

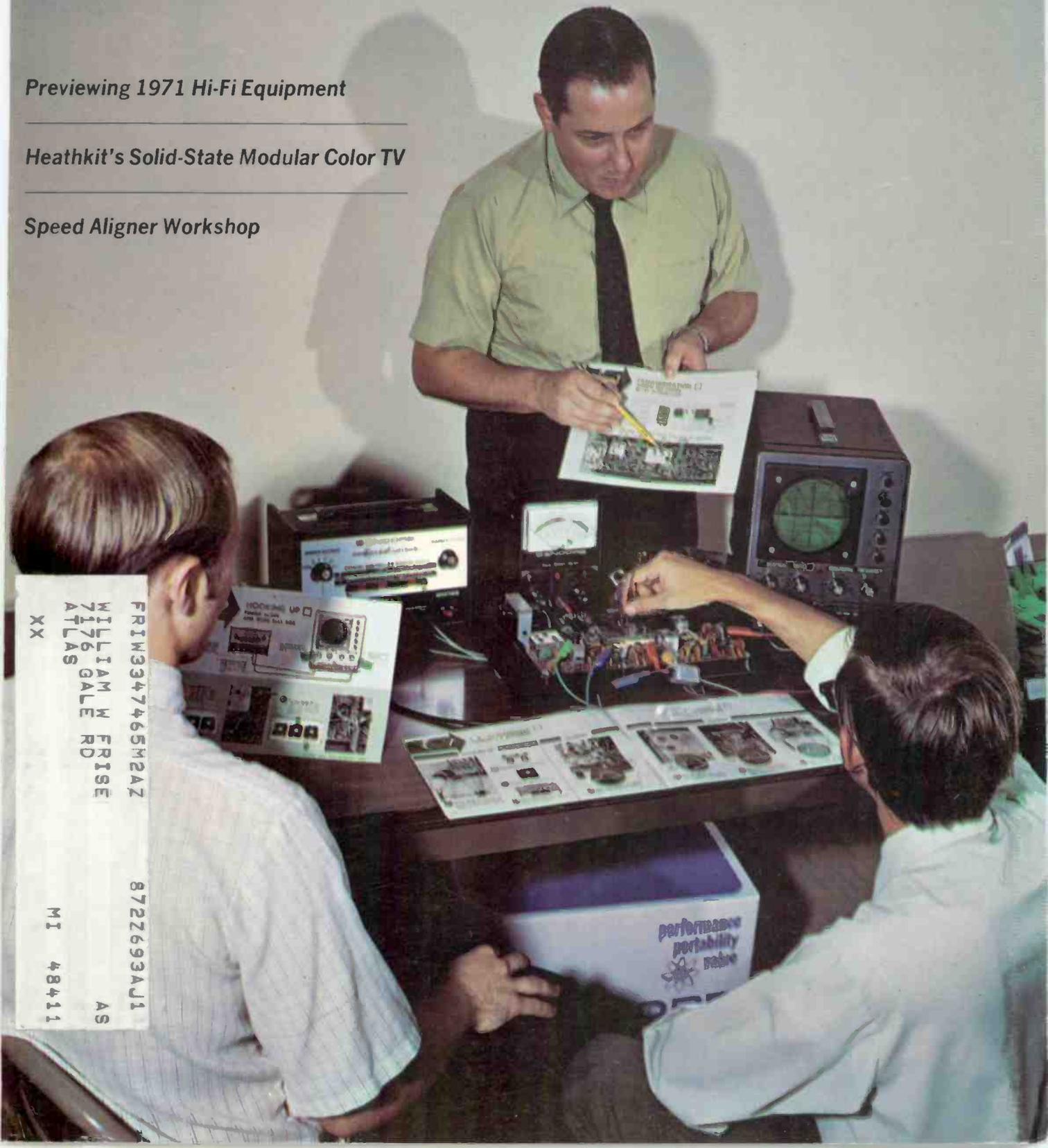
# ELECTRONIC TECHNICIAN/DEALER

WORLD'S LARGEST TV-RADIO SERVICE & SALES CIRCULATION

*Previewing 1971 Hi-Fi Equipment*

*Heathkit's Solid-State Modular Color TV*

*Speed Aligner Workshop*



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## SIGNAL TRACER PROBE



Gain 3000 at 2 KHz. Bandwidth 50 Hz to 200 MHz. Z 3500 $\Omega$  to 350 K $\Omega$ . Output 0.3 p-p volts. Noise -45db. Supplied with anti-overload probe tips: Eico PST-2, Kit \$19.95, Wired \$29.95.

## NEW OSCILLOSCOPE/VECTORSCOPE



DC-8MHz (usable to 10 MHz). 5" flat-face CRT. Sensitivity 12 MV RMS/CM. Negligible relative H & V phase shift. Excellent curve tracer with Eico 443 (below). Eico 465. Kit \$179.95. Wired \$249.95.

## NEW SOLID STATE FET-TVM'S



AC RMS/DCV: 0-1, 3, 10, 30, 100, 300, 1000V. P-P ACV: 0-2.8, 8.5, 28, 85, 280, 850, 2800V. DC Input Z 11 M $\Omega$ . Ohmmeter 0.2 $\Omega$  to 1000 M $\Omega$ . 4 1/2" 200  $\mu$ A meter. Eico 240, Kit \$59.95, Wired \$79.95. With 6 1/2" meter & AC/DC Current readings. Eico 242 FET-TVOM, Kit \$69.95, Wired \$94.50.

## NEW TRANSISTOR ANALYZER



Tests trans-conductance and Beta in and out of circuit. Measures FETs, bipolars, diodes, rectifiers, SCRs, UJTs. Built-in voltmeter, ohmmeter. 50 $\mu$ A taut band meter movement. Eico 685, Kit \$99.95. Wired \$149.95.

## CRT TESTER AND REJUVENATOR



For all B-W & Color Picture Tubes. Each gun of Color Tube measured individually and numerically, provides required gray scale tracking information. Eico 633, Kit \$79.95, Wired \$109.95.

## TUBE TESTER



Tests all standard tubes plus decals, magnonals, 7-pin nuvistors, popular TV picture tubes. Professional, compact, lightweight, and modest price. Eico 635, Kit \$44.95, Wired \$69.95.

## NEW CURVE TRACER



New professional transistor/diode curve tracer enables any general-purpose oscilloscope to display direct readouts of the most meaningful data. Eico 443, Kit \$99.95, Wired \$149.95.

## NEW SOLID STATE SINE/SQUARE WAVE GENERATOR



Provides simultaneous sine and square wave outputs. Covers 20 Hz-2MHz, 5 bands. Max. distortion 0.25%. Rise time at 20 KHz <0.1  $\mu$ sec. Eico 379, Kit \$69.95, Wired \$99.95.

## NEW SOLID STATE SIGNAL TRACER



Output 400mw. Inputs: 1mv RF; 63 mv AF; Hum >60 db below 400 mv. 200  $\mu$ A meter. Provides substitution output Xfmr & spkr. Eico 150, Kit \$59.95, Wired \$79.95.

## SOLID STATE COLOR GENERATOR



Standard offset carrier type stable 10-bar display plus precision dots, crosshatch, individual series of V & H lines; gun killers. Feeds to ant. terminals. Portable, battery/AC. Eico 385, Kit \$69.95, Wired \$99.95.

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Model 1A1  
1 K  $\Omega$ /V



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4 K  $\Omega$ /V

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# TEKFAX

**COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS  
AND TECHNICAL INFORMATION FOR 4 NEW SETS**



	SCHMATIC NO.		SCHMATIC NO.
PHILCO-FORD	1332	SYLVANIA	1333
Color TV Chassis 20HT70/20HT71		Color TV Chassis D15-1, -2	
RCA SALES CORP.	1331	ZENITH	1334
TV Chassis KCS183 Series		TV Chassis 14B36	

## COMPLETE MODEL/CHASSIS INDEX FOR ALL CIRCUIT DIGESTS AND TEKFAX FROM JANUARY 1961 THROUGH DECEMBER 1970

### MONTH IN WHICH SCHEMATIC APPEARS

607-613	Jan. 1961	851-853	May 1964	1105-1110	Sept. 1967
614-620	Feb. 1961	854-858	June 1964	1111-1116	Oct. 1967
621-627	Mar. 1961	859-863	July 1964	1117-1122	Nov. 1967
628-633	Apr. 1961	864-870	Aug. 1964	1123-1127	Dec. 1967
634-636	May 1961	871-875	Sept. 1964	1128-1133	Jan. 1968
637-643	June 1961	876-881	Oct. 1964	1134-1139	Feb. 1968
644-650	July 1961	882-887	Nov. 1964	1140-1145	Mar. 1968
651-656	Aug. 1961	888-893	Dec. 1964	1146-1151	Apr. 1968
657-662	Sept. 1961	894-900	Jan. 1965	1152-1157	May 1968
663-669	Oct. 1961	901-908	Feb. 1965	1158-1163	June 1968
670-675	Nov. 1961	909-916	Mar. 1965	1164-1169	July 1968
676-680	Dec. 1961	917-923	Apr. 1965	1170-1175	Aug. 1968
681-686	Jan. 1962	924-926	May 1965	1176-1181	Sept. 1968
687-692	Feb. 1962	927-934	June 1965	1182-1187	Oct. 1968
693-698	Mar. 1962	935-942	July 1965	1188-1193	Nov. 1968
699-705	Apr. 1962	943-950	Aug. 1965	1194-1198	Dec. 1968
706-709	May 1962	951-953	Sept. 1965	1199-1204	Jan. 1969
710-716	June 1962	954-961	Oct. 1965	1205-1210	Feb. 1969
717-723	July 1962	962-969	Nov. 1965	1211-1216	Mar. 1969
724-729	Aug. 1962	970-975	Dec. 1965	1217-1222	Apr. 1969
730-735	Sept. 1962	976-982	Jan. 1966	1223-1228	May 1969
736-743	Oct. 1962	983-988	Feb. 1966	1229-1234	June 1969
744-749	Nov. 1962	989-995	Mar. 1966	1235-1240	July 1969
750-755	Dec. 1962	996-1001	Apr. 1966	1241-1246	Aug. 1969
756-761	Jan. 1963	1002-1009	May 1966	1247-1252	Sept. 1969
762-766	Feb. 1963	1010-1015	June 1966	1253-1258	Oct. 1969
767-772	Mar. 1963	1016-1022	July 1966	1259-1264	Nov. 1969
773-779	Apr. 1963	1023-1028	Aug. 1966	1265-1269	Dec. 1969
780-784	May 1963	1029-1035	Sept. 1966	1270-1275	Jan. 1970
785-790	June 1963	1036-1041	Oct. 1966	1276-1281	Feb. 1970
791-797	July 1963	1042-1047	Nov. 1966	1282-1287	Mar. 1970
798-805	Aug. 1963	1048-1054	Dec. 1966	1288-1293	Apr. 1970
806-811	Sept. 1963	1055-1060	Jan. 1967	1294-1299	May 1970
812-817	Oct. 1963	1061-1067	Feb. 1967	1300-1305	June 1970
818-822	Nov. 1963	1068-1073	Mar. 1967	1306-1310	July 1970
823-828	Dec. 1963	1074-1080	Apr. 1967	1311-1315	Aug. 1970
829-833	Jan. 1964	1081-1086	May 1967	1316-1320	Sept. 1970
834-838	Feb. 1964	1087-1092	June 1967	1321-1325	Oct. 1970
839-843	Mar. 1964	1093-1098	July 1967	1326-1330	Nov. 1970
844-850	Apr. 1964	1099-1104	Aug. 1967	1331-1334	Dec. 1970

### ADMIRAL

Chassis:	
C21B12-1, 1AG, 1AS, 1HR,	
1N, 1R, 1C	910
C21B13-1	910
C21B15-1, 1AG, 1AS	910
C21C12-1AG, 1AS, 1C	910
C21C15-1, 1AG, 1AS	910
D4	883
D11	890
D42-1	883
D44-1, 2, 4	883
D61-1, -2, -4	844
D412-1	883
D414-1, 2, 4	883
D415-1	883
D416-1, 2, 4	883
D610-1, -2, -4	844
D761-1	928
D1160-2, -6	890
D1161-2, -6	890
D4117-1	883
G2	991
G3	956
G4	944
G5, 2G5, 3G5, 5G5, 7G5, 9G5	1074
G6	936
G7 Series	976
G11	920
G13 Series	997
G61-2	936
G310-1, -4	956
G336-1	956
G416-1, -5	944
G417-1	944
G422-1	944
G610-2, -3	936
G612-1	936
G613-1	936
G617-2	936
G618-4	936
G620-1, -2, -3, -4, -6	936
G1161-2, -3	918
H1-1A, H2-1A	1016
H1-1A, 1H1-1A, 1AH1, H2-1A	1300
H3-1A, H4-1A, 1H4-2A	1093
H10	1069
H12, 1H12	1044
K15	1147
NA1-1A	1273
T22H4-1AX	1326
T3K3-1A, T3K3-1B	1294
T3K4-1A, T3K4-1B	1205
T7H2-1A, T9H1-1A	1281
TG2-1	1170
TG2-2	1291
TH3-1A, TH4-1A, T2H4-1A,	
T3H4-1A, T8H4-1A	1199
TI0H1-1AX	1217
TK2-1A	1241
TL2	1316
1D4	883
1D11	890
1D13-2	883
1D42-2	883
1D61-1	903
1D412-2	883
1D611-1, -2, -3, -4	903
1D760-1	928
1D761-1	928
1D1160-5	890
1D1161-5	890
1G310-1	956
1G311-1	956
1G312-1	956
1G611-1	936
1G1155-1	918
2D4	883
2D11	890
2D42-1	883
2D412-1	883
2D413-1, 3, 4	883
2D414-1	883
2D415-3	883
2D1163-1	890
2G4	944
2G421-1	944
7D413-1	873
8D4	883
8D418-1	883
8G4	944
8G423-1	944
9D410-1	883
9D412-1	883
9G4	944
9G410-1	944
9G413-1	944
9G416-1	944
15H1	608
16A4D, C	823
16A9, U	657
16B4C	823
16UA4D, C	823
16UB4C	823
18D8B	686
19B8B	686
19H10	1317
19K3U	816

### SCHMATIC NO.

### 19M3U

19M3U	816
19R3U	816
19T3U	816
19UB8B	686
19UD8B	686
20A7, B	644
204A7	644
20B7	644
20C7	644
204A7B	644
24A2	808
24B2	808
24C2	808
24D2	808
24UA2	808
24UB2	808
24UC2	808
24UD2	808
24UE2	808

### AIRLINE

Chassis:	
1078-233, 243, 1078U233, 243	766
10-116-254, -254U	847
1174-184, 117U-184, 1188-184	831
12-124-24U, 12-124-34U	909
Model:	
GCI-12420A, B	1295
GCI-13668B	1282
GEN-12440C	1312
GEN-13460A	1304
GEN-173A Radio	787
GEN-1225A Trans. Radio	753
GEN-1266A	945
GEN-1866A	1003
GEN-1867A	1036
GEN-1967A	1081
GEN-2485A	902
GEN-8077A, GEN-8447A	1106
GEN-11160A	1274
GEN-11269A	1208
GEN-11460A	1256
GEN-11461A, GEN-11481A	1330
GEN-11469A	1202
GEN-11760A	1279
GEN-11769B	1220
GEN-11960A	1292
GEN-12069A	1183
GEN-12078A	1165
GEN-12349A	1183
GEN-12448A	1165
GEN-13160A	1244
GEN-13168A	1146
GEN-13469A	1165
GEN-13768B	1238
GEN-17148A	1165
GEN-17158A	1165
GHJ-1466A	978
GHJ-1566A	978
GHJ-1786A	978
GHJ-4516A	978
GHJ-4546A	978
GHJ-4556A	978
GHJ-3067A	1042
GHJ-3367A	1042
GHJ-8247A	1100
GHJ-8257A	1100
GHJ-14098A	1128
GHJ-14148A	1128
GHJ-14168A	1128
GHJ-14549A	1223
GHJ-14829A, GHJ-14849B	
GHJ-14859B	1229
GHJ-17949A, 59A	1189
GMW-1447A	1068
GMW-1457A	1068
GMW-14447A	1087
GMW-14457A	1087
GTC-1684A	831
GTC-1694A	831
GTC-2684A	831
GTC-3914A	847
GTC-3944A	847
GTC-3954A	847
GTC-4015A	909
GTC-4415A	909
GTC-4445A	909
GTC-4455A	909
GTC-4914A	847
GTC-4944A	847
GTC-4954A	847
GTM-1583A	784
GTM-1827A Clock Radio	814
GTM-2583A	784
GVC-9019A Reverb	800
WG-1683A	746
WG-2313A AM/FM Console	778
WG-2343A	778
WG-2373A, BB	778
WG-2343B	778
WG-2373B	778
WG-2683A	746
WG-2785A	888
WG-4225A	620
WG-4234A	694
WG-4325A	620
WG-4334A	694
WG-5220A	655

### SCHMATIC NO.

WG-5226A	655
WG-5230A	655
WG-5320A	655
WG-5326A	655
WG-5330	655
WG-6050B	713
WG-6051B	713
WG-6052B	713
WG-6150B	713
WG-6152B	713

### ANDREA

Chassis:	
VT119	630
VTT323-5	818

### CORONADO

Chassis:	
1197-153	860
Model:	
TV2-7110A	1124
TV2-7112A	1129
TV2-7310A	1117
TV2-9368A	1015
TV2-9398A	943
TV2-9442A	783
TV2-9453A	1105
TV2-9454A	1070
TV2-9552A	1061
TV2-9553A	1061
TV2-9590A	643
TV2-9591A	643
TV2-9592A	643
TV2-9620A	665
TV17-9386A	860
TV17-9444A	743
TV21-9367A	1102
TV21-9643A	1094

### DELCO

Model:	
7276605 Auto Radio	684
7284742 Reverb Unit	804
7284893 Reverb Unit	804
7286315 Cadillac Auto Radio	815
980134 Auto Radio	652
980464 Radio	777
980656 Auto Radio	826
980886 Auto Radio	864
9821137 Radio	793
983687 Auto Radio	707
985332 Auto Radio	701
985431 Radio	769
985694 Auto Radio	833
988414 Auto Radio	650
R59 and T-59-12V Garage Door Opener Transmitter/Receiver	724

### DELMONICO

Model:	
PTV-19	649

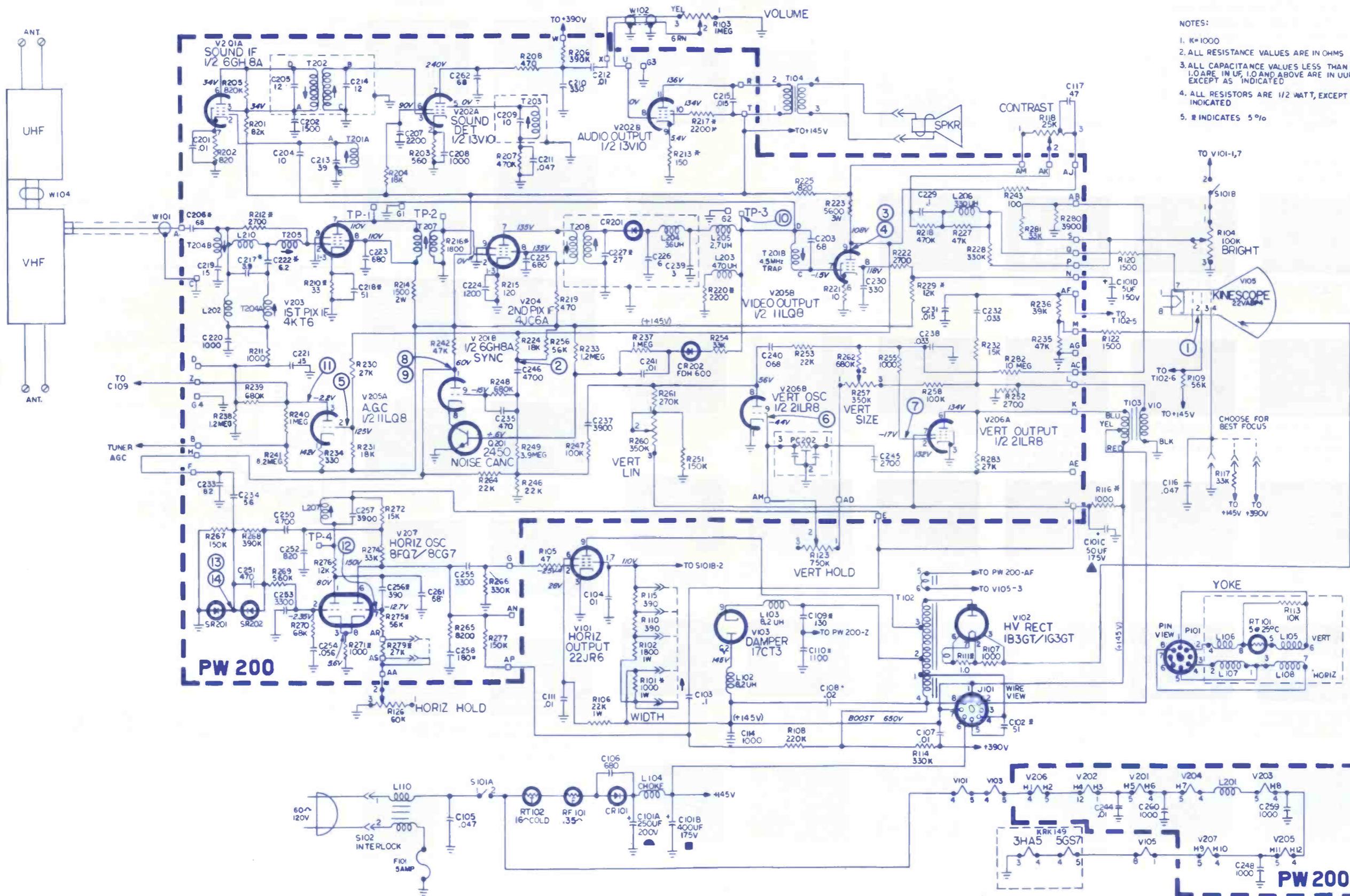
### DUMONT

Chassis:	
120509-B Stereo Amp	733
120591A	709
120592B	709
120593A	709
120600A	663
120601A	663
120622A	802
120623B	802
120633 Series 900	756
120644A	802
120677A	813
120678B	813
120679A	813
120684A	813
120688A	802
120689A	813
120699	891
120708	876
120712	876
120722	891
120725	876
120780	962
120783	962
120804A, B	1071
120805A, B	1071
120806B	1071
120807A, B	1071
120810	962
120827-A	1025
120846-B	1025
120847-B	1025
120856A, B	1056

### SCHMATIC NO.

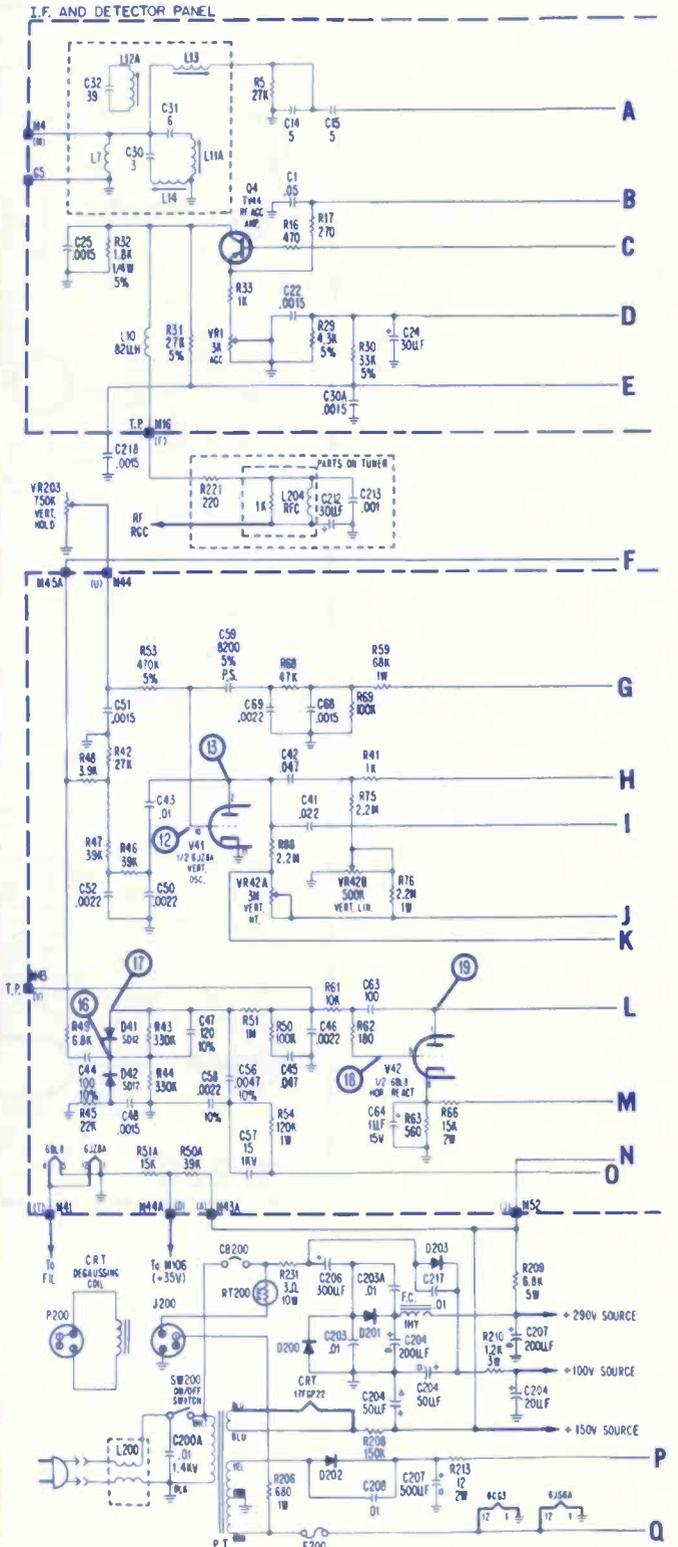
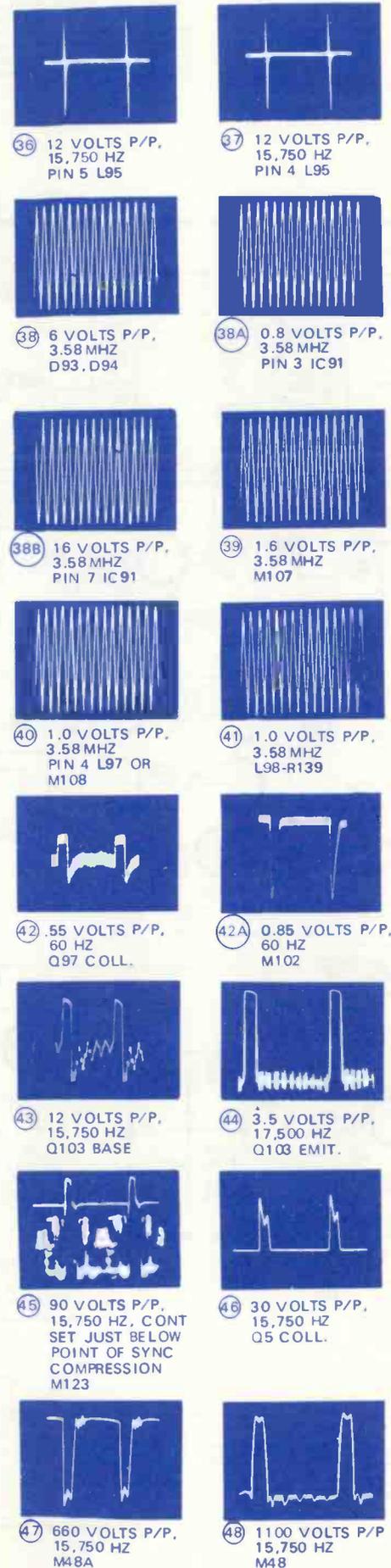
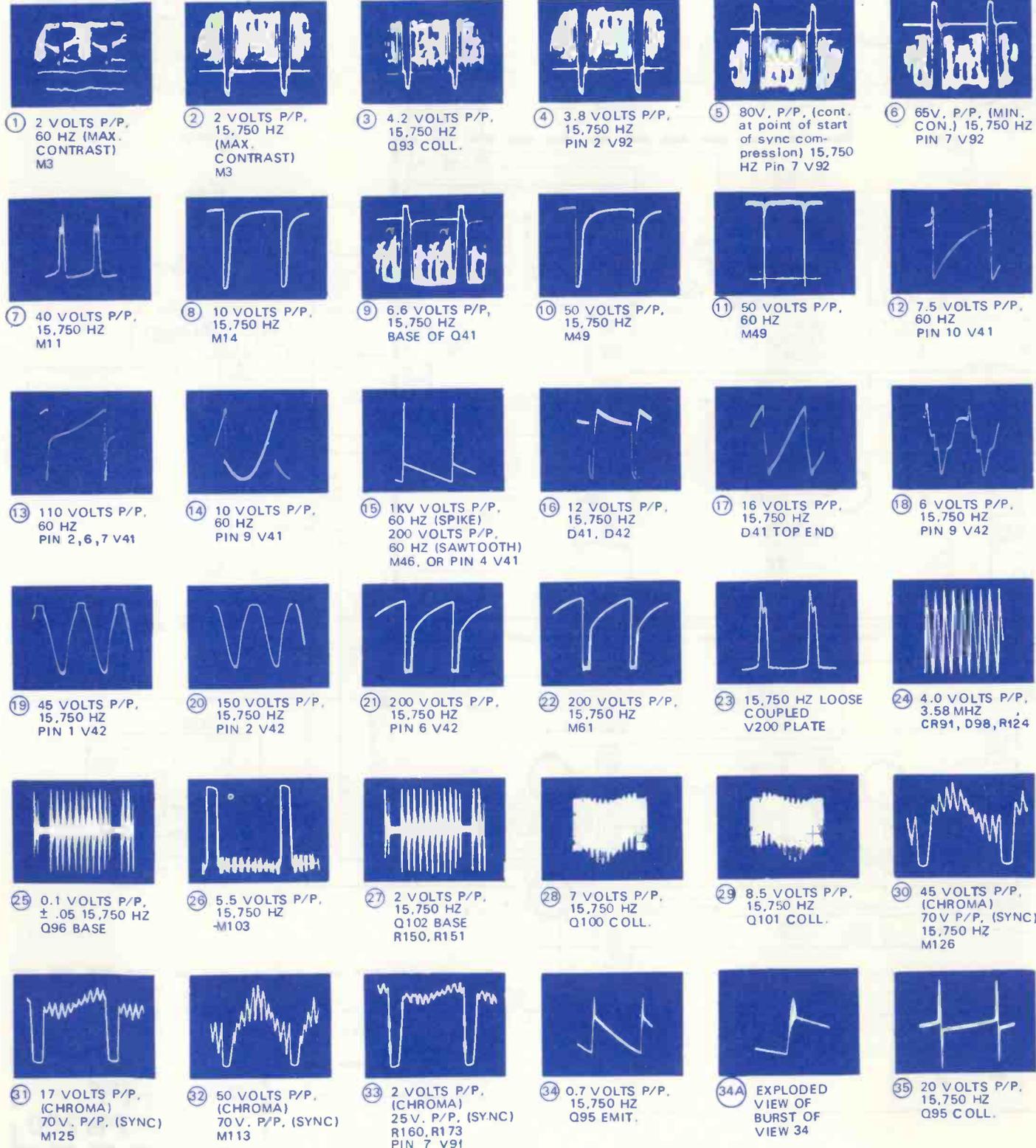
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120842	1033	M638	1171	TS-587	919	T-909 Trans Radio	824	CTC39XAA	1319	528.70370,71	1133	585-1, -2, -4, -5	922	H-883N29 Radio	846
120843	1033	M649	1101	TS-588	964	Chassis:		CTC40	1219	528.71120	1120	682-1, -2, -3 Trans Radio	668	H-M1800, 01, 03 Phono	734
120846	1033	M685	1123	TS-589	899	N1052	935	CTC41	1314	528.72280	1114	Chassis:		H-M1900, 01, 03 Phono	734
120837	1033	M687	1112	TS-592	1149	N1200	932	CTC43	1308	528.72281	1114	SYMPHONIC		V2393-4 Trans Radio	679
120848	1033	N-1	1307	TS-594	1031	N1204	932	CTC47	1278	528.72282	1114	Chassis:		V-2407-4 Radio	789
120852, 853, 855	1172	HEATH		TS-596	957	11H25	613	KCS30F, H, K, M	687	528.72500	1160	TSL-001	747	V-2409-1, -2, -3	625
120883, 884, 890, 896	1212	Model:		TS-597	1021	11J27	705	KCS130YAB, YAC	705	528.72940	1249	TELECTRO		V-2409-4, -5, -6, -7, -8	688
120894	1212	AA-21 Stereo Amp	829	TS-599	1298	11N56	636	KCS134	627	529.61580	955	Model:		V-2411-1, -3	634
120895	1212	GR-22	773	TS-611	1196	12J27	676	KCS136	669	529.61581	955	215 Tape Recorder/Radio	807	V-2414-1, -2	660
120904, 911	1239	GR-53	839	TS-612A	1203	12N50	662	KCS136M	1008	529.70120	967	MM-214 Tape Recorder	801	V-2417-1, -2, -3, -4, -5, -6	711
120914A, B	1221	HOFFMAN		TS-613	1232	13N51	754	KCS136.ML Series	1161	529.70121	967	TELEFUNKEN		V-2436	758
120921, 923	1290	Chassis:		TS-908C-02 to D-02	924	13N52	754	KCS136X	879	562.10096	972	Model:		V-2444-1, -2, -3, -4, -5, -6, -9, -10	795
120962, 964	1303	913-000366, 386	1166	TS-912A	819	13N53	744	KCS137 Series	744	564.10003	972	77 Stereo Tape Recorder	715	V-2444-1, -2, -3, -9, -10	837
120969, 970	1288	BP318 Trans Radio	703	TS-914A-00 to A-07	951	14G20	750	KCS137	988	564.10000	988	V-2451-2 CB Transceiver	817	V-2446-1, -2, -3, -4	825
120976, 977, 980, 981, 982, 983, 984	1313	Model:		TS-921 Series	1142	14N30	871	KCS138	750	564.10001	988	V-2451-2CB Transceiver	774	V-2451-2 CB Transceiver	817
Model:		P708 Trans Radio	703	TS-924B, C	1225	14N50	730	KCS140A, B	730	564.10002	988	V-2474-1, -2, -3, -6, -7	875	V-2475-1, -4	887
12P50	1005	Model:		TS-930 Series	1260	15G20	905	KCS142	834	564.10003	988	V-2476-1, -4	900	V-2478-1, -2	907
12P50	975	P708 Trans Radio	703	TS-934	1296	15J25	982	KCS142XA	982	564.10004	988	TOSHIBA		V-2483-1	1053
12P60/12P61/W	1280	KORTING		TTS-587	884	15J27	884	KCS143F	906	564.10005	988	Model:		V-2495-11	961
29P10	1248	Model:		VTS-587	919	15M91	898	KCS144E	998	Model:		9TL-3655 Trans Radio	685	V-2486 Series	996
35P01/35P02	1177	MT 2233, 2243 Tape Recorder	865	WTS-435	614	15N30	914	KCS147A, B	786	Chassis:		10PG	712	V-2487 Series	1002
EP-40 Air Purifier Ionizer	618	Recorder Constellation	853	WTS-436	731	15N50	921	KCS148	927	SONORA		V-2496 Series	1023	V-2498 Series	1029
P-1913 Stereo/Radio	790	LAFAYETTE		Model:		16J27	980	KCS149AA, AB, AD	942	Model:		V-2515-2 Phono	734	V-2515-6 AM/FM/Tuner	771
1800/2000 Series	742	Model:		202 Auto Radlo	727	16J26, A	965	KCS151A	917	GTC-3014A, B	821	V-2528-3 Radio	846	V-2528-2	1092
FIRESTONE		KT-236 Stereo Amp	610	203 Auto Radio	727	16N35	971	KCS152A	916	GTC-3114A	821	V-2652-2	1092	V-2655-2-3-4-7-8-13	1058
Chassis:		MAGNAVOX		204 Auto Radio	727	16NT82	1017	KCS153	959	GTC-4014A	821	V-2656-1-2	1121	V-2659 Series	1143
12-129-94U	918	Model:		1TMC Auto Radio	673	16QT85	948	KCS154A, B	948	GTC-4044A	821	V-2660	1162	V-2664 Series	1157
FISHER		77-01 AM/FM Tuner	794	2TMR Auto Radio	691	17C21, A, V, AV	1099	KCS155	966	GTC-4114A	821	V-8001	1213	ZENITH	
Model:		Chassis:		12MAM Auto Radio	661	17J25	1084	KCS156	1019	GTC-4144	821	Model:		40 Radio	857
800 AM/FM Stereo Amp	693	19P7-1, -2, -3	700	14MF Auto Radio	647	17J28	1096	KCS157 Series	1116	Model:		Royal 50L Trans Radio	781	Royal 150 Radio	635
FLEETWOOD		19T5, 7, 11, 12, 13 and	731	19P7-1, -2, -3	700	17KT50	1017	KCS158 Series	1119	563P197	852	Chassis:		Royal 490 Trans Radio	811
Chassis:		A19T8 Series	731	19T5, 7, 11, 12, 13 and	731	17NT45	1078	KCS161	1022	563P197	852	1Y21B55	1139	6GT4222 Radio	635
1000	632	109 Mopar Auto Radio	731	19T8 Series	731	18CT24	1305	KCS162	1028	564K236M	989	6JT4021 Trans Radio	720	6JT4121 Trans Radio	720
1010	632	1961 Plymouth	664	19T8 Series	731	18J32	1151	KCS163 Series	1065	565P198	1060	6KT4021 Trans Radio	781	6KT5028 Radio	857
GENERAL ELECTRIC		C2AA-18806-M-N Auto Radio	741	19T8 Series	731	18L33	1130	KCS164	1050	Chassis:		2DC1605	894	2DC1605	1079
Chassis:		C2YA-18806-E Auto Radio	741	19T8 Series	731	18L43	1137	KCS165 Series	1104	1051-90	642	2DC1803	1110	2DC1803	1110
AA	889	RV2F C20Z-18875-C	723	19T8 Series	731	18L43	1137	KCS166 Series	1104	1156-89	696	2DC2555	1079	2DC2555	1079
AB	963	Auto Radio Reverb	723	19T8 Series	731	18NT45	1125	KCS168 Series	1192	TRW-621 Trans Radio	690	2DC3651	949	2DC3651	949
AC	1164	MUNTZ		19T8 Series	731	18NT45	1125	KCS169 Series	1306	SPARTON		2DC3712	1073	2DC3712	1073
AD	1148	Chassis:		19T8 Series	731	18QT85/18MT70	1118	KCS171 Series	1198	Model:		2DC3741	1041	2DC3741	1041
AE	832	T68A14	940	19T8 Series	731	19FT60B	1250	KCS173 Series	1180	12M5-P Stereo Phono	732	2DC3815	1156	2DC3815	1156
AF	1191	T68A15	940	19T8 Series	731	19HT15	1250	KCS174 Series	1182	Chassis:		2DC3818	1127	2DC3818	1127
AG	832	T68H28	947	19T8 Series	731	19K T40B	1242	KCS175 Series	1204	19L1	765	2DC3819	1168	2DC3819	1168
AH	1148	OLYMPIC		19T8 Series	731	19KT50/50B	1207	KCS176 Series	1269	23K2	714	2DC3916	1222	2DC3916	1222
AI	1191	Model:		19T8 Series	731	19L21	1233	KCS177 Series	1251	STERLING		2DC3918, 19	1210	2DC3918, 19	1210
AJ	832	77-01 AM/FM Tuner	794	19T8 Series	731	19P22	1226	KCS178 Series	1270	1/633US AM/FM/SW	641	2DC3920	1193	2DC3920	1193
AK	832	Chassis:		19T8 Series	731	19QT85R	1197	KCS183	1331	Radio Phono	641	2DC4815	1178	2DC4815	1178
AL	1148	34 Series	722	19T8 Series	731	19S32	1235	KCS184A	1315	STRIBEL		3912	1227	3912	1227
AM	1148	35 Series	633	19T8 Series	731	20HT70	1332	RC-1214A Radio	792	Model:		1096-243	788	1096-243	788
AN	1148	36-02 Series	672	19T8 Series	731	20HT71	1332	RC-1216 Radio	863	4P19 Series Trans Radio	668	1095-232	729	1095-232	729
AO	832	36-08, -09 Series	762	19T8 Series	731	20L23	1264	RS-194A Reverb Amp	615	19L17 Series	704	UNITED SCIENTIFIC LABS		14M20	893
AP	832	40 Series	849	19T8 Series	731	20P22	1299	RS-200 Stereo Adapter	721	21TC1-C2	851	Model:		14M21	1054
AQ	832	43 Series	835	19T8 Series	731	20P24	1267	RS-206-A Record Changer	868	21LC3	851	Contact 23 CB Transceiver	896	14M22	878
AR	832	44 Series	812	19T8 Series	731	20R27	1276	REGENCY		21LC12-1	851	UTICA		14M23	916
AS	832	45 Series	882	19T8 Series	731	20S32/A	1293	Model:		21LC14-1	851	Model:		14M27	934
AT	832	47 Series	1062	19T8 Series	731	20T33	1287	CB-27 Citizens Band Radio	658	23E01	757	Model:		14N22	1001
AV	832	48 Series	912	19T8 Series	731	20V35	1253	CBM-27 Citizens Band Radio	658	45C31-1 Stereo	738	Model:		14N26	958
AW	832	49 Series	901	19T8 Series	731	PHILHARMONIC		Chassis:		45P36 Stereo	859	Model:		14N27	1080
AX	832	70-01 FM Multiplex Adapter	702	19T8 Series	731	Chassis:		TSL-001	689	G9400 Stereo	738	Model:		14N28	1010
AY	832	Model:		19T8 Series	731	RAYTHEON CO.		RAYTHEON CO.		Model:		Model:		14N29	969
AZ	832	T907 Series	981	19T8 Series	731	TWR-1 "Raytel" Citizens Band Radio	640	RAYTHEON CO.		Chassis:		Model:		14N29Z	1067
B-1	1191	T908 Series	993	19T8 Series	731	Raytheon Two-Way Encoder/Decoder	895	SHERWOOD		1096-243	788	Model:		14N31	986
B-2	953	T910 Series	985	19T8 Series	731	Model:		Model:		1095-232	729	Model:		14X21	1039
B-3	861	T911 Series	1088	19T8 Series	731	RAYTHEON CO.		S-3000 111 FM Stereo Tuner	612	UNITED SCIENTIFIC LABS		Model:		14Y21Z	1169
B-4	930	T914 Series	954	19T8 Series	731	RAYTHEON CO.		SILVERTONE		Model:		Model:		14Y33	1163
B-5	990	T915 Series	1181	19T8 Series	731	RAYTHEON CO.		Model:		Chassis:		Model:		14Z21, 14Z21Z	1252
B-6	1075	T916 Series	1140	19T8 Series	731	RAYTHEON CO.		6122	1009	1096-243	788	Model:		14Z37	1216
B-7	1214	T917 Series	1186	19T8 Series	731	RAYTHEON CO.		6150	995	1095-232	729	Model:		14Z38, 14Z43	1240
B-8	1046	T919 Series	1012	19T8 Series	731	RAYTHEON CO.		6151	995	UNITED SCIENTIFIC LABS		Model:		15M22	908
B-9	1265	T920 Series	1103	19T8 Series	731	RAYTHEON CO.		6152	995	Model:		Model:		15Y6C15	1174
B-10	866	T921 Series	1059	19T8 Series	731	RAYTHEON CO.		6153	995	Model:		Model:		16F23, Q	616
B-11	1156	T922 Series	1079	19T8 Series	731	RAYTHEON CO.		6154	995	Model:		Model:		16J2BOS	698
B-12	1173	T923 Series	1076	19T8 Series	731	RAYTHEON CO.		6155	995	Model:		Model:		16K20, QS	739
B-13	1236	T924 Series	1135	19T8 Series	731	RAYTHEON CO.		6156	995	Model:		Model:		16N24	1006
B-14	1318	T925 Series	1111	19T8 Series	731	RAYTHEON CO.		6157	995	Model:		Model:		1628C, 19	1284
B-15	1011	T927 Series	1158	19T8 Series	731	RAYTHEON CO.		6158	995	Model:		Model:		17G28, Q	651
B-16	1037	T928 Series	1311	19T8 Series	731	RAYTHEON CO.		6159	995	Model:		Model:		20YJ37	1126
B-17	1141	T932 Series</													

SYMBOL	DESCRIPTION	RCA PART NO.		
C101A	250µf 100v., elect.	114845	R123	Control vert hold
C101B	400µf 100v., elect.	114845	R126	Control horiz hold
C101C	5µf 100v., elect	114845	R260	Control vert lin
C101D	5µf 100v., elect	114845	RF101	0.35Ω, fuseable
L102	8.2µh	107385	RT102	Thermistor-16Ωcold
L110	Line choke	114293	T102	x-former-horiz output
L207	Stabilizer	114486	T103	x-former-vert output
R118	Control contrast	131033	T104	x-former-audio output
			RT101	Thermistor-Temp comp
				Yoke Deflection
				118701
				131012
				121223
				124263
				114480
				131105
				131032
				124275
				118375
				125226



- NOTES:
1. K=1000
  2. ALL RESISTANCE VALUES ARE IN OHMS
  3. ALL CAPACITANCE VALUES LESS THAN 1.0 ARE IN UF, 1.0 AND ABOVE ARE IN UUF EXCEPT AS INDICATED
  4. ALL RESISTORS ARE 1/2 WATT, EXCEPT AS INDICATED
  5. # INDICATES 5%<sub>o</sub>

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 0.3V peak-to-peak at center tap of chroma control or M110 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 5 MHz bandwidth similar to B&K Model 1450. Line voltage 120V.

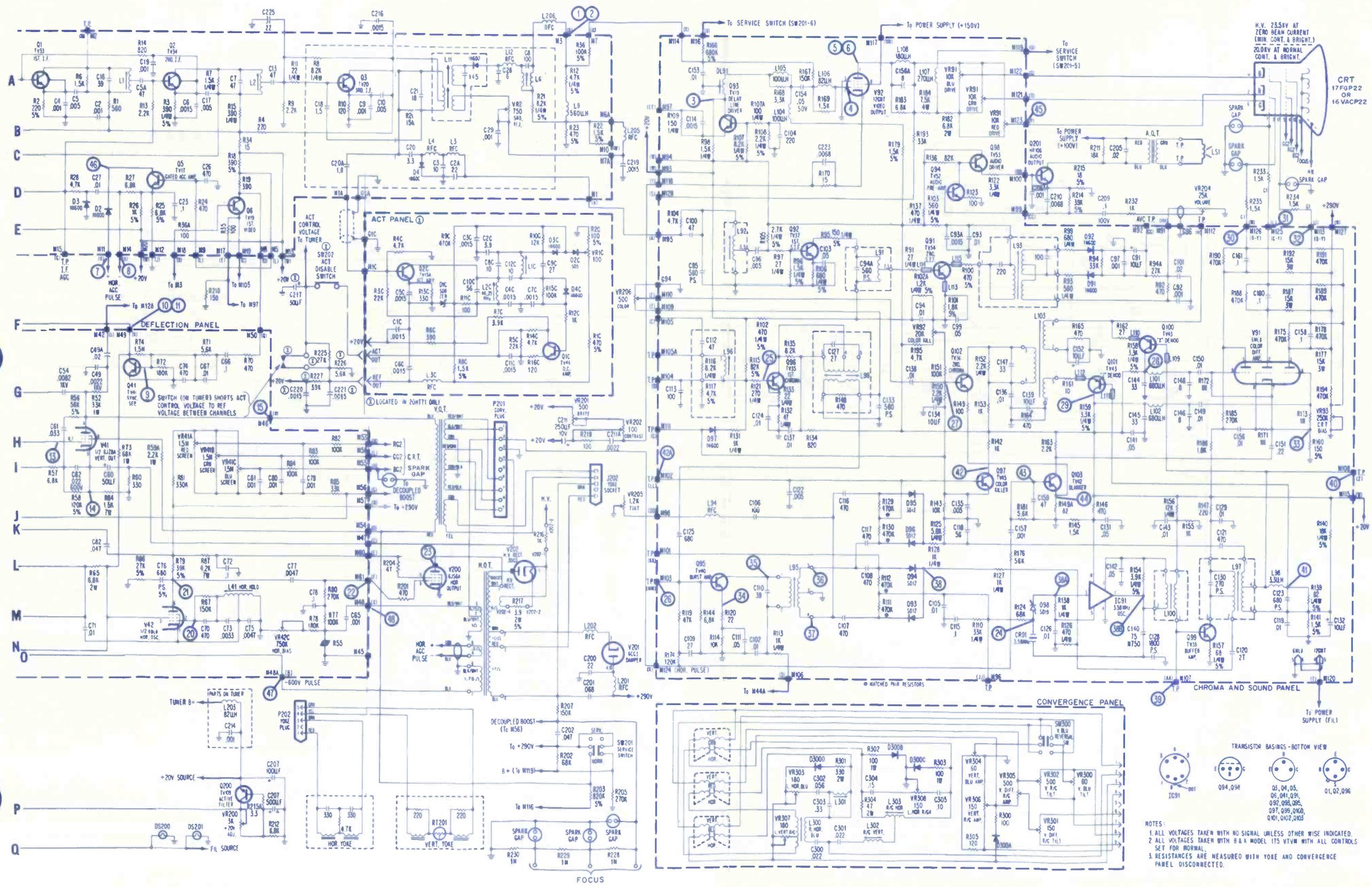


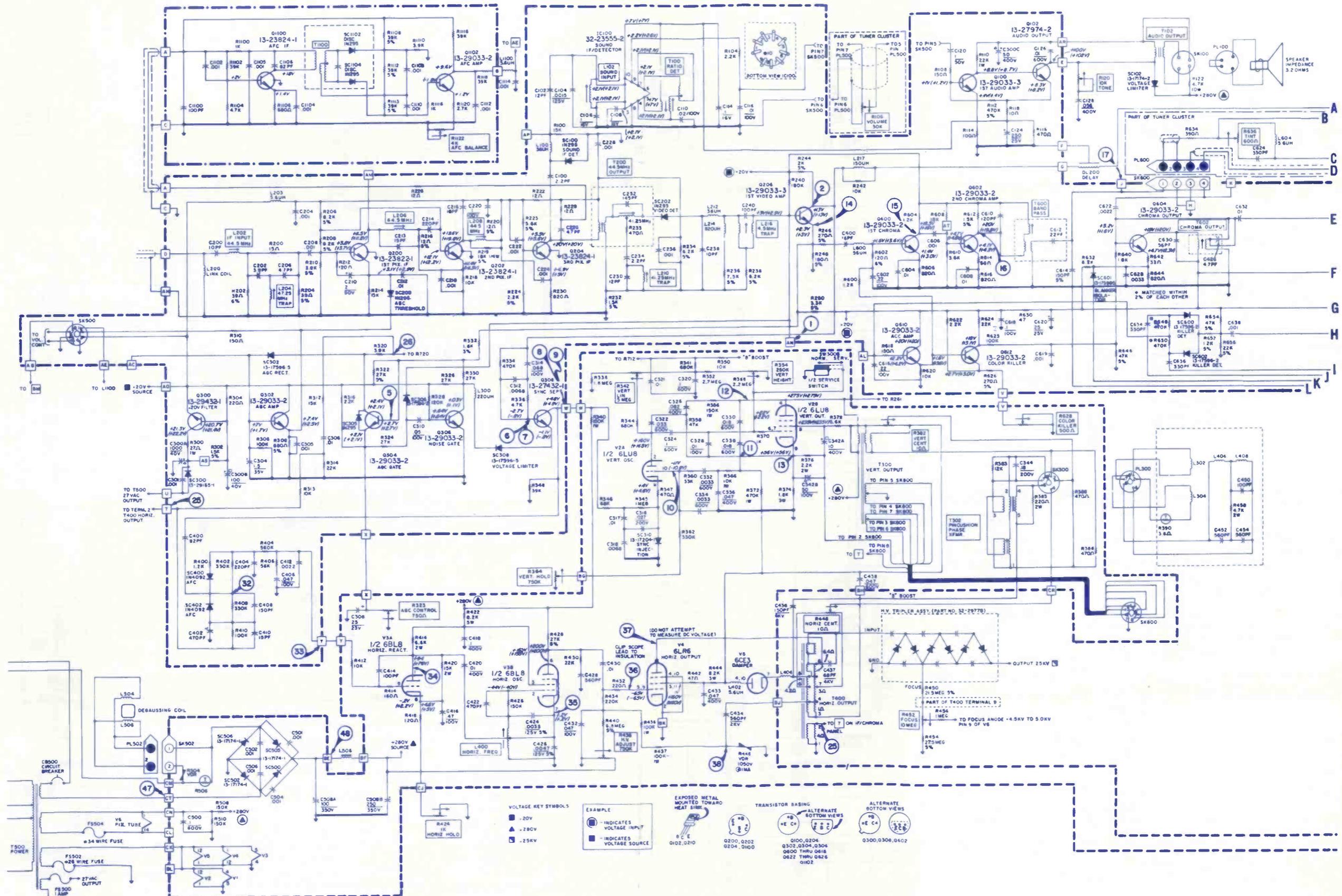
**PHILCO-FORD Color TV**  
Chassis 20HT70/20HT71

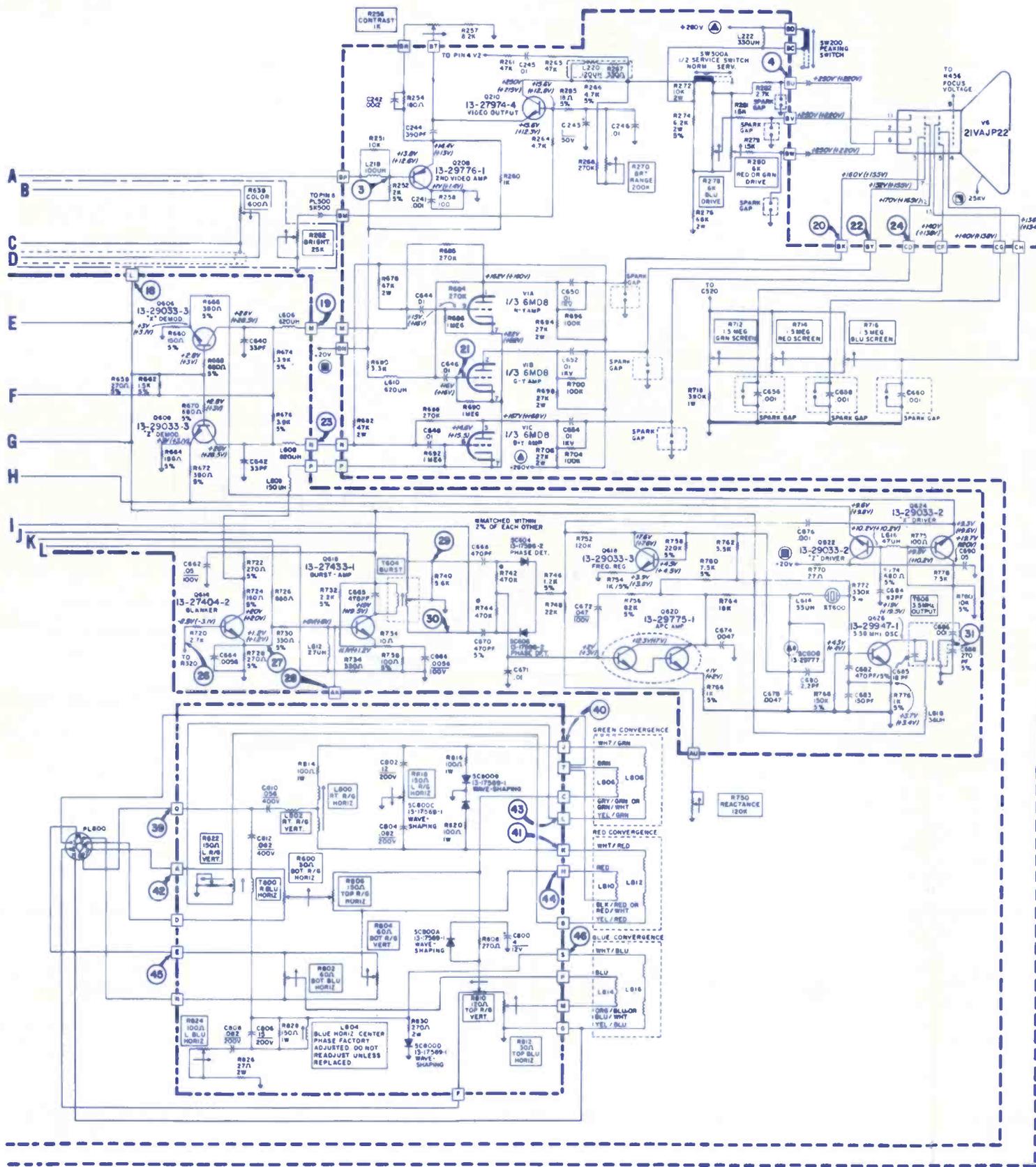
SYMBOL	DESCRIPTION	PHILCO-FORD PART NO.
C204A	200 μf/350v	30-2616-15
C204B	50 μf/200v	30-2616-15
C204C	50 μf/200v	30-2616-15
C204D	20 μf/200v	30-2616-15
C207A	500/100v	30-2616-14
C207B	500/100v	30-2616-14
C207C	200/100v	30-2616-14
C207D	400/100v	30-2616-14
CB200	circuit breaker	42-2136-6
F200	no-36 wlre 1 in filament pwr	

L41	horiz hold coil	32-4891-2
L91	sound interstage coil	32-4836-2
L93	sound ratio det coil	32-4828-1
L94	tint control	32-4685-44
L96	chroma take off coil	32-4878-3
R195	4.7K color killer control	
RT200	degaussing thermistor	33-1386-1
RV55	horiz bias varistor	33-1379-2
SW200	on/off	42-2167-1
AOT	audio output	32-10119-1
FC	filter choke	32-10095-2
VOT	vertical output	32-10117-3

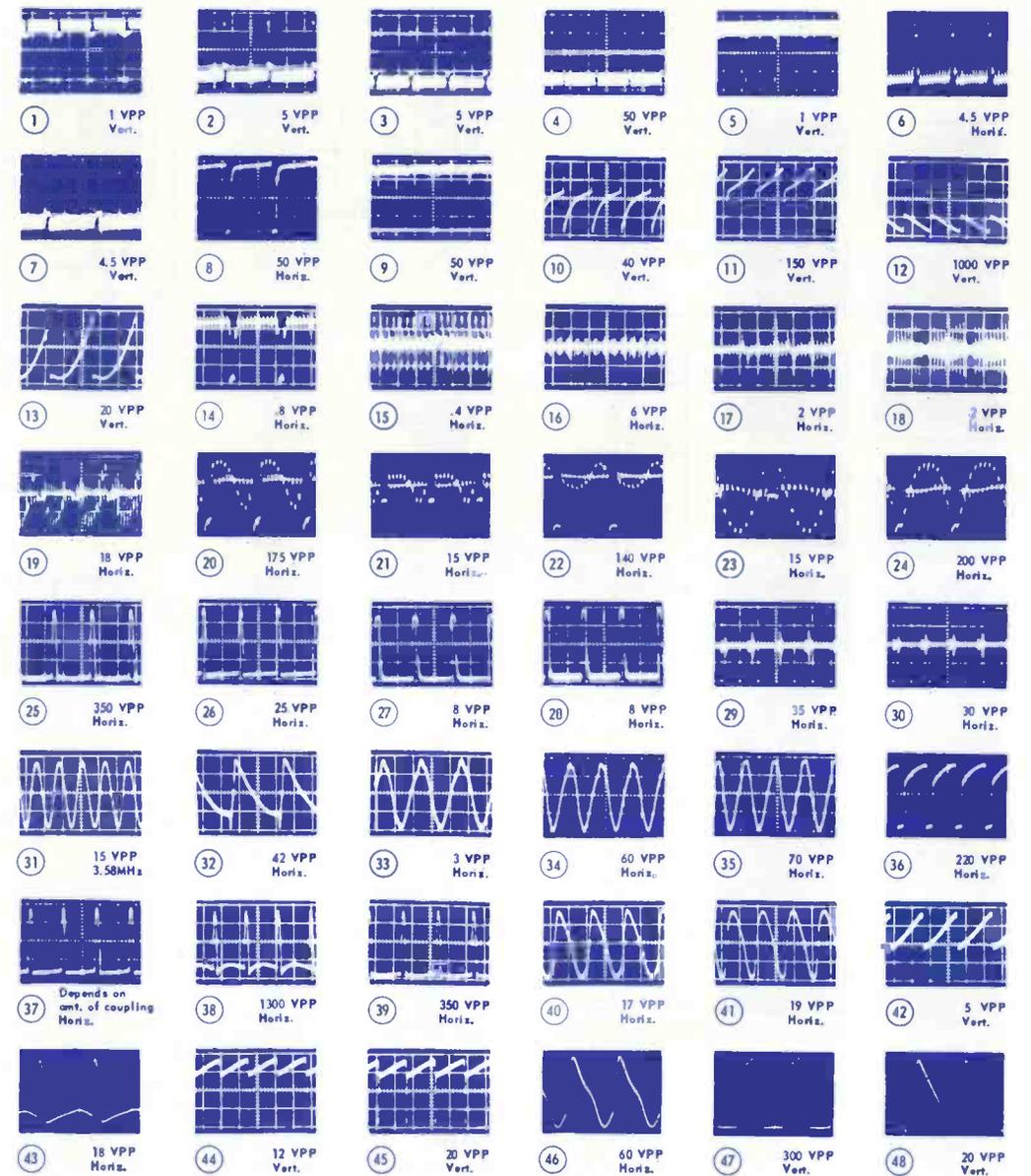
HOT	horiz output	32-10132-1
PT	power	32-10096-2
VR91	video drive control	33-5632-1
VR92	color killer control	33-5628-6
VR93	color bias control	33-5628-12
VR201	brightness control	33-5631-22
VR202	contrast control	33-5631-7
VR203	vertical control	33-5631-4
VR204	volume control	33-5631-25
VR205	tint control	33-5631-5
VR206	color control	33-5631-3
yoke		76-14118-4







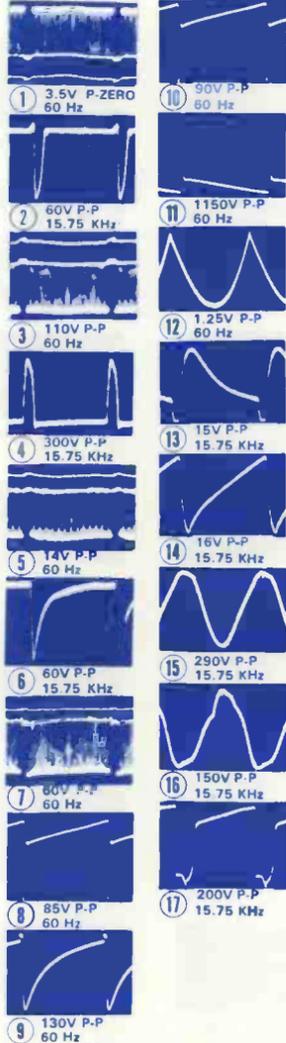
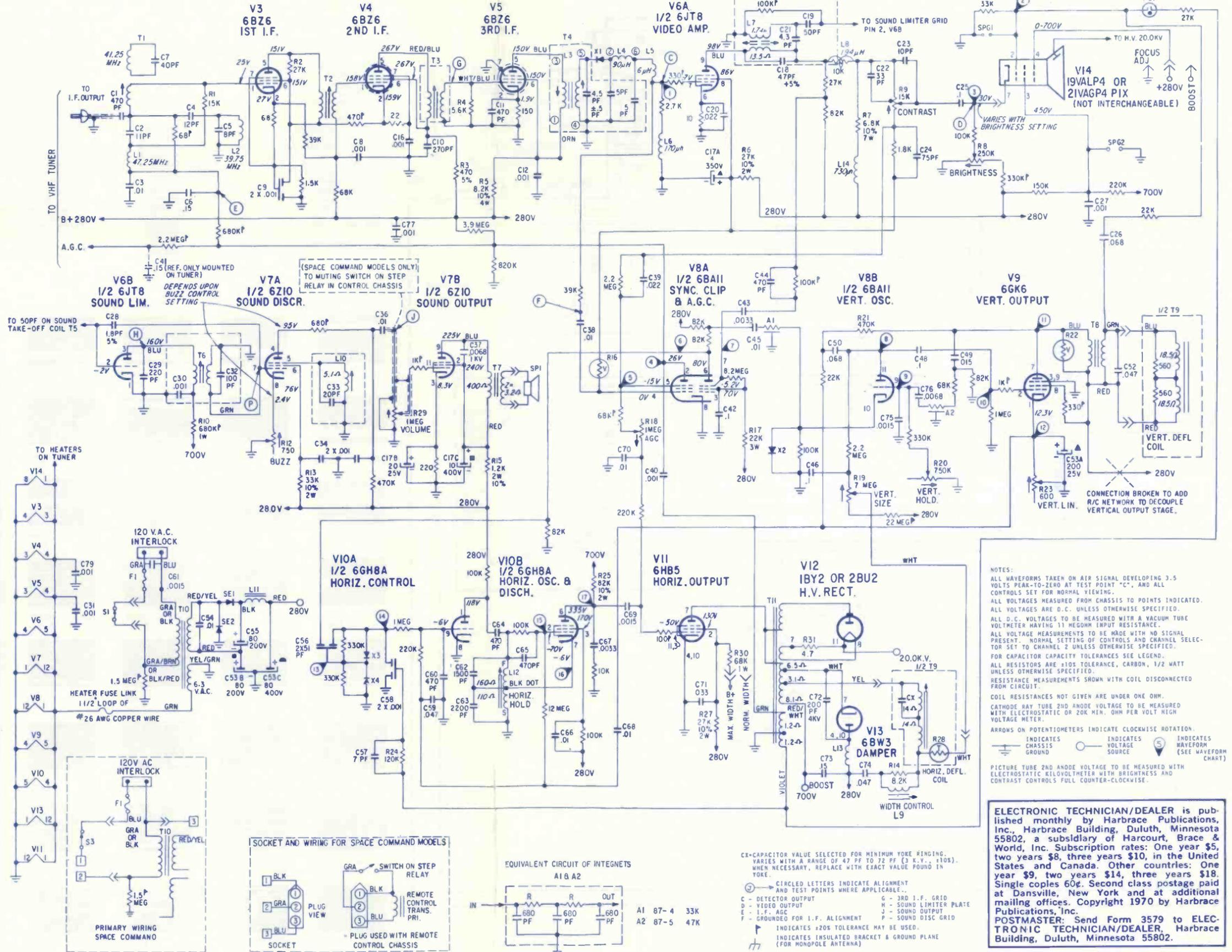
SYMBOL	DESCRIPTION	SYLVANIA PART NO.		
C300-3	3 section electrolytic	41-29788-1	R106-30K	volume (-1 CH)
A	-100/40v		R106-30K	volume (-2 CH)
B	-100/40v		R120-10K	tone
C	-50/400v		R256-1K	contrast
			R262-25K	bright
			R270-200K	brightness range
C509-2	2 section electrolytic	41-33341-1	R323-750	AGC
A	-100/350v		R342-5M	vert linearity
B	-250/350v		R364-750K	vert hold
			R382-10	vert centering
R446	VDR-1ma@1050v	38-29959-1	R424-1K	horiz hold
R504	VDR-67ma@20v	38-17071-2	R448-10	horiz centering
R506	thermistor-120Ω cold, 1.25Ω hot	38-17071-4	R452-10M	focus
L102	sound input	57-23832-2	R628-500	color killer
L400	horiz frequency	50-23508-1	R636-600	tint
L402	5.6μh-RF choke	50-15904-4	R638-600	color
T100	ratio detector	57-23547-1	R712-1.5M	green screen
T102	audio output	56-16018-11	R714-1.5M	red screen
T300	vert output	56-29826-1	R716-1.5M	blue screen
T400	horiz output	50-29664-1	R750-120K	reactance
T500	power (-1 CH)	55-33165-1	CB500	circuit breaker
T500	power (-2 CH)	55-33165-2		yoke deflection
T600	bandpass	50-27405-1		UHF (-2 CH)
T602	chroma output	50-29658-1		UHF (-1 CH)
T604	burst	50-27406-1		



SYMBOL	DESCRIPTION	ZENITH PART NO.
C17A	4 MFD electrolytic cap	22-2744
C17B	20 MFD electrolytic cap	22-2744
C17C	10 MFD electrolytic cap	22-2744
C53A	200 MFD electrolytic cap	22-3863
C53B	80 MFD electrolytic cap	22-3863
C53C	80 MFD electrolytic cap	22-3863
R8	250K $\Omega$ bright control	63-6489
R9	15K $\Omega$ contrast control	63-6491

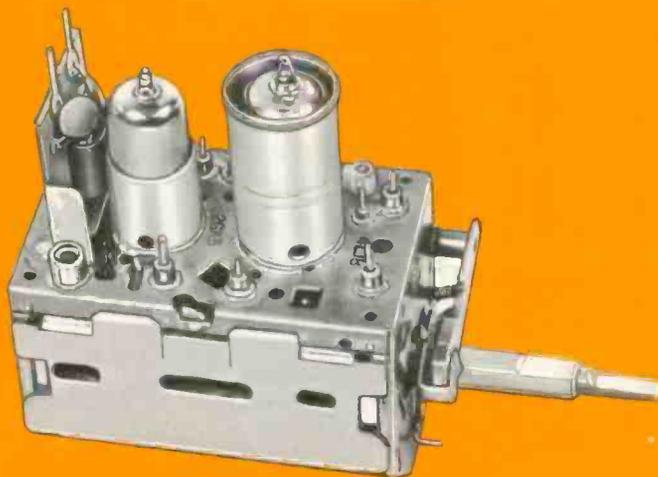
R12	750 $\Omega$ buzz control	63-8719
R16	voltage dependent resistor	63-5058
R18	1M AGC control	63-4833
R19	7M vert size control	63-6433
R20	750K vert hold control	63-7185
R22	voltage dependent resistor	63-7447
R23	600 $\Omega$ vert lin control	63-8720
R28	thermal resistor mounted in yoke	63-8187
R29	1M volume control	63-6349

L12	horiz osc coil	S-56877
T5	sound take off coil	S-74446
T7	audio output trans	95-2893
T8	vert output trans	95-2333
T9	yoke	95-2899
T10	power trans	95-2200
T11	horiz sweep trans	S-87025
A1	integrator	87-4
A2	integrator	87-5



**NOTES:**  
 ALL WAVEFORMS TAKEN ON AIR SIGNAL DEVELOPING 3.5 VOLTS PEAK-TO-ZERO AT TEST POINT "C", AND ALL CONTROLS SET FOR NORMAL VIEWING.  
 ALL VOLTAGES MEASURED FROM CHASSIS TO POINTS INDICATED. ALL VOLTAGES ARE D.C. UNLESS OTHERWISE SPECIFIED.  
 ALL D.C. VOLTAGES TO BE MEASURED WITH A VACUUM TUBE VOLTMETER HAVING 11 MEGOHM INPUT RESISTANCE.  
 ALL VOLTAGE MEASUREMENTS TO BE MADE WITH NO SIGNAL PRESENT. NORMAL SETTING OF CONTROLS AND CHANNEL SELECTOR SET TO CHANNEL 2 UNLESS OTHERWISE SPECIFIED.  
 FOR CAPACITOR CAPACITY TOLERANCES SEE LEGEND. ALL RESISTORS ARE  $\pm 10\%$  TOLERANCE, CARBON, 1/2 WATT UNLESS OTHERWISE SPECIFIED.  
 RESISTANCE MEASUREMENTS SHOWN WITH COIL DISCONNECTED FROM CIRCUIT.  
 COIL RESISTANCES NOT GIVEN ARE UNDER ONE OHM.  
 CATHODE RAY TUBE 2ND ANODE VOLTAGE TO BE MEASURED WITH ELECTROSTATIC OR 20K MIN. OHM PER VOLT HIGH VOLTAGE METER.  
 ARROWS ON POTENTIOMETERS INDICATE CLOCKWISE ROTATION.  
 INDICATES CHASSIS GROUND. INDICATES VOLTAGE SOURCE. INDICATES WAVEFORM (SEE WAVEFORM CHART).  
 PICTURE TUBE 2ND ANODE VOLTAGE TO BE MEASURED WITH ELECTROSTATIC KELOVOLT METER WITH BRIGHTNESS AND CONTRAST CONTROLS FULL COUNTER-CLOCKWISE.

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SENCORE SM158

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and at \$120.00 less  
than competition!  
only \$275.00

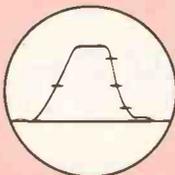
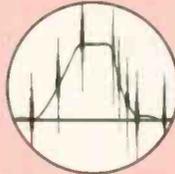


Here are 7 Reasons why we call the SM158 the Speed Aligner

**AUTOMATIC ALL CRYSTAL CONTROLLED MARKERS:** You will never spend any more time looking up marker frequencies or interpreting them when you own an SM158; they are automatic. For example, want the chroma carrier on any RF curve, IF curve, or chroma curve, simply push the chroma carrier marker button. Want the sound, video, adjacent carrier markers or any other marker on any curve, just push the button as directed on the panel. The SM158 is fast and saves you time . . . that's why we call it the speed aligner.

**UNLIMITED MARKER AMPLITUDE:** The marker height control is like a powerhouse; crank it up as far as you want, even to the point where the markers are larger than the scope screen, without upsetting the response curve. Each marker is crystal controlled on fundamental frequencies and post-injected so that you may place all markers on the curve at unbelievable heights without affecting the curve in the least. That's why we call the SM158 the speed aligner.

**EASY TO CONNECT:** Just four connecting cables clearly marked TO TV and TO SCOPE. It takes just seconds to connect . . . that's why we call the SM158 the speed aligner.

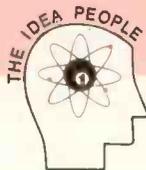


**TWO EXTRA VHF CHANNELS:** Competition has only two VHF channels; the SM158 has an extra high channel and an extra low frequency channel to prevent any co-channel interference. The SM158 is interference-free . . . that's why we call it the speed aligner.

**PLENTY OF SWEEP WIDTH:** A full 15 megahertz sweep signal, constant on all IF, chroma and RF curves, provides adequate sweep width to cover new solid state IF amplifiers. Competition covers only 12 megahertz. The SM158 gives you the full picture the first time . . . that's why we call it the speed aligner.

**GENERATES A ZERO REFERENCE BASE LINE:** You know where zero is with the SM158. All alignment instructions show a base line, yet some competitors do not generate a base line. You can follow TV manufacturers' instructions to the "T", easier and faster with the SM158 . . . that's why we call it the speed aligner.

**SWITCHABLE HORIZONTAL OR VERTICAL MARKERS:** want to tilt markers 90 degrees so you can view markers better in traps or for leveling? Merely pull the MARKER HEIGHT control out and markers appear horizontally — a real plus feature.



# SENCORE

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Sioux Falls, South Dakota 57107

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ELECTRONIC TECHNICIAN/DEALER

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Jim Smith of Sencore is seen on this month's cover busily instructing technicians at a sweep aligner workshop—see page 47 for more details.

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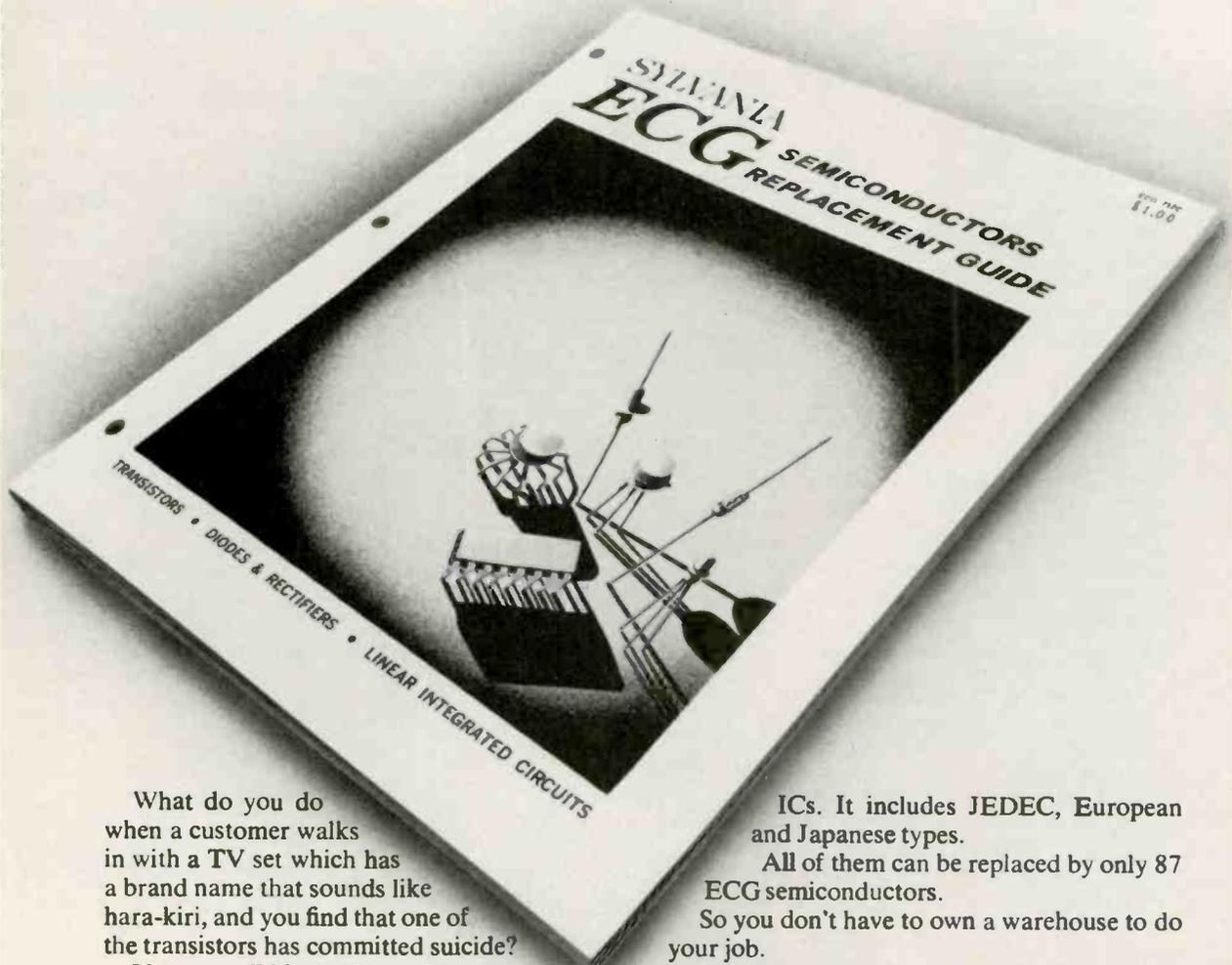
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## Video Phonographs



On October 13, in the well packed Terrace Room of the Hotel New Yorker, AEG-Telefunken and English Decca put on the first American public demonstration of a phonograph that played TV programs—both the audio and the video! Although presented at the Audio Engineering Society's Annual Convention, this phonograph is a subject that should be of considerable interest to the entire electronic industry.

Fortunate enough to be among those attending this demonstration, I found the picture quality excellent with only an occasional flicker. The latter was probably due to the difficulties that they encountered when converting electrical power from the hotel outlets to the voltage and frequency that is standard in Germany.

Each video disc appeared as a sheet of flexible plastic which lay flat on the turntable. We were advised that they could be inexpensively reproduced and once popular might even be inserted in newspapers or magazines as a very dynamic supplement covering sporting events and other interesting TV subjects.

The stylus was not shaped like a conventional needle but appeared more like a wedge-shaped knife blade. The blade slides along the record groove and functions as a pressure sensor. As each vertically modulated segment of the groove passes out from under the trailing edge of the stylus, it springs back into shape. The resulting change in stylus pressure is transferred to a transducer, which in turn varies its electrical output. In this manner they were able to overcome the critical inertia of a needle and experience a frequency response unattainable by conventional means.

Rotating at 1800 rpm, with a groove width of only 0.3 mil, a 12-in. record is able to contain 12 minutes of TV programming. I am certain that longer recording times will be possible in the near future and we were advised that color programming with stereo sound is in the process of being perfected.

When reading a technical paper describing the phonograph, the Decca representative indicated (as I recall) that the phonograph had a 3MHz bandwidth with a 75dB signal-to-noise ratio—a very impressive response. Even ignoring its marvelous applications in the field of video recording, there are tremendous possibilities with such a system. By multiplexing, such a response could in theory permit the recording of nearly 100 single-channel 30kHz audio programs on but one side of a record. Extending the recording time to 36 minutes and the program material to four-channel sound (with complete channel separation) would still permit in the neighborhood of eight programs per side of a 12-in. record. In either case, the cost per recorded channel of truly high-fidelity music would be reduced drastically when considering the amount of program material recorded on each record.

Unfortunately the tremendous size of the crowd and program scheduling prohibited the usual question and answer period during this presentation. This was disappointing since I was concerned with two aspects of the presentation. The system presently relies on vertical groove modulation, a technique discarded during the early development of conventional phonographs in favor of horizontal groove modulation.

I was also concerned with the speaker's comment that unlike optical phonograph playback systems [I have personal patents for an optical phonograph which is designed to play current horizontally modulated records grooves without touching them and which in theory is capable of a frequency response at least as high as the video phonograph described], the stylus in their system is able to push aside any dust that has collected on the record. Everyone with a conventional phonograph knows the effect that dust has on noise and record wear. In the case of an optical phonograph, the dust is generally not visible since it lies in a different focal plane than the recessed record groove being viewed; and, if desired, a protective covering could be used in conjunction with the record to eliminate the possibility of dust ever having a chance of collecting on it.

*Phillip Waller*

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# LETTERS

## Comments on Articles

After just reading your editorial: "Let's Have Everyone Look Alive" (Oct. ELECTRONIC TECHNICIAN/DEALER), I think it's about time someone straightened out some disillusioned TV service technicians. I can understand why so many technicians put the blame on broadcast engineers for faults in colorcasting. The blame should not be put on the engineers at the station, but rather on the designers of the equipment made available to the engineers.

First, I was surprised to read that you were "shocked to see only one color monitor in a control room. . . ." Have you ever walked into a showroom and seen two color-TV sets ever looking identical? I am willing to wager you or any of your readers haven't. Yet you expect us to have up to 15 color monitors looking identical. Through experience, I can say you are asking for the impossible! This is why one master monitor is used to set-up our various video sources. If we didn't use one monitor, we would be compensating for aberrations in the monitors rather than differences between actual video sources.

Second, we set-up our studio cameras and film-chain cameras on E.I.A. Logarithmic Reflectance Charts (more commonly known as "chip charts") using the actual light the cameras will be operating under. The trick here is to obtain identical waveforms out of all three vidicons and, in some cases, an image-orthicon tube also! By meaning "identical waveforms," I mean: amplitude, pedestal or set-up, differential gain or slope, and gamma. This is as difficult to achieve as getting three Englishmen and a Chinaman to sing "Danny Boy" alike. You know as well as we do that no two pieces of gear (or tubes) ever exhibit "identical" operating characteristics let alone a combination of three similar tubes and a fourth dissimilar tube. It may comfort you to know, however, that we are constantly modifying and updating our cameras, as technology advances, striving for this ideal goal which someday may be a reality.

Next, let us consider an ideal camera which can reproduce a perfect color picture in the control room. This is still not good enough: From the camera control panel, the signal goes through the video switcher, a stabilizing amplifier or two, phase equalizers, low-pass filters, usually a couple of distribution amplifiers, and then to the transmitter. The distortions to the col-

or signal the aforementioned units introduce are beyond the scope of the average technician or engineer, but nevertheless are far from negligible. This is not to say that some units don't work properly, they do the jobs they are intended for, but also do a little more: add distortion. For example, each video source has a *different* color burst signal riding on the back-porch of every horizontal sync-pulse. This includes video-tape recorders which have other special problems due to interchangeability among various TV stations with varying sub-carrier phase relationships. But this is a problem all of its own. Even though an acceptable color picture can be obtained from each source when viewed individually, when two or more sources are mixed in a lap-dissolve or a special effect wipe, only *one* burst can be discerned at a time by a monitor or a receiver. Therefore the video switcher uses the burst from one source only for synchronizing the color of as many sources as are punched-up on the switcher. Because of this property of our equipment, the result may be that one source appears acceptable while one or more of the other sources may appear blue or green. This happens due to phase shifts caused by many imperfections in our gear such as tolerances in our test and calibration equipment or even the fact that interconnecting video cables are of different lengths and therefore can cause a system phase shift between sources.

Although I've just skimmed the areas of potential colorcast distortions, I hope most technicians now can sympathize with the broadcast engineers. And let it be known that the engineers' hands are tied about the problem. I personally feel we engineers and you technicians should join together and put the blame where it belongs: in the designers' hands. Let's unite and get them to "Look Alive!"

MYLES H. MARKS, ENGR.

### WIIC-TV

This letter is in reference to your article entitled "Why a Trigger-Sweep Scope," which appears in the September 1970 issue of ELECTRONIC TECHNICIAN/DEALER.

We are very pleased that you selected a Zenith chassis for your article, but noted upon reading it that some discrepancies were stated which are inaccurate. The following information should clarify inaccuracies:

All waveforms [provided by Zenith] were observed on a Model 535A Tektronix oscilloscope.

- Waveform 3, Figure 7.

This waveform is shown correctly. The top portion is positive-going com-

posite video information. The two "dots" at the lower portion, appearing during the vertical blanking interval, are the peaks (negative-going) of the vertical blanking pulse. Negative vertical blanking pulses are coupled to the emitter of the video driver (Q201). These pulses, along with the video information on the base, cause Q201 to saturate the negative pulses along with the video appearing at its collector. Due to the effect of the emitter-base junction in the transistor, when blanking pulses are injected at the emitter, an additive (or matrixing) function takes place. Thus, the negative pulses are "added" to the positive going video information at the base and the resultant waveform appears correctly as shown in Waveform 3. In some instances scope-trace intensity may have to be increased to observe these peaks.

- Waveform 53, Figure 67.

Here again, the waveform polarity is correct. The top portion indicates positive going composite video along with the negative vertical blanking pulses from the collector of Q203.

- Waveform 30, Figure 40.

The correct polarity of this pulse is negative as shown. Observing the schematic will show that this pulse is taken from a secondary winding of the vertical output transformer from a point which is negative with respect to ground.

- Waveform 31, Figure 41.

In this case the waveform is taken directly across the coil. The scope should be isolated from the TV receiver or a differential probe could be used. Therefore, the polarity may be displayed either positive or negative depending on hook-up. Chassis ground is not reference in this case. The schematic shows that waveform 31 should be measured directly across the coil.

- Waveform 52, Figure 66.

The waveform that you measured at test point 21 (which must be the same polarity as waveform 52) was negative, which is correct as shown. Waveform 52 merely couples to the cathode of the vertical oscillator and a phase reversal, as you measured, is not possible. Sync injection at the vertical oscillator cathode must be negative, which is shown correctly in waveform 52 (negative).

When the negative pulse (waveform 21) appears at the emitter of Q203, it drives the transistor into hard conduction, reducing the collector voltage. No phase reversal occurs between emitter and collector. Thus, negative pulse appears at the collector of Q203 for vertical blanking application.

- Waveform 10, Figure 17.

In this instance, waveform 10 was

*continued on page 76*

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# NEWS OF THE INDUSTRY

## Wanted by the FBI

*The electronic industry must be credited for the high caliber of men in the field. There are, however, outsiders who use us and our customers for their own unethical gain.*

*We must realize that these people are not of our industry. They are an affront to the many honest technicians in electronics. In an effort to correct this, we are publishing the following:*

Stanley Elmer Butler, also known as Stanley Edward Butler, Stanley Butler, Earl Day Burger, Earl Dayburger, "Stan" is a fugitive of the FBI in that he allegedly defrauded a bank concern in Brunswick, Ga., of several hundred dollars in 1964. Butler has been employed as a TV repairman, serviceman, or electronics technician in the states of Georgia, Florida and Texas.



On May 11, 1965, Butler was indicted by a Federal Grand Jury in Savannah, Ga., and he failed to appear. The following is a description of Butler:

Sex: Male; Race: White; Date of Birth: April 27, 1925; Place of Birth: Bayshore, N.Y.; Height: 6 ft.; Weight: 140 lb (in April, 1965); Eyes: Brown; Scars and Marks: 12-in scar at center of abdomen; Education: 12th grade; Military Service: U.S. Navy; Social Security No.: 111-52-38; Last known address: Gulfport, Miss.

Anyone knowing the whereabouts of Butler should immediately contact the nearest FBI office. Telephone numbers for FBI offices may be located on the first page of local telephone directories.

## Volunteer Work by Raytheon Men Helps Inmates Get Good Jobs on the Outside

Spending time to help men who are serving time is paying off just the way they want it to for Ennis Ward of CADPO and Irving Spector of EDL, Wayland, Mass. The two equipment division men volunteer an evening each week to giving instruction in TV repair to inmates of the Norfolk County House of Correction.

"The results," according to Sheriff Charles W. Hedges, administrator of the jail, "have been fantastic. Men have left here and found good jobs because of the training and instruction they received from these two dedicated and competent gentlemen."

Their particular project, Mr. Spector said, is to help keep some 26 TV sets in operation. Most of the sets are second-hand, donated to the jail by stores and individuals. The Raytheon men show interested prisoners, usually a group of three or four, how to put the sets in working order and how to repair them when they break down.

On their weekly visits, they have supper with the prisoners and then work with them in solving the TV problems that have arisen during the week.

"It's quite rewarding," Mr. Ward said. "We have a chance to talk with the men, learn what they are thinking and sometimes help give them a sense of direction." He said the volunteers' visits tend to offset the bitterness many prisoners harbor. "When they feel they're not forgotten, that somebody cares about them, it gives them a new outlook," he said.

He noted that there are several other volunteer instructors at the jail. They teach high school subjects, auto me-

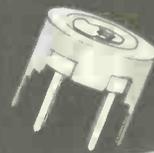
chanics, baking and cooking, and others.

Sheriff Hedges, in a letter to Elliot Ross of CADPO standards and calibration lab, also expressed appreciation



for the equipment supplied to the repair shop by CADPO. "We occasionally find we have test equipment which is no longer economically repairable," Mr. Ross stated, "and which we try to place in schools or other institutions."

## COLOR TV CONTROLS



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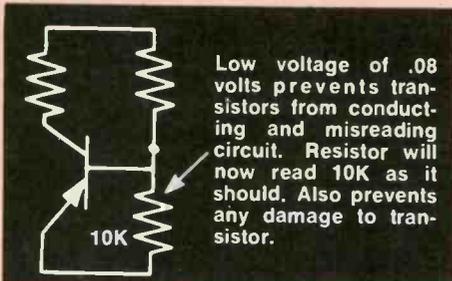
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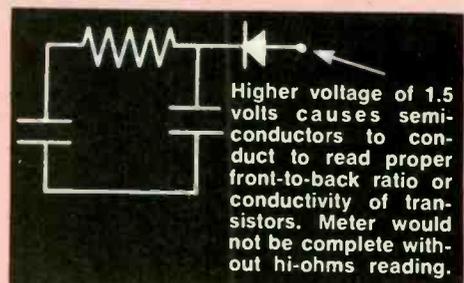
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## NEW AND NOTEWORTHY

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



### VECTORSCOPE/COLOR GENERATOR 700

*Cathode switch allows the vector pattern to be displayed in the same position regardless of CRT drive method*

The IO-101 Vectorscope/Color Generator combines conventional solid-state devices with computer-type integrated circuitry to provide visual readout of the important characteristics of the chroma signal. Specifications indicate that it also produces the standard 9 x 9 display of color bars, shading bars, dots, cross hatch, vertical lines and horizontal lines—plus the 3 x 3 display of all these patterns—and a clear raster for purity adjustments. A unique feature of the instrument is a grid-cathode switch which allows the vector pattern to be displayed in the same position regardless of the drive method used for the color CRT. Variable front panel tuning provides for channels two through six. Plus and minus going video signals are available with the turn of a front panel control; and for sync, chroma and in-circuit video problems a front panel sync output is available. Front panel switchable crystal-controlled sound carrier oscillator,

shielded leads, front panel gun shorting switches, lead-piercing grid jacks and two 500w ac outlets are additional features. Kit price \$124.95. Heath.



### CAR STEREO TAPE PLAYERS 701

*Sensor ejects defective cassettes*

The Model 12R200 cassette play/record car stereo is said to feature solid-state circuitry, and a sensor that ejects defective cassettes. It is operated on 12vdc, with front load, dust door and Fast Forward and Rewind push-button controls. The tape player is designed to automatically shut off and eject cartridges. A remote control mike can be mounted on either side of the unit. The unit reportedly plays pre-recorded stereo/monaural cassettes or will make monaural recordings. Price \$119.50. RCA.

### INDOOR ANTENNA 702

*Includes solid-state VHF amplifier*

An indoor antenna, called Chroma I, includes a solid-state VHF amplifier which reportedly increases incoming VHF TV signals seven times. It is designed to eliminate or minimize "snow" in primary and suburban areas but reportedly will not overload in metropolitan areas with strong signals. In addition to the built-in amplifier, the antenna employs a single 75Ω coaxial shielded cable. The shielded cable is said to include a combination unit which splits UHF and VHF signals to provide separate antenna inputs to the TV set, matching the shielded cable to the impedance of the TV set to minimize ghosts and color smears. Price \$21.95. Channel Master.



FOR MORE  
NEW PRODUCTS SEE  
PAGE 63

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We're all for independence.

In fact, some of our very best friends are independent. Independent distributors and service technicians. And they've done a lot for us.

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A long time ago we found out that nobody, but nobody, works harder than somebody who's independent.

An independent doesn't have any Big Daddy to fall back on if things get a little rough. To make it, he's got to produce, whether it's sales or service.

That's just what our independent distributors and service technicians have done. Produced. And made it.

In making it for themselves, they've made it for us. Which is one selfish reason we're so proud of our partnership with our independents.

It's also a good reason for not changing that relationship, for not disturbing a good thing. We don't compete with our independents. We'll continue to support them. Anything else would be self-defeating.

You might say that at Sylvania, we're perfectly happy to be dependent on our independents.

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## **TEKLAB REPORT**

This solid-state modular chassis not only represents a step into the future but is designed for simplified troubleshooting and servicing.

# Introducing Heathkit's Solid-State Modular Color TV

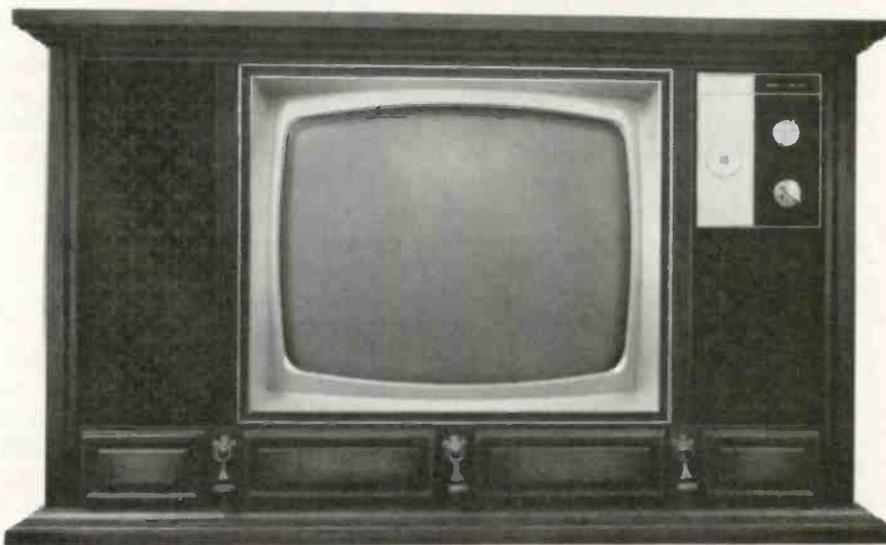
by Joseph Zauhar

■ Joining the parade of solid-state modular chassis for 1971, Heath Co. has introduced its Heathkit Model GR-270. This solid-state chassis employs 45 transistors; 55 diodes; 2 silicon controlled rectifiers; 4 integrated circuits containing another 46 transistors and 21 diodes; plus 2 tubes, the CRT and high-voltage rectifier.

A rear view of the chassis (Fig. 1) shows the 10 snap-in modular circuit boards and other important components and service controls.

This report proved to be very in-

Heathkit's Model GR-270 Color TV receiver in a Mediterranean style cabinet.



teresting, being the first color-TV chassis assembled by the ELECTRONIC TECHNICIAN/DEALER staff. We found the chassis easy to assemble because of a number of time-saving features: The manual provides clearly written step-by-step instructions with large fold-out pictorials—all critical circuits are preassembled and preadjusted, which includes the UHF and VHF tuners, the high voltage assembly, the automatic fine tuning assembly, and the IF amplifier assembly.

After assembling the chassis, we noted that it contained a number of important features, some Heathkit exclusives: Automatic Fine Tuning (AFT); Automatic Degreasing Circuit; Bridge type Low-Voltage power supply with high and normal ac taps for voltage corrections; Dual VHF Antenna inputs—300 $\Omega$  balanced or 75 $\Omega$  coaxial input; Plug-in circuit boards; and Plug-in transistor sockets.

The final checkout and adjustments proved to be a simplified procedure. After assembling a circuit board it could be checked with an exclusive check-out meter provided. The troubleshooting manual charts provide voltage and resistance measurements for given points on the board or chassis, so simplified that even a beginner could do some of

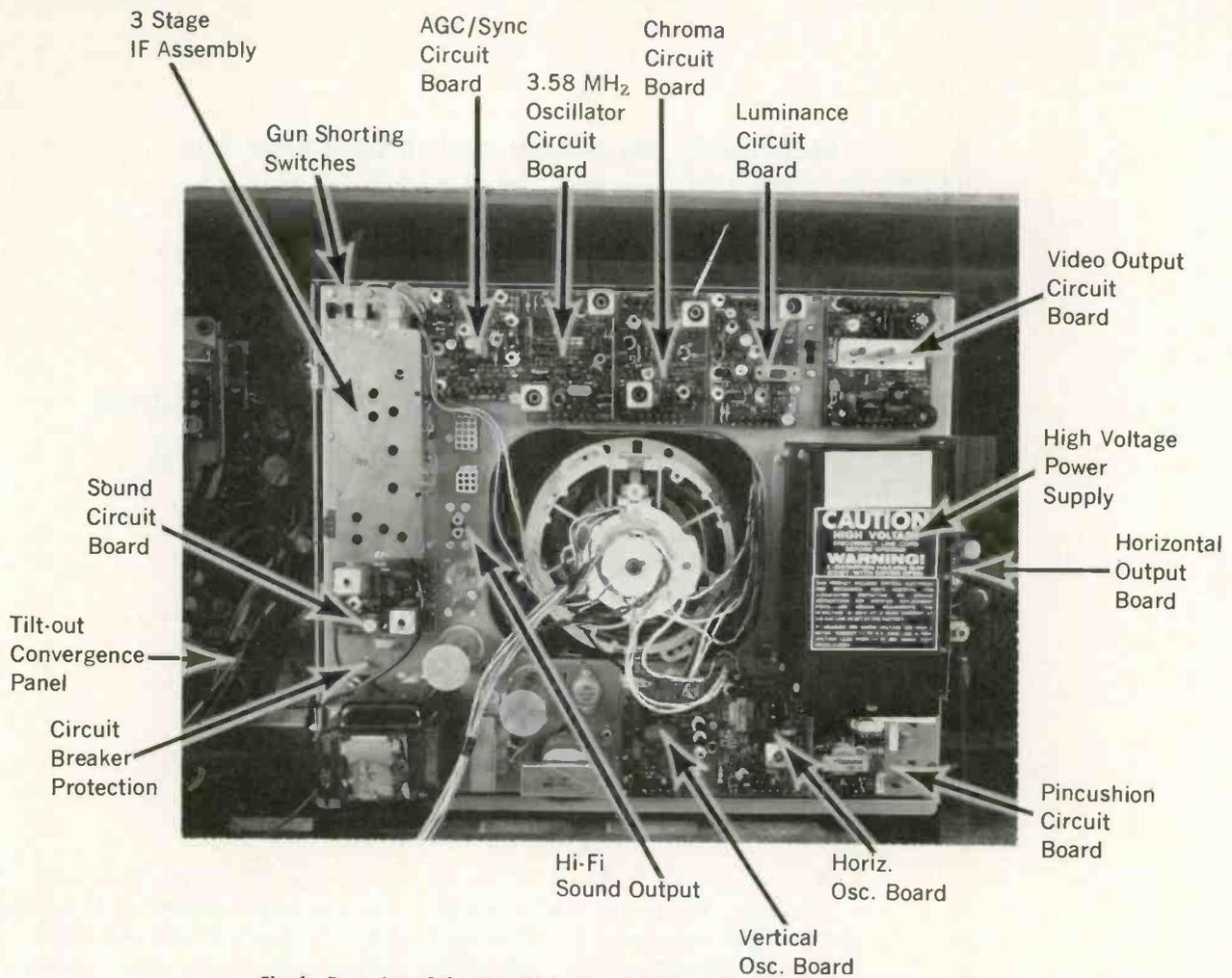


Fig. 1—Rear view of the chassis showing the 10 snap-in panels and service controls.

the troubleshooting. The chassis included a built-in dot generator and gun killing switches, everything needed for complete set-up of gray scale and convergence. The convergence and secondary control panel tilts out from the front of the cabinet exposing the Height, AGC, Color Killer, Tone, Video Peaking, Dots and Convergence controls for instant adjustment.

The solid-state VHF tuner uses a MOS-Field-Effect transistor and Gold/Niobium contacts for better electrical connections and longer wear. The three stage, solid-state IF section is contained in a single factory-aligned and assembled unit.

We also assembled the Remote Control receiver, Model GRA-70-6. Nine TV functions can be controlled with its transmitter. They are as follows: TV ON/OFF, VHF channel selector, and the Tint and Color control can be rotated in a clockwise or counterclockwise direction.

The remote-control receiver employs 6 transistors, 1 integrated circuit (equivalent to 10 transistors, 1 diode, and 15 resistors); all of which are mounted on a circuit

board. The final adjustments were simplified by a built-in meter.

According to the manufacturer, their electronic centers will service and return solid-state TV circuit modules within two working days. During the 90-day warranty period, TV modules will be serviced or replaced with no charge for labor or parts. After the initial 90-day warranty period the TV modules will be serviced or replaced at a fixed charge of \$5.00 per module for labor and parts for a period of two years.

The following circuits are just a few of the important circuits employed in this solid-state TV chassis, and an understanding of these circuits will prove useful when troubleshooting is necessary.

#### Color, Automatic Color Control, and Color Killer Amplifier

The video signal is coupled from the output of the IF circuit board to pin 11 on the chroma circuit board. Coupling capacitor C353, coil L351, resistor R359, and capacitor C354 shown in Fig. 2, form a wave-shaping network at the 3.58MHz color signal frequencies.

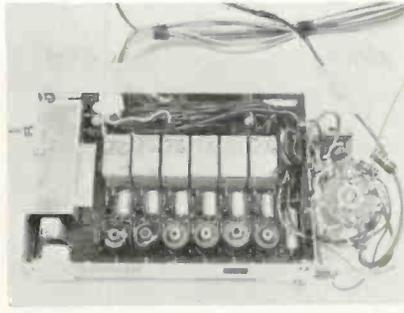
The gain of the first color amplifier, transistor Q354, is controlled by the collector voltage of the ACC (Automatic Color Control) amplifier Q352 in the following manner: A voltage divider made up of resistors R354, R355 and R356, and ACC amplifier transistor Q352 sets the base bias of transistor Q354 for maximum gain when no color signal is present.

The ACC detector develops a negative voltage when a color signal is present. This negative voltage is coupled to the base of transistor Q351 through resistor R351 and pin 5 of the chroma circuit board. When the color signal increases, transistors Q351 and Q352 conduct less, which increases the voltage at the base of transistor Q354. Because of the forward automatic gain characteristics of transistor Q354, the amplification of the chroma signal is reduced.

The amplified color signal is coupled through capacitor C355 to the base of the second color amplifier transistor Q355. Base bias for this stage is provided by voltage divider resistors R363 and R364. The signal at the collector of transistor Q355 is



The handy check-out meter along with well written service data simplifies troubleshooting of the chassis.



The nine TV-function solid-state remote control receiver has self-contained meter for adjustment purposes.

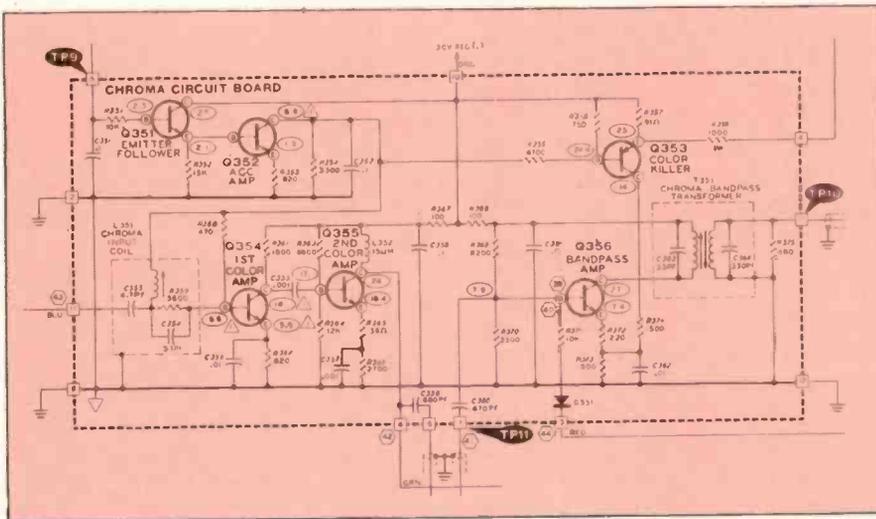


Fig. 2—The chroma circuit board contains the Color, Automatic Color Control, and Color Killer Amplifier circuits.

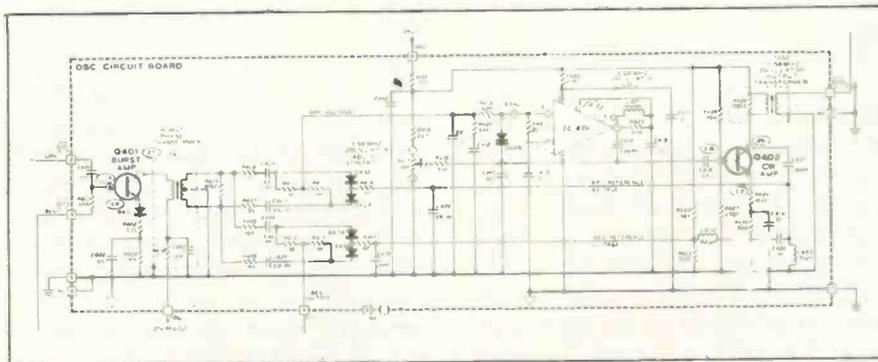


Fig. 3—Schematic of the 3.58MHz Oscillator, Phase Detector, ACC Detector and Burst Amplifier circuits. The 3.58MHz Oscillator, IC401, is a modified Colpitts circuit.

connected through pin 8 on the chroma board to pin 2 on the oscillator board. The signal is also coupled through capacitor C359 to the Color control through pin 9. The center tap of the Color control is connected through pin 7 and capacitor C360 to the base of the bandpass amplifier, transistor Q356. Transistor Q356 is biased by a voltage divider, consisting of resistors R369 and R370. Pulses from the blanking amplifier transistor, located on the

luminance circuit board, are applied to pin 3, through diode D351 and resistor R371 to the base of transistor Q356 to turn the transistor OFF and prevent color signals from appearing during the retrace portion of the scan.

The color killer controls the emitter circuit of transistor Q356 as follows: Base bias for the killer transistor Q353 is provided by the same voltage divider network that set the bias on the first color signal ampli-

fier, transistor Q354. An adjustable bias is applied to the emitter of transistor Q353 by a voltage divider made up of resistors R357 and R358, and the Killer control. The emitter voltage of transistor Q353 can be adjusted either positive or negative with respect to the base voltage, which is applied by the ACC amplifier. Since transistor Q353 is a PNP-type transistor, and the emitter voltage is adjusted slightly positive with respect to the base, collector current will flow. When no color signal is present, the Killer control is adjusted so that just enough collector current is allowed to flow through resistors R373 and R374 to make the emitter of the bandpass amplifier, transistor Q356, positive with respect to its fixed base bias. Since the bandpass amplifier is an NPN-type transistor, no collector current is then allowed to flow and the transistor is turned OFF. When a color signal is present, the ACC voltage at the junction of resistors R356 and R355 will go in a positive direction. This will cause the killer transistor to turn OFF and the bandpass amplifier to return to a normal operating condition.

### 3.58 MHz Oscillator, Phase Detector, ACC Detector & Burst Amplifier

The 3.58MHz oscillator, IC401, is a modified Colpitts circuit as shown in Fig. 3. Feedback energy necessary to sustain oscillation is coupled from the output (terminal 7) of IC401 to the input (terminal 3) by the ac capacity voltage divider, capacitors C415 and C413. The operating frequency is determined by the 3.58MHz crystal, CR401, and the capacity of varactor diode D406. The frequency of the oscillator can be varied over a limited range by changing the automatic phase control voltage across the varactor diode. In this manner, the automatic phase control voltage and the voltage determined by the divider network, comprised of resistors R416 and R417, will control the oscillator frequency and phase. Resistors R418 and R419 serve to isolate the oscillator input circuit's ac signal from the dc control voltages.

The output of the oscillator circuit is coupled through capacitor

C418 to the base of the continuous wave amplifier, transistor Q402. The base bias for this stage is provided by a voltage divider, resistors R427 and R428. The amplified reference signal present at the collector of transistor Q402 is developed across the primary of transformer T402 and coupled by its secondary through pin 11 to pin 2 of the video output circuit board. A portion of the signal at the collector of transistor Q402 is fed back through capacitor C421 and resistor R414 to the junction of automatic-phase-control detector diodes D402 and D403. The collector signal is phase shifted 90° by capacitors C420 and C421 and fed through resistor R415 to the junction of ACC detector diodes D404 and D405.

The color signal at the output of the second color amplifier on the chroma circuit board is coupled through capacitor C401 to the base of the burst amplifier Q401. A positive-going keying pulse, derived from the horizontal output transformer, is also coupled to the base of Q401 through resistor R401. Transistor Q401 is gated into conduction by the keying pulses, which arrive at the transistor base coincidentally with the burst signal. The burst appears across the primary of transformer T401. During conduction, resistor R402 and capacitor C402 provide an effective ac bypass. Resistor R402 offers the desired amount of emitter degeneration for amplifier stability and determines the maximum voltage gain. The burst amplifier base-to-emitter bias is maintained below cutoff between burst-key pulses to assure that only color sync information is applied to the APC (Automatic Phase Control) detector. Cutoff bias is provided by the discharging action of emitter bypass capacitor C402 through emitter resistor R403. Emitter current flow, caused by the application of the burst-keying pulses, places a positive bias on the emitter, which effectively reverse biases the transistor during scan time. Diode D401 prevents this bias voltage from exceeding the reverse emitter-to-base breakdown voltage. The burst signal is coupled to the secondary of transformer T401, which is loaded by resistor R405.

Because of the grounded center tap of the secondary, the voltages appearing at the opposite ends of the transformer T401 secondary will be 180° out of phase with each other. The signal on one end is fed through resistor R406 and capacitor C404 to the anode of detector diode D402. The signal at the other end of the transformer is coupled through resistor R407 and capacitor C405 to the cathode of detector diode D403. When the burst signal and the reference signal from the oscillator are compared in the diodes for both phase and frequency and found to be "locked in," there will be no voltage developed at the junction of resistors R410 and R411.

The control voltage from the phase detector will vary in polarity depending on the direction of the error in frequency or phase with respect to the 3.58MHz burst signal. This variable control voltage is applied to the anode of varactor diode D406 and causes the tuned frequency in the input circuit of the oscillator to change. The oscillator frequency will increase or decrease until it is locked in phase and frequency with the 3.58MHz burst signal. The APC voltage filter network is made up of capacitor C411 and resistor R420 in series with capacitor C412.

The burst signal is also supplied to the ACC detector diodes D404 and D405. The operation of the ACC detector is exactly the same as that of the APC detector, except that the 3.58MHz reference input is shifted 90°. The detector will produce a negative dc voltage at the junction of resistors R412 and R413 that is proportional to the amplitude of the applied burst signal. A fixed dc bias voltage developed across a voltage divider network (resistors R423 and R424) is applied through resistor R415 and diode D405 to this same junction. The fixed dc voltage and the developed ACC voltage is coupled through pin 4 of this board to pin 5 on the chroma circuit board.

### Color Demodulator

The 3.58MHz oscillator reference signal, which is obtained through pin 2 of the video output circuit board, is coupled to the phase shift

network shown in Fig. 4. The phase of the reference signal at the junction of coil L301 and capacitor C301 can be shifted approximately 70° to allow for proper tint adjustment. The reference signal at this point is coupled by capacitor C302 to terminal 4 (REF "B") of the demodulator integrated circuit, IC301. The phase of the reference signal is also shifted 103° by a network consisting of coil L302, resistor R302 and capacitor C304. This "second reference signal" is coupled by capacitor C303 to terminal 5 (REF "A") of IC301. The chroma signal at pin 1 of the circuit board is coupled through capacitor C305 to terminal 3 of IC301.

IC301 contains two doubly-balanced synchronous detectors (balanced to both reference and chroma signals).

The chroma signal at terminal 3 of the integrated circuit is connected to the parallel inputs of transistors Q316 and Q318 (see Fig. 5). Opposite-phase chroma signals from the differential amplifier, transistors Q315 and Q316, are supplied to transistor switches Q307, Q308, Q309 and Q310. Opposite-phase chroma signals from the differential amplifier, Q317 and Q318, are supplied to transistor switches Q311, Q312, Q313 and Q314. The switches are controlled by two signals: the reference signal at pin 4, which is applied to the bases of transistors Q311 and Q314; and the "second reference signal" at pin 5, which is applied to the bases of Q307 and Q310. The chroma signal currents from each differential amplifier will flow into one of the two outputs, depending upon the instantaneous state of the individual switches.

The outputs from each of the two synchronous detectors are applied to a resistive decoder matrix made up of resistors R318 through R326 where color-difference signals are developed. These color-difference output voltages from the matrix are fed to emitter follower transistors Q322, Q323 and Q324. The 250Ω resistors at the emitter of each output transistor offer protection against damage from accidental short circuits.

DC bias and color signals for the red output amplifier, transistor Q302

(Fig. 4), are developed across resistor R305, which is bypassed by capacitor C307. DC bias for the green amplifier, transistor Q303, is developed across resistor R309 which is bypassed by capacitor C309. DC bias and color signal for the blue amplifier, transistor Q301, is developed across resistor R313 which is bypassed by capacitor C311. The outputs of the three transistors will now contain color as well as the luminance signal.

[This circuit represents a complete reversal in the electronics industry. At one time color circuits were simplified to the point where only the red and green color signals were demodulated and the CRT was not only used to produce the picture but to combine the red, green and luminance signals for a synthesized

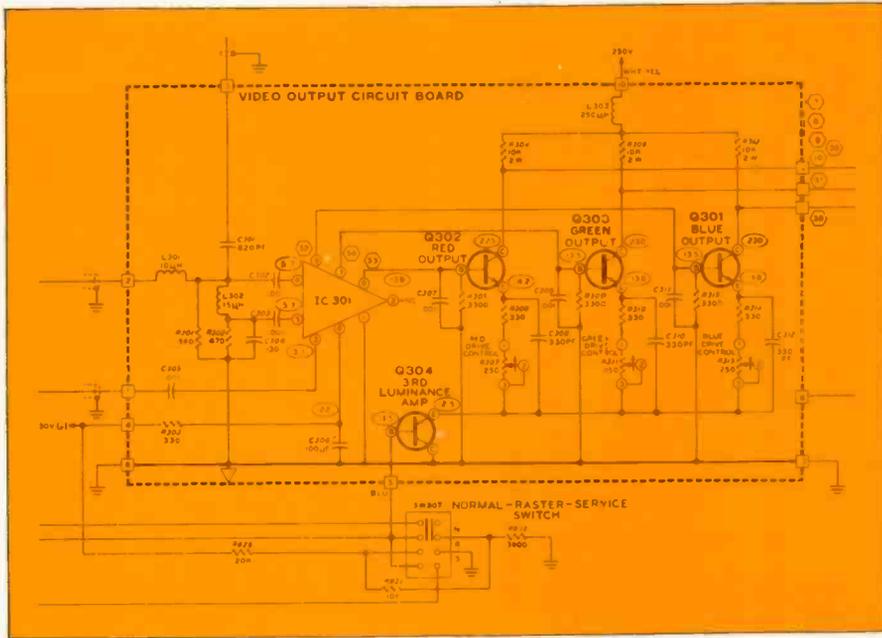
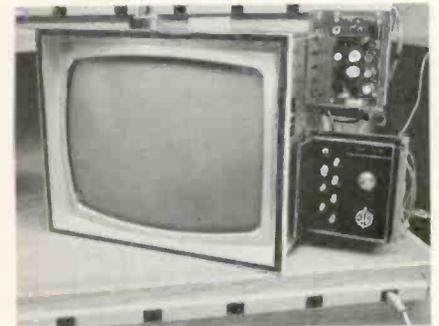


Fig. 4—The Color Demodulator circuit contains an integrated circuit, IC301, with two doubly-balanced synchronous detectors.



Front view of the TV-set console with tilt down convergence and secondary control panel, simplifying set-up adjustments.



The CRT, chassis and control assemblies can be mounted in a wall, your own cabinet, or a Heath TV cabinet.

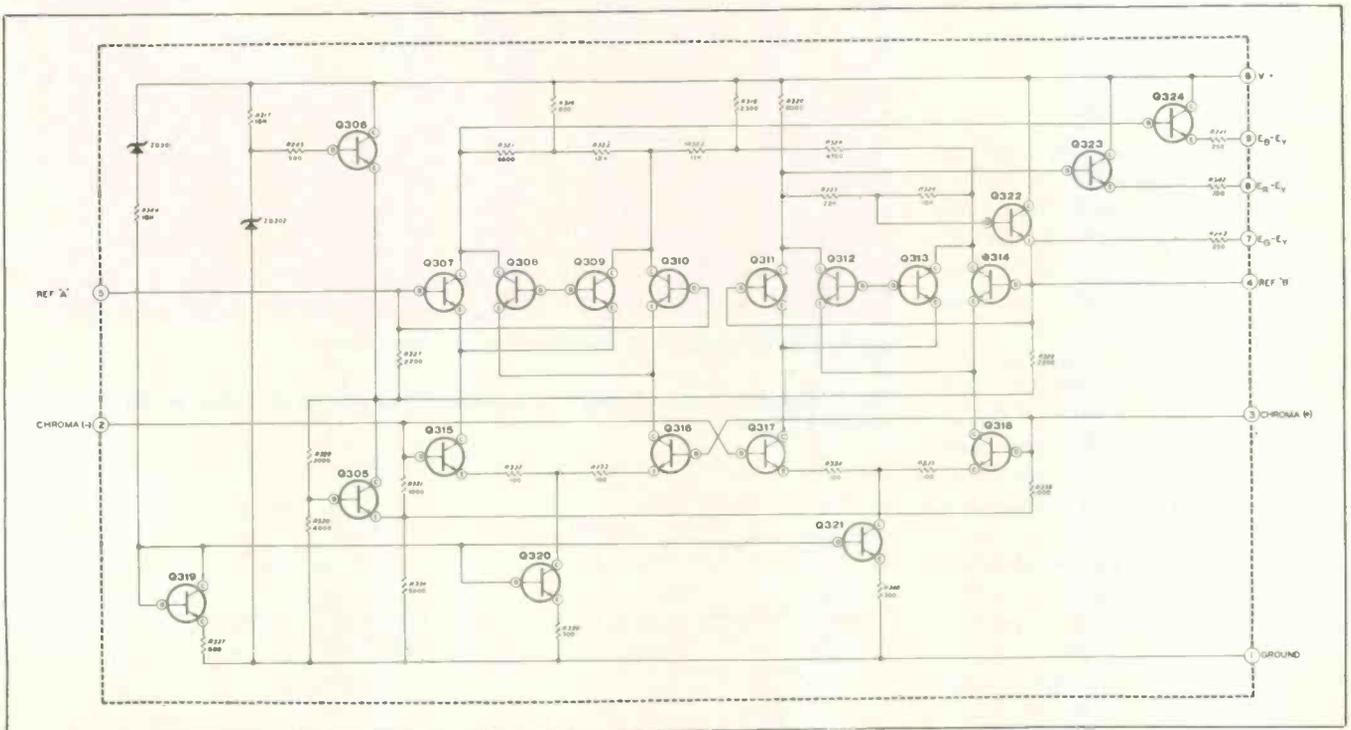


Fig. 5—Schematic of Integrated Circuit IC301 located on the video output circuit board.

blue signal. Recently the circuits were improved so that besides producing the picture, the CRT was required to only mix the three demodulated color signals with the luminance signal. Now we have reached the sophistication where all required signals are produced and mixed prior to being applied to the CRT—the production of mixed signals no longer being dependent on individual tube characteristics.]

### High Voltage Generation

During the horizontal retrace, the steep side of the horizontal “fly-back” waveform causes high voltage pulses to be induced in transformer T701. Fig. 6 shows how the secondary of transformer T701 steps up the pulses to an even high voltage and applies the pulses to the plate of the high voltage rectifier tube, V701. High voltage dc at the cathode of tube V701 is filtered by the capacitance between the inside and outside coatings of the picture tube.

A 180M high-voltage resistor, R700, is coupled from the cathode of tube V701 to the focus control (potentiometer R702 and resistor R703) and the Screen Grid controls (resistors R847, R848 and R849) to provide focus and screen voltages. Resistors R700, R702 and R703 also provide a high voltage discharge path to ground when the TV set is turned OFF.

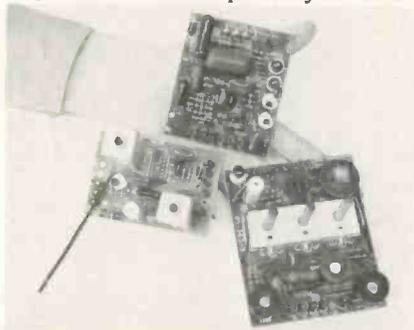
### High Voltage Regulation

The high voltage is regulated by controlling the amount of energy made available to the horizontal output circuitry. These circuits are supplied by the energy stored during the horizontal trace time (Fig. 7), primarily in commutating capacitors C603 and C604. These capacitors are charged during the trace time through one winding of transformer T703. To provide a means of controlling the energy on the commutating capacitors, the inductance of T703 is designed to resonate with capacitors C603 and C604 at a frequency that is approximately twice the horizontal scanning frequency. The exact resonant frequency is made variable by the high-voltage regulator circuitry. The resonance of the primary of transformer T703



A typical Heathkit Electronic Center located in Hopkins, Minn.

and capacitors C603 and C604 is made variable by controlling the inductance of the transformer's primary with a saturable reactor, T702. The saturable reactor load winding (green to red) is connected in parallel with the primary of trans-



The relative size of the vertical oscillator, sound and video output modular plug-in circuit boards.

former T703. Changing the current in the reactor control winding (B/W) varies the total inductance represented by the two parallel windings of reactor T702 and transformer T703. The control current for the reactor is determined by the high-voltage regulator, transistor Q601. The collector current of this transistor is controlled by the voltage across the yoke return capacitor C609. This voltage, which reflects high-voltage changes, is sampled by the high-voltage adjustment control and is compared to a reference voltage determined by zener diode ZD601. The resulting voltage difference, representing high-voltage changes, controls the conduction of the high voltage regulator transistor Q601. ■

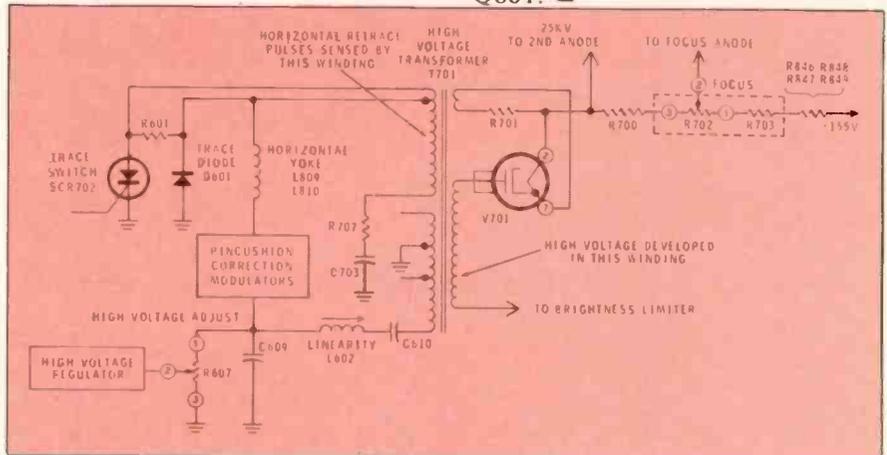
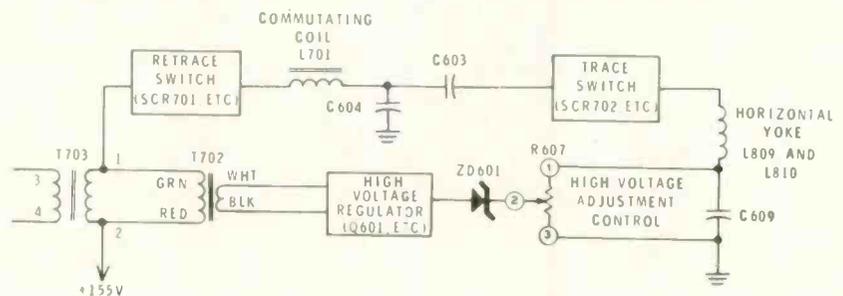


Fig. 6—A partial schematic of the high-voltage generation circuit.

Fig. 7—The block diagram illustrates the relationship of components making up the high-voltage regulating system.



# Previewing 1971 Hi-Fi Equipment

by Joseph Zauhar

Listed are some of the Hi-Fi equipment you may encounter in the coming year.

■ Magnetic tape continues to be the fastest growing consumer electronic product for the first quarter of this year. Tape recorders, including reel-to-reel and cassette equipment, totaled 1.6 million units, compared to 1.2 million units in the same 1969 period.

The FM share of radio sales continues to increase with 5.0 million radio sets sold in the first quarter of this year compared to 4.1 million sets in the same period in 1969.

These figures are based on the total U.S. sales of the products, including imports, and were released by the Electronic Industries Association's Marketing Services Department.

Listed are some of the better quality home entertainment equipment that contain new features. They are not necessarily in the high price range. The specifications given are as indicated in current manufacturers' literature and the models are listed in alphabetical order with no other significance in the sequence.

## Admiral Corp.

The Audio 7500 (STC751) is a three piece modular stereo component system featuring the Tunnel Reflex sound system found in the company's console and portable stereos. It has field effect transistors, four speakers, an FM/AM receiver, four-speed record changer, built-in stereo cassette



tape recorder, slide lever controls and a floating diamond stylus. The lightweight tone arm has a cueing lever designed to permit accurate manual placement of the tone arm in selected bands of the record. The solid-state chassis has 20w power output. This model retails for \$339.95 in a walnut grained cabinet.

## AIWA

### Selectron International Co., Inc.

The AIWA Model TPR-2001 AM/FM/Stereo FM Multiplex Receiver-Staar System Stereo Cassette Recorder is produced with a walnut finish enclosure and black tuning panel. According to manufacturer specifications the unit is rated at 40w RMS and employs solid-state circuitry: 46 transistors, 17 diodes, 8 varistors and 1 SCR.

Featured are a slide-rule tuning dial, stereo indicator, concentric knob receiver, mode selector for AM/FM/FM Multiplex, tape, phonograph or auxiliary source, separate Tone, Volume and Balance controls and tuning control. A front-mounted stereo headphone jack is included, and the speak-



ers are automatically switched OFF when headphone pin is inserted. The "Speakers OFF" switch is provided to cancel the main speakers for extension speaker listening.

Also included is a stereo cassette recorder module featuring a Staar system, front-loading slot. Special circuitry is said to insure separate channel stereo from cassettes. The manufacturer has provided push button controls for record, pause, fast forward, stop and rewind.

## Allied Radio Shack, Div. of Tandy Corp.

A Knight-Kit Model KG-996, 240w stereo FM/AM receiver is designed with silicon-transistor circuitry and an FET front end which reportedly provides  $2\mu\text{v}$  of FM sensitivity. The receiver has a rated response of 20 to 30,000 Hz,  $\pm 1$  dB, with less than 1 percent harmonic distortion. Stereo separation is over 30dB and the signal-to-noise ratio is 50dB.

Sliding type Bass and Treble controls

allow accurate, easy adjustment of sound, and toggle switches control interstation Silencing, Scratch and Rum-



ble filters, Loudness Contour and AFC. Inputs are provided for tape head, magnetic phono, crystal phono, and auxiliary. An ac speaker switch selects main, remote, both speakers or speakers OFF for private listening through the stereo headphone jack.

Other features include automatic stereo-mono FM switching and a stereo FM light that indicates reception of a stereo broadcast. A signal strength tuning meter helps pinpoint stations for best reception.

The stereo FM/AM receiver kit is priced at \$229.95, complete with a walnut veneer wood case which measures 5 in. by 18½ in. by 14½ in.

## Altec Lansing

A deluxe AM/FM Cassette Music Center, Model 912A, includes an FM tuner which has three FETs, two crystal filters and an integrated circuit. Also featured are a Garrard turntable, Staar cassette stereo tape recorder with two VU meters for recording from any source, black-out dial with illuminated center tune meter, slide controls for Volume, Balance, Bass and Treble, and a Volume Range switch for low-level listening. The system includes direct-plug-in modular circuitry, an electronic protection system, push-button controls for power, FM, AM, Phono, Auxiliary, Cassette, High Filter, Mute, Loudness, Mono, Volume Range and Speakers, front panel microphone inputs and tape recorder gain controls and spring loaded terminals for all speakers.

The manufacturer's specifications indicate  $1.9\mu\text{v}$  IHF sensitivity for the tuner. In the amplifier, the 8Ω, RMS power output on both channels is 44w. Frequency response is  $\pm 1$ dB for

15 to 45,000Hz. The phono sensitivity is 5.0mv, and the tape recorder frequency response is 50 to 10,000Hz.

The music center is housed in a



walnut cabinet, and a dust cover is provided. The dimensions are 6 $\frac{7}{8}$  in. H by 21 $\frac{1}{2}$  in. W by 19 $\frac{1}{2}$  in. D.

### Audiovox Corp.

A Model C-886 AM/FM/MPX Home Receiver has been designed with an eight-track stereo tape player. These units combined in one makes it a complete home entertainment center.

One unit consists of an eight-track stereo tape player, complete with program indicator light, manual and automatic track switching, four-pole ac synchronous motor. The second unit is a complete AM/FM/MPX multiplex broadcast receiver with automatic gain control, automatic frequency control and changeover circuit. The third unit, a fully regulated stereo pre-amplifier and amplifier, with peak music output



power of 80w and three sets of RCA type input jacks, allows for the input of a ceramic or magnetic cartridge record changer or any additional audio systems.

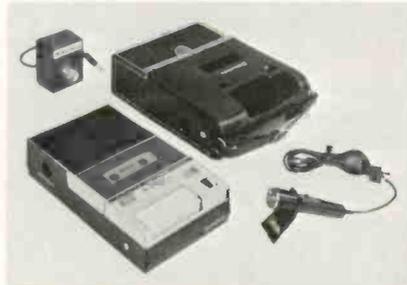
The manufacturer's specifications indicate that the frequency response of the AM audio is from 100 to 3000Hz and the FM audio is from 100 to 6000 Hz. The entertainment center contains a total of 36 transistors and 16 diodes.

The dimensions of the main unit measure 17 $\frac{3}{4}$  in. W by 9 in. D by 4 $\frac{1}{2}$  in. H, and it weighs 40 lb.

### Bell and Howell

A Model 294M Music Model Player/Recorder includes a 294 cassette tape recorder which allows the raising or lowering of the pitch of a prerecorded note by 3 percent or  $\frac{1}{4}$  tone. The Pitch Control makes it possible to tune the recorder to match the pitch of an organ, piano or other musical instrument.

Convenient operating controls include: push-buttons for Record/Play, Fast-Forward, Rewind and Stop modes. Also included is a Volume control, Detachable Pitch control, and battery/VU meter which monitors recording level and battery condition. The automatic record level feature eliminates the need for adjustments when recording. Jacks are provided for



earphone, microphone and direct recording from other equipment. The unit operates on five C-size batteries, or from an ac/dc converter.

According to the manufacturer's specifications the unit has a frequency response of 50 to 7000Hz with a signal-to-noise ratio greater than -40dB.

The dimensions of the unit are 4 $\frac{7}{8}$  in. W by 8 $\frac{3}{4}$  in. D by 2 $\frac{3}{8}$  in. H with a net weight of 4 lb 6 oz.

### Benjamin Electronic Sound Corp.

A Model 2036 AM/FM Stereo Receiver has been designed to provide a low-distortion output of 70w EIA. Baxandall feedback-type Bass and Treble Tone controls are featured for a wide variety of tones. Volume controls with separate loudness pushbuttons and pushbuttons for power, main and remote speaker switches are also employed.



The C117 automatic turntable, made in Great Britain, reportedly has wow below 0.2 percent and flutter below 0.06 percent, and a four-pole heavy duty motor.

The genuine oiled walnut speaker cabinets have an especially designed 8-in. woofer plus a 3 $\frac{3}{8}$ -in. tweeter and uses air-suspension enclosures for clean tone response.

A newly-designed cassette tape recorder provides both recording and playback facilities with the other components of the music system. Pushing in the cassette turns ON the entire unit for recording or playing a pre-recorded tape. At the end of the tape the cassette pops out and the amplifier shuts OFF.

The tape recorder has a harmonic distortion of less than 1.5 percent and a speed accuracy of  $\pm 0.3$  percent. The frequency response is 30Hz to 11kHz  $\pm 2$ dB, and the signal-to-noise ratio is 50dB.

The center section dimensions are 9 $\frac{7}{8}$  in. by 20 $\frac{3}{8}$  in. by 16 $\frac{1}{8}$  in., and its shipping weight is 65 lb.

### Bogen

A High-Fidelity Manual Turntable, Model B-111, has been developed for applications in stereo and monophonic



sound systems with two speeds—33 $\frac{1}{3}$  and 45 rpm.

The unit has a dynamically balanced cast aluminum turntable for smooth and stable operation and a hysteresis synchronous motor for constant speed, unaffected by variations in line voltage. A light-weight, studio-type tone arm with a revolving counter-weight provides simple and accurate adjustment of the stylus pressure. The turntable employs a polyurethane belt drive to reduce possible flutter and wow, in conjunction with an aluminum, die-cast platter.

The plug-in pick-up head accepts all standard phono cartridges and the anti-skating device permits light tracking

without skips or distortion. The unit is automatically turned OFF by a shut-off mechanism after the record has been played.

The turntable, priced at \$99.95, is furnished with tone arm, cartridge, walnut base and dust cover.

### British Industries Co.

A Model 71/3R Stereo Receiver is designed with a computerized tuning



circuit in the FM section, providing full noise suppression. When tuned accurately the "center tune light" illuminates and the sound goes ON.

According to the manufacturer's specifications the FM section has a sensitivity of  $1.8\mu\text{V}$  maintained during muting. The IF amplifier also incorporates three integrated circuits in combination with crystal filters, and the multiplex section contains integrated circuits and specialized filters for noise-free amplification of stereo signals and optimum noise rejection and stereo separation.

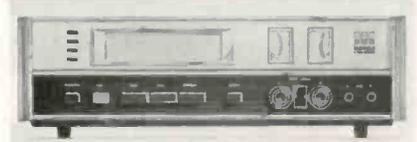
The AM section has the same computing network as in the FM section, using the "center tune light."

The power amplifier has an output of 100w RMS, both channels driven and the power bandwidth rated full power at all frequencies. Speaker fuses and a quasi-complimentary output circuit offer protection against shorts and overload.

The unit price is \$497.00.

### BSR McDonald

The Model RD8S 8 Track Record/Playback Deck incorporates an exclu-



sive operating feature that allows the user to pre-select how much of the tape he wants to hear or record. The unit will play the entire tape continuously or automatically eject the tape after the first or fourth program. This feature overcomes the common cause of 8-track cartridge damage.

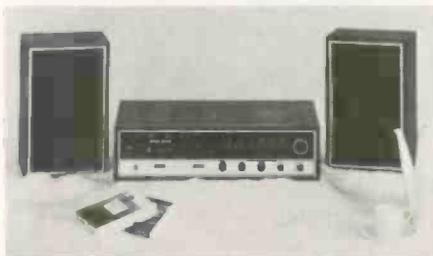
The deck is of particular interest to

the customer who already owns a 8-track playback system for his car; and with the new deck he can record his own tapes at home.

Completely compatible with any BSR McDonald or other stereo systems, the unit comes complete with a factory-installed walnut cabinet and 3 ft patch cord.

### Channel Master

This AM/FM/FM Stereo Receiver, Model 6206, comes with an eight-track cartridge player and is designed with solid-state circuitry, delivering 16w of music power through two bookshelf speakers. The circuitry employs 8 transistors in the radio tuner, 3 in the multiplex section and 18 transistors in the audio circuit, plus 26 diodes and 2 thermistors. The receiver covers from 540 to 1600kHz on the AM band and 88 to 108kHz on the FM band. The manual controls include: vernier tun-



ing, power ON/OFF, Volume, separate Bass and Treble plus Balance.

Other features include: dial light, slide rule tuning dial, track indicator light, 100v outlet and speaker connecting cords. The tape cartridge player switches tracks automatically.

The amplifier unit measures  $16\frac{3}{4}$  in. by 5 in. by  $10\frac{1}{2}$  in. and speaker enclosure is  $11\frac{3}{8}$  in. by 7 in. by  $4\frac{3}{4}$  in. in walnut finished wood cabinets.

### Commodore

A Model MPX 1000 AM/FM Stereo Multiplex receiver has been designed with AFC and a eight-track cassette tape player. The AM/FM Stereo Receiver has solid-state circuitry and a built-in Stereo Eye for accu-



rate FM stereo tuning.

According to the company's specifications the unit delivers 80w peak output with less than 1 percent distortion at 5w.

The speaker cabinets, finished in walnut, contain four speakers, two  $6\frac{1}{2}$  in. woofers and two  $3\frac{1}{2}$  in. tweeters.

The satin finish walnut (wood cabinet) has a brushed aluminum front and measures 23 in. by 5 in. by 8 in.

### Concord Electronics Corp.

A Stereo Cassette Tape Deck, Model F-106, includes such deluxe features as VU meters, tape counter, pause control, noise filter and headphone monitoring. In addition to the pause control, the unit has a remote control capability for use with the RC-3 remote control to start or stop the recording.

An automatic stop system stops the tape motion and the motor at the end of the tape cassette, reducing excessive wear; and a pilot lamp indicates when the tape runs out. The recorder also features separate channel record level controls.

According to the manufacturer's specifications the unit has a frequency response of 40 to 12,000Hz and wow and flutter less than 0.2 percent RMS.

The input and output patch cords, RC-3 remote control switch and the



microphone are accessories included with the recorder. The unit measures  $10\frac{1}{2}$  in. D by  $10\frac{1}{4}$  in. W by  $3\frac{1}{2}$  in. H and weighs 4 lb 6 oz.

### Craig Corp.

A Model 2614 Portable Cassette Recorder features a simplified rotary tape function control, easy snap-in leading and an automatic level control. The unit, with a storage compartment for a microphone, also features earphone and adapter jacks, and operates on six C-size batteries. It records and plays up to one hour with standard C-60 cassettes or longer with extended

play cassettes. All mono and stereo music cassettes can be played with full-



ly compatible monaural sound. The recorder is finished in a white and blue color combination.

The wow and flutter is reportedly less than 0.35 percent RMS, output power is 1000mw peak, and the signal/noise ratio is 35dB. The frequency response is 150 to 6500Hz. The speaker size is 2½ in. by 4 in. (oval) and the outside dimensions are 8⅝ in. W by 10 in. L by 2¾ in. D. The unit weighs 3.3 lb with batteries and has a retail price of \$35.95.

## EICO

A Cortina-2 Model 3780 Silicon Solid-State 50w AM/FM Stereo Receiver employs an advanced field-effect transistor (FET) and all silicon semiconductor design. The RF, IF and MPX sections come pre-assembled and



pre-aligned for easy construction. The preamp controls inputs and outputs for every music program source, and the FM tuner circuit has time-switching multiplex for mono and stereo FM reception.

The kit sells for \$109.95 and the factory assembled unit costs \$169.95.

## Electro Brand, Inc.

A complete home entertainment stereo center, Model EB 6560, is an AM/FM/FM Stereo Multiplex Receiver with stereo cassette deck. The

unit plays prerecorded cassette tapes or records directly from a radio or phono. The amplifier is fully transistorized and has 10w music power. The receiver has separate Balance, Bass, Treble, Loudness and Tuning controls. A six position function switch is provided on the front panel for Phono, AM, FM, FM AFC, FM Stereo and Tape Auxiliary.

Other features on the tape deck include two VU meters, volume controls, dual auxiliary inputs, push-button keyboard controls for record, rewind and fast forward.

Two mikes and a dust cover to protect the tape deck are included. The



walnut grain wood cabinet measures 24½ in. by 6 in. by 11 in. and has a shipping weight of 30 lb.

## Electrographic Corp. of America

A four-piece Solid-State Modular Music System is designed for the component market. The music system has a deluxe Garrard turntable, with a cueing device; a diamond stylus; and a smoked dust cover.

The component module houses an AM/FM and FM Multiplex radio, as well as an eight-track stereo tape cartridge player. Two air suspension speaker enclosures are also included in the package. The Model 4GT644, named "The King IV," is a genuine walnut veneer unit, with blacklighted calibrated circular tuning dial.

This 100w IPP system has slide controls for separate bass, treble, balance and volume. The matching air-suspension



system incorporates 12 Duocone speakers for maximum sound reproduction. The system has a suggested list price of \$249.95.

## Elpa Marketing Industries, Inc.

A Thorens Model TD-125 Series Three-Speed Turntable is designed with solid-state circuitry replacing me-



chanical methods of speed control. The motor rotor velocity is governed by a Wien Bridge transistorized oscillator. Its frequency is varied by a switch to change the motor speed and can be viewed on the built-in stroboscope.

The changer employs a 16-pole synchronous motor mounted on a separate but integrated chassis with a belt-drive system acting as a filter between motor pulley and flywheel of the turntable. The dynamically balanced turntable platter weighs 7 lb and measures 12 in. A push-pull amplifier is rated at 20w.

All controls are conveniently accessible on the front panel. The ON/OFF slide switch, the three-speed selector, fine speed control and the illuminated window for the stroboscope are the only visible controls. The unit measures 18 in. L by 5 in. H by 14 in. W and sells for \$205.00.

## Emerson

The Model 31M17 Solid-State Dual Channel Stereo Amplifier has 30w of audio output. Some of its features include: FET tuner with four IF stages, three-gang capacitor in both FM and AM sections, automatic frequency



control, boost type Bass and Treble controls, stereo headphone jack and phono input jack.

Other features included are tape jacks for recording off the air or playing pre-recorded material, and an audio augmentor which reproduces full tonal values even at low volume.

The high compliance free floating cone speakers in the sealed acoustic chamber, crafted of oiled walnut, measures 8 15/16 in. W by 13¾ in. H by 8⅝ in. deep.

The main unit cabinet comes in

oiled walnut and features a "soft glow" black out tuning dial and tilt-up control panel. The tuner amplifier measures 16 3/4 in. W by 4 1/2 in. H by 10 5/8 in. D.

### Fisher Radio

The Model 701, a Four-Channel AM/FM Receiver, features three FET's, four IC's, Muting, Auto Scan electronic tuning and a usable sensitivity (IHF) of 1.7  $\mu$ v. The amplifier has 250w of music power, 125w per stereo channel, and sliding front and rear channel Volume controls.

Other features include dual Bass, Treble and Balance controls for front and rear channels; Four-way Speaker selector; and a High Filter switch for front and rear channels. A Loudness



switch is also employed for the front and rear channels.

The dimensions (including control panel and AM antenna) are 16 15/16 in. W by 5 1/4 in. H by 16 1/2 in. D. The unit weighs 34 lb.

### General Electric

A stereophonic eight-track tape cartridge component system, Model M8630, includes an FM/AM/FM-stereo tuner. The contemporary-styled system is designed to accept all standard eight-track tape cartridges and reportedly provides up to 36w of peak music power (18w EIA music power). A band of function lights indicate the unit's operational mode. A special "Reinsert" light reportedly warns if a tape cartridge has been inserted incorrectly.

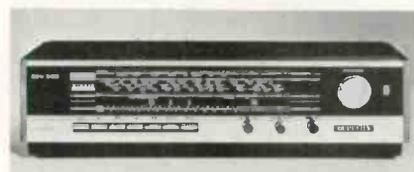
The speaker system features 5- by 7-in. speakers in closed box cabinets that can be separated up to 16 ft. Other features include slide-action con-



trols, switchable automatic frequency control (AFC), a stereo headphone jack located up front, lighted radio dial and jacks for external speakers, phonograph input and tape output. The unit comes in walnut color finish on wood. The retail price is \$179.98.

### Grundig

This Solid-State FM/AM/SW Receiver, Model RTV 340, features key-



board selector controls, flywheel tuning, tuning meter, stereo indicator light, stereo/mono switch and sliding station markers. Also included are built-in FM/AM antennas and cassette /tape/phono jacks.

Manufacturer's specifications indicate an FM tuning range of 87.5 to 108MHz and an AM tuning range of 510 to 1620MHz. The SW section covers 3.15 to 8.8MHz.

The walnut-satin-finish cabinet measures 22 in. by 6 in. by 9 in., and the receiver has a retail price of \$149.95.

### Harman-Kardon

The Model CAD5 Cassette Deck has been designed with a built-in Dolby noise reduction processor. The manufacturer's specifications indicate that the tape deck is engineered to exacting standards and accomplishes an accurate tape speed of 1 7/8 IPS. The electronic speed control reportedly holds the minimum speed variation to within  $\pm 1$  percent.

The tape head has four laminations per stack for extended frequency response and the pole piece design eliminates the "contour effect," which causes boomy bass. The bass reportedly extends down to 30Hz.

The unit plays standard cassettes on Dolby processed cassettes without the need for special adjustments, and variable Dolby process controls are available for record and playback modes if the user wishes to set the player critically for special tape cassettes. These rear panel controls are used in conjunction with a built-in test tone oscillator, which is push-button activated.

The frequency response is  $\pm 2.0$ dB below 30Hz to beyond 12,500Hz with a signal-to-noise ratio of better than 50dB at 0VU. The unit measures



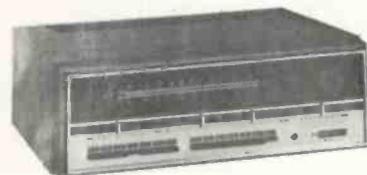
12 1/2 in. W by 9 in. D by 3 1/4 in. H and weighs 10 lb.

### Heathkit

A Model AR-29, 100w, AM/FM/FM Stereo Receiver has been designed with field effect transistors, integrated circuits and plug-in circuit boards.

The stereo amplifier reportedly delivers 100w of IHF music power, 70w continuous. The transformerless output circuitry is protected by a special dissipation-limiting circuit for short circuit conditions. All inputs on both channels, including tape monitor, are individually adjustable to eliminate changes in volume when switching sources.

The pre-assembled, prealigned FM tuner has 1.8  $\mu$ v sensitivity using FET design. Three IC's are used in the IF section providing AM rejection capability and greater reliability. An IC



performs four separate functions in the Multiplex section for stereo.

A nine-pole IC filter provides IF bandpass with more than 70dB selectivity and a "mute" function attenuates station noise on FM without affecting tuner sensitivity.

Modular plug-in circuit boards make assembly faster while built-in test circuitry makes troubleshooting easier.

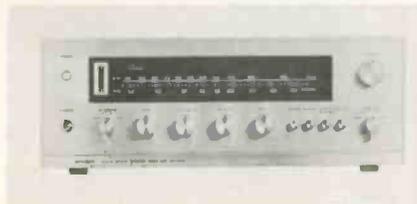
The cabinet, finished in oiled pecan, measures 17 11/16 in. W by 13 1/8 in. D by 6 3/8 in. H with feet. The kit sells for \$285.00 and weighs 33 lb.

### Hitachi

The Model SR-600 AM/FM Stereo Receiver is developed with a dynamic output power of 50w (8 $\Omega$ ), RMS power 35w (8 $\Omega$ ). The receiver employs 38 transistors, 25 diodes and 1 FET transistor. The FM tuner has a fre-

quency range of 88 to 108MHz, a sensitivity of 20dB quieting at  $1.7\mu\text{v}$  and an IHF practical sensitivity of  $2.8\mu\text{v}$ . The AM band has a sensitivity of  $20\mu\text{v}$ .

The amplifier has a frequency response of 20 to 50,000Hz, a power



band width of 20 to 30,000Hz, and the distortion is less than 0.5 percent.

The stereo receiver contains an AM high sensitivity ferrite antenna, tape monitoring circuit, scratch noise filter, Loudness control, and Phono Input High/Low Level switch to meet cartridge output.

Other circuit features include: FET front end, mechanical filter, antenna attenuator, automatic switching circuit, tuning meter, stereo indicator, FM Muting switch, Phono Sensitivity switch, and speaker selector. The unit measures 16 in. W by 6 in. H by 12 in. D and weighs 19 lb.

### James B. Lansing Sound, Inc.

The Model SA660 is a Solid-State Preamplifier and Power Amplifier combined in a single unit. And according to the manufacturer's specifications the amplifier has a power output of 120w continuous RMS power, 60w per channel, at any frequency from 10Hz to 30kHz. The frequency response from high level inputs is



$\pm 0.75\text{dB}$  from 20 to 20,000Hz,  $\pm 1.5\text{dB}$  from 10 to 130,000Hz. From the high level inputs the harmonic distortion is less than 0.2 percent from 20 to 20,000Hz at 120w or any level less than 120w. It employs 37 silicon transistors and 23 silicon diodes.

Controls found on the unit include the Volume, Balance, Concentric Bass and Treble, and Input Selector, Lever Switches, Power, Loudness, Test, Tape Monitor and Stereo/Mono.

Other special features include a built-in Aural Null stereo balancing system in addition to a three position Phono switch for the best possible signal-to-noise ratio.

The unit measures 5 1/16 in. by 16 3/16 in. by 13 3/4 in. and weighs 26 lb.

### Lear Jet Stereo Inc.

A Model H-460 Eight-Track Stereo Tape Player with AM/FM, FM stereo radio, automatic changer, and matching speakers is designed to incorporate a complete sound center in one unit.

The circuitry is solid-state throughout, employing 19 transistors and 23 diodes. The two-band, super heterodyne radio covers frequency ranges from 540 to 1600kHz in the AM band and 88 to 108MHz in the FM band.

The amplifier has a power output of



6w music power per channel or a total of 24w peak music power. The unit measures 13 1/8 in. H, 8 1/8 in. W and 8 1/8 in. D, and weighs 59 lb.

### Lloyds Electronic, Inc.

The Model 9V88 Solid-State FM/AM Stereo Radio and Stereo Cassette Tape Recorder includes twin stereo microphones and two acoustically balanced speaker enclosures with a woofer, tweeter and cross over in each enclosure.

The receiver has an illuminated slide rule dial with a black-out face and a stereo indicator light.

Two record level meters are featured on the recorder, one for each channel. Other features include piano key cassette operation, a pause feature, slot load and cassette eject, digital tape counter and tape monitor switch.

The cabinets are finished in genuine



wood veneer, walnut finish; and the main unit measures 4 1/4 in. H by 13 in. W by 12 1/4 in. D and has a total weight of 20 lb.

### Magnavox

The Model 1P9280, a Mini Compact Custom Stereo System, includes a mini record player with an 8-in. turntable, diamond/sapphire stylus and 45 rpm adapter. The side-mounted, solid-state stereo amplifier includes a Stereo Balance, continuously variable Bass and continuously variable Treble control. The speaker system consists of



two 6-in. speakers in a walnut cabinet. It also features a headphone jack and switches, and comes complete with dust cover. It sells for \$99.90.

### Mallory Battery Co.

A high-fidelity, battery-operated, solid-state cassette tape recorder is portable and designed for travel, home or office. Features include automatic



level control for high-fidelity recording, full-range dynamic speaker, and fast forward and rewind for instant replay. Featured is a cassette "pop up" system for easy cassette removal and replacement.

The Model MCR-1232 has a built-in AM/FM drift-free radio to provide direct recording off the radio. It operates on six alkaline batteries or ac house current.

### Marantz Co., Inc.

An AM/FM receiver contains an amplifier designed to deliver 60w of RMS power with both channels driven at, or below, its rated distortion of 0.3 percent at any audible frequency.

The Model 27 receiver employs variable overlap drive circuitry de-

signed to eliminate cross-over notch distortion. The unit includes dual concentric Bass and Treble controls, low



frequency filter, front panel headphone jack, quick-connect speaker and antenna terminals, speaker selector switch, and loudness compensation for complete control flexibility.

The amplifier/receiver has an etched front panel and black-out dial and comes in a woodgrain finished case. It is priced at \$319.

### Mercury

An FM/AM Stereo FM Radio and Stereo Eight-Track Home System, Model PX501, delivers low distortion



on all channels. The radio portion features blackout slide rule tuning, an FM indicator light, selector switch for FM/AM, FM stereo, phono or eight-track tape, AFC and an external FM antenna.

The eight-track cassette system includes a channel indicator light, automatic channel switching for continuous play, phono-input jack, headphone jack, pre-amp output, external fine tuning head adjustment, and switchable auxiliary ac outlet.

The walnut cabinet measures 18 in. W by 4 $\frac{7}{8}$  in. H by 10 in. D. The 5-in. speakers are housed in walnut cabinets, each measuring 12 $\frac{3}{8}$  in. H by 8 in. W by 5 $\frac{1}{2}$  in. D.

### Midland

A 10w AM/FM/Stereo Receiver, Model 19-520, includes 17 transistors, 12 diodes and 2 rectifiers. The controls on the unit include Volume, Tone, Balance, Tuning, four-position function selector, AFC, and power ON/OFF. The power output is 10w  $\pm$ 1dB,

2w per channel RMS, 8w total. The frequency response is 50 to 17,000Hz with a channel separation of 20dB. The input sensitivity is 1.5 mV.

Oiled walnut finished wood is used for the cabinet. The unit comes with magnetic phono, two 5-in. enclosed speakers and an FM antenna. The receiver dimensions are 4 $\frac{1}{2}$  in. by 15 $\frac{1}{2}$



in. by 8 $\frac{1}{8}$  in. The speaker cabinets each are 9 in. by 7 $\frac{3}{8}$  in. by 5 $\frac{3}{8}$  in. Total shipping weight is 13 $\frac{1}{2}$  lb.

### Motorola

A portable Cassette Player/Recorder, Model GP31GU, is designed with a built-in ac power supply or will play on four C-size cells. The unit contains solid-state components for instant performance and a capstan drive system is employed for an accurate tape speed of 1 $\frac{7}{8}$  IPS, reducing wow, flutter and fluctuating pitch. A double track recording system is used and the cassette has two sides—simply flip the cassette to play the second track. The player/recorder has fingertip controls located on top of the unit with one clearly marked to avoid accidental erasure. The "Record" interlock button is located separately from the keyboard. The player/recorder is equipped

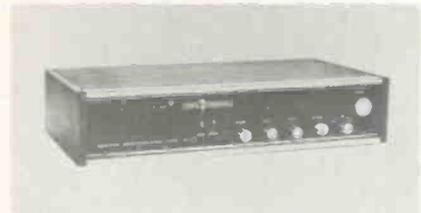


with an auxiliary input jack and a companion patch cord accessory. The unit is equipped with a view meter to check the condition of the batteries and the recording volume levels. It includes a microphone with a remote control switch and convenient microphone stand.

### Muntz

A Model HT-800 AM/FM/FM-MPX tuner has been designed with an eight-track cartridge playback. Some

of the features include: illuminated dial, Bass and Treble controls, Loud-



ness and AFC switch, plus built-in AM and FM antennas.

The unit has a frequency range of 535 to 1605kHz on the AM band and 88 to 108MHz on the FM band. The AM sensitivity is rated at 200 $\mu$ v while 10 $\mu$ v for the FM receiver. The amplifier output power is said to be 10w per channel with a frequency response of 50 to 10,000Hz.

A walnut finished cabinet, with brushed aluminum trim, measures 20 in. W by 4.5 in. H by 9 $\frac{1}{4}$  in. D. The unit weighs 13 lb.

### Norelco

#### North American Philips Corp.

The Model 790 Receiver combines electronic touch tuning on FM with a direct-coupled, low-distortion amplifier. Its frequency response is 20 to 20,000Hz  $\pm$ 0.5dB. Total harmonic distortion at all levels is less than 0.2



percent and 1M distortion is 0.5 percent. The tuner section features variable capacitance diodes that permit instant touch control tuning of three FM stations. It also incorporates FM stereo multiplex, variable bandwidth AM and world-wide shortwave bands. The receiver has both low- and high-level inputs for magnetic and ceramic cartridges as well as a tape recorder input and switchable outputs for two speaker systems and headphones. It has Volume, Balance, Contour, Bass and Treble controls. It also has a noise filter, a stereo/mono switch and speaker selector. Also included is an easy-to-tune slide-rule dial with an automatic FM stereo indicator and a walnut case. The suggested list price is \$299.95.

## Panasonic

A new Stereo Music Center, the Spartan Model SE-970, includes a stereo phonograph changer, is styled



with a black cabinet and silver trim and contains an AM/FM/AM stereo radio.

The four-speed record changer comes with a magnistate cartridge and flip-over diamond stylus. Separate output jacks provide for taping records or broadcasts and auxiliary input jacks permit controlling other hi-fi components.

Separate, continuous tone controls provide precise adjustment of the treble and bass. Matching speaker cabinets each contain a 6½-in. speaker system.

The solid-state FM/AM/AM stereo radio incorporates illuminated slide rule tuning. AFC locks in the FM signals for drift-free reception while a stereo eye automatically selects only stereo stations.

This model retails for \$229.95.

## Peerless Telerad, Inc.

The Model HSP-77 FM/AM/AM Multiplex Stereo Eight-Track Tape Player System includes a twin speaker system with woofer and tweeter. The solid-state stereophonic player has



an illuminated dial, tuning meter, and slide controls for bass, treble, volume and balance. Other features include a built-in ac outlet for the record changer, and tape input jacks.

The size of the master unit is 17¾ in. by 11 in. by 4½ in.

## Philco Ford Corp.

The Model M4760U FM/AM Receiver comes with a top-mounted turn-

table and a four-speaker air-suspension sound system. Called the "Symphony" it has 70w of peak music power (35w EIA music power). Specifications indicate that FM receiver sensitivity is 4.5µv for a 30dB signal-to-noise ratio and that the AM sensitivity is 400µv/M for a 20db signal-to-noise ratio. The amplifier has a frequency response of 40 to 50,000Hz.

The four-speed turntable employs an 11-in. turntable. It has 1.0 gram of tracking force variation, 0.2 percent wow and 1 percent flutter. The cartridge frequency response is 20 to 18,000Hz and an output range of 80mv per channel. A ten-year exchange guarantee is offered on the diamond stylus.

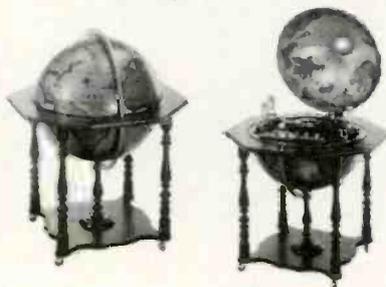
A 9-in. oval woofer and 10½ by 4-in. exponential horn is used in each



speaker enclosure. Speaker cables for up to 28 ft of stereo separation is included. The cabinet and speaker enclosure are made of genuine wood veneers and wood solids. The speakers (each enclosure) measures 16 in. H by 11¾ in. W by 9¼ in. D.

## Phono-Sonic Radio Corp.

A Solid-State Radio, "The Antique Globe," is designed with 17 transistors,



AM/FM multiplex stereo, dual ample amplifiers and a sensitive AM/FM tuner. Other features include a drift-free AFC control, jacks for external speakers and a jack for the tape deck. The unit employs two speakers for full stereo reproduction of sound.

The phono is a fully automatic four speed BSR deluxe changer with an automatic shut-off.

The unit measures 32 in. L by 49 in. H by 32 in. D and weighs 80 lb.

## Quatron Corp.

A Model 48H Automatic Eight-Track Stereo Tape Cartridge Changer will operate automatically and continuously without reloading tape and can



play over 12 hours of stereo music before repeating a selection.

The built-in amplifiers provide 30w of audio power (15w peak per channel) with a claimed frequency response of 50 to 15,000Hz ±3dB and a total harmonic distortion of less than 1 percent at 15w. The magazine capacity is 12 eight-track tape cartridges, standard or double album.

The unit has a walnut vinyl finish cabinet and measures 18¼ in. W by 9 in. H by 16¼ in. D and weighs 32 lb.

## RCA

A Stereo Module System with eight-track tape player, Model VS6025, solves space problems by combining the tuner, amplifier, automatic turntable and eight-track stereo cartridge player all within a single cabinet. Other features include slide-rule vernier tuning, balanced flywheel, stereo light, and built-in FM and AM antennas. FM audio response: 20 to 15,000Hz. IHF rated FM sensitivity: 5.0µv. Stereo channel separation: 20dB at 1000Hz.

The solid-state amplifier section has 60w peak power output and a frequency response of 50 to 20,000Hz ±3dB.

The eight-track stereo tape cartridge section has automatic or manual track selection and up to 80 min of playing time on a single cartridge.

The Mark I Studiomatic four-speed turntable includes a muting switch for eliminating pick-up noise during the



change cycle, plus a pause selector cueing control.

Each speaker enclosure houses an 8-in. woofer and a specially designed, low-distortion 3½-in. tweeter. The receiver/turntable and tape unit measures 10½ in. H by 23½ in. W by 14 in. D, while each speaker measures 10 in. H by 20 in. W by 7½ in. D.

### Roberts Div. of Rheem Manufacturing

A complete Home Stereo Center, the Model 333X, combines reel with cartridge and cassette recording and playback. The unit employs cross field heads and provides a frequency response of 30 to 23,000Hz ( $\pm 3$ dB) at 7½ IPS with reel, 30 to 18,000Hz ( $\pm 3$ dB) with cartridge and 30 to 16,000Hz ( $\pm 3$ dB) with cassette. Transfer from reel-to-cartridge, reel-to-cassette or from any auxiliary source provides an opportunity to build a library of cartridges and cassettes.

Dual VU meters are employed for setting of precise record levels.



The unit has a power output of 12w each channel at standard music power and a total of 24w from two 4-in. built-in speakers.

The recording system used is a four-track stereo/manual cross field bias system on reel, an eight-track stereo system on cartridge and a four-track system on cassette recording.

Specifications indicate that the signal-to-noise ratio is better than 50dB on reel and better than 45dB on cartridge and cassette. The unit measures 10.6 in. by 13.8 in. by 18.3 in., and the complete unit is priced at \$559.95.

### Sansui Electronics Corp.

A Model AU999 Control Amplifier is developed with a number of new in-

novations. These include the ability to combine two recorders or decks in a tape-copying operation while independently handling other program material; electrical separability of the preamplifier-control section from the power amplifier for handling different programs or for introducing electronic crossover networks; and a frequency-equalizing system that uses three tone controls, each of them a calibrated, stepped selector switch, with separate selection of the turnover frequencies at which each will be effective.



Specifications indicate that the basic power amplifier is direct-coupled throughout with frequency response of 5 to 100,000Hz  $\pm 1$ dB at normal listening levels. It is rated for a music power output of 180w (4 $\Omega$ , IHF) with distortion less than 0.4 percent (either total harmonic or intermodulation). Preamplifier response is 20 to 70,000 Hz  $\pm 0.5$ dB,  $-1.5$ dB, with IHF hum and noise figures better than 80dB for the phonograph and microphone inputs, better than 85dB for the tuner and auxiliary positions.

The complete elimination of all coupling capacitors and transformers in the amplifier section is said to remove a major cause of intermodulation and phase distortions, resulting in superior audibly response, particularly in the low-frequency range.

Continuous power output is 70w per channel at 4 $\Omega$ , 50w per channel at 8 $\Omega$ . Power bandwidth is 10 to 30,000Hz at 8 $\Omega$ , IHF. Hum and noise are down 100dB or better. When coupling capacitors are required in the preamplifier section, mylar types are used instead of conventional electrolytics. Total harmonic distortion is reportedly less than 0.1 percent at the rated output voltage of 1v (5v maximum).

The preamplifier and amplifier sections can be separated electrically by a switch. This facilitates insertion of electronic speaker-system crossovers or permits using the preamp as the control center of a larger system while the power amplifier functions as an independent line amplifier. Up to three stereo speaker systems can be connected and selected, two of them simultaneously.

Of the two phonograph inputs, one has a standard input impedance of 50K; the other can be varied from 30

to 100K to accommodate special cartridges or optimize the response to the cartridge's characteristics. Independent level adjustments for the phonograph and auxiliary inputs permit the matching of all inputs so that there is no change in volume when switching from one function to another.

The audio control center and amplifier sell for \$299.95.

### Scott

A medium priced compact AM/FM Stereo/Phono System, Model 2516, is designed with a choice of three air-suspension speaker systems. The system features solid-state component circuitry, including FET transistor AM/FM front end, integrated circuit IF amplifier and direct coupled all-silicon output circuitry. The automatic turntable is a three-speed unit by Garrard, and includes a Pickering V-15 magnetic cartridge.

Convenience features for the system



include automatic stereo switching, stereo indicator light, precision signal-strength meter, and a complete control complement incorporating dual, Loudness, Bass and Treble, Speaker Balancing Control, and Tape Monitor Control. Also included are provisions for plugging in a tape recorder or tape cartridge player, stereo headphones and extra speakers.

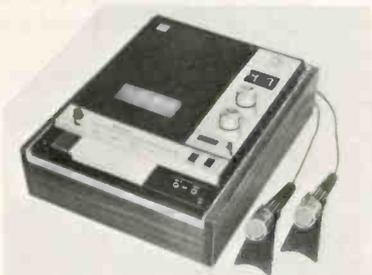
The system is available with a choice of speaker systems. Specifications for the system are as follows: Peak power, 100w; IHF power, 40w; amplifier frequency response, 18 to 25,000Hz; AM sensitivity, 5 $\mu$ v to 600kHz; IHF tuner sensitivity, 2.0 $\mu$ v.

### Sharp Electronics Corp.

A four-track, two channel stereo cassette tape recorder deck, Model RD-409, is reportedly ready-to-play in less than 5 sec without annoying tape threading. The unit employs push-button controls for recording, playback,

rewind, fast forward and stop. A convenient pause switch provides a virtually instant stop, preventing tape waste.

The unit records and plays back in



both stereo and monaural with a frequency response of 40 to 10,000Hz, and employs VU meters for precise recording levels. It has an extended recording time of up to 2 hrs.

The tape player is compact, measuring 3 in. H by 8 in. W by 10 in. D, and is styled in a walnut finished cabinet. It weighs 4.9 lb.

### Sherwood

The Model S-8500, a 150w ( $\pm 1$ dB) Stereo Receiver is developed with features such as a solid-state pre-aligned Ceramic FM IF filtering circuit. The circuit is reportedly measurably superior to crystal filters. Hermetically sealed metal-encased microcircuits are used to eliminate field failures common to conventional plastic-encapsulated integrated circuits.

Six push buttons are employed that enable independent or simultaneous operation of two pair of speakers



(main and remote). Output terminals are provided for a separate mono extension speaker. Other front panel conveniences include a stereo headphone jack for private listening, switches for loudness contour defeat, stereo/mono, tape monitoring and high filter. A zero-center tuning meter pinpoints FM tuning and the receiver has an FM output distortion as low as 0.2 percent at 100 percent modulation on FM, plus  $-95$ dB spurious response rejection to reduce interference in difficult signal areas.

The all-silicon transistor amplifier reportedly has a frequency response of  $\pm 1$ dB, and FM tuner sensitivity (IHF) of  $1.8\mu\text{V}$  ( $-30$ db noise and

distortion) with interchannel FM hush.

The unit measures  $16\frac{1}{4}$  in. L by 12 in. D by  $5\frac{1}{4}$  in. H with a shipping weight of 27 lb.

### Sony

A Model 124-CS Solid-State Easy-Matic complete Stereo Cassette-Recorder system is contained in a lightweight, briefcase-size package. It has a built-in speaker and two external full-range speakers to provide full stereo separation.

Some of the features include push-button operation, pop-up cassette ejection, record interlock, record level and battery strength indicator.

Manufacturer's specifications indicate that the unit has a frequency re-



sponse of 50Hz to 10,000Hz and a signal-to-noise ratio of 45dB. The ac/dc solid-state chassis employs 16 transistors and 9 diodes.

The dimensions of the recorder are  $6\frac{11}{16}$  in. W by  $2\frac{11}{16}$  in. H by  $9\frac{3}{4}$  in. D, and the system weighs 7 lb.

### Stereo Magic Specialties Corp.

A Model CT-104 Home Tape Player, with walnut speakers, features an optional push button channel selector for remote control. Other features include separate controls for volume, tone, balance, and push button or automatic channel selection.

The unit plays all eight-track car-



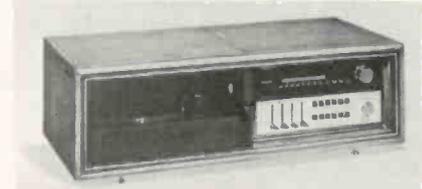
tridge tapes and automatically recycles them indefinitely for continuous entertainment.

The walnut speakers measure  $8\frac{3}{4}$  in. by  $11\frac{1}{2}$  in. by  $4\frac{3}{8}$  in. and the

main tape player measures  $11\frac{1}{2}$  in. by  $4\frac{3}{8}$  in. by  $10\frac{11}{16}$  in. and weighs 15 lb. The self-contained music system sells for \$99.95, complete with speakers.

### Sylvania

The component stereo, Model CS20W, features the linear slide controls for cut/boost bass and treble, stereo balance, acoustic level, automatic FM stereo switching and push-button functions. The solid-state power gives 12w EIA, 100w IHF and



240w peak music power. Dual 1015 automatic turntable with magnetic cartridge, cue control and counter-balance arm are included plus convenient facilities for adding tape or stereo cassette.

The cabinet is of oiled walnut. Dimensions are  $18\frac{3}{8}$  in. H by  $32\frac{1}{4}$  in. W by  $15\frac{1}{8}$  in. D.

### TEAC Corp. of America

A new Tape Transport, the Model TCA-40, is designed for a  $\frac{1}{4}$  track, two-channel stereo playback and four-



channel stereo playback (in-line). It also includes  $\frac{1}{4}$  track, two-channel erase and record heads which may be utilized for future step-up capabilities of the equipment. It features automatic reverse for uninterrupted playback of two-channel tapes.

The unit is a 3 motor solenoid operated auto-reverse tape deck, and is fair-traded at \$365.

### Topp Electronics Inc.

The Model CTP-2083X Home Music and Recording Center employs

solid-state circuitry for instant sound. The music center is a home-type electric stereo cassette tape recorder and player with AM/FM/AFC/FM stereo multiplex radio and built-in power amplifier.

Recordings can be made directly from the integral tuner, microphone or from any external program source.



The computer type console employs forward facing level control meters with front control panel.

The amplifier has 70w peak output. Other features include a tape footage counter and speaker, plus Balance, Bass and Treble controls.

The cassette tape recorder has a capstan drive with a tape speed of 1 7/8 IPS and a piano styled keyboard control.

The air suspended four-way speaker system uses a 6 1/2-in. duo-cone PM dynamic speaker.

#### Webcor Consolidated Merchandising Co.

A solid-state Stereo FM/AM/FM Receiver, Model WFX-258, comes with a built-in stereo eight-track cartridge player and four-speed Garrard automatic turntable. Also included with the system are two omnidirectional air-suspension speakers in walnut grained wood cabinets. Other features include a slide rule tuning dial; separate Bass, Treble, Volume and Balance controls; lighted channel indica-



tors; push-button channel change; and a stereo headphone jack.

The main unit comes in a walnut  
*continued on page 53*

## Speed Aligner Workshop

by Don Multerer

Kicking off a whole new seminar concept.

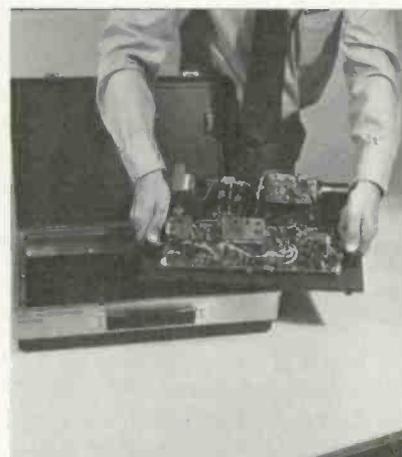
■ Distributors and technicians across the country have continually asked for a seminar where they could work with test equipment—actually sitting down and diddling a little on their own. We are now giving them that chance.

Distributors sponsoring a "Speed Aligner Workshop" are told that they can invite only 20 men on a first come, first serve basis. Sencore in turn supplies four specially prepared, late model TV chassis; four new SM158 Speed Aligner Sweep Marker Generators; four PS148A Oscilloscope/Vectorscopes; four BE156 Bias Boxes and four FE14 Field Effect Multimeters; along with a factory direct field engineer or technical representative. Each of these men serve as the instructor for the three-hour workshop session.

There are four work tables with five service technicians assigned to each table. Each service technician follows the instructor step-by-step through a complete chassis alignment starting with equipment familiarization and continuing on to chassis familiarization, IF overall alignment, IF "link" tuner alignment, stage-by-stage IF alignment, IF chroma alignment and tuner alignment. Quite a bit, isn't it? That is why it takes three hours and the seminar is limited to only 20 technicians. ■



Five technicians work together under the direction of Jim Smith to align a tuner and IF strip.



This self-contained classroom unit consists of a TV tuner, IF strip and power supply.

# Tuned Circuit Signals

by Phillip Dahlen

## Some basic principles concerning the function of RF circuits.

■ Technicians seldom directly observe the RF signals in the tuned circuits that they service. Generally such procedures are avoided since most circuits are so badly detuned by attaching a scope that these signals are no longer present to observe. Alignment is, therefore, generally done with a scope demodulator probe or at the output of a receiver's demodulation circuit. There the effects of the RF signal are observed rather than the original signal.

As an introduction to next month's special issue on radio communication, it was felt that it might be helpful to observe what does occur in RF tuned circuits. To accomplish this we assembled a small circuit board using a number of RF-circuit components that were purchased for use in this and subsequent articles. It includes a 1.8775 MHz crystal, two diodes, two transistors, three potentiometers, three tuning capacitors, two air-core RF coils and one adjustable iron-core RF coil (Fig. 1). This board was used in conjunction with a Leader LBO-501 oscilloscope, Hickock DP160 high-frequency counter and DP200 capacitance measuring modules, Sencore RC146 substitution box, EICO 379 sine/square wave signal generator and EICO 150 signal tracer (Fig. 2).

### PULSE SIGNAL GENERATORS

There are a number of inexpensive signal generators on the market, no larger than pen-sized flashlights, which emit a pulse that can be picked up by receiver RF and IF circuits tuned to different frequencies. The function of these generators can be demonstrated with the use of the square-wave generator.

Like pulses, square waves can be thought of in two ways: They are the waveform that results when

abruptly switching a voltage ON and OFF, or between positive and negative, at a predetermined rate or frequency; and they are the result of a sine wave being combined with an infinite number of its harmonics. The latter concept can be used to explain how a pulse generator works to provide the desired RF or IF frequency for a tuned circuit. It can be demonstrated by tuning in the various harmonics of a square wave with an RF coil and variable capacitor.

Most technicians are familiar with the square waves that normally appear on a scope when the sweep rate of the scope matches the primary frequency of the square wave (Fig. 3). Applying a sine wave of the same frequency to the scope's horizontal input, rather than using the scope's internal saw-tooth-wave generator, changes this familiar waveform to the pattern shown in Fig. 4. As will be demonstrated later in the article, there are occasions when this form of horizontal sweep is more convenient than the conventional form.

### Single Resonant Circuit

To demonstrate the principle of square-wave harmonics, we tuned our signal generator to 100kHz and attached its square-wave output to the antenna winding of an air-core broadcast-band RF coil while attaching the sine-wave output of the signal generator to the scope as a reference signal. By using a variable capacitor in conjunction with the substitution box, we were able to tune the secondary winding of the RF coil (Fig. 5) so that a sine wave was developed corresponding to the fundamental frequency of the square wave (Fig. 6). *The signal generator provides both sine and square waves of the same frequency. The tuned circuit changes the square wave into*

*a sine wave of that same fundamental frequency. When the sine wave applied to the scope's vertical input is of the same frequency and phase angle as the sine wave applied to the scope's horizontal input, the resulting scope pattern will resemble a circle.*] By replacing the high-frequency counter module with a capacitor measuring module, we were able to measure the amount of capacitance in the circuit connected in parallel with the RF coil. In this instance it was found to be 0.019 $\mu$ f.

Reducing the amount of capacitance in parallel with the coil increases the resonant frequency of this tuned circuit. Reducing it to 0.0043 $\mu$ f caused the circuit to resonate at 200kHz, the square wave's first harmonic (two vertical waves appearing during one complete horizontal sweep—Fig. 7).

With a further reduction in parallel capacitance we were able to obtain the 300kHz second harmonic (Fig. 8), the 400kHz third harmonic (Fig. 9), the 500kHz fourth harmonic (Fig. 10), the 600kHz fifth harmonic (Fig. 11), the 700kHz sixth harmonic (Fig. 12), the 800kHz seventh harmonic (Fig. 13), the 900kHz eighth harmonic (Fig. 14) and the 1MHz ninth harmonic (Fig. 15). At frequencies above this harmonic the tuned circuit seemed capable of resonating only at alternate harmonics. Fig. 17 shows the scope pattern corresponding to the 19th harmonic (2MHz). The 21st harmonic is shown (Fig. 18) with the scope switched back to its more conventional internal sweep.

### Dual Resonant Circuit

More uniform harmonic waveforms were obtained by using a dual tuned circuit (Fig. 16). The square-wave output of the signal generator was connected to the antenna winding of an air-core broadcast-band RF coil. The secondary winding of that coil was connected in series with the antenna winding of a second air-core broadcast-band RF coil and the variable capacitor. This in effect added a few extra loops to the secondary winding of the first coil with the variable capacitor connected as before. The secondary winding of the second RF coil was

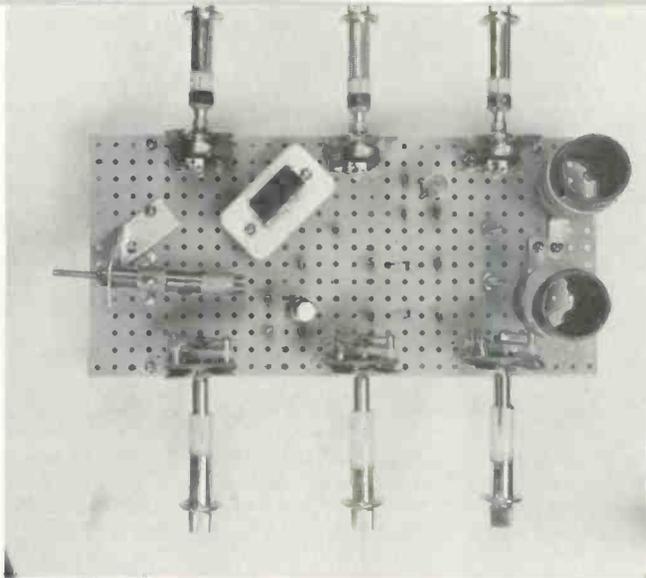


Fig. 1—An assortment of components to be used in RF circuits.



Fig. 2—Electronic instruments used in conjunction with the circuit board.

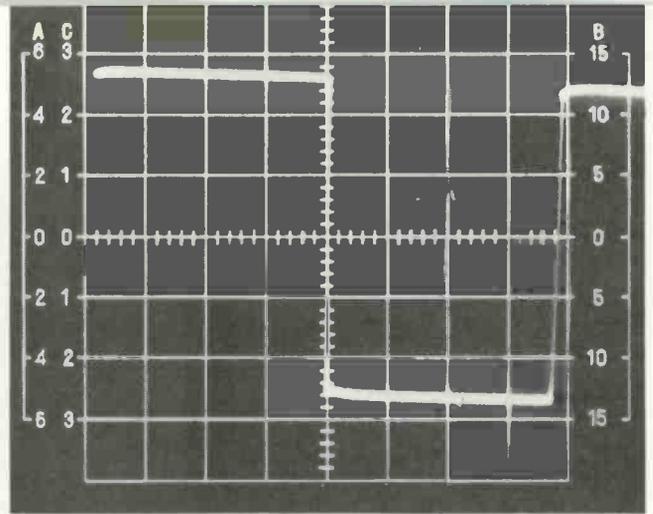


Fig. 3—Square waves that normally appear on a scope when the sweep rate of the scope matches the primary frequency of the square wave.

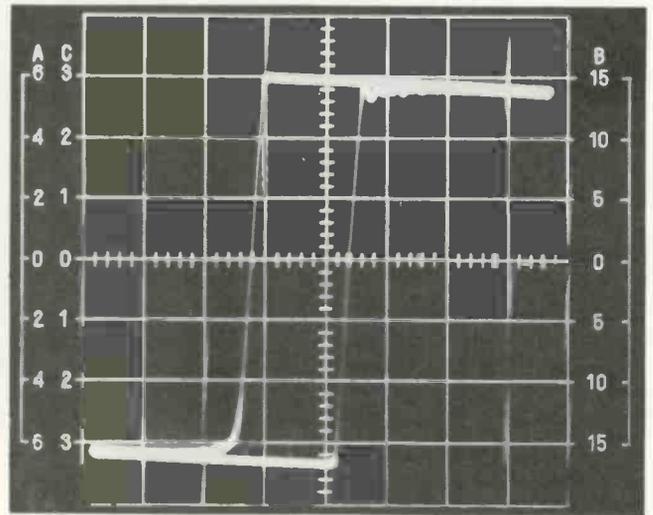


Fig. 4—Pattern that results when applying a square wave to the scope's vertical input and a sine wave to its horizontal input.

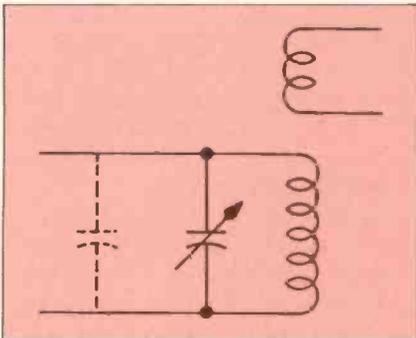


Fig. 5—The single resonant circuit contains a coil and capacitor connected in parallel.

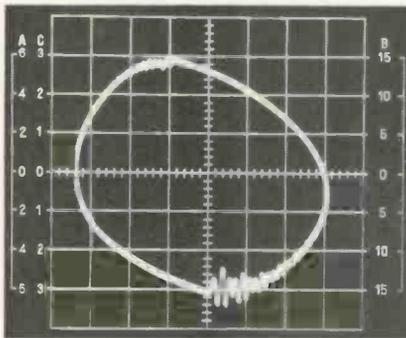


Fig. 6—Pattern that results when applying a filtered square wave to the scope's vertical input and its fundamental-frequency sine wave to the horizontal input.

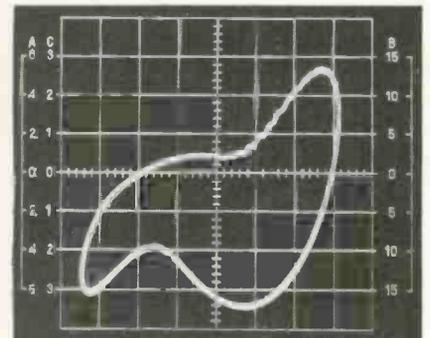


Fig. 7—Pattern that results when applying a square wave's 200kHz first harmonic to the scope's vertical input and its fundamental-frequency sine wave to the horizontal input.

Fig. 8—Pattern that results when applying a square wave's 300kHz second harmonic to the scope's vertical input and its fundamental-frequency sine wave to the horizontal input.

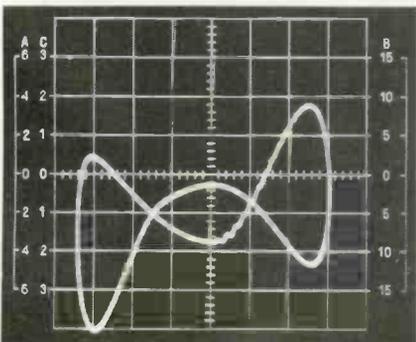


Fig. 9—Pattern that results when applying a square wave's 400kHz third harmonic to the scope's vertical input and its fundamental-frequency sine wave to its horizontal input.

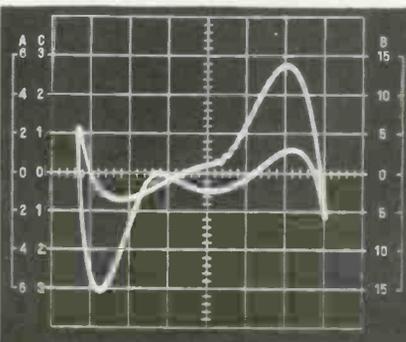
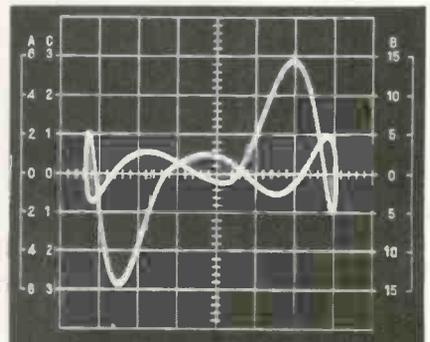


Fig. 10—Pattern that results when applying a square wave's 500kHz fourth harmonic to the scope's vertical input and its fundamental-frequency sine wave to the horizontal input.



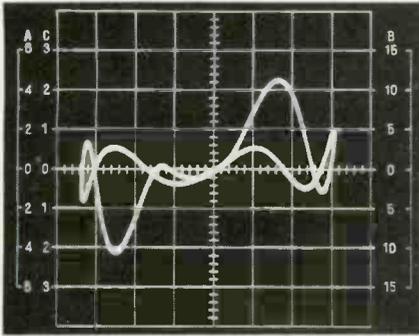


Fig. 11—Pattern that results when applying a square wave's 600kHz fifth harmonic to the scope's vertical input and its fundamental-frequency sine wave to the horizontal input.

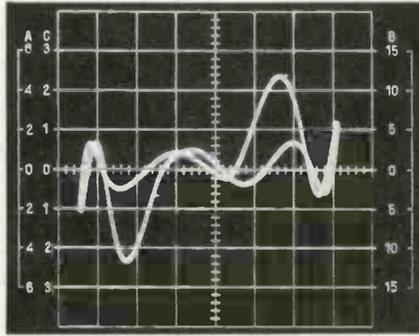


Fig. 12—Pattern that results when applying a square wave's 700kHz sixth harmonic to the scope's vertical input and its fundamental-frequency sine wave to the horizontal input.

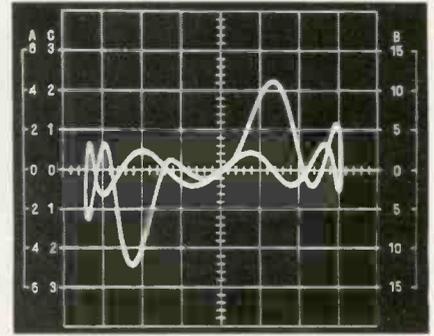


Fig. 13—Pattern that results when applying a square wave's 800kHz seventh harmonic to the scope's vertical input and its fundamental-frequency sine wave to the horizontal input.

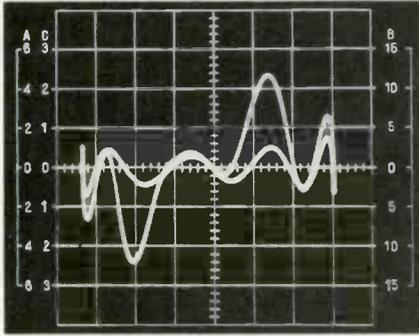


Fig. 14—Pattern that results when applying a square wave's 900kHz eighth harmonic to the scope's vertical input and its fundamental-frequency sine wave to the horizontal input.

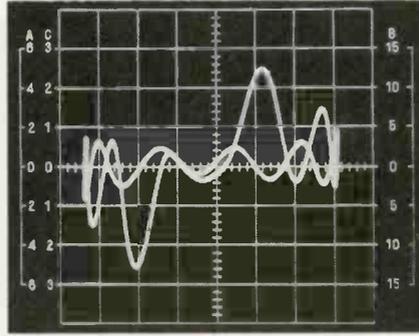


Fig. 15—Pattern that results when applying a square wave's 1MHz ninth harmonic to the scope's vertical input and its fundamental-frequency sine wave to the horizontal input.

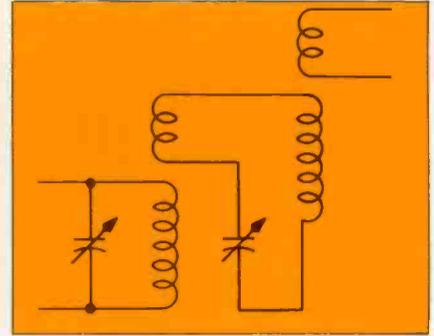


Fig. 16—A schematic of the dual resonant circuit.

tuned with another variable capacitor as in the previous circuit (Fig. 5).

With the signal generator connected as before and the scope connected across the second tuned circuit, a virtually uniform waveform was observed on the scope when it was set for continuous scan using its internal saw-tooth oscillator (Fig. 19). When resetting the scope for a triggered-sweep scan we found that the resonant-frequency signal was not as uniform as it first appeared (Fig. 20). During its earlier mode of operation the scope had been synchronized at the resonant frequency but failed to also be synchronized with the modulating signal.

By switching the scope to a horizontal sine-wave sweep, we observed that the tuned circuit was resonating at 1MHz or the ninth harmonic of the basic 100kHz square-wave frequency (Fig. 21). The previous, more conventional scope traces might have allowed us to falsely conclude that the resonant frequency was only 500kHz.

## TUNING RF SIGNALS

The ability of the scope to operate with vertical and horizontal input frequencies as high as those encountered in the broadcast band permitted us to make some very interesting observations with the scope.

### Single Resonant Circuit

In order to see what occurred in our single tuned circuit (Fig. 5) when it was made to resonate at the frequency of an applied RF signal, we tuned the signal generator to about 1MHz and applied its sine-wave output to both the horizontal input of the scope and the antenna winding of the coil—the scope's vertical input being obtained from across the variable capacitor.

With the aid of the high-frequency counter, we were able to observe that the circuit resonated at 1.05 MHz (a circular pattern then appeared on the scope—Fig. 22). At 1.04MHz we saw that the applied signal was below the tuned circuit's resonant frequency (Fig. 23), while

at 1.06MHz the applied signal appeared above the tuned circuit's resonant frequency (24). At higher or lower frequencies only a horizontal line was seen on the scope. The circuit's resonant frequency could have, of course, been changed by adjusting the variable capacitor connected in parallel with the coil.

By inserting a crystal, designed to vibrate at 1.8775MHz, between the variable capacitor and coil (Fig. 25), we were able to make the resonant frequency of this circuit much more critical. The signal generator was then adjusted so we could observe the circuit resonating at this higher frequency. Although the scope patterns appeared the same as before (Fig. 22, 23 and 24), the high-frequency counter did not operate with enough significant read-out digits to differentiate the resonant frequency from those frequencies just above or below resonance—the instrument reading 1.88MHz over the entire frequency range. From the very fine tuning required on the signal generator to obtain the

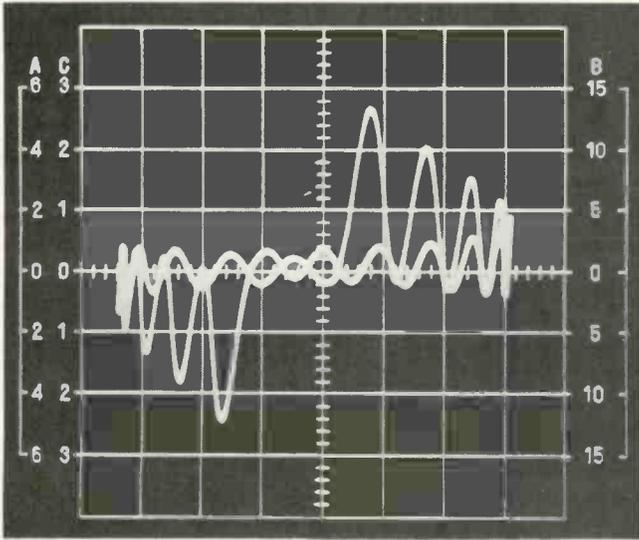


Fig. 17—Pattern that results when applying a square wave's 2MHz 19th harmonic to the scope's vertical input and its fundamental-frequency sine wave to the horizontal input.

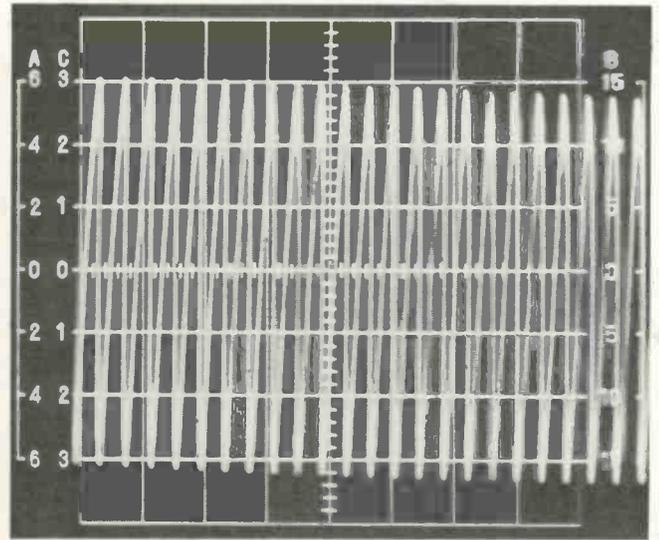


Fig. 20—This same waveform no longer appears uniform when the scope is adjusted for trigger sweep.

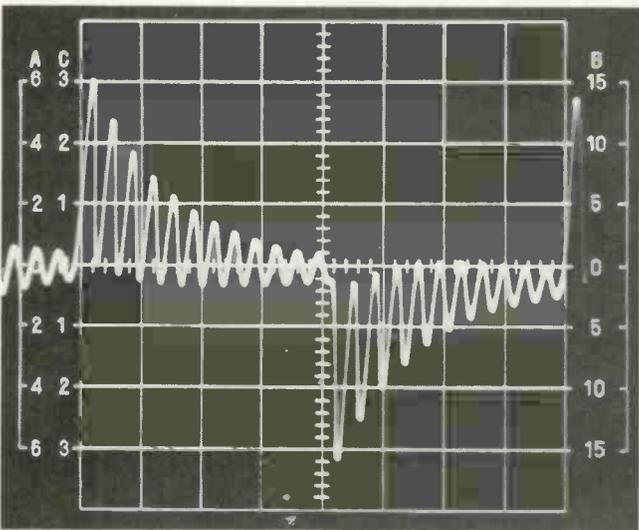


Fig. 18—Waveform that results when a square wave's 2.2MHz 21st harmonic is applied to the scope's vertical input during a conventional horizontal sweep.

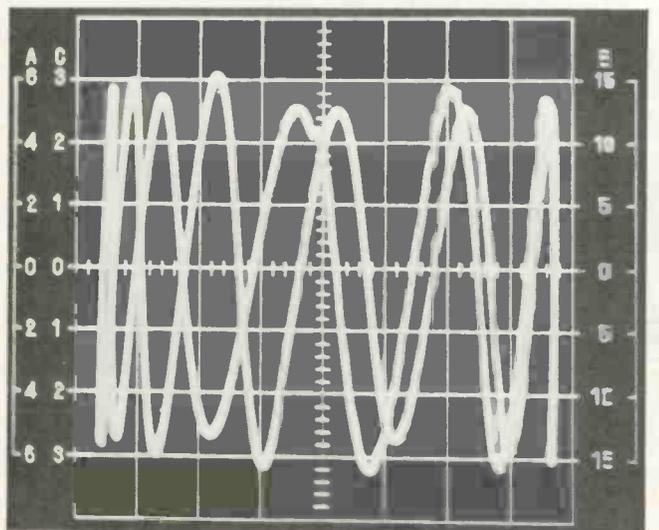


Fig. 21—When switched to sine-wave sweep, the scope indicates that the second resonant circuit is tuned to the square wave's tenth harmonic.

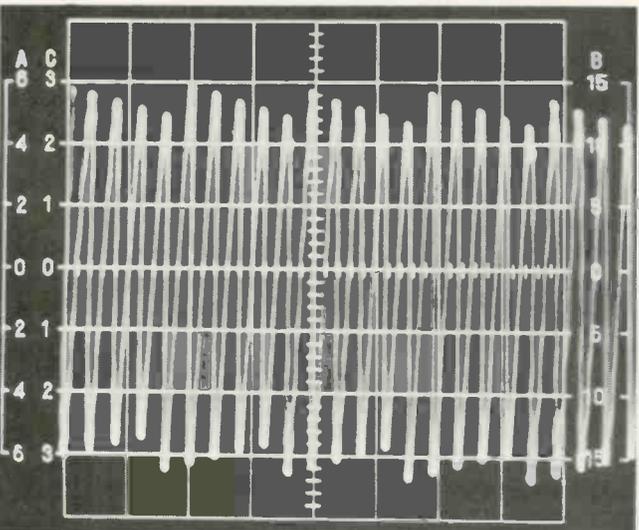


Fig. 19—A waveform resulting from harmonic of a square wave is developed in the second resonant circuit and appears virtually uniform when the scope is set for continuous sweep.

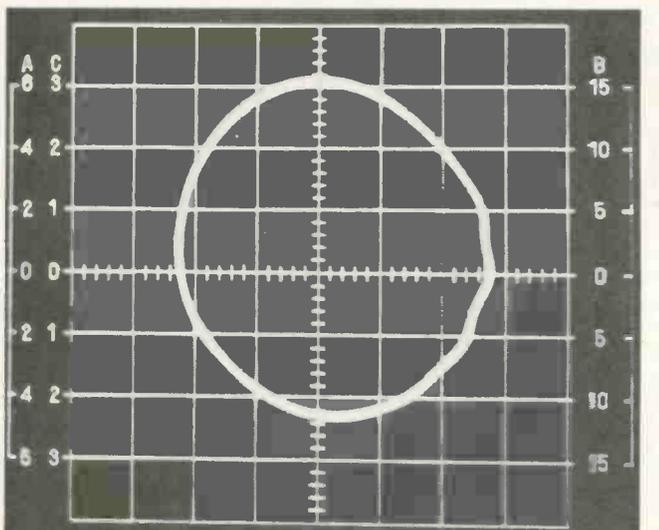


Fig. 22—A circular pattern appears on the scope as the circuit resonates at 1.05MHz.

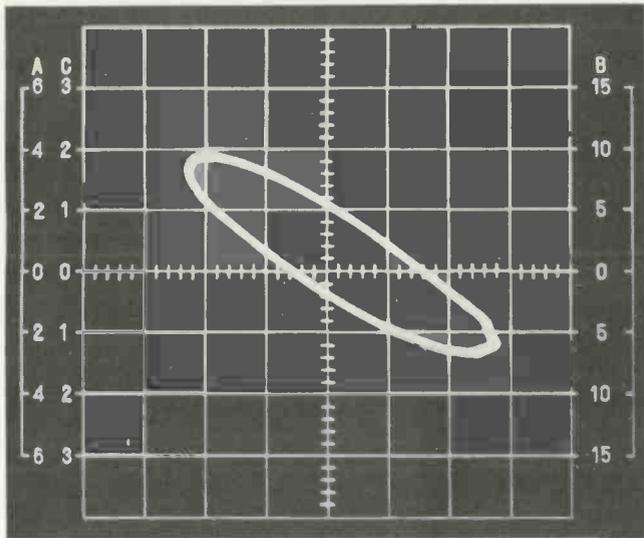


Fig. 23—An oval pattern moves in a counterclockwise direction as the frequency of the applied signal is reduced to 1.04MHz.

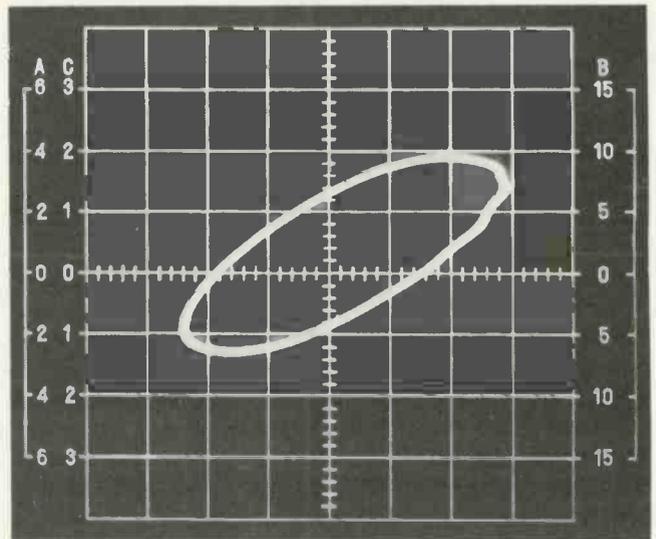


Fig. 24—An oval pattern moves in a clockwise direction as the frequency of the applied signal is increased to 1.06MHz.

resonant frequency, we could tell that the circuit was very sharply tuned. The crystal was not used with the signal generator's square-wave output since the overtones available contained too little power to cause it to resonate.

By connecting the antenna winding of the coil in our single tuned circuit (Fig. 5) between the leads of a large TV antenna and ground, we found that the circuit was unable to adequately differentiate between radio stations. Fig. 26 shows the beat wave that appeared on the scope as the carrier signals of two radio stations broadcasting at about 700kHz were mixed. From the photo we estimate that the beat frequency was about 100kHz. (The scope was used as a continuous-sweep instrument for making this photograph.)

### Dual Resonant Circuit

Better station separation was obtained when using the dual resonant circuit (Fig. 18), and we were able to use it to tune the entire broadcast band. Although the high-frequency counter did not offer us any help in determining frequencies tuned in this circuit, we were able to determine these frequencies with the aid of the signal tracer, which permitted us to hear the radio announcers give the call letters of their stations.

The strongest station received on the dual resonant circuit had a carrier frequency of about 600kHz.

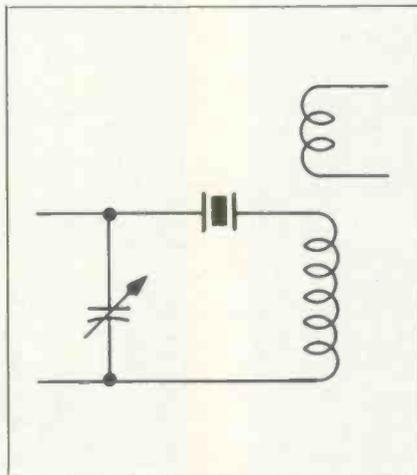


Fig. 25—Inserting a crystal between the variable capacitor and coil increases the resonant circuit's selectivity.

Unlike the previously received signals, upon which there appeared to be 100kHz modulation, this carrier was modulated by music (Fig. 27).

Since the carrier was not modulated by a continuous sine wave, but rather by musical tones which changed at frequent random intervals, we had some difficulty photographing a distinct picture of the resulting carrier wave form. We were, however, able to successfully take pictures by using the scope's trigger sweep. One trace was permitted to appear on the scope whenever the applied signal exceeded a certain predetermined amplitude—the scope then completing the wave pattern.

In this manner complete wave patterns were flashed on the screen at a random rate somewhat controlled by the trigger-level setting. Fig. 28 shows four consecutive scope sweeps of various carrier waveforms produced as a result of the music. Without this technique the scope traces would have appeared as but a white band of light changing shape faster than the eye could effectively register waveforms. [This photograph would seem to indicate that this radio station, despite FCC regulations, was broadcasting with more than 100 percent modulation. In the seventh roll of vertical squares we see a straight white line, which would seem to indicate that the music was actually cutting the radio station off the air during short intervals.]

The radio station's RF wave is shown in Fig. 29. The amplitude of this wave can be seen varying rapidly in response to the modulating music.

### CONCLUSION

In this month's article we have been able to see how RF signals are tuned in resonant circuits, how square waves produce harmonics that can be tuned, and some broadcast radio signals that can appear in tuned circuits. The next article in this series will cover the conversion of radio-frequency (RF) signals to intermediate-frequency (IF) signals. ■

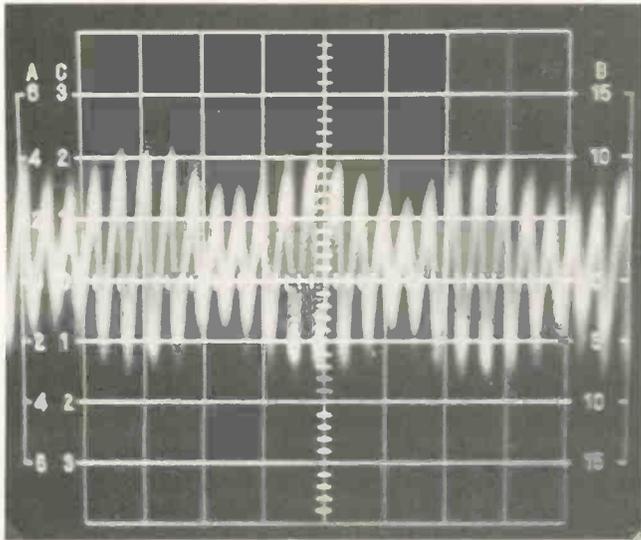


Fig. 26—A beat frequency appears when two radio stations are received simultaneously on a tuned circuit.

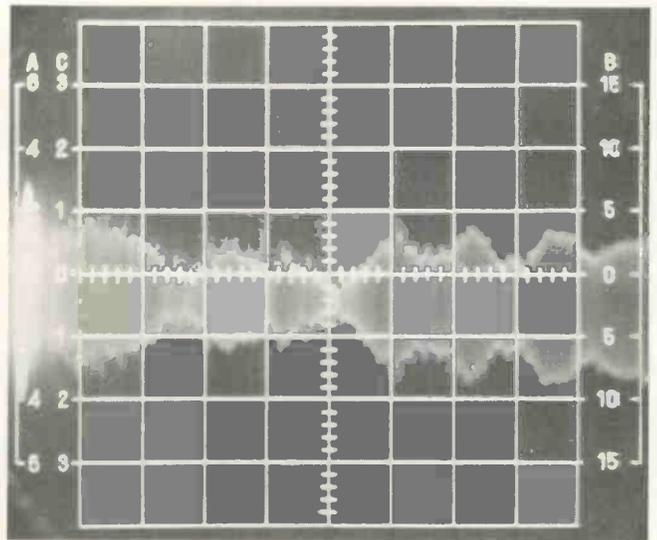


Fig. 27—The modulated carrier of a radio station.

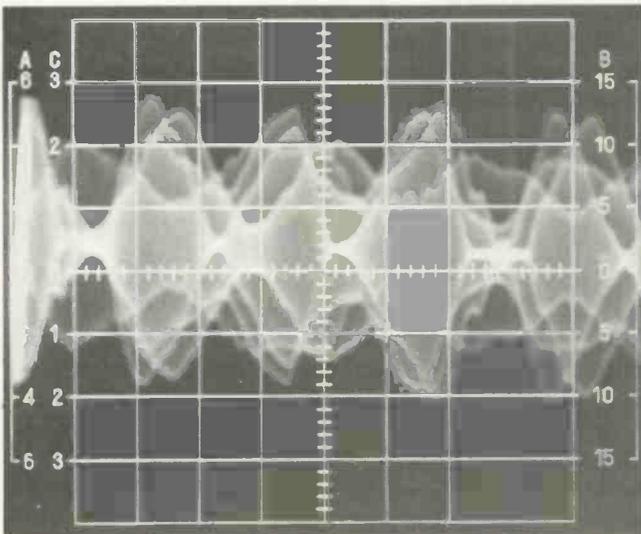


Fig. 28—Four exposures showing a radio station's modulated carrier at various intervals of time.

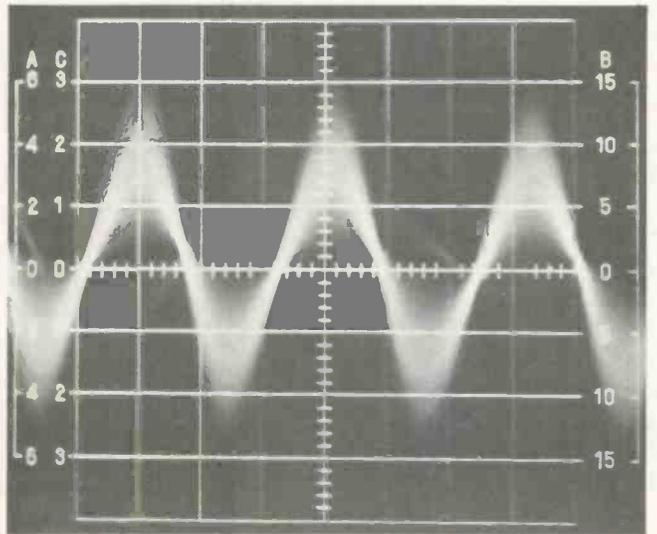


Fig. 29—The amplitude of this radio wave varies in response to the modulating signal.

## HI-FI...

*continued from page 47*

grained wood cabinet measuring 24¾ in. by 8½ in. by 14½ in. The dust cover and 45 RPM adaptor are accessories included with the system.

### Weltron Co.

A fully-transistorized Recording and Playback Unit, Model WTR-800, has been developed for endless loop cartridges. It is designed for use with existing stereo receivers or amplifiers.

The recorder/player, with automatic level control circuits, is engineered to provide recordings with full-dynamic range without the constant need for adjustments. A functional control al-

lows selection of program modes with automatic cartridge ejection at the end of the selected cycle.

The user can reportedly record on his eight-track cartridge and play them



back on his existing receiver without any loss of range, and with minimum attention to controls. The recording and playback unit is priced at \$139.95.

### Zenith

The Hayden Model B449W is a solid-state modular tuner/amplifier with the "Circle of Sound" concept

that brings stereo music to all parts of the room. The 40w unit, with FM and



AM bands, tuning meter and inputs for tape and phono, fits in a wall shelf, bookcase or on an end table.

The two cylindrical high compliance speaker units drive sound outward in all directions surrounding the room with stereo sound. The cabinet is finished in a grained walnut color. ■

# One-Write Contract Form Saves Time, Improves Service

The design of a simplified system to economically  
comply with the Truth in Lending Act.

■ When the new Truth in Lending Act became effective, most dealers had to get new retail sales contract forms to comply with the new requirements. However, TV Engineers, Inc., of Flint, Mich., went one step further and developed a compact six-part form set that provides all necessary records—for customer, bank, delivery, invoicing and office record—at the initial writing.

As soon as the new law was passed, John Toth, company president, and Gary Poling, general manager, reviewed their retail contract paperwork to determine the most practical approach to take. The obvious solution would have been to use a new standardized contract agreement form available from suppliers. This, however, would have involved extra paperwork and increase clerical preparation and processing time.

Instead, they decided to develop a unit system so that all required papers could be prepared at the initial writing. This would reduce clerical time for both the dealer and the bank and, in addition, eliminate transcribing errors and improve customer service. To assist them with the project they enlisted the services of John M. Bourbeau, a forms system specialist from the Flint office of Moore Business Forms, Inc.

## The New System

The new system is based on a specially designed form, which produces all necessary records at the initial writing. All parts and carbons are attached to a stub on the left side for easy separation and distribution.

Printed blockout areas on the delivery portion and contract terms and conditions on the back of the invoice and customer copies are the key features. Colored paper also is used as an aid in recognition and distribution of parts.

The form set is prepared at the time of the sale. Upon completion, the parts are detached by a quick snap of the stub, leaving the used carbons attached to the stub for easy disposal. The parts are then distributed as follows:

Part four, Customer Copy (pink), is given to the customer. The back of this copy contains the terms and conditions of the sale.

Parts one and two, Original Invoice and Duplicate Invoice (white), are sent to the bank for approval and subsequent billing to the customer.

Part three, Office Copy (yellow), is retained as a permanent record of the sale.

Part five, Data Processing Copy (buff), goes to the data processing

department where the data is entered into their system for financial and statistical use.

Part six, Delivery Copy (goldenrod), goes with the merchandise when delivery and installation of the consumer electronic product is made. The printed blockout area on this part prevents financial and personal data from being readable by service personnel.

## Its Advantages

Some of the advantages of the new form system include:

- It meets all requirements of the Truth in Lending Act.
- All required documents are prepared at the initial writing.
- Speediset construction reduces clerical preparation and processing time.
- Colored parts aid in recognition and distribution.
- Printed blockout area on delivery copy prevents personal and financial data from being readable.

“Our new retail installment contract form set fits our needs perfectly,” explained Poling. “It saves paperwork for us and for the bank; transcribing errors, which occur when separate forms are used, are eliminated; and customer service and relations have been improved.” ■

This specially designed one-write contract form set, developed by TV Engineers, Inc., is used in preparing all necessary records—contract, original and duplicate invoice, plus office, data processing and delivery copies—all with the initial writing.

FOR SERVICE CALL CE2-0135

DELIVERY 7099

G. SMITH  
Delivery Date: ASAP  
Approved by: PH

T.V. ENGINEERS, INC.  
3102 SO. DORT G3392 W. MILLER RD.  
PHONE: 232-0133 PHONE: 732-1620  
FLINT, MICH. 48507 9-25 1970

TERMS: 36 MO

SOLD TO: JOHN DOE  
ADDRESS: 123 MAIN ST. CITY: ANY CITY PH: 16 78  
COUNTY: UNION ZIP CODE: 48500  
DELIVERY DIRECTIONS: REAR ENTRANCE - AFTER 5 P.M.

QUAN	MODEL NO	DESCRIPTION	PRICE	TERMS
1	MC 40 MAHOGAN	PILOT STEREO		

C.O.D.

FOR SERVICE CALL CE2-0135 DATA PROC. COPY 7099

FOR SERVICE CALL CE2-0135 CUSTOMER COPY 7099

FOR SERVICE CALL CE2-0135 OFFICE COPY 7099

FOR SERVICE CALL CE2-0135 DUPLICATE INVOICE 7099

FOR SERVICE CALL CE2-0135 ORIGINAL INVOICE 7099

G. SMITH  
Delivery Date: ASAP  
Approved by: AM

T.V. ENGINEERS, INC.  
3102 SO. DORT G3392 W. MILLER RD.  
PHONE: 232-0133 PHONE: 732-1620  
FLINT, MICH. 48507 9-25 1970

TERMS: 36 MO

SOLD TO: JOHN DOE  
ADDRESS: 123 MAIN ST. CITY: ANY CITY PH: 16 78  
COUNTY: UNION ZIP CODE: 48500  
DELIVERY DIRECTIONS: REAR ENTRANCE - AFTER 5 P.M.

QUAN	MODEL NO	DESCRIPTION	PRICE	TERMS
1	MC 40 MAHOGAN	PILOT STEREO		

C.O.D.

T.V. ENGINEERS INC. WARRANTS THAT IT WILL PROVIDE ANY REQUIRED SERVICE ON THE ITEM ABOVE DESCRIBED FREE OF CHARGE FOR A PERIOD OF 90 DAYS FROM AND AFTER SALE THE FOREGOING IS IN LIEU OF ALL WARRANTIES EXPRESS, IMPLIED OR STATUTORY AND T.V. ENGINEERS MAKES NO WARRANTIES OF MERCHANTABILITY THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION OF THE FACE HEREOF.

SELLER RETAINS A SECURITY INTEREST IN ABOVE ARTICLES. TERMS OF AGREEMENT ON REVERSE SIDE.

Any unpaid balance may be paid at any time, provided a minimum Finance Charge of \$10.00 to be retained by seller or assigns, and any unearned Finance Charge will be refunded based on the "Rule of the 78's". Payments by overdue more than 10 days subject to a late charge of 5% of the payment amount, provided the late charge may be no more than \$5.00 for each overdue payment. The Finance Charge will begin to accrue on the date of the contract or the date of delivery, whichever occurs latest. Payments to be made at the place designated by seller.

PREVIOUS ADDRESS: NONE  
EMPLOYED BY: ROE CONSTRUCTION Co.  
PREVIOUS EMPLOYER: NONE  
MARRIAGE INCOME: \$200 PER WK  
MARRIAGE OR RES: WILLIAM R. DOE  
ADDRESS: 456 FIRST ST.  
RENTING OR BUYING TERMS: RENTING

WIFE'S NAME: MARY  
WIFE'S EMPLOYER: HOUSEWIFE  
WIFE'S APPROX. INCOME: NONE  
MISC. CREDIT CARD: JONES DEPT. STORE  
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Net	\$ 372.00
Down Payment	
Cash	NONE
GOOD	-
Total Down Payment	0
5. Unpaid Balance of Cash Price	372.00
7. Charge for Credit Life Insurance	N.A.
8. FINANCE CHARGE	134.36
9. Total of Payments	504.36
10. \$ 504.36	Deferred Payment Price (Sum of Items 5, 8, 9)

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x John Doe

x John Doe

# The More You Learn, The More You'll Earn

by Bernard Shine

A short time ago, schools throughout the country re-opened their doors to begin the 1970-71 year. From youngsters in the primary grades to young adults in colleges and universities, millions of students are back in school to take advantage of the learning process—to better themselves, thus bettering their careers and their way of life.

■ Many electronic technicians are striving to better themselves by upgrading their skills. Some, however, are doing little or nothing to further their education because they feel incapable of absorbing additional knowledge or lack the necessary motivation. This group should take a long, hard look at the pros and cons

before they decide whether or not it is worth the effort.

## Improved Skills Mean Improved Wages

One of the world's best motivators is money. Show almost anyone a stack of bills and he'll do nearly anything to earn it—if it is a sure thing and if it is honest. That is why I find it hard to comprehend why more technician/dealers do not avail themselves of the tremendous educational opportunities that are all around them, waiting to be accepted. "Learning Improves Earning" is a sure thing, and there is no question that it is honest.

No one knows better than the technician/dealer that the service business has changed drastically over the years. The wiser radio servicemen of 25 years ago saw the potential of TV and expanded into this growing segment of the service market. In the same way, radio-TV men of today have the great opportunity of reshaping their careers to become not just radio-TV technicians but *electronic* technicians. The demand for competent service on mobile communications gear, hi-fi, home intercom systems, medical electronic apparatus, sound and strobe lighting, garage door openers, etc., is *not* just

around the corner, it is here now. And it is ready for the men who prepare themselves by a program of study and self-improvement.

Other areas that are fast becoming heavily electronic-oriented are fire and burglar alarm systems, speed and temperature controls on household appliances, and marine depth finders, to name a few. And new uses for electronic circuitry are cropping up all the time.

This can mean only one thing to the true electronic technician—he must stay abreast of our growing industry if he wants to grow with it. And this kind of advanced study will not be a drag when he realizes that he would not be in the business in the first place if he did not have a fond fascination and love for electronic circuitry.

## Not Necessarily Formal Schooling

Education is acquired in many different ways. The word itself means "discipline of mind or character through instruction or study." Formal schooling, of course, is great. Electronic institutes (classroom or home-study courses) are probably the best and fastest way to acquire the knowledge to keep up with today's technology. Many high schools, vocational schools and colleges conduct adult evening classes in specific subjects which will tie in with specific requirements, at little or no cost to you. If you have already had some formal training, do not smugly tell yourself that there is nothing more to learn. Take advance courses on some of the new material which did not even exist when you last "cracked a book."

Actual schooling is not the only way to keep up with the times either. Nor is it the total answer. Self-study is also a very important part of the discipline. Books by experts in their fields, and publications such as the one you are now reading, regularly supply a wealth of knowledge to those that diligently go after it. Literature from manufacturers will familiarize you with electronic equipment that you have not heretofore serviced. Component literature will improve your understanding of why a certain type of part should be used rather than another. Attendance and

*continued on page 76*



Bernard J. Shine is marketing manager of Sprague Products Co., which is the distributors' supply subsidiary for Sprague Electric Co. "Barney" has been associated with Sprague Products Co. in various sales and marketing capacities since 1957. Prior to attaining his present post, he had been New England district manager. He majored in marketing at Boston College and also attended Northeastern University. Barney was previously with the Communications Div. of the Massachusetts State Police and the sales engineering staff of the Boston Gas Co.

## TEST INSTRUMENT REPORT

# Sencore's PM 157 Power Monitor

by Phillip Dahlen

This instrument not only measures applied voltage and current drain but is calibrated to indicate the amount of ac power consumed by electronic products under test.



Sencore's PM 157 Power Monitor. For more details circle 900 on Readers Service Card.

■ Recently we encountered a problem on the ELECTRONIC TECHNICIAN/DEALER bench which had us puzzled. Whenever a certain TV set was allowed to run for a moment and then turned OFF, it would open the circuit breaker with every attempt to turn it ON—for up to 30 minutes after it was first turned OFF.

Not certain whether the problem was in the circuit breaker or some other portion of the TV set, we wound a  $1\Omega$  high-wattage resistor by wrapping insulated solder around a paper cup. Connecting the resistor across the open circuit breaker and a voltmeter across the resistor, the ac voltage scale was used to directly indicate the amount of current passing through the TV set. The 0.6 amp normal current was observed as it surged to 10 amp when the TV set was turned ON a second time, thus indicating that the trouble was in some other portion of the TV set. (A malfunction in the high-voltage power supply was causing an SCR diode to continuously conduct during those periods.)

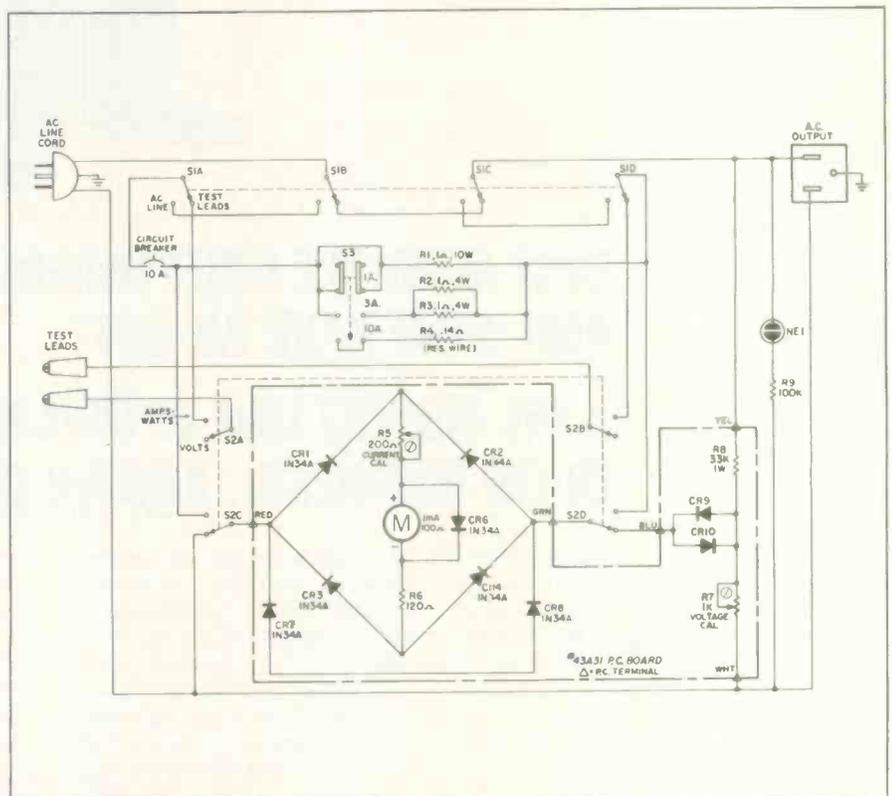
Sencore has developed a new product, the PM 157 Power Monitor, which eliminates such cumbersome techniques. Power consumed by the TV set (or other electronic product) can be determined by plugging it into the power monitor or, if a fuse has opened, connecting the product to the monitor test leads.

The power monitor can be used to indicate the line voltage applied

to an electronic product; the amount of current that it is conducting; and, assuming 115vac line voltage, the amount of power that it is consuming. A handy power conversion chart can be used should the line voltage vary significantly from 115 vac. (*One word of caution!* The test leads are designed to apply power to the unit under test and should not be connected to a power line for voltage measurements—this the me-

ter can do internally. Failure to follow these instructions could damage the instrument.)

The test instrument comes with a 0 to 135vac scale plus 0 to 1.0, 0 to 3.0 and 0 to 10.0 amp ac scales and a scale showing approximate power consumption when there is 115vac of line voltage. Still another set of meter scales included indicate safe current ranges for various fuse resistors. ■



Manufacturer's schematic of the Power Monitor.



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# TECHNICAL DIGEST

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

## RCA SALES CORPORATION

### FM Stereo—Synchronous Detector Circuit

Many RCA stereo receivers use a four-diode synchronous detector circuit to extract left and right channel audio from the multiplex stereo signal. The following circuit description of the synchronous detector should enhance the service technician's knowledge of FM stereo circuitry.

Detected composite audio consisting of left plus right (normal audio), left minus right (sidebands of the suppressed 38kHz subcarrier) and a 19kHz pilot signal, is applied to the input of the multiplex circuits. The 19kHz signal (pilot) is separated from the composite audio, am-

plified, doubled in frequency, and is used as a 38kHz demodulator drive signal that is applied to the primary of transformer T1.

The amplified and doubled pilot furnishes a high-level 38kHz signal at secondary of transformer T1, with the terminals (2) and (3) alternately delivering positive and negative output to switch the diodes of the synchronous detector "ON" and "OFF" in such a manner that L+R main-channel and L-R subcarrier (composite audio) are recombined into left and right channel signals. This composite audio signal is applied to the center-tap of the secondary of transformer T1.

Synchronous detector operation depends on the fact that the L-R sideband information of the composite audio signal surrounding the suppressed 38kHz carrier is constantly changing polarity at a 38kHz rate.

Consider first when the 38kHz signal is of negative polarity at transformer T1 terminal No. 3. Now the upper two diodes (CR1 and CR2) become conductive, effectively connecting the left output to the center tap of transformer T1. This allows L+R and the detected +(L-R) to appear at the left output of the detector. The right information, +R and -R, then cancels and predominantly left channel audio is delivered to the left output circuit.

When the polarity of the 38kHz signal reverses, the lower two diodes (CR3 and CR4) become conductive. Now, the right output is connected to the center tap of transformer T1. At this time, the L-R sideband information also reverses polarity and the signals at the output of the detector are L+R and the detected -(L-R). These signals, when combined, provide left cancellation so predominantly right channel audio is delivered to the right output circuit.

When the 19kHz pilot signal falls below 6%, or when monophonic signals are present, the stereo indicator light will not be lit and a minus 9v is applied to the center tap of T1. This causes diodes CR2 and CR4 to conduct, directing equal amounts of audio to both channels for monophonic operation.

## OLYMPIC

### Table Radio Model CR-31—Service Hints

**Symptom:** Distorted sound after 15 to 30 min. operation.

**Correction:** Check or replace audio output transistors Tr 6 and 7. Also measure resistor R14, and replace if value has decreased to less than 5.6Ω. Some units may have been produced with thermistor SDT-09 omitted from chassis. This component is easily identified on the circuit board as a red colored disc in the area of the output transistors.

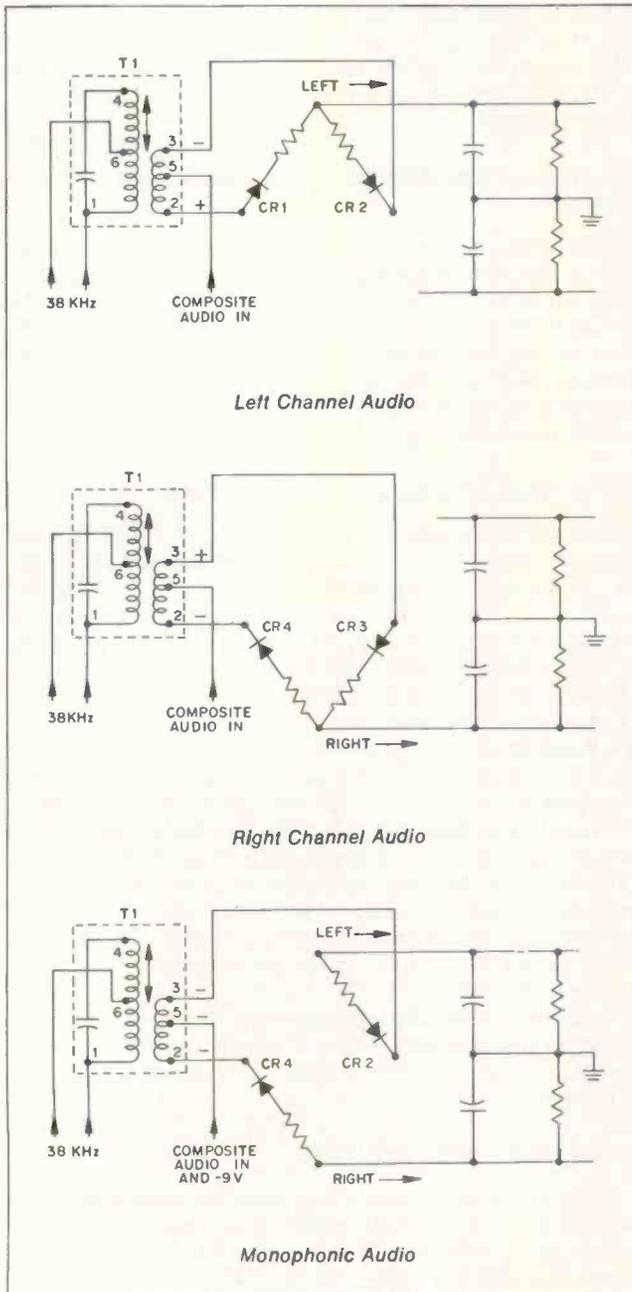
**Symptom:** No sound, audio amplifiers check out but the front end is inoperative.

**Correction:** Converter transistor (Tr-1) is frequently defective. Also check by substitution capacitor C3, 30μf/3v.

### Table Radio Models 32/33/34/35—Service Hints

**Symptom:** Weak and distorted sound.

**Correction:** Replace output transistors Tr-8 and 9 and also replace resistor R40, 2.7Ω. Use a 3.3Ω, ½ w resistor if unable to obtain specified value.



# COLORFAX

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

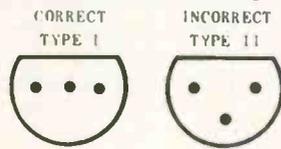
## ADMIRAL

### Color TV Chassis K10—Transistor Q17 Replacement

Replacement transistor 57A149-12 should have the base configuration illustrated as Type I. Admiral received some from the supplier with the Type II configuration and may have shipped some into the field. Only the Type I will perform satisfactorily in the transistor Q17 application of the K10 chassis.

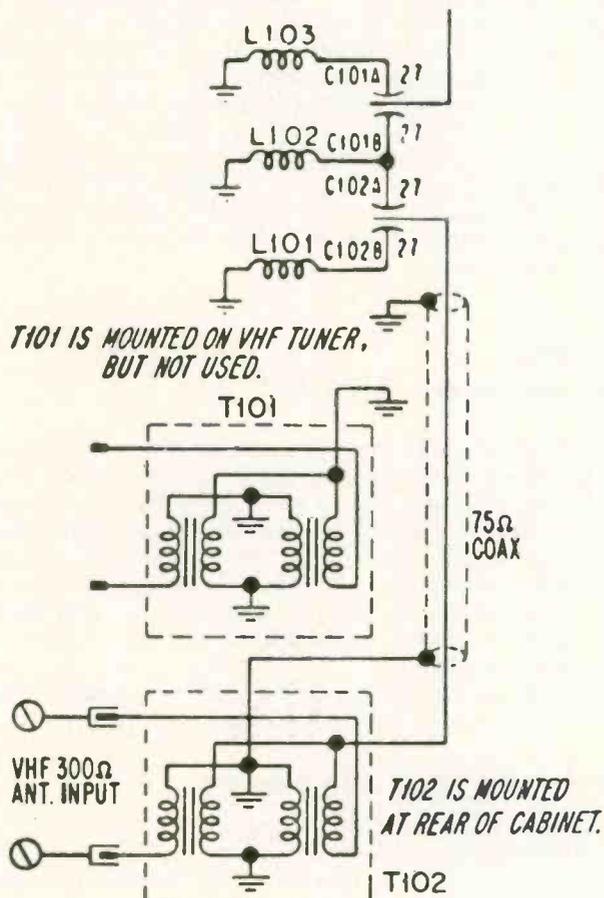
If you have any of the Type II 57A149-12 transistors, return them to your distributor for replacement.

Note that transistors 57A149-12 and 57A150-12 are used alternately as transistor Q-17 in production. Either part can be used for field replacement; however, the basing configuration differs so you will have to interchange leads when replacing one with the other. The base diagrams for both are shown on the K10 schematic.



### 94A286-10 & 94A330-3—Tuner Replacement

When you replace the above tuners in 1971 color TV sets, check the antenna terminal board on the cabinet back. If it has a VHF Balun attached, you must disconnect and ground the Balun on the replacement tuner. Then connect the 75Ω coax from the terminal board to the replacement tuner in the same manner as the original tuner was connect-



ed. The schematic shows this arrangement.

If you do not make this correction on the replacement tuner when an external balun is used, you will cause partial loss of signal and ghosting.

An instruction sheet will be included with these tuners in the future.

## MAGNAVOX

### Color TV Chassis T947—Protection of the Delay Line

The Delay Line on the T947 chassis (Model 1C6104) is mounted on the vertical chassis section and protrudes outward about 1/2 in. past the chassis frame. If the chassis should be turned over on its side it is possible that the delay line or its connections can be broken. If the chassis must be laid on its side with the delay line facing down, protect the delay line from possible physical damage by securely supporting the edges of the chassis so that it does not rest on this component.

### Color TV Chassis T924/T939/T950 Chassis—Series Filament Ground Return

These chassis have series string filaments, and the only path to the main chassis ground from the end of the filament string in the VHF tuner is through the shield of the IF cable. If continuity between the VHF tuner and the main chassis, through the IF cable shield, is interrupted, the filaments will not have a ground return path. Check for continuity of the filament string using chassis ground and not the tuner assembly as ground reference.

### Color TV Chassis T924—Replacing Filament Transformer

You are cautioned that a wiring error in installing a replacement transformer can result in transformer over heating, which may be inadvertently diagnosed as a defective transformer. This error can result from transposing the transformer's black lead and its black/white lead. Referring to Service Manual 7297, Section 4.2, you will see that the schematic for versions using the "Quick-On" feature (T924-03 etc.) shows the "QUICK-ON" switch connected to the yellow transformer lead. When the main ON-OFF switch is in the OFF position, the line voltage is applied across the complete transformer primary. If the black and black/white leads are transposed in hooking up the replacement transformer, the entire line voltage would be applied across the primary section between the yellow and black leads. Under these circumstances you would not notice any problem with the QUICK-ON switch in its OFF position. However, with the switch in the ON position severe overheating of the transformer will result.

Under normal operating conditions the external surface of the transformer will reach a temperature that is uncomfortable to the hand. This does not indicate a defective transformer.

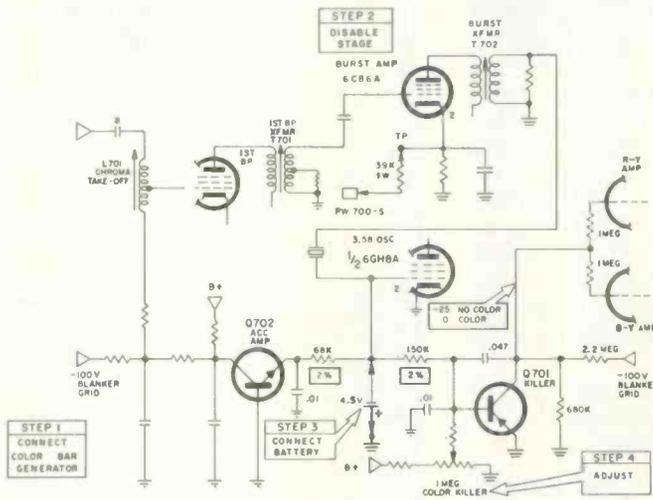
### TV Model 1T5261—Power Cord 1A9182

Some of the power cords may have the leads improperly connected at the cigarette lighter plug end. The negative battery connection should go to pin five on the receiver power plug and the positive to pin three.

## RCA SALES CORPORATION

Color TV Chassis CTC38, CTC39, CTC41, CTC42, CTC43—  
Color Killer Adjustment

Since the color-killer circuitry in these five chassis is similar, the explanation and set-up procedure given here applies to all of them. In most areas, the conventional method of adjusting the color killer is adequate. Simply position the tuner to a vacant channel, adjust the control from the clockwise extreme until colored snow is visible, and then readjust it until the color disappears. While this technique is completely satisfactory under most conditions, refinement of the threshold adjustment may be necessary in those instances when broadcast stations inadvertently



Simplified ACC/Color Killer Circuits

allow a small amount of burst signal to be transmitted with a monochrome signal. The killer system in this series of receiver chassis was designed with high burst sensitivity to enhance fringe-area color reception, and because of this, "leaking" burst may open the chroma channel, even though this burst is attenuated as much as 20dB (1/10 normal). This results in intermittent colored snow during monochrome reception. The adjustment to be described normally will make it possible to maintain color killing during monochrome reception when residual burst is present and also allow normal color reception.

In all these chassis, the color-killer stage is a transistor switch. When this switch is OFF (the transistor not conducting) negative voltage obtained from the blanker grid circuit is allowed to bias OFF the difference-amplifier stages. When turned ON, or conducting, the killer switch enables the difference-amplifier tubes to conduct by removing the negative grid bias and supplying a ground return for the grid resistors.

The conduction point of the switch transistor is dependent on both 3.58MHz oscillator grid bias and the Killer control setting. Conduction is controlled by combining a positive potential from B+ (through the Killer Control) with a negative potential from the 3.58MHz oscillator grid. The resultant voltage is applied to the base of the killer transistor. With no color signal input, the oscillator grid voltage is low (approximately -3.5v); and the positive voltage from the killer control balances that obtained from the oscillator grid. Under these conditions the base bias is zero and the transistor switch is cut OFF. During color reception the oscillator grid voltage increases to approximately -8v. This increased negative bias is sufficient to override the positive potential from the killer control, biasing the killer switch ON and enabling the color-difference amplifiers.

In those areas where a transmitter is known to leak burst, the best policy is to refrain from changing the original

setting of the color killer. If this control has been adjusted, it may be returned to the optimum setting using the factory set-up procedure which follows:

**Step 1.** Connect a color bar generator to the chassis in order to supply a constant-level color signal.

**Step 2.** Defeat the burst amplifier stage by connecting the cathode of the burst amplifier tube to approximately 270v B+ through a 39K, 1w resistor. The burst amplifier cathode is TP701 in the CTC38 and CTC39 chassis; TP704 in the CTC41, CTC42 and CTC43 chassis. The necessary B+ potential is available at terminal PW700-S in all chassis. This step makes the oscillator grid voltage independent of incoming color signal amplitude.

**Step 3.** Connect negative 4.5v bias (use a battery—VS 1149 or equivalent) to the 3.58MHz oscillator grid (Pin 2) through a 470µH choke (Stock No. 124271). It is necessary to isolate the grid with a choke to prevent loading, since the oscillator must be running during the setup procedure to produce color on the screen. This step establishes the optimum oscillator grid bias with the oscillator running for killer adjustment.

**Step 4.** Adjust the Killer control to kill the color bars on the picture tube screen.

An alternate setup procedure, which requires less equipment but which requires somewhat more skill, may be used in lieu of the factory adjustment:

**Step 1.** Tune receiver to a color broadcast.

**Step 2.** Connect a VTVM through a 470K resistor to the grid of the 3.58MHz oscillator.

**Step 3.** Adjust the receiver fine tuning (away from sound) until the VTVM indicates -4.5v.

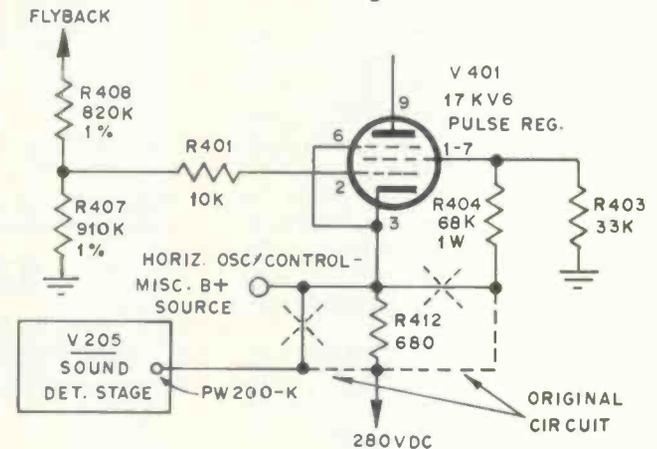
**Step 4.** Adjust the killer control until color is just killed and no further.

## Color TV Chassis CTC22AD—Pulse Regulator Circuit Modifications

In early production versions of chassis CTC22AD, Pulse Regulator tube failure causes resistor R412 to open, and the instrument may then operate with marginal picture quality after the tube is replaced. The symptoms would be those associated with reduced horizontal drive.

By changing the B+ source point for the regulator screen grid resistor (R404) as shown, the circuit "shuts down" its horizontal operation whenever resistor R412 fails. The B+ source for the sound detector stage is also changed to this point. Symptoms for resistor R412 failure in receivers containing these changes will be: no sound, no raster.

The value of resistor R407 and R408 may be either 820K, 1% or 910K, 1%. If replacement is required, use the same value resistor as the original. Stock numbers are:



820K, 1%—126429; 910K, 1%—126428. Check the high voltage operation after resistor replacement and adjust according to service manual.

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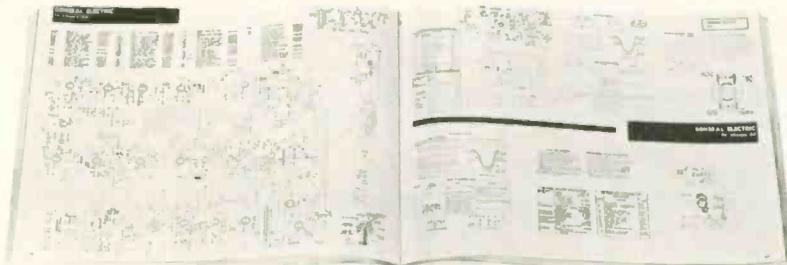
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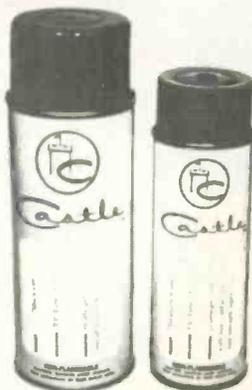
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of degreaser/cleaner for high-pressure spray removal of dirt from the contact surfaces and a re-lubricating spray for the cleaned tuner contacts. The kit comes complete with instructions. Price \$5.50. Castle.

### MOBILE TABLE 704

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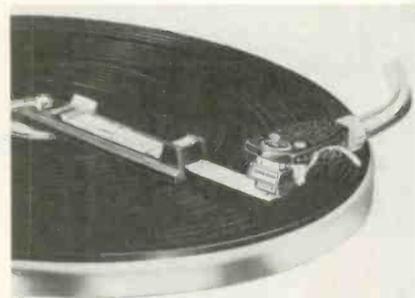
An outdoor, all-channel preamplifier with a reported frequency range of 54 to 890MHz has been designed to improve color- and B/W-TV pictures in deeper fringe areas. The preamplifier, Model 42875, is a 75Ω output device which is connected to shielded cable to eliminate powerline and ignition interference. Specifications indicate that the preamplifier features high gain and low noise as well as lightning protection and a tuneable FM trap. Price \$47.25. Jerrold.



### STYLUS FORCE GAUGE 706

*Stylus pressure is measured in playing position*

A stylus force gauge, Model SFG-2, has been developed to measure the tracking force of a manual or automatic turntable tone arm. The design of the force gauge is based upon a positive counterweight balance principle. It is designed to measure stylus pressure with the tone arm in actual playing position and is reportedly accurate to within 0.1 gram in the optimum tracking range of 1/2 to 1 1/2 grams. In use, the counterweighted end of the gauge is aligned with the spindle of the turntable. The tone arm is placed on the unweighted end with the stylus in a channel to insure proper positioning. The counterweight is then adjusted until reference bars are aligned. At that point the stylus pressure can be read on the gauge's scale. If a stylus force in excess of 1 1/2

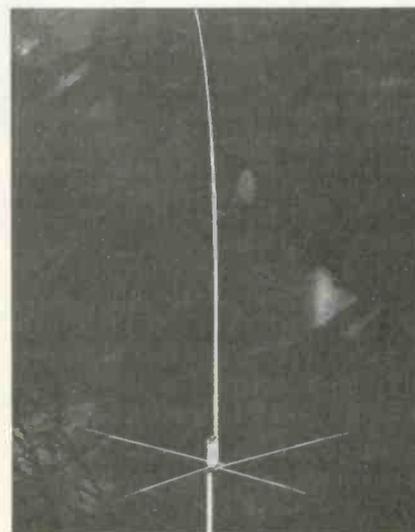


grams is to be measured, the stylus is placed in a second channel, which makes it possible to get an extended force measurement of up to 3 grams. Price \$4.95. Shure.

### ANTENNA 707

*Designed to withstand severe weather conditions*

A fiber-glass base station antenna, Model M-317, has been designed to withstand up to 115 mph winds and is guaranteed for 10 years not to fade or deteriorate from intense sun, heat, rain or snow. Specifications indicate that the antenna is fully grounded for reduced receiver noise and that the fiber-glass construction eliminates many detuning and static problems. Price \$59.95. Antenna Specialists.



### AC ADAPTER 708

*Solves the problem of varying polarities*

An ac adapter, Model BC9, has been designed with a reverse polarity plug to handle both positive and nega-

# BLUE STUFF

Doesn't Rattle  
when you shake it



and it's a good  
thing it doesn't

Here's why - Continuous polishing compounds like BLUE STUFF must be free to migrate on the tuner contacts as the channel selector rotates. If the compound were to thicken and harden (cake up) it would prevent good contact from being made and you'd have a callback.

How can you tell if a product will harden on the contacts? Chances are that if it will cake up on contacts it will also cake up in the can. So, just shake the can and see if it rattles. If it doesn't rattle that means it didn't need a marble to keep the compound from settling out and hardening, and that's a good indication that it will not harden on the tuner contacts.

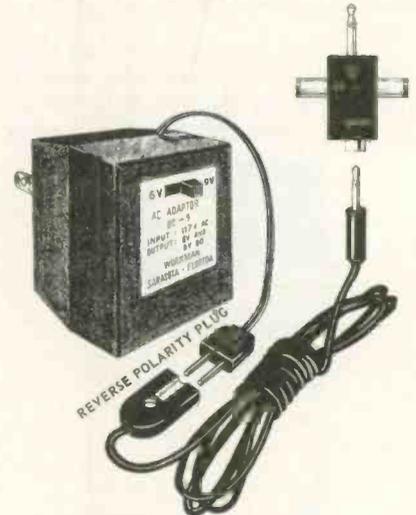
Pick up a can of BLUE STUFF and shake it. . . .  
What you don't hear tells you a lot.

**TECH**  
**SPRAY** better chemical tools for technicians

P. O. Box 949 Amarillo, Texas • Canada: Wm. Cohen, Montreal • Export: Empire Exporters, N.Y.C.

## NEW PRODUCTS

tive polarities. Specifications indicate that the adapter also comes with a four-way plug to handle a variety of plugs including European standard. The adapter is equipped with a switch for 6v and 9v use. Workman.



### CAMERA BATTERY

709

Blister-packaged  
for dealer display

The PX-825 battery, designed for instamatic-type cameras, is being offered in a blister card package for dealer display racks. Specifications indicate that the wafer-shaped 1.5v Duracell is an all-purpose alkaline battery featuring "fool proof" insertion in cameras. Mallory.



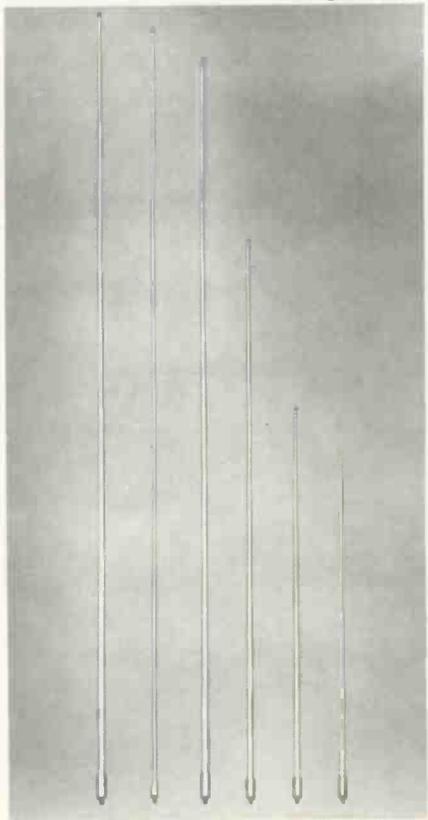
### CB ANTENNA

710

Available in fiberglass  
or stainless steel

A complete line of mobile Citizens Band Antennas is developed ranging from 18 to 105 in. and available in fiberglass or stainless steel. Featured in the line are the 1 to 1 plus 4 and

the 1 to 1 plus 6, which have an adjustable tuning tip to give the lowest possible SWR. The top loaded design of the antenna solves the problem of low efficiency. Constructed of fiberglass, the antenna series reportedly offers strength, durability and noise-free performance. The antennas sell for \$10.95 to \$11.95. Pearce-Simspon, Inc.

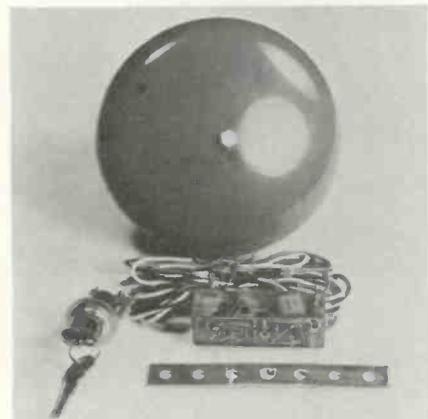


## BURGLAR ALARM

711

Triggered by voltage drop without using switches

The alarm system, developed without special tripping or triggering switches, detects any sudden drop in battery voltage. Such a drop occurs when a door is opened, automatically turning on the dome light; or when a lighted glove compartment, trunk or engine compartment is opened. It is activated when the starter is used or



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 Color Vision Electronics  
 Columbia Radio & Supply  
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 Consumer Electronics  
 Joe Coomes Dist.  
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 Covington Distributing  
 Craft Radio  
 Crescent Electronics  
 Cumberland Electronics  
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 D & H Distributing  
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 D & S Electronics  
 Dale Electronics  
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 B. J. De Jarnatt Wholesale Co.  
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 Denison Supply  
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 A. Dukis Appliance Dist.  
 J. V. Duncombe Electronics  
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 Electronic Equipment  
 Electronic Materials  
 Electronic Parts Co., Inc.  
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 Electronic Supply Co.  
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 Electorex  
 Elliott Electronics  
 Emerald Electronics  
 Emerson-Dumont Southern Cal.  
 Emerson-Midwest

Emerson-Northwest  
 Emerson Radio of N. E.  
 Emerson Radio of Pa.  
 Emerson Radio of Ohio  
 Emerson TV of Indiana  
 Emerson of W. Pa., Inc.  
 Empire Sales  
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 Frances Electronics  
 Frackelton Co.  
 Frack Radio & Supply  
 Frontera Electronics  
 Ft. Wayne Electronics  
 Fullers Sound Electronics  
 General Electronics  
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Main TV Supply  
 Manfred Electronics  
 Mar Vac Electronics  
 Marzas & Klausner  
 Marietta Radio & TV Supply  
 Martin Distributing  
 Masline Electronics  
 Master Electronics  
 Albert Mathias Co.  
 May Electronics  
 May & Jackson Dist.  
 Melville Radio Corp.  
 Metro Electronics  
 Ferguson Electronics  
 Metronix - Detroit  
 Midland Specialty  
 Mid-Ohio Electronics  
 Mid State Supply  
 Mid State Radio  
 Midwest Electronics  
 Miller Jackson  
 Millers Electronic Supply  
 Missouri Cable Co.  
 Mitchell Electronics

Ralph's  
 Randolph, Hale & Matthews,  
 Randolph & Parks, Inc.  
 Randolph & Rice  
 Rankin & Houser  
 Ratic Company  
 Reeves Electronic Supply  
 Reed Radio Supply  
 Rein Distributors  
 Remcor Electronics  
 Resco Electronics  
 Rim Electronics, Inc.  
 Risher Electronics  
 Robertson Electronics  
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 The Tube Mart  
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 Wallicks Electronics  
 Walker Radio  
 L. B. Walker Radio Co.  
 Warren Radio  
 Walco, Inc.  
 Wedemeyer Radio  
 Westchester Electronics  
 Wesco Electronics  
 Western Electronics  
 Westside Electronics  
 David White  
 Whitehead Radio  
 Wholesale Electronics  
 Wible Radio Supply  
 Wicks Radio  
 Wilcox Radio Distributors  
 H. A. Williams  
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**BLUE STUFF  
 IS IN GOOD COMPANY**

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 Giant Electronics  
 League Electronics  
 Glen Electronics  
 Eldred Electronics  
 Grice Electronics  
 Guaranteed Maintenance  
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 Hesco Supply  
 Halley Electronics  
 Hamburg Bros.  
 Hammond Electronics  
 Harco Electronics  
 Hargis Austin  
 Hatry Electronics  
 Harp Electronics  
 E. A. Helwick Electronics  
 Hemcar Radio  
 Henshaw TV Supply  
 Hialeah Electronics  
 Hollander Company  
 Holt Electronics  
 Hooper Electronics  
 Hope Electronics  
 Houston Electronics  
 Howard Electronics  
 Howat Electronics  
 Hughes Supply  
 Hurley Electronics  
 Huston Electronics

and here are some of the good companies where you can get it!

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 Inland Electronics  
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 Jersey Electronics  
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 Roberts Kay Co.  
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 Keith Electronics  
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 Kenton Corporation  
 Kentucky Electronics  
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 Kimbal & Stark Electronics  
 Kinde Distributing Co.  
 Klausner Electronics  
 Knight Distributors  
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 L & S Electronics  
 Lake Charles Electronics  
 Land Electronics  
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 Main Line Distributors

Peninsula Electronic Supply  
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 A. A. Peters  
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 Pilgrim Electronics  
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 Precision Electronics  
 Pringle Electronics  
 Purchase Radio Supply  
 RCA Victor Dist. Co.  
 Radio Distributing Co.  
 R K Distributing Co.  
 R P C Electronics  
 R & R Electronic Supply  
 R S L Distributors  
 Radisco  
 Radio & Appliance Dist., Inc.  
 Radio Electric Supply  
 Radio-Electronic Equipment  
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If we've left anyone out let us know and we'll run an ad for them

**TECH SPRAY** P. O. Box 949  
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makers of BLUE STUFF and other chemical tools for technicians

## NEW PRODUCTS

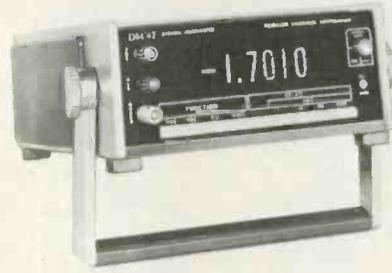
the headlights are switched ON, but is not triggered by the dashboard clock. A sudden voltage drop fires an SCR diode which activates a loud emergency bell. The module and other components reportedly can be mounted quickly and easily with push-in-place, gummed backing. The Audiotex Electronic Solid-State Auto Alarm Kit No. 30-3180 is priced at \$29.95. GC Electronics.

### DIGIT MULTIMETER 712

Full 4½ digit with 0.02% dc accuracy and 10µv resolution

A full 4½ Digit Multimeter, Model DM42, is designed to offer 0.02% dc accuracy with 10µv resolution and 0.02% ac accuracy with 100µv resolution. The multimeter features reportedly include 100% overranging, variable sample rate, five full readings per second, small size and computer styling. Five ranges of dc volts with 10µv resolution, four ranges of ac volts with 100µv resolution and six ranges of

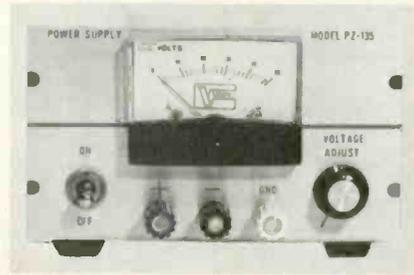
ohms with 0.01Ω resolution are said to be featured. Complete price \$690. Precision Standards Corp.



### POWER SUPPLY 713

Outputs of 0 to 25v at currents to 1a

A low-cost general-purpose power supply, Model PZ-135-A, is designed to provide outputs of 0 to 25v at cur-

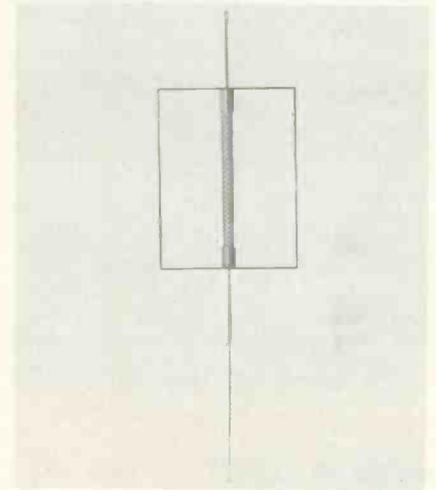


rents of up to 1a. Specifications indicate that regulation is better than 50mv for load variations and ±10mv for line voltage regulations with ripple less than 1mv RMS. Features include electronic current limiting, floating output, 10 turn voltage control, rear panel connection for output, remote sensing and an external current limit adjustment. Price \$48. Viking.

### FIBERGLASS ANTENNA 714

Copper armoring process for ruggedness and reliability

An antenna, Model FG-27, with a fiberglass center support, reportedly features a copper armoring process which prevents change or shift in the antenna's resonant frequency. The construction is said to combine fiberglass flexibility and larger element diameter. New-Tronics.



## Introducing the world's only \$339 triggered scope.

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

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

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



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

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

Going like hotcakes at your Leader distributor.

## Seeing is believing.

### LEADER INSTRUMENTS

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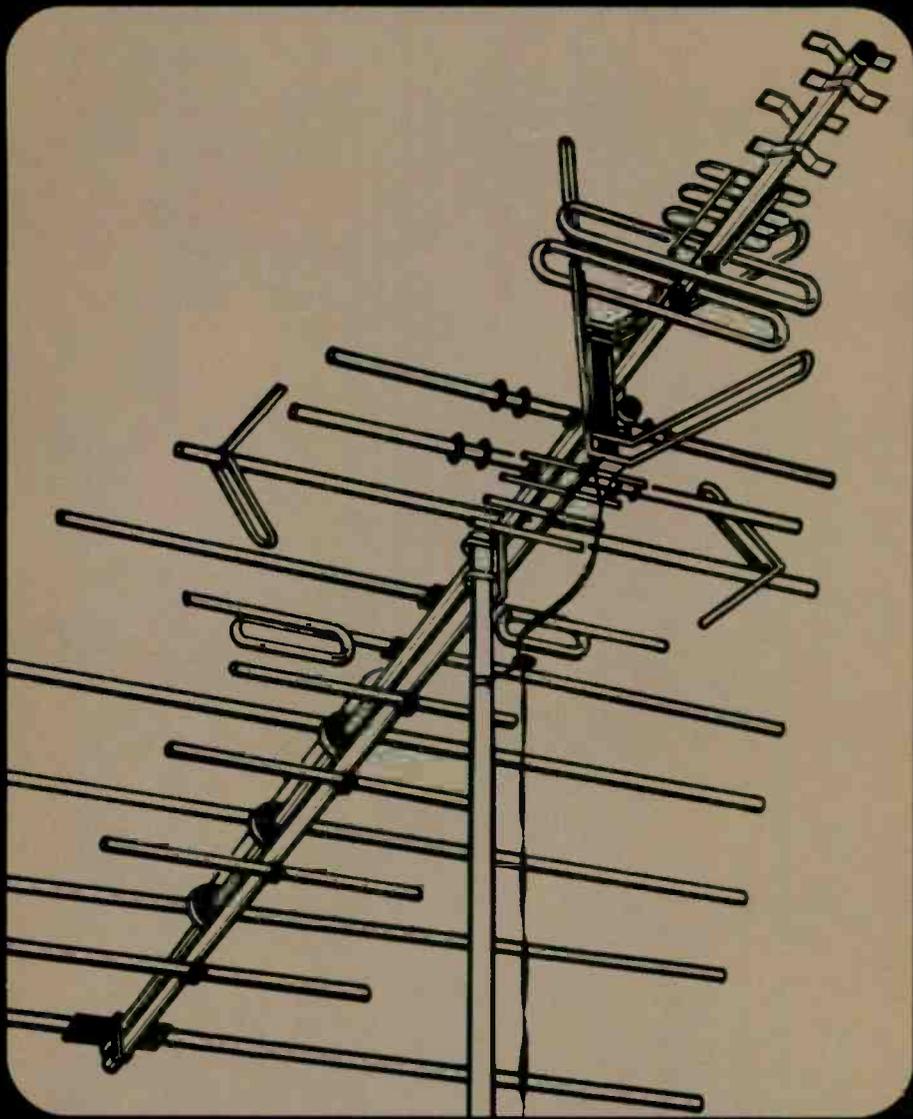
### X-RAY ALERT 715

Emits a warning signal if HV rises above permissible level

A device, designed to warn of harmful X-ray emissions from color-TV



sets, emits a red warning signal whenever TV-set voltage rises above a permissible level. According to the manufacturer, the device may be quickly attached to any color-TV set, and con-

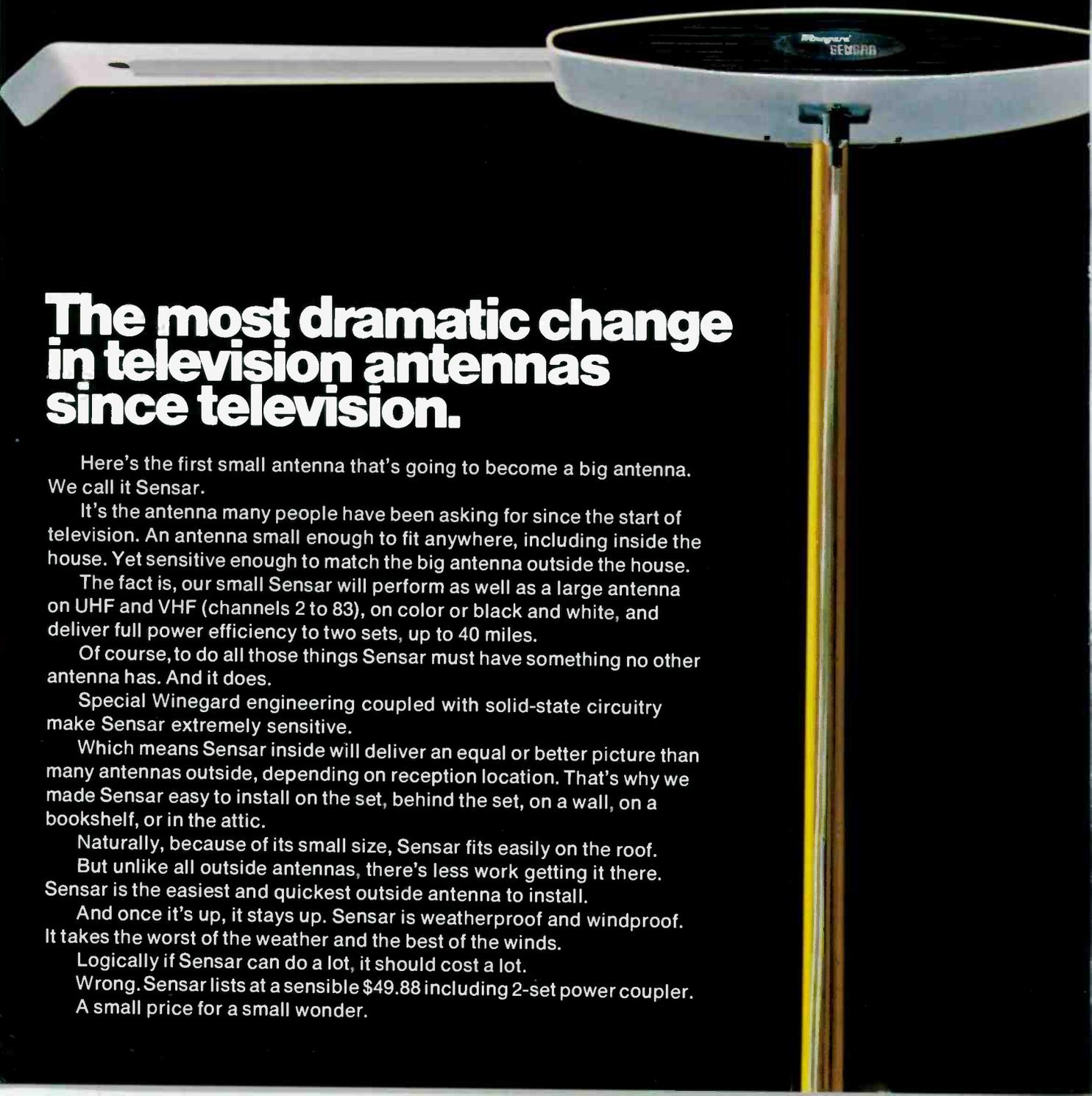


**The biggest  
is no longer  
the best.**

Introducing Winegard's  
**SENSAR**



# Introducing Winegard's **SENSOR**™



## **The most dramatic change in television antennas since television.**

Here's the first small antenna that's going to become a big antenna. We call it Sensor.

It's the antenna many people have been asking for since the start of television. An antenna small enough to fit anywhere, including inside the house. Yet sensitive enough to match the big antenna outside the house.

The fact is, our small Sensor will perform as well as a large antenna on UHF and VHF (channels 2 to 83), on color or black and white, and deliver full power efficiency to two sets, up to 40 miles.

Of course, to do all those things Sensor must have something no other antenna has. And it does.

Special Winegard engineering coupled with solid-state circuitry make Sensor extremely sensitive.

Which means Sensor inside will deliver an equal or better picture than many antennas outside, depending on reception location. That's why we made Sensor easy to install on the set, behind the set, on a wall, on a bookshelf, or in the attic.

Naturally, because of its small size, Sensor fits easily on the roof.

But unlike all outside antennas, there's less work getting it there. Sensor is the easiest and quickest outside antenna to install.

And once it's up, it stays up. Sensor is weatherproof and windproof. It takes the worst of the weather and the best of the winds.

Logically if Sensor can do a lot, it should cost a lot.

Wrong. Sensor lists at a sensible \$49.88 including 2-set power coupler.

A small price for a small wonder.



**Sensar installs  
anywhere in  
minutes.**

**Inside**



**At home  
in the home.**

**Outside**



**Goes up faster.  
Goes up easier.**

**In-between**

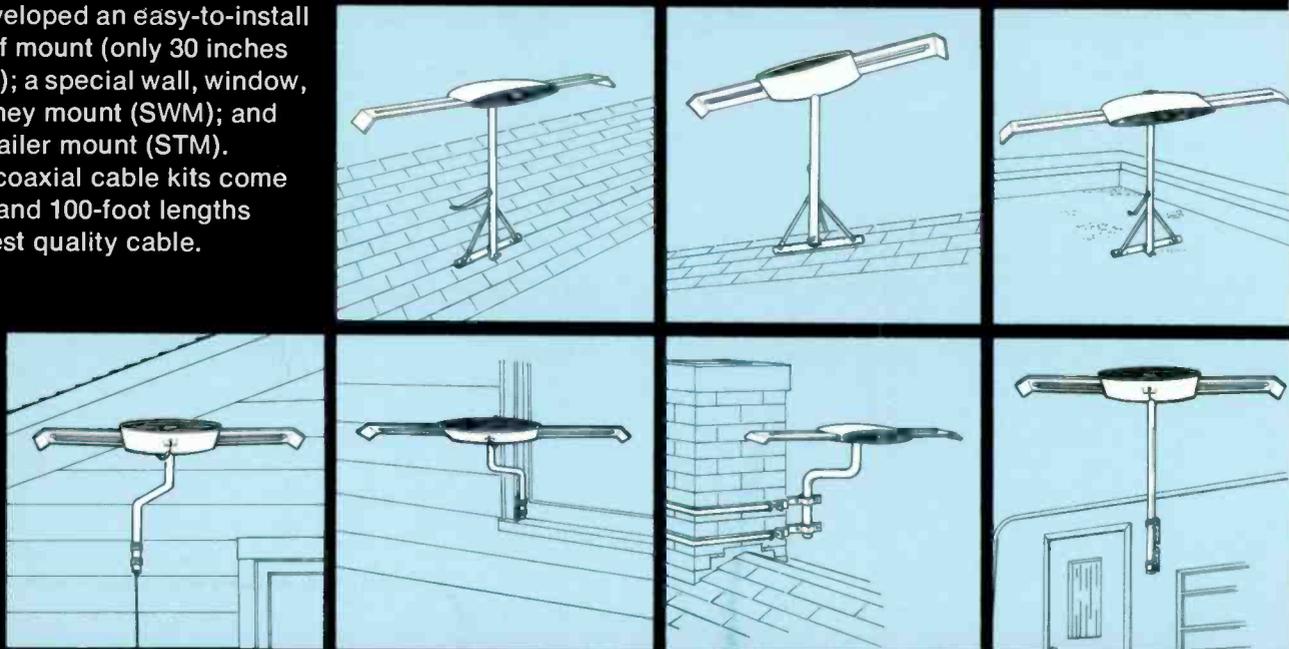


**Takes to the attic.  
Doesn't take over  
the attic.**

# And Winegard has everything to make it big.

Because Sensor is such a dramatic breakthrough in television antennas, we've created dramatic packaging, displays, sales aids, and advertising.

We've developed an easy-to-install tripod roof mount (only 30 inches tall) (SRM); a special wall, window, and chimney mount (SWM); and a travel trailer mount (STM). Sensor's coaxial cable kits come in 50, 75, and 100-foot lengths of the finest quality cable.



As you can see, we've put a lot of work into Sensor. But we feel it's well worth it. We believe Sensor is the first honest small television antenna of its type. The antenna we've been trying to make since we started making antennas.

## SENSOR<sup>TM</sup>

Model SR-20 (solid-state) \$49.88 fair trade list with 2-set power coupler—use up to 40 miles.  
Model SR-10 (not solid-state) \$34.88 fair trade list with 2-set coupler—use up to 10 miles.



**Winegard**  
ANTENNA SYSTEMS

WINEGARD COMPANY • 3000 KIRKWOOD STREET • BURLINGTON, IOWA 52601

## NEW PRODUCTS

stantly displays a small amber signal to show that the set is operating normally. Retail price \$29.95. Safety Engineering, Inc.

### SCANNING MONITOR RECEIVER 716

Designed to cover  
118 to 136MHz

A scanning monitor radio receiver, which automatically scans from one to eight selected frequencies in the Aeronautical Band, has been designed to cover both ground and air communications. It stops for any communication, then continues the signal search when the transmission ends. The receiver uses easily installed plug-in crystals to monitor any frequency desired in the 118 to 136MHz range. Rated sensitivity of  $1\mu\text{v}$  is achieved over any 10MHz spread within this range. Price: \$149.95. Electra Corp.



### CORDLESS POWER HANDLE 717

For light-duty jobs in  
difficult-to-reach places

A portable, rechargeable power source for small work tools is designed to do a wide variety of light-duty jobs in difficult-to-reach places, or where  
*continued on page 74*



# how to get a \$400 frequency counter for \$199.95\*



## ...build the new Heathkit® IB-101

- Accurate counting, 1 Hz to over 15 MHz
- Automatic trigger level for wide range input without adjustment
- Five digit readout with Hz/kHz ranges & overrange indicators give eight digit capability
- High Z input
- Computer-type integrated circuitry eliminates divider chain adjustment

The latest Heath breakthrough in low cost, high quality instrumentation. New IB-101 counts from 1 Hz to over 15 MHz; advanced integrated circuitry eliminates blinking readout & divider chain adjustment.

Overrange indicator & Hz/kHz switch give the IB-101 8-digit capability. Set the range switch to kHz & the display reads out to the nearest kHz... push the range switch to Hz and read down to the last Hz. Overage & Hz/kHz indicators light up to give error-free measurement & correct range at all times. Automatic decimal locator eliminates interpolation & figuring.

Exclusive Heath-designed input circuit uses a dual-gate, diode-protected MOSFET... provides proper triggering without adjustment from less than 100 mV to over 200 V. Input Z is 1 megohm shunted by less than 20 pF to minimize circuit loading & error. Other features include sockets for all 26 IC's & 5 display tubes... 120/240 V AC operation & convenient handle/tilt stand.

Compare the new Heathkit IB-101... then order yours. **Kit IB-101, 7 lbs... \$199.95\***

**IB-101 SPECIFICATIONS:** Frequency Range: 1 Hz to greater than 15 MHz. Accuracy:  $\pm 1$  count  $\pm$  time base stability. Gate Times: 1 millisecond or 1 second with automatic reset. **INPUT CHARACTERISTICS** — Sensitivity: 1 Hz to 1 MHz, less than 100 mV rms. 1 MHz to 15 MHz, less than 250 mV rms, after 30 minutes warmup. Trigger Level: Automatic. Impedance: 1 Megohm shunted by less than 20 pF. Maximum Input: 200 V rms, DC — 1 kHz. Derate at 48 V per frequency decade. **TIME BASE:** Frequency: 1 MHz, crystal controlled. Aging Rate: Less than 1 PPM/month after 30 days. Temperature: Less than  $\pm 2$  parts in  $10^7$ /degree C. 20 to 35 degrees C after 30 minutes warmup.  $\pm .002\%$  from 0 to 50 degrees C. **GENERAL:** Readout: 5 digits plus overrange. Temperature Range: Storage: —55 to 80 degrees C. Operating: 0 to 50 degrees C. Power Requirements: 105-125 or 210-250 V AC, 50/60 Hz, 8 watts. Cabinet Dimensions: 8 1/4" W x 3 3/8" H x 9" D not including handle. Net Weight: 4 1/2 lbs.

HEATH COMPANY, Dept. 24-12  
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Enclosed is \$ \_\_\_\_\_, plus shipping.

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... for more details circle 109 on Reader Service Card

**No woman should be allowed  
to drive alone at night...**

***...without citizens  
two-way radio***

*Sure as fate it's going to happen*—the inevitable inconvenience on the highway that *could* turn into a nightmare for someone close to you.

Unless, of course, her car is equipped with citizens two-way radio to close the gap between auto and help *instantly* when trouble occurs.

To more than a million American families, citizens two-way radio already has become not only a marvelous everyday convenience but a vital and irreplaceable communications link. It can bring a squad car, travel information, a friendly voice or a loaf of bread with equal facility. And for less than the cost of a new set of tires.



Can you think of a better way to promote family togetherness or peace of mind?

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2001 Eye Street, N. W. Washington, D. C. 20006 Citizens Radio Service Section



## BOOK REVIEWS

**UNDERSTANDING SOLID-STATE CIRCUITS** by Norman H. Crowhurst, published by Tab Books, hardbound \$7.95, paperback \$4.95.

Beginning with a simple comparison of common characteristics of a triode tube and an NPN transistor, the author continues with characteristic curves and then further develops the readers' concept of semiconductors with simple linear amplifier circuits. Additional chapters deal with power amplification, feedback, sinusoidal oscillators, function generator oscillators, gain-controlled amplification, control and logic circuits, plus integrated circuits.

In the preface the author expresses his opinion that: "Generalizations are never too helpful. Schematics that merely explain 'how it works' without giving values, either circuit components or voltages and currents, are not too helpful. To be meaningful, enough specifics must be included, as well as enough general trend information, to help project these specifics beyond their immediate application." We feel that the author did an excellent job of actually doing this when writing the book.

This book should be of value to either new electronic technicians that need to learn more fundamental semiconductor principles or to more experienced technicians that need to expand their understanding of certain semiconductor applications.

**DIRECT TRANSISTOR SUBSTITUTION HANDBOOK** by H. A. Middleton, published by Hayden Book Co., 224 pages, paperback \$2.95.

Transistor substitution can be a major headache in electronic servicing. Although not so critical in audio circuits, in some dc-coupled TV circuits the situation can be so critical that even replacing a transistor with another containing the same type number is not adequate. (Recently we substituted a transistor for another containing the same type number but labeled for a different circuit. As later verified by the manufacturer, tolerances were still not close enough and the transistor destroyed itself.)

This book should be of value to any electronic technician that realizes that the possible range of transistor substitutions is dependent on the semiconductor circuit. The main portion of the book, 202 pages, contains a photographically reproduced computer listing of nearly 12,000 different transistors that are now on the market.

As explained in the book, the best substitutions are followed by a double asterisk and good ones by a single asterisk, while those without an asterisk are substitutions suitable only for non-critical circuits. For each transistor the listing includes a lead code, which refers to a table of transistor lead arrangements, and a base code which specifies one of 231 base diagrams. (There are 232 base codes but in our copy of the book one code is without a diagram.)

Although the book does not contain any transistor specifications, it does list an extremely large number of transistors.

As stated by the author in the preface, much of the information and a large percentage of the illustrative material included in this book was obtained from General Electric. Although a few of these illustrations were too poorly reproduced to be read, in general the material included in this book should be of considerable value to technicians servicing this brand of TV set.

**GENERAL ELECTRIC COLOR TV SERVICE MANUAL** by Robert L. Goodman, published by Tab Books, vinyl cover \$7.95, paperback \$4.95.

In addition to providing 12 full-size schematic diagrams and a chapter on tuner service and alignment, the book contains service data and tips, alignment and adjustment instructions, plus information concerning modifications for the CA, CB, KC, KD, KE, G1, H1 and C1 chassis.

This book should prove to be a very helpful service aid.

**HOME-CALL TV REPAIR GUIDE** by Jay Shane, published by Tab Books, hardbound \$6.95, paperback \$2.95.

Time permits us to only skim through the books that we review each month. However, we found it very difficult to do so with this book—the author was just too interesting.

The introduction to this book covers such subjects as the problem of defining the customer's complaint on the phone, developing confidence with the customer, the amount of time that should be spent on a house call and the problem of actually getting the TV set fixed. Since it is not possible to carry a schematic for every TV set requiring repair in the field, the book deals with the general principle of repair and what to look for in specific brands of TV sets.

One very interesting feature is the

checklist included at the end of each chapter. In table form the author lists complaints, the condition of the receiver and a number corresponding to the possible trouble that should be checked. Following each such table is a page or more of "causes/cures" in numerical order.

Although we do not recommend actually bringing this book along into the home for servicing—it would build up about as much confidence in the technician as a doctor reading a medical book in the presence of his patient—we do feel that the book would be of value to any electronic technician that does service TV sets in the customer's home.

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# NEW PRODUCTS

*continued from page 71*

there are no electric outlets available. The power handle reportedly features shockproof construction which protects against damage from being dropped. Power takeoff is reportedly provided at each end to give both clockwise and counterclockwise rotation. The unit rests on a charging console when not in use. Jensen.

## MONITOR RECEIVER 718

VHF-FM scanning monitor covers eight channels

A High-Band VHF FM monitor receiver has been designed to provide automatic scanning of eight crystal-controlled channels. Designated APO-



75, the solid-state receiver reportedly covers the 150 to 175MHz band. The scanning system automatically monitors on a sequential basis all eight channels within one second by means of electronic switching. A by-pass feature lets the receiver skip selected frequencies. Price: \$149.95. Fanon Electronics.

## BURGLAR ALARM 719

Effective surveillance for 3500 sq ft area

A solid-state, microwave-doppler radar system, operating in the 400



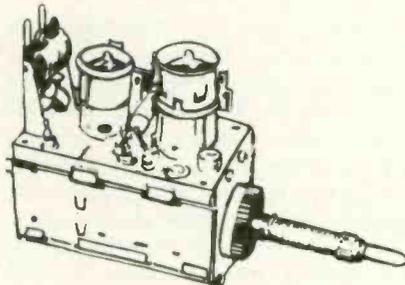
MHz range, has been designed to detect any motion in an area up to 3500 sq ft. Sustained human movement for

4 seconds or more within the protected area will reportedly energize the alarm relay contacts. The unit may be powered either from 110vac or 12vdc, and it reportedly functions in a multiple alarm system or as a single unit. Price \$99.50. Artronix.

## TV TUNERS 720

Exact replacements for many popular TV sets

A large assortment of replacement tuners have been designed as exact tuner replacements, meeting the mechanical and electrical requirements of the original factory tuner. They are reportedly available for many of the most popular B/W and color TV sets. Dealer net \$15.95. Castle.



## POWER SUPPLY 721

With over-voltage protection

A power supply, Model PS-163, is designed to provide 0.05% load regulation. The unit reportedly has an output current of 500ma and an input power of 12va. The power supply weighs 12 oz. and sells for \$73. GPS Corp.



## COLOR CRT GUN BOOSTER 722

Bias between the grid leads are changed to restore emission

A solid-state device has been designed to restore emission in either the red, blue or green guns to near original peak. The device is connected to the weak gun by making two quick con-

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## FM TRANSCEIVERS

**Model 2301 \$375<sup>00</sup>**  
132-174 MHz

VHF-FM 1 CHANNEL  
1 pair of crystals and 1 set of standard batteries.

**Model 2301A \$475<sup>00</sup>**  
132-174 MHz

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1 pair of crystals and 1 set of standard batteries.

**Model 2302 \$595<sup>00</sup>**  
450 to 470 MHz

UHF-FM 1 CHANNEL  
1 pair of crystals, 1 set of standard batteries and Tone.

**Model 2303A \$475<sup>00</sup>**

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Available in 2 Frequency Ranges  
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\*Model 2303A available with tone at additional charge.

Professional performance! Perfectly designed for efficient dependable and continuous heavy duty use. Provides instant voice contact with base stations mobile units and other portable transceivers • Compatible with all 2-way systems • Receiver and transmitter operates on independent frequencies • sensitive, noise immune squelch • external connections for antenna, earphone and charger • 1.6 watt output. FCC TYPE ACCEPTED & D.O.C. APPROVED—U.S. BUREAU OF MINES APPROVED

**SONAR RADIO CORPORATION**

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Please send information on the SONARCOM. Dept. 225

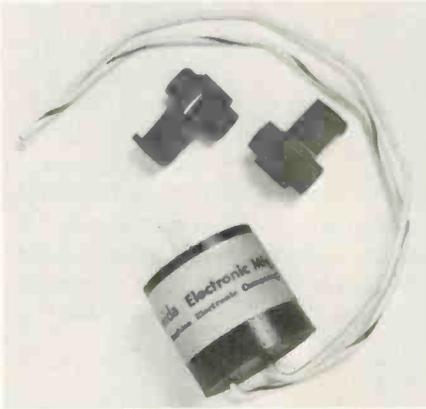
Name \_\_\_\_\_

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City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

... for more details circle 122 on Reader Service Card

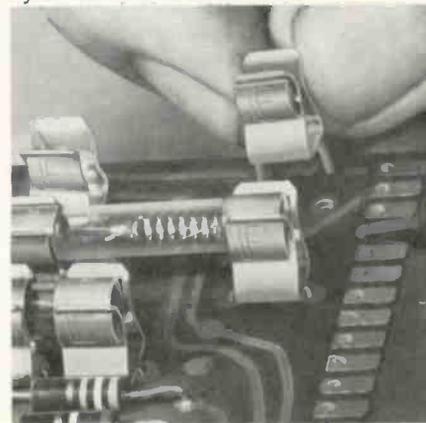
nections. Specifications indicate that the tube filament voltage is not increased, only the bias between grid leads are changed to restore emission. Dealer net \$4.59. Oneida.



### FUSE CLIP 723

*Twin metal tab mounting prevents misalignment*

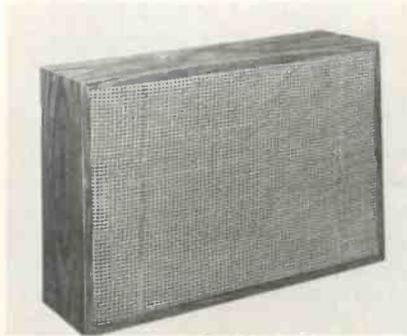
A miniature bronze fuse clip, rated up to 15a, has been designed for printed circuit board installation. The clip reportedly features twin metal tab mounting to prevent rotation or misalignment during assembly. Specifications indicate that the clip can be used on printed circuit boards up to 0.093 in. thick and that it can be inserted by hand or machine. Littelfuse.



### SPEAKER SYSTEMS 724

*Heavy-duty cabinet construction*

Acoustically engineered and decorator styled book-shelf speaker systems are designed with 12-in. or 8-in. high-fidelity cone speakers and a provision for mounting a 4-in. tweeter. The speaker system is said to feature a heavy-duty cabinet with vinyl simulated oiled walnut finish covering and complementing cane grille blends with the walnut decor. Each cabinet has a thick composition board back, and reportedly is stain-proof, scuff-proof,



and washable, making it ideal for home and industrial sound systems. The Model LS-85S, with an 8-in. speaker, has a suggested retail price of \$18.95. RMS Electronics, Inc.

### INVERTER 725

*Crystal controlled for frequency accuracy*

Specifications indicate that a crystal controlled, 12vdc to 120 vac, 60Hz inverter provides a frequency accuracy of  $\pm 0.005\%$  over a temperature range of  $-40^{\circ}\text{C}$  to  $+55^{\circ}\text{C}$ . The inverter is reportedly short circuit proof. It is designed to start motors, lamps, and other heavy starting current loads up to its 200vac rating automatically. And with its high frequency stability it is

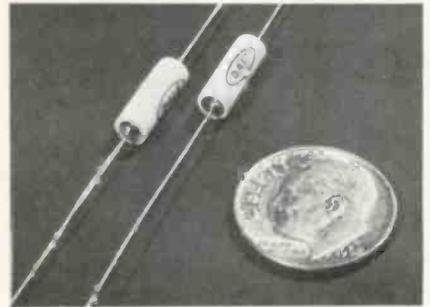
said to be useful for even operating electric clocks. Price \$169. Electronics-Atlanta.



### FUSE RESISTOR 726

*Comes in a choice of 5 sizes and various tolerances*

Fuse resistors reportedly capable of operating as both standard resistors



## THE GREAT PUT-ON CRC CONTACT CLEANER



Put it on rotary switches, computer heads, tuners, jeweled bearings, gyros... those sensitive contacts that must be microscopically clean.

A quick spray and it penetrates. Degreases. Cleans away dirt, moisture, oils. Lifts solids right out of metal pores.

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Dresher, Pa. 19025



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

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**fix-it**  
**tools**

*make tricky jobs easy*



**SUPER LONG NUTDRIVERS**

Over 20" long with 1/4" and 5/6" hex openings, color-coded plastic (UL) handles, full length hollow shafts.

Eliminate skinned knuckles and the frustration of trying to reach tuners, bezels, other up-front components from the back of a TV set with ordinary tools.

Extra length means more convenience, greater driving power for many other "fix-it" jobs.

**INVERTED PALNUT DRIVER SHANKS**

Fit all Xcelite "99" handles, including Tee and ratchet types. Popular 7/16" and 1/2" external hex sizes, hollow shanks.

Save time, prevent damage to fastener or equipment when removing Palnuts on balance controls, on-off switches, volume control shafts of most TV sets, record players, portable radios.



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**NEW PRODUCTS**

and series fuses are being produced in five sizes ranging from 1/4w to 1 1/2w, with value ranges from 0.1Ω to 7.4K. Specifications indicate that standard tolerances are 3%, 5%, 10% and a low of 1%, and that the units are packaged in non-hygroscopic ceramic tubes. Dale.

**LETTERS**

*continued from page 25*  
 inadvertently inverted (mirror image) due to a printing error. A negative sample pulse is integrated and used in the horizontal AFC stage. Therefore, the waveform should have been inverted vertically, but not turned upside down. If the sample pulse were positive, as was used in earlier chassis designs, the waveform would be correct as shown.

We sincerely hope this information has helped to explain the waveforms shown.

FRANK HADRICK, MANAGER  
 Technical Publications  
 Zenith Sales Company

**For Sale**

I have subscribed to your magazine for quite a number of years and have found it very interesting.

I wish to sell my Radio & TV Service Shop and my modern home, which is situated on the same lot 30 ft away. I would sell both to a party interested in a good established business, especially a color RCA franchise. Bad health is forcing me to do only part time work now.

MR. CLAUDE AYOTTE  
 Claude's Electric  
 St. Jean Baptiste, Man.  
 Canada

**GUEST AUTHOR...**

*continued from page 56*  
 participation at seminars and workshops conducted by schools, manufacturers and associations also pay off in broadened horizons.

**Technical Know-How Not Enough**

While a sound knowledge of electronics makes a great base upon which to build an electronic service business, technical training is only half the battle. Too few service shop operators bother to learn fundamental business practices. This is

probably one of the reasons why a substantial percentage of service shops go out of business each year. In addition to being a *good technician*, the successful shop owner must also be a *good businessman*. Courses or self-study books on small business operations, merchandising and sales promotion are almost as important as technical study. In this regard, the Small Business Administration, a department of our Federal government, makes available a lot of helpful information. Contact your local SBA office, or write to: Small Business Administration, 1441 L Street N.W., Washington, D.C. 20416.

Another form of self-study toward self-betterment is observation. Pay attention to the leading service shops in nearby towns and cities. You will find that 9 out of 10 successful shop owners got that way with the help of schooling or self-study, so they know what they are doing. Observe their methods of operation. How do they handle pick-up and delivery, call-backs, guarantees, etc.? Are their shop and store layouts partly responsible for their success? Do they advertise consistently by means of newspapers, circulars or direct mail? Do they offer regular or periodic specials? Their business ideas may not always work out equally well for you, but you would not be too far off base by taking a lesson or two from a pro who has proven himself.

Thinking in terms of learning from others in your field, you really should consider joining a local electronic trade association, especially one with national affiliation. Made up of members from the electronic service fraternity, these associations are an excellent media for cross-fertilization of ideas and gathering of knowledge about the electronic service business. If you do not know where your nearest association is located, write to me at Sprague Products Co., North Adams, Mass. 01247, and I will make certain that you are put in touch with someone who can help you.

While the "back-to-school" idea may not appeal to everyone, bear in mind that education comes in many other forms too. So choose the methods that best suit your capabilities, and remember... *the power of learning will enhance your earning power.* ■

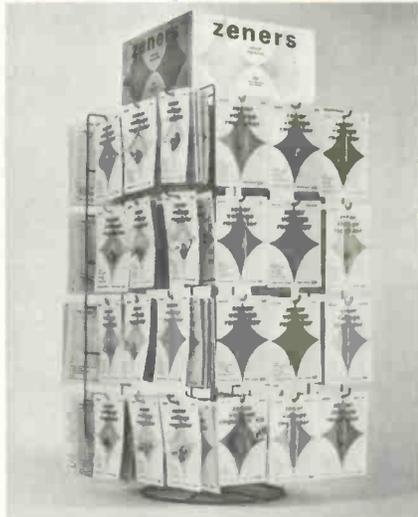
# DEALER SHOWCASE

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

## ZENER DISPLAY 727

*Features 48 popular types in bubble packs*

A Zener merchandising program is designed for the electronic hobby market. The colorful, compact counter



merchandising center—called the Carousel—features 48 most popular IR Zener Voltage Regulator Diode types. Each device is bubble packed in IR's Diamond Line card which gives specifications, full listing of the entire Zener series, and pre-pricing at net resale. IR.

## TAPE HEAD DEMAGNETIZER 728

*Plugs into auto cigarette lighter*

A tape head demagnetizer and cleaner is designed for eight-track stereo cartridge players and records. The demagnetizer reportedly is a protective mechanism which extends tape head life and reduces wear. The unit cleans and removes excessive magnetic



build up on the head, preventing sound distortion. The Model SA-83 is used for car cartridge players and plugs into the cigarette lighter. The car unit is priced at \$8.95. Duotone.

## CASSETTES & TAPE 729

*Uniform tape speed without any jamming*

A line of Hi-Fi blank cassettes and cartridge tapes has been produced. The tapes are reportedly sealed in precision housings which assure perfect fit and uniform speed, with a special design that is said to prevent jamming. A plastic storage box is supplied free with each cassette. GC Electronics.



## LOW-BAND TRANSCEIVER 730

*Power output of 1.6w in the 32 to 50MHz region*

A Model 2303A low-band (32 to 50MHz) transceiver is being offered for two-way communications in metropolitan areas for police, public services and business applications where communications is a problem. The transceiver employs a solid-state chassis and 1.6w of output power for performance in the 32 to 50MHz region. Separate transmit and receive channels, a sensitive squelch circuit, compatibility with all existing two-way communication systems, plus external connections for antenna, earphone and battery charger, are some of the features employed. Available for use

in either the 32 to 41MHz or the 42 to 50MHz bands, the unit is supplied



with crystals for one channel and a set of 12 AA batteries. The unit measures 7¼ by 3 by 1½ in. and weighs 2.6 lb. Price \$475. Sonar.

## B/W PORTABLE TV 731

*Equipped with protective screen*

The Model 6141, a 19-in. family portable TV set, is equipped with a protective screen designed to keep the picture tube dust free and add to the slim-line contemporary styling. The set is said to utilize advanced, state-of-the-art circuitry. Channel Master.



## TURNTABLE DISPLAY 732

*Each turntable is described by a copy panel*

A metal display stand has been designed specifically to accommodate the 610/X, 510/X and 310/X turntables. The display is built to take only a couple of square feet of floor space, and can be moved from place to place without difficulty, because of its sturdy construction. Each turntable

# passivated rectifier

GE-509



- Up to 1000 volts PIV
- Transient Voltage Protection
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- All Diffused Structure
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- Hermetically Sealed
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**applications:**

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- TV and Radio Power Supplies
- Time-Delay Circuits
- Communications Equipment
- Power Logic Circuits
- SCR Trigger Circuits
- ARC Suppression
- Small Portable Appliances
- Battery Chargers
- General Purpose Power Supplies
- TV Damper Diodes
- Low Level Limiters

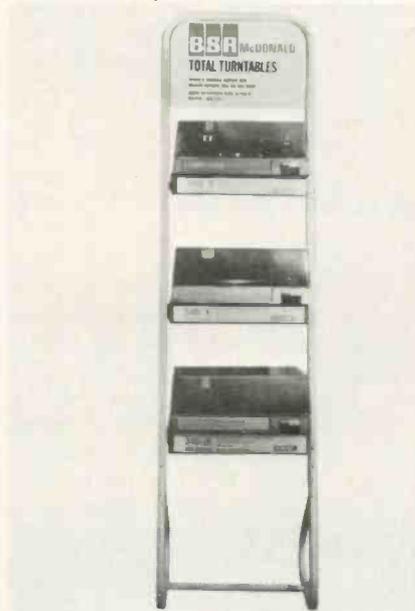
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OWENSBORO, KENTUCKY

GENERAL ELECTRIC

## DEALER SHOWCASE

is fully described by a copy panel immediately under it, complete with a feature-for-feature price build-up from low-end to high-end models. BSR.



### CB RADIO 733

23 channels with all crystals included

The Tiger 23, featuring 23 channels with all crystals included, employs the company's Hetrosync circuit. A three-position delta tune switch is designed to correct off-frequency transmissions. A large illuminated combination RF-S



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for electronic technicians/dealers

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meter, an automatic noise limiter with manual override switch and an automatic modulation control are some of the features offered. Weighing 4.5 lb and measuring 6¾ in. W by 2¾ in. H by 8½ in. D, the unit also features a PA system, modulation light, illuminated dials and plug-in dynamic mike. Solid-state circuitry and a super-sharp ceramic filter are used. Price \$149.95. Pearce-Simpson.

### SPEAKER 734

Weatherproof with color-coded speaker cable

An extension speaker, which brings the sounds of stereo system outdoors, includes color-coded cable that simplifies installation. Once installed, the weatherproof speakers can reportedly be left outside. The speaker has a built-in volume control and a dual cone design. It is placed in a natural redwood enclosure and is priced at \$15.95. Argos.



### STEREO HEADSETS 735

Volume and tone controls provided for each ear

A stereo headset, Model SP-104, features Volume and Tone controls for each ear to permit full fidelity listening enjoyment, plus a Stereo/Monaural



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ELECTRONIC TECHNICIAN/DEALER

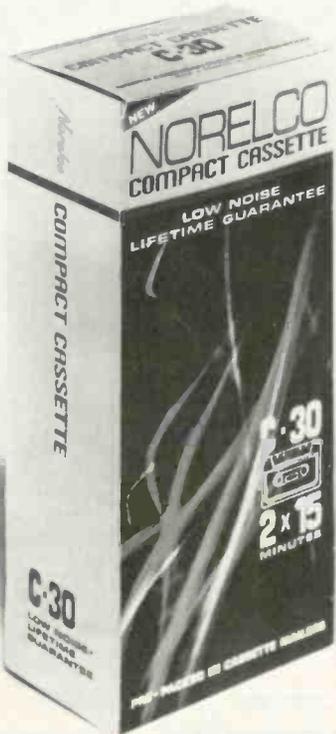
switch and adjustable padded leatherette headbands. Oversized foam filled earpieces are said to completely surround the ear to eliminate external noise with greater comfort. The headset comes equipped with a 10-ft coil cord to permit greater listening mobility. Suggested net price, including leather finished vinyl carrying case with handle, is \$34.95. Mura.



**CASSETTE 736**

30-minute recording time for brief communication needs

A 30-minute cassette has been added to the manufacturer's line of 60-, 90- and 120-minute cassettes. The cassette reportedly features 15 minutes'



recording time on each playing side. Norelco.

**TV/FM ANTENNA HARDWARE 737**

Complete antenna department requires only 3 sq ft of floor space

A packaged program has been designed for the do-it-yourself TV antenna market. In 3 sq ft of floor space, this complete antenna department will reportedly handle 85% of all the antenna installations. The No. TVD merchandiser consists of 6 color-engineered outdoor antennas plus 20 carefully selected blister packed antenna hardware items. Both the antenna carton and hardware cards are in Glo-Pak colors for impulse sales. The entire line includes installation instructions to make it easy for the installer. Included with the free merchandise display center is a pop-up mast for displaying the antenna. Also available are point of purchase materials to promote volume sales. List price \$448.39. IE.



**CASSETTE DUPLICATING SYSTEM 738**

Choice of reel or cassette master unit

A modular cassette duplicating system reportedly consists of a master



unit which can be obtained in either reel or cassette format. Both master

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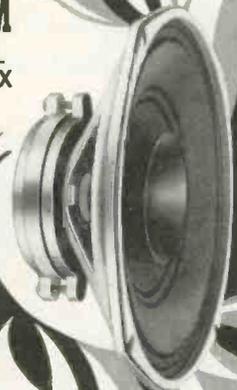
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234 East Marquette Road  
Chicago, Illinois 60637

units are said to be capable of driving as many as 10 cassette copiers. Specifications indicate that master and copier units come in either two- or four-track format. Prices are \$499.95 for the master units and \$299.95 for the copiers. 3M.

### TAPE CASSETTE 739

Frequency response from 30 to 20,000Hz

A Hi-Fi tape cassette has been developed for a frequency response extending from 30 to 20,000Hz. Specifications indicate that the tape features a greatly improved signal-to-noise ratio, as well as reduced sound distortion. Price \$3.59. TDK Electronics.



### MICROPHONE 740

Diaphragm safe from dust and magnetic particles

A microphone designed for hand-held use and sound reinforcement reportedly eliminates contact noise. Specifications indicate that the microphone is shock-isolated and omnidirectional. A four-stage filter reportedly protects the microphone from pop-



ping and breath sounds and also prevents dust and magnetic particles from reaching the diaphragm. The microphone is said to have a frequency response of 80 to 13,000Hz with -55dB output. Price \$120 with stand. Electro-Voice.

### TWO-WAY RADIO 741

Compact design with rapid-change battery packs

A hand-held, two-way radio light enough to fit in the palm of a hand has been designed to meet stringent performance and structural requirements. The unit reportedly provides a selection of 30 combinations of power ratings and power sources in the 150.8 to 174MHz frequency range. Specifications indicate that the user may obtain a transmitter with a 100 to 200mv RF power output or a more powerful transmitter rated at from 1 to 2w. Each unit consists of a radio section and battery pack. The top section contains the transmitter and receiver portions; while the bottom section is a

## The sure way to ELIMINATE CALLBACKS



Only Injecto-All's new **BLUE LUBE** foam spray contains Oxident — an anti-oxidation chemical that cleans contacts, keeps them permanently clean and prevents callbacks. Eliminates picture streaking and intermittents with one application.

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molded plastic case containing batteries and attaches directly to the radio compartment through a twist-on,



twist-off connector. The Automatic Power Level is a standard feature of all 150MHz models, and it compensates for drop-offs in output power that otherwise would occur if battery voltage decreases with use. The radio circuits are all solid-state, using silicon transistors, thick film hybrid integrated circuitry and modular construction. General Electric.

#### MICROPHONE 742

*Shock-mounted cartridge reduces noise*

A Model 515SB-G18 unidirectional gooseneck microphone is designed for use in areas where suppression of background noise is desired. The microphone reportedly is made for virtually any fixed-mounted installation and offers greater working distance pickup and rejects ambient noise more efficiently than an omnidirectional microphone. Specifications indicate that a leaf switch controls the microphone circuit and/or relay circuit and two switch halves operate independently of

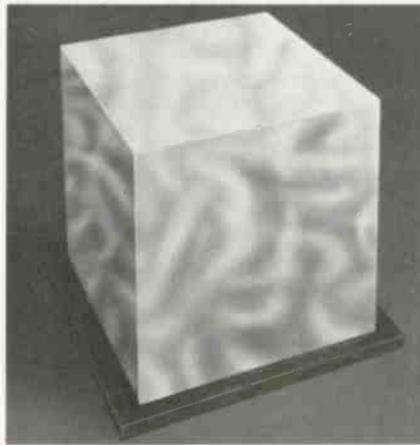


each other to afford complete flexibility in wiring. Another reported feature is a shock-mounted dynamic cartridge that cuts mechanical shock and vibration noises for quiet operation. The microphone is said to have an 80 to 13,000Hz frequency range and sells for \$53. Shure.

#### PLEXIGLASS CUBE 743

*Both functional and decorative in the home*

A cube made of soft white plexiglass has been designed to fulfill a variety of decorative uses in the home. It can reportedly serve as a table or a sculpture and also be activated by the audio portion of a radio or Hi-Fi set to respond to color. Each side measures 18 in. EICO.



#### AMPLIFIER/PREAMPLIFIER 744

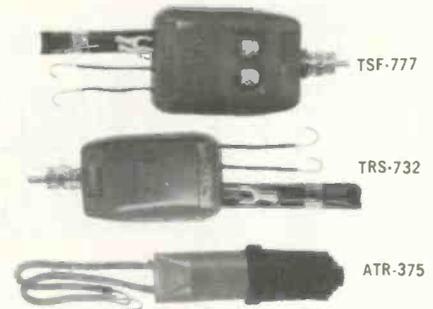
*Employs a toroidal transformer drive system*

A solid-state stereo amplifier-pre-amplifier combination, Model 1200,



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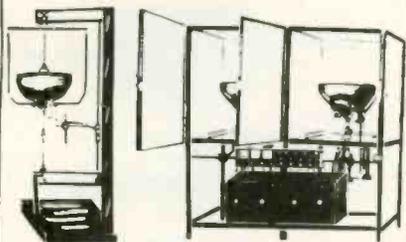
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## TECHNICAL LITERATURE

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

### Relays 400

A 6-page, two-color brochure describing a relay which allows the safe control of machinery and appliances from a remote distance is available. Five models are listed and illustrated including the basic models FR-101 and FR-102, and special types such as the FRE-103 plug-in complete unit, and the FRP-104 octal base plug industrial relay. Typical applications with schematic drawings and brief descriptions are included. Also.

### Component Selector 401

A quick delivery identification system—featuring a 3-level popularity grading guide—is highlighted in a 36-page shortform catalog published by the manufacturer. The identification system utilizes bold face type, light face type and parentheses to indicate product availability based on nationally exhibited usage patterns. Ohmite.

### Semiconductor Cross-Reference Guide 402

A cross-reference and replacement guide, HEP HMA-07 lists more than 25,000 devices for HEP replacements, including 1N, 2N, 3N, JEDEC, Japanese, Dutch and other foreign numbers in addition to thousands of manufacturer's regular and special "house" numbers. The guide has special emphasis on replacement coverage of the device numbers found in consumer products equipment, particularly Japanese merchandise, and several thousand industrial MRO market device types. This semiconductor cross-reference guide and catalog includes the full-line product catalog, which gives the minimum/maximum ratings and electrical characteristics for 285 HEP devices, as well as the cross-reference information. The HEP devices are listed by type number with a packaging index, device dimension drawings and selection guide information. Motorola.

### Antennas 403

A revised 32-page catalog, No. 710, illustrates and describes the entire line of over 100 TV-RM outdoor and indoor antenna models and more than

200 electronic products for home and commercial systems. Also new is catalog No. 107 featuring commercial systems equipment for MATV, CCTV, ITV, ETV, CATV and NATV installations. Winegard

### Tools 404

Bulletin No. N670 introduces two new reversible ratcheting handles for use with more than 60 of the company's individually available Series "99" nutdriver, screwdriver and special purpose blades. The ratchet mechanism incorporated in the regular (Model 99-1R) and tee type (Model 99-4R) plastic (UL) handles is described as being built to highest socket wrench quality standards and fully enclosed to keep out dirt and grit. Xcelite.

### Semiconductors 405

A 52-page "Entertainment Semiconductor Almanac" is obtainable from the manufacturer. The catalog contains approximately 20,000 cross references for universal replacement semiconductors, selenium rectifiers for color TV, dual diodes and quartz crystals. Also included are application and technical data along with prices. General Electric.

### Electronic Tools 406

A 56-page catalog contains a comprehensive listing of the manufacturer's line of electronic assembly tools. The items displayed include tweezers, pliers, soldering equipment, magnifiers, etc. Electronic Tool Co.

### Antennas 407

An illustrated catalog of CB antennas has been announced by the manufacturer. The catalog contains more than 125 different antennas and antenna accessories. There is a complete selection of directional gain antennas, omni-directional base station antennas and a selection of colinears and ground planes. Also featured is a section on mobile antennas as well as a line of white fiber glass antennas. Antenna Specialists.

### Color TV Controls 408

A 32-page, vest-pocket-size cross-reference No. X67, lists Color TV Controls for Convergence, Audio, Color, AGC Delay, Focus, Brightness, Sensitivity, Horizontal Frequency, Horizontal Centering, Vertical Linearity and Vertical Centering. The booklet cross-indexes TV set part numbers to the manufacturer's. Corresponding part numbers are in numerical order with specifications and illustrations of the part. Workman.

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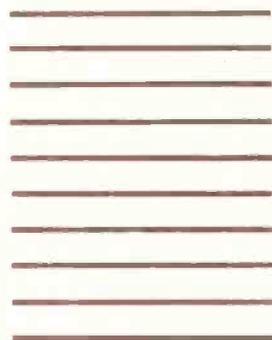
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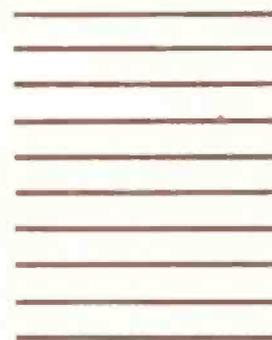
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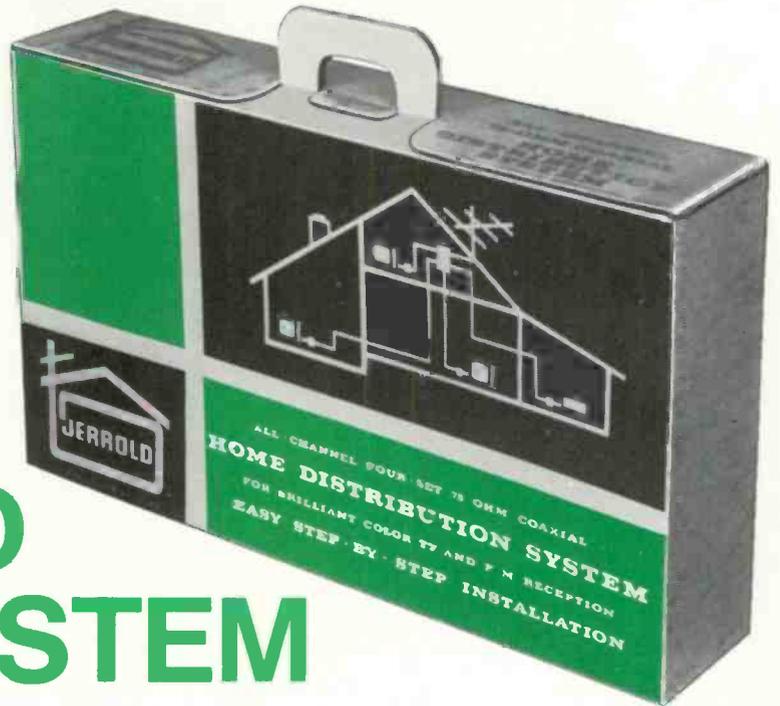
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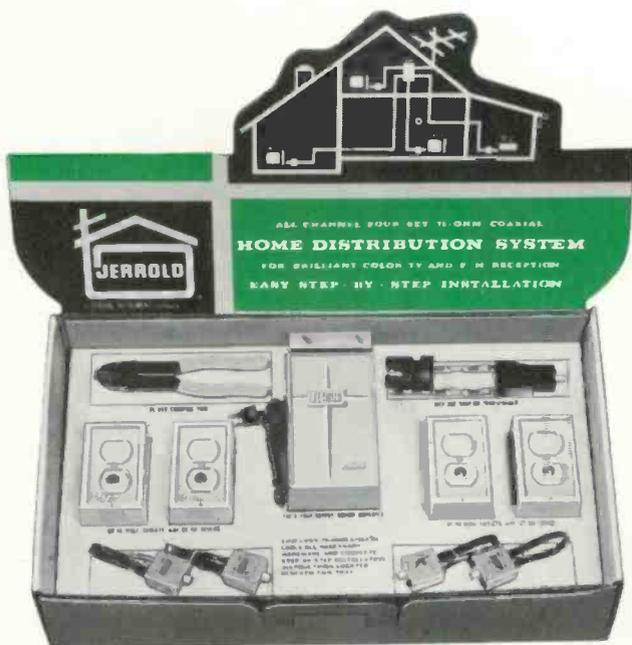


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