future, join the ISCET!

TAKE THE CET TEST



Mr. Proud says

no one
around
feels
better
than
me . . .

now that I'm a CET!
Certified Electronic Technician

WHY ISCET?

To provide a professional Trade Association to promote the welfare of Electronic Technicians.

WHO BELONGS TO ISCET?

Electronics Technicians who have passed the NEA CET exam and are registered with NEA. Members come from broadcasting, electronics distribution, electronics journalism, manufacturing, teaching, military service, industrial, marine, communications aviation, and from consumer electronics.

WHAT ARE ISCET'S MAJOR FUNCTIONS NOW?

NEA turned direction and administration of the national Apprenticeship and Training Programs and the CET Certification Program over to ISCET. ISCET represents technicians by being a member of the Electronics Industry Council and by helping to promote the continuance and effectiveness of the National Electronic Service Conference.

HOW MUCH ARE THE ANNUAL DUES?

\$15.00 for 12 months of membership.

HOW DOES A CET JOIN?

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Please send me CET information Please send me ISCET information

Name

Address

City State Zip



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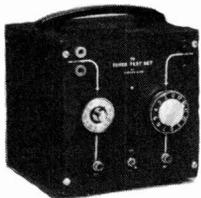
Spray Pack guarantees silent, smooth operation, with absolutely no harmful aftereffects for both color, and black and white sets.

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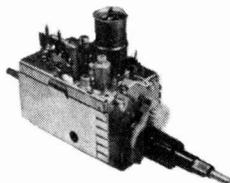
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SCIENTIFIC TUNER SERVICE

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Chicago, Ill. 60621 312-873-5557

. . . for more details circle 119 on Reader Service Card

READERS' AID

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

Schematic Needed

I need a schematic for a Premier Model 88N musical instrument amplifier. If anyone has one or knows where I can obtain one, I will gladly pay the cost of having a copy sent to me.

FRANK M. DICKINSON

Route 9-W
Stony Point, N.Y. 10980

I need a schematic for an Ansafone Model KH85-F. If anyone has it, I am willing to remunerate.

JOHN S. HLUCHY

286 Garrett Road
Mountainside, N.J. 07090

Recently I was given a Model No. 15 Brunswick S/M 148612, which is not working. When I tried to get it fixed, I soon learned the only way I can do this is with a schematic of this radio. Any information you could give me would be greatly appreciated.

RICHARD C. POSPISHEK

1626 Almond Blossom Lane
San Jose, Calif. 95124

I am in need of a schematic for a Conley Electronics Model ATP-102 cassette recorder—I can't repair it until I get one, and the company has apparently gone out of business some eight years ago. If anyone has or is able to obtain this information, please let me know.

DAVE GEALEY

308 Todd Way
Mill Valley, Calif. 94941

I have an old Crosby radio, Model No. 30-S. It seems by the label that chassis 30-S, 31-S, 33-S and 34-S are the same. I need a schematic diagram and also a source for tubes.

TERRY E. MAYBERRY

1330 S. 600 West
Swayzee, Ind. 46986

Due to an unfortunate accident, my service data for most of my test equipment has been destroyed. I have replaced all but three, which the manufacturers could not supply. I need service manuals or at least schematics on the B & K Model 1075 Television Analyzer, the B & K Model 850 Color Generator, and a Heyer Model 326

Ignition Oscilloscope. I will gladly pay any costs incurred in making copies of any or all of these items.

JIMMIE W. RAMBEAU

General Delivery
Jonesboro, Ill. 62952

Information Requested

Please see if you can find out the name of the distributor for the "Hi-Mood" AM-FM radio sold by S. H. Kresge stores. We have tried for months to find this information, but no luck. We need a band switch for it, so would greatly appreciate the information.

O. V. HOWELL

Route 1
Mars Hill, N.C. 28754

I have a Callmaster Model 240 that is not working. I need a book on this unit, but I do not know the address of Phonemaster Inc. or Lansing who made the unit for Phonemaster. Please send me the address of either or both of these companies, so I can send to them for the information I need.

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Control Box Needed

I have an antenna rotator marked "Tele-Rotor Model TRA-4." Unfortunately, I received it without the control box. I believe this was one of the first rotators used by hams when rotating beam antennas were the latest thing. Can you tell me what company made this rotator, and are they still in business?

THOMAS L. SIGLIN

20 Chase Lane
Levittown, L.I., New York 11756

Service Information Needed

We would like to get service information on Models RS-101 and RS-202 telephone answering devices built by the Remington International division of Martin Electronics Mfg. Corp. of Hialeah, Fla. If any one can supply us with this information, we would be glad to pay for copies, or can make copies ourselves.

FERGUS P. LEA

Lea Radio Service
1334 Washington Ave.
Portland, Maine

Parts Needed

I need the operation and service manual for a Rek-O-Kut Imperial II (Record cutter and playback). Also, I need parts for Rek-O-Kut Model TR-43H (Recording turntable) and parts for Rek-O-Kut Model M-12S (overhead lathe). Anyone having these items, or any information on where they may be obtained for a reasonable price, please contact me.

LUIS E. GELARDI

P.O. Box 723
New Britain, Conn. 06050

Antenna Wanted

I need an external loop antenna, part number RLL-007, for a model 260 General Electric ac-battery radio manufactured in 1947. This part is not available from General Electric, as it is not listed on their current list of available parts.

EUGENE W. THOMPSON

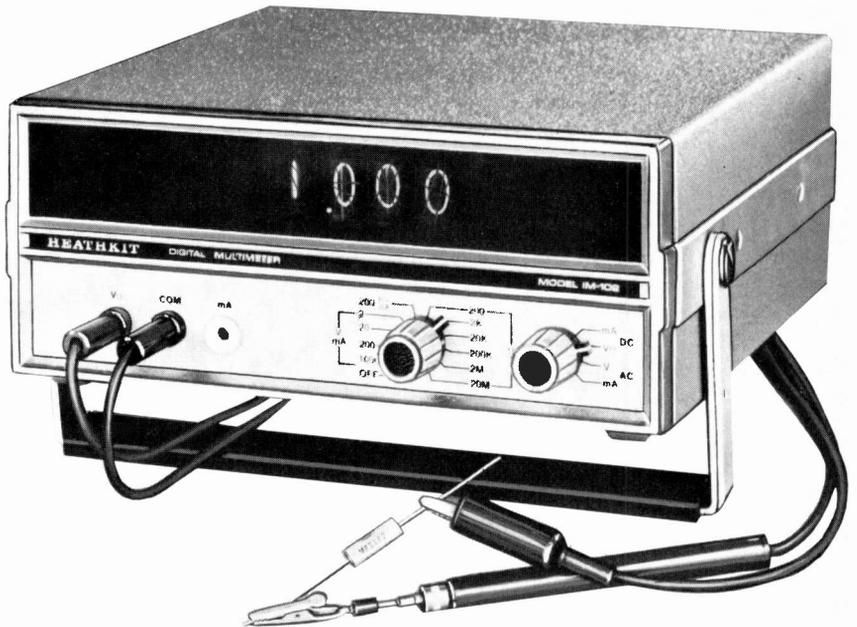
1, Box 48½A
Joliet, Ill. 61486

For Sale

I have 840 Sam's Photofact sets. The last 266 sets are still in monthly shipping cartons. These are for sale (as a group only) at ½ the current placement value.

TOM DOUGLAS

500 Ogden Drive
Ashville, Tenn. 37218



New Heathkit Digital Multimeter... lab precision for only 229.95!*

- 3½ digits for 100 uV resolution on 200 mV range, 1 V on 1000 V
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A breakthrough in instrumentation! The new Heathkit IM-102 brings you a true Digital Multimeter (circuitry and readout) meeting lab-quality specs for about half the price of comparable wired DMMs. The unit accurately measures AC and DC voltages and currents, and resistance, with no need to change probes or switch meter for changes in DC polarity. It automatically displays positive or negative DC voltage and current, indicating correct amplitude and polarity. Five overlapping ranges measure voltage from 100 uV to 1000 V on DC (either polarity); 5 ranges cover 100 uV to 500 V on AC; 10 ranges measure 100 nA to 2 A on AC or DC; and 6 ranges measure resistance from 0.1 ohm to 20 megohms. Input impedance is approx. 1000 megohms on 2 V range (10 megohms on higher ranges), with overload protection on all ranges. Decimal point automatically placed with range selection. Overrange indicated by front panel light. A preassembled precision DC calibrator is furnished. And an internal circuit plus a unique transfer method provides accurate AC voltage calibration. Other deluxe features included at this low price are: all solid-state design with cold cathode readout tubes and a "memory" circuit to assure stable, non-blinking operation; detachable 3-wire line cord (no batteries needed); dual primary power transformer; isolated floating ground; aluminum cabinet with die-cast zinc front panel and tinted window. Standard banana jack connectors and test leads included. Kit assembles in about 10 hours. For lab spec. performance at half the cost... order your IM-102 today!

Kit IM-102, 9 lbs. 229.95*
Kit ID-1041, 30 kV high-voltage probe, 1 lb. 6.95*



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NEWS OF THE INDUSTRY

Background Concerning Hearing Conducted by New York Legislature

As you know, the November Editor's Memo in *ELECTRONIC TECHNICIAN/DEALER* was concerned with the *NEW YORK TIMES*' report on what occurred at a New York Legislative hearing concerned with the possible licensing of electronic technicians. In that memo reference was made to correspondence written by Frank Moch, Executive Director of NATESA, concerning this matter.

Since Frank's letter to the Chairman of the Joint Legislative Committee on Consumer Protection, State of New York, provides some additional background concerning what did occur, we are printing it in its entirety.

Dear Mr. Kunzeman:

I have just read the front page article in the September 24, 1971 *NEW YORK TIMES* entitled, "TV Repair Shops Scored In Hearing," and to say the least, I am horrified at the allegations made.

When I received a Xerox copy of your announcement, dated September 7th, I immediately made photocopies and sent them to 14 key people in our industry in New York State, so that they might participate. I personally planned to attend but other commitments made it impossible. Assurances that others would attend, eased my thinking. I have checked with those closest to New York City since reading the article, and was told that word came to them that the hearing had been cancelled. So it appears that someone deliberately did not want service people present, possibly because they could refute allegations with facts. The fact that even factory and distributor personnel were not in attendance lends credence to the reports of cancellation.

It is a matter of record that this organization has been in the forefront in defense of the consumers' interests, because we are adult enough to know that only when the public is served properly can we expect proper respect and compensation. We are businessmen, so we know that the millions of home electronic devices that do need service regularly guarantees that no businessman need cheat. We are very cognizant that home electronics is the most complex device in the home, so we have continuously conducted and encouraged up-dating technical seminars. NATESA for the past 20 years has sponsored and urged licensing of TV-radio service to assure technical prowess of technicians, and business ethics of service companies. A check with New York Attorney Lefkowitz will confirm these facts.

We will be the first to admit that there is a small fringe of very obvious con-artists in our industry. Intelligent people recognize the same pattern in every human endeavor. There also is a large and equally obvious element of incompetents operating out of their hip pockets. The clearly incompetent testimony condemning the entire industry by inference, heard at your hearing, simply reinforces the position of the undesirables mentioned above, because the public is told they have no chance of fair treatment, so they may just as well surrender to the clip artists whose names are well known as a result of very expensive and extensive advertising, and/or to the fellow down the street in the basement or the in-plant self-styled "electronics genius" because their rates are impossibly low. In either case, the quality is non-existent, and cost in the final analysis is sky high.

Is this what your committee wanted? I do believe that you need the guidance of NATESA to produce a license bill that will be a credit to your committee and all sincere consumer welfare advocates, and a boom to consumerism.

We enclose a copy of our "Joys of Electronic Living,"

which is an excellent consumer advisory piece based upon 25 years of NATESA experience in working for the public welfare.

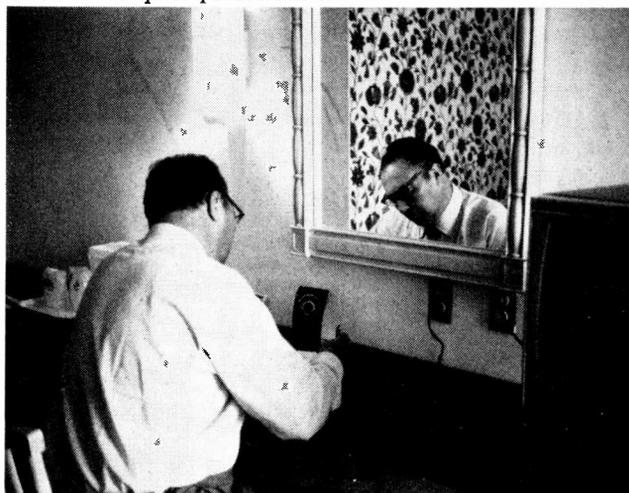
Frank J. Moch
Executive Director
NATESA

ISCET Holds Board Meeting In New Britain, Conn.

At this meeting it was indicated that details concerning the Associate Level CET exam are being asked for by many vocational schools. An Associate CET is one who has passed the general electronic portion of the CET exam not directly related to any specific field, such as consumer electronics.

When an Associate CET has completed four years of experience, he can then complete the CET exam for his field to become fully certified.

The new CET exam series was discussed. Many favorable comments were volunteered. The format and layout is felt to be quite professional.



Daniel Berestain in the process of taking a CET exam at the ISCET Board meeting in New Britain, Conn.

Plans for next year's convention were outlined to the board by Dick Glass, CET. Together with NEA, NATESA, and the Television Electronic Association of Louisiana, this August convention in New Orleans should be the first that will be representative of nearly the entire consumer electronic servicing field.

The ISCET has acquired more than 140 members since July 31, 1971. Society membership is over the 500 mark and is gaining momentum.

The executive director was asked to pursue CET examination promotion with the trade press and with electronic distributors.

Recognition was made of the ISCET of Oregon Chapter and authorization to issue the charter was adopted.

A report on the ISCET TECH (Technical Electronic Clearing House) was given. Ray Demonbrun of Kentucky will be gathering donated schematics, manuals, magazine and technical information for a library. The ISCET hopes to eventually be able to make this source of hard-to-find information available to anyone.

Ron Crow, CET
ISCET Executive Director

Thanks, Ron, for a fine meeting and report. I would like to say that a very interesting job is being done in the area of training and certification of technicians at the high school and vocational level. This is of great importance.

continued on page 54

Cut arc-back in TV damper circuits with RCA tubes...

6AF3

6AY3B

6BS3A

6CG3/6BW3

6CJ3/6CH3

6CL3

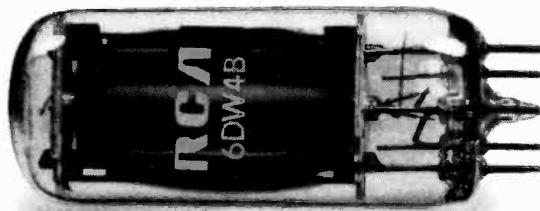
6DW4B

17AY3A

17BE3/17BZ3

17BS3A/17DW4A

All have the pre-coated cathode!



These are the 10 most popular industry types for TV damper circuits. The cathodes in these RCA tubes are pre-coated to reduce arcing.

A special manufacturing process pre-coats the cathode and pressure-welds the coating. This produces a smooth, uniform surface that virtually eliminates arcing.

In every way, the quality that goes into these tubes backs up your reputation for quality work. Systematic

parts inspection, tough environmental testing, sample life testing . . . these are some of the ways we build quality in and then check it out.

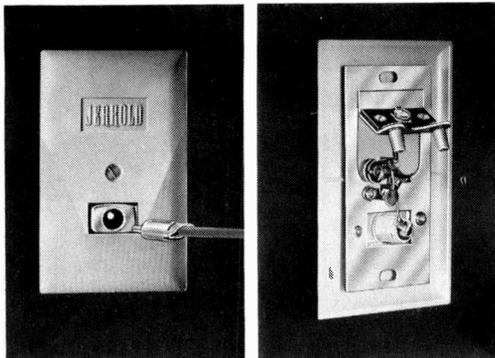
See your RCA tube distributor for the complete line of RCA tubes for damper circuits, high-voltage circuits and all your other tube needs.

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

RCA

NEW AND NOTEWORTHY

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



UNIVERSAL TAPOFF 701

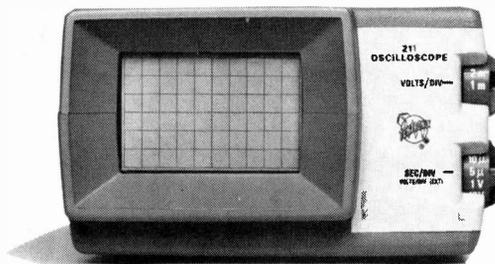
Features continuously variable isolation from 12dB to 23dB

A new all channel tapoff has been developed for use in any type of MATV system. Called OMNI-TAP, the unit features continuously variable isolation from 12dB to 23dB, and reportedly can be used in any TV outlet box, regardless of location in the building. When the system is installed, a potentiometer control built into each OMNI-TAP can be adjusted for signal equalization. This simplifies MATV design and installation, as well as reducing inventories. The unit also features universal cable bushings for the feeder cable connections. Accepting RG-59 through RG-6 size cables, the feeder cable connectors use a quick crimp for the shield and jacket, plus a single binding post for both center conductors. The unit provides a 75Ω output and is recommended for installations within 20 miles of a TV transmitter, with coaxial cable running to the TV set input for shielding from "direct pickup." Jerrold Electronics Corp.

CB TWO-WAY RADIO 702

Mobile 23 channel with scan alert

The Cobra 28, a new mobile CB two-way radio with exclusive Emergency Channel 9 Scan Alert, reportedly enables the operator to simultaneously monitor Channel 9 and any one of the other 22 channels of his choice. It automatically locks on to the first signal to come in, and once the signal has stopped, the receiver continues to scan both channels again. Scanning lights indicate the presence of the scanning mode. The unit is said to have a full 5w input power with Dyna-boost speech compression, RF noise blanker, automatic noise limiter, PA system output, Delta tune, channel indicator lights and Power/S meter. The receiver utilizes dual conversion for better selectivity. It measures 2½-in. by 6-in. by 8½-in., and weighs 4½ lb. to make installation easy in any car, truck or camper. The Cobra 28 operates on 12v dc, but may be used with the Dynascan PAC-24, a 117v ac optional power pack. It comes complete with plug-in dynamic microphone. Price: \$169.95. Dynascan Corp.



MINISCOPE 700

Operates from ac line or internal batteries

The Model 211 scope is reportedly all solid-state, is double insulated and has an integral 1M probe. Bandwidth is rated at 500kHz. Weighing 3 lb and measuring 3 by 5¼ by 9 in., the unit operates from ac line, or up to 5 hours on internal batteries. Deflection factors are said to be 1mv/div to 50v/div. Sweep rates extend to 1 μs/div. It is designed for field maintenance, and other applications where space and portability are primary considerations. Trigger controls are simplified to one rotary control. A bright baseline is provided at all sweep rates, even with no signal in. When a signal is received, the scope triggers on the signal. Internal and external trigger circuits reportedly provide stable displays from about 7Hz to 500kHz. Some applications do require an adjustable trigger level. Turning the control clockwise causes the scope to trigger on the positive slope of the triggering waveform. Rotating the control further clockwise causes the scope to trigger on the negative slope of the triggering waveform. The unit is equipped with an integral flip stand which tilts the scope to a convenient viewing angle for bench-top operation. Price: \$545.00 (includes batteries). Tektronix, Inc.



**FOR MORE
NEW PRODUCTS
SEE PAGE 53**

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Request it from us, and that's the way you'll get it. We've made it our business to see that all the orders we fill are delivered on the double!

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For a third thing, by hiring highly conscientious people who know time is money and see to it no time is wasted in expediting your shipment.

All in all, when it comes to making

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For more information, contact your local stocking Columbia distributor. Columbia Electronic Cables, 11 Cove Street, New Bedford, Massachusetts 02744 (Phone: 617-999-4455 • Telex: 929411). California: 1950 Naomi Avenue, Los Angeles, Cal. 90011.



Columbia Electronic Cables

Jack Darr's Service Clinic No. 2

Jack Darr's SERVICE CLINIC NUMBER 2



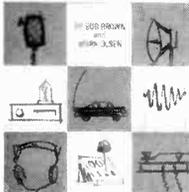
Here's more of the Jack Darr wisdom (and wit!) in book form—a valuable collection of timely service hints and trouble solutions covering color and monochrome TV, radio, stereo, phono, recorders, CB gear, etc. Discusses the "engineering" servicing approach, efficiency, and how a technician may condition his thinking to produce more in a given time period. Like the first volume, the content was selected on the basis of usefulness to the average technician, covering a wide range of electronics devices. Each of the 10 chapters covers a general category of interest, and in each the subject matter is arranged in logical order to enable you to find what you need quickly. Not only provides a wealth of information, but also hours of enjoyable reading. 176 pps., numerous illus. Hardbound.

List Price \$7.95

Order No. 566

64 Hobby Projects For Home & Car

64 HOBBY PROJECTS FOR HOME AND CAR



Here's a variety of gadgets bound to please almost everybody—from the hobbyist and experimenter to the engineer who likes to make things in his home workshop. From an auto ice alarm to a vibrator rejuvenator, from an amazing electric candle that lights with a match to a splash alarm for the swimming pool, there's a host of fun-to-build devices, many of which are quite unique. Some are simple, while others are more involved. Some you can put together in less than an evening; others offer more of a challenge. For the home there are 28 individual projects, for the car a total of 36, each accompanied by a schematic and or pictorial diagram and parts list. If you like to build, here's a fine collection of practical projects with everything worked out for you except the fun! 192 pps. Hardbound.

List Price \$6.95

Order No. 487

How to Use Test Instruments in Electronics Servicing



A long-needed, practical handbook on test equipment applications—ranging from the use of audio gear to tube and transistor checkers. Just what you need to put your test equipment to work. Not a "how-it-works" treatment, but a "how-to" manual describing specific tests and troubleshooting techniques for the electronic technician. You'll discover new ways to use your scope and several new "tricks" you can perform with multimeters. You'll learn signal-injection troubleshooting, how to measure inductance and capacitance with the help of your signal generator, pointers and pitfalls for using markers, sweeps and pattern generators, shortcuts and special techniques for color TV troubleshooting, how to test audio circuits and FM stereo equipment, and much more. 256 pps., over 200 illus. Hardbound.

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Electronic Circuit Design Handbook



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

List Price \$17.95

Order No. T-101

Handbook of Semiconductor Circuits



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

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Order No. G-30

Modern Electronic Troubleshooting

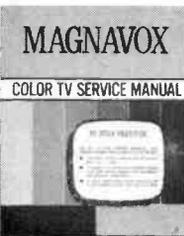


A down-to-earth handbook that deals with today's electronic servicing problems on a practical level, using modern test instruments and advanced troubleshooting procedures to cope with the special problems created by printed boards and solid-state circuitry. It is hard to conceive of a book that encompasses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

List Price \$7.95

Order No. 474

Magnavox Color TV Service Manual



All the data you need to repair Magnavox color TV receivers—from the Series 37 to T940 chassis—including 12 full-size schematic diagrams complete with oscilloscope waveforms. Singled out for special treatment is the Magnavox T936 hybrid chassis. The special servicing data given will enable you to master this unique chassis. Also

included are 34 tuner schematics, and a host of case history solutions and factory modifications. You'll find numerous alignment shortcuts and tips on troubleshooting tricky solid-state circuits. In addition, as a bonus there are chapters on general color TV troubleshooting, antennas and transmission lines, and another on test equipment techniques. 160 pps., 8½" x 11", plus 36-page foldout section containing 12 full-size schematic diagrams. Long-life vinyl cover.

List Price \$7.95

Order No. 526

How to Use Vectorscope-Oscilloscopes, Sweep-Marker Generators

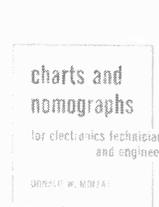


At last, a practical guide that tells how to use modern TV test instruments. Scope types and specifications are covered, including DC dual-trace amps, and probes. Thoroughly explains vectorscopes, with details on vector timing charts, demodulated patterns, phase and frequency measurements; practical oscilloscope applications, encompassing how to make peak-to-peak and DC measurements, time-base measurements, video and sync waveform analyses; sine, square, and triangular wave testing; using the new push-button signal & sweep-marker generators; vectorscope troubleshooting and alignment techniques; how to isolate defective ICs and transistors, using as examples more of the current modular TV circuits. 256 pps., over 225 illus.

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Order No. 550

Charts & Nomographs for Electronic Technicians & Engineers



Saves you hours of time and trouble by giving you instant solutions to hundreds of electronic problems. Even if you are highly proficient with a slide rule, finding the solution to everyday problems requires quite a bit of time. With this book, all you do is turn to the appropriate chart and use a straight-edge to determine the answer. In most cases the answer is given in its final form and determination of decimal points is unnecessary. Moreover, you can easily determine the effect of changing values just by pivoting the straight edge. What's more, the final Chapter shows you how to solve almost any electronic equation graphically; thus, you can make up your own special nomographs and charts to suit repeated specific needs. Large, easy-to-read scales, BIG 8½" x 11" format. Comb-bound.

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Universal tap simplifies MATV design

by Bert Wolf

Manager Jerrold DSD/ECSD Division

Until now, MATV system design has been somewhat complex. You had to calculate losses in decibels and specify a fixed tap-off isolation value at each receiver location.

The new Jerrold OMNI-TAPs have changed all this. OMNI-TAPs are universal. That is, *any* OMNI-TAP can be used *anywhere* in *any* MATV system. The secret is adjustable isolation, which you can vary simply by turning a screwdriver after the system has been installed.

Aside from simplifying system design, OMNI-TAPs also reduce your inventory problems. Since OMNI-TAPs can be varied continuously over a 12 to 25 dB range, one type of OMNI-TAP replaces three types of conventional tap-offs.

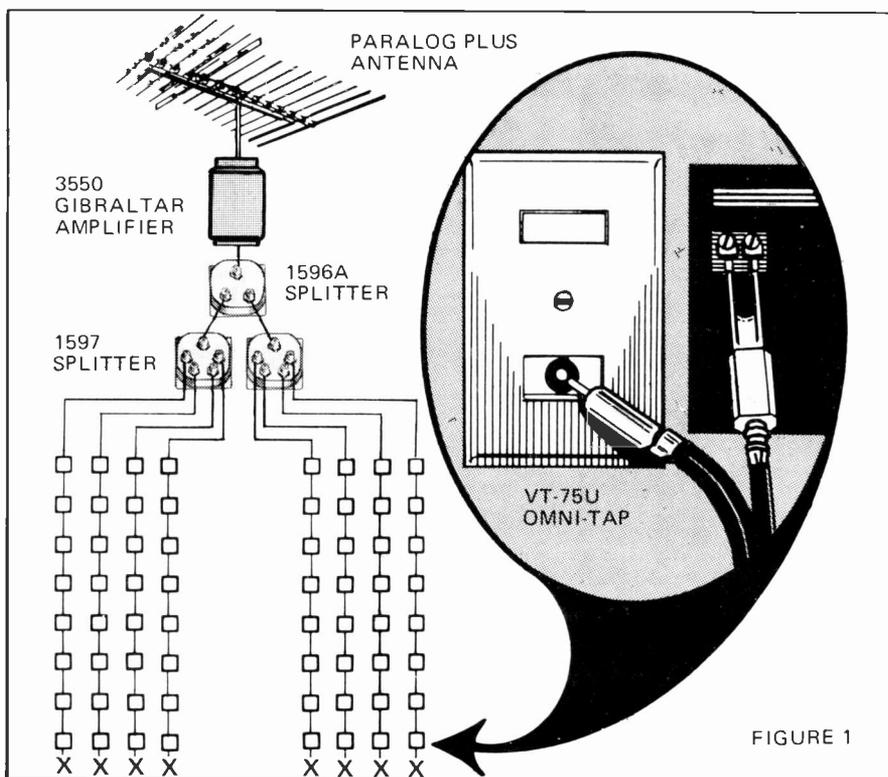
Figure 1, for example, shows a typical 8 story apartment house, older school or hotel, with eight TV outlets per floor. OMNI-TAPs are used for every TV outlet. Because tap insertion loss is very low (average about 0.6 dB per tap at VHF), isolation is adjustable, and Jerrold CAC-6 cable loss is minimal, (3.2 dB/100' at VHF), your system calculations are greatly simplified. Just use a Jerrold Gibraltar 3550 amplifier, fed by a Paralog Plus antenna. A new motel or school would be similar, except that trunklines would be run horizontally.

If your particular system is smaller, reduce the number of trunklines and tapoffs, but nothing else. The 3550 is economical enough even for small systems. If the system is bigger, add trunklines and tap-offs, but nothing else. The 3550 can easily handle up to 100 OMNI-TAPs. (For systems over 100 tap-offs, use the 3661 or 3880.)

Choose the antenna as you would an ordinary home TV antenna, except that it usually pays to choose the next larger model. If signals are weak, simply add a Powermate preamplifier.

Figure 1 is a VHF-only system. But adding UHF channels is no problem. Simply use a VU-FINDER PLUS antenna instead of the PARALOG PLUS, and a 4400 82 channel amplifier in place of the 3550. No other changes are required because the OMNI-TAPs,

the splitters and the cable can handle UHF frequencies with no difficulty.



Adjusting Omni-Tap Isolation

Once the system is installed, you have to make sure it works properly. In many cases, no adjustments will be necessary. The OMNI-TAPs will work fine in the system just as you receive them.

In large systems, however, you will have to adjust the OMNI-TAPs so that they provide more isolation near the Head End amplifier than they do at the ends of the trunklines.

There are two ways to adjust OMNI-TAP isolation:

1. With a Field Strength Meter, such as the Jerrold 747. You should have a Field Strength Meter for MATV work anyhow, and this is the easiest way to adjust OMNI-TAP isolation.

Start by turning all of the OMNI-TAPs fully clockwise, for

maximum attenuation. Then, go to a tap in the middle of the trunkline and make sure you can read at least 1000 microvolts of picture carrier signal on the highest channel the system carries. If the reading is less than 1000 microvolts, turn the OMNI-TAP counterclockwise until you get 1000 microvolts. Repeat for each tap until you get to the end of the line.

2. With an Ohmmeter. Connect the Ohmmeter between the arm of the OMNI-TAP potentiometer and the center conductor of the tap output. Set the first four OMNI-TAPs in each trunkline (nearest the Head End) to 700 ohms. Set the next two OMNI-TAPs in each trunkline to 500 ohms. Then, reduce each tap-off in the line by 100 ohms until you get to the end of the line.

For help in laying out a system or solving specific system problems, contact Jerrold via your local Jerrold distributor.

Or, for more information on MATV systems, write Jerrold Electronics, P.O. Box A, Philadelphia, Pa.

TEKLAB REPORT

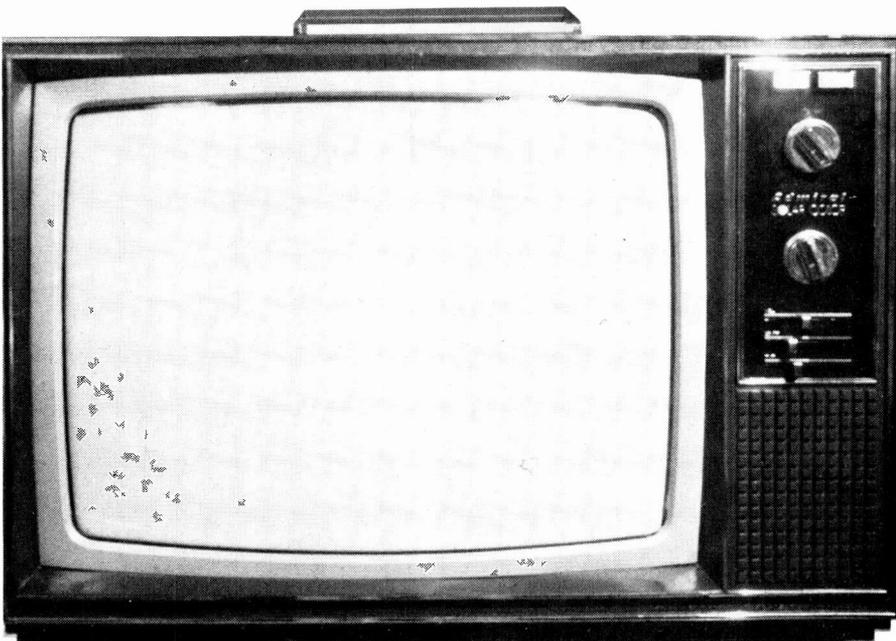
Admiral's Color-TV Chassis K18

by Joseph Zauhar

Now a single touch of a switch fine tunes the picture and corrects the fleshtone colors

■ According to national color-TV set sales reports, the trend is going towards large-screen portables and away from color-TV console sets. Many retail TV-set dealers feel that the large screen color-TV portables will be one of the hottest selling items for the Christmas holiday season. The increase is possibly due to the lower price and portability of the set.

Admiral added another set to the color parade by introducing its Model 19T111C color-TV set with the 1K18-1A chassis. It includes a deluxe decorator TV cart. The TV set has a 19-in. (measured diagonally) Solarcolor black matrix color picture tube.



Admiral's Model 19T111C Color-TV set employing the 1K18-1A chassis.

Viewing the TV set from the front we noted a new AUTOMATIC FINE TUNING and COLOR MONITOR control. A single touch now automatically fine tunes the picture and "locks in" flesh tone shading. The VOLUME, TINT and COLOR controls are of the slide throttle type. To give the control panel the uncluttered look, the VERTICAL, CONTRAST, BRIGHTNESS and HORIZONTAL controls are hidden under the front bottom edge of the cabinet.

For added servicing convenience, the cabinet bottom is removable for component or fuse replacement. The etched and copper-bonded circuits are road-mapped on both sides for test-point and component identification.

The K-18 Solarcolor chassis is a hybrid type employing both tubes and transistors. Solid-state components are said to be used in critical circuit areas for a higher degree of efficiency and reduced power consumption. A three-stage IF amplifier circuit with solid-state video and sound detectors is used to improve picture quality in weak signal areas. The horizontal output tube cathode current is fed through a winding in the dual-function circuit breaker for full overload protection.

Other features include: keyed automatic gain control, instant play, advanced high voltage sweep transformer, automatic degaussing, "anti-pin cushion" yoke winding, and a solid-state low level demodulator circuit.

As we review these important cir-

cuits, they can be followed in this month's Tekfax schematic No. 1391.

Noise Gate Circuit

The solid-state noise gate circuit (Fig. 1) in this chassis employs one transistor and one diode. Capacitor C355 and resistor R333 provide the bias voltage which keeps the transistor in a cut-off condition for any signal of less amplitude than the sync pulse.

Diode D302 allows capacitor C355 to charge through resistor R331 and prevents the discharging of the capacitor through the same path, forcing it to discharge through resistor R332.

Any noise spike of greater amplitude than the sync pulse will cause transistor Q301 to conduct, consequently shorting its collector to ground through the transistor. At this same instant, the same noise spike is present at the collector of transistor Q301 through resistor R314 and coil L312 and is consequently decoupled to ground through transistor Q301. This action provides a virtually noise-free signal for the composite signal amplifier tube, V302C.

control grids of the B-Y and R-Y color amplifiers through resistors R749 and R750. Then the phase shift occurs, producing a corrected phase shift which restores hues to their proper phase angles.

If the fleshtone color is correct, there is no error signal and no correction takes place, since all colors, other than the ones which are 90° or 270° from Q, will produce an error signal and all colors are affected by this action.

There are vertical and horizontal blanking pulses present in the R-Y and B-Y signals fed to the color monitor circuit through resistors R751, R749; and capacitor C738 provides cancellation of these pulses.

Resistors R751 and R752 are connected directly to the blue and red picture tube control grids. This configuration is used because of the

dc component constituted in the RC coupling networks of the color difference amplifier plate circuits. This dc component of the coupling networks would not be detected if R751 and R752 were coupled to the color difference amplifier plates.

Color Difference Amplifiers

The color difference amplifiers in this chassis are contained in a 6AC10 three section triode tube. The primary purpose of the difference amplifier is to amplify the demodulated chroma signal to a level sufficient to drive the picture tube.

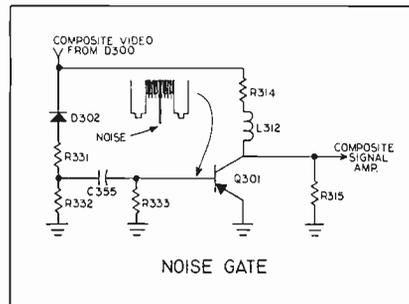


Fig. 1—A simplified schematic of the solid-state noise gate circuit employing one transistor and one diode. Courtesy of Admiral Corp.



Fig. 2—Front control panel showing the new AUTOMATIC FINE TUNING/COLOR MONITOR control (top right). The VOLUME, TINT and COLOR controls are the slide throttle type.

Color Monitor

The AUTOMATIC FINE TUNING (AFC)/COLOR MONITOR Control (Fig. 2) located on the front panel of the TV set, serves two purposes. With a single touch, the control automatically fine tunes the picture and "locks in" your preferred fleshtone shading.

The color monitor input circuit is a matrix type, and the output produces a resultant correction signal, which is fed back to the demodulator's output to restore proper color phase.

Output color signals from the R-Y and B-Y amplifiers are coupled through resistors R752 and R751, producing a positive or negative error signal along the Q axis (Fig. 3 and 4). This error signal is coupled to the color monitor transistor Q700 through capacitor C737 and resistor R747.

Being connected in an emitter-follower configuration, transistor Q700 provides impedance matching and couples the error signal to the

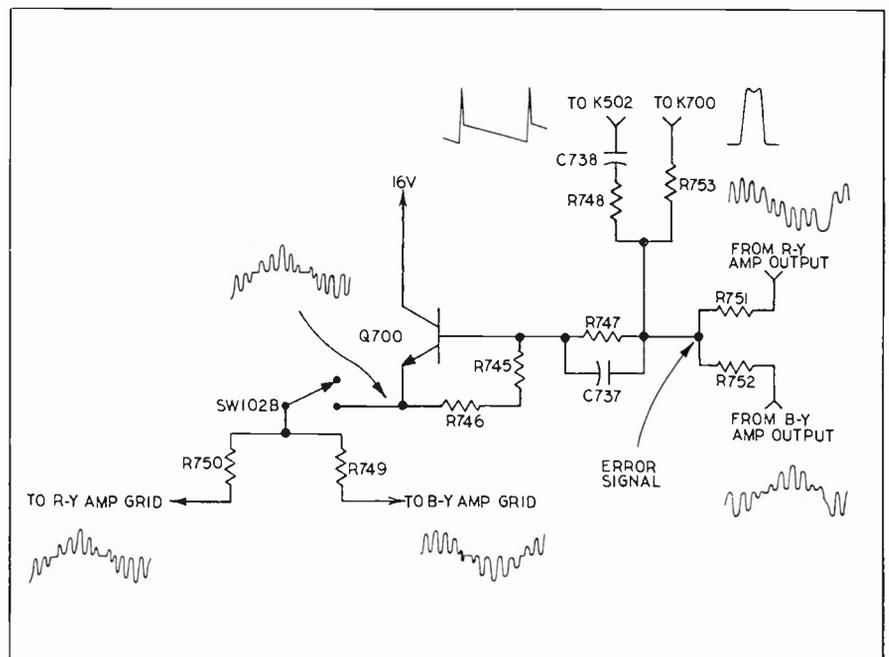


Fig. 3—Schematic of the matrix-type color monitor circuit, which produces a correction signal fed back to the demodulator's output to restore proper color phase. Courtesy of Admiral Corp.

(See this month's Tekfax Schematic No. 1391.)

R-Y and B-Y signals are coupled from the demodulators to the R-Y and B-Y amplifier control grids. Voltages of unequal amounts are coupled to the control grids provided by the bias bleeder network, consisting of resistors R713, R714, R715 and R716 in the demodulator sections. Color monitor error signals are coupled to the controls grids of the R-Y and B-Y stages.

The G-Y signal is recovered from the common color-difference amplifier cathode resistors, R727 and R730. Since this signal is coupled to the grounded grid G-Y amplifier cathode, no plate phase shift takes place. This provides the correct signal polarity and it is coupled to the picture tube green control grid.

Picture tube retrace blanking is accomplished by negative vertical and horizontal pulses coupled to the color difference amplifier cathodes and is obtained from the vertical and horizontal output transformers. The negative pulses present on the cathodes allow the color-difference amplifiers to conduct heavily, lowering their plate voltages and biasing the picture tube to a cut-off condition. The plate circuits of the color difference amplifier tube V700 employs partial dc coupling. Resistors R726, R728 and R731 couple the dc component while capacitors C726, C727 and C729 derive the signal coupling components.

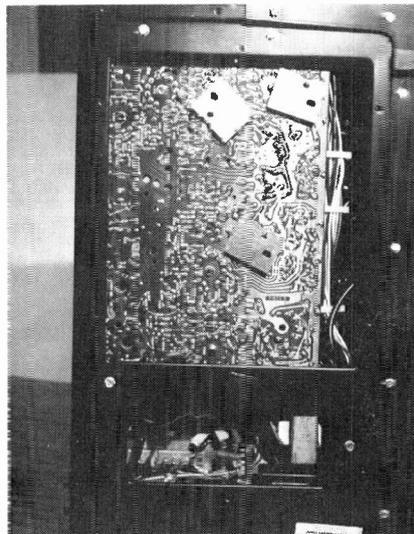
The R-Y and B-Y signals are fed from the picture tube control grids to the color monitor circuit. The resultant error signal is fed back to

the R-Y and B-Y amplifier and control grids.

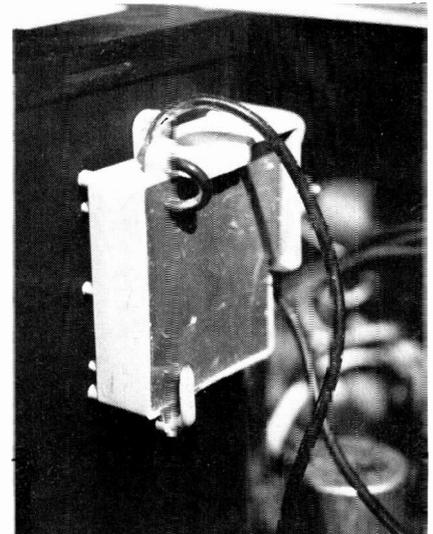
Chroma Amplifier and Automatic Chroma Control

The chroma amplifier stage consists of one pentode section of an 8CB11 tube. (Again see this month's Tekfax Schematic No. 1391.) Chroma signal is coupled from the emitter of transistor Q300 to the chroma amplifier tube V301B control grid through T700 (chroma take-off transformer) with a tuned second-

ary circuit. This tuned circuit couples only the color side bands and high frequency video information. Then the color signal is amplified, passed on through T701 (chroma bandpass transformer) to the burst gate cathode and color control. The color control divides the chroma signal, and its setting establishes the desired level coupled to the demodulators. Transformers T700 and T701 establish the bandwidth of the color bandpass system, passing only those frequencies de-



The bottom of the set has a removable screen to eliminate chassis pulling for most component replacement.



Admiral's new focus module provides a sharper picture under all contrast and brightness levels.

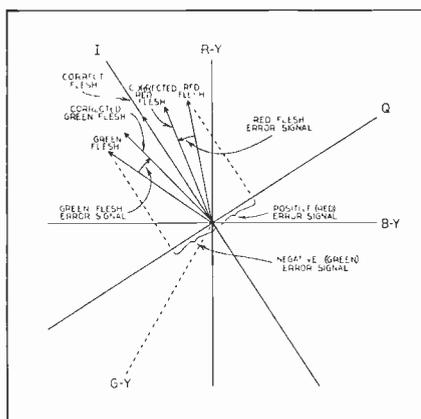
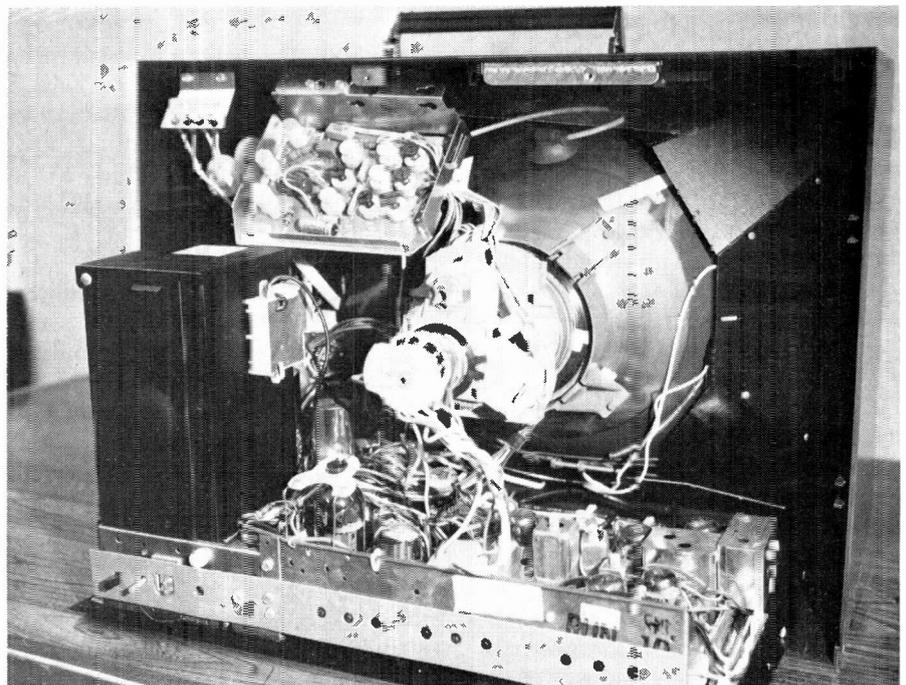


Fig. 4—Vectors indicate the results of the chroma phase shifts in Admiral's color monitor circuit. Courtesy of Admiral Corp.



Rear view of the Admiral 1K18-1A color-TV chassis, which is exposed after removing the cabinet back.

sired in the color bandpass spectrum.

Automatic chroma control (ACC) is provided by the ACC diode D705, resistor R744, capacitor C736 and resistor R743. Burst signals from TP703 are coupled to diode D705, which provides a rectifying action, charging capacitor C736 and producing a negative dc voltage. This voltage is applied to the control grid of V301B through the secondary winding of the chroma take-off transformer T700, controlling its gain. If there is an increase in the chroma signal, the burst signal would also increase, producing a negative voltage, which reduces the chroma amplifier tube (V301B) gain. If there is a decrease in chroma signal, the opposite sequence takes place.

Color Demodulation

The demodulator circuits consist of two phase sensitive detectors employing two diodes in each section (Tekfax Schematic No. 1391). These diodes are switched by a zero and nominal 100° phase shifted 3.58 MHz subcarrier signal. This operation allows separation of chroma information from the color sidebands. A 3.58MHz phase establishment is obtained through the chroma demodulator transformer T703.

This transformer consists of one primary and two secondary windings. The top secondary winding (Terminals No. 5 and 6) is loosely coupled, providing a nominal 100° phase shift with respect to the primary; while the bottom winding (Terminals No. 3 and 4) is tightly coupled, providing a 0° phase shift. The adjustment of the top secondary winding establishes the demodulation angle.

The chroma signal is coupled to the R-Y and B-Y demodulators through capacitors C717, C720, coil L700 and the COLOR control (R131). The COLOR control adjusts the amplitude of the color signal to provide COLOR INTENSITY control.

We find two signals (Fig. 5) one of chroma and one of 3.58MHz, used for the biasing of diodes D703 and D704, and which provide a resultant output. Forward bias is required to allow conduction of either diode D703 or D704, which means the anode must be positive with respect

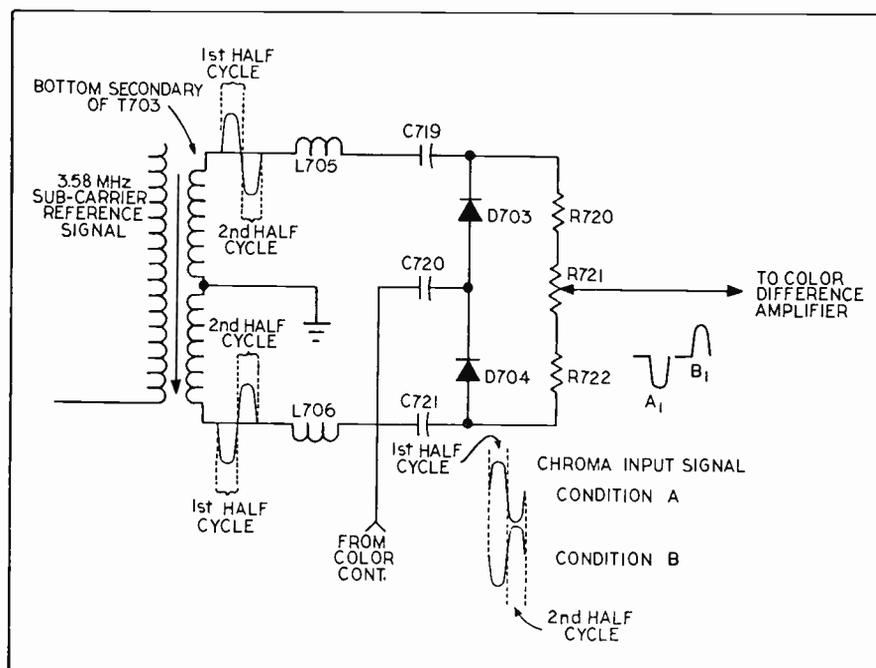


Fig. 5—The color demodulator circuits consist of phase sensitive detectors employing two diodes. Courtesy of Admiral Corp.

to the cathode. Of the two input signals, the 3.58MHz subcarrier, being the reference signal, is constant whereas the chroma signal varies in amplitude and phase, depending upon the color information being received. Each diode conducts for 180° or one-half of the input sub-carrier cycle.

Horizontal Output System

The K18 color-TV chassis employs a 24LQ6 tube for the horizontal output, a 3DF3 tube for high-voltage rectification, and a 12CL3 damper tube.

The horizontal oscillator's positive drive sawtooth is coupled to the horizontal output tube (V503) control grid through capacitor C524. Negative control grid voltage is supplied from the voltage produced across voltage dependent resistor (VDR) RV102 and potentiometer R112, by the charge current of capacitor C116. During conduction time (one-half trace time) of V503, a magnetic field builds up in the high voltage transformer T103, which provides the sawtooth current for the horizontal deflection coils. During the sharp cut-off interval of V503, this field collapses, producing a large positive pulse, which is rectified by the high-voltage rectifier tube (3DF3A), to provide second anode and focus voltage. At the time the

pulse returns to 0v, the damper tube (V504) conducts, removing unwanted oscillations or ringing and providing the first half of the horizontal sweep field.

This large pulse from the collapsing field provides the keying pulses and horizontal retrace, as well as the B+ boost source.

The winding configuration between Terminal No. 14 and ground in the high-voltage transformer supplies a negative pulse used for horizontal retrace blanking. A clamping diode, D106, is reverse biased with the negative pulse, but forward biased to remove positive unwanted oscillations or ringing at this point. This operation provides a clean, negative, retrace blanking pulse to maintain proper operating characteristics. The horizontal retrace blanking pulse is coupled to the color difference amplifier cathodes through capacitor C527 and resistor R537.

The focus voltage is obtained from the voltage dividing bleeder network, consisting of resistors R119, R120, R121 (focus control) and R136. This network is in parallel with the second anode voltage and "taps off" a portion of the 25kv high voltage supply, which is fed to the focus anode element in the picture tube.

continued on page 62

Heath's AR-1500 Receiver—Part II

by Phillip Dahlen

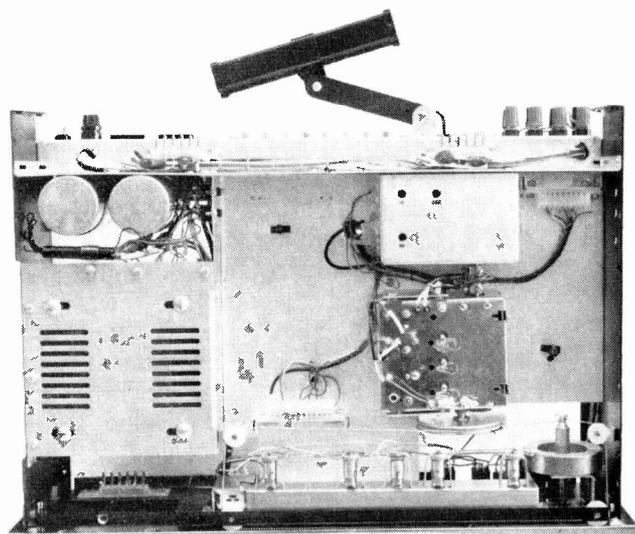
More information concerning the interesting features found in this sophisticated audio product

■ Last month's article told of the high AM and FM sensitivity observed while using this receiver, demonstrated the use of the receiver's scope terminals and showed the excellent response to 20Hz and 20kHz square waves fed through the audio amplifier. Now we will list many of the interesting features that we observed in this receiver, plus the manufacturer's specifications.

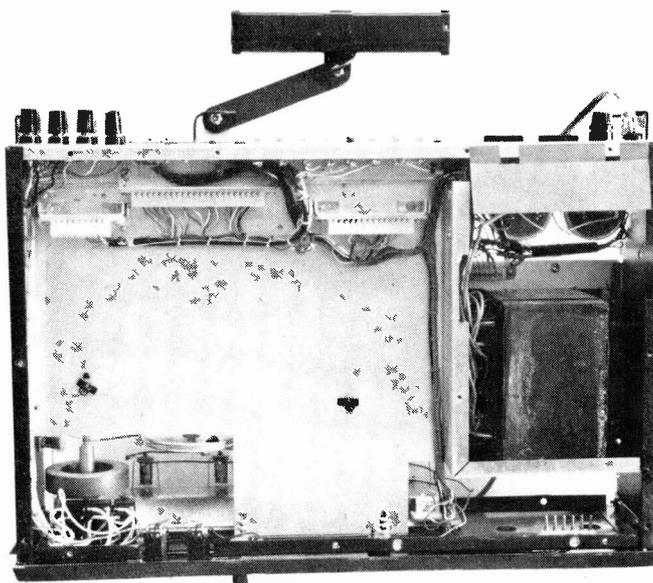
Receiver Features

Front controls are provided on the receiver for **AM-FM tuning**, **volume** (the sound level for both headphone and speaker channels, simultaneously), **balance** (movement to left of center decreases right channel output, while movement to right of center decreases left channel output), **treble** (movement to right of center produces treble boost, while movement to left of center produces treble attenuation), and **base** (movement to right of center produces base boost, while movement to left of center produces base attenuation).

Front-panel switches include **tone flat** (TREBLE and BASE controls function when the switch is in its OFF position, while both channels have a flat frequency response when it is in its ON position—the square waves were observed when this switch was in its ON position), **loudness** (when in the ON position, it compensates for the nonlinear characteristics of the human ear at low-volume levels), **blend** (reduces high-frequency noise from FM stereo signals with possibly some loss of stereo separation), **monaural** (when in the ON position, it combines the selected signals, feeding the resulting signal to both speakers), **tape monitor** (when in the ON position, the original program material is disconnected from the output amplifier circuits and is monitored by this amplifier off the tape recording—provided the recorder has separate record/playback heads), **tape** (this switch selects tape program material), **auxiliary** (this switch selects auxiliary input program material), **phonograph** (this switch selects phonograph input program material), **AM** (this switch selects AM radio program material), **FM Stereo** (this switch permits tuning in only those FM stations that are transmitting a stereo multiplex carrier signal), **FM Automatic** (this switch permits tuning in all FM stations, providing stereo reception when the multiplex carrier signal is received), **Speaker 2** (connects left and right channels to one pair of speakers), **Speaker 1** (connects left and right channels to another pair of speakers—both sets of speakers can be used at the same time if desired), and **Power** (turns ON or OFF the receiver



Top view of receiver chassis with circuit boards removed.



Bottom view of receiver chassis with circuit boards removed.

er and one of the two ac power outlets at the back of the receiver).

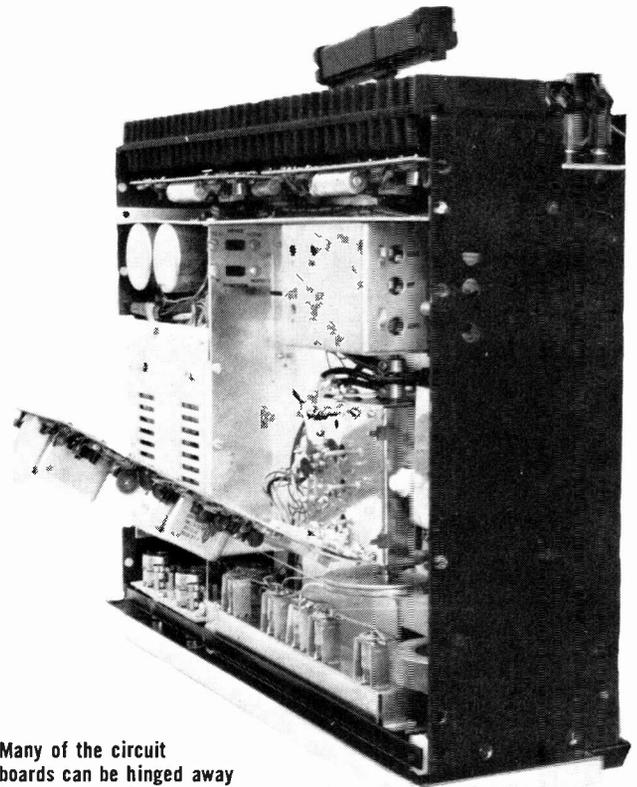
Next to the **stereo-earphone jacks** (which remain ON whatever the speaker selection) there is a **squelch control**, which will determine the noise level at which the FM tuner will squelch (this circuit is also designed to switch

OFF the audio signal whenever the discriminator voltage indicates that the tuner is not tuned to the approximate frequency of an FM station).

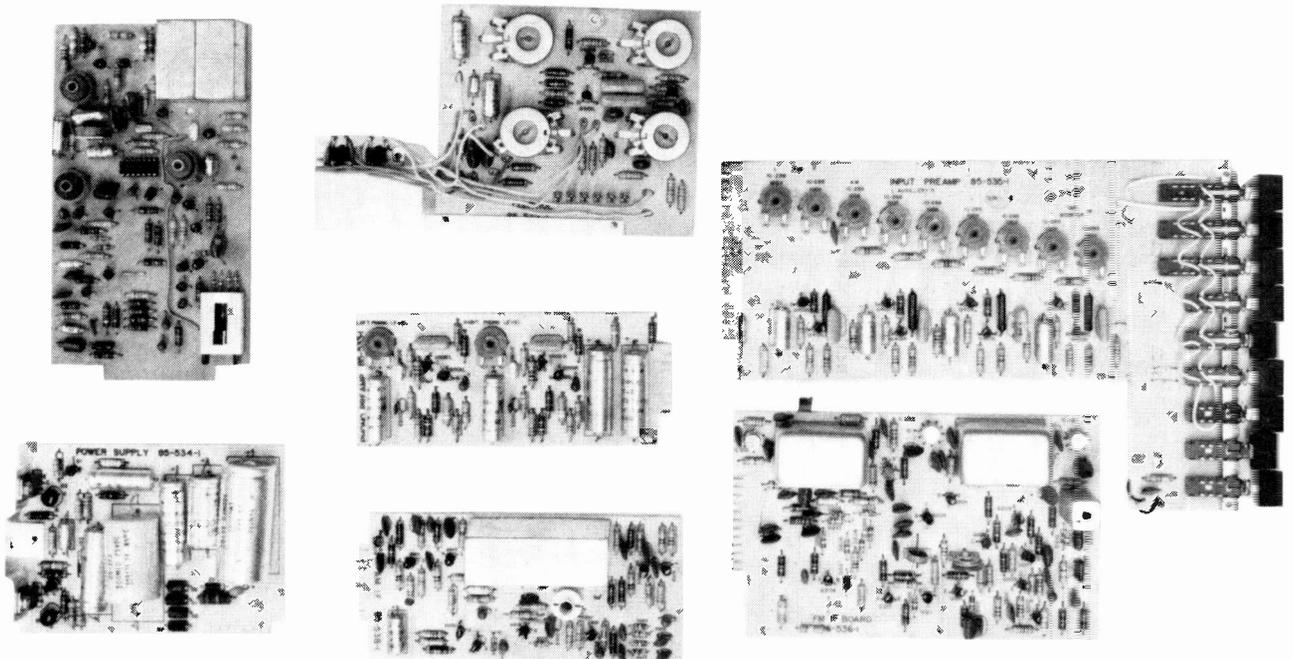
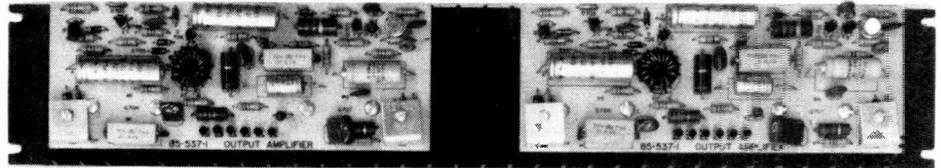
On the front panel there is also a **dial scale** to indicate the frequency of the AM or FM station received, a **tuning meter** to assist in accurately tuning to the frequency of the FM station signal received, a **signal meter** to indicate the relative strength of AM and FM station signals, and an **FM stereo indicator lamp** to show when an FM stereo multiplex carrier signal is present.

When switching between the various modes of operation, it is desirable to maintain the same output signal level. For that reason, separate controls are provided under the receiver for adjusting each of the following inputs: phono right, phono left, FM left, FM right, AM auxiliary left, auxiliary right, tape left, tape right, tape monitor left and tape monitor right.

At the rear of the receiver there are four terminals for the left and right speakers in speaker system one, four terminals for the left and right speakers in speaker system two, a 300Ω FM antenna terminal, a 75Ω FM antenna terminal, a ground terminal, an AM antenna terminal, and left and right channel terminals for the phonograph input, auxiliary input, tape recording, tape monitor, tape output, preamplifier output and power amplifier input. Scope horizontal and vertical sweep terminals are also included. All of this plus the AM rod
continued on page 67



Many of the circuit boards can be hinged away from the chassis as well as unplugged.



Circuit boards used in Heath's AR-1500 receiver. Top: Left and right channel output amplifier circuit boards mounted on heat sink. Middle right: Input preamplifier circuit board. Bottom right: FM-IF circuit board. Bottom center: AM-IF circuit board. Bottom left: Power supply circuit board. Top left: Multiplex circuit board. Top center: Control circuit board. Lower center: Phonograph preamplifier circuit board.

TABLE I
Model AR-1500 Receiver Test Report

Description	Specifications	Test Results
Amplifier		
IHF Power (both channels simultaneously) at 0.25% THD		
Left channel across 8Ω load	90w	99.4w
Right channel across 8Ω load	90w	101.5w
IHF continuous power at 0.25% THD		
Left channel across 8Ω load	60w	85.8w
Right channel across 8Ω load	60w	85.8w
Damping factor at 1kHz		
Left channel	60	>73
Right channel	60	>73
Phono sensitivity to obtain 60w of output power per channel across an 8Ω load		
Left channel	1.8mv	1.8mv
Right channel	1.8mv	1.8mv
Phono overload using input level controls		
Left channel	145mv	147mv
Right channel	145mv	146mv
Auxiliary sensitivity to obtain 60w of output power per channel across an 8Ω load		
Left channel	140mv	139mv
Right channel	140mv	140mv
Auxiliary overload using input level controls		
Left channel	>10v	>10v
Right channel	>10v	>10v
(Other inputs have same sensitivity and overload as auxiliary input)		
Tape output		
Left channel	900mv	940mv
Right channel	900mv	940mv
IM distortion with 1w output		
Left channel	<0.1%	0.007%
Right channel	<0.1%	0.008%
IM distortion at rated output (18.2v)		
Left channel	<0.2%	0.008%
Right channel	<0.2%	0.01%
Hum and noise with shorted phono input		
Left channel	63dB	63dB
Right channel	63dB	65dB
Hum and noise with shorted auxiliary input		
Left channel	75dB	76dB
Right channel	75dB	78dB
Auxiliary frequency response with 1w output		
Left and right channels	—1dB from 10Hz to 80kHz	—1db from 5Hz to 100kHz
AM Tuner		
Sensitivity: 20dB S-N/N		
Manually aligned—using radiating loop		
600kHz	<300μV/M	110μV/M
1000kHz	<300μV/M	215μV/M
1400kHz	<300μV/M	128μV/M
Instrument aligned—using 200pf dummy antenna		
600kHz	50μV/M	20μV/M
1000kHz	50μV/M	18μV/M
1400kHz	50μV/M	6μV/M
FM Tuner		
Sensitivity for 3% THD or 30dB quieting	1.8μV	1.6μV
Selectivity (6dB below limiting—tuned to 98MHz)	90dB ± 400kHz	104dB ± 400kHz
Image rejection (IR = 2(IF) + FT = 2 (10.7MHz) + 98MHz = 119.4MHz)	100dB	100dB
Capture ratio $\left(CR = -\frac{1\text{dB level} - 30\text{dB level}}{2} \right)$	1.5dB	1.4dB
IM distortion (1000μV input at 98MHz)	<0.1%	0.06%
FM stereo channel separation		
50Hz	35dB	34dB
10kHz	25dB	24dB
15kHz	20dB	20dB
19kHz and 38kHz suppression	≥55dB	63.5dB
SCA suppression	55dB	61dB

Semi-Tips Part IV

by Jack Jaques

This is the fourth article in a series intended to aid and guide the electronic technician in using replacement semiconductors to their fullest advantage. This month's article refers specifically to the "small-signal" bipolar transistor, which is defined as having a maximum collector current of less than 1a and/or a maximum power dissipation of less than 1w. The device may be either silicon or germanium, PNP or NPN, in any one of a large variety of case styles, and probably marked with some particular number (or group of numbers) that means absolutely nothing to anybody except the original manufacturers.

■ Arbitrary transistor numbering, along with the many foreign types, undoubtedly causes most of the confusion and headaches for the service-technician when he is faced with replacing a defective device. It is for this basic reason that a number of reputable manufacturers offer semiconductor replacement lines (such as Motorola's HEP line), which selects specific devices that are compatible with an "equal-or-better" marketing and cross-referencing philosophy. While this philosophy appears good on the surface, and is very strictly adhered to during actual cross-referencing, the primary requirements of intelligence and patience on the part of the service-technician still remain. It is this portion of the replacement effort that will be covered here, as well as methods of determining adequate replacements for devices that are not covered by the current cross-reference guide.

Considering devices that are listed in the cross-reference guide, it must be assumed that the replacement device is adequate from the standpoint of all electrical parameters as well as power dissipation and operating frequency. However, there is the possibility that the case styles may be different, and that adjacent components might require slight moving.

The author is HEP technical manager of Motorola Semiconductor Products, Inc., Phoenix, Ariz.

Most important, it *must* be determined that the replacement device goes into the circuit exactly as the original: i.e., collector to collector, base to base, emitter to emitter. A point should be made that although the two devices may be in the exact same case style, the basing can be quite different.

The most common basing configurations are EBC, ECB, BEC, BCE, CEB, and CBE for three-lead devices; and EBC Case, EB Case C, BEC Case, B E Case C, ECB Case, and EC Case E for four-lead devices (all as viewed from the bottom in a left to right or clockwise manner). In most cases, it is a simple matter to bend and twist the leads in such a manner that they will conform to the required configuration. It is quite obvious that a reliable circuit schematic must be followed in order to assure proper connections.

Quite often metal cases (TO-5, TO-18, TO-39, TO-72, etc.) will have one of the elements electrically connected to the case. This connection should be verified with an ohmmeter and the proper steps taken to completely insulate the case from other circuit components. Some of the newer types of plastic spaghetti are excellent for this purpose, or they may be wrapped with plastic electrical tape.

Since the electrical characteristics of the device to be replaced are considered of prime importance, it will often be found that the case style of

the replacement does not even resemble the original. However, this factor should very rarely cause difficulty, other than a slight relocation of adjacent components.

Occasionally it will be found that even though the foregoing procedures have all been carefully adhered to, and that the replacement device was the one recommended by the cross-reference guide, the circuit still does not operate correctly, may not even operate at all, or will operate for a short period of time and then cut out or fail completely. This fact can then probably be blamed on either one or both of two possibilities:

A transistor must be biased correctly if it is to function properly. Assuming that the bias voltage and current specifications are not available, it then becomes a matter of empirically (trial and error) adjusting the biasing resistors in the circuit itself. Generally this task can be performed quite successfully by using one or more resistor substitution boxes and a milliammeter. At this point, the published specifications of the substitute transistor involved should be reviewed to make certain that *none* of the maximum ratings are exceeded. By connecting a milliammeter into the collector circuit, varying the substitution resistance values, and monitoring the results, a very satisfactory replacement can almost always be achieved. Monitoring techniques will naturally vary from circuit to circuit. However, the most common methods include a scope, the human ear, and a VTVM (or FET VOM).

The results should provide a circuit wherein the transistor(s) is operating well below the actual maximum ratings of the device, and the device itself should feel only slightly warm to the touch after an extended period of operation. The same adjusting and monitoring techniques should also be applied whenever the manufacturer's voltage and current ratings are available. After a few jobs are performed using these techniques, the technician should become very skillful and proficient in making optimum transistor replacements in a minimum amount of time.

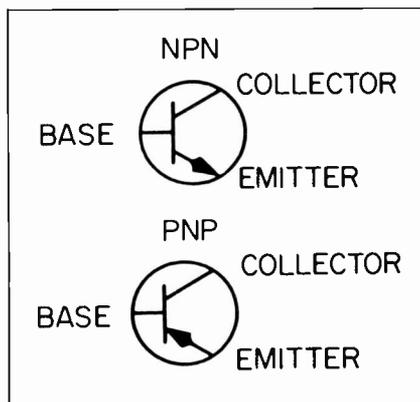
The second possibility for an un-

satisfactory replacement could probably be blamed on one of the least understood and certainly least discussed conditions. This condition is referred to as the actual manufacturing process of the original device versus the manufacturing process of the recommended replacement. Some of the more common processes involved are termed alloy, annular, diffusion, drift, epitaxial, grown, mesa, planar, etc., etc., plus many combinations of these processes. This article could not possibly answer the logical question for all of these manufacturing processes, "why?" but merely suffice it to say that in some instances devices made by different processes are not directly interchangeable without making some (usually minor biasing resistor) changes. Cut-off frequency, collector cut-off current, saturation voltage, switching times, etc., are merely a few of the device characteristics that can be affected by the actual manufacturing processes.

So far this article has considered only the devices for which a replacement has been offered through a cross-reference guide. However, the technician will frequently encounter special-numbered devices that are not listed in any cross-reference guide and for which he can find no electrical information upon which to start making a cross-reference himself. In most cases, a suitable replacement can be determined by following a few simple procedures.

NPN or PNP

The schematic symbol will indicate the device polarity (note the symbols below). The emitter arrow



Basic transistor schematic symbols.

always points *away* from the junction when the device is NPN, and always points *toward* the junction when the device is PNP.

If a schematic or symbol is not available, the polarity can be easily determined in the following manner: With the circuit energized, connect the negative lead of a voltmeter to the emitter terminal and measure the voltage to the collector or base. If the voltage reading is positive, the transistor is NPN. If the voltage reading is negative, the transistor is PNP. (Note that the voltage polarity determines the middle letter—negative voltage = pNp, positive voltage = nPn.)

Germanium or Silicon

Measure the transistor's emitter-to-base voltage. If this voltage is approximately 0.25v, the transistor is germanium; while if this voltage is approximately 0.6v, the transistor is silicon. Since most schematic diagrams include normal voltage readings, the germanium or silicon determination can easily be made from this source.

Operating Voltage Considerations

Voltages from collector to base, collector to emitter, and emitter to base should be noted from either the schematic diagram or by actual measurement with a voltmeter. The device selected for replacement should have voltage ratings of at least three to four times the actual operating voltages for each of the three categories. This type of safety factor is necessary to protect the transistor against voltage spikes, transients and surges inherent in most circuits.

Collector Current Requirements

Collector currents are rarely noted on schematics. However, a milliammeter can be easily connected in series with the collector, and the actual current requirements can be readily determined. The collector current should be measured under maximum signal conditions, and a safety factor of three to four times the measured current should be used.

Gain Considerations

Due to the complex scope of this

subject, only one gain parameter will be considered. This parameter is the common-emitter dc current gain, referred to as h_{FE} , beta, or β . From the standpoint of the most common applications, the following general rules should be used as a guideline.

High-gain devices (h_{FE} above 300) will find usage in preamps, RF stages and converters. Medium-gain devices (h_{FE} from 100 to 300) will find usage in RF and IF stages, oscillators, mixers, drivers, etc. Low-gain devices (h_{FE} up to 100) will find usage in output stages, AGC, drivers, video amplifiers, etc.

Power Dissipation

Power dissipation will rarely ever present a problem with small-signal devices, so long as the recommended voltage and current safety factors are observed. In those rare cases where additional dissipation is required, the addition of a small heat sink would be recommended.

Cut-Off Frequency

The cut-off frequency parameter is usually specified as being "typical" and should not create any replacement problem so long as the replacement device cut-off frequency is adequate for the application involved. As a general rule, it is recommended to use a device with a typical cut-off frequency of at least twice the circuit operating frequency. AM radio and audio circuits will easily tolerate devices that are designed to operate at several hundred MHz.

Conclusion

While the information provided in this article is certainly not "all inclusive," it is hoped that enough replacement information has been presented to permit the technician to turn out better work in less time and to help alleviate the problem of *waiting* for virtually unattainable transistors. One point that should be made quite clear is that any serious technician involved in semiconductor circuitry will only be able to attain maximum benefit from this information after having put it to the actual test and repeating it enough times to become proficient in his work. ■

Epoxies and the Electronic Technician

by Elliott Kanter

New developments make heat-free "soldering" a practical tool for electronic servicing

■ Recently some old tablets dating back to the early stone age were uncovered. The information contained should be of great interest to today's electronic technicians and dealers. The tablets were a journal of an early serviceman, operating his business some tens of thousands of years ago. One specific entry alluded to our shop owner repairing a metal spear for a customer by heating the metal over a fire until it was quite hot, and then forming a joint with another metal which, when melted, fused the two parts together.

If we examine just how our stone-aged predecessor repaired that item, we can draw a startling comparison to our current method of repair. Daily, we heat two metals, using another metal which flows or melts when heated to permanently join them. We call this soldering. It is interesting to note that in these tens of thousands of years we have made few improvements in the ancient art of soldering. Granted, the open fire has been replaced by a sophisticated electrically heated iron or gun, and there has been a great improvement in the alloys and fluxes used. However, when all things are considered, we are still basically using the same age-old methods to repair space-age electronic components.

It is not the intent of this article to convince you to discard your trusty soldering tool (that would be a great mistake), but rather to enlighten you as to the more up-to-date methods available today for making electrical connections.

There is an alternative to soldering, one with few of the problems we must contend with, such as joining dissimilar metals, heat-damage to sensitive components, and the ability to make permanent repairs without being tied to ac power lines. This method uses a common tooth-

Conductive-Epoxy Glossary

CONDUCTIVITY: The powdered-metal fillers' ability to conduct an electrical current—stated as a decimal value of resistance per centimeter at a given temperature.

CURE: A period of time required for the various components of an epoxy to settle and harden. It is usually stated as a given time at a specific temperature.

SHELF LIFE: The period of time the unmixed or unopened premixed epoxy will remain suitable for use while remaining in a storage area. Guidelines to storage area, temperature and humidity may be included.

WORK LIFE: A period of time during which the opened container of epoxy is suitable for use. It may be given as a specific time at a given temperature.

List of Manufacturers

Ablestik Adhesives, 833 W. 182nd, Gardena, Calif.
Acheson Colloids Co., 1635 Washington, Port Huron, Mich.
Adhesive Products, 1660 Boone, Bronx, N.Y.
Allaco Products, 130 Wood Rd., Braintree, Mass.
Amicon, 25 Hartwell, Lexington, Mass.
Aremco Products, Box 145, Briarcliff, N.Y.
Astrodyne, 355 Middlesex Ave., Wilmington, Mass.
Bacon Industries, 192 Pleasant, Watertown, Mass.
Biggs Co., 1547 14th, Santa Monica, Calif.
Cermalloy-Cermet Div., 14 Fayette, Conshohocken, Pa.
Chomerics, 77 Dragon Ct., Woburn, Mass.
Conap, 184 E. Union, Allegany, N.Y.
Devcon, Endicott St., Danvers, Mass.
Dynaloy, 7 Great Meadows Ln., Hanover, N.J.
Electro-Materials Corp. of America, 605 Center, Mamaroneck, N.Y.
Electro-Science Labs, 1133 Arch, Philadelphia, Pa.
Emerson & Cumming, 869 Washington, Canton, Mass.
Epoxy Products, Box 1404, New Haven, Conn.
Epoxy Technology, 65 Grove, Watertown, Mass.
G C Electronics, 400 S. Wyman, Rockford, Ill.
Hardman, Inc., Belleville, N.J.
Hughes Aircraft, Centinela Ave., Culver City, Calif.
Hysol, Franklin St., Olean, N.Y.
Isochem Resins Co., 99 Cook, Lincoln, R.I.
Kenics, 1 Southside Rd., Danvers, Mass.
Mereco Products, 530 Wellington, Cranston, R.I.
Nitine, 697 Rt. 46, Clifton, N.J.
Packaged Resins, 130 Wood Rd., Braintree, Mass.
Sigma Plastronics, 14531-33 Tireman, Dearborn, Mich.
TRA-CON, 55 North, Medford, Mass.
Tapecon, 475 River Rd., Rochester, N.Y.
3M Adhesives Div., St. Paul, Minn.
Transene, Rte. 1, Rowley, Mass.
USM Corp. Chemical Div., Boston St., Middletown, Mass.

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pick as a tool. The wonder "cure-all" is known as electrically conductive epoxy.

Most of us are familiar with the more common types of epoxies and have from time to time used them to join broken parts or join pieces of wood, plastic or ceramic. While we were using just this one form of epoxy, industry was busy preparing the micro-circuits we now find in many consumer electronic products with a glue, or epoxy, which besides having the capability of joining materials exhibits a high degree of electrical conductivity.

Basically, an epoxy consists of two ingredients, a resin and a hardener. When these two ingredients are mixed together in the proper proportions, they join and form a substance capable of cementing two objects together rapidly and with a bond which is frequently stronger than the original materials. A conductive epoxy differs only slightly in that a metal powder filler (gold, silver, copper, etc.) is added to the mixture, resulting in a high level of conductivity along with the bond-strength associated with conventional epoxy.

The chemical reaction of the two substances forming the epoxy requires a period of time for them to harden and settle. This is referred to as the *cure time*. You will find that this time might vary from a few minutes at 400°F to many hours or even days at room temperature. At the same time, the ratio of the mix, the amount of metal-powder filler and type of metal affect the end-resulting conductivity, usually expressed in a decimal value of resistance per centimeter.

A number of companies produce conductive epoxies for the electronics industry and furnish them in either one-part-premixed form or in separate containers which must be mixed according to the manufacturer's specifications. This requirement for mixing accurately weighed amounts of the substance has to date had a great deal to do with the limited use of these remarkable products in the electronic servicing industry. Few of us possess accurate scales or would be willing to make the necessary investment in equipment just to be able to avoid dam-



Fig. 1—Combining the two-part conductive epoxy in a two-to-one ratio.

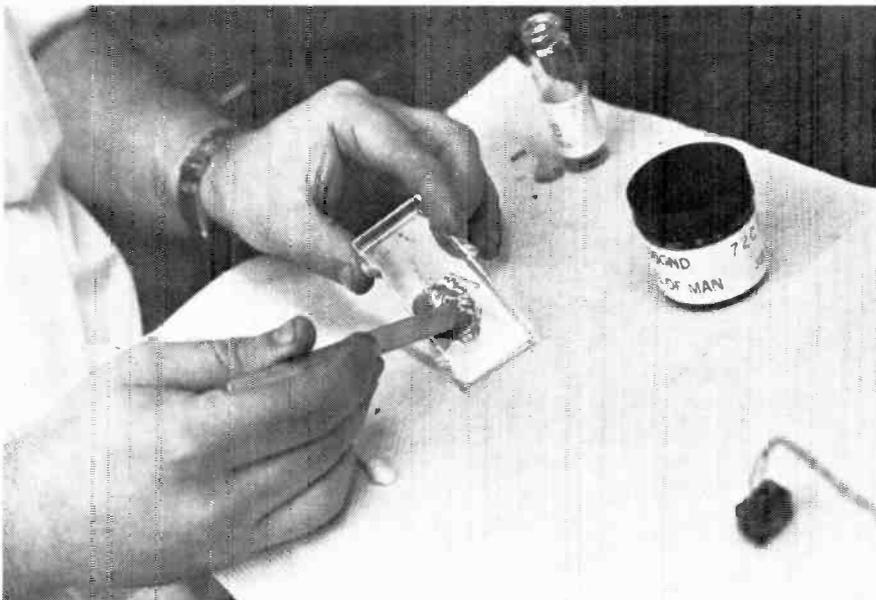
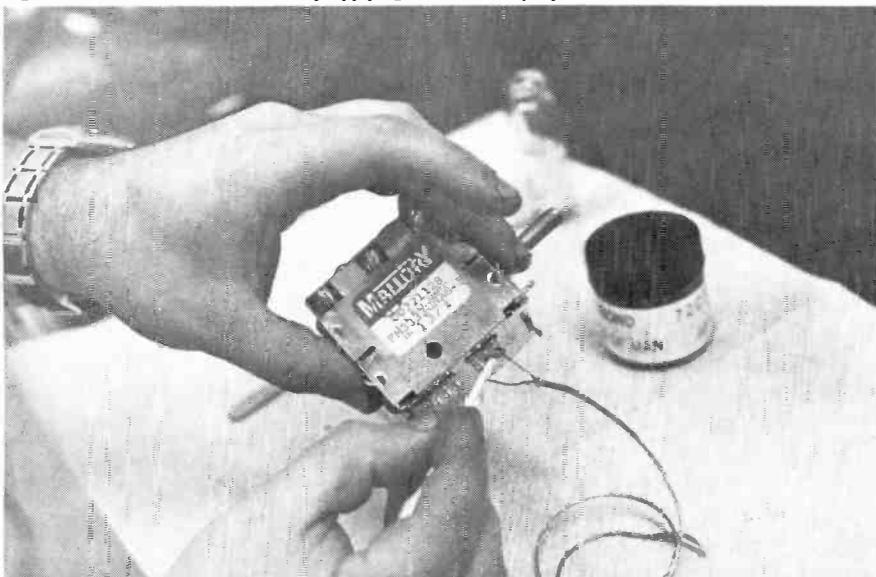


Fig. 2—Manufacturer's specifications require that both parts be completely mixed with a wooden stirrer.

Fig. 3—The circuit is "soldered" by applying conductive epoxy with a cotton swab.



age to heat-sensitive components or to save a few minutes of soldering time.

Cost too enters into the picture. A silver or gold-filled conductive epoxy is rather high priced when you consider the cost of a roll of solder. However, in 1967 a copper-filled epoxy was developed, which, according to published information, exhibits electrical conductivity comparable to many silver-filled epoxies.

We all know that copper is an excellent conductor and considerably less expensive than conductors made of silver or gold. This single breakthrough has made it possible for the wider use of conductive epoxies. Small portions of premixed epoxy have been introduced in syringe-type applicators, quick-frozen to improve storage shelf life.

Besides cost, measurement considerations and cure time, a third parameter must also be considered—*work life*. This factor determines how long the epoxy will be suitable for use once it has been mixed or the premixed container opened. This might vary from less than 15 minutes at room temperature to a few hours, depending on the type of epoxy selected. Again, a rather limited work life has hindered the application of conductive epoxy to service-oriented business.

Assuming that you do want to use conductive epoxy or must use one, how do you go about selecting or specifying the right epoxy for the job? A logical first step would be to contact a number of manufacturers who specialize in conductive epoxies. Their data and catalog sheets will assist you in determining exactly what type of epoxy would best and most economically fit your requirements.

Ideally, the epoxy you select would require little or no mixing, provide a reasonable work life and most important to you, allow for room temperature vulcanization (RTV) or cure. The best possible epoxy for a given job is useless to you if it requires additional apparatus such as heat lamps or ovens to effect a cure. A number of epoxies are furnished in small amounts which will allow you to use only what you need for a job and avoid

TYPICAL PROPERTIES:	
Adhesive type: Epoxy/Amine	RESISTIVITY:
Filler: Copper Powder (99% pure)	Cured ½ hour @ 250°F — 0.004 ohm-cm
Filler Content: 82.0% (by weight)	Cured 1 hour @ 200°F — 0.004 ohm-cm
Consistency: Light paste, slightly flowable	Cured 2 hours @ 150°F — 0.004 ohm-cm
Work Life @ 77°F: 45 minutes	Cured 48 hours @ 77°F — 0.008 ohm-cm
Cure Options: ½ hour @ 250°F, or 1 hour @ 200°F, or 2 hours @ 150°F, or 7 days @ 77°F (See Instructions)	RESISTIVITY AFTER HEAT AGING:
Hardness (Shore D): 80 88 (degassed)	Cured and aged 168 hours @ 150°F — 0.004 ohm-cm
Lap Shear Strength @ 77°F Cured 2 hours @ 150°F: 1350 psi Cured 1 hour @ 200°F: 1350 psi	Cured and aged 168 hours @ 225°F — 0.004 ohm-cm
Thermal Conductivity: 22.6 BTU/hr/ft. ² /°F/in.	RESISTIVITY @ ELEVATED TEMPERATURE:
Coefficient of Expansion: (-65°F to 75°F) 17.2 in/in/°F x 10 ⁻⁶ (70°F to 150°F) 29.0 in/in/°F x 10 ⁻⁶	Cured 1 hour @ 225°F
	Tested @ 77°F — 0.004 ohm-cm
	Tested @ 125°F — 0.005 ohm-cm
	Tested @ 150°F — 0.006 ohm-cm
	Tested @ 200°F — 0.009 ohm-cm
	HUMIDITY RESISTANCE:
	(Cured 1 hour @ 200°F)
	No increase in resistivity after 168 hrs. exposure @ 98% RH and 130°F, plus 7 days water immersion @ 77°F.
INSTRUCTIONS:	AVAILABILITY: ABLEBOND 163-4 is available in one pound (three component) kits. It is also furnished premixed and frozen in 1cc or 2.5cc disposable containers.
Three component kit	STORAGE: When stored in unopened containers @ 80°F (maximum), the storage life of the bulk (unfrozen) adhesive is at least one year.
(1) Using a gram balance, combine the three ingredients in the following ratio: Part A (Epoxy Resin) — 5.0 pbw Part B (Hardener) — 2.2 pbw Part C (Copper Powder) — 32.8 pbw	Frozen premixed ABLEBOND 163-4 must be stored con- tinuously @ -40°F or colder. Storage life is one year (minimum).
(2) Mix for approximately one minute or until uniform- ly blended.	CAUTION: These products may cause skin irritation to sensitive personnel. If contact with skin occurs, wash af- fected area immediately with soap and water.
(3) Apply within 45 minutes after mixing.	DISCLAIMER: All statements, technical information and recommendations contained herein are based on tests we believe to be accurate, but the accuracy or completeness thereof is not guaranteed, and the following is made in lieu of warranty express or implied: Seller and manufacturer's only obligation shall be to replace such quantity of the prod- uct proved to be defective. Neither seller nor manufacturer shall be liable for any injury, loss or damage, direct or con- sequential, arising from the use or inability to use the product. Before using, user shall determine the suitability of the product for his intended use, and user assumes all risk and liability whatsoever in connection therewith. No statement or recommendation not contained herein shall have any force or effect unless in an agreement signed by officers of seller and manufacturer.
(4) Cure at one of the following minimum schedules in an oven pre-stabilized at the desired cure tem- perature: ½ hour @ 250°F, or 1 hour @ 200°F, or 2 hours @ 150°F, or 7 days @ 77°F	
NOTE: (a) Heat curing is recommended for optimum elec- trical and physical properties. It is also recommended that the cure temperature be at least as high as the maximum temperature that the cured compound must withstand in service. Otherwise, electrical resistivity will increase when the cured compound is exposed to temperatures higher than the original cure temperature.	
NOTE: (b) Heat curing above 250°F may be necessary for service applications above 250°F. ABLEBOND 163-4 can be successfully cured in thin sections at temperatures as high as 350°F, if the compound is vacuum degassed prior to application. Otherwise, the air entrapped during mixing will expand to form a very porous compound. Vacuum degassed ABLEBOND 163-4 will exhibit more flow and slightly lower resistivity than the non-degassed compound.	
Write or phone ABLESTIK ADHESIVE CO., 833 West 182nd Street, Gardena, Calif. 90247 / Telephone (213) 321-6252	

Fig. 4—Typical sheet listing special data for one conductive epoxy.

costly waste. The epoxy you select will probably be of the copper-filled variety and exhibit excellent thermal as well as electrical conductivity.

Because you will only be using it for specialized jobs, it must be capable of long shelf storage without deterioration of any of the components. It must be easy to use and require few if any precautions. Its price will be reasonable as compared to silver- or gold-filled epoxies, but still considerably more than the cost of conventional solder.

With the drawbacks of cost, mixing, limited work life and cure time required, why should an electronic technician use conductive epoxy? The answer is probably on your

bench right now. We have all come across units requiring nothing more than reconnecting a broken lead, but we can't do it! The broken lead might very well be on a tape head, in a tiny FM front-end, a speaker cone or a dozen more places where soldering, at least in the conventional sense, would be impractical. Some of the newer semiconductors require special precautions to guard against static electricity and heat. While the latest in soldering tools offer isolated tips, the problem of heat damage is still apparent and with us. In addition, repairs or modifications to plug-in modules can be made with ease by using epoxy. For example,

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Hickok's Model 3301 Digital Multimeter

by Phillip Dahlen

Designed for quick, 3½-digit measurements



Hickok's Model 3301 Digital Multimeter. For more details, circle 900 on the Reader Service Card.

■ Fast, accurate measurements, shown to an adequate number of significant figures, offer considerable help in quickly measuring various portions of a defective solid-state or tube circuit. And this 3½-digit instrument is designed to permit a maximum reading of 1999 on any of its 27 ranges, a flashing indicator warning against over-range measurements.

For measuring resistive compo-

nents in a solid-state circuit, the instrument is said to provide a maximum voltage drop of only 24mv on all ohm and thousand ohm ranges. However, when using the megohm ranges, there is a 2.4v drop at full scale, which is adequate for checking the forward conductance and reverse leakage of most semiconductors.

Additional manufacturer specifications include the following:

Ranges and Accuracy

DC Voltage: 0.1% of reading, ±1 digit

AC Voltage: 1.5% of reading, ±1 digit, from 22Hz to 50Hz

0.5% of reading, ±1 digit, from 50Hz to 50kHz

1% of reading, ±1 digit, from 50kHz to 100kHz

There are five ac and dc voltage ranges from 100mv to 1kv, maximum resolution being 100µv.

DC Current: 0.2% of reading, ±1 digit

AC Current: 1.5% of reading, ±1 digit, from 22Hz to 50Hz

0.5% of reading, ±1 digit, from 50Hz to 50kHz

1% of reading, ±1 digit, from 50kHz to 100kHz

There are five ac and dc current ranges from 100µa to 1a, maximum resolution being 100na.

Resistance: 0.3% of range, ±1 digit, for readings over 1000Ω

1.25% of reading, ±1 digit, for 100Ω to 100k ranges.

There are seven resistance ranges from 100Ω to 100M.

Overload Protection

The instrument is designed to handle up to 1000v rms on all ac voltage scales, 1500v peak on all dc voltage scales, 10 times the range setting on all current scales, and 250v rms on all resistance ranges.

Automatic Features

Continuous automatic zeroing eliminates the need to periodically calibrate or adjust the multimeter, the circuit adjusting for zero before every reading. Polarity is automatically displayed and the decimal point is automatically positioned.

Options

The internal rechargeable battery pack option provides 20 hr. of continuous battery operation. Measurements can be made at rated accuracy during recharge. The BCD option provides output information for data acquisition systems.

Physical Description

The instrument measures 3½ in. H. by 8¾ in. W. by 13 in. D. It weighs 8¾ lb.

Misapplication Ruins More Good Sound Installations

by Arch Hoyne

Today there are excellent products available to provide quality sound reproduction for voice and music for both indoor and outdoor installations. The sad fact is, however, that the misuse and abuse of these products has caused much dissatisfaction on the part of the installer and even more important, on the part of the customer or end user.

■ There was a time when it was believed that the more speakers and the more powerful the amplifier, the better the sound system would perform. Today, of course, nothing could be further from the truth! A minimum of speaker systems properly placed and properly installed can be most effective using a minimum of power.

In large churches and auditoriums, we have seen too many examples of the sound installer trying to fill the room with sound through the use of a multitude of speaker systems which serve only to frustrate the audience and render the speaker at the rostrum ineffective.

It has been said that good professional sound men, who have a real knowledge of today's sound market and the available products, could make a very comfortable living by simply going around and correcting bad existing installations.

Let us not be so bold as to say here that horns, sound columns or single speaker systems are not the answer, for each has its application for a particular installation and situation.

In large indoor areas with high ceilings and reverberation problems, sound columns are today's problem solvers, but their proper installation is the key to a successful sound system.

The following factors are critical

and should always be considered when installing sound columns:

- Choose the proper column.
 - Primarily for voice
 - Primarily for music
 - Special application columns designed for both voice and music
- Because of directional characteristics, make sure the column will cover the distance required to project the sound.
- Make certain that the sound column is properly installed, approximately 5 to 6 ft above floor level, and properly directed where the audience is. Remember, there are no people hanging from the rafters.
- The horizontal placement of sound columns is usually not critical, but the vertical placement is. The sound pattern of an engineered sound column is approximately 120° horizontal and 30° vertical.
- In general, sound columns require only about 25 percent of the power required by conventional single-cone speakers, giving a uniform, comfortable sound level from the first row to the last.
- Installation costs are vastly reduced through the use of sound columns in large or small areas, because a very minimum number of units are required.



Arch Hoyne, vice president of Argos Products Co., Inc., has been in the electronic industry for over 25 years. He has been involved in both distribution and OEM sales as a sales representative and in manufacturing. In 1946, he began with one of the largest distributors in the country and remained for almost 10 years before going into sales in the Chicago Area. Almost 9 years were spent with Cornell Dubilier Electronics, where he served as district manager, regional manager and distributor marketing manager. The last 5 years have been devoted to the marketing of sound products to both the distributor and OEM fields.

The simple truth is that even after the proper equipment has been selected, it is very often improperly installed. Products that have been specifically engineered to perform a given function are unjustly criticized because they do not perform as expected in some different manner.

Such basics as improper positioning of speaker systems and incompatible amplification and wiring can turn an otherwise successful installation into disenchantment for the customer and product dissatisfaction from the standpoint of the sound contractor or installer.

Many manufacturers are at fault for not providing complete specifications and instructions. By the same token, the sound contractor makes improper installations because he has preconceived notions based on previous installations and different conditions.

One of the biggest abuses in large auditoriums or church areas is overpowering and multitudinous numbers of speakers that are not required.

Through the use of a minimum number of the proper devices, feedback can be virtually eliminated and the actual operating power may be less than 5w.

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NEW PRODUCTS

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

TOOL KIT

703

Each tool is in clear view always ready-to-hand

A new 72-piece tool kit reportedly contains everything needed by professional electronic technicians. Each tool stores neatly in its own place in an attache case in clear view and always ready-to-hand. Included in the kit are



screwdrivers, pliers, wrenches, an alignment tool, burnisher, crimping tool/wire stripper/bolt cutter, knife, saw, instrument oiler, inspection mirror, spring tool, stainless steel rule, pick/scribe, scissors, tweezers, heat sink, voltage tester, soldering aid, and temperature-controlled soldering iron. Wrenches, pliers, screwdrivers, etc. come in a range of sizes and styles. The attache case is vinyl, has a lock and measures 13 by 18 by 4½ in. A removable pallet in the lid holds many of the tools, each in its own pocket. There is also a pocket for service manuals and schematic diagrams. Price complete: \$139.50. Attache case alone is \$39.50. Telvac Instrument Co.

EPOXY CASTING COMPOUND 704

Clear, semi-flexible casting epoxy system

Tra-Cast 3011 is designed to be a low-viscosity, solvent-free clear epoxy



system with long pot life and high impact resistance. The solvent can be handled and mixed at room tempera-

tures, developing strong bonds to most electronic materials, including glass, ceramics, metals, most organic polymers and plastic laminates. The system cures at room temperatures, with low exotherm and minimum shrinkage, to a glass-clear, semi-flexible product with high electric insulating properties and improved resistance to weathering, water, gases, vapors, petroleum solvents, fuels, lubricants, mild acids, alkalis, and many other organic and inorganic materials. Tra-Con, Inc.

CARTRIDGE TAPE HEAD CLEANER 705

Works automatically in matter of seconds

The 8-track "Double Header" reportedly requires no liquids or solvents for cleaning the tape head and capstan shaft. It is said to be effective when used periodically to prevent graphite build-up, which often causes tape pullout and breakage. It is designed to clean the graphite deposits from the magnetic tape head with a gentle buffing action, thus restoring full richness of tone, frequency response and general performance. It can be inserted into the tape player in the same manner as any cartridge. Chemtronics, Inc.



CRT AUTO-TRACKER 706

Automatically checks CRT gun tracking

A new CRT Auto-Tracker has been designed for automatically checking color CRT gun tracking. Said to feature computer memory circuits that store CRT information during the emission checks, the instrument is designed to automatically compare the color guns to each other for a 1.5-to-1 ratio simply by pushing the automatic tracking button. Results are read directly on the meter as good or bad. This simplified procedure is said to eliminate the need for any computation, metered current measurements, or other systems that take far more

WorldRadioHistory

time and are open to mistakes. The entire test takes only about two minutes. The CR161 Auto-Tracker is designed not only for testing the standard three-gun color CRT, but also the "single gun" Trinitron and b/w tubes



as well. All functions, including filament voltage setting, gun balance setting, shorts test, shorts removal, emission check, and three rejuvenation positions are reportedly covered with a single switch. The unit is housed in a brushed steel and vinyl-clad carrying case, with setup book included. Price: \$140.00. Sencore, Inc.

CCTV SYSTEM 707

System for security applications

The compact MW-501 system is designed for such varied applications as area surveillance, gate control, small-business protection, or hazardous area control where remote monitoring is essential or more economical. Specifications indicate 550 center line resolu-



tion, 4000-to-1 automatic light control, capability of detecting 4 candles of illumination, regulated power supplies, and rugged solid-state circuits. The camera is normally equipped with a C-mount 25mm, f1.9 lens and is said to have plenty of output power to reliably drive the 9-in. monitor over

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HEATH ...

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antenna, switched and unswitched power receptacles, the power fuse and line cord.

Manufacturer Specifications

Along with the receiver we received a 12-page report from Heath (in addition to the manual), providing us with their specifications for the AR-1500 receiver and the test results that the company obtained from the particular model sent us. Space does not permit us to include all of these statistics in this article, but some of the more interesting ones are shown in Table I on page 45. ■

NEWS ...

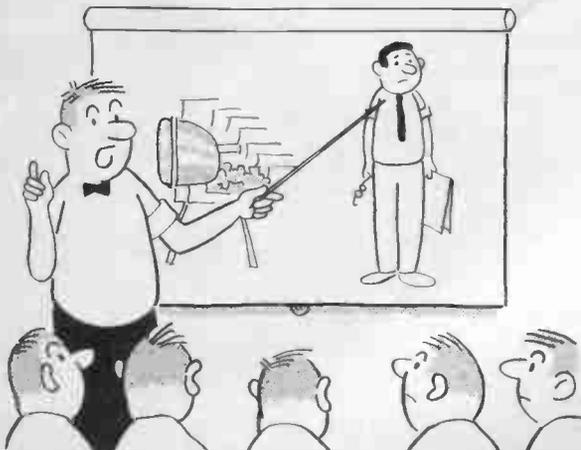
continued from page 54

—"Semiconductors From A to Z" by Phillip Dahlen, now Editor of this magazine—was published in book form by Tab Books immediately upon its completion.

We are pleased to report that not only has the book required reprinting in this country, but that interest has been such that it has been translated into Spanish and this year Paraninfo has begun publishing the book in Madrid, Spain, under the title, "Semiconductores de la A a la Z."

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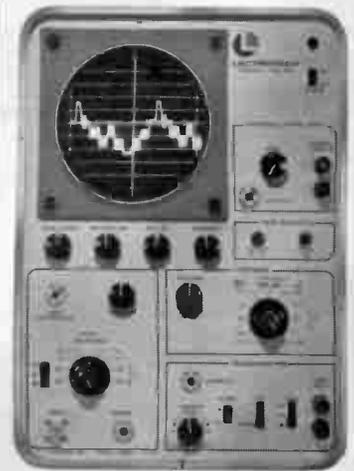
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You as a TV serviceman must have the necessary equipment to make repairs. A volt meter, oscilloscope, various generators, and etc. BUT, you cannot rebuild the picture tube! Why not investigate this opportunity. Being in the service business, you should take advantage of any piece of equipment that would be helpful to you. You should have your own picture tube rebuilding unit! You could rebuild any picture tube, be it black and white or color or 20mm, etc. ANY PICTURE TUBE! You could build the finest quality tube available. This tube would have the finest contrast and color definition. The building of the picture tube has been developed into a simplified process. It is easier to rebuild a picture tube than to repair the circuit on the average television set. We can offer you the most revolutionized compact unit on the market today. This unit will only require 4 x 8 ft. of space. The unit will not hinder your present business. While a picture tube is being processed, you will still be able to do your bench repairs or make service calls. Why not have your own tube rebuilding plant? Why not be a distributor? In some areas, the picture tube must be shipped and as a result, you must wait quite a period of time for the picture tube. With your own rebuilding unit, you could immediately rebuild the old tube and return it to the customer within a matter of hours!

Can you imagine rebuilding only four color tubes per day? You sell these tubes for \$60.00 each. Your total cost to rebuild these tubes would be \$7.00 each. This leaves a \$53.00 profit on each tube. This leaves you a net profit for the day of \$212.00. Not a bad day's pay. Let's cut this figure by one half. Build only two color tubes per day. Your net profit would be \$106.00 per day. Work a five day week. Your earnings would be \$530.00. Sound fantastic? Facts are facts!

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Equipment to operate your TV service business is necessary. Your own picture tube rebuilding plant should also be an absolute must. Why not realize all the profits instead of buying your picture tubes at costly prices.

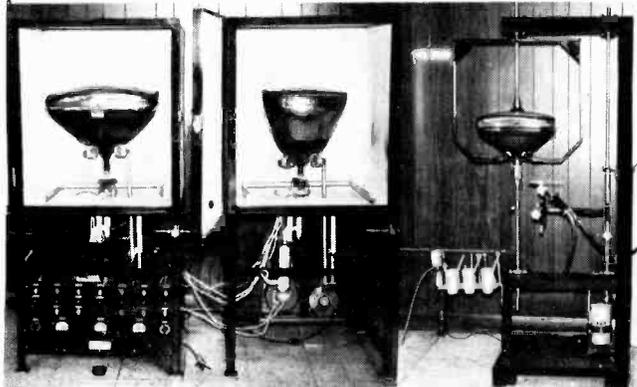
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NEWS...

continued from page 30

but often gets far too little attention. Of course, the "Associate CET" is a very new thing, but will become well known in the future. Complete requirements and information are available through the ISCET office.

This program should stimulate and encourage much good talent for our industry since it sets a goal of achievement for the student.

Allied with this program are the outstanding efforts being made on both the national and state levels to create, improve and assist vocational and high school electronic classes. NEA, EIA, ISCET and others are all contributing in this work. We would like to hear from you if you have any ideas on the subject.

Your Reporter,
Ed Schon, CET

General Electric Seeks Help of Trade Association Leaders

Dick Glass, CET, Executive Vice President of the NEA, gave us glowing reports concerning a recent trip to Portsmouth, Va. Not only he, but Norris Browne, CET (President of the NEA), Leo Shumavon (President of NATESA), Frank Moch (Executive Director of NATESA) and John Gooley (Assistant Executive Director of NARDA) were invited to the General Electric plant at G.E.'s expense to assist in efforts to make their brand of TV sets even more serviceable.

Dick says that G.E. is working to make its TV sets the most serviceable in the business! He said that "they are using the NEA serviceability program, inviting technicians in on it, and doing practically everything we have asked them to do in the National Electronics Service Conference meetings."

Research Vehicle Developed for Highway Communications

This unique research vehicle, developed by GTE Sylvania Inc., is used in evaluating a buried antenna highway communications system for the Federal Highway Administration.



The vehicle measures signal strength and noise levels of several antenna models which are buried in a test roadway. Based on test results, GTE Sylvania's Sociosystems Products Organization will recommend antenna models and related equipment, as well as techniques, for the development of a highway communications system whereby drivers and authorities can exchange messages.

ET/D Feature Series Translated into Spanish

As many of our readers recall, a series of articles that ran for several years in *ELECTRONIC TECHNICIAN/DEALER* continued on page 67

COLORFAX

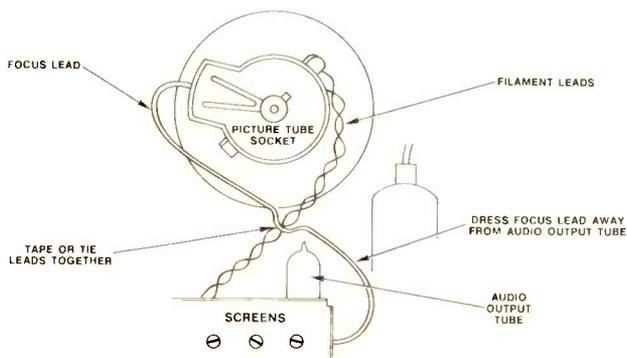
The material used in this section is selected from information supplied through the cooperation of the respective manufacturers or their agencies.

RCA SALES CORP.

Color-TV Chassis CTC38/39—Picture Tube Focus Lead

Lead dress is established in a specific configuration in TV sets for several reasons. One reason is to prevent interference between the various circuits in the receiver. Another important reason is to insure the reliability and safety of the instrument.

The consequences of changing leads from their intended position can be severe. Symptoms and hazards bearing no relation to the original service problem can be induced into the receiver.



One such possibility concerns the positioning of the focus lead attached to the picture tube socket of the CTC38 and CTC39 chassis. During manufacture, the black focus lead is attached with tape or a tie wire to the two brown filament leads. This lead dress is established to keep the focus lead away from the audio output tube. If this lead dress is not maintained, over a period of time heat from the tube may cause deterioration of the insulation. The result can be an audio output tube failure, due to arcing between the lead and the tube elements.

To insure maximum reliability, this lead dress should be checked whenever the receiver is serviced for any reason.

Color-TV Chassis CTC46 Series—Color-Temperature Adjustments (Revised)

To make a proper color temperature adjustment, first set the SCREEN controls to minimum (full CW). Next, adjust the DRIVE controls to maximum (full CW). Then turn the KINESCOPE BIAS control to minimum (full CW).

Position the SERVICE switch to the SERVICE position and advance the SCREEN controls one at a time, properly balancing their output to just produce a horizontal white line. If one or more of the guns will not light, advance the KINESCOPE BIAS control until the dimmest gun will just light, then proceed with SCREEN control settings as just outlined. The BRIGHTNESS control has no effect when the SERVICE switch is in the SERVICE position.

Position the SERVICE switch to raster position. Set the BRIGHTNESS control to a normal viewing level and adjust the DRIVE controls for 9300° Kelvin color temperature (white raster). One of the DRIVE controls must be at maximum when the set-up is completed.

Next move the SERVICE switch (S601) to the NORMAL position, turn the COLOR control to minimum (fully CCW)

continued on next page

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COLORFAX

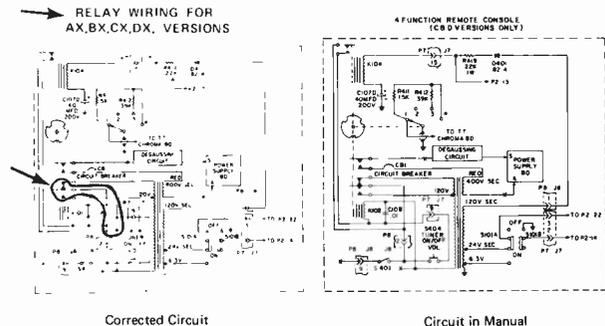
continued from page 55

and check the gray scale tracking from low lights to high-lights throughout the usable brightness range. If gray scale does not track properly, repeat steps two and three.

MAGNAVOX

Color-TV Chassis T958 with 704065 Remote Control—Stepper Relay Circuit Change

The ON-OFF/VOLUME Stepper circuit for the C and D versions of color-TV receiver chassis T958 was modified to include a second relay, K104. This modification is indicated in Service Manual 7331 Section 4.1 in the block



labeled "Relay Wiring for AX, BX, CX, DX Versions" and in Service Manual 7326 (704059 and 704065 Remote Control Receivers), Page 9 in the block labeled "AX Four-Function Remote-Console Only." The schematic and la-

beling of these diagrams in both manuals are in error and should be corrected as indicated in the illustrations shown. The arrows in the illustration at the left indicate the areas in need of correction. The illustration on the right indicates the correct wiring for relays K102 and K104. This correction should be noted in both of the indicated service manuals.

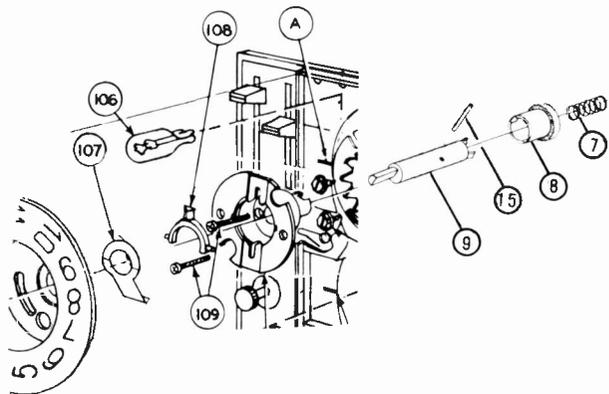
Color-TV Chassis T958—High-Voltage Rectifier Tube 3DB3

Starting with the AC production code, all T958 chassis will use the 3DB3 high-voltage rectifier tube. The tube socket wiring in these chassis is different from that used for the 3A3/3CU3 tubes and they cannot be used as a substitute. If a 3A3/3CU3 is inadvertently installed in one of these chassis in the place of a 3DB3, the result will be no high voltage.

ADMIRAL

Color-TV Chassis K20—Service Hint

After early production models, the following changes were made to eliminate the possibility of the VHF tuner and the channel indicator disc getting one-half turn out of step.



- Spring No. 107 was changed from 19A384-1 to a heavier spring No. 19A384-2 (or two 19A384-1). See illustration.
- Compression spring No. 7 in the VHF fine tuning shaft was changed from 19A248-2 to a heavier spring, 19A248-1. This spring is already in sets using the 94C381-5 VHF tuner.

Color-TV Monitor Chassis 12K20—Set-Up Procedure

Should you find it necessary to readjust the color monitor in new models using the 12K20 chassis, the following sequence of adjustments will insure proper color registration and monitor action:

- FINE-TUNING, BRIGHTNESS, CONTRAST and COLOR-LEVEL controls must be set properly.
- Turn the color monitor OFF.
- Set the TINT control for proper or desired fleshtones.
- Turn the color monitor ON.
- Adjust the COLOR PREFERENCE control to produce a slightly pink fleshtone. This control is located in the back of the TV set on the chassis apron and should be set slightly to the right of center.

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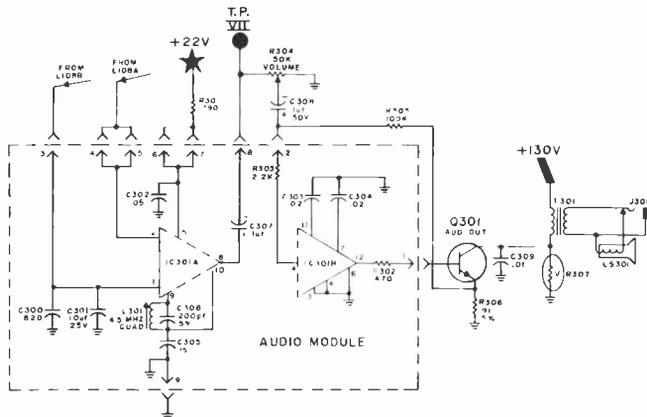
TECHNICAL DIGEST

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

GENERAL ELECTRIC

TV Chassis U-1—Audio Circuit

With the exception of the input coil, VOLUME control, and the output stage, the entire audio circuit is assembled to a plug-in type module, shown in the illustration. The module is a circuit board measuring about 2.25 by 1.75 in., and containing an integrated circuit (IC) and a few other components.



The IC contains a detector section and an audio amplifier section. The detector circuit operates much the same as the quadrature detector used in tube-type receivers. The quad coil, L301, is the only tuning adjustment on the module, and it should be tuned for maximum audio.

The sound take-off coil, L108, couples the 4.5MHz signal to the module and it also couples a bias voltage from Terminal 3 of the module to Terminal 4. If the secondary of L108 opens, there will be no bias voltage at Terminal 4 and the module will not function.

Audio signals from the detector circuit are coupled through capacitor C307 to Terminal 8 of the module. From this point, they are coupled to the VOLUME control and then back to the audio section of the IC through capacitor C308 and resistor R303.

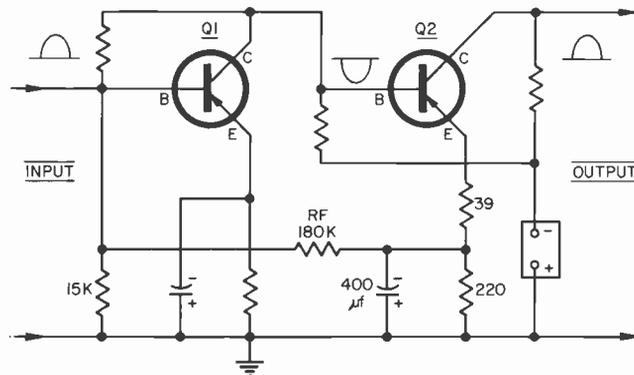
The audio output transistor, Q301, is biased for Class A operation. Base bias is obtained through the audio section of the IC. The bias level is controlled by a voltage which is fed from the emitter of Q301 through resistor R305 to the IC. To prevent thermal runaway, this bias circuit is connected in a negative feedback configuration—an increase in emitter voltage causing a decrease in base voltage and vice versa. The collector circuit is protected from transient pulses by the voltage dependent resistor, R307.

WESTINGHOUSE

Transistor Compensating Circuit

If there are two similar amplifiers that follow each other, an extra component between their circuits can result in improved current stability. The circuit illustration shows two direct-coupled audio amplifiers with a feedback resistor from the emitter circuit of transistor Q2 to the base of transistor Q1.

A positive alternation at the base of transistor Q1 produces a negative alternation at the base of transistor Q2,



and a positive alternation is present at the collector of Q2. Since there is no polarity reversal from base to emitter, the negative alternation at base Q2 is also present on its emitter. Alternations at the base of Q1 produce alternations of the opposite polarity at the emitter of Q2. These alternations are filtered by the 400µf capacitor to produce an average voltage, which is fed back to the base of Q1 through an 180K resistor. The small feedback voltage opposes the tendency of the bias of Q1 to change.

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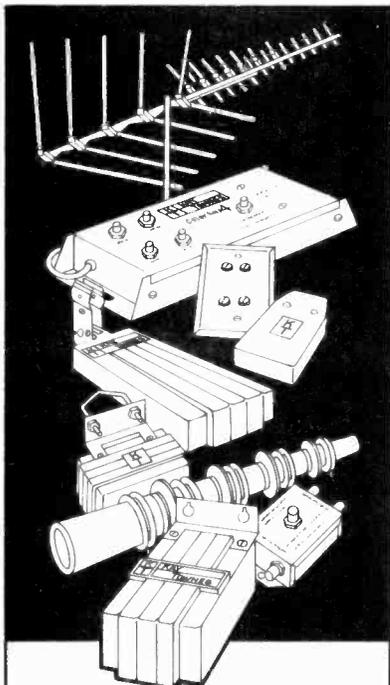
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- Performs the 4 basic tests on all types of FETs including pinch-off.
- Performs the 3 basic tests on all types of bipolar transistors.
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continued from page 53

cable lengths of over 200 ft. The camera measures 5 in. by 3 3/8 in. by 10 in. and weighs 6.4 lb. The 9-in. monitor is



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LIQUID ADHESIVE 708

Ready to use without catalysts, heat, mixing or solvents

"Permabond" is a one-component liquid adhesive that is said to bond rubber, metal, glass, plastics, wood, porcelain and many other materials in 10 to 45 sec. It is ready to use without catalysts, heat, mixing or solvents. The adhesive has to be applied to only one surface and one drop covers 1 sq in. It flows easily into cracks and crevices. Eco-



nomical, 1 lb of Permabond is said to supply 30,000 one drop applications at less than 1/4¢ per drop. The adhesive is reportedly colorless, transparent and impervious to many chemicals and weathering. It is available in four formulations and viscosities and comes in 1/3 oz and 1 lb sizes. Techni-Tool, Inc.

RATCHET SCREWDRIVER SET 709

Shaft adjustable from 1 to 3 in.

This compact screwdriver set is designed for switching from Phillips to Slot to Hex in seconds by changing drivers in the common handle. Up to seven times more power can be obtained with these tools when using the reversible ratchet "Palm-Grip" that snaps into place at the end of the handle. The set is said to come complete with two sizes of Slot drivers, two sizes of Phillips drivers and 10 sizes of Hex drivers in standard increments from 5/16 in. to 5/64 in. Each driver locks into the handle with its own

collet and set screw, and the shaft is adjustable from 1 in. to 3 in. in length for getting into hard-to-reach areas.



All drivers and collets are said to be made of durable, heat treated tool steel, coming with handle and "Palm-Grip" in a handy, durable pouch. J. Mills Tool & Mfg. Co., Inc.

FM MULTIPLEX SIGNAL GENERATOR 710

Checks separation and balance and serves as a sweep marker

The Model LSG-230 FM Multiplex Generator reportedly provides RF and IF markers and multiplex signal output, having a 3v output at approximately 19kHz with a continuously ad-



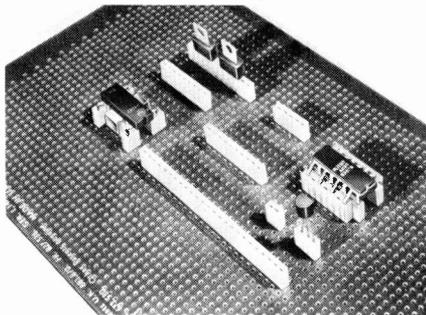
justable frequency range of 75 to 110MHz. Rated separation is over 30dB from 50Hz to 15kHz. The instrument checks separation and balance in FM receivers and tuners and also serves as a sweep-marker for 10.7MHz FM and IF alignments. It

features a 115-230v, 50/60Hz dual power supply, measures 10½ in. H by 7 in. W by 11 in. D and weighs 13½ lb. Accessories include a 300Ω, 75Ω (open) cable. Price: \$175.00. Leader Instruments Corp.

INTEGRATED CIRCUIT SOCKET STRIP 711

Can be mounted in any configuration

The A23-2033 TR 25 contact single strip socket is reportedly a new concept in socket design for integrated circuit and semi-conductor devices. Specifications indicate that it is molded in transparent glass filled Nylon 12, is capable of accepting either flat or



round leads and can be cut into any number of contacts and mounted in any configuration on an 0.1 in. matrix. It is fitted with gold flash phosphor bronze contacts giving a life of up to 10,000 insertions with an electrical resistance of 15mΩ maximum. Jermyrn.

TUNER CARE KIT 712

Supplies cleaning and lubrication for tuners

The tuner care kit reportedly consists of a can of Royal Clean, a tuner degreaser, and Royal Lube, a lubricant and tuner cleaner. These two nozzle-equipped units are designed to clean and lubricate tuner contacts, eliminating TV troubles caused by dirty or oxidized tuner contacts. Tuners are first pressure cleaned with Royal Clean, which is said to be fast drying, non-flammable and does not affect plastics. It reportedly dissolves dirt, grease and oil, and evaporates after application with no residue to gum up tuner contacts or to affect frequency sensitive components. The cleaner is followed with a pinpoint application of dripless foam spray, Royal Lube, applied directly to the tuner contacts. The thick



lubricant is said to maintain constant protection of the contacts, cleaning and lubricating them as the viewer changes channels. Price of kit: \$4.98. Injectorall Electronics Corp.

MONITOR-MATCH 713

For all frequency radio coverage

The Hustler Monitor-Match, Model 5-M, is reportedly designed for net-

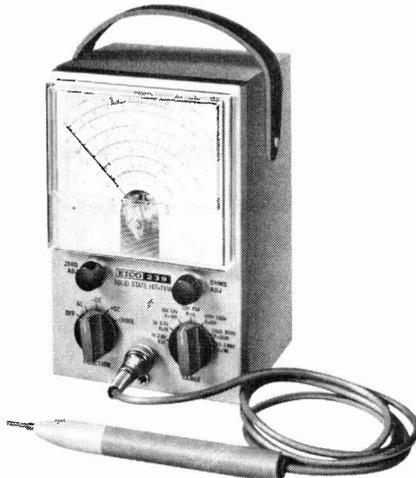


work isolation and impedance matching in conjunction with a regular outside mounted or windshield antenna. It is said to cover the 25 to 50MHz, 140 to 175MHz and 300 to 500MHz bands. Installation requires only that connectors be plugged in. New-Tronics Corp.

FET-TVM 724

Checks semiconductor and vacuum tube circuits

The Model 239 FET-TVM is battery-powered and is reportedly of a compact, advanced, solid-state design enabling it to check semiconductor and vacuum tube circuits on the bench or in the field. The model features 11M dc input impedance. It reads ac rms and dc voltages in seven 10dB steps from 1 to 1000v on a large 4½-in. meter. It is said to measure p-p ac voltages from 0 to 2800 and check re-



sistances from 0.2Ω to 1000M on seven ranges. It includes a time-saving Uniprobe. Size: 8½ in. H by 5 in. W by 5 in. D. Price: \$39.95 for the kit, \$59.95 for the factory-wired version. EICO Electronic Instrument Co.

Pollution control: A corporate responsibility



Pollution and pollution abatement have become important aspects of every business. They affect budgets, profit and loss, position in the community, corporate image, even the price of stock in some cases.

Pollution is a now problem that is receiving now attention from astute businessmen. Water treatment plants, fume scrubbers and filtration systems, land reclamation, plant beautification, litter prevention, employee education programs, are all types of things industry is doing to help in the pollution fight.

But regardless what a businessman is doing today he must be considering pollution control efforts for tomorrow.

One thing he can do is write for a free booklet entitled "71 Things You Can Do To Stop Pollution." It doesn't have all the answers on pollution. But it might give a businessman a few ideas for both today and tomorrow.

**People start pollution.
People can stop it.**



Keep America Beautiful



Advertising contributed for the public good

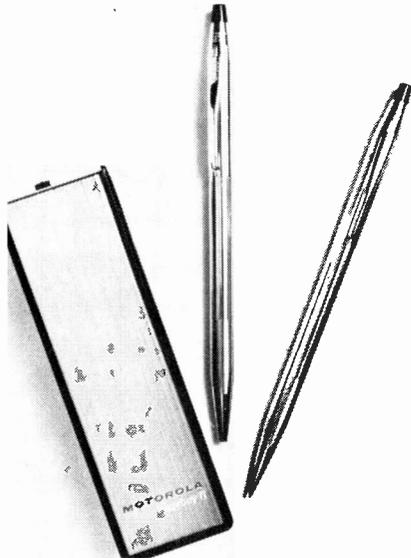
DEALER SHOWCASE

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

RADIO PAGING RECEIVER 714

Capable of providing citywide communications coverage

Weighing less than 4 oz and only slightly larger than a pen-and-pencil set, the "Pageboy II" radio pager can be conveniently worn and is reportedly capable of providing citywide communications coverage. With a typical citywide paging system, the caller wishing to contact a person wearing a page simply dials a 7 digit number. This activates a distinct "beep . . . beep . . . beep" tone, alerting the user to an



incoming call. The unit automatically resets itself to the "listen" mode after each page is received, so once it is turned ON, it reportedly needs no handling. A special built-in "memory" option is designed to permit the user to delay receipt of a page when its interruption might be inopportune. Motorola, Inc.

DIGITAL TELEPHONE DIALER 715

Functions without magnetic tapes

A new dialer, Model 401, reportedly consists of a send unit (type SU-401) and a display unit (type DU-401). No magnetic tapes are said to be used. The SU is a continuous automatic digital telephone dialer which is installed at each customer location, and is actuated by burglar and/or fire sensors. Up to a thousand customer located send units may reportedly operate with a single display unit, communicate to the DU both location and type

of emergency, and permit audible verification of the disturbance by a central control operator in order to minimize false alarms. Features of the new

Model 401

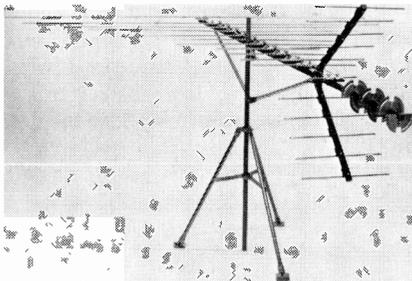


systems are said to include microphone inputs for audible disturbances, completely solid-state components, triggers with normally open or normally closed contacts, digital readout on "nixie" display and visual and audible alarms. Bourns Security Systems, Inc.

ANTENNA 716

Features corner reflector driven disc director array

The Star-Track is said to feature a corner reflector driven disc director array for total UHF band coverage, in conjunction with the standard accepted array of multiple tuned, cut-to-channel VHF elements. Specifications



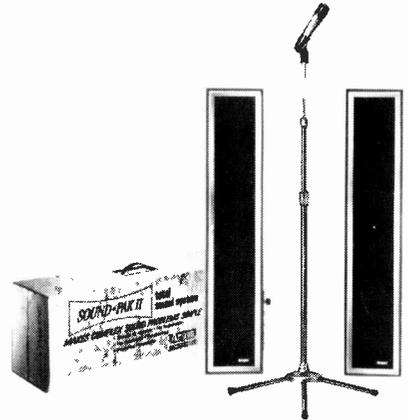
indicate that all aluminum weather-proof elements and heavy gauge aluminum 1-in.-sq. crossarm provide structural strength. Heavy duty aluminum snap-lock brackets secure the elements. All elements of varying lengths in the VHF section are supported by plastic insulators. The antenna features Reynolds Aluminum Colorweld durable gold finish. RMS Electronics Inc.

PACKAGED SOUND SYSTEM 717

Features simple installation and one-control operation

Sound Pak II is packaged in an easy-to-carry carton and reportedly consists of a master column speaker with built-in electronics, a remote

column speaker, a microphone, stand and cable. It features simplicity of installation, one-control operation and versatility. Installation consists of plugging the master column into an outlet, plugging in the microphone and connecting the remote column with two terminal strip screws. If security considerations are a factor, the system can be quickly removed for locked storage. The unit features two microphone capability for dual participation or remote paging. Simultaneously a phonograph, tape or tuner can be plugged in for permanent recording of program material. Elec-

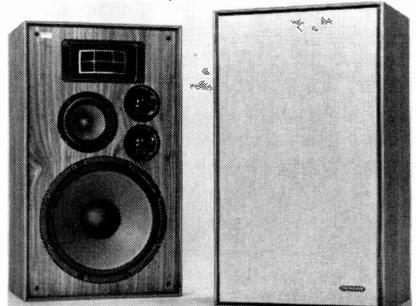


tronic circuitry is designed to adjust the volume for different voice levels spoken into the microphone. This gives great user freedom and reportedly makes it impossible to overload and distort the sound by speaking too loudly. Price: \$295.00. Argos Products Company.

SPEAKER SYSTEM 718

Use as full-range stereo speaker system or in multi-amp setup

A 60w speaker system, the Model CS-E700 is designed for regular or Multiple-amplifier use. Incorporating a 12-in. woofer, a 5-in. mid-range and a multi-cellular horn tweeter, the system reportedly provides high tonal separation, "no fuzz" midrange and sharply identifiable highs. Mounted in an



acoustic suspension enclosure, the system has a rated response of 35Hz to 20kHz, with low distortion and an ability to handle high inputs. The system

continued on page 63

TECHNICAL LITERATURE

Capacitor Replacement Manual

A capacitor replacement manual, No. K-110, covers over 300 different makes from Admiral to Zenith, including TV sets as well as home and auto radios, high-fidelity equipment and CB transceivers manufactured from 1947 up through December, 1970. This 40-page manual lists original part numbers for each manufacturer and list prices. Sprague Products Co., 65 Marshall St., North Adams, Mass. 02147.

Replacement Chart

A Solid-State Quick Selection Replacement Chart, No. 1L1367, lists the 79 entertainment SK-Series devices by application for dimensional outlines and terminal diagrams for each type. RCA Electronic Components, 415 S. Fifth St., Harrison, N.J. 07029.

Alarm Equipment Catalog

Space Age Security is the name of a 64-page catalog describing 350 intrusion and fire alarm products. Many are UL listed. The alarm equipment offered ranges from relatively simple "open-loop" hardware to the latest ultrasonic, radar and infrared intrusion detectors. Many storeroom supplies also are available. Major product categories include intrusion systems, fire systems, fire and intrusion detectors, remote controls, annunciators, telephone dialers, lock specialties, tools, accessories, and books. Products are described in some detail regarding application, principle of operation, and specifications to allow skilled technicians to make the right selection. The catalog features 6 pages of "Application Notes" for alarm equipment. A general alarm system discussion is followed by notes on how to apply the many detector options. Some basic installation procedures are presented. For custom installations, a number of diagrams are presented to permit design and fabrication of basic systems by a skilled installer. Mountain West Alarm Supply Co., 4215 N. 16th St., Phoenix, Ariz. 85016.

Products Catalog

An illustrated, 8-page leaflet, No. 108, describes a line of lubricants, penetrants and rust inhibitors; while a 2-page chart lists specific individual applications. LPS Research Labs., Inc., 2050 Cotner Ave., Los Angeles, Calif. 90025.



Chemtronics Introduces the "Slim-Jim" Transfer Tuner Spray



Pull sprayheads off from both cans



Insert stem of "Slim-Jim" into large can and press down



Withdraw "Slim-Jim" replace sprayheads

A "Slim-Jim," pocket-size tuner spray that fits conveniently almost anywhere. Shirt pocket. Service Caddy. You name it.

The ideal size and shape for service calls. Handy to use. Handy to store. Handy to carry around. Lets you add to your caddy those extra tubes you sometimes wish you had.

But that's not all. The "Slim-Jim" is refillable. Fills completely to service as many as 6 to 10 sets each time.

You save by buying economy, bench-size 24-oz. cans of Tun-O-Wash, Tun-O-Foam and/or Tun-O-Brite to fill and refill the "Slim-Jim." Best of all, there are no special gadgets for transferring either. Takes just half a minute and is so simple, you're bound to wonder, "Why didn't someone think of this before?"

You asked for it. Chemtronics listens.



Available at your local distributor in the Transfer Kit

KIT 1 Two 24 oz. Tun-O-Wash
Two "Slim-Jim" Transfer cans

KIT 2 One each of Tun-O-Wash and Tun-O-Brite
Two "Slim-Jim" Transfer cans

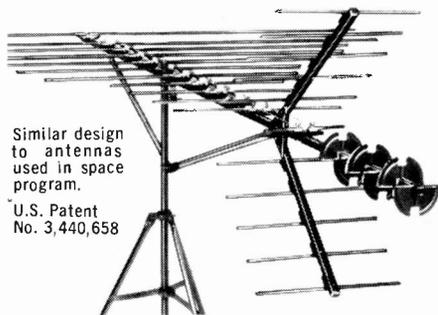
KIT 3 One each of Tun-O-Wash and Tun-O-Foam
Two "Slim-Jim" Transfer cans

CHEMTRONICS INC.

1260 Ralph Avenue, Brooklyn, N.Y. 11236

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

**"STAR-TRACK"™ the most
Advanced Space-Age
VHF/UHF/FM Color
Antennas ever introduced!**



Similar design to antennas used in space program.

U.S. Patent No. 3,440,658

- Corner Reflector Driven Disc Director Array for total UHF coverage!
- Multiple Tuned, Cut-to-Channel VHF Elements for total VHF and FM coverage!
- Maximum construction for long installation life!
- Exclusive Reynolds Aluminum COLORWELD durable baked enamel Gold finish!
- Includes RMS SP-332 VHF/UHF Splitter for economical single down-lead installation!

Model	RANGE OF RECEPTION	
	VHF	UHF
SK-716	Up to 50 miles	Up to 50 miles
SK-1117	Up to 125 miles	Up to 75 miles
SK-1519	Up to 150 miles	Up to 100 miles
SK-13	—	Up to 25 miles
SK-15	—	Up to 50 miles
SK-19	—	Up to 100 miles

Write for Catalog **RMS ELECTRONICS, INC.**
Profit 50 Antin Place, Bronx, N.Y. 10462
Details!— Tel. (212) 892-6700

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EPOXIES...

continued from page 50

you could add shielding by simply running a bead of epoxy on the printed-circuit board and adding copper-foil shield material as needed. Repairs could be made on RFI enclosures or added protection provided by filling seams and joints with conductive epoxy. Another application might be to provide additional or better ground connections between the printed-circuit boards and chassis. This can be accomplished because the epoxy can join dissimilar metals with ease, and a copper lead or strap can be joined to an aluminum chassis and then to a printed-circuit board with no difficulty.

Now that you have decided to use epoxies, you should carefully read all available literature from the manufacturer of your choice. Be sure to note if rubber gloves or protective materials are required. Set aside a portion of your bench as an epoxy station. You will find that a number of epoxies can be removed or thinned with lacquer thinner or Naptha. Take necessary precautions when storing and using these chemicals to avoid exposure to high temperatures or open flame. For safety sake, have a source of running water and soap nearby. Many products may cause skin irritation. If contact with the skin occurs, wash the affected area immediately with soap and water.

If having an electrically conductive epoxy isn't enough, check into the field of thermal-conductive epoxies. They are in a class by themselves. For the most part, thermal-conductive epoxies provide a high degree of thermal conduction between the item and the chassis, while at the same time maintaining excellent electrical isolation. This makes them a natural for solid-state equipment modifications where the replacement transistor won't fit the heat sink, or when you find that a given semiconductor will function better if it is suitably heat sunk.

It is a 1-2-3 operation. A glob of the epoxy is applied to the chassis or plate, the part is placed in the epoxy, and after the cure the component is effectively heat sunk and electrically isolated from the chassis. These thermal epoxies are quite rea-

sonable in price and deserve a place on your bench.

As time goes by, we find more and more gear assembled using conductive epoxies. There is no time like the present to up-date our thinking and get ready for the age of epoxies. ■

TEKLAB...

continued from page 42

Varying the FOCUS control, a part of the divider resistance, consequently varies the focus voltage. The jumpers found across resistors R119 and R120 perform the same operation only in a less selectable manner.

A positive pulse at Terminal BB of the high-voltage transformer is filtered by resistor R539 and capacitor C531 to provide B+ boost, 780v. Diode D105 and resistor R126 form the horizontal centering network.

The horizontal output tube (V503) cathode current is fed through a winding in the dual function circuit breaker CB101. During the presence of excessive cathode current, the breaker opens removing all B+ from the chassis.

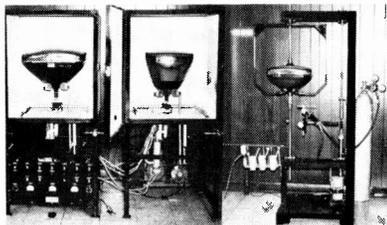
High Voltage Regulation

The K18 color-TV chassis employs a bias feedback type high-voltage regulation circuit. The primary controlling component in this circuit is RV102, the voltage dependent resistor (VDR) whose characteristic resistance decreases with an increase of applied voltage and vice versa. We find that the VDR current increases more rapidly with a large voltage than a smaller voltage. With this characteristic, applying an unsymmetrical positive pulse allows a rectifying action of the VDR since its operation is mostly affected by the positive portion of the pulse.

Positive pulses from the horizontal deflection coils are directly coupled to capacitor C116. This capacitor charges and discharges, providing a negative voltage at its junction with VDR RV102. The VDR provides a rectifying action, the resulting voltage being coupled through the filter network (resistors R113, R535 and capacitor C525) to the control grid of the horizontal output tube.

continued on page 64

**REBUILD
YOUR OWN
PICTURE TUBES?**



With the Lakeside Industries precision picture tube rebuilding unit, you can rebuild any picture tube, be it black and white or color or 20mm or etc. We offer you the most revolutionized precision equipment of our modern times. This unit is easy to operate and requires only 4 x 8 ft. of space. You can rebuild the finest tube available. The picture will be clear and sharp. Your cost to rebuild a color tube is \$6.60. Your cost to rebuild a black and white tube is \$1.85.

Profit? Imagine building four color tubes per day and if you sold these tubes for \$60.00 each. Total income \$240.00. Total cost \$26.40. Net profit \$213.60. Multiply this figure by five days per week. Your profit \$1,068.00 per week. Cut this figure in half! Build and sell only two color tubes per day. Your profit \$534.00 per week. Facts are facts, figures do not lie.

For further information, please send your name and address to Lakeside Industries, 5234 N. Clark St., Chicago, Ill. 60640. Phone: (312) 271-3399.

P.S. No salesman will call.

... for more details circle 112 on Reader Service Card

DEALER SHOWCASE

continued from page 60

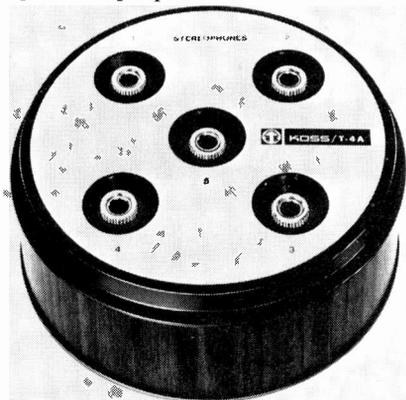
is said to feature newly developed free-beating cone papers—a special paper made from a variety of selected plant and animal fibers. The reported result is a lighter, yet stronger cone, with improved damping and transient response. The unit is also said to be equipped with a pair of separate level controls located on the front baffle, accessible by removing the no-tool snapout grille frame. The double LEVEL controls are designed for the adaptation of the CS-E700 to the acoustic requirements of any listening room. Each control has 3 positions—*increase, normal, and decrease*—in steps of 3dB. Price: \$189.00. U. S. Pioneer Electronics Corp.

FIVE SET CONNECTOR BOX

Designed for shared group "listen-in"

719

The Model T-4A connector box is designed to allow private listening for up to five people at one time. The box



fits standard headphone plugs. It is a round unit, 6 in. in diameter, with a walnut-like base combined with black trim and a spun aluminum panel. Price \$12.95. Koss Electronics, Inc.

SPEAKER SYSTEM

720

Total energy response for musical balance

The Model 6 system is reportedly a four-way, four-speaker system. The hand-rubbed walnut cabinet is finished on four sides and comes with a black base so that the system can be used as a console. It is said to incorporate a 15-in. woofer, 8-in. direct radiating mid-range element, 5-in. direct radiating tweeter and "Sonodome" ultra-tweeter. The Model 6 uses "Total Energy Response" design for the best musical balance throughout the listening area. Specifications indicate a fre-

quency range of 27Hz to 30KHz, impedance of 8Ω, crossover of 300/1,000/4,000Hz and 170° dispersion.



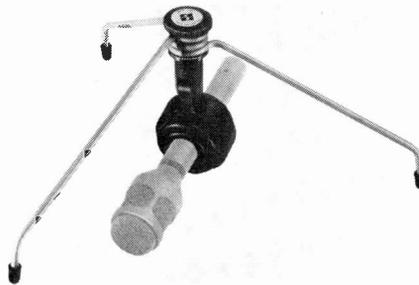
The base is 14 in. by 17 in. by 2½ in. Connections are push type binding posts, and the shipping weight is 74 lb. Price: \$198.00. Jensen Sound Laboratories.

MICROPHONE ISOLATION STAND

721

Designed to reduce that "hollow" sound

The problem of "hollow" sound quality often associated with attempts at distant sound pickup is reportedly greatly reduced by the use of a microphone isolation stand. These so-called "hollow" sounds are caused by direct sound waves and reflected sound waves cancelling each other. This phenomenon can be counteracted by locating the microphone as close to the floor as possible without actually touching it. In this way, the two paths of direct and reflected waves reportedly coincide to deliver the same natural quality of sound associated with close microphone pickup. The Model S55P Distant Pickup Microphone Isolation



Stand is said to put this principle to work while at the same time providing excellent shock isolation from floor vibrations. Price: \$28.00. Shure Brothers Inc.

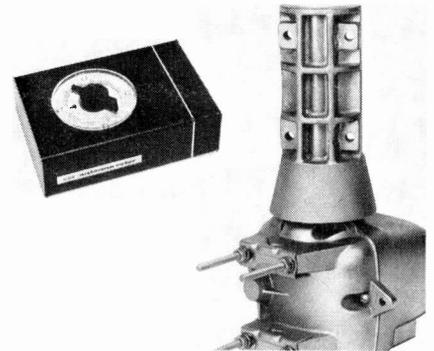
ANTENNA ROTOR SYSTEM

722

Fully automatic direction control

The AR-20 rotor is mounted in a heavy duty tie-cast aluminum housing, gold colored to match today's color antennas. Quick unit mounting is provided for through positive grip U-bolt clamps on the housing. A positive braking system is also included.

The control is said to be fully automatic and after the desired direction is set, the unit stops automatically and accurately. The dial face is illuminated when the system is in operation. The AR-20 is packaged in a full-color container which illustrates the most common reception problems. The contain-



er comes with a pop-up handle for easy carrying. Cornell-Dubilier Electronics.

STEREOPHONES

723

Designed to provide dual polarization capability

The Model PEP-77C earphone system reportedly provides a dual polarization capability for self-energized and 117v ac use. It features a lightweight headphone with "conform" ear cushions and adjustable headbands. In addition, it has a control console that accommodates the two sets of Superex Electrostatic Stereophones. The entire system reportedly retails for \$99.00 and is said to have the following features: 10Hz to 22kHz frequency response, independent-separate grounds (1 per channel) individual VOLUME channel controls, 15-ft. coiled cords, and 4 to 16 impedance. The console has a walnut finished cabinet with front and rear control panels featuring a SPEAKER-PHONES selector rocker



switch, illuminated ON-OFF rocker switch, and headphone jacks to accommodate two sets of stereophones. Superex Electronics Corp.

TEKLAB ...

continued from page 62

Under normal beam current variations, the horizontal output tube's control grid does not conduct during any portion of the horizontal period. But if we have a condition of heavy CRT conduction, the high-voltage transformer load increases, decreasing the amplitude of the positive

pulses to capacitor C116, and the supply voltage of C116 and RV102 is not rectified as much. The voltage of RV102 is then less negative, allowing the horizontal output tube to increase conduction and restoring the pulse amplitude to normal. The same but opposite sequence takes place during low level CRT conduction. As a result, the high voltage and yoke currents are regulated for brightness variations. ■



8 PACK VALUE

NEW 8 Packs of chemicals with box of 5 precision tools

NEW Valve for easy insertion of extension tube

NEW Ultra Wissh formula for Color TV. 6 oz. aerosol

• **MODEL SC6A-8**
ULTRA WISSH
with precision
screwdrivers.

• **MODEL HL6-8**
LUBRITE with
precision nut
driver.

• **MODEL HG6A-8**
MIRACLE BATH
with precision
wrenches.



TOOL
KIT
WITH
EVERY
PACK

ONLY **WORKMAN** *Electronic* **\$8.88**
FROM SARASOTA, FLORIDA PRODUCTS, INC. Dlr. Net

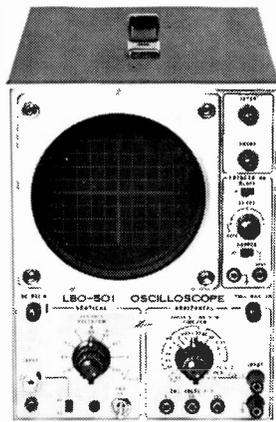
... for more details circle 125 on Reader Service Card

Leader's 5" triggered scope. Still only \$339.

Before you say you don't need a triggered scope, look what's happening to TV servicing: tubes are out, transistors and IC's are in.

With tubes you could play hit-or-miss, knowing the tube would take the overload. Try the same thing now, and good-bye transistors.

For new-era circuitry, Leader introduces a new-era troubleshooter. A triggered scope, just like the ones the TV designers use.



Now the wave shape is locked in and continuously displayed. Now you can look at a waveform containing high and low frequency components. Now you can determine voltage directly and instantly.

Before you say \$339 is a lot of bread, look what it buys: Leader's LBO-501 5-inch triggered scope, with a bandwidth of DC to 10MHz and a solid state package.

Going like hotcakes at your Leader distributor.

Instruments to believe in.

Leader
INSTRUMENTS CORP.

37-27 27th Street, Long Island City, N.Y. 11101, (212) 729-7411

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BOOK REVIEWS

HOW TO USE COLOR TV TEST INSTRUMENTS by Robert Goodman, published by Tab Books, 256 pages, hardbound \$7.95, paperbound \$4.95.

There are far too many intelligent electronic technicians in our industry that fail to understand how to make efficient use of the many types of test instruments now on the market—this being a significant reason why their profits fail to reach potential. This book should offer valuable assistance to any readers falling in that category.

The author includes in his book a word of thanks to test instrument manufacturers that assisted him in preparing it. They include B & K Dynascan Corp., Heath Co., EICO Instrument Co., Hickok Instrument Group, Lectrotech, RCA Electronic Instruments Operations, Sencore, Tektronix and Zenith Radio Corp.

Divided into 10 chapters, the book covers such topics as the color bench scope, color-bar generator, TV alignment considerations, basic alignment techniques, color TV alignment, vector-scope use, the TV analyst, sine/square-wave generator, curve tracer, and miscellaneous test gear.

The book is written in such a clear, easily read manner that it should be of value to both the experienced and inexperienced electronic technician.

FM STATION ATLAS compiled and published by Bruce F. Elving, Box 24, Adolph, Minn., 36 pages, paperbound \$2.00.

With the current pressures of our rapid-paced society, many of us find more time to relax while traveling in our cars than when at home. And it was for this very reason that I have had three factory-ordered cars with AM/FM radios prior to getting an FM receiver in our home.

Although under ideal conditions car FM radios are able to receive stations well over a hundred miles away, when traveling there is still the problem of tuning across the FM band for continued reception. This handy atlas is very helpful for those faced with this activity—as well as for those interested in attempting long-distance reception with their home FM receivers.

The book is an indexed atlas of maps showing the locations of U.S. and Canadian cities having FM stations, and listing the frequencies of these stations. This information is said to have been updated to July 1971.

1971 ARTICLE INDEX

COLORFAX

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LETTERS...

continued from page 27

critical of TV-set manufacturers. However, we do not serve the majority of our readers (electronic technicians and service dealers) by telling them that there are some problems—they already know it. We instead deal directly with the manufacturers that these letters complain about. In fact, I took such correspondence with me to the last National Service Conference, visited with the appropriate industry executives and followed up with correspondence.

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GUEST AUTHOR...

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It is worth repeating that a good knowledgeable sound man could be continually prosperous simply by correcting existing bad systems in schools, churches and auditoriums (many of which were just recently installed).

With today's sophisticated equipment and the data available, there is no excuse for anyone to have to live with a bad sound system in their church, school, hotel, meeting room or any other place where sound is required. Good sound should be the rule, not the exception.

Again, let us emphasize that there is a place for everything and everything in its place. Small reception rooms, offices and tea rooms are not meant for sound columns. A conventional speaker system will supply good low-level sound.

For outdoor use, horns are usually desirable, but there are many situations in shopping malls and large swimming pool areas where good outdoor sound columns have been designed to do a very satisfactory sound projection job and provide intelligibility not always found in other devices.

The large sound installer of today may employ as many as 20 to 30 electronic technicians. The sophisticated sound man may also employ the use of exotic measuring instrumentation, used for on-site survey work to determine the desired equipment and type of installation. This is normally for large expensive installations costing many thousands of dollars, and such instruments require a very large investment on the part of the sound contractor. ■



"Please don't breathe on the printed boards—you're warping them!" /1/54
/71/55
6/71/53

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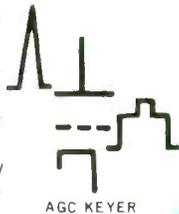
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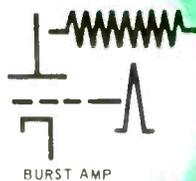
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PS163 DUAL CHANNEL DUAL TRACE

How often have you dreamed that you could see the gated AGC plate pulse and control grid keying signal to determine whether they are arriving at the same time? *The dual trace, triggered PS163 will do it.*



How often have you dreamed that you could see the flyback pulse and 9 cycle color burst at the same time to see if they are actually opening up the burst amplifier (gate)? *The dual trace, triggered PS163 will do it.*



These are only a few of the many things you can do with the PS163. Don't keep on dreaming, the PS163 Dual Trace Triggered Oscilloscope will be at your favorite Sencore distributor in a few days. Why not get it on order first and be miles ahead of your competition? You can tell HIM that you own the Sencore Dual Channel, Dual Trace, Triggered or Free Running, Quality Made Oscilloscope. It will compare to lab scopes costing four times as much and he knows it.

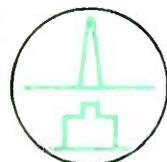


TRIGGERED OSCILLOSCOPE

How often have you dreamed that you could view color vector waveforms from the front of the scope and have amplifiers on each axis so you would not be restricted from viewing vectors in low level circuits or when the circuit is defective? *The dual channel, triggered PS163 will do it.*



How often have you dreamed that you could own a dual channel, dual trace scope which would operate either triggered or free-running?



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18VACP22	19HKP22	490BAB22
18VADP22	19HFP22	490BCB22
18VAHP22	19HJP22	490BDB22
18VAJP22	19HKP22	490BGB22
18VAQP22	19HQP22	490BHB22
18VARP22	19HRP22	490BRB22
18VASP22	19HXP22	490CB22
18VATP22	19JBP22	490CHB22
18VBAP22	19JDP22	490CUB22
18VBGP22	19JHP22	490DB22
19EXP22	19JKP22	490EB22
19EXP22/	19JNP22	490EB22A
19GVP22	19JQP22	490FB22
19EYP22	19JYP22	490GB22
19EYP22/	19JZP22	490HB22
19GWP22	19KEP22	490JB22
19FMP22	19KFP22	490JB22A
19FXP22	490AB22	490KB22
19GLP22	490ACB22	490KB22A
19GSP22	490ADB22	490LB22
19GVP22	490AEB22	490MB22
19GVP22/	490AFB22	490NB22
19EXP22	490AGB22	490RB22
19GWP22	490AHB22	490SB22
19GWP22/	490AHB22A	490TB22
19EYP22	490AJB22	490UB22
19GXP22	490AJB22A	490VB22
19GYP22	490AKB22	490WB22
19GZP22	490ALB22	490XB22
19HBP22	490AMB22	490YB22
19HCP22	490ANB22	490ZB22
	490ARB22	

Replaces **22** types

19VABP22	21FJP22A/
19VACP22	21GVP22
21AXP22	21FKP22
21AXP22A	21GUP22
21AXP22A/	21GUP22/
21AXP22	21FBP22A
21CYP22	21GVP22
21CYP22A	21GVP22/
21FBP22	21FJP22A
21FBP22A	21GXP22
21FBP22A/	21GYP22
21GUP22	21GZP22
21FJP22	21HAP22
21FJP22A	

Replaces **71** types

23VACP22	25AEP22	25BRP22
23VADP22	25AFP22	25BSP22
23VAHP22	25AGP22	25BVP22
23VALP22	25AJP22	25BWP22
23VAMP22	25ANP22	25BXP22
23VANP22	25AFP22	25BZP22
23VAQP22	25AP22A	25CBP22
23VARP22	25AP22A/	25CP22
23VASP22	25XP22	25CP22A
23VATP22	25AQP22	25FP22
23VAUP22	25ASP22	25FP22A
23VAWP22	25AWP22	25GP22
23VAXP22	25AXP22	25GP22A
23VAYP22	25AZP22	25RP22
23VAZP22	25BAP22	25SP22
23VBAP22	25BCP22	25VP22
23VBGP22	25BDP22	25WP22
23VBHP22	25BFP22	25XP22
23VBEP22	25BGP22	25XP22/
23VBGP22	25BHP22	25AP22A
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