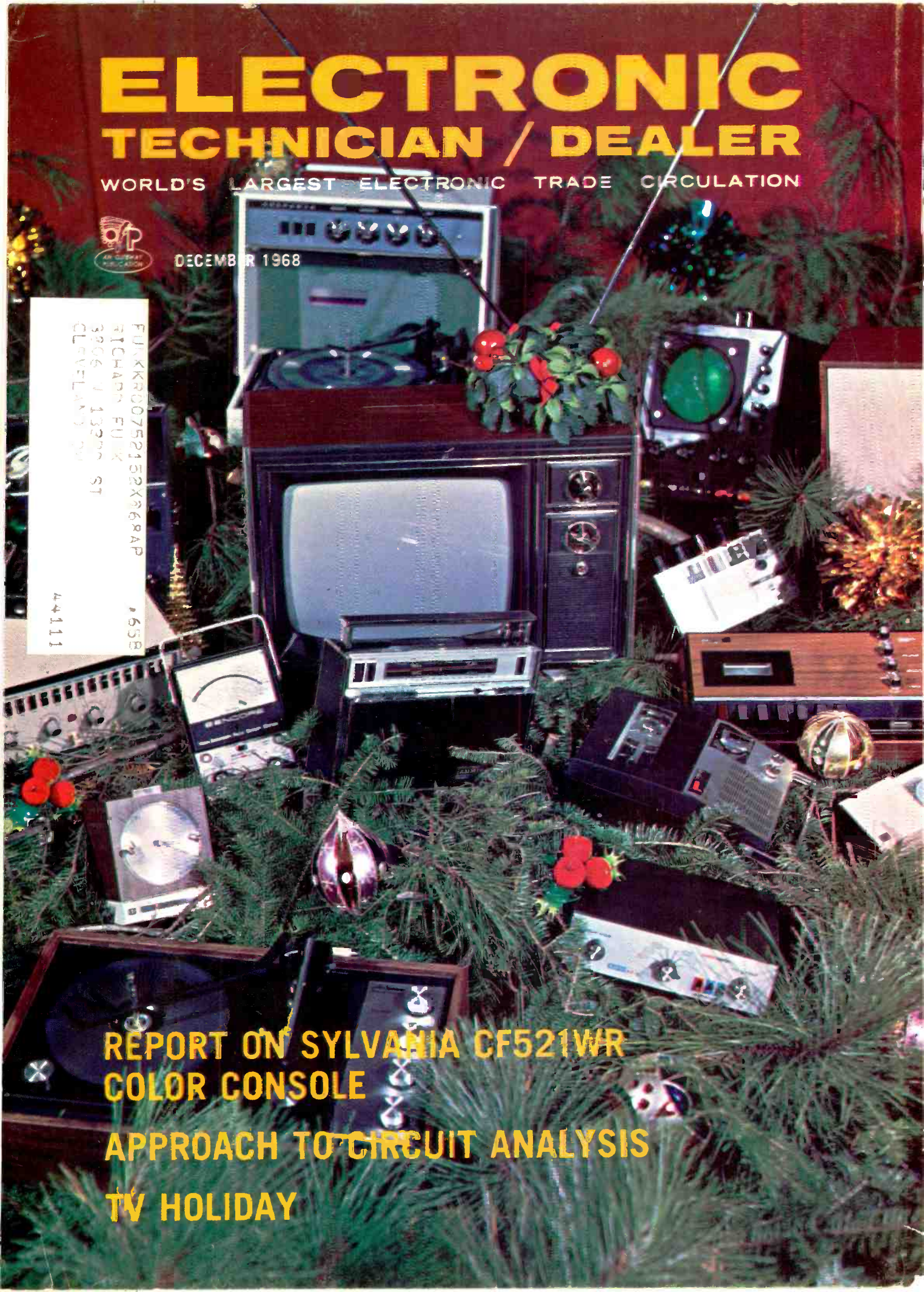
ELECTRONIC TECHNICIAN / DEALER

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

DECEMBER 1968



REPORT ON SYLVANIA CF521WR COLOR CONSOLE

APPROACH TO CIRCUIT ANALYSIS

TV HOLIDAY

The absolute end of an old fear.

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

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

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

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

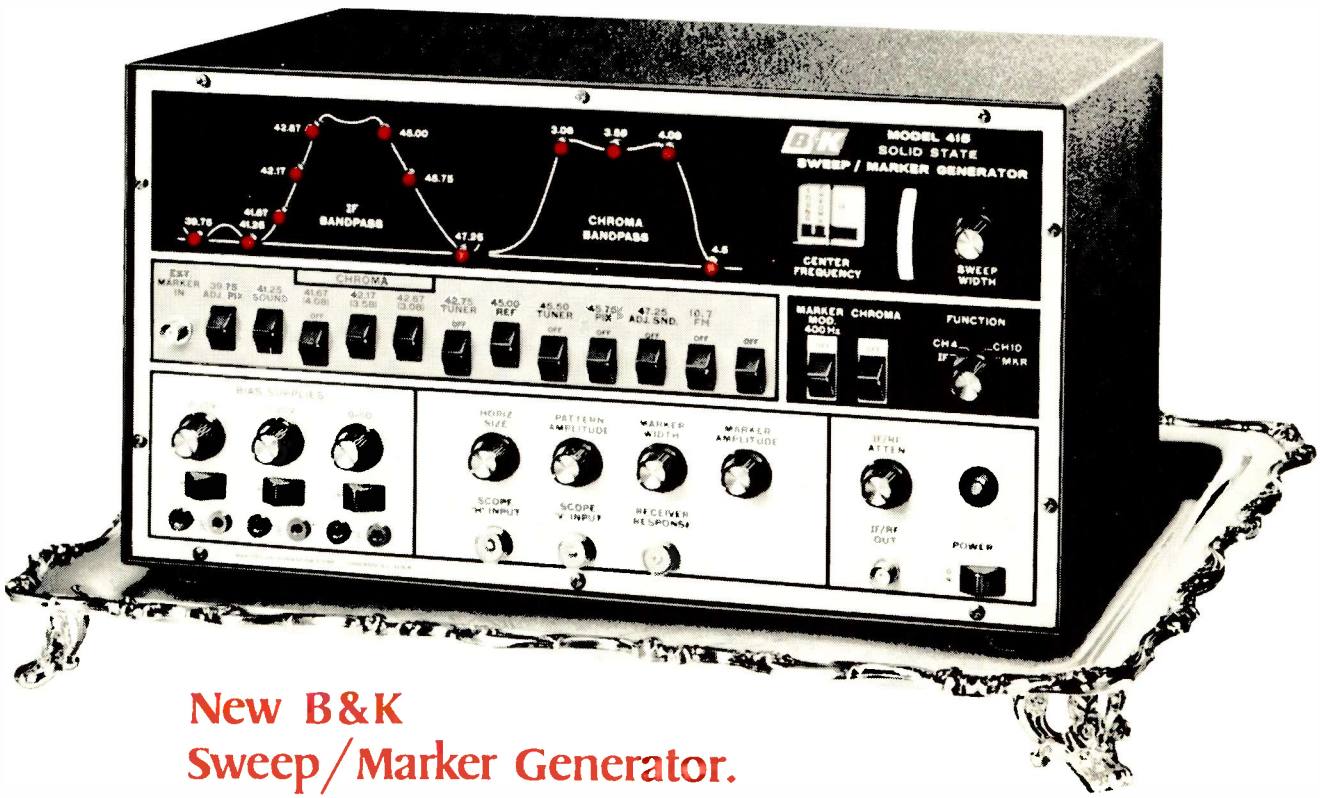
The Sweep/Marker Generator is both an instrument and a guide. As a guide, the bandpass and chroma bandpass curves are visually reproduced and the individual markers are clearly indicated by lights—right on the front panel—for quick, easy reference.

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

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

B&K

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



New B&K Sweep/Marker Generator.

ELECTRONIC TECHNICIAN / DEALER

TEKFAX

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

GROUP 196

	SCHEMATIC NO.
AIRLINE TV Model GEN-13469A	1194
GENERAL ELECTRIC TV Chassis P-1	1195
MOTOROLA TV Chassis TS611 Series	1196
PHILCO-FORD Color TV Chassis 19QT85R	1197
RCA VICTOR TV Chassis KCS171 Series	1198

COMPLETE MODEL/CHASSIS INDEX FOR ALL CIRCUIT DIGESTS AND TEKFAX FROM JANUARY 1961 THROUGH DECEMBER 1968

MONTH IN WHICH SCHEMATIC APPEARS

607-613 ..... Jan. 1961	806-811 ..... Sept. 1963	1002-1009 ..... May 1966
614-620 ..... Feb. 1961	812-817 ..... Oct. 1963	1010-1015 ..... June 1966
621-627 ..... Mar. 1961	818-822 ..... Nov. 1963	1016-1022 ..... July 1966
628-633 ..... Apr. 1961	823-828 ..... Dec. 1963	1023-1028 ..... Aug. 1966
634-636 ..... May 1961	829-833 ..... Jan. 1964	1029-1035 ..... Sept. 1966
637-643 ..... June 1961	834-838 ..... Feb. 1964	1036-1041 ..... Oct. 1966
644-650 ..... July 1961	839-843 ..... Mar. 1964	1042-1047 ..... Nov. 1966
651-656 ..... Aug. 1961	844-850 ..... Apr. 1964	1048-1054 ..... Dec. 1966
657-662 ..... Sept. 1961	851-853 ..... May 1964	1055-1060 ..... Jan. 1967
663-669 ..... Oct. 1961	854-858 ..... June 1964	1061-1067 ..... Feb. 1967
670-675 ..... Nov. 1961	859-863 ..... July 1964	1068-1073 ..... Mar. 1967
676-680 ..... Dec. 1961	864-870 ..... Aug. 1964	1074-1080 ..... Apr. 1967
681-686 ..... Jan. 1962	871-875 ..... Sept. 1964	1081-1086 ..... May 1967
687-692 ..... Feb. 1962	876-881 ..... Oct. 1964	1087-1092 ..... June 1967
693-698 ..... Mar. 1962	882-887 ..... Nov. 1964	1093-1098 ..... July 1967
699-705 ..... Apr. 1962	888-893 ..... Dec. 1964	1099-1104 ..... Aug. 1967
706-709 ..... May 1962	894-900 ..... Jan. 1965	1105-1110 ..... Sept. 1967
710-716 ..... June 1962	901-908 ..... Feb. 1965	1111-1116 ..... Oct. 1967
717-723 ..... July 1962	909-916 ..... Mar. 1965	1117-1122 ..... Nov. 1967
724-729 ..... Aug. 1962	917-923 ..... Apr. 1965	1123-1127 ..... Dec. 1967
730-735 ..... Sept. 1962	924-926 ..... May 1965	1128-1133 ..... Jan. 1968
736-743 ..... Oct. 1962	927-934 ..... June 1965	1134-1139 ..... Feb. 1968
744-749 ..... Nov. 1962	935-942 ..... July 1965	1140-1145 ..... Mar. 1968
750-755 ..... Dec. 1962	943-950 ..... Aug. 1965	1146-1151 ..... Apr. 1968
756-761 ..... Jan. 1963	951-953 ..... Sept. 1965	1152-1157 ..... May 1968
762-766 ..... Feb. 1963	954-961 ..... Oct. 1965	1158-1163 ..... June 1968
767-772 ..... Mar. 1963	962-969 ..... Nov. 1965	1164-1169 ..... July 1968
773-779 ..... Apr. 1963	970-975 ..... Dec. 1965	1170 1175 ..... Aug. 1968
780-784 ..... May 1963	976-982 ..... Jan. 1966	1176-1181 ..... Sept. 1968
785-790 ..... June 1963	983-988 ..... Feb. 1966	1182-1187 ..... Oct. 1968
791-797 ..... July 1963	989-995 ..... Mar. 1966	1188-1193 ..... Nov. 1968
798-805 ..... Aug. 1963	996-1001 ..... Apr. 1966	1194-1198 ..... Dec. 1968

SCHEMATIC NO.

AB 963
AC 1164
AD 1148
AY 832
A-1 1191
CB 953
DA 861
DB 930
DC 990
DD 1075
ETV 1046
FY 866
G-1 1159
H-1 1173
HB 1011
KC 1037
KD 1141
KE 1184
LW 621
LX 699
MW 717
MXT 785
P-1 1195
QX 772
QY 828
SA 911
SB 939
SC 1018
S-2 1155
TA 881
TB 1004
TC 1048
U5 692
VB 979
M575 609
M597 Series 745
TU 220 AM/FM Tuner 759

Model:
940A, B Radio 858
11R31, -33, T225A, -35A, -36A Radio ... 845
CT110, CP775 Trans Radio 619
M502XBN, EB, VY, 3XBN, EB, VY 772
M870VWD, M871VWD, R870VML, R870VWD 692
P970A Radio 809
RP2060A Stereo Phono 725
T-3000A, B Stereo Receiver 836
W360A Radio Intercom 796

GRANCO

Model:
704 AM/FM Radio 682

GENERAL ELECTRIC (CANADA)

Chassis:
M618 1030
M638 1171
M649 1101
M685 1123
M687 1112

HEATH

Model:
AA-21 Stereo Amp 829
GR-22 773
GR-53 839

HOFFMAN

Chassis:
913-000366, 386 1166
BP318 Trans Radio 703
Model:
P708 Trans Radio 703

KORTING

Model:
MT2233, 2243 Tape Recorder 865
MT3643/3633 Stereo Tape Recorder Constellation 853

LAFAYETTE

Model:
KT-236 Stereo Amp 610

MAGNAVOX

Model:
77-01 AM/FM Tuner 794
Chassis:
34 Series 722
35 Series 633
36-02 Series 672
36-08, -09 Series 762
40 Series 849
43 Series 835
44 Series 812
45 Series 882
47 Series 1062

SCHEMATIC NO.

48 Series 912
49 Series 901
70-01 FM Multiplex Adapter 702
T907 Series 981
T908 Series 993
T910 Series 985
T911 Series 1088
T914 Series 954
T915 Series 1181
T916 Series 1140
T917 Series 1186
T919 Series 1012
T920 Series 1103
T921 Series 1059
T922 Series 1072
T923 Series 1076
T924 Series 1135
T925 Series 1111
T927 Series 1158

MATSUSHITA

Model:
T-35 Trans Radio 719
MF800 Motional Feedback Amp 810

MONTGOMERY WARD

Model:
WG-399A FM Multiplex 768

MOTOROLA

Chassis:
436 Series 656
QTS-436 731
RTS-436 731
STS-435 614
STS-436 731
TS-435 614
TS-436 731
TS-440 700
TS-454 931
TS-458 1107
TS-460 Series 1089
TS-461 1047
TS-499 752
TS-576 681
TS-578 763
TS-584-05, -H 913
TS-586 904
TS-587 919
TS-588 964
TS-589 899
TS-592 1149
TS-594 1031
TS-596 957
TS-597 1021
TS-611 1196
TS-908C-02 thru D-02 924
TS-912A 819
TS-914A-00 thru A-07 951
TS-921 Series 1142
TTS-587 919
VTS-587 919
WTS-435 614
WTS-436 731
Model:
202 Auto Radio 727
203 Auto Radio 727
204 Auto Radio 727
1TMC Auto Radio 673
2TMR Auto Radio 691
13MAM Auto Radio 661
14MF Auto Radio 647
19P7-1, -2, -3 700
19T5, 7, 11, 12, 13, and A19T8 Series 731
109 Mopar Auto Radio 1961 Plymouth 664
C2AA-18806-M-N Auto Radio 741
C2YA-18806-E Auto Radio 741
RV2F C20Z-18875-C Auto Radio Reverb 723

MUNTZ

Chassis:
T68A14 940
T68A15 940
T68H28 947

OLYMPIC

Model:
6P28, 6P29, 6P30 992
CT-910 1064
Chassis:
9P56, 57, 58 1095
9P59, 60 1090
CTC19/21 Series 1077
JU-JCU 710
JWR 671
NB 820
NBU 820
NDP 1013

SCHEMATIC NO.

PACKARD-BELL

Model:
23DC16 748
MPX-1-1 Stereo Adapter 716
MSJ-202 1134
MSJ-204 1134
Chassis:
88-9 607
88-16 877
88-18C 941
88-19 970
98C15 1083
98C17 1131
98D14, C 677

PEARCE-SIMPSON

Model:
CBD-5 CB Radio 638

PERMA-POWER

Model:
G230, 1, 2 Remote Control Receiver 806
G340, 50 Transmitter 806
G-500 & RC-200 Remote Control 797

PHILCO-FORD

Model:
J-1720R Stereo Reverb 626
L-1532 Stereo Phono 761
L-1650 Stereo 764
M-1618 Stereo Phono 822
M-1660 Stereo Phono 822
NT-600 Radio 867
Q1054 1113
RC-65 Remote Control Receiver 737
T-63 Trans Radio 708
T-909 Trans Radio 824
Chassis:
N1052 935
N1200 932
N1204 932
11H25 613
11J27 613
11N56 636
12J27 676
12N50 662
13N51 754
13N52 754
13N53 754
14G20 855
14N30 871
14N50 862
15G20 905
15J25 1007
15J27 884
15M91 898
15N30 914
15N50 921
16J27 980
16JT26, A 965
16N35 971
16NT82 1017
16QT85 1017
17C21, A, V, AV 1099
17J25 1084
17J27, 27A 1063
17J28 1096
17KT50 1017
17N35 1049
17NT45 1078
18J32 1151
18L33 1130
18LT43 1137
18NT45 1125
18QT85/18MT70 1118
19QT85R 19QT85R

PHILHARMONIC

Chassis:
TSL-001 689

RAYTHEON CO

Model:
TWR-1 "Raytel" Citizens Band Radio 640
Raytheon Two-way Encoder / Decoder 895

RCA VICTOR

Model:
193-A-542-MV, MU 730
193-A-546-VM, MU 730
193-A-549-MV, -MU 730
213-G-21-M 736
213-G-23-M 736
213-G-23R 736
213-G-26M 736
213-G-27M 736
213-G-27-R 736
213-G-31-M 736
213-G-31-R 736

SCHEMATIC NO.

213-G-33-M 736
213-G-33-R 736
4VC6 Record Player 798
4VC8 Record Player 798
4VF606 Stereo Hi-Fi 827
4VF705 Stereo Hi-Fi 827
KRK105/112, KRK112 with 962709 IF Amp KRK105/KRK66 Series 856
MARK11 Citizens Band Radio 645
RFG35 Radio 863
RK-295 Stereo Adapter 721
RP-215-C1 Record Player 848
Chassis:
CTC11 706
CTC12, A, B, P, R 736
CTC16, X 885
CTC17X 952
CTC19 984
CTC20 1032
CTC22 Series 1109
CTC25 1040
CTC28 Series 1136
CTC31 Series 1144
CTC35 Series 1132
KCS130F, H, K, M 687
KCS130YAB, YAC 705
KCS134 627
KCS136 669
KCS136M 1008
KCS136 ML Series 1161
KCS136X 879
KCS136Y Series 744
KCS137 750
KCS138 750
KCS140A, B 730
KCS142 834
KCS142XA 982
KCS143F 906
KCS144E 998
KCS147A, B 786
KCS148 927
KCS149AA, AB, AD 942
KCS151A 917
KCS152A 915
KCS153 959
KCS154A, B 948
KCS155 966
KCS156 1019
KCS157 Series 1116
KCS158 Series 1119
KCS161 1022
KCS162 1028
KCS163 Series 1065
KCS164 1050
KCS165 Series 1104
KCS168 Series 1175
KCS169 Series 1192
KCS171 Series 1198
KCS173 Series 1180
KCS174 Series 1182
RC-1214A Radio 792
RC-1216 Radio 863
RS-194A Reverb Amp 615
RS-200 Stereo Adapter 721
RS-206-A Record Changer 868

REGENCY

Model:
C8-27 Citizens Band Radio 658
CBM-27 Citizens Band Radio 658

SETCHELL-CARLSON

Chassis:
159 639
361A 629
401 1066

SHERWOOD

Model:
S-3000 111 FM Stereo Tuner 612

SILVERTONE

Model:
6122 1009
6150 995
6151 995
6152 995
6154 995
6155 995
6156 995
6157 995
6164 1000
7110 1026
7111 1026
7114 1026
7120 1038
7121 1038
7122 1026
7128 1026
7131 1026
7151 1098
7152 1098
7154 1098
7155 1098
7156 1098

SCHEMATIC NO.

7157 1098
7158 1098
81401, 411, 421 1167
Chassis:
456.61580 955
456.61581 955
456.70120 967
456.70121 967
528.61580 955
528.61581 955
528.70120 967
528.70121 967
528.70370, 71 1133
528.71120 1120
528.71150 1138
528.72280 1114
528.72281 1114
528.72282 1114
528.72500 1160
529.61580 955
529.61581 955
529.70120 967
529.70121 967
562.10096 972
564.10000 972
564.10003 972
564.10000 988
564.10001 988
564.10002 988
564.10003 988
564.10004 988
564.10005 988

SONAR

Model:
"G" CB Transceiver 770

SONORA

Model:
563P197 852
563P197 852
564K236M 989
565P198 1060
Chassis:
1194-194 869

SONY

Model:
5-303W 751
8-301 667
TRW-621 Trans Radio 690

SPARTON

Model:
12M5-P Stereo Phono 732
Chassis:
19L1 765
23K2 714

STERLING

Chassis:
1/633US AM/FM/SW Radio Phono 641

STRIBEL

Auto Radio 622

SYLVANIA

Model:
4P19 Series Trans Radio 668
19L17 Series 704
21TC1-C2 851
21LC3 851
21LC12-1 851
21LC14-1 851
23E01 757
45C31-1 Stereo 738
45P36 Stereo 859
55C31-1 Stereo 738
G9400 Stereo 738
Chassis:
A02-1, -2 999
A04-1, -2 1051
A06, A07 1035
A06-1, -2 1085
B04-1, -2 968
B05-1, -2, -3 973
B06-1, -2, -3 960
B06-1, -2, -3, -4, -5 1108
B09-1, -2 1122
D01-1, -2 925
D01, -1 -2, -8 1043
D03, -3 987
D05 1024
D06-1, -2 1091
D07-1, -2 1115
D08-2 1154
D09-1, -2, -4 1150
D11-1, -2 1190
1-537-5, -6 611
406-3 Stereo 859

SCHEMATIC NO.

551, -2, -3, -5, -6, -7 680
552-1, -2, -9 646
558-1, -2 704
562, -3, -4 757
577, -1, -2 851
584-1 thru 7 933
585-1, -2, -4, -5 922
682-1, -2, -3 Trans Radio 668

SYMPHONIC

Chassis:
TSL-001 747

TELECTRO

Model:
215 Tape Recorder/Radio 807
MM-214 Tape Recorder 801

TELEFUNKEN

Model:
77 Stereo Tape Recorder 715
5051W Caprice AM/FM/SW Radio 674
5061W Jubilate AM/FM/SW Radio 654

TOSHIBA

Model:
9TL-3655 Trans Radio 685
Chassis:
10PG 712

TRAVLER

Model:
GTC-3014A, B 821
GTC-3114A 821
GTC-4014A 821
GTC-4044A 821
GTC-4054A 821
GTC-4114A 821
GTC-4144 821
GTC-4154A 821
Chassis:
1051-90 642
1156-89 696

TRUETONE

Model:
2DC1300B 767
2DC1300C 780
2DC1301B 767
2DC1301C 780
2DC1302B 767
2DC1302C 780
2DC1303B 767
2DC1303C 780
2DC1501A, B 894
2DC1605 983
2DC1605 1079
2DC1803 1110
2DC3555 1079
2DC3651 949
2DC3712 1073
2DC3741 1041
2DC3815 1156
2DC3818 1127
2DC3819 1168
2DC3920 1193
2DC4815 1178
Chassis:
1096-243 788
1095-232 729

UNITED SCIENTIFIC LABS

Model:
Contact 23 CB Transceiver 896

UTICA

Model:
T&C11 CB Transceiver 805

VOICE OF MUSIC

Model:
725 Tape Recorder 850

WEBCOR

Model:
1376 Stereo Phono 735
1377 Stereo Phono 735
2207 Tape Recorder 678
4210 Amp/Speaker System 749

WELLS-GARDNER

Model:
2DC3144 628
TV29491 628
WG4324, S2, S2V 628
WG4424 628

SCHEMATIC NO.

WESTERN AUTO

Model:
DC3438 Trans Radio 776
4DC7260A Tape Recorder 840
4DC7465 Tape Recorder 803

WESTINGHOUSE

Model:
H-790P6 Trans Radio 679
H-791P6 Trans Radio 679
H-883N29 Radio 846
H-M1800, 01, 03 Phono 734
H-M1900, 01, 03 Phono 734
Chassis:
V-2393-4 Trans Radio 679
V-2407-4 Radio 789
V-2409-1, -2, -3 625
V-2409-4, -5, -6, -7, -8 688
V-2411-1, -3 634
V-2414-1, -2 660
V-2417-1, -2, -3, -4, -5, -6 711
V2436 758
V2444-1, -2, -3, -5, -6, -9, -10 795
V-2444-1, -2, -3, -9, -10 837
V-2446-1, -2, -3, 4 825
V-2451-2CB Transceiver 774
V-2451-2 CB Transceiver 817
V-2474-1, -2, -3, -6, -7 875
V-2475-1, -4 887
V-2476-1 900
V-2478-1, -2 907
V-2483-1 1053
V2495-11 961
V-2486 Series 996
V-2487 Series 1002
V-2490 Series 1014
V-2496 Series 1023
V-2498 Series 1029
V-2515-2 Phono 734
V-2515-6 AM/FM/Tuner 771
V-2528-3 Radio 846
V2652-2 1092
V2655-2-3-4-7-8-13 1058
V2656-1-2 1121
V2659 Series 1143
V-2660 1162
V2664 Series 1157

ZENITH

Model:
40 Radio 857
Royal 50L Trans Radio 781
Royal 150 Radio 635
Royal 490 Trans Radio 811
Chassis:
1Y21B55 1139
6GT42Z2 Radio 635
6JT40Z1 Trans Radio 720
6JT41Z1 Trans Radio 720
6KT40Z1 Trans Radio 781
6KT50Z8 Radio 857
7KT45Z1 Trans Radio 811
8Y4836 1145
1M30T20 977
13M15 923
13X15 1034
13X18 1086
13Y12 1176
13Z13 1187
14L20 842
14L25 838
14M20 893
14M21 1054
14M23 878
14M27 916
14M32 934
14N22 1001
14N26 958
14N27 1080
14N28 1010
14N29 969
14N29Z 1067
14N31 986
14X21 1039
14Y21Z 1160
14Y33 1163
15M22 908
15Y6C15 1174
16F23, Q 616
16J28QS 698
16K20, QS 739
16N24 1006
17G28, Q 651
20YJ37 1126
23XC36 1027
24NC31 994
25MC30 886
25MC36 926
26KL20, 20QS 779
27KC20, Q 728
29JC20 675
S-54344 Hand Control 799
S-60804, 44, 1024 Remote Control 799
175-141, -142, -301, -302, -171, -172 Tuner 623

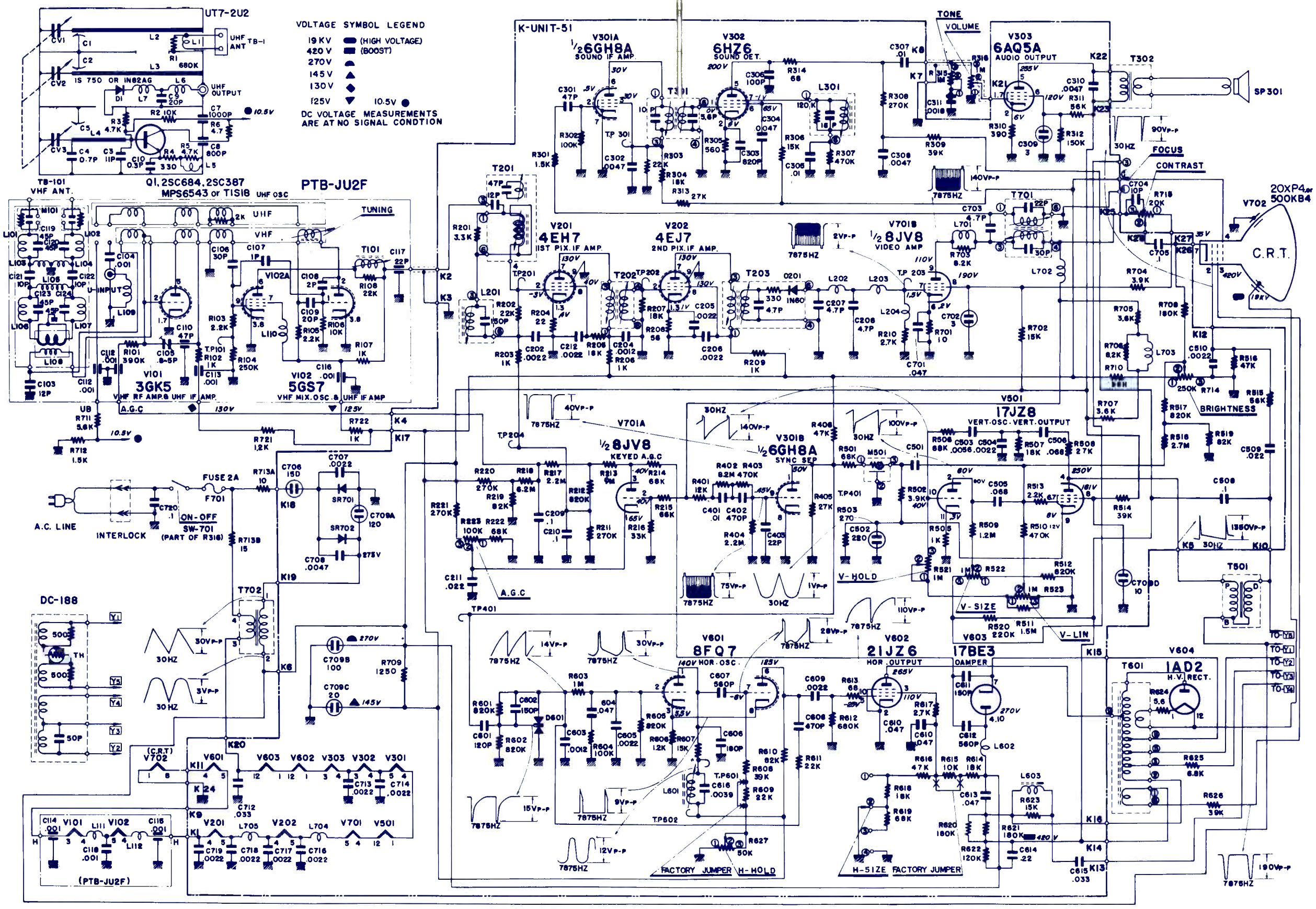
ELECTRONIC TECHNICIAN / DEALER **TEKFAX**

1194
AIRLINE
TV Model
GEN-13469A

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

DECEMBER • 1968

SYMBOL	DESCRIPTION	AIRLINE PART NO.
C606	180pf 500v 10% film mica	TV31139
C607	560pf 500v 5% film mica	TV3188
C709A,B,C,D	120µf/100µf/20µf/10µf @350v elect	TV32169
R713A,B	10Ω/15Ω 30w 10% resin	TV23175
R223	100K pot AGC (9V-150)	TV25243
R315	1M pot tone (9V-149)	TV25235
R316	1M pot vol w/on-off switch (9V-151UL) SW-701	TV25236
R521	1M pot vert hold (9V-117)	TV25237
R522	1M pot vert size (9V-119)	TV25238
R523	1M pot vert lin (9V-119)	TV25238
R627	50K pot horiz hold (9V-121)	TV25240
R714	250K pot bright (9V-118)	TV25239
R715	20K pot contrast (8V-007)	TV2572
L201	coil 47.25MHz trap (2TIF-487)	TV62248
L202	coil filter (2TL 970)	TV61474
L301	coil sound detector (TIF-551)	TV61478
L601	coil horiz hold (TL-23)	TV61174
L603	coil horiz lin (2TL-984)	TV61479
L701	coil peaking (TL-289)	TV61480
L703	coil peaking (TL-290)	TV61482
T201	xformer 1st pix IF & 50.25MHz trap (TIF-302)	TV62288
T202	xformer 2nd pix IF (TIF-383)	TV62365
T203	xformer pix detector (2TL-957X)	TV62343
T301	xformer sound IF (TIF-378)	TV62341
T302	xformer audio output (7T-182)	TV11219
T501	xformer vert output (8T-195)	TV11220
T601	xformer horiz output (8FT-650)	TV11221
T701	xformer 4.5MHz trap (2TIF-491)	TV62252
T702	xformer power (9T-219)	TV11222
M501	capristor (PRC-302)	TV3455
D601	dual diode (SELEN-26)	TV24226
F701	fuse 2a	.315002
	UHF tuner (UT7-2U2)	TV35158
	VHF tuner (PTB-JU2F)	TV35139
	deflection yoke (assembly)	TV61483



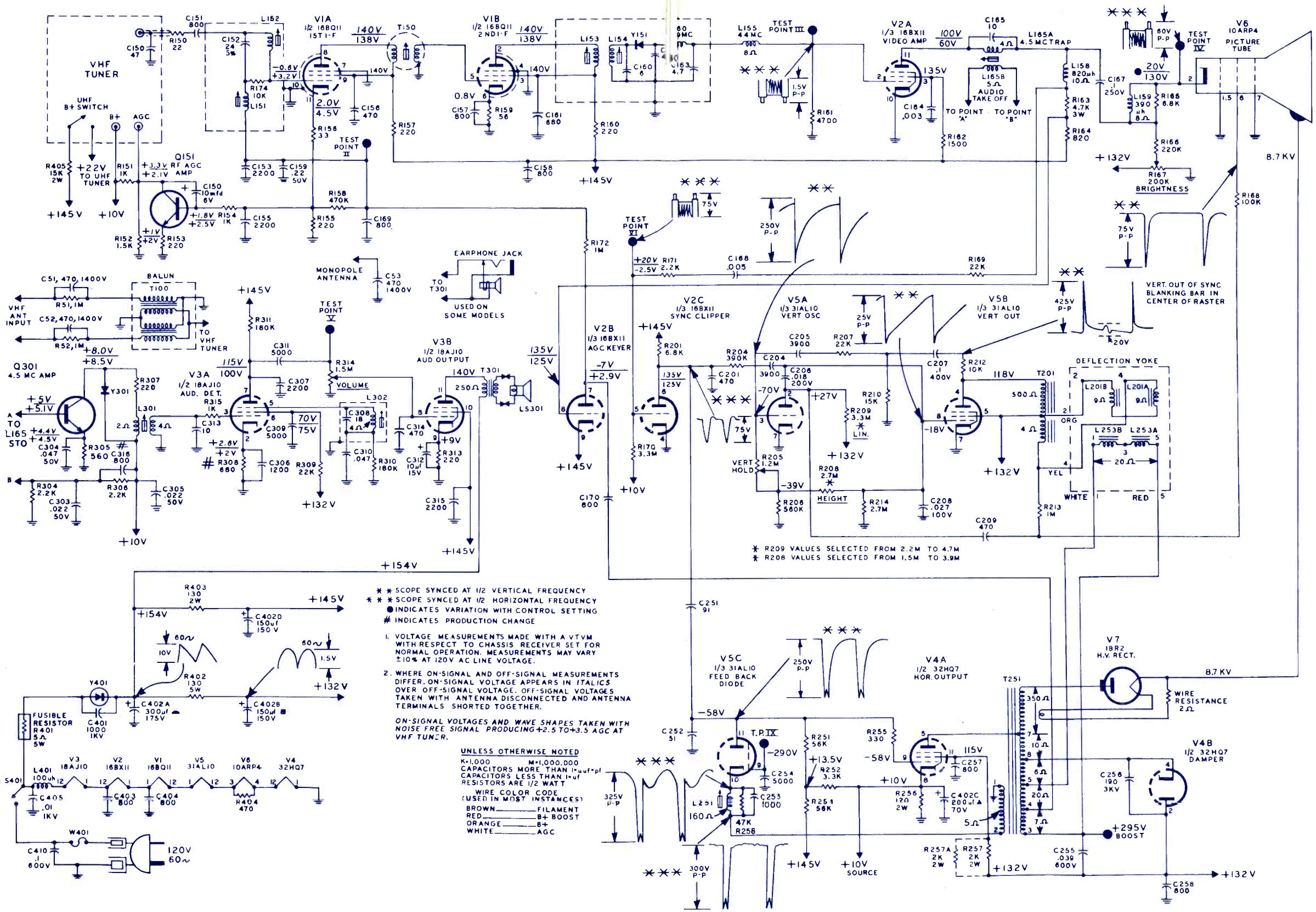
1195
GENERAL ELECTRIC
TV Chassis P-1

ELECTRONIC TECHNICIAN / DEALER **TEKFAX**

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

DECEMBER • 1968

SYMBOL	DESCRIPTION	GENERAL ELECTRIC PART NO.
R163	resistor film 4.7Ω 10% 3w	ET14X133
R167	control bright 200K 30%	ES49X20
R205	control vert hold 1.2M 30%	ES49X18
R256	resistor 120Ω 10% WW	ES14X7
R257	resistor 2K 2w WW	ES14X8
R257A	resistor 2K 2w WW	ES14X8
R314	control vol 1.5M 20%	ES49X19
R401	fusible resistor 5Ω 5	ES14X191
R402	resistor 130Ω 10% 5	/W ES14X10
R403	resistor 130Ω 10%	/W ES14X9
Q151	transistor NPN silicon	C amp ES15X10
Q301	transistor NPN silicon	4MHz amp ES15X7
Y151	diode germanium video detector	ET16X1
Y301	diode germanium audio limiter	ES16X2
Y401	diode silicon power rectifier	ES57X2
C402A	300μf 175v	ES31X7
C402B	150μf 150v	ES31X7
C402C	200μf 70v	ES31X7
C402D	150μf 150v	ES31X7
C152	24pf 5% NPO	ET18X123
C256	190pf 3kv	ES18X26
L151	coil 47 25MHz trap	ES36X753
L152	coil series link 1st IF grid	ES36X29
L153	coil video detector (primary)	ES36X757
L154	coil video detector (secondary)	ES36X587
L155	coil choke tweet 44MHz	ET36X583
L158	coil choke 820μh	ES36X25
L159	coil choke 390μh	ES36X26
L160	coil choke tweet 219MHz	ES36X722
L165A,B	coil 4.5MHz trap & STO	ES36X24
L201A,B	Yoke deflection vert	ES76X48
L253A,B	yoke deflection horiz	
L251	coil horiz osc w/core	ES35X2
L301	coil audio interstage	ES36X27
L302	coil quad w/core	ES36X665
L401	coil choke filament 100μh	ES36X28
T100	xformer VHF antenna balun	ES51X30
T150	xformer video IF	ES36X23
T201	xformer vert output	ES64X4
T251	xformer horiz output	ES77X4
T301	xformer audio output	ES64X1



* * SCOPE SYNCED AT 1/2 VERTICAL FREQUENCY
* * * SCOPE SYNCED AT 1/2 HORIZONTAL FREQUENCY
● INDICATES VARIATION WITH CONTROL SETTING
# INDICATES PRODUCTION CHANGE

1. VOLTAGE MEASUREMENTS MADE WITH A VTVM WITH RESPECT TO CHASSIS RECEIVER SET FOR NORMAL OPERATION. MEASUREMENTS MAY VARY ±10% AT 120V AC LINE VOLTAGE.
2. WHERE ON-SIGNAL AND OFF-SIGNAL MEASUREMENTS DIFFER, ON-SIGNAL VOLTAGE APPEARS IN *ITALICS* OVER OFF-SIGNAL VOLTAGE. OFF-SIGNAL VOLTAGES TAKEN WITH ANTENNA DISCONNECTED AND ANTENNA TERMINALS SHORTED TOGETHER.

ON-SIGNAL VOLTAGES AND WAVE SHAPES TAKEN WITH NOISE FREE SIGNAL PRODUCING +2.5 TO +3.5 AGC AT VHF TUNER.

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

WIRE COLOR CODE (USED IN MOST INSTANCES)
BROWN — FILAMENT
RED — B+ BOOST
ORANGE — B+
WHITE — AGC

ELECTRONIC TECHNICIAN / DEALER

TEKFAX

1196
MOTOROLA
TV Chassis TS611 Series

DECEMBER • 1968

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

SYMBOL	DESCRIPTION	MOTOROLA PART NO.
C201	.01µf 20% 2kv Z5U (use 21S129750)	21S180B15
C505	470pf 10% 500v silver mica	21S10052A39
C511	27pf 10% 4kv N1500 22TS611	21S180D82
C518	91pf 10% 5kv N1500	21S180A91
C802	150µf/350v 20µf/350v 200µf/175v 120µf/175v lytic	23C65807A21
C803	20µf 175v lytic	23C65808A17
E100	res-cap IF stack	51D67701A03
E400	res-cap AGC	51D67748A02
E401	res-cap clipper grid	51D67701A02
E502	spark gap	80C68147A06
E601	res-cap integrator	51D67701A04
E602	circuit breaker	80C66390A17
L101	41.25MHz trap	24D67754A14
L102	47.25MHz trap	24D67754A09
L104	resonant choke	24D66772A08
L106	compensating 100µh incls R115 18K	24D68002A12
L107	4.5MHz trap & ATO incls. R126, C114, L112	24V66552A63
L111	compensating 500µh	24D68002A01
L112	compensating 7.5µh	24D68002A30
L300	quet incls C306 C307 R305 R306	24V66553A22
L500	horiz osc incls core	24D68130A04
L501	horiz suppressor	24C66772A05
L504	horiz size & lin (incls R521 18K-3w)	24D69163A03
L701	def yoke 114° 20TS611	24G10250A07
	def yoke 114° 22TS611	24G10250A08
L800	choke line incls shg	24V68621A86
R122	6200 10% 7w WW	17S135556
R200	varistor	6C66263A16
R619	varistor	6C66263A07
R621	thermistor yoke	6C65884A07
R802	27 10% 4w fxd mtl film	17S101308I7
R124	contrast 30K tap at 10K (20TS611)	18D67502A05
	contrast 30K tap at 10K (22TS611)	18D66966A20
R203	brightness 100K (20TS611)	18D66966A19
	brightness 100K (22TS611)	18D66966A09
R308	vol 2M incls on/off switch (20TS611)	18D65083A55
	vol 2M incls on/off switch (22TS611-use 18D68021A01)	18D68021A06
R404	AGC 100K vert size 3.4M vert lin 500K	18D67678A02
R605	vert hold 750K (20TS611)	18D66966A18
	vert hold 750K (22TS611)	18D66966A21
R610	AGC 100K vert size 3.4M vert lin 500K	18D67678A02
R614	AGC 100K vert size 3.4M vert lin 500K	18D67678A02
Q100	noise gate M4933/A1V	48S134933
T100	1st IF	24D67754A12
T101	2nd IF	24D67754A15
T102	video detector	24V66552A61
T300	4.5MHz interstage	24V66552A64
T301	audio output	25D67552A22
T500	HV xformer complete	24D67602A15
T600	vert output	25D65840A19
T800	power	25D67448B03
T801	filament	25D67593A13

NOTES:

VOLTAGE MEASUREMENTS
1. TAKEN FROM POINT INDICATED TO CHASSIS WITH A VTVM ±20%.
2. LINE VOLTAGE MAINTAINED AT 120V AC.
3. *VARIES WITH CONTROL SETTINGS.
4. TAKEN WITH CONTRAST CONTROL AT MINIMUM AND ALL OTHER CONTROLS IN NORMAL OPERATING POSITION.
5. WHERE TWO VOLTAGES ARE SHOWN:
   UPPER VOLTAGES - WITH NO SIGNAL INPUT; TUNER ON CHANNEL WITH LEAST NOISE AND ANTENNA TERMINALS SHORTED.
   LOWER VOLTAGES - WITH TUNER ON STRONG STATION AND OUTSIDE ANTENNA.

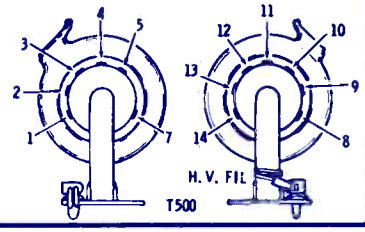
WAVEFORM MEASUREMENTS
1. TAKEN FROM POINT INDICATED TO CHASSIS WITH A WIDE-BAND OSCILLOSCOPE.
2. OSCILLOSCOPE SYNCED NEAR SWEEP RATE INDICATED.
3. TAKEN WITH STRONG SIGNAL, CONTRAST CONTROL AT MAXIMUM. ALL CONTROLS IN NORMAL OPERATING POSITION.

——— INDICATES PRINTED CIRCUIT BOARD.

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

NUMBERS LETTERS IN BOXES INDICATE TEST POINTS & ARE CROSS-REFERENCED TO THE PARTS LOCATIONS ILLUSTRATIONS.

⊙INDICATES WIRE WRAPPED TERMINALS.



1197 PHILCO-FORD Color TV Chassis 19QT85R

ELECTRONIC TECHNICIAN / DEALER **TEKFAX**

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

DECEMBER • 1968

OSCILLOSCOPE WAVEFORM PATTERNS 19QT85R CHASSIS

These waveforms were taken with the receiver AGC control adjusted for an approximate peak-to-peak output of two volts at the video detector, using an air signal. Do not reset AGC control when using color bar generator. All monochrome voltages taken with average air signal and all chroma voltages taken with a color bar generator connected to the antenna input terminals. The chroma peak-to-peak voltages were taken with the chroma control set for 0.5V peak-to-peak at Pin 2 of V40 and the tint control set for proper color bars (approximately mid-range), all other controls set for normal viewing. The frequencies shown are those of the waveforms.....not the sweep rate of the oscilloscope. All voltages taken with a wide band scope having a 5MHz bandwidth similar to B & K Model 1450.

1 2 volts p/p 60cps (max. contrast)

2 2 volts p/p, 15,750 cps (max. contrast)

3 65 volts p/p, 15,750 cps

4 0 2 volts p/p, 15,750 cps

5 2,8 volts p/p, 15,750 cps

6 2 5 volts p/p, 15,750 cps

7 135 V p/p, (max. con.) 15,750 cps

8 40 V. p/p, (min. con.) 15,750 cps

9 30 volts p/p, 15,750 cps

10 35 volts p/p, 15,750 cps

11 50 volts p/p, 15,750 cps

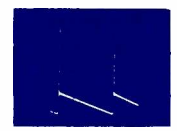
12 45 volts p p, 15,750 cps

13 45 volts p/p, 60 cps

14 39 volts p/p, 60 cps

15 130 volts p/p, 60 cps

16 14 volts p/p, 60 cps

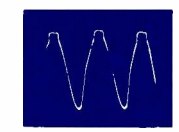


17 900 volts p/p, 60 cps (spike) 150 volts p/p, 60 cps (sawtooth)

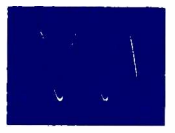
18 8.5 volts p/p, 15,750 cps

19 17 volts p/p, 15,750 cps

20 5.5 volts p/p, 15,750 cps



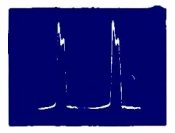
21 50 volts p p, 15,750 cps



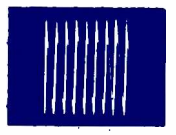
22 140 volts p p, 15,750 cps

23 180 volts p p, 15,750 cps

24 170 volts p/p, 15,750 cps

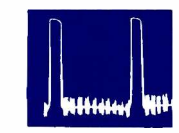


25 15,750 cps loose coupled



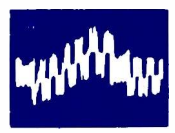
26 12 volts p/p, 3 58 mc

27 2 5 volts p p, 15,750 cps

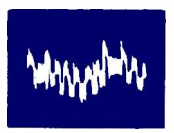


28 60 volts p/p, 15,750 cps

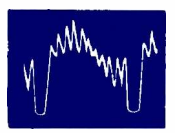
29 5 volts p/p, 15,750 cps



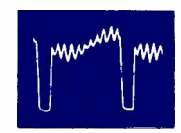
30 15 volts p/p, 15,750 cps



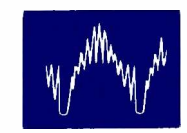
31 20 volts p/p, 15,750 cps



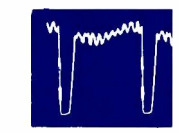
32 90 volts p/p, (chroma) 70 V. p/p, (sync) 15,750 cps



33 30 volts p/p, (chroma) 70 V. p/p, (sync) 15,750 cps

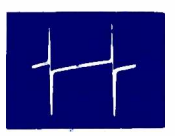


34 85 volts p p, (chroma) 70 V. p/p, (sync) 15,750 cps



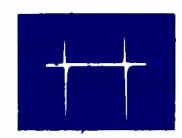
35 2 volts p p, (chroma) 5 V. p/p, (sync) 15,750 cps

36 6 volts p/p, 15,750 cps

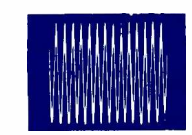


37 120 volts p/p, 15,750 cps

38 50 volts p/p, 15,750 cps



39 50 volts p/p, 15,750 cps



40 17 volts p p, 3 58 mc

41 140 volts p/p, 3.58 mc

42 9 volts p p, 3.58 mc

43 11 volts p/p, 3.58 mc

44 100 volts p/p, 15,750 cps

45 80 volts p/p 15,750 cps

46 135 volts p/p, 15,750 cps (max. contrast)

47 13 volts p/p, 15,750 cps

48 28 volts p/p, 15,750 cps

49 640 volts p/p, 15,750 cps

50 570 volts p/p, 15,750 cps

51 400 volts p p, 15,750 cps

52 310 volts p/p, 15,750 cps

NOTES.
1. ALL VOLTAGES TAKEN WITH NO SIGNAL UNLESS OTHERWISE INDICATED
2. ALL VOLTAGES TAKEN WITH B&K MODEL 175 VTVM WITH ALL CONTROLS SET FOR NORMAL.
3. RESISTANCES ARE TAKEN WITH YOKE & CONVERGENCE PANEL DISCONNECTED
4. BALLONS 1, 2, ETC INDICATE WAVE FORM TEST POINTS
5. REFER TO SECTION 5 FOR REMOTE RECEIVER & TRANSMITTER SCHEMATIC.

PHILCO-FORD
Color TV Chassis 19QT85R

CHROMA PANEL

ON CONTROL BRACKET

ON VHF/UHF TUNER MOTOR ASSY.

CONVERGENCE PANEL

P7 MATES WITH RP2 ON RM50 REMOTE RECEIVER

REFER TO SECTION 5 FOR PHYSICAL PLACEMENT OF LEAD CONNECTIONS TO B12, B13 AND B14

H.V. 25.5KV AT ZERO BEAM CURRENT (MIN. CONT. & BRIGHT)
24KV AT NORMAL CONT. & BRIGHT.

ALL TRANSISTOR BASINGS
BOTTOM VIEW

1198

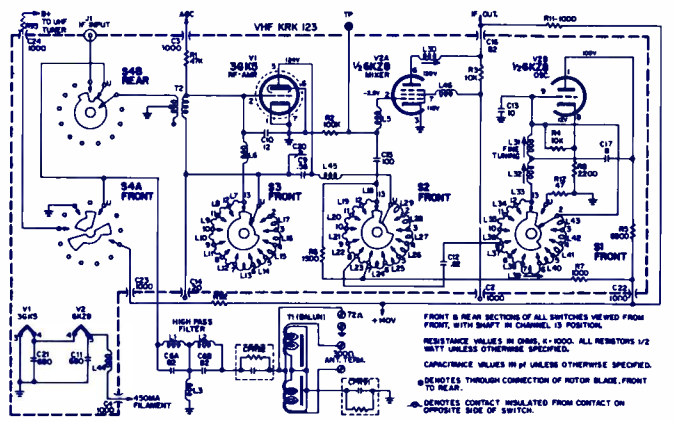
RCA VICTOR
TV Chassis KC171
Series

ELECTRONIC TECHNICIAN / DEALER **TEKFAX**

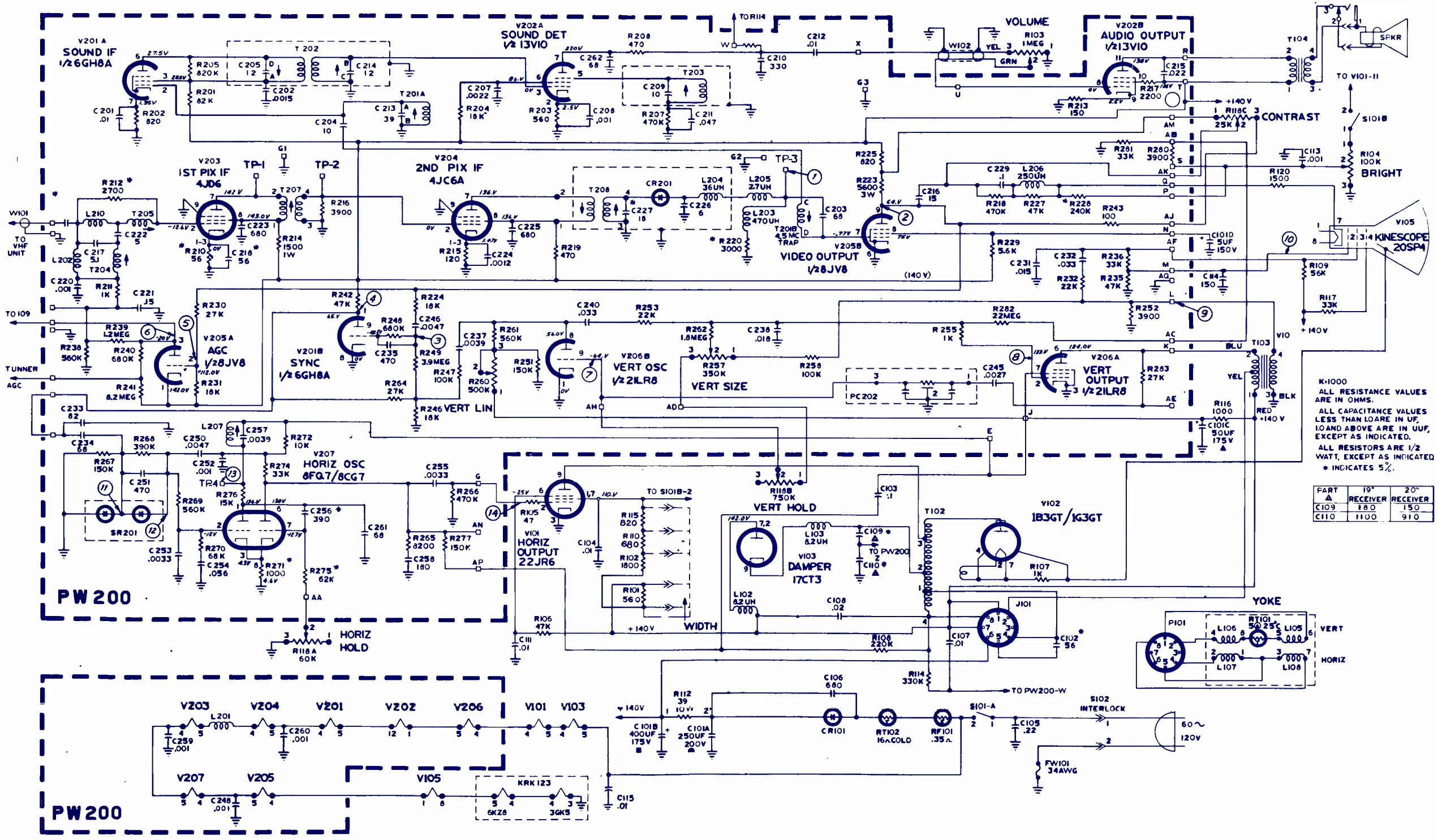
COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 5 NEW SETS

DECEMBER • 1968

SYMBOL	DESCRIPTION	RCA VICTOR PART NO.
	UHF tuner Assembly	KRK 122DC
	VHF tuner Assembly	KRK 123D
C101	4 section elect	114845
C101A	250µf 200v	114845
C101B	400µf 175v	114845
C101C	50µf 175v	114845
C101D	5µf 150v	114845
C109	150pf 5% 4kv N1500 cer KCS171A	124269
C109	180pf 5% 4kv N1500 cer KCS171B	124268
C226	6pf ± .5pf 500v NPO cer	121225
C256	390pf 5% 500v N750 cer	121227
CPR101	capristor 470pf 2.2M	109956
CPR102	capristor 470pf 2.2M	109956
L102	8.2µh	107385
L202	AGC	114315
L203	470µh	124271
L204	36µh	116056
L206	250µh	109944
L207	stabilizer	114486
R112	39Ω 10w	124272
R118	control contrast vert hold horiz hold KCS171A	124278
R118	control vert hold contrast horiz hold KCS171B	124279
R210	56Ω 5% ½w film	228605
R212	2.7K 5% ½w film	239935
R220	3K 5% ½w film	227097
R223	5.6K 3w	104180
R228	240K 5% ½w film	124273
R257	control vert size	121223
R260	control vert lin	121944
R271	1K 5% ½w film	224254
R275	56K 5% ½w film	225939
RF101	fuse .35Ω 1.1a	124263
RT102	thermistor 16Ω cold	114480
T102	horiz output	124277
T103	vert output	124274
T104	audio output	124275
T201	4.5MHz	114489
T202	sound IF	118411
T203	quad	118410
T204	47.25MHz trap	113097
T205	IF	113097
T207	IF	124276
T208	2nd detector	121779
	thermistor temp comp	118375
	deflection yoke AL156H AL160W	124256
	deflection yoke AL2308K WK	124337



KRK123D/122DC TUNER SCHEMATIC DIAGRAM



PART △	19" RECEIVER	20" RECEIVER
C109	180	150
C110	1100	910

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

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

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

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

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

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

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

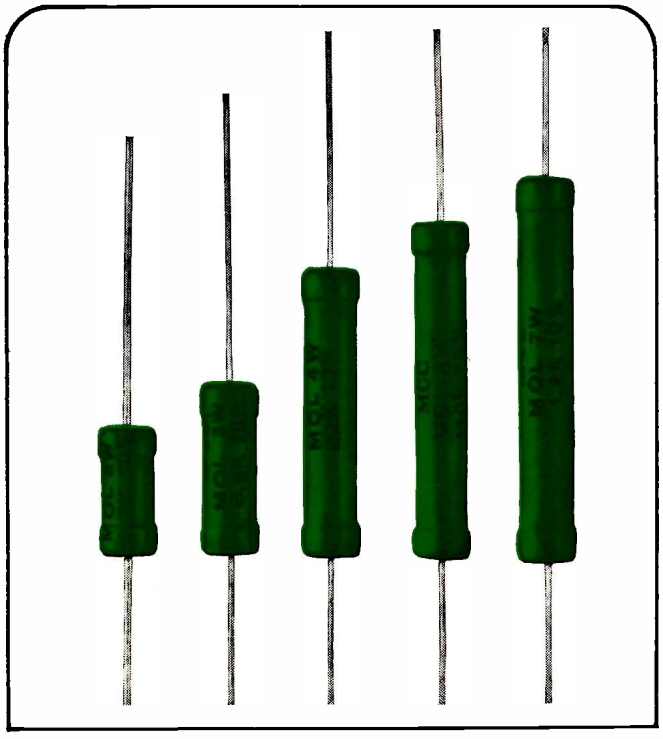
TSC

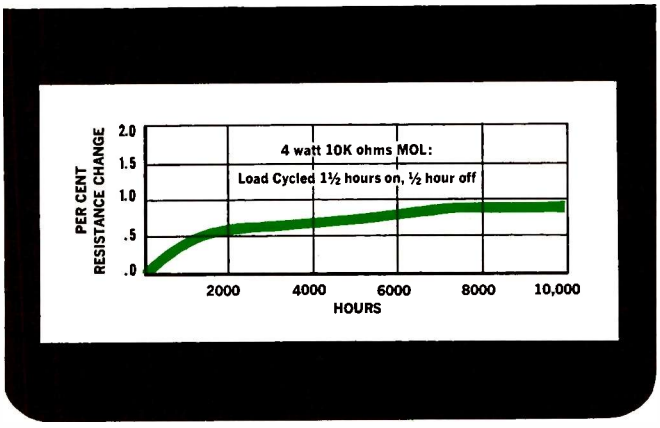
TUNER SERVICE CORPORATION *FACTORY-SUPERVISED TUNER SERVICE*

HOME OFFICE, MIDWEST	817 N. PENNSYLVANIA ST., Indianapolis, Indiana	TEL: 317-632-3493
UNDER NEW MANAGEMENT, EAST	547-49 TONNELE AVE., Jersey City, New Jersey	TEL: 201-792-3730
SOUTH-EAST	938 GORDON ST., S. W. Atlanta, Georgia	TEL: 404-758-2232
WEST	SARKES TARZIAN, Inc. TUNER SERVICE DIVISION 10654 MAGNOLIA BLVD., North Hollywood, California	TEL: 213-769-2720

MALLORY Tips for Technicians

"Trading up" resistors prevents call-backs





Typical stability test data: 10,000-hour load cycling test. Average resistance change is less than 1%!

Color television sets contain some potential trouble spots for fixed resistors. Sudden overloads or short-outs of a tube, diode or transistor, or leakage in a by-pass capacitor may cause enough current surge in a carbon resistor to cause it to open or to suddenly increase in value. You wind up with a strange set of symptoms that take a lot of point-to-point testing to unscramble.

EXAMPLE: Suppose a tube or capacitor shorts out. This may cause excessive current drain on the power supply which may affect a resistor in the bleeder network. This resistor may increase in value which would then reduce voltage in subsequent circuits. When this happens, a number of controls must be re-adjusted. By replacing the resistor with a Mallory MOL, the set is brought back to normal operation and the MOL construction virtually precludes this type of difficulty happening in the future.

Granted, resistors don't fail as often as other components. But when it happens, you can take out a simple insurance policy against call-backs by replacing faulty carbon resistors with Mallory MOL's. For just a few pennies more, you're putting a world of extra life and stability in a critical part of the circuit.

In a nutshell, MOL's are metal oxide film resistors with stability comparable to wire-wounds, but far lower in cost. They can stand brief overloads of several times rated wattage without damage. Humidity and vibration don't bother them. They're non-inductive up to 250 mc, so you can use them in rf and if sections without a worry. As for stability, we've run them on load cycle tests up to 10,000 hours and resistance values hold steady within 1%! No wonder every major TV manufacturer is using them.

MOL resistors are usually a bit larger than carbon types, so you may have to bend a few leads to fit them in. They come in 2, 3, 4, 5 and 7 watt sizes (which is more than you'll need in most carbon resistor replacements), in resistance values up to 500K.

Your Mallory distributor stocks MOL's in the values you'll need. And he has an up-to-date cross-reference list which shows you the Mallory part numbers to specify for popular TV sets, by manufacturer and chassis number. See him, or write to Mallory Distributor Products Company, a division of P. R. Mallory & Co. Inc., Indianapolis, Indiana 46206.

DON'T FORGET TO ASK 'EM—*"What else needs fixing?"*

. . . for more details circle 119 on postcard

ELECTRONIC TECHNICIAN / DEALER

DECEMBER 1968 • VOL 88 No. 6

COVER
Santa Claus may not bring you all the goodies you want, but service-dealers and manufacturers have them available to you and your customers in every size, shape and price.

TEKFAX • 16 PAGES OF THE LATEST SCHEMATICS • **Group 196**

AIRLINE: TV Model GEN-13469A
GENERAL ELECTRIC: TV Chassis P-1
MOTOROLA: TV Chassis TS11 Series
PHILCO-FORD: Color TV Chassis 19QT85R
RCA VICTOR: TV Chassis KCS171 Series

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POSTMASTER: Send Form 3579 to ELECTRONIC TECHNICIAN/DEALER, Ojibway Building, Duluth, Minnesota 55802.

ET/D EDITOR'S MEMO

We Thank You

It's the end of another year. It has been a year that has seen changes in the technician's status, changes in the state-of-the-art and changes in quality control. Most have been for the better, but there is still a long way to go in all these areas. We know it and you know it—but most of all, industry knows it.

During the past year we have covered test instruments, solid-state devices and technology, TV, radio, stereo and many other fields of interest. The continued excellent cooperation from the manufacturers in our rapidly advancing industry can only mean greater service to you next year in terms of more and better coverage of the latest circuit designs. This includes continued review of test instruments with timely circuit modifications and service hints in the Testlab report, Colorfax and Tech Digest sections.

In 1968 we featured over 70 circuit diagrams of television receivers and more than 100 technical articles on everything from burglar alarms to FM stereo equipment. As the inevitable advances in the state-of-the-art make news in 1969, we welcome the opportunity to keep you the best informed readers in our industry.

The A to Z Semiconductor series, which concluded in November after more than two years running, received overwhelming response and proves the interest of our readers in keeping up with the latest in technical advances.

It is our job to bring these advances to you. It's a job that takes the cooperation of a great many people—including you, our reader. On behalf of our publisher, Hugh (Scotty) Wallace, our technical staff headed by Joe Zauhar, and the many others whose diligent efforts have made ELECTRONIC TECHNICIAN/DEALER one of the most widely read technical magazines in its field, I wish to thank our readers, especially those who took the time to write us, and the many technicians, dealers and manufacturers who contributed their time, their patience and their equipment for cover photos, business profiles and technical features.

MOVING?

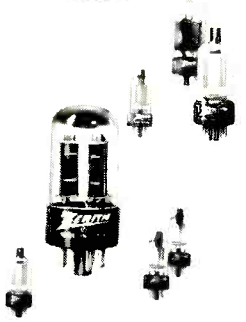
Be sure to let us know your new address. Please enclose a complete address label from one of your recent issues.

Zenith Tubes...
life-tested for greater dependability!

ZENITH TV PICTURE TUBES are rigorously tested at elevated line voltages for lengthy periods. Just one reason you can be sure of Zenith's great reliability and long life that better satisfies your customers. More than 200 Zenith quality tubes—for color TV, black-and-white TV, or special purposes—are in the complete line.

ZENITH "ROYAL CREST" CIRCUIT TUBES undergo over 1½ million hours of life-testing every month. Under actual operating conditions, they must meet the same quality standards as Zenith original parts—to perform with unrivaled dependability. Choose from a full line of more than 900 top-quality Zenith tubes.

Order all genuine Zenith replacement parts and accessories from your Zenith distributor



Exciting Surprises for You— and Your Family! Fun for all! Get the details at your Zenith Distributor's Parts Department.

Zenith B&W replacement picture tubes are made only from new parts and materials except for the glass envelope in some tubes which, prior to reuse, is inspected and tested to the same high standard as a new envelope. Some color picture tubes contain used material which, prior to reuse, is carefully inspected to meet Zenith's high quality standards.

BEST YEAR YET TO SELL THE BEST

FIFTIETH ANNIVERSARY 1918 1968 50 YEARS OF LEADERSHIP THROUGH QUALITY

ZENITH®

The quality goes in before the name goes on

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ET/D LETTERS TO THE EDITOR

Schematics Wanted

I need a schematic for a Pentron tape recorder about 10 years old using a 6X4, 6AQ5 and three 12AX7 tubes. This may be a 9T-3.

S. GLADSTONE

Mac's Radio & TV
Springfield Gardens, N.Y.

I have an old tube tester for which I cannot obtain recent roll charts. I would appreciate it if any of your readers can help me. It is a Simpson Model 220.

EMIL YUHASZ

Lajord, Sask.
Canada

I would like to obtain the address, schematic or any other information on a Model A-460 TV field strength meter made by the Approved Electronics Corp. of N.Y. We thoroughly enjoy your magazine and especially some of your business articles.

ROBERT W. JENSEN

Box 43
Orient, Iowa 50858

I have a DeVry 5in. oscilloscope which I am willing to sell before moving. I would appreciate it if you would mention it to your readers.

H. SCHUH

135-09 83rd Ave.
Kew Gardens, L.I., N.Y. 11435

I am in desperate need of a schematic for a Videola 1560/1561 made by Tech Master Corp. which used to be in Brooklyn. I wrote the firm and it appears that it has either moved or gone out of business. I will appreciate whatever assistance you can give me.

GONZALO BORRERO

Echegaray B-40
Litheda Hgts.
Rio Piedras, P.R.

Propaganda

In reference to the letter "Sample Budget Can Ruin Us" (ET/D, September 1968), students are made to believe that there are promising careers in electronics because of the propaganda ads put out by big companies.

There are not many good paying jobs in the field. Most employers will not pay a good wage unless it is in a salary position where the hours are unlimited. The companies that do pay well are under government contracts and job security is nil.

In this rapidly changing world, technical jobs are increasing and the number of good technicians is declining because of the low pay scales. Students considering an electronic future should be told the facts.

J. L. SOUDERS

Easton, Pa.

Short Circuit

I have subscribed to your magazine for about 14 years, living in hopes it would get better. You have taken up space telling how to service air conditioners, electronic ovens and other things. Then in later issues you come out and say we service men should stay with TV, radio and stereo. Please make up your mind.

Also, the Apprentice and the Pro article—disgusting. I imagine a TV set would scare that author into shock. Your schematic coverage is also off base, they never show the tuner on it. Believe me, we have tuner troubles here and some information would be helpful. Your articles about transistors are of little value to the serviceman. It is written too far above the technicians head. Engineers and scientists are the only ones who could understand the formulas.

I only renew my subscription to put your magazine in the shop and for people to look through. It will scare them and keep them from working on their own sets. Besides, the subscription is tax-deductible.

JOHN E. BEAL

Alney, Ill.

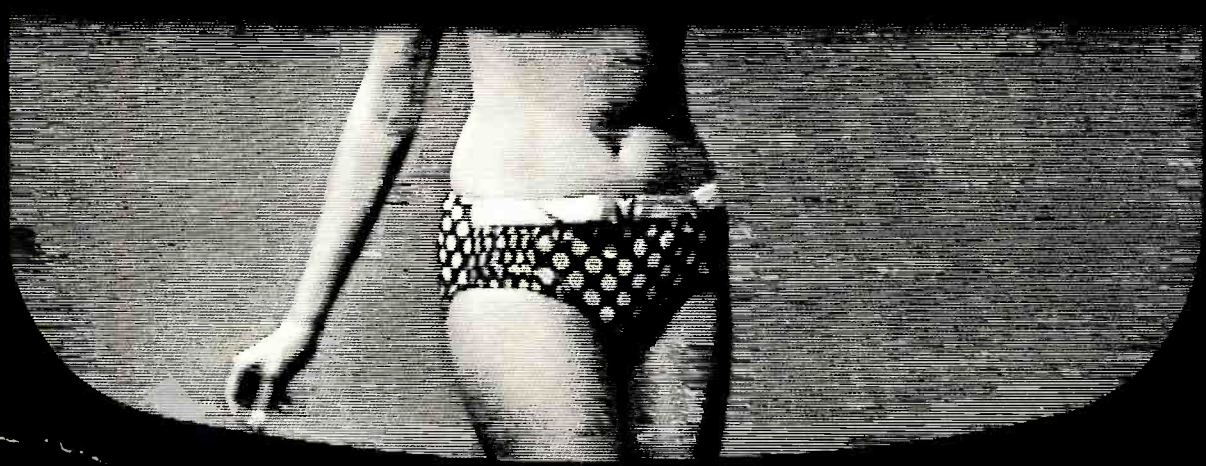
I congratulate John Beal on his fortitude. Fourteen years of subscription to a magazine just to fill up space must be some kind of record.

However, for Beal's benefit, in the last 10 years we did only one article on an oven. That was in 1959 when a new type of appliance called the "electronic oven" came on the scene. It was news then.

As for the "Apprentice and Pro" articles (the last one in August 1967), they were written to aid the novice technician with a few basic tips in servicing. The articles were very well accepted according to all the letters we received—with the exception of Beal's.

The transistor articles Beal speaks of are the A to Z semiconductor series which has been continued with overwhelming success for more than two years. The series started with basic transistor theory and worked up to the present technology of solid-state power supplies. Beal indicates that the series

There's nothing wrong with the set.



You fixed the picture a week ago, now you're back repairing your repair job. And paying for it.

Replacement parts are supposed to last longer than that.

Like electrolytic capacitors. If they're wound in computer-grade, 99.99% pure aluminum foil, they'll hold up for a long time at continuous temperatures of 85 C.

Like Arcolytic capacitors do.

Even though they cost the same as any other home entertainment capacitor. And come in more than 2000 exact replacement values to maintain the set's stability.

Any Arcolytic distributor can fill you in on the whole line of Arcolytic types—twist mounts, printed circuit twist mounts, tubular electrolytics (including very high capacitance values) and miniature tubulars in the smallest physical sizes. He can also sell you Elmenco capacitors.

Then you won't have to do repair jobs twice. If the lady in the set seems to be missing something, a week after you've done a repair job, it's her problem. Not yours.

Loral Distributor Products
A DIVISION OF LORAL CORPORATION **LLD-502**
Pond Hill Industrial Park, Great Neck, New York 11022

. . . for more details circle 118 on postcard

is over a technician's head and written for engineers and scientists. With such statements, we can only guess at his intelligence and training—an unfortunate situation and probably one of the reasons why many technicians worthy of their profession have had to suffer the abuses of a disgusted and apprehensive public.

But then, it's gratifying to know that even the "technicians" operating on the edge of total technical ignorance get some good from a trade publication—even if it's only to fill empty space. . . . Ed.

Retirement Sale

I have been in the servicing business since 1937, a long time subscriber to ELECTRONIC TECHNICIAN/DEALER, and now I am getting to the age where I must think of retiring. I have already given up my two-way radio business. I would appreciate it if you would let your readers know that I have some test instruments for sale. I have a Lampkin frequency meter, Lampkin modulation meter, grid-dip meter, crystal cabbrator, power supply and dummy antenna.

JERRY JACKSON
Jackson Radio & TV
Paris, Ky.

Wanted To Buy and Sell

I have a Webcor tape recorder in need of repair. I wrote to the Webcor address listed on my schematic but got the letter back stamped "moved-no forwarding address." Can any of your readers tell me where I might obtain parts for this unit?

I would also like to purchase a used B&K Model 445 CRT Checker. Perhaps one of your readers has one to sell. Here in Europe I service only B/W TV sets, so I don't need the more sophisticated units for color. Any help would be appreciated and keep up the excellent work.

SSGT. JOHN P. DINGES, JR.
Box 2081
APO, New York 09130

Comments from our readers are always welcome. Address your letters to:
The Editor
ELECTRONIC TECHNICIAN
Ojibway Building
Duluth, Minn. 55802

Only Ford's E-300 Econoline Van takes 3590-lb. payloads... 650 lb. more than any other Van!

Ford Econoline Vans come in three popular series, the E-100, E-200 and E-300. Their higher capacity axles and heavier construction let you carry more weight every trip. The E-300 SuperVan handles from 650 to 1350 pounds more payload than any other van of this type. And that's not all! The Econoline's long 105½-in. and 123½-in. wheelbases plus over 5½-ft. wide stance provide 39% more resistance to wind wander. Your power choice goes from the thrifty 170- or 240-cu. in Sixes up to the responsive 302-cu. in. V-8. And a compact, factory-installed Air Conditioner is now optional for optimum cooling. A special insulation package and tinted glass are also offered!

Only Ford gives you Twin-I-Beam riding smoothness. The unique front end made famous in Ford pick-ups. Two solid I-Beam axles for strength and coil springs for easy ride—the most rugged independent suspension yet!

Only Ford gives you an outside service center. Just lift the "mini" hood for easiest possible checking of oil, water, battery and windshield washer water. Here also is the brake master cylinder and voltage regulator!

Only Ford gives you over 38 sq. ft. of clear floor space—23% to 32% more than others.

Engine has been moved out of load-space. The result is more clear floor area, 8½ ft. long in standard van and over 10 ft. in the SuperVan. Items as long as 13 ft. fit beside the engine box.

Only Ford gives you driver "walk-thru" to the rear. No longer do you need to step outside to reach the load compartment. Engine cover is flat with raised edges for use as a package tray. See your Ford Dealer!

FORD
ECONOLINE
VANS

Ford

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GENERAL ELECTRIC

Current Portable TV—Quadrature Coil Tuning Capacitor

The quadrature coil tuning capacitor used in all current General Electric portable television receivers has a negative temperature coefficient to compensate for temperature-produced drift in associated components. The schematic designations, by chassis, for this capacitor are:

S-2 Chassis—C308
P-2 Chassis—C308
V-2 Chassis—C308
H-2 Chassis—C307
G-1 Chassis—C307

Should this capacitor not track properly with temperature, the audio may distort with temperature changes.

The audio may be good initially and become distorted in a few hours or it could be poor initially and gradually get better as the receiver reaches normal operating temperature.

When making repairs in any receiver using a quadrature grid audio detection system, it is good practice to check the audio quality at two temperature extremes—when the receiver is cold, and after it has reached normal operating temperature. If the audio is distorted at either of these points, it is possible that the capacitor is not tracking correctly and it should be replaced.

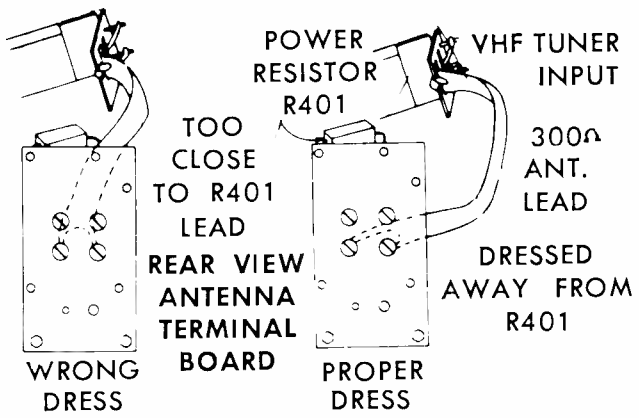
Replacement capacitors must have the proper temperature coefficient to insure reliable receiver operation. In the case of the chassis listed, the capacitor should be 18pf, 10%, *N470* (Cat. No. ET18X399).

After replacing the capacitor, the quad coil should be realigned and the receiver rechecked at both temperature extremes.

TV Chassis V—VHF Tuner 300Ω lead dress

The 300Ω twin lead which connects the VHF tuner input terminals to the antenna input terminal board can contact power resistor R401 if not properly dressed.

Heat from the resistor could melt the insulation on the 300Ω lead, causing a short from 120vac to the monopole antenna assembly.

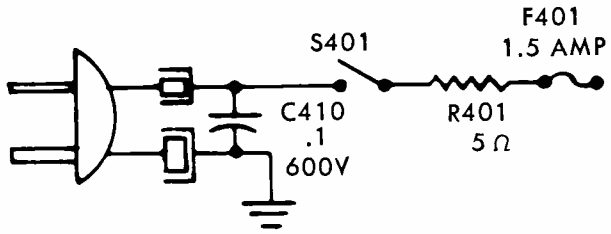


Refer to the drawing and dress the 300Ω lead well away from R401, as shown, before the back of the receiver is reassembled.

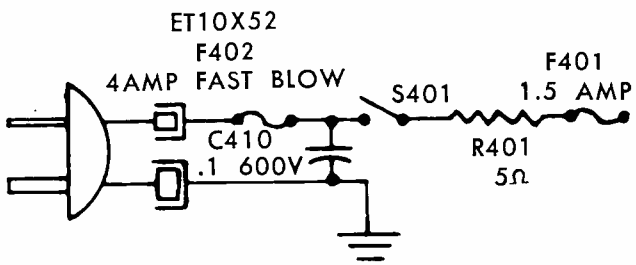
Check this lead dress whenever a "V" chassis receiver is serviced. Models included in this chassis line are M106, M107, M108, M138 and M140, containing VC chassis, V-1 chassis or V-2 chassis.

TV Chassis SB/SC—Lightning Protection

Starting with chassis stamped EN75, the SC chassis will incorporate a 4a fast blow fuse (ET10X52) in series with the ac line ahead of C410. This provides lightning protection for C410 even when the set is off. (This is in addition to F401 1.5a fuse already in the set.)



Schematic for SB and SC Prior to EN75

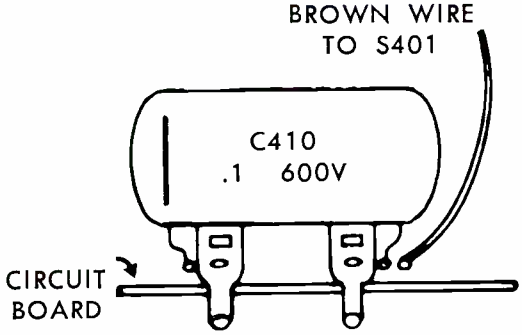


SC Schematic—EN75 and later

This feature should be added to every SB and SC chassis stamped below EN75 that comes in for service. The modification is simple and takes only a few minutes, since only the cabinet back needs to be removed. Your customers will appreciate this added protection.

Modification Procedure:

Unsolder end of C410 from circuit board beside small interlock pin. Unsolder brown wire to S401 from circuit board beside small interlock pin. Clip pigtail on one end of 5a fuse ET10X52 to 3/16in. long and install as shown in hole where brown wire was removed. Solder in place. Clip pigtail at top end of R402 to ½in. length. Splice the brown



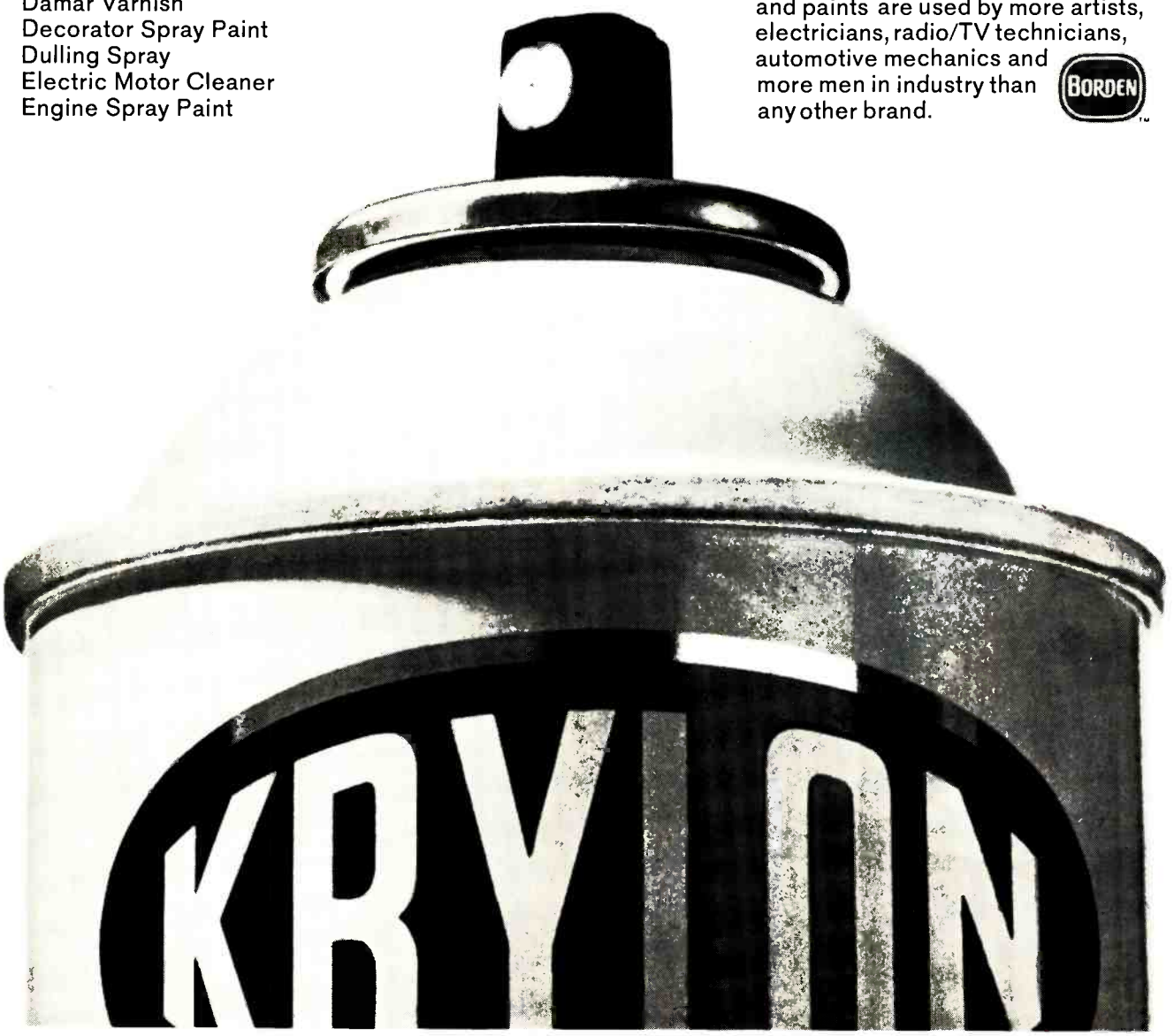
Configuration before Modification

What's in a name?

All-Purpose Primer
All-Purpose Silicone Spray
Anti-Rust Wax
Auto Body Under Coater
Automatic Choke Cleaner
Automotive Acrylic Spray
Automotive Trunk Paint
Battery Protector
Belt Dressing
Car Colors
Cleaner and Degreaser
Crystal Clear
Damar Varnish
Decorator Spray Paint
Dulling Spray
Electric Motor Cleaner
Engine Spray Paint
Glowing Fluorescent Spray Paint
Heavy Duty Silicone Lubricant
Hide-a-Mark Spray Coat
High Gloss Varnish
High-Heat Spray Paint
Hot Rod Primer
Insulating Varnish
Let-Go Super Penetrant and Rust Solvent
Matte Finish
Open Gear Lubricant
Paintable Silicone Mold Release
Pressure-Sensitive Spray Adhesive
Retouch Varnish
Rust Magic® Metal Primer
Satin Finish Varnish
Stencil Ink Sprays
Tuner Cleaner and Lubricant
Workable Fixatif
Zinc Chromate Primer

Krylon® protective spray coatings and paints are used by more artists, electricians, radio/TV technicians, automotive mechanics and more men in industry than any other brand.

BORDEN™



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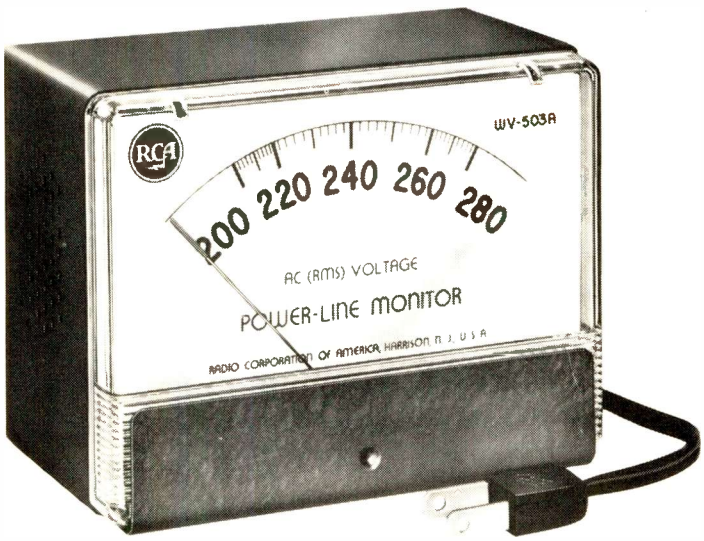
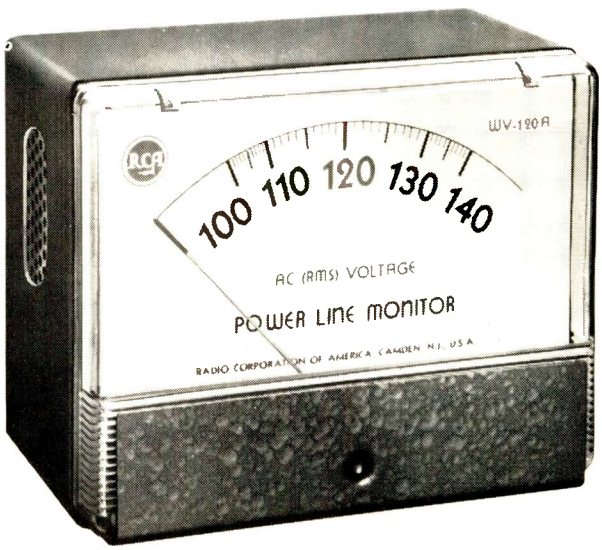
monitor



The RCA WV-503A 240-Volt Power Line Monitor is the big brother of the WV-120A. At a glance, it provides a continuous, accurate indication of the AC line voltage from 200 to 280 volts. Used in conjunction with a variable isolation transformer, it is an invaluable aid in selecting line voltages for TV servicing, test equipment calibration and the operation of electronic equipment that requires a known line voltage supply. ONLY $18.50.*



The RCA WV-120A Power Line Monitor is designed for use by radio-TV repair shops, labs, and industries where it is important to know the power line voltage at all times. Used in conjunction with the RCA WP-26A Isotap isolation transformer on a 50-60 cycle power line, it is an invaluable aid in selecting line voltages for TV servicing, test instrument calibration, and in the operation of electronic equipment that requires a known line voltage supply. AND IT'S ONLY $18.50.*

The RCA WP-26A TV Isotap is a higher rated version of the popular and reliable RCA WP-25A. It is designed for use as either an adjustable isolation transformer or as an adjustable autotransformer to facilitate testing and trouble-shooting of radio and TV receivers. It is particularly useful in the service shop for duplicating low or high supply-line voltage conditions often found in the home, and in checking operation of the oscillator sections of TV receivers. ONLY $40.00.* The WP-25A is still an excellent buy at only $27.50.*

*Optional Distributor resale price.

For a complete catalog of descriptions and specifications for all RCA test equipment see your RCA Test Equipment distributor or write RCA Electronic Components, Commercial Engineering, Department No. L46 WA, Harrison, N.J. 07029.

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

RCA

color

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

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

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

*Optional Distributor resale price.

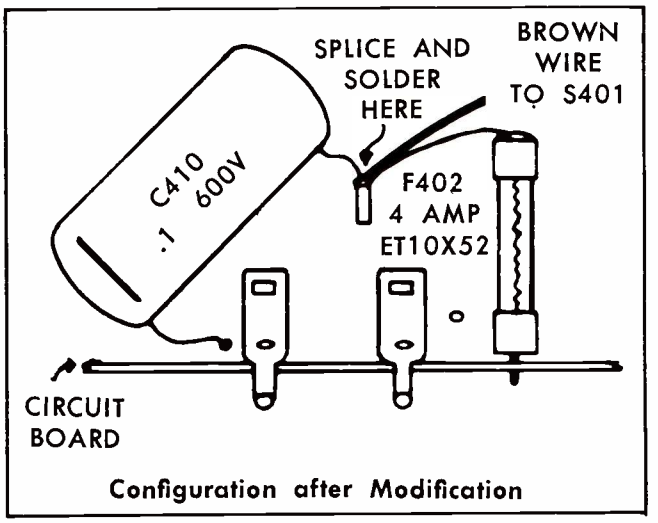
For a complete catalog of descriptions and specifications for all RCA test equipment see your RCA Test Equipment distributor or write RCA Electronic Components, Commercial Engineering, Department No. L-46-WB, Harrison, N.J. 07029.

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

RCA

. . . for more details circle 127 on postcard

ET/D TECHNICAL DIGEST



Configuration after Modification

wire, C401 pigtail and F402 pigtail together as shown and solder. Clip off any excess wire at joint and dress the splice outward to make sure that there is no possibility of splice touching vertical output transformer.

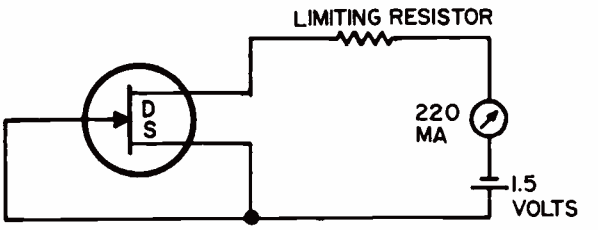
SYLVANIA

Testing Field Effect Transistors

The ordinary transistor tester runs into a brick wall when called upon to test a field effect transistor. In view of this fact, we will point out some ways of checking this type transistor and some of its characteristics.

First this type transistor is operated very much like a vacuum tube in that; (1) It has a high input impedance, (2) it is voltage operated and (3) it is biased like a vacuum tube. This type transistor has a low noise level. There are two channel types, N-channel and P-channel. The former type is made of N-type semiconductor material with P-type material (gates) deposited and P-channel uses P-type material deposited for use as gates.

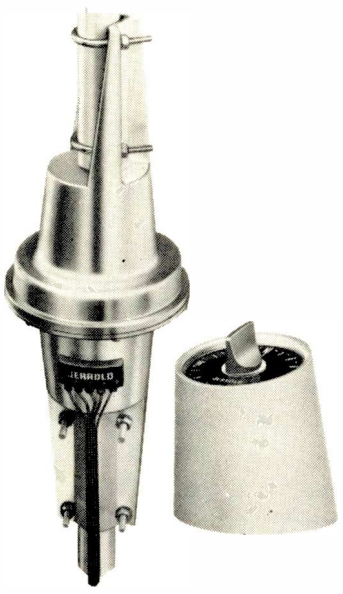
Unlike ordinary transistors, the input (gate) material is reverse biased to allow near zero or leakage current only to flow. The amount of voltage on this gate determines the current from source to drain. An ohmmeter may be used to check the front-to-back ratio of this diode junction the same way as in an ordinary diode or transistor junction. Caution: Some of these transistors for low signal levels are unable to withstand even ohmmeter currents and voltages. A suitable series current limiting resistor should be used on these types. Some of these transistors arrive from the vendor with a shorting ring to all terminals. This is to prevent static charges from breaking down the diode junctions, especially in IGFET's. When picking up or touching an IGFET device, the hand should be at ground potential. The leads can be



Join the rotor revolution...

...ith the fast-selling new Jerrold

DYNA ROTOR™



Orders are rolling in for the new Jerrold DYNA-ROTOR—fast. We're not surprised, for here . . . at last . . . is a profit-making rotor you can rave about:

- Combines all solid-state circuitry with unique dynamic spline drive
- Fully automatic rotor moves quickly—and precisely—to the point where it is aimed by the control unit—never loses synchronization, never drifts
- High torque drives through ice, snow, and high winds
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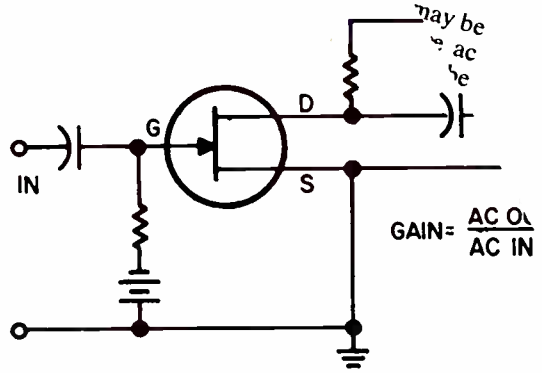
ET/D TECHNICAL DIGEST

clipped together with a p
ling to prevent unsafe vol clip or spring clip while hand-

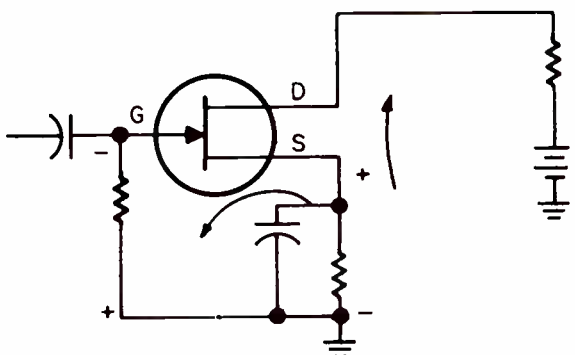
As in all transistors, ppearing between elements. ground potential. Of cou dering iron tip must be at energized when removing or circuit should be de-

A test for short or open device. made by connecting the gate to a 1.5v through a milliameter from transistors can be of current should flow. Less tha rminal. Connect condition and more than this indicat ce; 2 to 20ma

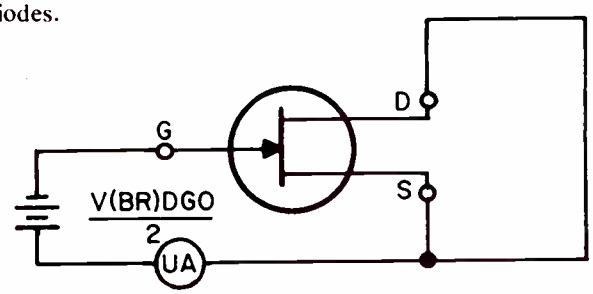
The transconductance (Gm) of a found by dividing the ac signal outp es an open input (gate) signal voltage, and the tion.



measured by connecting an amplier and comparing signal out to signal in. Shown in typical fixed and self-biasing arrangement.



The illustration shows the connections to make gate leakage tests. The resistance in this circuit will be very large allowing only nanoamperes or microamps current flow. This is true especially of the IGFET's. Junction type resistances are very temperature-sensitive, similar to semiconductor diodes.



Maximum voltages specified by the manufacturer indi cate lowest voltages that may be applied between element that will lead to device breakdown.

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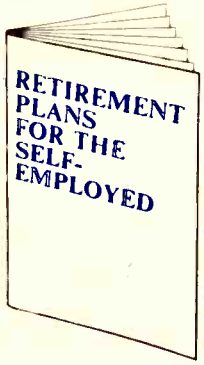

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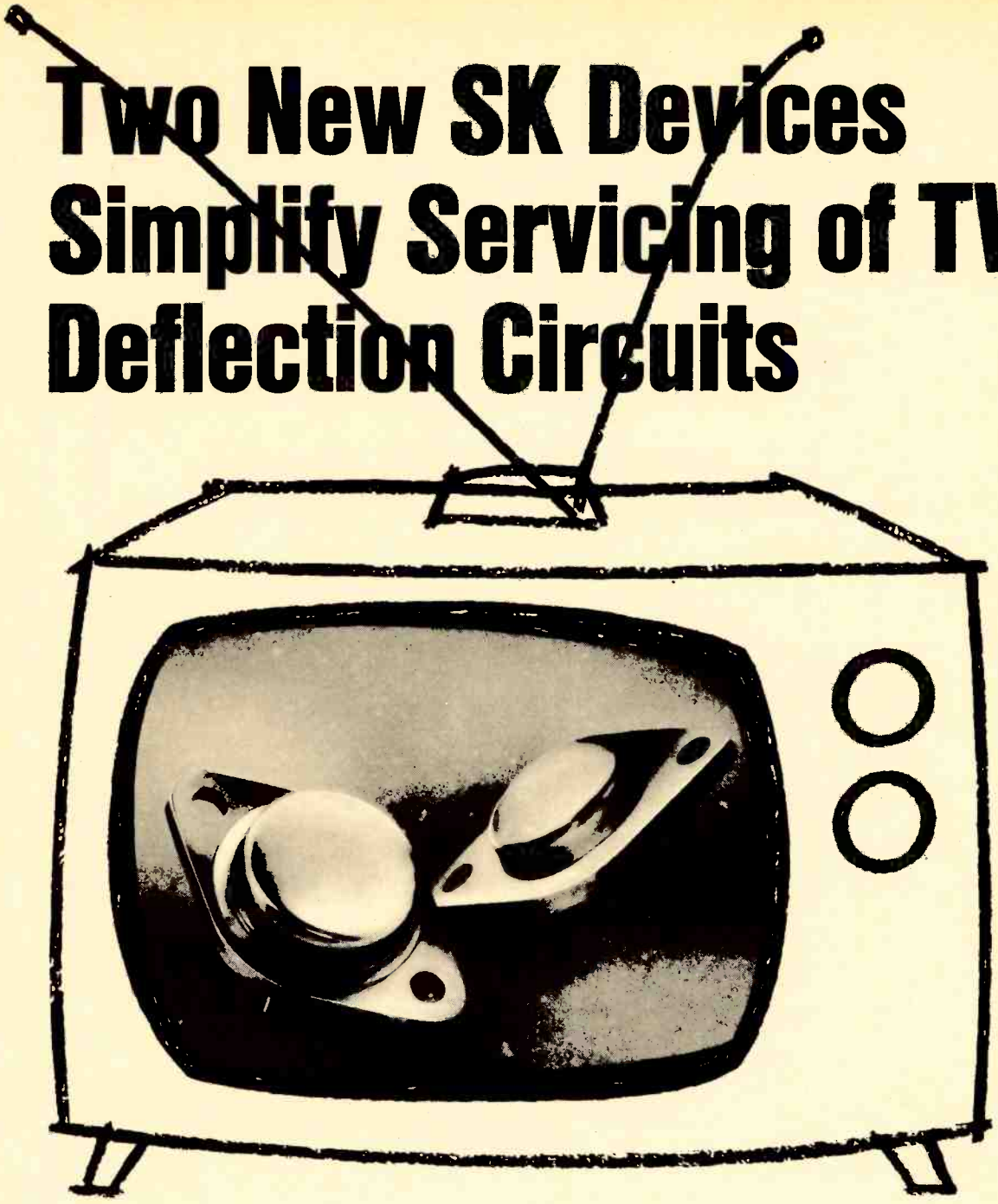

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ELECTRONIC TECHNICIAN / DEALER
DECEMBER, 1968

Approach to Circuit Analysis

Troubleshooting TV, radio or Hi Fi circuits is easier if you know how they work. Application of some well-known theories can help you analyze these circuits

How do you understand the meaning of a complicated electronic schematic? You probably start by looking for simpler inside circuits. It's common practice to study large schematics a section at a time to gain a better understanding of the over-all picture.

But for debugging and service problems the search must go in the other direction. Schematics usually provide enough information for a competent technician to build the unit, but test and operating information tends to be sparse. Normal dc and signal voltages may be omitted although they are helpful in finding malfunctions. Or they may be plainly stated yet have obscure meaning. An interesting circuit which is simple, popular and useful but hard to analyze is the Wheatstone Bridge.

One factor which noticeably complicates this problem is the added circuitry provided with the basic operational components. The extra components are necessary and regulate such things as bias, frequency response, provision for real parts tolerances and other practical matters. Yet their use may not be clear and they increase the complexity of possible service problems. In some extreme cases you may think that the designer himself did not understand the basic facts of voltage, current, impedance and function, or it may seem he must have tried very hard to hide them. But they are all there in the schematic. The problem is to get them out.

Basic Laws

If we know the value of a resistor and the voltage across it, Ohm's Law tells us how to find the value of the current through it. By applying Ohm's Law we can find out something about a circuit without making direct measurements. On a more advanced level, Thevenin's and Norton's Theorems also provide information about circuits. They are used to clear away complicated details so the true circuit functions are made clear. At first it may be hard to believe the final "equivalent" circuit could illustrate the behavior of a complicated circuit.

The wording of these two circuit generalizations depends upon how much detail the writer is trying to cover. As given here, they apply to dc circuits and to circuits which may be viewed as dc circuits. All bias circuits are dc and some filters and ac circuits resemble dc circuits so that even in their simplest forms these ideas are very useful. And by improving the definitions we can apply the basic theory to the uneven, erratic events in pulse and switching circuits.

Thevenin's Theorem states that "any real circuit of linear generators and resistances may be replaced for purposes of calculation by a single equivalent voltage generator in series with a single equivalent resistance." All Thevenin equivalent circuits look like Fig. 1, which could represent a battery, a large Hi Fi amplifier or many other electronic systems and situations.

Norton's Theorem states that "any real circuit of linear generators and resistances may be replaced for purposes of calculation by a single equivalent current generator in parallel with a single equivalent resistance." For instance, Fig. 2 could represent the

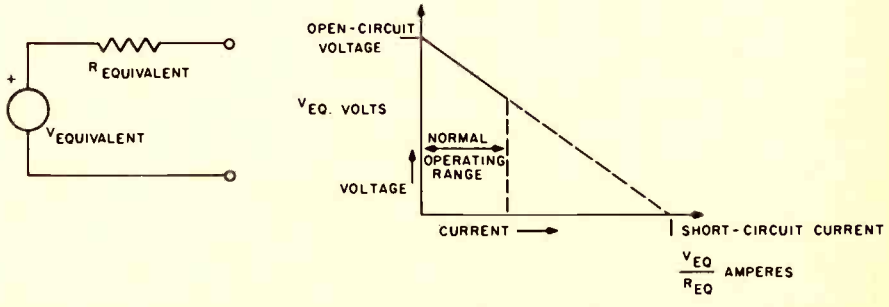
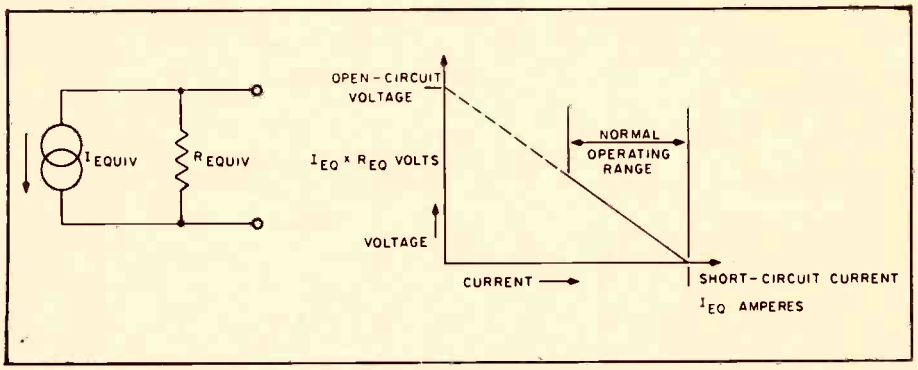


Fig. 1—A Thevenin equivalent circuit and its load line.

Fig. 2—A Norton equivalent circuit and its load line.



electrical behavior of a transistor or pentode output, a constant-current circuit, certain TV circuits and some industrial electronics circuits.

Equivalent Circuits

The real importance of these theorems appears in the simple circuits of Figs. 1 and 2, and in the large number of complicated real circuits that we can reduce to one of these two basic equivalents. Let's look more closely at the three key terms. They are: linearity, generator and equivalent.

Linearity is the property of simplest possible predictability. A circuit is linear if we can plot its voltage or current characteristics as a straight line. Most small-signal hi fi and radio circuits are linear because this is the only characteristic giving an output signal which duplicates the input signal. Limiting and clipping circuits are nonlinear, and switching components such as SCR's, thyristors and diodes are sharply nonlinear.

Electrical power comes from a source called a **generator.** In electronics we use the term loosely to include any circuit or device at whose two terminals we can find power. A transistor generates no power but if we ignore its dc supply biasing, the transistor seems to generate the signal power it has actually borrowed from its dc biasing. A voltage regulator circuit with a power supply in back of it appears to be a complete power source in itself when we make tests at its output terminals.

Equivalent indicates that performance calculations based on the paper circuit will yield paper measurements resembling the results of comparable tests on the real circuit. This important relationship can be very confusing to a beginner. For instance, suppose we say a power supply has a 1Ω output resistance or maybe we find this entry in a catalog. But there is no 1Ω resistor anywhere in its schematic. Instead, the resistor is in the circuit's Thevenin equivalent and is said to be responsible for the real circuit's voltage drop under load.

The voltage, current and resistance values in our equivalent circuit may all be different from anything immediately visible in the real circuit. In fact they probably are. How do we find the correct equivalent circuit?

We work out a paper circuit that will generate the same voltage and current values as the real circuit at any two load values. Because our real circuit is linear we can draw a straight line through these two results and all other possible voltage-current combinations from dead short to open circuit will lie on this same line. This line is called a "load line."

One of our two points is likely to be an open-circuit voltage measurement or a short-circuit current measurement. In practice we usually do not make both these extreme measurements because a real circuit that is happy facing either of these conditions usually sees the other as harmful and may be damaged by it. For example, if we want to make a load line for a power supply, we commonly use the open-circuit voltage as one of the test conditions, but we do not short the supply to discover its maximum current capability.

Instead, we apply a heavy load known to be within the capabilities of the supply, and plotting the results of these two tests we can estimate the actual short-circuit performance of the circuit. This method is in perfect accord with normal application of the supply, which does not operate into these extreme conditions anyway.

Another approach is the "thought experiment." In this experiment we avoid tests altogether until the picture is well worked out. And then if a test appears necessary, we can carry it out in an effective way. Using this approach we imagine the output terminals are opened-circuited. An inspection of the schematic will usually show that some of the components have no effect upon the output voltage which we can now estimate. Then we imagine the output terminals are shorted and we can estimate the maximum short-circuit current. See Figs. 1 and 2. This approach seems abstract but it works very well and clarifies many details of circuit operation.

Once we have the key voltage and current values worked out, we can draw the equivalent circuit. Our open-circuit voltage is the Thevenin generator's voltage value, the short-circuit current is the Norton generator's value, and either resistance is calculated by Ohm's Law.

This identical-twin relation between Thevenin's and Norton's Theorems is very interesting to the

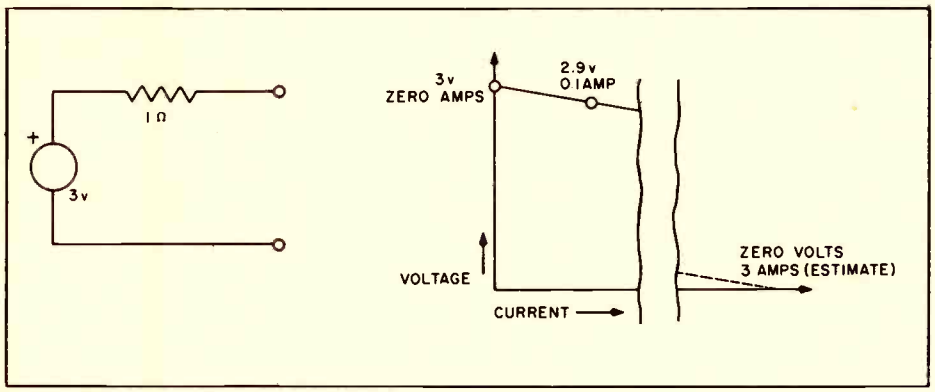


Fig. 3 — The Thevenin equivalent of a small battery.

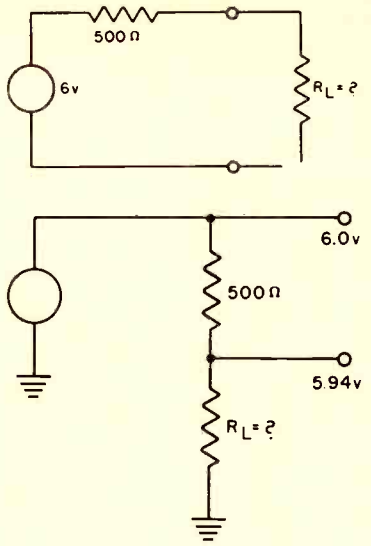


Fig. 4A — Initial sketch for the audio loading problem.

Fig. 4B — The same circuit redrawn to emphasize the relations between voltage, resistance and unknown load.

mathematically inclined. Called "duality" and perhaps confusing to beginners, it is an apparent interchangeability between the two theories. Sometimes it is hard to decide which one to use, but the difficulty disappears as you become more familiar with them.

One equivalent circuit emphasizes current; the other is in voltage terms. Taking another perspective, the Thevenin equivalent will be most useful if the load does not greatly affect the circuit's output voltage. Or the Norton equivalent will be more appropriate if the load does not have too much influence upon the circuit's output current.

Electronic circuits do not show any favoritism in preferring voltage or current signals but many workers do. Such a preference is a handicap. For instance, the spot on a TV screen moves in response to a changing magnetic field whose intensity must follow a sawtooth wave. A current signal is applied to the deflection yoke. The voltage signal observed is really a by-product of the yoke's inductance and resistance, which accounts for its unlikely appearance.

Using the Theory

A real understanding of Thevenin's theory won't come to you all at once and applications will seem rare at first. But with practice, new applications and meanings will appear.

The normal approach to Thevenin's theory involves a battery, perhaps because batteries are very simple. Let's suppose a small battery shows a no-load terminal voltage of 3.0v, and this drops under load to 2.9v at 100ma current. What is its Thevenin equivalent circuit?

We simply draw a Thevenin equivalent circuit and choose voltage and resistance values for it which would account for the results of the actual test. See Fig. 3.

At zero current load there would be zero voltage drop across the equivalent resistor. The generator voltage must be 3v. Now, if under load the terminal voltage drops but the equivalent generator voltage remains the same, the drop must be due to the current passing through the series resistor. A .1v drop at .1a would require a 1Ω resistance. We write that value next to the resistor.

Now we can estimate the current that would flow under any load. For instance, our Thevenin equivalent would deliver a calculated 3a into a short circuit. The real battery would, too, if its chemicals could keep up with the high demand. A class B amplifier drawing 0.5a of current would cause a drop of 0.5v in the supply voltage, which might require decoupling of the amplifier's input circuits.

Here is a problem which appears simple but resembles some harder ones. A 6v audio signal is to be sampled by a pickup circuit. The specs give the source resistance as 500Ω. What pickup circuit resistance will not reduce the signal voltage by more than 1%?

This is illustrated in Fig. 4A as a Thevenin equivalent with known generator and terminal voltages, known generator resistance, but unknown load resistance. Our problem is to find the smallest workable load resistance.

The picture becomes clearer if we redraw it, emphasizing the voltage divider effect which causes the voltage to drop under load. This is Fig. 4B. Since the same current flows through both known and unknown resistors, the voltages may be expressed by a proportion which gives the solution:

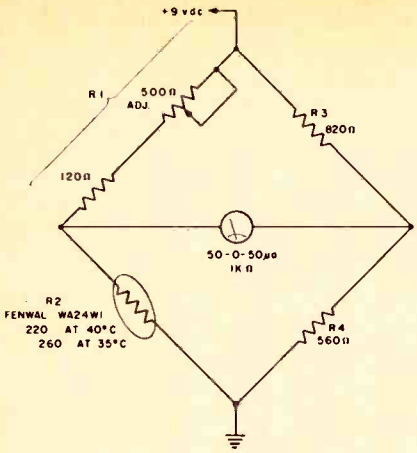
$$\frac{.06}{500} = \frac{6}{R_L + 500};$$

$$R_L + 500 = 50K;$$

$$R_L = 49.5K \text{ MW}.$$

Our result is almost intuitive. Yet with the help of the equivalent-circuit approach its accuracy is guaranteed, and we have a way to work out similar but harder problems.

The Wheatstone Bridge circuit is simple and yet hard to anaylze. But we can find a pair of Thevenin equivalents and assemble them into a single equivalent which will express the operation of the bridge over a small part of its range. Look at the bridge in Fig. 5A, for instance. Given the resistance shown, what will be the resistance in R1 at balance at 35°C? And what will be



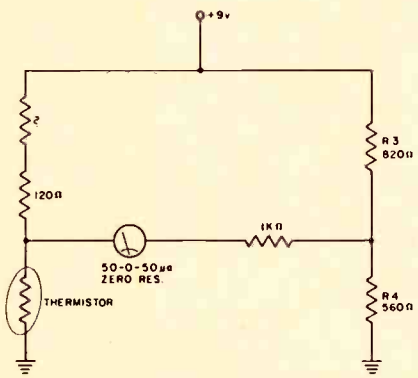


Fig. 5A – A Wheatstone bridge circuit as we might see it in an industrial schematic.

Fig. 5B – The Wheatstone bridge circuit after redrawing to emphasize its inside voltage dividers and the meter resistance.

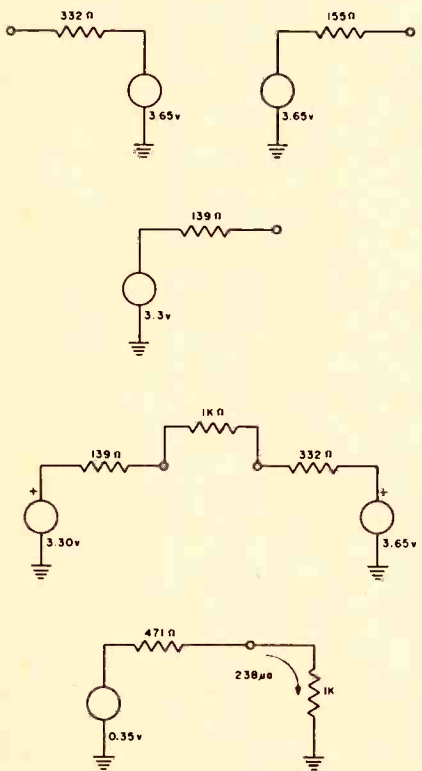
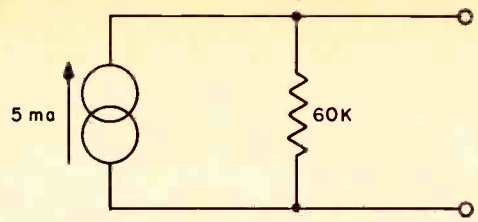


Fig. 6A – Thevenin equivalent of RH voltage divider.
Fig. 6B – Thevenin equivalent of LH voltage divider at 35°C.
Fig. 6C – Thevenin equivalent of LH voltage divider at 40°C.
Fig. 6D – Both Thevenin equivalents and meter resistance, at 40°C.
Fig. 6E – Final Thevenin equivalent and meter load at 40°C.



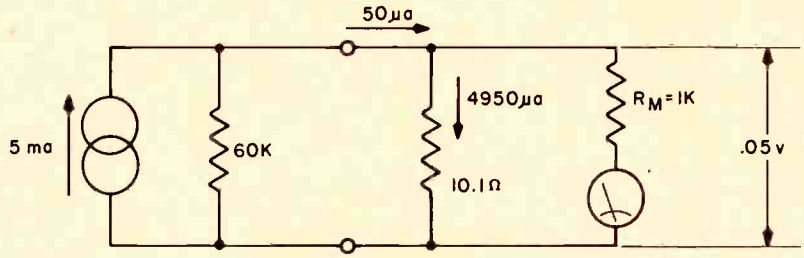


Fig. 7A – Norton equivalent of microammeter circuit.

Fig. 7B – Norton equivalent, with meter details and shunt load added.

the meter's approximate temperature range?

Although the thermistor's resistance varies nonlinearly with temperature, we can use a Thevenin equivalent for any specific temperature.

In Fig. 5B the bridge is redrawn as a pair of voltage dividers with a resistor and meter between them. This takes away most of the bridge mystery, and it shows that the bridge is balanced when both voltage dividers reduce the input voltage in the same ratio.

If the bridge is balanced at 35°C, we use the ratio from the RH side of the bridge to work out the unknown resistor in the LH side. That is,

$$\frac{820}{560} = \frac{X}{260};\ X = 381\Omega$$

Now we know all of the resistors in the circuit.

The rest of the solution proceeds in this way. The voltage across the meter terminals is the open-circuit voltage less drop due to current flowing through the bridge equivalent resistance as seen by the meter. We will draw Thevenin equivalents of the voltage dividers, one at a time, and then simply add up the results.

The RH side, composed of fixed resistors, always has the same equivalent. See Fig. 6A. Under no load, the terminal voltage will be 3.65v. Without actually performing the test we can see that if the terminal were shorted to ground, the current would be

$$\frac{9v}{820\Omega} = 11ma$$

and that 3.65v through 332Ω would deliver the same short-circuited current.

Applying the same procedure to the LH side we find the same voltage but a different equivalent resistance because the real resistors are of different values than in the RH side. See Fig. 6B.

Now we want to estimate what happens to the bridge when a temperature change unbalances it. We find that if the thermistor is warmed up to 40°C, its resistance drops to 220Ω. The LH equivalent becomes 3.3v through 139Ω, as in Fig. 6C.

In Fig. 6D everything is put back together, using the appropriate T. equivalents and including the meter resistance. At 40°C the total circuit resistance is 139Ω from the LH equivalent, plus 1K meter resistance, plus 332Ω from the RH equivalent. And the difference between generator voltages is 1.135v which gives us the new T. equivalent of Fig. 6E. A five-degree temperature rise will produce a meter current of 238μa, or roughly 48μa per degree C.

Summing up, the bridge will balance at 35°C with the adjustable resistor set at 261Ω for a total of 381Ω in that leg of the bridge. And the meter needle will indicate about

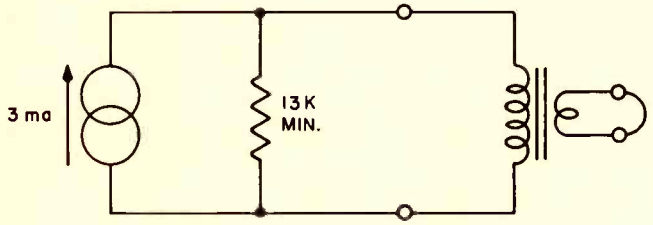


Fig. 8—Norton equivalent for audio output stage design problem.

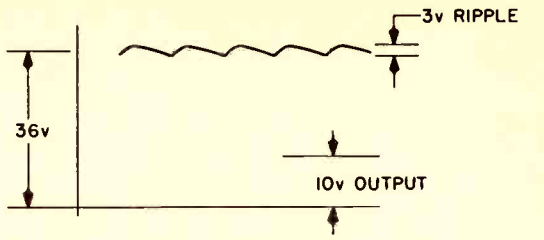


Fig. 9A—Input and output voltages for regulator problem.

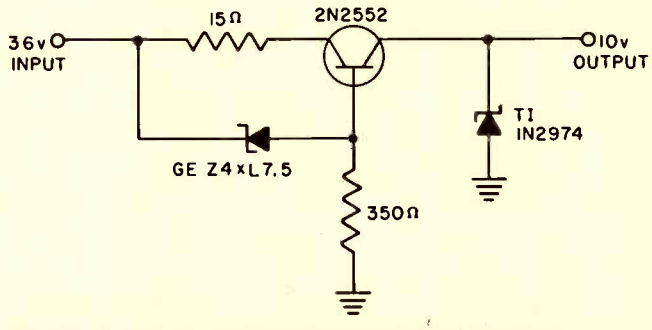


Fig. 9B—The simple current-limited zener regulator circuit.

1°C each way from balance.

Using Norton's Theory

Sometimes an otherwise careful current measurement test is spoiled by forgetting to consider possible effects of meter resistance. And it may not be immediately clear, for some applications, how much meter resistance is too much. Norton's theory provides a good perspective for sizing up this question.

For instance, suppose we want to use a 1000Ω 50μa meter to measure 5ma in a 300v circuit. What shunt resistance should we choose?

The circuit voltage is not very important since it will not enter directly into the test. We are already working in current terms. The Norton equivalent is appropriate here and the short-circuit current of 5ma is given. Since the open-circuit voltage would go to 300v, the parallel equivalent resistor is 60K. The Norton equivalent appears in Fig. 7A.

Adding the meter and its shunt we get Fig. 7B, with some voltages and currents being immediately apparent. At full-scale reading the meter is carrying 50μa, giving 50mv across its terminals and 4.95ma through its shunt resistor. The shunt must be 10.1Ω.

Further detail emerges. The 10.1Ω is insignificant compared to the 60K parallel generator resistance. But if we used the same meter to read 50μa full scale, with no shunt, its 1K would introduce more than 1% error.

Here is a more interesting problem, which is not so clear-cut. Some headphones requiring 10mv into an 8Ω load are to be used with a junk-box transformer and a small output tube. A simple voltage test shows the turns ratio of the transformer must be about 18:1. Choose a tube and estimate the grid signal required to deliver 10mw to the headphones.

The impedance transformation going back through the transformer is the square of the turns ratio so that the 8Ω load becomes 2.6K seen by the output tube. Knowing 10mw is required into this load, we can estimate the output tube must deliver 2ma of signal current.

Other requirements appear. To guarantee 2ma available in the real circuit we should plan for a tube that will deliver at least 3ma. And to avoid possible excessive distortion, the tube anode resistance should be not smaller than perhaps five times the load resistance. These requirements are summed up in Fig. 8. Our new problem is to find a tube and circuit which will have this Norton equivalent circuit.

A 6AQ5 would consume 30ma of dc current and this seems extravagent in view of the small signal current required. Perhaps an RF sharp-cutoff pentode...the 6AU6 comes to mind, and suggests that old standby, the 6AK5. It's not usually chosen for an output tube but its anode current of 7 to 8ma is right in the ballpark.

The 6AK5's transconductance of about 5ma per volt works out to an estimated grid signal of 0.7v to deliver the required power. This is safely within the roughly 1.4v bias apparently needed; so we go ahead with the bias design and perhaps a breadboard of the circuit.

Complex Applications

Not all circuits conveniently carry current and voltage signals in well separated parts of the schematic. And not all "signals" are signals in the usual sense that their variation over time is the essential part of the circuit operation. The output from a good power supply is a "signal" that carries no signal.

Here is an example of such a circuit. About 36v of dc carrying 3v of hum, as in Fig. 9A, is to be reduced to 10v of good dc by the circuit of Fig. 9B. How much hum should we expect to find at the output? What will be the output characteristics under load and overload?

In this arrangement, the transistor acts as an emitter follower imposing the zener's 7.5v across a 15Ω resistor. The resulting 500ma enters the transistor emitter terminal, a small control current flows

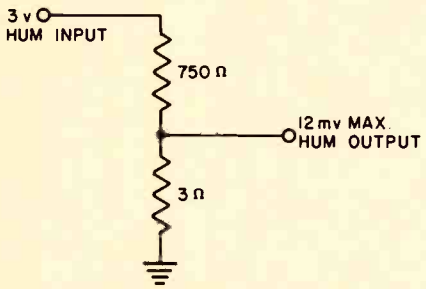
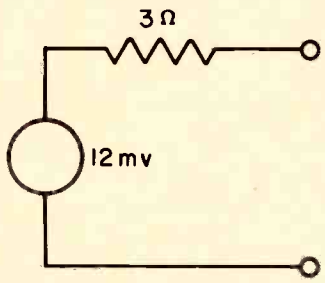


Fig. 10—Thevenin equivalent circuit for estimating maximum possible hum.



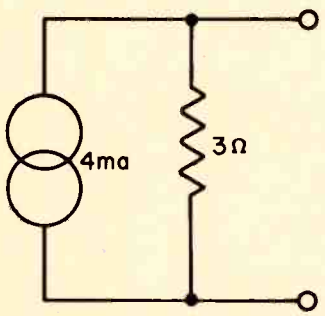
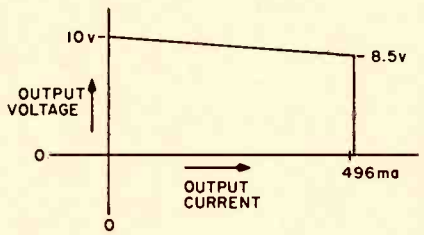
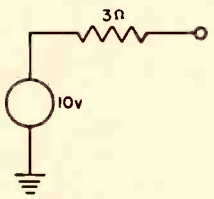


Fig. 11A—Thevenin hum generator.

Fig. 11B—Norton hum generator.





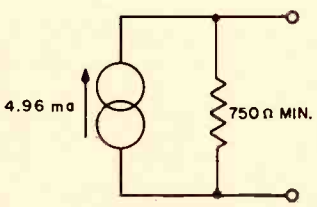


Fig. 12A—Broken load line illustrating regulated supply performance at normal and overload conditions.

Fig. 12B—Thevenin equivalent circuit describing dc power supply performance at normal load.

Fig. 12C—Norton equivalent circuit describing dc power supply performance at overload or short-circuit.

out the base terminal, and perhaps 496ma appears at the collector terminal.

We use a Norton equivalent circuit here because the transistor will try to deliver its 496ma for all collector voltages from saturation to breakdown. The hum voltage is lost, incidental noise is lost, and it appears that all regulation is lost, too. The voltage from collector to ground will depend only upon load resistance, being 0.496v for 1Ω load, 4.96v for 10Ω load, etc.

But a zener diode load for the constant current circuit will retrieve the voltage regulation without reintroducing the hum and noise. The output seen across the zener is good dc. If the output terminals are shorted, the zener goes out of action, and the output current is limited to normal operating values. This is a handy simple supply circuit for shop applications.

How much hum will remain in the output? We can guess its maximum level from the voltage divider circuit of Fig. 10. The voltage divider consists of the constant-current circuit's equivalent resistance in series with the zener's dynamic resistance. This reduces the 3v hum input to whatever hum appears at the output terminals.

The constant-current transistor's output resistance will not be less than its amplification factor times the resistance in its emitter circuit. Transistors have very high amplification factors and a conservative estimate for this case is *mu* equals 50. So 3v of hum through 750Ω equivalent resistance gives about 4ma of hum current at the collector terminal.

Since the zener has a dynamic resistance at normal operating current of about 3Ω, the 4ma of current will generate a hum level of 12mv which is seen across the output terminals. The situation can be summed up with either a Norton or a Thevenin equivalent, and both appear in Fig. 11.

Performance at dc is another question. Starting with zero load current we imagine we are making voltage measurements at the output terminals, at successively greater currents. At zero load the zener is receiving 496ma, and perhaps we find exactly 10v output. (Remember all real components have tolerances.)

As the load increases, the zener receives less current and its voltage drops in a way corresponding to a 3Ω resistor in series with the output. At perhaps 480ma load, the zener is not getting enough current to operate effectively and the terminal voltage is falling rapidly to zero. A little more current is available into a good short.

In Fig. 12 the situation is summed

continued on page 72

Let's Examine Sylvania's 'Gibraltar' Color TV Chassis

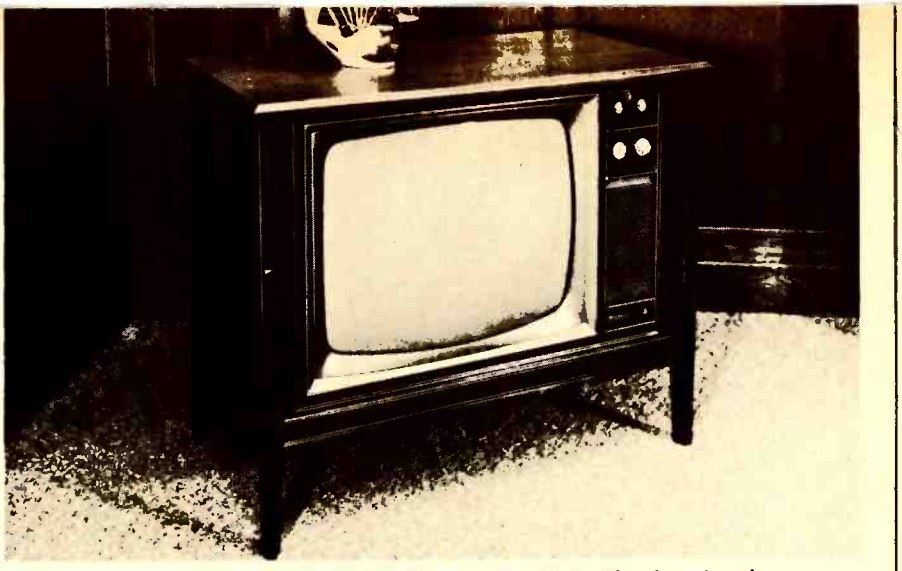


Photo showing Sylvania's model CF521WR color TV with the Gibraltar chassis.

ET/D TEST LAB REPORT

A little circuit 'knowledgeability' combined with the 'plugability' offered in this chassis can simplify servicing

■ Integrated circuits, color TV picture tubes, power and special-purpose tubes and some of the newer semiconductor devices are contributing to the rise in total electronic component sales during 1968.

Every year we see more solid-state components being employed in new color TV sets which account for some of the rises in semiconductor sales.

Despite declines during the first three months of 1968, U.S. factory sales of color TV picture tubes inched ahead of their 1967 pace as reported by Electronic Industries Assn's. Marketing Service Dept.

We recently unpacked a model CF521WR Sylvania color set employing the new "Gibraltar" chassis for Teklab evaluation.

This new chassis is a service technician's dream with the "plugability" concept carried throughout the entire chassis. The tuner cluster, deflection yoke, convergence section, automatic degaussing section, speakers and remote control unit have plugs for easy chassis removal.

The transistors employed have plug-in sockets eliminating time-consuming chassis removal to check and replace the transistors.

In addition this set has a number of features to simplify servicing, such as the wing bolts used on the back cover and a removable bottom panel.

Two-thirds of the active components in the Gibraltar chassis are transistors and it employs a new posted filament HV rectifier tube which is said to reduce warm up time. It virtually eliminates electrical shorts caused by shock, vibration or high temperature.

There are a number of features on this chassis which should add to its reliability:

The chassis has a line voltage switch which offers a choice of 120v or 125v.

A newly developed Mylar-insulated, solid impregnant flyback transformer is said to be impervious to moisture. The new solid silicon resin impregnants will not melt or support combustion.

A new horizontal output tube is said to handle 30w of dissipation.

The shunt regulator tube is mounted upright in a well-ventilated area with a special "chimney cap" to keep the tube as cool as possible for extended life.

About 66 percent of the circuit functions are transistorized and the lower B+ operating voltage results in a 100w reduction of power thereby reducing temperatures in the cabinet.

It also features improved color lock circuitry plus a more stable color oscillator tube.

We will now cover some of the important circuits used in this chassis.

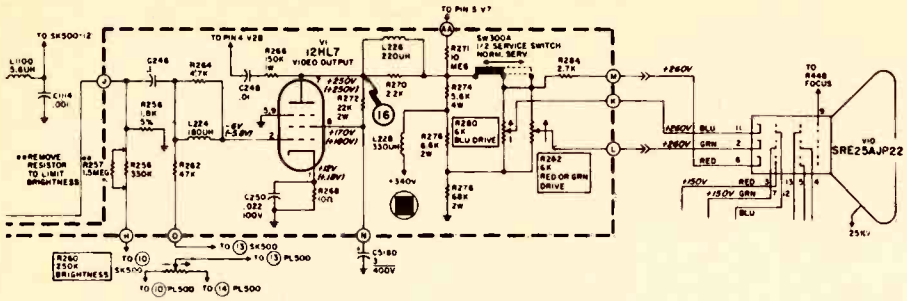


Fig. 1 – The brightness control and dc restoration circuit.

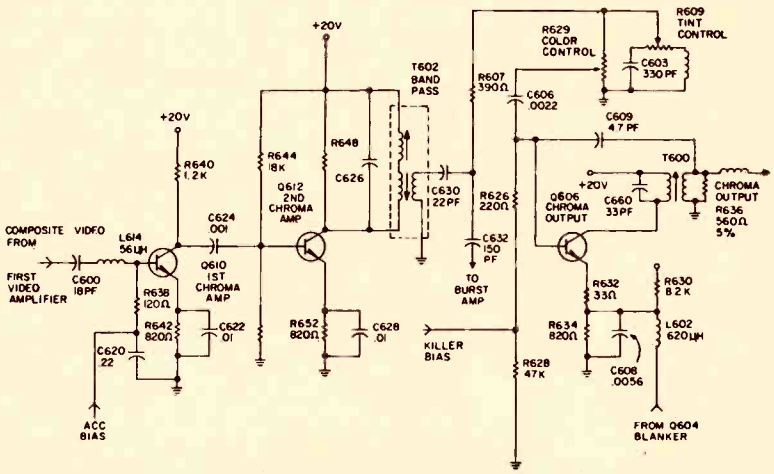


Fig. 2 – The chroma IF amplifier circuit shown attenuates low frequency video and passes frequencies in the chroma IF band.

Brightness Control and DC Restoration

The brightness control serves as a dc path for retaining dc restoration voltage from the video signal path (Fig. 1). The control has one end connected to the negative voltage developed at the horizontal output stage grid circuit. This allows a large negative range of available bias voltage for the video output stage. To decrease brightness, the control would be rotated in the direction of the HOT grid connection. This provides larger grid bias for the video output, a plate voltage of higher value and therefore a positive voltage on the CRT cathodes.

Dc restoration is accomplished in this chassis by dc coupling from the video detector to the cathode of the CRT. Part of this path is through the brightness control (R260).

Chroma IF Amplifiers

Complete composite video signals from the 1st video amplifier emitter are applied to the 1st chroma amplifier through C600 and L614 (Fig. 2). This network attenuates low frequency video and passes frequencies in the chroma IF band. The 1st chroma IF will amplify these signals by an amount determined by the ACC bias applied to the base of Q610 through R638.

All signals are then coupled through C624 to the second chroma amplifier Q612. The collector load for this stage consists of a resonant circuit C626 and the bandpass transformer primary T602. Sufficient bandpass is achieved by R648 in parallel with the resonant circuit.

The bandpass transformer has an upper and

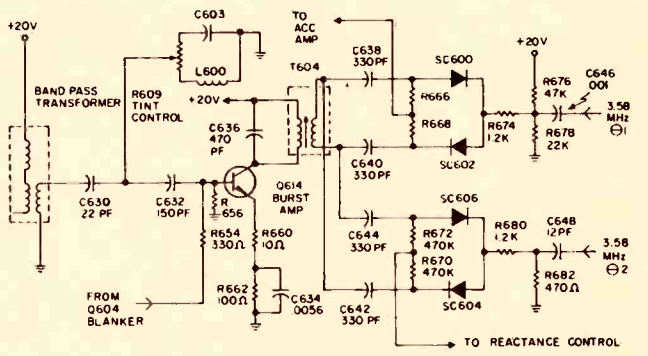


Fig. 3 – The burst amplifier and phase detector circuits.

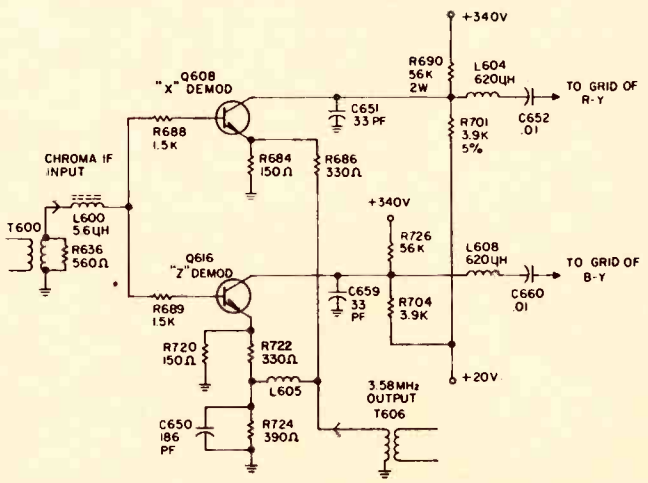


Fig. 4 – Schematic showing the X and Z demodulators.

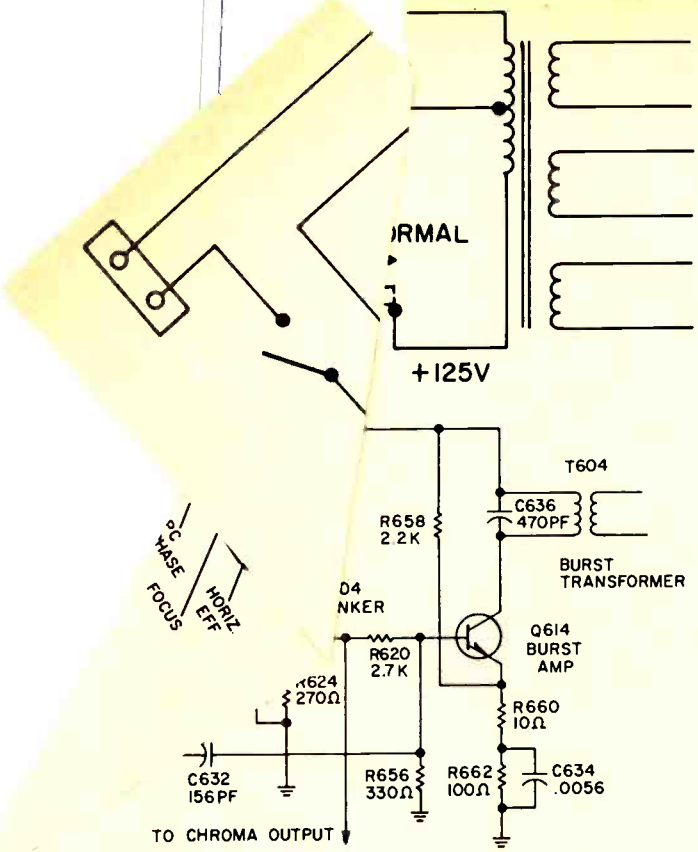


Fig. 5—A new switch at the back of the chassis offers a choice of 120v or 125v operation by switching taps on the power transformer primary.

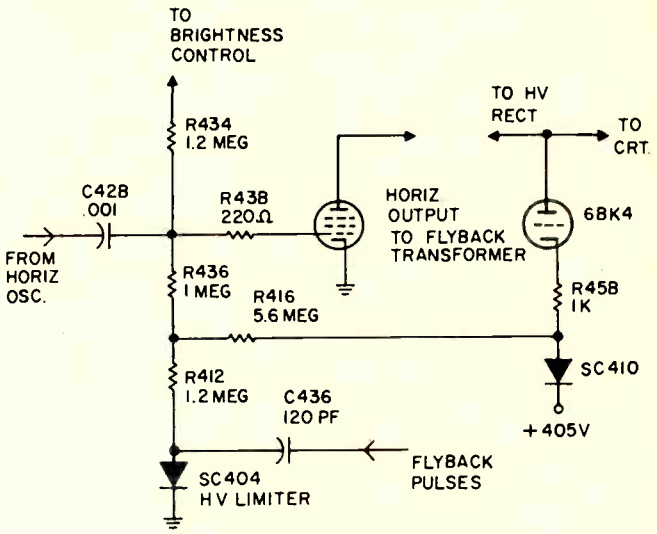


Fig. 6—Schematic of the blanker circuit used in the D12 and D13 chassis.

Fig. 7—Schematic of the HV protection circuits.

lower slug adjustment to be tuned to 3.1 and 4.1MHz respectively and pass the full chroma IF band of frequencies. The transformer output is applied to tint control R609 and color control R629. The tint control provides selective inductive or capacitive loading of the transformer output. This causes the entire chroma IF signal to shift in phase to provide full tint control. The color control allows attenuation of the color signals applied to chroma output stage, Q606.

A performance advantage is gained in the tint control circuitry. In earlier models the tint control was used to shift the received burst at the burst transformer. This resulted in a change in burst amplitude because of a change in "Q" of the burst circuit. This had side effects of varying burst amplitude and changing developed ACC voltage. Also the tint control required additional shielded wiring to the receiver control panel. In this new circuit the tint control has less effect on chroma amplitude even though it shifts the phase of the same chroma signal that is applied to the color control.

The base of chroma output transistor Q606 receives killer bias from the collector of color killer transistor Q602. The emitter circuit of Q606 receives a blanking pulse through L602 from the emitter of blanker transistor Q604 to eliminate 3.58MHz burst signals. This allows only true chroma signals to be passed through T600 to the "Z" and "X" demodulators plus providing suitable dc reference for the chroma signal.

Burst Amplifier

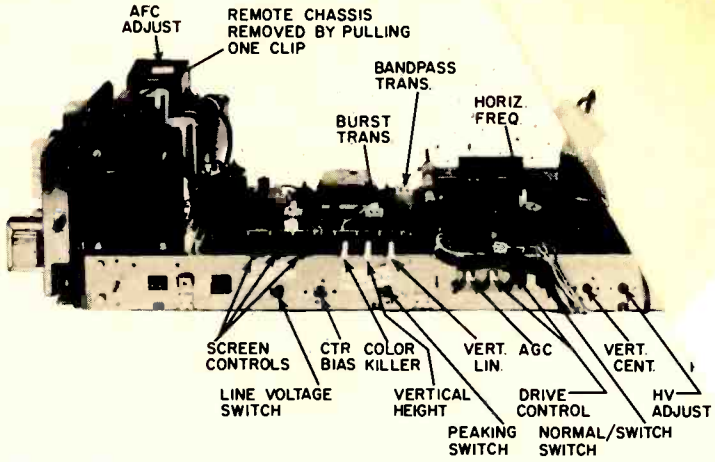
Chroma and burst information is applied to the burst amplifier, Q614. This stage is biased "off" under normal conditions because of R656 which keeps the base near emitter potential. During the burst interval a pulse from the blanker transistor Q604 biases the burst amplifier "on" and only the burst signal is allowed to pass (Fig. 3).

The burst amplifier therefore passes only color sync bursts which are amplified and applied to burst transformer T604. The output of T604 is applied to phase detector diodes SC606 and SC604 and killer detector diodes SC600 and SC602 ACC.

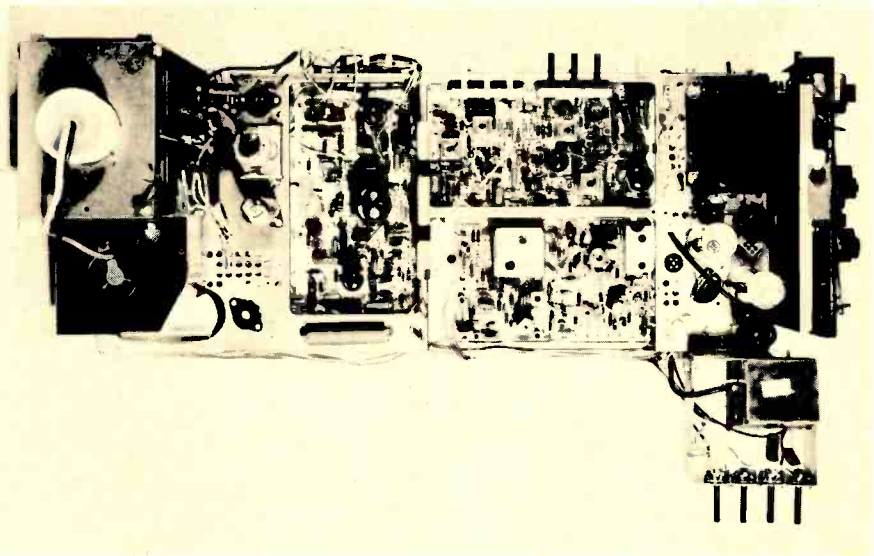
X and Z Demodulators

In order to demodulate the chroma sidebands, the X and Z demodulators provide synchronous detection of these signals with the 3.58MHz reference oscillator injection voltage. This voltage is several times the chroma input amplitude and provides large amplitude 3.58MHz pulses in the collector circuits of the demodulators. The phase of the 3.58MHz applied to the Z demodulator is shifted approximately 90deg by coil L605 and capacitor C650. The actual shift is selected to provide accurate color presentation.

When chroma signals are applied to the base of the demodulators, the phase and amplitude of the chroma will influence the average amplitude of collector pulses in each demodulator (Fig. 4). These pulses go in a less positive direction, nominally to about one-half the B+ voltage, 40v. If incoming chroma is in phase with reference pulses the collector pulses will drop to less than ½ B+ value. If they are out of phase, collector pulses will not be able to fall as low as ½ B+ value. If chroma signals are 90deg out of phase, part of



Rear view of the Gibraltar chassis showing service control locations.



Top view of chassis showing the plugability concept carried throughout the entire chassis.

the collector pulse will be below ½B+ value and part will be above ½ B+ value. The result is an average of zero change in collector pulses. The collector pulses are averaged by a low pass filter before application to the R-Y and B-Y amplifiers. These networks are C651 and L604 in the X demodulator, and C659 and L608 of the Y demodulator. After the collector pulse smoothing is complete, only color video remains and it is applied to the difference amplifiers through C652 and C660.

Power Supply Line Voltage Switch

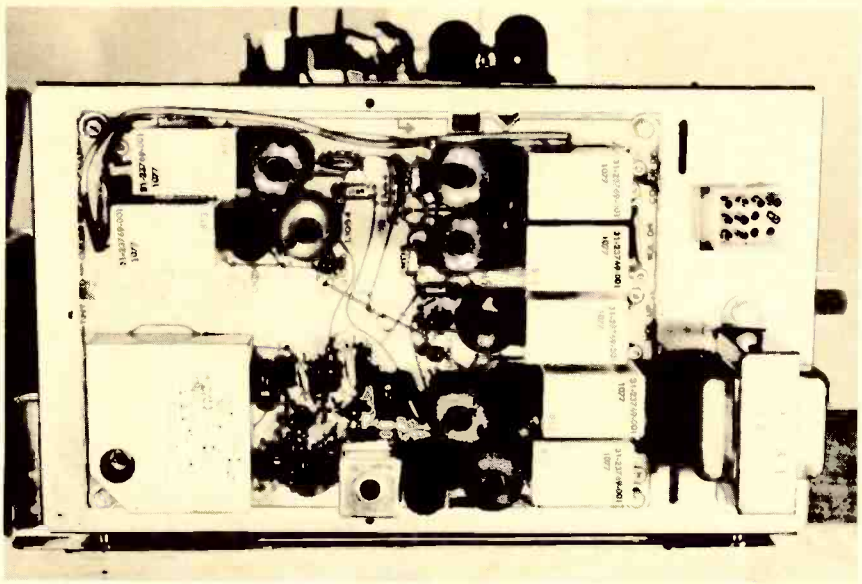
A new switch at the back of the D12, D13, D08 and D06 color chassis offers a choice of 120v or 125v "normal" operation. This is done by switching taps on the power transformer primary (Fig. 5).

The useful operating range in the lower switch position is 108v to 130v. In the higher position, the set will perform properly from 113v to 137v. Since the ranges overlap, most installations will be entirely satisfactory in the 125v position. Keeping the switch in this position provides the best over-all set life expectancy and reliability. All sets shipped from the factory will have the switch in this 125v position.

Blanker Circuit

The base of blanker stage Q604 receives a positive flyback pulse from a tapped winding on T400 (Fig. 6). These pulses are inverted to establish negative gating pulses in the collector circuit of Q604 which provides blanking of the CRT during horizontal retrace and grid leak bias for the color difference amplifiers. CRT bias control, R606, establishes the magnitude of these pulses and therefore the amount of grid leak bias developed at the difference amplifier grids. Depending on the conductivity of the difference amplifiers, their plate voltages will vary to control the average CRT grid bias.

Blanker state Q604 also serves as an emitter follower to supply positive pulses to the base of burst amplifier, Q614. These pulses serve as a gating function to allow only transmitted color sync bursts to



The remote control receiver chassis with plug connectors are easily removed by removing one clip on the mount.

pass. The emitter of Q604 is also connected through R622 and L602 to the emitter of the chroma output stage to remove burst during retrace.

High Voltage Protection Circuitry

This circuit consists of interconnected bias networks that serve the following purposes in case of high voltage regulator failure or circuit misadjustment:

1. Reduce horizontal output drive.
2. Decrease CRT conduction by negative biasing the final video amplifier.
3. Provide over-voltage protection for flyback, CRT and high voltage components.

Under normal conditions, the shunt regulator conducts through SC410 and the SC410 anode is very near B+ voltage of 405v (Fig. 7). This voltage is divided down by R416 and R412. However this voltage tends to raise the HOT grid voltage and turn it on "hard."

If the high voltage regulator should stop conducting, its cathode will become more negative and SC410 will be reverse biased. Now the positive voltage fed to the HOT grid through R416 is removed and the grid will become much more negative. In addition to the grid leak bias developed in this circuit, feedback pulses from T400 are also coupled to the HOT grid circuit. These are rectified and filtered by SC404 diode and R412 to produce additional negative HOT bias. Upon removal of the positive voltage from SC410 this bias exerts an even greater negative biasing of the HV transformer. This decreases the output power delivered by the HOT and will tend to keep the high voltage at a safe value.

It should also be noted that the HOT grid circuit voltage is applied to the brightness control and biasing circuit of the video output stage through R434 (Fig. 1 and 7). If regulation is lost, the increased negative voltage at the HOT grid is also applied to the grid of the video output causing decreased conduction. This would be reflected in more positive CRT cathodes and less CRT brightness. ■

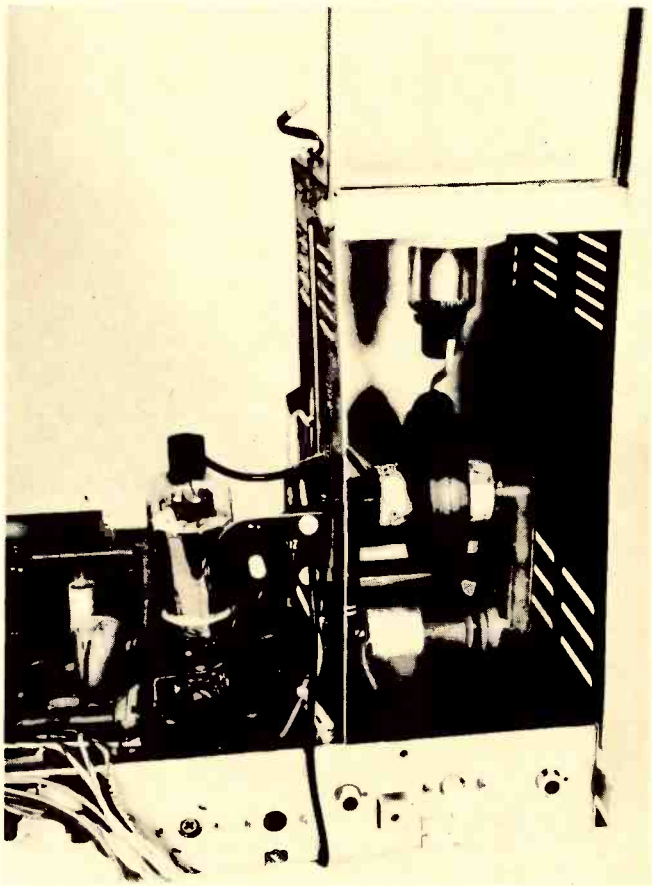


Photo showing the HV section of the chassis with a newly developed Mylar-insulated, solid impregnant flyback transformer. It reportedly resists moisture and will not melt or support combustion.

TEST INSTRUMENTS

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

Sencore Model PS148 Oscilloscope/Vectorscope

■ One of the most versatile combination instruments for color and B/W servicing, including modulation checks and lissajous patterns for communications or lab work is the oscilloscope/vectorscope combination. Because of the increase in color and transistorized sets, we decided to evaluate this modern test instrument and its many uses.

The new oscilloscope/vectorscope combination was connected to a late model Sylvania with excellent results. The vector pattern viewed on the screen was stable and clean, using a standard 10 bar color generator.

The vectorscope was easily connected to the set through two test leads attached to the output of the R-Y and B-Y chroma circuits. It can also be connected directly to the red and blue grids of the color CRT and one ground lead to the chassis. Then by flipping two switches at the back of the vectorscope, you are in business.

Various checks can be made with the vectorscope, making it a very useful instrument. Servicing color sync, AFPC adjustments, bandpass amplifier checkout, touchup alignment and 3.5MHz trap adjustments are only a few jobs this instrument can perform.

The oscilloscope is similar and has all the features of the field proven PS127 oscilloscope.

The oscilloscope can be used in a number of applications. This instrument combines the features of the voltmeter, ammeter, frequency and phase meter, waveform analyzer and many more.

There are a number of special applications for the scope, such as: synchroguide horizontal oscillator adjustments, color servicing determining frequency of an oscillator, TV and FM alignment and many more.

This oscilloscope has a number of features, some of which are not found on other scopes.

The vertical amplifier input controls are calibrated directly in peak to peak values for faster direct readings.

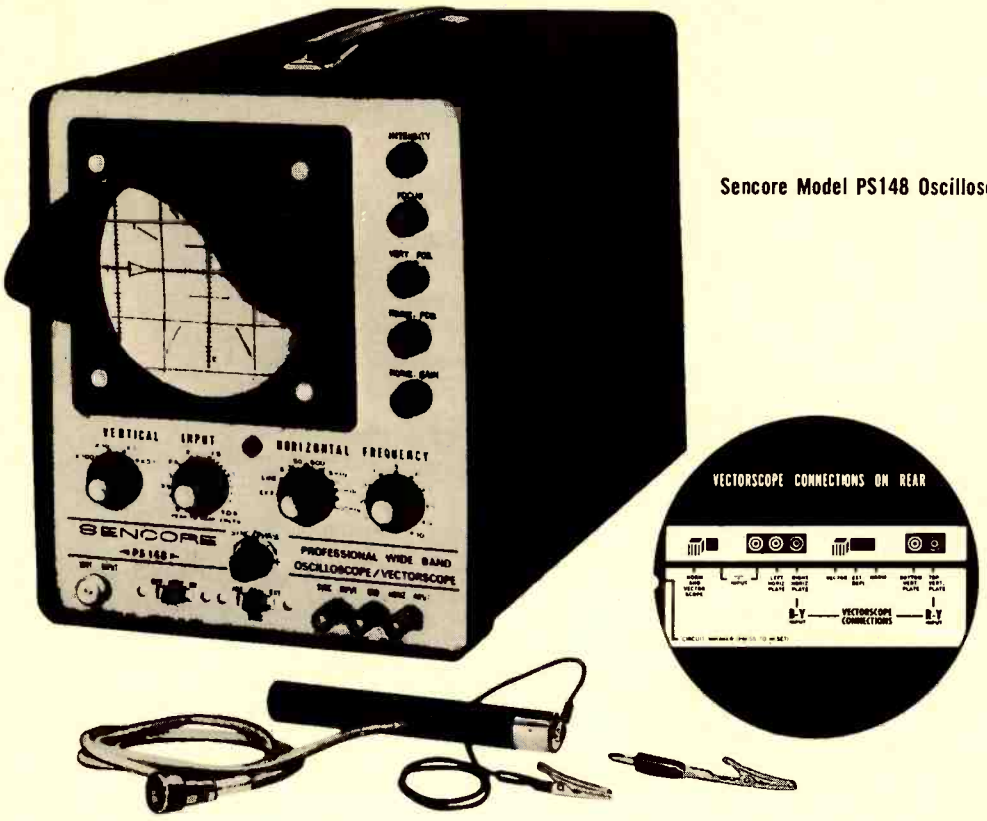
The vertical amplifier is completely wide band, 5 hertz to 6.5MHz from the most sensitive setting of .05v P-P per inch down to the less sensitive settings of the controls. No confusing band switching or narrow bands to distort the waveforms and result in erroneous analysis.

Both direct and Lo-cap probes are available on the same cable simply by moving the probe top to the opposite end of the double purpose probe body.

The Lo-cap probe allows measurement of P-P voltages up to 7kv P-P directly. You can measure the cathode of the damper or the plate of the horizontal output stage.

Direct connection to the CRT deflection plates (through blocking capacitors) is made available on the rear of the scope through banana jacks.

If you are thinking of a new scope, the additional $20.00 over the price of the PS127 for the vectorscope would be money well spent and a good investment.



Sencore Model PS148 Oscilloscope/Vectorscope

PS148 SPECIFICATIONS

Frequency Response (3db limits)
Vertical Amp: 5Hz to 6.5 MHz. RISE TIME .055s.
Horizontal Amp: 5Hz to over 400 kHz.

Deflection Sensitivity
Vertical Amp: Direct Terminal .017 ± 5% volts RMS/inch.
Low Capacity Terminal .17 ± 5% volts RMS/inch.
Horizontal Amp: At horizontal input jack .6 volts RMS/in.

Input Impedance
At vertical input jack-2.7M shunted by 20pf. Through vertical input cable-direct input jack, 2.7M shunted by 107pf. Through vertical input cable-low capacity jack, 27M shunted by 11pf. At horizontal input jack 3.2M shunted by approximately 18pf. At sync input jack 4.7M shunted by approximately 18pf.

Output Impedance
Vertical Amp: 2.7K each plate to ground.
Horizontal Amp: 18K each plate to ground.

Deflection Sensitivity of CRT thru External Deflection Jacks
Vertical Plates (External-Direct Position) 8.1 ± 10% Volts RMS/in.
Horizontal Plates (External-Direct Position) 15 ± 10% Volts RMS/in.

Horizontal Sweep Generator (Phantastron Type Oscillator Circuit)
Frequency Ranges continuously adjustable with approximately 10% overlap on all ranges. Range 1: 5Hz to 50Hz. Range 2: 50Hz to 500Hz. Range 3: 500Hz to 5kHz. Range 4: 5kHz to 50kHz. Range 5: 50kHz to 500kHz. TV Horizontal (7875Hz) and Vert. (30Hz) are marked on Horizontal Range Control with an "H" and a "V" for fast selection of these ranges.

Synchronization (Selectable and adjustable to over 4MHz)
Internal. External. Line Frequency. Sync adjustable between plus and minus.

Maximum Input Voltages
Thru Direct Input Jack or at Cable Input Jack—1kv P/P in presence of 1kv. Thru LO-CAP JACK 7kv P/P in presence of 1kv dc. Thru horizontal input jack—30 P/P in presence of 400 vdc. Thru sync input jack—30 P/P in presence of 600 vdc.

Physical Characteristics
Height: 11 in. Width: 9 in. Length: 15½ in. Weight: 22 lb.

One of Perry's oldest customers (for 22 years) brings a tape player in for service. Perry TV enjoys the prestige of its 25-year service record.

BREADTH, NOT DEPTH

Make an impact on your sales, even if you are a one-brand business, through careful buying, proper display strategy and by making every customer a king

■ "There are several ways to make a small business successful," says Charles F. Perry, owner of Perry Television in St. Louis, Mo. "These are careful buying, effective display strategy and especially, customer goodwill."

Selective Inventory

Like many small TV-radio service-dealers, Perry TV has a limited amount of space and manpower devoted to that vital part of the business called sales. A number of dealers believe the only way to sell is to jam the floors with stock so no matter what the customer wants, he is bound to find it.

Most small dealers can't afford that type of inventory. One way to get around that problem is to use careful "one-of-a-kind" buying. In other words, breadth, not depth, states Perry. This way I can stretch my inventory dollar and get the kind of sales floor impact the large stores have. I carry only one major brand of merchandise. If the customer is interested in that particular brand, I can usually satisfy him. I normally have up to 15 different color sets to choose from during fall and winter, and 10 in the summer.

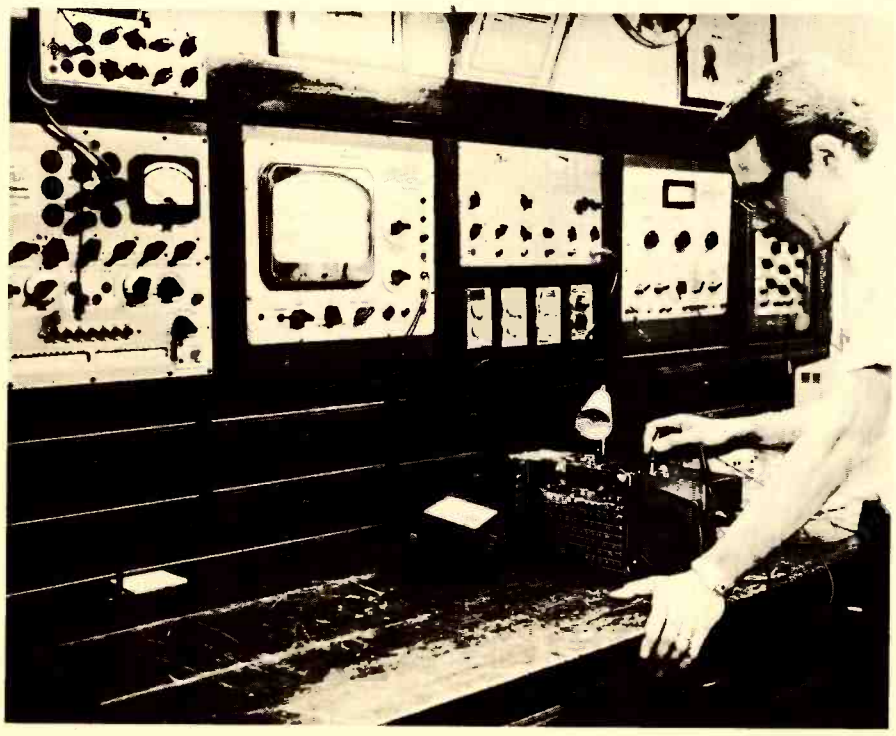
"But I have a trump card, too. I have a local supplier whose inventory is quite large. If I can't find a floor model that suits the customer's needs, I don't try selling him one from a brochure. Instead, I make an appointment to show him additional models at my supplier's showroom. This clinches the sale."

The results of this program have proven very profitable for Perry TV. Of the store's $95,000 income, more than half came from sales with the balance split into parts and service labor.

Tradition—Not Salesmen

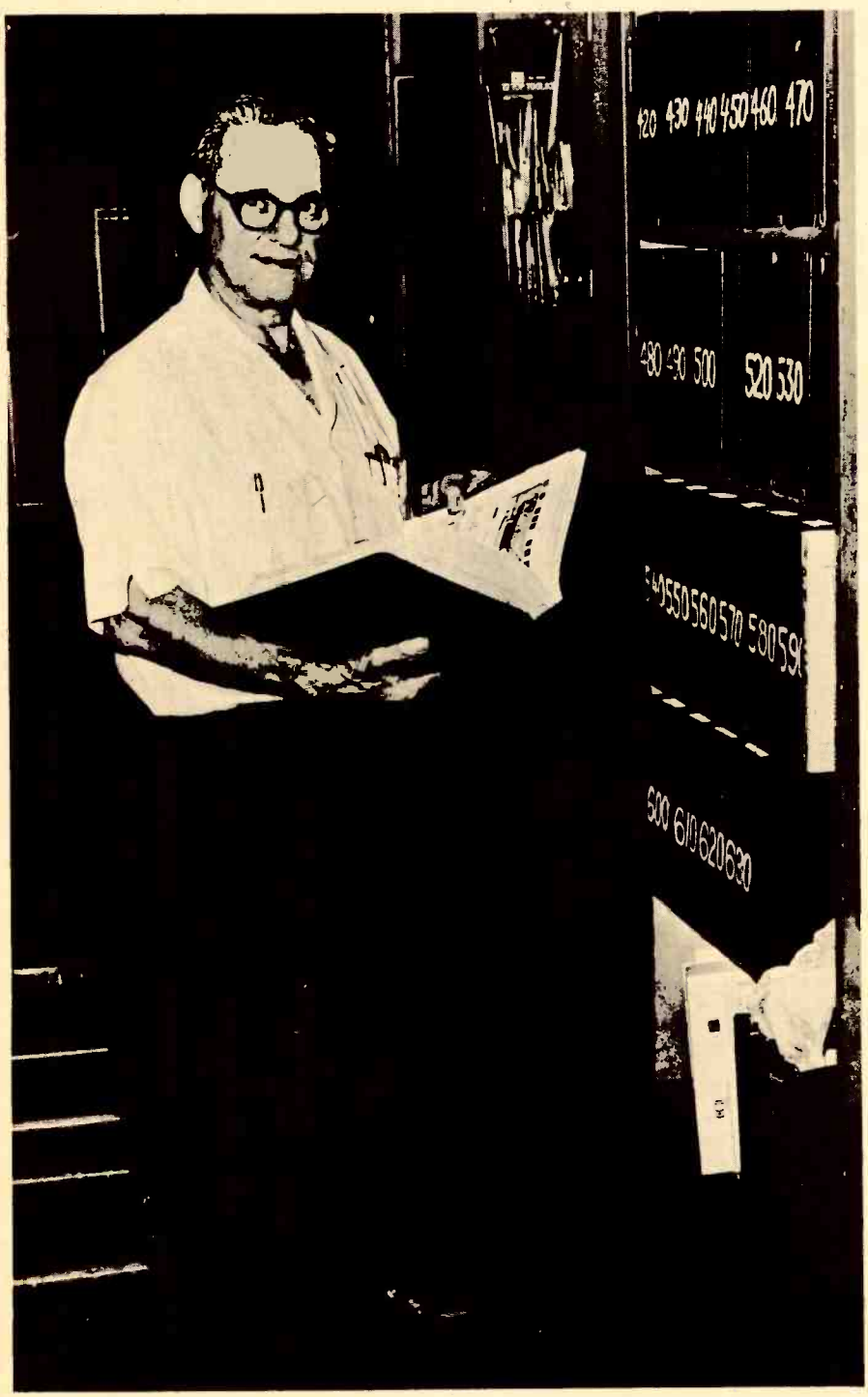
Perry's TV has no salesmen as such, but it does a considerable amount of advertising. The Yellow Pages and two community newspapers make up the bulk of it. The firm also sponsors a men's and a women's bowling team, and contributes support to several service clubs, church functions and boys' clubs.

As in most successful sales programs, Perry's TV operates with a strong backup of professional service. A 25-year community image of reliable electronic service is hard to beat, but Perry TV works every day at improving its image. "It isn't enough to just sell, we should, and do maintain a well-staffed, well-equipped service area and our prices are fair." Along with this tradition, Perry has invested more than the average shop his size in test



Charles Perry, (above) owner of Perry TV, merchandises one major brand and stocks as many as 15 different color sets. He stocks in breadth, not depth.

The built-in test instrument rack above the main work-bench is orientated toward efficient service. The technicians are provided with test instruments of all types in Perry's constantly upgraded shop.



Perry TV has schematics on all TV and radio sets dating back to 1920. His schematics fill dozens of shelves and filing cabinets.

instruments. He has added many of the bench area improvements himself such as built-in test instruments, and has accumulated schematics on every TV and radio since 1920.

Since a proper parts inventory is essential to a sales-service shop, Perry maintains a well-established stock "because we want to wrap up every job at its location without having to bring it into the shop."

Extras That Count

Perry Television is operated as any normal, well-run shop should be. It's the extras that make it unusual and noteworthy. Perry has no salesman, but knows the importance of courtesy and that a customer likes to be recognized. Therefore, it is standard policy at Perry's to learn a customer's name immediately and use it often. Perry encourages his staff to do this. "By my example," he states, "my men see that I'm genuinely interested in each customer and they naturally follow suit."

Customer Is King

"We take extra care to treat each customer like a king. When we go into a home on a service call the first thing we do is ask for old newspapers to set tools and parts on so we don't dirty the carpeting. When we finish the job, we ask for a dust cloth to wipe our fingerprints off the set. Of course, we could take these things with us. The point is, that by asking the customer for them she realizes we are taking pains to be respectful of her home and furnishings.

"Another extra we do in the shop is to clean the glass on every TV in for repair. On some sets it can take up to 20 minutes," Perry explains. "We point out to the customer that we do it as a shop courtesy. We also clean the dust from every set, inside and out. We do our best to be extra considerate of the customer and his business. We carry that into our service by charging a fair price no matter what the set's make. We approach each customer's job as if he were a king and urgently needed the set to entertain a castle full of guests." ■

Selling and Installing MATV Systems

Part six of this series is a complete listing of MATV equipment manufacturers including plain language specs

Preamplifiers / Antenna Matching Transformers (Baluns) / Mixers and Filters / Single Channel Head End Amplifiers / Broadband Amplifiers / UHF Broadband Amplifiers / Broadband Amplifiers / 82 Channel / Cable Powered Amplifiers and Accessories / Passive Splitters / Tapoffs / Matching Transformers

■ While some ordinary home-type TV antennas can be used for MATV systems, the following listing includes only antennas specifically designed and ruggedized for MATV. Additional information on the antennas and components can be obtained by writing directly to the following manufacturers: Blonder-Tongue Laboratories, 9 Alling St., Newark, N.J.; Channel Master, Ellenville, N.Y.; Finco, 34 W. Interstate St., Bedford, Ohio; Jerrold Electronics, 4th and Walnut, Philadelphia, Pa.; JFD Electronics, 15th Ave. at 62nd St., Brooklyn, N.Y.; Winegard, 3000 Kirkwood St., Burlington, Iowa.

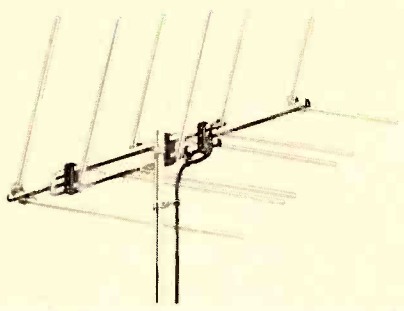
JFD Smoothline Series

Cover all UHF and VHF channels. Available in single channel and broadband models. Low VHF band models have five elements and provide 8db gain. High VHF band and all UHF band models have 10 elements and provide 10db gain. Three broadband models cover the entire UHF spectrum (14-36; 37-60; 60-83).

Silver-plated 75Ω output connector on all models. Heavy-duty construction and corrosion resistant finish.

JFD Rough Rider Series

Cover all UHF and VHF channels. Available in both single channel and broadband models, all log periodic types. Channel 2-6 and FM single channel models have six elements,



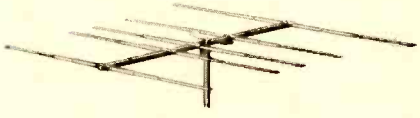
provide 8db gain. Channel 7-13 single channel models have 10 elements, provide 15db gain. Broadband VHF models cover entire VHF-FM spectrum, providing 5 to 12db gain. Broadband UHF models cover the entire UHF spectrum, 14-83, providing 12 to 14db gain.

All models have 75Ω output, heavy-duty double boom construction and high front-to-back ratios.

Jerrold J-Series

Cover VHF channels only. Available in single channel and broadband models. Low VHF and FM band single channel models have five elements, provide 6 to 8db gain. High VHF band single channel antennas have 10 elements and provide 10.5db gain. JFF-LO covers channels 2 through 6 (8db gain) and J55-hi covers channels 7 through 13 (8.5db gain). Broadband units are log periodics, while single channel models are Yagis.

All models are heavy duty with 75Ω output. Low UHF band models have sand-loaded elements for vibration damping.



Finco Single Channel Yagis

Cover VHF channels only. Low band and FM Yagis are available with five elements (7.3 to 8.8db gain). High band Yagis available with either five elements and (8 to 9db gain) or ten elements (9.9 to 11db gain).

All antennas feature 75Ω output and conductive coating process of corrosion protection.

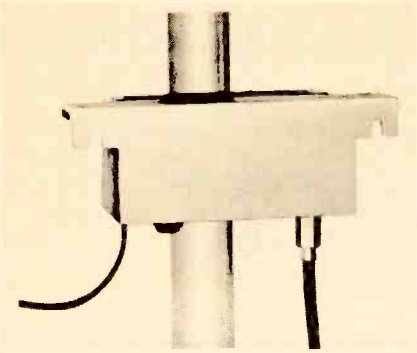
Preamplifiers

Blonder-Tongue Model CB

Single channel units for VHF band only. Tubed. 15db to 17db gain. Input, 300Ω; output, two 75Ω connectors; Noise Figure: channels 2 to 6-3.5db; channels 7 to 13-7db. Built-in power supply.

Blonder-Tongue Model CMA-U

Solid-state. Two models cover all UHF channels (14-59 and 58-83). Gain 13 to 14db. Noise Figure 9 to 11db; 300Ω input and 74Ω output. Used with separate power supply.



Blonder-Tongue Model CMA

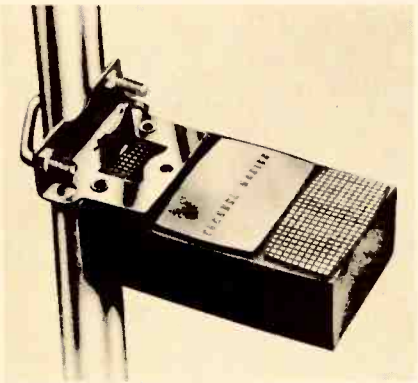
Solid-state. Single channel, covering VHF and FM bands only. Gain: channels 2 to 6-22db; channels 7 to 13-25db; 300Ω input and 75Ω output. Noise Figure: channels 2 to 6-4db; channels 7 to 13-5.5db. Used with Model 1514 remote power supply.

Blonder-Tongue Vamp-2-75

Broadband, VHF only. Solid-state; 300Ω input and 75Ω output. Complete with remote power supply; 13 to 15.5db gain; 3.5db to 4.5db Noise Figure.

Channel Master Model 7264

Solid-state UHF and VHF broadband. Gain: 13db-VHF; 16db-UHF. Noise figure: 3.5db low VHF band; 5db high VHF band; 8db UHF; 300Ω input, 75Ω output. Complete with remote power supply.



Channel Master Model 7060

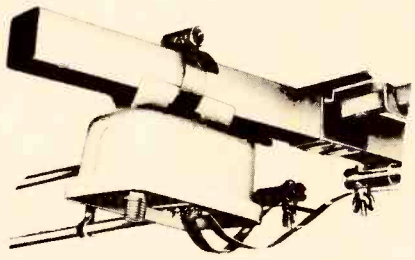
Solid-state. Broadband. Covers VHF and FM only; 10db gain; 5db Noise Figure; 300Ω input and 75Ω output. Uses nuvistors. Complete with remote power supply.

Jerrold Model CPM-107-L

Solid-state. VHF broadband. Gain: channels 2 to 6-18.5db; channels 7 to 13-12db. Noise Figure, 3.9db to 5.1db; 75Ω input, 300 and 75Ω outputs. Complete with remote power supply.

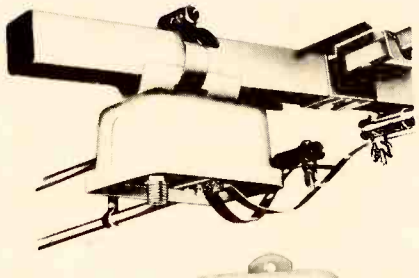
Channel Master Model 0041

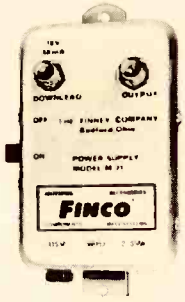
Solid-state. VHF only. Broadband, gain: 2 to 6-15db; 7 to 13-10db; 3.7db noise figure; 300Ω input; 300 and 75Ω outputs.



Finco Models M13 to M18

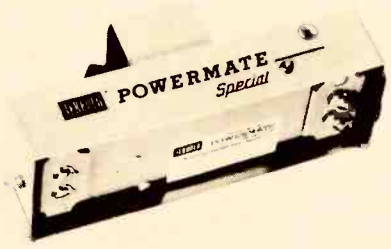
Single channel. Solid-state. Gain, 20 to 30db. Noise Figure, 3.5db to 4.5db. Available in choice of 300Ω and 75Ω inputs and outputs.





Finco Models M10, M11 and M12

All three models are solid-state, covering VHF and FM only. M10 is 300Ω input and output, M11 is 300Ω input and 75Ω output, and M12 is 75Ω input and 75Ω output. Gain is 20db. Noise Figure is 5.5db to 6.5db. All units are complete with remote power supply.



Jerrold Model LPM-102

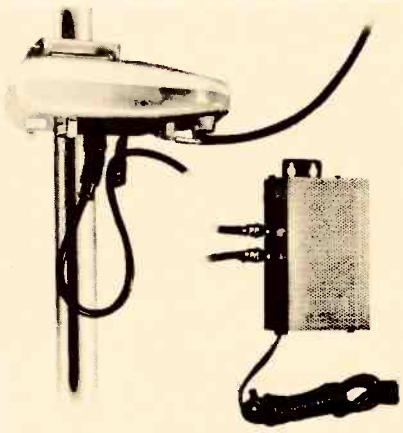
Solid-state. VHF broadband. Gain: 11.5db. Noise Figure, 5.5 to 7.5db; 300Ω input, 300Ω output. Complete with remote power supply.

Jerrold Model 4283

Solid-state. Broadband UHF and VHF. Gain: 13db VHF, 10db UHF; 300Ω input and dual 300Ω outputs. Complete with remote power supply.

Jerrold Model ACP-105-L

Solid-state. VHF and UHF broadband; 10.5db gain; 7db to 13.5db Noise Figure; 300 input and 75Ω output. Complete with remote power supply.



JFD Model SP-2700

Solid-state. VHF broadband, 15db gain; 4db to 8db Noise Figure. Passes all UHF channels. Complete with remote power supply; 300Ω input, 75Ω output.

JFD Model SP-2300

Solid-state. VHF broadband; 300Ω input and dual 300Ω outputs; 14db gain; 4 to 8db Noise Figure. Complete with remote power supply.

JFD Model SP-2701

Same as SP-2700 except input is 75Ω.

JFD Model SP-2730

Solid-state. VHF broadband, 28db gain. Noise Figure, 4 to 8db. Amplifies UHF channels slightly; 300Ω input and 75Ω output. Complete with remote power supply.

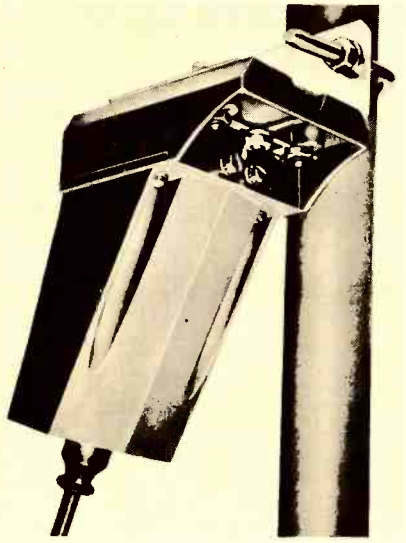
JFD Model SP-2314

Solid-state. UHF broadband; 300Ω input and output; 14db gain; 11db average Noise Figure. Passes all VHF channels. Complete with remote power supply.

JFD Model SP-2782

Solid-state. UHF/VHF broadband; 300Ω input and 75Ω output. Gain: UHF-14db; VHF-12db. Noise Figure

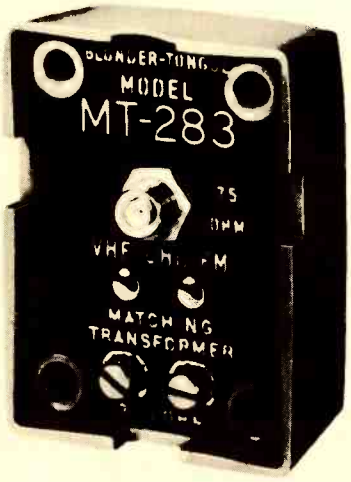
4 to 11db. Complete with remote power supply.



Winegard ACH Series
Eight solid-state preamplifiers. Complete with remote power supplies.

Models AC895 (75Ω) AC-823 (300Ω) cover all VHF, UHF and FM channels. Models AC-495 (75Ω) and AC-423 (300Ω) amplify UHF and pass VHF. Models AC-295 (75Ω) and AC-223 (300Ω) amplify VHF and pass UHF. Models AC-695 (75Ω) and AC-623 (300Ω) amplify FM.

Antenna Matching Transformers (Baluns)

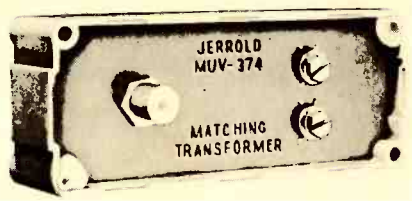


Blonder-Tongue Model MT-283
Passes VHF, FM and UHF. Insertion loss—0.8db to 1db; 300Ω input and 75Ω output. Mast or surface mounted.

Finco Model M231
Single channel. VHF only. Specify channel number. Similar in construction to M230.

JFD Model 8320
Matches UHF, VHF and FM; 0.7db to 1.2db insertion loss; 300Ω input and 75Ω output. Mast mounted.

Jerrold Model To-374A
VHF, FM only; 1.2db insertion loss; 300Ω input, 75Ω output. Mast mounted.



Jerrold Model MUV-374
Matches UHF, VHF and FM. Insertion loss, 0.75 to 1.5db; 300Ω input and 75Ω output. Passes ac. Mast mounted.

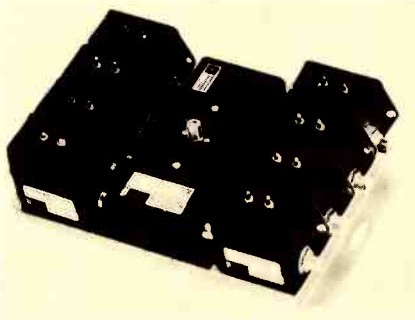
Finco M230
Matches VHF/FM band only; 300Ω input, 75Ω output. Passes ac. Boom or mast mounted.

Winegard Model T-283M
Matches UHF, VHF and FM; 300Ω input and 75Ω output. Specifications not available. Boom or mast mounted.

Winegard Model ST-75
Similar to Model T-283M but matches VHF only.

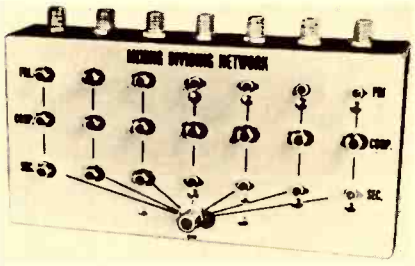
Mixers and Filters

Finco Models 244 and 245
High and low VHF band networks respectively. Model M-244 is factory aligned to 2, 4 and 6 but can be field tuned to any nonadjacent low VHF band channels. Model 245 is factory aligned to channels 7, 9, 11 and 13 but can be field tuned to any nonadjacent high VHF band channels.

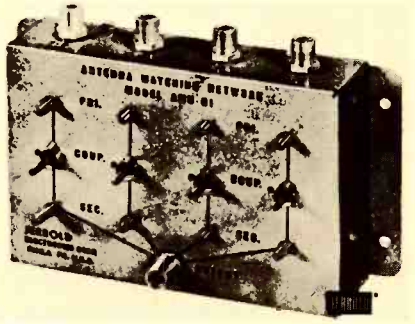


Blonder-Tongue MX Series
Single channel filters which mount into mixing bases (MX-LB for low VHF band and MX-HB for high VHF band). Each mixing base accepts up to four nonadjacent MX filters. Mixing loss is 1.2db. Skirt selectivity is -3db to -6db, 6 MHz from edge of passband.

Channel Master Model 7006
Mixes or splits 4 nonadjacent VHF high band channels. Specifications not available.

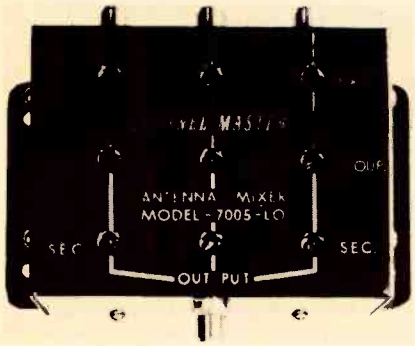


Finco Model M-243
Combines up to 7 VHF channels. Incorporates two-stage bandpass filter for each channel. Factory aligned for channels 2, 4, 6, 7, 9, 11 and 13, but tunable in the field. Maximum insertion loss 2db for each channel used. Each channel input used (7 channels available) is bandpass selective to pass only that particular channel.



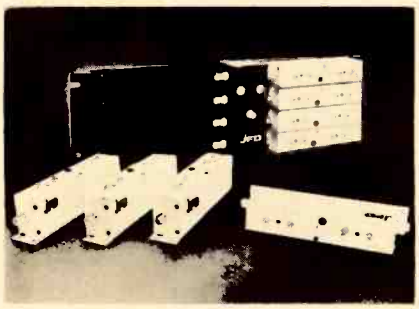
Jerrold Models AMN-LO and AMN-HI
AMN-LO combines 3 low VHF band channels. Factory tuned to channels

2, 4 and 6 but field tunable to any nonadjacent low VHF band channels. AMN-HI combines 4 high VHF band channels. Factory tuned to 7, 9, 11 and 13 but can be field tunable to any four nonadjacent high VHF band channels. Mixing loss is 2 to 2.5db. Skirt selectivity is -12db, 6db from skirt edge.



Channel Master Model 7005
Mixes or splits 3 nonadjacent VHF low band channels. Specifications not available.

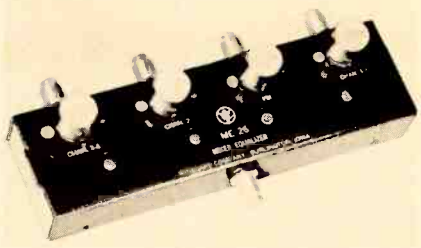
Jerrold Model UMN-3
UHF mixing network. Combines any three UHF channels. Can be factory tuned to specific channels. Mixing loss 1db. Skirt selectivity -19db, 6db from skirt edge. UHF channels mixed must be at least three channels apart.



JFD Model 8202 to 8283
Single channel filters covering entire TV band, UHF and VHD. Rejection outside passband (9MHz from center frequency) is at least 33db. Insertion loss is less from 2db. Factory tuned and extremely stable. Up to 8 nonadjacent single channel filters can be mixed into single output on mixing base. Signals can be equalized with built-in continuously adjustable 10db attenuators.

JFD Model 8285
Combines up to three nonadjacent low band (2-6 and FM) channels. Factory pretuned to channels 2, 4 and 6 but can be field tuned to any three nonadjacent low band channels. Rejection (9db from center frequency): 15db insertion loss: less than 1.5db.

JFD Model 8286
Combines up to four high band (7 to 13) channels. Factory pretuned to channels 7, 9, 11 and 13, but can be field tuned to any four nonadjacent high band channels. Rejection (9db from center frequency): 15db insertion loss: less than 1.5db.

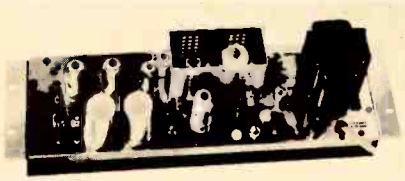


Winegard Model ME26
Handles up to four low VHF band and FM channels. Includes plug-in attenuator pads in 8 values, 0 to 20db. Factory aligned to any nonadjacent low VHF band channels, but can be tuned in the field.

Winegard Model ME713
Similar to Model ME26 but handles up to four high VHF band channels.

Single Channel Head End Amplifiers

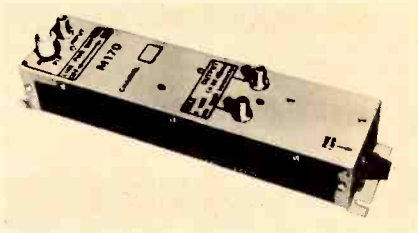
Blonder-Tongue Model HS
VHF. Self-powered; 30db gain; 4v (72dbmv) output capability; 75Ω input and dual 75Ω output; 20db gain control range. Tubed.



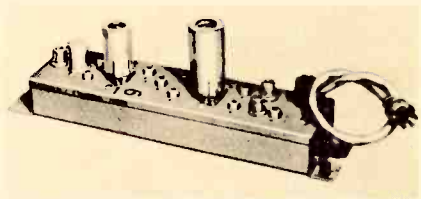
Blonder-Tongue Power Drive
VHF. Self-powered, with AGC; 58db gain; 6 (75.5dbmv) output; 40db AGC range; 75Ω input and two 75Ω mixing outputs. Tubed.

Blonder-Tongue Model MCA
Includes input and output filters. Solid-state; 51db gain; 2v (66dbmv) output; 40db AGC range. Self-powered; 75Ω input and dual 75Ω mixing outputs.

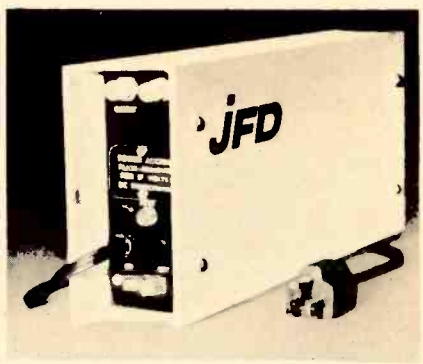
Jerrold Models M-AM and M-AA
Used with Model M-FS input filter, M-FCA output filter and M-ENC enclosures. VHF only. Self-powered. M-AM is manual, provides 33db gain. M-AA is AGC'd, provides 49db gain; 63dbmv output; 75Ω input and dual 75Ω mixing outputs. Solid-state.



Finney Model M170
VHF. Self-powered. Solid-state; 40db gain; 1v (60dbmv) output; 75Ω input dual 75Ω mixing outputs; 3 to 20db plugging pads to control gain.



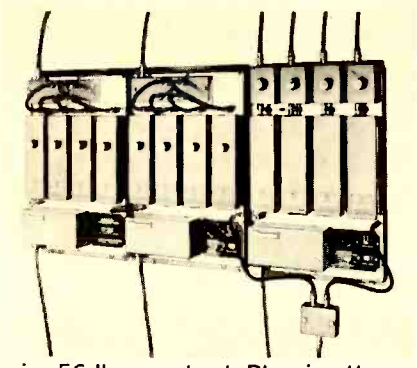
Jerrold Model PMA
VHF. Remote-powered; 28 to 33db gain; 1.5v output; 3 to 21db plug in attenuators provide gain control; 75Ω input and output. Tubed.



JFD Models SL3002 through SL-3083
UHF, FM and VHF. Solid-state; 32db gain; 4v (72dbmv) output; 15db gain control range; 75Ω input and dual 75Ω mixing output. Modular PC board construction. Self-powered and can also line power preamplifiers.

Jerrold Model HPM
VHF. Tubed; 42 to 46db gain; 4v (72dbmv) output. Self-powered; 75Ω input and two 75Ω mixing outputs; 20db AGC range.

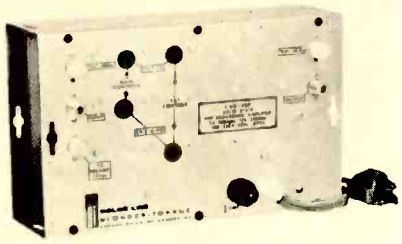
Winegard Model DS2 through DS83
UHF and VHF. Solid-state. Requires separate power supply; 30db



gain; 56dbmv output. Plug-in attenuator pads provide up to 20db gain control; 75Ω input and output.

Broadband Amplifiers

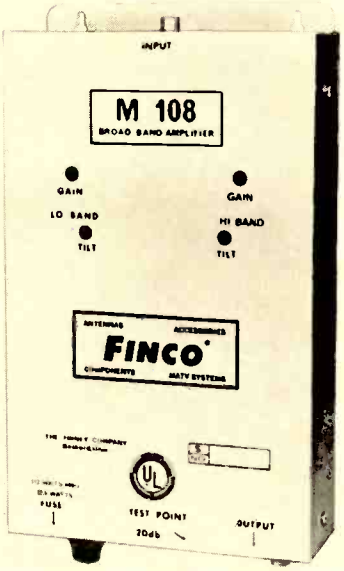
Blonder-Tongue Model MLA-FM
Gain: 33db low band, 40db high band. Tubed; 15 to 18db gain control range; 48dbmv output (7 channel operation).



Blonder-Tongue Model CVB-45P
43db gain; 54dbmv output per channel (7 channel operation); 18db gain control range. Solid-state. Provides AC power for preamp.

Channel Master Model 7030
30db gain; 47dbmv per channel output (7 channel operation); 20db gain control range. Tubed.

Blonder-Tongue Model 1217
Gain: 17db high band, 19db low band. Tubed; 63dbmv per channel output (7 channel operation). Tube life extender circuit reduces gain 3.5db and output capability to 61.5 dbmv.



Finco Model M108
42db gain; 50dbmv output per channel (7 channel operation). Solid-state.

Channel Master Model 7050
50db gain; 48dbmv output per channel (7 channel operation); 20db gain control range. Tubed.

Finco Model M110
50db gain; 60dbmv output per channel (9 channel operation). Tubed.

Finco Model M106
36db gain; 48dbmv output (7 channel operation). Solid-state.

Jerrold Model 3440
22db gain; 42dbmv output per channel (7 channel operation). Solid-state.

Jerrold Model 2880
Tubed; 44db gain; 60dbmv output per channel (7 channel operation).

Jerrold Model 3550
Solid-state; 33db gain; 45dbmv output per channel (7 channel operation); 8 to 10db gain control range.

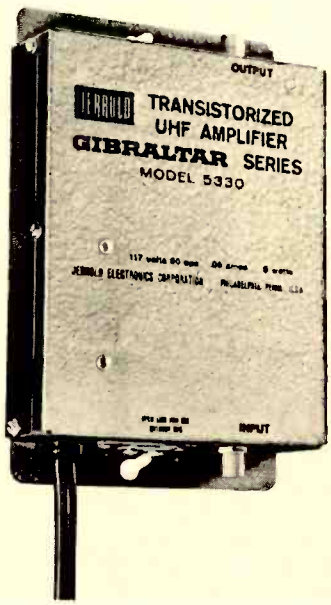
JFD Model V-3130
Solid-state; 30db gain; 54dbmv output per channel (7 channel operation); 15db gain control range. Modular PC board construction capable of cable powering accessories. Three-wire line cord.

Winegard Model DS-LO
Low VHF band only; 22db gain; 56dbmv output. Tubed. Requires separate power supply.

Winegard Model DS-HI
Similar DS-LO but handles high VHF bands.

UHF Broadband Amplifiers

Blonder-Tongue Model CUB-29P
Solid-state; 29db gain; 49dbmv output. Three-wire line cord.



Jerrold Model 5330
Solid-state. 22db gain; 50dbmv output capability.

JFD Model U-3140
Solid-state; 32db gain; 56dbmv output capability; 15db gain control range. Can line power remote accessories. Modular PC board construction. Three-wire line cord.

Winegard Model DS-UHF
Solid-state; 30db gain; 52dbmv output. Requires separate power supply.

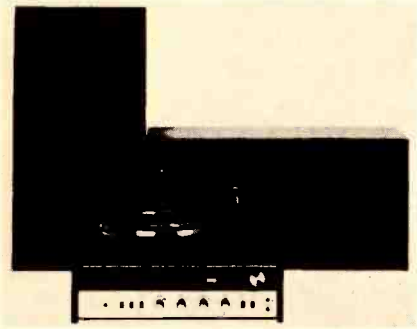
Part seven of this series will continue with the round-up of MATV equipment manufacturers and equipment. ■

ET/D DEALER SHOWCASE

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

Stereo System 700

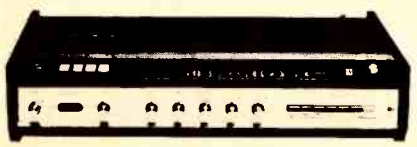
A new compact stereo model is designed to offer component quality sound and features. The model 2513 combines Scott's AM/FM/FM stereo receiver with the famous Dual 1009F automatic turntable. The system comes complete with two new S-15 three-way



air-suspension speakers. It offers a variety of advanced electronic features, including: Field Effect Transistor FM stereo tuner front end; Field Effect Transistor tone control; Integrated Circuit IF strip and preamplifier; direct coupled all-silicon output circuitry; microphone/guitar inputs; provisions for plugging in tape recorder or tape cartridge machine, stereo headphones, or extra speakers; complete component control complement including Dual Bass, Treble and Loudness controls, speaker balancing controls, and tape monitor controls. The Dual 1009F turntable employs cueing control, stylus pressure and anti-tracking adjustments, and a special fine adjustment for record speed. A Pickering cartridge and diamond stylus are standard equipment on the unit. The units are complete three-way systems each with a separate woofer, tweeter and midrange. Scott.

Cassette Receiver 701

Introduced is the new 3600 Casseiver, a single component combining a 65w FM stereo receiver and a professional stereo cassette recorder. With the Casseiver, the audio enthusiast can listen to FM, FM stereo, or prerecorded cassettes. He can also record



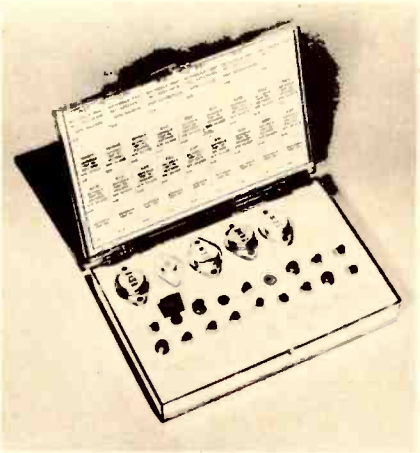
on cassettes from recorder, or directly from the receiver's FM stereo tuner. The receiver section features Scott's silver-plated field effect transistor front end circuitry. FET circuitry is also used in the tone control circuitry. Integrated circuits are utilized both in the IF strip, and in the preamplifier section. Glass epoxy printed circuit boards and solderless connectors are used in the chassis. The cassette mechanism is powered by a precision synchronous ac motor which is said to cut out annoying flutter and wow.

Control features of the cassette receiver are as follows: (Receiver section) TUNING control; POWER ON/OFF; SWITCHING for MAIN, REMOTE, or both sets of speakers; Noise Filter; MONO/STEREO switch; TAPE MONITOR control; VOLUME COMPENSATION control; DUAL BASS and TREBLE controls; BALANCE control; LOUDNESS control; Input selector; Center Tuning meter; and stereo headphone output. (Recorder section) LEFT and RIGHT LEVEL controls; Dual microphone inputs; Left and Record and Replay level meters; Resettable digital counter; and individual controls for opening the cassette section, RECORD, PLAY, FAST FORWARD, REWIND and STOP.

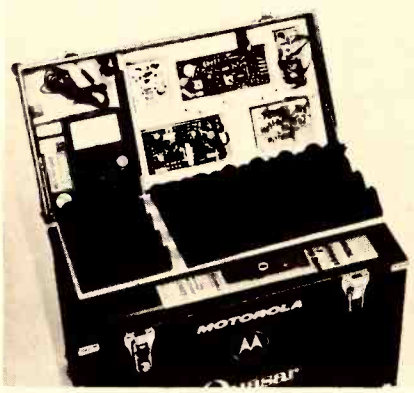
The tuner section of the receiver is said achieves 2.5μv sensitivity, with 80db cross modulation rejection. The stereo multiplex section utilizes solid-state time-switching multiplex circuitry. Separation is 30db and capture ratio is 2.5db. Price $399.95. Scott.

Service Caddies 702

Announced is a new service caddy for carrying replacement circuit modules for its all solid-state "Quasar" color television receivers. The firm also has made available through distributors a caddy for replacement transistors for home service of all solid-state B/W receivers. Designed to simplify the transport and servicing procedures on the firm's modular-design "Quasar" sets, the replacement module caddy includes a complete set of 10 replacement procedures. Ample room also is provided for carrying of service literature and a voltmeter plus other spare parts. Measuring 19¼in. by 9½in. by 14½in., the caddy is said to be sturdily built. It has a body of plywood which is covered by scuff-resistant vinyl and all hardware is made of steel. It features



a lift-out tray for additional storage room at the top of the case. The replacement transistor caddy for B/W all solid-state television consists of a



transparent plastic carrying case measuring 7½in. by 5⅛in. by 1¼in. thick, plus a complement of 23 transistors for servicing. the firm's transistorized chassis. The caddy can be slipped easily into most service cases. Motorola.

Portable Color TV 703

A new color portable with 10 plug-in circuits boards is announced. These circuits hold over 90 percent of all electronic components. Individual units hold complete discrete circuits and are said to be designed for service and reliability, rather than for space or production economy reasons. Nine of the ten boards are mounted on new quick connectors. The tenth board mounts on the picture tube and also has plug-in terminals. All electrical connections to units are made without any soldering through jack strips and plug connectors. The portable design incorporates many developments in reliability engi-

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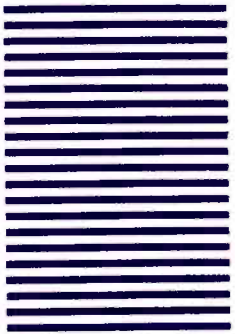

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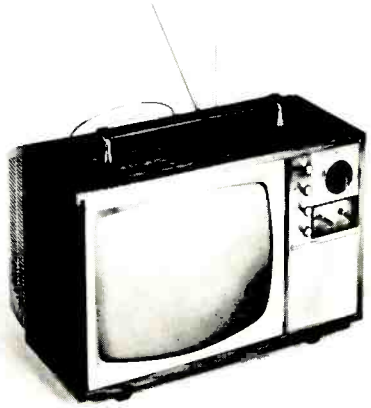
ET/D DEALER SHOWCASE

neering in addition to new etched circuit units and the quick connectors. Solid-state devices have been used wherever they improve picture performance as well as reliability. The



manufacturer has a factory exchange plan for units whereby they will be either repaired or salvaged in the factory. Other features of the unit are a clock, automatic turnoff, pillow speaker, walnut cabinet, 5in. UHF and VHF antenna, an internal-external antenna switch and four stages of IF amplification. Weight 44 lb. Marquette.

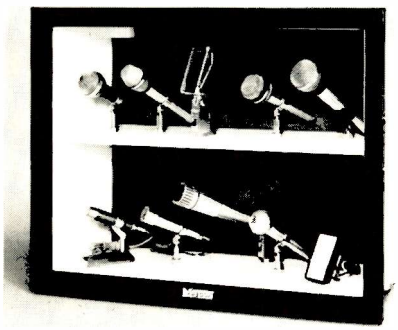
Antenna Display **704**

Announced is a free multicolor counter display for dealers and distributors displaying the Gavin Monitor 100UV indoor TV antenna. The display is printed in three colors and is made of sturdy Masonite with a double easel back. The Gavin Monitor 100UV is one of the newest indoor TV antennas in the line and provides excellent reception for both color and B/W sets for UHF and VHF stations plus FM radio. It has a slim design and fold down feature, permitting it to be placed out of sight behind the set when

not in use. The antenna mounts instantly to any TV set with an adhesive bracket said to eliminate the need for screws or bolts. Gavin.

Microphone Display 705

Announced is the availability of a point-of-sale microphone display show case. The "VECOR" display show case Model MD-10 is designed to display "VECOR" microphones. Each microphone is identified with its model



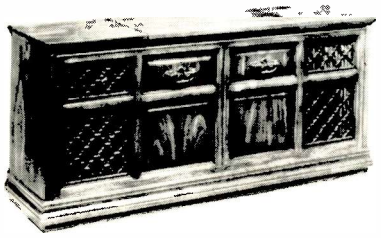
number in gold and black lettering. Finished in a walnut exterior and a walnut wood picture type frame, the display showcase measures 18in. x 24in. x 8in. inside. A plate glass in front allows the microphones to be seen and prevents dust collecting. Latches hold the plate glass in place to prevent pilferage. A literature rack on the side holds about 100 microphone folders describing the microphones. The display showcase is designed to be placed on the counter or hung on the wall with hooks attached to the display. Vidaire.

Tuner Cleaner 706

Introduced as a cleaner labeled Tun-O-Wash for (washing) all types of T.V. tuners. It is claimed to remove all the "gook and gunk" formed by deposits of grease, oil, etc. With the proper propelling force is said to dissolve and wash away grime in minutes. It is claimed that the cleaner removes dirt and film so well that once mechanical and electronic repairs are made, a protective lubrication is all that is needed. Chemtronics.

Stereo Console 707

The Alvaro Model G543 stereo console has Mediterranean styling and a built-in transistorized four-track, two-channel stereo tape deck. Features of the tape unit include three-speed operation, separate record play and erase heads, two dynamic microphones, automatic monitoring and an add-sound feature. This model also comes equipped with the new Acoustaphonic speaker chambers, two 10in. woofers,



two 3in. tweeters, two 2000Hz exponential horns, and a solid-state AM/FM/FM-stereo tuner. The Alvaro is equipped for Porta-Fi and also has diamond stylus and 60w of peak music power. General Electric.

COLORFAX

GENERAL ELECTRIC

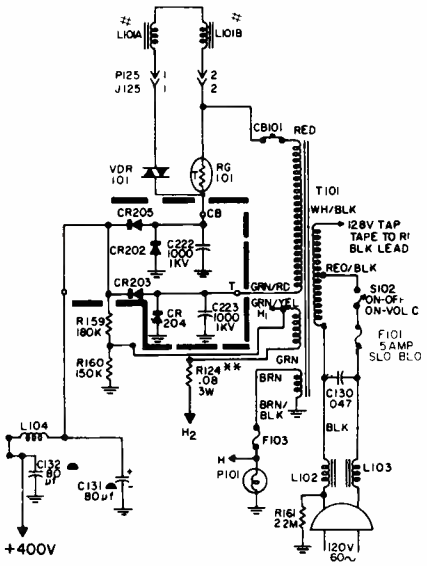
Color TV Chassis KC—High Line Voltage Tap on Power Transformer

All KC chassis power transformers are provided with a primary high voltage tap which is identified on the schematic diagram as "WH/BLK 128 VOLT TAP."

It has been determined, through recent tests, that for maximum reliability and minimum service, the high line voltage tap should be used whenever either of the following conditions exist.

1. Average line voltage equals or exceeds 123v.
2. Line voltage equals or exceeds 128v for a period of 15 minutes or more during normal viewing hours (even though the average may be less than 123v).

Whenever a KC chassis is serviced for any reason, measure the line voltage and change the primary tap if either of the above conditions exist.



Never attempt this on any KD chassis since the tap on the KD chassis transformer primary is for Insta-View and not high line voltage.

Procedures for Changing Primary Tap

1. Untape the White/Black transformer primary lead (this is the 128v tap which was taped to the Red/Black lead at the factory).
2. Clip the Red/Black lead from the terminal board and tape over the end of the lead.
3. Connect the White/Black lead to the terminal board lug previously occupied by the Red/Black lead.

RCA VICTOR

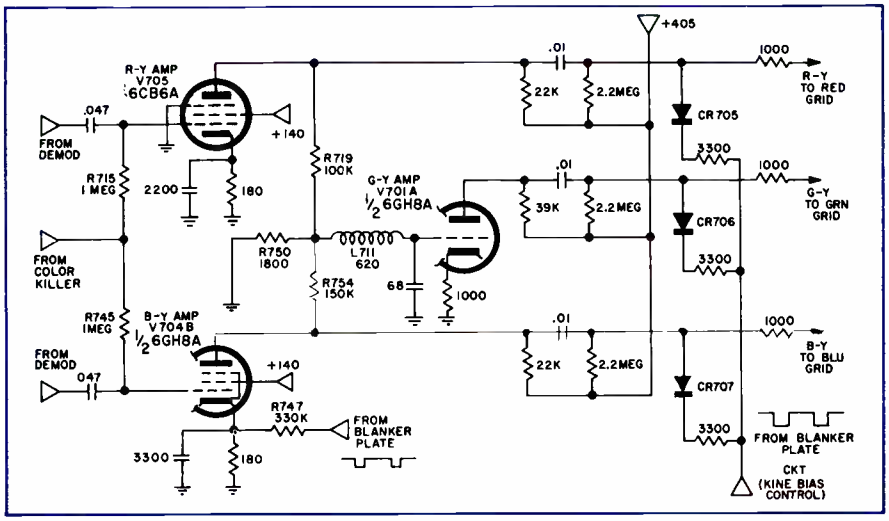
Color TV Chassis CTC38—Difference Amplifiers Circuit Description

In the CTC38 chassis, pentodes are used as the R-Y and B-Y amplifiers to amplify the low level color signals from the balanced diodes. The R-Y amplifier (V705) uses a 6CB6A tube. The B-Y demodulator (V704B) uses the pentode section of the 6GH8A tube. This is possible because the 6CB6 and the pentode section of the 6GH8 have similar electrical characteristics. Notice in the simplified schematic (Color Difference Amplifiers) that the grid leak resistor from each of the difference amplifier stages is connected to the color killer circuit rather than ground. In this chassis the balanced diode demodulators are not killed as were the tube-type demodulators in the CTC31. Therefore, the R-Y and B-Y amplifier stages are color-killed in this chassis. The G-Y amplifier is very similar to that of the CTC31 because the input signal for this stage is obtained by combining a portion of the R-Y and B-Y signals in a matrix network. The 3.58MHz trap in the grid circuit of the G-Y amplifier eliminates any 3.58MHz energy that might be amplified by this stage.

The ac coupling is used to drive the CRT grids as it was in 1968 two IF color chassis (shown in simplified schematic). Here again, the familiar diode clamp circuit is used to establish and maintain the dc operating point of the CRT tube grids. These clamp diodes are switched on during retrace by a negative going pulse at the plate of the blanker stage, and the low impedance presented by the forward-biased diodes effectively clamps the grids at a fixed potential that is established by the setting of the kine bias control. Notice also that 1K resistors appear in series with each grid lead to protect the diodes against any possible CRT arcing. Also added protection is provided by the 3.3K resistor in series with each diode.

An additional small pulse from the plate of the blanker stage is applied to the cathode of the B-Y amplifier. This pulse is used to adjust the operating point of the CRT blue grid so that the correct grid voltage is established, thus preventing a screen temperature shift under no color conditions when the B-Y amplifier stage is color-killed.

Courtesy of RCA Sales Corp.



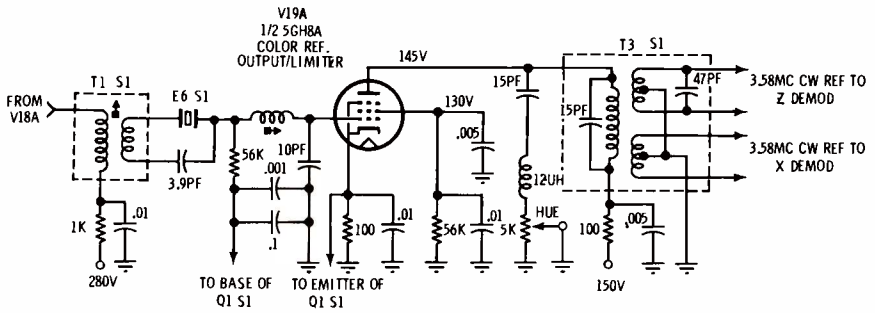
MOTOROLA

Color TV Chassis TS924—Color Sync Limiter Circuit Description

The loading effect on V19Z (½-5GH8A) imposed by the demodulator switching and the hue control network is minimized by using a pentode which is a constant current generator (plate current is independent of plate voltage).

The continuous color sync signal generated by the crystal is tuned by L2S1, C15S1, C14S1 and coupled to the grid of the limiter. With 18v P-P sync signal here, there is more signal than grid voltage-plate current "window" to pass it. Consequently, amplitude changes occur either beyond maximum plate current or below cutoff and do not appear in the output. As a result, a constant amplitude signal rings the plate load transformer (T3S1).

The plate circuit is tuned to 3.58MHz by T3S1 which also splits the signal into four phases by virtue of the two center-tapped secondary windings. From here the sync signal is coupled



to the two demodulators in such a phase as to detect "X" signals at one, and "Z" signals at the other.

To compensate for station-to-station variations of color sync phase plus accidental phase shifts caused by wave propogation, antenna characteristics and receiver alignment, a manual phase shift device is required in all color receivers. The "hue" control, as it is called, sets the phase of the reinserted reference carrier so that color demodulation occurs along the correct phase angle's axis. The standard reference, of course, is facial skin color. Only when demodulation occurs along the X and Z axis in this receiver will proper color voltages be passed on to the CRT. A phase shift error related to the reinserted carrier doesn't stop the demodulation process, but the recovered color difference signals will not turn the right CRT gun on or off at the right time. Therefore, reproduced color will be incorrect.

The hue control network is a C/L/R in series from V19Z's plate to ground and is a variable phase shift combination.

In round numbers, the 15pf capacitor (C20S1) presents about 3000Ω reactance. The 12μh coil (L8S1) is a nominal 270Ω and can be overlooked as far as phase shift control is concerned. The coil is there to suppress harmonics. The hue control (R912) is a 5000Ω potentiometer and is the only circuit variable in the actual hue control network.

The CW reference signal delivered to the demodulators by the secondary of T3S1 varies in phase with respect to the color sync driving signal as the hue potentiometer is varied. At resonance, T3S1 is basically a resistive load on V19Z. With a change in hue control resistance, which shifts signal phase at the plate of V19Z, reactance is introduced in the primary of T3S1. If signal phase is shifted above resonance, the load is primarily inductive reactance; below resonance, the load is capacitive reactance.

The phase response of a transformer is familiar to most technicians. The phase shift discriminator transformer with its familiar "S" curve response is a common example of employing the phase-shift characteristics of a transformer.

MAGNAVOX

Color TV Chassis T931/T933/T938 — Burst Amplifier Tube

The type 6MQ8 is now being used in some chassis instead of the 6KE8. Either the 6KE8 or 6MQ8 can be used as a replacement since these tube types are directly interchangeable.

Caution should be observed when removing forward bias to evaluate transistor action. Since removing forward bias turns off collector current, the collector voltage rises to its supply voltage and there is a possibility of this voltage exceeding the breakdown voltage on the transistor. A good rule to apply in these cases is to note the presence and value of the collector load and emitter resistors which will govern the amount of current flow if the breakdown voltage is exceeded. If these resistors will limit the current to a value within the power dissipation of the transistor, there is little likelihood of damage if the breakdown voltage is slightly exceeded for a brief interval.

As experience is gained using "in circuit transistor testing," the procedure for most transistors will simplify the following:

Measure collector voltage. If it is lower than the supply voltage, the transistor is conducting. With the meter still on the collector, short the base and emitter together. If the collector voltage rises to the supply voltage, the transistor is not shorted and is capable of being turned off. This simplified procedure will not work in all cases, i.e., a collector connected to ground. But as experience in servicing transistor circuits is gained, it becomes easier to see where this technique is applicable and it is a fast, simple way to evaluate a transistor without removing it from the circuit.

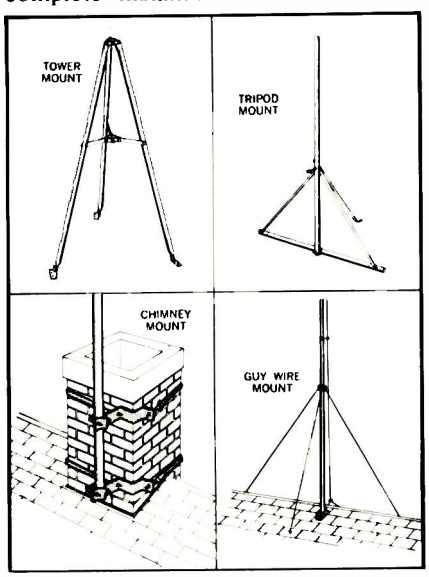
Once it is clearly determined that the current through a particular stage is incorrect, it is usually advisable to remove the transistor. This will allow you to check the transistor and measure the bias resistor values without the inaccuracies of having the transistor junctions across them. Every effort should be made to determine that a particular stage does contain a defect before any attempt is made to remove the transistor.

ET/D NEW PRODUCTS

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

Antenna Mounts 708

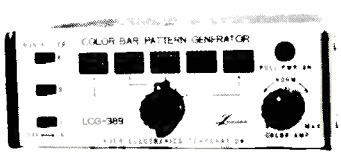
A new line of antenna mounts are introduced. The Gold Star Line consists of six models, all of which include the necessary mounting hardware for complete installation. Tower mounts



are offered in 3 and 5ft models, complete with 5 and 10ft masts, respectively, a 5ft patented tripod mount that attaches to any type roof, a 10ft chimney mount, and 5 and 10ft guy wire mounts. The line features rugged construction, Gold Shield finish, and special roof sealing pads to make all connections watertight. All mounts are said to install easily in just a few minutes. The mounts are packaged in individual display-type cartons. Winegard.

Color Bar Generator 709

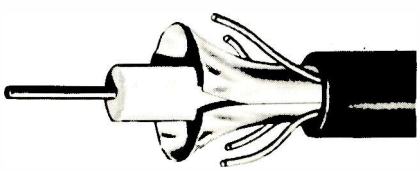
Announced is an ultra compact, solid-state color bar pattern generator used extensively for production testing and field servicing. The instrument is designed for convergence and synchronizing adjustments in color and monochrome TV receivers. Five basic patterns are displayed: (1) gated rainbow color bars, (2) square crosshatch, (3) horizontal lines, (4) vertical lines and (5) small well defined dots. Gun killers are provided for convergence adjustments. The only connection is made to the TV receiver antenna input. The unit features plug-in, computer-style PC boards and a fully regulated power supply.



Progressive scanning is used to prevent flickering of the horizontal lines. There is reportedly no jitter or crawl on the dot or line pattern. The oscillators are crystal controlled; flip-flop and logic circuitry are employed to generate stable and reliable sync, and signal pulses. Only silicon epitaxial planar type transistors are employed. RF output: Channels 5 and 6 selectable; 10mv open circuit from balanced 300Ω source. Patterns: Color bars: 10 gated rainbow. Crosshatch: Square with 21 vertical and 15 horizontal lines. Dots: at intersections of crosshatch. Vertical: 21 lines. Horizontal: 15 lines. Chroma level: 0-200%, continuously adjustable. Power Supply: 105-125v, 50/60Hz; 2VA approx. Size and weight: 2⅛in. h x 5⅞in. w x 7¾in. d. 2.9 lb. Price $99.50. Leader.

Coaxial Cable 710

A low-loss, 100 percent shielded and sweep-tested 75Ω coaxial cable especially suited for UHF MATV distribution systems is now available. The 8228 Duofoil cable has a small outer

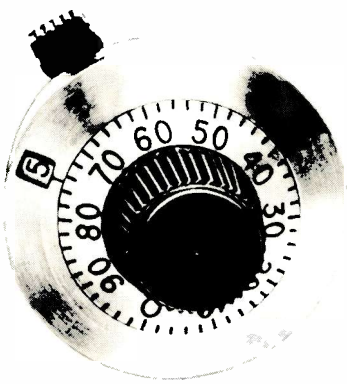


diameter (only 0.242in.) for extra space saving in conduit installation and the cable is easily terminated with standard F-type connectors. Greater flex life for the 82-channel cable is claimed by spiral-wrapping the four drain wires for equal distribution of stress. This provides longer service life and preserves the impedance value of the cable design.

Belden's 100 percent Duofoil shield is a polyester film with an aluminum laminant on both surfaces that minimizes signal radiation. At the same time, it protects the signal from degradation by auto ignition, electric motors, industrial machinery and other sources of electrical interference. Further protection of the signal energy field is accomplished by a low-loss cellular polyethylene dielectric and a jacket of black all-weather polyvinyl chloride. The coaxial cable is available in 100, 500 and 100ft. spools. Belden.

Turns-Counting Dial 711

A small, 1in. dia. turns-counting dial for application with ⅞in. dia. or smaller precision potentiometers is introduced. Designated the Model 11, this turns-counting dial provides 11 turns, using a single counter type wheel and a graduated circular dial; a total count of 1099



can be registered. The unit's housing is satin chromium. Brake lever knob and turning knob are both black plastic. Markings are black. The unit is also available in black with white markings. Standard shaft accommodations for this unit are ¼in. and ⅜in. Shaft adaptor kits for 3/16in. and 3/32in. shafts are also available on a special basis. Price is quantity $5.81. Spectrol.

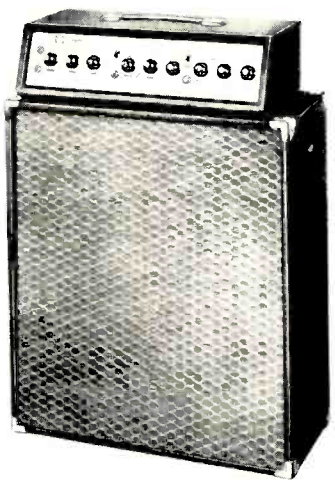
Tuner Cleaner 712

A new aerosol-type tuner cleaner is introduced. Specifically formulated for television tuners with critical nuvistor and transistor circuitry, NUVI-TRAN provides a much needed product offering the performance characteristics and packaging that will find favor with all service personnel. The cleaner is non-conductive, non-toxic, and claimed not to induce drift or detune neutralizing circuits. The product goes to work in seconds, is completely safe on all plastics used on TV tuners and will leave no residue on sprayed parts or exposed surfaces. The cleaner is

packed in an 8oz. aerosol can equipped with a pin-point spray extension for quick, efficient use in tight, confined areas which are normally hard to reach in many of the smaller sets with other available cleaners. The handy aerosol can fits in the serviceman's tool kit to be available for use on service calls. Suggested net price is $2.29 per can. GC Electronics.

Instrument Amplifier 713

Announced is a 1969 model Knight-Kit instrument amplifier with a matching speaker system. The 90w peak music power amplifier may be used for one instrument or a combination. The speaker system includes two Jensen 12in. heavy-duty speakers, acoustically baffled for superior tonal quality and response over a wide range. The portable amplifier rides atop the speaker enclosure and is connected with plug-in cord. Field-effect transistors in the preamp stages are said to assure low noise level with distortion-free performance.

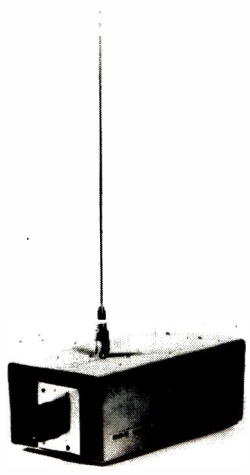


ET/D NEW PRODUCTS

The unit has dual channels with two inputs per channel and the normal channel is designed for lead, rhythm or bass guitar, voice, sitar, etc. Second channel features tremolo with separate intensity and rate controls, and reverberation using the popular Hammond reverb unit for the concert hall effect. A foot switch jack on control panel permits remote switching of reverb or tremolo with foot switch which is included. Separate treble and bass controls allow the operator to boost or cut either independently. Amplifier measurement 5¾ x 19¾ x 8¾in. The speaker enclosure measures 26½ x 10 x 22¼in. The detailed, fully illustrated step-by-step instructions make it easy to assemble the amplifier kit which includes precut wire and solder. Power Output: 90w peak music, 30w continuous sine wave power. Bass Boost 9db minimum, at 80Hz. Treble Variation: 20db at 10,000Hz. Reverb Depth: (variable) 0-50% min. Tremolo Depth: (variable) 0-75% maximum. Tremolo Speed: (variable) 2-10Hz. Controls: Normal Channel—Volume, Treble, Bass, Second Channel—Volume, Treble, Bass, Tremolo Intensity, Tremolo Rate, Reverb Depth. Signal-to-Noise: 60db below rated power output. Input Sensitivity: 40mv for rated output. Input Impedance: 500K. Input Capacitance: 10pf maximum. Semiconductors: 16 transistors, 6 diodes (includes 4 rectifiers). Price $169.95. Allied.

Wireless CCTV Camera 714

A wireless closed circuit TV camera that operates and transmits pictures to an unused channel of any TV set without connection by wire to the set is announced. This new camera employs

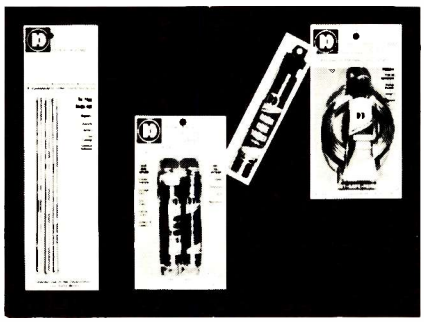


a crystal-controlled transmitter that sends the picture through the air to a standard TV set where the picture is received on either channels five or six, whichever happens to be the unused channel in a particular area. The camera requires no wires for connection to the TV, making its installation easier and application more flexible. It eliminates the need for tying the camera down to the monitors and makes it possible to use the camera and set it up quickly for many applications.

In addition to the built-in crystal-controlled transmitter, the solid-state camera has many features. It is light weight and compact and has outputs for both video and RF, switchable to either video monitor or to standard home TV receiver. For the sharpest pictures, its vidicon assembly is movable back and forth by a knob on the panel. The lens can also be focused. Its solid-state construction is said to contribute to its reliability and its plug-in type module design simplifies maintenance. Used with video monitors, it can provide sharp detail, a horizontal resolution of more than 550 lines. It reportedly can operate under almost any lighting conditions and can adjust changing light conditions from bright light to dark without blanking out. It has automatic light compensation over a range from 4000 to 1. Model WS822 is $495. GBC.

Solder 715

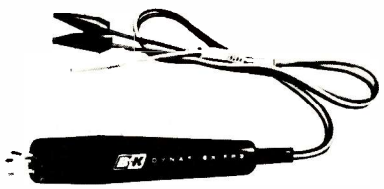
A complete line of solders and solder products for electrical work and for joining all types of metal surfaces, is introduced. The line is developed for the novice who needs to be informed of



the solder alloy that will give the best result for his application. Depend-a-Bond is said to be the most complete line of consumer solder products from one source. It includes specific solders for every application: for repairing radios, clocks, appliances, flatware, jewelry, chrome trim, cars, boats, gutters, antennas, piping, tools, etc. It can be used with most metal surfaces – stainless steel, chrome, nickel, brass, copper, aluminum, silver and their alloys. Solder products are sold in handy, economical blister packs, individual cartoned spools and bars. Packages are designed for easy storage and are color coded for quick selection. Each package contains complete, easy-to-follow instructions and a comprehensive list of applications. Alpha Metals.

Test Probe 716

Announced is a new test probe reportedly providing, for the first time, a practical method for making three termination touch-to-test contacts simultaneously using only one hand. Up to now, it has taken three separate probes, requiring the use of both hands, to test transistors, diodes and other compact components mounted on printed boards. The new three-point probe designed specifically for use with

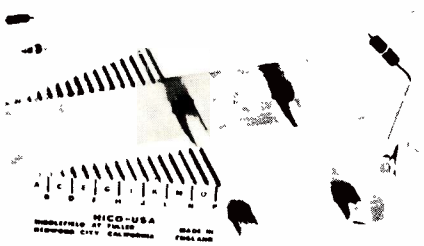


in-circuit transistor testers, vtvm's, vom's and tvom's the "Dyna-Flex" is said to provide positive, non-slip direct and can be used with one hand when making connections.

The probe has three spring-loaded needle-point tips which tilt or swivel on ball joints to permit automatic adjustment to any spacing from 1/32 to 5/8in. to fit the terminations of a wide variety of components. Three leads, color coded to their respective tips, terminate in insulated alligator clips for easy connection to the test instrument being used. The clips also permit rapid component test substitutions. B & K.

Bending Clamp 717

Announced is a precision device for fast, accurate bending of resistor, capacitor and diode leads for printed circuit and allied uses. The HICO-USA lightweight aluminum clamp is claimed to be easily adjusted and quickly handled by female operators. Each



bent lead will be identical – without lead strains or cracks. Leads may be up to 1¾in. long and can be bent to within 1/16in. of the ends of components. Price $12.95. Horizons International.

1968 ARTICLE INDEX

TECHDIGEST

TEST INSTRUMENTS

TV-RADIO SERVICING

ET/D NEWS OF THE INDUSTRY

Stereo Quarterly Appears on Newstands

The first or fall 1968 issue of a new quarterly, STEREO, has been placed on newstands across the country. Formerly published as an annual by HIGH FIDELITY magazine, a division of Billboard Publications, Inc., STEREO becomes a quarterly with its fall 1968 issue. Price is $1. The second or winter 1968 issue will appear in late December.

Norman Eisenberg, who edited the annual, is editor of the quarterly, while continuing as audio-video editor of the monthly HIGH FIDELITY.

"In going quarterly, STEREO fills a growing need," said Eisenberg, "for a popularly written periodical that covers a broad range of equipment and its use in the home, as well as records and tapes from the standpoint of their use as program material to feed to that equipment." The first issue contains articles on how to tell real Hi Fi equipment from imitations, a survey of kits, hints on upgrading TV sound, and evaluation of cassettes, a critical look at magazine test reports, "Tips for Tapesters," decor and installation photos, reviews of outstanding sonic releases and news of interest to consumers.

ICS Offers TV Servicing, Repair Course

A major new sales program, available from G/L Tab Books, Blue Ridge Summit, Pa., (publishers of the Gernsback Library) allows parts distributors to profitably participate in the training of needed TV service technicians.

The course can also serve as a drawing card to bring new customers into the distributor's store.

Developed by International Correspondence Schools, 79-year old leader in home-study education, the ICS TV Servicing/Repair Course consists of six large, carefully planned and fully illustrated texts to produce qualified technicians in six months...with no prior training.

Participants in the course also, upon successful completion, will receive the famous ICS diploma, attesting to his skills. Additionally, students receive a 24-model portfolio of TV schematics, an electronics dictionary, free counseling service and membership in the ICS TV Servicing Academy.

The entire program, based on the world-famous ICS method of teaching, lists for only $99....less then half the cost of any previous course on the subject. An easy-pay plan is also available for students.

Completely practical and thoroughly reviewed by industry experts, the course has been endorsed by the National Electronics Assn.

Tape Record Heads Tell When They Are About Worn Out

Michigan Magnetics has developed a system for telling when a tape recorder head is wearing out. Called "Spot Check," the head is so constructed that a red indicator appears on the face of the head when there are about 100 hours of useful life left.

For the first time the consumer will be forewarned that a head is about to wear out, and he can avoid the disappointment of making a recording only to find that the head had failed. Just as important, the user of a recorder will know when the head is not worn out.

With the widespread commercial use of tapes, the head will be welcomed by the broadcast industry, language laboratories and suppliers of background music where service contracts are used.

The heads will also be a boon to the service industry, as the repair man will know definitely whether or not a head is worn out and can warrant a tape recorder without worrying about the gap opening within the normal warranty period.

ET/D CATALOGS & BULLETINS

Electronic Supplies 400

A 350-page catalog lists many thousands of electronic products produced by 126 manufacturers. In addition, the catalog lists 71 manufacturers whose products are available but are not listed in the book because of space limitations. The catalog carries prices which are guaranteed up-to-date at press time. O.E.M. quantity prices are provided where applicable. The illustrated book offers a complete selection of electronic supplies, including electronic components, commercial sound systems, videotape recording systems, background music systems and intercoms. The catalog also describes a wide range of public address, amateur, CB and test equipment. Satterfield.

Color Video Tape 401

An eight-page booklet describes the VR400, a new 1 in. color video tape recorder. The four-color booklet explains the need for this particular 1 in. format; lists typical video tape applications, features and specifications. General Precision.

Electronic Instruments 402

A condensed catalog of electronic instruments is released. In addition to detailed descriptions and specifications of the company's rapidly growing product line, the 16-page brochure describes the West Caldwell facility, production, quality assurance, warranty and service policies. Domestic and international field engineering representative firms are listed. Electronic instruments in which integrated circuits are used includes counter/timers, frequency counters, pulse generators, frequency synthesizers and digital clocks. Monsanto.

Electronic & Electrical Books 403

Publishers of the Gernsback Library books have released their fall 1968 catalog. Describing over 100 current and forthcoming books, the illustrated 16-page catalog covers the following subject areas: broadcasting; basic technology; CATV; electric motors; electronic engineering; television, radio and electronics servicing; audio and Hi Fi; hobby and experiment; test instruments; and transistors. Tab Books.

General Catalog 404

A general catalog, No. 280, "Electronics for Everyone" is now available. The 536-page general catalog presents the latest in major brands of high fidelity components and tape recorders; videotape recorders, monitors and cameras; transistorized FM-AM and shortwave radios; phonographs and turntables; TV portables in various screen sizes; AM and FM-AM car radios and car stereo tape players; walkie-talkies and other Citizens Band two-way radios and accessories; Radio Amateur (Ham) gear; sound equipment and intercoms; microphones and speakers; test instruments; power supplies and converters; auto and motorcycle electronics accessories; a wide selection of do-it-yourself kits; antennas and towers; electrical accessories; electronics parts; receiving and special purpose tubes; TV picture tubes; semiconductors; wire and cable; tools; and technical books. Allied.

Recorder Heads 405

A new 20-page, two-color catalog contains mechanical and electrical specifications and typical response curves for production heads. A selection from the heads illustrated in this catalog will meet almost all requirements for full-, half-, quarter-, eight-track and cassette heads. Michigan Magnetics.

Amplifiers and Accessories 406

A six-page short-form catalog of commercial sound equipment—including amplifiers, booster, tuners, tape players, systems and accessories is available. Featured in the catalog, most of which is reprinted from the 1969 edition of Radio-Electronic Master, is the new "MOD Series" modular amplifiers with eight different modular inputs capable of comprising up to 256 different amplifier configurations. Also included are the "TPA Series" transistorized power amps and the conventional "Carillon Series" tube amplifiers. Bell P/A.

CIRCUIT ANALYSIS...

continued from page 42

up as a load line and two equivalent circuits, showing that even simple circuits may act like complex ones.

Other Applications

So far we have discussed dc-like circuits and the Thevenin and Norton equivalents that describe them. There is another field in which the same equivalents work if we are careful. We can analyze pulse circuits, too, into Thevenin and Norton equivalents.

When we are dealing with pulse circuits, we simply imagine the inside perfect generator produces a pulse rather than a dc output. And we assume the equivalent resistor has a constant value. This assumption is not true in real circuits but if we use the correct approach, it works anyway.

Our key to this application is to use the equivalent circuit for only part of the operating cycle, and then find a new equivalent circuit for the next part of the cycle. This sounds like a lot of work and perhaps rather risky, but it works well in practice because two equivalents are usually enough to analyze the complete operating cycle. It is generally very clear where one part of the operating cycle ends and another begins.

For instance, suppose we want to explain the operation of an astable multivibrator. This requires two equivalent circuits corresponding to very definite circuit events. One equivalent describes the circuit as it goes into saturation after being turned on, and the other will cover as it settles toward cutoff after receiving a turnoff signal. Try this approach to explain how the astable works, and to estimate its frequency of oscillation.

Here is some help. The sine-wave picture, in which things get along at about the same rate all of the time, doesn't work here. Instead, events start with a large upheaval as the OFF state seems to jump from one transistor to the other. This is followed by a gradual drifting period in which the voltages gradually slump back to appropriate values for another surge. Then the OFF state jumps again, and its jumping back and forth gives a good illustration of how the astable operates.

A TV deflection yoke and its driving system offer another example. The yoke requires a sawtooth current input. Try sketching out the sweep and retrace equivalent generators, and estimate the voltage signal you actually observe across the yoke. Now, if you had a Thevenin generator applying that voltage signal to the yoke, what current signal would you find?

You've convinced a good friend that designing his own circuits isn't so hard after all. He's returned with a simple power supply containing a 24v transformer, a full-wave bridge rectifier, and a 10pf surplus capacitor.

The capacitor seems healthy enough and there don't seem to be any shorts, but the circuit has blown several fuses and diodes. This always seems to happen just after it's turned on. Use an equivalent circuit to explain to him what is happening, and suggest something he can do about the problem. If you have some thermistor literature, pull it out. It'll help. ■

ET/D AD INDEX

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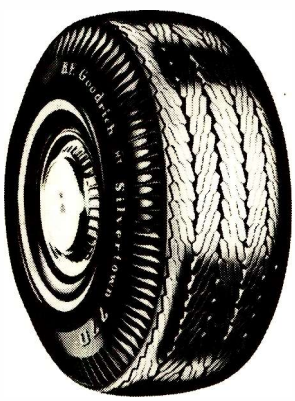

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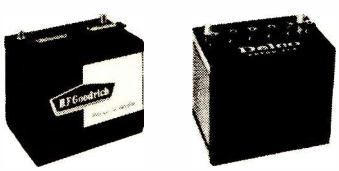

Auto Batteries

Goodrich Pow-R-Cell auto batteries from the P53 at 15 certificates to the S27 at 21 certificates. Delco Energizer auto batteries from the 557 at 16 certificates to the Y81 at 25 certificates.

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